Physics of Medical Devices

Third lecture

Endoscopy system

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Third Stage

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2021- 2022

What is Endoscopy?

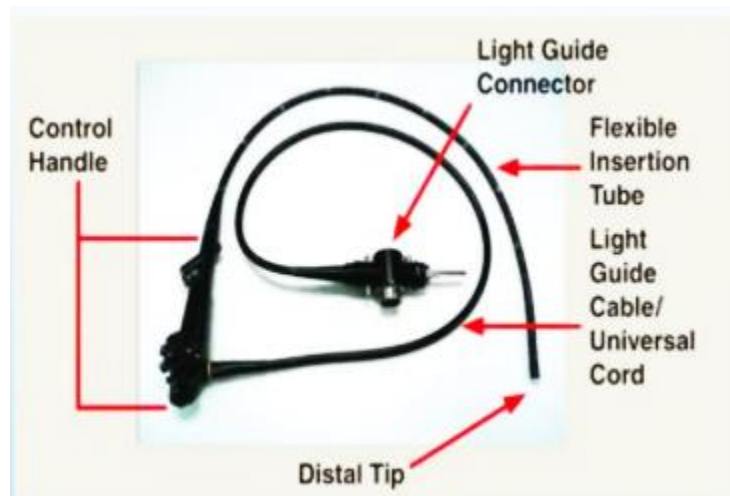It is a procedure used to view and operate on the **internal organs and vessels** of the body.
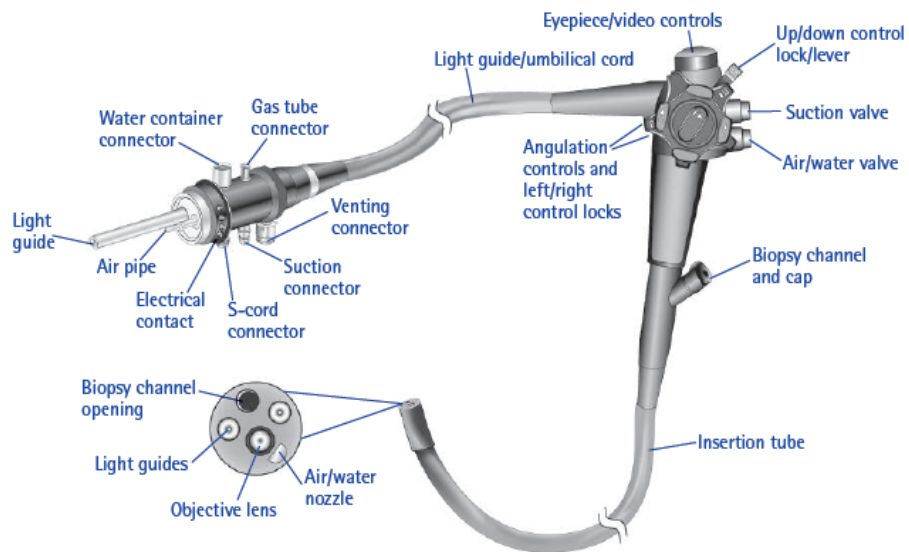
Principle (fiber optics)

- Fiber-optic endoscopes use bundles of thin glass fibers to transmit light to and from the organ being viewed.
- These fibers use the principle of total internal reflection to transmit almost 100 % of the light entering one end to the other end.
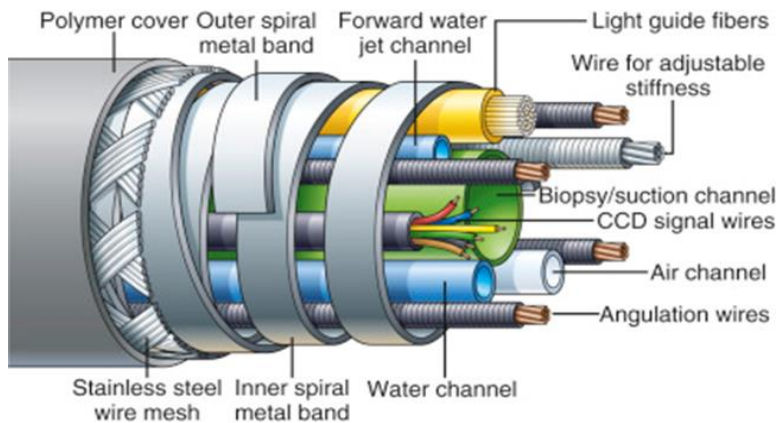
Basic components of an endoscope

- An endoscope consists of:
- A rigid or flexible tube.
- A light delivery system to illuminate the organ or object under inspection. The light source is normally outside the body and the light is typically directed via an optical fiber system.

➤ A lens system transmitting the image from the objective lens to the viewer, typically a relay lens system in the case of rigid endoscopes or bundle of fiber optics in the case of a fiberscope. An eyepiece lens. Modern instruments may be video scopes with no eyepiece. a camera transmits image to a screen for image capture. An additional channel to allow entry of medical instruments or manipulators

Light Guide Connector

Control Handle

Flexible Insertion Tube

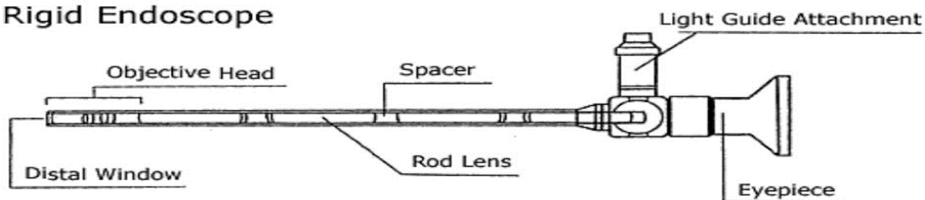Light Guide Cable/ Universal Cord

Distal Tip

▲ Flexible endoscopes have glass fiber bundles in the tubing that transmit a picture back to a camera or eyepiece. Flexible endoscopes also have a distal end that moves from two to four different directions for better viewing of the body cavity. (Courtesy of Endoscopy Support Services, Inc, www.endoscopy.com.)
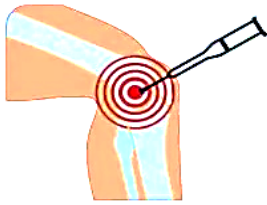

RIGID ENDOSCOPE

Types of endoscopy

What are the types of **Endoscopy?**
Based on **the area investigated,** endoscopy can be:

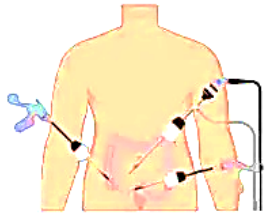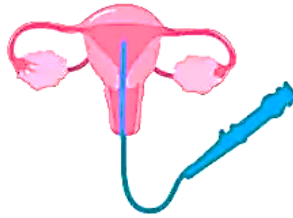| Arthroscopy for joints | Bronchoscopy for lungs | Colonoscopy for colon | Upper GI endoscopy |

What are the types of Endoscopy?
Based on **the area investigated,** endoscopy can be:
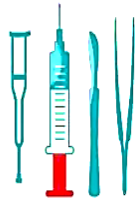
Laproscopy for
abdomen or pelvis

Hysteroscopy
for uterus

Cystoscopy for
bladder

Why **Endoscopy?**
Endoscopy **can be used** either as a

Diagnostic tool

Surgical tool

Why **Endoscopy?**
Endoscopy is used to **diagnose and treat:**
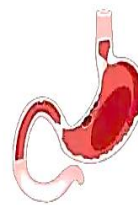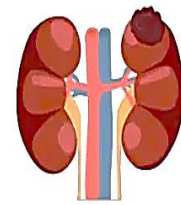
Source of bleeding

Polyps (group of
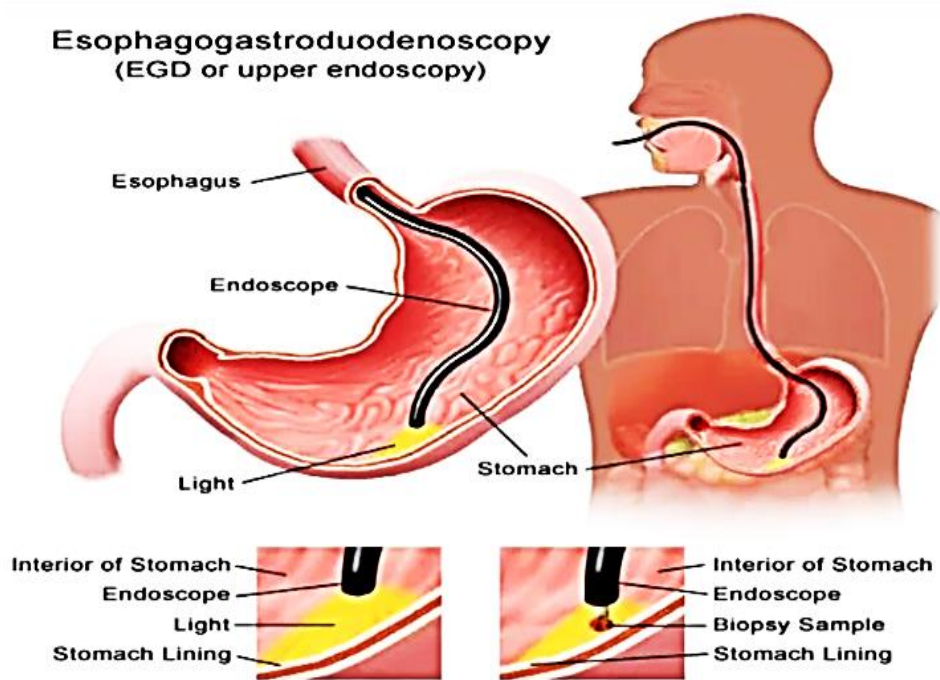Abnormal tissues)

Inflammatory
Bowel disease

Ulcers

Tumors

Endoscopic process

- The endoscope also has a channel through which surgeons can manipulate tiny instruments, such as forceps surgical scissors and suction devices.
- A variety of instruments can be fitted to the endoscope for different purposes.
- A surgeon introduces the endoscope into the body either through a body opening such as the mouth or the anus, or through a small incision in the skin.
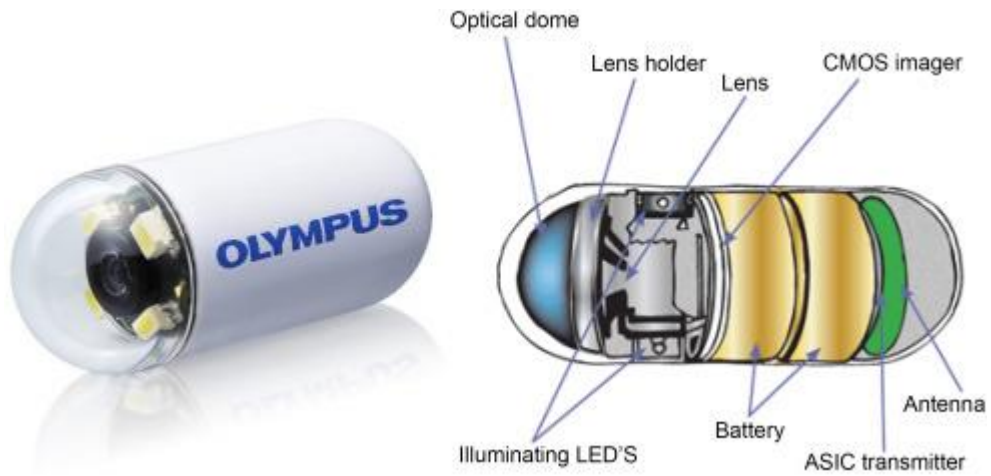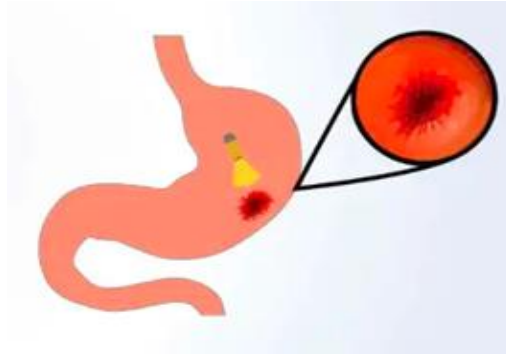

Functions

- View internal body parts using lighting system, camera/video and use of medical instruments to remove unwanted cancers.
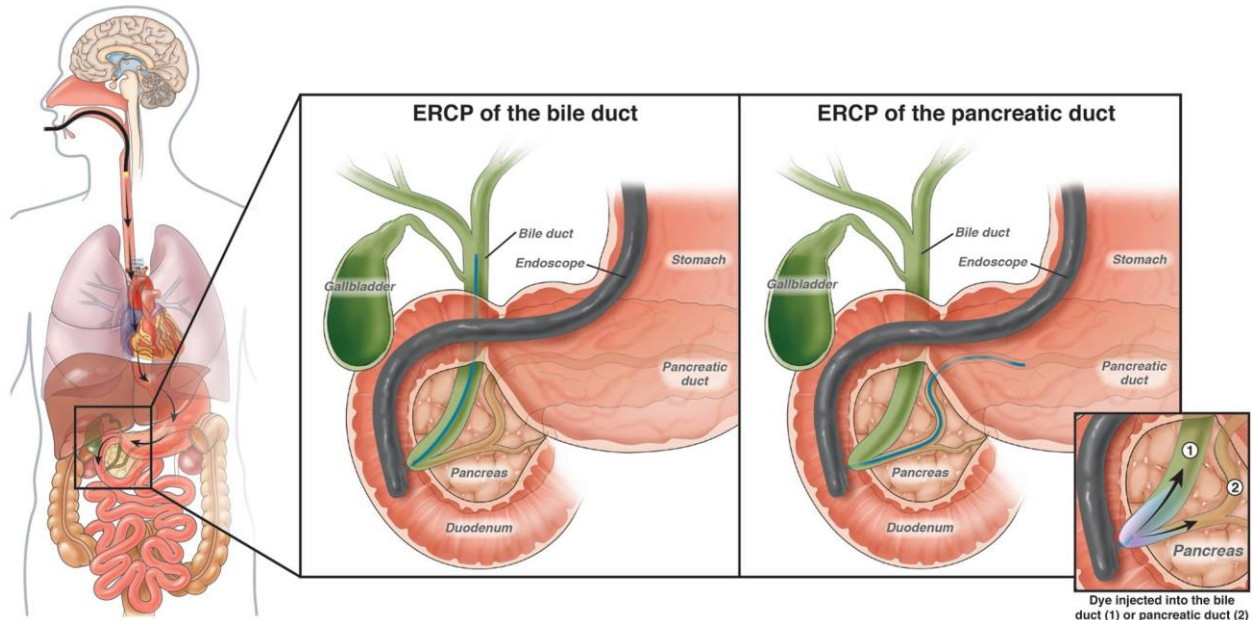- Enters through opening in body. Lasts 15 to 60 minutes.

Latest techniques in endoscopy

1. Capsule endoscopy: capsule with tiny camera swallowed that transmits the images as it passes through

Optical dome
Lens holder
Lens
CMOS imager
Antenna
Battery
ASIC transmitter
Illuminating LED'S

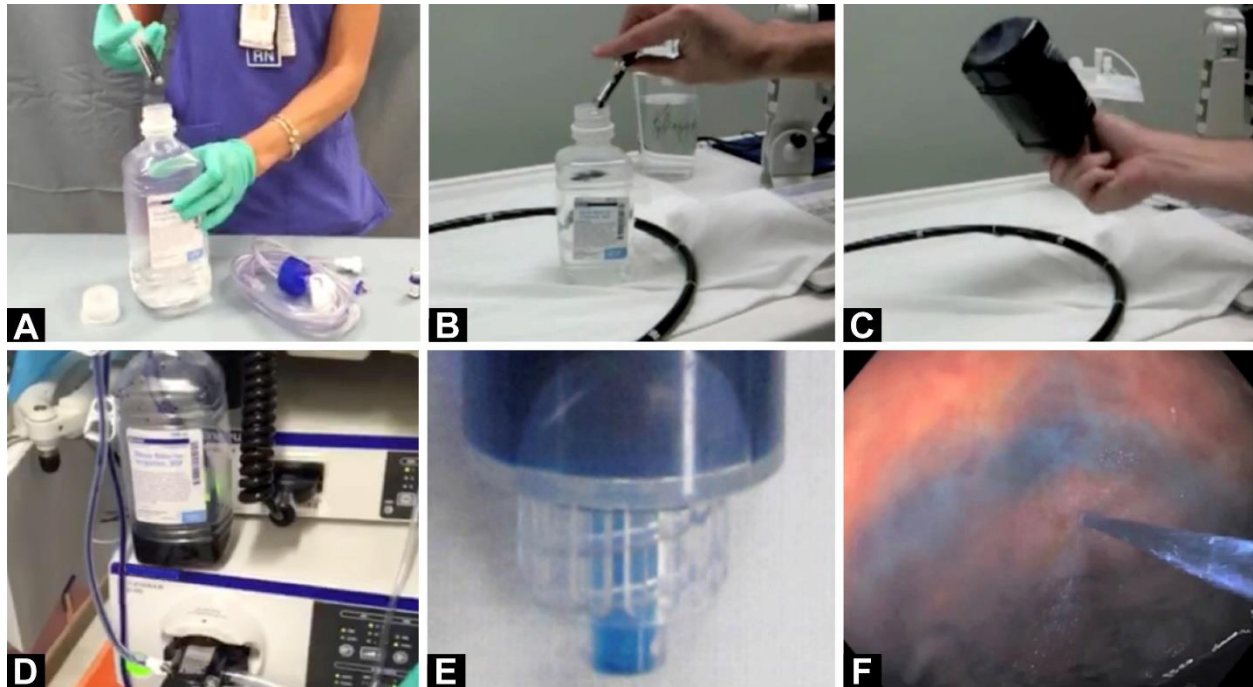2. Endoscopic retrograde cholangiopancreatography (ERCP): endoscopy and x-ray are combined to treat pancreatic and bile disease.

Patient undergoing ERCP
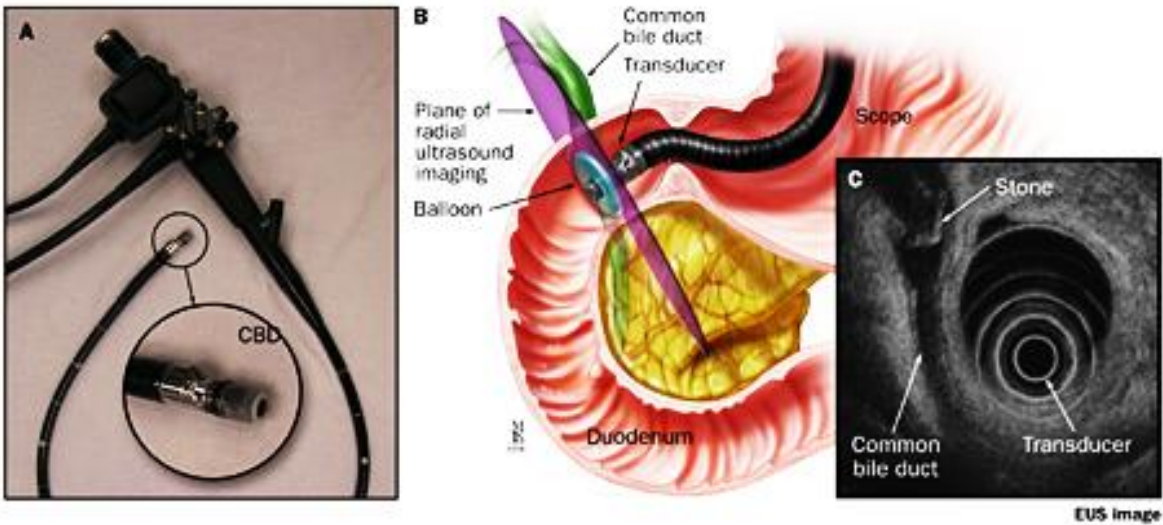

ERCP of the bile duct

ERCP of the pancreatic duct

Bile duct
Endoscope
Stomach
Gallbladder
Pancreatic duct
Pancreas
Duodenum

Dye injected into the bile duct (1) or pancreatic duct (2)

3. <mark>Chromo-endoscopy:</mark> dyes are installed before endoscopy to identify any lesions

4. <mark>Endoscopic ultrasound</mark>: high frequency sound waves are used to identify the digestive system and lung diseases

5. <mark>Narrow band imaging</mark>: filtered light is used for better visualization of internal organs.

Risks

- The main risks are infection, over-sedation, perforation, or a tear of the stomach or esophagus lining and bleeding. Although perforation generally requires surgery, certain cases may be treated with antibiotics and intravenous fluids.
- Occasionally, the site of the sedative injection may become inflamed and tender for a short time. This is usually not serious and warm compresses for a few days are usually helpful.