HEALTH TECH ACADEMY

Minimally Invasive Surgery

Surgical Skills

Lesson Objectives:

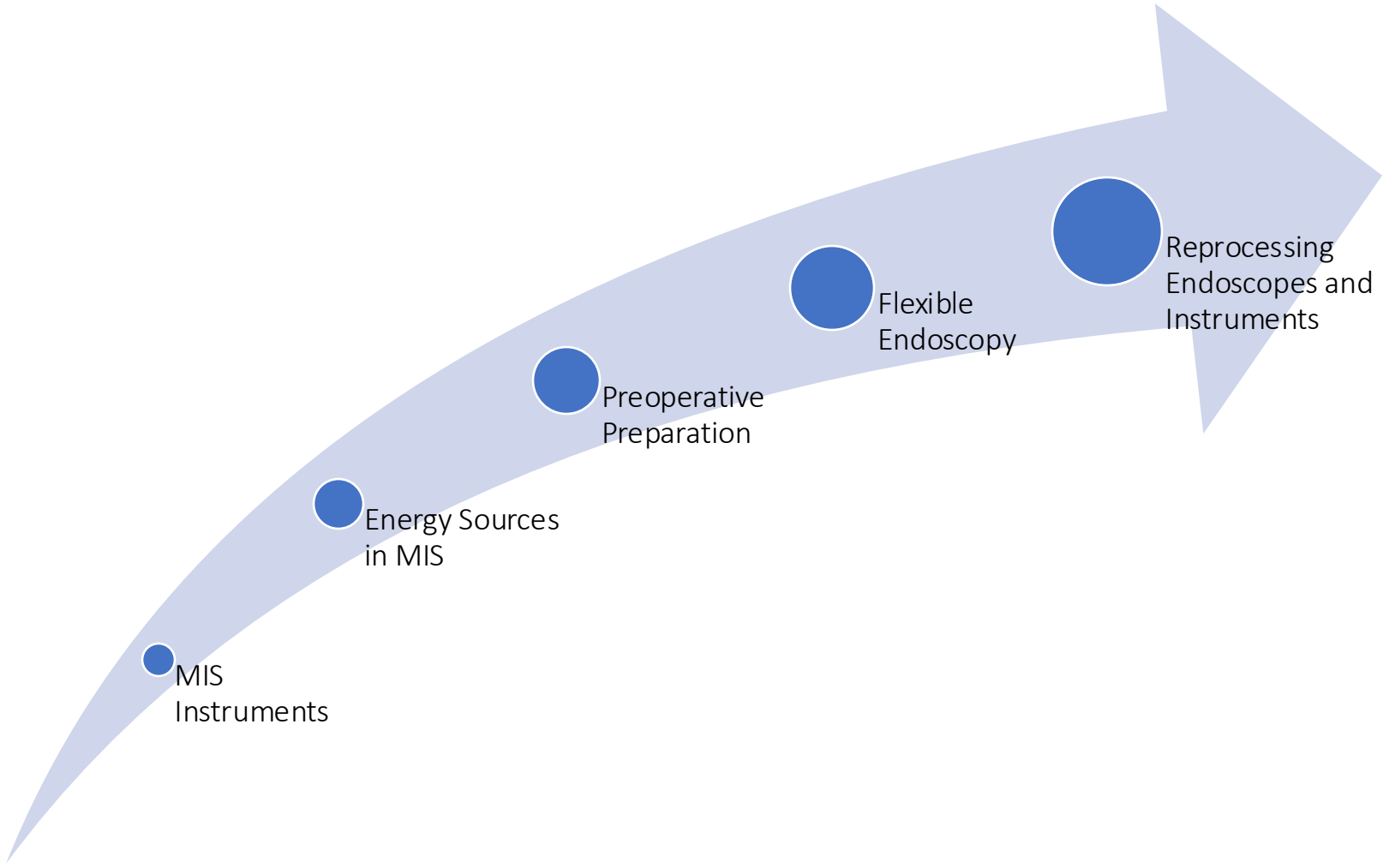
1. Describe the preparation of the patient for minimally invasive surgery (MIS)
2. Describe the function of each component of the imaging equipment used in MIS
3. Describe the surgical technique used for insufflation in laparoscopy
4. Describe the trocar-cannula system used in MIS
5. Describe the specific electrosurgical risks of direct and capacitive coupling
6. Describe the structure and function of a flexible endoscope

Minimally Invasive Surgery (MIS)

Surgical Techniques performed through small incisions or natural body openings.

- **Goals:**
  - Minimize trauma to the body.
  - Reduce postoperative pain.
  - Shorten recovery time.
  - Lower risk of complications compared to open surgery.
- **Examples:**
  - Laparoscopic surgery.
  - Arthroscopy.
  - Endoscopic surgery.
  - Robotic-assisted surgery.

Flow of Ideas

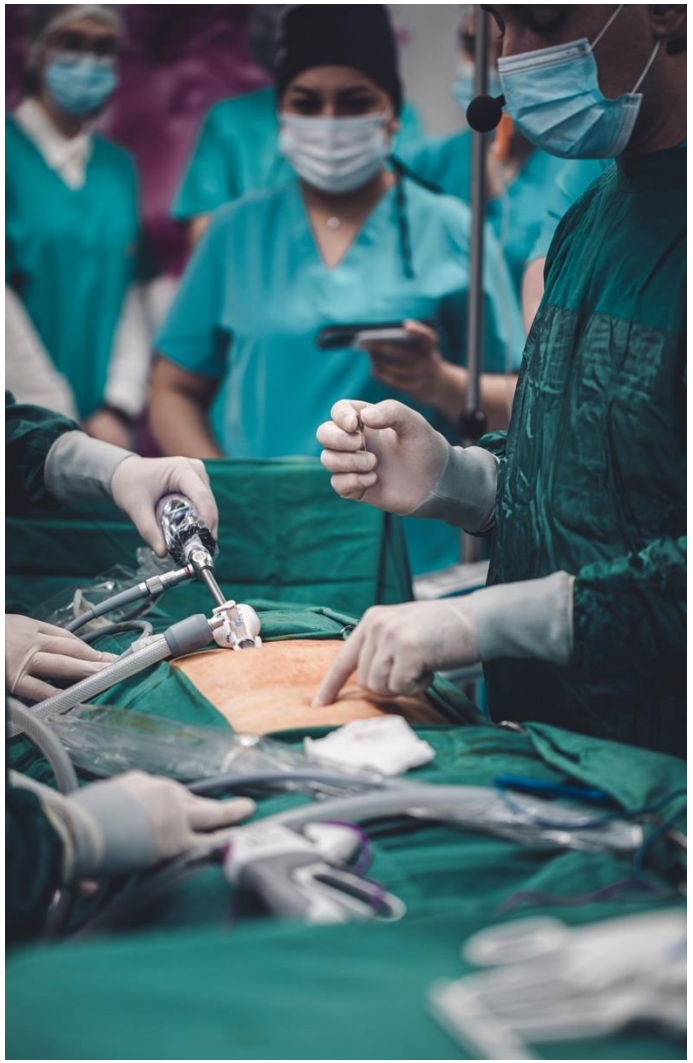


Technology and Techniques in Minimally Invasive Surgery

The imaging system must produce a clear view of the anatomy in real time to achieve the surgical goals while supporting safe surgery.

Imaging System includes:

- Surgical telescope (or endoscope)
- Camera head
- Camera control unit (CCU)
- Light source
- Light cable
- Video cables
- Monitor screen
- Image management system



Minimally Invasive Surgery Instruments

- **Design Features:**
  - Handles and fulcrums at a distance from working end.
  - Small hinges, springs, and valves.
  - Rotational design for increased maneuverability.

- **Common Instruments:**
  - Retractors: Extend from shaft tip, flare out or curve for tissue manipulation.
  - Scissors: Straight, curved, and hooked configurations.
  - Grasping Instruments: Clamps and forceps, with atraumatic or penetrating tips.

Energy Sources in Minimally Invasive Surgery

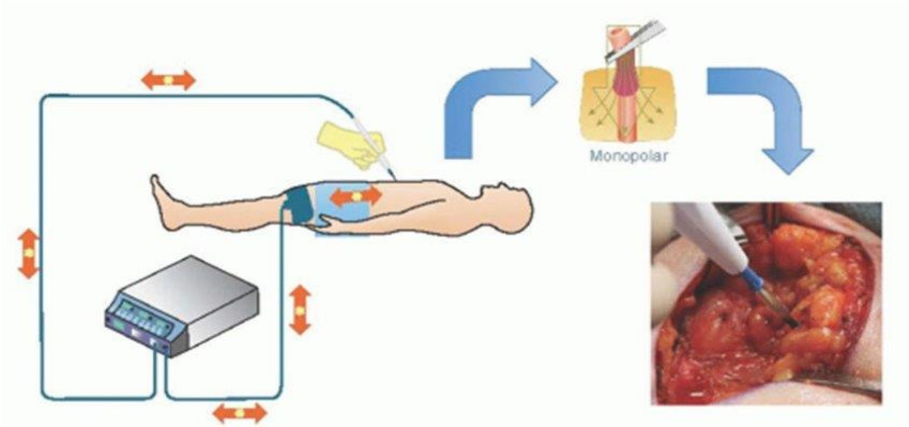
- Electrosurgery
- Ultrasonic Devices
- Lasers

Components of Electrosurgical Unit (ESU) Circuit

- ESU
  - Generates power
- Active electrode
  - Hand piece/pencil
- Patient
- Dispersive electrode (grounding pad)

Flow of Electricity:

- Generator
- Active electrode
- Surgical site
  - Heat (Hemostasis)
- Patient
- Dispersive electrode (G- pad)
  - Generator



Electrosurgical Risks

- Insulation Failure: Risk of burns due to damaged insulation.
- Direct and Capacitative Coupling: Burns from contact with conductive instruments.

- **Risk Reduction:**
  - Active electrode monitoring (AEM).
  - Regular inspection for damage.
  - Avoidance of hybrid cannulas.
  - Monitoring power settings.
  - Proper reprocessing of instruments.
  - Preventing cord damage and wet surface contact.

Ultrasonic Energy

- Ultrasonic technology in MIS for coagulation and cutting.
- Coagulates tissue by creating cool coagulum at cellular level.
- Minimal heat and no electrical energy involved.
- Systems include SonoSurg (Olympus America) and Harmonic scalpel (Ethicon, Johnson & Johnson).

Lasers

- Utilized in minimally invasive and endoscopic surgery.
- Lasing fiber introduced through cannula or telescope.
- Advances in digital technology enhance precision.
- Hazards include limited space and blind areas.

Four Interactions of Laser and Tissue

- **Absorption**
  - Tissue destruction
  - Heat, pressure, rupture
- **Transmission**
  - Through media
  - Water, aqueous humor

- **Reflection**
  - Mirror
  - Accidental
  - Inadvertent burn
  - Non-reflective Inst
- **Scattering**
  - Broken up & dispersed

Patient Preparation for MIS

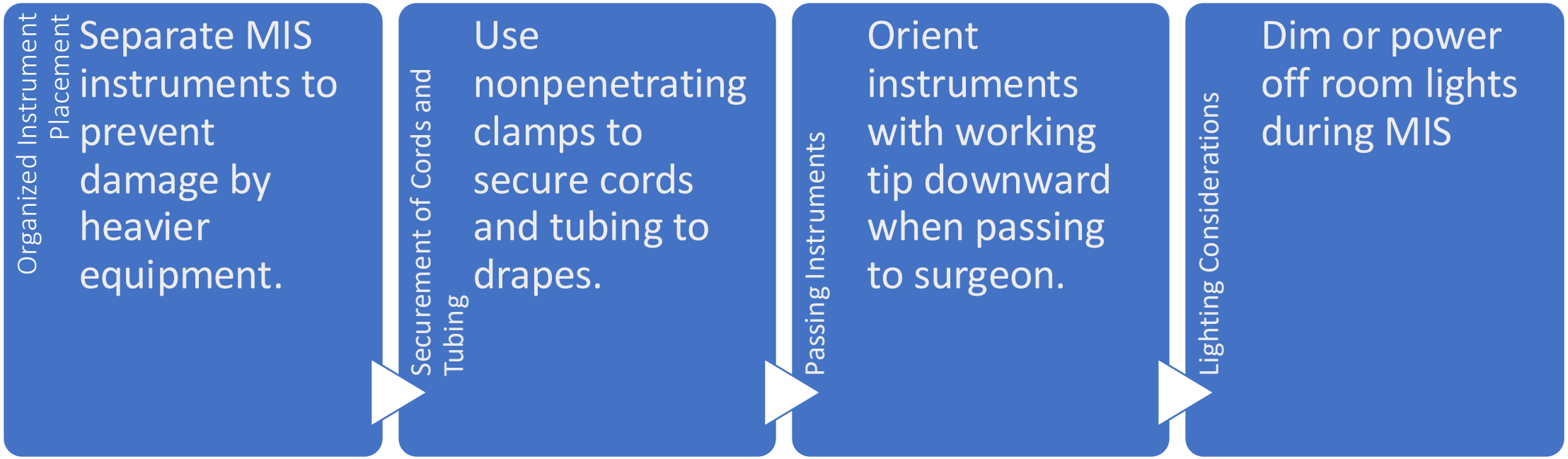
Patient Positioning

- Determined by Surgical Site: Varied positions for different procedures.
- Attention to Safety:
  - Immediate adjustment for intraoperative changes.
  - Prevention of patient sliding with appropriate devices.

Skin Prep and Draping

- Preparation for Conversion: Skin prep as for open surgery.
- Extended Draping: Matched to potential open incision area.

Surgical Setup for MIS



Converting to an Open Case

- Any minimally invasive surgery has the potential to become open case
- Perform this rapidly
- Communicate with circulator
- Quickly exchange instruments
- Count added instruments and sponges
- Initial counts should include all items that would need to be counted in the open procedure

Insufflation Used in Laparoscopy

- **Insufflation Overview**
  - Process: Fills abdominal/thoracic cavities with CO2 for visibility and instrument entry.
  - Benefits: CO2 is nontoxic, absorbable, nonflammable.
  - Warming: Maintains core temp, prevents lens fogging.
- **Creating Pneumoperitoneum**
  - Method: Surgeon inflates abdomen with CO2 via Veress needle/trocar.
  - Veress Needle: Springs retract upon resistance.
  - Control: Adjust for steady gas delivery.
  - Trocar Insertion: After abdomen inflation.

Watch the "Basic Laparoscopy: Access and Port placement" Video for an overview

Basic Laparoscopy: Access and Port placement Video

Basic Laparoscopy: Access and Port placement Video

- Summary of Video:
  - Access with insufflation needle – fill abdomen with CO2 (pneumoperitoneum)
  - Access may also be with an optical trocar port

Risks with MIS

- **Insufflation failure**
  - Can happen if pressure is lost in body cavity. Can be dangerous based on instruments in the body cavity at the time
  - Insufflation can also put pressure on surrounding body parts – this is notable in thoracoscopy, as this pressure may affect respiratory and heart function. Pressure and flow should be balanced with the patient's ability to tolerate

- Insulation Failure – Many electrocautery MIS instruments have a protective sheathing
- Direct coupling and capacitive coupling

Risk Reduction

- Active electrode monitoring
- Inspect instruments
- Correct cannula use
- Power setting problems
- Reprocessing
- Cord placement
- Prevent kinks and knots
- Avoid wet surfaces with cords

Watch the "Laparoscopic Instruments" Video for an overview

Laparoscopic Instruments Video

Click Here to watch the video!

Laparoscopic Instruments Video

Summary of Video:

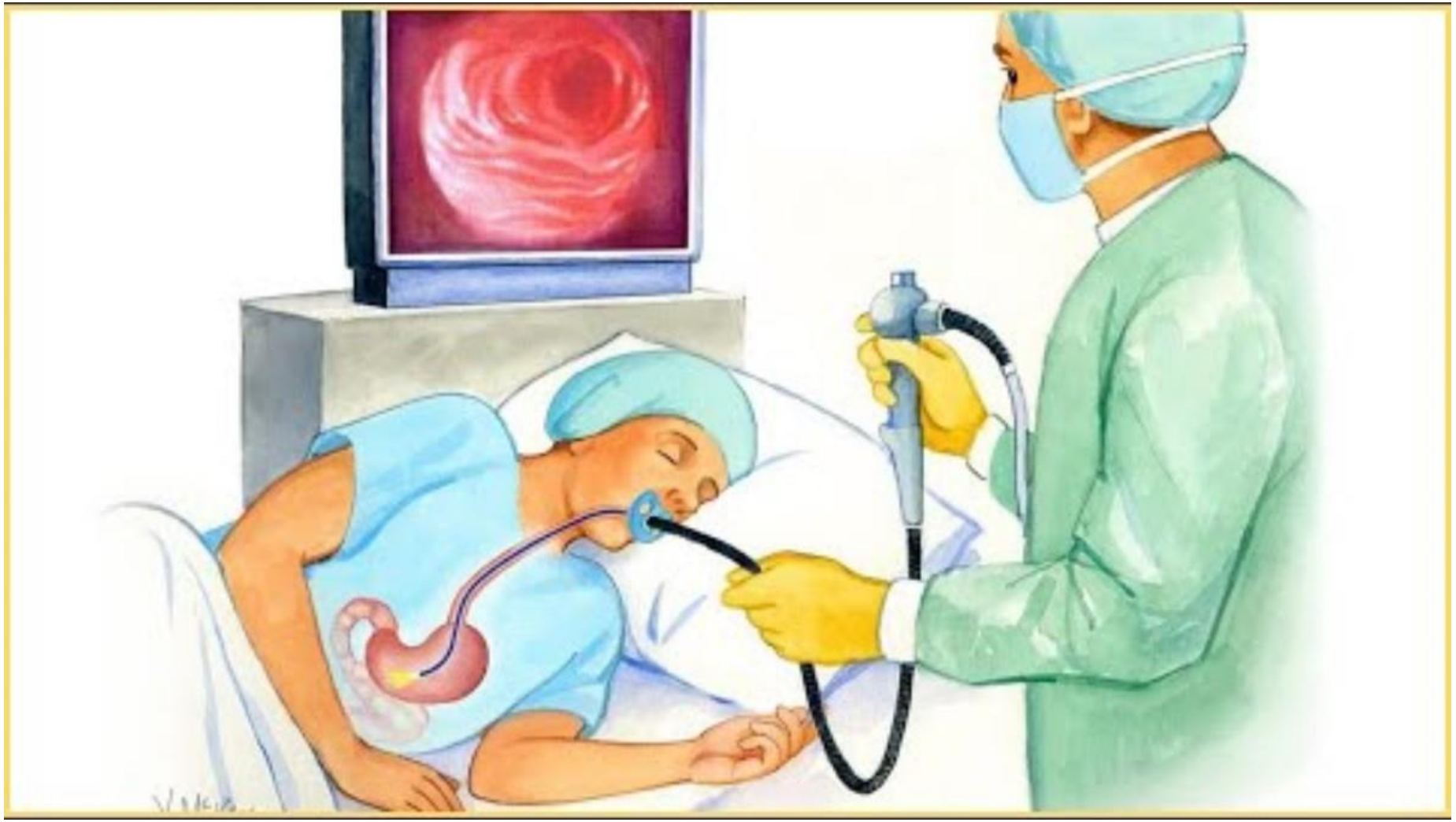
- Parts of instrument: Tip, Shaft, Handle
- Instrument is designed based on use
- Instrument works in a mirrored function – the port is a fulcrum
- Triangulation: Port placement and working area is triangulated

Principles of Flexible Endoscopy

- Viewing inside body passages or organs
- Introduced through a natural opening
- Advanced carefully
- Used for Biopsies and examination

Watch the "What is Endoscopy" Video

What is Endoscopy Video



What is Endoscopy Video

- Summary of Video:
  - Flexible scope/camera inserted through a natural body opening (Mouth, Anus, etc)
  - Can be done with sedation in outpatient setting

Types of Endoscopes

Flexible Endoscopes

- Structure: Head and insertion tube.
- Components: Control head, fiber-optic light channel, instrument channel.
- Functionality: Illumination, flexing mechanism, rotational views.

Echoendoscopes

- Structure: Similar to standard endoscope.
- Additional Feature: Ultrasound transducer at the tip.
- Functionality: Transmitting and receiving ultrasound signals for imaging.

Types of Endoscopes

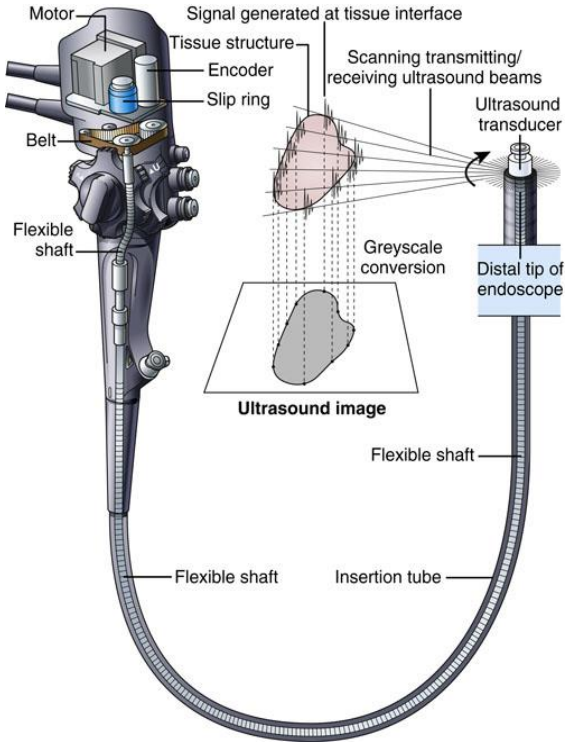
Capsule Endoscope

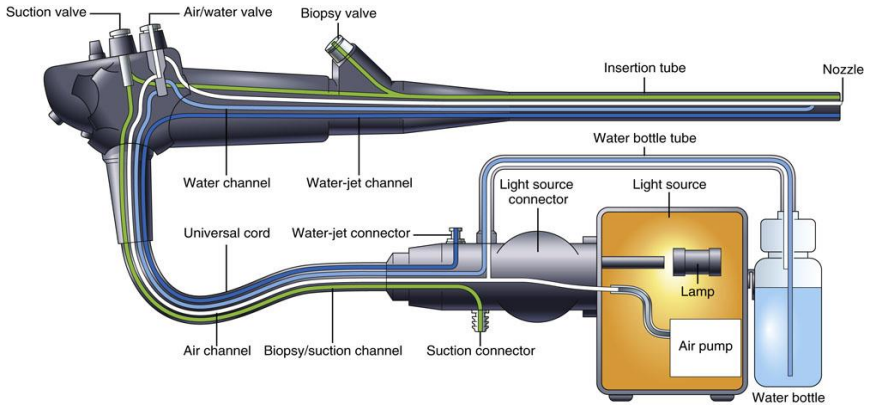
- Structure: Small capsule device.
- Components: Camera, lens, LED, battery.
- Functionality: Swallowed by patient, transmits images to sensors.

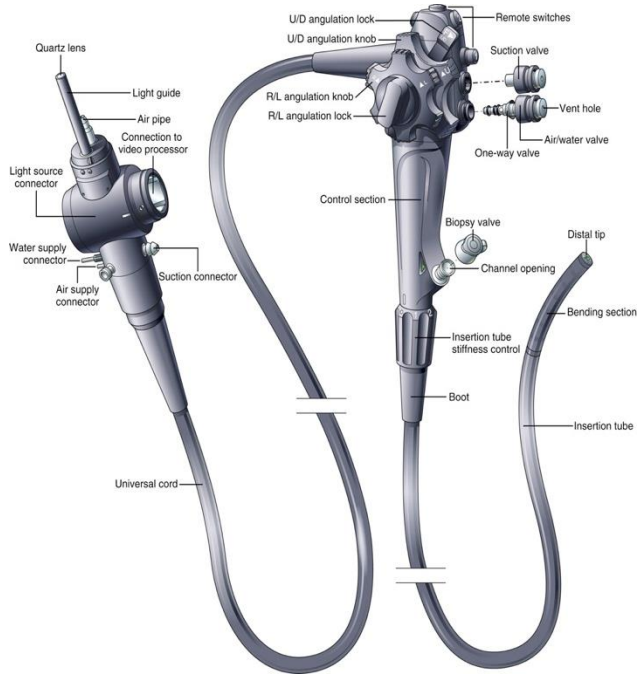
Imaging System

- Similarity to MIS: Camera control unit and documentation system.
- Usage in MIS: Assisted procedures for enhanced visibility.
- Combined Procedures: Abdomen and gastrointestinal tract enhanced with both technologies.

Endoscopes


Motor
Signal generated at tissue interface
Tissue structure
Encoder
Slip ring
Scanning transmitting/
receiving ultrasound beams
Ultrasound
transducer
Belt
Flexible
shaft
Greyscale
conversion
Distal tip of
endoscope
Ultrasound image
Flexible shaft
Flexible shaft
Insertion tube


Suction valve
Air/water valve
Biopsy valve
Insertion tube
Nozzle
Water bottle tube
Water channel
Water-jet channel
Light source
connector
Light source
Universal cord
Water-jet connector
Lamp
Air pump
Air channel
Biopsy/suction channel
Suction connector
Water bottle


U/D angulation lock
Remote switches
U/D angulation knob
Suction valve
Quartz lens
Light guide
R/L angulation knob
Vent hole
Air pipe
R/L angulation lock
Connection to
video processor
Air/water valve
One-way valve
Light source
connector
Control section
Biopsy valve
Distal tip
Water supply
connector
Channel opening
Suction connector
Air supply
connector
Bending section
Insertion tube
stiffness control
Boot
Insertion tube
Universal cord

Read Chapter 20 from the E-Book

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Thank you!

Get ready for your quiz and rest of the activities now. Best of luck!

Congratulations!

Lesson 20 is complete.