Endoscopic Anatomy Of The Gastrointestinal Tract

Essay

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List of Abbreviations

GERD …….. Gastro-oesophageal reflux disease.

ERCP …… Endoscopic retrograde cholangio-Pancreatography.

EGD ……. Esophago-gastroduodenoscopy.

SCJ ……... Squamo-columnar junction.

GOJ …….. Gastro-oesophageal junction.

LOS …….. Lower oesophageal sphincter.

EUS …….. Endoscopic ultra-sound.

IBD ……... Inflammatory bowel diseases.

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Introduction:

Progress in endoscopic technology has advanced the practice of medicine as it relates to gastro-intestinal tract. Over the last thirty years, clinicians have acquired unprecented access to gastro-intestinal lumen and pancreatic and biliary ductal systems. Direct examination of mucosal surface provides far greater information than that gained by other ways of examination. Further, endoscopic diagnosis and treatment of conditions have now supplanted many open surgical procedures. Ongoing technical improvements and innovations continue to extend potential endoscopic therapies (**American society for gastro-intestinal endoscopy, 2000**).

Endoscopic examination of gastro-intestinal tract is used in diagnosis of many diseases like diagnosis of gastroesophageal reflux disease "GERD" by detecting the anatomical changes around gastroesophageal junction in the form of detecting the presence of some degree of hiatal herniation (**Kim et al., 2008)**.

Endoscopy also used in detecting the anatomical variants in the pancreatic duct and biliary tract and differentiate them from another lesions by endoscopic retro-grade cholangiopancreatography “ERCP” (**Gulliver et al., 1991)**.

Aim of work:

The present study aims at providing a detailed description of the endoscopic anatomy of the gastrointestinal tract. Such description might help to overcome the challenges and complications which accompany the usage of endoscopy.

History of endoscopy

The word "endoscopy" is derived from the Greek by combining the prefix "endo" meaning "within" and the verb "skopein", "to view or observe". The result is an adequate term for the procedure of peering into the recesses of the living body. But "skopein" means not merely to look at something, but rather to view with a purpose, to observe with intent and to monitor **(Majumdar, 1993).**

Endoscopy is a medical procedure that uses tube-like instruments (called endoscopes). These are introduced into the body to look inside. This procedure is different from imaging tests, like x-rays and CT scans, which can get pictures from the inside of the body without putting instruments into it **(American cancer society, 2010).**

Endoscope, was used as early as the ancient Roman and Greek periods. An instrument considered a prototype of endoscopes was evidenced and discovered in the ruins of Pompeii **(Olympus corporation, 2011)**.

Philip Bozzini in 1805 made the first attempt to observe the living human body directly through a light guiding tube he created known as a Lichtleiter (**Fig. 1**) to

examine the urinary tract, rectum and pharynx. A system of lenses illuminated by candlelight. Subsequent instruments were designed based on the same principle: a light source external to the body created a light beam that was directed by lenses and mirrors towards the cavity **(Cadranel and Mougenot, 2006).**

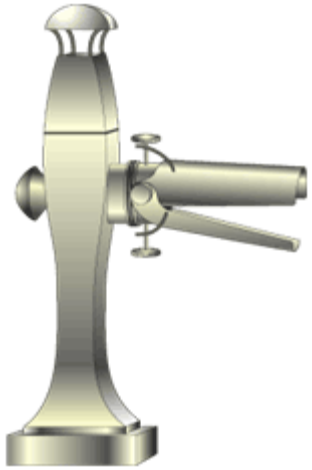


Fig.1: A diagram showing Lichtleiter (light guiding instrument) invented by Bozzini **(Olympus corporation, 2011)**.

In 1853, Antoine Jean Desormeaux of France developed an instrument specially designed to examine the urinary tract and the bladder. He named it "endoscope" (**Fig.2**) and it was the first time to use this term in history **(Olympus corporation, 2011).**

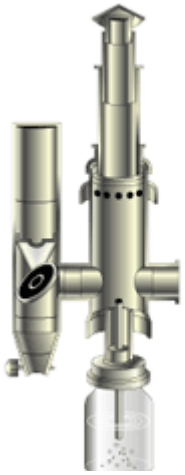


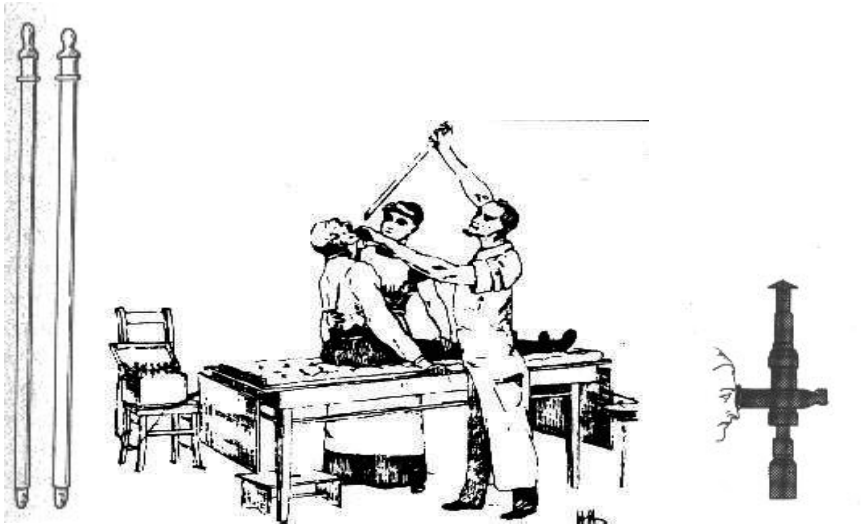
Fig.2: A diagram showing the endoscope invented by Desormaux **(Olympus corporation, 2011).**

The well-known instrument maker, Charriere, built the endoscope, and their name is still used to express the caliber of probes (French units) **(Cadranel and Mougenot, 2006).**

The Irish urologist Francis Richard Cruise (1834–1921) improved the illumination system and was able to examine not only the urinary tract, but also the rectum **(Cadranel and Mougenot, 2006).**

After a series of trials, Dr. Adolph Kussmaul of Germany succeeded in taking a look inside the stomach of a living human body for the first time in 1868. This was tested on a sword-swallower, who could swallow down a

straight, 47-centimeter long metal tube with a diameter of 13 millimeters (**Fig.3 A,B,C**) **(Olympus corporation, 2011).**



A B C

Fig.3: A diagram showing Kussmaul's Instrument (**Achord et al., 2005**).

However, all these early instruments were of limited use because they could not deliver enough light to the site of examination. They remained unsatisfactory until Thomas Edison invented the electric bulb in the United States at 1880. **(Cadranel and Mougenot, 2006).**

Gustave Trouvé (1838–1902), a French engineer, was the first to use internal illumination in 1873 to see the

human body cavities with his polyscope, commercialized under the name Eureka (in French j'ai trouvé means "I found"). This instrument could not be used for prolonged periods of time because of the heat generated by the light bulb **(Cadranel and Mougenot, 2006).**

Ten years later, two doctors named Max Nitze and Josef Leiter invented a cystourethroscope. In 1881, Johann von Mikulicz and his associates created the first rigid gastroscope for practical applications. This instrument, which was angulated to compensate for the anatomical angulations of the human esophagus, was equipped with a water circulation system to cool the light bulb and had channels for the light source and to introduce air **(Cadranel and Mougenot, 2006).**

In 1932, Dr. Rudolph Schindler invented a flexible gastroscope, a modified version of the earlier ones that allowed examinations even while the tube is bent. This tube was 75 centimeters in length and 11 millimeters in diameter. About 1/3 of the entire length of the tube toward the tip could bend to a certain degree. Rudolph Schindler examined the inside of a stomach through numerous lenses positioned throughout the tube with a miniature light bulb (**Fig. 4**) **(Olympus corporation, 2011).**

Fig.4: A Photograph showing the Gastroscope of Schindler (left) and detail of its tip (right) with an light bulb attached (arrow) **(Olympus corporation, 2011).**

Rudolf Shindler's Semiflexible endoscope was further modified through collaboration with instrument-maker Georg Wolf from Erlangen and named Schindler-Wolf flexible gastroscope**.** The rigid proximal part was followed by a flexible distal part composed of 6 units of 6 lenses, each with a total optical system containing 51 optical elements **(Cadranel and Mougenot, 2006).**

Despite the increased flexibility of the Schindler-Wolf gastroscope compared to the rigid instruments, some areas of the stomach could not be seen. In 1955, the Frenchman Charles Debray developed "Gastroflex". The flexibility was greatly improved over earlier instruments, the diameter was reduced to 10 mm, and the light was sufficient to take good photographs **(Cadranel and Mougenot, 2006).**

Fiberoptic endoscopy was pioneered by South African-born physician Basil Hirschowitz at the University of Michigan in 1957. Widespread use of fiberoptic endoscopes began in the 1960s. A fiberoptic cable is simply a bundle of microscopic glass or plastic fibers that literally allows light and images to be transmitted through curved structures **(Imaginis, 2008).**

Types of endoscopes

The two main categories of endoscopy are rigid and flexible endoscopes. Specific endoscopes are named after body parts being viewed like a colonoscope is used to view the colon.

Rigid endoscopes provide the best resolution images. They are made of a solid metal tube using lenses for imaging and fiber optics for lighting. Rigid endoscopes do not bend and are used for viewing parts of the body accessible to a rigid piece of equipment. This type of endoscopy equipment is used to view joints, some female reproductive organs, and the ear, nose and throat. Colonoscope is the other example of this type of endoscopy equipment (**Imaginis, 2008**).

Flexible endoscopes allow viewing of interior portions of the body not accessible using a rigid endoscope.

Fiberoptic using glass or plastic fiber bundles, takes the place of lenses. Optical clarity and resolution depend on the type of fiber used; the best quality images are generally provided by fused quartz fibers. Bronchoscopes, used to view the interior of the trachea and bronchi are an example of a flexible endoscope (**Imaginis, 2008**).

The types of endoscopes specific for gastrointestinal tract are named for body parts being viewed and they are: Colonscopy, ERCP, EGD.

- **Colonoscopy:** This type used for examination of the inside of the colon and large intestine to detect polyps, tumors, ulceration, inflammation, colitis diverticula, Chrohn's disease, and discovery and removal of foreign bodies **(Imaginis, 2008)**.

Endoscopic retrograde cholangio-pancreatography (ERCP):

This type uses endoscopic guidance to place a catheter for x-ray fluorosocopy with contrast enhancement. This technique is used to examine the liver's biliary tree, the gallbladder, the pancreatic duct to check for stones, other obstructions and disease. X-ray contrast is introduced into these ducts via catheter and fluoroscopic x-ray images are