STERILIZATION AND DISINFECTION: THE PREVAILING INDIFFERENCE

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ABSTRACT
Objective: *To evaluate the knowledge and attitude of health care professionals towards the process of sterilization and disinfection, and to check the adequacy of the reading material accessible to them.*
Design & Duration: *Prospective cross sectional study conducted in October-November 2006.*
Setting: *Three teaching hospitals of Punjab.*
Materials & Methodology: *The study comprised of three components. In the first part, sections devoted to this subject in the popular books read by the students of operation theatre assistant course and students of diploma in general nursing were examined for adequacy and authenticity of information. In the second part, standard operating procedures were examined regarding sterilization of textile, rubber tubes of suction units and diathermy hand pieces of 20 operation theatres of three teaching hospitals attached to undergraduate medical colleges of Punjab. In the third part of the study, working knowledge of 64 practicing operation theatre assistants and 57 practicing nurses was assessed through a questionnaire.*
Results: *It was found that popular books either did not contain the required information or the information provided was misleading or incorrect. Standard operating procedures for sterilization of selected items of all the operation theatres studied fell much below the standard of practice desired in the light of current knowledge and contemporary practices. Finally the working knowledge of the professionals studied was much below the bare minimum expected by the profession.*
Conclusion: *There is a dire need for upgrading the knowledge and attitude of health care professionals regarding sterilization, besides improving the operation theatres' sterilization procedures.*

KEY WORDS: *Sterilization, Disinfection, Asepsis, Operation Theatre Protocols, Nursing Curriculum*

INTRODUCTION

Asepsis is still considered the landmark breakthrough that revolutionized the practice of surgery. Unfortunately a gradual shift from proper application of aseptic techniques to misuse of antibiotics has led to the undermining of its foundations.

In a significant percentage of teaching hospitals of Punjab, the operation theatre assistant (OTA) or a technician of similar educational background is the immediate person considered responsible for the highly technical process of sterilization and disinfection. This person reports to operation theatre sister (head nurse) who is supposed to be the supervisor and the operation theatre manager as well.

This study was carried out to evaluate some aspects of the training, knowledge and attitudes of the health care professionals (nurses and OTAs) towards the process of sterilization and disinfection.

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MATERIAL & METHODS

The study was divided in to three components as follows:

1. Evaluation of popular reading material on the subject of sterilization and disinfection read by the students of operation theatre assistant course and diploma

in general nursing.

2. Evaluation of standard operating procedures regarding sterilization of porous load of textiles, rubber tubes connected to suction units across the sterile field, and of hand pieces and leads of electrosurgical (diathermy) units.

3. Evaluation of the working knowledge of practicing nurses and operation theatre assistants.

In the first component of the study, reading material was identified by selecting one popular book each, read by the students of the courses mentioned above; the popularity of the book was judged through a survey conducted on 15 consecutive students of each group. In the case of operation theatre assistants, the Trainers Manual for Operation Theatre Assistants[1], developed by the Health Department of the Punjab Government was selected; incidentally this happens to be the main reading material available to students. The book Practical Nursing Procedures[2] was selected after interviewing the students of a nursing school affiliated with one of the teaching hospitals. Authenticity of the information given in the selected books was determined by comparing it with the information available in contemporary literature.

In the second component of the study, data was collected regarding standard operating procedures for sterilization of selected items considering the following aspects:

1. Whether a provision for application of vacuum for removal of air from the sterilizing chamber was present in the steam sterilizers being used for sterilization of porous load of textile or not.

2. Which process of sterilization was being used for reusable rubber tubes of suction units and hand pieces and leads of electrosurgical (diathermy) units.

In the third component of the study a questionnaire was prepared in Urdu (the national language), comprising of the following five statements:

1. Boiling water can kill all types of micro-organisms.

2. Cleaning patient's skin with spirit (alcohol) or pyodine (povidone-iodine) makes it completely free from micro-organisms.

3. Scrubbing-up does not make hands completely free of micro-organisms.

4. Ten minutes dip in a chemical like 'Cidex' (gluteraldhyde) makes diathermy leads and suction tubes completely free of micro-organisms.

5. Surgical wound infection can be prevented by the use of a 'good' antibiotic.

It was distributed amongst 57 nurses and 64 operation theatre assistants working in a teaching hospital. They were instructed to mark the each statement as true or false without leaving any mark of identification on the questionnaire. The questionnaire was examined using a standard template developed for the purpose.

RESULTS

Component-1
Evaluation of the Reading Material
The manual read by the operation theatre assistants was not only deficient in providing bare minimum information required by their job but it was also found to contain misleading and incorrect statements. The chapter on sterilization and disinfection spreads a little over five pages comprising of 166 lines or just 844 words. Followings incorrect statements were detected:

Regarding Boiling - "Addition of 2% sodium carbonate is said to increase sterilizing quality (page 54)". The preceeding statement is wrong as the process of boiling cannot result in sterilization in the first place[3,4].

Regarding Dry Heat - "Articles are kept at 160^{o} C (320^{o} F) for 1 hour (page 53)". The preceeding statement is wrong as two hours are recommended for this purpose after all the items get heated to 160^{o} C[3,5,6].

Regarding Autoclaving - "At 134^{o} C only 30 minutes are required at 10 lbs pressure (page 54)". The preceeding statement is wrong as it is not possible to attain 134^{o}C at 10 lbs of pressure[3].

Regarding Rubber and Plastic Catheters (page 56)-They can be sterilized by:
a) boiling.
b) suspension in formalin.
c) immersion in mercuric chloride.
d) immersion in chlorhexidine.
The preceeding statement is wrong as none of the above processes can sterilize the equipment. Formalin alone is not recommended because of its toxicity[3,7].

Regarding Cystoscopes and Endoscopes - "Immersion in 0.5% solution of chlorhexidine in alcohol (75%) is used (page 56)". The preceeding statement is wrong as submersion in alcohol is contraindicated for endoscopes as it can weaken the lens cement[3].

The book does not tell anything about the actual operation of the autoclave nor does it tell anything about the limitations of downward displacement of autoclave. Moreover it does not tell anything about testing the process of sterilization.

The book on practical nursing procedures was also not found to be free of incorrect and misleading statements. A chapter comprising of eight pages of half the letter size paper is dedicated to sterilization, which contains the following incorrect statements:

Regarding Flaming - "Scissors, scalpels and forceps are dipped in a mixture of alcohol and directly flamed for sterilization (page 208)". The preceeding statement is wrong as the sterilizing temperature is not achieved by this process because of concomitant evaporative cooling[3].

Regarding Boiling - "This is the common method of sterilizing blunt instruments, glass items, hard rubber items like catheters and IV sets, etc. (page 208)". The preceeding statement is wrong as the process of boiling cannot result in sterilization in the first place.

Regarding Chemical Sterilization - "The agents of chemical sterilization are Halogens, Mercurial preparations, Phenol or Carbolic Acid, Chloroxylenol or similar preparations, Savlon (page 210-211)". The preceeding statement is wrong as none of the above chemicals are considered as sterilants[5].

Regarding Sterilization of Surgical Gloves - "Usually autoclaving is done, sometimes even less pressure (about 10 lbs) is used for 20 minutes (page 214)". The preceeding statement is wrong as a pressure <15 lbs will result in a temperature far below the minimum (121^{o} C) required for this purpose[3].

Component-2
Standard Operating Procedures
All (100%) the operation theatres were dependent on a downward displacement type of steam sterilizers for sterilization of linen and packs wrapped in linen.

Diathermy leads were being prepared by either dipping in some chemicals (45%) or boiling (30%) or autoclaving (25%) in different operation theatres.
Suction tubes were being prepared by either dipping in some chemicals (85%) or boiling (15%) in different operation theatres.

Component-3 (Questionnaire)
A questionnaire was distributed among 57 nurses and 64 OTAs containing statements regarding sterilization and they were asked to mark the statement as true or false. The results are shown in Table I.

DISCUSSION

Prior to the era of antisepsis, 140 years ago, about 50% of patients undergoing surgery used to die of infection. In 1865, Joseph Lister for the first time demonstrated the use of an antiseptic in surgery. By the year 1910, two years before his death, the mortality rate from amputation, one of the most commonly performed major surgical procedure of those days, had fallen from 40% to 3%[8].

Table I. Knowledge regarding Sterilization & Disinfection among OT Assistants (OTAs) & Nurses

True (T) or False (F) Statements	Incorrect Answers	
	Nurses	OTAs
1) Boiling water can kill all types of micro-organisms (F).	71.93%	56.25%
2) Cleaning patient's skin with spirit (alcohol) or povidine-iodine (Pyodine) makes it completely free from micro-organisms (F).	64.91%	76.56%
3) Scrubbing -up does not make hands completely free of micro-organisms (T).	43.86%	46.88%
4) Ten minutes dip in a chemical like gluteraldehyde (Cidex) makes suction tubes and diathermy leads completely free of micro-organisms (F).	68.42%	46.88%
5) Surgical Wound infection can be prevented by the use of a good antibiotic (F).	89.47%	85.94%

The current practices prevalent in many of our teaching hospitals, however, makes one wonder if our emphasis has shifted 'from' measures preventing entry of micro-organisms into patient's body 'to' the use of antimicrobial agents after micro-organisms have been allowed to enter after penetrating patient's defenses.

Our health care system reflects an image suggestive of intellectual deterioration and administrative chaos. The curricula of training programs are imported and grafted rather than developed and tailored according to our country's peculiar needs. Job descriptions either do not exist or are kept secret. As a result health care professionals are never sure of their intended role even up to the time of retirement from the job. It is thus not unusual to find a professional assigned a role for which he was neither trained nor employed. The deteriorating state of a process as fundamental as sterilization and disinfection is a true representative of our attitudes, as mentioned above.

Let us first examine the educational background and training of an operation theatre assistant. He is a matriculate and may possess one year diploma in operating room techniques issued by the Punjab Medical Faculty. The curriculum of this diploma revolves around a book that has been evaluated above and found grossly inadequate and misleading. It is noted with great concern that this book was developed by two senior professors of surgery apparently under the instruction of the Health Department of the Government of Punjab province.

Let us now explore the educational and training background of a nurse. She is also a matriculate and has obtained in addition a 3-year diploma in general nursing. The theatre sister has often undergone postgraduate training as well. The popular book taught to them was also found to be incorrect and misleading. One wonders how this book gained popularity among the nursing students, when the authenticity of its contents is far from acceptable.

Downward displacement steam sterilizers are no longer considered appropriate for sterilization of porous load ('packs') because of their inefficiency in evacuating air from the deeper parts of the load. Such air pockets can cause hindrance in steam penetration[3]. It is a matter of great concern that highly prestigious teaching hospitals of the province are still using these out-dated steam sterilizers for linen packs and majority of the instrument packets as well. Similarly standard operating procedures for sterilization of two of the most commonly used items in almost every surgical procedure were dangerously faulty in a very significant proportion of operation theatres studied. This state of affairs appears to be partly due to the fact that no effort seems to have been made for the involvement of properly trained experts on the subject for the development of national standards for this highly sensitive job.

Who is the appropriate professional for this job? Handling of the steam sterilizers require knowledge of basic physics, mechanical engineering and biology, while knowledge of chemistry, pharmacology and microbiology is essential for the chemical sterilization, besides knowledge and familiarity with various materials used in the processing, packing and testing for sterilization. It is sad to note that we have made no effort to either develop such a professional in this country or to create job opportunities to attract and employ those trained elsewhere.

The very high proportions of wrong answers found in the third component of this study seems to correspond well to the incorrect concepts conveyed to them either through poorly designed and irresponsibly written text, or to poor clinical habits displayed to them by their teachers and trainers.

CONCLUSION

1) Curricula for OT assistants and nurses should be revised to remove the misleading and incorrect contents and to fill the gaps in the knowledge transferred to them.

2) Posts of sterilizing engineer should be created and suitably trained professionals should be engaged to run the sterile supply departments.

3) Local faculty should be developed to teach this highly sensitive subject and plans should be made to provide continued medical education on the subject.

4) National Standards and guidelines should be drafted for the guidance of equipment manufacturers, purchasers and end users.

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