

## Insufficient sterilisation procedures and transmission of pathogens in developing countries.

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### Introduction

The inactivation of infectious pathogens by various sterilisation procedures of medical equipment is one of the pre-conditions to prevent the spread of diseases in surgery and obstetrics.

### Methods

Our Department has carried out pilot investigations in cooperation with Mr. Jan Huys, a Hospital Technician from the Netherlands (HEART Consultancy). These investigations have revealed that out of 25 autoclaves in 18 hospitals of Tanzania and Uganda, only 3 sets of equipment showed a sufficient function in sterilisation; 22 out of those 25 (88%), revealed serious problems. A sufficient sterilisation procedure did not take place.

For all 22 insufficiently working sterilisation equipment, it had been possible through training, repair and adaptation of the user guidelines, to overcome the deficiencies and to enable sufficient sterilisation. The most important measure has been to raise awareness to this problem in health institutions, to carry out training workshops, and to adapt the user guidelines for individual autoclaves. So far four training workshops for users and technicians in Tanzania and Uganda as well as during follow-up visits in the respective health institutions, our Department has started to tackle this problem. It is, however, dependent on a continuous financial support.

To overcome the problem of insufficient sterilisation, it is not necessary to buy new equipment, especially cannot be sustained in developing countries.

The problem of a possible transmission of diseases through insufficient sterilisation is not yet brought completely to the attention to our partners in the

South. We identify a need for information and the offer of training workshops.

### Details

#### STERILISATION PROCEDURE AND THEIR POSSIBLE PROBLEMS

##### Hot air sterilisers

The time protocols used for hot air sterilisers (180°C, 30 min.) have proved to be completely insufficient. Air, as a bad heat conductor, produces only after a longer period of time, namely 2 to 3 hours, the temperature indicated on the instrument panel inside instrument boxes. Using the hot air sterilisers and time protocols in the hospitals during our study, the instruments were only warmed up and left the steriliser still unsterile. It is possible to adapt the use of sterilisers to these identified necessities. This has to be done together with the training of the technicians in the correct preparation and handling of the sterilisation items.

##### Autoclaves

The technique of autoclaving is better and more secure than the sterilisation with hot air, especially for more sensitive materials like theatre clothing. Saturated steam in a closed container, heated up to 123°C at 1.2 bar or 134 °C at 2.1 to 2.3 bar gets sufficiently rid of all possible infectious agents.

The precondition for this sterilisation method is the complete removal of air pockets in the material. In the case of remaining air bubbles, e.g. in instruments of clothes, steam cannot reach all corners of the drum, which remains cooler and therefore unsterile.

This problem was solved in Europe with the help

of complex control and guiding instruments. These expensive and software-guided machineries are dependent on regular maintenance and repair as well as constant supply of electricity and water. These high-tech autoclaves were, and are, installed in many developing countries where they break down usually after a very short period of time. Locally, they cannot be repaired and are usually dumped as high-tech ruins near the theatres.

Simple, older autoclaves, which are operated manually or semi-automatically, are the only sterilisation equipments regularly used in health institutions and hospitals. In those equipments, sterilisation is usually insufficient due to the above-mentioned pockets of air, especially in the bigger drums of clothes and instruments. The users of that machinery are usually not aware of this problem, because pressure and temperature are measured in the autoclave chamber and, therefore, correctly indicated on the panel. If, however, the temperature curve is taken inside the drums of clothes, the highest temperature reached during the sterilisation process is often not higher than 30 to 40°C.

These alarming results, based on previous studies in cooperation with Jan Huys (Heart Consultancy /The Netherlands) have been seen in nearly all autoclaves of the 18 hospitals in Uganda and Tanzania during our investigations.

In 22 of 25 autoclaves, sufficient sterilisation in the used drums did not take place, the temperature reached only 30 to 40°C: incubation of pathogens instead of sterilisation with all the possible consequences of disease transmission did take place!

### **What can be done? What are possible solutions?**

A sufficient function of autoclaves can be made possible by the adaptation of the user protocol, especially in manually operated autoclaves. The introduction of one to four pulses of steam during the sterilisation cycle results in the removal or remaining air pockets and in a sufficient sterilisation procedure even with simple machines without vacuum pump.

These results, mainly obtained by Jan Huys of Heart Consultancy/The Netherlands could be repeated in all 22 autoclaves in Tanzania and Uganda, which have been identified previously as insufficient.

With the help of a standardised validation test (Bowie and Dick Test), an adequate user protocol with a

defined number of steam pulses could be introduced in the respective health facilities. At the same time, small hardware problems (malfunctioning valves and panels) can be repaired. In addition, it is essential to train the user personnel how to service and store the goods for sterilisation. It is also very important to train the hospital technicians in how to conduct the necessary servicing and maintenance. It has been shown that a better understanding of the sterilisation procedure is essential for the technicians to carry out better servicing.

Using the above-mentioned measures, all 22 malfunctioning autoclaves, could be brought back to a sufficient function within one to two days.

Two workshops in Moshi/Tanzania for 14 users and technicians and two workshops in Kampala/Uganda for 15 participants preceded the visits to the hospitals and the repair on the autoclaves.

During the workshops and the hospital visits, the following points were brought to our attention:

1. No participants or user in the hospitals was aware of the problem of insufficient sterilisation.
2. All participants were shocked and showed a maximum of cooperation to improve and correct the situation.
3. With relatively limited measures of training and maintenance, the problems could be solved.
4. Many participants of the workshops expressed the obligation to publish the knowledge on insufficient sterilisation and the possibilities how to improve the situation as soon as possible.