HOSPITAL INFECTION PREVENTION AND CONTROL MANUAL

Sri Lanka College of Microbiologists

2021

FOREWORD

It gives me great pleasure to write this message to the Hospital Infection Prevention and Control Manual compiled by the Sri Lanka College of Microbiologists. Infection prevention and control is needed now as never before due to many reasons. Increased resistance of microbes to antimicrobials, increased use of invasive devices and increase of immunocompromised population are a few of them with the COVID 19 pandemic giving a new dimension to it.

This comprehensive guide will facilitate infection prevention and control in hospitals of all categories especially where the services of a microbiologist are not available.

I believe this Manual compiled by the Sri Lanka College of Microbiologists will help in improving the infection prevention and control standards of our hospitals and help in combatting anti-microbial resistance by reducing hospital acquired infections.

Dr. Asela Gunawardena
Director General of Health Services
Ministry of Health, Nutrition and Indigenous Medicine

PREFACE

Health-care associated infections (HAI) are increasing locally and globally. This poses a risk to the public when accessing health services and to the health care workers when providing care to the patients. The rise in HAI is coupled with the exponential rise and spread of antimicrobial resistant pathogens. The two epidemics are intimately connected as the widespread abuse of antimicrobials is the main driver of antimicrobial resistance while poor infection prevention and control is the main reason for dissemination of these resistant pathogens.

The Sri Lanka College of Microbiologists published the Hospital Infection Control Manual in 2005. An updated edition, incorporating the evidence that has emerged during the last decade, was an urgent need. This second edition of the Manual was developed following an extensive review of the available literature and evidence in infection prevention and control along with adaptation of the recommendations to the local, Sri Lankan situation after wide-ranging consultation with relevant professional Colleges.

The College is grateful to the Past Presidents who initiated and continued the work of this Manual through their tenures, the members of the Editorial Board who took leadership in this project, the general membership for their contribution as authors and reviewers of the chapters and the members of other Colleges who contributed their perspectives to improve its relevance to the local context.

We are confident that this Manual will be an invaluable resource to infection prevention and control practitioners, clinicians and other health care personnel.

Sri Lanka College of Microbiologists

EDITORS-IN-CHIEF

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Dr. Janaki Abeynayake	-	Consultant Virologist
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Dr. Darshana Wickramasinghe	-	Consultant Microbiologist
Dr. Priyanka Wimalagunawardhana	-	Consultant Microbiologist
Dr. Omala Wimalaratne	-	Consultant Virologist

CONTRIBUTING PROFESSIONAL COLLEGES AND ASSOCIATIONS

- College of Anaesthesiologists and Intensivists of Sri Lanka
- College of Forensic Pathologists of Sri Lanka
- College of Ophthalmologists of Sri Lanka
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- Sri Lanka Society of Nephrology and Transplantation
- The College of Surgeons of Sri Lanka

ACKNOWLEDGEMENT

Dr. Anuruddha Abeygunasekera
Consultant Genitourinary Surgeon, Colombo South Teaching Hospital

Dr. A.A.H. K. Amarasinghe
Consultant in Community Dentistry, Oral Health Unit, Family Health Bureau

Dr. Amal Fernando
Consultant ENT Surgeon, District General Hospital, Gampaha

Dr. I.P.S. Gamage
Acting Consultant in Restorative Dentistry, District General Hospital, Kalutara

Dr. Janaki Karunasingha
Consultant Obstetrician and Gynaecologist, Castle Street Hospital for Women

Dr. K.K.S. Kuruppu
Acting Consultant Transfusion Physician, National Blood Transfusion Service

Dr. A.D. Mudalige
Consultant Intensivist, Colombo North Teaching Hospital

Dr. S.A.S.R. Siriwardana
Senior Lecturer and Consultant Radiologist, Department of Anatomy, Faculty of Medicine, University of Kelaniya

Dr. Medha Weerasekera
Consultant Neonatologist, Sri Jayewardenepura General Hospital

Dr. Nilmini Wijesuriya
Consultant Anaesthetist, Colombo North Teaching Hospital

Dr. Deepani Wewalwala
Consultant Eye Surgeon, National Eye Hospital of Sri Lanka

Dr. S.R.M. Iresha Udayamalee
Senior Registrar in Community Dentistry, Health Promotion Bureau

CONTENTS

CHAPTER

ABBREVIATIONS

Ab	-	antibodies
AER	-	automated endoscope re-processors
AFB	-	acid fast bacilli
Ag	-	antigens
AGP	-	aerosol generating procedures
AIIR	-	airborne infection isolation rooms
BHT	-	bed head ticket
BSL	-	biosafety level
CAUTI	-	catheter-associated urinary tract infection
CDC	-	Centers for Disease Control and Prevention
CI	-	chemical indicators
CJD	-	Creutzfeldt-Jakob disease
CLABSI	-	central line associated bloodstream infection
CNS	-	central nervous system
COPD	-	chronic obstructive pulmonary disease
CRE	-	carbapenem resistant enterobacteriaceae
CSSD	-	central sterile services department
CVAD	-	central venous access device
CVC	-	central venous catheter
ENT	-	ear, nose and throat
ESBL	-	extended spectrum beta lactamase
ETO	-	ethylene oxide
ETU	-	emergency treatment unit
FFR	-	filtering facepiece respirators
GAS	-	Group A streptococcus
GBS	-	Group B streptococcus
GI	-	gastro intestinal
GMT	-	good microbiological technique
GPD	-	general purpose detergent
HACCP	-	hazard analysis and critical control point
HAI	-	healthcare associated infections
HAP	-	healthcare associated pneumonia
HBV	-	Hepatitis B virus
HBsAb	-	Hepatitis B surface antibody
HBsAg	-	Hepatitis B surface antigen
HCV	-	Hepatitis C virus
HCW	-	healthcare worker
HD	-	haemodialysis
HEPA	-	high efficiency particulate air
HIV	-	human immunodeficiency virus
HLD	-	high-level disinfectant

ICNO	-	infection control nursing officer
ICU	-	intensive care unit
iGAS	-	invasive group A streptococcal
IPC	-	infection prevention and control
IV	-	intravenous
MDRO	-	multidrug resistant organism
MERS-CoV	-	Middle East respiratory syndrome corona viruses
MOH	-	Ministry of Health
MOIPC	-	medical officer infection prevention and control
MRSA	-	methicillin resistant *Staphylococcus aureus*
MSDS	-	material safety data sheet
NICU	-	neonatal intensive care unit
NPTCCD	-	National Programme for Tuberculosis and Chest Diseases
OPA	-	orthopthalaldehyde
OR	-	operating room
OT	-	operating theatre
PBU	-	premature baby unit
PE	-	protective environment isolation rooms
PHI	-	public health inspector
PICC	-	peripherally inserted central catheters
PM	-	post-mortem
PPE	-	personal protective equipment
PTB	-	pulmonary tuberculosis
PVC	-	peripheral venous cannula
PVD	-	peripheral vascular disease
SARS	-	severe acute respiratory syndrome
SCBU	-	special care baby unit
SOP	-	standard operating procedures
SSI	-	surgical-site infection
TB	-	tuberculosis
TSE	-	transmissible spongiform encephalopathy
VAP	-	ventilator associated pneumonia
VHF	-	viral haemorrhagic fever
VRE	-	vancomycin resistant enterococcus
VZIG	-	varicella zoster immunoglobulin
VZV	-	varicella zoster virus
WHO	-	World Health Organization

CHAPTER 1

INTRODUCTION

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1.1 Healthcare-associated infections

Healthcare-associated infections (HAI) are infections occurring in patients undergoing care in a health care facility which were not present or incubating at the time of admission. HAI also includes occupational infections in staff. Previous terms include "nosocomial" and "hospital-acquired" infection, but with health care delivery taking place in many other settings, the term "healthcare-associated" infection is preferred. Catheter-associated urinary tract infections (CAUTI), catheter-related bloodstream infection (CRBSI), surgical site infection (SSI) and ventilator-associated pneumonia (VAP) constitute the bulk of HAI.

HAI affect 5-15% of people seeking healthcare and result in hundreds of millions of preventable infections globally. In fact, HAI are considered the most frequent adverse event of healthcare delivery. HAI risk due to poor quality health care is much higher in middle income countries such as Sri Lanka, and the effects of HAI are higher but as surveillance is not well established, the true extent of the problem is unknown. It is likely that published data grossly underestimate the problem and that HAI constitute a hidden, severe drain on public funds.

HEALTHCARE EXPOSES PATIENTS TO THE RISK OF INFECTION

HAI cause increased morbidity, mortality and chronic disability, contributing to loss of productivity and low quality of life. Since HAI are often caused by antimicrobial resistant microorganisms such as methicillin resistant *Staphylococcus aureus* (MRSA), glycopeptide resistant *Enterococcus* (GRE) and extended-spectrum beta-lactamase (ESBL) or carbapenemase-producing *Enterobacteriaceae* (CPE), they are difficult and expensive to treat. Prolonged hospital stays and additional investigations and interventions add to the cost to patients, their families and the health system.

HAI may be transmitted from health care workers (HCW) to patients, from patient to patient and from patient to HCW. An important route of transmission of HAI is by direct contact from the hands of HCW. HAI may also be transmitted by droplets and through the air and dust. Less commonly HAI are transmitted by food or water or contaminated intravenous (IV) fluids or solutions. The hospitalized patient's normal defenses of the skin and mucous membranes are often compromised by invasive procedures. HAI are especially common in units with seriously ill patients, such as intensive care units but are found in every type of wards and health care settings.

1.2 Infection prevention and control

The incidence of HAI can be reduced considerably by good infection prevention and control (IPC) practices. IPC is a series of procedures and guidelines to prevent and control HAI and should be applied in all settings where healthcare is provided. Unfortunately, IPC practices in the developing world are well below the required standards. Many institutions and healthcare practitioners condone this level of IPC, attributing it to lack of resources. Poorly designed and overcrowded health care settings, lack of basic facilities such as electricity and water and chronic understaffing undermine IPC efforts. However, measures such as an explicit institutional commitment to IPC, a written IPC policy and guidelines do not require a high investment. While some IPC strategies are expensive, many approaches such as hand hygiene and staff education and training are low cost and highly effective.

INFECTION PREVENTION AND CONTROL GUIDELINES AND POLICIES SHOULD BE FOLLOWED BY ALL HEALTHCARE WORKERS IN ALL PATIENTS AT ALL TIMES

Staff compliance with existing guidelines, especially with regard to hand hygiene, is notoriously poor. It is high time that IPC is strengthened by capacity building of healthcare workers using practical, hands-on training embedded within their formal training. WHO guidelines on core components of IPC programmes were published in 2016. Long term behavioural change, increased staff accountability and actual implementation of the recommendations listed in guidelines and manuals are essential to make a difference.

Systematic surveillance and research is required to establish baseline rates of infection and to evaluate the effectiveness, including cost effectiveness and feasibility of IPC interventions. Innovative solutions for local constraints should be encouraged but should be validated by well-designed studies.

Improved IPC will contribute to fulfill one of the United Nations sustainable development goals (SDG) i.e. safe, effective and high quality health service delivery in the context of universal health coverage.

1.3 Scope of this manual

Infection control is now a key performance indicator used to assess the quality of healthcare in Sri Lanka. This manual has been developed as a comprehensive resource on the policies, guidelines and protocols that should be adopted, in both the state and private sector healthcare institutes, to ensure effective IPC. The recommendations in this manual are based on international published best practices, adapted to the local context. The intended users include hospital administrators, doctors, infection prevention and control and other nurses, all other healthcare staff, medical students and students following allied healthcare courses.

The prevention and control of HAI is a compulsory duty of all healthcare workers and requires the co-operation of every healthcare provider. The objective of this manual is to provide guidance to healthcare practitioners on standardized IPC procedures they can adopt

in their day-to-day work and make available evidence-based principles and practices to guide administrators to develop, implement, monitor and evaluate systematic programmes to reduce the risk of HAI in their institutions. This is a useful resource in training and education. This can be used to develop tools to operationalize IPC and draw up criteria for certification and accreditation. The references provide a valuable source for more detailed information.

Effective use of this manual is contingent on support from the administration (including adequate staffing, provision of required resources, fostering of an organizational safety culture, active surveillance of HAI, continuous monitoring of adherence to the recommended infection control practices and investment in education and training) and the commitment of the individual healthcare worker.

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CHAPTER 2

ORGANIZATION OF INFECTION PREVENTION AND CONTROL IN HOSPITALS

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Introduction

The organization of infection control in a hospital is very important for successful implementation of an infection prevention and control (IPC) programme. A three-tiered organization consisting of infection prevention and control committee (IPC committee), infection prevention and control team (IPC team) and infection prevention and control practitioners would be one way of establishing a structure for planning, implementation and effective communication in a hospital.

The National Advisory Committee on Infection Prevention and Control (expert committee on infection prevention and control) has to be in place at the Health Ministry level with the participation of all stakeholders in order to strengthen the process of IPC island wide.

For the implementation of infection prevention and control activities at individual hospitals, IPC committee, IPC team, infection prevention and control nursing officers (ICNO) and infection prevention and control medical officers (MOIPC) have a major role to play. In addition to implementing basic measures for IPC, healthcare facilities should prioritize their IPC needs and design programmes accordingly.

2.1. Infection prevention and control committee (IPC committee)

An IPC committee provides a forum for multidisciplinary input and cooperation, and information sharing. This committee should include wide representation from relevant departments: e.g. management, representatives from consultants, other healthcare workers, clinical microbiology, pharmacy, sterilizing service, maintenance, housekeeping and training services. The IPC committee should not be too large as this will be ineffective, nor should it be too small and non-representative as many issues relevant for effective IPC will not be addressed. The committee must have a reporting relationship directly to administration healthcare staff to promote programme visibility and effectiveness. In an emergency (such as an outbreak), this committee must be able to meet promptly.

2.1.1. Composition of IPC committee

A possible composition for the IPC committee is given below but amendments to this could be made to suit the local requirements.

- Medical director or administrative head of the institution
- Consultant microbiologist/virologist
- Medical officer infection prevention and control (MOIPC)
- Infection prevention and control nursing officer/s (ICNO)
- One consultant representing each of the major clinical disciplines (medicine, surgery, paediatrics, obstetrics and gynaecology etc.)
- Administrative officer (AO)
- Accountant

- Medical officer in charge of the outpatient department (OPD)
- Matron or representative
- Senior nursing officer (e.g. sister, nurse-in-charge) from each of the main sections of the hospital
- Public health inspector (PHI)
- Occupational health nurse (if any)
- Health education staff
- Overseer
- Hospital engineer
- Pharmacist
- Supervisor of the cleaning service
- Invite any other (e.g. regional epidemiologist, supervisor of kitchen staff etc.) as and when necessary

2.1.2. Mandate for IPC committee

- To determine IPC issues in the hospital, prioritize them and set out policies and guidelines to deal with each issue
- To enable sufficient resources to be made available for IPC activities (personnel, funds, space and infrastructure, opportunities)
- To respond to acute problems in IPC in a timely and responsible fashion
- To serve as an efficient means of communication in both directions i.e: grassroots level to top administration and the reverse and where required to the public and other interested bodies
- To ensure appropriate staff training in IPC and safety management
- To review and approve a yearly programme of activities for surveillance and prevention of infections
- To assess and promote improved practice at all levels of the health facility
- Monitor and evaluate the performance of the IPC programme

2.1.3. Meetings of IPC committee

- The IPC committee should appoint a chairperson who is responsible for setting the agenda and chairing the meetings
    - organizing IPC meetings
    - ensuring minutes are circulated in time

      The chairperson could be the consultant microbiologist or the administrative head of the hospital.
- The IPC committee should appoint a secretary who will organize meetings, prepare and circulate the minutes and inform all members regarding meetings. The secretary is usually an ICNO
- The minutes should include decisions, recommendations, assignments, actions and approvals
- Meetings should be held at least every three months
- The agenda should be circulated beforehand
- It is best if persons responsible for specific items/tasks prepare a short report on current status so that the discussion could be focused

- Items on the agenda could include,
  - Specific policies and guidelines and their implementation
  - Surveillance data (MRSA, HAI etc)
  - Audits of IPC practices
  - Planning of training programs
  - Infrastructure requirements for IPC
  - Specific IPC issues which may have arisen in the previous month
- It is important that the IPC committee meeting does not become a place where complaints are expressed by everyone with no plan of action to deal with them. It may be useful to have an initial 'brain-storming' meeting where all IPC concerns are brought up and written down. These can then be prioritized and dealt with over a period of time
- Responsibility must be given to a specified person for each decision taken during the meeting. The IPC team (see below) would be the main executors of decisions

2.1.4. Duties and responsibilities of IPC committee

- The IPC committee has 2 major responsibilities
  1. Setting up IPC in the hospital which will include developing a long-term strategy as well as timely and effective action for acute problems such as outbreaks
  2. Ensuring that the required infrastructure, including personnel and funding is made available for IPC activities within the hospital

2.1.5. Annual report of IPC committee

Prepare an annual report of the year's activities outlining the following:

- Members of committee
- Actions planned for the year (infrastructure, training, policies and guidelines, audits and surveillance and any other)
- Activities carried out during the year such as
  - Infrastructure development
  - Training programmes conducted
  - Policies and guidelines which have been implemented
  - Audits and surveillances undertaken
  - Specific IPC problems and their resolutions
- Planned activities which could not be completed
- A brief summary of sums spent in the year
- Funding requirements for the forthcoming year

2.2 Infection prevention and control team (IPC team)

2.2.1. Composition of IPC team

- Consultant microbiologist/virologist
- Medical officer infection prevention and control (MOIPC)
- Infection control nursing officer/s (ICNO)

2.2.2. Mandate of IPC team

- The IPC team is the executor arm of the IPC committee and is responsible for the day to day activities of IPC in the hospital as well as preparing the yearly work plan for review by the IPC committee and administration

- The main areas of work of the IPC team would include the following:
  - Planning and carrying out training activities
  - Surveillance and audits
  - Regular visits to all wards and units for liaison and attending to IPC related problems
  - Carry out the programme set out by the IPC committee
  - Monitor and manage incidents related to IPC (e.g. outbreaks, sharp injuries)

2.2.3. Meetings of IPC team

Ideally the ICNO and MOIPC should meet the microbiologist daily (briefly at least for 15 minutes) to plan the day and be informed about what is going on in the hospital. A longer once a week meeting of the IPC team would be useful in ensuring that the work is on the track and that problems are addressed appropriately. Reports which need to be prepared for the IPC committee meeting could be discussed at these meetings.

2.3. Duties and responsibilities of personnel

2.3.1 Lines of authority

It is important to identify the proper line of authority. Technical /functional head of the IPC team will be the consultant microbiologist and the team will work under the guidance of the microbiologist. The administrative head should ensure that only IPC activities are allocated to ICNO and MOIPC. Any deviation from this must have the authorization of the IPC committee.

2.3.2. Duties and responsibilities of MOIPC

- Work under the supervision and guidance of a consultant microbiologist and in the absence of a consultant microbiologist, the MOIPC should be linked with an offsite consultant microbiologist to obtain advice where required
- Work with the ICNO and as part of IPC team to develop and improve IPC policies. Having gained the approval of the IPC committee for such policies and in conjunction with the administrative head of the institution, arrange for implementation of the said policies
- Implement surveillance and audit with ICNO
- Visit patients/wards (with the ICNO) when required for IPC purposes
- Liaise with clinical staff and public health officials on matters relating to IPC activities in hospital
- Consult the laboratory staff when necessary and be responsible for arranging collection and transport of specimens required for IPC activities
- Assist in setting up and maintaining a database required for IPC purposes
- Assist the authorities in all matters relating to control of outbreaks within the hospital
- Initiate and participate in teaching/training activities relating to infections/ IPC
- When appropriate, be a participant in an “on call” rota for IPC activities

2.3.3. Duties and responsibilities of ICNO

- Engage in training (formal and informal)
- Implement protocols and guidelines
- Implement surveillance and audit
- Carry out trouble shooting on a daily basis
- Communicate to IPC team and IPC committee of IPC problems at ground level
- Assist in matters relating to control of outbreaks within the hospital

2.4 Training and education

- All medical officers designated and appointed as MOIPC should be given a basic 2-week course on infection prevention and control within 6 months of appointment
- All nursing officers designated and appointed as ICNO should be given a basic 2-week course on infection control within 6 months of appointment
- In addition to the basic training programme, they should attend annual training programmes

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CHAPTER 3

RISK ASSESSMENT IN INFECTION PREVENTION AND CONTROL

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RISK ASSESSMENT IN INFECTION PREVENTION AND CONTROL

Introduction

Risk assessment describes the overall process or method used to:

- Identify hazards and risk factors that have the potential to cause harm (hazard identification)
- Analyze and evaluate the risk associated with that hazard (risk analysis and risk evaluation)
- Determine the effective ways of risk communication, the appropriate ways to eliminate the hazard, or control the risk when the hazard cannot be eliminated (risk control)
- Establish a monitoring system

3.1. Importance of risk assessment

- Create awareness of hazards and risks
- Identify who may be at risk (e.g., patients, employees, cleaners, visitors, contractors, the public etc.)
- Determine whether a control program is required for a particular hazard
- Determine if existing control measures are adequate or if more should be done
- Prevent injuries or illnesses, especially when done at the design or planning stage
- Prioritize hazards and control measures
- Meet legal requirements where applicable

3.2. Instances when risk assessment should be done

There may be many reasons a risk assessment is needed, including:

- Before new processes or activities are introduced
- Before changes are introduced to existing processes or activities, or when new information is available concerning hazards
- When hazards are identified

3.3. Steps of risk assessment

It is done in 6 sequential steps

Step 1: Identify the hazards (What can go wrong?)

The overall goal is to find and record possible hazards that may be present in the healthcare setting. Hazard identification should be an integral part of workplace culture, involving everyone.

- Consider all aspects of the work including non-routine activities such as maintenance or repair

- Inspect the way the work is organized or done (include experience of people doing the work, systems being used etc.)
- Examine the risks to patients, staff, visitors, the public and the environment
- Consider the groups of people that may have a different level of risk such as young or inexperienced workers, persons with immune deficiency and pregnant mothers
- Map or describe the activity to be assessed

Step 2: Decide who might be harmed and how (Who is exposed to the hazard?)

For each hazard, it is important to assess who might be harmed (e.g. HCW, patient, visitor etc.). Also, in each case, it is necessary to identify how they might be harmed (e.g. potential for droplet/airborne/contact transmission etc.).

- Consider the number of individuals that might be affected over a stated period of time
- The most vulnerable individuals are more likely to suffer harm (e.g. inexperienced workers, persons with immune deficiency and pregnant mothers)

Step 3: Evaluate the risks (how bad the consequences of exposure are (severity) and how often would one get exposed (likelihood)?)

This involves

- Evaluation of the probability or likelihood of an exposure/injury
- Assessment of the severity of consequences of the exposure/ injury

The following tables describe how to evaluate the risks.

Table1: Qualitative measures of likelihood of exposure to a hazard

Level	Descriptor	Example description
5	Almost certain	Is expected to occur in most circumstances
4	Likely	Will probably occur in most circumstances
3	Possible	Possible to occur at sometime
2	Unlikely	Could occur at sometime
1	Rare	May occur only in exceptional circumstances

Table 2: Qualitative measures of consequence or impact after exposure to a hazard

Level	Descriptor	Example description
1	Insignificant	Insignificant impact
2	Minor	Minor impact
3	Moderate	Moderate impact
4	Major	Major impact
5	Catastrophic	Very high impact leading to loss of life

Table 3: Risk matrix

Likelihood	Consequences				
	1. Insignificant	**2. Minor**	**3. Moderate**	**4. Major**	**5. Catastrophic**
5. Almost certain	Moderate	High	Very high		Very high
4. Likely	Moderate	High	High	Very high	Very high
3. Possible	Low	Moderate	High	Very high	Very high
2. Unlikely	Low	Low	Moderate	High	Very high
1.Rare	Low	Low	Low	High	High

The priority for risk management should be based on the assessment as given above.

- **Low risk (green)** – Quick, easy measures implemented immediately and further action planned for when resources permit
- **Moderate risk (yellow)** – Actions implemented as soon as possible, but no later than a year
- **High risk (orange)** – Actions implemented as soon as possible and no later than six months
- **Very High risk (red)** – Requires urgent action. The corrective action should be implemented immediately

Step 4: Identify risk control measures

- Decide on the precautions (controls) that will most effectively eliminate or control the risk factors or exposure to hazards
- A combination of all risk control measures should be considered when implementing risk management. These risk control measures are:
  1. Elimination of a hazard or risk (e.g. eliminate potential exposure by not using needles)
  2. Substitution - Using safety devices (e.g. safety cannulae)
  3. Engineering controls (e.g. partitioning, isolation units, negative pressure rooms, bio-safety cabinets)
  4. Administrative controls (e.g. legislations/policies/protocols/guidelines/SOPs on various infection control practices and procedures such as promoting hand hygiene, training, vaccination, cough etiquette)
  5. Implement infection prevention and control practices
  6. Personal protective equipment - the last line of defence for healthcare workers against hazards related to infectious agents that cannot otherwise be eliminated or controlled (e.g. masks, eye protection. gloves, gowns, N95 respirators)

Step 5: Record your findings, proposed action, date of implementation and identify who will lead on what action

- This includes documenting the process and results of the assessment and sharing with relevant staff members

Step 6: Review your assessment and update if necessary

- It is essential to be sure that any changes in the workplace have not introduced new hazards or changed hazards
- Review the risk assessment:
  1. when a change has been planned
  2. routinely at least on an annual basis
  3. when there has been a significant change

3.4. Monitoring (performance measures)

There are two types of performance indicators

1. Process based indicators

These include the indicators which assess the processes/ practices/ measures which had been implemented to reduce the risk in the health care facility (e.g. availability of written policies, SOPs, training programmes, occupational health) or indicators that monitor the present state of health care facility (e.g. percentage who receive particular training, percentage who follow five moments for hand hygiene in a unit)

2. Outcome based indicators

These indicators assess the outcome of risk mitigation measures i.e. if processes or risk mitigation measures have actually led to improvement (e.g. SSI rate, mortality rate due to VAP) - Refer Annexure 3.1

3.5. Uncertainty

In situations where there is uncertainty regarding a risk, relevant authorities should take a cautious approach and, initially put in place the highest control measures reasonable in the circumstances. As more information is gathered about the risk and scientific uncertainty is no longer a concern, these measures can be scaled back if necessary.

3.6. Worker Education and Training

All health care facilities are required to develop, establish and provide the necessary training and education for all healthcare workers regarding health and safety to reduce the risks in the workplace.

References

- A step by step guide to COSHH assessment:2nd Edn; Published by the Health and Safety Executive. ISBN 978 0 7176 2785.
- Occupational Safety and Health, 2017. Answers Fact Sheets; Canadian Center for Occupational Health and Safety; Document last updated on February 15, 2017. Available at https://www.ccohs.ca/oshanswers/hsprograms/risk_assessment.html
- Ontario Health Care Health and Safety Committee, 2011.- Guidance Note for Workplace Parties # 5 Application of Hazard Control Principles, including the Precautionary Principle to Infectious Agents.
- World Health Organization, 2004. Practical guidelines for infection control in health care facilities.

Annexure 3.1

Infection control - Risk assessment and prioritization worksheet (an example)

Event / Conditions and Problems	What is the potential impact of this condition/problem on patients, staff, and visitors?				What is the probability of this condition/problem impacting patients and staff?				What is your organization's preparedness to deal with this condition / problem?				Numerical risk level
	High (3)	Med (2)	Low (1)	None (0)	High (3)	Med (2)	Low (1)	None (0)	None (3)	Poor (2)	Fair (1)	Good (0)	Total
POTENTIAL INFECTION:													
Surgical Site Infection													
VAP													
CRBSI													
CAUTI													
MRSA (hospital acquired)													
EMPLOYEES:													
Poor Hand Hygiene Compliance													

Risk Assessment Grid

Event	Probability of Event Occurrence				Potential Severity/Risk Level of Failure				Organizational Response				Current State of Preparedness			Risk Level For Org
Emergency preparedness	H 3	M 2	L 1	N 0	Lite Threatening 3	Permanent Harm 2	Temp Harm 1	Non 0	H 3	M 2	L 1	N 0	P 3	F 2	G 1	
Water Supply Unavailable		X					X		X					X		8
Patient Care Supplies Unavailable		X				X				X			X			9
Evacuation Required			X		X				X						X	8
Hi Risk Procedures and Processes	H 3	M 2	L 1	N 0	Lite Threatening 3	Permanent Harm 2	Temp Harm 1	Non 0	H 3	M 2	L 1	N 0	P 3	F 2	G 1	
Hand Hygiene Compliance>90%			X			X			X					X		8
Endoscope Contamination			X			X				X					X	6
Unauthorized Use of SUDs			X		X						X				X	6
Inadequate Cleaning/Disinfection of patient care equipment				X		X				X					X	5
Inappropriate use of Isolation		X				X				X			X			10

CHAPTER 4

STANDARD PRECAUTIONS

CHAPTER 4

STANDARD PRECAUTIONS

Standard precautions are the minimum infection prevention and control practices that apply to all patient care, which should be followed to reduce the transmission of healthcare-associated infections (HAI) in any setting where health care is delivered. These practices are designed to protect both health care worker (HCW) and prevent HCW from spreading infections among patients.

They should be used by **ALL** health care workers at **ALL** times when attending to **ALL** patients, regardless of suspected or confirmed infection status of the patient.
Standard precautions apply to blood, all body fluids, secretions and excretions (except sweat), non-intact skin and mucous membranes. Body fluids include CSF, pleural fluid, peritoneal fluid and amniotic fluid. Secretions include nasal secretions, sputum, tears and saliva. Excretions include faeces, urine and vomitus.

Education and training are critical elements of standard precautions because they help HCW to make appropriate decisions and comply with recommended practices.

Standard precautions include:

1. Hand hygiene
2. Personal protective equipment
3. Respiratory hygiene/cough etiquette
4. Sharps safety and safe injection practices
5. Cleaning, disinfection and sterilization of instruments and equipment
6. Environmental cleaning and disinfection
7. Linen management
8. Waste management

Following sections describe the components of standard precautions.

4.1 HAND HYGIENE

Introduction

Hand hygiene is the most effective measure to prevent healthcare associated infections (HAI) as transmission of pathogens mainly occurs via health care workers' hands.

Any person involved in patient care needs to be concerned about hand hygiene to:

- protect the patient from pathogens carried on their hands
- protect themselves from pathogens
- protect the health-care environment from pathogens

4.1.1World Health Organization (WHO) "Five moments for hand hygiene"

This should be practiced within the patient zone.

Patient zone - the patient and his/her immediate surroundings

Patient - any part of the patient, their clothes, or any medical device that is directly connected to the patient.

Patient surroundings -the bed rails, bedside table, bed linen, infusion tubing and other medical equipment, frequently touched surfaces such as monitors, knobs, buttons and bed head ticket of the patient.

Figure 1. Five moments for hand hygiene (WHO 2009)

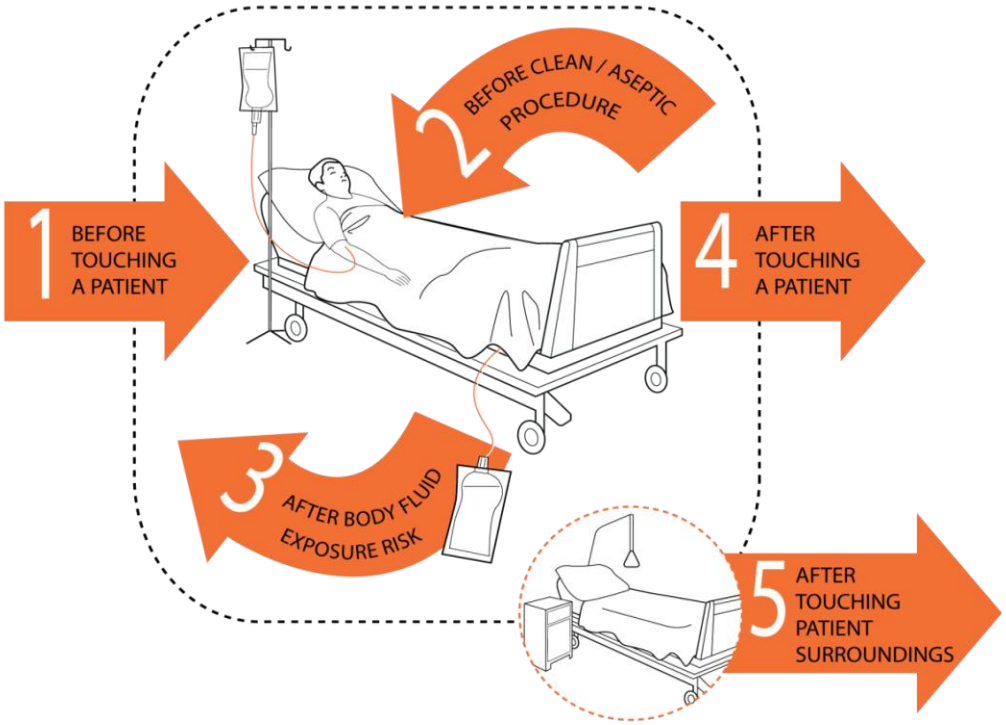


Table 1. Five moments for hand hygiene: explanation

Moment	Examples of care situations when the moment occurs	WHO recommendation	Comments
1. Before touching a patient	Shaking hands, helping a patient to move around, taking pulse, blood pressure etc.	Before touching patients	
2. Before clean/aseptic procedure	Oral/dental care, wound dressing, subcutaneous injection; catheter insertion, preparation of food and medication etc.	Before handling an invasive device for patient care, regardless of whether gloves are used or not If moving from a contaminated body site to a clean body site during patient care	This concept was enlarged to cover all transfers of microorganisms to vulnerable body sites potentially resulting in infection
3. After body fluid exposure risk	Oral/dental care, secretion aspiration; subcutaneous injection; drawing and manipulation of any fluid sample, opening draining system, handling excreta and waste, cleaning of contaminated and visibly soiled material or areas (lavatories, medical instruments) etc.	After removing gloves After contact with body fluids or excretions, mucous membranes, non-intact skin, or wound dressings If moving from a contaminated body site to a clean body site during patient care	This risk was generalized to include all tasks that can potentially result in hand exposure to body fluids. A paradox of body fluid exposure was resolved by including the notion of exposure risk instead of actual exposure.
4. After touching a patient	Shaking hands, helping a patient to move around or getting washed, taking pulse, taking blood pressure etc.	After touching a patient	
5. After touching patient surroundings	Changing bed linen, infusion speed adjustment, after touching monitors, holding a bed rail, clearing the bedside table etc.	After contact with inanimate objects (including medical equipment) in the immediate vicinity of the patient	Retained to cover all situations where the patient's immediate and potentially contaminated environment is touched but not the patient

4.1.2 Hand hygiene agents

Soap and water

- Hand washing with soap and running water is essential when hands are visibly dirty or visibly soiled with body fluids
- Liquid soap is better than bar soap. However, refilling of empty containers should be discouraged
- If only bar soap is available, provide small pieces which should be just adequate for the day. Place on a clean drainable rack or soap dish so that no water is retained

Alcohol hand rub

- The preferred preparation for routine hand hygiene if hands are not visibly soiled
- Has a good immediate activity but residual activity is poor
- Does not require drying with a towel, or a designated area for hand washing
- A commercial product with adequate quality control is recommended.
- Solutions containing 75-85%(v/v) of isopropyl alcohol or ethanol are effective (Method of preparation of in-house alcohol hand rub- Refer Annexure 4.1.1)

Other agents

These agents are preferred during outbreaks of HAI.

- 4% w/v chlorhexidine gluconate (has a good residual activity)
- 7.5% povidone iodine

4.1.3 Hand hygiene technique

Nails must be clean and short. Artificial nails, jewellery and wrist watches should not be worn.

Hand washing with soap and water

- Wet hands with water and apply the soap necessary to cover all surfaces
- Vigorously rub all surfaces of lathered hands systematically covering all surfaces, especially the tips of the fingers, the thumbs and the finger webs using the technique illustrated in Annexure 4.1.2
- Rinse hands with clean, running water and dry thoroughly with a single-use towel
- Duration of the entire procedure is 40-60 seconds
- Leave adequate single - use hand towels beside the sinks
- Keep a foot-operated bin to discard towels which are then collected and sent to the laundry for washing and reuse
- Use towel to turn off tap/faucet

Hand hygiene using alcohol-based handrub

- Apply 2-3 ml/of alcohol-based handrub
- Rub hands until dry, systematically covering all surfaces as illustrated in Annexure 4.1.3
- Takes only 20–30 seconds to complete

Note:

- Gloves do not replace the need for hand hygiene
- Hand hygiene is required before putting on gloves and immediately after removing gloves
- Hand hygiene products should not be applied to gloves

4.1.4 Surgical hand preparation

Refer Chapter 7.1

4.1.5 Hand hygiene compliance audits

- Regular hand hygiene compliance audits using WHO tools should be performed quarterly with trend analysis and feedback
- Implementation of improvement of hand hygiene practices:
  The WHO recommends implementation of hand hygiene practices in healthcare setting using multi-modal strategies. The strategies are recommended to be implemented together.

Table 2. Multi-modal strategies for implementing hand hygiene practices

Multimodal strategy		**Minimum criteria for implementation**
1A	System change: alcohol-based hand rub	Bottles of alcohol-based hand rub positioned at the point of care in each ward, or given to staff
1B	System change: access to safe continuous water supply and towels	One sink at least to every 10 beds Soap and fresh towels available at every sink
2	Training and education	All staff involved in the test phase receive training during Step 3 A programme to update training over the short, medium and long-term is established
3	Observation and feedback	Two periods of observational monitoring are undertaken during Steps 2 and 4
4	Reminders in the workplace	"How to" and "5 Moments" posters are displayed in all test wards (e.g. patients' rooms, staff areas, out-patient/ambulatory departments)
5	Institutional safety climate	The chief executive, chief medical officer/medical superintendent and chief nurse all make a visible commitment to support hand hygiene improvement during Step 3 (e.g. announcements and/or formal letters to staff)

References

- Boyce, J.M. and Pittet, D., 2002. Guideline for hand hygiene in health-care settings: recommendations of the Healthcare Infection Control Practices Advisory Committee and the HICPAC/SHEA/APIC/IDSA Hand Hygiene Task Force. American journal of infection control, 30(8), pp.S1-S46.
- Safety, W.P. and World Health Organization, 2009. WHO guidelines on hand hygiene in health care (No. WHO/IER/PSP/2009/01). World Health Organization.

Annexure 4.1.1

WHO guide to local production of alcohol hand rub

Requirements for small volume production

Reagents for formulation 1	Reagents for formulation 2
• Ethanol 96% • Hydrogen peroxide 3% • Glycerol 98% • Sterile distilled or boiled cold water	• Isopropyl alcohol 99.8% • Hydrogen peroxide 3% • Glycerol 98% • Sterile distilled or boiled cold water

- 10-litre glass or plastic bottles with screw-threaded stoppers or 50-litre plastic tanks (preferably in polypropylene or high-density polyethylene, translucent so as to see the liquid level) or stainless steel tanks with a capacity of 80–100 litres (for mixing without overflowing)
- Wooden, plastic or metal paddles for mixing
- Measuring cylinders and measuring jugs
- Plastic or metal funnel
- 100 ml plastic bottles with leak-proof tops
- 500 ml glass or plastic bottles with screw tops
- An alcoholmeter: the temperature scale at the bottom and the ethanol concentration (percentage v/v) at the top

Note:

- Glycerol: used as humectant (emollient), but other emollients may be used for skin care, provided they are cheap, widely available and miscible in water and alcohol and do not add to toxicity or promote allergy
- Hydrogen peroxide: used to inactivate contaminating bacterial spores in the solution and is not an active substance for hand antisepsis
- Any further additive to both formulations should be clearly labelled and be non-toxic in case of accidental ingestion
- A colorant may be added to allow differentiation from other fluids, but should not add to toxicity, promote allergy, or interfere with antimicrobial properties. The addition of perfumes or dyes are not recommended due to risk of allergic reactions

10-Litre preparations

These can be prepared in 10-litre glass or plastic bottles with screw-threaded stoppers.
Recommended amounts of products:

Formulation 1	Formulation 2
• Ethanol 96%: 8333 ml • Hydrogen peroxide 3%: 417 ml • Glycerol 98%: 145 ml	• Isopropyl alcohol 99.8%: 7515 ml • Hydrogen peroxide 3%: 417 ml • Glycerol 98%: 145 ml

Step by step preparation

1. The alcohol for the formula to be used is poured into the large bottle or tank up to the graduated mark
2. Hydrogen peroxide is added using a measuring cylinder
3. Glycerol is added using a measuring cylinder. As glycerol is very viscous and sticks to the wall of the measuring cylinder, it should be rinsed with some sterile distilled or cold boiled water and then emptied into the bottle/tank
4. The bottle/tank is then topped up to the 10-litre mark with sterile distilled or cold boiled water
5. The lid or the screw cap is placed on the tank/bottle as soon as possible after preparation, in order to prevent evaporation
6. The solution is mixed by shaking gently where appropriate or by using a paddle
7. Immediately divide up the solution into its final containers (e.g. 500 ml or 100 ml plastic bottles), and place the bottles in quarantine for 72 hours before use. This allows time for any spores present in the alcohol or the new/re-used bottles to be destroyed

Final products

Formulation 1	**Formulation 2**
Final concentrations: • Ethanol 80% (v/v) • Glycerol 1.45% (v/v) • Hydrogen peroxide 0.125% (v/v)	Final concentrations: • Isopropyl alcohol 75% (v/v) • Glycerol 1.45% (v/v) • Hydrogen peroxide 0.125% (v/v)

Quality control

1. Pre-production analysis should be made every time an analysis certificate is not available to guarantee the titration of alcohol (i.e. local production). Verify the alcohol concentration with the alcoholmeter and make the necessary adjustments in volume in the preparation formulation to obtain the final recommended concentration
2. Post-production analysis is mandatory if either ethanol or an isopropanol solution is used. Use the alcoholmeter to control the alcohol concentration of the final solution. The accepted limits should be fixed to ± 5% of the target concentration (75%–85% for ethanol)
3. The alcoholmeter shown in this information pamphlet is for use with ethanol; if used to control an isopropanol solution, a 75% solution will show 77% (± 1%) on the scale at 25 °C

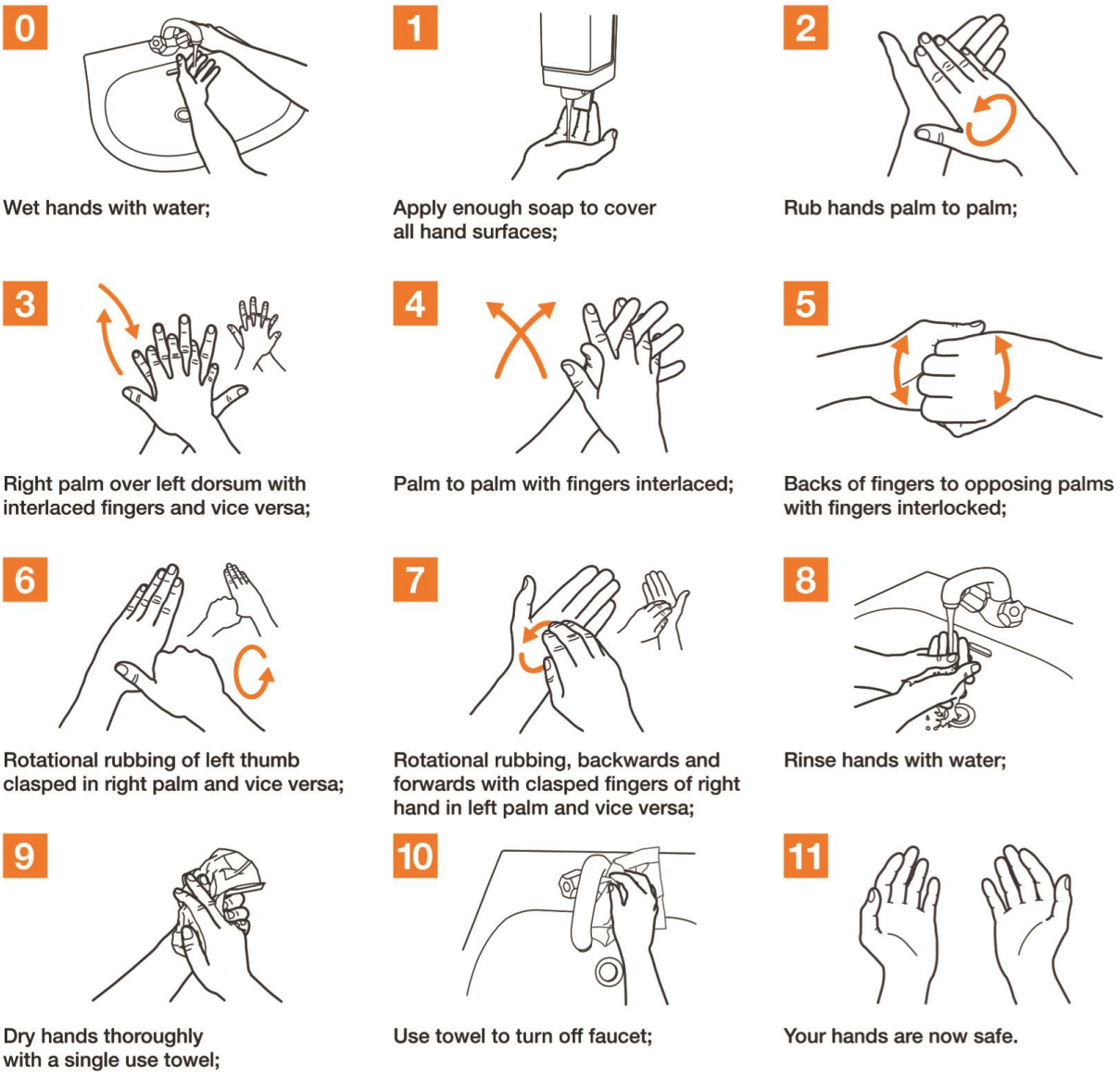
Annexure 4.1.2

Hand washing technique poster (WHO)

How to Handwash?

WASH HANDS WHEN VISIBLY SOILED! OTHERWISE, USE HANDRUB

Duration of the entire procedure: **40-60 seconds**



Annexure 4.1.3

Hand rubbing technique poster (WHO)

4.2 PERSONAL PROTECTIVE EQUIPMENT

Introduction

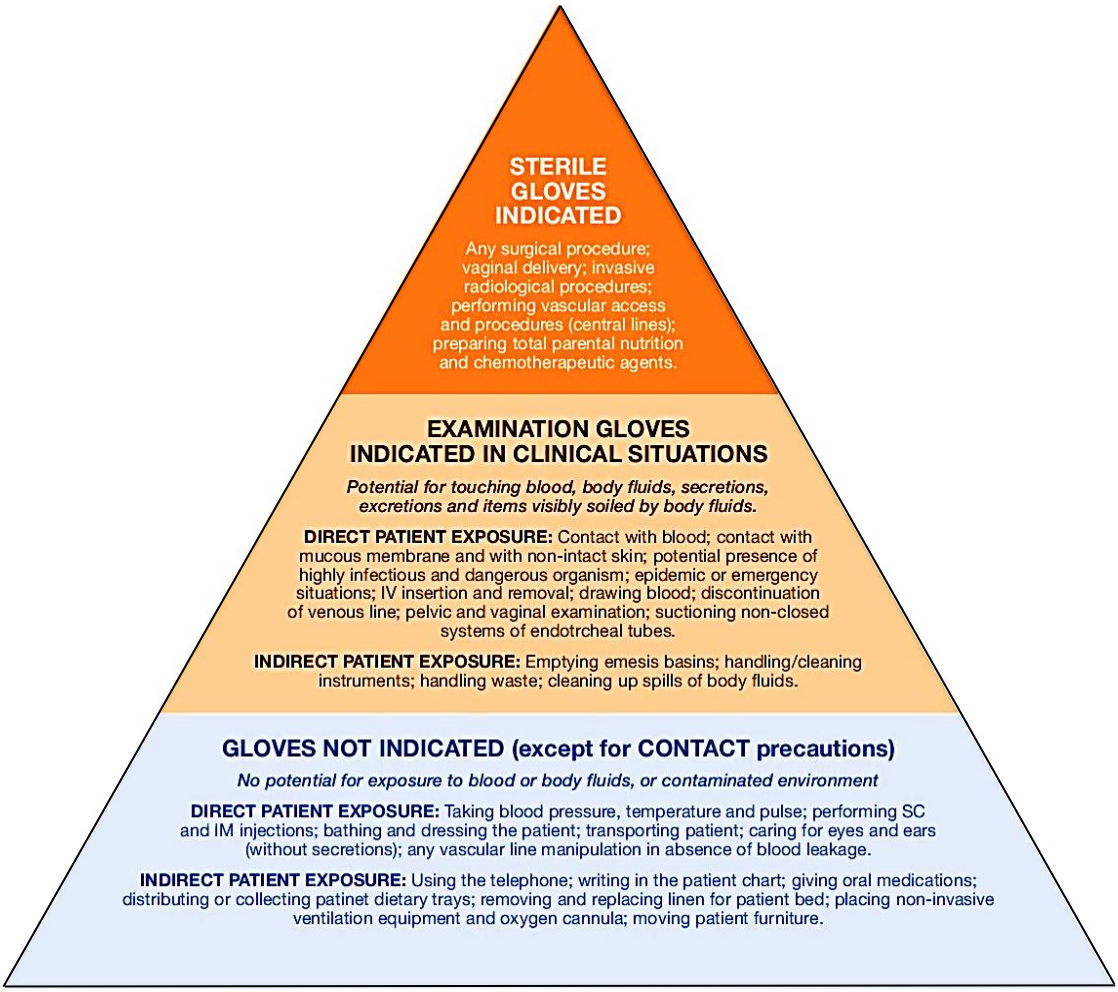
Personal protective equipment (PPE) refers to a variety of barriers used alone or in combination to protect mucous membranes, airways, skin and clothing from contact with infectious agents. When indicated, PPE should be selected rationally and appropriately based on the anticipated risk of exposure. It is necessary to provide appropriate types, sizes and styles of protective equipment. Each institution should have a regular risk assessment for every health care procedure *(Refer Chapter 3).*

4.2.1Primary uses and methods for selecting PPE

4.2.1.1 Gloves

- Gloves are used to prevent contamination of hands of healthcare workers (HCW) when
  - anticipating direct contact with mucous membranes, non-intact skin, blood or body fluids and other potentially infectious material
  - having direct contact with patients who are colonized or infected with pathogens transmitted by contact
  - handling or touching visibly or potentially contaminated patient care equipment and environmental surfaces
- Gloves can protect both patients and HCW from exposure to infectious material that may be carried on hands. Sterile gloves should be used for aseptic procedures and clean gloves for non-sterile procedures
- Gloves manufactured for healthcare purposes are subjected to Food and Drug Administration (FDA) evaluation and clearance. Non-sterile disposable medical gloves made of a variety of materials (e.g. latex, vinyl, nitrile) are available for routine patient care. Latex or nitrile gloves are preferable for clinical procedures that require manual dexterity and/or more than brief patient contact
- It is necessary to stock gloves in several sizes
- The selection of gloves is based on
  - Task that is to be performed (e.g. sterile or non-sterile procedure)
  - Size
  - Anticipated contact with chemicals and chemotherapeutic agents
  - Latex sensitivity
- Avoid unnecessary touching with contaminated gloves to prevent contamination of surfaces such as light switches, door and cabinet knobs, computer keyboards
- Change gloves during the care of a single patient to prevent cross-contamination of body sites
- Changing gloves between patients is necessary to prevent transmission of infectious material
- Gloves that fit tightly around the wrist are preferred for use with an isolation gown because they will cover the gown cuff and provide a more reliable continuous barrier
- Hand hygiene following glove removal further ensures that the hands will not carry potentially infectious material that might have penetrated through unrecognized tears or that could contaminate the hands during glove removal

Figure 1. The Glove Pyramid- WHO



4.2.1.2 Gowns

- Gowns are used
  - to protect the HCW's arms and exposed body areas and prevent contamination of clothing with blood, body fluids and other potentially infectious material
  - upon entering a room of a patient on contact precautions to prevent unintentional contact with contaminated environmental surfaces
- The need for and type of gown selected is based on
  - nature of the patient interaction
  - anticipated degree of contact with infectious material
  - potential for blood and body fluid penetration of the barrier (degree of fluid resistance)
  - whether they need to be reused or disposed
- The routine donning of gowns upon entry into an intensive care unit or other high-risk area does not prevent or influence potential colonization or infection of patients in those areas
- Full coverage of the arms and body from neck to the mid-thigh or below will ensure that clothing and body areas are protected
- Gowns should be removed before leaving the patient care area

4.2.1.3 Face masks and respirators

- Masks are used for three primary purposes in healthcare settings
  - To protect HCW from contact with infectious materials e.g. respiratory secretions, sprays of blood or body fluids
  - To protect patients from exposure to infectious agents carried in a HCW's mouth or nose
  - To limit potential dissemination of infectious respiratory secretions from a patient to the others
- Two types of masks are commonly available for use in healthcare settings
  - Medical/surgical masks
  - Respirators

Medical / Surgical masks

- Medical/Surgical masks are fluid resistant, disposable devices which provide barrier protection against large respiratory droplets and do not effectively filter inhaled small respiratory particles, fumes, or vapours
- Masks are worn for protection of healthy persons (worn to protect oneself when in contact with infected individual) or for source control (worn by an infected individual to prevent transmission to others) or both.
- Made up of a minimum of three layers of synthetic nonwoven material, with a filtration layer sandwiched in the middle (3 – ply masks). It is available in different thicknesses and has various levels of fluid resistance
- These should be of recommended standards (ASTM F2100, EN 14683, or equivalent)
- The medical / surgical mask should cover the nose, mouth and chin properly
- It is not intended to be used more than once
- It should be changed when wet, soiled, or damaged
- The medical /surgical mask should not be touched to adjust it or displaced from the face for any reason; if this happens, the mask should be safely removed and replaced
- It should be discarded and changed after caring for any patient on contact/droplet precautions
- Safely discard the mask, into an infectious waste bin. Wash hands after handling the used mask

Respirators

- This is designed to achieve a very close facial fit and to have an efficient filtration of airborne contaminants such as dusts, fumes, vapours, and infectious agents associated with inhaling small and large respiratory droplets
- These are designed to form a seal around nose and mouth. Masks come in various shapes (e.g. molded and non-molded), sizes, and filtration efficiency. Respirators with two pre – attached elasticated straps which are ultrasonically boned to the masks are recommended. Different sizes of masks are required to meet the needs of individual HCW. Therefore, fit testing needs to be done prior to use
- It should be worn in settings where aerosol generating procedures are performed.
- These are certified by the Centers for Disease Control and Prevention (CDC)/ National Institute for Occupational safety and Health (NIOSH), USA or quality compliant with

standards for particulate respirators e.g. NIOSH N 95,EN 149FFP2, or equivalent. They are tested for fluid resistance, filtration efficiency, flammability, and biocompatibility

- They should not be shared
- Available at different performance levels such as FFP2, FFP3 (FFP- Filtering Facepiece), N95, N99. Surgical N95 respirators are commonly used in healthcare settings and it is a subset of N95 Filtering Facepiece Respirators (FFR)
- People with medical conditions that make breathing difficult should seek medical advice before using them
- These are single use disposable devices. If damaged, soiled or if breathing becomes difficult, it should be removed, discarded properly and replaced with a new one

4.2.1.4 Goggles and face shields

- The eye protection chosen for specific work situations depends on the circumstances of exposure and other PPE used
- There are two types of goggles commonly used in health care settings, namely directly and indirectly vented goggles. Indirectly vented goggles provide the most reliable practical eye protection from splashes, sprays, and respiratory droplets from multiple angles to ensure a secure fit
- Personal eyeglasses are not considered as adequate eye protection
- Face shields can be used as an alternative to goggles and provide protection to other facial areas in addition to the eyes. Face shields that wrap around the sides of the face give further protection

4.2.2 Sequence of donning and doffing PPE

- There should be a guided procedure for donning and doffing of PPE to prevent contamination of skin and clothing
- Designated containers for used disposable or reusable PPE should be placed in a location that is convenient to the site of removal to facilitate disposal and containment of contaminated material
- Hand hygiene should always be performed before and after using PPE
  Refer Annexures 4.2.1 and 4.2.2

References

- Challenge, F.G.P.S., 2009. WHO guidelines on hand hygiene in health care: a summary. Geneva: World Health Organization.
- Siegel, J.D., Rhinehart, E., Jackson, M., Chiarello, L. and Health Care Infection Control Practices Advisory Committee, 2007. 2007 guideline for isolation precautions: preventing transmission of infectious agents in health care settings. American journal of infection control, 35(10), p.S65.
- World Health Organization, 2020. Advice on the use of masks in the context of COVID-19: interim guidance, 5 June 2020 (No. WHO/2019-nCov/IPC_Masks/2020.4). World Health Organization.

Annexure 4.2.1

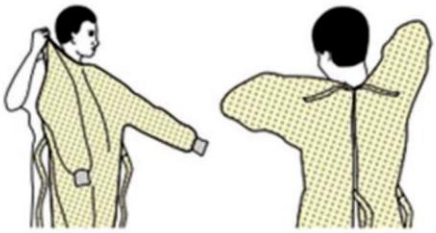
Sequence of donning PPE

SEQUENCE FOR PUTTING ON PERSONAL PROTECTIVE EQUIPMENT (PPE)

The type of PPE used will vary based on the level of precautions required, such as standard and contact, droplet or airborne infection isolation precautions. The procedure for putting on and removing PPE should be tailored to the specific type of PPE.

1. GOWN

- Fully cover torso from neck to knees, arms to end of wrists, and wrap arround the back
- Fasten in back of neck and waist



2. MASK OR RESPIRATOR

- Secure ties or elastic bands at middle of head and neck
- Fit flexible band to nose bridge
- Fit snug to face and below chin
- Fit-check respirator

3. GOGGLES OR FACE SHIELD

- Place over face and eyes and adjust to fit

4. GLOVES

- Extend to cover wrist of isolation gown

USE SAFE WORK PRACTICES TO PROTECT YOURSELF AND LIMIT THE SPREAD OF CONTAMINATION

- Keep hands away from face
- Limit surfaces touched
- Change gloves when torn or heavily contaminated
- Perform hand hygiene

CDC

Annexure 4.2.2

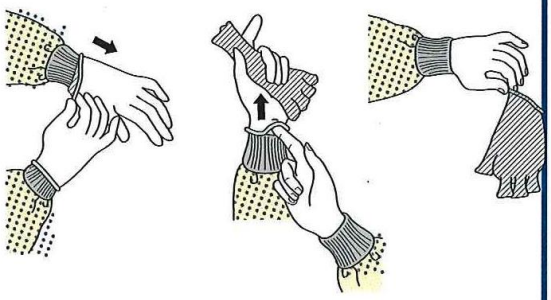
Sequence of doffing PPE

SEQUENCE FOR REMOVING PERSONAL PROTECTIVE EQUIPMENT (PPE)

Except for respirator, remove PPE at doorway or in anteroom. Remove respirator after leaving patient room and closing door.

1. GLOVES

- Outside of gloves is contaminated!
- Grasp outside of glove with opposite gloved hand; peel off
- Hold removed glove in gloved hand
- Slide fingers of ungloved hand under remaining glove at wrist
- Peel glove off over first glovet
- Discard gloves in waste container



2. GOGGLES OR FACE SHIELD

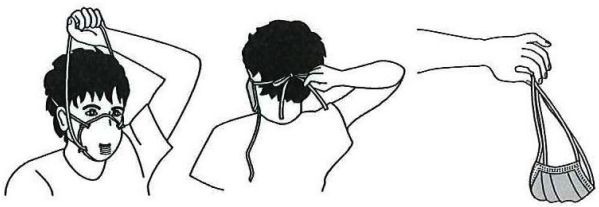
- Outside of goggles or face shield is contaminated!
- To remove, handle by head band or ear pieces
- Place in designated receptacle for reprocessing or in waste container

3. GOWN

- Gown front and sleeves are contaminated!
- Unfasten ties
- Pull away from neck and shoulders, touching inside of gown only
- Turn gown inside out
- Fold or roll into a bundle and discard

4. MASK OR RESPIRATOR

- Front of mask/respirator is contaminated — DO NOT TOUCH!
- Grasp bottom, then top ties or elastics and remove
- Discard in waste container



PERFORM HAND HYGIENE BETWEEN STEPS IF HANDS BECOME CONTAMINATED AND IMMEDIATELY AFTER REMOVING ALL PPE

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4.3 RESPIRATORY HYGIENE/COUGH ETIQUETTE

Introduction

Respiratory hygiene/cough etiquette is designed to limit the transmission of respiratory pathogens spread by droplet or airborne routes. These measures are important to prevent the transmission of all respiratory infections in healthcare settings.

The strategies target primarily patients and individuals accompanying patients to the hospital who may have undiagnosed respiratory infections but also apply to anyone including HCWs with signs and symptoms of a respiratory infection. These infection prevention and control measures should be implemented at the first point of contact with a potentially infected person.

4.3.1 Education of HCWs, patients and visitors

- Display visual alerts (e.g. posters, banners) in appropriate languages at the entrance to outpatient facilities (e.g. emergency departments, outpatient clinics) instructing patients and persons who accompany them to inform if they have symptoms of a respiratory infection when they first register
- Advise them to adhere to respiratory hygiene/cough etiquette

4.3.2 Respiratory hygiene/cough etiquette

- Cover mouth and nose with a tissue when coughing or sneezing. If tissues are not available, cover sneezes and coughs with inner side of the arm
- Use the nearest infectious waste bin to dispose of the tissue after use
- Perform hand hygiene after having contact with respiratory secretions and contaminated objects/materials
- Healthcare facilities should ensure the availability of material for adhering to respiratory hygiene/cough etiquette
    - Provide no-touch (peddle operated) bins with a lid, lined with a yellow bag for disposal of used tissue
    - Provide conveniently located hand hygiene facilities

4.3.3 Masking and separation of persons with respiratory symptoms

- During periods of increased respiratory infections in the community, advice the patients and visitors with respiratory symptoms to wear masks
- Advice to stay at least three feet away from others in common areas
- Advise HCWs to wear a medical/surgical mask for close contact with patients, in addition to other standard precautions, when examining a patient with symptoms of a respiratory infection
- These precautions should be maintained until it is determined that the cause of symptoms is not an infectious agent

Reference

- Centers for Disease Control and Prevention (CDC), 2009. Respiratory hygiene/cough etiquettein health-care settings. Available at: https://www.cdc.gov/flu/professionals/infectioncontrol/resphygiene.htm

4.4 SHARPS SAFETY AND SAFE INJECTION PRACTICES

Introduction

Occupational exposure to blood-borne pathogens from needle stick and other sharps injuries is a serious problem. Sharps injuries are primarily associated with occupational transmission of Hepatitis B virus (HBV), Hepatitis C virus (HCV), and Human immunodeficiency virus (HIV) but they have been implicated in the transmission of more than 20 other pathogens.
Sharps in health care settings are items generated in health care settings, such as used needles, syringes with needles, scalpels, blades, broken ampoules or other similar items that can puncture or cause a wound in those who handle them.

A facility's "culture of safety" is important for prevention of sharps injuries which include

- Considering sharps injury prevention as a prominent organizational priority
- Shared commitment of the management and staff to prevent sharps injuries
- Encouraging staff members to report sharps injuries promptly
- Promoting individual safety accountability

4.4.1 Activities with potential for sharps injuries

- Handling needles that need to be taken apart or manipulated after use
- Disposal of needles attached to tubing
- Manipulating the needle in the patient
- Recapping contaminated needles
- Using needles or glass equipment to transfer body fluid between containers
- Failing to dispose used needles in puncture-resistant sharps bins
- Performing procedures using sharps without proper workstations
- Bumping into another worker holding a sharp
- Passing or transferring sharps
- Decontaminating/processing of used equipment
- Injuries due to sharps left in unusual places such as laundry, mattresses, tables, trays or other surfaces

4.4.2 Prevention of sharps injuries

Role of administrators

- Eliminate the use of needle devices whenever safe and effective alternatives are available
- Provide needle devices with safety features
- Provide standard, labeled, leak-proof, puncture-resistant sharps bins
- Provide adequate quantities of necessary personal protective equipment (PPE) for HCWs
- Have a written policy and procedures for prevention of blood and body fluid exposure and handling of sharps in the institution with risk assessment of procedures
- Provide training on prevention of blood and body fluid exposure and handling of sharps
- Investigate all sharps-related injuries and take corrective and preventive actions
- Provide post-exposure medical evaluations and prophylaxis

Role of HCW

- Avoid using needles whenever safe and effective alternatives are available
- Avoid recapping or bending used needles
- Place sharps bin in areas where sharps are handled
- Promptly dispose used needle and other sharps in sharps bin
- Plan for the safe handling and disposal of needles before use
- Use PPE as recommended for the procedure based on risk assessment
- Store sharps bin out of the reach of children and pets
- Dispose sharps bin when 3/4th full
- Secure used sharp bins during transport to prevent spilling
- Follow standard precautions, infection prevention, and general hygiene practices
- Participate in blood borne pathogens training program
- Use devices with safety features provided by the institution
- Report any body fluid exposure immediately to the supervisor

4.4.3 Prevention of sharps injuries related to a procedure – safe sharps practices

- Be prepared - before beginning the procedure
  - Assess any hazards
  - Organize equipment at the point of use
  - Make sure workspace has adequate lighting
  - Keep sharps pointed away from the user
  - Locate a sharps bin, or have one nearby
  - Assess the patient's ability to cooperate
  - Get help if necessary
  - Ask the patient to avoid sudden movement
  - Prepare to use the device the moment the sharps are first exposed

- Be aware - during the procedure
  - Maintain visual contact with sharps during use
  - Be aware of staff nearby
  - Control the location of sharps to avoid injury to yourself and others
  - Do not hand pass exposed sharps from one person to another
  - Use predetermined neutral zone for placing/retrieving sharps
  - Alert others when sharps are being passed
  - Activate safety feature of devices if any with engineered sharps injury prevention features (any medical device that purportedly protects against percutaneous injuries), as soon as procedure is completed

- Clean up and dispose with care

  During clean-up;
  - Be accountable for sharps you used
  - Check procedure trays, waste materials, and bedding for exposed sharps before handling
  - Look for sharps/equipment left behind inadvertently

- Transport reusable sharps in a closed container
- Secure the container to prevent spillage

While disposing sharps;

- Inspect sharps bin
- Keep hands away from the opening of the sharps bin
- Never put hands or fingers into sharps bin
- If you are disposing sharps with attached tubing be aware that tubing attached to sharps can recoil and lead to injury. Maintain control of both tubing and the device during disposal

After disposing sharps;

- Visually inspect sharps bin for overfilling
- Replace bins before they become overfilled
- Keep filled bins for disposal in a secure area
- Improperly disposed sharps in work environment should be handled carefully and mechanical device should be used if unable to pick up safely with hand

4.4.4 Management of sharps injuries

Refer Chapter 9

4.4.5 Safe injection practices

The following recommendations apply to the use of needles, cannulae and intravenous delivery systems.

- Use aseptic technique to avoid contamination of sterile injection equipment
- Do not administer medications from a syringe to multiple patients, even if the needle or cannula on the syringe is changed
- Needles, cannulae and syringes are sterile, single-use items; they should not be reused for another patient nor to access a medication or solution that might be used for a subsequent patient
- Use fluid infusion and administration sets (i.e. intravenous bags, tubing and connectors) for one patient only and dispose appropriately after use
- Consider a syringe or needle/cannula as contaminated once it has been used to enter or connect to a patient's intravenous infusion bag or administration set
- Use single-dose vials for parenteral medications whenever possible
- Do not administer medications from single-dose vials or ampules to multiple patients or combine leftover contents for later use
- If multi-dose vials must be used, both the needle or cannula and syringe used to access the multi-dose vial must be sterile
- Do not keep multi-dose vials in the immediate patient treatment area. Store according to manufacturer's recommendations. Discard if sterility is compromised or questionable
- Do not use bags or bottles of intravenous solution as a common source of supply for multiple patients

References

- Centers for Disease Control and Prevention, 2016. The National Institute for Occupational Safety and Health (NIOSH). 2011. Niosh Hazard Review: occupational hazards in home healthcare (Publication No. 2010- 125) Atlanta. Available at: https://www.cdc.gov/niosh/docs/2010-125/default.html.
- Exposure to blood or other body fluids; International travel and health 2009; chapter 8; https://www.who.int/ith/ith2009chapter8.pdf.
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4.5 CLEANING, DISINFECTION AND STERILIZATION OF INSTRUMENTS AND EQUIPMENT

Introduction

All reusable instruments and equipment should undergo cleaning, disinfection or sterilization to prevent exposure of patients and health care workers to potentially infectious material. Choice of the method will depend on the intended use of the instrument.

Depending on the intended use of an item, medical and surgical equipment may require to undergo the following processes between use on different patients:

1. Cleaning alone
2. Cleaning, followed by disinfection
3. Cleaning, followed by sterilization

Cleaning: A process of physical removal of foreign material (e.g. dust, soil) and organic material (e.g. blood, secretions, excretions, microorganisms). It is accomplished with manual or mechanical action using water and detergents. Medical devices must be cleaned thoroughly before disinfection or sterilization.

Disinfection: A process that kills most pathogenic microorganisms. Disinfection does not destroy all bacterial spores. Medical devices must be cleaned thoroughly for effective disinfection. There are 2 levels of disinfection: high and low.

Low-Level Disinfection: A process capable of killing most vegetative bacteria, some viruses and some fungi. This process cannot be relied on to kill micro-organisms such as mycobacteria, including *Mycobacterium tuberculosis*, or bacterial spores. This method is used for processing non-critical medical devices and some environmental surfaces.

High-Level Disinfection: A process capable of killing vegetative bacteria, mycobacteria including *Mycobacterium tuberculosis*, fungi and both enveloped and non-enveloped viruses, and reducing number of bacterial spores bacterial spores. This is considered to be the minimum level of disinfection required for semi-critical medical devices.

Sterilization: A process used to make a product free from living microorganisms including bacterial spores and is required for reprocessing critical medical devices.

4.5.1 Recommended processing method based on Spaulding Classification

Spaulding Classification categorizes patient care devices/equipment as critical, semi-critical and non-critical based on the intended use. It provides a simplified outline on the recommended processing methods for devices/equipment.

Table 1. Recommended processing method based on Spaulding Classification

Category	Device/equipment	Products/process
Critical devices - Items entering sterile tissue, body cavity, vascular system and non-intact mucus membranes **Level of reprocessing** - Sterilization	• Surgical instruments • Implantable devices • Endoscopes that enter sterile cavities and spaces such as laparoscopes, arthroscopes and endoscopic accessories (e.g. biopsy forceps and sphincterotomes)	• Single use sterile items or • Sterilization by - Steam - Low temperature methods (e.g. plasma sterilization)
Semi critical devices - Items that make contact directly or indirectly with intact mucous membrane or non-intact skin **Level of reprocessing** - Sterilization is preferred. - Minimum level is high-level disinfection	• Flexible endoscopes that do not enter sterile cavities or tissues • TEE probes • Laryngoscopes • Flexible bronchoscopes and flexible cystoscopes (sterilization is preferred) • Respiratory therapy equipment (e.g. ventilator tubes, reservoir bags, humidifiers) • Specula (e.g.nasal, anal, vaginal – disposable equipment are recommended) • Tonometer footplate • Ear syringe nozzles • Ultrasound endocavity probes (e.g. transrectal, vaginal probes) • Pessary and diaphragm fitting rings (sterilization is preferred) • CPR facemasks • Ear cleaning equipment e.g. ear curettes, otoscope tips • Pessary and diaphragm fitting rings	• Heat sterilization always preferable whenever they are compatible • High level disinfection e.g. - 0.55% (w/v) ortho-phthalaldehyde (OPA) - In use (working) solution) equivalent to 2000 – 3500 ppm (0.2% - 0.35%) peracetic acid - 7.5% (w/v) hydrogen peroxide Some HLDs can be used as chemical sterilants *concentration, contact time and temperature varies among the high-level disinfectants and depend on manufacturer's instructions

Category	Device/equipment	Products/process
Non-critical devices and equipment - Objects that come in to contact with intact skin but not mucous membranes **Level of reprocessing**- Cleaning/low-level disinfection	• Dental lamps, external surface of dialysis machines • Bedpans, urinals, commodes • Stethoscopes • Blood pressure cuffs • Oximeters • Glucose meters • Thermometers • Hydrotherapy tanks • Patient lift-slings • ECG machines/leads/cups etc. • Ultrasound equipment/probes that only contact intact skin • Baby scales • Cardiopulmonary training mannequins • Surfaces of IV poles, wheelchairs, beds, call bells	• Cleaning - manual or mechanical • Low level disinfection e.g. - 60-90% alcohol - 0.1% hypochlorite - Quaternary ammonium compounds ***** Concentration and contact time depend on manufacturer's instructions

- Note: For decontamination of medical devices used on suspected or diagnosed patients with prion diseases (e.g. Creutzfeldt-Jakob disease (CJD) - *Refer Chapter 13.12*

4.5.2 Reprocessing of medical devices

- Reprocessing of medical devices is cleaning and disinfection or sterilization of reusable medical devices to make it safe to reuse on patients
- Health care settings should have written policies and procedures and clearly defined responsibilities for disinfection and sterilization processes
- Purchasing of medical devices and reprocessing equipment
  - Do not purchase medical devices that cannot be cleaned and reprocessed according to the recommended standards
  - Manufacturers should provide written information on safe and appropriate reprocessing of medical devices which should be available for easy access by the reprocessing staff
  - Newly purchased, non-sterile critical and semi-critical medical devices shall first be inspected and reprocessed before intended first time of use
  - Unit that will use the device and the other units involved with infection prevention and control, biomedical engineering, medical device reprocessing and purchasing should be involved in purchasing of devices and equipment

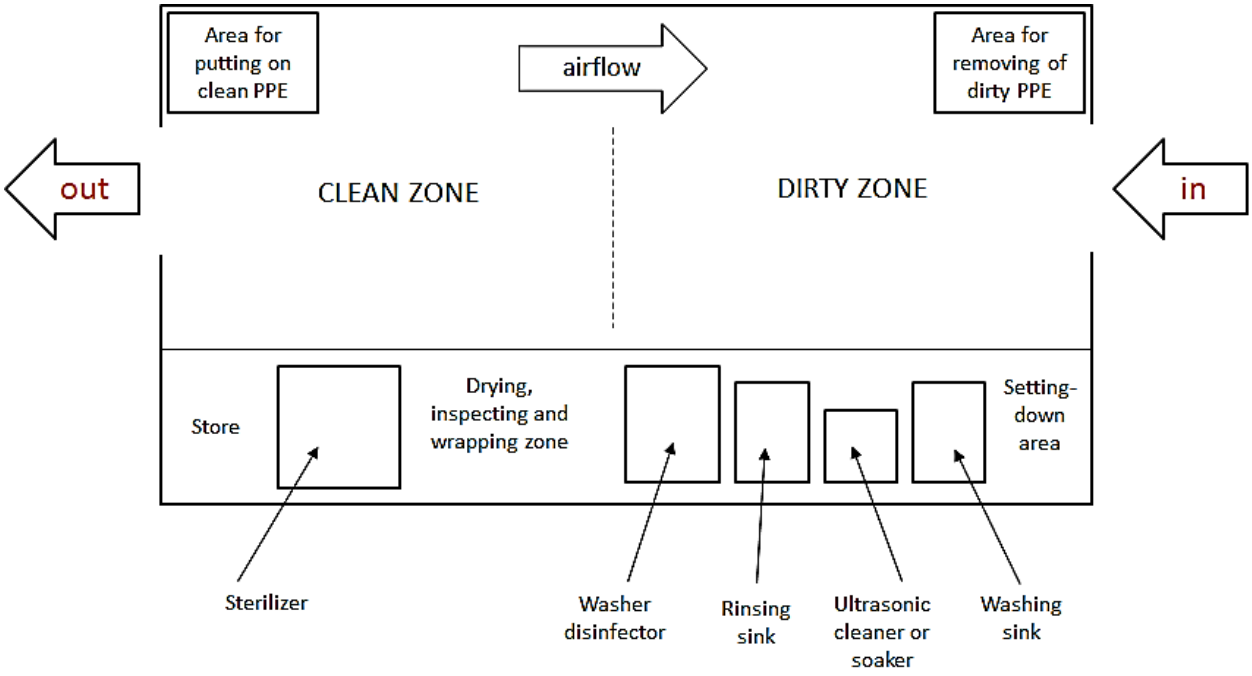
- Products used for disinfection and sterilization
  - Products should be appropriate to the level of reprocessing that is required for use of the medical devices and compatible with the device

- Product should be registered/approved based on available scientific literature by the relevant authorities
- Follow manufactures instruction for selection of disinfectant and to decontaminate instruments. Inappropriate disinfectant or incorrect concentration can damage instruments
- Suitability of the products to be used as a disinfectant in a hospital should be assessed by a committee including the consultant microbiologist of the institute before introducing into the hospital
- Before use, read the Material Safety Data Sheet (MSDS) for a full description on how to safely handle the product

4.5.3 Medical device reprocessing area

4.5.3.1 Design and layout

Figure 1. Layout of reprocessing area



- The space of reprocessing area should be adequate to support all the reprocessing activities.
- Reprocessing area should have
  - restricted access
  - physically separate dirty and clean zones
  - unidirectional controlled traffic flow
  - easily cleanable walls or partitions
  - adequate storage space
  - Area for changing, donning and doffing (removal) of PPE

- Doors should be kept closed at all times. Self-closing doors are recommended
- Work surfaces should be
  - designed to minimize crowding of workspace

  - cut-resistant, seamless and composed of a non-porous material
  - Stainless steel surfaces and backsplashes (back panel) are recommended
- A minimum of two adjacent sinks are recommended for decontamination. (If only one sink is available, precautions should be taken to avoid re-contaminating devices)
- Decontamination sinks should
  - be at a height that allows staff to use them without bending or straining
  - be placed approximately 36" (91cm) from the floor and depth should be 8-10" (20-25cm) for average built person to work comfortably
  - be deep enough to completely immerse items to be cleaned
  - be large enough to accommodate trays or baskets of instruments
  - have floor drains to accommodate water run off
  - be equipped with water ports for the flushing of instruments with lumens
- Conveniently located dedicated hand washing sinks at entrance and exit from all decontamination and preparation areas
- "Hands-free" sinks are recommended
- Eye-wash stations, deluge showers and spill cleaning equipment should be available

4.5.3.2 Water quality requirements

- Treated water (deionized, distilled or RO water) is preferred for the final rinse
- The quality of the water supply used for reprocessing should be checked as required

4.5.3.3 Ventilation

- Minimum 10 air changes per hour for dirty and clean areas
- Dirty areas: negative pressure
- Clean areas: positive pressure
- Exhaust air vented outdoors and not recirculated
- Portable fans should not be used in any reprocessing area

4.5.3.4 Temperature and humidity

- Room temperature of all decontamination work areas shall be between 16-18 °C and between 20-23 °C for the general work area and be monitored daily. Temperature in the sterilization equipment access room should be around 24-29 °C or as recommended by the equipment manufacturer
- Relative humidity shall be maintained between 30-60% (preferably 40-50%) in all areas except the sterile storage area where relative humidity should not exceed 70% and be monitored and recorded daily

4.5.3.5 Staff discipline

- Staff should not eat, drink, store food or apply cosmetics in the reprocessing area
- Staff should wear appropriate PPE
  - Gloves should be appropriate to the task, long enough to cover wrist and forearm, should be tear resistant
  - PPE should be removed at the end or when moving from soiled area to clean area and disposed appropriately
  - Wash hands after removing PPE

4.5.3.6 Cleaning of reprocessing area

- Should maintain a high level of cleanliness at all times
- Ideally, separate cleaning staff should be provided to clean decontamination areas
- The reprocessing area should be regularly cleaned
- There shall be a designated area to collect waste. The waste should be appropriately contained and disposed
- There should be area for storage of dedicated housekeeping equipment and supplies
- Cleaning should be done from clean area to dirty area
- Cleaning frequencies for reprocessing areas are given below:
  - Clean and disinfect all countertops, work areas, sinks and equipment surfaces at least daily
  - Clean and disinfect sinks after each shift and more frequently as necessary
  - Clean floors daily
  - Clean shelves daily in sterilization areas, preparation and packing areas and decontamination areas
  - Clean shelves in sterile storage areas at least weekly
  - Clean case carts and trollies after each use
  - Clean walls when visibly dirty or weekly
  - Clean light fixtures, sprinkler heads and other fixtures every six months
  - Spills should be cleaned up immediately

4.5.4 Transport of contaminated devices

- Do not transport contaminated devices through areas designated for storage of clean or sterile supplies or high-traffic areas
- Do not transport sterile and soiled devices together

4.5.5 Cleaning of contaminated devices

All reusable critical medical devices shall be cleaned before disinfection or sterilization. Cleaning removes foreign material from devices. It is done manually or mechanically using water, detergent or enzymatic products according to device manufacturer's and detergent manufacturer's instructions. Neutral or near neutral pH detergent solutions provide best material compatibility and soil removal.

4.5.5.1 Enzymatic cleaners

- Enzymatic cleaners are used to loosen and dissolve organic substances. These contain enzymes such as proteases and lipases which break down blood, body fluids, secretions and excretions from surfaces and equipment. Most enzymatic cleaners also contain a detergent
- Enzymatic cleaners should be used according to manufacturer's instructions for material compatibility, proper dilution and recommended contact time

4.5.5.2 Manual cleaning

- Manual cleaning is done for instruments which are delicate or difficult to clean or when mechanical cleaning is not available
- For manual cleaning either friction (rubbing or scrubbing the soiled area) or fluidics (fluid

under pressure) is used. Fluidics is used to remove soil from internal channels after brushing or when brushes cannot be used on these channels

- Completely submerge the immersible items during the cleaning process
- Remove gross soil using tools, brushes or cloth
- Minimise generation of aerosols when cleaning non immersible devices
- Clean devices with lumen with an appropriate brush and flush detergent solution manually or mechanically
- Rinse with potable water
- Check for obstruction or leakage of the lumen

4.5.5.3 Mechanical cleaning

E.g. Ultrasonic cleaners or washer-disinfectors

- Ultrasonic washers are strongly recommended for any semi-critical or critical medical device that has joints, crevices, lumens or other areas that are difficult to clean
- Use mechanical washers for devices which are compatible with mechanical washer, machine cycle parameter and chemical solutions that are being used
- Follow manufactures instructions and use compatible chemical solutions
- Manually clean heavily soiled instruments before mechanical cleaning
- When loading a washer-disinfector,
    - hinged instruments should be opened fully to allow adequate contact with the detergent solution
    - instruments should be disassembled as much as possible
    - stacking of instruments in washers should be avoided
    - Use printed records of each cycle parameter to monitor the washing process
    - Routine cleaning and maintenance of mechanical washer should be done according to manufacturer's instructions

4.5.5.4 Rinsing

- Rinse instruments thoroughly following cleaning to remove loosened soil and residual detergents
- Rinse lumens of instruments
- Lumens of intrathecal or intravascular devices should be rinsed with sterile water
- Dry instruments by air drying, or with a clean lint free towel
- Dry lumens with compressed medical grade or HEPA filtered air at pressure specified by the device manufacturer

4.5.5.5 Care of cleaning tools

- Follow manufacturer's instructions for use, cleaning, disinfection, drying, and storage of cleaning tools
- Inspect brushes and other cleaning equipment for damage after each use, and discard if necessary
- The use of single-use cleaning tools is recommended. If reusable tools are used, they shall be disinfected at least once daily

4.5.6 Sterilization

Table 2. Sterilization methods

Agent	Monitoring (Refer Annexure 4.5.1)	Comment
Steam sterilization (Autoclave) For critical devices which are not damaged by heat or moisture	• Biological indicators (BI) (preferably weekly except with loads with implantable devices which need BI with every load) • Chemical indicators (CI) – External and internal CI with each package • Physical indicators (each cycle)- time, temperature, pressure records Additional monitoring of pre-vacuum sterilizers includes a dynamic air removal test- Bowie-Dick test (daily) This should run within a test pack each day in an empty sterilizer before the 1st processed load.	Contact time/exposure time depends on the item sterilized All loads containing an implantable device shall be monitored with an additional BI and should be quarantined until the results of the biological indicator testing are available
Hydrogen Peroxide Gas Plasma For critical devices and some semi-critical devices that are damaged by moisture or heat such as some plastics, electrical devices, and corrosion-susceptible metal alloys	Sterilization shall be monitored with biological indicators (at least daily), chemical indicators (with each package) and physical indicators (with each cycle)	Some cycles are faster than steam sterilization. Safe for environment (end products are water and oxygen). Compatible with many medical devices. Cycle time and temperature vary, depending on the brand and model of sterilizer
Ethylene Oxide (ETO) gas • ETO is used to sterilize critical items (and sometimes semi critical items) that are moisture or heat sensitive and cannot be sterilized by steam sterilization • ETO has found to be toxic/carcinogenic to humans. Cycles are lengthy due to aeration requirements. Requires monitoring of the work areas and, control and monitoring of discharge into the environment • In addition, ETO is flammable, explosive and can be highly reactive with other chemicals • It is expensive compared to steam and incompatible with some materials e.g. silicone		

Immediate use steam sterilization (flash sterilization)

Immediate use steam sterilization is used only for situation where there is urgent or unplanned need. There should be a written procedure and trained staff for flash sterilization. Cycle parameter may vary with the type/design of sterilizer. Parameters for sterilization are established and preset by the sterilizer manufacturer and these guidelines should be followed. Flash sterilization should not be used to sterilize implants, sterilize complete sets or trays of instruments, compensate for inventory shortage or scheduling difficulties.

Types of autoclaves

There are several types of steam sterilizers that utilize different methods to remove air from packages and the chambers

- Dynamic air removal (pre vacuum): Uses a vacuum pump or water ejector to remove air from the chamber and the packaged devices during the pre-conditioning phase and prior to sterilization. Operate at 132 ℃ to 135 ℃
- Gravity sterilizer: uses gravity air displacement to remove air from the sterilizer chamber and packaged devices. Operate at 121 ℃ or higher
- Steam-flush pressure-pulse: Uses a repeated sequence of a steam flush and pressure pulse to remove air from the chamber and packaged item. Operate at 121 ℃ to 123 ℃, 132 ℃ to 135 ℃ or 141 ℃ to 144 ℃

Table 3. Time and temperature parameters for gravity displacement steam sterilization cycles

Item	Exposure time at 121 °C	Exposure time at 132 °C	Exposure time at 135 °C	Drying time
Wrapped instruments	30 minutes	15 minutes		15-30 minutes
			10 minutes	30 minutes
Textile packs	30 minutes	25 minutes		15 minutes
			10 minutes	30 minutes
Wrapped utensils	30 minutes	15 minutes		15-30 minutes
			10 minutes	30 minutes
Unwrapped porous items (e.g. instruments)		3 minutes	3 minutes	0-1 minute
Unwrapped non porous items and porous items (e.g. mixed load)		10 minutes	10 minutes	0-1 minute

Table 4. Time and temperature parameters for dynamic air removal steam sterilization cycle

Item	Exposure time at 132 °C	Exposure time at 135 °C	Drying time
Wrapped instruments	4 minutes		20-30 minutes
		3 minutes	16 minutes
Textile packs	4 minutes		5-20 minutes
		3 minutes	3 minutes
Wrapped utensils	4 minutes		20 minutes
		3 minutes	16 minutes
Unwrapped porous items (e.g. instruments)	3 minutes	3 minutes	NA
Unwrapped non porous items and porous items (e.g. mixed load)	4 minutes	3 minutes	NA

Note: Above tables are guides for cycle parameters for different items. For a specific sterilizer, sterilizer manufacturer's instructions for cycle parameters should be followed as parameters may vary depending on the instrument

4.5.7 Disinfection

4.5.7.1 High Level Disinfection

- High level disinfection is indicated for immersible, semi-critical devices that are damaged by other sterilization methods e.g. flexible GI endoscopes damaged by heat
- Equipment must be thoroughly rinsed, dried, and stored appropriately after disinfection with high level disinfectants (HLD)
- To limit exposure of the HCW to disinfectant vapour following engineering and work practice controls should be used
  - Ducted exhaust hoods
  - Air systems that provide 7–15 air exchanges per hour
  - Ductless fume hoods with absorbents for the HLD vapour
  - Tight-fitting lids on immersion baths
  - Personal protection e.g. nitrile or butyl rubber gloves (but not natural latex gloves), mask and goggles to minimize skin or mucous membrane contact
  - Use of automated endoscope processors
  - If engineering controls fail to maintain levels below the ceiling limit, institutions can consider the use of respirators
- Refer manufacturer's recommendation on each disinfectant for preparation, contact time, monitoring and disposal. Minimum effective concentration (MEC) of reusable solutions should be monitored according to recommended frequency using chemical test strips.
- Follow manufacturer's recommendation of the instrument to select appropriate and compatible disinfectant for each device
- These agents can be used as high-level disinfectants or sterilants based on appropriate concentration
- Use chemical test strip to assess MEC of the disinfectant. Do not use chemical tests strip after expiration date as it deteriorates with time

Table 5. Chemical characteristics and recommendation of high level disinfectants (HLD) and sterilants for use

Chemical Characteristics	**Hydrogen Peroxide 7.5%**	**Peracetic Acid In-use (working) solution) 2000 – 3500 ppm (0.2% - 0.35%)**	**Gluteraldehyde ≥2.0%**	**OPA 0.55%**	**Hydrogen Peroxide/Peracetic Acid 7.35%/0.23 %**
High-level disinfectant claim	Follow manufacturer's instructions				
Sterilization Claim	Follow manufacturer's instructions			None	Follow manufacturer's instructions
Activation	No	Refer manufacturer's instructions	Yes (alkaline glutaraldehyde)	No	No
Reuse life (number of days a product can be reused as determined by re-use protocol)	Follow manufacturer's instructions				
Disposal Restrictions	None	None	Appropriate neutralization has to be done using recommended agent before disposal	Appropriate neutralization has to be done using recommended agent before disposal	None
Monitor minimal effective concentration (MEC)	Yes (6%)	Yes	Yes (1.5% or higher)	Yes (0.3% OPA)	Refer manufacturer's instructions
Safety	Serious eye irritant	Serious eye and skin irritant (concentrated solution)	Respiratory and skin irritant	Eye irritant, stains skin	Eye irritant
Organic material resistance	Yes	Yes	Yes	Yes	Yes
Occupational safety and health administration (OSHA)	1 ppm time-weighted average (TWA)	None	None (The ceiling limit recommended by the American Conference of	None	Hydrogen Peroxide -1 ppm (TWA) for a conventional

Chemical Characteristics	**Hydrogen Peroxide 7.5%**	**Peracetic Acid In-use (working) solution) 2000 – 3500 ppm (0.2% - 0.35%)**	**Gluteraldehyde ≥2.0%**	**OPA 0.55%**	**Hydrogen Peroxide/Peracetic Acid 7.35%/0.23 %**
exposure limit			Governmental Industrial Hygienists is 0.05 ppm)		8-hour workday
Remarks	Inadequate rinsing may lead to side effects e.g. chemical irritation leading to pseudomembranous colitis	Does not produce harmful decomposition products, enhances removal of organic material, leaves no residue, remains effective in the presence of organic matter	Currently the use is limited	Stains protein. Contraindicated for urology instruments to be used on patients with a history of bladder cancer	Material compatibility concerns (lead, brass, copper, zinc) both cosmetic and functional, potential for eye and skin damage

4.5.7.2 Low level disinfection

Following agents can be used as low-level disinfectant (LLD) and/or antiseptic based on appropriate concentration. Refer manufacturer's recommendation for preparation, contact time, monitoring and disposal.

Table 6. Low level disinfectants and antiseptics

Agent	**Indication/s -uses**	**Comment**
CHLORINE RELEASING COMPOUNDS		
Chlorine releasing compounds Calcium hypochlorite (TCL- topical chlorite of lime, bleaching powder) Should be not less than 30% w/v of available chlorine	Blood spills -1% (10,000ppm) Surface cleaning -0.1% (1000 ppm) Disinfection of feeding bottles-0.01% (100ppm)	Solutions should be made fresh and discarded immediately after use. Avoid inhalation, contact with skin, eyes and clothing. Do not mix or allow contact with other chemicals (soaps, detergents paints, solvents combustible substances).

Sodium hypochlorite Liquid form (e.g. 3%, 5%, 10% - stock solutions) 1% (10,000 ppm) 0.1% (1,000 ppm) 0.01% (100ppm) e.g. diluted Milton solution *Preparation – see below		Can form carcinogenic products in the presence of formaldehyde. Do not use on metal objects (corrosive).
CHLOHEXIDINES		
Aqueous chlorhexidine gluconate solution 4% (w/v) equivalent to chlorhexidine gluconate solution 20% (v/v)	Surgical scrubbing MRSA decolonization Preoperative skin disinfection if the surgical site is next to a mucous membrane	Ototoxicity possible if instilled to middle ear. Avoid contact with the eyes when used as it can cause conjunctivitis and/or serious corneal damage. High concentrations and preparations containing alcohol/ surfactant may cause eye damage. Alcohol-based chlorhexidine should not be used on mucous membranes.
Chlorhexidine gluconate solution 2% (w/v) in 70% alcohol (alcoholic chlorhexidine)	Preoperative skin preparation Preparation of the skin prior to invasive medical procedures	
IODOPHORS		
Alcohol based/aqueous povidone iodine (10% (w/v) solution with 1%available iodine)	Preoperative skin preparation	Can cause hypersensitivity and skin irritation. Avoid use on large body surface areas for prolonged periods (increases serum iodine levels). Contraindicated in hyperthyroidism and other disorders of thyroid function.
7.5% (w/v) Povidone iodine scrub (available iodine 0.75%)	Hand hygiene	

Tincture of iodine (Iodine 2.5% (w/v), KI 2.5% w/v, 89% v/v purified water and ethanol)	Preparation of skin for aseptic procedures	
PHENOLIC DISINFECTANTS		
5% diluted solutions from stock solutions	For disinfection purposes in TB laboratories and disinfection of sputum mugs used by TB patients	Irritant. Avoid contact with eyes and skin. Avoid use in infant bassinets and incubators (causes hyperbilirubinaemia). Avoid use on plastic and rubber (mackintosh, mattress covers) since it is absorbed and may increase permeability to body fluids. Avoid use on porous materials as it leaves a film leading to irritation of skin and tissues. Can dispose into drains without special precautions.
ALCOHOL		
60-90% (v/v) ethyl/isopropyl alcohol	As an antiseptic - alcohol hand rub75-85% (v/v) ethyl/isopropyl alcohol *(Refer Chapter 4.1)* As a disinfectant for surface disinfection - 70% (v/v) ethyl/isopropyl alcohol	Optimum bactericidal concentration is 60%-90% solutions in water. Store at room temperature, in a dark container with a close-fitting lid in a well-ventilated area. Label as inflammable. Can damage the shellac mountings of lensed instruments, rubber and certain plastic tubing, and tonometer tips

Preparation of hypochlorite solution

- Prepare in a well-ventilated room to avoid inhalation. Wear appropriate PPE
- Add powder to water. Do not add water to the powder, because it generates chlorine vapour. Inhalation of released chlorine vapour is toxic at room temperature
- Chlorine vapour ceiling limit
- Residual particles can cause irritation, hence filtering of the solution is recommended

1. **Using hypochlorite powder (TCL/calcium hypochlorite/ bleaching powder)**

- Calculate the amount to be mixed with each litre of water by using the following formula: [% chlorine desired／% chlorine in bleach powder] × 1000 = Grams of bleach powder for each liter of water

Example: To make a 0.5% chlorine solution from bleach powder containing 35% active chlorine
[0.5%／35%] × 1000 = 0.0143 × 1000 = 14.3
Therefore, dissolve 14.3 grams of calcium hypochlorite powder in 1 liter of water to make a 0.5% chlorine solution.

2. Using liquid hypochlorite (Sodium hypochlorite or household bleach)

- Chlorine in liquid bleach comes in different concentrations. Any concentration can be used to make a dilute chlorine solution by applying the following formula:
  (% chlorine in liquid bleach／% chlorine desired) − 1 = Total parts of water for each part bleach

Example: To make a 0.5% chlorine solution from 3.5% bleach:
[3.5%／0.5%] − 1 = 7 − 1 = 6 parts water for each part bleach
Therefore, add 1 part 3.5% bleach to 6 parts water to make a 0.5% chlorine solution

4.5.8 Methods of cleaning, disinfection and sterilization of equipment and instruments

- All equipment and instruments should have a user manual and maintenance records
- Always follow manufacturer’s instructions (user manual) on reprocessing and compatibility of cleaning and disinfecting agents
- When using HLD or sterilant, follow manufacturer’s recommendation for preparation, appropriate exposure time/conditions and disposal
- Arrange the routine maintenance of machines according to manufacturer’s instructions by the local agent and/or authorized maintenance staff of the institution

Table 7. Methods of cleaning, disinfection and sterilization of equipment and instruments

- **Ventilators and accessories**

Equipment and device classification	Agents for decontamination/ disinfection	Disinfection/sterilization procedure
Ventilators	GPD 70% Alcohol	Follow manufacturer's instructions. If not available, wipe the surface with a soft cloth dampened with GPD, wipe with a clean cloth and allow to dry. Wipe with 70% alcohol. Pay special attention to cleaning of knobs, vapourizers, cylinders etc. Bellows, unidirectional valves and carbon dioxide absorbers should be cleaned and disinfected periodically. Perform cleaning daily and in-between patients. External filters should be changed between patients. Contact the local agent for sterilization and disinfection of internal machinery if required.
Ventilator tubing Single use/ reusable Single use tubes are the ideal	For reuse Cleaning - GPD/enzymatic detergent Sterilization - autoclave (if autoclavable) /sterilant or Disinfection - HLD	Change the tubing of same patient when visibly soiled or malfunctioning. Change tubes between patients. For reuse, should be cleaned and autoclaved or decontaminated with a sterilant/HLD. Rinse with sterile water. Store tubing dry and covered.
Humidifiers Reusable	For reuse Cleaning- GPD/enzymatic detergent Sterilization - autoclave (if autoclavable) /sterilant or Disinfection - HLD	Follow manufacturer's instructions Empty and clean the reservoir daily with GPD/enzymatic detergent. Use sterilized humidifiers for all patients. Sterilize the humidifier by autoclaving If not autoclavable decontaminate with a chemical sterilant/HLD and rinse with sterile water.

Equipment and device classification	**Agents for decontamination/ disinfection**	**Disinfection/sterilization procedure**
Reservoir bag Single use or Reusable Single use bags are preferred on patients with known or suspected infections such as tuberculosis	For reuse Cleaning - GPD Sterilization - autoclave or Disinfection - HLD	Reservoir bag is connected near the absorber and is protected from contamination by filters. For reuse, Clean by partially filling the bag with water and detergent and shaking the bag, and then rinsing with sterile water. Outer surface is washed with water and a detergent. Sterilize by autoclaving. Alternatively, disinfect using HLD, followed by adequate rinsing with sterile water.
Airways Single use or reusable	For reuse (metal airways) Cleaning - GPD Sterilization - autoclave	Clean with GPD and sterilize by autoclaving
Laryngoscopes Single use or Reusable	For re use Cleaning - GPD Sterilization-autoclave Disinfection-70% alcohol	Laryngoscope blades - Clean with GPD and sterilize by autoclaving or high-level disinfection. Handle - Clean with GPD between each patient use. If contaminated with blood/body fluids - Clean with GPD and disinfect with 70% alcohol
Endotracheal tubes Single Use	N/A	N/A
Endotracheal tube introducers (gum elastic bougie) Single use or Reusable	For reuse Cleaning - GPD Disinfection - HLD	Clean with GPD, rinse thoroughly with water and dry. Disinfect by immersing the tubing in HLD and rinsing with sterile water. Store tubes dry and covered.
Oxygen masks/mist tents Single use or Reusable Do not reuse if used on a patient with known/ suspected infection such as tuberculosis	For reuse Cleaning - GPD Sterilization - autoclave Disinfection HLD/ 70% alcohol	For reuse Clean with GPD, rinse thoroughly with water. Then dry and sterilize by autoclaving If non-autoclavable - Clean with GPD, disinfect with HLD or wipe with 70% alcohol if used on the same patient.

Oxygen tubing Single Use	N/A	Change between patients. Change the tubing in use on one patient when it malfunctions or becomes visibly contaminated

- **Suction apparatus**

Equipment	**Agents for Decontamination/ Disinfection**	**Procedure**
Suction catheters Single Use	N/A	
Suction tubing Single Use or Reusable	For reuse Cleaning - GPD/enzymatic detergent Sterilization - Autoclave/sterilant or Disinfection - HLD	Change daily and between patients. For reuse, clean with GPD/enzymatic detergent, rinse thoroughly with water. Then dry and sterilize by autoclaving. If non-autoclavable, sterilize using a sterilant or disinfect with a HLD and rinse with sterile water.
Bottles/jars Reusable	For reuse Cleaning - GPD/enzymatic detergent Sterilization - autoclave or Disinfection - 1% hypochlorite solution	Empty when 2/3 full or daily whichever is more frequent. Ideally should dispose into a sink connected to a closed drainage system. If disposed into open drainage system, decontaminate first. - *Refer Chapter 4.8 page 92* Empty and clean with GPD/enzymatic detergent. Rinse thoroughly with water. Then dry and sterilize by autoclaving If non-autoclavable - Disinfect by immersing in 1% hypochlorite solution for 30 minutes and rinse with water. Disinfect the metal lids with HLD.

- **Nebulizers**

Equipment	**Agents for Decontamination/ Disinfection**	**Procedure**
Nebulizer mask and chamber Single use or Reusable Ideally single use	For reuse Cleaning-GPD Disinfection-HLD	For reuse Clean with GPD, rinse thoroughly with water. Disinfect with HLD. Rinse with sterile water.
Tubing Ideally single use	For reuse Cleaning-GPD Disinfection-HLD	If reuse-flush with GPD, aspirate HLD into tubing using a syringe, immerse for 30 minutes and rinse well.
Peak flow meter Reusable With disposable single use mouth pieces with one-way valve or filter	For reusable parts wipe with 70% alcohol Cleaning - GPD and wipe with 70% alcohol if visibly contaminated	Dispose mouthpiece of a peak flow meter between uses on different patients. Change filter as directed by manufacturer

- **Infusion lines**

Equipment	**Agents for Decontamination/ Disinfection**	**Procedure**
Infusion pumps Reusable	**Cleaning** - GPD	Wipe daily and between patient use with GPD. Ensure surfaces completely free of feed and infusion residues.
Infusion stands	Cleaning - GPD	Clean daily in ICU/weekly in wards.

- **Miscellaneous items**

Equipment	Agents for Decontamination/ Disinfection	Procedure
Dressing trolley **Drug trolley** **Resuscitation trolley**	Cleaning-GPD Disinfection-70% alcohol	Clean thoroughly with GPD daily. Before and after procedures wipe with 70% alcohol. Must be dry before placing sterile packs, drugs or other items on the surface.
Patient trollies and wheelchairs	Cleaning-GPD Disinfection- 0.1% hypochlorite, If metal, wipe with 70% alcohol after washing with GPD	Clean with GPD between patients and at the end of the day. Disinfection of these non-critical equipment is not routinely required unless the equipment has come into contact with blood or body fluids, or patients with multi drug resistant organisms. Wipe with 0.1% hypochlorite or 70% alcohol (for metal trollies) after washing with soap and water.

- **Specula**

Equipment	Agents for Decontamination/ Disinfection	Procedure
Aural Specula Single use or Reusable	Cleaning- GPD Disinfection- 70% alcohol	Wash with GPD after each use or use 70% alcohol to disinfect
Vaginal Specula Single use or Reusable	Cleaning- GPD Sterilization- autoclave	Clean with GPD and sterilize by autoclaving
Proctoscopes Single use or Reusable	Cleaning- GPD Sterilization- autoclave	Clean with GPD and sterilize by autoclaving

- **Personal protective equipment**

Equipment	Agents for Decontamination/ Disinfection	Procedure
Goggles/Visors Single Use Reusable		If reuse-wash with GPD. Then wipe with 70% alcohol
Heavy duty gloves for cleaning staff	Cleaning- GPD Disinfection- 1% hypochlorite	Clean with GPD, immerse in 1% hypochlorite, wash and hang
Footwear/Boots	Cleaning- GPD Disinfection- 1% hypochlorite	Wash with GPD and dry regularly at least once a week If there is a spill immediately remove and soak in 1% hypochlorite and wash

- **Other items**

Equipment	Agents for Decontamination/ Disinfection	Procedure
Thermometer	Cleaning – GPD Disinfection- 70% alcohol	Clean with GPD and wipe with 70% alcohol in between patients, and if visibly soiled.
Stethoscopes	Disinfection- 70% alcohol	Clean with GPD, dry and wipe with 70% alcohol at the beginning and end of the ward round/clinic session, daily and after examining patients infected with MDROs. Dedicate one stethoscope per patient or clean with 70% alcohol between patients in ICU and PBU.
Sputum mugs	Disinfection- 5% phenolic disinfectant/ 1% hypochlorite	Cardboard sputum mugs should be disinfected using 5% phenolic disinfectant or 1% hypochlorite for 30 minutes and disposed of by incineration, burning or deep burial. Stainless steel/plastic mugs should be disinfected using 5% phenolic disinfectant or 1% hypochlorite for 30 minutes and then cleaned with GPD
Slings, Patient hoist orthopaedic supports	Cleaning- GPD	If made out of cloth dispose when contaminated with body fluids.
Surgical bowls (e.g. kidney trays)	Cleaning- GPD Sterilization- autoclave	Clean with GPD and sterilized by autoclaving after each use.
X-Ray equipment	Cleaning- GPD Disinfection– 70% alcohol	Keep equipment clean by damp dusting daily. Wipe with 70% alcohol after cleaning with GPD if overtly contaminated.
Mackintosh	Cleaning- GPD Disinfection– 1% hypochlorite	Immerse in 1% hypochlorite for 30 minutes then wash with GPD. Hang to dry
Plastic waste bins	Cleaning- GPD Disinfection– 1% hypochlorite	Should be lined with appropriately covered bin liner. At the end of the day, wash with GPD and store inverted for drying. If contaminated with blood or body fluids decontaminate with 1% hypochlorite

4.5.9 Storage and use of reprocessed medical devices

- Sterile storage area should be located in a limited access area in the reprocessing area. If access cannot be controlled, the sterile storage area should be enclosed e.g. cupboard, cabinet, closed cart
- Should be clean, dry, and dust-free area, that is easy to clean
- Relative humidity should be in the range of 30-60% and temperature should be between 18-23 °C
- Storage shelving should be non-porous, smooth and cleanable (wood is not acceptable)

- Open shelves shall be at least 250 mm (10”) off the floor, 5 inches from the ceiling unless near a sprinkler head (18 inches from sprinkler head) and 50 mm (2’’) from outside walls. Bottom and the top shelves shall be solid
- There should be adequate space to prevent crushing and damage of packages

Storage shelf life

- Usual shelf life of sterilized items
  - Peel pouches – 9 months
  - Fabric wrapped packs: 2 layers – 14 days, 4 layers – 30 days
  - Paper wrap (purpose made) – 30 days
- However, the shelf life of a sterile package is event related and depends on the quality of the packaging material, storage and transport conditions and amount of handling
- Packages should be handled aseptically
- Packages should be rotated as first in first out basis
- At point-of-use, package should be checked for integrity prior to opening the reprocessed medical device
- Do not use the packs after the expiry date or if the pack is wet or damaged

4.5.10 Quality Assurance (QA) of reprocessing

- All reprocessing documentation should be dated and signed by the person completing the documentation and/or verifying the test results
- The sterilization process should be documented
- Establish a written procedure for recall in case of sterilization process failure. Should be able to trace any package with regard to date and the cycle whenever indicated

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Annexure 4.5.1

Monitoring of sterilization process

1. Physical monitoring

- Bowie-Dick pack
  - All sterilizers should be checked daily using a Bowie-Dick pack (empty sterilizer) before loading the days load. The machine should not be used if this test is failed (Figure 2)
  - Bowie-Dick test packs
    - Should be used in dynamic air removal sterilizers only to detect air leaks and inadequate air removal
    - Should be packed in folded 100% cotton clean surgical towels
    - Should be placed horizontally in the front, bottom section of the sterilizer rack, near the door and over the drain, in an otherwise empty chamber
    - And run at 134 ^{o}C for 3.5 minutes
    - Should be used daily before the first process load
  - Air that is not removed will interfere with the steam contact
  - Sterilizer vacuum performance is acceptable if the sheet inside the test pack shows uniform colour change
  - Entrapped air will cause a spot to appear on the test sheet due to the inability of the steam to reach the chemical indicator

Figure 2. Bowie-Dick pack

- Monitoring the physical conditions of the chamber during sterilization
  - Includes print outs, digital reading, graphs, gauges to verify parameters of each cycle (e.g. time, temperature and pressure)

2. Biological indicators (BI)

- Check the sterilizers weekly using an appropriate biological indicator placed in a biological indicator test pack
  - *Geobacillus stearothermophilus* is used for steam sterilizers
  - *Bacillus atrophaeus* is used for chemical vapour sterilizers (ethylene oxide sterilizer - EO) and plasma sterilizer

- Commercially prepared BI or BI prepared locally by MRI are available
- BI is ideally placed inside a Process Challenge Device (PCD). PCD is a test pack or test tray that contains a biologic indicator with or without a chemical indicator. PCD is used to assess the effective performance of the sterilization process
- The BI test pack (PCD) should be placed in a fully loaded sterilizer in the front bottom area near the drain or according to the PCD and/or sterilizer manufacturer's instructions.
- The PCD is intended to challenge the sterilization process in a manner that is equal to or greater than, the challenge posed by the most difficult item that is routinely processed
- Keep a control biological indicator from the lot used for testing unexposed to the sterilization process and incubate with the test PCD Once sterilized, a BI is removed from the PCD and incubated to see if the microorganism will grow. Growth is an indication of sterilization failure
- Biological indicator should be placed with every pack which contains prosthetic material and implantable devices. This pack should not be issued or used until the result of the BI test is available
- Check EO sterilizer daily with BI. It should be placed in a plastic syringe with a plunger, then wrapped in a surgical towel and placed at the centre of sterilizing loads
- Send the BI to the laboratory for testing immediately after unloading the machine along with a control BI tube of the same batch

Preparation of biological indicator test pack;

- Should be standardized to create a significant challenge to air removal and sterilant penetration and to obtain interpretable results
- A standard 16-towel pack is recommended for steam sterilization
- Pack consists of 16 clean, preconditioned, absorbent surgical towels each of which is approximately 16 inches by 26 inches. Each towel is folded lengthwise into thirds and then folded widthwise in the middle. One or more biological indicators are placed between the eighth and ninth towels in the approximate geometric center of the pack
- When the towels are folded and placed one on top of another, they form a stack (approximately 6inch height) and weigh approximately 3 pounds

Figure 3. Biological indicator

		
Un exposed (Control)	Satisfactory sterilization	Unsatisfactory sterilization.

3. Chemical Indicators

- There are 6 classes of steam chemical indicators
  - Class 1- is a process indicator which differentiates processed from non- processed items (external chemical indicator- e.g. autoclave tape)
  - Class 2- to verify adequate air removal and steam penetration of vacuum assisted steam sterilizers e.g. Bowie-Dick test
  - Class 3- Single variable indicator reacts to single critical parameter
  - Class 4- Multi variable indicator for internal package monitoring reacts with two or more critical parameters
  - Class 5- Multi variable indicator for internal package monitoring reacts with all critical internal parameters in the sterilization process
  - Class 6- Indicator that reacts to all (for internal package monitoring)
- Chemical indicators should be placed on the outside and inside of every package
- Colour change of external indicators (autoclave tap) identify processed from non-processed items. If there is no colour change, do not use the pack as it indicates the pack has not undergone sterilization
- Internal chemical indicators verify the sterilizing agents has reached the content of the package and critical variables of the process have been met
- External CI (indicator tape) is a process indicator (Class 1) which indicates that the unit has been exposed to the sterilization process
- Use a commercially prepared chemical indicator with all packs
- Keep records of all results

Figure 4. External chemical indicator

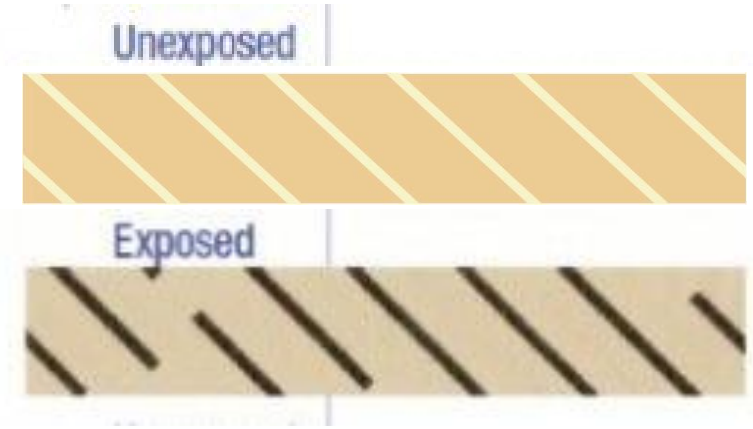
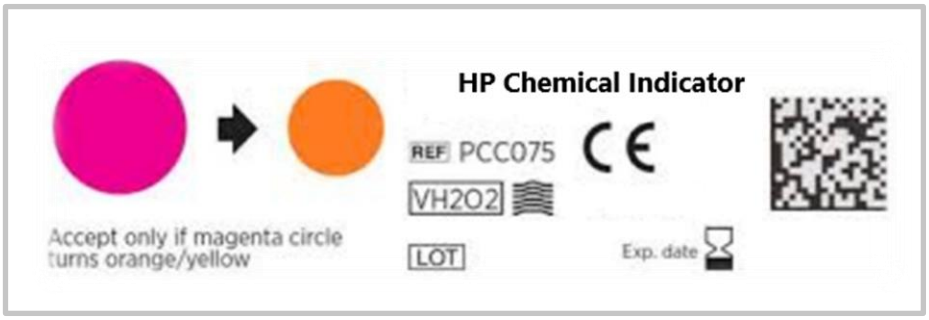


Figure 5. Internal chemical indicators

1.

2.



4.6 ENVIRONMENTAL CLEANING AND DISINFECTION

Introduction

Environmental cleaning is part of standard precautions, which should be applied to all patients in all healthcare facilities. Environmental cleaning programs require a standardized and multi-modal approach and strong management and engagement from multiple stakeholders and departments of the healthcare facility, such as administration, IPC team and maintenance unit. When cleaning is implemented by external companies contracted staff, including cleaning staff and cleaning supervisors should work closely with IPC team to ensure that environmental cleaning is performed according to best practices and facility policy.

4.6.1 Administrative responsibilities

- Ensure that the hospital has protocols for routine cleaning (floor, roof, walls, beds, bedrails, bedside equipment and frequently touched surfaces etc.)
- Provide adequate resources, written procedures for cleaning and disinfection of care areas and equipment. Assign responsibilities
- Only hospital staff should be allowed to clean special units (e.g. ICU, OT, isolation unit, SCBU, dialysis unit etc.)
- Provide continuing education to the cleaning staff
- Cleaning should be supervised by the nursing sister/nurse-in-charge, liaison nurses for IPC of the units and infection control nursing officer (ICNO)
- Establish systems and processes involving relevant departments within the hospital to effectively manage the procurement, upkeep, and maintenance of environmental cleaning supplies and equipment
- Maintain inventories regularly and inspect supplies and equipment to,
    - prevent stock-outs
    - anticipate supply needs
    - ensure availability of additional materials for contingencies such as outbreaks

4.6.2 General principles of environmental cleaning

- Keep the environment dry, clean, well ventilated and exposed to sunlight
- Wet cleaning and damp dusting is preferable, to prevent pathogens from being airborne from the surfaces that are being cleaned
- Use a general-purpose detergent (GPD) for environmental cleaning. Do not use disinfectants unless indicated e.g. spills, isolation rooms
- Use dedicated cleaning equipment with colour codes for different areas. e.g. clinical areas, toilets, kitchens
- Wear appropriate personal protective equipment (PPE) e.g. heavy-duty gloves, apron, boots when cleaning
- Wash hands with soap and water after cleaning

4.6.3 Factors contributing to proper environmental cleaning

1. Supporting infrastructure
2. Products/chemicals used
3. Equipment used for cleaning
4. Techniques used for cleaning

4.6.3.1 Supporting infrastructure

- Appropriate selection of finishes, furnishings and patient care equipment is important. Finishes, furnishings and other surfaces (e.g. floors) should be cleanable, easy to maintain and repair, nonporous, seamless and resistant to microbial growth
- There should be a designated space for storage, preparation, and care of cleaning supplies and equipment
- Separate soiled and clean areas and sluice rooms/areas should be available for reprocessing of noncritical patient care equipment
- There should be access to adequate water services and wastewater systems

4.6.3.2 Products/chemicals used for environmental cleaning

- Ensure that cleaning products are used appropriately. Appropriate good quality products for the purpose should be used in effective concentrations, for the required contact time
- These products should ideally be non-toxic, easy to use, soluble and low cost with acceptable odour
- Use minimum number of products
- Prepare a master list
- Follow manufacturer's instruction for preparation storage and disposal of cleaning products
- Standard operating procedures (SOPs) should be available for use of these products
- Cleaning solutions are usually available as concentrated solutions and need to be diluted before use
    - Preparation should be done in a designated place
    - Wear PPE
    - Follow manufacturer's instructions
    - Test for working concentration if indicated using test strips
    - When prepared in bulk, label with name of the product, concentration, dates of preparation and expiry
    - All containers used for cleaning solutions should be clean, dry and labelled with name of the product, concentration, dates of preparation and expiry
    - Portable containers should be appropriately-sized and narrow necked to prevent dipping of cleaning clothes. Squeeze bottles are preferred over spray bottles for applying cleaning or disinfectant solutions to cleaning cloths before applying to a surface
    - Do not top up. Clean the containers, dry and refill
    - Use until the expiry date or till the container is empty whichever comes first
- Cleaning solutions should be changed according to manufactures instructions. Change more frequently,
    - when visibly dirty

- when used on heavily contaminated area
- immediately after cleaning blood and body fluids

4.6.3.3 Cleaning equipment

- Cleaning equipment should be suitable for the purpose
- Cleaning equipment which generate dust (e.g. broom, dusters) should not be used
- Vacuums that are used to clean floor in special clinical areas should be fitted with high-efficiency particulate air (HEPA) filters and undergo regular maintenance, which includes changing the filters on a regular basis (i.e. included in a scheduled maintenance program)
- Cleaning cloths should be provided in adequate quantities to avoid overuse and cross contamination
- Microfiber cleaning cloths
  - Have tiny charged fibers which allow dirt particles to cling to the cloth by electrostatic attraction which enables easier cleaning of "difficult to reach areas"
  - Withstand repeated laundering
  - Only compatible with a few chemicals used for cleaning. Not compatible with chlorine based products
- Dedicated cleaning materials and equipment should be available and colour coded to ensure that these are not used in multiple areas. Colour coding should be clear and permanent
- Cleaning equipment should be clean and stored dry between uses
- Mop buckets
  - Two-bucket system (routine cleaning): one bucket contains a detergent or cleaning solution and the other contains rinse water
  - Three-bucket system (for disinfection): one bucket contains the detergent or cleaning solution, second bucket contains rinse water and the third bucket contains disinfectant solution

Cleaning cart

- Clean and soiled items (e.g. cleaning cloths) should be placed separately in the cart
- Never put personal items, food or beverages in the cart
- A lockable compartment for containers of cleaning and disinfectant solutions should be available in the cart
- Thoroughly clean the cart at the end of each shift/day
- While in use, never leave the cart unattended
- When not in use, store in a designated environmental cleaning services area

PPE

- Always perform hand hygiene immediately before wearing gloves (donning) and immediately after removal (doffing)
- Train cleaning staff on appropriate use, donning and doffing of required PPE for all environmental cleaning procedures and tasks for which they are responsible

- All required PPE should be worn before entering a patient care area and removed for disposal or reprocessing (if reusable) before leaving that area
  Exception: do not take off PPE in an airborne precaution area (e.g. TB ward) where the respirator (e.g. N95 or FFP2) should be removed only after departing that area
- Use safety data sheet (SDS) to determine required PPE for preparing environmental cleaning products and solutions
- Make sure all PPE (reusable and disposable) are,
  - well maintained (good quality, appropriately stored) and cleaned before use if reusable
  - Clean and disinfect all reusable PPE at least once a day
  - Conduct regular fit-testing for cleaning staff who are required to wear respirators
- Use of gloves for cleaning
  - Perform hand hygiene immediately before wearing and immediately after removing heavy duty gloves
  - Routine use of gloves is not recommended unless
    - patient area is on transmission-based precautions
    - risk of hand contact with blood or body fluids (e.g. cleaning a spill, cleaning the bed of an incontinent patient)
    - risk of prolonged contact with disinfectants (e.g. terminal cleaning)
  - When use of heavy-duty gloves is indicated, always change/reprocess between each cleaning session (e.g., routine cleaning of a patient zone under contact precautions, terminal cleaning of a general patient area)
  - Use reusable rubber heavy duty gloves for cleaning
  - Use chemical-resistant gloves (e.g. nitrile, latex) for preparation of cleaning chemicals
  - Personal attire of the cleaning staff
    - Sleeves should be at or above the elbow
    - Wear rubber-soled closed toe shoes or boots
    - Remove wristwatches and hand jewellery before starting cleaning tasks
    - Keep fingernails short and free of nail varnish

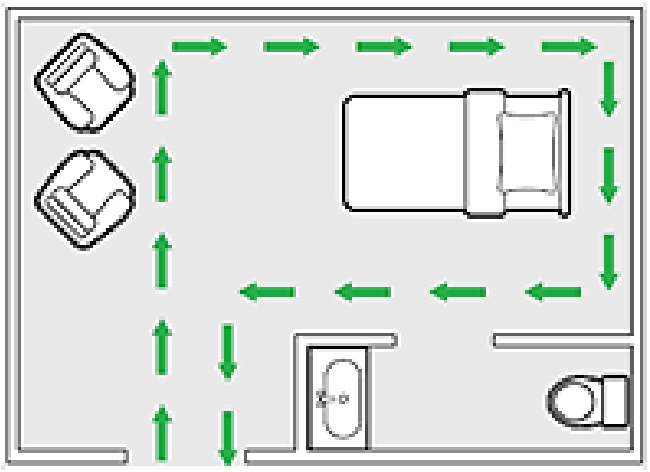
4.6.3.4 Cleaning techniques

Cleaning the surfaces

- Proceed from cleaner to dirtier areas to avoid spreading dirt and microorganisms e.g. clean low-touch surfaces before high-touch surfaces, clean patient areas (e.g. patient zones) before patient toilets
- Terminal cleaning should start with shared equipment and common surfaces, then proceed to surfaces and items touched during patient care that are outside of the patient zone, and finally to surfaces and items directly touched by the patient inside the patient zone
- Proceed from higher to lower heights in order to prevent dirt and microorganisms from dripping or falling and contaminating already cleaned areas.
  - clean bed rails before bed legs
  - clean environmental surfaces before cleaning floors
  - clean floors last to allow collection of fallen dirt and microorganisms

- Proceed in a systematic manner around the patient care area to avoid missing areas e.g. left to right or clockwise (figure 1)

Figure 1. Cleaning environmental surfaces



- Procedure for cleaning surfaces;
  - Thoroughly wet (soak) a fresh cleaning cloth in the cleaning solution
  - Fold the cleaning cloth in half until it is about the size of the hand. This will ensure that all of the surface area can be used efficiently (generally, fold them in half, then in half again, and this will create 8 sides)
  - Wipe surfaces using the general strategies as above
  - Regularly rotate and unfold the cleaning cloth to use all of the sides
  - When all of the sides of the cloth have been used or when it is no longer saturated with solution, keep it aside for reprocessing
  - Repeat process from step 1
- Use fresh cleaning cloths at the start of each cleaning session
- Change cleaning cloths when they are no longer saturated with solution. For higher-risk areas change between each patient zone (i.e. use a new cleaning cloth for each patient bed)
- Never double-dip cleaning cloths into portable containers (e.g. bottles, small buckets) used for storing environmental cleaning products or solutions

High-Touch Surfaces:

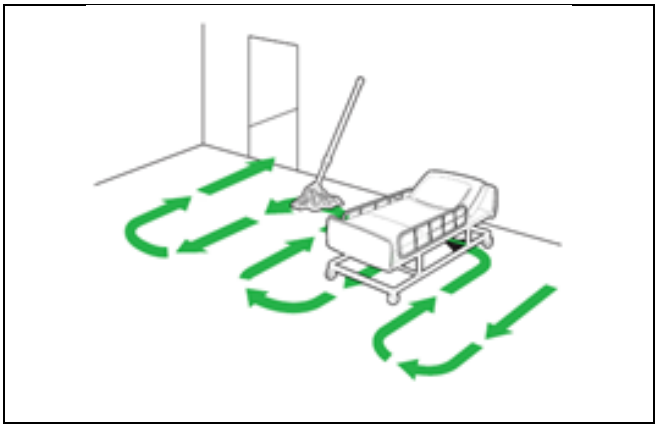
- Identify high touch surfaces and items in each ward /specialized areas/units. These should be cleaned frequently. Common high-touch surfaces include:
  - bedrails
  - IV poles
  - sink handles
  - bedside tables
  - counters where medications and supplies are prepared
  - edges of privacy curtains
  - patient monitoring equipment (e.g. keyboards, control panels)
  - transport equipment (e.g. wheelchair handles)

- call bells
- doorknobs
- light switches

Cleaning the Floors

- Floors are low touch surfaces and pose a low risk for pathogen transmission
- Therefore, for routine cleaning, daily cleaning is adequate and disinfectants are not necessary
- In situations where there is higher risk associated with floors (e.g. high probability of contamination), specific procedures, more frequent cleaning and use of disinfectants are recommended
- Procedure for cleaning floors;
  - Immerse the mop or floor cloth in the bucket with cleaning solution and wring out
  - Mop in a figure-8 pattern with overlapping strokes, turning the mop head regularly (e.g. every 5-6 strokes)
  - After cleaning a small area (e.g. 3m x 3m), immerse the mop or floor cloth in the bucket with rinse water and wring out
  - Repeat process from step 1
- Use wet floor or caution signs to prevent injuries
- Mop from cleaner to dirtier areas
- Mop in a systematic manner, proceeding from area farthest from the exit and working towards the exit (Figure 2)
- Change mop heads/floor cloths and buckets of cleaning and disinfectant solutions as often as needed (e.g. when visibly soiled, after every isolation room, every 1-2 hours) and at the end of each cleaning session
- Never shake mop heads and cleaning cloths as it disperses dust and droplets that could contain microorganisms
- Never leave soiled mop heads and cleaning cloths soaking in buckets

Figure 2. Cleaning the floor



4.6.4 Types of cleaning

Three types of cleaning are required for patient areas:

1. Routine cleaning
2. Terminal cleaning
3. Scheduled cleaning

Routine cleaning

Routine cleaning focuses on the patient zones. Aim of routine cleaning is to remove organic material and reduce microbial contamination to provide a visually clean environment.

Terminal cleaning

Terminal cleaning is done after the patient is discharged/transferred. It includes the patient zone and the wider patient care area. It aims to remove organic material and significantly reduce and eliminate microbial contamination to ensure that there is no transfer of microorganisms to the next patient (see below 4.6.6).

Scheduled cleaning

Scheduled cleaning is done concurrently with routine and terminal cleaning. It aims to reduce dust and soiling on low touch items or surfaces. Scheduled cleaning is performed on items or surfaces that are not at risk for soiling under normal circumstances, using neutral detergents and water. If they are visibly soiled with blood or body fluids, these items should be cleaned and disinfected as soon as possible.

4.6.5 Cleaning guidance

Floors and surfaces

Area/item	Agent	Method of cleaning/disinfection
Floors	GPD	Damp mop with GPD and water at least 3 times a day in clinical areas and keep dry Use 0.1% hypochlorite, • if there is an outbreak • in specialized patient areas: - dependency patients (e.g. ICUs) - immunosuppressed patients (e.g. bone marrow transplant, chemotherapy) - patients undergoing invasive procedures (e.g. operating theatres) - patients who are regularly exposed to blood or body fluids (e.g. labour rooms, burns units)
Mops	GPD	Rinse in water, soak in freshly prepared 0.1% hypochlorite for 30 minutes, rinse and hang to dry in a dedicated place with adequate sunlight, not touching the floor. Store dry. (Alternative- heat disinfection)

Area/item	Agent	Method of cleaning/disinfection
Mop buckets	GPD	Clean with GPD, dry and store inverted
Horizontal surfaces	GPD	Table tops, lockers, bed railings, half walls, ledges should be damp wiped daily with GPD. Tops of curtain rails should be damp wiped weekly
Walls	GPD 0.1% hypochlorite≠	Should be tiled or enamel painted up to 4-5 feet Damp wipe monthly For certain infections (diarrhoeal pathogens, MDROs etc.) and frank soiling disinfect with 0.1% hypochlorite
High touch surfaces*	GPD 70% alcohol or 0.1% hypochlorite≠	Frequent cleaning with GPD Disinfect in areas having patients with infections and in outbreaks (for metal surfaces- 70% alcohol)

**"High touched/frequently touched" surfaces - e.g. light switches, door knobs, tap handles, monitors etc.*

Furniture

Area/item	Agent	Method of cleaning/disinfection
Bed frames and cots	GPD 0.1% hypochlorite≠ or70% alcohol	Damp wipe with GPD on patient discharge or when soiled For certain infections (diarrhoeal pathogens, MDROs etc.) disinfect with 0.1% hypochlorite if used by a patient with infection
Mattresses and pillows	GPD 0.1% hypochlorite≠	Protect with waterproof covers. Covers should be intact. Wipe the covers with GPD between patients. For certain infections (diarrhoeal pathogens, MDROs etc.) and when soiled, disinfect with 0.1% hypochlorite
Other furniture	GPD 0.1% hypochlorite≠	Damp dust with GPD daily For certain infections (diarrhoeal pathogens, MDROs etc.), disinfect with 0.1% hypochlorite after discharging patients.
Lights and shades	GPD	Damp dust at least 3 monthly
Telephone	70% alcohol	Wipe daily
Toys	GPD	If soiled, wash with GPD. Avoid using soft toys as these cannot be adequately decontaminated

Dishes, glasses, cups, eating utensils	GPD	Wash with soap and water

Bathroom items

Area/item	Agent	Method of cleaning/disinfection
Floors of bathrooms and toilets	GPD 0.1% hypochlorite≠	Clean with GPD 5 times a day Disinfect in units with diarrhoea patients
High touch surfaces **	GPD 70% alcohol or 0.1% hypochlorite≠	Clean with GPD 5 times a day Disinfect in units with diarrhoea patients (for metal surfaces- 70% alcohol)
Commodes and toilet seats	GPD 0.1% hypochlorite≠	Clean with GPD 5 times a day. Disinfect surfaces with 0.1% hypochlorite in units with diarrhoea patients. Pouring disinfectants into lavatory pans or drains is not required
Wash basins (sinks) and taps	GPD	Clean with GPD 3 times a day
Patient washing bowls	GPD	All patients should preferably have their own bowls. Wash and dry daily
Mirrors, dispensers used for toilet paper soap etc.	GPD	Clean with GPD daily
Bathtub/bathing trolley	GPD	Bath is a potential source of Gram-negative infection, especially *Pseudomonas aeruginosa*. It should be cleaned with an appropriate disinfectant after each use

*****High touch surfaces in the bathroom- light switches, door handles- both outer and inner, sink and faucet handles, hand rails at toilet and shower, toilet flush handle***
≠ contact time for 0.1% hypochlorite is 10 minutes

Non critical reusable patient care equipment	*Refer Chapter 4.5*

4.6.6 Terminal cleaning

- Terminal cleaning is the thorough cleaning/disinfection of the patient zone, a wider patient care area and re-useable equipment either within the whole healthcare facility or within an individual ward/department/unit. This may be required in the following circumstances:
  - Following an outbreak or increased incidence of infection
  - Following discharge, transfer or death of a patient who has had a known infection
  - Following isolation/contact precaution nursing of a patient
- This aims to remove organic material and significantly reduce and eliminate microbial contamination to ensure that there is no transfer of microorganisms to the next patient
- The general terminal cleaning process includes;
  - Removal of soiled/used personal care items (e.g. cups, dishes) for reprocessing or disposal
  - Removal of facility-provided linen for reprocessing or disposal- *Refer Chapter 4.7*
  - Inspection of window treatments- if soiled, clean blinds on-site, and remove curtains for laundering
  - Reprocessing of all reusable (noncritical) patient care equipment
  - Clean and disinfect all low- and high-touch surfaces, including those that may not be accessible when the room/area was occupied (e.g. patient mattress, bedframe, tops of shelves, vents), and floors
  - Clean (scrub) and disinfect hand washing sinks
- Make sure that the ventilation of the area/room being cleaned is adequate; if there is no window, the door should be left open when applying hypochlorite/other disinfection solutions
- For checklist for monitoring terminal cleaning- Refer Annex 4.6.1

4.6.7 Assessment and monitoring of cleanliness and quality

- There should be a process in place to measure the quality of cleaning in the health care setting
- An action plan should be developed to identify and correct deficiencies
- Methods of monitoring cleanliness should be implemented e.g. conventional visual assessment, fluorescent marking. Routine culturing of environment and air is not recommended
- Cleaning audits should be carried out and results should be analyzed and disseminated with feedback to staff

4.6.8 Management of spills

- Spillages should be dealt with immediately
- Make the area safe i.e. do not allow people to walk through the spillage and never leave the spillage unattended. A display sign is helpful
- PPE must be worn
- Gather together all the equipment, disinfectants and waste receptacles/waste bags that are required to correctly and safely manage the spill. A spill kit should be available

- All items used to manage a spill must be disposed of correctly as per local waste policy - *Refer chapter 4.8*
- Safe working practices and procedures must be used to prevent exposure incidents during the management of spillages
- If an exposure incident occurs when dealing with a spillage, the local occupational exposure policy should be followed - *Refer Chapter 9*
- Recording and reporting of spillages should be done to avoid future incidents or exposures to blood and other body fluids and ensure that3wwwwwwer appropriate measures and equipment are in place to manage such spillages

4.6.8.1 Contents in a spill kit:

Single-use items in the spills kit should be replaced after each use of the spill kit

1. Scoop and scraper
2. Gloves – heavy duty rubber gloves
3. Plastic apron/ disposable polythene apron
4. Medical/surgical mask
5. Eye protection (face shield/goggles)
6. Absorbent material (paper towels/wadding)
7. Clinical waste bags (yellow bags) and ties
8. Disinfectant (hypochlorite powder or chlorine releasing granules to prepare 1% and 0.1% hypochlorite freshly prepared solution)
9. Detergents
10. Protocol for spill clean-up procedure (laminated)

4.6.8.2 Management of blood and body fluid spill

- Keep a “caution” board and isolate the area
- Wear appropriate PPE in the spill kit
- Cover area of the spill with an absorbent material (disposable paper towels/wadding) and allow to absorb
- Pour freshly prepared 1% hypochlorite solution (10000 ppm available chlorine) on the absorbent material
- Allow at least 10 minutes contact time
- Remove broken glass pieces using a forceps and discard into a sharps bin
- Remove absorbent material and dispose into a yellow bag
- Wipe the area with a detergent solution and allow to dry
- Remove PPE and place disposable PPE immediately in the yellow bag
- Tie the mouth of the yellow bag

- Wash hands wearing heavy duty gloves with running water. Remove heavy duty gloves and disinfect them in 1% hypochlorite
- Wash hands with soap and running water
- Arrange cleaning and disinfection of reusable supplies (e.g. mops, bucket etc.) immediately after the spill is managed

4.6.8.3 Management of other spillages (vomitus, faeces and urine)

Spillages of body fluids containing solid/semi-solid matter e.g. faeces and pus, need to be cleaned up and disposed into a yellow bag first as the presence of organic matter can markedly reduce the activity of any disinfectant applied.

- Wear appropriate PPE in the spill kit
- Cover and contain the spillage with an absorbent material
- Once absorbed, carefully clean the area removing the absorbent material with all organic matter (vomitus, faeces) and absorbed liquid (e.g. urine). Discard all into a yellow bag
- Mop the area with warm water and a GPD
- Wipe over the area with 0.1% hypochlorite solution (1000 parts per million available chlorine) and let it dry
- If the faeces, urine or vomitus was blood-stained, 1% hypochlorite solution (10000 ppm available chlorine) should be used
- Remove disposable PPE and place immediately into the yellow bag
- Tie the mouth of the yellow bag
- Wash hands wearing heavy duty gloves with running water. Remove heavy duty gloves and disinfect them in in 1% hypochlorite
- Wash hands with soap and running water
- Arrange cleaning and disinfection of reusable supplies (e.g. mops, bucket etc.) immediately after the spill is managed

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Annexure 4.6.1

CDC Environmental Checklist for Monitoring Terminal Cleaning

Date:	
Unit:	
Room Number:	
Initials of staff:	

Evaluate the following priority sites for each patient room

High-touch Room Surfaces	**Cleaned**	**Not Cleaned**	**Not Present in Room**
Bed rails/controls			
Tray table			
IV pole (grab area)			
Call box/button			
Telephone			
Bedside table handle			
Chair			
Room sink			
Room light switch			
Room inner door knob			
Bathroom inner door knob			
Bathroom light switch			
Bathroom handrails by toilet			
Bathroom sink			
Toilet seat			
Toilet flush handle			
Toilet bedpan cleaner			

Evaluate the equipment present in the room

High-touch Room Surfaces	**Cleaned**	**Not Cleaned**	**Not Present in Room**
IV pump control			
Multi-module monitor controls			
Multi-module monitor touch screen			
Multi-module monitor cables			
Ventilator control panel			

Mark the monitoring method used:		
Direct observation ☐	Fluorescent gel ☐	Agar slide cultures ☐
Swab cultures ☐	ATP(Adenosine triphosphate)system ☐	

4.7 LINEN MANAGEMENT

Introduction

The used linen in healthcare settings can harbour large numbers of potentially pathogenic microorganisms. This might lead to transmission of microorganisms to patients, healthcare workers or the environment potentially causing infections. Therefore, appropriate precautions should be taken to prevent transmission of infections through linen. These precautions apply to all stages of linen management.

Hospital linen is defined as all reusable textile items including:

- bed linen: bed sheets, blankets, cot sheets, duvet covers, pillowcases
- curtains
- hoist slings
- patient clothing (gowns, shirts, pyjamas etc.)
- staff clothing (gowns, coats, scrub suits, aprons, pyjamas etc.)
- towels

Every patient should have clean linen. Bed linen should be changed on discharge of a patient or whenever soiled or contaminated.

4.7.1 Segregation of linen

Table 1. Categories of linen

Category	Definition
Clean linen	Linen ready to be used
Used linen	All linen that is used by a person not known or suspected to be infectious or not contaminated with either blood or body fluids
Infectious linen	All linen used by a person known or suspected to be infectious and linen that is contaminated with either blood or body fluids

4.7.2 Handling used/infectious linen in the ward

- All staff that handle linen (clean or used/infectious) should adhere to the guidelines and protocols on linen management in the hospital
- Used and infected linen should be handled as little as possible with minimum agitation
- All linen should be sorted according to the category and bagged immediately after removal. Staff must not hand carry loose used linen, or leave them on the floor
- All staff must ensure that no extraneous items are disposed of with used linen, such as dentures, spectacles, sharps, incontinence pads and tissue as they may harm the laundry operators or cause damage to machines
- Staff should wear aprons and gloves when handling linen from infected patients or whenever handling linen contaminated with body fluids

- Used linen must be placed in a laundry bag. Infectious linen must be placed in a yellow bag (water soluble bags if available) and tied when 2/3 full. Staff who handles infectious linen should wear an apron, mask and heavy-duty gloves. All infectious linen is to be stored in a secure external area in the unit until collected
- A label should be attached to the bag identifying the ward or department along with the list of items contained in the bags. Individual items should be marked with the ward/unit identification with a permanent marker for easy tracking
- Staff should wash their hands after handling used linen, and after removing gloves and aprons

4.7.3 Transport of used linen and infectious linen

- Linen should not be carried along corridors un-bagged
- Separate washable carts/trolleys should be used for cleaned and used/infectious linen transport

4.7.4 Cleaning and disinfection of linen

- There should be dedicated washing machines for used and infectious linen
- Infectious linen should undergo thermal disinfection. If washing machines with thermal cycles are not available soaking in 0.05% hypochlorite solution for 15-30 minutes, prior to washing may be used

  For linen management in the laundry - *Refer Chapter 7.16*

4.7.5 Transporting cleaned linen

- Cleaned linen should be transported in a dedicated cart/trolley
- Linen should be adequately covered during transport

4.7.6 Storage of cleaned linen

- Clean linen should be stored in a clean, designated area preferably in a closed cupboard

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4.8 WASTE MANAGEMENT

Introduction

Healthcare waste management is an integral part of an infection prevention and control program in a hospital. Ineffective healthcare waste management leads to a significant health risk to the public, patients and hospital staff. Additionally, effective waste management has economic benefits such as cost savings linked to waste reduction and recycling of waste.

National Environmental Act – No 47 of 1980 states that "No person shall generate collect, transport, store, recover, recycle or dispose waste or establish any site or facility for the disposal of any waste specified in the Schedule VIII except under the authority of a license issued by the Authority and in accordance with such standards and other criteria as may be specified by the Authority".

Principles of achieving a safe and sustainable management of healthcare waste is achieved by clear delineation of responsibilities, development and adoption of safe and environmentally sound technologies together with appropriate operation with a monitoring system through capacity building.

Hazardous hospital waste is a unique form of solid and liquid waste generated in the process of diagnosis, treatment, and research of human and animal disease.

Hazardous waste, when ineffectively managed leads to occupational health risks to those who generate, handle, package, store, transport, treat and dispose them. It also results in environmental and public health risks through inappropriate treatment and/or disposal, which may contribute to environmental pollution and the spread of infectious diseases.

Scheduled waste license (SWL) and environment protection license (EPL) are regulatory requirements for a hospital for waste management. Application forms can be obtained from the central environmental authority (CEA) website.

4.8.1 Definitions of hospital waste

Hospital waste is classified into two types:

1. **Scheduled/hazardous waste**: Waste that is actually or presumably contaminated with biological, chemical and/or other hazardous material. These account for 10-25% of waste in a hospital.
2. **General or non-hazardous waste:** Waste that is not contaminated with blood, body fluids or, other infectious agents or material. These are generated in the administrative, kitchen and housekeeping functions and accounts for 75-90% of waste in the hospital e.g. paper, fabric, glass, food residues and containers.

4.8.2 Scheduled/hazardous waste

As defined by the World Health Organization, the basic categories of hazardous hospital waste include: infectious, pathological, sharps, chemical, pharmaceutical, genotoxic (including cytotoxic), waste with high content of heavy metals, pressurized containers and radioactive waste.

- **Infectious waste**

These are suspected to contain pathogens in sufficient concentration or quantity to cause disease in susceptible hosts. These include blood and blood products, items contaminated with blood and body fluids (e.g. dressings, cotton swabs and drip sets), microbiological cultures and items contaminated with microorganisms, excreta and clinical specimens.

- **Pathological waste**

These include human tissues, organs, body parts, foetuses and other similar waste from surgeries, biopsies, autopsies, animal carcasses, organs, and tissues infected with human pathogens.

- **Sharps**

Sharps include used or unused needles, syringes, cannulae, scalpel blades, razors, contaminated broken glass, and other similar material.

- **Chemical waste**

Chemical waste consists of discarded solid, liquid, and gaseous chemicals, used for diagnostic and experimental work and for cleaning, housekeeping, and disinfecting procedures. These are considered hazardous if at least one of the following properties is present; toxic, corrosive (pH<2 or pH>12), flammable, reactive (explosive, water-reactive, shock sensitive) or genotoxic.

- **Pharmaceutical waste**

These include expired, unused, spilt, and contaminated pharmaceutical products, drugs, vaccines, and sera that are no longer required. It also includes discarded items used in the handling of pharmaceuticals, such as bottles or boxes with residues, gloves, masks, connecting tubes and drug vials.

- **Genotoxic waste**

These are certain cytotoxic drugs, vomitus, urine, or faeces from patients treated with cytotoxic drugs, chemicals, and radioactive material. Cytotoxic or antineoplastic drugs are the principal substances in this category.

- **Pressurized containers**

Many types of gases used in health care are often stored in pressurized cylinders, cartridges, and aerosol cans. Once empty or of no further use (although they may still contain residues), these must be appropriately disposed.

- **Radioactive waste**

Radioactive waste includes any solid, liquid or pathological waste contaminated with radioactive isotopes of any kind (e.g. unused liquids from radiotherapy or laboratory research, contaminated glassware, packages or absorbent paper, urine and excreta from patients treated or tested with radionuclides).

- **Waste with high content of heavy metals (cadmium, mercury, lead etc.)**

Mercury containing thermometers and sphygmomanometers, CFL bulbs, dental amalgam, batteries etc.

- **Electrical and electronic waste (e-waste)**

Electronic waste includes electrical or electronic equipment or all waste containing electrically powered components. This is also known as WEEE (waste electrical and electronic equipment).

4.8.3 Waste Management

4.8.3.1 Waste management plan for a hospital

Healthcare waste management should be viewed as a part of infection prevention and control (IPC), and a local waste management plan could be developed by a committee including the IPC team. A typical waste management committee in a large hospital may contain the following members:

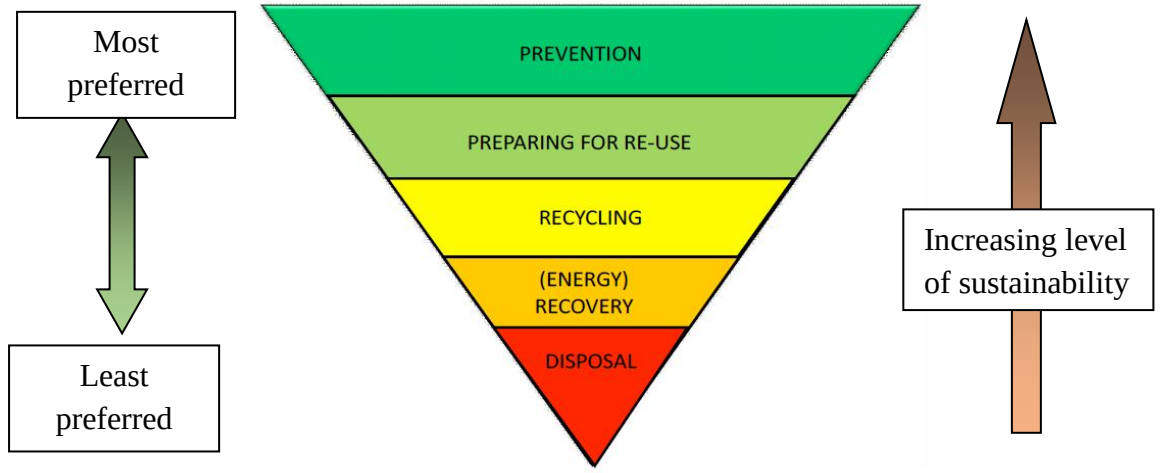
Head of the institution, consultant microbiologist, MOIPC, MO public health, administrative officer, biomedical engineer, accountant, senior matron, ICNO, PHI, chief pharmacist, overseer, manager of cleaning service

Invite any other personnel as and when necessary (e.g. officer from CEA, radiation officer).

4.8.3.2 Waste minimization

Waste minimization is a process, which reduces the amount of waste. This reduces waste handling and cost. This can be achieved by green health and zero waste concepts: use of biodegradable items whenever possible, reusable food containers, taking back leftovers (bring only the quantity required), and planning to reduce waste when performing tasks.

Figure 1. Waste management principle/waste hierarchy



4.8.3.3 Waste segregation/separation

Segregation is most effective when done at the point of generation of waste e.g. after use a syringe becomes hazardous waste but its original package does not. Therefore, the packaging can be placed into a non-hazardous waste container but the needle and syringe should be placed in a sharps bin.

The use of colour coding of hazardous waste containers is useful in segregating the different types of waste. To implement a uniform system of segregation throughout the country, the national colour code has been developed by the Ministry of Health.

Figure 2. National colour code for health care waste

Waste bags should be placed inside waste bins according to the above colour code. The size of the bags and the volume of the bins should be decided according to the need of the unit. Ideally, the bags and bins should carry the relevant symbol e.g. biohazard symbol for infectious waste, symbols for chemical waste and cytotoxic waste.

Waste bags

Plastic waste bags with following thickness should be used.

- For infectious waste-75 microns/300 gauged, leak-proof strong plastic bag
- For general and otherwaste-50 microns/200 gauged plastic bag
- For cytotoxic waste-120 microns/400 gauged plastic bag

Waste bags should be labelled to identify the source, and to allow problems with waste segregation to be traced back to the originated area.

Waste bins

Waste bins should be strong, durable and foot-operated with well-fitting lids.

Sharps bin

Sharps bin should be made of leak proof and puncture proof material and should be labelled with the biohazard symbol. The bin should have an opening on top, sufficient only to dispose the used sharps and should have a handle to carry.

Figure 3. Sharps bin

4.8.3.4 Waste handling

This includes collection, transport and storage of waste. Waste containers should not be kept in hallways or other public locations. Waste should be collected from each ward/unit on a regular schedule by an individual with a cart dedicated to waste collection. Waste should not be transported across hallways to another location for storage. The waste cart should be transported through the hospital using a specifically designated route to the storage area. The waste handler should wear a protective gown or apron, heavy duty gloves and boots.

To avoid injuries and infection transmission, trolleys and carts should:

- be easy to load and unload
- have no sharp edges that could damage waste bags or containers during loading and unloading
- be easy to clean and, if enclosed, fitted with a drainage hole and plug
- be labelled and dedicated to a particular waste type
- be easy to push and pull
- not be too high (to avoid restricting the view of staff transporting waste)
- be secured with a lock (for hazardous waste)
- be appropriately sized according to the volumes of waste generated

Waste, especially hazardous waste, should never be transported by hand due to the risk of accident or injury from infectious material or incorrectly disposed sharps that may protrude from a container. Infectious waste should be transported in closed carts. Hazardous waste should be transported by trained hospital staff.

Spare trolleys should be available in case of breakdowns and maintenance. The carts should be cleaned and disinfected daily. All waste bags should be tied before removing from the bins and should be intact during transportation.

4.8.3.5 Waste storage

Central storage area within a healthcare facility should be available away from the patient care area to store different types of waste safely according to the colour code until it is treated or collected for transport off-site. The waste collected should be disposed of as early as possible and should not be kept in the storage area for more than 48 hours. Infectious waste should be stored in a manner that maintains the integrity of the containers, prevents the leakage or release of waste from the containers, and provides protection from water, rain and wind, prevents the spread of infectious agents and maintains the waste in a non-putrescent state.

The storage area should:

- have an impermeable, hard-standing floor with good drainage (away from watercourses), the floor should be easy to clean and disinfect
- be cleaned regularly
- include the facility to keep general waste separated from infectious and other hazardous waste
- have a water supply for cleaning purposes
- have easy access for staff in-charge and for waste collection vehicles
- be lockable to prevent access by unauthorized persons
- have protection from the sun
- be inaccessible to animals, insects and birds
- have good lighting and at least passive ventilation
- not be situated in the proximity of fresh food stores and food preparation areas
- have a supply of cleaning equipment, protective clothing and waste bags or containers located conveniently close to the storage area
- have a wash basin with running tap water and soap that is readily available for the staff
- have spillage containment equipment
- be appropriate to the volumes of waste generated from each healthcare facility

4.8.3.6 Waste treatment and disposal

Non-hazardous waste

Composting and recycling are recommended whenever possible. Otherwise, dispose to a common garbage site/bin to be collected by the local authorities or bury in a common garbage pit.

Scheduled/hazardous waste

These can be treated and disposed onsite or off site by an authorized party approved by Ministry of Health and CEA.

- **Infectious waste**
  - These should be disposed of by using incinerator, hybrid autoclave (MetaMizer) or hydroclave adhering to the current regulations

- **Sharps**
  - After the bin is ¾ full, it should be disposed of by incineration or by using a hybrid autoclave

- **Pathological waste**
  - All anatomical waste from the operating theatre and placentae collected from the labour room should be collected in a yellow bag and transported to the closest crematorium for incineration

If there is a delay, store at 1-5°C in the mortuary

  - Disposal should be done under the supervision of PHI

- **Effluents**
  - Untreated effluent should be discharged through a sanitary sewerage system to a treatment plant or closed drainage system. There should be a dedicated sink/commode for this purpose. HCW should wear PPE and should avoid splashing and aerosol formation
  - If there is no closed drainage system, decontaminate with an equal volume of 1% hypochlorite solution or if tuberculosis is suspected 5% phenolic solution overnight, before discharging into the drainage system

- **Radioactive waste**
  - Solid radioactive waste is collected in appropriate containers and stored as required by the Atomic Energy Board and the Atomic Energy Regulatory Council in collaboration with the generators, for time periods suitable for complete decay of radioactivity. Thereafter, dispose as non-hazardous waste
  - Radioactive effluents of patients on radiotherapy should be discharged into a retention tank and kept until the radioactivity is decayed to background level and then discharged into a separate tank

- **Pharmaceutical waste**
  - Before treatment, pharmaceutical waste should be labelled and sorted according to the solids, semi-solids, powders, liquids or aerosols or by active ingredients, depending on the treatment options available
  - Special consideration is needed for controlled substances (e.g. narcotics), anti-infective drugs, antineoplastic and cytotoxic drugs, and disinfectants
  - Pharmaceutical waste should not be burnt or buried. It should be returned to the Medical Supplies Division for proper disposal
  - The recommended methods of disposal are thermal destruction by incineration in a high temperature incinerator, chemical inactivation, encapsulation or solidification
  - Antibiotics or cytotoxic drugs should not be discharged into municipal sewers or watercourses

- **Chemical waste**
  - Should not be discharged into sewerage systems
  - Should be disposed of by recycling, reclamation, chemical deactivation or neutralization as they are considered the recommended methods. Large quantities of these could be returned to the supplier. Where such an arrangement is envisaged,

appropriate provisions should be included in the original purchase contract for the chemicals
- Alternatives for the hazardous chemicals have to be used whenever possible
- Waste with high levels of cadmium and mercury should never be incinerated
- Minimization by substituting highly toxic and environmentally persistent cleaners and solvents with less toxic and environmentally friendly chemicals, using minimum concentrations where possible and by ensuring good inventory control
- Identification of hazardous components by chemical name and use Chemical Waste Tag
- Ensure that all chemical waste containers are closed securely and do not fill containers over the indicated fill line
- Keep exterior surface of containers free of contamination

- **Electronic waste (e-waste)**
  - Electronic waste or WEEE describes as discarded, obsolete, or broken electrical or electronic devices such as computers, toners, cartridges, mobile phones, refrigerators etc. They contain toxic substances such as lead, mercury, cadmium which can be of high concern to the environment and human health
  - CEA in collaboration with other stakeholder companies has a programme to collect all discarded electronic items. (Email: ceainfo@cea.lk, Website: www.cea.lk) – source: Government information center

4.8.4 Security

Hospitals should enforce rules and measures necessary to curtail and prevent scavenging of waste. Public access to hospital areas where waste is separated, collected, transported and stored prior to treatment and disposal should be limited. Measures should be taken to curtail attacks by scavenging animals and birds.

4.8.5 Training

Training of HCWs must be provided when
- new employees begin work
- existing employees are assigned new work responsibilities
- policy changes are made by the administration

4.8.6 Health and safety

An appropriate health and safety programme should be provided to include proper training, issuing PPE and surveillance on exposure injuries, immunization, post-exposure prophylaxis etc.

4.8.7 Emergency planning

The hospital management should be geared for handling unexpected situations such as accidental spills, equipment failures, delays or interruptions in waste collection, transport or treatment services and any other incident that require rapid actions.

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CHAPTER 5

ADDITIONAL / TRANSMISSION-BASED PRECAUTIONS

CHAPTER 5

ADDITIONAL / TRANSMISSION-BASED PRECAUTIONS

Introduction

Additional/transmission-based precautions are applied to patients suspected or confirmed to have infections transmitted by contact, droplet or air-borne routes. Transmission-based precautions are practiced while ensuring standard precautions. The infection prevention and control (IPC) team should be consulted before instituting transmission-based precautions.

5.1 Airborne transmission

Airborne transmission occurs by dissemination of either airborne droplet nuclei or small particles in the respirable size range (<5 μm) containing infectious agents that remain infective over time and distance.

Airborne precautions

- Individual room with adequate ventilation. This includes, where possible, the use of special air handling and ventilation systems - negative pressure ventilation with preferably 12 but at least 6 air exchanges per hour (air exhausted to outside through HEPA filters)
  Refer Chapter 7.11
- If negative pressure rooms are not available, a room with two strong exhaust fans could be used instead. Alternatively, a single room with good ventilation may be used. The door must be kept closed at all times, preferably self closing doors. Windows should be kept opened
- Donning PPE upon room entry and discarding them into yellow bin before leaving
- Staff should wear high efficiency respirator masks (e.g. N95) before entering the room
- Patient should be confined to the room
- Patient should wear a standard surgical mask if leaving the room
- Minimize number of staff and number of entries to the room
- Visitors should not be allowed to enter the room

5.2 Droplet transmission

Respiratory droplets carrying infectious pathogens transmit infection when they travel directly from the respiratory tract of the infectious individual to mucosal surface of the susceptible recipient, generally over short distances (usually droplet size >5μm in size). The maximum distance for droplet transmission is currently unresolved. Generally, it is considered as 3-6 feet.

Respiratory droplets are generated when an infected person coughs, sneezes, talks or during procedures such as suctioning, endotracheal intubation, chest physiotherapy and cardio pulmonary resuscitation (CPR).

Droplet precautions

- Individual room for the patient, if available
- When single room is not available cohorting with spatial separation of equal or more than 3 feet with a curtain between two patients. The curtains should be changed during terminal cleaning
- Donning PPE upon room entry and discarding into yellow bin before leaving
- Standard surgical splash proof masks (not a gauze mask) for healthcare workers
- Patient's movements should be restricted; patient should wear a standard surgical mask if leaving the room
- Patient should follow respiratory hygiene and cough etiquette
- Minimize visitors

5.3 Contact transmission

Contact transmission can occur either directly or indirectly.

- Direct Contact transmission: Microorganisms are transferred from one infected person to another person through skin and mucous membrane
- Indirect contact transmission: Transfer of microorganism through a contaminated object or intermediate person

  e.g. Hands of HCW, patient care devices such as thermometers and stethoscopes, inadequately cleaned or sterilized instruments or shared toys

Contact precautions

- Individual room for the patient if available. If not available, patients should be cohorted preferably with at least 3 feet spatial separation between beds
- Donning PPE upon room entry and discarding them before leaving
- A gown should be worn during patient contact or contact with contaminated surfaces or material
- Wash hands or use alcohol hand rub before and after contact with the patient and on leaving the room
- Restrict patient movement outside the room

Appropriate environmental and equipment cleaning, disinfection and sterilization procedures should be followed. Used PPE and other clinical waste should be collected in yellow bags and tied/closed within the isolation room. If reusable gowns are used, they should be sent for autoclaving. Dedicated non-critical patient care equipment used on the isolated patient (such as stethoscopes and blood pressure cuffs) should ideally remain in the isolation room.

Specific precautions for tuberculosis, viral haemorrahgic fever and other respiratory viral infections are discussed in relevant chapters.

Refer Chapter 13

Table 1: Infections which require specific transmission-based precautions

<table>
<tr><th colspan="3">Syndromes before pathogen identified</th></tr>
<tr><th>Contact precautions</th><th>Droplet precautions</th><th>Airborne precautions</th></tr>
<tr><td>Acute diarrhoea with likely infectious cause

Vesicular rash*

Respiratory tract infections in infants and young children*

History of infection or colonisation with multidrug resistant organisms (MDROs)**

SSTI or UTI with recent stay in a facility where MDROs** are prevalent

Abscess or draining wound that cannot be covered

Cough, fever, any pulmonary infiltrate, and recent travel to regions with outbreaks of SARS/MERS or avian influenza*</td><td>Meningitis

Petechial or ecchymotic rash with fever

Paroxysmal or severe persistent cough during periods of pertussis activity

Respiratory tract infections in infants and young children*</td><td>Vesicular rash*

Maculopapular rash with cough, coryza and fever

Cough, fever, upper lobe pulmonary infiltrate

Cough, fever, any pulmonary infiltrate in an HIV infected patient (or at high risk for HIV infection)

Cough, fever, any pulmonary infiltrate, and recent travel to regions with outbreaks of SARS/MERS or avian influenza*</td></tr>
<tr><th colspan="3">Known or suspected pathogens or infections</th></tr>
<tr><th>Contact precautions</th><th>Droplet precautions</th><th>Airborne precautions</th></tr>
<tr><td>Adenovirus pneumonia*, conjunctivitis*
Burkholderia cepacia pneumonia in cystic fibrosis patients
Clostridium difficile infection
Conjunctivitis-acute viral
Decubitus ulcer-infected, drainage not contained
Diarrhoea-infectious, in diapered or incontinent patient
Diphtheria-cutaneous
Ectoparasites-lice, scabies
Enteroviral infections-infants, young children
Furunculosis-infants, young children
Hepatitis A or E-diapered or incontinent patient
HSV-neonatal, disseminated, severe primary mucocutaneous
Human metapneumovirus
Impetigo</td><td>Adenovirus pneumonia*, conjunctivitis*, Diphtheria (pharyngeal), Haemophilus influenzae meningitis, epiglottitis, Haemophilus influenzae pneumonia (infants and children), Influenza, Meningococcal infections, Mumps, Mycoplasma pneumoniae pneumonia, Parvovirus B 19, Pertussis</td><td>Measles
MERS*
Monkey pox*
Tuberculosis-open pulmonary, laryngeal; draining lesions (e.g. from osteomyelitis) *
SARS*
Smallpox*
Varicella*
Viral haemorrhagic fevers*
Zoster-disseminated, immunocompromised until dissemination ruled out*</td></tr>
</table>

Contact precautions	Droplet precautions	Airborne precautions
Influenza infections MDRO** infection or colonization MERS* Monkey pox* Norovirus Parainfluenza infections-infants, children Rhinovirus* Rotavirus RSV infection-infants, children, immunocompromised Rubella-congenital SARS* Smallpox* *Staphylococcus aureus*-major SSTI Streptococcal (group A)-major SSTI* Tuberculous draining lesion Vaccinia-foetal, generalised, progressive, eczema vaccinatum Varicella* Viral haemorrhagic fevers* Zoster-disseminated, immunocompromised until dissemination ruled out *	Plague, pneumonic Rhinovirus* Rubella SARS* Streptococcal (group A) pneumonia, serious invasive disease, major SSTI*, pharyngitis or scarlet fever (infants or young children) Viral haemorrhagic fevers*	

** Condition requires two types of precautions*

*** Multidrug resistant organisms include carbapenem resistant Enterobacteriaceae (CRE), extended spectrum beta-lactamase producers (ESBL), multidrug resistant Acinetobacter, methicillin resistant Staphylococcus aureus (MRSA), penicillin resistant Streptococcus pneumoniae, vancomycin resistant enterococci (VRE), vancomycin intermediate S. aureus (VISA) and vancomycin resistant S. aureus (VRSA)*

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CHAPTER 6

CLINICAL GUIDELINES

CHAPTER 6

CLINICAL GUIDELINES

- This chapter describes the clinical guidelines which are recommended for prevention of certain healthcare associated infections e.g. ventilator associated pneumonia, central line associated blood stream infections, catheter associated urinary tract infections and surgical site infections

- Each healthcare institution should have institutional guidelines based on these guidelines. These should be compiled by an expert team including the consultant microbiologist, the relevant consultants and other staff who are involved in the management of patients

- Necessary protocols and tools should also be developed and maintained under strict document control by the infection prevention and control (IPC) team

- Teaching and training of relevant healthcare workers on these guidelines should be carried out by the IPC team

- Surveillance and audits of IPC practices according to standards with timely feedback are important

- Administrators of the hospitals should make the necessary resources available in adequate amounts

6.1 PREVENTION OF CENTRAL LINE-ASSOCIATED BLOOD STREAM INFECTIONS

Introduction

Central venous access device (CVAD) is a catheter introduced via a large vein into the superior vena cava or right atrium for the administration of parenteral fluids, medications or for the measurement of central venous pressure. CVAD insertion is a complex procedure that has the potential for immediate as well as delayed complications. Central line-associated blood stream infection (CLABSI) is one of such complications. For the purposes of this guideline, it includes femoral venous catheters as well.

Common types of CVADs

- Centrally inserted central catheters – inserted directly to subclavian, internal jugular, or femoral veins
  - Non-tunneled CVAD – percutaneously inserted into central veins (subclavian, internal jugular, or femoral) and are associated with increased risk of infection
  - Tunneled CVAD – tunneled under the skin and implanted into subclavian, internal jugular, or femoral veins and are associated with a lower rate of infection and may be more suitable when long-term (greater than 30 days) access is required
- Peripherally inserted central catheters (PICC) - inserted into basilic, cephalic, or brachial veins and enter the superior vena cava
- Implantable ports - tunneled beneath skin and have subcutaneous port accessed with a needle; implanted in subclavian or internal jugular vein

6.1.1 Strategies for prevention

Type of catheter material

- Polytetrafluoroethylene (Teflon) or polyurethane catheters have been associated with fewer infectious complications than catheters made of polyvinyl chloride or polyethylene

Basic requirements

- Catheter insertion should be done by trained medical officers with trained assistants
- CVAD should be inserted where there is a clear indication for its use and when the benefits obtained from CVAD access outweigh the risks of insertion
- Aseptic technique must be applied during all CVAD insertions to reduce the risk of local or systemic infection
- Use ultrasound guidance to place central venous catheters (CVC) to reduce the number of cannulations attempts and mechanical complications

Selection of sites and type of CVAD

- Weigh the risks and benefits of placing a CVAD at a recommended site to reduce infectious complications against the risk for mechanical complications

- Avoid using the femoral vein for central venous access in adult patients. Use a subclavian site, rather than a jugular or a femoral site, in adult patients to minimize infection risk for non-tunneled CVAD placement
- Avoid the subclavian site in hemodialysis patients and patients with advanced kidney disease, to avoid subclavian vein stenosis. Use a fistula or graft in patients with chronic renal failure instead of a CVAD for permanent access for dialysis
- Use a CVAD with the minimum number of ports or lumens essential for the management of the patient
- When adherence to aseptic technique cannot be ensured (i.e. catheters inserted during a medical emergency), re-site the catheter as soon as possible, i.e. within 48 hours

Hand hygiene and aseptic technique

- Perform hand hygiene, either by washing hands with soap and water or with an alcohol-based hand rub. Hand hygiene should be performed before and after palpating catheter insertion site as well as before and after inserting. Palpation of the insertion site should not be performed after the application of antiseptic, unless aseptic technique is maintained
- Maintain aseptic technique for the insertion and care of CVADs
- Sterile gloves should be worn for the insertion
- Use new sterile gloves before handling the new catheter when guidewire exchanges are performed

Maximal sterile barrier precautions

- Wear a cap, mask, sterile gown, sterile gloves, and use a sterile full body drape for the patient during insertion and guide wire exchange

Skin preparation

- Prepare skin with 2% (w/v) chlorhexidine with 70% alcohol before central venous catheter and peripheral arterial catheter insertion. If there is a contraindication to chlorhexidine, tincture of iodine, an iodophor, or 70% alcohol followed by aqueous 10% povidone iodine solution can be used as alternatives
- Antiseptics should be allowed to dry prior to placing the catheter

Maintenance of CVAD

- Appropriate post insertion care is vital to minimize complications
- Hand hygiene must be performed consistent with current policy prior to and after any manipulation of the CVAD or intravenous (IV) administration sets
- Inpatient CVAD insertion sites must be examined daily for any signs of local infection/inflammation, thrombosis, catheter integrity and position and the need for retaining the catheter. The findings must be documented in the patient's records. CVADs that are no longer clinically indicated should be promptly removed
- Patients transferring from other healthcare facilities with a CVAD in situ must have the device reviewed upon arrival for evidence of any infectious or mechanical complications
- Perform hand hygiene immediately before accessing the line. Clean and rub the access hub of the catheter with an antiseptic containing 70% alcohol for at least 15 seconds or 30

twists before accessing the hub ("scrub the hub"). Ideally the cap should be replaced with a new disposable cap

Catheter site dressing regimens

- Use either sterile gauze or sterile transparent, semi-permeable dressing to cover the catheter site
- Wear sterile gloves when changing the dressing on intravascular catheters
- Use 2% (w/v) chlorhexidine in 70% alcohol or 10% povidone iodine to clean the insertion site during dressing changes
- If the patient is diaphoretic or if the site is bleeding or oozing, use a gauze dressing until this is resolved
- Replace catheter site dressing if the dressing becomes damp, loosened or visibly soiled
- Do not submerge the catheter or catheter site in water. Showering should be permitted if precautions can be taken to prevent introducing organisms into the catheter (e.g., if the catheter and connecting device are protected with an impermeable cover during the shower)
- Replace dressings used on short-term CVAD sites every 2 days for gauze dressings and at least every 7 days for transparent dressings, except in those pediatric patients in whom the risk for dislodging the catheter may outweigh the benefit of changing the dressing
- Replace transparent dressings used on tunneled or implanted CVAD sites no more than once a week (unless the dressing is soiled or loose), until the insertion site has healed
- Ensure that catheter site care is compatible with the catheter material
- Use a chlorhexidine-impregnated sponge dressing for temporary short-term catheters in patients older than 2 months of age if the CLABSI rate is not decreasing despite adherence to basic infection prevention measures
- Monitor the catheter site visually when changing the dressing or by palpation through an intact dressing on a regular basis. If patients have tenderness at the insertion site, fever without obvious source, or other manifestations suggesting local or bloodstream infection, the dressing should be removed

Patient cleansing

- 2% chlorhexidine (aqueous) wash for daily skin cleansing can be used to reduce CLABSI

Catheter securement devices

- Use a sutureless securement device to reduce the risk of infection

Antimicrobial/antiseptic impregnated catheters and cuffs

- Use a chlorhexidine/silver sulfadiazine or minocycline/rifampin-impregnated CVC in patients whose catheter is expected to remain in place >5 days, if CLABSI rate is not decreasing after successful implementation of a comprehensive strategy to reduce rates of CLABSI

Systemic antibiotic prophylaxis

- Do not administer systemic antimicrobial prophylaxis routinely before insertion or during use of a CVAD to prevent catheter colonization or CLABSI

Antibiotic/antiseptic ointments

- Use povidone iodine antiseptic ointment or bacitracin/polymyxin B ointment at the hemodialysis catheter exit site after catheter insertion and at the end of each dialysis session if this ointment does not interact with the material of the hemodialysis catheter per manufacturer's recommendation
- Routine use of antiseptics is not recommended

Antibiotic lock prophylaxis

- Use prophylactic antimicrobial lock solution in patients with long term catheters who have a history of multiple CLABSI despite optimal maximal adherence to aseptic technique. A wide variety of antibiotic and antiseptic solutions have been used to flush or lock catheter lumens

Anticoagulants

- Do not routinely use anticoagulant therapy to reduce the risk of catheter-related infection in general patient populations

Replacement of CVADs including PICCS and hemodialysis catheters

- Do not routinely replace CVCs, PICCs, hemodialysis catheters or pulmonary artery catheters to prevent catheter-related infections
- Do not remove CVCs or PICCs on the basis of fever alone. Use clinical judgment regarding the appropriateness of removing the catheter
- If no evidence of infection is present a guidewire exchange to replace a malfunctioning non-tunneled catheter can be used

Replacement of administration sets

- In patients not receiving blood, blood products or fat emulsions, replace administration sets no more frequently than at 96-hour intervals, but at least every 7 days
- Replace tubing used to administer blood, blood products or fat emulsion within 24 hours of initiating the infusion
- Replace tubing used to administer propofol infusions every 6 or 12 hours, when the vial is changed

6.1.2 Central venous catheter care bundle

While individual IPC measures may lead to reduction in CLABSI rates the best outcomes are seen when multiple preventive measures are followed as a CVC care bundle.

Refer Chapter 6.9

6.1.3 Surveillance and audits

- Check lists on insertion and maintenance of CVC should be maintained

CLABSI Surveillance

- Calculate the device-associated infection rate (per 1000 device-days) using the following formula:

  CLABSI rate = Number of CLABSI for an infection site X 1000
  Number of CVAD days

  Numerator: Number of central line catheter related bloodstream infections X 1000

  Denominator: Number of central line-days (total number of days of exposure to central venous catheters by all patients in the selected population during the selected time period)

Audit of CVAD insertion and maintenance

- CVAD insertion and maintenance should be part of the routine audit programme. Additional audits may be carried out based on surveillance data

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6.2 PREVENTION OF VENTILATOR-ASSOCIATED PNEUMONIA

Introduction

Ventilator-associated pneumonia (VAP) is one of the most common nosocomial infections among patients in ICUs leading to significant morbidity and mortality and increased utilization of healthcare resources.

VAP is defined as pneumonia occurring >48 hours after endotracheal intubation. Known risk factors for VAP include prolonged intubation, enteral feeding, paralytic agents, underlying illness and extremes of age. Prior antibiotic use has been identified as a risk factor for healthcare-associated pneumonia (HAP) and VAP caused by multi drug resistant organisms (MDROs). Poor adherence to infection prevention and control (IPC) measures by the HCWs increases colonization of endotracheal tubes with resistant nosocomial pathogens.

Furthermore, other factors such as adherence to general IPC measures including standard precautions, hand hygiene, aseptic technique for relevant procedures, proper cleaning and disinfection of instruments and the environment, adequate bed spacing, adequate staffing and availability of isolation facilities for patients colonised or infected with known or suspected MDROs are also important in prevention of VAP.

6.2.1 Strategies for prevention

Recommendations for adults

- Basic Practices
  - Use non-invasive positive pressure ventilation in selected patients
  - Manage patients without sedation whenever possible. Interrupt sedation daily
  - Assess readiness to extubate daily
  - Perform spontaneous breathing trials with sedatives turned off
  - Chest physiotherapy and facilitation of early mobility
  - Use endotracheal tubes with subglottic secretion drainage ports if likely to require > 48-72 hours of ventilation
  - Change the ventilator circuit if visibly soiled or malfunctioning
  - Clean internal mechanisms including internal filters, according to manufacturer's instructions, by authorized staff at the unit. All ventilators should have a user manual and maintenance records
  - Elevate the head end of bed to 30-45 degrees
- Special approaches
  - Consider selective oral or digestive decontamination in selected patients (however, this carries a significant risk of promoting antimicrobial resistance)
  - Regular oral care with chlorhexidine
  - Prophylactic probiotics
  - Ultrathin polyurethane endotracheal tube cuffs
  - Automated control of endotracheal tube cuff pressure
  - Saline instillation before tracheal suctioning
  - Mechanical tooth brushing
  - Closed/in-line endotracheal suctioning

Recommendations for neonates

- Basic Practices
  - Use non-invasive positive pressure ventilation in selected patients
  - Minimise the duration of mechanical ventilation
  - Assess readiness to extubate daily
  - Manage patients without sedation whenever possible
  - Avoid unplanned extubation
  - Provide regular oral care with sterile water
  - Minimize breaks in the ventilator circuit
  - Change the ventilator circuit if visibly soiled or malfunctioning
- Special approaches
  - Lateral recumbent positioning of patient
  - Reverse Trendelenburg positioning
  - Closed/in-line suctioning systems

Recommendations for paediatric patients

- Basic practices
  - Use non-invasive positive pressure ventilation for selected patients
  - Assess readiness to extubate daily using spontaneous breathing trials in patients without contraindications
  - Avoid unplanned extubation
  - Provide regular oral care (i.e. tooth brushing or cleaning oral mucosa with gauze if no teeth)
  - Elevate the head end of the bed to 30-45 degrees
  - Change ventilator circuits if visibly soiled or malfunctioning
  - Use cuffed endotracheal tubes
  - Prevent condensate from reaching the patient
- Special approaches
  - Interrupt sedation daily
  - Prophylactic probiotics
  - Use endotracheal tubes with subglottic secretion drainage ports for older paediatric patients expected to require >72 hours of mechanical ventilation
  - Closed/in-line suctioning

IPC measures in endotracheal suctioning

Refer Chapter 6.8

6.2.2 Ventilator associated pneumonia (VAP) care bundle

While individual IPC measures may lead to reduction in VAP rates the best outcomes are seen when multiple preventive measures are followed as a VAP care bundle.

Refer Chapter 6.9

6.2.3 Surveillance of ventilator-associated pneumonia for infection control purposes

- Surveillance aims to evaluate process measures (adherence to individual preventive measures and bundles) and outcome measures (VAP rates, mortality, duration of mechanical ventilation and duration of ICU care and hospitalisation) related to ventilation
- Ventilator associated events (VAE) are divided into three broad categories:
  - Ventilator associated conditions (VAC)
  - Infection related ventilator associated conditions (IVAC)
  - Possible VAP and Probable VAP
- Hospitals using this system are advised to conduct active surveillance using CDC definitions and surveillance protocols. Daily aggregate ventilator data (daily minimum PEEP and daily minimum FiO2) are collected for all patients ventilated for 2 days or more to determine if they meet VAC criteria
  - Temperature
  - White blood cell count
  - Antibiotic exposure data

  are needed for patients who fulfil VAC criteria to determine if they meet IVAC criteria.

  Pulmonary specimen Gram stains and microbiology test results are required for patients who meet IVAC criteria to determine if they meet possible or probable VAP criteria.

  Surveyors can enter raw data into the CDC's online (if facilities available) "VAE calculator" to assist with case identification (http://www.cdc.gov/nhsn/VAE-calculator/index.html).

6.2.4 Cleaning and disinfection of ventilator and accessories

Refer Chapter 4.5

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6.3 PREVENTION OF CATHETER-ASSOCIATED URINARY TRACT INFECTIONS

Introduction

Catheter-associated urinary tract infection (CAUTI) is one of the most common healthcare-associated infections (HAI) worldwide and mostly reported due to the widespread and inappropriate use of urinary catheterization.

CAUTI is defined as the presence of symptoms or signs compatible with UTI in a patient with a urinary catheter for more than 48 hours with no other identified source of infection and significant levels of bacteria in a catheter urine specimen or in a midstream urine specimen when the catheter has been removed within the previous 48 hours.

6.3.1 General principles in urinary catheterization

- Indwelling catheters should be placed only for appropriate indications
- Whenever possible other methods of urine drainage such as condom catheters, intermittent urethral catheterization and adult disposable diaper pads should be used
- In patients with short-term indwelling urethral catheterization, antimicrobial-coated (silver alloy or antibiotic) urinary catheters may be considered
- Only persons who have had adequate training on correct technique of aseptic insertion and maintenance of catheter should be involved in catheter care
- Hand hygiene should be performed immediately before and after insertion and any manipulation of the catheter or drainage system
- The closed system should not be broken to collect samples
- Follow the urinary catheter insertion and maintenance care bundle - *Refer Chapter 6.9*

6.3.2 Procedure of catheter insertion

- Insert catheters using aseptic technique and sterile equipment. Clean the external meatus with sterile saline solution using sterile gauze/cotton swabs. In females, clean vulval area and urethral meatus
- Wash hands with soap and water and wear sterile gloves before inserting the catheter. A second pair of gloves should be available, if contamination occurs
- Lubricate the urethra with sterile, preferably single use packet/tube of anaesthetic gel
- Unless otherwise clinically indicated, consider using the smallest bore catheter possible, consistent with good drainage, to minimize bladder neck and urethral trauma
- Insert catheter gently without force. In case of undue resistance (e.g. strictures), seek specialized advice
- If unsuccessful in the first attempt, the catheter should be discarded and a new catheter should be used
- The balloon should be inflated with specified volume of distilled water
- Catheter should be anchored to the thigh securely with plaster to prevent movement.
  The name of the person inserted the catheter, the date, type and size of catheter and the volume of water in the balloon should be documented in the medical and nursing notes

6.3.3 Catheter care and maintenance

- Maintain a sterile, closed drainage system
- Maintain unobstructed urine flow
  - Keep the catheter and collecting tube free from kinking
  - The urine bag must be kept below the level of the bladder at all times, including when transporting the patient and emptying the bag. Do not let the urine bag touch the floor
- Do not disconnect the catheter and drainage tubes for any reason
- Do not clean the peri urethral area with antiseptics to prevent CAUTI while the catheter is in place. Routine hygiene to keep perineal area clean (e.g. cleansing of the meatal surface with saline during daily bathing or showering) is appropriate
- Catheter irrigation with antimicrobials or normal saline should not be done
- Systemic antimicrobial prophylaxis should not be routinely used at the time of catheter placement, catheter removal or replacement due to possible selection of antimicrobial resistance
- Routine addition of antimicrobials or antiseptics to the drainage bag should not be practised
- Changing indwelling catheters or drainage bags at routine, fixed intervals is not recommended. These should only be changed based on clinical indications such as infection, obstruction or when the closed system is compromised
- Antimicrobial treatment of CA-asymptomatic bacteriuria (CA-ASB) that persists 48 hours after short-term indwelling catheter removal in women may be considered to reduce the risk of subsequent CAUTI
- A urine specimen for culture should be obtained prior to initiating antimicrobial therapy for presumed CAUTI because of the wide spectrum of potential infecting organisms and the increased likelihood of antimicrobial resistance
- If an indwelling catheter has been in place for >2 weeks at the onset of CAUTI and is still indicated, the catheter should be replaced and a urine culture should be obtained from the freshly placed catheter prior to the initiation of antimicrobial therapy
- Screening for and treatment of CA-ASB are not recommended to reduce subsequent CA-bacteriuria or CAUTI in other catheterized patients, except in pregnant women and patients who undergo urologic procedures for which visible mucosal bleeding is anticipated

Emptying of the urine bag

- Emptying of the urine bag should be done by a trained healthcare worker. Perform hand hygiene before and after emptying the urine bag. Wear a pair of clean disposable gloves for each patient when emptying the urine bag
- Empty **t**he collecting bag using a separate, clean collecting container for each patient; avoid splashing, and prevent its outlet touching the receptacle

Transportation of a patient with a catheter

- Make sure that straps of the urine bag are untied before shifting the patient to avoid inadvertent pulling of the catheter with resultant trauma
- During transport maintain the closed drainage system

- The urine bag must be kept below the level of the bladder during transportation. Always use a device (e.g. hook attached to the trolley) to anchor the bag. Do not clamp the catheter during transportation

Catheter removal

- Remove catheters when they are no longer required

6.3.4 Intermittent catheterization

- Intermittent catheterization is an alternative to indwelling urethral catheterization to reduce CAUTI e.g. neurogenic bladder, spinal cord injuries, bladder atonia
- This method is reported to have fewer complications, compared with indwelling urethral catheterization, for catheter associated (CA)-bacteriuria, pyelonephritis, epididymitis, periurethral abscess, urethral stricture, vesicoureteral reflux, hydronephrosis, bladder and renal calculi, bladder cancer, and autonomic dysreflexia
- Intermittent catheterization is not commonly used for short-term catheterization, patients who are unwilling to perform frequent catheterization because of comorbid conditions or discomfort, or abnormal urethral anatomy (stricture, false passages, or bladder neck obstruction), impairment due to cervical spinal cord injury or other abnormality, obesity, and spasms.
- Clean rather than sterile technique may be practised in outpatient and institutional settings with no difference in risk of CA-bacteriuria or CAUTI

6.3.5 Urinary catheter care bundle

Refer Chapter 6.9

6.3.6 Surveillance and audits

Refer Chapter 11

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6.4 PREVENTION OF SURGICAL SITE INFECTIONS

Introduction

Surgical site infections (SSIs) are frequent in surgical wards and account for a high burden on patients and hospitals in terms of morbidity, mortality, prolonged hospital stay and additional cost. The aim of this chapter is to provide a range of evidence-based recommendations for interventions to be applied during the pre-, intra- and post-operative periods for the prevention of SSI, while considering the availability of resources.

6.4.1 Strategies for prevention

6.4.1.1 Pre-operative measures

- Minimize the pre-operative length of hospital stay
  - For elective surgery, ideally admit the patients on the day of surgery or previous night
- Identify and treat all infections
  - Identify and treat all infections including infections remote to the surgical site before elective surgery
  - Whenever possible, postpone elective surgeries on patients with infections until the infection has resolved
- Patient evaluation
  - Identify risk factors (hypertension, renal failure, COPD, PVD, diabetes, BMI $\geq$ 30, smoking), assess patients for pre-existing medical conditions and optimize the treatment plans (e.g. serum glycaemic control)
- Encourage tobacco cessation
  - Instruct patients to abstain from smoking and chewing tobacco for at least 30 days before an elective surgery
- Enhance nutritional support
  - Nutrition should be improved in patients who undergo major surgeries
  - Refer to a nutritionist if needed
- Antibiotic prophylaxis
  - Identify specific surgical procedures in which prophylactic antibiotics are beneficial, the optimal agents, timing and duration
    (Refer current national guidelines on empirical and prophylactic use of antimicrobials)
  - Do not apply antimicrobial agents (i.e. ointments, solutions or powders) to the surgical incision for the prevention of SSI
- Preoperative showering
  - Advice patients to have a bath using soap either the day before or on the day of surgery
- MRSA/MSSA screening and decolonization
  - Screening and decolonization are recommended only for patients awaiting cardiothoracic, neurosurgical, orthopaedic and transplant surgeries
- Mechanical bowel preparation
  - Do not use mechanical bowel preparation routinely

- However, mechanical bowel preparation may reduce the rate of postoperative infections in adult patients undergoing elective colorectal surgery

- Preoperative hair removal
  - If hair removal is necessary, this should be carried out with clippers and not with razors immediately before surgery and not on the previous evening
- Patient attire
  - The patients should wear clean, light coloured clothes, a cap and leggings
  - For specific procedures and clinical settings, appropriate specific theatre wear should be provided

6.4.1.2 Pre-operative and/or intra-operative measures - *Refer Chapter 7.1*

- Staff theatre wear
  - All staff should wear specific clean theatre wear, caps and masks in all areas. Staff should change the theatre wear before leaving the operating area
  - Wear a surgical mask that fully covers the mouth and nose when entering the operating room if an operation is about to begin or already under way, or if sterile instruments are exposed
- Surgical team wear
  - The operating team should wear sterile gowns during the operation
  - Scrubbed surgical team members should wear masks, caps, sterile gowns and gloves
  - Consider wearing two pairs of sterile gloves when there is a high risk of glove perforation and the consequences of contamination may be serious
- Jewellery, artificial nails and nail polish
  - The operating team should remove jewellery, artificial nails and nail polish before scrubbing
- Staff movements and doors
  - Staff wearing non-sterile theatre wear should keep their movements in and out of the operating area to a minimum
- Operating room doors
  - Keep operating room doors closed except as needed for passage of equipment, personnel, and the patient
- Hand decontamination
  - The operating team should wash their hands prior to the first operation on the list before donning sterile gloves, using an aqueous antiseptic surgical solution (e.g.4% chlorhexidine/7.5% povidone iodine) or antiseptic soap with a nail file for the nails. Ensure that hands and nails are visibly clean
  - When performing hand-scrubbing, scrub hands and forearms for 3-5 minutes. Before subsequent operations, hands should be cleaned for 2-3 minutes using the antiseptic solution

    Refer Chapter 7.1
- Antiseptic skin preparation
  - Prepare the skin at the surgical site immediately before incision using an antiseptic (preferably alcohol-based) preparation; chlorhexidine or povidone-iodine are suitable

antiseptics. Alcohol based chlorhexidine is the best option (2% chlorhexidine in 70% alcohol solution)
Refer Chapter 6.6

- Sterilization of instruments
  - All surgical instruments should be sterilized as recommended
    Refer Chapter 4.5
- Diathermy use
  - Do not use diathermy for surgical incision as this will increase the risk of SSI
- Maintaining patient homeostasis
  - Maintain body temperature above 36 ^{0}C in the perioperative period (excluding cardiac patients)
  - Intensively control perioperative blood glucose in both diabetic and non-diabetic adult patients.
  - Maintain optimal oxygenation during surgery to ensure that an oxygen saturation of more than 95% is maintained
  - Maintain adequate perfusion during surgery
- Wound irrigation and intra-cavity lavage
  - There is insufficient evidence to recommend for or against saline irrigation of incisional wounds before closure
  - Consider the use of irrigation of the incisional wound with an aqueous povidone iodine solution before closure of clean and clean-contaminated wounds
  - Antibiotic solutions are not recommended for wound irrigation before closure since this practice is associated with an unnecessary risk of contributing to antimicrobial resistance
  - Do not use wound irrigation to reduce the risk of SSI
  - Do not use intra-cavity lavage to reduce the risk of SSI
- Wound dressings
  - Cover surgical incisions with an appropriate dressing at the end of the operation

6.4.1.3 Postoperative measures

- Changing dressings
  - Use an aseptic non-touch technique for changing or removing surgical wound dressings
  - Perform hand hygiene before and after touching the surgical site or changing the dressing
    Refer Chapter 6.5
- Duration of surgical antibiotic prophylaxis
  - With the exception of a small number of surgical indications, the duration of surgical antibiotic prophylaxis should be a single dose
  - Antibiotic prophylaxis should not be continued until the drains are removed in order to prevent SSI
- Postoperative cleansing
  - Use sterile saline for wound cleansing up to 48 hours after surgery. Patients may shower safely 48 hours after surgery

- Topical antimicrobial agents for wound healing
  - Do not use topical antimicrobial agents for surgical wounds that are healing by primary intention

6.4.2 Proper theatre designing, commissioning, management and monitoring

Refer Chapter 7.1

6.4.3 Surgical site infection (SSI) care bundle

Refer Chapter 6.9

6.4.4 Education of healthcare workers, patients and carers

- Educate on how to prevent SSI including how to care and monitor the incision site and signs and symptoms of surgical site infections

6.4.5 Surveillance and audits

- Perform Surveillance and audits to;
  - monitor SSI rates and to take preventive measures
  - provide feedback to surgeons

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6.5 PREVENTION OF INFECTIONS DURING WOUND CARE

Introduction

The most important mode of transfer of pathogens to wounds is by the hands of healthcare workers. Other modes of transmission include contaminated patient care equipment, contaminated antiseptics and other solutions. It is therefore important to ensure that adequate infection prevention and control measures are combined with routine elements of care of wounds.

6.5.1 Ward structure and facilities

- Wards should be subdivided into units of four to six beds if possible, with adequate single rooms for isolation of infected patients
- Bed centers should be at least 7 to 8 feet apart with adequate hand washing facilities
- Turbulent air flow around the wound care area should be avoided (e.g. using fans)
- It is recommended to use single-use polythene apron during each wound dressing. Routine use of masks is unnecessary

6.5.2 Wound dressing

- Separate sterile packs with equipment and material required should be available for dressing individual wounds
- Suture removal of non-infected wounds should ideally be done at the beginning of the list
- Dressings of small wounds can be done at the bedside or in a designated area in an open ward
- Dressings of large wounds and burns should be done in a mechanically ventilated dressing room or operating theatre
- Patients with wounds infected or colonized with resistant organisms should be isolated and have their wounds dressed in the isolation rooms
- Infected wounds and contaminated wounds (e.g. colostomy) should be dressed at the end of the dressing list
- All discharging wounds should be adequately covered, and dressing must be changed immediately if they are soaked
- When an infected wound is dressed in a common dressing room or theatre, preferably 10 minutes should be allowed between patients. The cover (e.g. mackintosh) on the surface of the bed/table should be intact and it should be cleaned after each patient. It is preferable to use a disposable paper over that cover which should be changed after each patient

6.5.3 Dressing trolley

- Top surface should be thoroughly cleaned with 70% alcohol at the beginning of a dressing round
- The top of the trolley must be dry before the sterilized pack is placed on it
- Repeated cleaning of the trolley top during dressing round is unnecessary

- A yellow infectious waste bag of adequate size is fixed to the side of the trolley nearest to the patient to discard soiled dressings. Used instruments should be placed in a metal container e.g. a kidney tray
- The dressing pack is opened, and inner pack is placed in the centre of the trolley top. The inner wrap is opened with forceps by handling the corners only
- The supplementary packs are opened, and the contents are gently slid on to the inner wrap
- The requisite pack, supplementary packs, lotions and non-sterile items such as bandages, adhesive plaster and dressing scissors are placed on the lower shelf of the trolley
- Antiseptics and other lotions should be kept in small containers and replaced daily or preferably supplied as single use sachets and poured into galipot when required

6.5.4 Dressing technique

- Minimum of two nurses should be available
- The assistant nurse should prepare the patient, open the outer bag of dressing pack and supplementary packs and pour the lotions. Other nurse (dresser) prepares the trolley and performs the dressing
- Hand hygiene should be practised before and after the procedure
- A clean, non-touch technique is important when performing a wound dressing. Dresser should wear clean gloves when performing the dressing
- When non-touch technique is not followed, sterile gloves should be worn especially for dressing acute surgical wounds, surgical drain sites (e.g. Redivac), orthopaedic pin sites and burns
- To reduce opportunities for airborne contamination, a wound should be exposed for the minimum period of time. Dressings should be removed carefully with forceps or clean gloves and quickly placed in a yellow infectious waste bag and sealed. A large yellow infectious waste bag should be available for disposal of large dressings

Reference

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6.6 SKIN PREPARATION FOR INVASIVE PROCEDURES

6.6.1 Routine surgical sites

- For elective surgeries, patients are advised to have a shower or a bath (or bed bath) using soap, either the day before or on the day of surgery
- Avoid hair removal at the surgical site. If it is necessary, remove hair immediately prior to the surgery using clippers, preferably an electric clipper with a single-use head. Alternatively, depilatory creams can be used. Do not use razors for hair removal
- Antiseptic skin preparation

Table 1. Options for antiseptic skin preparation

When	Choice of antiseptic skin preparation
First choice - unless contraindicated or if the surgical site is not close to a mucous membrane	**Alcohol based solution of chlorhexidine** 2% (w/v) chlorhexidine gluconate solution in 70% alcohol (alcoholic chlorhexidine)
Alternative- if the surgical site is close to a mucous membrane	**Aqueous solution of chlorhe xidine** Chlorhexidine gluconate solution 4% (w/v)
Alternative - if chlorhexidine is contraindicated	**Alcohol based solution of povidone iodine** 10% povidone iodine alcoholic solution
Alternative - if both an alcohol-based povidone iodine solution and chlorhexidine are unsuitable or not available	**Aqueous solution of povidone iodine** 10% povidone iodine solution – this can also be used as a mucosal antiseptic (7.5% povidone iodine scrub can be used as an alternative)

- Apply antiseptic gauze swab over and well beyond the operative site in a concentric manner starting from the center and going outwards. Allow a minimum of 2 minutes of contact time prior to making the skin incision

Note:

- Chlorhexidine should not be used for pre-operative skin preparation of the surgeries on face or head (should not be allowed to contact with the brain, meninges, eye or middle ear). It can cause irreversible corneal damage on ocular exposure and sensorineural deafness if applied to the ear
- If alcoholic solutions are used, skin should be allowed to dry especially if diathermy is to be used
- Alcohol-based solutions should not be used on neonates or in contact with mucosa or eyes

6.6.2 Skin preparation for blood culture

- Aseptic precautions should be taken
- Wash hands with soap and water prior to starting the procedure
- Clean the selected site with 2% (w/v) chlorhexidine in 70% alcohol in a concentric manner from the center to outwards and allow at least 2 minutes to act
- If chlorhexidine is contraindicated, clean with 10% povidone iodine alcoholic solution (if not available, 70% alcohol followed by aqueous 10% povidone iodine solution can be used)
- If the patient is known to be allergic to iodine or alcoholic solutions, use 4% aqueous chlorhexidine
- Wash hands/use alcohol hand rub and wear a pair of sterile gloves
- Using a sterile needle and a syringe draw blood for culture
- After veniepuncture, residual iodine should be removed with surgical spirit and a small dressing should be applied over the puncture site

6.6.3 Skin preparation for other invasive procedures

E.g. lumbar puncture, lung aspirate, percutaneous needle biopsies

- Same as skin preparation for blood culture (6.6.2)

6.6.4 Skin preparation for central catheter insertion

- Prepare skin with a 2% (w/v) chlorhexidine with 70% alcohol before central venous catheter and peripheral arterial catheter insertion. If there is a contraindication to chlorhexidine, tincture of iodine, an iodophor, or 70% alcohol followed by aqueous 10% povidone iodine solution can be used as alternatives
- Antiseptics should be allowed to dry prior to placing the catheter

6.6.5 Skin preparation for peripheral cannula insertion

- Prepare skin with 70% alcohol, tincture of iodine, an iodophor or chlorhexidine gluconate

6.6.6 Skin preparation for minor procedures

E.g. Intra-muscular (IM) injections, venipuncture

- Prepare skin with 70% alcohol and allow to dry

References

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6.7 PREVENTION OF INFECTIONS ASSOCIATED WITH SURGICAL AND INTERCOSTAL DRAINS

6.7.1 Surgical drains

- Closed surgical drainage systems should be used whenever possible
- Drains should be removed as soon as possible
- Use aseptic techniques when handling drains
- Wet dressings must be changed
- Skin area around the open drains must be kept dry to avoid infection
- After removal of the drain, the wound should be covered with a dressing until the wound is healed and dry

6.7.2 Intercostal drains

- Intercostal bottle should contain either sterile water or sterile saline. This should be changed daily or more frequently when there is excessive drainage
- The drainage bottle must always be kept at a lower level than the site of drainage to prevent backflow
- Empty the contents into a sluice. Untreated effluent should be discharged through a sanitary sewerage system to a treatment plant or closed sewerage system if the facility is available. There should be a dedicated sink/commode for this purpose. Healthcare worker should wear appropriate personal protective equipment and should avoid splashing and aerosol formation
- If there is no closed sewerage system, decontaminate with an equal volume of 1% hypochlorite solution or if tuberculosis is suspected 5% phenolic solution overnight, before discharging into the sewerage system
- To re-use the bottles, clean bottles with GPD and send to CSSD for autoclaving
- The non-autoclavable bottles should be cleaned with GPD and immersed in 1% hypochlorite solution for 30 minutes. The metal lids should be immersed in a suitable disinfectant (e.g. peracetic acid, orthophthalaldehyde) and rinse with sterile water and dry

6.7.3 Transportation of patients with drains

- Maintain a closed sterile drainage system during transportation
- Do not clamp or disrupt the drainage system
- Do not raise the drainage bag or bottle above the level of the body cavity to which the drain is connected

Reference

- https://www.rch.org.au/rchcpg/hospital_clinical_guideline_index/Surgical_drains_(non_cardiac)/

6.8 PREVENTION OF INFECTIONS ASSOCIATED WITH ENDOTRACHEAL SUCTIONING

6.8.1 General principles

- Hands should be washed prior to suctioning and after contact with mucous membranes, respiratory secretions, endotracheal or tracheostomy tubes or any respiratory device used on a patient, whether or not gloves have been worn
- Secretions should not be allowed to accumulate in the lower respiratory tract. In ventilated patients' secretions including that collected above the tracheal cuff should be removed regularly. Secretions should be removed before patient is moved or before tracheal cuff is deflated for any reason

6.8.2 Suctioning procedure

- Suctioning should only be carried out when clinically indicated
- Practice hand hygiene before and after the procedure
- Wear sterile/clean gloves
- Use a sterile, single-use suction catheter
- A closed endotracheal tube suctioning system should be used whenever possible
- A gown and a standard splash proof surgical mask and eye protection should be worn
- Open the sterile package at the end that is to be connected to the suction apparatus and attach the suction tube holding the catheter through the packaging. The rest of the catheter is kept inside the packaging until it is removed with the gloved hand immediately prior to suctioning. Never leave a fresh catheter out of the pack
- The catheter should be introduced gently without suctioning
- Secretions should be removed with minimal trauma to the respiratory tract. Suction pressure should never exceed 80–100mmHg in neonates. 5 seconds should be sufficient. In adults it should be less than 150mmHg and 10-15 seconds should be sufficient for effective aspiration
- If suction needs to be repeated the gloves and the catheter should be changed
- Gloves and gown should be removed and hands should be thoroughly washed immediately after suctioning
- Physiotherapist should change the gown/apron and gloves and practice hand hygiene before moving to the next patient

6.8.3 Cleaning and disinfection of suction bottles and tubing

Refer Chapter 4.5

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6.9 CARE BUNDLES FOR PREVENTION OF INFECTIONS

Introduction

- A care bundle is a structured way of improving processes of care and patient outcomes
- It is a collection of interventions (usually 3-5) that are evidence based, when performed collectively, reliably and continuously, have been proven to achieve significantly better outcome than when implemented individually
- It ensures that the application of all the interventions is consistent for all patients at all times, thereby improving outcomes
- Insertion of devices and interventions such as surgical procedures increase the risk of healthcare associated infections (HAI). Implementation of care bundles when inserting and maintaining the devices will significantly reduce the risk of device related HAI
- Designing and implementation of the bundles should be decided locally
- Supplies or products which are required should be procured prior to implementation of the bundle
- Action plans/modifications in practices are required when expected results are not obtained
- Check lists should be maintained and regular audits should be done by the infection prevention and control team to monitor the compliance to care bundles which will provide the evidence of success i.e. lower rate of HAIs -Refer Annexure 6.9.1

Important care bundles in infection control

- Central venous catheter (CVC) care bundle
- Peripheral venous cannula (PVC) care bundle
- Ventilator associated pneumonia (VAP) care bundle
- Urinary catheter care bundle
- Surgical site infection (SSI) care bundle
- Tracheostomy care bundle

Following are examples of care bundles and they may be designed or modified according to the local setting/needs.

6.9.1 Central venous catheter (CVC) care bundle

CVC can cause central line associated blood stream infections (CLABSI). CVC care bundle prevents infection during insertion and maintenance of CVC -*Refer Chapter 6.1*

CVC insertion bundle

1. Perform hand hygiene and use maximum sterile barrier precautions, including the use of a cap, mask, sterile gown, and sterile gloves and apply a sterile body drape to the patient before inserting the CVC
2. Maintain aseptic technique throughout the insertion procedure
3. Use a single-use 2% (w/v) chlorhexidine in 70% alcohol for skin preparation of the site and allow to dry
4. Select the subclavian site if possible or internal jugular vein. Avoid femoral vein
5. Use sterile transparent, semi-permeable dressing to cover the catheter site

CVC maintenance bundle

1. Review the clinical need for the CVC daily and document

2. Examine the insertion site daily for any signs of local infection/inflammation, thrombosis, catheter integrity and position, and document. Check if the CVC dressing is intact or need to be changed
3. Use 2% (w/v) chlorhexidine in 70% alcohol or 10% povidone iodine to clean the insertion site during dressing changes
4. Perform hand hygiene immediately before accessing the line or site
5. Clean and rub the access hub of the catheter with an antiseptic containing 70% alcohol for at least 15 seconds or 30 twists before accessing the hub ("scrub the hub")

6.9.2 Peripheral venous cannula (PVC) care bundle

PVC care bundle prevents infection during insertion and maintenance of PVC.

PVC insertion bundle

1. Ensure that a PVC is clinically indicated
2. Perform hand hygiene immediately before PVC insertion
3. Prepare site with 2% (w/v) chlorhexidine with 70% alcohol, tincture of iodine, an iodophor or 70% alcohol followed by aqueous 10% povidone iodine solution
4. Antiseptics should be allowed to dry prior to placing the catheter
5. Maintain aseptic technique throughout insertion procedure
6. Use a sterile dressing to cover the cannula site

PVC maintenance bundle

1. Review the need for retaining the cannula daily and document
2. Perform hand hygiene immediately before accessing the line/site
3. Review the PVC dressing, whether it is intact or need to be changed
4. Clean and rub the access hub of the catheter with an antiseptic containing 70% alcohol for at least 15 seconds or 30 twists before accessing the hub ("scrub the hub")

6.9.3 Urinary catheter care bundle

Indwelling urinary catheters can lead to catheter associated urinary tract infections. This care bundle prevents infection during insertion and maintenance of urinary catheters -*Refer Chapter 6.3*

Urinary catheter insertion bundle

1. Consider alternatives to indwelling urinary catheterisation and document the indication for catheterization
2. Perform hand hygiene and maintain aseptic technique during insertion
3. Clean the urethral meatus with sterile saline prior to insertion
4. Use single-use sterile lubricant prior to insertion
5. Maintain aseptic technique when connecting indwelling urinary catheter to sterile closed drainage system

Urinary catheter maintenance bundle

1. Review the need for the indwelling urinary catheter daily
2. Maintain a closed drainage system
3. Perform daily meatal hygiene using sterile saline
4. Empty the drainage bag when ¾ full and use a clean container for each patient

5. Perform hand hygiene immediately prior to access or manipulation of the catheter
6. Keep the drainage bag below the level of the bladder and do not keep the tap of the bag in contact with floor

6.9.4 Ventilator associated pneumonia (VAP) care bundle

Artificial ventilation can lead to VAP. This care bundle prevents VAP in ventilated patients- *Refer Chapter 6.2*

1. Daily sedation vacations and assess the readiness to extubate daily
2. Use subglottic secretion drainage in patients likely to be ventilated for more than 48 hours
3. Use chlorhexidine as part of daily mouth care
4. Avoid the supine position, elevate the head end of bed to 30-45 degrees

6.9.5 Surgical site infection (SSI) care bundle

Refer Chapter 6.4

1. Give prophylactic antibiotics when indicated
2. Advice patients to have a bath using soap either the day before or on the day of surgery
3. If hair removal is absolutely necessary, this should be carried out with clippers and not using razors, immediately before surgery
4. Use 2% (w/v) chlorhexidine in 70% alcohol for skin preparation
5. Use aseptic technique for dressing changes

6.9.6 Tracheostomy care bundle

1. Provide adequate humidification
2. Check secretions at least 2 hourly and perform suctioning as required
3. Check inner tube regularly and clean using sterile saline or sterile water and replace if blocked with secretions
4. Change the dressing and tapes at least once in every 24 hours or more if soiled. Clean stoma and surrounding skin aseptically using sterile saline
5. Check cuff pressure regularly (in each shift), or following any intervention

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Annexure 6.9.1

Checklist for insertion of CVC (CVC insertion bundle) to be used in individual patients

Ward	Date	Staff name		
Inserting a Central Venous Catheter				
1. Surgical scrub was performed immediately before donning maximal sterile barrier precautions (i.e. headwear, mask, sterile gown and sterile gloves)			Yes	No
2. A sterile body drape was applied before inserting the CVC and aseptic technique was maintained throughout the insertion procedure			Yes	No
3. A single-use 2% chlorhexidine in 70% alcohol or was used for skin preparation of the site and allowed to dry			Yes	No
4. The subclavian site (if possible) or internal jugular vein was used			Yes	No
5. The CVC site was covered with a sterile transparent semi permeable dressing.			Yes	No

Checklist for maintenance of CVC (CVC maintenance bundle) to be used as an audit tool

Ward	**date**	**Staff name**											
Maintaining an Inserted Central Venous Catheter		**Pt 1**		**Pt 2**		**Pt 3**		**Pt 4**		**Pt 5**		**Pt 6**	
1. The clinical need for the CVC has been reviewed and recorded today		**Y**	**N**	**Y**	**N**	**Y**	**N**	**Y**	**N**	**Y**	**N**	**Y**	**N**
2. The CVC dressing is intact and has been changed in the last seven days		**Y**	**N**	**Y**	**N**	**Y**	**N**	**Y**	**N**	**Y**	**N**	**Y**	**N**
3. Hand hygiene was performed immediately before accessing the line or site		**Y**	**N**	**Y**	**N**	**Y**	**N**	**Y**	**N**	**Y**	**N**	**Y**	**N**
4. A single-use 2% chlorhexidine in 70% alcohol was used to clean the insertion site during dressing changes		**Y**	**N**	**Y**	**N**	**Y**	**N**	**Y**	**N**	**Y**	**N**	**Y**	**N**
5. The access hub has been cleaned with an antiseptic containing 70% alcohol before accessing rub the access hub for at least 15 seconds (“scrub the hub”)		**Y**	**N**	**Y**	**N**	**Y**	**N**	**Y**	**N**	**Y**	**N**	**Y**	**N**

Action plan (complete when all criteria not met)

Audit format to check compliance of CVC bundle

Summary Table of Central Vascular Catheter for insertion bundle	
Percentage compliance = $\frac{\text{total number of criteria achieved}}{\text{total number of criteria}} \times 100$	**EXAMPLE 3/5 x 100 = 60%**

	Summary Table of Central Vascular Catheter maintenance bundle	**Total**	Calculation for % compliance for each criteria	**Percentage compliance**
A	Total number			
B	Total number of patients that the clinical need for the CVC has been reviewed and recorded today		$\frac{\text{Total for B}}{\text{Total for A}} \times 100$	
C	Total number of patients whose CVC dressing is intact and has been changed in the last seven days		$\frac{\text{Total for C}}{\text{Total for A}} \times 100$	
D	Total number of patients where hand hygiene was performed immediately before accessing the line or site		$\frac{\text{Total for D}}{\text{Total for A}}$	
E	Total number of patients where single-use 2% chlorhexidine in 70% alcohol was used to clean the insertion site during dressing changes		$\frac{\text{Total for E}}{\text{Total for A}} \times 100$	
F	Total number of patients where the access hub has been cleaned with a single use antiseptic containing 70% alcohol before accessing rub the access hub for at least 15 seconds ("scrub the hub")		$\frac{\text{Total for F}}{\text{Total for A}} \times 100$	

Summary Table of Central Vascular Catheter maintenance bundle	
Total Percentage compliance = $\frac{\text{total number of criteria achieved}}{\text{total number of criteria}} \times 100$	Example: For 5 patients (all criteria met) 25/25 x 100 = 100% For 2 patients (3 criteria not met) 7/10 x 100 = 70%

CHAPTER 7

INFECTION PREVENTION AND CONTROL IN SPECIAL UNITS

CHAPTER 7

INFECTION PREVENTION AND CONTROL IN SPECIAL UNITS

- The design and the layout of special units are important in implementing successful IPC. The designing team should include:
  - Hospital administrators
  - Consultant microbiologist
  - Other relevant consultants (e.g. intensivists/ anaesthetists for intensive care units, paediatricians for special care baby units, surgeons for operating theaters etc.)
  - Finance officer
  - Architect
  - Biomedical engineer
  - Sister nurse-in-charge of IPC unit
  - Sister or nurse-in-charge of the unit
  - Any other person with special expertise
  - Manufacturers and other suppliers of clinical and support equipment and furnishing

- Adequate numbers of specially trained (pre-recruitment) staff should be available in all specialized units according to the workload of the unit. Continuous education and professional development of staff is mandatory. HCWs should be given training on IPC

- Guidelines, protocols and standard operating procedures on IPC should be available in the special units and these should be followed by HCWs

- Standard and additional precautions should be taken by all HCWs in special units in order to minimize healthcare associated infections

- Surveillance and audits of IPC practices according to standards with timely feedback are important to prevent and control HAI in special units

Following chapters describe the infection prevention and control (IPC) in different special care units

7.1 OPERATING THEATRE

7.1.1 Design and layout

Surgical operations and interventional procedures are performed in theatres with different types of artificial ventilation. This guideline refers only to conventionally ventilated and ultraclean-ventilated theatres.

- Conventionally ventilated operating theatres -for all basic surgeries
- Ultraclean-ventilated (UCV) operating theatres – for neurosurgery, orthopaedic, cardiothoracic and transplant surgery

The objective of prior planning of an operating theatre (OT) construction or renovation is to promote the highest standard of asepsis. The operating theatre location, type and number of operating rooms should be decided by the designing team. The team should include hospital administrators, surgeons, anaesthetists, microbiologist, engineers (structural, mechanical and electrical), architect, sister in charge, matron and the staff of infection prevention control (IPC) unit.

The designing team should get involved from the initial designing up to the commissioning/re-commissioning of the theatres.

To meet the objective and functions of the theatre, following aspects should be considered.

1. Functional requirements
2. Technical requirements
3. Environmental requirements
4. Other requirements

1. Functional requirements

- Location
  - Easy access to central sterile supplies department (CSSD)/sterilization unit, radiology department, emergency and surgical wards, surgical ICU, blood bank
  - Maximum protection from sun, sound, heat and wind
  - Independent of general traffic flow

- Size
  - General OT unit is approximately 6.5 m x 6.5 m x 3.5m
  - Additional room for heart lung machine, C-arm etc.
  - Paired OTs help in proper utilization of instruments and equipment

- Number of OTs
  - The number and the type of theatre suites should be decided at the time of designing and should be based on the number of surgical beds and the throughput of patients. Maximum of six suites are recommended in one OT complex

- Zoning
  - The entire OT complex can be divided into various zones

Table 1. Zoning of OT complex

Protective Zone	Clean zone	Sterile zone	Disposal Zone
• Reception, patient identification and case sheet check. • Waiting area for relatives • Changing rooms for OT staff/ surgeons • Store room • Sterilization area • Record and controller room • OT in charge office • Seminar and meeting room • Entrance to observation gallery	• Rest room for doctors • Nurses' duty room • Anaesthesia room • Recovery area	• Operating room • Sterile pack store • Trolley lay-up area	• Dirty wash up room • Disposal corridor and dedicated lift for transporting dirty linen, waste • Janitor closet

2. Technical requirements

- Internal design and finishes
  - Walls
    - Should be seamless and amenable to cleaning and disinfection and resistant to mechanical damage and biological attack
    - Painted in pale colour
    - Free of crevices and flaking
    - All corners should be smoothly curved
  - Door should be 1.2- 1.5meter-wide, swinging and self-closing
  - Ceiling
    - Should have the same features of walls. It should be able to bear the load of OT lights, X ray unit, TV camera, gas and electric panels
    - False ceiling should be 1 meter below the roof
  - Floor should be seamless, easily washable, non-staining, impervious and chemical-resistant

3. Environmental requirements

- Ventilation and air conditioning
  - Central air conditioning system
  - Must prevent build-up of anaesthetic gases
  - Should provide positive pressure ventilation with decreasing pressure gradient from sterile to protective zone
  - Should have appropriate air flows, air changes per hour, air pressures and pressure differentials for each area/ room

The system should comply with following standards

Table 2. Standards for ventilation

	Conventionally ventilated theatre	**Ultraclean ventilated theatre**
Air changes per hour (ACH)	Main OR - 20 ACH (Air velocity of 0.1-0.3 m/s) Room for laying up sterile instruments - 37 ACH Sterile pack store – 11ACH	Main OR >25ACH 37 ACH 11 ACH
Air filters	Two filters - primary and secondary Need not to be HEPA	HEPA filters of efficiency 99.9%

- Temperature should be between 20^0-24^0C (18^0C for orthopaedic theatres)
- Relative humidity should be kept between 40- 60 %
  - There should be devices to monitor differential pressure, temperature and humidity. Thorough sealing of all walls, ceiling and floor penetrations and tight-fitting doors are essential to maintain readable pressure
- Illumination to minimize eye fatigue, the ratio of intensity of general room lighting to that at the surgical site should not exceed 1:5, preferably 1:3. Colour and hue of the lights should be consistent. The overhead operating light should,
  - make an intense light within a range of 2700 -127000 lux into the incision without glare on the surface
  - be shadow-less
  - produce the blue – white colour of daylight
  - be freely movable both in horizontal and vertical ranges
  - should enable easy cleaning
  - should be aerodynamically designed to facilitate airflow
  - produce a minimum of heat (halogen bulbs generate less heat than other types)

4. Other requirements

- Electricity
  - Ensure continuous electricity supply
  - Stand-by generator system
  - UPS for all equipment
  - All electrical equipment in OT need proper grounding
- Water supply – beside normal supply of available water, separate reserve emergency overhead tank should be provided
- Gas supply - Built-in gas pipe line system to be ensured
- Plumbing
  - Plumbing should have impervious lining to seal contamination
  - Pipeline supply system should be able to cut off from mainline if the problem occurs anywhere along the delivery hosing/tubing
- Fire safety system - Fire detectors, hydrants and fire extinguishers should be provided. Fire exit route should be clearly identified

7.1.2 Commissioning of operating theatres

- This should include an assessment of engineering aspects with a commissioning report indicating the compliance with required standards according to the design. Next step should be a microbiological commissioning with an assessment of air quality.
- Engineering and microbiological commissioning and monitoring of operating theatre suites should take place in the following occasions.
  - Conventionally ventilated theatres
    - Conventionally ventilated theatres must be commissioned, after being built or after any substantial modifications that may affect airflow patterns in pre-existing theatre or after any period of disuse.
  - Ultra clean ventilated (UCV) operating theatres
    - Newly build UCV theatres must be commissioned before being used.
    - All UCV theatres should be re-commissioned following substantial modifications that may affect airflow patterns in pre-existing theatre or before being used after any period of disuse and annually on a regular basis.

7.1.3 Infection prevention and control measures

Surgical site infections (SSIs) are the commonest cause of healthcare-associated infections in low and middle-income countries and the second most common in high income countries. Therefore, maintaining high standards of IPC practices in operating theaters should be given high priority.

7.1.3.1 Staffing and theater discipline

Theatre attire

- All personnel who enter the restricted areas (clean and sterile zones) of the theatre suite should remove outdoor clothing before donning the freshly laundered attire intended for use within the surgical environment. During the shift, any soiled theatre attire should be changed as early as possible
- Sufficient supplies of theatre clothing should be provided daily
- Footwear with impervious soles should be worn. They should fit properly and provide adequate cover. Dedicated personalized footwear for all regular staff should be available
- The theatre staff should keep the hair clean and tidy. All the staff in the operating room should wear disposable caps, completely covering hair

Attire of scrub team

- Sterile theatre gowns
  - The scrub team should wear sterile theatre gowns
  - Theatre gowns should be made of waterproof, disposable material or tightly woven material of appropriate quality. Currently used conventional cotton clothing give some protection against contact contamination if they are dry, but skin scales carrying bacteria can escape through the large pores in cotton fabric. If cotton gowns are used, they must be changed whenever become soaked with blood or other liquids
  - Gowns should be wrap-around and back fastened

- Plastic aprons
  - Plastic aprons should be worn under the sterile theatre gowns by the scrub team for additional protection
- Face masks
  - The scrub team should wear standard splash proof disposable surgical masks which act as filters
  - The mask should completely cover the nose and the mouth and fit tightly
  - Tying or removing should be done touching only the tapes. Avoid touching the mask with gloved hands
  - The mask should be changed after each operation, and whenever it becomes contaminated or damp
  - Face masks are single-use items and must be disposed of as clinical waste immediately after removal. Following removal and disposal, hand hygiene should be performed
  - Masks should not be left around the neck or put into pockets for future use
- Visors and Goggles
  - Full-face visors or protective goggles/glasses should be worn for surgery with a high risk of blood or body fluids splashes
- Sterile gloves
  - Double gloves should be worn whenever required for surgeries with a high risk of trauma such as orthopaedic surgery
  - On the appearance of a visible tear or puncture, gloves must be removed and replaced with new ones after cleaning the hands with an antiseptic. The gown should also be changed when changing the gloves

On leaving the operating theatre

- All theatre personnel should change into outdoor clothing before leaving the theatre environment
- Members of the scrub team who leave the theatre for urgent matters (e.g. crash calls, ICU calls), should change their theatre clothing on return

Patient attire

- The patients should wear clean, light-coloured clothes, a cap and leggings

Scrubbing and dressing

Scrubbing and dressing should be done in designated places

Surgical hand scrub

- Remove all jewellery before scrubbing (rings, watches, bracelets)
- Fingernails must be kept short and free from nail polish. Artificial nails must not be worn
- Autoclavable nail brush/ nail file should be used **only** for the first hand wash of the day to remove debris underneath nails
- The scrubbing process must be thorough and systematic, covering all areas of the hands and forearms

- Apply 3-5 ml of antiseptic scrubbing solution (e.g. 4% chlorhexidine or 7.5% povidone iodine) to the hands and forearms before scrubbing. The initial scrub should last 3-5 minutes and in between cases scrubbing should last for 2–3 minutes
- Scrub each side of each finger, between the fingers and the back and front of the hands. Proceed to scrub the arms, keeping the hand higher than the arm at all times. Wash each side of the arm from wrist to the elbow
- Rinse hands and arms by passing them through running water in one direction only, from fingertips to elbows
- Hands should be dried using a sterile towel before donning sterile gown and gloves
- After performing the surgical scrub, members of the surgical team should keep hands up and away from the body so that the water runs from the tips of the fingers toward the elbows
- If hands or arms accidentally touch the taps, sink or other unsterile object during any phase of the scrub cycle they are considered contaminated and the scrub cycle must begin again
- Hands and forearms should be dried using a sterile towel and the proper technique should be followed when donning gown and gloves

Theatre behaviour

- The number of people inside the theatre should be kept to a minimum as shedding of 10,000 skin scales/person/minute is known to occur
- Unnecessary movement of staff within as well as in and out of the theatre during operations should be avoided
- Doors should be kept closed and door opening and closing should be minimized
- Restrict conversation in the theatre

Visitors

- Restrict visitors. Visitors who enter the operating theatre e.g. parents who accompany children until they are anaesthetized, paediatricians who attend the babies after caesarian sections should change into theatre attire. Parents who are only entering the anaesthetic room/recovery room may continue to wear their own clothing but must wear a theatre gown and footwear

Surgery on patients with infectious diseases or carrying multidrug resistant organisms

- Ward staff should notify the in-charge of the theatre in advance if there is a risk of transmission of infection from a patient (e.g. MRSA, HIV, HBV, chickenpox, open TB). Patients with MDR TB should not be sent to the theatre without discussing with the surgical and IPC teams
- Patients with such infections should be sent to the theatre as the last patient
- Patients having infections with a risk of air borne transmission (e.g. open TB, chickenpox) must be recovered in the operating room itself
- Surgical masks must be worn by all staff when attending to patients with TB and other respiratory tract infections. When performing aerosol generating procedures a N95 mask or equivalent must be worn

- Theatres need not be closed or fumigated after surgery on patients with tetanus and gas gangrene

Handling of equipment and consumables

- Equipment should be kept to a minimum
- Sterile packs should be kept in a stainless-steel cabinet which can be easily cleaned
- Laying-up of trolleys should not be done in advance
- Wrappings to be removed in the operating room immediately before use
- Theatre trolley should remain in operating theatre and ward trolley should not enter into operating theatre

7.1.3.2 Cleaning, disinfection and sterilization of theatre instruments and equipment

Types of equipment and general guidance for reprocessing

- Reusable items
  These should be cleaned and high-level disinfected as recommended by the manufacturer between each patient. This includes any tubing or device that is in contact with a patient
- Single use disposable items
  Single use items are not designed for easy cleaning, decontamination or repeated sterilization. Reuse of single use items can lead to transmission of infection and is therefore not recommended. They should be discarded appropriately at the point of use

➢ **Surgical instruments**

- Procedure for cleaning of instruments
  - Pre-wash before sending to CSSD should be done as soon as possible after using instruments
  - Wear personal protective equipment (plastic apron, heavy duty gloves, goggles, and boots)
  - Use a stainless-steel sink which is deep enough to completely immerse the equipment
  - Remove any gross soiling in the instruments by rinsing in tap water. Ensure all visible soiling is removed from the instruments. Thorough cleaning with a general-purpose detergent (GPD) and water will remove most microorganisms
  - Dismantle the instruments and immerse all parts in warm water (preferably 45^{o} C) and GPD. Follow manufacturer's instructions
  - Instrument should be immersed below the surface of the water while brushing and cleaning. Take precautions to prevent splash and injury
  - Rinse the instruments with running water. Inspect to ensure the instrument is clean. Dry appropriately
  - Pack instruments in the theatre if the cleaning step is completed within the OT before sending to CSSD. Theatre staff should place steri-tape inside and outside, indicate the date and initials. Check the steri-tape for colour change when the pack is received after sterilization
  - When transporting clean instruments to the CSSD use a dedicated clean, rigid, labelled container with a lid
  - Keep cleaning equipment (brushes and cloths) clean and dry between uses.

- Reusable nail brushes should be soaked in warm soapy water, rinse and autoclave
- For disinfection and sterilization of suction bottles and tubing, oxygen masks, kidney trays, mackintosh, buckets etc. - *Refer Chapter 4.5*

➢ **Anaesthetic equipment**

- Responsibility for decontamination of anaesthetic equipment should be vested in a well-trained member of the theatre nursing staff
- A clearly designated area near the operating rooms should be organized for this purpose with adequate space, appropriate wash basins with running water and drying and storage facilities

Reusable oxygen masks

- One of the most frequently and heavily contaminated pieces of equipment
- Immediately after use, mask connector should be removed and the mask is rinsed in tap water and scrubbed (using a brush). It should be rinsed and dried
- Autoclave if recommended by manufacturer (before autoclaving the plug should be removed)
- Alternatively immerse in a high-level disinfectant (HLD)/sterilant recommended by the manufacturer for the appropriate exposure time/ conditions

Oropharyngeal airways

- They are heavily contaminated after use
- If reusing metal airways, rinse under running water as soon as possible after use and then place in a solution of water and detergent. Clean with a brush, both inside and outside, and rinse thoroughly and autoclave

Laryngoscope blades, stylets and intubating forceps

- Laryngoscope blades require sterilization/ autoclave or high-level disinfection after cleaning with detergent
- Laryngoscope handles should be cleaned with detergent and water between each patient use. If contaminated with blood/body fluids, they should be washed and disinfected
  Refer Chapter 4.5

Endotracheal tubes and laryngeal masks

- Endotracheal tubes: Single patient use
- Laryngeal mask airways:
  - Single use devices are preferred
  - If reusable clean and reprocess with appropriate high-level disinfectant/ chemical sterilant with recommended exposure time. (up to 40 uses maximum)

Catheter mount

- Items labelled “single use only” should be discarded
- Multiple use products should be cleaned and high-level disinfected as recommended by the manufacturer for the appropriate exposure time/ conditions between each patient. This includes any tubing or device that is in contact with a patient

Bougies

- Re-use of these items has been associated with cross-infection. It is preferable that alternative single-use intubation aids are used when possible
- Clean with detergent and use an appropriate HLD/ sterilant according to manufacturer's instructions if re-used

Y pieces

- This is contaminated in a high percentage of cases
- Cleaning should be done after use. The Y piece should be removed from the tubing, rinsed under running water and placed in a solution of water and detergent. The inside should be scrubbed manually
- It should be properly dried before disinfection
- Metal Y pieces -autoclave or immerse in a HLD as recommended by the manufacturer for the appropriate exposure time/ conditions
- Plastic Y pieces - immerse in a HLD as recommended by the manufacturer for the appropriate exposure time/ conditions

Breathing systems

- Anaesthetic breathing circuits may be re-used as per manufacturer's instructions. If reusable, use the circuits with a new bacterial filter for each patient
- The bacterial/viral filter must be positioned between the circuit and the catheter mount/airway device (patient end of circuit). The bacterial/ viral filter must be discarded after each case and a new filter fitted for each patient
- If internal or external contamination is visible, or used for known high-risk infectious cases (e.g. open tuberculosis), the circuits should be cleaned, autoclaved or decontaminated with a HLD/ chemical sterilant as recommended by the manufacturer for the appropriate exposure time/ conditions and then rinsed with sterile water and dried.
- Tubes should be rinsed under running water, soon after use, and soaked in a large container filled with water and detergent
- Inside should be brushed
- Autoclave (if autoclavable) or use a HLD as recommended by the manufacturer for the appropriate exposure time/ conditions
- Store clean tubing after drying
- Microbiological filters placed at the machine end of the circuit should be changed weekly/according to manufacturer's instructions
- External surfaces of all anaesthetic equipment, including circuits must be wiped over with detergent and water between cases

Breathing bags

- Reservoir bag is usually connected near the absorber and the interior is usually protected from contamination by filters
- External surface is easily contaminated by hand contact during induction and emergence from anaesthesia
- Single use bags are preferred
- If reusable should be cleaned with detergent and water between each patient use

- If there is a risk of contamination of the interior of the bag use HLD/chemical sterilant recommended by the manufacturer for the appropriate exposure time/ conditions or autoclave according to manufacturer's instructions

Absorber and unidirectional valves

- Manufacturer's instructions should be followed when disassembling, cleaning and disinfecting
- The absorbent should be removed from the absorber
  The canister should be cleaned with water and a detergent. Ideally, it should be immersed in a HLD as recommended by the manufacturer for the appropriate exposure time/ conditions, then rinsed with clean water and completely dried before refilling

Sampling lines for side stream gas analysis:

- These need not ordinarily be sterilized before reuse. Sampled gas should not be returned to the anaesthetic circuit unless it is first passed through a viral filter (0.2 μm mesh)

Anaesthetic machines, monitors and surfaces

- The anaesthetic machine should be considered as an operating room furniture and receive the routine cleaning at the end of the list. Horizontal surfaces should be cleaned properly
- Thorough surface wiping should be done with a soft cloth, dampened with soap and water or a mild detergent. Special attention should be paid in cleaning around the knobs, vaporizers, cylinders etc.
- Routine daily sterilization or disinfection of internal components of the anaesthetic machine is not necessary if a bacterial/viral filter is used between patient and circuit
- Bellows, unidirectional valves and carbon dioxide absorbers should be cleaned and disinfected periodically according to manufacturer's instructions
- The surfaces of the anaesthetic machine and monitoring equipment should be cleaned with detergent and water after each session/between each patient. If soiled with blood / body fluids, they should be decontaminated and cleaned appropriately
  - This includes non-invasive blood pressure cuffs and tubing, pulseoximeter probes and cables, stethoscopes, electrocardiographic cables, blood warmers etc., and the exterior of anaesthetic machines and monitors, touch screens and control knobs
- Items such as temperature probes should be single patient use

Flexible laryngoscopes and bronchoscopes

- These are considered semi-critical
  Refer Chapters 7.5 and 7.9

Resuscitation equipment

- All reusable items should be appropriately cleaned and semi-critical/critical items must be high level disinfected /sterilized between patients

Ultrasound probes

- **Surface probes**

Non-critical use

- Following non-invasive procedures (for example, scanning over intact skin, transthoracic echocardiography -TTE) the ultrasound transducer should be disinfected in accordance with the manufacturer's recommendations
- This is a three-stage process: removal of gel and debris with a dry towel, wiping with a moist detergent cloth followed by spraying or wiping with an approved (usually alcohol-based) disinfectant solution. The ultrasound gel used should be sterile or ideally supplied as a single-use package

Semi-critical use

- For invasive procedures (for example, ultrasound guided regional blocks/vascular access), the probe and cable should be protected from contamination by use of a sterile cover and be prepared in such a way as to maintain the sterility of the procedural region. This particularly applies to the placement of central venous or perineural catheters. Any conducting medium (for example, ultrasound gel) between the probe cover and the skin must be sterile
- Following use, the transducer covering should be removed without contaminating the surface of the transducer or the ultrasound machine. The probe should now be processed as for a non-invasive procedure
- The cleaning procedure for both non-invasive and invasive procedures should also include the entire cable from the transducer to the machine and extend to the surface of the machine
- Any probe that is contaminated with blood or other biological fluid should be cleaned as for critical use and undergo high-level disinfection with a HLD recommended by the manufacturer

- **Internal probes**

Semi-Critical/Critical use

- Trans esophageal echocardiography (TOE) probes require management as semi-critical devices because they contact with gastrointestinal mucosa and potentially infectious bodily fluids
- When cleaning TOE probes it is important to ensure that disinfection and sterilization is undertaken of the probe tip and insertion shaft and also that the handle, cable, and external parts of the socket are decontaminated and disinfected, for example, by wiping over with water/detergent and a non-alcohol high level disinfectant/chemical sterilant
- It is important to ensure that manufacturer's instructions are strictly adhered to. Once sterilized, the TOE probe should be stored in a clean non-contaminated environment
- Care should also be taken when using the TOE probe to avoid cross-contamination between the hand manipulating the probe shaft and the probe controls and ultrasound machine controls

7.1.3.3 Environmental cleaning

Cleaning in between procedures

- It is preferable to clean the following surfaces and equipment with GPD in between procedures;
  - All reusable noncritical, nonporous surfaces e.g. mattress covers, pneumatic tourniquet/blood pressure cuffs, other patient equipment
  - High-touch areas e.g. control panels, switches, knobs, work areas, and handles
  - Theatre table and horizontal surfaces in the immediate vicinity
  - Trolleys used to transport patients
- Floor and walls should be cleaned and disinfected after each procedure if soiled/potentially soiled as evidenced by the presence of splash, splatter, or spray during the procedure
- If a patient with MRSA or open TB is operated, there should be 18 minutes gap (if 15 air exchanges/hour) or 14 minutes (if 20 air exchanges/hour) before cleaning the theatre after extubation

Daily cleaning

- Before the first procedure, make sure that the terminal cleaning has been performed at the end of the previous day. Wipe all the horizontal surfaces with a GPD before the list to remove any dust accumulated overnight
- Cleaning should be carried out at the end of the day or when necessary during the list e.g. soiling of the floor
- Floor should be wet mopped using GPD and water
- Dedicated, colour coded mops should be used for each area of the theatre. Wash mops in soapy water, dry in sunlight and hang
- Walls should be cleaned only if there is any splash
- Theatre table should be cleaned at the end of the list with GPD. Theatre lights above the theatre table should be cleaned with a damp cloth and GPD. If contaminated with blood or body fluids disinfect with 70% alcohol
- Trolley used for opening surgical packs should be wiped clean with 70% alcohol and allowed to dry
- Taps in scrubbing area should be cleaned with a detergent

Once a week cleaning

- All horizontal surfaces should be cleaned with GPD e.g. ledges, lights, light switches and A/C grills
- Clean the theatre table using GPD
- Taps in scrubbing area should be cleaned with a detergent
- Clean walls up to head height. Additional wall washing should be performed when there is visible soiling

Once a month cleaning

- Do all routine maintenance e.g. repairing doors
- Regular A/C services – preventive maintenance should take place monthly
- Entire walls, fittings and ceiling should be cleaned

Management of blood spills

Refer Chapter 4.6

7.1.3.4 Linen

Refer Chapter 4.7

7.1.3.5 Waste management

Refer Chapter 4.8

7.1.3.6 Occupational health

All categories of theater staff should receive 3 doses of hepatitis B vaccine and documentary evidence of antibody response should be available. Exposure to blood borne pathogens log should be maintained.

Refer Chapter 9

References

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7.2 INTENSIVE CARE UNIT

Introduction

Nosocomial infections are a common complication occurring in intensive care unit (ICU) patients. The frequent presence of invasive devices such as central venous catheters, urinary catheters, and endotracheal tubes predisposes for development of infections in these patients. The increased prevalence of multidrug resistant organisms (MDROs) that commonly colonize ICU patients and their increased predisposition to infections due to immunosuppression frequently lead to nosocomial infections.

7.2.1 Design and layout

Location

- ICU should be located in close proximity to operating theaters, emergency treatment unit (ETU), radiology department, cardiac catheter laboratory and endoscopy unit etc. depending on the type of ICU
- Close proximity is desirable to blood bank and diagnostic facilities

Floor plan and designated areas

- Designated areas in an ICU include reception, patient area, isolation rooms (source isolation or protective isolation or both), central nursing station, drug storage area, clean utility areas (equipment storage/linen storage), nourishment preparation area, staff rest areas, conference/teaching area, visitor area, dirty utility area
- Single entry and exit, apart from the emergency exit
- Entry should be through two sets of double doors. Both sets should not open at the same time

Patient area

- Should permit quick and unimpaired access of staff to patients
- Ideally, ward type ICU should have at least 225 square feet (20 square meters) per bed and room type ICU should have 250 square feet (25 square meters) per room with minimum width being 15 feet in the room type
- Single patient rooms should have an optimal clearance of 4 feet at the head and foot of the bed and not less than 6 feet on each side of the standard critical care bed

Isolation

- 10% of the ICU beds (1 or 2 per 10 beds) should be used for isolation purposes
- The ratio may be higher in special ICUs
- Negative and positive pressure isolation rooms are needed depending on the requirement Refer chapter 7.11

Sterile storage area

- Used for storage of all clean and sterile supplies (e.g. linen, instruments)
- Should contain a work counter and alcohol hand rub

- Shelving and cabinets for storage should be easy to clean (e.g. high-quality stainless steel) and should be located high enough off the floor allowing easy access to the floor underneath for cleaning

Dirty utility area

- Should contain a clinical sink and a sluice sink
- There should be adequate countertop space and space for cleaning supplies
- Separate covered containers must be provided for soiled linen and waste material
- Removal of soiled linen and waste should occur through a separate corridor
- All air supplied to the dirty utility room should be extracted

Hand hygiene facilities

- Hand washing stations and facilities for drying should be easily accessible from anywhere in the unit
- Sinks (deep enough to prevent splashing), elbow/foot operated taps or sensor taps, detergent dispensers and drying facilities must be available at the entrance and all designated areas. Ideally these should be available as one per two patients
- Alcohol hand rub must be available at the entrance and at the foot end of each bed

Heating, ventilation and air conditioning (HVAC) system

- It is desirable to have mechanical ventilation with a turnover of air (minimum 6 total air changes per hour with 2 air changes per hour composed of outside air) to keep airborne bacteria at a low level
- Re-circulated air should ideally pass through appropriate filters, preferably high efficiency particulate air (HEPA) filters
- Air flow must be from clean to dirty areas
- Air quality should be checked on commissioning and re-commissioning after renovation and optionally in an outbreak

Temperature is maintained at 16 °C to 25 °C

- Recommended level of humidity is 40% - 60%

7.2.2 Staffing and discipline

- Patient to nursing staff ratio should be 1:1 during all duty shifts
- Staff and visitors with obvious infections should not enter
- Number of visitors should be restricted
- Upon entering the ICU, visitors should be instructed regarding the use of alcohol hand rub
- Visitors and staff should not touch anything unless it is absolutely essential
- No one (including visitors) should enter the ICU bare-foot
- General housekeeping of the ICU should be done by hospital support staff, not by the staff of private cleaning services

ICU attire

- Regular staff
  - Change the street clothes to designated ICU attire upon entering. Short sleeved gowns or scrub suits with covered shoes are preferable
  - Bare below the elbows - no wrist watches, bangles, rings etc.
  - Wear appropriate PPE depending on the activities performed

- Visiting staff
  - No need to change clothes
  - Wear overalls if examine or make contact with the patient
  - Wear appropriate PPE whenever indicated
  - Physiotherapist should wear an overall, pair of gloves and a surgical mask. Should change the overall and gloves in between patients

Hand hygiene

- All regular and visiting staff and the visitors should practice hand hygiene upon entry and as per WHO five moments for hand hygiene

  Refer Chapter 4.1

7.2.3 Care bundles for prevention of infections

Refer Chapter 6

7.2.4 Cleaning, disinfection and sterilization of instruments and equipment

Refer Chapters 4.5 and 7.1

7.2.5 Environmental cleaning

Refer Chapter 4.6

7.2.6 Linen

Refer Chapter 4.7

7.2.7 Waste management

Refer Chapter 4.8

7.2.8 Occupational health

Refer Chapter 9

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7.3 SPECIALIZED BABY CARE UNITS

Introduction

There are two levels of care according to the gestational age, birth weight and the level of support needed for the newborns.

- Special care baby unit (SCBU) / Premature baby unit (PBU)
  - This is for babies who do not need intensive care. Ideally, this will be for babies born after 28 weeks gestation
    - For monitoring or observation
    - For gaining weight
- Neonatal intensive care unit (NICU)
  - This is the level of care for babies with the higher need for support. Often these babies will have been born before 28 weeks gestation or be very unwell after birth or needing mechanical ventilation or birth weight <1kg

However, in Sri Lanka this separation is not very well defined and babies needing intensive care are sometimes cared in SCBU.

Neonates who need specialized care are more prone to infections due to prematurity, low birth weight and invasive devices.

7.3.1 Design and layout

Provide separate space for:

- patient care
- isolation
- duty room
- storage
- rest rooms for HCW
- feed preparation area
- mothers' room
- dirty utility area
- disinfectants preparation area

Table 1. Standards for specialized baby care units

Type of design	SCBU/PBU	NICU
Multi-patient rooms	2.2 square meters (24 net square feet) per infant 1 meter (3 feet) between bassinets	11.2 square meters (120 net square feet) per infant 2.4 meters (8 feet) between incubators/warmers/bassinets/cribs Aisles > 1.2 meters (4 feet) wide
Single patient rooms	2.2 square meters (24 net square feet), at least 1 meter (3 feet) in all directions between cribs	> 14 square meters (150 net square feet) 2.4 meter (8 feet) wide aisles Space should be added for sinks, desks, cabinets, computers, and corridors
Hand washing sinks	1 sink for every 6–8 patients A sink in the resuscitation area 1 sink per 3–4 patients in admission, observation, and continuing care areas	1 sink for every 3–4 patients
Air supply		Positive pressure to adjacent areas • 90% efficiency filtration • 6 air exchanges/hour

7.3.2 Staffing, discipline and practices

- Minimum of 1:1 nursing care is required for ventilated and other critically ill babies
- Staff should wear sterile short sleeved gowns and perform hand hygiene when handling babies
- Parents should wear clean short sleeved gowns and perform hand hygiene if they are handling the baby
- Staff gowns should be removed after care of one infant and a new gown should be worn for handling the next infant if 1:1 care is not practiced
- Parent gowns should be removed at the end of the visit
- Cover gowns and other appropriate PPE must be worn:
  - In patient care activities likely to generate splashes or sprays of anybody fluid
  - When entering the infant's area (even if not handling the infant) in the following situations
    - Soiling with blood or body fluids is expected
    - If an infant is on isolation
- Hand washing and aseptic precautions
  - Instruct all visitors in appropriate hand hygiene and infection prevention measures
  - Adhere to "5 Moments of Hand Hygiene"
  - Wear sterile gloves for handling of all invasive devices. If non-touch technique is practiced, use clean gloves

- Provide skin antisepsis prior to invasive procedures using an appropriate antiseptic solution
  Refer Chapter 4.1

7.3.3 Milk preparation and storage

- Promote exclusive breast feeding
- Advise mother to practice hand hygiene before and after handling baby
- For mothers who are expressing breast milk, ensure hand hygiene and expression of milk into sterile containers
- Milk preparation areas should be separate and should not be used for other purposes. However, milk for each infant is decanted and mixed at their cot to minimize errors in administration. Do not prepare feeds in areas where patient care is taking place
- Store milk in sterile, labelled containers covered securely
- Label with infant's name, medical record (BHT) number, date of birth and date of pumping. Storage temperature – Refer Table 2
- Clean and disinfect the container after the infant is discharged
- Use oldest milk first
- When stored in a refrigerator or freezer with milk for other infants, place all the feeds for each infant into a larger, labelled, cleanable bin or zip-lock bag, one for each infant
- Powdered infant formula is not sterile and can be contaminated by the manufacturer, after the formula container is opened, during the preparation or during storage
- When formula feeds are used, take meticulous care with hand hygiene, disinfection and sterilization of the area and equipment used, storage, and length of time at room temperature
- It is safer to make only the amount of formula needed just before each feed

Table 2. Storage temperatures for breast milk

Type of breast milk	**Countertop 77°F (25°C) or colder**	**Refrigerator 40°F (4°C)**	**Freezer 0°F (-18°C) or colder**
Freshly expressed or pumped	Up to 4 Hours	Up to 4 Days	Within 6 months is best Up to 12 months is acceptable
Thawed, previously frozen	1–2 Hours	Up to 1 Day *(24 hours)*	NEVER refreeze human milk after it has been thawed
Leftover from a feeding *(if baby has not finished the feed)*	Use within 2 hours		

7.3.4 Cleaning, disinfection and sterilization of instrument and equipment

Table 3. Method of cleaning, disinfection and sterilization of instrument and equipment

Feed trolleys	• Wipe with a mild detergent each day and as required
Feeding bottles, teats and breast milk cups	• Wash with soap and water • Immerse in Milton solution (125 ppm available chlorine) for 30 minutes/boil in water for 20 minutes/steam sterilization • Use an oven to dry, if available
Breast Pumps	• Wash with detergent and water or soapy water, rinse and dry thoroughly after each use. Use Milton solution for disinfection as per instructions between uses. Each pump should be reserved for use by one individual and discarded when the baby is discharged
NG tubes for gavage feeding	• Use a disposable tube for each feed
Syringes used for feeding	• Discard after each feed.
Milk refrigerators/ freezers – these fridges/freezers are used to store expressed breast milk (EBM)	• Hand hygiene immediately before fridges are accessed is essential for both parents and staff • Each infant's EBM is stored in individual containers that require a daily wipe with a mild detergent to remove any spilt EBM • All external surfaces of refrigerators/freezers are to be damp dusted using a mild detergent each day and as required. All internal surfaces are to be cleaned using mild detergent wipes and defrosted according to schedules
Baby incubators	• Clean after each patient or once a week using manufacturer's instructions • When cleaning an incubator or warmer, remove and scrub all detachable parts • Wipe with damp cloth moistened with GPD. If baby is septic, disinfect according to manufacturers' recommendations
Baby weighing scales	• Clean with GPD between babies • Place the baby on its own sheet
Suction apparatus	*Refer Chapter 4.5*

7.3.5. Environmental cleaning

Refer Chapter 4.6

- Milk room
  - Clean twice daily using a GPD
  - Milk preparation areas should be cleaned with GPD after use

7.3.6. Management of linen

Refer Chapter 4.7

7.3.7 Waste disposal

Refer Chapter 4.8

- A dedicated domestic washing machine should be available for washing baby clothes and blankets. Baby clothes are washed with a mild detergent and hot water
- Clothes dryers should be used to dry all washing
- Wrap or cover NICU linens during transport from the laundry/CSSD and store them in closed cabinets to prevent contamination

7.3.8. Occupational health

- Exposure management and immunization - *Refer Chapter 9*
- All non-immune staff should get vaccinations for varicella, pertussis and hepatitis B and yearly influenza vaccine
- Staff who has an acute, transmissible, infectious illness should be excluded from work. This includes not working when acutely ill with signs and symptoms likely due to a transmissible infection. These include; fever, cough, influenza-like symptom, runny nose, sore throat, vomiting/ diarrhea, rash or conjunctivitis
- Staff members who have cold sores (herpetic lesions) should not work with newborns until the lesion is crusted and dry

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7.4 LABOUR ROOM

Introduction

Infection prevention and control (IPC) measures in the labour room are necessary to reduce the risk of transmission of infections to the mother, newborn and health care workers (HCWs). Potential sources of infections include blood and other body fluids (e.g. amniotic fluid), secretions, excretions, any contaminated equipment, linen and other items used in the labour room or contaminated environment. The risk of these infections can be substantially reduced by simple IPC measures.

7.4.1 Design and layout

Location

- Labour room should be located close to antenatal unit, postnatal unit, blood bank and operating theatre
- In addition, easy access to emergency department and ambulance area is necessary for emergency admission and transfers

Space

- The most important factor for defining the space and layout of the labour room is the number of labour beds in the unit
    - There are two types of labour rooms: Labour rooms with labour-delivery-recovery (LDR) room concept (a pregnant woman spends the duration of labour, delivery, and 4 hours postpartum in the same bed)
    - Conventional labour rooms (a pregnant woman is admitted to labour room only at or near full dilation of cervix and is shifted to the postpartum ward after 2 hours)

Functional areas

- Entry/reception area - waiting area, consult/discussion room, storage for wheelchairs
- Hand washing facilities at entries and exits
- Birthing area/suite - assessment/examination rooms, birthing rooms with bath rooms
- Newborn resuscitation room
- Isolation room/s
- Staff station/s
- Support areas - bays for resuscitation trolley, cleaner’s room, clean utility/medication room, dirty utility, washing room
- Store rooms for medication, sterile supplies, equipment and general supplies
- Staff areas - changing rooms with lockers and toilets, meeting rooms, offices, on-call rooms with toilets and showers
- Optional operating room area for emergency caesarean sections

Hand washing area

- Each LDR unit should have one hand washing area with a sink, elbow-operated taps, soap dispenser, single-use towels and a foot operated bin
- Hand washing protocol should be mounted on the wall above the hand washing area

7.4.2 Staffing and discipline

- One to one care for mothers on labour is needed
- Nurses and midwives should undergo a basic training on IPC related to obstetric care at the time of induction and at regular intervals
- One nurse should be appointed as a liaison nurse in IPC for the labour room and she should be responsible for early detection of problems related to IPC and communication with the IPC team
- Labour room attire
    - Dedicated clean scrub suits or gown is needed for the labour room staff. These should be changed if visibly soiled
    - Water proof disposable apron, gloves, mask, eye protection should be worn by the staff attending to deliveries
- Standard precautions should be practiced by all HCWs before, during and after labour
- Five moments of hand hygiene should be practised when handling all mothers and neonates
  Refer Chapter 4.1
- Additional precautions should be taken by HCWs when a patient with an infection is admitted to the labour room
  Refer Chapter 5

Other measures to prevent infections

- Antibiotic prophylaxis should be administered during vaginal delivery to high risk mothers to prevent Group B streptococcus (GBS) sepsis in the neonate
  Refer Chapter 13.5
- Vaginal examinations should be kept to a minimum to limit the risk of infection
- Routine perineal/pubic shaving prior to giving vaginal birth is not recommended

7.4.3 Cleaning, disinfection and sterilization of instruments and equipment

- All surgical items used for the delivery should be properly cleaned and sterilized before reuse. Individual delivery sets should be prepared and sterilized for each patient
  Refer Chapters 4.5 and 7.1

Table 1. Method of cleaning/disinfection/sterilization of instruments and equipment

Item	Method of cleaning/disinfection/sterilization
Baby cot, warmer and weighing scale	Wipe with 70% alcohol daily and after each use
Re-usable metal speculums	Clean with GPD and sterilize by autoclaving before reuse Disposable plastic specula are single use only
Mackintosh (contaminated with blood and body fluids)	Immerse in 1% hypochlorite for 30-minute, wash with GPD and hang to dry
Mattresses - with impermeable, intact covering	Wipe thoroughly with GPD in between patients and dry Wipe with 1% hypochlorite if contaminated with blood or body fluids
Delivery set	Use a sterilized delivery set for each patient. After use, wash instruments with GPD and send for autoclaving
Newborn resuscitation equipment	Should be disinfected using a high-level disinfectant (HLD) or sterilized
Newborn resuscitation equipment	Should be disinfected using a HLD or sterilized

Cleaning, disinfection and sterilization of other patient care equipment/items
Refer Chapter 4.5

7.4.4 Environmental cleaning

Table 2. Method of cleaning/disinfection of environmental surfaces

Item	Method of cleaning/disinfection
Floors	Mop three times per day with 0.1% hypochlorite, with dedicated mops for each area. Dry the mops in sunlight and store them dry. Wash mops in 0.1% hypochlorite after each use
Walls	Wet mop with GPD weekly

Cleaning and disinfection of other environmental surfaces and management of spill
Refer Chapter 4.6

7.4.5 Linen

- Linen should be changed in between deliveries
- Linen contaminated with blood and body fluids should be disinfected before sending to the laundry
- Appropriate receptacle to discard used linen should be available in each labour area. Hospital linen management policy should be followed when handling and managing linen
  Refer Chapter 4.7

7.4.6 Handling and disposal of sharps

Refer Chapters 4.4 and 4.8

7.4.7 Waste management

- Anatomical waste (e.g. placentae and dead fetuses) and clinical waste should be collected separately and should be sent for incineration
  Refer Chapter 4.8

7.4.8 Occupational health

Refer Chapter 9

References

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7.5 ENDOSCOPY UNIT

Introduction

Endoscopes can transmit pathogens by cross-contamination. It is important that the unit should be properly designed, and appropriate infection control and prevention measures are instituted and implemented in all endoscopy units in order to prevent/ minimize endoscopy-related transmission of infections.

7.5.1 Design and layout

- Reprocessing of endoscopic equipment should only be undertaken in a separate, purpose-designed reprocessing room with adequate facilities and situated close to the place where the procedure is being performed
- One-way workflow should be maintained
- The reprocessing room must have separate contaminated, clean, and storage areas. Contaminated and clean working areas must be strictly separated to avoid recontamination of reprocessed endoscopes and accessories
- The room should have appropriate ventilation (ideally positive pressure with 15 air changes per hour) and air extraction (with strong exhaust fans to achieve the above) in order to minimize the risks from chemical vapours. The unit should be well lit
- Separate sinks/trays of adequate size for washing, disinfection, and rinsing of endoscopic equipment must be available. In addition, a dedicated sink for hand washing is required
- The reprocessing area should have an eye wash station
- The storage area should contain designated drying cabinets to hang the reprocessed endoscopes

7.5.2 Staffing and discipline

- There should be adequate number of endoscopes depending on the workload of the unit
- Endoscope reprocessing should only be carried out by dedicated, specially trained and competent personnel following defined standard operating procedures (SOPs)
- The SOPs should be drafted for different types of endoscopes. They should be updated regularly and easily available to the staff who are carrying out the procedures
- Each new employee must have familiarization and safety instructions from a designated person
- Regular audits, supervised training and competency evaluation at regular periods should be carried out to maintain competency of personnel
- Staff must be familiar with the design, assembly, disinfectant compatibility and manufacturer recommendations of all endoscopes reprocessed in the unit
- Staff must be aware of and adhere to the safety precautions pertaining to the types of disinfectants/detergents/cleaning solutions used in the unit
- Persons decontaminating the endoscopes should wear a plastic apron, rubber gloves (heavy duty gloves), mask and eye protection with visors or goggles
- Cuts/ lesions on the hands and forearms of staff should be covered with a water proof plaster

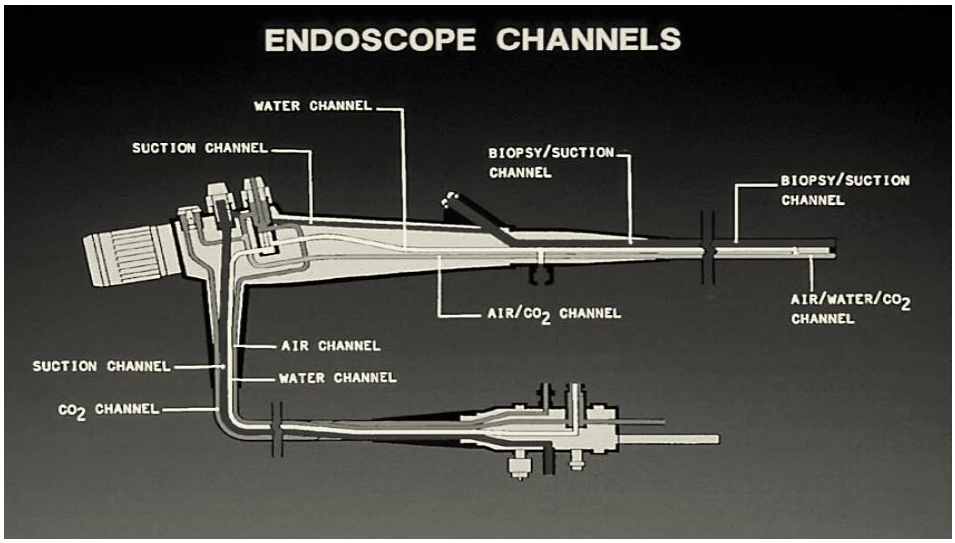
7.5.3 Cleaning, disinfection and sterilization of flexible endoscopes

Endoscopes entering sterile cavities (arthroscopes, laparoscopes, cystoscopes etc.) should be sterilized by autoclaving or plasma sterilization before each use. If they cannot be sterilized by these methods, they should undergo sterilization with a chemical sterilant.

For flexible endoscopes traversing mucosal tracts (bronchoscopes, GI endoscopes, flexible laryngoscopes etc.) high level disinfection would suffice.

- All chemicals used should be compatible with the endoscopes and automated endoscope re-processors that are used. Refer recommendations of manufacturers of endoscopes, chemicals and automated endoscope re-processors for information on material compatibility
- When newer disinfectants become available or already existing recommendations alter, persons or committees responsible for selecting disinfectants for endoscope reprocessing should be guided by the relevant authorities and by information in the scientific literature/ appropriate guidelines
- The storage, preparation, activation, dilution, deactivation, disposal, testing and quality control of the disinfectants/detergents/cleaning solutions used should comply with the manufacturers' instructions, recommended guidelines and the hospital waste management protocols
- The complete reprocessing cycle of every endoscope should be documented, including the name of the person undertaking each step
- A daily log recording the serial number of each endoscope used in each patient must be maintained for future tracing when a possible endoscopic transmission of disease is being investigated
- The endoscope should be disinfected between patients and at the end of the list

Figure 1: Endoscope channels and ports



Pre- cleaning

- Perform pre-cleaning immediately following completion of the endoscopy procedure to prevent formation of biofilm
- Upper and lower endoscopes should be placed in separate trays

- As soon as the endoscope is removed from the patient, wipe off excess blood, mucus or other debris from the outer surface of the scope using sterile gauze
- Place distal end of endoscope in a bowl containing enzymatic detergent or, if not available, general purpose detergent (GPD) and warm water and aspirate through suction channel for at least 30 seconds
- Flush out air/water through all the channels
- Disconnect endoscope from light source and transport to the reprocessing room. The endoscope should not be placed on any other work surface
- Perform visual inspection and leak test. Perform both dry and wet leak tests using the proper equipment and techniques described in the reprocessing instructions
- If the dry leak test fails, the endoscope should not undergo the immersion leak test. Sister-in-charge of the unit should be informed for necessary action. The damaged endoscope should be immediately removed from service and decontaminated according to manufacturer's specific instructions. Document the failed leak test and send for repair
- If no leakage is detected, proceed with cleaning

Cleaning

- Remove the air/water cleaning adaptor, suction valve, biopsy valve, distal hood and CO_2 valve and any other removable parts and place them in a tray of GPD solution
- Completely immerse whole instrument in the tray of GPD solution; all channels must be filled with GPD. Subsequent steps of the cleaning and brushing process should be done while it is completely immersed in the solution, avoiding splashing of contaminated liquids
- Clean all external surfaces of the instrument with gauze swabs, and clean the distal tip thoroughly with a device compatible soft brush or a special brush
- Pass a flexible, purpose-designed brush through the suction valve hole into the instrument channel up to the tip of the endoscope. Clean the bristles carefully after withdrawing the brush. Repeat until the channel is clean. This procedure should be repeated until the cleaning brush is completely clean when it emerges (at least three times down each channel)
- Similarly, insert the cleaning brush through biopsy channel opening and brush through to the tip of the endoscope. Clean brush and repeat until clean. Biopsy port should be cleaned with a soft brush. Brush all accessible channels similarly
- The size and type of cleaning brush must be appropriately matched to the size and type of endoscope channels, to ensure contact with channel walls. To ensure maximum effectiveness of cleaning and to avoid tissue carryover, single-use brushes are recommended. All reusable brushes must be thoroughly cleaned manually, followed by disinfection (preferably sterilization) after each use. Flush all lumens thoroughly with GPD solution and drain. All auxiliary water channels, wire channels, and balloon inflation channels must be cleaned according to manufacturer's instructions, even if they have not been used in that examination
- The GPD solution should not be reused and should be discarded after each cycle

Rinsing of device

- Rinsing between cleaning and disinfection is done to reduce the concentration of residues which might otherwise impair the efficacy of the chemical disinfectant
- Rinsing solution should not be reused and should be discarded after each cycle
- After thorough cleaning and rinsing, endoscope is ready for disinfection. Brushes should be disinfected with the endoscope

Disinfection of device

- Fill the tray with a high-level disinfectant which is compatible with the instrument
- Immerse the entire instrument in disinfectant and fill channels with the disinfectant
- Leave the endoscope immersed in the disinfectant solution for the recommended time according to manufacturer's instructions and recommended guidelines for device-specific reprocessing
- For storage, preparation, disposal and quality testing of high-level disinfectants - follow manufacturers' instructions - *Refer Chapter 4.5*

Rinsing of device

- Rinse the endoscope with copious amounts of sterile water. Flush all channels with water and drain
- The container of rinsing water must be anchored appropriately to prevent accidental spillage

Drying and storage of device

- Dry the endoscope externally and flush compressed filtered air through channels to expel all residual fluid. (70% alcohol may be aspirated through the channels to hasten drying at the end of the session)
- At the end of the list store the disinfected endoscopes vertically in a drying cabinet without coiling and without touching the bottom of the cabinet
- Disconnect valves as they can block the air flow through the endoscope channels. Store valves and distal caps separately, but with the endoscope. Valves should stay with a named endoscope as a set, to prevent cross-infection and enable full traceability

Automated endoscope re-processors (AERs)

- Whenever possible, AERs should be used to clean and disinfect endoscopes. They must be effective, safe, reliable and able to cope with endoscope design and throughput
- AERs that offer the relevant cycle steps (cleaning, disinfection and rinsing) are recommended for use
- AERs must be appropriately cleaned and maintained in order to prevent contamination of endoscopes during reprocessing
- Usage, cleaning, maintenance, quality control and process validation of AERs must be done in accordance with manufacturer's recommendations and established guidelines

7.5.4 Microbiological surveillance and prevention of HAI related to endoscopy

- Ideally, three sputum samples for AFB should be done before bronchoscopy
- Infection prevention and control team should conduct infection control rounds periodically in endoscopy units to ensure policy compliance. Breaches in policy should be documented and corrective actions should be instituted
- The carrying-case used to transport clean and reprocessed endoscopes outside the health-care institution should not be used to store an endoscope. A contaminated endoscope should always be cleaned and disinfected before placing in the carrying-case
- Periodic checking of the water safety should be done if tap water is used for rinsing during pre-cleaning. It is advised to perform routine microbiological testing at intervals of 3-4 months
- Periodic checking of final rinse water should be done in an appropriate frequency (Table1)
- A simple flush-through technique should be done for sampling of the interior lumens
- A swab-rinse technique can be used for sampling the exterior surfaces and the distal opening of the suction-biopsy channel port of endoscopes. (Reprocessed endoscopes should be free of microbial pathogens)

7.5.5 Rinse water quality

Table 1. Testing requirements and interpretation of results for endoscopy final rinse water

Hazard/hygiene indicator and frequency of testing	**Result**	**Interpretation**	**Action**
Aerobic colony count (Weekly)	>100 in 100 ml	Unacceptable	Discuss with IPC team; complete risk assessment; consider taking AER out of use (particularly for endoscopes used for sterile sites such as ERCP and bronchoscopes).
	10 – ≤100 in 100ml	Unsatisfactory	Discuss with IPC team; complete risk assessment to investigate potential problems; super-chlorinate or repeat self-disinfect cycle
	1 - 9 in 100 ml (on a regular basis)	Acceptable*	*Acceptable if *Pseudomonas aeruginosa* is not detected
	<1 in 100 ml	Satisfactory	N/A
Environmental mycobacteria (Quarterly)	> 0 in 100 ml	Unsatisfactory	Investigate immediately and take repeat sample
	0 in 100 ml	Satisfactory	N/A

Hazard/hygiene indicator and frequency of testing	Result	Interpretation	Action
Pseudomonas aeruginosa	> 0 in 100 ml	Unsatisfactory	Investigate immediately and take repeat sample
(Quarterly)	0 in 100 ml	Satisfactory	N/A
Endotoxin (Not routinely required)	≤ 30 EU/ml	Satisfactory	Risk low even above this level but would usually be associated with high microbial counts and subject to remedial action

7.5.6 Linen

Refer Chapter 4.7

7.5.7 Waste management

Refer Chapter 4.8

7.5.8 Occupational health

- All staff must be immunized with Hepatitis B vaccine
  Refer Chapter 9

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7.6 DIALYSIS UNIT

Introduction

In haemodialysis (HD) units, multiple patients receive extracorporeal treatment with prolonged blood exposures in the same area making them vulnerable to blood borne infections. Therefore, strict infection prevention and control measures are recommended in this setting.

7.6.1 Design and layout

- Key areas of the unit
  - Reception area - clerical area with patient files, waiting area for patients and visitors, toilet
  - Treatment area - separate treatment bays, isolation room, nursing station, toilet, hand washing and PPE bay, linen bay (clean and dirty), dialysate preparation area
  - Storage area
  - Staff and support areas - staff rooms, toilets, water treatment plant room, disposal room
- Patients should have specific dialysis stations assigned to them
- Clean and contaminated areas should be separated e.g. medication should not be handled in the area where used equipment or blood samples are handled
- Medications should be prepared and distributed from a central area in the unit

7.6.2 Staffing and discipline

- Staff members should adhere to standard precautions
- They should wear gowns, masks and eye wear for protection and to prevent soiling of clothing during initiation and termination of dialysis
- Staff members should wear gloves when handling patient's equipment at the dialysis station and should change gloves before and after contact with each patient or station
- Staff should wash hands between patients. If hands are not visibly soiled an alcoholic hand rub may be used
- Sharing of ancillary supply instruments such as trays, blood pressure cuffs, clamps, scissors, and other non-disposable items should be avoided
- Medication carts should not be used, so that the practice of sharing can be eliminated
- Special care should be taken to prevent needle stick injuries or other injuries when handling sharps. All staff members should receive a complete course of Hepatitis B immunization and their antibody status checked. It is preferable to have anti-HBs antibody level ≥ 100 mIU/ml with booster doses to maintain a sustainable protective antibody level as they are exposed to high-risk patients
  Refer Chapter 9
- Non-responders (after second course of vaccine) and HBs Ag positive staff should not work in a haemodialysis unit
- Staff members should not drink or eat in the dialysis treatment area
- Patients may be served meals or eat food brought from home, if reasonable hygienic measures are taken

- Used food utensils should be cleaned, in the usual manner, by the facility staff. No special cleaning of these items is needed

7.6.3 Infection prevention and control measures

7.6.3.1 Prevention of blood borne infections

- All haemodialysis patients should be screened for HBV, HCV and HIV infections on admission, and routinely tested thereafter (to be practicable annually)
- Recommend isolation of any blood borne virus positive patient with dedicated machine, other equipment, supplies and staff members. If facilities are available isolate in a dedicated room
- Obtain specialist advice for additional testing to be performed in case of seroconversions in Hepatitis B and Hepatitis C
- Recommend immunization of patients with chronic kidney disease (CKD), especially those that are dialysis-dependent, with hepatitis B vaccine, pneumococcal vaccine and influenza-inactivated vaccine. Other vaccines recommended for healthy individuals may be used if indicated, except for any live attenuated vaccines that are generally contraindicated in patients who are immunocompromised
- Patients on regular hospital haemodialysis who have responded to hepatitis B immunization (annual anti HBs antibody titre ≥10 mIU/ml), need to be tested for HBsAg once a year. Non-responders should be tested at least every 3 months
- Patients should be tested for HCV antibody at least every 6 months and antibody surveillance testing for HIV is not necessary for patients on regular hospital haemodialysis unless the patient is at high risk

7.6.3.2 Prevention of haemodialysis catheter associated infections

- Catheter exit site should be examined before each haemodialysis treatment session for signs of infection
- Catheter exit site dressing should be changed at each haemodialysis treatment
- Dry gauze dressings and povidone iodine ointment at the catheter exit site are recommended whenever possible

7.6.3.3 Key areas for patient education

- Hand hygiene
- General access care at home
- Risks associated with catheters
- Signs and symptoms of infections

7.6.4 Standards for water quality

- The fluid sample for microbiologic testing should be taken from the dialysate sampling port (fluid that has passed only from the first filter)
- Testing for bacteria and endotoxin assay are required preferably monthly
- Samples should always be collected before cleaning/ disinfection

Table 1. Maximum allowable levels for total viable microbial count (TVC) and endotoxins in dialysis water, in standard and ultrapure dialysis fluid (dialysate) and online-prepared substitution fluid

Fluid category and application	TCV	Action to be taken	Endotoxin (EU/mL)	Action to be taken
Dialysis water (RO water) - Basis for all fluid preparation Standard dialysis fluid -Minimum acceptable quality for routine HD	>100 (CFU/mL) Unsatisfactory	Take out of use until corrective action implemented	>0.25 Unsatisfactory	Take out of use until corrective action implemented
	>50 - ≤100 (CFU/mL) Borderline	Investigate cause and put corrective action in place	0.125-0.25 Borderline	Investigate cause and put corrective action in place
	0 - ≤50 (CFU/mL) Satisfactory	No action needed	<0.125 Satisfactory	No action needed
Ultrapure dialysis fluid -Recommended for routine HD/high-flux HD	≥10 (CFU/100 mL) Unsatisfactory	Investigate cause and put corrective action in place	≥0.03 Unsatisfactory	Investigate cause and put corrective action in place
	<10 (CFU/100 mL) Satisfactory	No action needed	<0.03 Satisfactory	No action needed
Online prepared substitution fluid -HF and HDF, priming solution, bolus administration	Sterile		Non-pyrogenic	

HD – haemodialysis, HF – hemofiltration, HDF – hemodiafiltration, CFU – colony-forming unit, EU – endotoxin unit

The production of ultrapure dialysis fluid is generally achieved by the use of additional filters which form part of the dialysis machine hydraulic pathway. BS EN ISO 23500:2015 states there is no requirement to test for bacterial growth or endotoxins when the haemodialysis system is fitted with endotoxin retentive filters that are operated according to the manufacturer's instructions, unless the manufacturer requires such tests to be performed (Reference: AAMI Dialysis Standards Collection: ANSI/AAMI/ISO 13959:2014: available at https://my.aami.org/aamiresources/previewfiles/13959_1409_preview.pdf)

7.6.5 Cleaning, disinfection and sterilization of equipment

Dialysis machine

- After dialysis is over, the machine should be cleaned and disinfected carefully and thoroughly according to manufacturer's recommendations
- If visible blood spills or other infectious material is present on the external surface of an HD machine, it should be cleaned separately (not to spread) before applying the disinfectant solution. If using disinfectant wipes, one wipe should be used to exclusively clean the blood stain followed by another wipe(s) for disinfection
- If sodium bicarbonate solution (buffer used in dialysis) in a jug is used, any "leftover" solution must be discarded and opened jugs should not be used after 24 hours

Other equipment

- At the end of each dialysis treatment or dialysis shift,
  - Non-disposable equipment should be cleaned and disinfected or sterilized by an appropriate method
  - Disposable items taken into an individual patient's HD station should be used only for that patient and be disposed after use
  - Unused non-disposable items should be cleaned and disinfected before returning to a common clean area or used on another patient, or be disposed if it cannot be disinfected
- Sharps should be discarded into the sharps bin and sent for incineration
- Vascular lines, all used towels or wipes and gloves that are contaminated with blood should be discarded in a biohazard waste container, and hand hygiene should be performed after glove removal

7.6.6 Environmental cleaning

- Cleaning and disinfection of environmental surfaces inside the HD units, especially those that are frequently touched by patients and staff, should be performed regularly
  - Clean with GPD and wipe with 0.1% hypochlorite
- For routine cleaning - *Refer Chapter 4.6*

7.6.7 Linen

Refer Chapter 4.7

7.6.8 Waste management

Refer Chapter 4.8

7.6.9 Occupational health

Refer Chapter 9

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7.7 BURNS UNIT

Introduction

Patients with burns are more prone to infections due to many reasons including loss of skin integrity. Burns greater than 25% to 30% total body surface are classified as large injuries. Burn wounds are free from bacteria at the beginning but are soon colonized by Gram positive bacteria and later by Gram negative bacteria. Bacterial infection is the most important cause of morbidity and mortality in patients with burns. Further, infections with multidrug resistant organisms (MDROs) are increasing in number leading to higher morbidity and mortality rates.

7.7.1 Design and layout

Burn patients should be managed in a highly specialized facility. Ideally, burn reference centers are preferred regionally. Otherwise, hospitals should have a separate burns unit depending on the number of in-patients.

- A burn unit/center should be self-contained, ideally with a dedicated theatre and an intensive care unit
- There must be allocated zones for each patient category including acute, non-acute, and infected
- Patients with extensive burns require rooms with both protective barrier precautions and source isolation precautions
- Isolation rooms
  - Ideally all patients with burns should be managed in positive pressure ventilated rooms with filtered air
  - Infectious patients should be managed in negative pressure ventilated rooms with filtered air
  - Facilities for hand hygiene should be available at each bed
    Refer Chapter 7.11
- Wound dressing room
  - Rooms should be mechanically ventilated with filtered air
  - Wounds of patients carrying MDROs should preferably be dressed in their own rooms
  - Contaminated dressings need to be taken away through separate doors to the dirty corridor
  - The bathroom and the dressing room of a burns unit should be adjacent with designated traffic directions, so that the patient can be taken directly to the dressing room after a bath and to the unit after dressing
- In the bathroom, ideally bathtubs should be available. However, if the tubs are not available, a dedicated specially designed trolley for proper drainage of water should be available
- Soap for bathing patients should be kept dry and restricted for individual use

7.7.2 Staffing and discipline

- There should be a dedicated, specially trained staff in the burns unit
- Change the street clothes to designated attire upon entering
- Wear appropriate PPE depending on the activities performed

7.7.3. Burn care

- Standard precautions should be practiced
- General supportive measures are important in prevention of infections e.g. nutrition
- Minimize staff and visitors entering the unit
- Strict adherence to hand hygiene and aseptic technique is important during wound dressing and invasive procedures
- Contact precautions should be followed when caring for patients infected/ colonized with MDROs - Refer Chapters 5 and 13.1
- Use sterile separate packs for each patient for wound dressing
- Sterile gloves should be used for handling the patient
- Prophylactic antimicrobial therapy is recommended only for coverage of the immediate perioperative period of excision or grafting
- Antibiotic therapy should be guided by culture and sensitivity tests
- Use of indwelling devices should be minimized and removed when no longer needed
- Tetanus toxoid should be given to all patients who are non-immune
- Routine surveillance wound cultures should be obtained on admission (particularly important for patients transferred from other facilities), at the time of dressing change and whenever decided by the burn management team
- Specific measures to prevent infection
    - Primary excision and skin grafting and application of dermal template
    - Local treatment with appropriate rotational antiseptics

7.7.4 Supplies

- Adequate supplies of sterile dressing material, linen and clean mackintoshes should be available for bathing and dressing of each patient
- Antiseptic solutions/creams should be readily available
- Bottles containing solutions prepared in the ward for wound dressing should never be topped up. They should be emptied, washed and sterilized daily. At least 2 sets of screw-capped bottles should be available for this purpose

7.7.5 Cleaning, disinfection and sterilization of instruments and equipment

Refer Chapter 4.5

7.7.6 Environmental cleaning

- Bath/bathing trolley
    - Bath is a potential source of Gram-negative infection, especially *Pseudomonas aeruginosa*. It should be cleaned with a detergent and disinfect with an appropriate disinfectant after each use

Refer Chapter 4.6

7.7.7 Linen

Refer Chapter 4.7

7.7.8 Waste disposal

- Follow general guidelines on waste disposal
- Dressings removed from each patient should be collected and sealed in a separate bag in the bathroom and taken away through the backdoor into the dirty corridor
  Refer Chapter 4.8

7.7.9 Occupational health

Refer Chapter 9

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7.8 OPHTHALMOLOGY UNIT

Introduction

Transmission of infections in ophthalmology units can occur from person to person, via contaminated ophthalmic devices/parts of equipment, contaminated contact lens solution bottles or multi-dose eye drops. The greatest risk factor for transmission of infections is poor hand hygiene in the clinic environment. Infections can also be transmitted during ophthalmic examinations, particularly those involving direct contact with mucous membranes and tears. Tears may contain infectious agents (viruses such as adenovirus, HIV, Hepatitis B and C) which may be transmitted to health care workers (HCW) and patients. Respiratory viruses can be transmitted from patients to clinician or vice versa due to the close proximity during slit lamp examination. In addition, hazards arise from improper disposal of waste.

7.8.1 Design and layout

- One or more separate/single rooms/cubicles should be available for care of ophthalmic patients with infections, such as bacterial or fungal keratitis, endophthalmitis or adnexal infection
- Adequate hand washing facilities and alcohol-based hand rub should be available in the wards and clinics
- Ophthalmic theatres should have separate autoclaving facilities due to rapid turnover of micro instruments

7.8.2 Staffing and discipline

- Staff should adhere to standard precautions
- Hand hygiene is the most important measure in preventing infections in an ophthalmology unit and should be strictly practiced, especially on the following occasions:
  - before and after contact lens insertion or removal
  - before and after contact with ocular surfaces and adnexa
  - before administering medication e.g. eye drops
  - after contact with body fluids such as tears
- Alcohol hand rubs are not recommended for use with contact lenses because the chemicals, residual debris and bacterial toxins on the hands may be transferred to the lens prior to being placed on the patient's eye. In optometry facilities hands should be washed when working with contact lenses, and any other times hands are likely to contaminate
- Contact lens insertion in eye clinics or theatre for post-operative patients or those with corneal epithelial damage should be done either wearing sterile gloves or using micro instruments without touching the lens or the eye
- Staff should use appropriate PPE depending on the procedure performed
- A nursing officer should be assigned for supervision of cleaning and disinfection who should also ensure an adequate supply of agents for cleaning equipment

7.8.3 Cleaning, disinfection and sterilization of instruments and equipment

Tonometer prism tips

- Follow manufacturer's instructions for cleaning and disinfection whenever available
- Tonometer prism tips should be wiped immediately after use with disposable non-abrasive tissue or with non-abrasive contact lens cleaner before the debris dries on the surface
- Disinfect by swabbing with 70% alcohol wipe in-between patients. Allow to evaporate
- At the end of the clinic, disinfect for 5-10 minutes in 3% H_2O_2 or in 0.5% hypochlorite (5000 ppm) available chlorine.
- After disinfection, the tonometer should be thoroughly rinsed in sterile water and air dried before use. A new solution of disinfectant must be provided for every clinic session
- If there is a suspected adenoviral infection, disinfect in 1% hypochlorite for 30 minutes (please note 3% hydrogen peroxide and 70% alcohol wipes have been shown to be insufficient to inactivate adenovirus and other viruses)
- Use a disposable tonometer tip/shield/prism/probe or non-contact tonometry in cases of infection or if the patient has HIV
- Tonometer prisms can become damaged with time. Regular inspection at the slit-lamp is recommended

Fundus lenses/ gonioscopy lenses

- Fundus lenses should be cleaned with mild detergent and water, and air dried or dried with a lint-free cloth. If infection is suspected, the lenses should be disinfected
- Clean the anterior glass element and the inside of the ring with Precision Optical Lens Cleaner or with a mild cleaning solution and a clean soft lint-free cotton cloth
- With all lenses the manufacturer's instructions for disinfection should be followed to prevent damage to the lens
- Store in a closed case or container

Slit-lamp biomicroscope

- The areas which come into contact with the patient (chin rest, head rim and hand grips) must be cleaned using 70% alcohol between patient examinations
- At the end of the day, it should be washed with soap solution and dried

Tonometer probes/fluorescein strips for tonometry

- These are single use, disposable items. These should never be reused

Pachymeter tips

- Should be cleaned with 70% alcohol

Trial contact lenses

- Ideally trial contact lenses should be disposed after single use. If not, follow manufactures instructions for disinfection
- They should be checked on a regular basis for evidence of damage and cracks. These could abrade the cornea, harbour debris or hold disinfectant, both leading to further ocular irritation

Contact lenses

- Ideally for single use only
- There are different types of lens care systems with different recommendations for use depending on the manufacturer
- Use sterile solution provided to rinse the lenses before wearing them after disinfection

Pneumotonometer tips/ Tonopen

- Should be covered with a disposable latex cover that is discarded after use

7.8.4 IPC measures during patient care

Diagnostic eye drops (anaesthetic, mydriatic, fluoresce) contact lens solutions and saline bottles

- Perform hand hygiene prior to accessing medications and solutions and immediately before drawing up or administering the medication
- Store the containers with the solutions under conditions recommended by the manufacturer.
- After opening, store the product within the recommended temperature range for the time recommended by the manufacturer
- Expiry dates must be checked and adhered to
- Mark the opening date on the bottle
- Ensure the bottle tip never touches the patient's eye (eyelids, lashes, eyebrows and facial skin) or HCW'S hand
- While using the bottle ensure that the bottle cap is held safely in the hand upside down and replaced immediately after use
- Where possible, a single-use dispenser should be used in out-patient examinations
- Ideally, each patient should have his or her own bottle of drops and where there is known infection, separate bottles for each eye

Eye dressings

- An infected eye must never be covered with a pad and/or bandage
- Used eye dressings must be disposed of immediately as clinical waste
- Eye shields must be washed before being re-applied and, if used on known infected cases. Must not be used on other patients
- Cotton wool, gauze swabs or tissues, used when instilling drops or ointment, must be disposed of immediately

Pathological specimens

- Scrapings of the cornea and conjunctiva may be taken using a disposable sterile surgical needle or blade
- If a spatula or loop is used it must be sterilized before and after each procedure by flaming, and allowed to cool. Alternatively, it may be sterilized using a high-level disinfectant

7.8.5 Environmental cleaning and disinfection

Refer Chapter 4.6

7.8.6 Linen

Refer Chapter 4.7

7.8.7 Waste Management

Refer Chapter 4.8

7.8.8 Occupational health

Refer Chapter 9

References

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7.9 ENT UNIT

Introduction

Proper infection prevention and control (IPC) practices are important in the ENT clinic, ENT ward, audiology clinic, hearing aid centre, and speech therapy room to prevent nosocomial infections. Diagnostic and therapeutic procedures can cause transmission of infections to patients and contaminate the working environment if the basic principles of IPC are not practiced.

7.9.1 Design and layout

- The layout of the unit should consist of clean and contaminated zones
  - **The clean zone** includes staff areas, storage areas for supplies, sterilized instruments and equipment
  - **The contaminated zone** includes the area contaminated with material from patient care and the instrument cleaning area
- Work areas should be well lit and well ventilated with uncluttered and easily cleanable bench space to accommodate the necessary equipment
- Work surfaces and bench tops in treatment areas must be non-porous, impervious to water, smooth without crevices and have sealed joints to facilitate cleaning and prevent the accumulation of contaminated matter
- Workflow for instruments and material must be from clean to contaminated areas. Care must be taken to avoid contaminated instruments or equipment re-entering clean areas

7.9.2 Staffing and discipline

- All staff must understand the purpose of and requirements within each area, and adhere to the protocols
- Staff should not bring personal belongings, changes of clothing or bags into clinical areas where cross-contamination is likely to occur
- Staff should use appropriate PPE (e.g. medical masks including respirators, face shield/goggles, gown/apron) depending on the procedure performed as there is a risk of aerosol generation
- Hand hygiene should be practised after each procedure and whenever required
- Nursing officer should be assigned daily for supervision of cleaning and disinfection of equipment

7.9.3 Care of patients with tracheostomy

- Tracheostomy should be performed under aseptic conditions
- When changing a tracheostomy tube, appropriate PPE should be used and aseptic technique should be followed
- No recommendation can be made for the daily application of topical antimicrobial agent(s) at the tracheostoma
- Tracheostomy care bundle - *Refer Chapter 6.9*

7.9.4 Cleaning, disinfection and sterilization of instruments and equipment

- Adequate number of sterilized instrument packets should be available in the ward and the ENT clinic
- Refer manufacturer's recommendations for cleaning, disinfection and sterilization of instruments and equipment
- Instruments that require autoclaving
  - Surgical instruments
  - Stainless steel, ear syringes, foreign body hooks etc.
  - All speculums, forceps
  - Jobsonhorne probe with ring curette
  - Lack's tongue depressor
- After sterilization all the sterilized instruments should be stored in a sterilized instrument tray. Sterility of the instrument trays should be maintained when handling sterilized instruments

Table 1. Cleaning disinfection and sterilization of instruments

Instrument	Method of cleaning/disinfection/sterilization
ENT chair	• Clean the ENT chair with 70% alcohol between patients. Discard used disposable covers if present
Auriscope/Otoscope	• Otoscope head should be cleaned externally with a damp cloth followed by disinfection with 70% alcohol • Instrument heads should not be placed in liquids
Sucker nozzles	• Keep used nozzles in containers with soap and water until sterilisation/disinfection • Autoclave or disinfect with high level disinfectant (HLD) before reuse
Sucker machine	• *Refer Chapter 4.5*
Gauze packs/Vicks	• Autoclave and store in a sterilized container. Maintain sterility of the container and the forceps used to handle autoclaved packs
Head lamp	• Disinfect with 70% alcohol application daily/end of the clinic session
Laryngeal mirrors	• Wipe or rinse with soap and water immediately after use • Use HLD to disinfect
Laryngoscope blades/handles	• *Refer Chapters 4.5 and 7.1.3*
ENT examination microscope	• Manufacturer's instructions and recommendations regarding cleaning, disinfection and maintenance of the instrument and each of its parts must be followed
ENT work station	
ENT operating microscope	
ENT endoscopes	• *Refer Chapter 4.5* ENT endoscopes and laryngoscopy blades commonly come into contact with lymphoid tissue, therefore transmission of Creutzfeldt-Jakob disease (CJD) is a possibility. Discuss with the consultant microbiologist regarding instrument reuse and re-processing when there is a suspicion of CJD.

Flexible laryngoscopes

Pre-cleaning should be done in the procedure room

- Immediately after removing the laryngoscope from the patient, with the laryngoscope still connected to the light source, wipe the insertion tube using a gauze pad or sponge soaked in a freshly prepared detergent solution
- If the laryngoscope features a suction valve, place the distal end of the insertion tube into the detergent solution and with the biopsy port inlet covered, suck the detergent up through the instrument channel for several seconds. Suck detergent and air alternatively to create agitation and to enhance cleaning. Finish by suctioning the instrument channel with air
- Disconnect the laryngoscope from the light source (and suction source, if necessary). Transport the laryngoscope in an enclosed container to the reprocessing room

Cleaning and high-level disinfection should be done in the reprocessing room

Refer Chapter 7.5

Storage and handling

- Store the laryngoscope by hanging it vertically in a clean, dry, well-ventilated, dust-free area or in a storage cabinet
- Do not reattach the suction valve and the biopsy port cap (if either is featured) during storage
- Do not coil the laryngoscope horizontally during storage or store the laryngoscope in a carrying case or a closed container
- When needed for a procedure, carefully remove the laryngoscope from storage
- Examine the laryngoscope and confirm it is dry and has not been damaged
- Reattach the suction valve and the biopsy port cap (if either is featured)
- Handle the laryngoscope with care during its transportation to the procedure room to prevent damage and recontamination
- Breaches in proper storage and handling of the laryngoscope can result in nosocomial infection and/or instrument damage

7.9.5 Environmental cleaning and disinfection

- The surfaces must be cleaned and the contaminated items should be disposed of, cleaned, disinfected or sterilized before the next patient is treated. Clinical contact surfaces in the contaminated zone that are not barrier protected must be cleaned after each patient.
- Working surfaces in the contaminated zone must be cleaned after every patient by wiping the surface with a GPD
- Any instruments placed in the contaminated zone but not used during that session must be regarded as contaminated. For this reason, all bulk supplies such as opened boxes of gloves, must be stored outside the contaminated zone and protected from contamination by splashes and aerosols
- For equipment that is difficult to clean, a protective covering such as a plastic wrap may be necessary. Items where barrier protection may be required include: computer equipment and tubing for suction. Ideally surface barriers should be changed between patients

  Refer Chapter 4.6

7.9.6 Linen

Refer Chapter 4.7

7.9.7 Waste Management

Refer Chapter 4.8

7.9.8 Occupational health

Refer Chapter 9

References

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7.10 DENTAL UNIT

Introduction

Infections in dental settings are transmitted by direct contact with blood, oral or other secretions and indirectly through contact with contaminated instruments and material, surgical equipment or environmental surfaces. Further, organisms may transmit through contact of oral, nasal or conjunctival mucosa with droplets and aerosols generated from an infected person during dental procedures. Adhering to effective infection prevention and control (IPC) measures can prevent cross infection in the dental care setting.

7.10.1 Design and lay out

- The layout of the unit consists of clean and contaminated zones.
  - **The clean zone includes:**
    - Office areas, staff rooms, waiting and reception areas
    - Areas used for storage of supplies, sterilized instruments and equipment
    - Sterile packs/surgical instruments laying out area
  - **The contaminated zone includes**:
    - The area contaminated with material from patient care i.e. the dental chair and surrounding area of 1m-1.8m diameter. Waste bin and sharp bin to discard the contaminated items from the patient should be placed within this area
    - Instrument cleaning area
- In the dental operatory, workflow for instruments and materials must be from clean to contaminated areas. Care should be taken to avoid contaminated instruments or equipment re-entering clean areas
- The boundaries of the contaminated zone need to be clearly defined, because this has implications for surface cleaning, placement of equipment and mobilization/movement in the clinic. The contamination within this zone during dental treatment should be minimized by determining contaminated surfaces and the areas where spread of droplets, splash and splatter will occur
- All surfaces and items within the contaminated zone should be considered as contaminated. These surfaces should be cleaned and the contaminated items be disposed of, disinfected or sterilized between patients. Clinical contact surfaces (dental chair and bracket table) in the contaminated zone that are not barrier protected should be cleaned after each patient
- Work areas should be well lit and well ventilated with sufficient uncluttered and easily cleanable bench space to accommodate necessary equipment
- Work surfaces and bench tops in treatment areas should be non-porous, impervious to water, smooth without crevices with sealed joints to facilitate cleaning and prevent the accumulation of contaminated matter
- Floor must be non-slippery and impervious with sealed joints. Carpets should not be used in clinical, laboratory and instrument reprocessing areas as they are not impervious

7.10.2 Staffing and discipline

- All dental staff should understand the purpose of and requirements within each area, and adhere to the protocols
- Staff may move from the clean zone to the contaminated zone but never the reverse direction
- Appropriate PPE should be worn in the procedure room – scrub suit and gown, surgical face mask, goggles or face shield, cap, gloves (respirator masks and boots where necessary)
- Staff should not bring personal items, street clothes or bags into clinical areas
- Avoid unnecessary items (e.g. carpets, curtains, wall hangings, flower vases, toys) inside the procedure room. One responsible person should be appointed to monitor the IPC practices

7.10.3 Cleaning, disinfection and sterilization of instruments and equipment

- Wear appropriate PPE before cleaning the instruments
- Clean dental instruments by scrubbing with GPD and water before disinfection/ sterilisation
- Cleaning with barrier washing machine is preferable to manual cleaning
- Dental instruments that require heat sterilization (autoclaving)
  - Dental surgical instruments including dental extraction forceps
  - All stainless steel, tungsten carbide, and teflon-coated dental hand instruments
  - Hand pieces
  - All burs and bur changers
  - All endodontic and orthodontic instruments
  - Air-water syringe tips
  - High-volume evacuator tips
  - Ultrasonic scaler tips
  - Metal impression trays
  - Intra-oral radiographic equipment that can withstand heat sterilization
- Dental instruments that require high level disinfection
  - Glass dappen-dishes
  - Wax knife
  - Other reusable items that cannot withstand heat
- Individual procedure related instrument packages are recommended to prevent potential contamination. After sterilization all the sterilized instruments should be stored aseptically in a closed container/cupboard. Sterility of the instruments should be maintained when handling sterilized instruments

Table 1. Cleaning, disinfection and sterilization of instruments

Instrument	Method of cleaning, disinfection, or sterilization
Dental chair	• Clean the dental chair and bracket table with GPD followed by 70% alcohol before and after each session • After each patient, clean clinical contaminated surfaces (e.g. headrest, arms of the chair, light and bracket table handles) with 70% alcohol. Discard used disposable covers • Disinfect the spittoon with 0.1% TCL leaving for 20 minutes followed by washing with a GPD at the end of the treatment session or as often as required • Develop a schedule for waterline maintenance (based on manufacturer recommended treatment methods) and assign a designated person
Hand-pieces	• Remove the hand piece from the tube between patients • Wash with GPD, brush and clean under running water. Dry with an absorbent paper • Sterilise by autoclaving, if not possible, disinfect with 70% alcohol • After each session, o Before sterilization lubricate the hand pieces with the lubricant recommended by the manufacturer and operate again for 10-20 seconds only with air so that the lubricant is properly distributed throughout the sensitive areas of the head
Ultrasonic scaler	• Autoclave ultrasonic scaler tips before using for each patient (follow the manufacturer's instructions) • Wipe ultrasonic scaler hand-piece between uses with 70% isopropyl alcohol impregnated wipes • Clean the scaler tip changer with a detergent and sterilize after each patient according to the manufacturer's instructions. Keep two changers, one for removing the used tips and the other to fix sterilized tips
Light cure machine	• Clean with a GPD followed by 70% alcohol
Impressions and prosthetic appliances	• Use disposable impression trays or autoclavable impression trays • Rinse all impressions in running water • Disinfect with an appropriate disinfecting agent (1% hypochlorite for 10 minutes) before sending to the dental laboratory • Disinfect prosthetic appliances received from the laboratory prior to insertion into the patient's mouth. For the appliances without metal parts – 1% hypochlorite solution. For appliance with metal parts - a disinfectant that does not corrode metal e.g. 70% alcohol. Rinse with sterile water following disinfection
Cotton wool	• Autoclave and store in a sterilized container. Maintain sterility of the container and the tweezers used for handling autoclaved cotton wool • Preparing separate cotton wool packs for each patient is recommended

Refer Chapter 4.5

7.10.4 Environmental cleaning

Cleaning of clean zone

Daily cleaning

- Table tops, lockers, ledges and other furniture
  - Office areas and patient waiting areas (outside the procedure room) - damp wipe with a general-purpose detergent (GPD)
  - Procedure room - damp wipe with GPD and disinfect with 0.1% hypochlorite or 70% alcohol
- Cleaning the floor
  - Mop with a GPD before and after each clinic session
  - Mops should be rinsed after each use, wrung and stored dry -*Refer Chapter 4.6*
  - Brooms must not be used in clinical areas as these disperse dust and bacteria
  - Blood or body fluid spillage -*Refer Chapter 4.6*
- Disinfect the instrument trolleys by wiping with 70% alcohol before and after procedures

Weekly/ monthly cleaning

- Clean windowsills, walls, ceiling fans, solid surfaces in the waiting room, clinic cupboards, shelves, beds and lockers with a GPD
- Wash the curtains in the waiting room or staff rooms
- Damp dust lights and shades every three months
- Clean the instrument trolleys thoroughly with a GPD weekly

Cleaning / disinfection of contaminated zone

- Working surfaces in the contaminated zone must be cleaned after every patient by cleaning the surface with a GPD followed by wiping with 70% alcohol. Wear appropriate PPE when cleaning
- Any instrument placed in the contaminated zone for a treatment session must be regarded as contaminated even if it was not used. For this reason, all bulk supplies such as opened boxes of gloves, cotton rolls or gauze must be stored outside the contaminated zone and protected from contamination from splashes and aerosols
- Certain items need barrier protection (covering with a plastic wrap). These items include: switches on dental chairs, computer equipment, operating light handle, tubing for suction, three-way syringe, scaler hand piece, instrument cradles (e.g. polymerising light, intra-oral camera and fibre-optic illuminator) and the bracket table and handle. Ideally surface barriers should be changed between patients
  Refer Chapter 4.6

7.10.5 Water lines and water quality

Dental unit waterlines (plastic tubing that carries water to the high-speed hand piece, air/water syringe, and ultrasonic scaler) can contain biofilms, which act as a reservoir of microbial contamination.

- Waterlines must be cleaned and disinfected according to manufacturer’s instructions
- Use a separate water reservoir system (a water bottle) to eliminate the flow of municipal water into the dental unit. This allows better control over the quality of source water for

patient care. Sterile water must be added to the reservoir manually and the cleaning agent should be added regularly to the bottle

- All waterlines must be fitted with non-return (anti-retraction) valves to help prevent retrograde contamination of the lines by fluids from the oral cavity
- Check water quality of main source and hand-pieces 3 monthly or as and when required
- Air and waterlines from any device connected to the dental water system that enters the patient's mouth (e.g. hand-pieces, ultrasonic scalers, and air/water syringes) should be flushed for 3 minutes at the start and the end of the day, and for 30 seconds between patients
- Sterile irrigants such as sterile water or sterile saline as a coolant are required for surgical procedures such as dento-alveolar surgery and dental implant placement
- Test dental unit water from each unit monthly for 3 months. If the unit meets standards, then test quarterly at a minimum. Dental equipment (e.g. hand piece) should be removed before the samples are taken from the reservoir. Collect the water samples from hand pieces after flushing for 30 seconds. Sterile gloves should be worn when collecting samples to avoid contamination

Table 2. Testing requirements and interpretation of results for dental unit water lines

Hazard / Hygiene Indicator	**Result**	**Interpretation**	**Action**
Aerobic Colony Count at 22 °C	>200 /ml	Undesirable	Discuss with microbiologist; investigate cause and put corrective action in place
	100 – 200 /ml	Acceptable	Ensure appropriate controls are in place
	<100 /ml	Satisfactory	N/A

7.10.6 Quality Control

- Maintain a sterilization record including daily steriliser cycle records
- All dental clinics should maintain adequate stocks of gloves (clean and sterile gloves) to change in between every patient. Regional dental surgeons and dental surgeons- in-charge should take necessary steps to make available the required stocks of gloves and masks for every dental clinic in their responsible district
- All hospital dental clinics including Adolescent Dental Clinics (ADCs), Community dental clinics (CDCs) and school dental clinics (SDCs) should have an autoclave to sterilize all dental surgical instruments. If autoclaving facilities are not available, it should be arranged from a nearby health care institution (MOH or hospitals)
- All dental clinics should maintain sterility of the surgical instruments when attending outreach programmes
- All dental surgeons and nursing officers should supervise junior staff on infection control procedures of the dental care setting

7.10.7 Linen

Linen contaminated with blood or body fluids (saliva, vomitus etc.) of patients should undergo thermal disinfection. If washing machines with thermal cycles are not available, soaking in 0.05% hypochlorite solution (500 ppm available chlorine)for 15 to 30 minutes prior to washing is used.

Refer Chapters 4.7 and 7.16

7.10.8 Waste management

Refer Chapter 4.8

7.10.9 Occupational health

Refer Chapter 9

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7.11 ISOLATION FACILITIES

Introduction

Isolation of patients is required to minimize or prevent transmission of certain infections (source isolation). In addition, isolation is also important to protect immunocompromised individuals from acquiring infections (protective isolation).

Refer Chapter 8

IPC practices in isolation facilities for infectious diseases are based on the mode of transmission of infectious agents. There are three types of transmission-based precautions: contact, droplet and airborne precautions which should be adhered to, in addition to standard precautions.

Refer Chapter 5

Patient placement

Potential for transmission of infectious agents should be taken into consideration in patient placement decisions.

Determine patient placement based on the following principles:

- Route(s) of transmission of the known or suspected infectious agent
- Risk factors for transmission in the infected patient
    - Priority should be given to patients who pose a higher risk for transmission to others (e.g. uncontained secretions, excretions or wound drainage; infants with suspected viral respiratory or gastrointestinal infections)
- Availability of single-patient rooms
- Consider other options (e.g. cohorting patients with the same infection)
- Risk factors for adverse outcomes resulting from a health care associated infection (HAI) in other patients in the area or room being considered for patient-placement

7.11.1 Design and layout

Location

- Isolation rooms for infectious patients should be located in the outpatient department, emergency treatment unit, ICUs, special baby care units, dialysis units and wards. The doors of these rooms should not open into other patient areas or common corridors
- In addition, a health care facility can have a dedicated isolation unit especially when an adequate number of isolation rooms are not available in the individual units. This should be located close to an entrance and away from hospital traffic

Types of isolation rooms in health care facilities

- For source isolation
    - Single rooms for infections transmitted by contact and droplets
    - Airborne infection isolation rooms (AIIR)
- For protective isolation
    - Protective environment isolation rooms (PE)

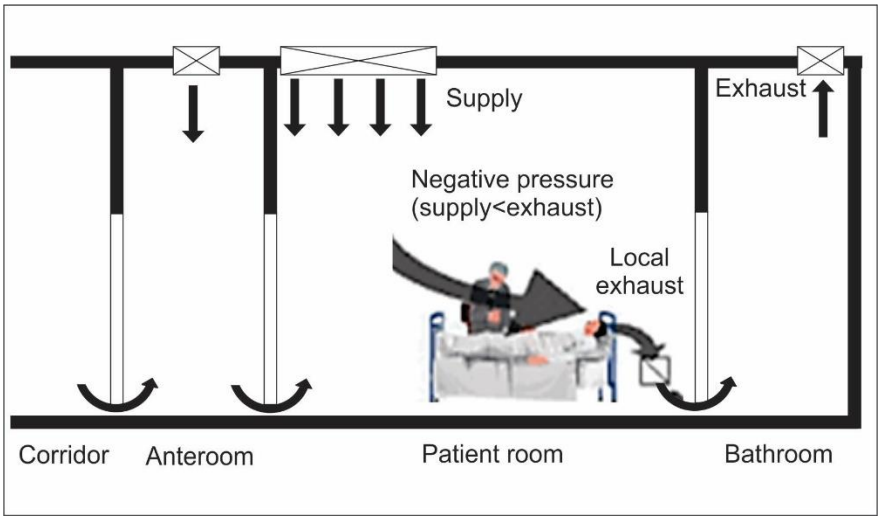
Single rooms for infections transmitted by contact and droplets

- An en-suite single room with double door entrance (ante room) and facilities for hand hygiene is required
- These rooms are required for patients with infections transmitted by direct or indirect contact and enteric infections. e.g. infections caused by MDROs (MRSA, VRE, ESBL, CRE etc.), *Clostridium difficile* and for patients with infections transmitted by droplets e.g. influenza, *Bordetella pertussis*, *Neisseria meningitides*
  Refer Chapter 5

Airborne infection isolation rooms (AIIR)

- These rooms are required for patients with infections transmitted by airborne route and during aerosol generating procedures of patients with respiratory tract infections
- AIIR should have following characteristics:
  - Negative pressure relative to adjacent spaces. AIIR negative to ante room/ante room negative to corridor
  - Ventilation system with at least 12 air changes per hour
  - Direct exhaust of air to the outside where the droplet nuclei will be diluted in the outdoor air or pass through HEPA filters
  - Air supply grills should be above the patient and exhaust should be placed low on the wall
  - Monitor air pressure daily with visual indicators (e.g. smoke tubes, flutter strips), regardless of the presence of differential pressure sensing devices (e.g. manometers)
  - Maintain temperature 20° C to 25°C and relative humidity 60% at all times
  - Ante room with hand wash sink
  - One toilet per AIIR
  - Self-closing doors (swing out for negatively pressurized spaces; swing in for positively pressurized spaces) with door sweeps (sliding doors preferred)
  - Keep the AIIR door closed when not required for entry or exit
  - Finishes should be smooth and cleanable
  - Seal all penetrations
- Regular checks of performance of the system are needed to ensure proper operation

Figure 1. Negative pressure isolation room



- If the above ventilation system is not available,
  - A room with 2 strong exhaust fans could be used
  - The extractor fan should provide 8-12 air changes per hour
- In the event of an outbreak or exposure involving large numbers of patients who require airborne precautions;
  - Consult infection prevention and control professionals before patient placement to determine the safety of alternative room that do not meet engineering requirements for an AIIR
  - Place together (cohort) patients who are presumed to have the same infection(based on clinical presentation and diagnosis when known) in areas of the facility that are away from other patients, especially patients who are at increased risk for infection (e.g. immunocompromised patients)
  - Use temporary portable solutions (e.g. exhaust fan) to create a negative pressure environment in the converted area of the facility
  - Discharge air directly to the outside, away from people and air intakes, or direct all the air through HEPA filters before it is introduced to other air spaces

Protective environment isolation rooms (PE)

- A protective environment is designed for high-risk immunocompromised patients (e.g. HSCT patients) to minimize fungal spore counts in the air and reduce the risk of invasive environmental fungal infections
  Refer Chapter 8

7.11.2 Staffing and discipline

- There should be dedicated trained staff for isolation units. They should be trained on correct use of appropriate PPEs and isolation precautions
- Patient movements should be minimised. Investigations such as X-ray and ECG as well as physiotherapy should be arranged in-ward whenever possible. Use designated portable X-ray equipment or other designated diagnostic equipment
- If transport or movements are essential, patient should wear medical mask and use a predetermined route to avoid exposure for others
- Notify the area receiving the patient of any necessary precautions as early as possible before the patient's arrival
- Limit the number of HCWs, family members, and visitors

7.11.3 Cleaning, disinfection and sterilization of equipment

Refer Chapter 4.5

7.11.4 Environmental cleaning

Special consideration should be taken to ensure cleaning of source isolation rooms.

- Clean these areas after non-isolation areas
- Spacing must be taken into account to facilitate easy access to equipment around the bed for cleaning
- Cleaning and disinfection of all patient-care areas are important for frequently touched surfaces, especially those closest to the patient, that are most likely to be contaminated

- Isolation rooms should be cleaned by the trained hospital staff and not by the cleaning service personnel. Cleaning should be monitored and the staff should be reinforced to promote consistent and correct cleaning
- Protocol for environmental cleaning and disinfection which includes cleaning procedures and required PPE should be made available. It should be understood by the relevant staff
- Environmental reservoirs of pathogens during outbreaks and specific cleaning and disinfectant agents use can be determined in consultation with the IPC team
- Take care to keep the door closed during the cleaning process (ventilation requirement)
- Cleaning carts should not be allowed into the room. They should be kept at the door and only the equipment and supplies needed should be brought in
- Dedicated, colour coded cleaning equipment and cleaning solutions should be available for individual room
- Change PPE immediately after cleaning

Refer Chapter 4.6

7.11.5 Linen

Refer Chapter 4.7

7.11.6 Waste management

- Separate arrangements should be available for garbage and infectious waste removal from isolation rooms in the form of separate staircases and lifts

Refer Chapter 4.8

7.11.7 Occupational health

Refer Chapter 9

References

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- Shweta K, Gupta SK, Chandrashekhar R, Kant S. Planning and Designing an Isolation Facility in Hospitals: Need of the Hour. Int J Res Foundation Hosp Healthc Adm 2015;3(1):48-56.

7.12 RADIOLOGY DEPARTMENT

Introduction

Radiology department carries out many invasive and non-invasive procedures. There is a risk of transmission of infections during these procedures and from patients and healthcare workers (HCWs) with infections. Possible risk areas include common waiting areas, examination rooms and procedure rooms.

7.12.1 Design and layout

- The department should be easily accessible for emergency patients, ambulant patients and inpatients. It should ideally be located on the ground floor with direct access to the emergency department
- Main areas:
  - Entry/reception areas (reception desk, waiting areas, consultation room, toilets, offices for clerical functions)
  - Procedural areas (general and digital x-ray rooms, dental/oral imaging, CT scanning, ultrasound, MRI suite, mammography rooms, angiography etc.)
  - Support areas (communications room, dark room, digital processing areas, film processing areas, store rooms for films, files, stationery, general consumables)
  - Staff offices and reporting areas
- The radiology unit should be air-conditioned to provide a comfortable working environment for staff and visitors. Interventional imaging rooms ideally require ventilation equivalent to operating rooms - Refer Chapter 7.1
- Path of travel for inpatients should be separated from outpatients as far as possible
- Hand washing facilities should be located in each procedure room, patient recovery areas and support rooms. Hand sanitizers should be available in addition

7.12.2 Staffing and discipline

- All staff including radiographers should have training on infection prevention and control (IPC) including hand hygiene and correct use of PPE
- Standard precautions and additional precautions (when indicated) should be followed
- Aseptic techniques should be followed when performing invasive procedures including interventional radiology
- HCWs should wear gloves and other appropriate PPE when handling specimens

7.12.3 Additional measures for IPC

- When scheduling the procedure list, patients who are infected or colonized with multidrug resistant organisms should be placed last in the list unless otherwise indicated
- During transportation of patients on additional (transmission based) precautions
  - Limit the use of public passages during patient transportation
  - Limit the transportation of infected patients. They should be transported only if the radiological procedure cannot be performed at the bedside
  - Both HCWs and patient should wear appropriate PPE. Patients with cough or under airborne precautions should wear a surgical mask during transportation

- Patient's wounds or skin lesion/s should be covered
- Coordinate with the radiology department in advance, regarding the arrival of the patient

7.12.4 Cleaning, disinfection and sterilization of instruments and equipment

- Decontamination of reusable items
  - Most instruments used during radiological procedures are disposable and should not be reused
  - Reusable items need to be thoroughly decontaminated between patients to prevent transmission of infections
  - Reusable items in a radiology department are divided into 3 categories

Table 1. Methods of decontamination of items

Item	Method of decontamination
Critical Endovascular or endovaginal ultrasound probes and reusable surgical instruments, such as forceps and needle drivers	Heat sterilization or sterilization using chemical sterilant or other method according to manufacturer's instructions, after each use
Semi-critical Endoscopes, cystoscopes, and respiratory and anaesthesia equipment	High-level disinfection after each use
Non-critical CT or MRI imaging gantry, noninvasive ultrasound probes, blood pressure cuffs and viewing station, keyboard and mouse	Wash with soap and water each use or decontaminate with a low-level disinfectant after each use according to manufacturer's instructions
X-ray film plates	Use lint-free cotton to wipe the imaging plates
Lead aprons	X-ray aprons should be cleaned daily by scrubbing with a soft bristle brush, using cold water and a mild detergent

Refer Chapter 4.5

7.12.5 Environmental cleaning

Refer Chapter 4.6

7.12.6 Linen

Refer Chapter 4.7

7.12.7 Waste management

Refer Chapter 4.8

7.12.8 Occupational health

Refer Chapter 9

References

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7.13 CARDIAC CATHETERIZATION LABORATORY

Introduction

Interventional cardiology is a branch of cardiology that deals specifically with catheter-based treatment of structural heart diseases. Common types of invasive procedures in cardiology are angioplasty/percutaneous coronary interventions, stenting, cardiac catheterization, embolic protection by inserting filters, percutaneous valve repair and atherectomy etc.

All these procedures carry risks; therefore, the aim of infection prevention and control (IPC) is to minimize the infectious adverse events of procedures.

The basic IPC procedures should always be adhered to. These include, patient selection, screening for distant site colonization with adequate decolonization when indicated, optimizing the patient factors, usage of maximal barrier precautions, usage of proven antiseptics, antibiotic prophylaxis when indicated and refraining from re-use of disposable items which were intended for single use.

7.13.1 Design and layout

- The unit should be designed according to the standards and be commissioned before use. Routine maintenance schedules should be strictly observed
- Ventilation system should ideally provide at least 15 air exchanges per hour of which at least 3 should be fresh air

7.13.2 Staffing and discipline

- Pre-recruitment and continuous training of personnel on infection control should be carried out and audits need to be arranged as per unit guidelines
- Adhere to standard precautions
- Proper hand hygiene practices should be followed
- Doors of the operating room should be kept closed, except as necessary for passage of equipment and personnel
- After the catheterization process has started, number of personnel allowed to leave or enter should be kept to a minimum

7.13.3 Patient preparation

- Identify and treat infections prior to elective procedures. Postpone the procedure until infection has resolved
- If hair removal is necessary, this should be carried out with clippers and not with razors immediately before the procedure
- Clean the skin with 2% (w/v) chlorhexidine in 70% alcohol. If it is not available clean with 70% alcohol followed by 10% w/v povidone iodine
- Use sterile gauze with semi permeable dressing to cover catheter site
- Avoid brachial artery cut down procedures

- Antibiotic coverage against skin flora should be used for the diabetic patients utilizing vascular closure device

7.13.4 Cleaning, disinfection and sterilization of equipment

- Reprocessing of items used in interventional cardiology is best avoided. If reprocessing is done equipment should undergo a suitable sterilization procedure
  Refer Chapter 4.5

7.13.5 Environmental cleaning

- Operating room cleaning - *Refer Chapter 7.1*
  - Standard protocol for cleaning has to be followed
  - If visible soiling occurs following a case, surfaces and equipment should be disinfected
  - After the last procedure of the day, wet vacuum or mop the floors with a dedicated mop using a GPD
  - Floor and walls should be cleaned and disinfected after a procedure if soiled/potentially soiled as evidenced by the presence of splash, splatter, or spray during the procedure
  - Air vents should be cleaned at least monthly
- Cleaning of other areas and furniture, spill management
  Refer Chapter 4.6

7.13.6 Linen

Refer Chapter 4.7

7.13.7 Waste management

Refer Chapter 4.8

7.13.8 Occupational health

Refer Chapter 9

Reference

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7.14 BLOOD BANK/ BLOOD TRANSFUSION SERVICES

Introduction

Primary goal of a blood transfusion service (BTS) is to ensure an adequate supply of safe blood products and transfusion related therapeutic services to fulfil the clinical needs of the patients. Transfusion service operations comprise of multistep processes that include blood donor recruitment and selection, blood collection, blood component processing, testing for transfusion transmissible infections and blood grouping, storage, compatibility testing and issue of blood products for transfusion. Scope of the transfusion services further extends to provision of transfusion and transplant related laboratory and clinical services and related research activities.

In all these activities, it is critically important to ensure the safety of all the stakeholders and personnel involved. The IPC measures should be well designed and effectively implemented with the aim of ensuring the following:

- Safety of blood donors who voluntarily donate blood
- Safety of BTS staff who are involved in blood collection, processing, testing, storage and distribution of blood products
- Safety of hospital clinical staff who handle and transfuse blood products
- Safety of patients who receive blood transfusions
- Safety of the general public and the environment

7.14.1 Design and layout

Blood transfusion services have to be well designed and appropriately managed in accordance with international safety standards.

- Blood centers should be located, constructed and maintained to suit the key operations of blood donor assessment, blood collection, donation testing, blood component preparation, blood product labelling, storage, compatibility testing and other transfusion related laboratory testing procedures
- Premises should be well designed with separate dedicated areas for above operations with facilities for effective cleaning and maintenance to minimize risk of contamination. There should be facilities for appropriate disposal of unusable blood products, test specimens and blood contaminated waste
- The workflow should be designed to allow for a logical flow of staff, blood donors and blood products in order to minimize the risk of errors. Working areas should not be used as passageways or storage areas
- Washing and toilet facilities and, if required, facilities for changing or eating should be available and maintained in a hygienic and tidy condition
- Premises should be carefully maintained and cleaned and where appropriate disinfected according to SOPs. Cleaning records should be retained

7.14.2 Staffing and discipline

- The staff who handle blood products and specimens should be aware of and strictly follow the basic hygienic work practices and general laboratory biosafety measures at all times
- Specific policies, protocols and procedures should be followed by the staff to ensure the safety of blood donors, blood products and transfusion recipients and the staff
- All staff should always strictly follow standard precautions
- Staff should wear appropriate PPE
- All staff should be vaccinated against Hepatitis B
- Standard laboratory safety practices should be followed when testing blood
  Refer Chapter 7.15
- All laboratory accidents and blood spills should be managed appropriately
  Refer Chapters 4.6
- Management of HCW potentially exposed to HBV, HCV and HIV should be done appropriately
  Refer Chapter 9

7.14.3 Measures to ensure safety of blood donors

- Following measures are in place to minimise any infection risk to blood donors at the time of donating blood:
  - Each donor's blood is collected through a single use blood collecting bag systems with sterile disposable needles
  - Use of blood collecting bags with integrated needle locking system also helps to prevent the risk of infection transmission through accidental needle injuries
  - Sterile single use disposable lancets should be used for finger pricking for haemoglobin testing. Sharps bin has should be available at the vicinity for direct disposal of sharps
  - Performing hand hygiene by staff and wearing gloves before and after each donation procedure
  - Preparing the skin at the blood collection site using an appropriate antiseptic
    (Refer Annexure 7.14.1)

7.14.4 Measures to ensure safety of blood supply

- Number of measures have been employed by blood transfusion services worldwide including National Blood Transfusion Service (NBTS), to minimize the risk of transfusion transmitted infections (TTI) in line with WHO recommendations on blood safety including:
  - Recruiting only voluntary non-remunerated blood donors avoiding high risk populations and individuals
  - Pre-donation assessment of every potential donor for their acceptability by a qualified and trained medical officer based on stringent donor selection criteria
  - Use of new sterile disposable blood collecting bags for each donation and checking for any leaks or evidence of contamination of the contents before use
  - Ensuring proper cleaning of venipuncture site based on validated SOPs

- Use of a blood bag system having a diversion pouch to divert initial aliquot of blood to reduce the risk of blood product contamination by skin flora
- Maintaining a closed-system during processing of blood components prevent the exposure of collected blood to microorganisms in the environment
- Testing of all donations for TTI in accordance with WHO recommendations covering HIV Type 1 and 2 (Ag-Ab), HBV (HBsAg), HCV (anti HCV Ab), Syphilis (VDRL/TPPA) and Malaria (Microscopy)

Table 1. Testing of donations for TTI

Infectious Disease/Pathogen	Laboratory tests performed by NBTS
HIV Types 1 and 2	HIV combined antigen-antibody enzyme immunoassay (EIA/CLIA)
Hepatitis B virus (HBV)	HBsAg enzyme immunoassay (EIA/CLIA)
Hepatitis C virus (HCV)	Combined HCV antigen-antibody enzyme immunoassay (EIA/CLIA)
Treponema pallidum (syphilis)	VDRL as a screening test and Anti-treponemal antibody (TPPA) on VDRL reactive donations
Malaria	Microscopic examination of blood films

- Introduction of NAT testing for HIV, HBV and HCV to strengthen the screening system
- Regular quality monitoring of blood products for bacterial contamination by automated bacterial detection systems

Maintenance of appropriate cold chain requirements of blood components during storage (Red cell at 2-4°C, FFP < -30°C). Platelets which have to be kept at 22°C are given a shorter shelf life of 5 days to minimize the impact of proliferation of any potential contaminating organisms)

- Leucocyte filtration of blood components to minimize the risk of infection by cell bound organisms such as EBV and CMV when given to susceptible patients
- Pathogen inactivation technology – currently available for platelet products only
- Promotion of appropriate clinical use of blood to avoid or minimize unnecessary transfusions when other medical and surgical alternatives to transfusions are used
- Establishment of hemovigilance program for monitoring of TTIs

7.14.5 Cleaning, disinfection and sterilisation of instruments and equipment

- Establish SOPs describing cleaning procedures
- Equipment should be cleaned and disinfected according to manufacturer's instructions
- A schedule for regular cleaning and disinfection is recommended for all surfaces with direct contact with the bag system (e.g. centrifuge, separator, storage shelves)
- Disinfectant solutions with sufficient and approved antimicrobial activity should be used

- Hypochlorite should not be used for disinfection of metal equipment as they are corrosive. 70% isopropyl alcohol should be used instead
- A cleaning plan should be established that specifies the cleaning intervals and methods to be used for the different equipment and premises
- Reusable glassware (e.g. contaminated glass test tubes) should be disinfected by autoclaving or by chemical disinfection [with 1% (10,000 ppm) hypochlorite solution for a minimum of 30 minutes] before they are cleaned with appropriate detergent
- Cleaning activities should be documented
  Refer Chapter 4.5

7.14.6 Environmental cleaning

Routine and regular cleaning is important to ensure a clean and dust-free environment in the blood bank premises.

- Administrative and office areas with no contact with blood products or test specimens can be managed with normal domestic cleaning
- Blood collection, processing, testing and storage areas should be cleaned by wet mopping. Dry sweeping is not recommended. Bacteriological testing of the environment is not recommended unless seeking a potential source of an outbreak
- Worktops should be routinely disinfected at the end of the day or work session with 0.1% sodium hypochlorite solution
- Any areas visibly contaminated with blood or body fluids should be disinfected immediately with 1% sodium hypochlorite solution and cleaned with detergent and water
- Blood spills should be contained, properly decontaminated and cleaned
  Refer Chapter 4.6

7.14.7 Waste disposal

Refer Chapters 4.8 and 7.16

Table 2. Different kinds of infectious waste and the recommended methods of safe disposal

Process	Sharps	Solid Non-sharps	Effluents
Blood donor assessment & selection	• Broken slides and glassware • Lancets and needles • Cuvettes • Pipettes • Micro-capillary tubes	• Contaminated glassware • Gauze and swabs • Gloves	• Used copper sulphate solution
Blood donation & post donation care	• Broken glassware and ampoules • Broken test tubes and glass slides • Needles from blood collection bags • Scissors	• Gauze and swabs • Gloves • Unacceptable blood units and test samples	• Disinfectants
Blood component processing & storage	• Scissors • Needles of transfer bags	• Unacceptable blood units • Contaminated blood bag tubing • Gloves	• Contaminated liquids generated from washed Red cell preparation
Blood transfusion laboratory testing	• Broken glassware and ampoules • Test tubes and slides • Pipette tips	• Blood sample tubes • Gloves • Micro-plates • Used test kit materials	• Blood and serum of test samples • Liquids contaminated with test specimens • Disinfectant solutions
Recommended method of disposal	• Dispose sharps at the point of use into puncture proof boxes with red and yellow strips • When the box is 3/4 full, close and seal the lid • Dispose through hospital waste disposable system – by incineration • OR maybe outsourced to a CEA approved service provider, authorised to collect, transport and dispose clinical waste	• Non-sharp, solid infectious waste should be autoclaved (121°C for 20 minutes) and incinerated • OR after autoclaving they can be disposed as non-infectious general waste • OR if autoclaving is not possible, they may be directly incinerated ensuring safe transport to the incinerator site • OR alternatively, disposal may be outsourced to a CEA approved service provider, authorised to collect, transport and dispose clinical waste	• Contaminated liquid waste can be sent to a closed drainage system through a dedicated sink • Or chemically disinfect (e.g. with equal volume of 1% sodium hypochlorite and kept overnight) and dispose through the general drainage system

7.14.8 Occupational health

- All staff should be provided with education and relevant training on work related risks and safety practices
- PPE should be provided for all staff as appropriate for their working areas considering the potential risk of exposure to infectious material
- All staff handling blood products and blood specimens should be vaccinated for HBV and be followed up for their antibody status
- First aid facilities should be provided
  Refer Chapter 9

References

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Annexure 7.14.1

Standard operating procedure for venepuncture for blood donation

- Perform hand hygiene and put-on sterile gloves
- Disinfect the skin - This is different to routine venepuncture because the contamination of the blood should be minimal. If the site selected is visibly dirty, wash the area with soap and water and dry. Skin antisepsis should be commenced at the intended site of venipuncture, using an enlarging concentric circular pattern (area 8cm x 8cm).

A. One-step procedure for skin antisepsis

- Apply a product combining 2% w/v chlorhexidine gluconate in 70% isopropyl alcohol
- Cover the whole area with the antiseptic and wait for at least 30 seconds
- Allow the area to dry completely

B. Two- step procedure for skin antisepsis

Step 1

- Apply 70% isopropyl alcohol
- Cover the area and wait for at least 30 seconds
- Allow the area to dry completely

Step 2

- Apply tincture of iodine or 2% w/v chlorhexidine gluconate in 70% isopropyl alcohol
- Cover the whole area with the antiseptic and wait for at least 30 seconds
- Allow the area to dry completely

C. Method currently practiced by NBTS – Sri Lanka (comprises of 3 steps)

Step 1

- Apply 70% isopropyl alcohol
- Cover the whole area with the antiseptic and wait for at least 30 seconds

Step 2

- Apply 10% w/v povidone iodine
- Cover the whole area with the antiseptic and wait for at least 30 seconds

Step 3

- Apply 70% isopropyl alcohol again;
- Cover the whole area with the antiseptic and wait for at least 30 seconds

International studies have shown that the 3 steps method is one of the most effective methods to be used.

7.15 LABORATORY

Introduction

Standard infrastructure facilities and safe working practices are important in clinical laboratories for the prevention of laboratory acquired infections including those caused by multi-resistant and hazardous organisms.

There are four different laboratory types depending on the dedicated laboratory work. The levels of containment range from the biosafety level 1 (BSL-1) to level 4 (BSL-4).

Table 1. Relationship of Risk Group to Biosafety Levels, practices and necessary equipment

Risk Group	Bio safety Level	Laboratory type	Minimum Laboratory Practices	Safety equipment
1	Basic-Bio safety Level 1	Basic teaching, research	GMT	None, open bench work
2	Basic-Bio safety Level 2	Primary health services, diagnostic services, research	GMT plus protective clothing, biohazard sign	Open bench plus BSC for potential aerosols
3	Containment-Bio safety Level 3	Special diagnostic services, research	As Level 2 plus special clothing, controlled access, directional airflow	BSC and/or other primary devices for all activities
4	Maximum containment-Bio safety Level 4	Dangerous pathogen units	As Level 3 plus airlock entry, shower exit, special waste disposal	Class 3 BSC or positive pressure suits in conjunction with class 2 BSCs, double ended autoclave (through the wall), filtered air

BSC - Biological safety cabinet, GMT- Good microbiological technique

7.15.1 Laboratory design and layout

- Should have separate areas for collection of samples, reception, and processing of specimens, preparation and storage of culture media, distribution of reports, decontaminating and washing. There should be an office area and separate eating and resting areas for the laboratory staff
- Should have adequate work space including bench space
- Separate sink for hand washing should be available
- Emergency shower and eyewash stations should be available

Work benches and general area

- Floor should be easily washable. Epoxy flooring coved to walls are preferable. (if that is not possible, large tiles with minimal groove space can be considered)
- Bench tops should be made of water resistant and scratch proof material withstanding routinely used chemicals
- Walls should be tiled up to six feet or more (preferably large tiles without grooves)
- Minimize horizontal surfaces other than essential surfaces such as bench tops, laboratory furniture etc.

Access to the laboratory

- The universal biohazard symbol should be displayed at the entrance to the laboratory
- Access should be through a single entrance
- Only authorized personnel should be allowed
- Children should be restricted

7.15.2 Staffing and discipline

General safety measures for personnel

- Keep long hair tied
- Should not
  - wear bangles and wrist watches while working
  - eat, smoke or drink inside the laboratory
  - put fingers, marker pencils etc. into the mouth
  - drink from laboratory glassware

Hand hygiene

- Laboratory should have facilities for hand hygiene such as hand wash basins, soap (preferably liquid soap) and single use towels
- Staff should wash their hands whenever indicated, including, after handling infectious material e.g. specimens, contaminated items, blood and body fluids, after working in the bench, after cleaning the laboratory/spill, after handling waste and before leaving the laboratory

  Refer Chapter 4.1

Clothing and protective attire

- Laboratory personnel who work at laboratory benches should wear
  - back fastened, long sleeved laboratory coats with elasticated cuffs made of 100% cotton or flame-resistant material where open flames are used
  - masks and water proof aprons when necessary
  - appropriate type of gloves for particular procedures. Care is needed to prevent contamination of equipment such as telephone, door knobs and computer keyboards
  - flat heeled, covered shoes
- Laboratory clothing should not be worn outside the laboratory area

7.15.3 Safe laboratory practices

Specimen reception

- Contaminated request forms should be discarded and replaced with new forms obtained from the ward/ unit
- Accept only non-leaking specimens. If a specimen container is leaking or broken, reception staff should not handle it. Record and inform relevant personnel according to the standard operating procedure (SOP). Inform the ward/unit to resend a sample
- If the specimen cannot be repeated:
  - Label another suitable container with the patient's details
  - Wear disposable gloves and place contaminated container on a tray placed in the biosafety cabinet
  - Remove cap/lid and transfer remaining specimen to the labeled new container
  - Decontaminate the soiled container and the lid and dispose into a yellow bag

Processing of specimens

- Do not place contaminated articles on the bench tops
- Operate homogenizers, centrifuges, sonicators and shakers carefully
- Minimize generation of aerosols during procedures
- Work inside a safety cabinet, whenever indicated
- Bunsen burners should not be used inside a safety cabinet, electric burners should be used instead
- Should not use cracked or chipped test tubes/bottles

Centrifuges

- Thick-walled glass or plastic centrifuge tubes must be used to avoid breakages
- Tubes only be 2/3rd filled to avoid spillage
- Tubes should be capped / plugged with cotton wool to avoid aerosol generation
- Proper balancing and loading will avoid breakages
- The lid of the centrifuge should not be opened until it has stopped rotating to allow settling of any generated aerosols. Centrifuges with safety features should be purchased

- Handling a breakage in a centrifuge – follow the steps below
  - Switch off the motor. The lid should not be opened for 30 minutes to allow settling of aerosols
  - If a breakage is discovered after the lid is opened, it should be immediately closed and kept for 30 minutes
  - Wear thick rubber gloves, laboratory coat, aprons and mask for cleaning
  - Forceps or cotton swabs held in forceps should be used to pick up glass debris. All broken tubes or glass fragment should be placed in a sharps container for disposal
  - Plastic buckets and all non-metal removable parts should be soaked in 1% hypochlorite solution (10,000 ppm) for at least 20 minutes
  - Metal centrifuge buckets should be disinfected according to manufacturer's instructions
  - The bowl and rotor should be swabbed with 70% alcohol and allowed to dry in air

Pipetting and suctioning

- Do not mouth pipette. Use mechanical devices for pipetting
- Use techniques which generate a minimal amount of aerosols
- Work inside a safety cabinet when necessary
- Plug all pipette ends with cotton wool
- Do not bubble air through solutions during pipetting
- Use pipettes which do not need expulsion of the last drop
- Do not keep used pipette tips on the tables/bench top. Discard into a jar containing disinfectant (0.1% (1000 ppm) hypochlorite or 5% phenolic disinfectant if used for tuberculosis). Maintain the fluid level at 2/3rd of the container

Handling of sharps

Refer Chapters 4.4 and 4.8

Opening of vials and containers

- Preferably within a safety cabinet
- Open rubber stoppers gently so as to minimize aerosolization
- Open tight-fitting lids using a gauze swab

Transport of specimen outside the hospital

- Specimens sent to other laboratories/reference laboratories should be packaged in properly labeled appropriate specimen containers and transport bags/carriers
- Specimens should be transported in leak-proof, secure transport boxes preferably with a lid and a handle. Place request forms separately in a pouch

Management of laboratory accidents

- Decontamination of skin - wash thoroughly with soap and water
- Decontamination of cuts/eyes - irrigate with water. Flush the affected area for minimum of 15 minutes using a large amount of clean flushing fluid under low pressure. Use emergency eye wash and shower for this

7.15.4 Environmental cleaning and disinfection

- Bench tops–use 0.1% hypochlorite or 70% alcohol (use 5% phenolic disinfectant in tuberculosis diagnostic laboratories) before commencement of work and at the end of the day
- Floor - wet mop with GPD twice daily
- Sinks/wash basins -clean with GPD
- Management of spills - *Refer Chapter 4.6*

7.15.5 Cleaning, disinfection and sterilization of equipment

- Safety cabinets
  - Before commencement of work and at the end of each work session
    - Wipe surface with 70% alcohol
    - Switch on the UV light for 30 minutes

  - Cleaning of the safety cabinet should be performed according to manufacturer's instructions
- Water bath - change water daily and clean with GPD
- Centrifuges, incubators, autoclaves–clean and disinfect according to manufacturer's instructions
- Laboratory glassware
  - Reusable glassware (e.g. tubes, pipettes, universal and bijou bottles) contaminated with infective material should be rendered non-infectious by autoclaving
  - Once rendered non-infectious they should be washed using a brush and a detergent in order to remove all organic material

7.15.6 Waste disposal

Non-infectious waste

Waste that is not contaminated with infective material and disposable items which are not contaminated with blood and body fluids.

Infectious waste: Eg

- Clinical specimens - blood/serum, pus, sputum, urine, body fluids and stools
- Contaminated items - specimen containers, soiled dressings/cotton wool, used bacteriological culture media
- Contaminated sharps - used syringes and needles, contaminated broken glassware

Infectious and non-infectious waste should be collected and disposed of separately. Infectious waste should be rendered non-infectious prior to disposal. Every laboratory should have a dedicated autoclave for decontamination and adequate material and protocols set-up to ensure pre-treatment of the infectious waste.

Infectious waste should be collected in leak proof yellow bags or containers suitable for autoclaving and properly sealed.

Contaminated sharps should be discarded directly in to a sharps bin by the user.

Disposal of infectious waste

- Clinical specimens
  - These should be rendered non-infectious by autoclaving
  - Untreated samples should not be poured into a sink or a drain unless it drains into a closed drainage system
- Histology specimens/anatomical waste (pathological waste)
  - Should be collected in a yellow bag and sent for incineration
- Specimen containers
  - Disposable containers should be incinerated or rendered non-infectious by autoclaving
  - Reusable containers should be decontaminated according to the hospital waste management guideline
- Bacteriological media

  - The used bacteriological media should be autoclaved and removed to yellow bags for disposal. The culture plates should be washed with adequate volumes of hot water to prevent clogging of pipelines with remaining culture media on the plates
- Sharps
  - The sharps bins should be disposed by incineration

Mechanical, chemical and biological monitoring of autoclaves for ensuring optimal sterilization has to be performed and well documented - *Refer Chapter 4.5*

Table 2. Procedure for the management of infectious waste

Step	Action
Segregation	Infectious waste should be • Placed in leak-proof bags or containers kept in a specified area until it is decontaminated (within 24 hours) • Segregated from other general and medical waste
Pre-treatment	Infectious waste should be decontaminated by autoclaving within 24 hours
Packaging	Yellow bags should be labelled with the biohazard symbol and clearly marked with the words
Labelling	Yellow bags should be labelled with the name of the institution and department, type of waste, date, name and signature of person sealing the bag/container
Storage, transport and disposal	Store, transport and dispose of disinfected infectious waste packaged in yellow bags with other yellow-bagged waste

Precautions to be taken when handling waste in medical laboratories, to avoid cross contamination:

- The re-useable laboratory items should never be mixed with disposable ones
- The contaminated items and single-use/disposable laboratory items must be autoclaved and should never be discarded with general waste

Management of other waste including laboratory chemical waste

Refer Chapter 4.8

7.15.7 Occupational health

- All laboratory workers should undergo training in safe laboratory practices before assuming duty at the laboratory
- Vaccinate the staff and confirm their sero-status against Hepatitis B. Rabies vaccine should be given before assuming duty at a laboratory where rabies work is done. Laboratory workers who routinely handle meningococcal cultures should be given meningococcal vaccine
- Post exposure prophylaxis should be given for high-risk exposure to meningococcal and brucella cultures

- All accidents should be documented in an accident register and further actions should be taken according to the SOPs
  Refer Chapter 9

References

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7.16 LAUNDRY

Introduction

The used linen in healthcare settings can harbour large numbers of potentially pathogenic microorganisms. This might lead to transmission of microorganisms to patients, healthcare workers or the environment, potentially causing infections. Hospital laundry plays a major role in preventing these infections by cleaning and disinfecting linen. Appropriate precautions should be taken when handling linen in the laundry.

7.16.1 Design and layout

- Ideally, the unit should be U shaped or rectangular shape
- The space should be decided according to the bed strength of the hospital
- The design should facilitate the main processes which are sorting, washing, drying, ironing, folding and packing
- It is preferable to separate working area into two parts: sorting and washing in one part and clean linen processing in the other part
- There should be separate areas as follows
    - Reception area- collection and sorting
    - Disinfection (sluicing) area
    - Washing area
    - Drying area
    - Sewing area
    - Folding and ironing/pressing area
    - Storage area
    - Recording and distributing area
    - Administration and rest area
- Floors should be rust proof, non-slippery and washable with sufficient gradient to provide easy flow of water
- Ceiling should be washable, moisture proof with a minimum height of 3.5M
- The wall should be light coloured, washable and free from crevices, corners, edges or projections
- Doors should be wide enough to admit heavy machinery and trolleys. Maximum light and natural ventilation should be provided from windows
- All steam lines should be properly insulated for protection of workers
- Distribution panel for power supply should be easily accessible and should be away from the direct path of escaping water vapour
- Adequate ventilation should be ensured
- There should be an adequate supply of running water

7.16.2 Staffing and discipline

- The laundry staff could be hospital staff and/or staff employed by a private contractor. There should be an in-charge nursing officer allocated to the unit for overall supervision and management
- There should be a separate uniform for laundry staff
- Laundry staff should be educated and regularly trained on linen management, management of accidental exposure to blood and body fluids etc.
- All staff that handle linen (clean or used) should adhere to the guidelines and protocols
- Staff should wear aprons and gloves when handling linen
- Staff should wash their hands after handling used linen, and after removing gloves and aprons
- The overall responsibility of safe linen management has to be under the guidance of the administration of the hospital, infection prevention and control (IPC) team and the quality and safety team. They will be responsible for,
  - monitoring the performance and auditing to ensure that the standards are being met
  - developing the specification for linen/laundry services

7.16.3 Categories of linen

- Clean linen - linen ready to be used
- Used linen - all linen that is used by a person not known or suspected to be infectious or not contaminated with either blood or body fluids
- Infectious linen - all linen used by a person known, or suspected to be infectious and linen that is contaminated with either blood or body fluids

7.16.4 Linen management in the laundry

- Segregation of linen and transport to the laundry
  - All linen should be sorted and bagged immediately after removal
  - Used linen should be sent in a laundry bag and infectious linen in a yellow bag. These should be tied, labelled and sent in a dedicated cart/trolley
    Refer Chapter 4.7
- Handling of linen in the laundry
  - Avoid sorting linen in the laundry
  - There should be a dedicated space in the laundry for temporary storage of linen
  - Use appropriate personal protective equipment (PPE) when handling linen
  - Take care when opening the infected linen bag and ensure that no extraneous items are disposed of with used linen (e.g. dentures, spectacles, sharps, incontinence pads and tissue) which may harm the staff or damage the machines
  - There should be dedicated washing machines for used and infectious linen
- Disinfection of infectious linen
  - Infectious linen should undergo thermal disinfection – (Refer Annexure 7.16.1)
  - If washing machines with thermal cycles are not available soaking in 0.05% (500 ppm) hypochlorite solution for 15- 30 minutes is done

- Storage of cleaned linen
  - Clean linen should always be stored in a clean, designated area preferably in a purpose-built cupboard, off the floor to prevent contamination with dust and/or aerosols
  - If a linen cart/trolley is used for the storage of linen, it should be enclosed. Ideally, cleaned linen should not be kept on trolleys, or stored in corridors, as this may result in contamination
- Transport of cleaned linen
  - Contamination of clean linen should be prevented by:
    - ensuring linen is adequately covered during transport
    - transporting the linen in a clean, dry condition
    - cleaning and disinfecting transport trolleys, prior to loading clean linen
    - reprocessing the linen which is (or thought to be) contaminated

7.16.5 Cleaning and maintenance of laundry

- Cleaning and disinfection of all working areas including equipment and storage shelves should be performed on a regular basis and records should be maintained
- Volumes, concentrations and expiry dates of disinfectants and detergents used should be monitored. Daily records should be maintained
- Temperature gauges should be regularly checked and calibrated
- Servicing of equipment should be performed according to manufacturer's recommendations
- Measures should be taken to minimise the risk of cross-transmission

7.16.6 Quality control and performance monitoring

- Written quality control system should be introduced and regularly monitored
- Multi-disciplinary audits should be undertaken to ensure linen is segregated appropriately
- Nursing officer in-charge of the laundry should ensure that the guidelines and protocols are implemented efficiently and that the IPC team is informed of any IPC non-compliance incidents
- Infection control nursing officer (ICNO) should monitor the adherence of the laundry staff to the guidelines and protocols provided
- If the service is outsourced, guidelines should be provided and compliance to the guidelines should be monitored. Proper contract specifications should be provided to the contractor after consulting the IPC team and should ensure that the contractor is compliant with the contract specifications
- Regular audits should be performed

7.16.7 Environmental cleaning

- The laundry should be cleaned daily
- Use dedicated cleaning equipment (e.g. mops, brooms, buckets) for each area
- Reception area
  - Clean the area with general purpose detergent (GPD) and keep dry
  - If infectious linen is sorted in the reception area perform wet mopping with 0.1% (1000 ppm) hypochlorite immediately after sorting

- Working area
  - All surfaces including the outer surface of the machines should be cleaned
  - Wet mopping with a GPD once a day after finishing work. Keep dry
  - Cleaning and disinfection of laundry machines should be done according to manufacturer's instructions
- Ironing and folding area
  - Wet mop with GPD once a day after finishing work and keep dry
- Storage area for cleaned linen

  Wet mop with GPD and keep dry - *Refer Chapter 4.5*

7.16.8 Waste management

Refer Chapter 4.8

7.16.9 Occupational health

- Hepatitis B vaccination should be given to staff handling linen and an adequate level (10 IU/ml) of anti HBs antibodies should be demonstrated and recorded

  Refer Chapter 9

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Annexure 7.16.1

Thermal disinfection times and temperatures for infectious linen

All wash cycles should be completed. If the cycle is interrupted, the wash should be started from the beginning. The washing process should have a disinfection cycle in which the temperature in the load is either maintained at 65 ^{0}C (150 ^{0}F) for at least 10 minutes or 71 ^{0}C (160 ^{0}F) for at least 3 minutes. With both of these options, 'mixing time' must be added to ensure heat penetration and assured disinfection. For machines of conventional design and a low degree of loading, 4 minutes should be added to these times to allow for adequate 'mixing time'. For machines with a heavy degree of loading, it is necessary to add up to 8 minutes. Heavily soiled/infected linen should also have a pre-wash cycle selected. Heat labile items should be washed at the highest temperature possible for the item.

Low degree of loading - Wash loads of 0.056Kg/ litre or less will have a mixing time of 4 minutes added to the temperature holding times.

High degree of load - Wash loads more than 0.056Kg/litre will have a mixing time 8 minutes added to the temperature holding times.

7.17 KITCHEN

Introduction

According to the Food Act 1980, it is a statutory obligation to treat food intended for human consumption in a controlled and regulated manner. Hence the hospital kitchen should comply with food hygiene regulation and other relevant regulations under the Food Act 1980. There should be a food safety policy for health care institutions in accordance with this act and hazard analysis and critical control point (HACCP).

Food may become contaminated with microorganisms through poor personal hygiene. Poor food handling practices can result in foodborne infections. Such illnesses may not be very serious in a healthy person, but in hospitalized patients these can be serious and may even be fatal.

'High risk food'

- food which supports the growth of micro-organisms and which are 'ready to eat' e.g. cooked meat and meat products, cooked fish and fish products, dairy products, cooked rice and pasta, enteral feeds and infant formulae

'Low risk food'

- food that will not support the multiplication of micro-organisms (ambient stable food such as bread, biscuits, sponges and cereals), or food which do support the multiplication of micro-organisms but when subjected to further processing such as cooking will eliminate or reduce any hazards to a safe level (raw meat/fish)

7.17.1 Design and layout of catering premises and kitchen

- Design and layout should comply with the "Food (registration of premises) Regulations - 2019" under food Act 1980. The layout and design, site and size must allow adequate working space to
  - facilitate safe hygienic production of food
  - provide personal hygienic requirement of food handlers
  - avoid airborne contamination
  - support all food hygienic practices
  - prevent cross contamination
  - separate clean and dirty activities like raw food reception and office work. Food store, washing and preparation, cooking, serving and waste storage
  - provide toilet facilities and sleeping accommodation located separately not directly open to food handling/preparation area
- Food premises should be kept clean, well maintained and well ventilated
- Premises should be fly-proof and rodent-proof
- Drainage should be designed to prevent waste draining from a contaminated area towards a clean area
- Food handling areas and stores for cleaning equipment used in food handling areas must be separated physically from sanitary and sleeping accommodation, and must not be directly accessible from those areas

- Floors and walls should be even and impervious, without cracks or open joints, smooth but not slippery and must be hardy and easily cleanable
- Doors should be easily cleanable, tight-fitting and wide enough for trolleys and equipment to pass without damage
- Separate sinks for washing food should be available. Sinks and draining boards should have a smooth, hard and even surface. Sinks and draining boards should be regularly cleaned
- Hand wash basins should be provided in all preparation areas and at each entrance. These must be kept exclusively for hand washing
- An ample supply of clean drinking water under adequate pressure from the main supply should be made available with proper protection against contamination

7.17.2 Staffing and discipline

- **Roles and Responsibilities of Staff**
  - **Director/Medical administrator**
    - Ensures the food hygiene policy is in place and is kept updated for significant changes
    - Ensures effective monitoring arrangements
    - Ensures that patients, staff and visitors are provided with safe food as per the current regulations and guidance
  - **Microbiologist/Infection prevention and control unit**
    - Ensures the food safety and hygiene policy is implemented
    - Provides appropriate training to staff
    - Collaborates with in-house kitchen managers and public health inspectors (PHI)
    - Detects, investigates, confirms and manages food-borne gastroenteritis
  - **Kitchen in-charge**
    - Ensures the maintenance of hygiene standards in kitchen
    - Ensures the maintenance of hygienic food supply to patients
    - Ensures hygienic storage of food
    - Reports any matters that may affect standards of food hygiene
    - Ensures adherence to the hospital food hygiene policy
    - Recognizes, prevents and alleviates food safety hazards of the food service facility
  - **PHI**
    - PHI is the authorized officer responsible for the enforcement of relevant regulations to ensure the safety of food for consumption
    - Ensures elimination of possible sources of food contamination
    - Monitors the conditions and hygienic operation within the food environment
    - Ensures compliance with relevant regulations
  - **Ward sister/Nurse in-charge**
    - Ensures hygienic transport of food in covered containers and serving of food hygienically
    - Ensures proper cleaning and storage of utensils used to transport of food
    - Educates patients and staff to wash hands before meals and before handling food

- **Hand hygiene**
  - The hands are the most common vehicle for transmission of micro-organisms
  - All food handlers should wash their hands using soap and running water, and hands dried thoroughly thereafter
  - Hands must be washed
    - before and after contact with food
    - before and after preparing and handling food and drinks
    - after using the toilet
    - before and after handling raw products
    - handling waste
    - after cleaning

- **Personal hygiene**
  - All staff is responsible for good hygienic practices and must be aware of the responsibility they have in prevention of food contamination
  - "Bare below the elbows" policy should be followed. Avoid wearing unnecessary jewelry
  - Avoid touching hair, ears and nose and putting hands into pockets when handling food
  - Cover all cuts and abrasions with a waterproof (preferably coloured) plaster/bandage
  - Do not smoke, chew betel or spit in kitchen
  - Do not cough or sneeze over food
  - Fingernails should be kept clean, short with no nail polish. False nails including overlays should not be worn
  - Long and shoulder length hair needs to be tied back off the face and beard should be trimmed
  - Wear clean and protective clothing (uniforms, caps, aprons, gloves when necessary)
  - Food Handlers should use gloves, bakery tissue paper or food handling utensils to handle ready-to-eat food (never use bare hands)

- **Clothing**
  - Food handlers must always wear appropriate clean clothing (preferably uniforms) and a cap
  - Uniform should not be worn outside the work place
  - Outdoor and work wear clothing are to be kept separately
  - Uniforms and aprons should be changed daily and whenever they have become soiled
  - Footwear must be kept clean
  - During any period of food preparation or food service a plastic apron and gloves must be worn and these should not be used for any other purpose

7.17.3 Food storage

- **General considerations**
  - Food in storage needs to be rotated by applying the principle of first in first out, to ensure that old supplies of food are not left at the back of shelves or cupboards
  - Food that has gone beyond the expiry date should be discarded
  - All food storage areas should be clean, dry and regularly checked for any sign of pests
  - Any spillage must be cleaned up immediately
  - All food in storage must be covered and dated
  - Food storage containers must be washed and dried regularly
  - Raw food should be stored or refrigerated in clean containers
  - Food should not be stored together with non-food items including chemicals

- **Dry storage**
  - Dry food must be stored in an appropriate environment to protect it from contamination and to maintain the safety and suitability of the food (e.g. cereals, flour, rice and canned products)
  - Dry goods
    - should be stored in cupboards or storage containers designated for food storage only in appropriate environment
    - should not be stored on the floor, in open packages or left uncovered
    - should be protected from contamination from pests (cockroaches, rats, flies, weevils etc.), cleaning chemicals stored above or next to food and from excessive humidity
  - Avoid topping up of storage containers. Storage containers should be emptied, cleaned and disinfected, air dried or dried with disposable paper towel at least weekly

- **Cold storage/frozen storage**
  - Food containing microorganisms which can multiply and/or produce toxins if not stored at correct temperatures for stipulated duration should be stored in cold/frozen storage
  - Cold storage
    - Examples for food that need to be stored below 5 °C in cold storage are milk, cheese, yoghurt etc.
    - Left-over cooked food should never be refrigerated and re-served
  - Frozen storage (-18 °C maximum -13 °C)
    - Examples for food that need to be stored frozen are meat and meat products, fish, ice cream etc.
    - Thawed food should never be refrozen

- **Refrigerators and freezers**
  - Should have adequate refrigeration facilities for fresh food and cook-chill meals
  - All food stored in the refrigerator/freezer must be covered and dated
  - Keep uncooked and cooked food separately
  - The outside of the refrigerator/freezer should be damp wiped daily, and any spillages inside should be cleaned up immediately

- The temperature of the refrigerator should be between 1 ºC – 4 ºC and freezer temperature should be -18 ºC, maximum -13 °C
- Temperature should be monitored daily
- Refrigerators should be cleaned daily and when spillages occur, and deep cleaned weekly
- Service and maintenance and calibration of refrigerators and freezers should be done on a planned schedule

7.17.4 Food serving to patients

- Serve immediately once the food arrives
- Meals and snacks should not be left with patients for excessive lengths of time (longer than1 hour) due to the risk of microbiological growth at room temperature. Any food served to a patient must be discarded, if not eaten
- Opened cartons, or made-up sip feeds should not be left for longer than 4 hours

- **Infant feeds**
  - Should be placed immediately into the designated refrigerator on arrival at the ward
  - Should be stored in the main body of the refrigerator (not in the door)
  - Feeds should not be left standing at room temperature for more than 1.5 hours before refrigeration
  - Refrigerated feeds should be used within 24 hours. All unused feeds must be discarded after 24 hours or in accordance with the “use by date and time” indicated on the feed label

7.17.5 Environmental Cleaning

- All cleaning should be carried out in accordance with the hospital cleaning protocols
- Food preparation area should be cleaned daily with a general-purpose detergent (GPD) and water. Dedicated cleaning equipment should be used for cleaning the kitchen
- Food preparation surfaces should always be clean and dry. Before and after any food preparation takes place, the whole surface must be cleaned thoroughly
- Wooden kitchen equipment must not be used and equipment and utensils must always be kept clean and dry
- The catering manager or supervisor must inspect the condition and cleanliness of the kitchen, equipment and utensils

7.17.6 Risk Assessment and risk management

- Should be done according to HACCP principles
  - Analysis of potential hazards in the current process and possible preventive measures
  - Identification of Critical Control Points in the process
  - Establish critical limits
  - Determine corrective actions
  - Introduce monitoring requirements and procedures, record keeping procedures and verification procedures

    Refer Chapter 3

7.17.7 Occupational health of food handlers

Routine screening of food handlers for food borne pathogens is not recommended.

- Food handlers who are suffering from vomiting, diarrhoea, sore throat or fever must stop work immediately and report to their kitchen in-charge. They should not come to work until asymptomatic for 48 hours, or longer depending on the infecting organisms
  - Staff with *E. coli* O 157 or shigella infection should not return to work until they have 2 negative stool specimens
  - Staff with Hepatitis A should not return until 7 days after the onset of jaundice and/or other symptoms
  - Staff with typhoid should not return to work until they have 3 negative stools specimens each obtained one week apart after completion of treatment
- The kitchen in-charge should ensure that such persons are excluded from work
- The kitchen in-charge must inform the IPC unit if they have more than one member of their staff off duty at one time with a gastrointestinal illness
- Staff with an immediate family member, living in the same house, who has a significant gastrointestinal illness, must report this to the kitchen in-charge who informs it to the IPC unit

Training and education of staff

- All food handlers, as part of their induction, should receive an appropriate training prior to commencing employment and at regular intervals. The overall aim is to develop knowledge on food borne infections and basic principles of food hygiene and personal hygiene

7.17.8 Waste management

- Waste generated should be segregated and removed when full and/or at the end of each day. Waste must not be allowed to accumulate in kitchen or left overnight
- The bags must not be overfilled and must be tied
- The bins for such bags should be maintained in a clean condition and be foot operated
- The staff should wash their hands after handling waste
- Waste collectors should not enter food preparation areas

Pest control

- Pests such as cockroaches, flies, mice, rats, ants, cats and dogs are a serious risk to food safety. Pests are a source of food contamination
- Good housekeeping is essential to control pests
- Staff must not feed birds or animals within the food preparation area or premises.
- All spillages should be removed as soon as possible
- Cover the food at all times and store them off the ground in pest proof containers
- Waste receptacles should be provided with foot pedals and tight-fitting lids and should not be overfilled
- If there are signs of uncontrollable pest activities in the kitchen, advice from a professional pest control service should be sought

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7.18 MORTUARY/ POST-MORTEM ROOM

Introduction

Personnel conducting or assisting an autopsy come in direct contact with body fluids, soft tissues and skeletal remains in different stages of decomposition. The common occupational hazards likely to be encountered in an autopsy room include infections, toxicity and radiation. HCWs are at risk of acquiring infections including blood-borne viral, bacterial and other viral infections. Thus, it is essential to assess the risk of infection prior to carrying out autopsies or handling dead bodies and implement infection prevention and control (IPC) measures accordingly.

Staff training and education, safe working environment, development of infra-structure, safe work practices including the use of recommended safety devices and vaccination are some of the important measures to minimize risk of infections.

While there is a need to maintain the confidentiality of a patient's medical condition even after his/her death, there is also an obligation to inform personnel who may be at risk of infection through contact with dead bodies so that appropriate measures can be taken to guard against infection.

Infections in autopsy rooms may be acquired by one or more of the following routes.

- An injury caused by an object contaminated with blood or body fluids or needle-stick injury
- Contact of blood or other body fluids onto an open wound or area of dermatitis
- Splash of blood or other body fluids to mucous membranes of the eyes, nose or mouth
- Inhalation of aerosolized particles
- Ingestion of pathogens

7.18.1Design and layout

- The mortuary should be located away from public areas and doors should be lockable
- The mortuary complex should consist of 3 distinguishable areas to minimize infectious hazards to workers and to prevent cross-contamination: dirty area, clean area and transition zone
- The 3 areas should be clearly demarcated. Exit and entry points should be indicated to ensure a uni-directional workflow to prevent contamination
- Floor, furniture and walls should be made of hard-wearing, easy to clean material which are resistant to disinfectants. These surfaces should be smooth and should be groove-free as much as possible to ensure proper cleaning
- Ideally there should be directional inward airflow without re-circulation to other areas
- Airflow from ventilation systems is best directed away from observers, preferably by drawing air into the mortuary at a higher level and discharging at a low level
- The ventilation system for the autopsy suite must minimize the spread of airborne pathogens ideally by being isolated from other ventilation systems. Where ventilation systems are not isolated, exhausted air must be directed through HEPA filters

- Clean area
  - Includes reception and waiting area, autopsy observation area, viewing area, stores, offices, rest rooms etc.
  - A clean area should not have access through a dirty area and it should not be connected to a dirty area
  - Observation area overlooking the post-mortem (PM) tables should ideally have access directly from outside, or from a clean part of the mortuary
  - Waiting areas with a toilet and wash basin, easily accessible to the viewing room are needed for people requesting to view the bodies of relatives or friends
  - Staff needs an appropriately located staff restroom and separate facilities for storing and preparing food and drinks

- Transition area

  Located between clean and dirty areas to allow staff and visitors to change into the appropriate protective clothing before going into the PM room or moving between clean and dirty areas
  - Includes washing, showering and changing facilities
  - Located between clean and dirty areas

- Dirty area
  - Includes
    - postmortem room
    - dirty utility room
    - instrument store
    - cleaners' room
    - soiled protective clothing discard area
    - body storage refrigerators area
  - All work on autopsies, unfixed specimens and handling of body fluids should be performed in this area
  - Dirty utility/instrument store/cleaners' room should open directly off the PM room. Dirty utility room is used for cleansing and disinfection of instruments after use and their storage. Chemical solutions may also be prepared or dispensed in this room. An autoclave should be provided in this room for sterilizing instruments unless sterilizing facilities are provided elsewhere. A sink is required for washing and disinfecting instruments. Waterproof aprons are washed and hung to dry in this room. The reserve stock of instruments, unused specimen jars, and chemical solutions are stored in this room
  - Cleaning equipment for use in the PM room and body store should be kept in an en-suite cleaners' room. This space should have general cleansing facilities
  - Specimen store
    - Shelves of impervious material will be required for jars or containers of various sizes. Floor space or space below high benching will be required for formalin containers. The room must be continuously ventilated because of the hazard arising from formalin

- When taking specimens away from the PM room, they should be placed in suitable containers with clean surfaces. Secondary containment in a robust lidded carrier is appropriate when transferring specimens to other areas, such as the pathology laboratories

7.18.2 Staffing and discipline

- Standard precautions are to be practiced by the staff at all times
  Refer Chapter 4
- Cover any skin abrasions or cuts with waterproof dressings before starting work
- Change from outdoor clothes to appropriate protective clothing and PPE including:
  - Scrub suit
  - A long-sleeved surgical gown
  - A plastic apron long enough to overlap boots
  - Waterproof boots with dorsal reinforcement
  - Cut-resistant protective gloves or double gloves
  - A face shield (visor) which covers the entire face and neck region. If a visor is not available goggles and a splash proof face mask could be used
  - For additional respiratory protection (e.g. SARS, MERS, COVID-19, TB), a ventilated visor or if not available a disposable particulate respirator (e.g. N95 mask) should be worn
- Always wash hands before leaving a dirty work area (adhere to standard hand washing technique)
- Avoid touching the face, eyes, nose and mouth with gloved or ungloved hands
- Remove protective clothing after use and do not wear it outside the mortuary
- Do not smoke, drink or eat in any work/autopsy area
- A qualified person should provide supervision
- Standard operating procedures (with bio safety issues addressed) should be developed

7.18.3 IPC measures during PM examination

- Before starting the PM examination ensure;
  - Adequacy and availability of PPE
  - Air and water supply working properly
  - Drains working, cleaned/disinfected
  - Availability of soap, disinfectants, paper towels, swabs, specimen containers
  - Equipment needed for PM cleaned/disinfected and ready for use
  - Detailed risk assessment of the dead body- ensure that available facilities/protective measures are compatible with the risk group (Refer Table 1)
- During PM examination;
  - Never pass instruments from hand to hand during a PM examination
  - To prevent accidental falls, do not lay instruments indiscriminately after use. Keep them in a container with detergent solution
  - Never attempt to catch a falling instrument
  - Try to avoid operations likely to cause splashing or generate aerosols, such as washing down with high pressure hoses, cleaning instruments under running water and squeezing organs that have been removed from the body

  - Refer specific guidelines in special cases e.g. viral haemorrhagic fevers, prion diseases *Refer Chapters 13.9 and 13.12*
  - Samples should be labeled (including hazard warnings) and contained for transport to other locations
- Following biosafety measures should be practiced routinely
  - Personnel should be trained in hazard identification and work procedures
  - Access to work area should be controlled and limited, hazard signs displayed
  - Extreme precautions with sharps should be observed
  - Special equipment may be used to contain or control chemical fumes, splatters, or biological aerosols

7.18.4 Risk assessment of dead bodies and categorization

- Some infections are known to present an increased risk of infection to those handling the deceased when undertaking certain activities, such as a PM examination or embalming
- When a body is known or suspected to be infected with such infection, carefully consider whether a PM examination or embalming is necessary
- One should make sure that all people coming into contact with the deceased during body transfers, PM examinations, embalming, exhumations are fully informed of the risks and safe working practices are followed
- PM examinations and embalming should not be carried out on the deceased known to be infected with the most hazardous microorganisms (e.g. *Ebola* virus) except under exceptional circumstances (e.g. for clinical or medico-legal reasons), and then only by specialized units.

Table 1. Categorization of infectious diseases depending on the risk

Risk group A (Very high risk)	**Risk group B (High risk)**	**Risk group C (Medium risk)**	**Risk group D (Low risk)**
Ebola Rabies Yellow Fever Small Pox Invasive group A streptococcal infection (Untreated) Anthrax Plague	Prion diseases Hepatitis B, C, D HIV Typhus	Typhoid and paratyphoid fever Scarlet fever Tuberculosis Cholera Diphtheria Dysentery (amoebic or bacillary) Untreated meningococcal disease Food poisoning Relapsing fever	Influenza Chicken pox/shingles Legionellosis Tetanus Pertussis Acute encephalitis Mumps, Measles, Rubella Lyme disease MRSA Pneumonia

- PM examinations for Risk group ‘A’ infections other than rabies should not generally be performed - *Refer Chapter 13.11*
- Interim recommendations published by the Centers for Disease Control (CDC) and WHO classified SARS-CoV-2 as a Risk Group B biological agent (Table 1). Contrary to this provisional assignment, with the current evidence and practice, it can be argued that SARS-CoV-2 is comparable to Risk Group A pathogens due to the rapid and worldwide spread.

Suggested actions to be taken for a dead body with a risk of infection

- Risk of infection to the others should be assessed by the clinician with consultation of the microbiologist

Table 2. Suggested actions according to the risk category

Activities	A-Very High	B-High	C-Medium	D-Low
Body bag** to be used	Yes[#]	Yes*	Advised	No
Body may be removed from bag	No	No	Yes	-
Embalming permitted	No	Not advised	Yes	Yes
Viewing body by bereaved	Face only	Yes**	Yes	Yes
Touching body by bereaved	No	Yes**	Yes	Yes

Yes[#]- For Rabies, refer General Circular No.01-22/2004 or later
Yes- For HIV/AIDS, Hepatitis B and C and other blood borne hepatitis this is only necessary if there is leakage of body fluids*
*Yes**- Yes, except if the cause of death is Typhus or if there is leakage of fluids posing an infectious disease risk*
***Cadaver bag should be no less than 150µm thick, should be zippered or closed tightly with tapes and bandage strips. Pins are not to be used. Should be tagged with appropriate colour codes/tags (e.g. Category A-red, B-yellow, C- grey)*

Information to be passed on with the dead body to mortuary staff and funeral directors

- Patient died with a known/suspected infection (not the diagnosis)
- Advice on precautions required
- Where they can get further information if required
- Specimen Infection Control Notification Sheet (Refer Annexure 7.18.1*)* to be filled by ward staff to send with the body

7.18.5 Cleaning, disinfection and sterilization of instruments and equipment

- Ideally, an automated washer-disinfector should be provided for the cleaning and disinfection of instruments after use
- The non-metal instruments used for postmortem examination should be placed in a plastic container with 0.5% sodium hypochlorite solution before cleaning
- Metal instruments can be soaked in 5% phenol for 10-15 minutes
- Staff should segregate reusable equipment from disposable items. Reusable equipment should be placed in containers with solid sides and bottoms, made of metal or autoclavable plastics, and sent for sterilization
- Use of alcohols in the PM room should be restricted to wiping over equipment that cannot be immersed in water or treated with corrosive disinfectants
- PPE such as waterproof boots and visors should be cleaned with detergent and water. Disinfect if used for cases with known or suspected infections
  Refer Chapter 4.5

7.18.6 Environmental cleaning and disinfection

- Regular cleaning using detergent and water is usually adequate for all mortuary surfaces. For known or suspected high-risk cases, disinfection should be carried out using an appropriate disinfectant such as;
  - 0.1% sodium hypochlorite solution
  - 5% phenolic solution
- Effective removal of organic matter is essential before disinfection
- Mortuary staff needs to ensure that adequate supplies of disinfectants at in-use concentration are available
- Surfaces - tables, benches and floors require regular decontamination to remove blood and other spillage occurring during and between cases, as well as being thoroughly cleaned and disinfected at the end of each day. Staff should also clean all floor drains and gullies at least daily
- Management of a spill - *Refer Chapter 4.6*
- Outside of the cadaver bag should be wiped with 5000 ppm (0.5%) hypochlorite if soiled
- Contact microbiologist for any clarifications when handling bodies with prion disease or viral haemorragic fever
  Refer Chapter 4.6

7.18.7 Waste management

- All waste from the PM room should be classified as clinical waste and discarded into yellow bags. No black bags should be allowed in the dirty areas
- Waste organic solvents awaiting disposal will need to be stored in well ventilated areas
  Refer Chapter 4.8

7.18.8. Occupational health

- Dealing with incidents and accidents
  - The mortuary needs to have clear procedures in place for dealing with incidents and accidents. Staff should be encouraged to report incidents of ill-health
  - Standard operating procedures should cover the arrangements for:
    - immediate action in the event of an accident where there is a risk of infection
    - reporting, recording investigating and notifying accidents, incidents and ill-health including those with the potential to cause ill-health
- Due to high risk of exposure to blood and body fluids, the mortuary staff should be offered pre-recruitment immunizations (e.g. HBV)
  Refer Chapters 4.4 and 9

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Annexure 7.18.1

Specimen Infection Control Notification Sheet

Infection Control Notification Sheet

[To be filled by the doctor certifying the death]

Name of deceased : _____

Date and time of death : _____

Ward : _____

Is the dead body a potential source of infection?

YES / NO / UNKNOWN (*circle as appropriate)*

If **YES,** the body present a potential infectious hazard of transmission by: (circle as appropriate)

Inoculation **Aerosol** **Ingestion**

Instructions for handling remains (if YES, tick as appropriate):

Can relatives view the body ☐

Body bagging required ☐

Embalming presents high risk ☐

Signature : _____

Name : _____

Designation : _____

Date : _____

CHAPTER 8

INFECTION PREVENTION AND CONTROL IN IMMUNOCOMPROMISED PATIENTS

CHAPTER 8

INFECTION PREVENTION AND CONTROL IN TRANSPLANT PATIENTS

Introduction

Immunocompromised patients are at a higher risk of infections, often with opportunistic pathogens. Furthermore, there has been a significant rise in the immunocompromised population in the last few decades as a result of improvement in transplant medicine along with the development of numerous new classes of immunosuppressive drugs that offer novel therapy to these patients. Therefore, infection prevention and control has become a cornerstone in the management of modern treatment modalities such as solid organ transplant (SOT) and haematopoietic stem cell transplant (HSCT).

Patients who undergo transplants experience sequential suppression of immunity, allowing various potential complications due to infections at different phases of the transplantation process to occur. Pre- and post-transplant infection surveillance and accurate diagnosis of clinically significant infections are essential to provide optimal care.

8.1 Infection prevention and control in solid organ transplant

8.1.1 Prevention of donor derived and recipient derived infections

1. Epidemiological history and physical assessment

- Risk stratification from the donor medical and social history; identification of high-risk donors
- Careful physical assessment of the donor and the donor organs

2. Serological screening

All potential transplant donors and recipients should be tested for prior exposure to infections including Cytomegalovirus (CMV IgG), Epstein-Barr virus (VCA IgG), Varicella zoster virus (VZV IgG), Herpes simplex virus (HSV IgG), Hepatitis B virus (HBs Ag if not vaccinated/ HBs Ab level if vaccinated), Hepatitis C virus (HCV Ag+Ab), Human immunodeficiency virus (HIV Ag+Ab), Syphilis (VDRL) and *Toxoplasma gondii* (Toxoplasma IgG)

3. Bacteriological screening

- MRSA screening of both donor and recipient – decolonization should be done if positive for MSSA or MRSA. Swabbing and testing for MRSA following decolonization is not done routinely.
- Testing for latent TB – tuberculin test/ interferon gamma release assay

4. Vaccination of transplant recipient

- Recommended vaccines
  - Hepatitis B vaccine (preferably before transplant)
  - Influenza vaccine (annually)

8.2 Infection prevention and control in haematopoietic stem cell transplant

Minimizing opportunistic and life-threatening infections requires stringent infection prevention and control in many areas

8.2.1 Room ventilation

HSCT recipients, especially during conditioning and pre-engraftment period, should be placed in single patient rooms with protective isolation that incorporate the following features:

- ≥12 air exchanges/hour
- Point-of-use or central HEPA filters with 99.97% efficiency for removing particles ≥0.3μm in diameter
- Efficiency of HEPA filters should be checked every 3 months by performing a particulate count preferably by a third party. Filters should be replaced based on the efficiency report and on manufacturer's recommendations. When there is ongoing construction, filtration efficiency should be monitored frequently to determine the appropriate time for replacement
- Mixed air (recirculating: fresh air, 70-75%: 30-25%) or fresh air 100% to be circulated
- Positive pressure in rooms should be maintained between 10-20Pa. Meter indicating the pressure should be available for monitoring
- Continuous pressure monitoring is required especially while rooms are occupied. There should be an alarm system to alert staff when there is a pressure differential problem
- Consistent positive air pressure differential between the patient's room and the hallway or ante-rooms should be maintained
- Pressure in the adjoining toilet should be maintained less than the room (by using an exhaust fan)
- Backup emergency power and redundant systems should be provided to maintain room pressurization and a constant number of air exchanges when the ventilation system is shut-off for maintenance, repair or in the event of a power failure
- Well-sealed rooms, without gaps between walls and windows, outlets, floor and ceiling, should always be used in HSCT units
- Air handling system should never be shut off even when the room is not occupied. Consider set back mode for energy conservation
- Self-closing doors to maintain constant pressure differentials. Glass panels can be installed in either the door or the wall of the HSCT recipient's room to enable the nursing staff to observe the patient even when the doors are closed
- Following monitoring records should be maintained:
  Pressure, temperature, humidity, number of air exchanges per hour, efficiency of HEPA filters, alarm checks (on pressure gauges), general housekeeping. electrical maintenance, plumbing and carpentry
- Air sampling surveys should be conducted every 6 months and every 3 months during periods of hospital reconstruction. Additional sampling required in an outbreak of fungal infection
- Room temperature should be maintained between 22-25 °C

8.2.2 Water quality

- Water quality should be monitored every 3 months
- Water to the wash room should pass through a UV light. Life span of the UV bulb should be monitored
- Disposable shower-heads with inbuilt bacterial filters should be used. They should be disposed according to manufacturers' recommendations

8.2.3 Construction and renovation

- Planning for construction or renovation should include an approach for intensified mould control measures (higher rates of room air changes >12/hour) in addition to general room ventilation conditions
- Whenever possible false ceilings should be avoided
- HSCT recipients should avoid construction and renovation areas whenever possible
- Avoid transporting equipment and supplies to be used by HSCT recipients through construction and renovation areas
- Construct rigid, dust-proof barriers with airtight seals between patient care areas and construction or renovation areas to prevent dust from entering patient care areas
- HSCT recipients may benefit from wearing N95 respirators while outside the HEPA filtered areas, especially during the pre-engraftment period
- Areas above false ceilings located under or adjacent to construction areas should be routinely vacuumed

8.2.4 Building cleaning

- Permanent trained staff should be appointed to the unit. They should demonstrate competency prior to allocation for the task

8.2.5 Environmental cleaning

- Exhaust vents and all horizontal surfaces should be cleaned daily with detergent and recommended disinfectant using a sterile towel and disinfected mop heads
- Terminal cleaning after patient discharge should be done using a disinfectant e.g. chlorine-based solution with 1000 ppm available chlorine (0.1% hypochlorite) – *Refer Chapter 4.6*
- Floor should be disinfected twice daily by wet mopping using a solution with 1000 ppm available chlorine
- Walls should be cleaned weekly with a disinfectant
- Bathroom/toilet should be cleaned and disinfected twice a day with a phenolic disinfectant
- Thorough cleaning during and after any construction activity including minor renovation projects is critical
- Floor surfaces and finishes should be smooth, nonporous, and scrubbable (e.g. vinyl) to minimize dust levels
- Carpets should not be installed in HSCT unit hallways, outside of patient rooms or inside the rooms. HSCT recipients should not be exposed to vacuuming
- Damp dusting should be practiced to avoid generation of aerosolized dust

- Water leaks should be cleaned up and repaired as soon as possible to prevent mould proliferation in floor, walls, ceiling tiles, cabinets and in and around all HSCT patient care areas. If cleanup and repairs are delayed ≥72 hours after the water leak, the involved materials should be assumed to contain fungi and handled accordingly e.g. discarded (preferably) or cleaned
- Design and selection of furnishings should focus on creating and maintaining a dust-free environment. Upholstery should be smooth, nonporous and easily cleanable
- Finishes (e.g. wall coverings, window shades and countertops) used in HSCT units should be scrubbable, nonporous, and easily disinfected to minimize dust accumulation
- Defects in roofing, tiling, flooring, walls, windows, fixtures or seals that manifest as ingress of water and dust should result in an immediate notification for corrective action
- Once a patient is discharged from the unit, a thorough terminal cleaning and disinfection must be done (refer Appendix 1 for checklist)
- Spill management - *Refer Chapter 4.6*

8.2.6 Isolation and barrier precautions

- When indicated, HSCT recipients should be placed on airborne, droplet, or contact precautions in addition to standard precautions
- Each room is made up of three main areas: the ante-room (optional), the main room and bathroom. The door to the room and the door to the bathroom must be closed all the time. The main door and ante-room door should never be opened at the same time
- Door signage with protective precautions to be clearly displayed at entry to patient's room
- Restricted entry has to be ensured (no visitors unless essential for patient management)
- Those who have signs and symptoms of community respiratory viral infection, skin rash, vomiting or diarrhoea within last 48 hours should not be granted access, including staff and visitors
- Hand washing facilities must be available at the entrance to each patient room with single use hand towels. Hand dryers are not recommended
- Trolley for PPE should be set up outside the room (ante-room) with alcohol hand rub, gowns, gloves, masks, neutral detergent wipes for cleaning and 70% isopropyl alcohol wipes for disinfection
- Alcohol hand rub to be placed at the entrance to the room and at bedside

8.2.7 Hand hygiene

- Hand washing is preferable over alcohol hand rub
- HSCT recipients and bystanders should be encouraged to practice good hand hygiene (e.g. washing hands before eating, after using the toilet, before and after touching a wound) *Refer Chapter 4.1*

8.2.8 Equipment

- Dedicated patient equipment in each room must be cleaned and disinfected appropriately prior to reuse after patient discharge
- All non-dedicated equipment should be cleaned and disinfected appropriately after use *Refer Chapter 4.5*

8.2.9 Toys

- Toys that cannot be washed or disinfected after use should be avoided. Toys provided in an individual patient room should be thoroughly washed before they are brought into the room and thereafter, at least once weekly or as required
- Water-retaining bath toys should not be used
- Toys should not be shared

8.2.10 Flowers/plants

- Fresh or dried flower arrangements should not be allowed in the unit

8.2.11 Healthcare personnel

- Immunization of all HCWs with the following vaccines is recommended to prevent transmission of vaccine preventable diseases to HSCT recipients
  - Hepatitis B (immunity should be checked)
  - MMR (measles, mumps and rubella)
  - Tdap (tetanus, diptheria and pertussis)
  - Varicella (if no evidence of protection i.e. not vaccinated or no past history of infection)
  - Annual influenza vaccine
- HCWs caring for HSCT recipients should preferably receive inactivated vaccines (e.g. inactivated influenza vaccine, inactivated polio vaccine) to minimize the theoretical risk of transmission of vaccine virus to HSCT recipients
- If a live vaccine (Varicella, MMR) is given, HCW should avoid working in HSCT units for a minimum of 4 weeks
- All HCWs with infections that are potentially transmissible to HSCT recipients or candidates should be restricted from direct patient care activities
- On significant exposures to fever rash illness, HCW should be assessed for quarantine purposes
- HCWs with draining skin and soft tissue infections or other skin or mucous membrane lesions (e.g. HSV lip lesions) that cannot be completely covered, should be excluded from patient contact
- The extent of work restrictions (e.g. leave from work versus temporary reassignment to non-patient care duties) will depend on the specific infection
- Work exclusion policies should be designed to encourage HCWs to report their illnesses or exposures to the infection prevention and control unit

8.2.12 Visitors

- Visitors are not allowed unless essential for patient management. Generally, children less than 12 years of age are not permitted entry to the unit
- HSCT units should have written policies regarding the screening of all visitors for communicable infections. Trained personnel (e.g. administrative or nursing personnel) should perform active screening daily at key entry points to the units, particularly during the respiratory virus season

- Visitors with signs or symptoms suggestive of communicable infections (e.g. fever, upper respiratory infection or flu-like symptoms, diarrhoea, rash) or with recent exposures to communicable infections (e.g. chickenpox, mumps, measles, pertussis) should be excluded from entry
- Visitors who have received live vaccines recently (e.g. within 6 weeks of receiving chickenpox vaccine or a history of receiving an oral polio vaccine within the previous 3 to 6 weeks) should not visit the unit
- All visitors must follow hand hygiene and isolation precautions
- Annual vaccination with influenza vaccine is recommended for all family members >6 months of age and household contacts of these patients

8.2.13 Patient skin care

- HSCT recipients should take daily showers or baths using a mild soap before, during and after transplantation depending on the clinical status
- For patients with graft versus host disease (GVHD), regular lubrication of dry, intact skin with emollients may decrease pruritus and maintain skin integrity. Ointments and creams are more effective than lotions and less likely to sting when applied to sensitive skin
- Routine inspection of skin sites likely to be portals of infection (e.g. perineum, intravascular access sites) is recommended during neutropaenia
- Maintain good perineal hygiene to minimize loss of skin integrity and risk of infection. (Gentle but thorough perineal cleaning after each bowel movement and thorough washing and drying of the perineum after each episode of urination)
- The use of rectal thermometers, enemas, suppositories and internal rectal examinations are contraindicated
- Nails of the patient should be cut short

8.2.14 Patient oral care

To reduce the risk of oral and dental infections, all HSCT candidates and their caregivers should be educated regarding the importance of maintaining good oral and dental hygiene.

- All HSCT candidates should receive a dental evaluation and relevant treatment before conditioning therapy begins
- HSCT recipients with mucositis and HSCT candidates undergoing conditioning therapy should maintain oral hygiene by performing oral rinses 4-6 times/day with 4% chlorhexidine, sterile water, normal saline or sodium bicarbonate solutions
- HSCT recipients and candidates should brush their teeth 2-3 times/day with a soft regular toothbrush which should be replaced regularly. If the recipient cannot tolerate a toothbrush, a foam tooth swab can be used
- Routine dental supervision to monitor and guide the patient’s maintenance of oral and dental hygiene should be provided
- Elective dentistry should be postponed until the patient has demonstrated substantial immune recovery
- HSCT recipients and candidates should not wear fixed orthodontic appliances or space maintainers from the start of conditioning therapy until pre-engraftment mucositis resolves

- If wearing dentures, use them only while eating. Clean them twice daily with a soft toothbrush. When not wearing them, soak dentures in antiseptic denture soaking solution. The solution should be changed daily
- Patients with GVHD of the oral cavity should undergo frequent dental evaluation because of the accelerated pace of dental caries in those patients

8.2.15 Vaccination of household contacts

- Annual influenza vaccine is recommended
- Avoid oral polio vaccine
- Susceptible household contacts of candidates should complete VZV vaccination at least 3 months prior to transplant

8.2.16 Diet

- The diet should be designed to reduce the bacterial content of the food. This diet should be followed until 3 months after transplant. Allogeneic transplant patients should follow the diet until all immunosuppressive therapy is discontinued
- Follow good food hygiene and personal hygiene when preparing food. Store food appropriately and safely. Food should be well cooked and freshly prepared. Expiry date of food should be checked. Never leave hot food to cool or cold food to warm on the table. Eat hot food hot (>60 ^{0}C) and cold food cold (<50 ^{0}C). Preferable to eat food within one hour of preparation
- Fruits with peels can be allowed and have to be freshly cut
- Transplant recipients should use boiled cooled water for drinking purposes and for preparation of fruit juices and milk. Avoid bottled water
- All food consumed by the patient is preferably pressure cooked

High risk foods are raw and undercooked seafood, meat and poultry, probiotic yoghurts, probiotic capsules, raw or partially cooked eggs, cold smoked sea food, raw sprouts and salads, pre-cut fruits, pâté and meat spreads, soft and semisoft cheese, unpasteurized milk and dairy products made from unpasteurized milk, well water and tank water unless regularly tested for water quality, raw or non-heat-treated honey, raw nuts and nuts in shells

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CHAPTER 9

INFECTION PREVENTION AND CONTROL IN HEALTHCARE WORKERS

CHAPTER 9

INFECTION PREVENTION AND CONTROL IN HEALTHCARE WORKERS

Introduction

Healthcare workers (HCWs) are at a higher risk of exposure to infectious agents. All HCWs should adhere to standard precautions and additional precautions for prevention of healthcare associated infections. In addition, immunization against some of the vaccine preventable diseases is recommended.

9.1 Pre-employment assessment

HCWs are at risk of acquiring infection through occupational exposure. Hospital employees can also transmit infections to patients and other employees. Therefore, an employees' health programme must be in place to prevent and manage infections in hospital staff.

Employees' health should be assessed at recruitment and should be repeated when there is a significant change in duties. The new employee should not commence work until all checks are completed and they are presumed fit to work (Refer Annexure 9.1)

9.2 Training of HCWs on infection prevention and control (IPC) and occupational health

- Pre-employment and in-service health education of HCW on occupational health hazards such as HIV, HBV, HCV and TB, should be conducted on a regular basis by the IPC/ health education units
- It is recommended for all HCW to undergo mandatory training on "Infection prevention and control in a healthcare facility" and "Occupational safety" during the period of orientation on recruitment. Thereafter they should attend and produce evidence of similar activities organized by the health authorities to maintain their knowledge

9.3 Recommended immunizations

9.3.1 Hepatitis B vaccination

- All HCWs who are involved in patient care and may come in contact with blood, body fluids, secretions/excretions or sharps should be vaccinated against HBV
- Hepatitis B vaccination should be carried out as a 3-dose schedule at 0, 1 and 6 months with a recommended vaccine
- HBs antibody levels should be tested 6-8 weeks after completion of the 3-dose vaccination series. The protective titer is ≥10 mIU/ml. For certain groups (ongoing high risk of exposure to blood borne viral infections) it is preferable to have HBs Ab level at 100 mIU/ml with boosters to maintain a sustainable protective Ab level
- HCWs who do not respond to the primary vaccine series (HBs antibody titer <10mIU/ml) should be tested for HBs Ag
- HCWs who do not respond to the primary vaccine series and are HBs Ag negative should complete a second 3 dose vaccine series at 0, 1 and 6 months

- Revaccinated HCWs should be tested for adequate levels of HBs antibody, 6-8 weeks after completion of the second 3 dose vaccination series
- If seroconversion has been achieved following a full course of hepatitis B vaccine, regular testing and booster doses are not routinely recommended
- Those who do not respond to two courses of hepatitis B vaccine (primary non-responders) need counselling and education
- Those who have received hepatitis B immunization in the past and have never had antibody testing should consult the infection control team for further advice

9.3.2 Other useful vaccines

- HCWs are at a higher risk of contracting infections such as varicella, measles, mumps and rubella. Any HCW who is non-immune, is encouraged to be vaccinated against these diseases.
  - **MMR (measles, mumps and rubella) vaccine** – two doses with a minimum interval of 4 weeks
  - **Varicella vaccine (chickenpox)** - two doses with a minimum interval of 4 – 8 weeks
- Specific immunizations should be considered as and when they are recommended by the health authorities to meet the current need or for HCW working in high-risk areas and HCW who are at high risk for complications of specific infections (e.g. annual seasonal influenza in outbreak situations, typhoid and hepatitis A vaccine for food handlers)
- Vaccines as post exposure prophylaxis may be indicated in certain situations (e.g. meningococcal infection, rabies and chickenpox)

9.4 HCW with symptoms of infection

Any HCW with infections should report their illnesses/incidents for further evaluation and management. They should remain off work when they are ill with symptoms that are likely due to an infectious disease such as:

- Influenza-like illness/Acute respiratory infection
- Gastroenteritis
- Conjunctivitis
- Infected skin lesions (if direct contact with patients or food)
- Varicella
- Herpes zoster if in an exposed area

9.5 Occupational exposure to blood and body fluids

- Injuries due to needles and other sharps and splashes to mucous membranes have been associated with transmission of infectious agents such as Hepatitis B (HBV), Hepatitis C (HCV) and HIV
- Blood and body fluids such as cerebrospinal fluid, synovial fluid, pleural fluid, peritoneal fluid, pericardial fluid, and amniotic fluid are the most important sources
- Accidental exposures to blood and body fluids may occur by,
  - Percutaneous inoculation with needles or sharp instruments
  - Contamination of mucous membranes of mouth, eyes and other mucosal areas with splashes
  - Swallowing of blood, secretions or body fluids
  - Contamination of non-intact skin (open wounds, dermatitis or eczema)

- Transmission can specially occur in dialysis and transplant units, haematology units among multi-transfused patients, patients on treatment for malignancies, diabetes clinics and sexually transmitted infection (STI) clinics
- Poor IPC practices can lead to infection among these patients. HCWs should be trained in IPC practices and encouraged to report any breach of practice

Preventive measures

- Hepatitis B vaccination of susceptible HCW
- Screening for blood borne viruses and vaccination against HBV for patients belonging to high-risk groups e.g. oncology patients, dialysis patients, patients requiring frequent blood transfusions
- Primary prevention
  - Strict adherence to standard precautions
  - Use of safer devices e.g. vacuum tubes for venepuncture
  - Safe handling of sharps - *Refer Chapter 4.4*
  - Use of personal protective equipment (PPE) in appropriate circumstances
  - Use of disposable items as much as possible
  - Use of single-dose vials whenever possible
  - Avoidance of unnecessary injections and procedures
  - Use of proper methods of disinfection/sterilization for reusable patient care equipment
  - Adherence to good infection control practices
    - Change gloves between patients
    - Avoid reinsertion of needles into multi-dose vials/saline bags
    - Avoid use of same needles or syringes for several patients
    - Avoid keeping drawn medication inside syringes for some time before giving injections
    - Prevention of contamination of injection equipment and medication
  - Proper laundry and waste disposal
  - Prevention of mucous membrane exposure
    - Avoid touching mouth, nose or eyes with gloved or ungloved hand
    - Avoid direct splatter from patients to the face of HCW
- Continuous education of HCW, patients and other care givers on methods of transmission and prevention
- Proper monitoring of all above activities

9.6. Management of a HCW potentially exposed to HBV, HCV or HIV

- The risk of infection after percutaneous injury is approximately:

Hepatitis B	30%
Hepatitis C	3%
HIV	0.3%

1. Provide immediate care to the exposure site
    - Percutaneous injury - Wash wound and skin thoroughly with soap and running water. Allow free bleeding of wound. Do not rub or squeeze the injured site, do not apply antiseptics
    - Splash to the mouth - Spit out and rinse the mouth several times with clean water
    - Splash to eye - Irrigate eyes with normal saline or running water. If contact lenses are worn, wash the eyes both before and after removing the lenses
    - Remove contaminated clothes
2. Report all exposures to the IPC team without delay and inform the supervisor
3. Determine the risk associated with exposures

Factors to be considered in assessing exposures

Type of exposure

- Percutaneous injury
- Mucous membrane exposure
- Non-intact skin exposure
- Human bites

Type of fluid/tissue

- Blood
- Body fluids
    - cerebrospinal, synovial, pleural, peritoneal, pericardial, amniotic fluid, semen, vaginal secretions
- Other potentially infectious material (OPIM)
    - saliva, vomitus, urine or faeces when contaminated with blood

Nature of the injury

- Superficial/Deep
- Type of needle (solid/hollow bore)
- Visible blood in the sharp instrument at the time of injury
- Presence/ absence of PPE (gloves/mask/goggles)

Assess the risk factors for blood-borne viral infections of source patient

Hepatitis B vaccination status and immunity of the healthcare worker

4. Obtain blood samples from source patient and test for HIV Ag/Ab, HBs Ag and HCV Ag/Ab
5. Obtain blood samples from exposed healthcare worker for HIV Ag/Ab, HBs antibody (when required) and HCV Ag/Ab
6. Post-exposure prophylaxis (PEP)- Risk assessment and decision on PEP should be carried out by the medical officer-IPC/STD

9.6.1 Post-exposure management of HCW potentially exposed to HIV

- **Determine the HIV status of the source patient**

I. Known positive patient

- If venereology team available on-site, contact immediately regarding PEP or start PEP immediately with available drug regimen (starter pack) and refer to nearest venereology team

II. Patient with unknown sero-status

When source patient is available

- A blood sample should be obtained for HIV testing from the source patient after informed consent
  - When the source patient has the capacity to consent to HIV testing, informed consent is required. If not, consent may be obtained from a surrogate, or anonymous testing may be done if a surrogate is not immediately available
- If facilities are available, perform rapid HIV Ag/Ab test (immunochromatographic test)
  - if rapid test is positive – start PEP immediately and refer to venereologist
  - if rapid test is negative – assess the risk of exposure to decide on PEP
- If testing is not available immediately, consider severity of exposure and epidemiologic likelihood of HIV exposure to decide on immediate PEP
- In addition to the rapid test, HIV Ag/Ab ELISA test should be performed at the closest STD clinic as soon as possible. Please send sample with properly filled request form indicating that it is a sample of a source patient after an occupational exposure

When source patient is not available

- Decision regarding initiation of PEP should be made on a case by case basis. Consider severity of exposure and epidemiologic likelihood of HIV exposure

- **Timing of the initiation of PEP**
  - When a potential occupational exposure to HIV occurs, every effort should be made to initiate PEP as soon as possible, ideally within 2 hours, but can be extended up to 72 hours post exposure
  - Baseline blood sample should be taken for full blood count (FBC), renal function test (RFT) and liver function test (LFT)before commencement of PEP
- **Recommended PEP regimen**
  - Three drug regimen – Tenofovir disoproxil fumarate (TDF) 300mg daily, Emtricitabine (FTC) 200mg daily, efavirenz (EFV) 600mg daily or lopinavir/low-dose ritonavir (LPV/r) 400/100mg 12 hourly. A venereologist could decide on alternative regimens according to special circumstances, if there are any
- **Duration of PEP regimen**
  - PEP needs to be given for 28 days. When the source patient is confirmed to be HIV-negative, it is recommended to discontinue the PEP regimen
- **Baseline and follow up testing of exposed healthcare worker**
  - Perform HIV Ag/Ab testing for 3 months post-exposure (At baseline, 6 weeks and 12 weeks)

For further information refer General Circular No 01-19/2017 Management of healthcare workers following occupational exposure to blood and other body fluids and post-exposure prophylaxis for HIV or contact National STD/AIDS Control Programme (NSACP - telephone 011 – 2667163) or regional STD clinic

9.6.2 Post-exposure management of HCW potentially exposed to HBV

Vaccination and antibody response status of exposed person	**Management**		
	Source **HBsAg positive**	Source **HBsAg negative**	Source **Unknown or not available for testing**
Unvaccinated	HBIG × 1 dose. Initiate HB vaccine series. Check antibody status 6-8 weeks after completion	Initiate HB vaccine series. Check antibody status 6-8 weeks after completion	Initiate HB vaccine series. Check antibody status 6-8 weeks after completion
Incompletely vaccinated	Take blood for antibody and give a HB vaccine dose 1. ≥10mIU/ml –Reassure and complete vaccination schedule 2. <10mIU/ml - HBIG x 1 dose. Complete the schedule. Recheck HBs Ab after 6-8 weeks	Complete the schedule. Check antibody status after 6-8 weeks	Complete the schedule. Check antibody status after 6-8 weeks
Previously vaccinated ***Known responder***	No treatment (can consider a HB vaccine booster dose)	No treatment	No treatment
Previously vaccinated **Known primary non-responder**	HBIG × 2doses one month apart	No treatment	If high risk source/setting, treat as for HBsAg positive source
Previously vaccinated **Antibody response unknown**	Give HB vaccine booster dose. Check antibody titre 1. ≥10mIU/ml - no treatment 2. <10mIU/ml -administer HBIG ×1 dose and a vaccine booster. Recheck after 6-8 weeks	1. No treatment 2. Test exposed person for anti-HBs	Test exposed person for anti-HBs 1. If adequate - no treatment 2. If inadequate - administer booster vaccine dose` Recheck after 1month

HBIG – Hepatitis B specific immunoglobulin

- Persons who have previously been infected with HBV are immune for reinfection and do not require post-exposure prophylaxis
- A responder - person with adequate levels of serum antibody to HBs Ag (anti-HBs ≥10 mIU/ml)
- A primary non-responder - person with inadequate response after 2 full courses of vaccination (anti-HBs <10 mIU/ml)

9.6.3 Post-exposure management of HCW potentially exposed to HCV

Anti HCV status of the exposed person	**Management**	
	Source known patient with HCV infection or high risk for HCV	**Source unknown or low risk for HCV**
Anti HCV negative	1. Counseling by a specialist 2. Check exposed person for HCV RNA at 6 weeks and at 12 weeks 3. Check exposed person for anti HCV Ab at 12 weeks and 24 weeks 4. If exposed person remains anti HCV negative at 24 weeks infection can be excluded	Check exposed person for anti HCV Ab at 24 weeks

9.6.4 Report exposure

- Report all exposures to IPC team through ward sister
- Report all needle-stick/ sharp injuries to National STD/AIDS Control Programme (NSACP) using the Exposure Report form of General Circular Letter No: 36/2001 of Ministry of Health

9.7. Infection prevention and control (IPC) in other infections

Refer Chapter 5

Infection	Prevention	Post-exposure management
Conjunctivitis	Hand washing, gloves, disinfection of instruments	No specific management
Diphtheria	Droplet precautions (for patients with pharyngeal symptoms) Contact precautions (for patients with cutaneous lesions)	Benzathine penicillin IM 1.2 mu single dose *or* Erythromycin oral 1g daily for 7 days Efficacy of antimicrobial prophylaxis is *not* proven A dose of adult tetanus toxoid / diphtheria (aTd) vaccine if HCW has not been vaccinated within previous 5 years
Hepatitis A	Contact precautions	Post exposure prophylaxis is indicated for persons with increased risk of HAV associated complications (e.g. immunocompromised and chronic liver disease) Hepatitis A vaccine can be given within 2 weeks of exposure. Intravenous immunoglobulin (IVIG) can be given for patients. when vaccine is contraindicated
Meningococcal disease	Droplet precautions	For HCWs who had intensive, unprotected contact (i.e. without wearing mask) with infected patients (e.g. mouth to mouth resuscitation, endotracheal intubation, endotracheal tube management or close examination of the oropharynx) *Ciprofloxacin 500mg oral single dose or Ceftriaxone 250mg IM single dose or *Rifampicin 600mg orally every 12 hours for 2 days (**Not* recommended for pregnant women) Vaccination
Pertussis	Droplet precautions	Erythromycin 500mg orally four times daily for 7 – 14 days can be given Efficacy not well documented
Brucella	Contact and droplet precautions	For high-risk exposure in the laboratory Doxycycline 100 mg or co-trimoxazole 160/800 mg 12 hourly for 3 weeks. Need long term follow up
Tuberculosis	*Refer Chapter 13.6*	
Viral respiratory infections	*Refer Chapter 13.7*	
Varicella	*Refer Chapter 13.8*	
Acute gastrointestinal infections	*Refer Chapter 13.10*	
Rabies	*Refer Chapter 13.11*	

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Annexure 9.1

Specimen Pre-employment Health Assessment Questionnaire

A. Job activity description

Will this job require:	Yes	No	Details
An essential need for accurate colour vision or hearing			
Clinical contact with patients, or contact with human blood, blood products, or tissue			
The undertaking of or assisting with exposure-prone procedures			
Work that may directly affect the safety of others			
Other hazards (e.g. radiation, carcinogens, etc.)			
Regular night-work or lone working			
Food handling & the preparation of food			
Work with Class 2 or 3 pathogens			
Work with animals or insects			

B. Past and present medical information

How would you describe your general health most of the time?	[ ] Excellent [ ] Usually good [ ] Sometimes not so good [ ] Very good [ ] Just OK

Condition	No	Yes	If yes please specify
Have you had any significant illness, admission to hospital or surgical procedure performed in the last five (5) years? (Excluding normal pregnancy and delivery)			
Are you currently being treated by a doctor for any physical condition?			
Are you currently being treated by a doctor for any psychological condition?			
Are you currently taking any prescribed medication?			
Do you have any known allergies (insects, drugs, chemicals, animals, other)?			
Do you have skin problems (including eczema, dermatitis, or associated allergies (e.g. latex)?			
Have you ever sustained an injury in a vehicle accident or sporting incident to the extent that you required medical attention?			
Do you have any musculoskeletal problems including any difficulties in standing bending lifting or other movements (back pain, arthritis, pains in upper limbs, lower limbs, neck, and shoulder)?			
Do you suffer with any disease or taking any drugs that could affect your immunity?			
Do you have any health problems* that may have been caused or made worse by work?			

Has a doctor ever advised you not to be exposed to any particular work situation, chemical or organism?			
Have you ever had a blood or body fluid exposure incident while at work?			
Did you have any follow-up investigations for this exposure?			
Have you ever being treated for tuberculosis (TB)?			
Have you been given TB prophylaxis?			
Do you have symptoms** suggestive of TB?			
Do you have any medical condition(s) that would require reasonable adjustment(s) to be made to your workplace or working practices?			
Do you have any other relevant health or social issue that is not covered elsewhere in the form?			

* *Examples of illnesses or other conditions which may be relevant include (but are not limited to): vision deficiencies, disorders of the heart or arteries, chronic infections, epilepsy, fits, fainting, black-outs, giddiness, back trouble, arthritis, chest complaints, drug and alcohol-related problems, nervous or psychiatric conditions, removal of your spleen etc.*

*** General ill health, Loss of energy, Unexplained low-grade fever, Loss of appetite, Unexplained weight loss, Persistent cough with/without production of sputum, Coughing up blood, Night sweats.*

(Continued on next page)

C. Immunity against infectious diseases

Have you had;	YES	NO	DATE	Result / comments
TB tests (Mantoux, QuantiFERON, etc.)				Result:
BCG vaccination				Scar size: mm. (The size of the scar is an indicator as to whether you may or may not have immunity to tuberculosis.)
Hepatitis B immunisation*			1 2 3	Mention the dates if you have been given additional doses
Hepatitis B antibody test*				mIU/ ml
Rubella (German measles) immunisation				
Rubella antibody test*				Immune/ non-immune
Tetanus immunisation				Date of last booster
Diphtheria immunisation				
Chickenpox or shingles				
Varicella (VZV) antibody test*				Immune/ non-immune
If indicated,				
Hepatitis A vaccination				
Typhoid vaccination				
Meningococcal vaccination				
Other				

**Please attach copies of laboratory reports if available*

CHAPTER 10

MANAGEMENT OF AN OUTBREAK

CHAPTER 10

MANAGEMENT OF AN OUTBREAK

Introduction

Definition of an outbreak

- The occurrence of cases of a disease in excess of what would normally be expected in a defined community, geographical area or season. An outbreak may occur in a restricted geographical area or may extend over several countries.
- A single case of a communicable disease long absent from a population or caused by an agent not previously recognized in that community or area or the emergence of a previously unknown disease.

10.1 Objective of outbreak management

- The objective of outbreak management of communicable diseases is to interrupt transmission as quickly as possible to prevent further cases
- To accomplish this, it is necessary to
  - recognize when a potential or actual outbreak has occurred
  - eliminate the source
  - stop further spread
  - prevent recurrence
  - effectively communicate with all concerned parties
  - disseminate lessons learnt

10.2 Managing an outbreak

- If an outbreak is suspected, ward/unit staff should immediately inform the infection prevention and control (IPC) team. IPC team should visit the unit concerned to investigate.
- Healthcare workers involved in managing an outbreak include microbiologist, clinicians, administrator of the hospital, epidemiologist, medical officer-infection prevention and control (MOIPC) and infection control nursing officer (ICNO)
- IPCT may consider forming an outbreak control team (OCT) depending on the nature and magnitude of the outbreak. An OCT is a multi-disciplinary group which will work together to investigate an outbreak. This team is responsible for planning and coordinating the investigation. This team should,
  - meet regularly and discuss the issues related to management of the outbreak until it is under control
  - take major decisions such as ward closure when required
  - designate a person to communicate with media if necessary

10.3 Steps in the management of an outbreak

Step 1 - Establish the existence of a probable outbreak

- Establish the probable outbreak according to the above definitions using surveillance data and other relevant information

Step 2 - Confirm the outbreak

- It is important to
  - ensure that the disease has been properly identified since control measures are often disease-specific
  - rule out laboratory errors as the basis for the increase in reported cases
- Review the clinical findings and laboratory results
- **As soon as an outbreak is confirmed, take immediate relevant control measures**
  - Study the available information to identify relevant control measures
  - Review and strengthen the relevant infection control practices e.g. hand washing, isolation, environmental cleaning, aseptic procedures, disinfection and sterilization, restriction of movement of patients and visitors
- Summarize the clinical features using frequency distributions and make sure that the clinical features are consistent with the diagnosis

Step 3 - Construct a working case definition

- A case definition is a standard set of criteria for deciding whether an individual should be classified as having the particular infection of interest
- The outbreak management team forms a case definition once an outbreak has been declared
- A case definition includes clinical criteria with restrictions by **time, place, and person**
- As the diagnosis may be uncertain, different categories of the case definition, such as **"confirmed", "probable", "possible"** or **"suspected"** may be used

Step 4 - Find cases systematically and record information

- **Surveillance** may be conducted as **passive surveillance** by describing the situation and asking for reports of similar cases or may be conducted as **active surveillance** to collect information on any additional cases
- **Prepare a data collection tool** e.g. questionnaire that includes identifying information, demographic information, clinical information, risk factor information and reporter information on each case
- **Record all the cases noting patient details, date and time of onset of symptoms in each case, date of admission, place, infection details etc.**
  - Analyze the data to identify common features of the cases. e.g. age, exposure to risk factors
- **Microbiological investigations** should be performed depending on the suspected causative organism. Consult the microbiologist to decide on appropriate specimens to confirm the diagnosis
  - Epidemiological typing of the aetiological agent could be done depending on the facilities available

Step 5 - Perform descriptive epidemiology

- Descriptive epidemiology is defined as epidemiological studies that aim to describe the distribution of diseases and determinants. It provides a way of organizing and analyzing these data to describe variations in disease frequency in terms of time, place and person

- An epidemic curve (e.g. histogram) should be developed based on place and time of occurrence of cases (time in the x-axis and number of cases in the y-axis). This helps to determine common source, probable time of exposure, probable incubation period etc.

Step 6 - Develop a hypothesis

- Formulate a hypothesis about suspected causes for the outbreak based on a literature survey and common features of cases
- Depending on the outbreak, the hypothesis may address the source of the agent, the mode (and vehicle or vector) of transmission, and the exposures that caused the disease
- The hypothesis should be testable, since evaluating hypothesis is the next step in the investigation

Step 7 - Evaluate the hypothesis epidemiologically

- After a hypothesis that might explain the cause of the outbreak has been developed, the next step is to evaluate the acceptability of that hypothesis
- The hypothesis is tested by a case-control study, cohort study or microbiological study to delineate the problem and identify the source
    - *Case-control study* – a group of uninfected patients (control group) is compared with infected patients (case group)
    - *Cohort study* – a defined high-risk population (cohort) is identified and followed prospectively
    - *Microbiological study* – planned according to the known epidemiology of infection problem. This identifies possible sources and routes of transmission
- If necessary, reconsider, refine, and re-evaluate hypothesis when analytic epidemiology is unrevealing

Step 8 - Implement control and prevention measures

- Control and prevention activities should be implemented as early as possible at the outset of an outbreak
- When appropriate control measures are identified and available, they should be initiated before an epidemiological investigation is launched.
- Specific control measures are directed against one or more components in the chain of transmission (i.e. agent, source, mode of transmission, portal of entry and susceptibility of the host) as soon as they are identified.
- Control measures may include,
    - identification and elimination of a contaminated product
    - identification and treatment of carriers
    - modification of nursing procedures
    - correction of lapses in technique or procedure
    - implementation of transmission-based precautions
    - immunization of individuals susceptible to infection

Step 9 - Monitoring and evaluation

- Monitor the continuity of implemented specific control and preventive measures and evaluate their effectiveness
- Continue to follow up of cases after the outbreak, clinically as well as microbiologically
- If active surveillance was initiated as part of case finding effort, it should be continued

Step 10 - Communicate findings and document the outbreak

- It is important to develop a communication plan at the outset of the investigation. Informing all relevant parties of all details of the investigation is critical throughout the investigation
- The final task is to summarize the investigation, its findings, and its outcome in a report, and to communicate/present this report in an effective manner to all relevant parties (IPC committee, departments involved and the administration)

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CHAPTER 11

SURVEILLANCE AND AUDITS IN INFECTION CONTROL

CHAPTER 11

SURVEILLANCE AND AUDITS IN INFECTION CONTROL

Introduction

Surveillance of healthcare associated infections (HAIs) and antimicrobial resistance (AMR) as well as monitoring/audits of healthcare practices according to IPC standards with timely feedback are recommended at healthcare facility level and national level to prevent and control HAI and AMR.

Surveillance

Surveillance is defined as the continuous and systematic process of collection, analysis, interpretation and dissemination of descriptive information for monitoring health problems.

11.1 The main objectives of surveillance

- To assess level of infection over time in order to determine the need of preventive or control measures
- To detect outbreaks of infections early, in order to allow timely investigation and implement control measures
- To determine the effectiveness of preventive and control measures implemented
- To provide statistics on healthcare associated infections for comparison and bench marking

11.2 Where to apply the surveillance procedure?

- All hospital sites where there is a potential for healthcare associated infections to occur

11.3 How is surveillance performed?

11.3.1 Planning

- It is not feasible to conduct surveillance for all events; therefore, surveillance is often targeted, with a focus on specific events, processes/procedures, organisms, medical devices or high-risk patient populations
- An initial assessment should include:
  - the types of patients that are served by the health care setting
  - the key medical interventions and procedures that are provided in the health care setting
  - the frequency of different types of infections within a particular health care setting
  - the impact of the infection (including percentage of case fatality and excess costs associated with the infection)
  - the preventability of the infection
  - the need for reporting as national or institutional quality indicators (e.g. *Staphylococcus aureus* bacteraemia)

11.3.2 Data collection

- This must be done using validated, published definitions for HAIs

- HAIs are best expressed as rates, i.e. the proportion of cases from the number of persons at risk over a particular period of time

11.3.3 Data analysis

- The recommendation is to calculate incidence density rates in hospitals i.e., the measurement of new cases of infection (incidence) during a defined period of time at risk in the patient/resident population (e.g. length of stay in a hospital calculated as patient-days)
- Where medical devices are inserted and/or surgical procedures are performed, rates of device-associated or surgical site infection should also be calculated on an ongoing basis

11.3.4 Apply risk stratification methodology

- It may be useful to stratify rates of hospital acquired infections by standardized risk ratios/rates to compare the rates with other hospitals
- Examples of risk stratification methods include use of patient days as a denominator, use of risk factors in the collection of SSI rates, monitoring device associated infection (DAI) rates by ICU types etc.

11.3.5 Interpretation of data

- Surveillance data require interpretation to identify areas where improvements to infection prevention and control practices can be implemented
- HAI rates may be compared to both the facility's own previous HAI rates and benchmarks, or to external standards or benchmarks set by other health care settings
- When comparing HAI rates to those of other health care settings, it is essential that the same case finding methods are used, the same case definitions are applied and the same methods for risk stratification are employed

11.3.6 Communication of results

- This should take place on an ongoing, systematic basis and be targeted to those with the ability to change infection prevention and control practices
    - Infection prevention and control (IPC) committee
    - Patient care staff following the identification of an emerging risk of infection, to remind or notify of the required precautions
    - A particular patient care area or specialty care area, focused on the risk of specific types of infections that are of importance to these groups
    - Local/national public health unit when there is a reportable communicable disease event

11.3.7 Evaluation

- Periodic review of the surveillance system should be part of regular IPC committee meetings

11.4 Topics for surveillance in a hospital

- Healthcare Associated Infections (HAIs)
    - Central line associated bloodstream infection (CLABSI)
    - Surgical-site infection (SSI)

  - Ventilator associated pneumonia (VAP)
  - Catheter-associated urinary tract infection (CAUTI)
  - *Clostridioides difficile* (*Clostridium difficile*) infection/ antibiotic associated infections
- Multi-Drug Resistant Organisms (MDROs)
  - Methicillin Resistant *Staphylococcus aureus* (MRSA)
  - Vancomycin resistant *Enterococcus* (VRE)
  - Multi-drug resistant Gram-negative bacteria (MDRGNB)
  - Carbapenem resistant *Enterobacteriaceae, Pseudomonas* species and *Acinetobacter* species
- Respiratory viruses

Audits

11.5 What is an audit?

- Healthcare audit involves comparing current practice with ~~to~~ evidence based best practice in the form of standards, identifying areas for quality improvement and implementing changes to practice to meet the standards
- An audit should be a full cycle i.e. an initial audit, implementing changes which are identified in the initial audit and a re-audit to demonstrate improvement

11.6 Key points in audit

- Relevance of the topic
- Appropriateness of the standards
- Reflection on current practice and the appropriateness of changes planned
- Implementation of change
- Demonstration of improvement

11.7 Description of the audit should include

- Title
- Reason for choice
- Dates of first and second sets of data collection
- Criteria to be audited and standards set with justification
- Methodology of the audit
- Results of the first data collection and comparison to standards which have been set
- Summary of subsequent discussion, and a plan of change agreed
- Changes implemented
- Results of second data collection and comparison to standards set
- Improvement achieved
- Reflection on audit in terms of the principles of good IPC practice

11.8 The audit cycle

11.9 How is an audit performed?

Stage 1 - Preparation

- Choose a topic/identify the problem
  - Preferably one which is a high priority in IPC
  - This may involve areas in which there is a high risk of infection
- Identify available resources
  - IPC team
  - Existing guidelines

Stage 2 - Select criteria

- Define the criteria - this should be in the form of a statement
- Define the standard - usually a target (e.g. percentage)

Stage 3 - Measuring level of performance

- Collect the data
  - May be from laboratory records, ward documents or observations
  - May be retrospective or prospective
- Analyze the data collected
  - Compare actual performance with the set standards
  - Discuss how well the standards were met
  - If the standards were not met, identify the reasons for it

Stage 4 - Making improvements

- Present the results and discuss them with the relevant teams in the hospital
- The results should be used to develop an action plan to bring actual practices closer to standards, specifying what changes need to be done, how, when and by whom will it be done

Stage 5 - Maintaining improvements

- This follows up the previous stages of the audit, to determine whether the actions taken have been effective, or whether further improvements are needed
- It involves repeating the audit (i.e. targets, results, discussion); hence the terms 'audit cycle' or 'audit spiral'

11.10 Topics for audits in a hospital

- Compliance to aseptic insertion and management of peripheral and central lines
- Compliance to aseptic insertion and management of urinary catheters
- National Quality Indicators (mandatory requirement of the Ministry of Health, Sri Lanka (Refer Annexure11.1)
    - Hand hygiene compliance (Refer Annexure 11.2)
    - *Staphylococcus aureus* bacteraemia
    - Post LSCS infection

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- Guidelines on core components of infection prevention and control programmes at the national and acute health care facility level; World Health Organization, Geneva, Switzerland; Available at, https://www.who.int/gpsc/ipc-components/en/.
- Healthcare Associated Infections; Centers for Disease Control and Prevention (CDC), USA; Available athttps://www.cdc.gov/hai/infectiontypes.html.
- National Healthcare Safety Network (NHSN), CDC; USA; Available at, https://www.cdc.gov/nhsn/index.html.

Annexure 11.1

National Quality Indicators

HAND HYGIENE COMPLIANCE (HHC) RATES

A. Total Hand Hygiene Compliance

$$\text{Total HHC for the Unit} = \frac{\text{Total Correct Moments}}{\text{Total Observed Moments}} \times 100$$

*** The auditor could assess the HHC separately for individual units and also could calculate a composite figure for all units which will reflect HHC among all critical units.

B. Job Category-Specific Hand Hygiene Compliance

$$\text{HHC (Nurses)} = \frac{\text{Total Correct Moments (Nurses)}}{\text{Total Observed Moments (Nurses)}} \times 100$$

*** The auditor could work out HHC for different job categories such as Medical Officers, Attendants and Nurses etc.

C. Hand Hygiene Compliance among Specific Categories

$$\text{HHC (Female Nurses)} = \frac{\text{Total Correct Moments (Female Nurses)}}{\text{Total Observed Moments (Female Nurses)}} \times 100$$

*** Auditor can work out HHC for other categories by changing bold prints with a different job category.

D. Moment Specific Hand Hygiene Compliance

$$\text{HHC for all Bef-Pat moments} = \frac{\text{Total Correct Bef-Pat Moments}}{\text{Total Observed Bef-Pat Moments}} \times 100$$

*** The auditor can work out HHC in relation to other moments by changing the bold print with different moments.

Annexure 11.2

Hand hygiene audit data collection form

Hand Hygiene Observation - Data Collection Form Form No [ ]

Unit	[ ]	Start Time	[ ]	Finish Time	[ ]
Date	[ ]	Auditor	[ ]	Duration of Session (Mins.	[ ]

HCW	Moment	Action	HCW	Moment	Action	HCW	Moment	Action
	○ Bef.- Pat. ○ Bef. - aspt. ☐ Aft. - B.f. ☐ Aft. Pat. ☐ Aft.- P.Surr.	☐ Rub ☐ Wash ☐ Missed		○ Bef.- Pat. ○ Bef. - aspt. ☐ Aft. - B.f. ☐ Aft. Pat. ☐ Aft.- P.Surr.	☐ Rub ☐ Wash ☐ Missed		○ Bef.- Pat. ○ Bef. - aspt. ☐ Aft. - B.f. ☐ Aft. Pat. ☐ Aft.- P.Surr.	☐ Rub ☐ Wash ☐ Missed
	○ Bef.- Pat. ○ Bef. - aspt. ☐ Aft. - B.f. ☐ Aft. Pat. ☐ Aft.- P.Surr.	☐ Rub ☐ Wash ☐ Missed		○ Bef.- Pat. ○ Bef. - aspt. ☐ Aft. - B.f. ☐ Aft. Pat. ☐ Aft.- P.Surr.	☐ Rub ☐ Wash ☐ Missed		○ Bef.- Pat. ○ Bef. - aspt. ☐ Aft. - B.f. ☐ Aft. Pat. ☐ Aft.- P.Surr.	☐ Rub ☐ Wash ☐ Missed
	○ Bef.- Pat. ○ Bef. - aspt. ☐ Aft. - B.f. ☐ Aft. Pat. ☐ Aft.- P.Surr.	☐ Rub ☐ Wash ☐ Missed		○ Bef.- Pat. ○ Bef. - aspt. ☐ Aft. - B.f. ☐ Aft. Pat. ☐ Aft.- P.Surr.	☐ Rub ☐ Wash ☐ Missed		○ Bef.- Pat. ○ Bef. - aspt. ☐ Aft. - B.f. ☐ Aft. Pat. ☐ Aft.- P.Surr.	☐ Rub ☐ Wash ☐ Missed
	○ Bef.- Pat. ○ Bef. - aspt. ☐ Aft. - B.f. ☐ Aft. Pat. ☐ Aft.- P.Surr.	☐ Rub ☐ Wash ☐ Missed		○ Bef.- Pat. ○ Bef. - aspt. ☐ Aft. - B.f. ☐ Aft. Pat. ☐ Aft.- P.Surr.	☐ Rub ☐ Wash ☐ Missed		○ Bef.- Pat. ○ Bef. - aspt. ☐ Aft. - B.f. ☐ Aft. Pat. ☐ Aft.- P.Surr.	☐ Rub ☐ Wash ☐ Missed
	○ Bef.- Pat. ○ Bef. - aspt. ☐ Aft. - B.f. ☐ Aft. Pat. ☐ Aft.- P.Surr.	☐ Rub ☐ Wash ☐ Missed		○ Bef.- Pat. ○ Bef. - aspt. ☐ Aft. - B.f. ☐ Aft. Pat. ☐ Aft.- P.Surr.	☐ Rub ☐ Wash ☐ Missed		○ Bef.- Pat. ○ Bef. - aspt. ☐ Aft. - B.f. ☐ Aft. Pat. ☐ Aft.- P.Surr.	☐ Rub ☐ Wash ☐ Missed
	○ Bef.- Pat. ○ Bef. - aspt. ☐ Aft. - B.f. ☐ Aft. Pat. ☐ Aft.- P.Surr.	☐ Rub ☐ Wash ☐ Missed		○ Bef.- Pat. ○ Bef. - aspt. ☐ Aft. - B.f. ☐ Aft. Pat. ☐ Aft.- P.Surr.	☐ Rub ☐ Wash ☐ Missed		○ Bef.- Pat. ○ Bef. - aspt. ☐ Aft. - B.f. ☐ Aft. Pat. ☐ Aft.- P.Surr.	☐ Rub ☐ Wash ☐ Missed
	○ Bef.- Pat. ○ Bef. - aspt. ☐ Aft. - B.f. ☐ Aft. Pat. ☐ Aft.- P.Surr.	☐ Rub ☐ Wash ☐ Missed		○ Bef.- Pat. ○ Bef. - aspt. ☐ Aft. - B.f. ☐ Aft. Pat. ☐ Aft.- P.Surr.	☐ Rub ☐ Wash ☐ Missed		○ Bef.- Pat. ○ Bef. - aspt. ☐ Aft. - B.f. ☐ Aft. Pat. ☐ Aft.- P.Surr.	☐ Rub ☐ Wash ☐ Missed
	○ Bef.- Pat. ○ Bef. - aspt. ☐ Aft. - B.f. ☐ Aft. Pat. ☐ Aft.- P.Surr.	☐ Rub ☐ Wash ☐ Missed		○ Bef.- Pat. ○ Bef. - aspt. ☐ Aft. - B.f. ☐ Aft. Pat. ☐ Aft.- P.Surr.	☐ Rub ☐ Wash ☐ Missed		○ Bef.- Pat. ○ Bef. - aspt. ☐ Aft. - B.f. ☐ Aft. Pat. ☐ Aft.- P.Surr.	☐ Rub ☐ Wash ☐ Missed
	○ Bef.- Pat. ○ Bef. - aspt. ☐ Aft. - B.f. ☐ Aft. Pat. ☐ Aft.- P.Surr.	☐ Rub ☐ Wash ☐ Missed		○ Bef.- Pat. ○ Bef. - aspt. ☐ Aft. - B.f. ☐ Aft. Pat. ☐ Aft.- P.Surr.	☐ Rub ☐ Wash ☐ Missed		○ Bef.- Pat. ○ Bef. - aspt. ☐ Aft. - B.f. ☐ Aft. Pat. ☐ Aft.- P.Surr.	☐ Rub ☐ Wash ☐ Missed
	○ Bef.- Pat. ○ Bef. - aspt. ☐ Aft. - B.f. ☐ Aft. Pat. ☐ Aft.- P.Surr.	☐ Rub ☐ Wash ☐ Missed		○ Bef.- Pat. ○ Bef. - aspt. ☐ Aft. - B.f. ☐ Aft. Pat. ☐ Aft.- P.Surr.	☐ Rub ☐ Wash ☐ Missed		○ Bef.- Pat. ○ Bef. - aspt. ☐ Aft. - B.f. ☐ Aft. Pat. ☐ Aft.- P.Surr.	☐ Rub ☐ Wash ☐ Missed

Total Moments **Total Correct Moments**

Coding of Health Care Worker

Dr.M. - Doctor Male	N.M. - Nurse Male	NS - Nursing Sister	XR.M.-Xray Male
Dr. F. - Doctor - Female	N.F. - Nurse Female	NM - Nursing Matron	XR.F.- Xray Female
C.M. - Consultant Male	At.M.- Attendant Male	PT.M. - Physion Male	Other - Specify
C.F. - Consultant Female	At.F.-Attendant Female	PT.F.-Physio Female	

CHAPTER 12

ENVIRONMENTAL CONTROL

CHAPTER 12

ENVIRONMENTAL CONTROL

Introduction

The environment plays a role in transmitting infections through aerosolized microbe laden particles, dust, dirt and liquid residues etc. This possibility should be kept to a minimum by good design of buildings (to allow little dust build-up and easy cleaning), adhering to infection control measures during construction and renovation, ensuring quality of air and water, and by regular cleaning of the environment and monitoring. The hospital environment should be visibly clean, free from dust, dirt and acceptable to patients, their visitors and staff.

12.1 Environmental cleaning and disinfection

Refer Chapter 4.6

12.2 Infection control during construction and renovation

- 'Construction clean' is the level of cleaning performed by construction workers to remove gross soil, dust and dirt, construction material and workplace hazards within the construction zone. This is done at the end of the day or more frequently if needed
- 'Hospital clean' begins where the construction site ends i.e. outside the hoarding and is generally done by the staff of the health care institution
- An infection control risk assessment must be completed prior to construction and renovation activities (Tables 1, 2 and 3). The risk assessment consists of the following 3 steps
  1. Identify the type of construction activity (Table 1)
  2. Identify the patient areas at risk (Table 2)
  3. Match the type of construction activity with the patient areas at risk (Table 3)

Table 1. Type of construction activity

Types	Construction activities
Type A	Inspection and/or non-penetrating of walls or ceiling. It includes, but not limited to: - Removal of ceiling tiles for visual inspection limited to one tile per $5m^2$/50sq.ft - Painting (but not sanding) - Wall covering, electrical trim work, minor plumbing, and activities that do not generate dust or require cutting of walls or access to ceilings other than for visual inspection
Type B	Small-scale and/or short duration ($\leq$8 hours) activities that create minimal dust; include, but are not limited to: - Installation of telephone and computer cabling - Replacement of ceiling boards (up to $1m^2$ per cubicle) - Access to chase spaces for maintenance services which includes behind walls or above ceiling - Cutting of walls or ceiling where dust migration can be controlled - Drilling works that generates dust

Types	Construction activities
Type C	Work that generates a moderate to high level of dust or requires demolition of any fixed building components or assemblies; include, but are not limited to: - Sanding of walls for painting or wall covering - Removal of floor-coverings, ceiling tiles, and casework - New wall construction - Minor duct work or electrical work above ceilings - Major cabling activities - Any activity which cannot be completed within a single work shift
Type D	Major demolition and construction projects; include, but are not limited to: - Activities that require consecutive work shifts - Heavy demolition or removal of a complete cabling system - New construction

Table 2. Patient areas at risk

Low risk	Medium risk	High risk	Highest risk
Office area, Basement, Retail outlets, (non-food related)	Admitting unit, Out-patient clinics, Endoscopy, Radiology, Food preparation areas, Physiotherapy	Trauma & Emergency, Labor & delivery ward, Pediatrics, medical and surgical units/ wards, Pharmacy, Newborn nursery, Day surgery unit, Central stores, Laboratories	Bone marrow transplant unit, All intensive care units including burn ICU, Cardiac catheterization laboratory, Pharmacy Sterile Unit, Operating rooms, Negative air/positive air pressure rooms, Isolation rooms (in all wards/units), Dialysis unit, CSSD, Oncology ward, Any unit caring for immunocompromised patients

Table 3. IC risk matrix – Class of precautions: construction activity by patient areas at risk

Patient area at risk	Type of construction activity			
	Type A	Type B	Type C	Type D
Low risk	Class I	Class II	Class II	Class III/IV
Medium risk	Class I	Class II	Class III	Class IV
High risk	Class I	Class II	Class III/IV	Class IV
Highest risk	Class II	Class III/IV	Class III/IV	Class IV

Using Table 3, identify the classes of risk. Infection control precautions to be taken for the respective classes of risks are described in Table 4.

Table 4. Description of required infection control precautions by class

Class	Pre-construction	During construction of project	Upon completion of project
Class 1		- Execute work by methods to minimize raising dust from construction operations - Immediately replace a ceiling tile displaced for visual inspection	- Clean work area upon completion of task
Class 11	- Identify the type of construction project - Identify those patients at risk area - Discuss with contractor and other relevant personnel regarding control of dust generation, patient placement and putting up of barriers - Inform IPC team and get advice	- Provide active means to prevent airborne dust from dispersing into atmosphere - Water mist for work surfaces to control dust while cutting - Seal unused doors with duct tape - Block off and seal air vents - Place dust mat at entrance and exit of work area - Remove or isolate air handling system in areas where work is being performed	- Contain construction waste before transport in tightly covered containers - Wipe work surfaces with detergent and water - Wet mop and/ or vacuum before leaving work area - Remove alterations of air handling systems
Class 111	- Identify the type of construction project - Identify those patients at risk area - Discuss with contractor and other relevant personnel regarding control of dust generation, patient placement and putting up of barriers - Inform IPC team and get advice	- Remove or isolate air handling system to prevent contamination of duct system - Complete all barriers i.e. sheetrock, plywood, plastic, to seal area from non-work area - Maintain negative air pressure within work site if necessary - Contain construction waste before transport in tightly covered containers - Cover transport receptacles or carts. Tape covering unless solid lid	- Do not remove barriers from work area until completed project is inspected by the IPC team and other relevant personnel, and thoroughly cleaned - Remove barrier materials carefully to minimize spreading of dirt and debris associated with construction - Vacuum work area including barriers with HEPA-filtered vacuums (in clinical areas) - Wet mop area with water & detergent /disinfectant in clinical areas - Remove alteration to the air handling system in areas where work is being performed

Class	Pre-construction	During construction of project	Upon completion of project
Class 1V	- Identify the type of construction project - Identify those patients at risk area - Discuss with contractor and other relevant personnel regarding control of dust generation, patient placement and putting up of barriers - Inform IPC team and get advice	- Isolate air handling system to prevent contamination of duct system - Complete all barriers i.e. sheetrock, plywood, plastic, to seal area from non-work area - Maintain negative air pressure within work site if necessary - Contain construction waste before transport in tightly covered containers - Cover transport receptacles or carts. Tape covering unless solid lid - Seal holes, pipes, conduits and punctures appropriately - Workers can wear cloth or paper coveralls that are removed each time they leave the work site - All personal entering the work site are required to wear shoe covers. Shoe covers must be changed each time the worker exits the work area	- Do not remove barriers from work area until completed project is inspected by the IPC team and other relevant personnel - Remove barrier materials carefully to minimize spreading of dirt and debris associated with construction - Contain construction waste before transport in tightly covered containers - Vacuum work area with HEPA-filtered vacuums - Wet mop area with disinfectant in clinical areas - Remove isolation of air handling system in areas where work was performed
Class 11,111 & 1V	**Upon completion of project** - Put on air conditioning full blast for 2 days - Lock doors to prevent intruders - Final walk-through inspection - Observe if any dust on furniture - Review effectiveness of actions taken for any problems noted before - Air sampling if necessary		

- Consultation with all the stakeholders should be carried out in advance before construction/renovation
- IPC team of the hospital should assist in the above activities and should be able to supervise and guide the process

12.3 Water quality

- Contact Food and Water Microbiology Reference Laboratory Medical Research Institute for sample collection and further details. Telephone: 0112693556 or 0112693534 Ext.133

Table 5. Testing requirements and interpretation of results for hot and cold-water systems

Hazard/Hygiene Indicator	Result and interpretation	Action
Legionella Timing/Frequency of Testing - as indicated by risk assessment	≥1000 cfu/L Unsatisfactory	The system should be re-sampled; review the control measures; carry out risk assessment to identify any remedial actions, including possible disinfection of the system.
	≥100 - <1000 cfu/L Undesirable	- If only one or 2 samples are positive, system should be re-sampled. If a similar count is found again, review control measures; carry out risk assessment to identify any remedial actions - If the majority of samples are positive, the system may be colonized, even though at a low level, with legionella. Disinfect the system; carry out immediate review of control measures and risk assessment to identify any other remedial action required.
	<100 cfu/L Satisfactory	No action
*Pseudomonas aeruginosa** Timing/Frequency of Testing - in augmented care wards, as indicated by risk assessment (sample to be collected without pre-flushing)	>10 in 100ml Unsatisfactory	Investigate the cause and corrective actions to be in place. Re-sample after 3 weeks.
	1-10 in 100ml Undesirable	Re-test and refer back to those responsible for the Water Safety Plan to determine what actions may be required
	0 in 100 ml Satisfactory	No action

**Investigation of water supplies for other Pseudomonas species may be required during outbreak investigations.*

Table 6. Testing requirements and interpretation of results for hydrotherapy pool water samples

Hazard / Hygiene Indicator **Timing / Frequency of Testing**	**Result and interpretation**	**Action**
Escherichia coli Weekly (collect sample while in use)	>0 in 100 ml Unsatisfactory	Investigate immediately and take repeat sample
	0 in 100 ml Satisfactory	N/A
Coliform bacteria (Total coliforms) Weekly (collect sample while in use)	>10 in 100 ml Unsatisfactory	Investigate immediately and take repeat sample
	1 - ≤10 in 100 ml Acceptable*	* This level is considered acceptable provided that Aerobic Colony Count is <10/ml, *E. coli* is not detected, disinfectant & pH values are acceptable and coliforms are absent in repeat samples
	0 in 100 ml Satisfactory	N/A
Pseudomonas aeruginosa Weekly (collect sample while in use)	>50 in 100 ml Unacceptable	Close pool and seek advice on remedial actions required
	>10 in 100 ml Unsatisfactory	Investigate and take repeat sample
	Borderline	Take repeat sample
	0 in 100 ml Satisfactory	N/A
Aerobic Colony Count Weekly (collect sample while in use)	> 100 / ml Unsatisfactory	Immediate investigation required
	>10 - ≤100/ ml Borderline	Take repeat sample. Acceptable in the absence of *E.coli* or coliforms. Repeated raised counts require further investigation.
	0 - ≤10 / ml Satisfactory	N/A
Staphylococcus aureus As part of wider investigations only –in discussion with the consultant microbiologist	>0 in 100 ml Unsatisfactory	Investigate immediately and take repeat sample
	0 in 100 ml Satisfactory	N/A

Hazard / Hygiene Indicator **Timing / Frequency of Testing**	**Result and interpretation**	**Action**
Legionella Quarterly (depending on risk assessment) and before pool used for first time / after it has been shut down	> 1000 in 1 litre Unsatisfactory	Close pool immediately. Carry out "shock hyperchlorination", drain, clean and disinfect. Review risk assessment. Re-test before re-opening.
	20 – ≤1000 in 1 litre Borderline	Take repeat sample. Drain, clean and disinfect pool and review risk assessment and controls.
	<20 in 1 litre Satisfactory	N/A

Table 7. Testing requirements and interpretation of results for birthing pool water samples

Hazard / Hygiene Indicator **Timing / Frequency of Testing**	**Result and interpretation**	**Action**
Escherichia coli Weekly (collect sample while in use)	>0 in 100 ml Unsatisfactory	Investigate immediately and take repeat sample
	0 in 100 ml Satisfactory	N/A
Coliform bacteria (Total coliforms) Weekly (collect sample while in use)	>10 in 100 ml Unsatisfactory	Investigate immediately and take repeat sample
	1 - ≤10 in 100 ml Acceptable*	* This level is considered acceptable provided that Aerobic Colony Count is <10/ml, *E. coli* is not detected, disinfectant & pH values are acceptable and coliforms are absent in repeat samples
	0 in 100 ml Satisfactory	N/A
Pseudomonas aeruginosa Weekly (collect sample while in use)	>50 in 100 ml Unacceptable	Close pool and seek advice on remedial actions required
	>10 in 100 ml Unsatisfactory	Investigate and take repeat sample
	1 - 10 in 100 ml Borderline	Take repeat sample
	0 in 100 ml Satisfactory	N/A

Legionella Quarterly (depending on risk assessment) and before pool used for first time / after it has been shut down	> 1000 in 1 litre Unsatisfactory	Close pool immediately. Carry out "shock hyperchlorination", drain, clean and disinfect. Review risk assessment. Re-test before re-opening.
	20 – ≤1000 in 1 litre Borderline	Take repeat sample. Drain, clean and disinfect pool and review risk assessment and controls.
	<20 in 1 litre Satisfactory	N/A

- Requirements of water quality standards of other units
  - Endoscopy unit - *Refer Chapter 7.5*
  - Dialysis unit - *Refer Chapter 7.6*
  - Dental unit - *Refer Chapters 7.10*

12.4 Air quality

- The requirements of the air quality may differ depending on the type of facility and individual units
  Refer individual special units in Chapter 7

References

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CHAPTER 13

PREVENTION AND CONTROL OF SPECIAL INFECTIONS IN THE HEALTH CARE SETTING

13.1 MULTIDRUG RESISTANT ORGANISMS

Introduction

Multidrug resistant organisms (MDROs) are bacteria that are resistant to one or more classes of antibiotics.

Important MDROs encountered in healthcare setting include:

- Methicillin resistant *Staphylococcus aureus* (MRSA), vancomycin intermediate *Staphylococcus aureus* (VISA) and vancomycin resistant *Staphylococcus aureus* (VRSA)
- Extended spectrum β-lactamase (ESBL) producers
- Carbapenem resistant *Enterobacteriaceae* (CRE)
- Multi drug resistant *Acinetobacter baumannii* (MDR-Ab)
- Vancomycin resistant *enterococcus* (VRE)

Most infections caused by MDROs are hospital acquired and the most common mode of transmission is via the hands of healthcare workers. Due to increasing prevalence of MDROs observed in hospitals, limited antimicrobial options and the high cost of managing these infections, the prevention and control of MDROs has become a national priority where all healthcare facilities and personnel should take responsibility.

13.1.1 Control interventions

1. Administrative measures
2. Education and training of HCW
3. Judicious use of antimicrobial agents
4. MDRO surveillance
   a) Surveillance for MDROs isolated from routine clinical cultures
   b) Surveillance for MDROs by detecting asymptomatic colonization
5. Infection prevention and control (IPC) precautions
   a) Standard precautions
   b) Contact precautions
   c) Cohorting and other MDRO control strategies
6. Environmental measures
7. Decolonization

1. Administrative measures

- Make MDROs prevention and control, a patient safety priority within the hospital
- Provide financial support and human resources
- Collect epidemiological data and devise effective control strategies
- Implement systems to communicate information about MDROs to relevant personnel and provide updated feedback at least annually
- Implement a multidisciplinary process to monitor and improve the adherence of HCWs to standard and contact precautions

- Implement systems to identify patients colonized/ infected with a MDRO and to notify receiving healthcare facilities prior to transfer of such patients within or between facilities
- Support participation of the hospital in local, regional, and national programmes to combat MDRO problems

2. Education and training of HCW

- Provide education and training on risk and prevention of MDRO transmission during orientation and in-service training programmes for HCW

3. Judicious use of antimicrobial agents

- Promote optimal treatment of infections and appropriate antimicrobial use
- Implement multidisciplinary process to review antimicrobial utilization, local susceptibility patterns (antibiograms), and antimicrobial agents available in the institution to facilitate appropriate antimicrobial use
- Implement systems (e.g. computerized physician order entry, comments in antibiotic susceptibility reports) to prompt clinicians to use the appropriate antimicrobial agent/s and regimen for the given clinical situation
- Provide clinicians with antibiograms and analysis of current trends, updated at least annually, to guide antimicrobial prescribing practices
- Implement a process for appropriate review of prescribed antimicrobials. Prepare and distribute reports of findings to prescribers and provide suggestions for improving antimicrobial use

4. Surveillance

- Use standardized laboratory methods in microbiology laboratories to determine antimicrobial susceptibility of MDROs
- Ensure that laboratories promptly notify IPC team when a novel resistance pattern for that facility is detected
- Store isolates of selected MDROs for molecular typing when needed to confirm transmission or delineate the epidemiology of the MDROs within the hospital
- Prepare facility-specific and unit-specific (e.g. ICU, oncology unit) reports on antimicrobial susceptibility patterns and monitor for evidence of emergence or transmission of MDROs
- Monitor trends in the incidence of target MDROs in the facility over time using appropriate statistical methods

5. IPC precautions to prevent transmission of MDROs

- **Standard precautions** - follow during all patient encounters in all settings
  Refer Chapter 4
- **Contact precautions** - implement routinely for all patients infected or colonized with target MDROs

A. Patient placement

- Isolate patients with known or suspected MDRO colonization or infection in single rooms with en-suite toilet and shower facilities and hand wash sink where possible. Give highest priority to those patients who have conditions that may facilitate transmission, e.g. uncontained secretions or excretions, patients with diarrhoea or incontinence
- When single-patient rooms are not available, cohort patients with the same MDRO in 2, 4 or 6 bedded rooms or patient-care area. A toilet should be dedicated for infected patients
- If cohorting is not possible place patients with MDROs in rooms with patients who are at low risk for acquisition of MDROs and associated adverse outcomes from infection and are likely to have short lengths of stay. Contact IPC team for advice
- Documents including the patient's notes and charts should not be taken into an isolation room
- Only essential equipment and supplies should be taken into the room
- The door to the room should be kept closed unless it is likely to compromise patient care
- The appropriate signage should be placed on the outside of the door to alert HCWs of the need to apply contact precautions

B. Hand hygiene

- Adequate hand washing facilities and alcohol hand rub should be available for staff and visitors
- Hand hygiene should be performed using soap and water or alcohol hand rub on entering the room/bed space prior to touching the patient and again before or on exiting the isolation room or bed space and in other circumstances as outlined in the 'WHO 5 moments for hand hygiene'

  Refer Chapter 4.1

C. Personal protective equipment (PPE)

- PPE are required for potential contact with blood or body fluids. Gowns and gloves should be donned prior to entering an isolation room or bed space for all interactions that may involve contact with the patient or potentially contaminated areas in the patient's environment
- A surgical mask, protective eyewear and a disposable apron should be worn if there is a potential for generation of splashes or sprays of blood and body fluids
- Use masks when performing splash-generating procedures (e.g. wound irrigation, oral suctioning, intubation), when caring for patients with open tracheostomies and when there is evidence of transmission from heavily colonized sources (e.g. burn wounds)
- PPE should be removed on completion of a task and before leaving the patient's room or bed space
- Hand hygiene should be performed before donning and after removing PPE

  Refer Chapter 4.2

D. Visitors

- Visitors and staff from other wards and departments (e.g., physiotherapists, radiographers, other medical teams, students etc.) should only enter after getting permission and instruction from the nurse-in-charge
- An information sheet detailing contact precautions should be displayed prominently

E. Cleaning and decontamination of environment, patient-care equipment and linen

- Local policies for environmental cleaning and equipment decontamination, waste and linen management should be applied rigorously
- Instruments or equipment should preferably be single-use and disposable
- Multiple-patient-use items should be decontaminated appropriately before use on another patient, in accordance with local policy and manufacturer's instructions
- The room should be disinfected after the patient's discharge with a chlorine releasing agent (e.g. 0.1% hypochlorite) with special attention to frequently touched areas, horizontal surfaces and dust-collecting areas (e.g. ventilation grids). Curtains should be removed and laundered. Mattress covers should be checked for damage and disinfected.
- After an outbreak or incident of MDRO colonization or infection, the ward must be cleaned thoroughly to reduce environmental contamination
- All linen from patients infected with or colonized with MDRO should be considered as infected, including bedding and adjacent curtains. Linen should be removed from the bed with minimal agitation and should be further managed in accordance with local policy

  Refer Chapters 4.5, 4.6 and 4.7

F. Healthcare waste

- Local policies for waste management should be applied rigorously

  Refer Chapter 4.8

G. Patient movement and transport

- When a patient with an MDRO is transferred to another hospital, the receiving clinical staff should be informed of the patient's MDRO carriage status
- Unnecessary equipment and linen should be removed before transporting patients
- Patients on stretchers should be covered with a clean sheet before leaving the ward

- **Ambulance transportation**
  - Ambulance staff should adhere to standard precautions
  - To minimize the risk of cross infection, ambulance staff should use alcohol hand rub after contact with each patient
  - The ambulance service should be notified in advance of any infection risk, by the responsible ward staff

- The patient may travel with other patients, unless the patient is deemed at high risk of transmission of MDRO (e.g. diarrhoea, discharging lesions which cannot be covered with an impermeable dressing) or if the other patients requiring transport are especially vulnerable, e.g. immunocompromised or upon recommendation of the IPC team
- Ambulance staff should wear a single use disposable plastic apron and gloves and minimize patient contact where possible
- After transporting the patient, linen should be placed into a laundry bag and sent to the laundry
- Local areas of patient contact (e.g. chair, stretcher) should be cleaned and disinfected
- After patient contact, protective clothing and gloves should be removed and hands decontaminated using alcohol hand rub
- Fumigation and prolonged airing of the ambulance is not necessary

H. Deceased patients

- The IPC precautions for handling the dead body are the same as those used in life
- Any lesions should be covered with impermeable dressings. Plastic body bags are not necessary

6. Environmental measures

- Clean and disinfect surfaces and equipment that are in close proximity to the patient (e.g. bed rails, over bed tables) and frequently-touched surfaces in the patient care environment (e.g. doorknobs, light switches, tap handles) on a more frequent schedule compared to that for minimal touch surfaces
- Prioritize room cleaning of patients on contact precautions

7. Decolonization

- Currently, there are no recommended regimens available for the routine decolonization of patients harbouring MDRO other than MRSA
  Refer Chapter 13.2

13.1.2 Intensified interventions to prevent MDRO transmission

- These should be implemented when incidence or prevalence of MDROs are not decreasing despite implementation of and correct adherence to the routine control measures described above or when an outbreak of an epidemiologically important MDRO (e.g. VRE, MRSA, VISA, VRSA, MDR-GNB) is identified within a healthcare facility or unit
- A risk assessment of the situation should be carried out along with an evaluation of the measures already in place.
- Implement additional interventions and continue to monitor the incidence of target MDRO infection. If rates do not decrease, implement more interventions as needed to reduce MDRO transmission

1. Administrative measures

- Evaluate healthcare system factors for their role in creating/sustaining transmission of MDROs, including: staffing levels, education and training, availability of consumable and durable resources, communication processes, policies and procedures, and adherence to recommended IPC measures (e.g. hand hygiene and standard/contact precautions)
- Develop, implement, and monitor action plans to correct system failures
- Update healthcare providers and administrators on the progress and effectiveness of the intensified interventions and action plans to improve

2. Enhanced educational interventions

- Intensify the frequency of MDRO educational programs for HCWs including cleaning staff, especially those who work in areas where MDRO rates are not decreasing. Provide individual or unit-specific feedback

3. Judicious use of antimicrobial agents

- Review the role of antimicrobial use in persistence of MDRO problem. Control and improve antimicrobial use as indicated. Antimicrobial agents that may be targeted include vancomycin, third-generation cephalosporins, quinolones and carbapenems

4. Surveillance

- Obtaining active surveillance cultures (ASC) to detect colonizers should be considered depending on the available resources
- Consider obtaining ASC for targeted MDROs from patients in populations at risk (e.g. patients in ICU, burn, bone marrow/stem cell transplant, and oncology units; patients transferred from facilities with high MDRO prevalence rates, and patients known to have been previously infected or colonized with a MDRO)
- Calculate and analyze prevalence and incidence rates of targeted MDRO infection and colonization in populations at risk
- Conduct culture surveys to assess the efficacy of the enhanced MDRO control interventions
- Obtain cultures of HCWs for target MDRO when there is epidemiological evidence implicating the HCW as a source of ongoing transmission

5. Enhanced IPC precautions

- Use of contact precautions
  - Implement contact precautions routinely for all patients colonized or infected with a target MDRO
  - Don gowns and gloves before or upon entry to the patient's room or cubicle
  - When ASC are obtained, implement contact precautions until the surveillance culture is reported negative for the target MDRO
- Implement policies for patient admission and placement
  - When transmission continues despite adherence to standard and contact precautions and isolation or cohorting patients, assign dedicated nursing and ancillary service staff to the care of patients with MDROs only

- Stop new admissions to the unit if transmission continues despite the implementation of enhanced control measures described above. This decision should be taken by senior hospital management on the advice of the IPC team or outbreak management team, as the last resort

6. Enhanced environmental measures

- Dedicate noncritical medical items (e.g. stethoscope, blood pressure cuff) to use on individual patients known to be infected or colonized with MDROs
- Assign dedicated staff to targeted patient care areas to enhance consistency of proper environmental cleaning and disinfection
- Monitor (i.e. supervise and inspect), audit and give feedback on cleaning performance
- Obtain environmental cultures (e.g. surfaces, shared medical equipment) when there is epidemiological evidence that an environmental source is associated with ongoing transmission of the targeted MDRO
- Vacate units for environmental assessment and intensive cleaning when previous efforts to eliminate environmental reservoirs have failed

Reference

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13.2 METHICILLIN RESISTANT *Staphylococcus aureus*

Introduction

Methicillin resistant *Staphylococcus aureus* (MRSA) is resistant to many beta lactam antibiotics, including penicillins, cephalosporins (except for 5th generation cephalosporin: ceftaroline and carbapenems. Similar to methicillin-sensitive strains of *S. aureus* (MSSA), MRSA can colonize skin, mucous membranes and skin lesions in patients and HCWs. It causes infection in susceptible patients. Compared to MSSA infections, MRSA infections are difficult and costly to treat.

13.2.1 Transmission of MRSA

- **Contact spread**
  - **Hands** – transient hand carriage by HCW is the most likely route of spread from patient to patient.
  - **Skin conditions** – eczemas, dermatitis, psoriasis or cuts and wounds of HCW can harbour and transmit the bacterium. Paronychia in HCWs could also be a source of infection to patients.
  - **Equipment** – MRSA can spread when incorrectly decontaminated equipment are used between patients.

- **Transmission may less frequently occur through**
  - **Dispersed skin scales** of patients or HCW infected/colonized with MRSA
  - **Droplets** generated by patients infected/colonized with MRSA in the lower respiratory tract, during coughing or respiratory procedures

13.2.2 Prevention and control of MRSA transmission

Contact precautions should be taken to prevent MRSA transmission.

Refer Chapter 5 and Chapter13.1

- **Isolation**
  - Isolate ideally in an en-suite single room. Explain the reason for isolation to the patient
  - The door of the room should be kept closed, especially during procedures like physiotherapy, wound dressing and bed making
  - When isolation in a single room is not possible, patients harbouring MRSA could be cohorted in a corner of the ward (cohort isolation), ideally away from patients with invasive devices such as catheters and IV infusions
  - Other patients in the cubicle must not be pre- or post-operative or have invasive devices in-situ
  - A dedicated hand-washbasin should be available for these patients
  - These patients require a dedicated toilet and bathroom facilities
  - Any lesion from which MRSA is isolated should be covered with a clean dressing
  - Continue isolation until 3 consecutive sets of negative swabs obtained 48 hours apart. There should be at least 24 hours between each set of swabs

- **Barrier nursing**
  - One nurse should be allocated for the patient or the cohort
  - Strict hand washing practices should be adhered to before and after attending to patients. Soap and running water should be available
  - Do not enter room unnecessarily
  - Clean gloves and gowns should be worn by the staff attending to the patient
  - Discard used gloves and gowns into a bin within the isolation area
  - Masks are not indicated (except for the procedures producing aerosols such as chest physiotherapy, suctioning, bronchoscopy, wound dressings or when attending to patients with infected sputum)
  - Do not lean on to/touch bed, furniture etc.
  - While handling MRSA patients, HCW should avoid direct contact with other patients

- **Equipment**
  - A dedicated stethoscope, thermometer, blood pressure cuff etc. should be kept in the room or isolation area and cleaned appropriately after use
    Refer Chapter 4.5

- **Linen**
  - Linen should be managed as infectious linen
    Refer Chapter 4.7

- **Environmental cleaning and disinfection**
  - Isolation room/area should be cleaned daily, including bed, bedside cupboard, table and floor. Mop/wipe with 0.1 % hypochlorite. Disinfect the metal surfaces with 70% alcohol - *Refer Chapter 4.6*

- **Movements**
  - As far as possible minimize patient visits to other units/departments. If visiting another unit such as physiotherapy or radiology, inform beforehand to take necessary precautions, such as hand hygiene, wearing gloves and aprons

- **Transfers**
  - MRSA patients should not be transferred to other wards or hospitals without informing the IPC team and the ward or hospital concerned
  - MRSA status should be clearly indicated in the transfer form/bed head ticket
  - Patients colonized with MRSA but no longer required to be hospitalized can be discharged

- **Medical records**
  - Medical records of affected patients should be flagged according to hospital policy

- **Visitors**
  - Restrict visitors
  - Patients should be informed that there is no risk to healthy relatives and friends

- Visitors do not need protective clothing if they do not involve in patient care
- Sitting on the patient's bed should be strictly prohibited
- Visitors should wash their hands before leaving the patient's room
- Bystanders assisting the patient should wash hands with soap and water, and ideally, wear gloves and gowns. Designated bystanders should not attend to other patients and should restrict their movements

- **Staff screening**
  - This is confined to MRSA outbreaks. Instructions should be obtained from IPC team regarding screening

13.2.3 Patient management

Treatment

- Patients infected with MRSA should be treated with relevant antibiotics guided by an antibiotic sensitivity test

Screening

- Patients should be screened for colonization as follows:
  - Nose – both nostrils swabbed with one swab
  - Perineum/groin – both sides swabbed with one swab
  - Axilla – both axillae swabbed with one swab
  - Throat swab
  - Swabs from any wounds or open lesions
  - Any line sites
  - Urine from patients with indwelling urinary catheters
- Swabs are moistened with sterile saline before obtaining specimen.

Decolonization

- The microbiologist should be consulted before instituting decolonization protocol
- Colonized patients should undergo a 5-day MRSA decolonization protocol
  - Daily baths with 4% chlorhexidine in detergent solution is recommended. (Alternatively, 7.5% povidone-iodine, 0.1% octenidine or bleach baths can be used)
    - The skin should be moistened and the undiluted 4% chlorhexidine applied thoroughly to all parts of the skin before rinsing in the bath or shower
    - A disposable sponge or flannel should be used to apply the antiseptic solution and discarded after use
    - Special attention should be paid to sites such as axillae, groin, perineum and buttock areas and other skin folds
    - Solution should be left on the skin/hair for at least 30 seconds before rinsing and should not be vigorously scrubbed off. Avoid contact inside the ear canals and eyes
    - After bath, dry patient with a clean towel. Change towel daily
  - Wash hair with 4% chlorhexidine followed by normal shampoo daily (at least on days 1, 3, 5)

- Apply 2% mupirocin nasal ointment to anterior nares three times a day. A match-head size portion of ointment/cream to be applied to each nostril using a disposable cotton swab. Alternatively, chlorhexidine cream, neomycin/chlorhexidine cream or povidone iodine cream can be used
- Apply 2% mupirocin on colonized or infected skin lesions (avoid use on deep/extensive wounds)
- Change personal clothing and bed linen daily
- After 5 days, stop decolonization procedure
- Repeat screening 48 hours after completing decolonization protocol. If patient has had antibiotics for MRSA re-screen 48 hours after completing the treatment
- If patients are having skin lesions, continue body wash daily for at least five days and then revert to once or twice a week when lesions are controlled

Decolonization of MRSA in children

- Colonized children should undergo 5-day MRSA decolonization protocol
  - Daily baths with 0.1% octenidine or 4% chlorhexidine (do not use 4% chlorhexidine in children less than 2 months of age)

Discharging an MRSA patient

- MRSA is not a contraindication for discharging or the transferring the patient to another healthcare facility. The other healthcare facility involved in the patient's care must be informed that the patient has MRSA
- When discharging an MRSA positive/decolonized patient, write on the diagnosis card- "MRSA positive patient–on admission, isolate and inform IPC team for screening"

Readmitting an MRSA patient

- On readmission isolate the patient and inform IPC team

References

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13.3 MENINGOCOCCAL INFECTION

Introduction

Neisseria meningitidis can cause life threatening infections. Therefore, if a patient with suspected or confirmed meningococcal infection is admitted to a ward, health care workers (HCWs) should adhere to strict infection control measures to prevent transmission of infection. As the infection is transmitted by droplets, droplet precautions should be taken in addition to standard precautions. Incubation period is 3-4 days, with a range of 2-10 days.

13.3.1 Infection prevention and control (IPC) measures

If a patient is suspected/confirmed of having meningococcal infection:

- Isolate the patient in a separate room. If such a room is not available, spatial separation of ≥3 feet and drawing a curtain between patient beds is advised
- Those who attend to the patient should wear standard surgical masks
- Use an N95 mask if performing an aerosol generating procedure such as suctioning, intubation or physiotherapy
- Strict IPC measures should be followed specially until 24 hours of antibiotic treatment is completed
- Inform IPC team
- Fill the notification form and arrange to inform the Epidemiology Unit

13.3.2 Prevention of secondary cases

- **Post exposure chemoprophylaxis**
  - The rate of secondary disease in close contacts is highest immediately after onset of disease in the index patient. Therefore, antimicrobial chemoprophylaxis should be administered as soon as possible (ideally within 24 hours of exposure)
  - Chemoprophylaxis is not useful if more than 14 days have elapsed since last contact with the index case
- **Who should receive chemoprophylaxis?**
  - The information should be collected about the patient's contacts during the 7 days prior to the onset of illness and until the patient has had 24hours of appropriate antibiotic therapy
  - Chemoprophylaxis is indicated for all "close contacts" defined by,
    - Those who have had prolonged contact in close proximity (<3 feet) to the patient or those who have been exposed to patient's oral/respiratory secretions (e.g. mouth-to-mouth resuscitation, suctioning, intubation or physiotherapy)
    - Household members living with the patient, people who are in intimate contact or sleeping in the same bedroom with the patient
    - Passenger seated directly next to an index patient during travel lasting ≥ 8 hours
    - Childcare staff and children who had been in the same care group for two/more full days (or a cumulative period of around 20 hours) and anyone exposed to oral secretions e.g. kissing (chemoprophylaxis is not usually indicated for school contacts, transportation or office contacts unless they meet the criteria for close contact)

- Systemic antimicrobial therapy of meningococcal disease with agents other than third-generation cephalosporins might not reliably eradicate nasopharyngeal carriage of *N. meningitidis*. Therefore, if other agents have been used for treatment, the index patient should receive prophylactic antibiotics for eradication of nasopharyngeal carriage before being discharged from the hospital

13.3.3 Antibiotics used for chemoprophylaxis

- Ciprofloxacin (oral)
  - Adults: 500mg stat
  - Children: 2-5years - 125mg stat
    5-12yrs - 250mg stat
    12-18 years - 500mg stat
- Rifampicin (oral) - This may be used as an alternative to ciprofloxacin
  - Adults: 600 mg 12 hourly for 2 days
  - Children: Age appropriate dose should be given 12 hourly for 2 days
    Neonate-1year - 5mg/kg
    1-12 years - 10mg/kg (max 600mg)
    12-18 years - 600mg

  Contraindications - Rifampicin is not recommended in pregnancy and in liver disease. It interacts with many other drugs e.g. oral contraceptives, anticoagulants, antidiabetics, steroids and propranolol.
- Ceftriaxone
  Suitable for pregnant women and people for whom rifampicin and ciprofloxacin are contraindicated. It is given as a single I.M. injection.
  - Adults and children over 12 years: 250 mg IM
  - Children1 month to 12 years: 125 mg IM

13.3.4 Meningococcal vaccine

- Quadrivalent vaccine can be given to unvaccinated contacts of patients with infection caused by a non-B serogroup
- If two or more cases of serogroup B disease occur within the same family vaccination against serogroup B should be offered to all household contacts
- However, sero-grouping is not currently available in Sri Lanka
- Laboratory workers who routinely work with meningococcal isolates should receive meningococcal vaccine

References

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13.4 INVASIVE GROUP A STREPTOCOCCAL INFECTION

Introduction

Group A streptococci can cause severe invasive infections. The organism spreads by close contact between individuals through respiratory droplets, direct skin contact and contact with contaminated objects such as towels or beddings. Hospital outbreaks of group A streptococcal (GAS) infection can be devastating and occasionally result in the death of previously well patients.

13.4.1 Case definitions

- Invasive group A streptococcal (iGAS) infection
  Illness associated with the isolation of GAS from a normally sterile body site, such as blood, cerebrospinal fluid, joint aspirate, pericardial/peritoneal/pleural fluids, bone, endometrium, deep tissue or abscess at operation or post mortem.

- Severe GAS infections
  GAS has been isolated from a normally non-sterile site in combination with a severe clinical presentation, such as streptococcal toxic shock syndrome (STSS) or necrotizing fasciitis.

- Peri-partum GAS infection
  Isolation of GAS up to 7 days post discharge or delivery in the mother in association with a clinical infection, such as endometritis, STSS, wound infection, or isolation from a sterile site.

13.4.2 Infection prevention and control (IPC) measures

13.4.2.1 Basic recommendations

- **Surveillance**
  - Implement and sustain a good laboratory-based surveillance
  - Following a case of healthcare-associated GAS infection the IPC team should consider prospective enhanced surveillance which may include, sampling of infected wounds of patients in the vicinity of the index case or who are being cared for by the same health care workers (HCWs)

- **Contact precautions**
  - **Patient Isolation**
    - Patients or a suspected patient with iGAS should be isolated for a minimum of 24 hours of effective antibiotic therapy
    - Cases of necrotizing fasciitis and other cases where there is significant discharge of potentially infected body fluids or high risk of shedding (e.g. mothers and neonates on maternity units and patients on burns units) and where there is a tendency to spread in overcrowded areas, should be isolated until culture negative

- **Personal protective equipment (PPE)**
  - HCWs should wear PPE including disposable gloves and aprons when in contact with the patients or their equipment and the immediate surroundings
  - Breaks in the skin must be covered with waterproof dressings
  - Fluid repellent surgical masks with visors must be used at operative debridement/change of dressings of patients with necrotizing fasciitis and for procedures where droplet spread is possible (e.g. bronchoscopy, suctioning or dressing wounds that are producing a large amount of exudate)
  - Visitors should be offered suitable information regarding IPC precautions and relevant PPE following a risk assessment of the visitor's level of direct contact/involvement in the affected person's care
  - Visitors should be provided with the facilities to be able to adhere to IPC practices

    Refer Chapter 4.2

- **Hand hygiene**
  - Adhere to hand hygiene recommendations

    Refer Chapter 4.1

- **Environmental cleaning**
  - The isolation room, furniture, and equipment should be disinfected with 0.1% hypochlorite (1000 ppm) daily
  - Only washable furniture should be used in the isolation room/area
  - Communal facilities such as baths, bidets and showers should be cleaned and decontaminated between each patient especially in delivery suits, post-natal wards and other high-risk areas, such as burns units

- **Linen and waste**
  - Since the patient is considered infectious, linen and waste must be handled as infectious

    Refer Chapter 4.7 and Chapter 4.8

- **Transferring patients**
  - Transfer only if unavoidable or essential for the patient's care
  - Details of the risk of infection must be communicated to the IPC team, ambulance service and the receiving facility

13.4.2.2 Special recommendations

- **Infections occurring in mothers and babies**
  - Babies born to infected/colonized mothers are detected by umbilical, ear, and nasal swab cultures
  - Antibiotics should be administered to mother and baby, if either develops suspected or confirmed iGAS disease in the neonatal period. Pregnant women infected or colonized with GAS prior to admission should be treated and have this clearly documented in the patient's notes
  - Mother and baby should not be separated unless the mother or baby requires admission to an ICU

- **Management of close contacts**
  - Antibiotics should not be routinely administered to contacts of GAS cases
  - Close contacts of iGAS cases should be informed of the signs and symptoms of GAS to turn up for treatment, if they develop symptoms within 30 days of exposure to the index patient
  - Communication and advice to close contacts
    - Relevant information should be provided promptly to the patient and close personal contacts
    - Proper documentation should be maintained

- **Prevention of transmission**
  - Transmission is minimized by adhering to standard and contact precautions
  - Antibiotic prophylaxis should be considered for HCWs who sustain a needlestick injury or direct contamination of mucous membranes or breaks in the skin with potentially infectious material
  - All HCWs in contact with the patient, either in direct contact or working in the close vicinity (patient's bed space), should be considered as possible sources of healthcare-associated GAS
  - HCWs in contact with a case of healthcare associated GAS infection should be considered for screening if they have suffered a sore throat or skin infection, or have had skin lesions/dermatitis/eczema, vaginitis or pruritus ani within seven days of the onset of the infection in the patient. If so, the relevant swabs should be taken from the HCW
  - Ideally isolates from positive swabs should be sent for typing along with the patient isolate (typing is currently not available in Sri Lanka)
  - The IPC team may decide to screen asymptomatic HCW in certain circumstances
    - Those present in operating theatres and performing post-operative dressing changes on surgical cases
    - Those performing vaginal examinations or dealing with episiotomies and those present at deliveries for maternity cases
    - If there is a strong epidemiological link with the outbreak cases with the HCW

- **Communication and advice to mortuary and pathology staff**
  - In the event of death, the hospital mortuary staff should be informed of the risk of infection and routes of transmission
  - Pathology staff should be informed when tissue from a case of necrotizing fasciitis is sent for examination

13.4.3 Management of an outbreak of GAS infection

An outbreak should be considered if there are two or more cases of suspected GAS infection related by person or place. These cases will usually be within a month of each other but the interval may extend to several months.

Steps of management include:

- Formation of outbreak control team
- Epidemiological investigation
- Screening of HCWs
    - Initial HCW screening should include throat and skin lesions. Other sites known to be implicated in transmission are nose, anus, and vagina, and screening of these sites is advised when a HCW is implicated in transmission and throat and skin lesions are negative
- Screening of patients
- Environment as source of outbreak
    - The method and frequency of cleaning and decontamination of equipment and relevant ward areas should be reviewed
    - Environmental sampling
- Use of chemoprophylaxis
    - Recommendations for chemoprophylaxis should be made by the outbreak control team on a case by case basis
- Communication strategy
    - Patients, close contacts and HCWs should be provided with clear, concise information about the outbreak. Information should be provided to relevant HCWs to encourage heightened awareness of the symptoms of GAS infection, to take specimens from symptomatic patients, give early treatment where GAS infection is suspected, and promptly notify the outbreak control team
- Management of colonized and infected HCWs and patients
- Eradication of carriers

  Refer Chapter 10

13.4.4 Management of colonized and infected healthcare workers

- Eradication of carriage
    - HCW contacts who have been screened and found to be positive for GAS should receive eradication therapy. Clearance screens should be taken 24 h after completing treatment, and again at 1, 3, 6, and 12 weeks following the end of treatment
    - Pharyngeal carriage: Treatment options include,
        - Oral penicillin (500 mg four times a day for 10 days) or amoxicillin (500 mg three times a day for 10 days)

        - Clindamycin (300 mg four times a day for 10 days) or azithromycin (maximum dose of 500 mg once a day for 3 days) should be used for eradication of throat carriage in cases where first-line therapy with penicillin has been unsuccessful
    - Non-pharyngeal carriage: Penicillin treatment alone may not be sufficient. Treatment options include clindamycin 300 mg four times a day for 10 days, or azithromycin 12 mg per kg per day (maximum 500 mg once a day) for 5 days
- Failure of eradication
    - Persistent or recurrent GAS colonization may indicate re-colonization within the household. Screening of household contacts should be considered in such circumstances
- Length of exclusion from work
    - HCWs with symptomatic or asymptomatic GAS pharyngitis should stay away from clinical work until at least 24 hours of appropriate therapy and resolution of symptoms
    - A longer period of time may be required for HCWs with skin lesions or in other circumstances where carriage has been linked to an outbreak or confirmed transmission

Reference

- Steer, J.A., Lamagni, T., Healy, B., Morgan, M., Dryden, M., Rao, B., Sriskandan, S., George, R., Efstratiou, A., Baker, F. and Baker, A., 2012. Guidelines for prevention and control of group A streptococcal infection in acute healthcare and maternity settings in the UK. Journal of Infection, 64(1), pp.1-18.

13.5 GROUP B STREPTOCOCCAL DISEASE IN NEONATES

Introduction

Group B streptococci (GBS) are normal inhabitants of the human gastrointestinal tract and are also part of the normal vaginal flora in approximately 10-30% of adult women. It is one of the leading causes of early-onset neonatal sepsis in Sri Lanka and in the world.

Infections in newborns occurring within the first week of life are designated as early-onset disease. Late-onset infections occur in infants aged more than 1 week, with most infections evident during the first 3 months of life.

13.5.1 Recommendations for intrapartum prophylaxis

- A risk-based approach has been used in this guideline
- Intrapartum antibiotic prophylaxis should be given if the following risk factors are present
  - Amniotic membrane rupture ≥18 hours
  - Intrapartum temperature ≥100.4 ºF (≥38.0 ºC)
  - Preterm labour with pre-labour rupture of membranes
  - History of GBS disease/colonization
    - Having a previous infant with invasive GBS disease
    - GBS bacteriuria during any trimester of the current pregnancy
    - GBS detected in vaginal/rectal swabs in current pregnancy after 35 weeks of POA/at the time of delivery (if carrier state detected before 35 weeks of POA, screening for GBS is recommended at 35-37 weeks/at delivery)
- Conditions not requiring intrapartum prophylaxis
  - Elective caesarean section (no labour, no rupture of membranes) irrespective of carriage of GBS or gestational age
  - Maternal GBS colonization in previous pregnancy
- The antimicrobial agents and duration of intrapartum prophylaxis
  - Benzyl penicillin 3g (5mu) IV loading dose followed by 1.2g (2mu) IV 4 hourly or ampicillin 2g IV loading dose followed by 1g IV 4 hourly until delivery is recommended
  - In immediate penicillin hypersensitivity, clindamycin 900 mg IV 8 hourly or vancomycin 1g IV 12 hourly until delivery, can be substituted. To optimize the efficacy, the antibiotics should be given at least 2 hours prior to delivery
  - If chorioamnionitis is suspected, broad-spectrum antibiotic therapy including an agent active against GBS should replace GBS-specific therapy (Refer National Antibiotic Guideline, 2016)

13.5.2 Other infection control measures

- Mothers should not handle babies other than their own, in the neonatal unit/ward
- Neonatal unit staff should adhere to standard precautions (hand hygiene before and after patient contact, wearing disposable aprons when carrying infected babies)
- Barrier nursing should be carried out for infected babies

- If GBS infection has been diagnosed in 2 or more infants older than 7 days or if there is evidence of spread from an index case in the same location, following additional infection prevention and control (IPC) measures should be taken:
  - All staff must adhere to hand hygiene before and after patient contact and between patients
  - Babies in the unit should be screened for GBS colonization by culturing throat, ear, perineal and umbilical swabs, as directed by the IPC team
  - Colonized or infected infants should be cohort nursed with dedicated staff. Only babies with infection need antibiotic treatment

References

- McGee, L., Schrag, S. and Verani, J.R., 2010. Prevention of perinatal Group B streptococcal disease; revised guidelines from CDC, 2010.
- Osvald, E.C. and Prentice, P., 2014. NICE clinical guideline: antibiotics for the prevention and treatment of early-onset neonatal infection. Archives of Disease in Childhood-Education and Practice, 99(3), pp.98-100.
- Royal College of Obstetricians and Gynaecologists, 2012. Group B Streptococcal Disease, Early-onset (Green-top Guideline No. 36).
- Sri Lanka College of Microbiologists in collaboration with Sri Lanka College of Obstetricians & Gynecologists, 2016. Pregnancy related infections in Empirical and Prophylactic Use of Antimicrobials, National Guidelines of Sri Lanka.

13.6 TUBERCULOSIS

Pulmonary tuberculosis (PTB) is an airborne infection caused by *Mycobacterium tuberculosis*. Patients with sputum smear microscopy positive for acid fast bacilli (AFB) carry a greater risk of transmission of infection to the others.

13.6.1 Three-level hierarchy of tuberculosis infection prevention and control measures

1. Administrative controls
2. Environmental controls
3. Respiratory protective controls

1. Administrative controls

- Develop a policy to triage and manage presumptive PTB patients
- The triage procedure should be conducted by a responsible person (e.g. a trained nurse) to identify potentially infectious patients at the outpatient department (OPD)/ETU of hospitals and district chest clinics
- Provide advice on cough etiquette and respiratory hygiene. Offer surgical masks for patients having cough for more than 2 weeks and any other symptoms suggestive of PTB
- Presumptive PTB patients should be evaluated promptly by the medical officer. If there is a delay, patients should be kept in an isolation room or in a well-ventilated area
- After being evaluated by the medical officer, presumptive PTB patients should be sent to a designated cough area to collect the sputum sample for TB screening tests
- Refer patients with bacteriologically confirmed PTB to the relevant treatment facility promptly and ensure registration for appropriate treatment and follow up
- Provide surgical masks to diagnosed patients and ask them to continue wearing surgical masks until they have had at least 2 weeks of treatment
- Maintain a presumptive TB register in OPD areas and a register of TB patients diagnosed and notified at facility level in the IPC unit of the hospital

2. Environmental controls

- Physical separation of PTB patients or people suspected of having PTB, requires rational designing, construction or renovation of buildings
- In general settings with open PTB patients, natural ventilation is the preferred method for ensuring an adequate air exchange. Position windows and doors in opposite walls of wards and rooms. Keep windows and doors open to maximize cross ventilation. Maintain openings in or above entrance doors to improve cross ventilation where doors cannot be left open
- When natural ventilation alone cannot provide sufficient ventilation rates, place exhaust fans strategically to obtain adequate dilution. Consider installation of wind driven extraction fans such as “Whirly Birds” or electric extractor fans to ensure that air within the facility is removed effectively
- If patients with smear positive PTB need to be admitted to the hospital, they should be isolated, preferably in a single room with airborne isolation precautions

- The aerosol-generating procedures (AGPs) such as bronchoscopy, sputum induction or nebulization in people who are diagnosed or suspected to have PTB should be carried out in an appropriately engineered and ventilated area

3. Respiratory protective controls

- Healthcare workers (HCWs) should use fit tested particulate filter respirators (PFR e.g. N95 masks) in situations where there is an increased risk of transmission, such as AGPs
- Keep a register on fit test results (name, date of fit test, results, respirator type and size, batch number of the respirator, date of next yearly test)
- Select and procure different models/sizes of respirators in adequate amounts to ensure an uninterrupted supply
- Train staff on when and how to wear and how to wear the respirators safely
- Put up signs at the entrance to indicate high risk areas and to remind staff to wear respirators before entering the area

13.6.2 General IPC precautions

- IPC precautions in PTB should be taken during the first 2 weeks after starting effective anti TB treatment and until the sputum microscopy becomes negative for AFB
- Patients with suspected/confirmed respiratory tuberculosis, regardless of the sputum status, should not be admitted to an open ward having immuno-compromised patients and transplant/oncology patients until declared non-infectious by the physician in-charge, preferably in consultation with the microbiologist
- Minimize the duration of hospital stay
- Patients should wear a surgical mask for 2 weeks after starting treatment and whenever they leave the room for an essential medical care
- Isolation of patients
    - Isolate in a single room with negative air flow ventilation in relation to the surrounding areas. If this is not available, a room with two strong exhaust fans could be used. Alternatively, a single room with good ventilation may be used
    - Room should have a washbasin and an attached toilet
    - The door must be kept closed at all times (preferably self-closing doors)
    - Ensure adequate supply of hand wash, antiseptics and single use towels
    - An infectious waste bin lined with a yellow bag should be kept inside the room
    - Whenever possible, provide the patient with a disposable cardboard sputum mug (spittoon) with an inner polythene lining and a fitting lid. It should be disposed of by incineration, burning or deep burial after disinfecting with 5% phenolic disinfectant or 1% hypochlorite for 30 minutes. If disposable mugs are not available, a reusable (plastic or stainless steel) mug should be provided. Disinfect the mug before washing with GPD
    - Visitors should be restricted, as far as possible
    - Babies of sputum positive mothers need not to be separated from the mothers and breast feeding should be continued with baby on prophylactic INAH therapy, with mother wearing a mask
    - Contact with staff should be kept to a minimum without compromising patient care

Refer Chapter 5 and Chapter 7.11

- Protective clothing for HCWs
  - Gloves are not usually necessary, but should be worn for contact with respiratory secretions or contaminated articles
  - Plastic aprons and gowns should be worn for contact with patients and their environment to avoid contamination of clothing
  - HCWs should use fit tested particulate filter respirators (PFR e.g. N-95 masks) particularly for AGPs e.g. during bronchoscopy, sputum induction and autopsy of suspected or confirmed cases of tuberculosis. Ordinary surgical masks do not provide the required level of protection
- Hand hygiene
  - Adhere to five moments of hand hygiene. Hands must be washed after touching the patient or potentially contaminated articles and before taking care of another patient
  - Wash hands thoroughly and dry with a single use towel
- Equipment
  - Ideally, disposable respiratory equipment and accessories should be used
  - Where this is not possible, they should be thoroughly cleaned and disinfected or sterilized before reuse - *Refer Chapter 4.5*
- Movements
  - Limit movements of patients within the hospital to a minimum e.g. to X-ray department
- Contact tracing
  - Contact tracing is an integral part of the routine management of the patients with tuberculosis. Presumptive or confirmed TB cases should be notified by 816A form to IPC unit by the relevant medical officer. IPC unit should send the notification to National Programme for Tuberculosis and Chest Diseases (NPTCCD)

References

- Guideline on Infection control in Tuberculosis prepared by National Tuberculosis Control Programme. (in print).
- Jensen, P.A., Lambert, L.A., Iademarco, M.F. and Ridzon, R., 2005. Guidelines for preventing the transmission of Mycobacterium tuberculosis in health-care settings, 2005.
- National Institute for Health and Care Excellence, 2016. Tuberculosis: NICE Guideline NG33.
- National Manual for Tuberculosis Control, National Programme for Tuberculosis Control and Chest Diseases, 2016. Ministry of Health, Sri Lanka
- World Health Organization, 2009. WHO policy on TB infection control in health-care facilities, congregate settings and households (No. WHO/HTM/TB/2009.419). World Health Organization.

13.7 INFLUENZA AND OTHER RESPIRATORY VIRAL INFECTIONS

Introduction

The viruses that are commonly responsible for respiratory tract infections include Influenza viruses [e.g. Influenza A (H1N1), Influenza A (H3N2) and Influenza B], Respiratory Syncytial virus, Adeno virus, Parainfluenza virus, Human Metapneumo virus, and Corona viruses (e.g. SARS-CoV-1, MERS-CoV, SARS CoV-2). Some of these viruses cause outbreaks, epidemics or pandemics.

Case definition

An individual presenting with a febrile illness (fever >38°C) with the spectrum of respiratory symptoms ranging from influenza like illness (cough, sore throat, rhinorrhoea) to pneumonia with onset within previous 10 days.

Reservoirs of infection in healthcare settings

Patients with clinical or subclinical infections/carriers.

Mode of transmission

- Droplet (droplet nuclei ≥5µm)
- Contact- direct or indirect
- Airborne spread (droplet nuclei <5µm) - during aerosol generating procedures (AGPs)
  - Endotracheal intubation, extubation
  - Manual ventilation and open suctioning of airways
  - Cardiopulmonary resuscitation
  - Bronchoscopy
  - Surgery and post mortem procedures in which high-speed devices are used
  - Non-invasive ventilation (NIV) e.g. BiPAP/ CPAP
  - High frequency oscillatory ventilation (HFOV)
  - Induction of sputum

Patients at high risk of developing severe disease due to influenza virus

- Pregnancy (including up to two weeks postpartum)
- Age ≥ 65 years
- Children <2 years
- Chronic cardiac, pulmonary, renal, hepatic or neurological disease
- Diabetes mellitus
- Immunosuppression
- Morbid obesity (BMI ≥40)

13.7.1 Infection control precautions in the hospital

- Standard, droplet and contact precautions should be adhered to at all times
- Airborne precautions should be practised when performing AGPs

In the OPD

- Separate area and a queue for patients with flu-like symptoms
- Facilities for proper disposal of tissues/wipes
- Well ventilated room in the OPD to examine patients
- PPE for HCW e.g. surgical mask, gloves
- Hand washing/alcohol hand rub
- Health education of patients in the OPD to minimize spread
- Instruct patients to practice respiratory hygiene and cough etiquette (some patients may need assistance)
    - Cover coughs and sneezes (with single use tissue or with the inner surface of the arm or forearm)
    - Encourage to use disposable, single use tissues
    - Dispose of tissues into the bin for infectious waste promptly
    - Hand wash after coughing/sneezing/using tissues
    - Spatial separation of persons with acute respiratory symptoms

If the patient is admitted to the hospital

- Standard precautions/contact precautions for HCW
    - Hand hygiene (wash hands well with soap and water before and after attending to the patient)
    - Respiratory hygiene and cough etiquette
    - Use PPE
        - Surgical face mask when entering a cohort area – masks disposed inside patient room >1m from patient
        - PPE are not a substitute for good hand hygiene
    - HCW suspected/confirmed – should not attend to patients during the infectious period
    - Stethoscope, thermometers, nebulizer masks and other equipment should be used for a single patient as far as possible without sharing between patients. These should be cleaned and disinfected after each use - *Refer Chapter 4.5*
    - Follow proper infection control practices and procedures for cleaning of patient care equipment/environment/linen/utensils and for proper waste disposal
      Refer Chapters 4.5, 4.6, 4.7
- Droplet precautions
    - Single room/cohort isolation - care for symptomatic patients should be organised in a separate area in the ward. Patients who are in labour, organise a separate area in the labour room
    - Provide disposable, splash proof surgical mask to the patient
    - Patients spacing (>1 meter apart)
    - Privacy curtains
    - Restrict entry of personnel/visitors to the patient area

  - Limit transport and movement
  - During transport: a surgical mask on the patient reduces environmental contamination
  - Instruct patients to practice respiratory hygiene and cough etiquette
- Airborne precautions
  - AGP should be performed only when essential
    - Minimum number of HCWs should be involved in the procedure
    - Should be performed in a well-ventilated single room with the doors closed
    - N-95 masks, impermeable gown, gloves and eye protection to be used by all HCWs attending the procedure
    - Environment/equipment should be cleaned after the procedure
    - Visitors should be limited during the procedure
  - Educate staff, bystanders and patients regarding personal hygiene, frequent hand washing, covering the nose and mouth while sneezing or coughing and sanitary disposal of oral and nasal discharges and other material contaminated with secretions
  - Spillage of respiratory secretions should be managed appropriately
    Refer Chapter 4.6

Required duration of transmission-based precautions

- 24 hours after the resolution of fever and respiratory symptoms
- For prolonged illness with complications – until the patient has improved clinically
- Immunosuppressed persons and children – may remain infectious for a longer period

13.7.2 Specific prophylaxis for influenza viruses

- **Pre-exposure prophylaxis**
  Influenza vaccine
  - Inactivated trivalent (A-H1, H3 and B) vaccine available in Sri Lanka.
  - Strains are updated annually
  - Sri Lankan vaccine type - Southern hemisphere vaccine
  - Annual vaccination is recommended
  - Vaccination is indicated for HCW and patients with risk factors

- **Post-exposure prophylaxis for Influenza A and B**
  Antiviral chemoprophylaxis with oseltamivir could be considered for HCW with risk factors/ high risk individuals after individual assessment.

13.7.3 IPC measures to be taken in an outbreak of respiratory infection

- Each institution should have a preparedness plan
- In outpatient setting, all patients with respiratory symptoms, should be directed to a separate triage area for assessment and to decide on the course of management
- Standard surgical splash proof masks should be given to the patient to be worn continuously
- Discharge other patients, if they can be managed as outpatients
- Source isolation should be done in a single side room, until clinical recovery. If this is not possible, cohort isolation with barrier nursing is an alternative
- Movement of patient outside the room should be limited to medically necessary purposes Avoid overcrowding and maintain adequate ventilation

- Keep visitors to a minimum
- Strictly adhere to standard precautions
- • Those entering isolation room/area should wear a standard surgical splash proof mask and follow droplet precautions Contact precautions should be practiced when carrying out invasive procedures or handling secretions
- Staff with symptoms should not attend to high-risk patients

13.7.4 IPC measures to be taken when a patient suspected of having an infection with a high-risk respiratory virus (e.g. SARS CoV-1, MERS-CoV, SARS CoV-2) is admitted

- Inform ICNO/microbiologist/virologist/head of the institution/Epidemiology Unit
- IPC measures should be started when the patient enters triage with symptoms of acute febrile respiratory illness
- Standard, droplet and airborne precautions should be practiced
- Isolate the patient in an isolation room or transfer to National Institute for Infectious Diseases(NIID/former IDH) according to national/institutional policy
- Ideally isolation should be in a negative pressure room
- Isolation room doors must be kept always closed at all times and staff entering the room must be kept to a bare minimum. A dedicated stethoscope, thermometer, blood pressure cuff etc.. should be kept in the room or isolation area and cleaned appropriately after use *Refer Chapter 4.5*
- Practice barrier nursing - *Refer Chapter 13.2*
- Ensure that triage and waiting areas are adequately ventilated
- Encourage the use of respiratory hygiene, followed by hand hygiene
- Ensure that HCWs performing AGPs use PPE, including gloves, long sleeved fluid resistant gowns, eye protection and particulate respirators (N95 or equivalent)
- In addition to standard precautions, all individuals providing direct care entering an isolation room/cubicle of patients with confirmed infection, should wear
  - a N95/equivalent mask
  - eye protection (i.e. goggles or a face shield)
  - a clean, long-sleeved gown and gloves
- Single use disposable PPE must be used, as far as possible, when handling the patient. If any items are to be reused, disinfect immediately
- Perform hand hygiene before and after contact with the patient and his/her surroundings and immediately after removal of PPE
- Avoid movement and transport of patients out of the isolation room or area unless medically necessary
- If transport is required, use routes of transport that minimize exposures of staff, other patients and visitors. Patient should wear a standard surgical mask
- Inform the receiving area of the patient's diagnosis and necessary precautions to be taken, before sending the patient
- Clean and disinfect patient contact surfaces (e.g. bed) with routine disinfectants after use
- Ensure that HCWs who transport patients wear appropriate PPE and perform hand hygiene afterwards

- All HCWs including the supporting staff should be trained on IPC measures. A member of the staff (e.g. matron) should be identified to observe whether the procedures are carried out correctly
- Keep visitors to a minimum. If they are to enter the room, they need to wear PPE. Hand washing before leaving is mandatory
- Specimens for microbiological investigations (nasopharyngeal aspirate, sputum, bronchoalveolar lavage, throat or nasal swabs) should be collected as early as possible and sent to the laboratory in viral transport media in leak proof containers and packed safely according to instructions.
- Spillage of respiratory secretions- manage as for blood spills - *Refer Chapter 4.6*
- Linen should be managed as infectious linen - *Refer Chapter 4.7*
- Waste should be managed as infectious waste - *Refer Chapter 4.8*
- If a member of staff develops fever or respiratory symptoms within 10 days of caring for a patient, immediately report to the IPC team/ICNO. During this period avoid contact with other patients or staff members

13.7.5 In the event of a death from suspected or confirmed seasonal influenza A infection

- Notify immediately to Epidemiology Unit by telephone, fax or by email. If it is a maternal death notify the Family Health Bureau as well
- A post- mortem is mandatory in all maternal deaths
- Standard precautions should be used when handling diseased individuals/when preparing bodies for autopsy
- Proper hand washing with soap and water is necessary after handling the dead body
- There is no indication for sealing off coffins/withholding dead body without release but contact by family members with the deceased should be discouraged.
  Family members having any contact with the deceased should be discouraged. If contact occurs hands should be washed immediately with soap and water

13.7.6 In the event of a death of a patient from suspected or confirmed patient having an infection with a high-risk respiratory virus

- Follow the relevant national and local guidelines

References

- Epidemiology Unit, Ministry of Health., 2014. Summary Guidelines for Clinical Management of patients with Middle East Respiratory Syndrome –Corona Virus (MERS – CoV) infection- EPID/CDC/PI/2014/G.
- Ministry of Health and Indigenous Medicine, 2015. Summary Guidelines for Clinical Management and Laboratory Investigation of patients with Seasonal Influenza Virus Infection, . General circular 02-78/ 2015.
- Public Health England, 2019. PHE guidance on use of antiviral agents for the treatment and prophylaxis of seasonal influenza. Version 10.0.

13.8 VARICELLA INFECTION

Introduction

Varicella is an acute, highly infectious disease caused by the varicella zoster virus (VZV). The secondary infection rate of a household contact can be as high as 90%.

An outbreak of varicella can be defined as two or more epidemiologically related cases appearing within a week. An outbreak of varicella can occur among patients in a healthcare institution or among healthcare workers (HCWs).

Modes of transmission

- Droplet transmission-conjunctival, nasal, or oral contact with VZV-containing droplets (size >5μm) generated from an infected person by coughing, sneezing, and talking or during bronchoscopy medical procedures
- Airborne transmission through aerosolized respiratory secretions and vesicle fluid
- Direct contact with vesicle fluid
- Indirect spread from articles freshly contaminated with vesicle fluid or respiratory secretions of patients

Incubation period

- The incubation period ranges from 10-21 days (usually 14-16 days)

Period of communicability

- Between 2 days before the onset of rash until the lesions are crusted (usually 5-7 days)

High risk person/contact

Persons at increased risk for complications from varicella disease;

- Pregnant women
- Immunocompromised persons
- Neonates whose mother develop chickenpox from 7 days before to 7 days after delivery
- Newborn infants ≤ 7 days of age born to non-immune mothers with an exposure to a source other than the mother
- Infants who have severe congenital or other underlying condition that require prolonged intensive or special care during the first year of life
- Hospitalized premature infants born at <28 weeks of gestation or whose birth weight is ≤1,000 g regardless of their mothers' evidence of immunity to varicella

13.8.1 Management of varicella patients during an outbreak

- Notification
  - Chickenpox is a notifiable disease
- Source isolation
  - A patient with uncomplicated disease could be discharged on oral aciclovir and advised to seek medical attention if complications develop
  - Patients with severe disease or complications should be managed in the hospital

- If managed in the ward,
  - Ideally, the patient should be isolated in a properly ventilated isolation room with negative air pressure
  - If this facility is not available, isolate the patient in a side room with door closed and windows opened
  - Patients should be nursed preferably by staff known to be immune to varicella
  - Non-immune pregnant staff and immunocompromised staff members should not have contact with the patient
  - Use standard, contact and airborne precautions - *Refer Chapters 4 and 5*
  - Mattresses and pillows should have impermeable covers
  - After discharging the patient, furniture, fittings, horizontal surfaces and all medical equipment should be wiped with 0.1% (1000 ppm) hypochlorite
  - The patient should be isolated until all the lesions are crusted and no new lesions appear within a 24-hour period

13.8.2 Management of contacts

Immune contacts

- People with a past history of varicella or vaccination or with laboratory evidence of immunity are considered immune and no further action is required
- Whenever possible, immunocompromised contacts should be tested for VZV IgG irrespective of a past history of varicella. Contact virologist/microbiologist regarding the management of such individuals

Non-immune contacts

- A person without a past history of infection or vaccination should be considered as non-immune
- If facilities are available, check for varicella zoster IgG antibodies. All IgG negative individuals are considered susceptible
- Action is only needed when susceptible patients/HCWs have had a significant exposure

A significant exposure is considered as;

- An exposure of a susceptible individual to a patient with varicella infection fulfilling one of the following criteria
- Being in the same room for 15 minutes or more, or face-to- face contact with a case of chickenpox from 2 days before the onset of rash, until all the lesions are crusted or
- Direct contact with a shingles rash on an exposed part of the body during the infectious period from the onset of rash until the lesions have crusted over

Post-exposure management

- **Non-immune staff without risk factors**
  - Vaccination – *Refer Chapter 9*
  - Consider aciclovir prophylaxis in an outbreak situation **only**, if VZV vaccination cannot be arranged

- **Non-immune patients without risk factors**
  - Discharge the patients who are fit to be discharged and advise to seek medical attention if they develop varicella
  - Offer or advice about vaccination
- **Non-immune staff/patients with risk factors**
  - Pregnant women

    ≤ 20 weeks of gestation
    - single dose of Varicella zoster immunoglobulin (VZIG) should be administered as soon as possible or up to 10 days after first exposure

    >20 weeks of gestation
    - Either VZIG or aciclovir prophylaxis is recommended
  - Immunocompromised persons
    - Aciclovir prophylaxis is recommended
  - High risk neonates and infants
    - single dose of VZIG should be administered as soon as possible or up to 10 days after first exposure
    - IVIG and or aciclovir prophylaxis can be considered in the absence of VZIG
- Treat with aciclovir if they develop varicella
- Non-immune HCWs should refrain from working in high-risk areas (specially units with immunocompromised, obstetric or neonatal patients) between 8-21 days after exposure as they could be infectious during this period (or up to 28 days if VZIG is given)

13.8.3 Post-exposure prophylaxis

Varicella vaccine

- The vaccine can be given to children above 1 year, adolescents and adults
- However, it is contraindicated in the following instances
  - Immunocompromised patients (each patient should be assessed individually for eligibility)
  - Pregnancy
  - Hypersensitivity to neomycin or any component of the vaccine
  - Hypersensitivity to a previous dose
- Timing
  - The vaccine is recommended to be given within 3 days of exposure but can be given up to 5 days after exposure
- Dosage and administration- each dose - 0.5 ml given deep subcutaneously
  - Children from 1-12 years - two doses of varicella vaccine, with an interval of 4-6 years
  - Adolescents and adults - two doses of varicella vaccine, with an interval of 4-8 weeks

Varicella Zoster Immunoglobulin (VZIG)

- Refer manufacturer's instructions for dosage as different products will have different formulations
- For high-risk patients who have continued exposure to varicella-zoster virus ≥3 weeks after initial VZIG administration, a second dose of VZIG should be considered

- Individuals receiving regular IVIG replacement therapy do not require VZIG if the most recent dose was administered ≤3 weeks before exposure

Indications for VZIG

VZIG is indicated for the following categories who have had a significant exposure to varicella

- Pregnant women without evidence of immunity within first 20 weeks of gestation
- Newborn infants whose mothers have signs and symptoms of varicella around the time of delivery (i.e. 7 days before to 7 days after delivery)
- Newborn infants ≤ 7 days of age born to non-immune mothers with an exposure from other than the mother
- Infants who have severe congenital or other underlying condition that require prolonged intensive or special care during the first year of life
- Hospitalized premature infants born at <28 weeks of gestation or whose birth weight is ≤1,000 g regardless of their mothers' evidence of immunity to varicella
- Immunocompromised patients without evidence of immunity (aciclovir prophylaxis is preferred according to latest evidence)

Note: If a person develops varicella in spite of being on prophylaxis, aciclovir therapy should be started within 24 hours of onset of rash.

IVIG for prophylaxis

When VZIG is unavailable IVIG with or without aciclovir can be used in high-risk infants and neonates for prophylaxis.

Aciclovir prophylaxis

- Aciclovir prophylaxis can be considered in above risk groups when VZIG is not available or not indicated
- Aciclovir prophylaxis in first trimester of pregnancy needs to be discussed with the clinical team to assess the risks and benefits

Table 1. Prophylactic aciclovir dosage

Age category	Oral aciclovir
Children < 2 years	10mg/kg 4 times daily from day 7 to 14 after exposure
2 – 17 years	10mg/kg (up to a maximum of 800mg), 4 times daily from day 7 to 14 after exposure
≥18 years	800mg 4 times daily, from days 7 to 14 after exposure

13.8.4 Treatment of varicella

- For the maximum benefit, oral aciclovir therapy should be given within the first 24 hours of onset of rash
- Persons who present within 24 hours of onset of rash should be considered for oral aciclovir therapy
- IV aciclovir should be considered for neonates, immunocompromised patients and patients with complicated varicella infection

13.8.5 Herpes Zoster (Shingles)

- Non immune individuals may develop varicella if exposed to patients with shingles
- A patient is infectious from the onset of rash until all the lesions are crusted

Transmission

- Direct contact with exposed zoster lesions
- Indirect contact of vesicle fluid from freshly soiled articles
- Less commonly, airborne transmission of mucous membrane secretions if the person has disseminated or oro-facial (trigeminal) disease

Treatment

- Treatment should be initiated as early as possible for maximum benefit with oral aciclovir
- Prolonged therapy will be required for immunocompromised individuals
- IV aciclovir needs to be considered in complicated disease

Infection control measures

- Lesions should be kept covered
- Patients and HCW with trigeminal or disseminated zoster should be managed as varicella infection for infection control purposes

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13.9 VIRAL HAEMORRHAGIC FEVERS

Introduction

Viral Haemorrhagic Fevers (VHF) are severe and life-threatening viral diseases that are endemic in parts of Africa, South America, the Middle East, Eastern Europe and South Asia. VHFs are of particular public health importance because

- They can spread readily within a hospital setting
- They have a high case fatality rate
- They are difficult to recognize and detect rapidly
- There is no effective treatment

This guideline covers only the VHFs that are caused by pathogens classified as Advisory Committee on Dangerous Pathogens (ACDP) Hazard Group 4 (e.g. Ebola, Marburg, Lassa, Crimean-Congo Heamorrhagic Fever, Kyasanur Forest Disease viruses).

Main routes of transmission for most VHF infections are direct contact (through non-intact skin or mucous membrane) with blood or body fluids and indirect contact with environment contaminated with splashes or droplets of blood, body fluids, secretions and excreta.

Patients suspected or diagnosed with VHF should be transported to a designated healthcare institution for further management as soon as possible. Until such time the current institution must have means and methods of managing the patient while containing the infection.

13.9.1 Hospital care

- Every healthcare institution should have a trained and a designated team identified to manage a suspected VHF patient
- Isolate immediately when a patient is known/suspected of having VHF
- Authorities should be alerted (virologist, microbiologist, director of the hospital, regional epidemiologist, Epidemiology Unit)
- Standard precautions contact and droplet should be practised with all the patients
    - Use dedicated medical equipment
- Assign HCWs to attend and limit the number of HCWs attending to the patient
- Strictly no other personnel/visitors are allowed in the isolation room
- Avoid contact with patient's body fluids and minimize contamination of the environment
- All needles and sharps should be handled with extreme care and disposed in puncture-proof, sealed containers
- Safely dispose patient's body fluids, excreta and contaminated items
- Limit the use of invasive procedures and reduce the number of injectable medications Procedures that can increase environmental contamination with infectious material or create aerosols should be minimized

- Prior to entering the patient isolation rooms/areas, ensure that HCWs rigorously use PPE and perform hand hygiene. PPE should include double gloves, disposable and impermeable gown or coverall and apron, particulate filter respirator (e.g. N95), eye protection (goggles or face shield), head cover and rubber boots or over-shoes
- Donning and doffing of PPE should be done under supervision (by a trained person with similar PPE on) in a designated area. Training in donning and doffing should be given prior to assigning HCWs
- PPE must be removed slowly and consciously in the correct sequence to reduce the possibility of self-contamination
- Ensure regular and rigorous environmental cleaning, decontamination of surfaces and equipment. Contaminated environmental surfaces should be cleaned and then disinfected as soon as possible using 0.5% (5000ppm) hypochlorite. Floors and horizontal work surfaces should be cleaned at least once a day with clean water and detergent
- Promptly evaluate HCWs exposed to blood or body fluids of suspected or confirmed patients and if necessary, place them in quarantine

13.9.2 Sample collection, handling for routine laboratory testing and other invasive procedures

- Specimens taken for laboratory analysis should be kept to the minimum necessary for patient management and diagnostic evaluation. Specimen logistics should be discussed in advance between clinician and the appropriate laboratory
- Specimens shall be collected in fluid-tight containers and then placed in plastic bags that are sealed, and transported in a leak-proof container directly to the laboratory
- Laboratory staff should be alerted. The specimens must be handled in a Class II biosafety cabinet with biosafety level 3 or 4 practices

13.9.3 Disinfection of reusable instruments and equipment

(Refer Chapter 4.5)

- Single use items should not be reused at any time
- Recommend use of dedicated equipment (e.g. stethoscopes) for each patient
  If this is not possible, decontaminate the items between each patient contact

Table 1. Standard operating protocols (SOPs) for equipment decontamination

Item category	Examples	Procedure
Medical furniture/ hospital hardware/ utensils	• bed frames and stretchers • polypropylene buckets • chairs with plastic sheet • bedpans with handle (polypropylene) • sheets, mattress • urinals with plastic lid • intravenous poles •	SOP 1 Decontaminate surfaces as soon as possible; clean and then use standard hospital disinfectant (e.g.0.5% hypochlorite - 5000 ppm)
Item category	**Examples**	**Procedure**
Non- electromechanical medical devices	• tourniquets (for blood testing), latex rubber • measuring tape/ruler	SOP 1 See above
Mechanical medical equipment	• blood pressure cuffs • stethoscopes • sphygmomanometers, aneroid • mechanical scales	SOP 2 If possible, dismantle the devices to facilitate thorough cleaning. Devices should be thoroughly cleaned first with water and soap using appropriate PPE to remove organic matter and then wiped with alcohol
Electro- mechanical hospital equipment	• infrared thermometer • electrocardiogram (ECG) and monitor cables • pulse oximeter • laboratory clinical diagnostic equipment	SOP 2 If battery operated, remove battery
Electro- mechanical respiratory equipment	• oxygen concentrators • flow splitter for oxygen concentrator • suction system, general purpose • general anaesthesia machine • ventilators	SOP 3 Respiratory and anaesthesia equipment should be disassembled, filters discarded, cleaned and disinfected
Medical/surgical instruments	• scissors • forceps • scalpels • retractors • clamps	SOP 4 Combined protocol that includes physical contaminant removal (manual or ultrasound cleaning) and either physical or chemical disinfection or sterilization

13.9.4 Clinical waste

(Refer Chapter 4.8)

- Wear a full set of PPE and heavy duty/rubber gloves, when handling infectious waste
- Waste should be segregated at point of generation to enable appropriate and safe handling
- Waste should not be stored more than 24 hours before being destroyed
- Sharp objects (e.g. needles, syringes, glass articles) and tubing that has been in contact with blood or body fluids should be placed inside puncture resistant waste containers located as close as practical to the patient care area
- Solid, non-sharp, infectious waste should be collected using leak-proof waste bags in covered bins
- Infectious solid waste should not be transported by hand
- Covered trolley or a wheeled bin with a lid is recommended to transport waste. After each use, all surfaces of the trollies or bins should be disinfected with 0.5 % hypochlorite
- Infectious waste and sharps should be incinerated
- Autoclaving can be done as an alternative, if incineration facilities are not available
- After decontamination, the waste should be placed in a designated pit of appropriate depth (e.g. 2 metres)
- Waste such as faeces, urine and vomitus, and liquid waste from washing can be disposed in to a sanitary sewer or in pit latrines dedicated to VHF patients

13.9.5 Management of spills

(Refer Chapter 4.6)

13.9.6 Management of linen

(Refer Chapter 4.7)

- Soiled linen should be placed in clearly-labelled, leak-proof bags or buckets at the site of use and the container surfaces should be disinfected (using an effective disinfectant e.g. 0.05% hypochlorite) before removal from the isolation room/area
- Heavily soiled, contaminated linen should preferably be incinerated or processed by autoclaving, especially if safe cleaning and disinfection are not possible or reliable
- Linen meant to be washed and decontaminated, should be transported directly to the laundry area in its container and laundered promptly
- Contaminated linen should not be washed by hand
- Wash linen with detergent and water, rinse and then soak in 0.05% hypochlorite (500 ppm) for approximately 30 minutes
- Linen should then be dried according to routine standards and procedures

13.9.7 Handling of dead bodies

- Disposal of the body should take place as soon as possible
- Do not perform an autopsy. If an autopsy is absolutely necessary please seek advice of microbiologist/virologist

- The body should not be released to the relatives
- Only trained personnel with recommended PPE should handle the body
- Do not wash, clean or embalm the body
- Do not remove any inserted medical equipment from the body
- Place the body in 2 "body bags" (mortuary sacks), one within another and close. Wipe the surface of the body bag with 0.5% hypochlorite
- Explain to the family that viewing the body is not possible
- Transport the body to the cremation site as soon as possible. Assign a health facility staff person to accompany the body to ensure that the safety precautions remain secure during the journey. Disinfect the vehicle after transport
- Cremate the body

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13.10 DIARRHOEA

Introduction

Diarrhoea in a healthcare facility may lead to outbreaks which could affect patients, healthcare workers (HCWs), and visitors. Any case of diarrhoea, among patients or staff should be regarded as potentially infectious and treated as such unless an infectious cause can be confidently excluded.

Common infectious causes of gastroenteritis include viruses (e.g. rotavirus, norovirus, adenovirus), diarrhoeagenic *Escherichia coli*, *Salmonella* species, *Shigella* species, *Campylobacter* species, *Clostridioides difficile (Clostridium difficile)*, *Vibrio cholerae*, *Yersinia enterocolitica*, *Giardia lamblia* and *Cryptosporidium* species.

13.10.1 Infection control and prevention measures

- **Isolation**
  - Patients presenting with gastroenteritis must be isolated promptly (unless an infectious cause can be confidently excluded) and cared for using contact isolation precautions
  - Patients should be isolated in an isolation room with en-suit toilet or in the diarrhoea unit or cohort isolated in a cubicle at the end of the ward, near a dedicated toilet. These patients should be attended by a dedicated team of HCWs. They should not attend to the other patients.
  - Restrict visitors. Instruct visitors to wash hands immediately before leaving isolation area

- **Hand hygiene**
  - Strict hand washing with soap and water is essential by all HCWs attending to the patient. Alcohol hand rub should not be used as this is not effective against norovirus, adenovirus and *C. difficile* spores.
  - Adequate supply of running water, soap (preferably liquid soap) and single use towels/tissues must be ensured to facilitate hand washing.

- **Personal Protective equipment (PPE)**
  - Gloves and disposable aprons should be used for all patient contact or handling of excreta.
  - Aprons and gloves must be removed before leaving the patient's room and disposed of as infectious waste. Hands must be decontaminated immediately using soap and water.

- **Patient transfers**
  - Patients who are symptomatic or are recovering from diarrhoea should not be transferred to other wards or health care settings unless they have been asymptomatic for 72 hours and passed a normal stool or an infective cause has been ruled out.
  - If patients need to attend other areas for diagnostic testing, advice should be sought from the infection prevention and control (IPC) team.

- **Cleaning and disinfection**
  - Clean ward/room more frequently especially the toilets, high touch surfaces such as door knobs, taps, flush handles etc.
  - Dedicated items should be allocated to each patient (e.g. bedpan)
  - Used bed pans, urinals, vomit bowls etc. should be first emptied into the toilet bowl and flushed with the lid closed. When emptying, extra care should be taken by the user to avoid exposure to human waste and contamination of the work environment including the generation of aerosols.
  - Clean with soap and water and then thermally disinfect, rinse and dry. Thermal disinfection in a washer disinfector is preferable to chemical disinfection. If it is not available disinfect with 2% phenolic disinfectant or hypochlorite solution with at least 1000 ppm available chlorine depending on the possible pathogens and material compatibility of the utensil.
  - Disinfect spills of secretions/excretions - *Refer Chapter 4.6*
  - Use separate mops for isolation area
  - Once the patient is discharged, do terminal cleaning - *Refer Chapter 4.6*
  - All contaminated linen must be segregated, handled and laundered safely and appropriately - *Refer Chapter 4.7*
  - All waste generated in isolation areas must be disposed in yellow bags - *Refer Chapter 4.8*

13.10.2 Health education

- Educate the HCWs and patients regarding drinking boiled cooled water, eating only properly cooked food, keeping food and water covered, and washing hands before eating and preparation of food, and after using the toilet.
- Food should be eaten only in the dining area.

13.10.3 Management of staff with diarrhoea

- Any member of staff who experiences acute gastroenteritis and/or vomiting must not present for work. If they are at work when this happens, they should report their symptoms to the supervising officer.
- They must not return to work until they have been asymptomatic for 48 hours.
- Staff is required to submit a sample of faeces for investigations.

13.10.4 Food safety

- Ensure good hygiene practices.
- Keep food covered. Cooked food should be covered as much as possible during distribution and until consumption.
- Special attention should be paid to control flies.
- Staff who care for patients with diarrhoea should not be involved with food preparation in the ward

13.10.5 Management of an outbreak of gastroenteritis

In addition to the above measures, following steps should be carried out.

- Ward staff or the laboratory should inform the IPC team regarding a possible outbreak.
- IPC team must visit the ward/s and the kitchen (in suspected food poisoning) and laboratory to make direct inquiries.
- Collect epidemiological data regarding the onset of diarrhoea, whether one or more wards are affected, dietary history and common food eaten by infected patients .
- Specimens of stools and/or vomitus and remnants of suspected food should be sent to the microbiology/reference laboratory.
- Inform PHI of the hospital. In hospitals where PHIs are not available medical officer of health (MOH) in the area should be informed.
- Discharge other patients early if possible.
- Closure of ward to new admissions may be necessary in a major outbreak which could not be controlled by initial IPC measures.
- Display a notice at the entrance to indicate that there is an outbreak of diarrhoea in the ward and restrict visitors.

Refer Chapter 10

13.10.6 Suspected food poisoning

In addition to above control measures, following steps should be carried out.

- Kitchen staff should be questioned and observed on food hygiene, personal hygiene, cooking practices, storage of raw food and cooked food, cleaning of cutting boards and knives etc.
- Suspected food items should be sent to the reference/public health laboratory for microbiological investigation.
- Temporarily stop salads and other uncooked food preparations in the kitchen.
- Any food handler suffering from diarrhoea or vomiting or gastrointestinal infections, skin rashes, boils or any other skin lesions, infected wounds, and throat infections should be investigated.
- Send samples of faeces to the laboratory for investigation, if necessary. Infected catering staff should not handle food until 3 consecutive faecal samples are negative.
- Food processing areas in the wards must be observed and proper food hygiene instructions should be given. If babies and neonates are affected, preparation of bottle feeds and cereals should be observed.
- Bacteriological testing of water samples and chlorination of water sources may be necessary.
- Ensure hygienic transport of food from kitchen to wards.

13.10.7 Antibiotic associated diarrhoea

- *Clostridioides difficile* is known to cause diarrhoea and colitis in health care settings especially in vulnerable groups like elderly and patients on antibiotics.
- Since the causative agent is an anaerobic spore forming bacillus which is not killed by alcohol and its tendency to cause outbreaks, it creates special challenges to IPC.

- Ideally the patient should be isolated in a room with an attached bathroom. If this is not possible cohort with other patients with similar symptoms. Start barrier precautions without waiting for laboratory confirmation.
- After caring of the patient remove the gloves and wash hands with soap and water. After settling of symptoms continue barrier precautions for another 48 hours.
- Advise the patient to wash hands and bathe to reduce spores on the hands and skin.
- Dedicated instruments should be kept for the patient.
- A sporicidal disinfectant should be used to clean the environment. Meticulous cleaning of environment and hand washing are important because the spores of *C. difficile* survive well in environment, floors, bedpans and hands of HCWs
- The antibiotic prescribing pattern and usage need to be reviewed to prevent outbreaks.

Reference

- Royal Cornwall Hospital NHS trust UK, 2015. Policy for the management of patients and staff with diarrhoea.

13.11 HUMAN RABIES

13.11.1 General measures

- Natural transmission of rabies from human to human has never been documented. A clinically suspected case of rabies could be admitted to a general medical or surgical ward.
- Patient should be cared preferably in an isolation room if available or in an area in the ward with minimum disturbances.
- Panic situation among staff should be avoided when there is a patient in the ward with suspected rabies.

13.11.2 Infection prevention and control precautions

- HCW should wear gloves and a surgical mask when attending to a rabies suspected patient.
- It is recommended to wear gloves, masks, gowns and eye protection when collecting saliva samples for ante mortem diagnosis of rabies.
- Patient's clothing, bed linen and other personal items should be boiled and then washed with soap and water if reused.
- Spillage of secretions or body fluids should be disinfected with freshly prepared 1% hypochlorite solution for 20 minutes.
- Any equipment used on the patient (suckers, ventilator tubing etc.) should be disinfected. *Refer Chapter 4.5*

13.11.3 Post-exposure anti rabies therapy

- HCW does not need any post-exposure anti rabies therapy unless there is direct contamination of mucous membranes or open wounds with the patient's saliva or secretions, or they have been bitten or scratched by the patient while nursing.
- If there is a suspected high-risk exposure to a HCW, contact rabies unit/infection control team for further management.

13.11.4 Handling a dead body

- The body should not be handled unnecessarily. Relatives should be informed to dispose the body, preferably by cremation as soon as possible.
- Embalming of body is not recommended. However, if it is essential, undertaker should be informed and advised to wear protective clothing (mask, gown, gloves, boots and a face shield)
- Sealing the coffin is not required.

Please contact the Department of Rabies, MRI for further details
Telephone. 0112693532-4, 0112698660

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13.12 TRANSMISSIBLE SPONGIFORM ENCEPHALOPATHIES (PRION DISEASES)

Introduction

Transmissible spongiform encephalopathies (TSEs) are rare, fatal, degenerative diseases affecting the central nervous system (CNS) that occurs in humans and several other mammals. The most common human TSE form is Creutzfeldt-Jakob disease (CJD). CJD is both an infectious and inherited, progressive neuro-degenerative disease transmitted by an abnormal form of a protein known as a prion. This disease results in dementia, incapacitation and death.

TSE agents exhibit an unusual resistance to conventional chemical and physical decontamination methods. Infection can spread from person to person during invasive medical procedures.

13.12.1 Infection prevention and control (IPC) measures

- There is no evidence that normal social or routine clinical contact of a prion disease patient presents a risk to healthcare workers, relatives and community. Other than standard precautions there are no special requirements for general care of these patients. Isolation is not necessary, and they can be nursed in an open ward.
- However, when certain invasive procedures are performed, there is the potential for exposure to prion protein. In these situations, it is essential that the infectivity of the tissue involved is considered and appropriate measures are in place to prevent iatrogenic transmission.

Table 1. Evaluating risk in health care setting

Risk (infectivity of sample)	Low	High
Sample type	Blood, CSF, urine, faeces, tissues of reticulo-endothelial system	Brain, spinal cord, posterior eye

IPC measures for sample collection and other invasive procedures

- Every effort should be taken to minimize the risk of infecting the operator or contaminating the environment
- The majority of samples taken or procedures performed will be of low risk at ward setting (i.e. blood drawing, lumbar puncture). Contact with small volumes of blood (including inoculation injury) is considered low risk, though it is known that transfusion of large volumes of blood and blood components may lead to variant CJD (vCJD) transmission.
- Standard precautions should be adhered with blood, CSF and other body fluid samples.
- Sample should be marked with “Biohazard” label, and inform the laboratory in advance that a sample is being sent.
- Cover surfaces of all non-disposable equipment with a fluid impermeable material.
- Involve a minimum number of required HCW.
- Ensure that only trained staff, who are aware of the hazards, carry out invasive procedures.

- When taking biopsy samples or performing other invasive procedures, HCW should wear face and eye protection, gloves and liquid repellant aprons as appropriate. Disposable drapes should be used for surgical procedures. Sharps and clinical waste should be disposed safely.
- Single-use disposable surgical instruments and equipment should be used where possible, and subsequently destroyed by incineration.
- For reusable instruments - Refer Table 2

Table 2. Handling of reusable instruments – patients with or "at increased risk" of CJD (other than vCJD)

Tissue infectivity	**Status of the patient**		
	Definite or probable	Possible	At increased risk
High	Incinerate	Quarantine	Quarantine
Low	Quarantine	Reprocess and return to use	Reprocess and return to use

- Do not reuse quarantined instruments until diagnosis is excluded. A negative brain biopsy in the absence of a confirmed alternative diagnosis, does not suffice to take instruments out of quarantine.
- Effective tracking of reusable and quarantined instruments should be in place to ensure their usage on the same patient.

Cleaning and decontamination of reusable instruments

- All surgical instruments used on any patient must undergo thorough cleaning to remove blood and tissue soiling.
- Instruments should be kept moist until cleaned and decontaminated. They should be cleaned as soon as possible.
- Avoid mixing instruments with instruments used for other patients.
- HCWs performing cleaning and decontamination should be educated and provided with appropriate PPE.

Decontamination methods for reusable items

- **Autoclave/ Chemical methods**

  Immerse in 1N sodium hydroxide (NaOH) and heat in a gravity displacement autoclave at 121°C for 30 minutes, clean, rinse in water and subject to routine sterilization.

  OR

  Immerse in 1N NaOH or 2% sodium hypochlorite for 1 hour, transfer instruments to water, heat in a gravity displacement autoclave at 121°C for 1 hour, clean and subject to routine sterilization.

  OR

  Immerse in 1N NaOH or 2% sodium hypochlorite for 1 hour, rinse in water, then transfer to open pan and heat in a gravity displacement (121°C) or porous load (134°C) autoclave for 1 hour, clean and subject to routine sterilization.

OR

Immerse in 1N NaOH and boil for 10 minutes at atmospheric pressure, clean, rinse in water and subject to routine sterilization.

OR

Immerse in 2% sodium hypochlorite (preferred) or 1N NaOH (alternative) at ambient temperature for 1 hour, clean, rinse in water and subject to routine sterilization.

OR

Autoclave at 134°C for 18 minutes.

- **Chemical method**

  Flood with 2N NaOH or undiluted sodium hypochlorite, let stand for 1 hour, mop up and rinse with water.

Decontamination of work surfaces

- When possible, work surfaces should be covered with impermeable, disposable cover sheets
- Potentially contaminated surfaces should be disinfected and mechanically cleaned
- Flood with 2N sodium hydroxide or undiluted sodium hypochlorite for one hour followed by water rinses
- Surfaces which cannot be treated in this manner should be thoroughly cleaned

Spillage

- For blood and body fluid spills, use absorbent material to soak up the spill and freshly prepared10-15% sodium hypochlorite or 2N sodium hydroxide should be poured on and should be left one hour to decontaminate. Wash the area with water and neutral detergent and dry
- Any waste (including cleaning tools such as mop heads and used PPE) should be disposed as clinical waste

Clinical waste

Table 3. Disposal of clinical waste

Diagnosis of CJD	High risk tissues	Low risk tissue and body fluids
Definite	Incinerate	Normal clinical waste disposal
Probable	Incinerate	Normal clinical waste disposal
“At increased risk”	Incinerate	Normal clinical waste disposal

Bed linen

- Should be washed and dried according to standard practice unless they are not contaminated with body fluids. No further processing is necessary.
- Contaminated linen should be incinerated.

13.12.2 Occupational safety

- HCW who work with patients with definite, probable or possible CJD/vCJD, or with potentially infected tissues, should be appropriately informed about the nature of the risk and relevant safety procedures.
- All HCWs should comply with standard IPC precautions.
- The highest potential risk in the context of occupational exposure is from exposure to high infectivity tissues through direct inoculation (e.g. sharps injuries, puncture wounds or contamination of broken skin and exposure of the mucous membranes).
- Following an exposure, free flowing of blood from wounds should be allowed. Wounds should be washed (avoid scrubbing) with warm soapy water, rinsed, dried, and covered with a waterproof dressing or further treatment given appropriate to the type of injury.
- Splashes into the eyes or mouth should be irrigated with normal saline or water.
- The accident should be reported to the infection control unit and documented.

13.12.3 Handling a dead body

- In a situation of a death of a patient with confirmed or suspected CJD, the removal of the body from the ward should be carried out using normal IPC measures. It is recommended that the dead body be placed in a sealed body bag prior to moving.
- Postmortem remains an essential element in confirming the clinical diagnosis. All personnel involved should be made aware of the relevant history of the patient. Disposable masks, impermeable clothing (gowns/aprons), goggles and gloves should be worn
- Manual saws are recommended.
- A full postmortem examination is discouraged.
- Embalming an autopsied or traumatized body is not encouraged.
- Embalming bodies which have not being autopsied can be performed adhering to standard precautions.
- Superficial contact by relatives, such as touching or kissing the face, need not be discouraged if the body has not been autopsied or traumatized.
- Burial in closed coffins does not present any significant risk of environmental contamination.
- Cremated remains are considered to be sterile, as the infectious agents do not survive incineration range temperatures (1000°C).
- Formalin and glutaraldehyde fixed tissue specimens must be handled with the same precautions as fresh material as they retain infectivity.

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13.13 SCABIES

Introduction

Scabies has a prolonged asymptomatic phase in primary infection; therefore, an outbreak suggests that person-to-person transmission has been occurring within the institution for at least 2-6 weeks. If a person has had scabies before, symptoms appear much sooner (1-4 days) after exposure and can transmit scabies, even if they do not have symptoms.

13.13.1 Clinical manifestations of scabies

- Conventional (typical) scabies
  - The most common symptoms are pruritus (especially at night) and papular skin rash in the web spaces of the fingers and toes, wrists, elbow, armpit, buttocks, breasts in females, and genitals. In infants and very young children, the scalp, face, neck, palms, and soles often are involved. Tiny raised serpiginous burrows may be found.
  - These lesions can become infected with bacteria such as *Staphylococcus aureus* or beta-hemolytic streptococci.
- Crusted (or Norwegian or hyperkeratotic) scabies
  - This variant of scabies affects high-risk groups such as immunocompromised patients, elderly and people who are very ill.
  - It is characterized by vesicles, thick crusts/plaques and extensive scales affecting large areas of the body. Itching may be absent.
  - It is highly contagious (infested with millions of mites), severe and hard to treat and carries a high risk for invasive bacterial infections and mortality.

13.13.2 Transmission

- Transmission occurs primarily by the transfer of the impregnated females during direct, prolonged skin-to-skin contact with an infected person.
- Occasionally transmission may occur via fomites (e.g. bedding or clothing).
- Any infected person can transmit the infection from the time he/she acquired it (even when asymptomatic) until the treatment is completed.

13.13.3 Treatment of patients with scabies

Table 1. Treatment of patients

Agent	Method	Other notes
5% Permethrin cream	Two applications -one week apart Apply all over the body. Wash off after 8 - 12 hours. For crusted scabies: every 2-3 days for 1-2 weeks	For children aged 2 months or older Kills mite and eggs. Highly effective.

Agent	Method	Other notes
Sulphur 5 -10% ointment (petroleum jelly/petrolatum as the base of ointment)	Apply topically to entire trunk and leave for 24 hours before being washed off. Use daily for 3 consecutive nights.	Treatment of choice in infants <2 months and lactating women
25% Benzyl benzoate (for adults) Lower concentrations may be used in children (10% or 12.5%)	Three applications on consecutive days	May cause immediate skin irritation. Less effective than permethrin. Can be used for treatment of crusted scabies.

- All members of the affected household should be treated simultaneously.
- Treatment should be applied to the whole body including the scalp, neck, face, and ears. Particular attention should be paid to the webs of the fingers and toes and lotion brushed under the ends of nails.
- It is important to warn users to reapply treatment to the hands if they are washed.
- Patients with hyperkeratotic scabies may require 2 or 3 applications of medicines on consecutive days.
- Need consultation of a dermatologist for severe cases or if not responding to treatment.

13.13.4 Infection prevention and control measures

- All members of the household and any other potentially exposed persons should be treated at the same time as the infested person to prevent possible re-exposure and re-infestation.
- Bedding and clothing worn or used anytime during the 3 days (72 hours) before treatment should be machine washed and dried using the hot water and hot dryer cycles or be dry-cleaned or boiled (>50 ^{o}C) for 10 minutes.
- Items that cannot be dry-cleaned or laundered can be disinfested by storing in a closed plastic bag for several days to a week. Scabies mites generally do not survive more than 2 to 3 days away from human skin.
- Children and adults usually can return to child care, school, or work the day after completion of treatment.
- Cut nails short and clean to remove any mites or eggs that may be present.
- Vacuum rugs, furniture and bedding, and discard the vacuum-cleaner bag away when finished.
- Laundry workers should wear gowns and gloves.
- All toys and shoes should be sealed in polythene for 10 days to reduce the mite population.
- Avoid sharing clothes and improve personal hygiene.

13.13.5 Additional measures for control of crusted (Norwegian/hyperkeratotic) scabies

- Unrecognized crusted scabies often is the source of institutional outbreaks of scabies. Therefore, persons with crusted scabies and their close contacts, including household members and HCWs should be treated rapidly and aggressively to avoid outbreaks.
- Until successfully treated, patients should be isolated/cohort isolated and barrier nursing should be practiced.
- Caretakers should take strict contact precautions including the use of protective garments such as gowns, gloves, and shoe covers.
- Hands should be washed when gloves are removed.
- Rooms should be thoroughly cleaned and vacuumed after use.
- Environmental disinfestation using pesticide sprays or fogs generally is unnecessary and is discouraged.
- Precautions should be continued until skin scrapings have been negative for three consecutive days.

13.13.6 Scabies in HIV infected patients

- *Sarcoptes scabiei* proliferates to an alarming degree in HIV infected patients.
- These patients should be examined for scabietic burrows when admitted.

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