Flexible endoscopes were introduced in the mid-1950s. They utilize the properties of glass fiber bundles in flexible instruments to let doctors diagnose and treat disease in ways not possible with rigid devices. Endoscopic procedures are a major part of nearly every hospital’s practice. Use of endoscopic procedures greatly reduces the amount of surgical trauma. Patient suffering is reduced, recovery time is shorter, and the chance of nosocomial infections is lessened.

**Objective 1:**
Understand the structure of flexible endoscopes.

Flexible endoscopes (scopes) are long and complex devices used to see abnormalities and pathologies inside the body, to perform diagnostic tests, and to obtain tissue specimens for biopsy. They are appropriately named:

- **Flexible** means capable of bending to gain access to internal body organs.
- **Endo** means inside; a flexible endoscope can visualize inside the body.

Endoscopes have a control head and a flexible shaft with a maneuverable tip. Hundreds of fiber-optic fibers (rods) are arranged around one or more lumens. There are also lenses and mirrors, coils or springs, and cables running the length of the endoscope to control the tip’s movement. An imaging cable is also usually included. A special covering allows the scope to be bent gently (not sharply at right angles) to maneuver inside the body.

Some flexible endoscopes are used only to examine internal organs. Others, such as a typical gastrointestinal scope, are more complicated and have a biopsy channel, a mechanical system to maneuver the scope, an optical system to transmit images for viewing, and another channel for irrigation.

Images travel through the scope to the eyepiece or monitor for viewing and can be transmitted optically or electronically from the distal tip. The scope’s head is connected to a light source (and to a computer-driven monitor if it is a videoscope) by a universal cord. The light source channel also contains an air pump and a water supply.

The endoscope’s control section contains the fiber bundle or image-conducting cable, control wires to move the distal tip and, usually, several other channels. The largest channel is for instruments and allows passage of flexible accessories such as biopsy forceps, diagnostic brushes, and snares from a port in the scope’s head through the tip and into the field of view within the body. Other channels are used for suctioning, to transmit air to distend the organ being examined, and for jets of water to clean the distal lens when it becomes soiled with bile, secretions, blood, feces, or other materials during a procedure.

Endoscopes require several connectors:

- The light guide connector houses the light guide which must be attached to a light source.
- The air pipe connector transmits air for insufflation when connected to an air pump.
- The suction connector removes fluid matter from the body.
- The water container connector provides water to wash the scope’s lens.
- The gas tube connector provides the carbon dioxide (C02) for insufflation.
Objective 2: Discuss special processing issues for flexible endoscopes.

Endoscopes have long, dark, and narrow channels which become contaminated with body fluids during medical procedures and create a perfect breeding ground for viruses and bacteria. Their complex design and numerous construction materials complicate the cleaning process and make them more difficult to reprocess than many smaller and more delicate instruments.

It is not easy to recognize infectious transmissions which are, unfortunately, a possible surgical complication involving the use of scopes. Although several studies have indicated that infection risk is low, the actual rate of disease transmission may be greater than studies suggest.

Endoscopes must always be thoroughly cleaned and high-level disinfected between uses. (Note: Sterilization is preferred recommended when the scope is passed through an inclusion.)

A common cause of irreparable damage to accessory instruments arises from forcing the accessory through the biopsy channel when an obstruction is encountered. This can cause the accessory instrument to buckle somewhere between the technician’s fingers and where it enters the endoscope. Use of automatic scope reprocessors does not replace the need to manually clean (including thorough brushing of) the endoscope.

Objective 3: Review common types of flexible scopes.

There are a variety of flexible endoscopes in use today.

Bronchoscope. Bronchoscopy involves the direct visualization of the tracheobronchial tree and is done for:
- Diagnosis to secure uncontaminated secretion for culture, to take a biopsy, or to find the cause of a cough or hemoptysis.
- Treatment to remove a foreign body, to excise a small tumor, to apply a medication, to aspirate the bronchi, or to provide an airway during performance of a tracheotomy.
- Tiny forceps at the end of the bronchoscope are manipulated for a tissue biopsy. The diameter of a flexible scope is small enough to reach into the bronchi of the upper, middle, and lower lobes for examination or biopsy.

The setup for flexible bronchoscopy includes the following:
- Fiber-optic light source
- Flexible bronchoscope
- Flexible biopsy forceps
- Flexible cytology brush (optional); if used, slides and alcohol are necessary to collect a specimen
- Suction unit

The bronchial endoscope is passed through a “bite block” positioned between the patient’s upper and lower teeth to protect it from the usually severe and costly damage that occurs when a patient bites it forcefully. (This block may be unnecessary in patients who have lost their teeth.)

Cystoscope/Ureteroscope. A flexible cystoscope is used to visualize the urethra and bladder. A ureteroscope is passed through the urethra and bladder, past the ureter, and finally into the kidneys to look for obstructions such as kidney stones. It can also be used for patients who cannot assume a lithotomy position, such as those with spinal cord injuries or severe arthritis. Flexible cystoscopy may be accomplished with the use of a local anesthetic.

The following instruments are required:
- Cystoscope/Ureteroscope
- Light source
- Biopsy forceps
- Snares (guidewires)
- Electro-surgical unit and accessories
- Suction unit
- Air and water feed supply

Objective 4: Explain techniques to process flexible endoscopes.

Manufacturers of endoscopes and accessories must be consulted for processing instructions. Recommendations of the hospital’s Infection Control Committee and Centers for Disease Control (CDC) are also helpful.

Sterilization is not mandated for most flexible scopes because their materials are not heat-stable. Most scopes can be completely immersed in liquid and must be thoroughly cleaned prior to disinfection. Use of automatic scope reprocessors does not replace the need to manually clean (including thorough brushing of) the endoscope.

Technicians reprocessing endoscopes should follow Standard (U niversal) Precautions. They should wear personal protective equipment including gloves, gowns, face masks or shields, and hair covers or other protective head gear. Scopes should be reprocessed in a large, well-ventilated area with an appropriate enzymatic detergent.

Cleaning is the most important step and should begin at the point-of-use during the pro-
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A scope should be thoroughly cleaned before it is disinfected. Soft, lint-free cloths or sponges and brushes specifically designed for this use are needed. Cleaning accessories may be disposable or reusable. If reusable, they must be thoroughly cleaned after use and sterilized or disinfected, according to the manufacturer’s recommendations.

Six basic steps are required to clean and reprocess scopes:

1. Pre-cleaning to remove gross debris from external surfaces and internal channels. Use a soft, lint-free cloth to wipe the insertion tube with a detergent formulated for scopes. Suction the detergent solution through the scope until the solution is visibly clean. Alternate suctioning solution and air. Finish with water. Clear the air and water channels.

2. Leak testing to help ensure that the flexible covering and the internal channels are water-tight. This involves submerging the scope and looking for bubbles.

3. Cleaning to remove organic matter from the spiral-wound configuration of brushes is very difficult (if not impossible). Brushes are best cleaned by use of ultrasonic cleaning and steam sterilization or should be discarded after each use. To properly clean:
   - Detach all removable parts; soak and scrub or brush them.
   - Immerse the scope in a detergent solution; clean its exterior.
   - Accessible channels should be brushed with a brush which is of proper size for the lumen’s opening. An enzymatic-detergent must be suctioned or pumped through channels to remove dislodged material.
   - Thoroughly brush the entire biopsy/suction channel system until no debris is visible on the brush.
   - The scope’s tip must be wiped or brushed to remove any debris lodged in or around the air and water nozzle.
   - Attach cleaning adapters to the endoscope and cover the biopsy port.

4. Disinfecting by immersing the instrument in a basin with the appropriate solution for the correct amount of time (use a timer). Use a basin large enough for the scope; assure that cleaning adapters fill all channels with disinfectant until no bubbles exit the channels. Place all valves and removable parts in the disinfectant; cover with a tight lid. A flter immersion, purge the channels with air to remove the disinfectant. A flter disinfection, the scope must be thoroughly rinsed (preferably with filtered water) to remove all traces of the disinfectant from the internal channels. Reusable parts placed in detergent before cleaning must also be cleaned, rinsed, disinfected, and rinsed again prior to drying and storage. Parts which are heat stable should be packaged, steam-sterilized, and then properly stored in their package.

5. Drying is needed regardless of whether the scope is processed manually or by machine. After rinsing, irrigate with 70% isopropyl alcohol followed by forced-air drying. Dry the exterior and purge the remaining water from the channels to prepare the scope for storage.

6. Storing to keep scopes in proper conditions for reuse. Scopes should be stored (a) with the insertion tube hanging vertically—not coiled, (b) with the control body’s weight supported and angulation locked off and (c) in a dry, dust-free cabinet with good ventilation. Removable parts such as control valves, distal hoods, and caps should not be in place.

Endnote


References

6. Sterilization is _______ when the scope is passed through an inclusion.
   a. required
   b. preferred

7. Infectious transmissions are _______ when scopes are used.
   a. possible
   b. not possible

Objective 2: Discuss special processing issues for flexible scopes.

2. The universal cord of a flexible endoscope
   a. connects the scope's head to a light source
   b. contains the suction channel
   c. contains the suction channel
   d. all of the above

3. The endoscope's fiber bundle is contained in
   a. the instrument channel
   b. the control section
   c. the biopsy channel
   d. the suctioning channel

4. The venting connector in an endoscope
   a. suctions fluid matter from the body
   b. provides water to wash the scope lens
   c. provides CO2 for insufflation
   d. allows penetration of ETO gas during sterilization

5. The largest channel of an endoscope is for
   a. instruments
   b. suctioning
   c. transmitting air to distend organs
   d. supplying water to clean the distal lens

Objective 3: Review common types of flexible scopes.

8. A bronchoscope is used to
   a. visualize the urethra and bladder
   b. visualize the upper digestive tract
   c. inspect the entire large intestine
   d. provide an airway during performance of a tracheotomy

9. A cystoscope is used to
   a. visualize the urethra and bladder
   b. visualize the upper digestive tract
   c. inspect the entire large intestine
   d. provide an airway during performance of a tracheotomy

10. A gastroscope is used to
    a. visualize the urethra and bladder
    b. visualize the upper digestive tract
    c. inspect the entire large intestine
    d. provide an airway during performance of a tracheotomy

11. A colonoscope is to
    a. visualize the urethra and bladder
    b. visualize the upper digestive tract
    c. inspect the entire large intestine
    d. provide an airway during performance of a tracheotomy

12. Which of the following is/are needed for a flexible bronchoscopy?
    a. fiber optic light source
    b. flexible bronchoscope
    c. flexible biopsy forceps
    d. all of the above

13. Which of the following types of scopes is used to look for obstructions such as kidney stones?
    a. esophagoscope
    b. urerteroscope
    c. bronchoscope
    d. sigmoidoscope

14. Which of the following types of scopes can be used to control bleeding ulcers?
    a. esophagoscope
    b. bronchoscope
    c. urerteroscope
    d. sigmoidoscope

15. Which of the following types of scopes is used to remove polyps?
    a. colonoscope
    b. esophagoscope
    c. bronchoscope
    d. cystoscope

Objective 4: Explain techniques to process flexible endoscopes.

16. Processing instructions for endoscopes can be obtained from
    a. manufacturers of scopes
    b. the hospital's Inspection Control Committee
    c. Centers for Disease Control
    d. all of the above

17. Sterilization _____ mandated for most scopes.
    a. is
    b. is not

18. It _____ necessary to manually clean an endoscope if an automatic scope reprocessor is used.
    a. is
    b. is not

19. Endoscope cleaning should begin
    a. at point of use
    b. after the scope is disassembled
    c. after the scope is leak-tested
    d. after the scope is dried

20. Scopes should be stored after drying
    a. with the insertion tube coiled
    b. with the insertion tube hanging vertically
    c. with the insertion tube laid horizontally on a shelf
    d. any of the above is appropriate as long as the scope is not damaged.