# Endoscope

The basic technology behind the modern endoscope was developed in the early 1950s by English physicist Harold Hopkins.

Endoscope is an instrument used to examine the interior of a hollow organ or cavity of the body. The device uses fiber optics and powerful lens systems to provide lighting and visualization of the interior of a joint. The portion of the endoscope inserted into the body may be rigid or flexible, depending upon the medical procedure.

Endoscopes may be rigid or flexible. The two types differ in appearance, but function in similar ways.

Flexible endoscopes are useful for looking at the digestive and respiratory tracts because they bend in places. They use fibre optics to shine light into the body.

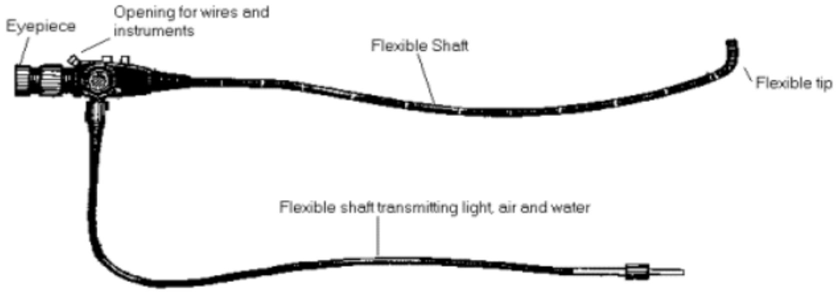
Rigid endoscopes are much shorter than flexible endoscopes. They are used to look at the surface of internal organs, and may be inserted through a small cut in the skin. Rigid endoscopes are commonly used to examine the joints.

***Components***

An endoscope consists of

- a rigid or flexible tub
- 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 a bundle of fiberoptics in the case of a fiberscope.
- an eyepiece.
- A camera transmits image to a screen for image capture.

- an additional channel to allow entry of medical instrument like foreceps, scissors,etc.




***Working***

Light from a bright lamp outside the patient's body shines into one of the endoscope tubes.

The light bounces along the walls of the fiber-optic endocope tube into the patient's body cavity.

The diseased or injured part of the patient's body is illuminated by the light shining in.

Light reflected off the body part travels back up a second fiber-optic tube, bouncing off the glass walls as it goes.

The light shines up into the physician's eyepiece so, looking down, the physician can see what's happening inside the patient's body

***Types of endoscopes***

Arthroscope: Joints

Bronchoscope: Esophagus and lung

Colonoscope: Colon and bowel

Cytoscope: Bladder

Duodenoscope: Small intestine

Esophagogastroduodenoscope: Esophagus, stomach and small intestine

Fetoscope: Womb

Gastroscope: Stomach

Hysteroscope: Womb

Laparoscope: Abdomen

Laryngoscope: Larynx

Rhinoscopy - examination of the inside of the nose.

Sigmoidoscope: Large intestine

Thoracoscope: Thorax

***Applications***

Endoscopy allows doctors to check for irritation, ulcers, inflammation and abnormal tissue growth in the internal organs. It can be used to close off a blood vessel or remove small growths.

# Foetal Monitor

The foetal monitor a device used during labour and birth, or during certain testing (non-stress test, contraction stress test, etc.) to record the baby's heart rate, and sometimes mother's contractions. It can be used intermittently or continuously. This type of foetal monitoring is usually carried out in birthing facilities. Electronic Foetal Monitors are used to detect and trace the foetal heart rate and uterine contractions. These are usually monitored at the same time however, each one can be obtained separately. In terms of electronic foetal monitoring, it is either external or internal. Electronic foetal monitoring is a valuable tool for measuring foetal well being and assessing labour progress.

Pinard´s stethoscope (simple wooden funnel) can still be used for this purpose. Electronic foetal monitoring was introduced during the 1970s with the advent of CTG (cardiotocography).

The information readily available is the heart rate and the heart sound signals. The condition of the foetus is assesses by studying the heart rate and blood flow.

**Cardiotocography**

Cardiotocography (CTG) is a technical method for recording (-graphy) the foetal heartbeat using ultrasound (cardio-) and the uterine contractions (-toco-) during pregnancy, typically in the third trimester. The machine which is used to perform the monitoring is called a cardiotocograph, commonly known as a foetal monitor.

Sensors are placed against the mother's abdomen and are connected to a heart rate monitor, which produces a record of the baby's heartbeat. Cardiotocography records changes in the foetal heart rate and their temporal relationship to uterine contractions.

An elastic belt is placed around the mother's abdomen. It has two round plates about the size of a tennis ball which make contact with the skin. One of these plates uses ultrasound to measure the baby's heart rate. The other measures the pressure in the abdomen and the mother's contractions.
The CTG belt is connected to a machine which interprets the signal coming from the plates. The baby's heart rate can be heard as a beating or pulsing sound which the machine produces.
It is normal for a baby's heart rate to vary between 110 and 160 beats a minute. This is much faster than an adult heart rate, which is about 60-100 beats per minute. A heart rate in a baby that doesn't vary or is too low or too high may signal a problem. Changes in the baby's heart rate that occur along with contractions form a pattern.
The pressure-sensitive contraction transducer, called a tocodynamometer (toco) has a flat area that is fixated to the skin by a band around the belly. The pressure required to flatten a section of the wall correlates with the internal pressure, thereby providing an estimate of it.

**Methods for monitoring FHR**

1. ***Abdominal Foetal ECG(AFECG)***

Electrodes are placed on the the mother’s abdomen and recordings of the combined maternal and foetal ECG are taken.  The electrodes are placed at the umbilicus and above symphysis.
The FHR is computed from FECG by shaping the QRS wave.
A number of difficulties are associated with recording the abdominal fetal ECG. They principally concern isolating the abdominal fetal ECG signal from the other electrical activity detected at the maternal abdomen. Noises from maternal muscles, amplifier noise, etc are also present. They can be decreased using notch filters.
The maximum amplitude of the fetal ECG signal at the maternal abdomen is about 100-300μv. This is a fraction of the maternal ECG amplitude recorded at the maternal -abdomen.

2. ***Foetal PCG***

Heart sounds are picked up by highly sensitive microphones. They are amplified by low noise amplifiers and filtered by band pass filters.

3. ***FHR measurement by Ultrasound***

Doppler fetal heart rate monitor is a hand-held ultrasound transducer used to detect the fetal heartbeat for prenatal care. It uses the Doppler effect to provide an audible simulation of the heart beat.

It derives the rate of foetus heart from blood flow signals and displays it.

US frequency used is 2-2-5 MHz. Hand held probes with piezoelectric crystals are used. Sound can be heard through loud speakers.

The advantage of the Doppler fetal monitor is the electronic audio output, which allows people other than the user to hear the heartbeat. One disadvantage is the greater complexity and cost and the lower reliability of an electronic device.

4. ***FHR using direct FECG***

FHR is measured by placing electrodes directly on the foetus by making an incision on the mother's abdomen. Electrodes used are scalp, suction and clip electrodes.

# Oximetry

Oximetry is a noninvasive method for monitoring a person's oxygen saturation (SpO2).

Oxygen saturation is an indication of the cardio-pulmonary functions.

**Principles of Pulse Oximetry**

The principle of pulse oximetry is based on the red and infrared light absorption characteristics of oxygenated and deoxygenated hemoglobin. Oxygenated hemoglobin absorbs more infrared light and allows more red light to pass through. Deoxygenated (or reduced) hemoglobin absorbs more red light and allows more infrared light to pass through. Red light is in the 600-750 nm wavelength light band. Infrared light is in the 850-1000 nm wavelength light band.

Pulse oximetry uses a light emitter with red and infrared LEDs that shines through a reasonably translucent site with good blood flow. Typical adult/pediatric sites are the finger, toe, pinna (top) or lobe of the ear. Infant sites are the foot or palm of the hand and the big toe or thumb. Opposite the emitter is a photodetector that receives the light that passes through the measuring site.

There are two methods of sending light through the measuring site: transmission and reflectance. In the transmission method, the emitter and photodetector are opposite of each other with the measuring site in-between. The light can then pass through the site. In the reflectance method, the emitter and photodetector are next to each other on top the measuring site. The light bounces from the emitter to the detector across the site. The transmission method is the most common type used and for this discussion the transmission method will be implied.

After the transmitted red (R) and infrared (IR) signals pass through the measuring site and are received at the photodetector, the R/IR ratio is calculated. The R/IR is compared to a "look-up" table (made up of empirical formulas) that convert the ratio to an SpO2 value. Most manufacturers have their own look-up tables based on calibration curves derived from healthy subjects at various SpO2 levels. Typically a R/IR ratio of 0.5 equates to approximately 100% SpO2, a ratio of 1.0 to approximately 82% SpO2, while a ratio of 2.0 equates to 0% SpO2.

## Types Of Oximetry

Two types of oximetry are there – invitro and invivo oximetry.

### *Invitro Oximetry*

The oxygen saturation is measured by taking the blood out of the body and measuring in a lab.

### *Invivo oximetry*

The oxygen saturation of the blood is measured while blood is flowing through the vascular system by means of transducers.