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Disinfection of trans-oesophageal echocardiographic probes: current practice and the challenge of new pathogens

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Summary

Recent concerns about human transmissible spongiform encephalopathies and the poorly defined risk of prion transmission have led to a reappraisal of disinfection procedures for medical equipment, including echocardiographic transoesophageal probes. As limited data are available on both the transmission risk and preventive measures for prion diseases subsequent to the use of such probes, no universally recommended guideline has been published. However, general recommendations about good clinical practice can be summarized to permit each echocardiography laboratory and physician to review and update their current procedure protocol.

Key words: disinfection; nosocomial infections; prion; prevention; transoesophageal echocardiography

Background

Disinfection of transoesophageal echocardiographic (TEE) probes must prevent the transmission of infectious agents from one patient to another. Previous procedures were mainly directed against bacteria and viruses [1], but prion diseases represent a particular problem given their unusual resistance to conventional chemical and physical decontamination methods. In addition, very little is known about their transmission and their detection remains difficult. Recently, abnormal prion protein (PrP^{sc}) immunostaining has been reported in the lymphoid tissue of patients with variant Creutzfeldt-Jakob disease (vCJD), including the tonsil [2]. Endoscopic procedures including biopsy may therefore carry a higher risk of instrument contamination with prions than TEE probes, but cleansing and disinfection procedures of the latter still need to be reviewed.

Glatzel and colleagues recently reported a worrying increase in the incidence of CJD in Switzerland [3]. Although all recognised clinical and molecular markers combined indicate that none of the Swiss patients had vCJD, understanding the underlying chain of events remains a national research priority. Furthermore, lack of data has caused some extreme reactions; for example, blood collection centers in Switzerland do not accept donors who have undergone an endoscopic examination within the previous 12 months. Although this controversial decision was taken with the idea to prevent the transmission of hepatitis C virus after endoscopic biopsy, no specific data exist to confirm its efficacy, and its value to prevent prion transmission remains unknown. Nevertheless, this raises the question if patients prior to TEE should be informed that they may become ineligible as blood donors because they will be considered as being potentially infected!

Probes for echocardiographic transoesophageal examinations are used several hundred times. During examinations, they are inserted into the oesophagus and stomach of patients and are therefore exposed to pathogens from the mouth and throat, secretions from the oesophageal-gastric tract and, occasionally, small amounts of blood from mucosal erosions.

TEE probes are semi-critical devices that require an intermediate-level disinfection protocol since they come into contact with mucous membranes. Transducers should neither be soaked in sodium hypochlorite (ie, bleach), nor be sterilized using techniques such as auto-

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Table 1
Glutaraldehyde- and formol-free disinfectant solutions commercially available in Switzerland for manual disinfection of TEE probes.*

Product name	manufacturer	active ingredient	time and concentration	remarks
Deconex 53 PLUS®	Beiersdorf AG Borer Chemie AG	quaternary binding, guanidine derivative	4% for 15 min	no need for prior enzyme solution**; guanidine detachs protein residues – absence of damage to the material is guaranteed by the manufacturer
Gigasept® Med	Schuelke & Mayr	quaternary binding, glycol derivative, amphotenside	4% for 15 min	absence of damage to certain materials is provided by the manufacturer upon request only
Anioxide 1000® ***	Anios	peracetic acid	1500 ppm for 15 min or 60% (900 ppm) for 30 min	absence of damage to most materials; complete follow up still limited

* Disinfectant solutions should be glutaraldehyde- and formol-free in Switzerland [4].
** If a different disinfectant solution has been used previously, it must be completely eliminated to avoid interaction and loss of efficacy (eg, with alkylamin). The manufacturer recommends to clean the probe of all residual products with detergent prior to the use of Deconex 53 Plus®.
*** Other peracetic acid-based disinfectant solutions for manual disinfection of endoscopes are available in Europe (eg Bioxal M®, Peralkan®, Nu-Cidex®, SPA activat®, Dynacide®) and recommended for use at different concentrations, the use of which is still limited in Switzerland.

claves, ultraviolet gamma radiation, ethylene oxide, steam or heat, because severe damage will result. Furthermore, most of these procedures or chemicals are not efficacious against prions. Similarly, TEE probes should not be soaked in alcohol since damage can result on the strain relief/housing joint. Thus, the cleansing and disinfection process for these devices must comply with complex and sometimes conflicting requirements such as disinfectants' efficacy, innocuity to the material, safety concerns of the healthcare workers, as well as feasibility. Disinfection must eradicate all transmissible pathogens. Commonly-used products containing aldehyde are known to fix proteins and prions in particular [4]. In addition, they should be used under strict conditions, ie, a controlled system to aspirate vapours which are toxic to the lungs, mucosal surfaces and skin. Non-glutaraldehyde-/non-formol-based disinfectants available in Switzerland for the manual disinfection of TEE probes are listed in table 1. As mentioned previously, disinfectants and procedures must not alter the probe and manufacturers should be able to recommend some appropriate solutions. It is essential that disinfection procedures be feasible as an excessively complicated procedure might not be widely implemented and respected.

Current practice

No case of transmission of either viral or prion disease infection from one patient to another due to TEE probes has been reported. Nevertheless, current practice must be continuously updated to maintain an optimal standard of care and to avoid possible contamination during diagnostic procedures. Potential risk of infection by viruses and prions cannot be simply ignored. They should not be exaggerated either, which would lead to excessively complicated or costly procedures such as single-use TEE probes. In this case, the risk would then be to deprive patients of a useful investigation, necessary for their future care.

During the meeting of the Swiss Society of Cardiology in June 2002, the Committee of the Working Group of Echocardiography raised the issue of TEE probe disinfection. Although it appeared too early to publish guidelines since hard data are lacking, some basic rules of good practice can be described and there was a consensus among members to issue the following recommendations. These have been prepared in collaboration with the Swiss-NOSO CJD Task Force which has recently published new recommendations concerning the prevention of transmission of vCJD disease [4, 5].

Recommendations

We would recommend that every echocardiography laboratory and physician performing TEE examinations:

- review their own cleansing and disinfection protocol for TEE probes;
- adopt a written protocol for cleansing and disinfection, in collaboration with the infection control and hospital hygiene specialists in the local institution (an example is provided in table 2) and with the approval of the probe manufacturer;
- follow the disinfectant manufacturer's instructions carefully; in particular, adhere strictly to the time recommended by the manufacturer to soak the TEE probes in disinfectant;
- maintain a logbook of all examinations for traceability (mentioning which probe was used for which patient and time of renewal of the disinfectant solution);
- use single-use latex sheaths (table 3) as systematically as possible.

For patients suspected to be infected with prions, in particular cases of dementia or young (<50 years) patients with recent psychiatric diseases of unknown origin, every procedure should be reconsidered. If a TEE examination is necessary, use of a latex sheath is mandatory.

Future perspectives

New scientific data and possibly laws and regulations will require a regular reappraisal of these procedures. In addition, a close collaboration with the Swiss-NOSO CJD Task Force to update the current recommendations will be necessary to ensure maximum patient safety. In the meantime, all physicians performing TEE are invited to share their experience with

Table 2
Transoesophageal echocardiographic probes: example of a disinfection protocol.

A. Prior to TEE
Inform the patient about the procedure, indication, side-effects, and infectious and noninfectious risks.
Ask about known virus infection and latex allergy (in addition to bleeding disorders, oesophageal problems, allergy, etc.).
Record in the logbook the probe identification number (if different probes exist), the patient's name, indication, date and hour (with respect to renewal of disinfectant solution).
Check probe integrity.
Use a latex sheath as systematically as possible.
See also footnote.*
B. During TEE
Change gloves after insertion of the probe to avoid contamination of the handle and ultrasound machine.
C. Immediately after TEE
Remove latex sheath and change gloves (gown, goggles and mask recommended as protection against splashing droplets).
Immediately wash the probe using single-use damp gauze or towel to remove all mucous and secretions and rinse thoroughly (running water should not be used to avoid splashing) to ensure that all residual material is well removed (in case of residual material, a soft cleaning brush can be used).
Dry with paper towel.
Check probe integrity.
Immerse for 15 min in a 4% Deconex 53 Plus solution.
Remove gloves and disinfect hands with an alcohol-based handrub solution.
Use a new pair of non-sterile gloves.
Rinse probe thoroughly in a large amount of filtered or sterile water.
Dry with single use tissue/towel (do not use paper, except if sterile).
Alternatively, use alcohol to speed up the drying process.
Store in a case, protected by single-use paper/plastic/towel (foam must be avoided; thermoformed support are allowed but need to be disinfected in between use).
Remove gloves and disinfect hands with an alcohol-based handrub solution.
* According to storage conditions and/or initial manipulation, some experts have suggested to wipe the probe with an alcohol-impregnated damp gauze before use with or without latex sheath. It is obviously important that the probe be completely dry before use.

Table 3
Advantages and disadvantages of single-use latex sheaths.

Advantages	**comments**
Good protection against all pathogens Single use	False sense of security with risk of tears (and porosity). Note: the handle and the machine are not covered by the latex sheath!
Disadvantages	
Possible difficulty to insert the probe	Not a problem for experienced users in most patients.
Alteration of image quality	Not a problem if enough ultrasound jelly is used and all air bubbles are removed within the sheath to ensure a good transducer-latex contact.
Additional cost	Between 1 and 2 CHF per sheath.
Allergy to latex	Rare contra-indication to the use of sheath.
Latex sheaths are available in Switzerland from Aichele Medico AG, Langenhagstrasse 21, 4147 Aesch,or Philips AG, In des Luberzen 29, 8902 Urdorf (sets include gel + syringe).	

colleagues and report new data, products, incidents and concerns to the Working Group of Echocardiography.

References

1 Rutala WA. Selection and use of disinfectants in healthcare. In: Mayhall CG, ed. Hospital Epidemiology and Infection Control. 2nd ed. Philadelphia: Lippincott Williams & Wilkins; 1999. p. 1161–87.

2 Wadsworth JDF, Joiner S, Hill AF, Campbell TA, Desbruslais M, Luthert PJ, Collinge J. Tissue distribution of protease resistant prion protein in variant Creutzfeldt-Jakob disease using a highly sensitive immunoblotting assay. Lancet 2001;358:171–80.

3 Glatzel M. Rogivue C, Ghani A, Streffer JR, Amsler L, Aguzzi A. Incidence of Creutzfeldt-Jakob disease in Switzerland. Lancet 2002;360:139–41.

4 Ruef C, Pittet D, the Swiss-NOSO-CJD Task Force. Prévention de la transmission nosocomiale de la maladie de Creutzfeldt-Jakob: nouveaux défis, nouvelles recommandations. Swiss-NOSO 2001;8:9–13. *(available at: www.swiss-noso.ch)*

5 Iffenecker A, Ruef C, the Swiss-NOSO-CJD Task Force. Risque de transmission des prions: prise de position sur le traitement des instruments chirurgicaux thermostables avant stérilisation. Swiss-NOSO 2002;9:25–28. *(available at: www.swiss-noso.ch)*