



MONITORING THE PERFORMANCE OF AUTOCLAVES IN CENTRAL STERILIZATION SUPPLY DEPARTMENT OF MEDICAL COLLEGE HOSPITAL

Microbiology

Shivani Sharma

Assistant professor, Department of microbiology chintpurni medical college and hospital Bungal, Pathankot

ABSTRACT

Sterilization plays an important role in task of providing quality of care to the patients. Keeping the importance of proper monitoring and sterilization process in the hospital, it was planned to check the efficacy of autoclave by multiple parameters. A number of tools are available to assess the performance of Autoclave; these include physical, chemical and biological indicators. Sterilization is an infection control technique and essential practice in control of disease transmission and propagation.

KEYWORDS

Sterilization, Chemical Indicators, Biological Indicators

INTRODUCTION

Sterilization means to free an object from all living and viable germs. To fulfill this claim the microbiology is confronted with some fundamental problems under the action of microbial agents the microorganisms do not die at the same time even if there is a homogenous population. The assurance level that an object is free from all living and viable germs must be so high that it is practically impossible to proof this by a test for sterility. On the other hand the absence of microorganisms of high resistance in the objects to be sterilised makes it feasible to use microorganisms of high resistance as test organisms for the manufacture of microbiological indicators. These indicators make it possible to guarantee the application of a certain efficacy of microbial agents. Whether this efficacy is sufficient to reach the wanted sterility assurance level depends, last but not least.¹ Sterilization plays an important role in the task of providing quality of care to the patients and the C.S.S.D ensures the optimum availability of sterilized products. Therefore it is very important for the healthcare workers and staff of the C.S.S.D to understand the significance of proper sterilization techniques and procedures.²

As there is no visual way of determining whether a particular article is sterile or not, it has been the practice to use a color change indicator with the article when placed in the steam sterilization chamber. The indicator changes its color under the sterilizing condition of the autoclave thus indicated that the particular article or package has been passed through the proper sterilizing cycle. The indicator may be in the form of ribbon or card to which a color changes ink has applied. Keeping the importance of proper monitoring and sterilisation process in the hospital, it has planned to check the efficacy of autoclave of C.S.S.D by multiple parameters.³

Biological indicators have been produced commercially since 1957, and biological indicator based on *B. Stearothermophilus* spores have become the accepted mechanism for monitoring steam sterilisation process. The association of operating room nurses, the centre of disease control and the association of advancement of medical instrumentation all recommended at least weekly biological monitoring of steam sterilizers. Conventional biological indicators require at least 24 hrs of incubation to observe spore growth which can result in costly delay for medical applications.⁴

MATERIALS AND METHODS

Study area: The present study was undertaken in the Department of Microbiology in collaboration with the Department of Central Sterilization Supply Department.

Study period: The study was conducted for a period of 40 weeks from 2013-2014.

This prospective study was done for the monitoring of sterilization in autoclaves in the Department of C.S.S.D with the help of various sterilization controls such as chemical control and biological control.

In C.S.S.D there were three autoclaves and, chemical and biological monitoring of all the three autoclaves was done.

40 tests of biological controls were carried out in 40 weeks. It was

carried out once week .and chemical controls were also carried out weekly in C.S.S.D Department. Daily autoclave log table was also prepared for its working and efficiency monitoring.

Source of data collection: The data was collected from the C.S.S.D Department of Medical college Hospital.

Sample size: The list of sterilization equipment and their capacity was procured from CSSD and the load of the material to be sterilized was obtained from microbiology department. The sample size was of 40 weeks.

Method of sterilization:

The activities of CSSD were observed and the sterilization techniques were noted.

Prospective study or records maintained at the department to analyze the workload and equipment sterilization

We see that the method of steam sterilization was being operated in autoclaves in CSSD at temperature of 121°C

The process of steam sterilization was carried out as follows:

- 1) The Autoclave was filled with water
- 2) Water inlets valve were opened
- 3) Water was filled up to $\frac{3}{4}$ glass level marked.
- 4) Thereafter water valves were closed. Operating valve was put in the position after filling
- 5) The autoclave was switched on, wait for 30-45 min till the right side pressure gauge indicates 15 PSI
- 6) The machine was loaded and then the door was closed tightly and the operating valve was put in to the position.
- 7) After 15-20 min which was the holding time, we put the operating valve in to 'Fast' exhaust. The left side pressure gauge and the temperature gauge were come down and then operating valve was put in to "vacuum" exhaust.
- 8) When the left side pressure gauge comes to "zero" the operating valve was put in off/ slow position. Therefore the door was opened and the load was taken out.

Chemical control: In case of chemical control self adhesive autoclave tapes and Brownes tubes were used. self adhesive autoclave tapes were impregnated with ink which changes the colour after the completion of cycle. Browne's tubes also contain the chemical which changes the colour after the completion of cycle.

A cycle was selected and the surgical drum consisted of surgical dressings and linen material was inserted inside it with autoclave tape outside the drum. Before the starting of cycle the autoclave was done with its physical monitoring. The colour of the tape was brown before the starting of cycle. After the completion of the cycle the colour was changed to black which shows the effective sterilization. Although the autoclave tapes only tell us that the process goes effectively and completely. This was done on weekly basis for 40 weeks.

In case of Browne's tubes the colour will be change from red to green.

Biological control: Biological test were carried out in the autoclaves

for its monitoring. This test was carried out with the help of test organism (*B. Stearothermophilus*). This biological test was done after the autoclave has passed its physical checks

1. Paper strips or discs containing atleast 10^6 spores of *B. Stearothermophilus* were taken.
2. The strip was placed in the centre of load in the coolest part of chamber or the part which was less accessible to steam.
3. A particular cycle was selected for autoclaving and after the completion of cycle the strip was transferred in the laboratory for further processing.
4. In the laboratory the media soybean casein digest medium (tryptone soya broth) was made for the incubation of the strip.

TRYPTONE SOYA BROTH

It is general purpose medium for the cultivation of fastidious and non fastidious microorganisms and for sterility testing of moulds and lower bacteria.

Method of preparation

- 1) 30.0 grams of media was suspended in 1000ml distilled water
- 2) Media was heated to dissolve it completely.
- 3) Media was sterilized by autoclaving at 15lbs pressure (121°C) for 15 minutes.
- 4) The strip was incubated aerobically in T.S.B at 56°C for 5 days.
- 5) At the same time a positive unautoclaved control strip was also incubated in T.S.B.
- 6) After 3-5 days the results were noted for the growth of bacteria.
- 7) The result was checked for the presence of turbidity or no

OBSERVATION AND RESULTS

There were 3 autoclaves. The specifications were as follows
 Operation pressure-15-20 PSI
 Operation temperature- 121-126 °C
 Electrical needs- 420 volts

Hydrostatic test pressure:-
 Jacket- 2.6kg/cm³
 Chamber- 1.9kg/cm³
 50HZ A.C supply
 Completes 50 cycles in 3 phases

TABLE NO 1 (STEAM STERILIZATION)

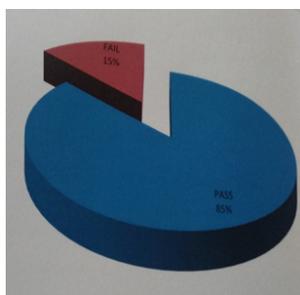
STEAM STERILIZATION	TEMP.	HOLDING TIME	FOLLOWED	NOT
			YES	NO
	121° C	15-20 Min	✓	
	124° C			✓
	131-134 °C			✓

From table no 1 we see that the steam sterilization process is carried out in autoclaves the department of CSSD and the temperature conditions at 121°C with holding time of 15 minutes is followed. The temperature conditions of 124°C and 131-134°C is not followed. It means the daily autoclave log table and the biological and chemical indicator results are carried out based on this temperature.

TABLE NO 2 (BIOLOGICAL CONTROL)

BIOLOGICAL INDICATOR	Total number of cycles	No. of cycles failed
<i>B. Stearothermophilus</i>	40	6(15%)

This test was carried out once a week .A total of 40 biological indicator tests were performed Out of total 40, 6 failed. This indicated the failure of autoclave.



Biological indicator test result



Biological indicator test result (turbidity seen in one tube showed the growth of *B. stearothermophilus* and in another tube turbidity was not seen)

TABLE NO 3 (CHEMICAL CONTROL)

CHEMICAL INDICATOR	YES	NO
SELF ADHESIVE AUTOCLAVE TAPES	✓	
BROWNE'S TUBES	✓	

The chemical indicators used were self adhesive autoclave tapes and Browne's tubes. These were the packing tapes presented with a specially formulated steam sensitive ink. Color changed from white to black ensures the sterilization. Manufactured from treated crepe paper , it was coated with high performance , cross linked , pressure sensitive adhesive and bonds well to linen used for packing the item used every day None of the strip failed during the study period thereby indicated that as for as strip method for sterilization was concerned; all the autoclaves passed the criterion.

In case of Browne's tubes the color would change from red to green in successful sterilization process. All the cycles during the study passed the results.



Browne's tubes color change from red to green



Autoclave tape before and after sterilization

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