Wet sets: Assessing the issues
by Mark Duro CRCST, FCS

The world of sterilization is a very complex one. With all the variables related to steam sterilization, there is always an opportunity for something to go wrong. Observing moisture in or on steam-sterilized items is one example. From time to time we may observe that a pack is wet after it is removed from the sterilizer and cooled or receive a call from the Operating Room (OR) stating that they opened a set and it was found to be wet.

Post-sterilization moisture in terminally sterilized sets is clinically unacceptable and can be a nuisance to investigate. A resource to help investigate this issue is AAMI ST79 Annex P, Moisture Assessment, which explains that, “Wet packs are a concern because the moisture on or within a package can create a pathway for microorganisms to migrate from the outside to the inside of a package.”

It is important to understand that there is a difference between a wet pack and a wet load. AAMI ST79 Annex P states, “Visible moisture left in (interior) or on (exterior) a package after sterilization and the proper cooling period should be considered a wet pack. If moisture is present on or in two or more packages the load should be considered a wet load.” In most cases the single wet pack issue is mostly due to user error. For example, it could be due to improper loading, placing a wrapped set under a rigid container system, not using the correct packaging material, or failing to use the proper dry-time for the item and for the sterilizer. Other factors that lead to external moisture can be tied to poor clinical practice, load contents and configuration, sterilization process failures, boiler system issues, poor sterilizer performance or environmental issues.

Visible exterior moisture that can be seen immediately in Sterile Processing can be caught early. AAMI ST79 Annex P states “Moisture found on the outside of a package may be caused by condensate dripping from the sterilizer cart railings or shelves, collection of condensation in improperly trapped steam lines, or condensation dripping from metal items on a shelf above other items.” Poor load configuration or overloading can be a culprit with external moisture. When loading textile packs like basin sets, ensure that they are leaning or facedown so as to not retain moisture.

Investigating interior moisture
An interior moisture event, however, is far more problematic. When we receive a call from the OR stating that they received a wet pack, there is a series of investigations that can start the investigation. One either of these are obtained, CS personal can begin the process of tracking that individual set to the actual load and verifying that the printout met all stated parameters. A common failure that occurs in almost every CS is when staff fail to verify cycle selection either before a load is started or upon load release. Once the load has been identified, if it is determined that it was in fact run correctly, sterile processing technicians should try to find other items that were included in that same load and open a few samples to ensure the load was not a complete failure. It is not unheard of for a full load of instruments to be accidentally run on a Bowie-Dick cycle or other cycle that was not compatible. When a load is run on a Bowie-Dick cycle it is often noticed immediately upon cycle completion. It is extremely important, if not working in an automated environment (i.e., in which sterilizers are connected to instrument tracking system software), that the person initialing the cycle print-out verify that the load exposure and dry time are accurate. This will help prevent wet loads or wet packs. In my experience, in instances of a single wet pack, the incident can usually be attributed to poor tray configuration, inappropriate contents or improper assembly.

Some of the sterilizer issues that can contribute to wet packs can be identified
easily. It is possible for container load cards, locks, lot control stickers, tape, barcode labels and other debris to be clogging the sterilizer drain. Refer to the sterilizer’s written instructions for use to establish how often to clean the drain screen. It is best practice to complete this task daily.

Tray configuration is also a culprit with wet packs or wet sets. Sometimes orthopedic loaner trays may enter a facility in a configuration for which they have not been validated to be sterilized. Spinal procedure trays are notorious for having multiple levels of screws and rods that are placed in tight multilevel plastic polymer trays that do not allow for adequate steam removal. It is important to ensure that the trays that do come in on loan are in their intended configuration. In an effort to reduce the number of trays, vendor services, with the intention of being helpful, may add extra levels to a tray. However, this rearrangement usually adds more density to the set which can contribute to it being wet post-sterilization. Rubber finger mats can also cause internal moisture if not placed properly in the set. Improperly aligned mats that do not allow for proper steam removal will also retain moisture. It is important that sets are not too heavy or overloaded and that items that are placed in sets be steam permeable. Occasionally, CS staff is asked to put items in sets that are not intended to be processed in a steam sterilizer.

Failing to disassemble instruments is another contributing factor. There are many instruments that must be disassembled properly before sterilization or they could retain moisture. With some heavier sets, absorbent tray liners may be needed to assist in wicking excess moisture. It is also important to ensure when assembling kits, especially complex multi-tiered trays, that the contents be thoroughly dried before packaging and sterilization. In addition, if rigid containers are being used it is imperative that the manufacturer’s validated filters be used and if there are reusable valves that they be properly inspected and maintained. Refer to your container manufacturer’s instructions for use to verify whether they can be stacked during sterilization; not all containers can be stacked when loaded into a sterilizer.

A common mistake with loading peel packs is that they are not placed on edge. Peel packs should be sterilized on edge with adequate space between them to ensure proper steam penetration and drying. Racks designed for this purpose can facilitate proper pouch orientation, sterilant contact, and drying.

**Wet load**

In the event a wet load is identified (several trays from samples taken from the same load are found to be wet), the load should be recalled and the contents repackaged. The sterilizer should be identified and temporarily taken out of service until testing on that unit can be completed. AAMI ST79 8.3.1 recommends, “If ‘wet packs’ are observed, they should not be released. They should be reprocessed in a manner that ensures that excess moisture/condensation does not occur. They should be repackaged (including the outer wrapper), and the Cs should be replaced with new ones. Sterilized textiles should be removed and replaced with freshly laundered textiles that have not been ironed. Disposable products such as gauze and cotton balls should be discarded.”

When it is observed that wet packs and wet loads are occurring frequently, it is important to document exactly when these events occur. Document the dates and times and whether it is isolated to a specific sterilizer or if it is in multiple sterilizers. Try to isolate a common cause related to timing, as interruptions with the steam supply could be a contributing factor. When trying to figure out if it is a facility failure, a team including CS, Facilities, the sterilizer manufacturer’s representative or service technician, as well as infection control and risk management should be involved. Having a solid team in place can help better investigate the possibilities of the steam supply or sterilizer failure. This team can further investigate possible reasons for the failure. The steam supply to the sterilizer(s) should be evaluated. Is the steam coming from a source that also supplies other areas such as the linen department or dietary or is the steam independent? Some sterilizers have dedicated steam generators rather than house steam and if not properly maintained with routine preventative maintenance, these generators can contribute to wet packs/loads. When documenting, have staff note the location of the failed items (e.g., are they on a specific location or shelf, or were wrapped items placed under containerized items?). Another potential factor that can contribute to wet packs/wet loads is excessive entrained water in the steam supply. The steam dryness should be between 97 percent and 100 percent. Having well-maintained steam traps to discharge condensate can help resolve this issue.

Improperly maintained in-house or independent steam supplies can also be an issue. It is important to have boilers maintained per the manufacturer’s guidance.

Proper cooling of sets is essential. Load configurations may vary as well as the metal mass of the load and this will affect the cooling time. It is important that loads are not cooled directly under incoming cool air as this can create moisture on packs. It is imperative to ensure the load properly cools before load items are moved as removing items prematurely and placing them directly on stainless steel surfaces such as solid shelves, tables or case carts can create condensate underneath the set.

It is important for the sterile storage area to be maintained at the correct temperature and humidity. If the storage area and the cooling area are too cold condensation could be present. One final non-sterilizer-related factor that can result in wet packs is when you have a major catastrophic event that renders your storage area out of temperature and humidity range. Failures with chilling and air handling systems can completely render your sterile inventory compromised. For example, if your air handling system and chillers go down, it is possible to have warm humid air enter your department if the air chillers do not return back to service at the same time as the air handling system does. In this situation you can almost instantly notice condense on packs, containers, carts, windows and shelves. Many CS professionals have experienced catastrophes like this when their temperature and humidity spike to extremely high levels. In an event like this it will be important to have a plan or procedure in place so the CS department can effectively recover. Most facilities will not carry enough reprocessing supplies to recover but it is extremely important to be prepared. It is also good to have a list of goods that may need to be ordered emergently, in the event your entire inventory needs to be reprocessed. The items could include:

- Tray liners
- Wrapping material
- Chemical indicators
- Indicator tape
- Container filters, locks and load cards
Wet sets: Assessing the issues

1. All containers can be stacked when loaded into the sterilizer.
   A. True
   B. False

2. Wet packs are a concern because the moisture on or within a package can create a pathway for microorganisms to migrate from the outside to the inside of a package.
   A. True
   B. False

3. To assist with eliminating moisture with heavier sets, the following can be done:
   A: use an absorbent tray liner
   B: wrap the kit twice
   C: add more metal mass to the set

4. Which AAMI ST79 Annex helps users assess and investigate moisture?
   A: Annex B
   B: Annex M
   C: Annex P

5. It is best to put cooling carts of sterilized items in a place where cool air is blowing on them as they will cool faster.
   A. True
   B. False

6. In case your entire department needs to repack due to excessive humidity, it helps to have the following on hand:
   A. Wrapping material
   B. Chemical indicators
   C. Indicator tape
   D. All of the Above

7. Peel pouches should be placed on edge in steam sterilizers.
   A. True
   B. False

8. It is acceptable to reuse textiles that were part of a wet load?
   A. True
   B. False

9. If one item is found to be wet the entire load should be considered a wet load.
   A. True
   B. False

10. Sterilization failures are usually due to faulty equipment.
    A. True
    B. False

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