Decontamination of laryngoscopes in The Netherlands

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In this study the decontamination procedures of laryngoscopes in Dutch hospitals are described, based on a structured telephone questionnaire. There were substantial differences between decontamination procedures in Dutch hospitals and the standards of the APIC (Association of Professionals in Infection Control and Epidemiology), CDC (Centers of Disease Control) and ASA (American Society of Anesthesiology) were met in full in 19.4% of the hospitals. The standards of manual decontamination, used in 78% of the 139 hospitals, were particularly disappointing; manual cleaning was considered inadequate in 22.9% of these hospitals and manual disinfection did not meet the standards of the APIC, CDC or ASA in any of these hospitals. Decontamination by instrument cleaning machines as a standard procedure was used in 30 (22%) hospitals. In three of these hospitals the blades were subsequently sterilized. We suggest adherence to the infection control guidelines of the CDC, APIC and ASA, until the safety of less conservative infection control practices are demonstrated.


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The importance of appropriate disinfection of equipment for preventing infection has been emphasized.1 However, Esler2 in a recent survey of decontamination of laryngoscopes in the United Kingdom (UK) concluded that ‘there appears to be no rationale regarding the aim of laryngoscope cleaning or agreed methods to achieve that aim’. The results of this and other studies,3 4 and the culture results of our own laryngoscope blades considered ready for use, provided the basis to study the decontamination procedures of laryngoscopes in The Netherlands.

For a decontamination procedure to be appropriate, the equipment should first be thoroughly cleaned. A process in which all organic matter and other residues are removed using water, mechanical action, and detergents or enzymatic products.5 6 Subsequently, disinfection or sterilization should be performed; disinfection describing a process that eliminates many or all pathogenic micro-organisms, with the exception of bacterial spores, from inanimate objects.6 7

Therefore, to assess the procedures for decontamination of laryngoscopes, it should be known how both cleaning and disinfection/sterilization are carried out and whether or not the correct sequence is followed. Unfortunately, these processes have not been adequately described in previous studies. In addition, the use of a postal questionnaire as a tool to acquire this information, is in our opinion, too restrictive and may have a negative impact on the validity of the results. The aim of this study was to assess laryngoscope decontamination procedures in The Netherlands and to compare them with current guidelines.

Methods

The decontamination procedure in our hospital at the time of this study consisted of manual cleaning by brushing or wiping using a detergent and rinsing under running water followed by disinfection by wiping with a gauze soaked in ethanol 70%. The decontamination procedures in the other 138 Dutch hospitals were studied by means of a structured telephone questionnaire (Appendix A) asking open questions if possible. During the first 15 interviews, the questionnaire was adjusted if necessary. If data were missing or if there was doubt about the answers, the hospitals were contacted again within 1 week. If machines were used during the decontamination process, the hospital’s central sterilization department was contacted in order to obtain information on the details of the process.

Manual cleaning was considered adequate when all of the following criteria in every case were fulfilled: (1) the blade was brushed or wiped, (2) a detergent or enzymatic agent
was used, and (3) the blade was rinsed under running tap water.

Machine cleaning was considered adequate providing a detergent or enzymatic agent was used.

Results
All but one of the 140 Dutch general hospitals with facilities allowing general anaesthesia provided full details of their decontamination practices (response rate 99.3%). In 91 (65.5%) hospitals decontamination guidelines were present.

Fibrelight laryngoscope blades were used in 121 (87.1%) hospitals, conventional blades in 16 (11.5%) and in two (1.4%) hospitals both types were used. During decontamination of conventional blades the bulb was not removed in eight (44.4%) hospitals, it was removed in four (22.2%) and this was unclear in six (33.3%).

Manual decontamination—cleaning and subsequent disinfection by hand—was performed as standard practice in 109 (78%) of the 139 hospitals. However, in six of these hospitals (5.5%) decontamination by machines was performed as an exception. The reasons were: (1) ‘infected patients’ (three hospitals), (2) at the end of each day (two hospitals), and (3) once a week (one hospital).

Manual cleaning was performed in three (2.8%) hospitals by rinsing under running water only, in four (3.7%) by wiping only (without water), in two (1.7%) by brushing with a detergent solution (no running water), in 96 (88.1%) by brushing or wiping and rinsing under running water, and in four (3.7%) sometimes by brushing and rinsing under running water and sometimes only by rinsing under running water.

Detergents or enzymatic agents were used routinely in 93 (85.3%) hospitals, never used in 14 (12.8%), and sometimes used in two (1.8%). Disinfection was always carried out in 100 (91.7%) hospitals, never in five (4.6%) and occasionally in four (3.7%). The disinfectants used were: alcohols (ethanol 70%/isopropylalcohol 60%/others) in 86 (79.6%), a mixture of alcohol and chlorhexidine 0.5% in 21 (19.4%) and sodium dichloroisocyanurate 250 mg litre⁻¹ in one (0.9%). Of the 107 alcohol based disinfectants, 7 (6.5%) were antiseptics.

The disinfectant was brought in contact with the blade by wiping with a soaked gauze in 80 (76.9%) hospitals, by fogging in two (1.9%), and by immersion in 22 (21.1%). The duration of immersion was unclear in nine hospitals and 10.9 min (2–30 min) (mean and range) in the others.

Decontamination using instrument-cleaning machines as the standard treatment was used in 30 (22%) of the 139 hospitals. In three of these hospitals the blades were subsequently sterilized; in two by autoclaving at 134°C (3.5 min) and in one by plasma sterilization (60 min, 93°C). In the other 27 (19.4%) hospitals, no subsequent sterilization procedure took place. In one of these hospitals, no detergent or enzymatic agent was used during decontamination. For these 27 hospitals the total duration of the washing cycle was ≥60 min in six (22%) hospitals, between 40 and 60 min in 17 (63%), between 20 and 40 min in two (7%) and unknown in two (7%). The maximum temperature reached was ≥90°C in 20 hospitals (74%), between 70 and 90°C in 3 (11%), less than 70°C in 3 (11%), and unknown in one (4%). The duration of maximum temperature was 12 min in one (4%) hospital, 10 min in four (15%), 9 min in two (7%), 5 min in two (7%), and unknown in 18 (67%).

Discussion
The results of this study show that there are substantial differences in the decontamination procedures in Dutch hospitals which compares with the situation in the UK. However, more important is that the standards of the APIC, CDC and ASA, and the Dutch standard (Table 1), are met in only the minority of these hospitals (maximal 19.4 and 26.6%, respectively) This represents a potentially harmful situation.

Manual decontamination
An important drawback of manual decontamination, practiced in the majority of the hospitals in The Netherlands and the UK is that quality control is cumbersome, which has been recognized as a risk factor in the transmission of infectious agents. To determine whether manual cleaning was being performed adequately, a standard is required. However, as there proved to be no standard, we developed our own, based on cleaning guidelines for endoscopes. Using this modest standard, manual cleaning was inadequate in 25 (22.9%) of the 109 hospitals.

Manual disinfection results were even worse. None of the Dutch hospitals met the standards of the APIC, CDC or ASA. This was mainly because alcohols are no longer recognized to be high-level disinfectants. Unfortunately,

| Table 1 | Cleaning and disinfection/sterilization guidelines of laryngoscope blades. *How to perform ‘meticulous cleaning’ is not well defined for laryngoscope blades. **High-level disinfection is a procedure that can be expected to destroy all micro-organisms, with the exception of high numbers of bacterial spores. It can be achieved by high-level disinfectants or moist heat (70°C for 30 min). ^Ethanol 70% is not considered a high-level disinfectant. When an antiseptic containing ethanol 70% was used, in this study this was considered equivalent with the use of ethanol 70%.

| Cleaning | Always meticulous cleaning* before disinfection/sterilization |
| Disinfection | High-level disinfection** or sterilization |
| APIC/CDC/ASA/DWIC: | Ethanol 70% immersion for 5 min^ |
| AMC: | Association of Professionals in Infection Control and Epidemiology^ |
| PIC | Centers of Disease Control^ |
| CDC | American Society of Anesthesiology |
| ASA | Dutch Workingparty on Infection Prevention^ |
| DWIP: | Academic Medical Center; the hospital where this study was performed |
the use of alternative high-level disinfectants (e.g. glutaraldehyde solutions) is complicated by Control of Substances Hazardous to Health (COSHH) regulations applicable throughout the European Union. However, even the Dutch standards—making the use of alcohol compulsory—were only met in 12 hospitals (11.0%). The majority failed to meet this standard as the method of application did not allow for the required contact time (5 min), because of the rapid evaporation of alcohol. Wiping the blade with alcohol, used in the majority of Dutch hospitals and also popular in other countries, has a questionable effect on the human immunodeficiency virus (HIV) and will not lead to the elimination of hepatitis B virus (HBV) or mycobacteria. The same holds for fogging, which is not recommended by the CDC as it is potentially dangerous to the hospital worker.

The concept of universal precautions, which dictates that decontamination procedures should be the same for each patient as each patient should be considered to be potentially infected with blood-borne pathogens, was not followed in 7.2% of the Dutch hospitals. This is in contrast with the UK where ‘only a few units practise universal precautions’. Many studies—and logic—have proven the validity of this concept as patients infected with HIV, HBV or mycobacteria can not be distinguished from non-infected patients on clinical grounds. The use of antisepsics did not result in the judgement of inadequate disinfection although they are considered inappropriate for disinfection of medical equipment. Much worse, however, was the use in ‘special cases’ of sodium dichloroisocyanurate in one hospital. This disinfectant is not approved in The Netherlands for use on medical equipment if used without subsequent mechanical cleaning and sterilization and the concentration used was 2.5 times the maximum concentration, representing a potential hazard.

Decontamination using machines

Although in three of the 30 hospitals routinely using instrument cleaning machines the blades were subsequently sterilized, leading to a clearly defined end result, the end result in the others was less certain; in many of them not all details of the disinfection process could be obtained. In addition, there is uncertainty about the temperature/time combinations needed for adequate disinfection, which according to the CDC, APIC and ASA is high-level disinfection. We were unable to find studies describing the lowest temperature/time combinations needed to eradicate the micro-organisms giving the highest infection rates as they are able to cross even intact mucous membranes; mycobacteria and viruses such as HBV. It is questionable whether wet pasteurisation (30 min at 70°C), proposed by the APIC and CDC, will result in high-level disinfection, as infectivity of HBV in serum is not lost at 60°C for up to 4 h and equipment should be boiled in water for at least 20 min before safe use can be guaranteed. In addition, machines being able to provide these conditions must be validated to ensure the proper end result is reached. The decontamination results in the 27 hospitals using instrument cleaning machines without subsequent sterilization were, according to the APIC, CDC and ASA guidelines, adequate in eight hospitals, probably adequate in 12, inadequate in three, and could not be determined in four hospitals.

Among the factors that have contributed to the great variety of decontamination procedures are the limited awareness of infection control procedures by many anaesthetic personnel and the difficulty to establish a cause-effect relationship between anaesthetic practice and postoperative infection. Only a few reports identified the laryngoscope as the most likely source of cross-infection, which is in contrast to the other endoscopes. There seems to be no valid argument that this risk is any different for laryngoscopes, especially as blood is often encountered on the blade of the laryngoscope after use.

Therefore, together with other authors, we think that it is in the best interests of our patients to adhere to the infection control guidelines of the CDC, APIC and ASA where possible, until the safety of less conservative infection control practices has been established. Patients would rather support approved-guidelines than ‘non compliant’ practices, which were recently compared in Newsweek with having unprotected sex.

Our decontamination procedure was changed after this study; after buying laryngoscopes with the highest resistance to the damaging effect of sterilization, all laryngoscopes are now mechanically cleaned and steam sterilized after use. Moreover, the Dutch guidelines are being changed and will soon be in accordance with the CDC, APIC and ASA guidelines.

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Appendix A

Questionnaire decontamination procedures laryngoscope blades

Name and telephone number of the hospital.........../.......

Type of laryngoscope:

- brand: Penlon/Heine/Upsher/Medicon/Riester/Welch-Allyn/other..................................................
- fibrelight/conventional/both
- battery/accumulator/both

Do they have decontamination guidelines? yes/no
During decontamination of a conventional blade the bulb is:

- not removed
- removed
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