DISINFECTION AND STERILIZATION OF ANAESTHETIC EQUIPMENT

ESSAY

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بسم الله الرحمن الرحيم

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INTRODUCTION

For some years, there has been concern over the role of anaesthetic and ventilatory equipment in the transmission of infection. It is known that those pieces of anaesthetic apparatus which come in direct contact with the skin and mucous membranes of the patient: face mask, air way, endotracheal tube, catheter mounts, suction catheters, are all liable to become contaminated with micro-organisms (Stark, Green and Pask,1962).

Those concerned with decontaminating anaesthesia equipment find themselves faced with a dilemma as to how much sterilization should be attempted. Most, if not all, would agree that sterilization of equipment is essential after use in a patient with a demonstrated or suspected infection of the resiratory tract or who is known to harbor a particularly virulent organism such as Mycobacterium tuberculosis or Pseudomonas aeruginosa. Likewise most anethesiologists would agree that patients whose resistance to infection is impaired should be anaesthetized only with sterile equipment. However, the vast majority of patients do not fall into these categories and less vigorous approach is usually adopted.

Those who argue that more vigorous approaches are not needed and feel that sterilization is being advocated to an unreasonable degree advance the following arguments:-

1) Millions of anaesthetists suggest that recognizable morbidity from cross-infection by contaminated anaesthesia equipment is rare. Although it is recognized that equipment does become contaminated, periodic decontamination will reduce the number of organisms present so that, the number actually transmitted to the patient is small.

The macrophages of the normal healthy patient can then combat these organisms.

2) Sterilization is difficult, costly and may carry with it certain dangers to the patient and hospital personnel. Although certain items are easily sterilized, others, particularly bulky rubber items, do not lend themselves easily to present techniques. Sterilization entails a heavier capital outlay for equipment, increased work for personnel and requires increased storage space. Many forms of sterilization may damage equipment. Liquid, gas and chemical sterilization may leave residues in the equipment that can subsequently cause harm to the patient.

3) The very nature of maneuvres required in anaesthesia makes sterility impractical.

Proponents for more vigorous attempts at sterilization argue as follows:

1) Cases of cross-contamination caused by anaesthesia and respiratory therapy equipment have been reported.

2) The risk of cross-contamination may be greater than is commonly beleived because it is frequently difficult to pinpoint the exact cause of a postoperative infection.

3) The humid environments that frequently exist in anaesthesia equipment provide a potentially favorable habitat for gram negative organisms, which are assuming a greater role in noso-comial infections.

4) Patients undergoing anaesthesia and surgery are more likely to develop respiratory infections than a normal population.

Many have underlying diseases that reduce their resistance. Anaesthesia will interfere with ciliary and mucus activity and surgery may interfere with their ability to cough and deep breathe.

5) Although, there is general agreement that sterilization of equipment is essential after use in a patient with a respiratory infection or a particularly virulent organism, it is frequently impossible to identify these patients at the time they undergo anaesthesia.

Furthermore, the loss of distinction between pathogens and non pathogens means that any organism is a potential cause of infection.

Therefore, all patients are at risk and all equipment is suspect.
It is hoped that future development will provide some answers to the dilemma described above. In the meantime, serious thought should be given to upgrading the care at every facility.

However, Jenkins and Edgar (1964) found all the corrugated tubing in one hospital to be contaminated with Pseudomonas pyocyanea, and showed experimentally that a small proportion of these organisms could be caught up in the inspiratory gas. They showed further that coughing into anaesthetic apparatus caused heavy contamination of masks and Y-pieces, and that soda-lime in a Water's canister was ineffective as a bacterial filter. However, as a result of experimental work, Stark, Green and Pask (1962) concluded that it was unlikely that infection would be transmitted from patient to patient via anaesthetic machines, but did state that if a patient was known to be infected with virulent organisms, then readily sterilizable apparatus should be used.

Virtually every organism has been isolated from anaesthetic equipment, and transmission of infection from such apparatus to patient has been confirmed in a number of instances (Joseph, 1952, Wyant and Nansan, 1957, Tinne et al., 1967, Old et al. 1972).

Cross-infection from self-inflating breathing bags (Cartwright and Hargrave, 1969), humidifiers (Grieble et al., 1970), and ventilators (Phillips and Spencer, 1965) is now well documented.

Furthermore, Babington, Baker and Johnston (1971) have even demonstrated the upstream spread of bacteria along the expiratory tubing of a simulated patient-ventilator circuit. Apart from the obvious risk of direct contamination of the patient from a ventilator circuit, the expired gas may carry micro-organisms into the room air. There is no doubt, therefore, that cross-infection can occur via anaesthetic equipment and ventilators (Roberts, 1973), and it is the responsibility of the anesthesiologist to ensure that such equipment is decontaminated before use.

BACTERIOLOGICAL VIEW
AND
TRANSMISSION OF INFECTION
IN
ANAESTHESIA

Definitions

1) Bacteria: minute unicellular plant-like organisms which usually multiply by binary division. This term is usually applied to the vegetative growing forms.

2) Spores : the normal resting stage in the life cycle of certain bacteria. Spores are more difficult to kill than vegetative bacteria.

3) Viruses: infectious agents smaller in size than bacteria. Some are barely visible with the light microscope but most are beyond this range.

4) Antiseptic: any substance that has a bactericidal or bacteriostatic effect and that can be safely applied to the skin.

5) Bacteriostat: an agent which will prevent bacterial growth but does not necessarily kill the bacteria.

6) Bacteriocide (Germicide): an agent which kills bacteria.

7) Sanitation: reduction of the number of bacteria to safe level.

8) Decontamination: getting rid of a harmful substance. This is a general term encompassing cleaning, disinfection and sterilization.

9) Disinfection: a process which destroys all vegetative bacteria but not necessarily all spores. This term is usually reserved for inanimate objects. Formerly, this was used to designate destruction of pathogenic organisms, but the terms pathogen and non pathogen appear to have lost relevance.

10) Sterilization: destruction of all forms of micro-organisms, including bacteria, spores and viruses. There is no such thing as almost sterile or practically sterile. An object is either sterile or not sterile.

Concepts of Disease Transmission

The theory of disease transmission by germs, which include a broad spectrum of bacteria and viruses, is over one hundred years old, but certain elements of the mechanics of transmission are still vague. The minimum infective amount and the incubation periods for infectious diseases vary, depending on the relationship between the organism and the patient. For example, one million or more staphylococcus albus micro-organisms may be required to produce an abscess in unbroken skin. If there is a skin break, however, then a few organisms will produce an infection. Recent studies (Westood and Satter, 1976) reveal that a single virus is sufficient for infection, and transmission of adenovirus infection in man can occur with one infective unit per 60,000 liters of air.

Incubation times may vary from few hours for some organisms to several weeks or months for others e.g. tuberculosis and infections hepatitis. The low infective doses, prolonged incubation periods and lack of understanding the mechanics of transmission often make it difficult to determine the source of infection.

The anaesthesiologist manipulates and invades the respiratory tract and the vascular tree in nearly every phase of patient care. These systems are frequently the portals of entry and location for infection, therefore, attempts to prevent contamination during patient contact should be a standard practice.

Infections of the upper respiratory tract are common diseases among population, and more than fifty percent (inate from the viral spectrum. Since the