Infection control in anaesthesia in regional, tertiary and central hospitals in KwaZulu-Natal. Part 3: Decontamination practices

Abstract

Background: Anaesthetic equipment is a potential vector for the transmission of disease. This study was undertaken to observe current infection control practices among anaesthetic nurses regarding the decontamination of anaesthetic equipment in regional, tertiary and central hospitals in KwaZulu-Natal.

Method: All hospitals that were classified as regional, tertiary and central hospitals on the KwaZulu-Natal Department of Health website (15 in total) were visited. All available anaesthesia nurses were invited to participate in a structured interview.

Results: Thirty-four anaesthesia nurses were interviewed. Results revealed that decontamination of anaesthetic equipment and other infection control practices were inadequate or inappropriate in several of the hospitals. Practices varied from one healthcare facility to another, as well as within the same facility.

Conclusion: Current infection control practices among anaesthesia nurses regarding the decontamination of anaesthetic equipment in the observed hospitals are poor. In light of the high prevalence of many infectious diseases, in particular human immunodeficiency virus, hepatitis B and tuberculosis in KwaZulu-Natal, it is critical that issues relating to decontamination practices are urgently addressed.

Introduction

Inadequately decontaminated anaesthetic equipment is a potential vector for infection in the nosocomial transmission of disease.\(^1\)\(^2\)\(^3\) The transmission of hepatitis C virus between patients in a hospital in Australia from contaminated breathing circuitry has been reported.\(^4\) Our study was undertaken to examine the decontamination practices of selected anaesthetic equipment by anaesthesia nurses in operating theatres in regional, tertiary and central hospitals in KwaZulu-Natal.

Method

Research approval was obtained from the Biomedical Research Ethics Administration and the Postgraduate Education Committee of the University of KwaZulu-Natal. Thereafter, further permission was obtained from the KwaZulu-Natal Department of Health and the respective hospital managers of all hospitals that were classified as regional, tertiary and central hospitals on the KwaZulu-Natal Department of Health website.\(^5\) Names of the visited hospitals and the interviewed healthcare workers were kept strictly anonymous. Fifteen hospitals were visited. This included one central, two tertiary and 12 regional hospitals.

The study involved a structured interview with individual anaesthesia nurses (Table I).

Anaesthesia nurses who were present and available on the day of the hospital visits were invited to be interviewed. Informed consent was obtained. The questions were open-ended. Specific key phrases were looked for in the responses. The obtained responses were compared to a set of model answers, based on current international best practice. For example, laryngoscope blades, Magill forceps and nasopharyngeal temperature probes require at least high-level disinfection (HLD) for decontamination.\(^1\)\(^2\)\(^6\)\(^7\)
There are three essential stages in HLD.\textsuperscript{6,9}

- **Cleaning**: Removal of all visible contamination from all surfaces with water and friction, e.g. use of a brush, and fluids, i.e. fluids under pressure, together with enzymatic products. Sequestered organic material poses the greatest risk of cross-contamination for patients as it impedes the effectiveness of these cleaning processes by reacting chemically with the germicide, and/or by forming a protective physical barrier for microorganisms.

- **Immersion in a high-level disinfectant**: For example, orthophthalaldehyde (Cidex-OPA\textsuperscript{b}) and glutaraldehyde (Cidex\textsuperscript{c}). The duration of immersion should be in accordance with the manufacturer’s recommendations.

- **Removal of the disinfectant**: This is achieved by adequate rinsing under tap water.

All three steps are fundamental to the effectiveness and safety of HLD. Definitions used in infection control practices are given in Table II.\textsuperscript{1,2,6,8,9}

### Table I: Anaesthesia nurse interview

| Question | Description |
|----------|-------------|
| Question 1 | Explain in detail the steps taken to clean the following anaesthetic equipment:  
- Laryngoscope blades.  
- Nasopharyngeal temperature probes.  
- Magill forceps.  
- Laryngoscope handles. |
| Question 2 | How many of the Macintosh\textsuperscript{3} and Macintosh 4\textsuperscript{th} laryngoscope blades are present in each operating theatre? |
| Question 3 | How many Magill forceps are available in each operating theatre? |
| Question 4 | With regard to the bowl containing water to clean the suction tubing and suction bowl (Yankauer\textsuperscript{e}):  
- How often is the water changed?  
- How often is the bowl changed? |
| Question 5 | With regard to humidification and exchange moisture and filters:  
- Describe where they should be placed in the anaesthetic circuitry.  
- Are they routinely used in all or only in selected patients, or are they not routinely used? |
| Question 6 | Are oropharyngeal airways resused or disposed after each use? If reused, describe their decontamination. |
| Question 7 | Describe how self-inflating resuscitation bags (Ambu\textsuperscript{b}) are decontaminated? |
| Question 8 | Do you feel that you have enough time between each case to adequately clean anaesthetic equipment and still perform your other duties? |

### Table II: Definitions and classifications used in infection control practices

| Type | Description |
|------|-------------|
| Decontamination | A process of removing pathogenic microorganisms from an object or surface so that it is no longer capable of transmitting infectious particles. It is a combination of the processes of cleaning, disinfection, and/or sterilisation. |
| Cleaning | A process of removing organic and inorganic material from an object or surface with water and enzymatic products or detergent. It is the first step in all decontamination processes. |
| Disinfection | A process that eliminates many or all pathogenic microorganisms, except bacterial spores, on objects or surfaces. There are three levels of disinfection based on the antimicrobial spectrum and rapidity of action: |
| High-level disinfection | - Destroys all microorganisms (mycobacteria, vegetative bacteria, viruses and fungal spores), except large numbers of bacterial spores in a relatively short exposure time.  
- Examples of disinfectants: Glutaraldehyde, orthophthalaldehyde, hydrogen peroxide and peracetic acid.  
- Used for semi-critical instrument decontamination. |
| Intermediate-level disinfection | - Destroys mycobacteria, vegetative bacteria, most viruses, and most fungi, but does not kill bacterial spores.  
- Examples of disinfectants: 70% isopropyl alcohol, iodophor and phenolic compounds, concentrated quaternary ammonium compounds, e.g. hospital cleaners and disinfectants with a tuberculocidal claim.  
- Used for non-critical instruments and environmental surfaces when a tuberculocidal agent is necessary. |
| Low-level disinfection | - Destroys lipid or medium-sized viruses, some fungal spores and vegetative bacteria.  
- Examples of disinfectants: Diluted quaternary ammonium compounds, e.g. hospital cleaners and disinfectants without a tuberculocidal claim.  
- Used for non-critical items and surfaces when a tuberculocidal agent is not needed. |
| Sterilisation | A process whereby all types of microorganisms, e.g. mycobacteria, vegetative bacteria, viruses and fungal spores, including bacterial endospores, are eliminated. Examples of methods include pressurised steam (autoclaves) or low-temperature sterilisation methods, e.g. ethylene oxide gas and hydrogen peroxide plasma, as well as hot air ovens. It is used for critical instrument decontamination. |
### Table III: Decontamination practices regarding laryngoscopes, nasopharyngeal temperature probes, Magill forceps, and laryngoscope handles

| Hospital | Laryngoscope blade decontamination | Magill’s forceps decontamination | Nasopharyngeal temperature probe decontamination | Laryngoscope handle decontamination |
|----------|-----------------------------------|---------------------------------|-----------------------------------------------|-----------------------------------|
|          | Method | Non-compliance | Method | Non-compliance | Method | Non-compliance | Method | Non-compliance |
| A        | Sodium bicarbonate soak and Hibitane® | No HLD | Soap and water | No HLD | Soap and water | No HLD | Cleaned once a week | Not cleaned after each patient |
|          | Wash, brush and Hibitane® | | | | | | |
| B        | HLD | No brushing | HLD | Nil | HLD | Nil | Wiped with Biocide D® |
| C        | Soap and water | No brushing, No HLD | Steam sterilisation | Nil | Not used | Not cleaned | Not cleaned | |
| D        | HLD | No brushing, No soap detergent | Steam sterilisation | Practice varies | HLD | Practice varies | Wiped with Hibitane® | Performed daily |
|          | | | | | | | | |
| E        | HLD | No soap detergent | HLD | No soap detergent | HLD | Nil | Wiped with Biocide D® | Nil |
|          | | | | | | | Water only | No HLD | Wiped with water | No disinfectant |
| F        | HLD | No initial washing, No brushing, No soap detergent | HLD | No initial washing prior to disinfection | Sheath | No HLD | Wiped with Hibitane® | Wiped with Biocide D® |
| G        | HLD | Nil | HLD | Nil | HLD | Nil | Not cleaned | Not cleaned |
| H        | HLD | Nil | HLD | Nil | Not used | Wiped with soap and water | No disinfectant |
| I        | HLD | Nil | HLD | Nil | Glove covering | No HLD | Wiped with Biocide D® | Performed daily |
| J        | HLD | No soap detergent, No brushing | HLD | No soap detergent, No brushing | HLD | No soap detergent, No brushing | Wiped with Hibitane® | Performed weekly |
|          | | | | | | | | |
| K        | HLD | Nil | HLD | Nil | HLD | Nil | Sterilisation | Performed weekly |
|          | | | | | | | | | |
| L        | HLD | No brushing | Soap and water | No HLD, performed daily | Not used | Soap and water | No disinfectant, performed daily |
|          | | | | | | | | | |
| M        | HLD | No soap detergent, No brushing | HLD | No soap detergent, No brushing | Glove covering | No HLD | Wiped with Hibitane® | Performed weekly |
|          | | | | | | | | | |
| N        | HLD | Nil | Steam sterilisation | Nil | Soap and water | No HLD | Wiped | Performed daily |
| O        | Soap and water | No HLD | Soap and water | No HLD | Soap and water | No HLD | Wiped with water | No disinfectant, performed daily |

HLD: high level disinfection
Results

During the study period, 35 anaesthesia nurses were available, 34 of who consented to being questioned. The results pertaining to the questions posed in the nurse interview are now presented.

**Question 1: Explain in detail the steps taken to clean the following anaesthetic equipment: laryngoscope blades, nasopharyngeal temperature probes, Magill forceps and laryngoscope handles**

The responses pertaining to Question 1 on the decontamination of laryngoscope blades, nasopharyngeal temperature probes, Magill forceps and laryngoscope handles and are presented in Table III and summarised in Figures 1-4. Sterilisation or HLD are the recommended methods of decontamination with regard to laryngoscope blades, nasopharyngeal temperature probes and Magill forceps (Figures 1-3). Use of other non-recommended practices implies that the required minimum standard for decontamination of the equipment was not met. This includes the following categories:

- **Inadequate HLD:** Non-compliance to HLD protocol noted, e.g. omission of washing with soap and water.
- **Neither sterilisation nor HLD:** For example, cleaning with alcohol or soap and water only.
- **Varying practice:** The method of decontamination practised in the operating theatre unit varied between recommended and other non-recommended methods, e.g. soap and water. Practice depended on the preference of the anaesthesia nurse, rather than established protocol.

Results for the practices concerning laryngoscope handle decontamination were the most varied (Figure 4). Hibitane®, an alcohol-based disinfectant, and Biocide D®, a chloride-based disinfectant, were used at hospitals where low to intermediate disinfection was practised. However, only one hospital practised disinfection with the appropriate disinfectant using the appropriate frequency, i.e. after each use.

**Questions 2 and 3: How many of the Macintosh® 3 and Macintosh® 4 laryngoscope blades are present in each operating theatre? How many Magill forceps are available in each operating theatre?**

The results pertaining to Questions 2 and 3 are shown in Figures 5 and 6.
Question 4: With regard to the bowl containing water to clean the suction tubing and suction bowl (Yankauerm) how often is the water changed? How often is the bowl changed?

Table IV: Decontamination of the suction bowl

| Hospital | Frequency of changing items |
|----------|----------------------------|
|          | Water only                  | Bowl and water            |
| A        | After each patient          | Daily                     |
|          |                             | Weekly                    |
| B        | After each patient          | Daily                     |
| C        | Daily                       | Daily                     |
|          |                             | Not changed               |
| D        | After each patient          | Not changed               |
|          |                             | Daily                     |
| E        | Not used                    | Not used                  |
| F        | Not used                    | Not used                  |
| G        | After each patient          | After each patient        |
| H        | After each patient          | Daily                     |
| I        | After each patient          | After each patient        |
| J        | After each patient          | Daily                     |
| K        | After each patient          | Not changed               |
| L        | After each patient          | Not changed               |
| M        | After each patient          | After each patient        |
| N        | After each patient          | Daily                     |
| O        | Daily                       | Daily                     |

The results pertaining to Question 4 are tabulated in Table IV and shown in Figure 7.

Question 5: With regard to humidification and exchange moisture and filters, describe where they should be placed in the anaesthetic circuitry. Are they routinely used in all or only in selected patients, or are they not routinely used?

Results pertaining to Question 5 on the correct placement of humidification and exchange moisture and filters in the anaesthetic circuitry are depicted in Figure 8. There was incorrect placement of the breathing system filter at only one hospital, where the reusable angle piece was placed between the filter and the facemask. The angle piece was reused without decontamination. All hospitals used a new filter for each patient.

Question 6: Are oropharyngeal airways resued or disposed after each use? If reused, describe their decontamination

Results pertaining to Question 6 on the use of either disposable oropharyngeal airways or reused airways after their sterilisation are tabulated in Table V and is shown in Figure 9. Disposable oropharyngeal airways were used at 12 hospitals. Three hospitals reused them after decontamination by sterilisation.
Question 7: Describe how self-inflating resuscitation bags (Ambu®) are decontaminated?

Results pertaining to Question 7 on Ambu® bag decontamination are tabulated in Table VI and shown in Figure 10. Only one hospital sterilised the Ambu® bag after each use. Thirteen other hospitals used some other method of cleaning. The Ambu® bag was not cleaned between patients at one hospital.

Table VI: Ambu® bag decontamination

| Hospital | Method              |
|----------|---------------------|
| A        | Soap and water      |
| B        | Wiped with Biocide D® |
| C        | Wiped with Hibitane® |
| D        | Wiped with Biocide D® |
| E        | Not cleaned         |
| F        | Soaked in Biocide D® |
| G        | Soaked in Biocide D® |
| H        | Wiped with Biocide D® |
| I        | Wiped with Hibitane® |
| J        | Wiped with Biocide D® |
| K        | Sterilisation (gas) |
| L        | Soaked in Biocide D® |
| M        | Soap and water      |
| N        | Soaked in Biocide D® |
| O        | Soap and water      |

Figure 10: Ambu® bag decontamination

Question 8: Do you feel that you have enough time between each case to adequately clean anaesthetic equipment and still perform your other duties?

Results pertaining to Question 8 on adequacy of time allocated for decontamination are shown in Figure 11.

Figure 11: Adequacy of time allocated for decontamination

Discussion

Anaesthesia nurses are responsible for the routine decontamination of anaesthetic equipment. It was clear from their responses that current infection control practices regarding the decontamination of anaesthetic equipment in regional, tertiary and central hospitals in KwaZulu-Natal are poor.

Decontamination of laryngoscope blades, nasopharyngeal temperature probes and Magill forceps require at least HLD or sterilisation, which needs to be carried out in strict accordance with accepted guidelines. With regard to the decontamination of laryngoscope blades, nasopharyngeal temperature probes and Magill forceps, 67%, 60% and 53% of hospitals did not meet the minimum standard required for their reprocessing, respectively. This means that many of the hospitals did not meet the minimum required standards pertaining to decontamination or reprocessing. They either did not practise sterilisation or HLD, or were noncompliant with the HLD protocol, for example, the omission of cleaning prior to immersion.
The laryngoscope handle presents a potential route for patient-to-patient transmission of blood and organisms from the oropharynx. Only one hospital decontaminated laryngoscope handles after each use (Table III and Figure 4).

The suction bowl becomes contaminated with oral secretions, blood and vomitus when the anaesthetist dips the catheter into the water. The catheter is often then reused on a patient. Changing the water only is ineffective as the bowl becomes contaminated with blood and secretions with each use, and will contaminate the clean new water placed in it. Some hospitals also used these bowls as a common receptacle for used laryngeal mask airways and oropharyngeal airways. Of the hospitals that used these bowls, 77% did not decontaminate them between patients.

Breathing system filters significantly reduce the transmission of microbes and other particulate matter in breathing systems. If the breathing circuit is to be reused, the use of an effective filter is recommended. The position of the filter is also important (Figures 12 and 13). Although all the surveyed hospitals in this study used filters, the filter was placed in an incorrect position on the breathing circuit, behind the angle piece, at one hospital. In this position, the angle piece, which is reused, is not protected from contamination.

Oropharyngeal airways are regularly contaminated with blood and microorganisms. They are for single-patient use only and must be discarded after each use. However, 20% of the surveyed hospitals reused them after sterilisation.

Self-inflating resuscitation devices, e.g. Ambu® bags, are used in resuscitation situations and during the transportation of critically ill patients between the critical care unit and operating theatre, and must be sterilised after each use. Only one hospital practiced appropriate decontamination of the Ambu® bag (Table VI and Figure 10). Paediatric Ambu® bags in the obstetric theatre are used more frequently than adult ones and have been linked with disease transmission.

Breathing system filters significantly reduce the transmission of microbes and other particulate matter in breathing systems. If the breathing circuit is to be reused, the use of an effective filter is recommended. The position of the filter is also important (Figures 12 and 13). Although all the surveyed hospitals in this study used filters, the filter was placed in an incorrect position on the breathing circuit, behind the angle piece, at one hospital. In this position, the angle piece, which is reused, is not protected from contamination.

The laryngoscope handle presents a potential route for patient-to-patient transmission of blood and organisms from the oropharynx. Only one hospital decontaminated laryngoscope handles after each use (Table III and Figure 4).

The suction bowl becomes contaminated with oral secretions, blood and vomitus when the anaesthetist dips the catheter into the water. The catheter is often then reused on a patient. Changing the water only is ineffective as the bowl becomes contaminated with blood and secretions with each use, and will contaminate the clean new water placed in it. Some hospitals also used these bowls as a common receptacle for used laryngeal mask airways and oropharyngeal airways. Of the hospitals that used these bowls, 77% did not decontaminate them between patients.

Breathing system filters significantly reduce the transmission of microbes and other particulate matter in breathing systems. If the breathing circuit is to be reused, the use of an effective filter is recommended. The position of the filter is also important (Figures 12 and 13). Although all the surveyed hospitals in this study used filters, the filter was placed in an incorrect position on the breathing circuit, behind the angle piece, at one hospital. In this position, the angle piece, which is reused, is not protected from contamination.

Oropharyngeal airways are regularly contaminated with blood and microorganisms. They are for single-patient use only and must be discarded after each use. However, 20% of the surveyed hospitals reused them after sterilisation.

Self-inflating resuscitation devices, e.g. Ambu® bags, are used in resuscitation situations and during the transportation of critically ill patients between the critical care unit and operating theatre, and must be sterilised after each use. Only one hospital practiced appropriate decontamination of the Ambu® bag (Table VI and Figure 10). Paediatric Ambu® bags in the obstetric theatre are used more frequently than adult ones and have been linked with disease transmission.

Our results show that current infection control practices in anaesthesia in regional, tertiary and central hospitals in KwaZulu-Natal are grossly inadequate and inconsistent, with practices varying from one healthcare facility to another, as well as within the same facility. Several factors may be responsible for this. Healthcare professionals may erroneously conclude that the risk of nosocomial infection associated with contaminated anaesthesia equipment is sufficiently low enough to permit complacency and ignorance of minimum reprocessing standards. The varying recorded practices within the same theatre complexes suggest that this is a human factor, i.e. owing to complacency and ignorance. Insufficient time may be allocated to the decontamination process. Our findings also revealed that inadequate numbers of laryngoscope blades and Magill forceps were available per theatre to allow for compliance with the minimum duration of exposure in order to achieve effective HLD in 73% and 93% of hospitals, respectively. Hence, the items are reused according to need, rather than after adequate decontamination. An erroneous concern over cost containment is compromising patient safety.

Furthermore, reprocessing instructions provided by manufacturers of these operating theatre instruments may be incomplete or inadequately communicated, and may also vary from one manufacturer to another. Another pertinent factor was the lack of a comprehensive set of published and endorsed guidelines on infection control in anaesthesia. The contribution of such guidelines by anaesthesia bodies (such as American Society of Anesthesiologists, Association of Anaesthetists of Great Britain and Ireland...
and Australian and New Zealand College of Anaesthetists) to standardisation and effective communication of infection control practices and guideline compliance, as well as to the prevention of nosocomial infections in those countries, is indisputable.1,2,20 However, regulations and guidelines are only effective if coupled with healthcare worker compliance. Therefore, infection control practices should be audited on a regular basis.

A major limitation of this study was that with one-on-one interviews, some of the nurses may have felt compelled to give “the correct answer” instead of describing what was actually practised. Furthermore, only regional, tertiary and central hospitals were surveyed. This begs the question if such substandard practice is prevalent in academic centres and major hospitals, what practices are being carried out in smaller district hospitals?

**Conclusion**

Lack of adherence to recommended best practice facilitates the nosocomial transmission of potential pathogens. In light of the high prevalence of many infectious diseases, particularly human immunodeficiency virus, hepatitis B and tuberculosis in KwaZulu-Natal, it is critical that infection control in anaesthesia is urgently addressed. The use of sterilisation for the decontamination of anaesthetic equipment and the use of single-use anaesthetic equipment of appropriate quality must be promoted. There is a need to adopt and standardise decontamination protocols at a national level. Systems must also be established for monitoring and regular auditing of practice.

**Conflict of interest**

There is no conflict of interest to declare.

**References**

1. Recommendations for infection control for the practice of anaesthesiology. American Society of Anaesthesiologists [homepage on the Internet]. c2012. Available from: http://www.asahq.org/For-Members/Standards-Guidelines-and-Statements.aspx
2. Association of Anaesthetists of Great Britain and Ireland. Infection control in anaesthesia. Anaesthesia. 2008;63(9):1027-1036.
3. Yee KF. Decontamination issues and perceived reliability of the laryngoscope: a clinician’s perspective. Anaesth Intens Care. 2003;31(6):658-662.
4. Chant K, Kocumba K, Munro R. Investigation of possible patient-to-patient transmission of Hepatitis C in a hospital. New South Wales Public Health Bulletin. 1994;5(5):47-51.
5. Provincial hospital contact details. KwaZulu-Natal Department of Health [homepage on the Internet]. Available from: http://www.kznhealth.gov.za/hospitals.htm
6. Veerabadran S, Parkinson IM. Cleaning, disinfection and sterilization of equipment. Anaesth Intens Care Med. 2010;11:451-454.
7. Statement on standard practice for infection prevention and control: instruments for tracheal intubation. American Society of Anaesthesiologists [homepage on the Internet]. 2010. c2011. Available at: http://www.asahq.org/For-Members/Practice-Management/Practice-Parameters/Statement-on-Standard-Practice-for-Infection-Prevention-and-Control-Instruments.aspx
8. Muscarella LF. Prevention of disease transmission during flexible laryngoscopy. Am J Infect Control. 2007;35(8):536-544.
9. Guideline for disinfection and sterilization in healthcare facilities. Centers for Disease Control and Prevention [homepage on the Internet], 2008. c2011. Available from: http://www.cdc.gov/hicpac/Disinfection_Sterilization/toc.html
10. Simmons SA. Laryngoscope handles: a potential for infection. AAAN J. 2000;68(3):233-236.
11. Call TR, Auerbach FJ, Riddell SW, et al. Nosocomial contamination of laryngoscope handles: challenging current guidelines. Anesth Analg. 2009;109(2):479-483.
12. Williams D, Dingley J, Jones C, Berry N. Contamination of laryngoscope handles. J Hosp Infect. 2010;74(2):123-128.
13. Tyagi A, Kumar R. Filters in anaesthesia and intensive care. Anaesth Intensive Care. 2003;31(4):418-433.
14. Daggan R, Zefeiridis A, Steinberg D, et al. High-quality filtration allows reuse of anesthesia breathing circuits resulting in cost savings and reduced medical waste. J Clin Anesth. 1999;11(7):536-539.
15. Rees LM, Sheraton TE, Modestini C, et al. Assessing the efficacy of HME filters at preventing contamination of breathing systems. Anaesthesia. 2007;62(1):67-71.
16. Wilkes AR. Heat and moisture exchangers and breathing system filters: their use in anaesthesia and intensive care. Part 1: History, principles and efficiency. Anaesthesia. 2007;62(1):67-71.
17. Wilkes AR. Heat and moisture exchangers and breathing system filters: their use in anaesthesia and intensive care. Part 2: Practical use, including problems, and their use with paediatric patients. Anaesthesia. 2011;66(1):40-51.
18. Kramer A, Kranabetter R, Rathgeber J, et al. Infection prevention during anaesthesia ventilation by the use of breathing system filters (BSF): joint recommendation by German Society of Hospital Hygiene (DGKH) and German Society for Anaesthesiology and Intensive Care (DGAI). GMS Krankenhaushygiene Interdisziplinär. 2010;5:1-19.
19. Miller DH, Youkhana I, Kanurarathne WU, Pearce A. Presence of protein deposits on cleaned re-usable anaesthetic equipment. Anaesthesia. 2001;56(11):1069-1072.
20. Guidelines on infection control in anaesthesia. Australian and New Zealand Colleges of Anaesthetists [homepage on the Internet], 2005. c2011. Available from: http://www.anzca.edu.au/resources/professional-documents/documents/professional-standards/professional-standards-28.html