CONSENSUS STATEMENT ON INFECTION CONTROL MEASURES IN THE INTENSIVE CARE UNIT

BY
INTENSIVE CARE SECTION,
MALAYSIAN SOCIETY OF ANAESTHESIOLOGISTS

IN COLLABORATION WITH
ANAESTHETIC & INTENSIVE CARE SERVICES
MINISTRY OF HEALTH

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This is the third edition of the Consensus Statement on Infection Control Measures in the Intensive Care Units. This edition supersedes the previous editions.

FOREWORD FROM THE NATIONAL ADVISOR OF ANAESTHETIC AND INTENSIVE CARE SERVICE MINISTRY OF HEALTH

Healthcare-associated infection is a major healthcare challenge especially among the critically ill patients. The increasing use of interventions in the course of treatment predisposes the immunocompromised hosts to infections resulting in prolonged ICU stay and increased morbidity and mortality. Prevention of healthcare-associated infection in the ICU is thus of paramount importance from the economic point of view as well as patient outcome.

Unlike the infection control guidebook published by the Ministry of Health, which covers a wide range of services, this booklet only focuses on the intensive care units. It is very specific and detailed and includes all the common procedures in the ICU including the housekeeping routine thought to be too trivial to be mentioned. As such, I believe clinicians and unit managers will find this booklet extremely useful.

The Intensive Care Section of the Malaysian Society of Anaesthesiologists is to be commended for its efforts in continually upgrading its guidelines and advancing good intensive care practice. This is the second review of the guidelines formulated in 1997 and last reviewed in 2004. Undoubtedly this edition will provide the reader the most up to date information based on recent clinical evidence and consensus.

I thank Dr. Tan Cheng Cheng and the expert panel for their effort in producing this new edition. Their sacrifice and contribution to advance intensive care and promote best current practice is much appreciated.

Dr. Ng Siew Hian
The National Advisor of Anaesthetic and Intensive Care Service
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FOREWORD FROM THE CHAIRPERSON OF INTENSIVE CARE SECTION

The Intensive Care Section of the Malaysian Society of Anaesthesiologists first published the Guidelines on Infection Control Measures in the Intensive Care Units in 1997. After seven years, the second edition was published in September 2004, providing specific and practical guidelines.

As new evidence on infection control emerge, a review of the 2004 statement has become necessary. As in the previous edition, the recommendations have been based on clinical evidence. When clinical evidence is unavailable, the recommendations have been based on group consensus taking into consideration, factors such as cost containment and availability of resources. New topics such as surveillance, management of outbreaks of multidrug resistant organisms and handling of deceased patients have been added.

The Intensive Care Section of the Malaysian Society of Anaesthesiologists would like to thank members of the Expert Panel for their time and contributions in preparing this consensus statement.

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LIST OF ABBREVIATIONS

CRBSI	Central venous catheter related blood stream infection
CVC	Central Venous Catheter
CVC-CB	Central Venous Catheter Care Bundle
ESBL	Extended Spectrum Beta Lactamase
HAI	Hospital Acquired Infection
HCW	Health Care Worker
HIV	Human Immunodeficiency Virus
ICU	Intensive Care Unit
MDR-GNB	Multidrug Resistant Gram-negative Bacilli
MDROs	Multidrug Resistant Organisms
MRSA	Methicillin Resistant Staphylococcus Aureus
NAICU	National Audit of Intensive Care Unit
NNIS	National Nosocomial Infection Susveillance
PPE	Personal Protective Equipment
VAP	Ventilator-associated Pneumonia
VCB	Ventilator Care Bundle
VRE	Vancomycin Resistant Enterococcus

CATEGORY OF RECOMMENDATIONS

Recommendations are rated according to the following categories:

- **Category 1A.** Strongly recommended for implementation and strongly supported by well-designed experimental, clinical, or epidemiologic studies.

- **Category 1B.** Strongly recommended for implementation and supported by certain experimental, clinical, or epidemiologic studies and a strong theoretical rationale.

- **Category 1C.** Required by state or federal regulation, or representing an established association standard.

- **Category II.** Suggested for implementation and supported by suggestive clinical or epidemiologic studies or a theoretical rationale.

INTRODUCTION

Intensive care unit (ICU)-acquired infection is a substantial problem in the hospitals. The common infections include ventilator-associated pneumonia, bacteraemia, urinary tract infection and catheter-related bloodstream infection.

The 2008 Malaysian Registry of Intensive Care (formerly known as the National Audit of Adult ICUs) report showed a ventilator-associated pneumonia rate of 13.5 per 1000 ventilator days in 30 Malaysian ICUs. This fell within the 80th percentile of the National Nosocomial Infection Surveillance (NNIS) benchmark. The incidence of catheter-related bloodstream infection in Hospital Sultanah Aminah Johor Bahru in 2005 was 9.4 per 1000 catheter-days compared to 1.8 to 5.2 per 1000 catheter-days from the NNIS database. Healthcare-associated infections are more common in ICUs than in general wards due to severity of illness, use of invasive devices, immunosuppression, previous use of antibiotics and prolonged hospital stay.

The Institute for Healthcare Improvement in the USA initiated the 100,000 Lives Campaign by introducing care bundles and measures with the aim of preventing 100,000 deaths between January 2005 and July 2006 and every year thereafter. Many countries later adopted this campaign.

Two measures of particular importance in ICU are the reliable use of ventilator care bundle (VCB) to reduce ventilator-associated pneumonia and the central venous catheter care bundle (CVC-CB) to reduce catheter-related bloodstream infection. The VCB was implemented in Ministry of Health hospitals in 2007 while the CVC-CB was implemented in 2008. Since then, the incidence of VAP has decreased.

In addition to the above care bundles, other control measures to prevent ICU-acquired infections are equally important. Therefore we hope that this updated consensus statement will help ICUs in their endeavour to combat ICU-acquired infections.

ADMINISTRATIVE SUPPORT

1. Prevention and control of hospital-acquired infection (HAI) should be a patient safety priority. (IB)

2. Administrative and financial support should be available to prevent and control HAI transmission within the healthcare organization. (IB)

3. Adequate staffing is important to prevent outbreak of infections as outbreaks have been observed during periods of inadequate staffing. (1B)

HEALTH CARE WORKERS

1. Staff nurses shall change out of their uniforms and wear ICU attire while working in the unit.

2. White coats are to be removed upon entering the ICU.

3. Long sleeves are to be rolled up above the elbow when handling patients and equipment.

4. It is advisable for those who wear headscarves to change to caps while on duty. Headscarves or ties if worn shall be neatly tucked into blouses/shirts and should be laundered daily

5. Sweaters and vests, if worn, must be cleaned daily.

6. Ear studs (not dangling earrings) and flat wedding rings are allowed. Bangles, bracelets and watches are not permitted when handling patients. (1C)

7. Hepatitis B, meningococcal and varicella vaccines should be provided for all care providers in ICU. (IC)

8. Staff with transmissible infections is advised not to work in ICU until treated. (II)

HAND HYGIENE

1. Hand hygiene is the single most important infection control practice to reduce transmission of microorganisms from one person to another or one site to another on the same patient. (IA) Hand hygiene includes handwashing, antiseptic handwash, antiseptic hand rub or surgical hand antisepsis. (Refer Appendix I)

2. Hand hygiene should be practised:

   2.1 before and after each contact with patients. (IB)
   2.2 when hands are visibly soiled. (IA)
   2.3 before and after contact with body fluids or secretions and mucous membranes. (IA)
   2.4 after contact with contaminated or soiled materials. (IA)
   2.5 before and after performing invasive procedures. (IB)
   2.6 before putting on and after removing gloves. (IB)
   2.7 before and after contact from a contaminated to a clean site on the same patient. (II)
   2.8 after contact with inanimate objects (including medical equipment) in the immediate vicinity of the patient. (II)
   2.9 after personal use of the washroom. (IB)

3. **Steps in Handwashing**: (Refer Appendix II)

4. **Hand hygiene technique**: (Refer to Table 1 on page 4)

   Do not wear artificial fingernails or extenders when having direct contact with patients. (1A)
   Keep natural fingernail tips less than ¼ inch in length. (II)
   Remove watch and jewellery before performing hand hygiene. (II)

Table 1: Hand Hygiene Techniques

Level	Washing technique	Dura-tion	Drying	When needed
Routine handwash	Wet hands and lather using liquid handwash Rinse under running water Do not touch taps with clean hands – if elbow or foot controls are not available, use paper towel to turn tap off	10-15 seconds	Pat dry using paper towel or a fresh portion of a roller towel	Before eating After going to the toilet Before contact with patients (e,g, physical examination, emptying a drainage bag) Before injection or venepuncture Before and after routine use of gloves After handling any instruments or equipment soiled with blood or body fluids
Aseptic handwash	Wash hands Thoroughly using antimicrobial solution (4% chlorhexidine with 70% iso-propyl alcohol) and rinse carefully Do not touch taps with clean hands	1 minute	Pat dry using sterile paper towel	Before any invasive procedure (e.g. arterial cannulation, bone marrow aspiration, bronchoscopy, central venous catheterisation, haemodialysis catheter insertion, lumbar puncture, pulmonary artery catheterisation, peritoneal dialysis catheter insertion, tracheostomy, chest tube insertion, urinary catheterisation)

Level	Washing technique	Dura-tion	Drying	When needed
Surgical handwash	Wash hands, nails and forearms thoroughly using an antimicrobial solution (4% chlorhexidine with 70% iso-propyl alcohol) Rinse carefully, keeping hands above the elbows No touch techniques apply	First wash for the day 5 minutes; subse-quent washes 3 mins	Dry with sterile towels	Before any invasive surgical procedure

- Routine and aseptic hand hygiene can be carried out using waterless alcohol-based hand rub. Apply product to palm of one hand and rub hands together, covering all surfaces of hands and fingers, until hands are dry. Waterless alcohol-based hand rub is more efficacious and is preferred over anti-microbial soap and water. (IB)

- Do not refill dispensers. (1A)

GLOVES

1. Wearing gloves is not a substitute for hand hygiene. (IA)

2. Wear non-sterile gloves when in contact with blood, saliva, body fluids, secretions, excretions, contaminated items or surfaces, mucous membranes and non-intact skin. (IB)

3. Wear sterile gloves for procedures such as arterial cannulation, bone marrow aspiration, bronchoscopy, central venous catheterisation, haemodialysis catheter insertion, lumbar puncture, pulmonary artery catheterisation, peritoneal dialysis catheter insertion, tracheostomy, chest tube insertion and urinary cathetherisation, dressing and tracheal suction. (IA)

4. Change gloves after contact from a contaminated to a clean site on the same patient. (II)

5. Remove gloves promptly after use and dispose used gloves into the yellow clinical waste bin. (IB)

MASKS AND PERSONAL RESPIRATORY PROTECTION DEVICES

1. Surgical mask is to be worn during procedures to prevent health care worker (HCW)'s respiratory secretions from contaminating sterile sites (e.g. dressings, central venous and arterial cannulation) and/or to reduce the risk of splashing of patient's body fluids to HCW (e.g. tracheal intubation, tracheal suction, tracheostomy, chest physiotherapy). It is to be used on patients who are coughing to limit spread of infectious respiratory secretions.

2. Particulate filter personal protection device (N95), which is capable of filtering 0.3micron particle is to be worn when attending to patients with infectious air-borne diseases (e.g. pulmonary tuberculosis)

3. Powered Air Purifying Respirator (PAPR) is to be used by HCW when carrying out aerosol-generating procedures in patients with highly infectious and deadly airborne diseases e.g. tracheal intubation in patients with severe acute respiratory syndrome (SARS)

PROTECTIVE EYEWEAR OR FACE SHIELDS

1. Wear protective eyewear or face shield during procedures that are likely to generate splashes of blood, body fluids, secretions e.g. tracheal intubation, tracheal suction, tracheostomy, dressing, physiotherapy, chest tube insertion. (IB)
2. Personal eye glasses and contact lenses are not considered adequate eye protection.

GOWNS

1. Wear plastic apron to protect HCW's clothing from contamination with blood or body fluids e.g. physical examination, tracheal intubation, tracheal suction, dressing, sponging, physiotherapy. (IB)
2. If there is a risk of splashing of large amount of blood or body fluids, wear impermeable or fluid-resistant gown to protect HCW's clothing and skin. (IB)
3. Wear sterile gown during aseptic procedures e.g. tracheostomy, central venous catheterisation, lumbar puncture, chest tube insertion (IB)

Refer to Table 2 for personal protective equipments (PPEs) required for common ICU procedures on page 8

Table 2: PPE for common ICU procedures

Procedures	Hand wash			Gloves		Gown		Goggle/Eye shield	Apron
	Routine	Aseptic	Surgical	Sterile	Non sterile	Sterile	Non sterile		
General Hygiene Care									
Eye care	√				√				√
Hair shampoo	√				√				√
Oral toilet	√				√				√
Sponging	√				√				√
Invasive Procedures									
Arterial catheter		√		√				√	√
Bone marrow aspiration		√		√		√		√	
Bronchoscopy		√		√			√	√	
Blood culture		√		√					√
Central venous catheter, Haemodialysis catheter		√		√		√		√	
Chest tube		√		√		√		√	
Lumbar puncture		√		√		√		√	
Nasogastric tube insertion	√				√				√
Peripheral venous catheter	√				√			√	√
Pulmonary artery catheter		√		√		√		√	
Peritoneal dialysis catheter		√		√		√		√	
Tracheal intubation	√				√			√	√
Tracheostomy		√		√		√			
Tracheostomy tube change	√			√				√	√
Urinary catheter insertion		√		√					√
Wound dressing		√		√					√
Respiratory care									
Physiotherapy	√				√			√	√
Tracheal suctioning	√			√				√	√
Ventilator tubing change	√			√				√	√

Note: Mask is to be worn for all the above procedures

ISOLATION PRECAUTIONS

1. **Standard Precautions** (IB) apply to blood, all body fluids, non-intact skin, mucous membranes, secretions and excretions except sweat. They entail:

   1.1 Hand-washing before and after every patient contact.
   1.2 The use of gloves, masks, gowns and eye protection in situations in which exposure to body secretions or blood is likely or possible.
   1.3 The safe disposal of sharp instruments and needles in impervious containers (sharps bins).
   1.4 The placement of soiled linens in impervious bags and bloody or contaminated materials such as feces or urine in sanitary toilets.

   The 2007 Center of Disease Control (CDC) guidelines included 3 more components to the above. They are:

   1.5 Safe injection practices.
   1.6 Use of mask for insertion of catheters or injection of material into spinal or epidural spaces.
   1.7 Respiratory hygiene / cough etiquette: All HCW, patients and visitors who have any sign of respiratory illness should cover their nose or mouth when coughing and practice hand hygiene after contact with respiratory secretions.

2. **Transmission-based precautions** (IB) are to be implemented when standard precautions alone are insufficient to prevent transmission of infections. They apply to patients known or suspected to be infected or colonized with pathogens that can be transmitted via airborne, droplet or contact routes.

   Refer to Table 3: Specific infection control measures based on type of transmission on page 9

Table 3: Specific infection control measures based on type of transmission

Type of precaution	Selected patients	Infection control measures
Contact • Includes touching any of mucous membrane • Spread can occur by direct contact (hands to body surface) or by indirect contact (body surface or hands to contaminated environmental surface or patient care items).	Colonization of any bodily site with multidrug-resistant bacteria (*MRSA, VRE*), enteric infections (*C.difficle, E.coli* 0157:H7), viral infections (*RSV, HSV, enterovirus, parainfluenza*), scabies, impetigo, non-contained abcesses or decubitus ulcers (especially for *Staphylococcus aureus* and group A *streptococcus*)	In addition to standard precautions: • Isolation room preferred or else patients should be cohorted • Keep doors closed at all times • Hand hygiene before entering and leaving the room • Wear gloves, gowns or plastic aprons before entering room • Change gloves after contact with contaminated secretions • Equipment must be dedicated to the cohort area (e.g. stethoscopes, thermometers, blood glucose monitoring equipment, tapes, scissors etc) • Minimise risk of environmental contamination during patient transport (all soiled linen to be changed to clean ones prior to transportation). Inform receiving unit of patient's infectious status so that adequate preparations can be made on receiving the patient
Droplet • Large particles containing micro-organisms expelled during coughing, sneezing, talking or suctioning • These particles can travel not more than **3 feet** away from the source.	Known or suspected; *Neisseria meningitidis, Mycoplasma pneumoniae, Haemophilus influenzae type B, Bordetella pertussis,* diphtheria, pneumonic plague, rubella virus, mumps virus, adenovirus, parvovirus B19, RSV	In addition to standard precautions: • Isolation room preferred or else patients should be cohorted • Keep doors closed at all times • Wear a surgical mask when within 3 feet of the patient • Mask any non-intubated patient during transport • Observe cough etiquette

Type of precaution	Selected patients	Infection control measures
Airborne • Spread depends upon aerosolisation of small particles of the infectious agent, 5µ or less in size, that can then travel over long distances through the air.	Known or suspected; *Mycobacterium tuberculosis*, varicella-zoster virus, measles, smallpox, SARS	In addition to standard precautions: • Place patient in an AIIR* (Airborne Infection Isolation Room) • If AIIR is unavailable, place patient in a single well ventilated room. An air-conditioned room must be negative pressure • Keep doors closed at all times • A certified respirator (N95) must be worn when entering the room of a patient with diagnosed or suspected tuberculosis. Whenever possible, non-immune individuals should not enter the room of patients with confirmed or suspected measles or chickenpox • Minimise transport of the patient • Procedures for these patients should be scheduled at times when they can be performed rapidly and when waiting areas are less crowded • No visitors are allowed into the room • Observe cough etiquette

* AIIR-Monitored Negative Pressure Relative to the surrounding area, 12 air-exchanges per hour for new construction and renovation and 6 air-exchanges per hour for existing facilities, air exhausted to the outside or recirculated through HEPA filtration before return.

INTRAVASCULAR CATHETERS

1. Catheter insertion

1.1 Central venous catheter (CVC)

1.1.1 Observe components of CVC Care Bundle. (1A)

a. Hand hygiene

b. Maximal barrier precautions include wearing of cap, mask, sterile gloves and long-sleeved gowns by the operator and those assisting in the procedure. The cap should cover all hair and the mask should cover the nose and mouth tightly. The patient should be covered with a full-sized sterile drape, with a small opening for the site of insertion.

c. Use chlorhexidine 2% aqueous or chlorhexidine 2% in 70% alcohol for skin antisepsis.

d. The subclavian approach is preferred to the jugular or femoral when not contraindicated.

e. Review daily in view of early detection of catheter-related bloodstream infection (CRBSI) and removing unnecessary catheters.

1.1.2 Use CVC with minimum number of ports or lumens essential for the management of the patient. (1B)

1.1.3 If removing body hair is needed, cutting is preferred to shaving. (II)

1.1.4 If implementation of a comprehensive strategy to reduce rates of CRBSI fails, consider using antibiotic-impregnated CVCs when catheters are expected to remain in place for more than 5 days. (1B) Other indications include burns and oncology.

1.2 Arterial catheter

1.2.1 Wear sterile gloves for the insertion of arterial catheters. (IA)

1.2.2 Use sterile dressing set. (1B)

1.2.3 Clean access site with chlorhexidine 2% with 70% iso-propyl alcohol. (IA)

1.3 Peripheral venous catheter

1.3.1 Use an upper instead of a lower extremity site for catheter insertion. Replace a catheter inserted in a lower extremity to an upper extremity site as soon as possible. (IA)

1.3.2 Non-sterile gloves are acceptable for the insertion of peripheral intravascular catheters. Do not touch access site after cleaning with 70% alcohol swab. (IA)

2. Catheter site dressing

2.1 Use either sterile gauze or sterile, transparent, semi-permeable dressing to cover the catheter site (IA). If the patient is diaphoretic or if the site is bleeding or oozing**,** a sterile gauze dressing securely held with adhesive tape is preferred. (II)

2.2 Change catheter-site dressing if the dressing becomes damp, loosened, or soiled with blood (IB). Otherwise replace dressings every 2 days for gauze dressings and at least every 7 days for transparent dressings. (II)

2.3 Do not use topical antibiotic ointment or creams on insertion sites. (IA)

3. Replacement of intravascular catheters

3.1 Promptly remove any intravascular catheter that is no longer essential. (IA)

3.2 Replace all catheters inserted during a medical emergency as soon as possible and not later than 48 hours. (II)

3.3 Do not routinely change catheters over guidewires except in difficult cases. (IB)

3.4 There is no place for routine replacement of intravascular catheters (CVC, arterial). (IB)

3.5 Replace peripheral venous catheters every 72-96 hours to prevent phlebitis. (IB)

4. Replacement of administration sets, needleless systems and parenteral fluids

4.1 Administration sets

4.1.1 Replace administration sets (including 3-way stopcocks, tubings and add-on devices) after 72-hour intervals, unless catheter-related infection is suspected or documented. (IA)

4.1.2 Replace tubing and syringes used to administer propofol infusion every 6 hours. (IA)

4.2 Needleless systems

4.2.1 Wipe the access port with a pre-packed 70% alcohol wipe before use and access the port only with sterile devices. (IB)

4.2.2 Change the needleless components after 72 hours. (II)

4.3 Parenteral fluids/Blood/Blood products

4.3.1 Complete the infusion of lipid emulsions or lipid-containing solutions within 24 hours and change the administration set. (1B)

4.3.2 Designate one port exclusively for parenteral nutrition if a multilumen catheter is used. (II)

4.3.3 Avoid administering parenteral nutrition via femoral central venous catheter. (1A)

4.3.4 Complete the infusion of blood or other blood products within 4 hours and change the administration set. (II)

4.4 Intravenous injection ports

4.4.1 Clean injection ports with a pre-packed 70% alcohol swab before accessing the system. (IA)

4.4.2 Cap all stopcocks when not in use. (IB)

4.4.3 All injection ports must be clear of blood residue at all times.

4.5 Intravenous admixtures

4.5.1 Prepare medications using a 'no-touch' technique**.** Sterile intravenous and irrigation fluids must be labeled with the date and time opened and discarded within 24 hours if not used. (II)

4.5.2 Use single-dose vials for parenteral medications when possible. (IA)

4.5.3 Do not combine the leftover content of single-use vials for later use. (IA)

4.5.4 If multi-dose vials are used

a. Clean the access diaphragm with 70% alcohol swab and let dry before use. (IA)
b. Refrigerate after they are opened if recommended by the manufacturer. (II)
c. Discard multi-dose vial if sterility is compromised. (IA)

URINARY CATHETERS

1. Catheterise only when necessary. (IA)

2. Insert urinary catheters using aseptic technique and sterile equipment. (IA)

3. Maintain closed sterile drainage. (IA)

4. Do not change catheters at arbitrary fixed intervals. (IB)

5. Bladder irrigation with antimicrobials is of limited benefit.

APPARATUS / EQUIPMENT

1. Patient care items are divided into 3 categories based on the Spaulding Classification, a classification system used to aid in determining the degree of disinfection or sterilization required for various medical devices:

   1.1 **Critical:** Items or medical devices that enter sterile tissue or the vascular system.
   1.2 **Semi-critical:** Items that come in contact with mucous membranes or non-intact skin.
   1.3 **Non-critical:** Items that come in contact with intact skin.

2. All reusable medical devices must be thoroughly decontaminated before disinfection or sterilization. (IA) (Refer to Table 4 on page 18)

3. **Ventilator circuits with humidifiers** (Semi-critical)

   3.1 Change the circuit when visibly soiled. Do not routinely change on the basis of duration of use. (1A)
   3.2 Drain and discard periodically any condensate in the circuit. Take precautions not to allow the condensate to drain towards the patient. (1B)

3.3 Wear gloves and mask when performing the above procedure. (1B)
3.4 Perform routine hand hygiene before and after the procedure. (IB)
3.5 Use closed system for filling of water into heated water humidifier.

4. **Oxygen humidifiers** (Semi-critical)

4.1 Change oxygen delivery system (nasal prongs, mask) between patients or when visibly soiled. (IB)
4.2 Use sterile water to fill bubble-through humidifiers. (II)
4.3 Change bubble-through humidifiers every 24 hours. (II)

5. Nebulisers (Semi-critical)

5.1 Clean, disinfect, rinse with sterile water and dry nebulisers between treatments on the same patient. (1B)
5.2 Use nebulisers that have undergone sterilisation or high-level disinfection for each patient. (1B)
5.3 Use only sterile fluid for nebulisation and dispense the fluid into the nebuliser aseptically. (1A)
5.4 Use aerosolised medications in single dose vial whenever possible. (1B)
5.5 Metered dose inhalers are recommended over nebulisers. (II)

6. Respiratory tract suction devices (critical)

6.1 Use sterile, single-use catheters when using open method suctioning. (II)
6.2 Use sterile water to remove secretions from suction catheter. (1B)
6.3 Change entire length of suction-collection tubing and canisters between patients. (IB)
6.4 Closed-suction system is recommended for infectious cases. (II)

Table 4: Disinfection and sterilisation of devices:

Spaulding classification	Devices	Disinfection/ sterilisation	Processes
Critical (enters sterile tissue or vascular system)	Implants, scalpels, needles, cardiac and urinary catheters	**Sterilisation** Time: prolonged contact (hours)	Purchase as sterile Sterilise by steam under pressure. If heat labile, use ethylene oxide gas or chemical sterilants eg 2% glutaraldehyde-based products, 6% stabilised hydrogen peroxide, peracetic acid
Semi-critical (touches intact mucous membranes [except dental])	Flexible endoscopes, laryngoscopes, endotracheal tubes, face mask, breathing circuits, bronchoscopes and their accessories (except for biopsy forceps and specimen brush, which are considered critical items), nebulisers and their reservoirs, oral and nasal airways, resuscitation bags, stylets, suction catheters and suction collection canisters	**High-level disinfection:** Destroys all microorganisms except high numbers of bacterial spores Time : 20 minutes or more	Wet pasteurisation at 76°C for 30 minutes or chemical disinfectants eg 2% glutaraldehyde-based products, 6% stabilised hydrogen peroxide, chlorine, peracetic acid. Heat sterilisation is preferred for between patient processing of heat stable instruments. Follow high-level disinfection by rinsing with sterile water and drying. (IB) If no sterile water available, rinse with tap water followed by an alcohol rinse and forced-air drying.

Spaulding classification	Devices	Disinfection/ sterilisation	Processes
Semi-critical (touches intact mucous membranes [except dental])	Thermometers Temperature sensors	**Intermediate-level disinfection:** Inactivates tubercle bacilli, vegetative bacteria, most viruses and fungi. Does not necessarily kill bacterial spores. Time : 10 minutes or less	Chemical disinfectants: sodium hypochlorite, ethyl or isopropyl alcohol, phenolic and iodophor solutions.
Non-critical (touches intact skin, not mucous membranes)	Stethoscopes, bedpans, blood pressure cuffs, crutches, bed rails, bedside table, patient furniture	**Low-level disinfection:** Kills most bacteria, some viruses and fungi. Cannot reliably kill resistant microorganisms *(*e.g. tubercle bacilli, bacteria spores) Time : 10 minutes or less	Chemical disinfectants: ethyl or isopropyl alcohol (70-90%), sodium hypochlorite 5% 1:50 dilution, iodophor solution, quarternary ammonium germicidal detergent.

ENVIRONMENTAL CLEANING

1. Linen

1.1 Bed linen can become rapidly contaminated with colonised skin scales. Every patient should have clean, freshly laundered bed linen at least daily or when soiled. (IA)

1.2 Place used linen into the linen bag and do not leave them on the floor. (IB)

1.3 Place linen used by infected patients or soiled with blood and body fluid into sealed linen bags that prevent leakage (alginate bags). (IB) Handle them as minimal as possible.

1.4 Do not sort linen in ICU at any time. (IB)

2. Housekeeping (Refer to Table 5 on page 22)

2.1 Follow the ward cleaning schedule, with adequate daily cleaning of all areas including the sinks and equipments. (IC)

2.2 Detergent and water are adequate for cleaning surfaces in non patient-care areas (e.g. administrative offices). (II)

2.3 Clean walls, blinds or windows in patient-care areas when visibly dusty or soiled and when patients are discharged with Chlorine (NaDCC tablets or freshly prepared Sodium hypochlorite 5% 1:10 dilution equivalent to 5000 ppm of available chlorine. (II)

2.4 Change curtains weekly and when patients are discharged. (II)

2.5 Protect mattresses and pillows with impermeable material. Clean and disinfect between patients. (IB)

2.6 Clean the bed and other items used by the patients when patients are discharged. Only use the bed for the next patient after it is completely dry. (IC)

2.7 Disinfect reusable items and equipment in the isolation room with solution of 1:100 equivalent to 500 ppm of available chlorine when an infected patient is discharged. If possible, open the windows to air the room. Only use the room for the next patient when it is completely dry. (IC)

2.8 Use Chlorine (NaDCC tablets or freshly prepared Sodium hypochlorite 5% 1:10 dilution equivalent to 5000 ppm of available chlorine) for cleaning up body fluid spillage. Alternatively, stabilized chlorine absorbent powder or granules can be used. For disinfection of the isolation room of patients with infectious diseases, solution with 1:100 equivalent to 500 ppm of available chlorine will be required. (IC)

3. Waste disposal

3.1 Disposal of waste must comply with hospital protocol. (IC)
3.2 Dispose needles and sharps directly into puncture resistant containers, which should be available next to the areas used for injection or venepuncture. The containers should not be filled more than ¾ full. (IC)
3.3 Never recap, bend or break needles. (IC)
3.4 Discard dressings and other supplies saturated with blood or other potentially infectious material into clinical waste bag. (IC)

Table 5: Housekeeping

Areas / Equipments	Disinfection	Frequency
Floors, walls, sinks –non spillage areas	1000 ppm of Sodium Hypochlorite 5%	Clean floor and sink 3 times daily Clean wall at least daily
Floors, walls and table tops –spillage areas	Confine and contain the spill by using paper towels or disposable absorbent material (stabilized chlorine absorbent powder or granules) to absorb the bulk of the spill. Clean with 5000 ppm Sodium hypochlorite 5%	As soon as possible
Table tops	500 ppm Sodium hypochlorite 5% or Quaternary Ammonium compound e.g. Benzyl ammonium chloride with alcohol	At least daily and when patient is discharged
Bed and railings	Quaternary Ammonium compound e.g. Benzyl ammonium chloride with alcohol	
Drip stands and transducer holders		
Stethoscope		
Pressure bags		
Computer Keyboards		
Monitors	Quaternary Ammonium compound e.g. Benzyl ammonium chloride	
Infusion pumps		
Ventilator surfaces		

HANDLING OF DECEASED PATIENTS

1. All bodies of deceased patients should be handled using standard precautions, as bloodborne pathogens may remain infective for some time. If additional precautions were required before death, staff handling the body after death should continue these precautions.

2. Infectious conditions in the recently deceased that present particular risks include, tuberculosis, group A streptococcal infection, typhoid fever, paratyphoid fever, hepatitis B and C, HIV, meningococcal sepsis, Creutzfeldt-Jakob disease and anthrax.

3. Staff who handles dead bodies must wear protective clothing consisting of impermeable gown or apron, mask, and gloves.

4. All invasive devices must be removed with care to prevent excessive leakage from the sites. The sites should be covered appropriately to contain leakage of body fluids.

5. It is recommended to use occlusive dressings (eg Op-Site, Tegaderm) to cover all wounds, skin breaks and puncture sites to contain body fluids. Extra padding with dressings may be placed under the occlusive dressing.

6. Any spilled blood or body fluids must be wiped with 10,000 ppm. Sodium hypochlorite.

7. After removing protective clothing and gloves, hands should be washed thoroughly.

8. Used linen or protective clothing should be placed in bags according to infectious risk.

VISITORS

1. Advise families and visitors about the importance of hand hygiene. (II)

SURVEILLANCE

1. Surveillance allows detection of new emerging organisms, clusters of infection or outbreaks. It also monitors epidemiologic trends, allows early isolation of patients who are colonised with MDROs and assesses efficacy of infection control interventions.

2. The simplest form of surveillance is the antibiogram. Its limitation is that it does not distinguish colonisation from infection, thus may lead to inappropriate use of antimicrobials.

3. Clinicians should be provided with antimicrobial susceptibility reports and analysis of current trends with updates at least annually to guide antimicrobial prescribing practices. (1B)

4. Optimal timing and interval timing of surveillance cultures are not well defined. Cultures may be obtained routinely at time of admission to ICU or on periodic basis e.g. weekly. (IB)

5. Sites from where cultures are obtained have to be carefully considered e.g. consider tracheal aspirate as the sampling site of choice if the rate of VAP is high. Refer to table 5 for sampling sites for MDRO.

CONTROLLING MULTIDRUG RESISTANT ORGANISMS

Multidrug resistant organisms (MDROs) are defined as micro-organisms, predominantly bacteria that are resistant to one or more classes of anti-microbial agents e.g. MRSA, VRE, ESBL, resistant *Acinetobacter baumanii* and *Pseudomonas aeruginosa.*

1. Prevention of Transmission of MDROs

1.1 Obtain environmental cultures (e.g. surfaces, shared medical equipments) when there is epidemiologic evidence that an environmental source is associated with on-going transmission of targeted MDROs. (1B)

1.2. Decolonisation

1.2.1 Decolonisation involves treatment of person with a specific MDRO usually MRSA to eradicate carriage of that organism. This includes use of mupirocin in the patient's nares or in combination with oral antibiotics (e.g. rifampicin in combination with trimethoprime-sulfamethoxazole or ciprofloxacin) plus the use of an antimicrobial soap for bathing. Monitor susceptibility to detect emergence of resistance to decolonising agent.

1.2.2 Decolonisation regimes are not sufficiently effective to warrant routine use. Therefore, decolonisation is limited to MRSA outbreaks. Do not use topical mupirocin routinely for MRSA decolonisation as resistance may emerge. (IB)

1.2.3 Regimes and efficacy of decolonisation protocols for VRE and MDR-GNB have not been established.

2. MDROS Outbreak

2.1. An MDRO outbreak occurs when there is either :

- several cases of MDROs which are epidemiologically associated by person, time or place.
- an increase in the number of cases with a frequency clearly in excess of normal expectancy.
- even one case when previously there has never been a case of MDRO.

2.2. The laboratory usually picks up the increase in the number of cases and alerts the physician.

2.3. Management of MDROs outbreak (Refer to table 6 on page 27)

2.3.1 An outbreak is not a reason to close ICU or refuse new admissions. (II)

2.3.2 Notify infection control team, ICU staff and relevant disciplines. (IB)

2.3.3 Monitor and analyse prevalence and incidence of MDRO infection and colonisation. When possible, distinguish colonisation from infection. (IB)

2.3.4 Review and reinforce standard and contact precautions. Verify compliance of infection control measures among all HCWs and visitors.

2.3.5 Cohort patients with the same MDROs. Staff assigned to the cohort should work with these patients only. (IB)

2.3.6 Monitor cleaning performance to ensure consistent cleaning and disinfection of surfaces in close proximity to patient and those likely to be touched e.g. bedrails, carts, knobs.

2.3.7 For MRSA, VRE and MDR-GNB outbreak, refer to Table 4.

2.3.8 No recommendation can be made regarding when to discontinue contact precautions.

Table 6: Management of MDROs outbreak

Outbreak	MRSA	VRE	MDR-GNB
STANDARD PRECAUTION	Observe strict adherence to both measures Ensure compliance by auditing regularly		
HAND HYGIENE			
ROOM ASSIGNMENT	Isolation room if possible. If not available, cohort. Never place MRSA positive patient with VRE positive patient	Isolation room If possible. If not available, cohort	Isolation room if possible. If not available, cohort
GLOVES	At all times when in the room Remove gloves prior to exiting isolation room Wash hands immediately		
LONG GOWNS	If in contact with the patient or in the isolation room Remove gowns before exiting isolation room		
MASKS/FACE SHIELDS/EYE WEAR	Mask to be worn at all times Face shields or eye wear if splattering is likely		
DEDICATED EQUIPMENT	At all times		
ACTIVITY OUTSIDE ROOM	Limit movement and transport of patients Notify receiving department regarding patients with MDROs		

Outbreak	MRSA	VRE	MDR-GNB
SURVEILLANCE SWABS	• Nasal swabs from all ICU patients • Wound swabs if applicable • Nasal swabs from staff only if implicated in transmission	• Rectal swabs from all ICU patients • Wound swabs in applicable • Rectal swabs from staff only if implicated in transmission	• In the setting of a respiratory reservoir outbreak, tracheal aspirate culture should be sent from suspected patients
DECOLONISATION (only during outbreak)	• For nasal positive patients, use topical mupirocin 2% tds for 5 days • For body positive, use chlorhexidine 2% bath for 5 days, hair wash for 2 days with contact time of 1 minute • For open wound, cover wound with occlusive dressing	• No recommenda-tion	• No recommenda-tion

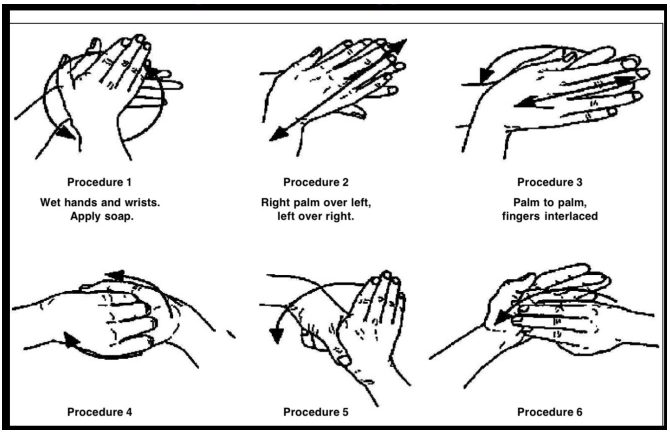
EDUCATION

1. Vigilance on the part of health care workers in infection control will determine the success of infection control. Education of all personnel should be carried out regularly to reinforce and update their knowledge and practices.

2. Clinicians should be aware that Indiscriminate use of antibiotics exerts selective pressure leading to the development of MDROs. These antibiotics include vancomycin, third generation cephalosporins, anti-anaerobes, quinolones and carbapenems. (IB) Judicious use of antibiotics includes the appropriate antimicrobial agent, dose and duration.

Appendix I: Hand Hygiene

Appendix II: Steps in Hand washing



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