

SURGICAL INSTRUMENTATION

[This page intentionally left blank.]

Surgical Instrumentation



Instrument Assembly and Preparation

[This page intentionally left blank.]

OBJECTIVES

Following training, employees will be able to:

1. Recognize the common use instrumentation.
2. Identify instruments for different types of surgical uses.
3. Identify the different parts of instruments.
4. Distinguish the difference between hand-held and powered instruments and flexible and rigid endoscopes.
5. Explain the proper placement of instruments into trays, sets, and containers.
6. Understand the proper stringing of string instruments and how to place instruments on the stringer to assure easy access.
7. Demonstrate testing procedures for all instruments and identify malfunctions.
8. Define the different care and handling aspects for surgical instruments.
9. Discuss recommended processing procedures for all surgical instruments.
10. Demonstrate the proper placement of instrument trays and sets on the sterilization carts.
11. Know the correct storage and transportation for both soiled and sterile instrument sets and trays.
12. Explain the difference between floor grade and surgical grade instruments.

[This page intentionally left blank.]

SURGICAL INSTRUMENTATION

1. INTRODUCTION

a. As surgical technology continues to advance, so does the type and complexity of surgical instrumentation. Surgical instruments are a major investment in the hospital setting and require special care and handling to maintain proper function and longevity. This is dependent solely on how an instrument is used and cared for. The operating room staff, as well as the SPD technicians, are required to use, assemble, and recognize thousands of different types of surgical instruments and devices.

b. Not all facilities are involved in cleaning and sterilization of surgical instrumentation. However, they may be required to assemble special procedure trays for clinics, dental, and special use areas. These areas may utilize surgical grade instruments, versus the ward or floor grade instruments, with the different types of surgical instruments available. Regardless of the type of support offered a medical facility, the SPD technician should be familiar with the different types of surgical instruments in the event the facility decides to include SPD in the care, handling, and assembly of surgical instrumentation.

c. SPD is responsible for inspecting the instruments prior to sterilization to assure the instruments have been cleaned properly, tested, and checked for proper function and damage (cracked box locks, etc.), and assembled according to an accurate and detailed procedure list, agreed upon by the operating room. A damaged instrument should be sent for repair and a replacement placed in the set.

d. Instruments are divided into several classifications:

(1) Hand held, which consist of general use, microsurgical, and laser.

(2) Flexible and rigid endoscopes that require light carriers and fiberoptic cords, fiberoptic rigid telescopes used with bridges, sheaths, and obturators.

(3) Powered equipment which can be electrical, pneumatic, or battery operated.

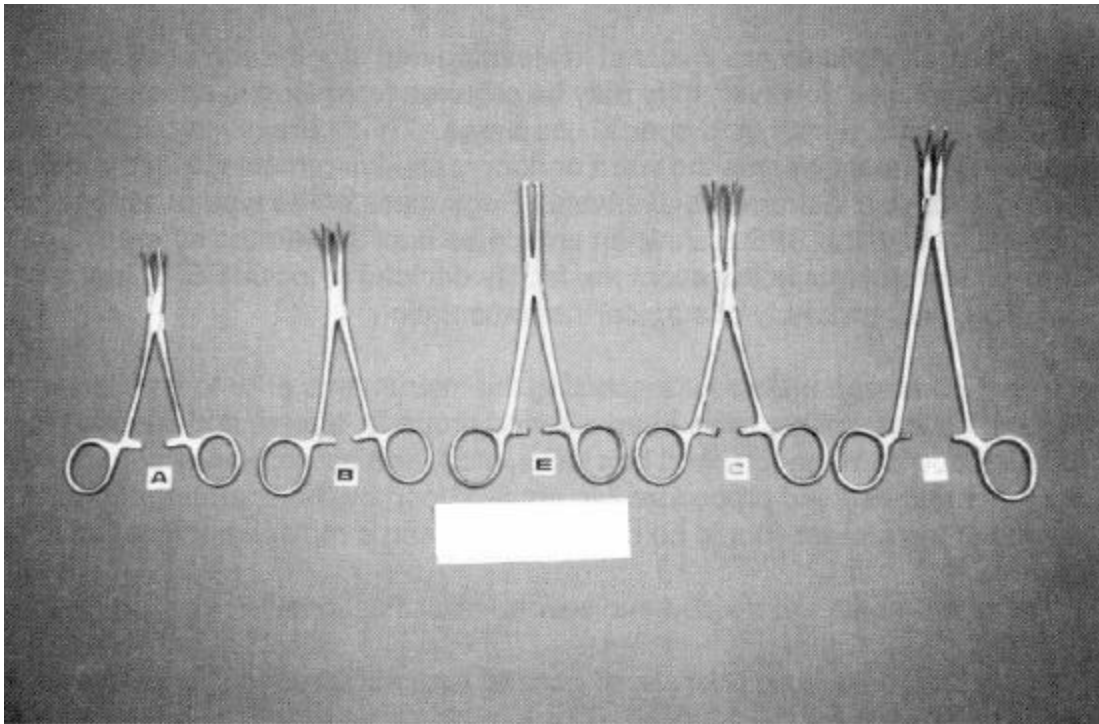
2. HAND HELD SURGICAL INSTRUMENTS

a. Hand held are the most common type of surgical instrumentation. Once the general, most common types of instruments are identified, the technician will be able to recognize them regardless of the different patterns, designs, and sizes utilized for specific surgeries. For example, tissue forceps used in eye surgery will resemble tissue forceps used in general surgery, the only difference being the size. The same holds

true for retractors, needle holders, etc. The exception to this would be the specialized instruments used for orthopedic and dental procedures.

b. The basic uses for these instruments fall into the following categories:

(1) **Hemostatic Forceps.** These forceps can be called clamps, artery forceps, and hemostats. The main purpose of hemostats is to achieve hemostasis (control of blood flow in the vessel). Most hemostats are available in different lengths, curved and straight, with serrated jaws. Some also have toothed ends. Examples of hemostats: Mosquito, Kelly, Carmalt, Schnidt tonsil, and Kocher.

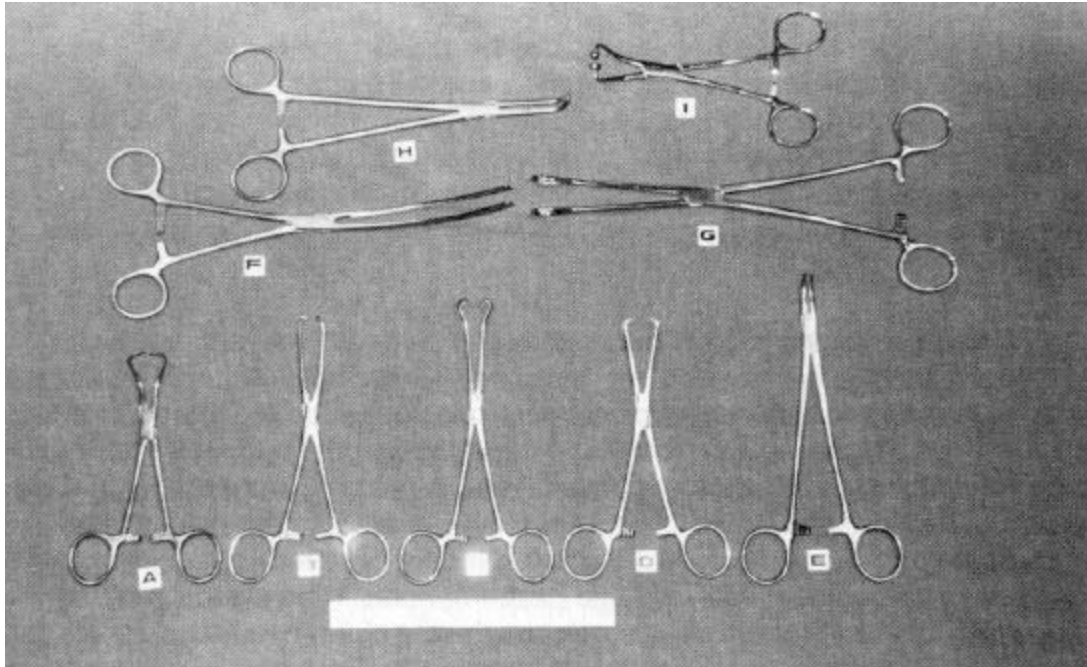


Hemostatic Forceps

(A) Mosquite, (B) Kelly, (C) Kocher, (D) Carmalt, (E) Schnidt Tonsil

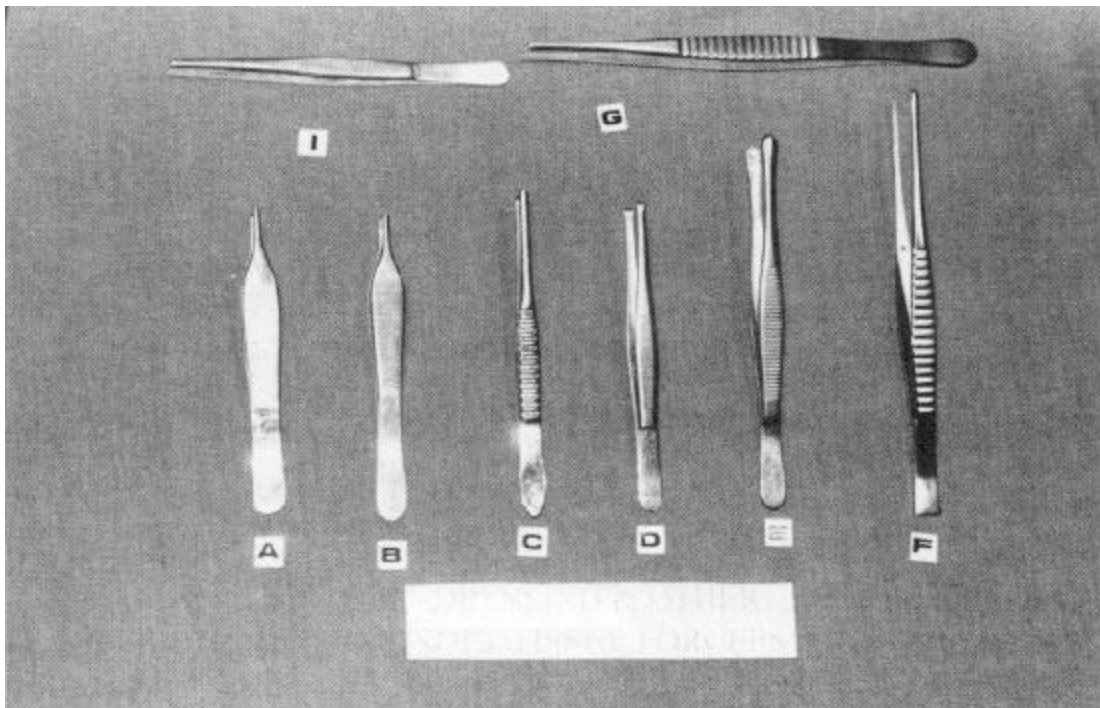
(2) **Soft Tissue Forceps.** Similar to hemostats, these forceps are used for holding and retracting soft tissue for longer periods. Characteristics include fine teeth or ridges on the jaws to provide a more delicate grip without trauma to tissue. They also consist of ring handles and box locks, as do the hemostatic forceps. Examples are: Backhaus Towel, Allis Intestinal, Babcock Intestinal, Kocher Artery, Mixer Gall Duct, Kantorwitz Right Angle, and Forester sponge forceps.

(3) **Other Soft Tissue Forceps (Thumb).** Thumb forceps do not have box locks or ring handles but rather have spring handles which are held closed by the



Soft Tissue Forceps

(A) Backhaus Towel, (B) Allis Intestinal, (C) Babcock Intestinal, (D) Lahey Goiter, (E) Mixer Gall Duct, (F) Doyen Intestinal, (G) Forrester Sponge, (H) Kantorwitz Right Angle, and (I) Nonperforating Towel Clamp



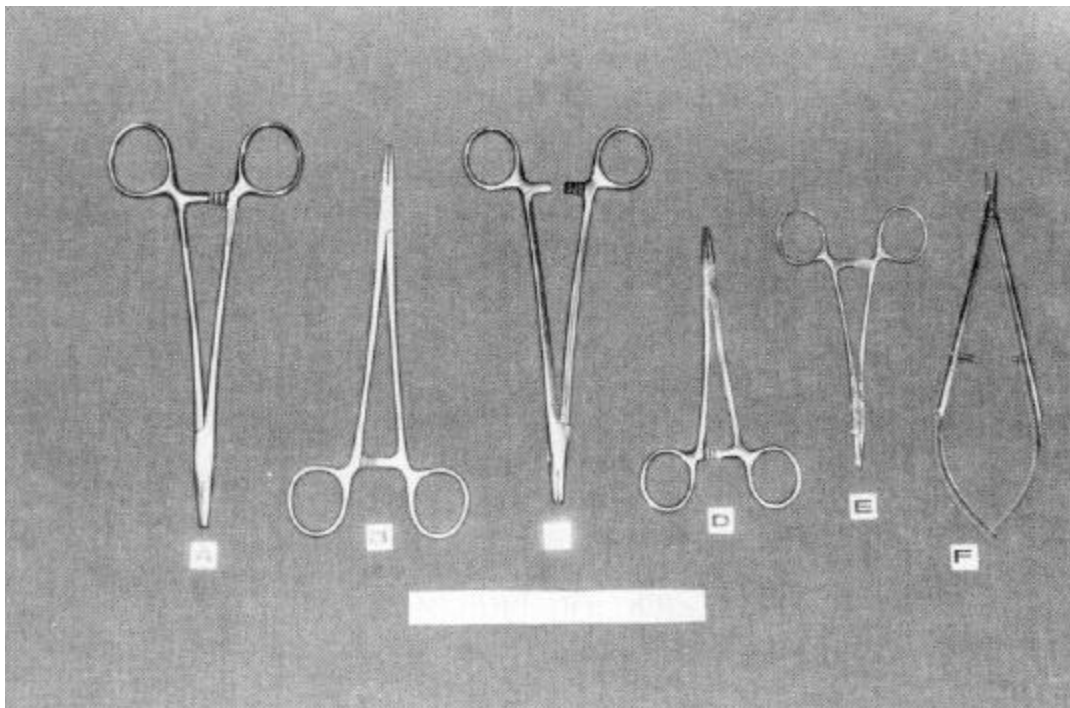
Thumb Forceps

(A) Adson, (B) Brown-Adson, (C) Thumb w/teeth, (D) Bonnie, (E) Russian, (F) Cushing, (G) DeBakey, and (I) Dressing

thumb and finger pressure. Sometimes this type of forceps is referred to as dressing forceps when the jaws are serrated and the instrument is used to grasp delicate tissue or wound dressing. A heavier version of this type of forceps is referred to as thumb tissue forceps used for grasping heavier tissue where the teeth will provide a more secure grasp. Examples of thumb forceps: Adson, Brown-Adson, Hudson, Dressing, Tissue Forceps with Teeth, Russian, Cushing, and DeBakey.

(4) **Needle Holders.** Sometimes referred to as needle drivers, this type of instrument is mainly ring handled, similar to hemostats but with smaller jaws which are shorter and thicker. Needle holders hold needles which are attached to sutures. These instruments are also available in a variety of lengths and styles and may be curved or straight. Needle holders have inserts in the jaw to prevent excessive wear of the instrument. These inserts are mainly made from tungsten carbide granules in a cobalt or other metallic paste. Needle holders with tungsten carbide inserts are normally identified with gold plated handles. The inserts can be replaced as they wear down, which prolongs the life of the needle holder and defrays the replacement cost of an entire instrument. Examples of needle holders: Mayo-Hegar, Crile-wood, Olsen-Hegar, Collier, and Webster.

Needle holders can also have spring handles which allow the user maximum results with minimum rotation of the wrist and hand. Most spring handled needle



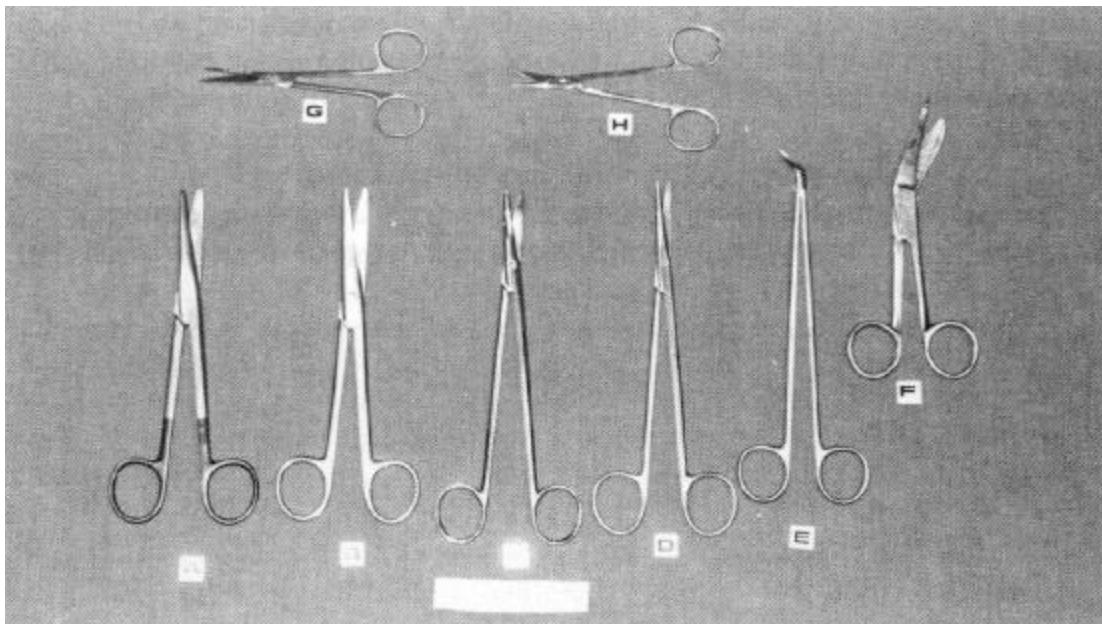
Needle Holders

(A) Mayo-Hegar, (B) Crile-Wood, (C) Olsen-Hegar, (D) Collier, (E) Webster, and (F) Castroviejo

holders will have a lock or catch to secure the needle and are used in surgical procedures requiring delicate suturing in tight or poorly exposed areas. Spring handled needle holders may also contain replaceable inserts. An example of a spring handled needle holder is a Castroviejo, 7 or 9 inch.

(5) **Scissors.** A large variety of scissors are utilized in the surgical suite to include many lengths, styles, curved, straight, sharp, and blunt. In general, curved scissors are used to cut and dissect tissue, while straight scissors are used for cutting sutures and any tissue when a smooth, straight cut is desired, such as a damaged nerve or blood vessel. Scissors can be used for probing, dissecting, and spreading tissue. These scissors should never be used to cut paper or tubing. Bandage scissors may be utilized for this purpose.

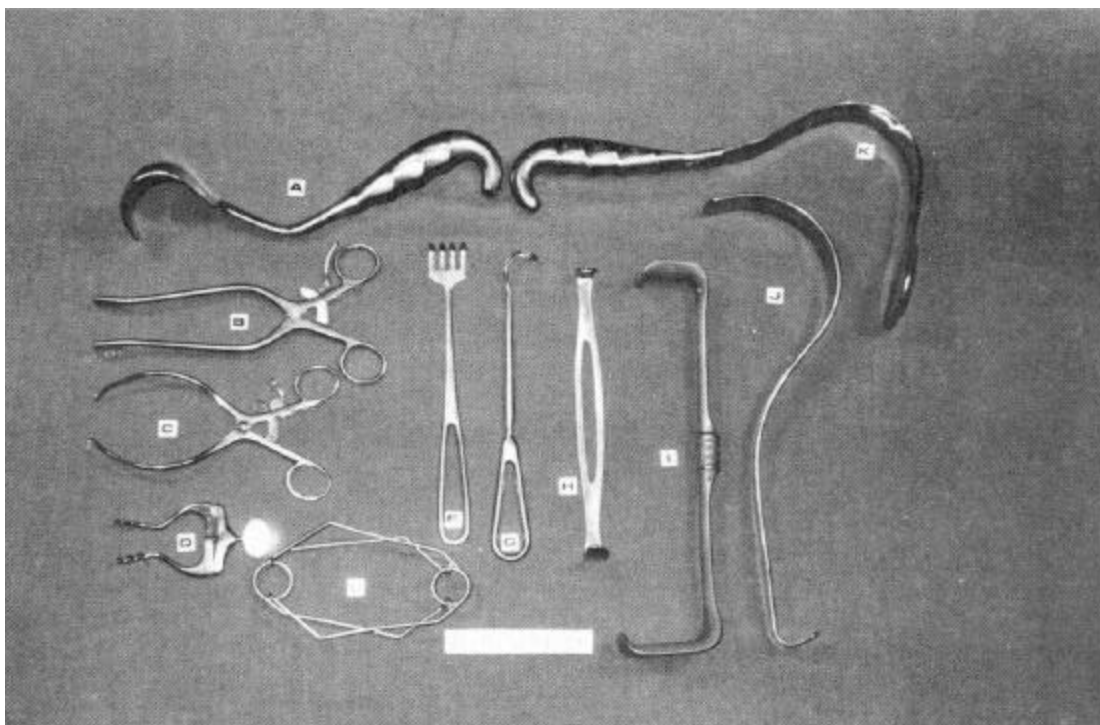
Major types of scissors include Mayo scissors, identified by heavy curved or straight blades with rounded tips; Metzenbaum (Metz) scissors, similar to Mayo only lighter in pattern and more delicate; Iris (dissecting) scissors, resembling cuticle scissors but more delicate in style. Operating or general use scissors can be used for cutting sutures and gauze. The heavier types are used for cutting fine wire sutures and are identified by angular blades with serrated edges with a groove for holding the wire as it is being cut. Scissors may also have tungsten carbide cutting edges which provide finer cutting with longer lasting wear. Scissors with tungsten carbide inserts are identified by gold plated ring handles.



Scissors

(A) Mayo Dissecting Straight, (B) Mayo Dissecting Curved, (C) Metzenbaum, (D) Metzenbaum Delicate, (E) Potts-Smith, (F) Lister Bandage, (G) Iris Straight, and (H) Stevens Tenotomy

(6) **Retractors.** Many varieties and sizes of retractors are available, and the use of specific retractors will largely depend on the type of surgical procedure being performed. Retractors are used for holding the incision open to provide exposure to the surgical site. Smaller types held by the fingers or hand retract skin and subcutaneous tissue in shallow surgical areas. Larger, heavier models retract muscle tissue and organs in deeper surgical sites. Some retractors are held in place by an assistant while the surgeon completes the procedure, while self-retaining retractors require no assistant to hold them. Self-retaining retractors are held open by their own action and may be used in conjunction with the hand held retractors. Examples of retractors: Richardson-Eastman, Mayo, Jansen Mastoid, Weitlaner, Cerebellum, Gelpi, Volkman Rake, Green Goiter, Army-Navy, Deaver.



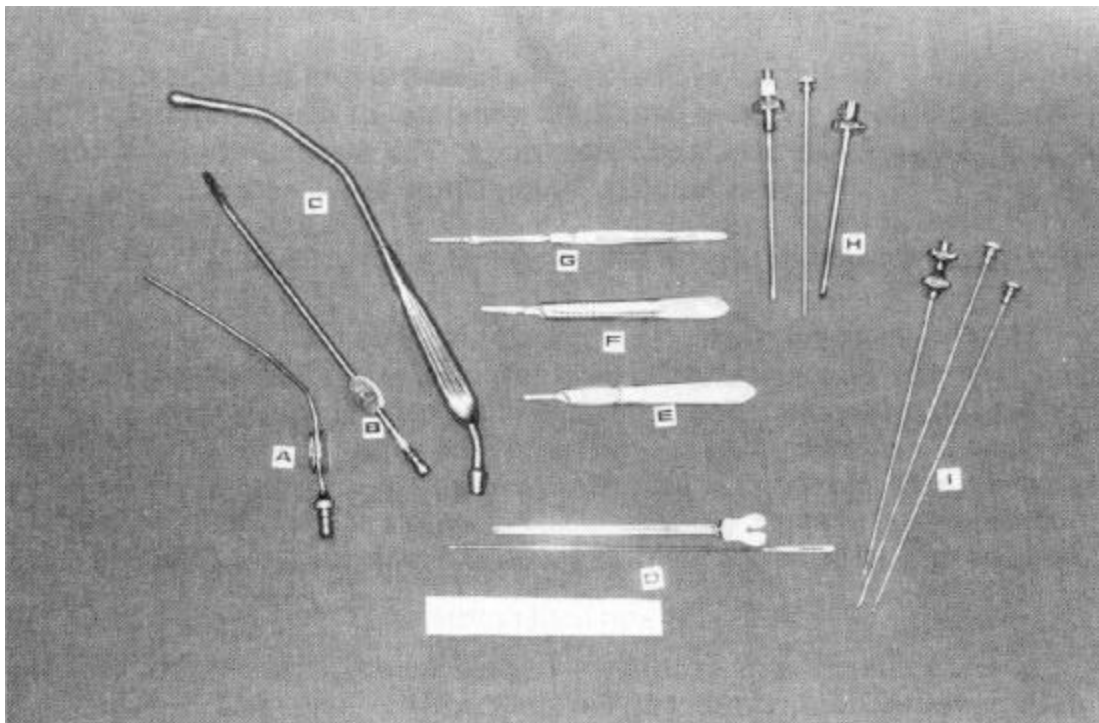
Retractors

(A) Mayo, (B) Cerebellum, (C) Gelpi, (D) Janson Mastoid, (E) Spring Wire, (F) Volkman Rake-Sharp, (G) Green Goiter, (H) Army-Navy, (I) Richardson-Eastman, (J) Deaver, and (K) Sweetheart

(7) **Miscellaneous.** Probes, biopsy needles, and suction tubes are a few of the miscellaneous instruments required for use in surgery or some clinical procedures. Probes may be used to explore the depth and direction of body ducts, sinuses, or cavities. They may also be used as an aid in dilating or irrigating an area of the body, such as a duct. Knife handles are available in several styles and require disposable blades that may be changed frequently during the surgical procedure. Example of probes and knife handles are probe with eye, optical probes, and knife handles number 7, 4, and 3.

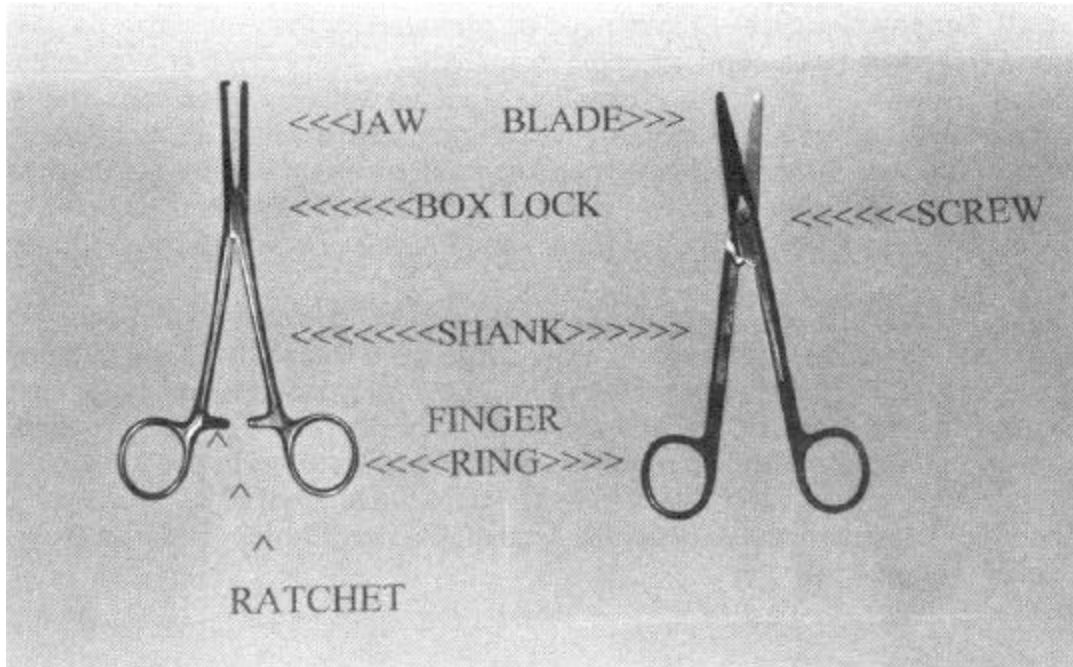
(8) **Biopsy Needles.** Biopsy needles are used for the removal of fluids or tissue for the purpose of microscopic examination. Many sizes and varieties of biopsy needles are available in stainless steel, as well as disposable varieties. Disposable needles do not require sharpening and inspection as do reusable biopsy needles. Reusable biopsy needles must be sharp and free of burrs to assure proper function and avoid damage and trauma to tissue. Examples of biopsy needles: Abrams Pleural Biopsy Punch and Franklin-Silverman Biopsy Needle.

(9) **Suction Tubes.** Suction tubes are used for the removal of blood, tissue, and fluids from the surgical site to allow surgeons a clear view of the anatomical structures during the operative procedure. Several types of tubes can be used, depending on the procedure, and many will have removable tips that require close attention during the cleaning process. The tube is attached to suction tubing connected to a graduated reservoir to measure the amount of fluid removal. Examples of suction tubes: Pool Abdominal, Frazier, Rhoton, and Yankauer Suction Tubes.



Miscellaneous Instruments

- (A) Frazier Suction, (B) Rhoton Suction, (C) Yankauer, (D) Probe w/eye and Groove Director, (E) No. 3 Knife Handle, (F) No. 4 Knife Handle, (G) No. 7 Knife Handle, (H) Abrams Needle, and (I) Vim Silverman Needle



"Anatomy" of the Hand-held Instrument and Scissors

The structure of a typical hand-held hemostat or clamp consists of jaws, box lock, shanks, ratchets, and finger rings. The surgical scissors consists of jaws, shanks, finger rings, and a screw.

3. ANATOMY AND QUALITY OF SURGICAL INSTRUMENTATION

a. The majority of surgical instruments are made from stainless steel which will vary in grade. Stainless steel, in most respects, is an ideal material that resists rusts, nicks, maintains a fine point, and, in the case of scissors, retains a keen edge for cutting. However, many are misled by the name "stainless," since stainless steel can spot and stain. In actuality, stainless is a "misnomer." There really is no "stainless" type of steel. Many surgical instrument companies "passivate" instruments prior to selling them, to assure the least amount of staining and spotting.

b. Passivation is a process which helps ensure an uninterrupted protective layer of chromium oxides is present on the surface of the instrument. This protective layer helps prevent against corrosion, spotting, and staining. Passivation occurs by exposing an instrument to the atmosphere or certain other oxidizing agents which results in a thin, protective surface or film. The chromium oxides are actually strengthened by repeated exposure to the oxidizing conditions that exist when washing and reprocessing instruments occur. Repeated instrument processing actually passivates it further, which explains why older instruments tend to stain and spot less than the new ones.

c. Other metals used in the construction of some surgical instruments are titanium alloy, copper, and brass. Some instruments are electroplated which means the instrument has a highly polished finish and often is easier to keep shiny. The disadvantage to this type of finish is the electroplating process can leave holes in the finish, resulting in potential rust and deterioration of the plating. Once the plating starts to deteriorate, the instrument should no longer be used for two reasons: the plating can chip off into the surgical wound site and cause infection and, once the plating is chipped, sterilization of the instrument cannot be accomplished.

d. There are four basic types of instrument finishes available. Shiny or mirror finish, which tends to reflect light and can restrict the vision of the surgeon. This finish does not spot and discolor as easily as other finishes. Satin or patina finish and the dull or matte finish reduce the glare at the wound site but tend to stain and spot more frequently. The matte finish is attained by a sandblasting technique utilizing glass beads or silicone. The fourth finish is an ebonizing type and is achieved by placing the instruments in a chemical bath. It is a nonglare finish primarily used for laser surgery. This finish is a black, microscopically irregular surface which scatters and absorbs laser energy. It keeps the energy from bouncing onto tissue surrounding the intended target and damaging the healthy tissue.

e. Instruments are available in two grades. The common instruments, hemostats, scissors, and soft tissue, are available in a "floor grade" metal. These instruments are made from forgings of lower grade quality metals and are usually plated. They usually bend or break easily, and the precision of key features is less exact than the higher quality O.R. grade instruments. Plated instruments can be scratched or chipped relatively easily and rust much easier than the higher quality instruments. They must be replaced more frequently. O.R. grade instruments are made from 300-4 grade stainless surgical steel and are more resistant to corrosion and wear. It is vital that the lower grade instrumentation be processed separately from the O.R. grade instruments. Rust, like cancer, can spread if these instruments are mixed. It is vitally important to protect the resources invested in surgical instrumentation.

4. CARE AND HANDLING

a. Care of the surgical instrument begins in surgery during their use. The instruments should be rinsed or wiped periodically to prevent blood and body fluids from drying. Avoid bouncing, dropping, and placing large, heavy instruments on top of delicate ones. The weight of a mass of instruments or entanglement in a haphazard heap can cause damage. Instrument counts are vital for patient care, as well as preventing loss by accidentally throwing them into the trash with the disposable drapes or sending them to the laundry with the surgical linens.

b. Blood and saline are the most common causes for deterioration of stainless steel. Exposure to these two elements will result in corrosion and ultimately pitting. Other chemicals to avoid are:

Aluminum chloride	Barium chloride	Calcium chloride
Blood	Carbolic Acid	Chlorinated lime
Dakin's solution	Ferrous choride	Mercury bichloride
Phenol	Mercury salts	Potassium thiocyanate
Ferrous chloride	Hydrochloric acid	Iodine

c. After surgery, string instruments not used during the procedure should be re-strung on their instrument stringer and placed back into the tray with any retractors or miscellaneous instruments not used. The instruments used during the procedure should be rinsed in water and any gross soil removed. Whenever possible, the soiled instruments should be placed in a soaking solution containing an enzymatic agent, and all instruments placed in covered containers and back into the case cart (an enclosed metal cart) for transportation to SPD. In the event your facility does not utilize a case cart system, the instruments should be placed into covered containers and picked up utilizing a closed/covered cart system.

5. RECOMMENDED PROCESSING PROCEDURE

a. Reprocessing of surgical instruments involves several steps:

- (1) Safe transport to the decontamination area.
- (2) Cleaning, safe handling, and decontamination.

b. Safe transport after use is designed to prevent contamination of personnel and the environment. Instruments and items should be placed in covered containers and/or impervious bags for transport to the decontamination area. Personal protective equipment is required of all decontamination personnel, and these requirements must be followed to prevent exposure to the technician, regardless of the types of items received into the area.

c. All instruments set up in the operating room will require reprocessing, regardless of their use during the procedure. Instrument sets opened and not used still require processing through an ultrasonic washer/sterilizer or washer/decontaminator. Inspect the instruments for tissue or bone remaining in the teeth or grooves. Remove this debris by holding the instrument under the surface of the water and scrubbing the area with an instrument brush.

d. During the cleaning process, always remember to open all instruments. For example, scissors should be opened, instruments with box locks should not be in a locked position, and multipiece retractors, staplers, etc., should be disassembled prior

to cleaning, as well as the required decontamination apparel required and mentioned in the Decontamination Chapter. This allows for all areas to be exposed to the cleaning process. Attention to all cannulated items or items with lumens, such as suction tubes, needles, and some orthopedic instruments is vital. These areas may harbor blood and body tissue. Brushes are available from manufacturers in many sizes, allowing access to the cannulated areas, and should be used faithfully to assure any and all debris is removed.

e. During the initial cleaning and throughout the subsequent steps, instruments should be handled in such a manner as to avoid damage to the instrument and to prevent injury to the technician. Heavy rubber or plastic gloves should be worn, as well as the required decontamination apparel required and mentioned in the Decontamination Chapter. This includes face shields or goggles, gloves, plastic apron, hair cover, and rubber shoe covers. Instruments should be handled in small groups to avoid tangling and damage. Needles should be separated and processed separately. The technician should watch for scalpel blades still attached to knife handles, and these should be removed and disposed of in sharps containers. All scalpel blades, disposable needles, saw blades, and drill points used during a surgical procedure should be disposed of by the operating room staff but may be inadvertently overlooked. Many instruments contain sharp edges and parts, and extreme care should be taken by the technician while handling any sharp item.

f. Only nonabrasive cleansers should be used for instrument cleaning, as the abrasive cleaners can damage the surface of the instrument, resulting in corrosion and rust. Instruments should be exposed to detergents that maintain a pH between 6 and 8. A neutral pH of 7 is ideal since a pH level too high (alkaline) or too low (acidic) will damage the surface of the instrument. Once this process is complete, rinse the instruments, then place them in the ultrasonic.

g. If the gross soil has been removed properly, the ultrasonic should remove the remaining soil. Gross soil is defined as excessive blood or body tissue that would impair the use of the instrument. Visual blood or body tissue is not necessarily defined as gross soil. The ultrasonic will penetrate into the box locks, joints, and screw areas of the instrumentation. The cleaning solution utilized by the ultrasonic should be changed frequently, as mentioned in the Decontamination Chapter. Instruments should be placed loosely in the ultrasonic, in metal baskets. Avoid plastic and rubber in the ultrasonic cleaner as they will absorb the sonic energy and the process of cavitation will not take place. After removing them from the ultrasonic, visually inspect the instruments for cleanliness. Instruments should then be rinsed and processed through the washer/sterilizer. Items that cannot be processed through the washer/sterilizer should be rinsed and placed in the drying chamber of the ultrasonic. If a drying chamber is not included on existing equipment, the instruments should be air dried or patted dry with an absorbent material so that no water is left standing on the instruments.

h. Microsurgical and delicate eye instruments should not be processed through a washer/sterilizer because the turbulent action of steam mixed with water may damage them. Once these delicate instruments are processed through the ultrasonic, rinsed, and dried, they should be processed on a sterilize cycle only to assure a decreased bioburden is achieved to allow safe assembly by the preparation room instrument technician.

i. Washer/sterilizers are the next step in the cleaning process. Stainless steel instruments should not be processed close to instruments made of metals, such as nonanodized aluminums, brass, copper, or chrome plating. A reaction known as electrolysis may occur, resulting in metal plating onto another. This reaction can result in permanent damage and staining. Ideally, demineralized or deionized water should be used in the washer/sterilizer to prevent mineral buildup and chemical reactions associated with regular tap water. A drying cycle should be set to assure the instruments will dry completely and not emerge wet after the cycle. If the instruments do not dry completely, steps should be taken to dry the instruments. Utilizing an air hose to blow excessive moisture from the instruments or manually drying with absorbent material are two recommendations.

j. Newer washer/sterilizers consist of a lubrication cycle that exposes instruments to a lubricant that helps prevent stiff and hard working joints, box locks, and assures smooth action of multifaceted items such as rongeurs, retractors, and stapling devices. Most facilities do not have the newest available processing equipment, and lubrication of instruments must be accomplished in the preparation area, prior to sterilization.

k. Controversy still exists concerning the order of processing instruments. Some institutions recommend processing the instruments through the washer/sterilizer first to protect the technician working with the contaminated items. Washer/sterilizers may not remove all of the soil and will bake any remaining debris onto the instrument, which makes it more difficult to remove. The ultrasonic will not be able to remove baked on debris and would require the technician to manually clean all instruments. A reminder -- proper attire and safe handling are the keys to proper processing of instruments and still allow protection for the decontamination room technician.

l. Telescopes, fiberoptic cords, and power equipment will require manual cleaning and disinfecting and cannot be processed in the same manner as the general hand held instrumentation.

6. PREPARATION AND STERILIZATION

a. Recommended steps to follow in the preparation area:

(1) Inspection for cleanliness and proper function.

- (2) Separating instruments that require repair or replacement.
- (3) Set or tray assembly and single instrument packaging.
- (4) Preparation for sterilization.
- (5) Sterilization and sterile storage.
- (6) Transport to point of use.

b. Once the instruments have been received into the preparation area, a thorough inspection for cleanliness and proper function must be done while assembling the instrument tray or prior to storage. Depending on the facility, instruments are either assembled into sets or trays, or stored until the next surgical schedule is received. Once the schedule is posted, instrument sets will be assembled for those particular cases and the process is repeated. It is ideal to have the sets pre-assembled in case of emergency surgery or add-on cases.

c. If any instrument is received into the preparation area with visible evidence of soil, it should be returned to decontamination for reprocessing. Never clean an instrument in the clean preparation environment. Proper instrument function and condition should also be assured. To check a needle holder, place it in the locked position and hold it up to the light. Visible wear is apparent when a gap is noted between the tungsten carbide inserts and should be replaced. Another method would be to place an appropriate size suture needle into the jaws, closing the ratchets to the second position and attempting to turn the needle with the fingers. If the needle turns, the inserts are worn and should be replaced. Extreme care should be taken to avoid injury.

d. Other items to look for will include checking for nicks, rust, corrosion, burrs, pitting, and cracks in the box lock. Certain instruments should be checked for proper jaw alignment, freely moving box locks, loose screws, and freely moving hinges on scissors or other multijointed instruments. The proper tension is required with scissors to allow cutting surfaces of scissors to meet properly. Test instruments with box locks and ratchets to assure proper tension. The tips of instruments with jaws should just meet before the ratchet is engaged. As the jaws engage, the entire length of the jaw should mesh. The instrument should be tested by locking the ratchet into the notch and gently tapping it against the palm of your hand, or gently against a counter edge. If the ratchet disengages or pops open, the instrument requires repair.

e. Scissors should be tested for sharpness by cutting a single layer of gauze. A sharp pair of scissors will cut cleanly through, all the way to the tips. Burrs may be noted on the tips of the scissors as you are cutting the gauze, even if the blades appear sharp. Paper should never be used to test scissors because it can dull the scissors and

is not a true test for sharpness. There are new products available for testing the cutting edge of scissors which resemble the texture of tissue.

f. A detailed instrument repair program should be established, and a reputable instrument repair company contracted with, to assure the instruments are repaired correctly and returned in a timely manner. Cost will be a major factor in the repair of surgical instrumentation and should be tracked. A designated area should be set aside for damaged instrumentation and the instruments should be repaired on a set schedule. It is vital that all malfunctioning instruments be repaired and not returned to an instrument set. An improperly functioning instrument could cause delays during the course of the surgery, or worse, cause harm to the patient.

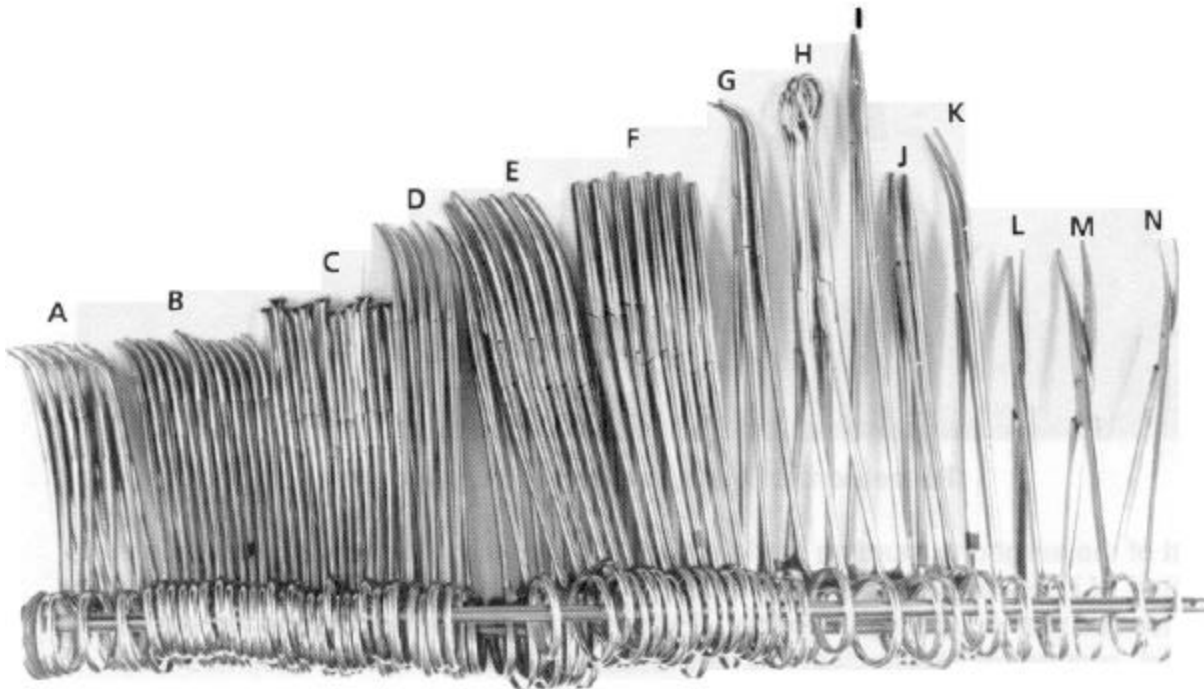
7. INSTRUMENT SET ASSEMBLY

a. Instrument trays should be assembled using a detailed photo procedure. Ring-handled instruments should be placed on a stringer, instrument rack, or other means that allows the instruments to remain in an open or unlocked position. This will allow the sterilant contact to all surfaces. Instruments with multi parts, such as a Balfour retractor or tonsil snare, should be disassembled to allow all parts exposure to the sterilant.

b. Instruments placed on a stringer or rack will require placement in such a manner to prevent damage to the instruments and easy, orderly access by the operating room scrub nurse. The illustration below shows the proper alignment of string instruments. The scissors can be turned in, toward the center of the stringer, as long as the tips do not touch another instrument. In many cases, the tips of the curved scissors will face away from the center of the stringer to prevent damage to the curved tips. The shorter instruments are at the end of the stringer, with the longer toward the center. This order aids the operating room nurse since the instruments at either end of the stringer will be used first during the procedure, with progression to the longer instruments as the case proceeds.

c. Knife handles, tissue forceps, pickups, probes, etc., may be wrapped in medical grade paper or placed in pockets to allow easy access to the items. **Note illustration.** Foam inserts can be purchased by the roll or individually. The foam may be cut to the desired length, depending on the number of instruments used. It is important to remember only medical grade paper or materials should be placed inside an instrument tray. Nonmedical grade paper will contain pulp and wood particles that can redeposit on instruments during a pre-vacuum sterilization cycle. Other items, such as gauze, cotton tipped applicators, etc., should be packaged separately from the instrument sets to allow proper exposure to the sterilant. Gauze is not recommended to be included in surgical instrument trays but, if it is, it must be included on the count sheet. Operating room nurses are required to do a sponge count, and any additional gauze placed in the tray or set may not be accounted for.

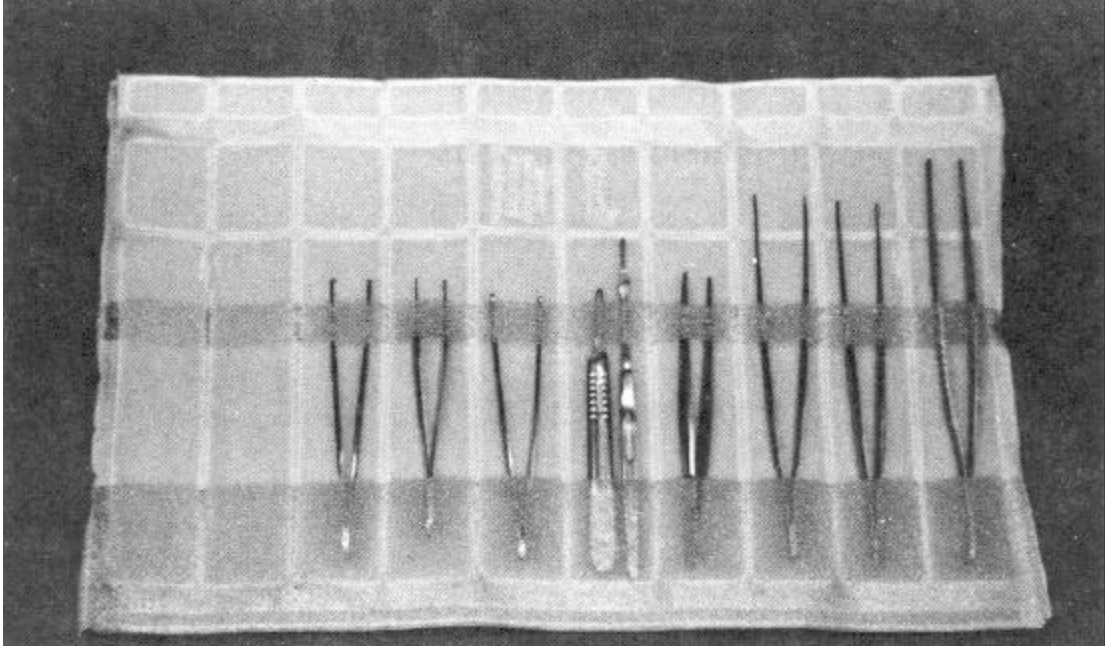
**PROPER ALIGNMENT
OF
STRING INSTRUMENTS**



(A) Backhaus Towel, (B) Kelly Forceps, (C) Allis Intestinal Clamps, (D) Crile Forceps, (E) Carmalt, (F) Kocher Clamps, (G) Right Angle Clamps, (H) Forrester Sponge, (I) DeBakey Needle Holder, (J) Mayo-Hegar Needle Holder, (K) Curved Metzenbaum Scissors, (L) Straight Mayo Scissors, (M) Curved Mayo Scissors, (N) Curved Metzenbaum

d. Instruments should be placed in a tray with a perforated bottom. The perforations should be small enough not to allow the instruments to protrude through. Many facilities utilize towels or absorbent disposable tray liners to prevent this. The tray liner may also be used to wick moisture away from the instruments and allow rapid drying during the sterilization dry cycle. Place the instruments in such a manner to allow contact to all surfaces during the sterilization cycle. Large heavy items, such as retractors, should be placed on the bottom of the tray. The stringed instruments should go in last, to assure no heavy item will be placed on top that may damage the delicate tips. See illustration for instrument placement.

e. Basic sets should be standardized and reviewed periodically. So-called basic sets have the tendency to grow to such an extent that personnel complain about the large number and kinds of instruments being processed but not used. Periodic review of basic instrument sets should be done on a routine basis, with the input of the

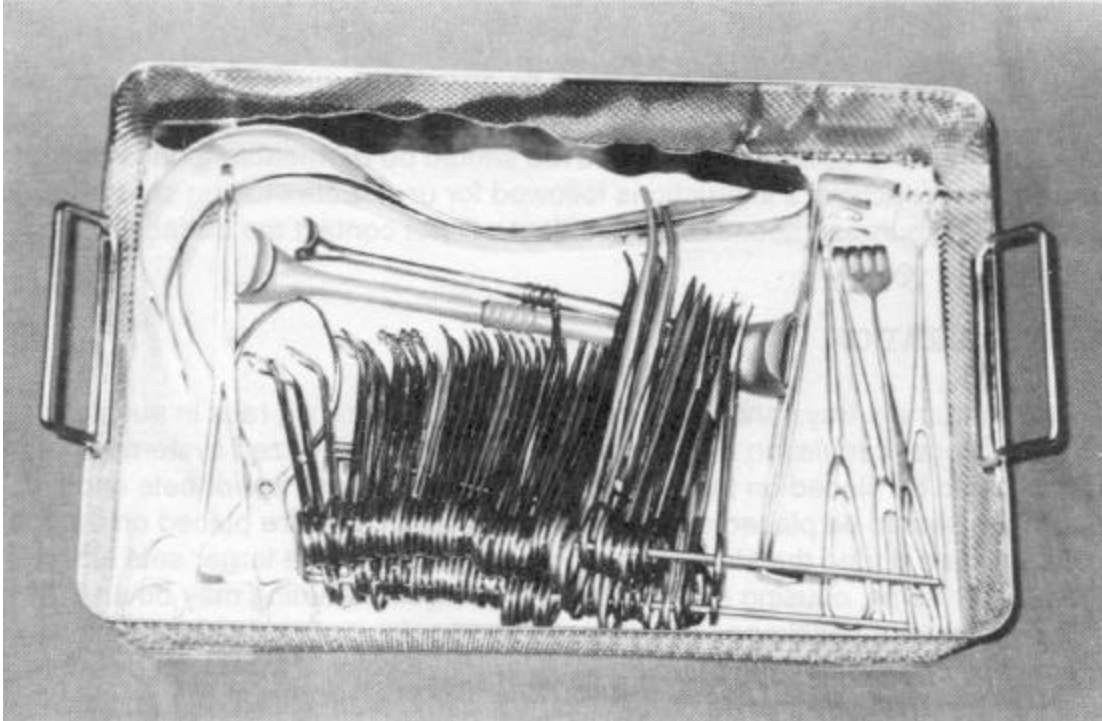


Placement of Instruments in Foam Inserts

surgeons, nursing staff, and SPD supervisor. It is vital to maintain the number of instruments in each set to allow the set to remain functional, yet not overloaded with unused instruments. Excessive instruments increase the weight of the set, require excessive cleaning, and assembly time. If the set becomes too large and the staff feel they require all the instruments, it is suggested breaking the set down into a regular basic set and a smaller supplement set. The instruments should be placed in a definite or fixed pattern within the tray to allow easy access to the instruments by the scrub nurse. Instrument sets may be placed on the sterile field contained in their tray and individual instruments removed as needed.

f. Recommended weight for an instrument set is 16 to 17 pounds, but the size of the tray used will determine how many instruments can be placed into a set and safely sterilized. Instruments should not be over crowded into a too small tray. This will prevent the proper exposure to the sterilizing agent. Placement and tray size are as vital, if not more important, than a weight limitation. Many specialized orthopedic trays will weigh in excess of 40 pounds, yet may be safely sterilized due to proper placement of items in the set. Containerized systems will increase the weight of the set but do not compromise sterility because of the weight increase. Good judgment in set assembly, tray size, and safety issues should be utilized when assembling any surgical instrument set.

g. Specific trays can be purchased for sterilization of micro surgical instruments and delicate ophthalmic (eye) instruments. These trays contain inserts that prevent movement and allow greater protection for these instruments.



Instrument Placement

h. Once the set is assembled, a content inventory list is added with the initials of the SPD technician who prepared the tray. This serves as a double check for the technician and may be used to enhance communication between SPD and the operating room staff, as well as providing a good quality improvement tool. The set is then wrapped with muslin or nonwoven disposable wrap, or placed into a container system, and placed on the sterilization rack in an upright manner. Never tip a surgical instrument set on its side. Tipping will cause displacement of the instruments and may damage them. This includes storage and transportation of the sterile set.

i. Individual instruments can be packaged in peel packs (paper/plastic pouches) or wrapped in muslin or nonwoven disposable wrap. When using peel packs, place the handle or holding end toward the opening end of the pack to assure aseptic presentation. Double peel packs or paper plastic pouches are required for items packaged for use in surgery. This means the instrument or item to be packaged should be placed in an appropriate sized pouch, sealed, then placed in the next larger size pouch. This will allow the circulating operating room nurse to open the first package and the scrub nurse to access the inner pouch without compromising the sterility of the operating field. Double wrapped muslin or nonwoven disposable wrap accomplishes the same effect. When using a wrapper, the outer wrap should be extended around the tray or item and never tucked. Wrappers and techniques will be discussed in the Packaging Chapter. Double peel packs may be preferred by some O.R.s for items packaged for use.

j. If the instrument has sharp points, tip guards can be utilized for protection of the instrument. Commercially available tip guards or foam sleeves can be purchased for this purpose. Tip guards or foam sleeves should be permeable to the sterilant used and the manufacturer's instructions followed for use. Latex tubing should never be used for this purpose because the sterilant will not contact the surface of the instrument.

8. STERILIZATION

a. Instrument trays should be placed on the sterilization rack in such a manner to allow proper circulation of the sterilant. Large containerized systems or surgical trays should be placed on the bottom rack, while smaller trays or sets and individual packages should be placed on the top rack. If large sets are placed on the top rack, condensation during the sterilization cycle may form on the larger sets and drip onto the smaller items, causing staining of the packages. Staining may be an indication of a contaminated package. Linen packs and basin or utensil sets should be processed separately from the surgical instrument sets. If this is not possible, the linen items should be placed on the top rack of the sterilization cart and the instruments sets on the bottom rack. Limit mixed loads as much as possible. Mixing muslin or linen items with instruments can cause staining of the surgical instruments.

b. The illustration shows a loaded sterilization cart. Note the wrapped basins and small tray are placed on the top shelf. Adequate space is allowed to provide good sterilant circulation to ensure proper drying at the end of the cycle.

c. Each item assembled and sterilized should be marked with the name of the set or name of the item individually wrapped and the initials of the technician assembling the item. If one technician assembles a set and another technician wraps the set, due to shift change and lack of time to complete the wrapping, then both initials should be noted in or on the package set. A quality assurance program should be implemented in order to verify that instrument sets are complete. An example would be a quality assurance monitor where instruments are double checked.

d. As mentioned earlier, several conditions can cause spotting and staining of surgical instruments. Steam provided to the sterilizer may contain minerals and rust deposits from the steam line. Steam line filters can aid in prevention of some of these deposits. All instruments and sets that have been opened but not used, or have outdated, will require reprocessing through decontamination due to spotting and staining, which may lead to malfunction of the instruments.



Placement of Trays for Sterilization

e. Another cause of staining can be attributed to the pH of the water and detergent used by the laundry. If surgical linens and muslin wraps are washed in a detergent high or low in pH and improperly rinsed, the residual soap may redeposit on the instruments during the sterilization cycle. It is recommended sterilizing surgical linen packs alone.

f. Other causes of stains:

STAIN

Rust colored - light or dark

CAUSE

Mineral deposits from tap water in final rinse.
Laundry improperly rinsed-detergent residue.

	Incorrect pH detergent utilized in the washer/sterilizer-decontaminator. Combining imperfect chrome instrument with stainless steel instruments.
Bluish-gray stain	Cold sterilizing solutions inadequately rinsed from instruments.
Purple-black stain	Ammonia in detergents. Amines from impure steam in lines.
Corrosion (rust)	Insufficient rinsing of instruments and/or linen during processing. Dried blood or residual soil in box locks. Prolonged exposure to harsh chemicals. Inferior grade instruments.
Pitting	Exposure to saline, potassium chloride, blood, or other components/compounds. Detergent residue or high pH. Metals with dissimilar composition processed together.

g. Cracked box locks are caused from blood and debris buildup which has the appearance of rust. The solution for this problem is thorough cleaning with ratchets open to prevent this buildup.

9. STORAGE AND TRANSPORTATION

a. Once the sets/packages are sterilized, a cooling time is required prior to dating and handling. Containerized systems may be labeled and moved prior to complete cooling, since the metal or anodized aluminum containers will provide protection and will not allow for strike through as a muslin or nonwoven wrap will. The technician should wait until the container is cool enough to handle, yet not cause injury because it is still warm. Wrapped sets must be entirely cool prior to dust covering and handling. If wrapped sets are handled prior to cooling, the sterile integrity of the package will be compromised.

b. A sterile storage area should be provided for all sterilized sets kept in SPD. The sets should be placed on the shelves in such a manner to avoid tearing of the dust cover or wrap. Containerized systems may be stacked as needed. Again, instrument sets should

never be tipped to avoid damage and disarray of the instruments contained within. If instrument sets must be stored in the operating room, they should be transported in clean, covered, or contained carts and handled with care and good judgment during transportation and storage.

10. ENDOSCOPIC EQUIPMENT

a. Endoscopic equipment may be rigid and/or flexible. This equipment is used to view the body organs, either through an orifice such as the mouth or anus, or through small puncture sites over joints or in the abdomen, for example. Endoscopic instruments are complex and may consist of several lenses carefully aligned along the instrument, one or more lumens, and may contain fiberoptic bundles. All endoscopy equipment require extreme care during use and cleaning. Detailed procedures and information for sterilization are required to prevent unnecessary damage to the equipment. Inservices should be provided to the technician to assure thorough knowledge is attained.

b. Rigid endoscopes include cystoscopes, resectoscopes, laparoscopes, arthroscopes, and hysteroscopes. Flexible scopes include gastrointestinal scopes, bronchoscopes (see illustration), sigmoidoscopes and colonoscopes. New and innovative designs are being introduced to the medical/surgical field as technology improves.

c. Rigid endoscopes may contain channels, ports, hinges, and stopcocks that must be cleaned and rinsed properly to remove debris, such as mucus, blood, and other body fluids. Rigid sheaths are used with telescopes, and they, too, contain channels and stopcocks. Close attention is required when cleaning these items. Air and water pistols can be utilized to dislodge debris from these areas, and protective attire is always required to prevent exposure to aerosols that might be produced. A neutral pH detergent should be used to prevent damage to sensitive parts. Some rigid endoscopes that do not contain lenses may be processed through the washer/sterilizer, such as a Jako Laryngoscope. Always follow the manufacturer's recommendations concerning proper cleaning and sterilization procedures. Telescopes used with rigid sheaths should be hand washed and dried. Never process a telescope through an ultrasonic or washer/sterilizer. Some sheaths and resectoscopes will not tolerate the ultrasonic due to the type of epoxy used to manufacture the sheath. For example, a Berry rotating sheath used for cystoscopies.

d. Care must be taken while cleaning the lens on rigid telescopes. Alcohol may cause the glass to appear scratched, if used repeatedly. Preventive care should include the following:

- (1) Do not boil or autoclave telescopes or resectoscopes.
- (2) Never bend, drop, or pile instruments on top of telescopes.

(3) Do not use ultrasonic cleaning which tends to loosen optical cement from the lens.

(4) Routinely lubricate stopcocks or moving parts with silicone lubricant.

(5) Use only nonabrasive metal polish on metal parts only.

e. Telescopes should also be checked for clear vision. If the field is not clear, the telescope should be washed, dried, and reinspected. Inspect the cover glass on the working end for cracks or chips. A half-moon but clear view could indicate a dent on the outside of the scope. If the view appears foggy, this denotes a leak somewhere on the telescope which has allowed moisture to enter. The shaft of the telescope and the light cord contain bundles of glass rods that conduct light to allow visualization of internal body parts. The telescope and light carrier are attached to a powerful light source which allows the light to travel through the glass bundles. Care must be taken not to bend the cords or light carriers in such a manner as to damage these glass bundles.

f. Light carriers or cords supplied today are manufactured to withstand steam sterilization. Always check the light carriers by holding one end to the light while viewing through the other. Look for any black areas or dots. Black dots denote areas where the fiberoptics are broken. Light carriers or cords in this condition should be repaired or replaced.

g. All rigid sheaths, telescopes, and any instrument containing lumens should be thoroughly dried prior to storage or ethylene oxide sterilization. If moisture is allowed to remain during storage, bacterial growth may occur. Moisture remaining during ethylene oxide sterilization can cause a chemical reaction that may harm the patient.

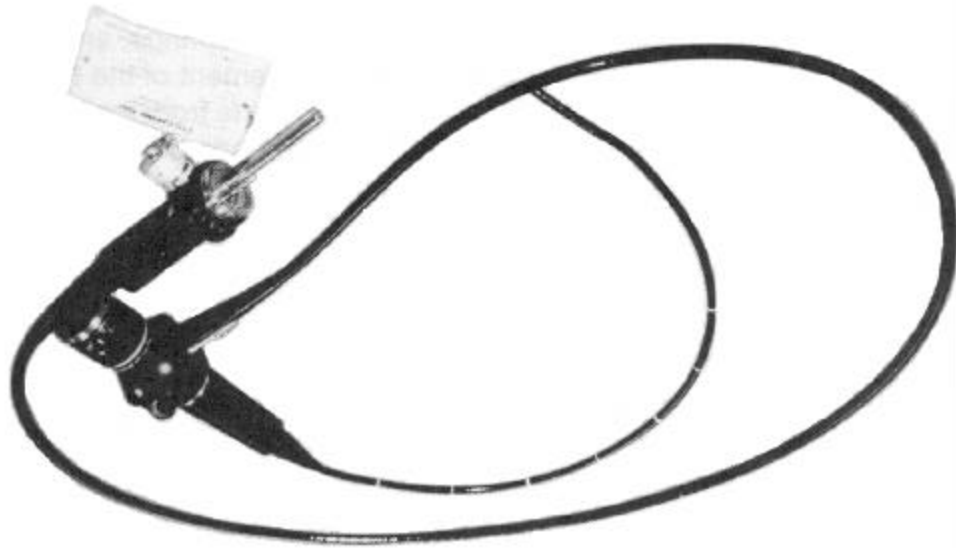
h. All rigid telescopes used in the operating room should be terminally sterilized prior to use. Disinfection produces a clean but nonsterile item. A new process recently introduced involves a liquid sterilizing agent called paracetic acid. A 30-minute processing time is required, and the telescope may then be introduced to a sterile field utilizing aseptic technique. Some telescope manufacturers claim their telescopes may be steam sterilized. It is important to recognize that the expansion during heating and contraction during cooling are completely different for metal and plastic. The difference in contraction and expansion may damage the plastic parts and will shorten the life of the instrument. To maintain the longest life expectancy from any rigid telescope, it is recommended that ethylene oxide be used for sterilization.

i. Regardless of how the telescope is processed, all completely metal components of endoscopic instruments can, and should, be steam sterilized. Telescopes and other items not designated for steam sterilization should be packaged separately.

j. Flexible endoscopes consist of fiberoptic glass bundles arranged around a lumen or lumens, a series of lenses and mirrors, coils, springs, and cables running the entire length of the instrument to control the movement of the tip. The covering is an impervious material that protects the working parts from moisture and other fluids (see illustration). The insertion tube length is marked so the surgeon knows how far the tube has been inserted into the body. The insertion tube is attached to the head or viewing lens of the flexible scope. An attachment can be added to the head of the flexible scope that has a flexible viewing cable with a lens attached, so someone assisting with the procedure may view what the surgeon is seeing. Attached to the head of the scope is another cable containing fiber bundles called the universal cord. This cord is inserted into the light source to enable light to be transmitted through the insertion tube which allows enough light to illuminate inside the body. Included in the head of the scope is a knob which allows the surgeon to turn and move the distal tip of the insertion tube. This enables complete viewing of the area.

k. Some flexible endoscopes will have a biopsy, air, and water channel. The biopsy channel allows insertion of flexible biopsy forceps, grasping forceps, and snares to obtain a biopsy or remove polyps. The air and water channels allow irrigation and air insertion to better visualize the area. Immediately following the procedure, these ports and channels should be flushed, brushed, and rinsed to prevent any debris from drying. The flexible scope can then be processed on an endoscopic processor which cleans and disinfects the scope. Many endoscopic processors will also provide a drying cycle. If terminal sterilization is indicated, an air hose with a pistol end should be used to assure no moisture has been left in any port or channel. If indicated, the EtO cap should be placed on the designated area of the scope to assure equal pressure and sterilant contact during the sterilization cycle. Newer endoscopes may contain a tiny camera or micro-chip to allow photos during the procedure. Also, newer versions may not require the EtO cap. Always check the manufacturer's information prior to processing any scope. Detailed and current procedures should be maintained in the decontamination and preparation areas of SPD.

l. Hospitals vary in the requirements for sterilization and disinfectant levels used for reprocessing scopes. The procedures utilizing scopes will normally determine the type of processing required. This, along with input from infection control, will normally determine the level of disinfection or sterilization. All reprocessing should be accomplished within SPD, regardless of the point of use. Clinics, the operating room, and the Chief, SPD, should work out methods of transportation, time schedules, and cleaning procedures to assure adequate support to the services for the cleaning, care, and handling of all endoscopes.



Flexible Endoscope with EtO Cap Attached

m. Accessories used with these flexible scopes consist of long, small wire springs, and adequate cleaning is difficult to achieve. Submersion in a blood and protein dissolving solution is recommended, followed by processing in the ultrasonic and washer/sterilizer. These items, once thoroughly dried, may either be placed in the tray with the flexible endoscope for ethylene oxide sterilization or packaged separately and steam sterilized. Many facilities have switched to the costly disposable accessories due to the difficulty cleaning the reusable ones.

11. POWERED EQUIPMENT

a. Power equipment utilized by surgery includes a wide variety utilizing different power sources. Power sources may be electrical, either line current or battery, compressed medical gasses, such as carbon dioxide, nitrogen, or compressed air. Equipment powered by gasses are referred to as pneumatic or air-powered instruments. Examples of power equipment are: reamers, drills, screwdrivers, and saws used by orthopedic and some neurosurgeons. Craniotomes, drills, and perforators are used by neurosurgeons. Dermatomes are used by plastic and general surgeons to take skin grafts, and sternal saws are used by thoracic surgeons to cut the sternum.

b. Powered equipment should be cleaned and cared for according to the manufacturer's recommendations, but under no circumstances should a power instrument be immersed in a solution of any kind. They should never be processed through an ultrasonic or washer/sterilizer. The attachments used with the equipment, however, may be processed in the same manner as most stainless steel surgical instruments. These attachments can include chucks, chuck keys, burr guards, hudson and trinkle adapters, and wrenches. These attachments are all metal and will retain a great deal of blood and debris. Close attention should be give to ensure the power equipment and attachments are thoroughly inspected and cleaned. All attachments must be removed from the equipment before processing. Saw blades, drill points, and bits should be discarded in the operating room after the surgical procedures. These items should not be reused because the sharp cutting edge cannot be guaranteed once they have been used.

c. Skull perforators should be checked frequently and sent for sharpening on a routine basis. Due to their cost and complexity, a maintenance schedule should be established. Disposable, single use perforators are being produced by several vendors but the cost still remains high. Air hoses should be inspected prior to cleaning for any damage, then washed with a mild detergent and lukewarm water. Never immerse the cord into any solution. If the equipment has an electrical cord, the cord may be washed with a cloth soaked with mild detergent solution. Other components are also cleaned in this manner, then wiped with a disinfectant to assure safe handling prior to packaging.

d. Newer powered equipment requires no lubrication since they are self-lubricating and are enclosed with a sealed casing. Older equipment will require some lubrication, and this should be done during the testing process. Pneumatic equipment should be hooked up to compressed air and tested within the required PSI (pounds per square inch), and the pressure never exceeded to prevent damage to the equipment. Battery operated power equipment may be tested also with a battery pack. If compressed air is not provided with a wall gauge and a tank is required to be stored in SPD, measures must be taken to secure the tank safely to the wall. A battery pack may also be purchased and kept in SPD to test the battery operated equipment. Any equipment that does not function correctly should be sent for repair. If backup equipment is not available, a loaner piece will be required to assure surgery cases are not canceled. Any time equipment malfunctions the operating room should be notified.

e. Sterilization by a prevacuum sterilizer is recommended most frequently for a large majority of equipment. If gravity displacement sterilizers are used, the sterilization time must be lengthened. Electrical equipment should be sterilized by ethylene oxide to prevent damage to the electrical parts. With the variety and complexity of power equipment available, it is recommended that detailed cleaning, testing, and assembly procedures be provided for the technician's use. Frequent inservices will keep the SPD staff abreast of current changes and technology. Remember, always follow the manufacturer's recommendations.

12. NEW TECHNOLOGY

a. As surgical procedures and techniques change, so do the types of surgical instrumentation and implants. For example, orthopedic implants are being developed and improved upon at such a rate that it is difficult for medical centers to keep pace with the instrumentation required to perform these implants. Because of this, many companies loan the instrumentation to the medical centers. It is more cost-efficient for both parties.

b. Because of the number of new implants, each medical center SPD should develop a procedure to handle the instruments being brought into the medical centers. It is recommended that the instrumentation being loaned be brought directly to SPD with a detailed list of every item in the set. The sales representative and the SPD supervisor or technician should review the list against the instrument set. If any item is not in the set, it should be noted.

c. The instrument set should then be processed through decontamination, assembled, and wrapped for terminal sterilization. The name of the set, operating room number, case number, and, preferably, the patient's name, should be listed on the instrument set. After sterilization, this set should be placed on the case cart prior to the case. In the event your medical center does not utilize a case cart system, the instrument set should be delivered to the operating room.

d. After surgery, the loaner instrument sets must be returned to decontamination, processed, and reassembled. The company's sales representative should pick up the loaner instrument set from SPD.

e. Prior to leaving the medical center, the SPD supervisor or technician should again check the set against the list to assure all parts have been accounted for. In the event a piece is missing, the sales representative or SPD personnel will check with the surgical suite or with SPD to attempt to locate the part.

f. By using a check list, SPD will not be inadvertently charged for an instrument or part that was not present when the set was sent to the medical center. In some cases, instrument sets are shipped to a medical center without the sales representative being present. Insist that the company send a list with the loaner sets. In the event an instrument set contains implantable pieces, the sets should be received by SPD at least 48 hours prior to the scheduled case to assure the quarantine time is achieved.

g. To maintain a loaner program, cooperation between the operating room and SPD is vital. Details should be worked out between the two areas, and all companies that supply loaner instrument sets should be notified of the program. This system is extremely important since SPD is responsible for all items sterilized. Instrument sets brought into the medical center may not be clean, and there should be no doubt about

the cleanliness of an item prior to sterilization. All items leaving the medical center should be thoroughly cleaned to prevent any cross- contamination.

h. Each medical center should develop a comprehensive system of tracking all loaner instrumentation and implants utilized by the operating room.

13. **SUMMARY.** Surgical instruments, flexible and rigid scopes, and powered equipment come in many varieties, complexities, and include numerous pieces, parts, and attachments. A good working relationship between the operating room staff and the SPD staff is vital to provide the information, service, and continued support to assure safe patient care. The SPD technicians should routinely observe surgery to understand the necessity of accurate tray and set assembly and proper function of all equipment. Training programs can be established by SPD to aid in the training of new operating room nurses, nursing students, and SPD technicians in instrument identification and set assembly. With technology and innovative instrumentation always changing, we must continue to sharpen our skills and knowledge.

[This page intentionally left blank.]

SURGICAL INSTRUMENTATION TERMS

Box Lock
Blade
Ebonize
Electroplate
Endoscope
Finger Ring
Forceps
Hand Held
Hemostat
Jaw
Matte
Passivation
Pneumatic
Power Equipment
PSI
Ratchet
Retractor
Satin
Shank
Tissue Forceps

[This page intentionally left blank.]

QUESTIONS

TRUE/FALSE

1. All powered equipment utilized in the surgical suite today requires EtO sterilization due to the complexity of the equipment.
2. It is not necessary to check light cords for adequate light transmission or broken fiber bundles.
3. All hand-held surgical instrumentation must be checked for cleanliness and proper function.
4. Instrument trays opened in the surgical suite, but not used, are still required to be reprocessed through decontamination.
5. Cracked box locks will not affect the function of the instrument and can be used without repair.