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Reason behind wet pack after steam sterilization and its consequences: An overview from Central Sterile Supply Department of a cancer center in eastern India

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Root cause of wet pack;
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Prevention;
Conclusion

Summary Wet pack after steam sterilization process that means there are surely obtain millions of microorganisms that can breed and multiply rapidly and objects are unsterile and can never be used for further procedure.

There are many reasons behind the wet pack occurrences after autoclaving like poor quality of wrapping materials, faulty valves of rigid container, faulty loading and packaging technique, poor steam quality, sterilizer malfunction and may be design related problems in CSSD sterile storage area.

Cause of wet pack after steam sterilization processes may occur severe problems because of wasted time and effort, increased work load, increased cost, potentially contaminated instruments, infection risk to the patient, poor patient outcomes and delayed or cancellation of procedures.

But such wet pack scenario can be avoided by various methods by using good steam (water) quality, performing periodic maintenance of the Autoclaves, avoidance of sterilizer overloading, allowing adequate post sterilization time to cool down the materials to room temperature, using good quality wrapping materials, properly maintain temperature and humidity of sterile storage area etc.

Abbreviations: AAMI, Association for the Advancement of Medical Instrumentation; ANSI, American National Standards Institute; INR, Indian rupees; USD, United states dollar.

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Introduction

The presence of any residual moisture on inside or outside of a sterilized product, results in the item being referred to as 'wet pack'.

Wet packs are a concern because the residual moisture can creates a potential pathway of microorganisms to travel from outside environment to the packaging materials and possibly contaminating the instruments after sterilization.

Wet pack issue is universal especially where sterilization done by steam processes. There are several issues behind for wet pack occurrences like; poor quality of wrapping materials, poor load configuration and packaging technique, poor steam quality, faulty planning or design of central sterile supply department (CSSD), poor sterilizer condition and poor inventory management system.

The consequences of wet packs are wasted time and effort, increased work load, increased cost, potentially contaminated instruments, infection risk to the patient, poor patient outcomes and delayed or cancellation of procedures.

Briefly discuss the points mentioned above

Poor packaging materials quality

The purpose of packaging materials is to provide a sterile barrier and maintaining sterility until it is used. Packaging materials should be wrapped in such a way that it allows steam and air into the package, but keeps bacteria out.

But some countries still using reusable linen as a wrapper for steam sterilization purposes. Due to cotton thread, moisture can retain during steam sterilization processes and finally condensation occurred in both sides of the packaging materials [1].

Problem in rigid container system

Condensation might occur in rigid containers during post-vacuum phase when maximum pressure drop to atmospheric pressure at the end of the sterilization cycle.

Illustrative example:

1) A reading (printout) of 25 kilopascals (KPa) on a pressure gauge in post sterilization, that means some moisture (25% of water in gas form) is still remain inside the container that cannot be removed by vacuum pump (Fig. 1).
2) Temperature difference between the sterilizer chamber and inside container may create condensation inside the surgical set.

Complete steam evacuation inside rigid container at drying phase is rarely possible and such residual steam is very challenging for complete dryness of a sterilized product.

During drying phase, some percentage (example: 25% moisture) of moisture present in the sterilizer chamber implies that water vapor is present in the chamber and containers. When aeration takes place (the sterilizer chamber returns to ambient pressure by filling air) at the end of the cycle, the remaining steam mixes with the influx of air and achieves a mixture [depending on the final load temperature (80—90 °C) and the temperature of the incoming air (25—30 °C)]. As soon as the door of the autoclave is opened, the mixture inside the sterilizer chamber escapes into the environment, but the mixture inside the container will be retained and condenses into water during the entire phase of cooling up-to room temperature. Because warm air can hold considerably more water vapor than cold air during the cooling phase, the relative humidity inside the container will possibly increase.

When 100% relative humidity is achieved, the steam will condense to liquid because the air can no longer hold it in vapor form.

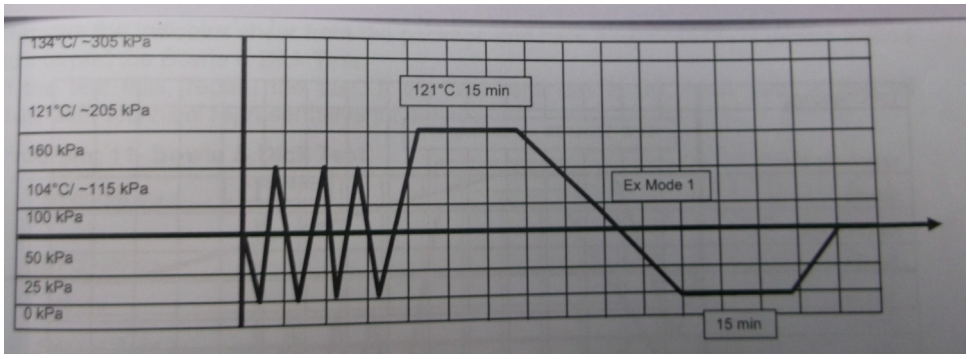

Figure 1 Steam sterilizer vacuum pump depth up-to 25 kpa.