
NC Statewide Program for Infection Control and Epidemiology (SPICE)
University of North Carolina School of Medicine

Slides developed by SPICE

Welcome to Section F, Application of Cleaning, Disinfection, and Sterilization Principles to Patient Equipment. This is the sixth of seven modules in the state approved course required to meet compliance with the NC Rule .0206 Infection Control in Health Care Settings. This course is specifically designed for the Out patient Practice Settings.
With the advent of managed care, increasing numbers of patients are receiving their care in ambulatory-care settings. Many of these patients have communicable diseases, immunocompromising conditions, or invasive devices. Therefore, adequate disinfection in these settings is necessary to provide a safe patient environment.

Because the ambulatory-care setting (outpatient medical surgical facilities) provides the same risk for infection as the hospital setting, the Spaulding classification scheme for cleaning, disinfection, and sterilization of patient care items should be followed. The Spaulding classification scheme described in more detail in Module E includes that decision making about reprocessing can be made by using the following principles: that critical devices that enter sterile tissue require sterilization; semi-critical devices that contact mucous membranes or non-intact skin require high-level disinfection (HLD); and that noncritical equipment that only contact intact skin requires low-level disinfection.
In this lecture we will apply the Spaulding classification scheme, the principles of asepsis, the CDC Guidelines, and the sanitation rules to the commonly used devices, instruments, and procedure used in the ambulatory patient care setting to include care provided for physical therapy, pharmacy, OB/GYN, ophthalmology, and endoscopy. Not all patient care items will fit into one of the 3 Spaulding categories for reprocessing because of the design or delicate constructive materials used. For example, diaphragm fitting rings that have contact with mucous membranes of the vaginal area would melt if soaked in a chemo-sterilizer solution. Sometimes alternative technologies for sterilization can be used after the risk of the alternative disinfection process is weighed. In this module, we will discuss issues and controversies with equipment needing disinfection modifications as well as common items used and the appropriate disinfection practices.
We are beginning with Physical Therapy. Physical and occupational therapists often provide services to patients with surgical and nonsurgical wounds and to debilitated patients. Patients receiving physical therapy are at increased risk to be colonized or infected with multidrug-resistant bacteria because of frequent healthcare exposures. The challenge in this area is that often multiple patients are receiving therapy at the same time and one therapist will be moving from patient to patient, with shared equipment in crowded conditions. Strict adherence to infection control practices is needed to reduce the risk of infection and prevent cross-transmission of pathogenic organisms.
The highest risk patients receiving physical therapy are those with chronic debilitating conditions, post trauma, including especially those with burns, or wounds. The greatest risk for cross transmission in PT is sharing hydrotherapy equipment. During tanking procedures, if it is necessary for personnel to enter the tank with the patient, the patient and healthcare worker should be free of any open lesions or wounds.

Patients who are colonized or infected with MDROs (e.g., MRSA, or VRE) should be managed on Contact Precautions. Infected or colonized patients should be seen separately ideally as the last patient of the day. If appropriate, patients should be alerted to the potential spread of their disease, and informed how they can assist in avoiding transmission of the infection to others.
Hydrotherapy tank cleaning and disinfection between patients may be facilitated by using disposable plastic wrapping as shown in this picture. The slings may be difficult to clean when contaminated because of texture of the canvas and ties. Regardless of whether the plastic is used, the tank, head rest, water slings, and other surfaces should be wiped with an EPA approved disinfectant detergent after each patient use.
A plastic disposable single patient use liner may be used in the hydrotherapy tanks for each patient to facilitate cleaning. As seen here a hole is punctured in the tank’s plastic liner at the drain site to dispose of the tanking solution. The tank’s liner is removed and disposed of in the regular trash. Plastic liners are not required, but if used the tank is rinsed with an EPA-approved disinfectant detergent at end of the day. If a liner is not used the tub should be rinsed and cleaned between each patient.
- Tank cubicle curtains changed monthly or as needed
- Mop used to clean tanks is rinsed in housekeeping closed and hung to dry
- Hands washed only in sinks designated only for handwashing.

The tank cubicle curtains should be changed at last monthly and whenever observed to be visibly soiled. The mop used to clean the tanks and tubs and hole punching tool if used, should be rinsed in the housekeeping closet and hung to dry at the end of each day. Hands must be washed only in sinks designated for handwashing. A waterless handwashing agent should also be provided in strategic locations.
The splinting tanks and pans should be emptied weekly, cleaned, and refilled with tap water. The hot pack hydrocolator tanks are emptied and cleaned every 2 weeks. The hydrocolator water should be checked and recorded (e.g. weekly) to assure >160 degrees F. Pt must have clean hands, no open areas. ColPak is cleaned biannually, temperature monitored daily (10-21° F).

The splinting tanks and pans should be emptied weekly, cleaned, and refilled with tap water. The hot pack hydrocolator tanks are emptied and cleaned every 2 weeks. The hydrocolator water should be checked and recorded weekly to ensure that it remains greater than 160 degrees F, the high heat helps to decrease the number of viable pathogens. Clean towels should be used to wrap the hot packs. Similarly, Colpak should be cleaned at least biannually or if visibly soiled and the temperature monitored daily to be maintained at 10-21° F. Patients should have clean hands and no open areas.

Splints may be reused for same patient only after undergoing thorough cleaning. The splint should be scrubbed with an EPA approved germicidal detergent and rinsed with tap water, then allowed to dry before use on the patient. Sinks should be cleaned before being used to clean the splints, and only one splint at a time should be in the sink.
Hi-touch surfaces such as hand weights, parallel bars, stair rails, treadmills, stationary bikes, and canes should be cleaned after each use, in addition to routine weekly cleaning. Wheelchairs, cuff weights, and mats should be wiped down with an EPA-approved disinfectant detergent weekly and when obviously soiled.

Paraffin baths should not be used on the hands of a patient with non-intact skin. Prior to use, the thermometer should read 125-130°F. These paraffin bath unit should be cleaned minimally monthly with an EPA approved germicidal disinfectant.
Infection Control in Rehabilitation Areas

- Shared equipment cleaned after each patient use with EPA-approved disinfectant detergent.
  - Pulse oximeters,
  - Stethoscopes,
  - Blood pressure cuffs
  - Vibrators
- \(O_2\) tubing if used without a humidifier can be reused by the same patient for up to 4 weeks. (Store tubing in plastic bag with pt name between uses.) If used with a humidifier it must be disassembled after 72 hours.

When portable equipment such as pulse oximeters, stethoscopes, blood pressure cuffs, and vibrators are used, they should be thoroughly cleaned with an EPA-approved disinfectant detergent after patient use.

\(O_2\) tubing if used without a humidifier can be reused by the same patient for up to 4 weeks. (Store the tubing in plastic bag with patient’s name between uses.) If used with a humidifier, it must be disassembled after 72 hours. When portable suction machines are used, the exterior of the machine and tubing that goes from the portable suction machine to the air chamber on the pleurevac should be wiped with an EPA disinfectant detergent after each use, and the tubing changed weekly.
Medical office and ambulatory care practices serving pediatric populations frequently offer a variety of toys in the waiting areas and toys are sometimes used as part of therapy. Because these are high touch surfaces that are exposed to uncontrolled secretions and excretions, care must be taken to prevent these items from becoming a high risk reservoir for cross-transmission.
Toy Policy

- Toys should be of a washable material
- Used washable toys are cleaned with soap and water, rinsed with tap water and dried or wiped with 70% alcohol at the end of day or when soiled.
- Non-washable toys (puzzles, puppets) may be used by older children who do not put them in their mouths
- Non-washable toys are gas sterilized or disposed of if soiled
- Patient on contact/droplet precautions, provide toys to keep, or clean well before use by another child.

Items used by younger children who have a tendency to put things in their mouth, should be made of washable materials. Used washable toys should be cleaned with soap and water, rinsed with tap water and dried or wiped with a 70% alcohol at the end of each day or when soiled.

Non-washable toys (e.g. puzzles, puppets) may be used by older children (i.e. those who do not put items in their mouth). Non-washable toys may be gas sterilized or disposed of if soiled. Alcohol-based hand wipes should be made available in waiting areas for care givers to use for cleaning the children’s hands or cleaning the toys before use.

If a toy is used by a child who has a communicable disease, or is on contact or droplet precautions, it should be cleaned as described above before being used by another child. Ideally, children on precautions will have their own toys.
For Ambulatory Care Facilities that include pharmacy services, aseptic technique is critical to reduce the risk of infection associated with pharmaceutical products. Adherence to recommended practices can reduce the risk of product contamination and potential infection. Infection Control should be involved to monitor and assess pharmacy when appropriate by doing periodic (annual) environmental rounds, quality control studies, antibiotic utilization studies, outbreak investigations, and product recalls initiated by the manufacturer or government.
Critical hand hygiene should be performed using antimicrobial soap, or ABHR by pharmacy staff:

- Upon arrival at work,
- After eating, drinking or handling food,
- After using the toilet,
- Prior to preparing IV medications,
- Repackaging and handling medications,
- Returning from outside pharmacy area.
Personnel should avoid direct hand contact with medications. Counting trays, spatulas, and other appropriate, clean measuring or counting devices should be used. If it is necessary for personnel to directly handle medications (i.e. tablets or capsules) a clean pair of examination gloves must be used to protect the person and the medications. Clean tweezers are used in lieu of gloves to fill dispensing wheels for controlled substances. Tablet counting trays should be cleaned with 70% alcohol at start of each shift, and when visibly soiled.
Medication storage bins, shelves, and interior of dispensing machines should be cleaned on a regular schedule, when dust and debris has accumulated, or after a spill of a medication, and when visibly soiled.

No food, drinks or specimens may be stored in refrigerators, freezers or other areas intended for storage of pharmaceuticals or supplies.

Pharmacy refrigerators and freezers should be wired to sound alarms that are continuously monitored.

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Pharmacy refrigerators and freezers should be wired to sound alarms that are continuously monitored. An alarm should activate if the temperature goes outside the proper range. Often times the maintenance personnel are the ones who monitor the alarms and are instructed to notify pharmacy of any alarms. Personnel should be responsible for the routine cleaning refrigerators and when spills occur.
General housekeeping practices in the pharmacy include that countertops are wiped down with an EPA approved disinfectant detergent or 70% alcohol at least once during each shift.

- Keep the floor clear of boxes and clutter.
- Food may not be consumed in laboratory area of pharmacy; drinks may be consumed in all areas except IV room in preparation or supply areas.

It is a good idea to keep boxes and clutter off the floor, to allow for adequate cleaning of the floors.

Also, food may not be consumed in laboratory areas of a pharmacy; however, drinks may be consumed in all areas except the IV preparation or supply areas.
Multi dose vials are to be discarded per USP Guidelines at 28 days or according to manufacturer’s expiration date, whichever is sooner. Aseptic technique must be used when entering a medication vial. Vials should be handled with clean hands or clean gloves. Always cleanse the rubber diaphragm of the medication vial with alcohol before inserting the needle into the vial. Use a sterile needle syringe with needle or a sterile vial adaptor for each access. Healthcare workers should avoid touch contamination of the vial adaptor prior to penetrating a vial; repeat alcohol cleansing and discard contaminated needle/syringe. If contamination occurs after the vial is penetrated, discard the vial and the needle and syringe.

Single dose (preservative free) medication vials are intended for one time use only, and must ALWAYS be discarded after one use.
Contaminated materials from the pharmacy are to be disposed of by the following procedures. Needles should be discarded in a designated needle containers and are not recapped before disposal. Materials contaminated with trace amounts of anti-neoplastic drugs (e.g. tubing, syringes, gloves, etc) should be placed in plastic zip-lock bags and discarded in red trash bags.

Bulk cytotoxic waste (i.e. containers retaining >3% of their original volume) should be disposed in hazardous waste drum for disposal to toxic waste disposal center. Personnel wear surgical mask, 2 pairs of gloves, and a smock during preparation of hazardous products.
Materials contaminated with potentially infectious agents, (e.g. BCG vaccine) are, per NC Waste Rules, to be discarded in red biohazard bags for incineration. If BCG is used for treating bladder cancer by installation then upon completion of the procedure, the first urine voided after should be poured into a hopper or dirty utility sink. The urine should be disinfected by adding an equal amount of undiluted bleach. Allow to stand for 15 minutes before flushing. Healthcare workers should be wearing PPE including N95 respirators.

Bloody items with less than 20ml of blood per unit per unit vessel (e.g. bloody gloves) do not need to placed in the red trash bags. Items that contain greater than 20 ml of blood per unit vessel that cannot be poured down a toilet or flushable hopper must be discarded in red trash bags.

Red bag waste containers should be removed at least once a day.
In the ambulatory care setting blood drawing is frequently done less than ideal situations.

What wrong with this picture?

Answer:
Needle boxes are unsecured by the sink and monitor.
Clean items are stored within splash range (<3 feet from sink)
Needle box on wall is above the head of patient’s chair.
Patient chair and trash can are blocking access to the hand washing sink.
Drink can is on the counter by patient card plate machine.
Clean and dirty are poorly defined.
**Reusable Devices:** These devices often resemble a pen and have the means to remove and replace the lancet after each use, allowing the device to be used more than once. Some of these devices have been previously approved and marketed for multi-patient use, and require the lancet and disposable components (platforms or endcaps) to be changed between each patient. However, due to failures to change the disposable components, difficulties with cleaning and disinfection after use, and their link to multiple HBV infection outbreaks, **CDC recommends that these devices never be used for more than one person.** If these devices are used, it should only be by individual persons using these devices for self-monitoring of blood glucose.

Adapted from http://www.cdc.gov/injectionsafety/blood-glucose-monitoring.html•
Single-use, auto-disabling fingerstick devices: These are devices that are disposable and prevent reuse through an auto-disabling feature. In settings where assisted monitoring of blood glucose is performed, single-use, auto disabling fingerstick devices should be used.

Simple rule for safe care:
Fingerstick devices should never be used for more than one person.

Adapted from http://www.cdc.gov/injectionsafety/blood-glucose-monitoring.html
Blood glucose meters are devices that measure blood glucose levels.

- Whenever possible, blood glucose meters should be **assigned to an individual person and not be shared**.
- If blood glucose meters must be shared, the device should be approved for use with more than one person and should be cleaned and disinfected per manufacturer’s instructions after every use— even if not visibly contaminated— to prevent carry-over of blood and infectious agents. If the manufacturer does not specify how the device should be cleaned and disinfected then it should not be shared.

**Simple rule for safe care:**
**Blood glucose meters should not be shared**

Adapted from http://www.cdc.gov/injectionsafety/blood-glucose-monitoring.html
Electronic thermometers are equipped with two probes (red for rectal) and (blue for oral) and disposable plastic sheaths. A new plastic sheath should be used for each temperature. The cord, probe, and unit should be thoroughly cleansed weekly and when visibly soiled with alcohol single-use pledget. Do not place unit on surfaces in patient/exam room.

Studies show that electronic thermometers become contaminated with microorganisms such as *C. difficile* when not appropriately cleaned.
Alternatives for ambulatory care are disposable thermometers that are available in the market place. The obvious benefit is they do not need to be cleaned and reprocessed.
Ear tympanic membrane thermometers are equipped with a probe and disposable plastic probe covers. A new plastic cover should be used for each temperature. The unit, including the end of the probe, should be wiped daily and when visibly soiled with 70-90% alcohol.
Cleaning routines for EKG cables should include that they are wiped with 70 – 90% alcohol between each patient use. Use an EPA-approved registered disinfectant detergent to clean cables with blood or body fluid contamination.
The CDC Guidelines For Environmental Infection Control in Health-Care Facilities recommends that blood pressure cuffs be cleaned and disinfected with an EPA-approved disinfectant detergent or 70 to 90% alcohol routinely, or when visibly soiled. Since these Guidelines were published in 2003, the CDC has issued more specific recommendations that items like blood pressure cuffs, pediatric scales, and exam tables should receive low level disinfection between each patient use.

This is a change in practice for some facilities that may have been disinfecting these high touch items only weekly. However, these patient care items contact patient’s skin directly, and regulatory surveyors (CMS DHSR) will expect to observe low level disinfection between individual patient use. Alternatively, some facilities may choose to use disposable single-use blood pressure cuffs, or single-use cuff liners.
Pictured here are diaphragm fitting rings being soaked in alcohol for reprocessing. Limited studies have evaluated disinfection techniques for some semi-critical items that contact mucous membranes such as diaphragm fitting rings, cryosurgical probes, transesophageal echocardiography probes, flexible cystoscopes, or vaginal probes. Because of the delicate nature of the materials that make up these particular pieces of equipment, the standard high-level disinfection practices would cause damage or destroy these instruments. Therefore, we will describe for each of these items recommendations from the CDC Guidelines for Disinfection and Sterilization for best practices to reprocess these items.
The CDC has supported the recommendation of a diaphragm fitting ring manufacturer that involved using a soap and water wash followed by a 15 to 20 minute immersion in 70–90% alcohol. This disinfection method should be adequate to inactivate HIV, HBV, and HSV even though alcohols are not classified as high-level disinfectants because their activity against picornoviruses is somewhat limited. No data are available regarding inactivation of human picornoviruses (HPV), the causative agent of genital warts, by alcohol or other disinfectants because in vitro replication of complete virions has not been achieved. Thus, even though alcohol for 15 to 20 minutes should kill pathogens in genecology, no clinical studies directly support this practice.
The cryosurgery probes should be HLD with a FDA approved liquid chemo-sterilizer solution (e.g., 2% glutaraldehyde) for a minimum of 20 minutes. Any portion of the probe that could have mucous membrane contact like the probe stem should be disinfected by wrapping with a cloth soaked in the chemo-sterilizing solution for a minimum of 20 minutes. Ensure that the wrapped probe stem is placed in a covered basin during this process. After disinfection, the probe tip and probe stem should be rinsed with sterile water or tap-water and dried before use. In order to prevent damage to the electrical component, this may have to be accomplished using several water-soaked cloths. If tap water is used, rinse or wipe down with alcohol as the final step.
Vaginal ultrasound probes should be cleaned and disinfected in the following manner: remove the condom and wipe the probe clean with a fresh, clean, alcohol soaked cloth. Immerse the cleaned ultrasound probe in a closed/covered container filled with a FDA-approved chemo-sterilizer solution (i.e. 2% glutaraldehyde), and soak for at least 20 minutes, or per the manufacturer’s directions for time and temperature. Upon completion of the soak cycle, rinse the probe thoroughly with sterile water and allow to air dry on a clean towel. If tap water is used, rinse or wipe down with alcohol as the final step.
Vaginal speculae

- Should be cleaned with detergent and water and steam sterilized. Specula should be stored in a manner that clearly indicates which are soiled and which are cleaned and ready for sterilization.

Vaginal speculums are frequently used GYN equipment in Ambulatory Care. Reusable vaginal speculums should be placed in a container of water with or without soap immediately after use to prevent secretions from drying on the equipment. A practical method to facilitate cleaning is to place used speculae directly into an enzymatic detergent and water for the recommended time and dilution (i.e. 3 minutes). After soaking, the speculae should be cleaned using a clean cloth or brush, then the instruments should be rinsed with tap water and allowed to dry prior to packaging for steam sterilization.

In order to retrieve supplies when a sterilizer malfunctions (i.e. biological indicator turns positive) the speculae should ideally be individually wrapped in peel packs. An internal and external indicator should be used with each peel pack and the date and load number should be written on the package. After sterilization, the speculae should be stored in a manner that prevents contamination. Vaginal speculae that are labeled single use must be discarded after use.
Moving on to how to reprocess commonly used ENT equipment in Ambulatory Care. Reusable, ear speculae should be washed with detergent and water and then autoclaved after each use. Alternatively disposable ear speculae may be used. Curettes (used to clean the ear canal of ear wax) should be cleaned and disinfected in the same manner. If tap water is used for rinsing and a HLD solution immersion is used in place of autoclaving, then the equipment should receive a final rinse with alcohol and allowed to air dry.

Ear irrigations should be performed using sterile solutions. Non disposable rubber tips on audioscopes/ tympanometers should be washed with soap and water, soaked in alcohol 5-10 minutes and allowed to air dry.
Per the CDC Guidelines for Disinfection and Sterilization, in view of the potential for transmission of viruses like herpes simplex (HSV), adenovirus 8, or HIV by tonometer tips, the CDC recommended that tonometer tips be wiped clean and disinfected for 5 to 10 minutes with either 3% hydrogen peroxide, 5000 ppm chlorine, 70% ethyl alcohol, or 70% isopropyl alcohol. However, more recent data suggest that 3% hydrogen peroxide and 70% isopropyl alcohol are not effective against adenovirus capable of causing epidemic keratoconjunctivitis and similar viruses and should not be used for disinfecting applanation tonometers. Structural damage to Schiotz tonometers has been observed with a 1:10 sodium hypochlorite (5000 ppm chlorine) and 3% hydrogen peroxide. After disinfection, the tonometer should be thoroughly rinsed in tap water for 15 to 20 seconds, and air dried before use. Although these disinfectants and exposures times should kill pathogens that can infect the eyes, no studies support this.

The guidelines of the American Academy of Ophthalmology for prevention infections in ophthalmology focus on only one pathogen, HIV. Because a short and simple decontamination procedure is desirable in the clinical setting, swabbing the tonometer tip and the tonopens with a 70% isopropyl alcohol wipe is sometimes practiced. Preliminary reports suggest that wiping the tonometer tip with a alcohol swab and then allowing to air dry might be effective in eliminating HSV, HIV, and adenovirus. However, these studies involve only a few replicates in a controlled setting, and further studies are needed.
The Gonio Lens is a high touch item when a patient exam is being done. Frequently the Physician or health care personnel will touch the eye area and may inadvertently contact the mucous membranes of the eye during the exam. Gonio Lens should be disinfected between patient use by immersion in a 1 to 10 dilution of bleach solution for 10 minutes, rinsed thoroughly in 3 cycles, and allowed to dry before storage.
The slit lamp is another high touch item during patient exams. The entire slit lamp should be disinfected between use by wiping the head rests, chin rests and handlebars with a 1:100 dilution of bleach and water, or 70 to 90% alcohol between patient uses.

Eye drops must be used as prescribed on the label. If an eye drop is labeled “single-patient use” or “single use only” then by Federal Law it cannot be used on multiple patients. A multi-dose eye drop may be used on more than one patient with the following exceptions: if used on a patient with known or suspected conjunctivitis it must be discarded after each use. If there is suspicion that the bottle has been contaminated (e.g., the tip has touched a patient’s eyelashes or eye), it should be discarded after a single use. Or, if there is any sign that the fluid in the bottle is no longer safe to use (e.g. turbidity, color change, unusual odors) then it should not be used.
Inadequately cleaned and disinfected endoscopes may result in transmission of infectious diseases. Strict adherence to the cleaning and disinfection guidelines provided in this module is essential to eliminate the risk of endoscopic-related infections. More healthcare associated outbreaks have been linked to contaminated endoscopes than to any other medical device although, the incidence of infection associated with their use is reportedly low (about 1 in 1.8 million). The 5 essential steps for endoscope reprocessing include: cleaning, disinfecting, rinsing, drying, and storing. To prevent the spread of HAI all heat sensitive endoscopes (GI, bronch, nasopharyngeal) must be properly cleaned, and at a minimum high level disinfected after each use. Because of the types of body cavities they enter, flexible endoscopes acquire high levels of microbial contamination also called bioburden during each use from 100,000 CFU to 1,000,000,000 CFU with the highest levels found on the suction channels.

First, mechanically clean external surfaces: include brushing internal channels, flushing each internal channel with tap water and a detergent or enzymatic cleaner. Second, disinfect by immersion of the endoscope in high level disinfectant and perfuse disinfectant into the suction/biopsy channel and air/water channel and expose for at least 20 minutes (or FDA cleared temperature to exposure time). Third, rinse the endoscope and all channels should be rinsed with sterile water, filtered water, or tap water depending on its use. Fourth, dry the insertion tube and inner channels should be purged with air, flushed with alcohol to assist drying, purging all channels with air and dry the exterior. Fifth, store the endoscope in a way that prevents recontamination (hung vertically in a clean location). Laparoscopes, arthroscopes, bronchoscopes may be high-level disinfected or sterilized.
Immediately after the procedure, staff should perform initial wiping and flushing of scopes and accessories. This procedure should be performed shortly after use (ideally within 20 minutes) to prevent drying of secretions within and on the scope and accessories (e.g. brushes, biopsy forceps). Appropriate PPE must be worn to prevent staff exposure to blood or other potentially infectious material. The insertion tube should be wiped with a detergent-soaked lint-free cloth. It is best not to use alcohol impregnated wipes; it is better to use an enzymatic detergent to inhibit protein coagulation. Next immerse the distal tip into enzymatic detergent and depress the suction valve only to aspirate detergent for 30 seconds. If you push air/water with the suction, you will be mostly pulling and the goal is to have enzymatic solution in these channels.

It is important to suction the water or enzymatic solution until clear, including the biopsy channel. Next, turn off the suction pump and light source. Failure to power down equipment will cause contaminated water to come out the distal end and around the air/water channel. Attach air/water channel to the cleaning adapter. The cleaning adapter allows water to go down the air line and water lines (these are two separate lines). The normal air/water valve cover does not allow water to flush down the center line. Immerse the distal tip in clean water. Set the light source airflow to high. Depress and feed water for 30 seconds. Release the air/water channel cleaning adapter for 10 seconds or more to allow air through the channel. Then turn off the light source. Disconnect all removable parts and confirm water resistant cap is dry and clean and attach to scope. The scope is now ready for transport to reprocessing area and should be covered. If the endoscope reprocessing area is not located in the immediate vicinity and transport is required, place scopes and accessories in a plastic bag with a BIOHAZARD label on it. A dirty scope should not be left in a clean area, Scopes needing reprocessing should be placed in a designated area for dirty scopes only.
Once in the reprocessing area, perform the leak test first. Staff must leak test the endoscope following the manufacturer’s instructions. The leak test is performed to detect damage to the interior or exterior of the endoscope. It is done prior to immersion of the endoscope in reprocessing solution to minimize damage to parts of the endoscope not designed for fluid exposure. First thing for staff to do is to remove valve covers from the endoscope. Then, attach the leak tester and pressurize the endoscope before submerging it in water. With the pressurized endoscope completely submerged, the should be flexed at the distal portion in all directions. The point is to observe the insertion tube, distal bending section, and the universal cord for bubbles coming from the interior of the scope for one minute. If a leak is detected, or the endoscope appears damaged, the scope should be wiped off with a low-level disinfectant, and sent in a biohazard labeled bag for ETO gas sterilization ideally. After sterilization, the scope should be sent out for repair. If ETO sterilization is not possible, then the scope should be sent for repair with a biohazard label attached.
Meticulous mechanical cleaning is the most important step in removing the microbial burden from an endoscope, accessories and instruments and reduces the level of microbial contamination by 4 to 6 logs. Retained debris may inactivate or interfere with the capacity of the active ingredient of the high level disinfectant to effectively kill or inactivate microorganisms. Cleaning endoscopes and accessories is necessary before either automated or manual disinfection. Use fresh low-sudsing (aids with visualizing process) solution of enzymatic solution for each scope to prevent cross-contamination. These solutions are NOT microbiocidal and will not retard microbial growth. Fully immerse and disconnect all parts. Whenever possible wash and soak the scope for two to five minutes. Repeatedly activate valves during cleaning. Brush all accessible endoscope channels including the control head, insertion tube, and umbilicus of the endoscope. Use a brush size compatible with each channel. After each passage rinse the brush, removing any visible debris in the detergent solution before retracting and reinserting it. Clean and high level disinfect brushes at the end of the day. All brushes should be inspected between uses, and replaced when worn or damaged. It is important to suction the water or enzymatic solution until clear, including the biopsy channel. Be sure appropriate adaptors are used to achieve adequate flow through all channels. The elevator channel of scopes have small requires manual reprocessing using a 2 to 5 cc syringe even if even if a channel adapter is found to fit the reprocessing machines. Thoroughly rinse with sterile or tap water, to purge the channels, then force air dry after removing from enzymatic cleaning solution. Dry the endoscope and accessories with a soft lint free cloth to prevent dilution of high level disinfectant solution.
Use only FDA approved chemo-sterilizer solutions compatible with endoscopes.

- MEC Test HLD solution at least daily or with each immersion (one product exception)
- Use right test strips for HLD
- Check product expiration dates
- Create HLD reprocessing log
- Maintain log book of results for 5 years

Use only FDA approved chemo-sterilizer solutions compatible with the endoscopes used in your practice or facility. The FDA maintains a list of liquid chemical sterilants and high level disinfectants, and the website can be found in the references of this module. The FDA-cleared label claim for high level disinfectants should be used unless there are scientific studies that demonstrate an alternative exposure time is effective for disinfecting semi-critical items. For example if a >2% glutaraldhyde is used, scientific data show that all immersible internal and external surfaces should be in contact with this high level disinfectant not less than 20 minutes at 20 degrees C or 68 degrees F. A thermometer may be used to measure temperature. The solution should be discarded according to manufacturer’s instructions and whenever the chemical indicator indicates that the concentration is less that the minimum effective concentration (MEC). The date the test strip bottle is opened and expiration date should be recorded on the bottle. Facilities should maintain a log of MEC test results which includes the date, test results and name of individual performing the test. UNC has been advised to keep the high level disinfection MEC log records for five years. The frequency of using the MEC test strips for high level disinfection is based on the fact that immersion of the device or item is taking place, whether it be a scope or another device in the cleaning phase, that precedes the immersion in a sterilizing solution. All immersion baths should be tested using MEC test strips minimally daily if used daily. Some surveyors have implied that MEC strip tests should be done after each immersion for processing scopes because of the volume of water carried over from the cleaning process. Although this is not recommended in the CDC Guidelines, it may be necessary to carry out in order to meet regulatory surveyor expectations. There is only one exception to MEC testing the solution. The new product that is a combination of 7.35% HP and 0.23% peracetic acid is the only product the FDA gave a pass to not requiring test strips for high level disinfection because of the strength of the peracetic acid content. The manufacturer’s instructions state “No Test Strips Required”. 
It is important that appropriate cleaning adapters, fill all channels of the endoscope with disinfectant until a steady flow can be seen exiting the opposite end of each channel. This is always necessary to ensure perfusion of the scope channels since it cannot be visually confirmed. Care should be taken that all channels are filled with HLD and that no air pockets remain within the channels. The channels should be pressure locked in order to retain the HLD in place for the recommended time (e.g. 20 minutes). Complete microbial destruction cannot occur unless all exterior and interior surfaces are in contact with the HLD (e.g. glutaraldehyde) for recommended time. Exposure to the HLD vapors can present a health hazard, therefore a cover with a tight fitting lid should be used to minimize chemical vapor exposure. In addition, the reprocessing area should have engineering controls to ensure good air quality. All channels should be completely flushed with air before removing the endoscope from the HLD. This preserves the concentration and volume of HLD and prevents exposure from dripping and spilling.
Staff may rinse with sterile, filtered, or tap water. The rinse water should be discarded after each use or cycle. The exterior and all interior channels should be thoroughly rinsed by suctioning water into all channels to remove the HLD from the interior and exterior surfaces of the scope. Rinsing prevents exposure and potential injury of skin and mucous membranes from chemical residue. Colitis has been associated with GI scope procedures from HLD residuals.

Staff should follow rinsing with injecting alcohol (70 to 90%) injection rinse and then all channels purged with forced air drying using compressed. To prevent damage be careful not to use excessively high air pressures, 10 psi is ideal, though no more than 20 psi should be used. Purging all channels with air decreases the risk of bacteria, such as *Pseudomonas aeruginosa*, a common water contaminant of tap water, and fungi which multiply in a moist environment. Alcohol purges should be used even if sterile water is used for rinsing. Alcohol is used as a solvent to assist drying the interior channel surfaces. Alcohol mixes with the remaining water on the channel surfaces and acts to encourage evaporation of the residual water as air flows through the channel. Healthcare facilities should use fresh alcohol that has been properly stored in a closed container between uses. Alcohol, when exposed to air, rapidly evaporates and if below the recommended percentage level cannot be relied upon to assist in the drying process. Purging the channels with air assists the alcohol to evaporate moisture and then all channel adapters should be removed. The scope exterior should be dried with a soft lint free cloth; along with all removable parts stored detached from the scope to prevent trapping of liquid inside the scope.
Storage of Endoscopes

- Protect from contamination and damage
- Store in cabinet or clean cart/area
- Cover/tag clean endoscope to denote HLD
- Storage facilities cleaned regularly
- Storage case not ever suitable for storage or transport

Endoscopes should be stored in a manner that will protect the endoscope from contamination and damage. Correct storage of the endoscope will prevent damage to the exterior of the device by protecting the device from physical impact. To facilitate drying, the endoscope should be stored vertically with the distal tip hanging freely. A storage cabinet with good ventilation will encourage continued air drying of the surfaces and prevent undue moisture buildup in the cabinet interior, thereby discouraging any microbial contamination of the cabinet surfaces. If a cabinet is not available, the endoscope may be stored on the endoscope cart or other designated area in a clean location. The reprocessed endoscopes should be covered with a clean paper sheath, tagged, or stored in a manner (clean cabinet/room) that denotes that the scope has been HLD and is ready for use. The storage facilities should be cleaned regularly. Importantly, carrying cases supplied by the manufacturer are never suitable for storage or transport from one facility to another.
Automatic endoscope reproprocessors (AERs) standardize the disinfection process and decrease personnel exposure to disinfectants. However, no currently available automatic reproprocessors provide adequate cleaning of endoscopes. It is necessary to follow all steps for the mechanical cleaning of the endoscope before using an AER.

Be sure to compare the reprocessing instructions of the AER's and endoscope manufacturer and resolve any conflicting recommendations. It is important to check that all adapters are attached according to the manufacturer’s directions to ensure exposure of all internal surfaces with HLD. Do NOT rely on adapters to clean elevator channels if present on any scope. The valves and other removable parts should be placed into the soaking basin of the AER. Unless the AER has a dedicated space for accessories, these items should be reprocessed separately. If the AER has a cycle that uses detergent, the product should used be compatible with endoscope and AER machine. Improper amounts and dilutions of the detergent may allow detergent residue to remain on the internal and external surfaces of the endoscope and/or on the sink surfaces of the reprocessor. Detergent residue may interfere with the action of the HLD. The AER time and temperature settings should be appropriate for the type of HLD used. The AER machine should be allowed to complete all cycles or phases. If cycles or phases are interrupted, HLD cannot be ensured. If a final alcohol rinse cycle is not included in the AER machine, this step should be done manually. As already described after the final rinse the scopes should be purged with air.
Thank you for touring with me
References

- Rutala WA, Weber DJ, HICPAC. CDC guideline for disinfection and sterilization in healthcare facilities, 2008. MMWR. Available at CDC.gov.