



## 1. Endoscope

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- Is the examination of internal body cavities using a specialized medical instrument called an endoscope.
- Is a medical tool used for diagnosis and treatment of human diseases by inserting through natural body orifices like mouth and nose.

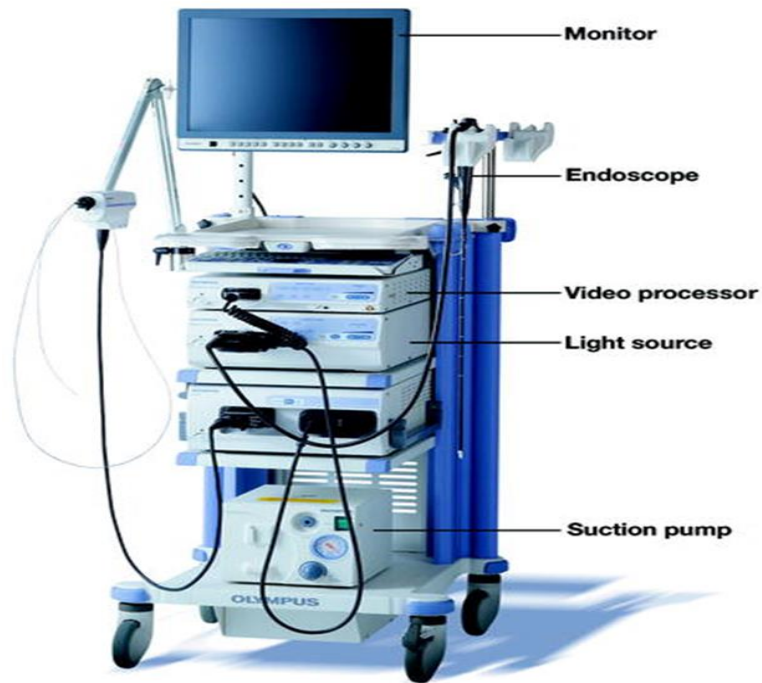
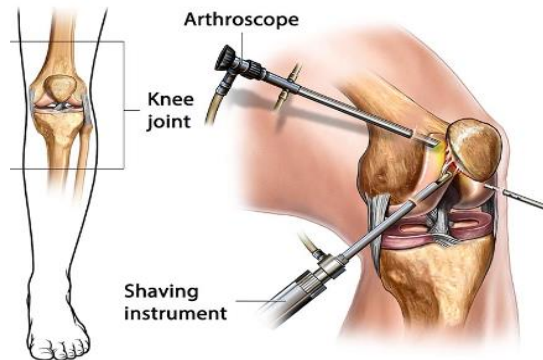


Fig1:endoscopy

- Depending on the body part, each type of endoscopy has its own special term, such as:
  - laparoscopy (abdomen, uterus, fallopian tube)
  - laryngoscopy (vocal cords)
  - bronchoscopy (lungs)
  - colonoscopy (colon)

- arthroscopy (joint)

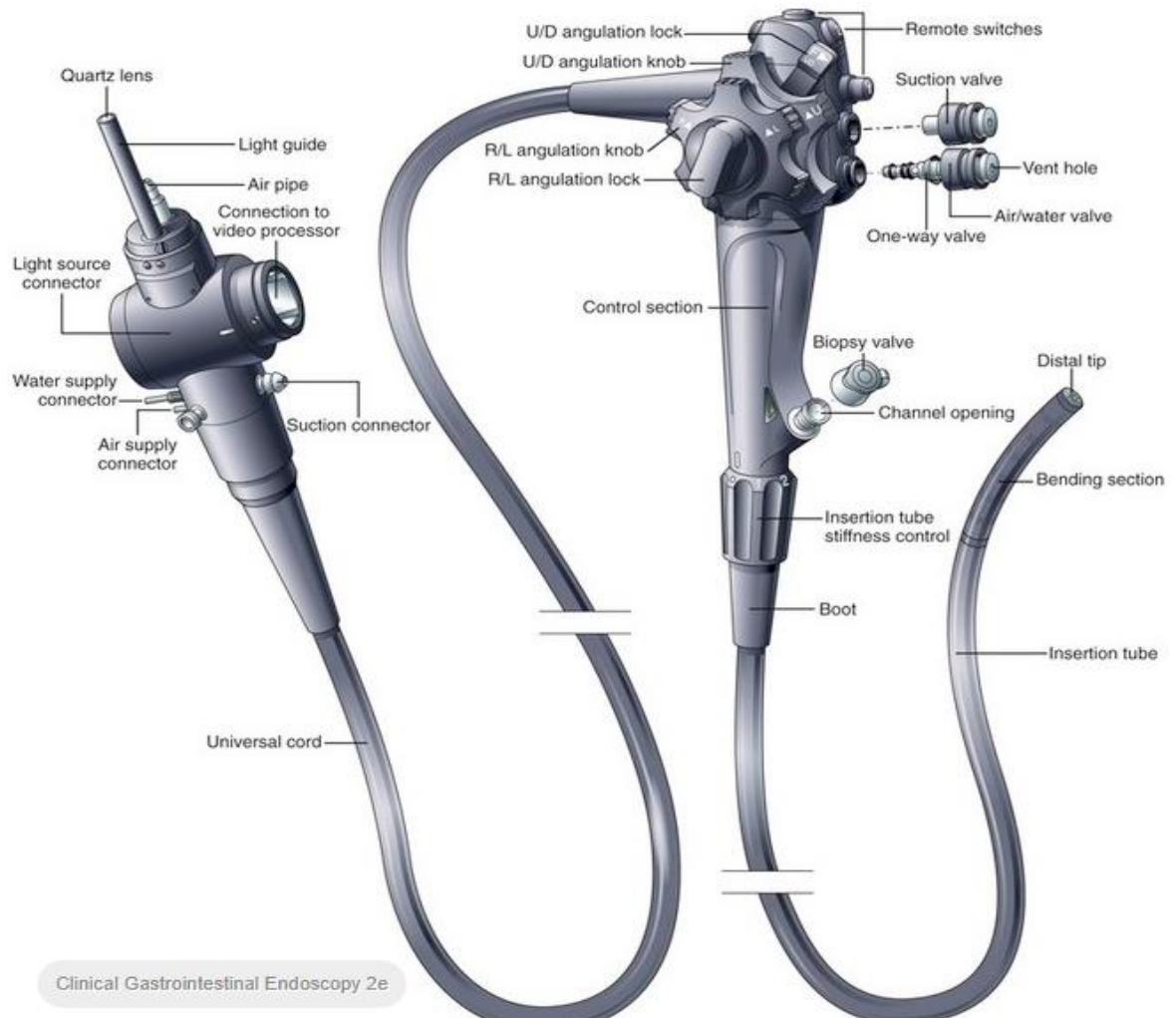


- Gastroscopy (stomach)



## 2. Basic components of an endoscope:

The total length of the upper endoscope is about 1.5 meters, and can be longer for a colonoscope or enteroscope. An umbilical cord connects the endoscope to the video processor, and contains the light guide, electrical connectors, and conduits for air, water, and suction.



Clinical Gastrointestinal Endoscopy 2e

Fig 2: The basic components of the device

### 2.1. Distal tip

The distal end of an endoscope contains the:

1. Optics that form the endoscopic images.
2. A large instrument channel is present for :
  - Delivery of instruments
  - Removal of tissue and suction.
3. The air/water channel directs:

- Either water flowing across the outer surface of the objective to clear debris
  - Or air to insufflate and expand the organ being examined.
4. The angulation control knobs for manipulating the distal end and the bending section contains a set of hinges that allow the distal tip to deflect at large angles as high as  $270^\circ$ .
  5. A lock for maintaining distal tip deflection
  6. Air/water and suction valves
  7. Remote switches for freezing, capturing, and storing images.

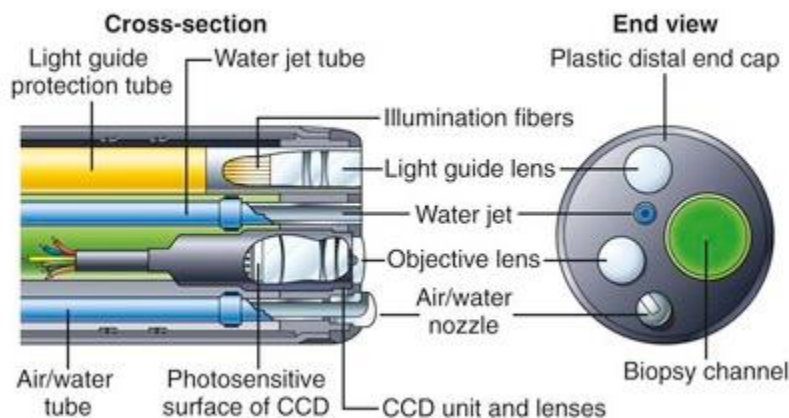


Fig 3: relative location of the distal tip components.

## 2.2. Insertion Tube

An exposed cross section of the insertion tube is shown in Figure 4, the outside consists of a:

1. Durable plastic covering capable of withstanding caustic bodily fluids, such as gastric acid and bile, and disinfectants for cleaning the instrument.
2. Under the covering is a wire mesh to prevent twisting or stretching during use.

3. Below the mesh are helically shaped steel bands that maintain the round shape and provide mechanical protection.
4. The contents of the insertion tube include the light guide, imaging bundle, angulation control wires, air and water pipes, and instrument channel.

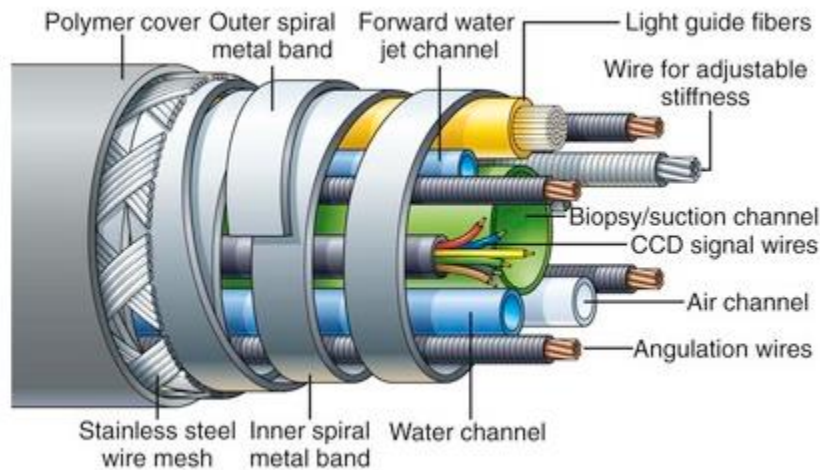


Fig 4: The components of the insertion tube.

### 2.3. The Objective Lens

- Function...

The objective lens can provide:

1. A large field of view
2. High image resolution.

- Components...

Since it is very difficult to achieve both of these requirements with a simple lens, endoscopes use multiple lenses to form the image.

1. A diverging lens (negative focal length) is needed to maximize the field of view.



2. A pupil is located behind the objective lens to block extraneous internal reflections.
3. An intermediate lens helps focus the image onto the detector.
4. An achromat corrects for chromatic aberrations so that all the colors in the visible spectrum will focus onto the same plane at the detector.

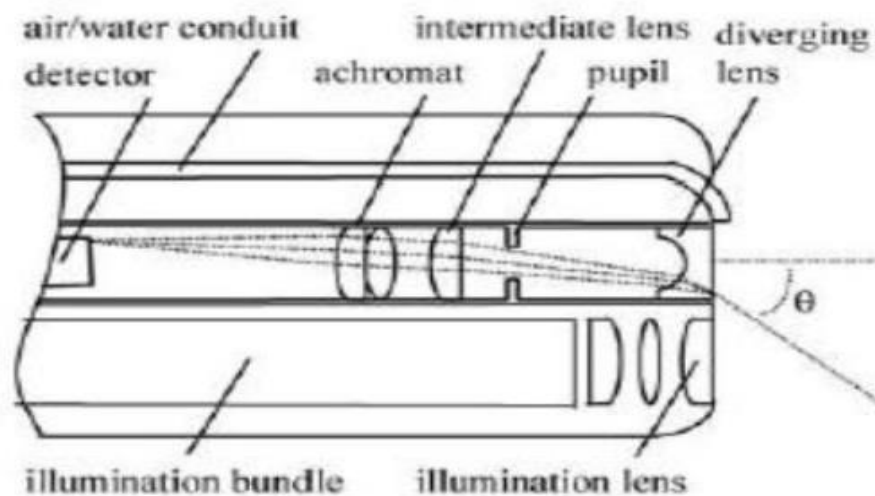


Fig 5: The objective lenses

#### 2.4. Angulation Control

The angulations are produced by a durable set of guide wires that deflect the distal end in four directions, termed up, down, left, and right, by convention.

\* The angulation control knobs are connected to a sprocket that moves the guidewires connected to the distal tip.

\* If desired, a brake can be applied to lock the position of the deflection.



## 2.5. Air, Water, and Suction Valves

An air pump in the light source provides air under mild pressure to a pipe protruding from the light source connector of the endoscope. This air is carried by an air channel (tube) to the air/water valve on the control section. If this valve is not covered, the air simply exits from a vent hole in the top of the valve (see Fig. 5). This vent hole allows the air pump to pump freely when air is not needed, reducing wear and tear on the pump. If the endoscopist wants to insufflate the patient, he or she covers the vent hole with a fingertip; this closes off the vent and forces air down the air channel, exiting the instrument through the nozzle on the distal tip. A one-way valve is incorporated into the shaft of the air/water valve (see Fig. 3.1) to hold air in the patient during examination. During endoscopy, the GI tract is typically insufflated to a pressure slightly above atmospheric pressure. If it were not for this one-way valve in the system, air from the organ under examination would flow back into the nozzle on the distal tip, up the air channel in the insertion tube, and out the hole in the air/water valve whenever the operator removed his or her finger from the valve. The antireflux valve is required to keep the patient insufflated.

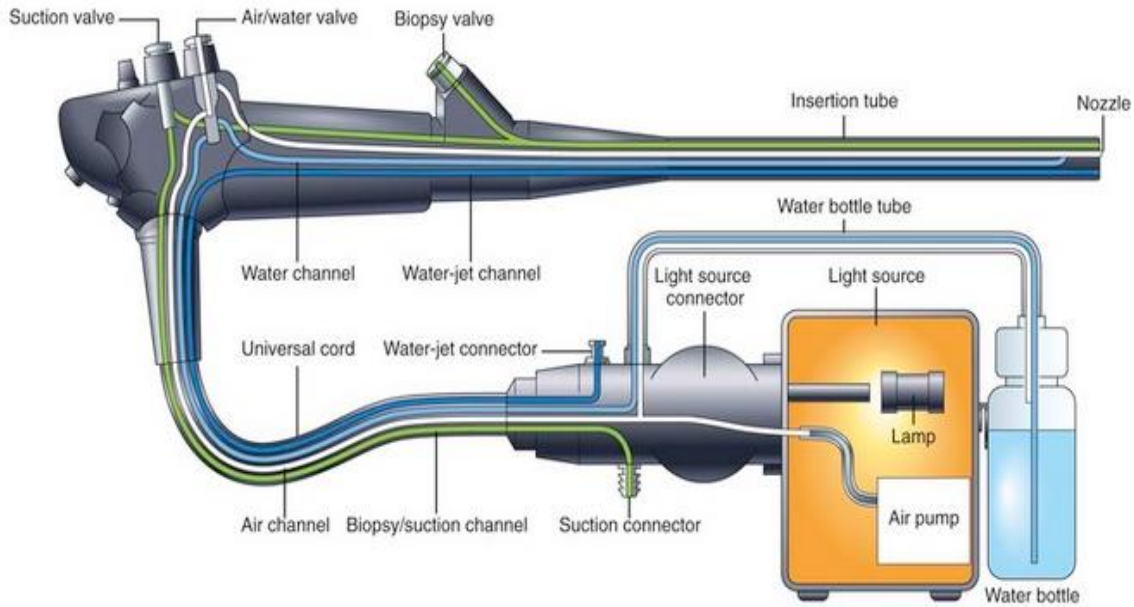


Fig 5: Configuration of air, water, and suction systems.

## 5. Block diagram of Endoscope

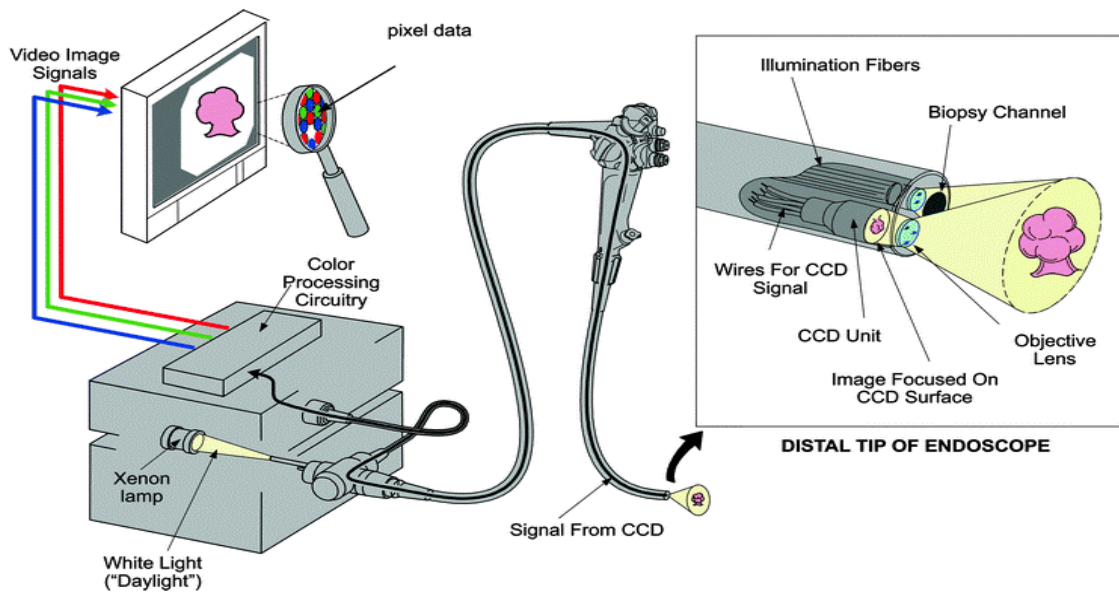


Fig 6: Block diagram of Endoscope