GUIDELINES ON INFECTION CONTROL IN ANAESTHESIA

May 2014

COLLEGE OF ANAESTHESIOLOGISTS
ACADEMY OF MEDICINE OF MALAYSIA

IN COLLABORATION WITH

MALAYSIAN SOCIETY OF ANAESTHESIOLOGISTS

GUIDELINES ON INFECTION CONTROL IN ANAESTHESIA

May 2014

Endorsed by:

Council Members, College of Anaesthesiologists
Academy of Medicine of Malaysia
2014 - 2015

President	*Datin Dr V Sivasakthi*
Deputy President	*Dr Tan Cheng Cheng*
Hon Secretary	*Associate Professor Dr Raha Ab Rahman*
Hon Treasurer	*Professor Dato' Dr Wang Chew Yin*
Council Members	*Professor Dr Lim Thiam Aun*
	Dr Lim Wee Leong
	Dr Patrick Tan
	Dr Thohiroh Abd Razak
Coopted Council Members	*Dr Raveenthiran Rasiah*
	Dr Sushila Sivasubramaniam

Published by

College of Anaesthesiologists, Academy of Medicine of Malaysia

In collaboration with

Malaysian Society of Anaesthesiologists

Contributors

1. **Dr Kavita Bhojwani**
   Senior Consultant and Head
   Department of Anaesthesiology and Intensive Care
   Hospital Raja Permaisuri Bainun
   Ipoh, Perak, Malaysia
2. **Dr Mohd Rohisham Bin Zainal Abidin**
   Consultant and Head
   Department of Anaesthesiology and Intensive Care
   Hospital Tengku Ampuan Rahimah
   Klang, Selangor, Malaysia
3. **Dr Mafeitzeral Mamat**
   Anaesthetist and Senior Lecturer
   Anaesthesia and Critical Care
   Faculty of Medicine
   Universiti Teknologi MARA
   Sungai Buloh, Selangor, Malaysia
4. **Dr Shahridan Fathil**
   Consultant
   Department of Anaesthesia
   JurongHealth @ Alexandra Hospital
   Singapore
5. **Dr Noorulhana Sukarnakadi Binti Hadzarami**
   Specialist
   Anaesthesiology and Intensive Care
   Department of Anaesthesiology and Intensive Care
   Hospital Kuala Lumpur, Kuala Lumpur, Malaysia

Reviewers

1. **Dr Anselm Suresh Rao**
   Consultant Anaesthesiologist and Intensivist
   Gleneagles Hospital
   Kuala Lumpur, Malaysia
2. **Dr Jeyaseelan P Nachiappan**
   Consultant Infectious Disease Paediatrician
   Hopital Raja Permaisuri Bainun
   Ipoh, Perak, Malaysia
3. **Datin Dr Ganeswrie Rajasekaram**
   Senior Consultant Clinical Microbiologist and Pathologist
   Hospital Sultanah Aminah
   Johor Bharu, Johor, Malaysia

CONTENTS

Message from the President of the College of Anaesthesiologists, Academy of Medicine Malaysia	**4**
Introduction	**5**
Recommendations for Preoperative Hand Decontamination	**6**
Antiseptic Agents and Skin Preparation	**6**
Sharps Use and Disposal	**7**
Theatre Wear and Codes of Practice	**8**
Preventing Drug Contamination	**13**
Anaesthetic Apparatus	**14**
Anaesthetic Machines	**19**
Infection Control Guidelines Specific to Peripheral Nerve Blocks	**20**
Conclusion	**21**
References	**22**

MESSAGE

My dearest Colleagues,

It is with great pleasure that I take this opportunity to write a few lines in these latest "Guidelines on Infection Control For Anaesthesiologists" which is the culmination of hard work and dedication from a select group of senior anaesthesiologists. Infection prevention and control came to the public awareness after the rise of MRSA and C. difficile in particular in the middle of the last decade. This publication is indeed timely as we see an increasingly difficult problem of resistant organisms emerging and treating them has become challenging. The guidelines highlights the need for healthcare professionals to understand and put into practice the principles of infection prevention and control in order to improve patient outcomes.

The contents of these guidelines cover a spectrum of areas ranging from hand washing, antiseptics used, sharps use and disposal, theatre wear, cleaning of anaesthesia machines and other apparatus and lastly the recommendations for preoperative hand decontamination as well as performance of peripheral nerve blocks.

I strongly believe that if we strictly adhere to the practices in these evidence based guidelines, we collectively can make a difference to ensure that infection is curtailed and that the best outcome for the patient can be achieved!

I conclude by thanking the contributors, the panel of reviewers and the secretariat for making this possible.

Datin Dr V Sivasakthi
President
College of Anaesthesiologists
Academy of Medicine of Malaysia

INTRODUCTION

The practice of anaesthesia must be made as safe as possible to all patients, anaesthetists and other health care providers, thus it is absolutely vital that infection risks to all parties are kept to a minimum. These guidelines on infection control are focused with particular emphasis on issues anaesthetists would be facing and dealing with in their daily practice. It is meant to complement the Ministry of Health Malaysia book on 'Policies and Procedures on Infection Control 2nd Edition, prepared in 2009'.

These guidelines cover hand hygiene, invasive procedures, regional anaesthesia, the wearing of gloves, masks, gowns, movement within and outside the operating theatre and the surgical order of patients in an operating list.

We would like to thank Associate Professor Datin Dr Norsidah Abdul Manap, Past President of the College of Anaesthesiologists, 2011-2013, for initiating the development of these guidelines. A special note of appreciation to reviewers, Datin Dr Ganeswrie Rajasekaram, Dr Anselm Suresh Rao and Dr Jeyaseelan P Nachiappan.

RECOMMENDATIONS FOR PREOPERATIVE HAND DECONTAMINATION

Agents or methods of skin decontamination that cause skin abrasions should not be used. Using a scrubbing brush on the skin is not recommended. An approved antiseptic agent (chlorhexidine gluconate 4% or povidone iodine 7.5%) should be used for handwashing.

'Surgical scrub' aseptic handwash should be carried out for a minimum duration of two minutes. In between cases, the use of alcohol gel hand rub applied using the recommended technique is considered adequate in the operating theatre where the hands are clean and have already been decontaminated by conventional methods.

ANTISEPTICS AGENTS AND SKIN PREPARATION

Alcohol based solutions are more effective and preferable to aqueous solutions for skin preparation (chlorhexidine gluconate 0.5% in alcohol 70%; povidone iodine 7.5%). They should be allowed to dry thoroughly after application on the skin.

Controversy still exists regarding the safest antiseptic solution to use for regional blockade. Some of the more commonly used solutions are povidone iodine, chlorhexidine gluconate with and without isopropyl alcohol, iodophor preparation in isopropyl alcohol and isopropyl alcohol alone. Both, povidone iodine and chlorhexidine solutions, have not received specific Food and Drug Administration of the USA (FDA) approval for use before regional anaesthesia (spinal, epidural and peripheral block) because of a lack of clinical testing. At present, the Material Safety Data Sheet registered with the FDA does not describe adverse neurological or central nervous system events after recommended povidone iodine or chlorhexidine use.

It has, however, been shown that 0.5% chlorhexidine in 70% alcohol may be the most effective in maintaining an aseptic state on the skin surface

for a prolonged period of time and therefore reducing the overall risk of epidural catheter colonization.[2,3]

For the insertion of a central venous line (CVL), 2% chlorhexidine in 70% alcohol is recommended. Povidone iodine should be used in infants less than two months old.

Gross contamination at the site of procedure should be subjected to a pre wash using a non antimicrobial soap and thoroughly dried prior to antiseptic preparation. Apply the antiseptic skin preparation in concentric circles moving away from the proposed incision site to the periphery; allow sufficient prepared area to accommodate an extension to the incision or new incisions or drain sites to be made or site for regional block. Allow the alcohol to dry after the application and before the use of electrocautery. The type of the skin preparation may need to be modified according to the condition of the skin (e.g. burns) and the location of the incision site (e.g. alcohol and alcohol based solution should not be used on mucous membranes).

Ideally, antiseptics should be available as ready-for-use dilutions in small, single-use containers. Multi-use containers are liable to contamination each time they are opened. Multi-use antiseptic solutions, if used, should be labelled with the date it was opened and used within the 'use by date'. It should never to be refilled and must be discarded after the expiry date.

SHARPS USE AND DISPOSAL

Use an appropriate size and type of 'sharps' bin / box for the anticipated procedure and volume of usage. Do not place 'sharps' bins / boxes in areas where there may be an obstacle to environmental cleaning. Avoid overfilling; the sharps containers must be closed securely when three-quarters full. Used needles must not be resheathed / recapped. Surface contamination by blood or body fluids should be dealt with promptly, as stated per the "Policies and Procedure on Infection Control", Ministry of Health). Policies to use safety devices ought to be phased in. Staffs in OT ought to be familiar with local protocol following sharps injury.

THEATRE WEAR AND CODES OF PRACTICE

Gloves

Sterile gloves have to be worn for invasive procedures such as CVL insertions, arterial line insertions, nerve blocks (neuraxial, peripheral, ultrasound guided), fibreoptic intubation and endotracheal suction. The addition of a second pair of surgical gloves significantly reduces perforations to the innermost glove, reduce hand contamination and also reduces the risk of transmission of blood borne pathogens.

Cannulation of central veins is to be performed using full aseptic technique including the wearing of facemask, sterile gown and gloves, and the use of a sterile field bordered by sterile drapes is required.[1]

Gowns

The purpose of theatre gowns and drapes is to prevent bacteria from the health care worker or the non sterile area of the patient passing through the material directly into the surgical wound or into the air.

Face Masks

A single 3 ply surgical mask (filter size < 1.1 microns) is to be worn by all members of the scrub team. There is insignificant evidence to support the continued wearing of masks for non-scrubbed staff to prevent wound infection.[1] It does however provide a barrier for airborne organisms and also protects the health care worker against blood, body fluid splashes, smoke and laser plumes. Masks should not be worn outside theatre areas or left tied around the neck. After surgery, the mask should be removed and disposed appropriately. A fresh mask should be worn for each operation. In vertical laminar flow theatres, a mask should be worn during prosthetic implant surgery.

Performance of aerosol generating procedures such as endotracheal intubation, bronchoscopy and endotracheal suctioning for patients who have highly infectious respiratory infections (e.g. Severe acute respiratory syndrome (SARS), avian influenza, H1N1 influenza) require the use of a Powered Air Purifying Respirator (PAPR) by the health care worker.

Theatre Caps

Theatre personnel should wear disposable headgear even though there is little evidence for the effectiveness of this practice the exception being the scrub staff because of their close proximity to the operating field. Headgears are still recommended as it helps to keep hair out of the way and different colours are use to indicate the position of personnel. After use, headgears must be disposed off and not worn outside the operating theatre. Cloth caps, if used, must be washed daily.

Theatre Footwear

Well fitting footwear with impervious soles should be worn and should be regularly cleaned to remove splashes of blood and body fluid. Procedures should be in place to ensure that this is done regularly. Studies of bacterial contamination of the Operating Theatre (OT) corridor floors indicate a change of footwear should occur as far from the OT as possible.[5] OT footwear is forbidden outside the operating theatre complex. Overshoes lead to a significant increase in floor colony and may also contaminate the hands when they are put on or removed.[7]

Jewellery

Wearing of rings or other jewellery during procedures are strongly discouraged. If religious or cultural influences strongly condition the personnel's attitude, simple and practical solution allowing effective hand hygiene is for the personnel to wear the ring(s) around the neck on a chain as a pendant.[8]

Artificial fingernails are not allowed and nails to be kept short, less than 0.5cms. Removing nail polish from operating room (OR) personnel prior to scrubbing and from patients prior to surgery on their hands is recommended. There are concerns that micro-organisms can proliferate in chipped, peeled nails because they remain relatively protected from antimicrobial effect of soap or alcohol scrubs and can act as a vehicle for the transfer of infective agents.[9,10]

Visitors

For parents accompanying children, they are required to wear an overcoat and a change of footwear. They will need to leave the operating room after the induction. If visitors are to enter the OR and stay on for the entire duration of surgery (e.g. husbands accompanying wives for Caesarean sections), they should change into theatre attire.

Attire on Leaving Operating Theatre

Theatre staff should wear an overcoat when leaving the OT and change their footwear. Surgical masks and caps must be removed. If an overcoat is not worn, they must change into new OT attire on return to the OT. Wearing OT attire in public areas can give the impression that discipline is lax. Although there is insufficient evidence to support the wearing of overcoats over surgical attire to prevent infection, the practice is desirable aesthetically.[11]

Movement in OT and OT Layout

The doors to the OT and OR should be kept closed except when necessary for passage of the patient, personnel, supplies and equipment. Disrupted pressurisation causes a mixture of the clean air of the OT with the corridor air which has a higher microbial count. Cabinet doors should remain closed.[12]

Room temperature must be maintained between 18 - 21^{0}C at all times. Humidity should be maintained at 50 - 60%. The OR should be 1^{0}C cooler than the outer area. This aids in the outward movement of air. A thermostat and humidistat suitable for the OR application ought to be made available, properly positioned and calibrated.

Operating room doors need to be kept closed during procedures to optimise the efficiency of the ventilation system. A conventionally ventilated theatre should have an airchange rate of 15 - 20 airchanges/hour or at least three exchange of fresh air (1 airchange every 3 minutes). Each airchange will, assuming perfect mixing, reduce airborne contamination to 37% of its former level.

Operation Theatres are designed to have gradients of cleanliness from general areas at the periphery of the suite (changing rooms, rest area, corridors and disposal rooms), through intermediate areas (scrub, anaesthetic) to the cleanest areas (theatre and lay-up). Given this concept of gradients, measures such as red lines (over which non-theatre feet must not tread) are arbitrary. Whilst they may enforce discipline, they are unlikely in themselves to have any effect on patient infection.

Use of either one (one trolley from ward to OT table) or two transfer trolleys (one from ward to transfer zone and another from transfer zone to OT table) does not seem to affect number of airborne bacteria in theatre.[13] The use of two trolleys does have a lower bacterial counts on floors but the contribution to airborne infection is negligible.[14] If beds are used to transport patients from wards into theatre, the bedding should be removed and be replaced with clean, fresh linen.

Personal items are not encouraged to be brought into OTs but should be kept in lockers provided.

Despite the lack of evidence, adhesive mats are used at air-locks as sticky surface that collects debris from trolley wheels and footwear. However there is a concern that it may become a reservoir and a source of contamination. Therefore, it should be replaced daily.[15]

Listing of Biohazard Patients

Most microbes found in the circulating air of the operating theatre originate from the staff and very little originate from the patient. However, if theatre ventilation is effective air should not be a source of infection regardless of whether the procedure is dirty or clean. Surface contamination is more likely to pose a risk of transmission of infection than air. The only practical way of reduction of microbes is by cleaning and disinfection of relevant surfaces. Therefore, the operating table, surface and items of equipment in direct contact with the patient should be cleaned between patients. Traditionally ‘dirty’ cases or infective cases are put last in the list as this

would facilitate the process of adequate decontamination. However this is not necessary provided the cleaning of surfaces is done adequately during a list.

A conventionally ventilated OR does not need to lie idle for more than 15 minutes before a clean procedure is performed following a dirty operation. Vertical laminar flow OR need only 5 minutes to replace the full volume of air in the theatre.

Use standard precautions for all patients. Take extra care with sharps and ensure that all measures are in place to minimise the risk of needle stick injury or contamination with blood. The operating team should be experienced and the procedure unhurried. The addition of a second pair of surgical gloves significantly reduces perforations to the innermost gloves.[16] Gowns and drapes that are waterproof and disposable are recommended as they offer better protection.[17]

Cleaning the OR in-between Patients

After the patient has left and before the next patient enters the OR, surfaces such as the operating table and any equipment in direct contact with the patient should be cleaned with a detergent and allow to air dry. 15 minutes is sufficient for conventionally ventilated theatres to lie fallow after dirty cases and before the next case. Floors should also be cleaned with detergent and dried. Disinfectants are unnecessary apart from their use in the removal of body fluid spillage. Walls and ceilings are rarely heavily contaminated; cleaning them twice a year is a reasonable practice.[11]

PREVENTING DRUG CONTAMINATION

Syringes and Needles

Syringes and needles are sterile, single-use items and after entry or connection to a patient's vascular system or attachment to infusions, a syringe and needle should be considered contaminated and used only for that patient.

Before use, prepared syringes and needles should be stored in a clean container and syringes capped to avoid contamination. It is preferable to use a single drug tray for each patient to minimize cross-contamination and to reduce the need to recap the needle. After use or at the end of the anaesthetic, all used syringes with needles should be discarded into an approved sharps container.

Presentation of Drugs for Injection

Because of the potential for cross infection, the use of the contents of multiple dose vials and ampoules for more than one patient is not recommended except in a dispensing situation where different doses are drawn up before administration of first dose to a patient. Likewise it is recommended that any infusion should be prepared and used for one patient only.

Intravenous Drip Set

All infusions, administration sets or items in contact with the vascular system or other sterile body compartments are for single-patient use. Connections and injection ports in intravenous lines should be kept to a minimum. Injection ports should be maintained with a sterile technique, kept free of blood and covered with a cap when not in use.

ANAESTHETIC APPARATUS

Items of anaesthetic equipment may become contaminated either directly or indirectly. Contamination is not always visible and all used pieces of equipment must be assumed to be contaminated and disposed off or, if reusable, undergo a process of decontamination. There is a need to designate a person who is responsible for ensuring equipment cleanliness. The following measures are intended to minimise the risk of transmission of infection in the respiratory tract via anaesthetic equipment.

Single-use Equipment

The balance between single-use items and re-usable equipment will require local determination based on an assessment of patient safety, the available facilities and cost. Packaging should not be removed until the point of use for infection control, identification, traceability in the case of a manufacturer's recall, and safety.

Decontamination

Decontamination is a combination of processes including cleaning, disinfection and/or sterilisation used to make a re-usable item safe to be handled by staff and safe for further use on patients. Effective decontamination of reusable devices is essential in reducing the risk of infection.

Decontamination Processes

Cleaning - removal of foreign material from an item. This usually involves washing with a detergent to remove contamination followed by rinsing and drying. All organic debris, e.g. blood, tissue or body fluids, must be removed before disinfection or sterilisation, as its presence will inhibit disinfectant or sterilant from contacting microbial cells. Cleaning before sterilisation is of the utmost importance in the effectiveness of decontamination procedures and in reducing the risk of transmission of pathogens and prions.

Enzymatic detergents can aid in the cleaning of difficult to remove organic matter. It is intended for use in soaking or pre-cleaning instruments as a first step in the disinfection or sterilization cycle.

Ultrasonic cleaner or washer converts high frequency sound waves into mechanical vibration in solution. This equipment aids in loosening and "lifting off" organic soil from hard to reach areas of medical devices such as biopsy forceps of endoscope.

Low Level Disinfection - kills most vegetative bacteria (except *M.tuberculosis* and bacterial spores), some fungi and some viruses. Examples of such disinfectants are sodium hypochlorite, 70% alcohol and chlorhexidine.

High Level Disinfection - kills vegetative bacteria (not all spores), fungi and viruses. With sufficient contact time (often several hours), these high level disinfectants may produce sterilisation, e.g. the use of aldehydes, peracetic acid and chlorine dioxide.

Sterilisation - A process used to render an object free from viable micro-organisms, including all bacteria, spores, fungi and viruses, with techniques such as autoclaving (but see prions later).

Risk Assessment

The choice of equipment and / or the level of cleanliness / disinfection / sterility required of reusable items may be assessed against the risk posed to patients of transmission of infection during any procedure in which the equipment is employed. It has been proposed that medical devices be classified into three groups:

1. Critical devices - the device will penetrate skin or mucous membranes enter the vascular system or a sterile space - these devices require sterilisation.

2. Semi critical devices - the device will be in contact with intact mucous membranes or may become contaminated with readily transmissible organisms - these devices require high-level disinfection or sterilisation.

3. Non critical devices - the device contacts intact skin or does not contact patient directly - these devices require low-level disinfection or cleaning.

INFECTION CONTROL RECOMMENDATION FOR ANAESTHETIC APPARATUS

Anaesthetic Facemasks

Although normally in contact with intact skin, these items are frequently contaminated by secretions from patients and have been implicated in causing cross-infection; local disinfection is not normally effective[18]. These items should preferably be single-use items or to be sterilised between patients by an audited Sterile Supplies Department (SSD) in accordance with the manufacturer's instructions.

Airways and Tubes

Oral airways, nasal airways and tracheal tubes should be of single-use type since they readily become contaminated with transmissible organisms and blood.[19,20] Ideally, supraglottic airways should be of the single-patient use type but supraglottic airway designed for repeated use should be sterilised no more often than the manufacturer recommends. A supraglottic airway used for tonsillectomy or adenoidectomy should not be used again. We recommend single-use supraglottic airways.

Catheter Mounts and Angle Pieces

It is recommended that these items are single-patient use type or sterilised if it is to be reused.

Anaesthetic Breathing Systems

It was previously recommended "an appropriate filter should be placed between the patient and the breathing circuit (a new filter for each patient)". Although it appears that pleated hydrophobic filters have a better filtration performance than most electrostatic filters, the clinical relevance of this has yet to be established.[21,22]

The disposable anaesthetic breathing circuits are supplied as non-reusable items. In practice, most departments of anaesthesia used these circuits for more than one patient or for more than one operating session in conjunction with the use of a new filter for each patient.

We recommend that anaesthetic circuits to be routinely changed on a daily basis. If visibly contaminated or used for highly infectious cases, e.g. tuberculosis, the circuits should be changed between patients and safely discarded. No attempt should be made to reprocess these items.

Laryngoscopes

As with anaesthetic facemasks, laryngoscopes are known to become contaminated during use. Current practices for decontamination and disinfection between patients are frequently ineffective, leaving residual contamination that has been implicated as a source of cross-infection.[23,25] Blades are also regularly contaminated with blood indicating penetration of mucous membranes, which places these items into a high-risk category.[25] Proper cleaning of laryngoscope blades is of great importance before decontamination / sterilisation, particularly of residue around light sources or articulated sections. New purchases should be of a design that is easy to clean. Although repeated autoclaving may affect the function of laryngoscopes, re-usable laryngoscope blades should be sterilised by an audited SSD between patients, following the manufacturers' instructions.[26] Plastic sheaths may be used to cover blades and handles to reduce contamination but it has been noted, especially with blade covers, that these have created difficulties during tracheal intubation.

There are an increasing number of inexpensive, single-use laryngoscope blades and handles of improving design available, and their use is to be encouraged. The choice of blade must be dictated by Departments of Anaesthesia. Traditional blades should be available at all times in case difficulty is encountered.

Laryngoscope handles also become contaminated with micro-organisms and blood during use, and they should be washed / disinfected and, if suitable, sterilised by SSDs after every use. The knurled handles of laryngoscopes cannot be cleaned reliably manually if covered in blood or body fluids.

Anaesthetists should show great care when handling laryngoscopes: wear gloves during intubation and place used instruments in a designated receptacle to prevent contamination of surfaces, pillows and drapes.

Fibreoptic Bronchoscopes

These are expensive items which cannot be autoclaved. Decontamination is dependent on sufficient contact time with high level disinfectants. It is important that the washing and cleaning process removes all organic soil from all surfaces of the scope. Decontamination is best achieved with an automated endoscope reprocessor. With the uncertainty of the future implications of variant Creutzfeld Jakob Disease (CJD), these items should have a unique identifier which should be recorded at every use to permit future tracing.

Bougies

Re-use of these items has been associated with cross-infection.[27] Manufacturers recommend that a gum elastic bougie may be disinfected up to five times between patients and stored in a sealed packet. It is preferable that alternative single-use intubation aids are employed when possible.

Resuscitation Equipment

Single-patient use equipment should be kept in a sealed package or should be re-sterilised between patients according to the manufacturer's instructions. All training equipment should be handled similarly.

Humidifier

Sterile water is used to fill humidifiers. Hot water bath type humidifiers should be disinfected between uses.

ANAESTHETIC MACHINES

Routine daily sterilisation or disinfection of internal components of the anaesthetic machine is not necessary if a bacterial / viral filter is used between patient and circuit. However, manufacturers' cleaning and maintenance policies should be followed, and bellows, unidirectional valves and carbon dioxide absorbers should be cleaned and disinfected periodically. All the surfaces of anaesthetic machines and monitors should be cleaned on a daily basis with an appropriate disinfectant or immediately if visibly contaminated.

Sampling Lines for Side Stream Gas Analysis

These need not ordinarily be sterilised before reuse because of the one-way flow of gas through them. Sampled gas from a capnograph or other such measurement device should not be returned to the anaesthetic circuit unless it is first passed through a viral filter.

Carbon Dioxide Absorbers

When a filter is used in the circuit as describes in above, sterilisation of the carbon dioxide absorber prior to every case is not necessary nor with most models is it practicable although disposable versions and models capable of being sterilised are available. The device including the unidirectional valves should be disinfected regularly.

Surfaces

The surfaces of anaesthetic machines and monitoring equipment, especially those areas which are likely to have been touched by the gloved hand that has been in contact with blood or secretions, should be regarded as contaminated and should be cleaned at the earliest opportunity, probably between patients. Local policies should be in place to ensure that all equipment that touches intact skin, or does not ordinarily touch the patient at all, is cleaned with a detergent at the end of the day or whenever visibly contaminated. This includes non-invasive blood pressure cuffs and tubing, pulse oxymeter probes and cables, stethoscopes, electrocardiographic cables, blood warmers etc, and the exterior of anaesthetic machines and monitors. Items such as temperature probes should be for single patient use or sterilized for multiple use.

INFECTION CONTROL GUIDELINES SPECIFIC TO PERIPHERAL NERVE BLOCKS

Introduction

Infectious complications associated with regional anesthesia are rare. However, the complications associated central neuraxial techniques including meningitis, paralysis, and death are potentially more devastating. Fortunately, the reported frequency of such complications is low[27].

The frequency of infection associated with continuous peripheral nerve blocks (PNBs) remains more undefined. Cases of localized infection, bacteremia and abcess formation have been reported after continuous peripheral nerve blocks (CPNBs).[28] Increased risk factors for the development of catheter inflammation / infection includes; Intensive Care Unit stay, trauma population, prolonged (>48 hours) duration of catheter use, absence of perioperative antibiotic prophylaxis, axillary or femoral catheters, contamination of local anesthetic solution and the frequency of catheter dressing changes[27,28].

Although single-shot PNBs is believed to have a lower infectious risk when compared with CPNBs, severe complications have been reported with single-shot techniques as well. Nseir had reported the only fatal case of single-shot PNB (axillary block) complicated by streptococcal necrotizing fasciitis in an elderly patient undergoing carpal tunnel decompression.[29] However, more reports of such complication may emerge as the use of PNBs increases.

Disinfectant Solution

Chlorhexidine gluconate in an alcohol-based solution should be considered the antiseptic of choice prior to the performance of all PNBs. Chlorhexidine gluconate mixed with isopropyl alcohol is more effective compared to povidone iodine in preventing epidural catheter colonization.[3]

Sterility of Ultrasound Probes

The usage of ultrasound machine in performing these procedures adds another factor to possible risk of infection. Unlike the single use disposable kits and needles, ultrasound machine is a multi-user platform for multiple patients. The placement of protective sterile covers e.g. adhesive transparent dressings on the transducer while performing PNBs is essential for infection control purposes.

CONCLUSION

These guidelines should be followed along with the Ministry of Health Malaysia book on 'Policies and Procedures on Infection Control 2nd Edition, 2009'. This shall minimise infection risks to patients as well as healthcare workers.

It is the responsibility of all theatre and clinical staff to ensure standards are complied to and that these guidelines are disseminated effectively to all. Safe work procedures together with proper risk identification and assessment should be developed and carried out. The OT committee of each hospital should be involved along with the Infection control committee to achieve good infection control and safe practices leading to better patient care.

REFERENCES

1. Guidelines on Infection Control in Anaesthesia, Australian and New Zealand College of Anaesthetists Review PS28 2005.

2. Sakuragi T, Yanagisawa K, Dan K. Bactericidal Activity of Skin Disinfectants on Methicillin-Resistant Staphylococcus aureus. *Anesth Analg* 1995;81:555-8.

3. Kinirons B et al. Chlorhexidine versus povidone iodine in preventing colonization of continuous epidural catheters in children; A randomised, controlled trial, Anesthesiology 2001;94(2):239-244.

4. Mitchell NJ, Hunt S. Surgical face masks in modern operating rooms - a costly and unnecessary ritual? *J Hosp Infect* 1991;18:230-42.

5. Humphreys H, Russell AJ, Marshall RJ, Ricketts VE, Reeves DS. The effect of surgical theatre headgear on bacterial counts. *J Hosp Infect* 1991;19:175-80.

6. Nagai I, Katada M, Takechi M, Kumamoto R, Ucoka M, Matsuoka K, Jitsukawa S. Studies on the mode of bacterial contamination of the operating theatre corridor floor. *J Hosp Infect* 1984;15:50-5.

7. Humphreys H, Russell AJ, Marshall RJ, Ricketts VE, Reeves DS. Theatre overshoes do not reduce operating theatre floor bacterial counts. *J Hosp Infect* 1991;17:117-23.

8. WHO Guidelines on Hand Hygiene in Health Care. 2009;132-133.

9. Carter R. Ritual and risk, Nursing Times 1990;86:117-23.

10. Arrowsmith VA, Maunder JA, Taylor R. Removal of nail polish and finger rings to prevent surgical infection. Cochrane Database of Systemic Reviews 2001, Issue 4.

11. Report From the Hospital Infection Society Working Group On Infection Control In The Operating Theatres. Behavious and Rituals in the Operating Theatre. http://www.otjonline.com/links_infection_control.php

12. Policies and Procedures for Infection Control, Ministry of Health Malaysia. 2nd edition, Pg 93.

13. Lewis DA, Weymont G, Nokes CM, Cribb J, Prothero DL, Marshall DW, James PA. A bacteriological study of the effect on the environment of using a one- or two-trolley system in theatre. *J Hygiene* 1978;80:57-67.

14. Aylife GAJ, Collins BJ, Lowbury EJL, Babb JR, Lilley HA. Role of the environment of the operating suite in surgical wound infection. *Rev Infect Dis* 1991;13 Suppl A,10:S800-4.

15. Hingst V. The importance of adhesive dry mats for the reduction of germ spreading in hospitals. *Zentralbl Bakteriol* 1978;167:83-86.

16. Tanner J, Parkinson H. Double gloving to reduce surgical cross-infection. *Cochrane Database of Systematic* Reviews 2006, Issue 3.

17. Granzow JW,Smith JW, Nicholls RL, Waterman R, Muzik AC. Evaluation of the protective value of hospital gowns against blood strike-through and MRSA penetration. *Am J Infect Control* 1998;26:85-93

18. MacCallum FO, Noble WC. Disinfection of anaesthetic face masks. *Anaesthesia* 1960;15:307.

19. MillerDH,YoukhanaI,KarunaratneWU,PearceA.Presence of protein deposits on cleaned re-usable anaesthetic equip- ment. *Anaesthesia* 2001;56:1069-72.

20. Chrisco JA, Devane G. A descriptive study of blood in the mouth following routine oral endotracheal intubation. *Journal of American Association of Nurse Anesthetists* 1992;60:379-83.

21. Wilkes AR. Breathing system filters. British Journal of Anaesthesia. CEPD Review 2002;2:151-4.

22. Wilkes AR, Benbough JE, Speight SE, Harmer M. The bacterial and viral filtration performance of breathing system filters. *Anaesthesia* 2002;55:458-65.

23. Ballin MS, McCluskey A, Maxwell S, Spilsbury S. Contamination of laryngoscopes. *Anaesthesia* 1999;54:1115-6.

24. Esler MD, Baines LC, Wilkinson DJ, Langford RM. Decontamination of laryngoscopes: a survey of national practice. *Anaesthesia* 1999;54:587-92.

25. Phillips RA, Monaghan WP. Incidence of visible and occult blood on laryngoscope blades and handles. *Journal of American Association of Nurse Anesthetists* 1997;65:241-6.

26. Jerwood DC, Mortiboy D. Disinfection of gum elastic bougies. *Anaesthesia* 1995; 50:376.

27. Hebl JR and Adam D. Infectious complications of regional anesthesia Current Opinion in Anesthesiology 2011,24:573-580.

28. Capdevila X, Bringuier S, Borgeat A, Infectious Risk of Continuous Peripheral Nerve Blocks. *Anesthesiology* 2009:110:182-188.