Photos by Shannon Mauer, CST

Sterile Processing

The Other Side of Surgical Services

Shannon Maurer, CST

Behind every strong operating room is a strong sterile processing department (SPD). Sterile processing is an often overlooked division of surgical services, but it plays a critical role in patient care. Before an instrument can be placed on the back table or in a surgeon's hand, it must first be cleaned, decontaminated and sterilized. All of this occurs in the SPD, also known as the central service and supply department.

As contaminated instruments arrive in the SPD, they are cleaned of all material that would later hinder sterilization. This means scrubbing away bioburden such as dried blood and sputum. It also means prying bits of adhesive drape from the teeth of an Adson tissue forceps, or removing medication labels from a prep cup. Once this is accomplished, instruments are decontaminated and terminally sterilized. With the aid of machines, chemicals and good old-fashioned arm power, an SPD technician renders the items safe for handling without gloves. Then the instruments can be assembled, packaged and are resterilized for use.

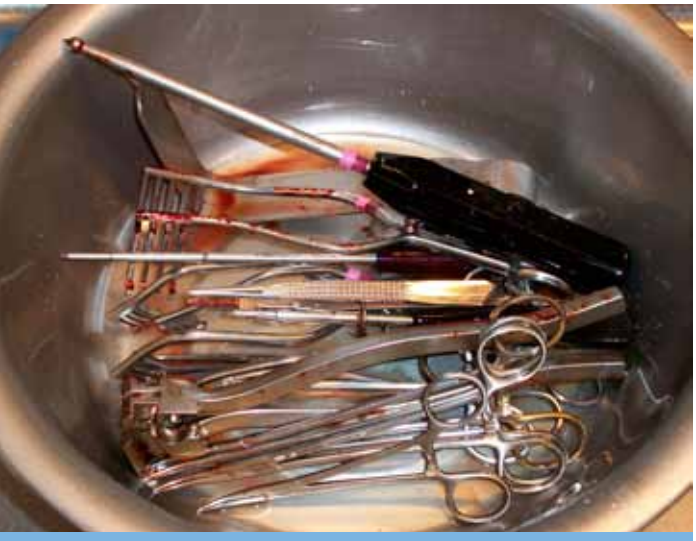
The sterile processing department may provide instruments for an entire hospital as well as select medical facilities in the local area. On any given day, an SPD technician might package and sterilize a multitude of surgical instruments, implants, towels, glass syringes, sheets, sponges, cameras and microscope slides — all of which may require different cleaning and sterilization techniques. Every time an SPD tech prepares items for patient use, he or she follows standards and recommendations set forth by multiple agencies, including The Joint Commission (TJC), and the Association for the Advancement of Medical Instrumentation (AAMI).[12] Though SPD employees don't have

LEARNING OBJECTIVES

- Learn about the role of a sterile processing technician
- Outline the surgical technologist's role in sterile processing
- Identify what steps are needed when pre-cleaning instruments before and after surgery
- Examine which items are particularly susceptible to damage
- Consider the effect the sterile processing department has on the operating room

Dirty orthopedic instruments just after surgery

The same orthopedic instruments sprayed with enzymatic solution



The same orthopedic instruments just two minutes after being sprayed. The enzymatic solution helps dissolve most of the visible bioburden

direct patient contact, their role in patient care is vital. Some may argue that the SPD is the first line of defense against all surgical site infections (SSIs).

THE ROLE OF A STERILE PROCESSING TECHNICIAN

What happens within the SPD is more complex than just washing contaminated items and assembling instrument trays. SPD technicians and surgical technologists understand many of the same principles: infection control, microbiology, instrumentation and asepsis. And while a surgical technologist must retain this knowledge, an SPD technician's expertise also includes selecting appropriate decontamination methods; selecting packaging material that protects instruments while allowing for optimal sterilization; choosing appropriate sterilization parameters; and handling items in a manner that preserves sterility. An SPD technician's main duties include being responsible for checking surgical instruments for functionality; conducting routine care and testing of sterilization equipment; properly rotating sterile supplies; and completing regular quality control assessments of the department's processes, products and personnel. Whenever the OR receives new instrumentation, SPD technicians must learn how to properly decontaminate and sterilize those instruments. The intricacy of some surgical instruments, the complexity of the manufacturers' processing instructions and the evolving needs of the OR, are just a few of the many challenges that an SPD technician encounters on a daily basis.[12]

INSIDE THE STERILE PROCESSING DEPARTMENT

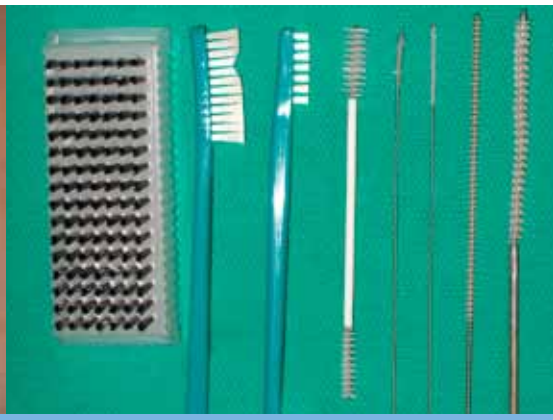
When used instruments arrive in the SPD, they enter through the decontamination area. The decontamination area is separated from the rest of the department by a wall to minimize the spread of contaminants to other areas. An SPD technician dons appropriate personal protective equipment (PPE) before handling any instruments brought into the decontamination area. At a minimum, decontamination PPE includes a sleeved, impervious gown or apron, and gloves, but when there is risk of splashing or contaminant aerosolization, a mask, eye protection and a hair cover are worn.[2]

Before instruments can be decontaminated, or made safe to handle without PPE, they must be cleaned. Cleaning and decontamination are crucial steps in sterile processing because sterilants (such as steam) will not penetrate debris left on instruments.[3]

Cleaning removes visible bioburden and foreign material, and how an instrument is cleaned depends on many factors. The instrument manufacturer's written instructions, the type of contaminant, the shape and design of the instrument, the amount of visible gross debris and the type of cleaning solution used are all considerations

A brush cleaning the lumens of a laparoscopic probe with holes

The tip of that same brush after going through the lumens. The brush reveals some of the bioburden that had been hidden inside the lumens



A sampling of brushes used in the decontamination area of sterile processing. Some brushes, like the slender ones, are designed specifically for cleaning lumens

before cleaning.[2]

An SPD technician may opt to soak or spray the instruments with an enzymatic solution to loosen bioburden. Prior to arrival in the SPD, instruments should be disassembled, if possible, to allow the enzymatic solution to come in contact with hidden surfaces. An SPD technician scrubs away excessive external debris and uses a slender brush, followed by a water flush, to clear all lumens. Foreign material, such as fragments of adhesive drape and bone cement, are removed as well.

Mechanical cleaning, such as the use of an ultrasonic cleaner, may be used in place of or in conjunction with, manual cleaning if the instruments are free of excessive bioburden. However, an ultrasonic cleaner is appropriate only for non-delicate instruments, and for instruments that can withstand being submerged in liquid.[18]

> To uphold the practices of patient safety, an SPD tech must be able to identify hundreds of instruments and follow guidelines from multiple agencies, including one's place of employment.

The SPD technician then decontaminates the instruments, which makes them safe to handle without PPE. An SPD technician has numerous factors to consider before selecting a decontamination method: Are the instruments semi-critical or critical devices? Should they be subjected to high-level disinfection or sterilization? Can they withstand exposure to high temperatures and submersion? Should they be decontaminated manually or mechanically?

Mechanical decontamination equipment, such as a washer-sterilizer, is preferred over manual methods of decontamination.[5] Washer-sterilizers resemble large dishwashers and use a combination of chemicals, heat and saturated steam to decontaminate instruments. To keep each instrument set intact, and to prevent individual items from being misplaced, an SPD technician will keep instruments in their original pan when loading them into the washer-sterilizer. Delicate instruments, however, are often placed in a separate pan to keep them from being crushed by heavier instruments.

Once the instruments have been decontaminated, they are ready to be inspected, assembled, packaged and sterilized. To prevent cross-contamination, these tasks occur in a separate area of the SPD called the "clean area." Washer-sterilizers can be installed in the wall that separates the decontamination area (the "dirty area") from the clean area. The washer-sterilizer will have two doors — one through which the SPD technician loads dirty instruments, and one directly opposite from it where the decontaminated instruments are unloaded into the clean area. This layout keeps the dirty area and clean area functionally and physically separated — a standard of practice highly recommended by both the Centers for Disease Control and Prevention (CDC) and AAMI.[2,14]

An SPD technician assembles instrument sets using a countsheet — the same countsheet used by the surgical technologist and circulator to track instruments during surgery. The instruments are checked for functionality and damage,

and defective instruments are removed from service. Exposure indicators are placed with the instruments to show if sterilization parameters have been met. Instrument sets are then either sealed in a rigid container or wrapped. Individual items that aren't a part of a set are either peel-packed or wrapped separately.

To uphold the practices of patient safety, in addition to being able to identify hundreds of instruments, an SPD tech must know and follow guidelines from multiple agencies, including his or her place of employment. Everything an SPD tech sterilizes must remain sterile until it's opened in the OR. Instruments must be assembled and packaged in a manner that allows steam and chemical sterilants to penetrate the packaging material and contact all surfaces inside the wrapper. Packaging material must be able to withstand tears and punctures, be opened in the OR easily and aseptically, allow for the use of tamper-evident seals and protect the sterile contents from microorganisms.[2]

After instruments are properly decontaminated, assembled and packaged, they can be sterilized. Steam sterilization is the most popular — and preferred — method of sterilization because it doesn't use potentially harmful chemicals. The CDC recommends this method for all items that can withstand heat and moisture.[14]

To prepare for steam sterilization, an SPD technician loads items onto a metal cart which is rolled into a large sterilizer. Before being pushed into the sterilization chamber, each item is stamped with a lot sticker to show when it was sterilized, which sterilizer was used and which cycle of the day the item was run in. In the event of a recall, all items from that particular load cycle will be removed from sterile storage and reprocessed.

Steam sterilization is divided into two segments: exposure time (when items are subjected to time, temperature, pressure and steam) and dry time (when all moisture is removed from the load). Not all instruments require the same exposure and dry times, and not all types of steam sterilization require a dry cycle. Some instruments may be damaged if sterilized beyond the manufacturer's recommended guidelines.

After a load has been steam sterilized, it is extremely hot. In fact, if it's immediately removed from the sterilizer and exposed to cooler air, moisture will form on the instruments and on the outside of the packaging material. Condensation can occur with any packaging material — rigid containers, wrappers or peel-packs. Moisture that forms on the outside of the package acts as a channel for microorganisms to enter. In rigid containers, the condensation that forms on the outside will drip through the filter and allow contaminants to reach the inside contents.[2] For this reason, SPD technicians allow the load to cool for a minimum of 30 minutes, although factors such as room temperature, humidity, the density of the load and the density of the instrument trays may lengthen cooling time.[2] Since cooling time affects how quickly the OR will receive sterile items, SPD technicians must balance the needs of the OR with correct sterile processing technique.

SPD technicians also are responsible for properly trans-

A washer-disinfector is loaded with dirty surgical instruments. Once the door is closed and a cycle is selected, the instruments will be mechanically decontaminated

A sterile processing technician wraps a small drill

porting and storing sterile instruments. Though transport practices may differ from one facility to another, organizations such as AAMI have specific recommendations about the transport of items through the SPD, to other departments and to outside facilities. Incorrect handling and storage can damage the protective wrapping or container, and cause damage to the instruments.[2]

THE SURGICAL TECHNOLOGIST'S ROLE IN STERILE PROCESSING

Since sterile processing occurs apart from the OR, there is a tendency for surgical technologists and SPD technicians to function as separate entities, each with their own mission. Their paths may never cross, but they share a common goal. The surgical technologist's role in sterile processing is crucial in ensuring patient safety. Without ever leaving the OR, a surgical technologist plays a critical part in the cleaning, decontamination and sterilization process.

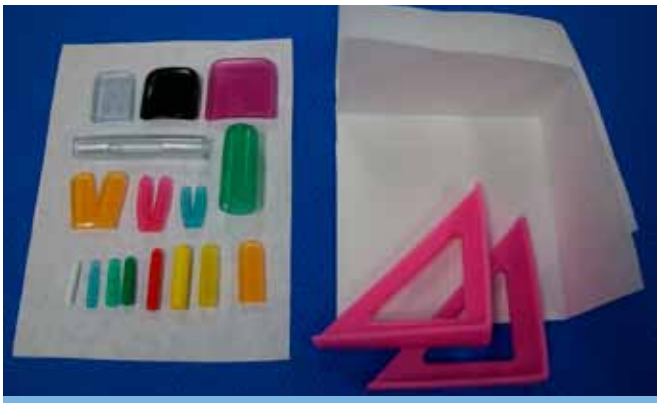
PRE-CLEANING INSTRUMENTS DURING AND AFTER SURGERY

One of the duties of a surgical technologist during surgery is to clean the instruments. It becomes second nature to wipe instruments clean after they are used. Yet after the final counting of sponges and sharps, instruments often are thrown back into the tray. The lumens of Frazier suction tips, which were never flushed during surgery, are left full of blood that quickly will congeal to a paste-like consistency. Heavily-soiled items, such as weighted speculums and hysterectomy forceps, will remain caked with dried blood.

When instruments arrive in the SPD in this condition, they already have been subjected to the harmful effects of bioburden. After about 20 minutes, a component in blood begins to cause damage that can lead to pitting, rusting and cracking of stainless steel instruments.[6] Bodily fluids and tissues become more difficult to remove after they dry. When an instrument needs to be sterilized and returned quickly to the OR, pre-cleaning items will assist in the process. Pre-cleaning can be the difference between resorting to immediate-use sterilization in the OR, and receiving a terminally sterile instrument set from the SPD.

Suggestions for pre-cleaning:

1. Wipe instruments clean and keep lumens flushed throughout surgery. Soiled instruments that will not be reused should be allowed to soak in a basin of sterile water for the remainder of the procedure.[5]
2. Immediately after surgery, spray instruments with an



A few of the many items a sterile processing technician can use to protect instruments and wrappers from being damaged during and after sterilization. Shown are assorted tip protectors, a disposable paper tray liner, disposable paper corner protectors and non-disposable silicone corner protectors

A sterile processing technician pushing a cart of unsterile instruments into a steam sterilizer

A sterile load of instruments after being removed from the sterilizer. The indicator tape has changed color

enzymatic solution. Enzymatic sprays designed for this purpose will begin to loosen bioburden.[16]

3. Before transporting instruments to the SPD, cover them with a damp towel. Keeping instruments moist prevents blood from hardening and makes the cleaning and decontamination processes less time-consuming.[6,16]
4. Place heavily-soiled instruments in a basin of sterile water. When instruments are coated in blood, soaking them in a small amount of sterile water can jumpstart the cleaning process. Due to the risk of spillover and splashing, transporting instruments in a basin of water is not recommended.[5]
5. Flush endoscopes before leaving the procedure room. This keeps fluids and small debris from adhering to the intricate channels of the endoscope. Thoroughly flushing an endoscope and wiping down its exterior immediately after use is highly recommended by the Centers for Disease Control and Prevention, the US Food and Drug Administration and the Department of Veterans Affairs.[11]

EXAMINE RIGID CONTAINERS AND WRAPPED ITEMS BEFORE USE

Wrapped items are particularly susceptible to damage because the wrapper can tear during handling. As heavier wrapped items are dragged across shelves and carts, the weight of the items crushes the outer wrapper. When the wrapper meets resistance — such as a sharp edge of a cooling rack or an uneven surface — it snags, creating a tear or puncture that may go unnoticed until the item is opened for surgery. Heavy, large instrument sets are more susceptible to punctured wrappers since the sheer density can prevent adequate drying and allow moisture to remain in the pan or on the wrapper. For this reason, it is recommended that instrument sets weigh no more than 25 pounds.[4,13,14,15]

Although sturdy, rigid containers aren't indestructible, over time a lid may become bent or a latching mechanism will stop working properly. If the lid and base don't form a tight, even seal, or if the filter mechanisms are damaged, the sterility of the instruments inside can't be guaranteed. A lid that is difficult — or impossible — to remove may indicate that the lid was forced into place in the SPD. If a surgical team member pries a damaged lid off a container, the items inside can become contaminated. Because sterility cannot be guaranteed in these circumstances, manufacturers recommend that damaged rigid containers be removed from service immediately.[1,7,9,17]

Sterility is affected by the quality of the wrapping material or rigid container, how a sterile item is stored and handled and how often a sterile item is handled.[8] SPD technicians have many products they can use as an extra layer of protection to sterile items, such as plastic trays specially made to transfer heavy instrument sets, absorbent tray liners and protective caps for sharp tray corners.[16]

> On any given day, an SPD technician might package and sterilize a multitude of surgical instruments, implants, towels, glass syringes, sheets, sponges, cameras and microscope slides — all of which may require different cleaning and sterilization techniques.

Despite all of these precautionary measures, instrument sets still can be contaminated. Whether by manufacturer defect or by human error, rigid containers and wrappers can fail to preserve the instruments inside. Before introducing an instrument into the sterile field, surgical technologists must look at the instrument's packaging material to make sure there is no damage or contaminants. If it is not intact, they should not use the contents. The SPD should be told about any rigid container or wrapper that is damaged. New materials may need to be ordered or the method of processing instruments may need to be evaluated.

Suggestions for examining containers and outer wrappers:

1. Before opening any rigid container or wrapped item, ensure all tamper-evident seals are intact and sterilization process indicators have changed color. If a seal is broken, or if the indicators are unchanged, do not use the instruments. They are considered unsterile.[10, 13]
2. Before opening a rigid container, examine the seal between the lid and the bottom. If the lid is loose, dented or looks like it has been forced into place, do not use the instruments. The same applies if the lid is being held in place by sterilization tape. If the container isn't sealed properly, its contents are considered unsterile.[13]
3. After opening a rigid container, single-use filters need to be removed and inspected for moisture and holes. If holes are found, instruments should not be used. Once a filter has been punctured, dislodged or otherwise dam-

aged, the contents of a rigid container are considered unsterile.[13] If a filter is missing, the contents are considered unsterile.

4. After removing an item from a wrapper, examine the wrapper for holes. After taking a sterile item from its wrapper, the surgical technologist should hold the item while a nonsterile team member inspects the wrapper for holes. (Holes are more easily seen if the wrapper is held up to the light.) After the wrapper passes the inspection, the instrument set may be placed on the sterile back table.

Surgical technologists are consistently involved in sterile processing whether they are aware of it or not. Surgical instruments pass through many hands on their journey through the SPD and the OR, and how they are treated will affect their sterility. Paying attention to the integrity of wrappers and rigid containers is crucial to maintaining a sterile field. Even simple actions, such as spraying soiled instruments with a wetting solution, improves instrument turnover time and helps break down contaminants. Although these steps may be time-consuming, they go a long way toward preserving instrumentation and protecting the surgical patient.

ABOUT THE AUTHOR

Shannon Maurer, CST, became a surgical technologist while in the US Air Force, and passed the national certification exam before completing her enlistment. Since then she has worked in surgical services, sterile processing and pathology. She recently earned her master's degree in writing and is working on a nonfiction book for middle-grade readers. Shannon and her husband, who currently serves in the military, are stationed in Virginia with their cat, Phoebe.

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