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CASE REPORT/STUDY

Role of Instrument Trays in Clinical Care

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ABSTRACT

Surgical instrument trays are a very common tool in hospitals, laboratories and clinics. They allow for easy access to instruments that would otherwise be difficult or impossible without them. Instruments must be sterilized before they can safely remove any bodily fluids or debris from the body, and autoclaves use these containers to protect their contents. The corners are covered with metal trays so that no one side gets too hot while being careful not let anything touch other surfaces in case there's an accidental burning sensation caused by steam coming off of one object hitting another accidentally, this could cause severe injury. These safety precautions help ensure your patients receive clean devices without ever knowing what happened during processing thanks again accessory collaboration. The design of a tray is critical to its efficiency. The more instruments it holds, the higher number procedures can be completed in one go and with less time spent waiting for supplies or waste materials from previous surgeries. The importance behind this becomes evident when considering high volume clinical practices that require specific equipment like scalpels; however, there are some other benefits too. Eliminating unnecessary items saves money by minimizing costs associated with owning them.

Keywords: Hospitals, Instrument Trays, Surgeries.

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INTRODUCTION

Surgical Instrument Trays (ST) are flat open/closed containers that hold surgical instruments. Each ST contains the instruments needed to perform a surgical procedure or family of procedures. Every healthcare facility involves the usage of instrument trays. They are used in hospitals, laboratories, clinics, and emergency facilities. The composition of the trays is made by surgeons mostly and reflects all instruments needed for a specific surgery. It is important to understand the essence of instrument trays in inpatient care to increase efficiency and promote patient care.

They are the containers that protect the instruments in several ways and are used for holding the instruments during the sterilization process in an autoclave, protection from damage, transporting the medical instruments from one location to another, and storing them by keeping them sorted when not in use. They are usually metallic trays with corners covered and large bead edges helping in easy cleaning, stacking, and handling. They can be made of various materials like stainless steel, enamel, aluminum, and polymers.

They are available with or without covers, in different types of styles and sizes, and can accommodate numerous medical instruments. The trays are mainly used in healthcare facilities during surgical procedures as well as for sterilization, autoclaving, and storage. Each tray contains the instruments needed to perform a medical procedure or family of procedures. Instrument trays fall in the medical devices category and belong to class I and are treated with the same protocol as class I instruments.[1]

When the tray configuration is properly designed, it is designed in such a way so that it can offer a minimum set of required instruments to perform the highest number of clinical procedures. They are used in operating rooms (OR). The importance of trays can be justified by convenience and safety. Also, the elimination of unnecessary instruments in trays can promote time savings, less operational effort, and smaller costs in ORs, without negatively impacting the patients.

CATEGORIZATION OF CLINICAL INSTRUMENT TRAYS

A basic instrument tray can be of stainless-steel type. But the standard version is a solid stainless-steel tray that is available in various sizes and with configurations like flat and domed. However, there are many specialist trays to fulfill specific types of medical demands. They include:

Perforated Tray

It includes perforations to enable better instrument sterilizing and drying. There are also the standard perforated instrument

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trays best used for autoclave and cold sterilization. They are made up of auto-polymerizing polymethyl-methacrylate (PMMA) resin, thermoplastic material and visible-light curing resin. Its depth ranges from 25 to 150 mm. The range of thickness is 1 mm to 3.0 mm. The finish is of mild steel. They are used to take a negative imprint of hard and soft tissues.

Mesh Tray

Wire mesh enables thorough sterilization of medical items and equipment by allowing unimpeded airflow. It is made up of stainless steel 202, 304, 316, Gi Hot dip Galvanized, Gi electro galvanized, powder coated. The thickness is from 3 mm to 10 mm. The finish is of hot dip galvanized finish applied after fabrication. They are used in conjunction with hospital bedside tables or over bed tables to hold patient meals, medicines, and other items.

Wire Mesh Trays are used as an alternative to Regular Instrument trays and provide the most effective Sterilization in an Autoclave:

- Excellent Air Removal from the wire mesh (effective pre-vacuum cycles) as against in the Instrument Trays which have air trapped inside.
- Steam Penetration is extremely efficient due to the open mesh design, as compared to regular Instrument trays which do not have any holes/perforations.
- This can be used for all types of loads such as Solid/ Hollow/ Porous (Linen).
- This has double bar protection at the top and the bottom of the mesh which ensures durability and efficiency in the sterilization process.
- The same wire mesh trays can be used for rinsing & cleaning of instruments, Sterilization cycles, transportation as well as storage.

Drying Tray

It enables healthcare professionals to select the necessary medical instrument at a glance. Its steam pressure is 3.3 kg/ cm^2, steam consumption is 25 lb/hr, insulation is 50 mm at 100^oC. They are used to carry equipment such as forceps, scissors, knives, cotton and spirit etc.

Stainless steel and Polymers are two of the most popular material options for sterilization trays used in the pharmaceutical and medical industries. In terms of toughness, long shelf life, and resistance to contaminant absorption, surgical stainless steel outperforms plastic trays, especially for medical use.[2]

Various types of trays are made so that they could be versatile in terms of the ways they are used. Like, stainless steel trays, they can be autoclaved or used as storage units. They are available in different sizes. Seamless designing on various products helps in easy cleaning and flat lids enable trays to be durable.

ADVANTAGES OF USING INSTRUMENT TRAYS

There are various benefits of instrument trays. First of all, modern trays are made from materials, such as enhanced steel alloys and composites. These boost the strength, stiffness, and durability of the trays while simultaneously reducing their weight. New types of plastics and polymers with tremendous shape retention properties can withstand enormous heat and radiation, allowing for increased sterilization as well.

Secondly, new designs allow for advanced capabilities, enhanced versatility, and improved safety and reliability. The cost of procurement and administration is reduced since one tray contains all the necessary equipment, the time, and money of contacting many suppliers. It improves efficiency, which implies that more procedures can be done in a short span since the time for preparation is considerable. The waiting time for patients can be reduced, and their procedures can be carried out as early as possible.

According to the data the average administrative cost of Trays was $ 500 for those involving on- site trays. The cost of purchasing a custom tray was calculated to be $ 1,421.55.55 through any supplier, which is quite cheap and beneficial to the medical facility.

The disadvantages include the reduced strength, stiffness, and durability of the instruments over time. Another disadvantage is the weight of some trays. Some of the trays also have reduced shape retention, properties and cannot withstand high heat and radiation.

IMPACT OF STERILIZATION ON INSTRUMENT TRAYS

Healthcare settings are highly vulnerable to fungi, viruses, and deadly bacteria that can cause fatal complications. When surgery is being carried out or conducted, one of the most important items in maintaining sterility is a tray that can be speedily sterilized and utilized. Using non-sterilized instrument trays drastically increases the likelihood of transmitting disease from one patient to another. Sterilizing each piece of the tray is critical to keep each patient as safe and healthy as possible. Sterilization kills, deactivates, or eliminates all forms of life and other biological agents which are present on instrument trays.

Means of sterilization can be heat, chemicals, irradiation, high pressure, and filtration as well. The other methods that can be used to sterilize the trays include steam heat, ethylene oxide gas, or chemicals. Using an autoclave to sterilize instrument trays is the most prominent method. It involves:

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Place the tray to be sterilized, inside the autoclave chamber.

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After that, the autoclave subjects its content to pressurized saturated steam that reaches a temperature of 121°C (250°F).

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Essentially, the sterilization process uses temperatures that are higher than the boiling point of water.

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This procedure can take between 20–90 minutes, depending on the size of the autoclave chamber.

VARIOUS TYPES OF INSTRUMENT TRAY STERILIZATION

The classifications of instrument tray sterilization include:

Disinfection

Most pathogens on trays are eliminated; microbial contamination is reduced on the surface. Freshly produced 10% bleach and 70% ethanol are two highly used clinical disinfectants.

Radiation Sterilization

Involves exposing the trays to radiation for sterilization. The main difference between different radiation types is their penetration and hence their effectiveness. UV rays have low penetration and thus are less effective, but it is relatively safe and can be used for small trays sterilization. X-rays and Gamma rays have far more penetrating power and thus are more effective for large tray sterilization.

Chemical Method of Sterilization

Heating provides a reliable way to get rid of all microbes, but it is not always appropriate as it can damage the tray to be sterilized. In that case, chemical methods for sterilization are used, this involves the use of harmful liquids and toxic gases without affecting the trays. Sterilization is effective using gas like ethylene oxide because it penetrates quickly onto the tray like steam. This takes around 16 to 18 hours which is more than steam sterilization.

Heat Method

The heat is used to kill the microbes on the tray surface. The extent of sterilization is affected by the temperature of the heat and the duration of heating.

Steam Sterilization:

Steam, along with added moisture is the most effective since steam alone is not adequate. Above normal atmospheric pressure is needed for temperature increase to destroy microbial life. No living organism can survive moisturized saturated steam for 15 minutes or longer, at 250^{o}F. At the end of the heat and moisture process, the re-evaporation cycle must be sufficient in drying the trays to maintain sterility.

Flash Sterilization

It considers temperature and pressure. Its original definition was that an item that has been unwrapped should be kept at 132°C for 3 minutes at between 27 and 28 pounds of pressure that requires a gravity displacement sterilizer. Depending on the caliber of sterilizer purchased, and the item being sterilized, time will fluctuate.[3] This process can be very effective, but is complicated and has costs involved which may make custom trays all the more recommendable.

Based on the type of heat used, heat methods are classified into-

Wet Heat Sterilization

In most hospitals, this is a mostly commonly used method that is done in autoclaves. It uses steam heated to 121–134°C under pressure. This is a very effective method that kills all microbes, bacterial spores, and viruses on instrument trays. It kills microbes by the process of hydrolysis and coagulation of cellular proteins, which is efficiently achieved by intense heat in the presence of water. The intense heat comes from the steam.

Dry Heat Sterilization

It is one of the earliest forms of sterilization practiced. It uses hot air that is either free from water vapor or has very little of it, where this moisture plays a minimal or no role in the process of sterilization. Here trays are exposed to high temperatures (160–170°C) either by flaming or a hot air oven. Flaming is used for metallic trays. The metallic end of the tray is heated to red hot on the flame. The proper time and temperature for dry heat sterilization is 160^{o}C for 2 hours and in case of high velocity hot air sterilizers is 190^{o}C for 6–12 minutes.

CONCLUSION

Proper usage of instrument trays can be challenging. Concerned users should ensure that trays are used in an appropriate manner that will facilitate the sterilization process, protect the trays from potential damage and facilitate their safe and proper use. It will help them to use safe, functional, and sterile instrument trays. Future research in the case of instrument trays may be targeted at two promising directions: traceability of instrument trays and cross-sectional analysis of instrument tray content which will be beneficial to patient care in the long run.

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