COMPARISON BETWEEN PARTIAL AND COMPLETE LAPAROSCOPIC WRAP SURGERY FOR PATIENTS WITH GASTRO-OESOPHAGEAL REFLUX DISEASE

Thesis

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SURGICAL ANATOMY OF THE OESOPHAGUS

The oesophagus is a hollow muscular tube, which is about 25 cm long, and connects the pharynx to the stomach. It commences in the neck at the level of the lower border of the cricoid cartilage (C6), and descends in the superior and posterior mediastinum, ending in the abdomen at the cardiac orifice of the stomach (T10 and left 7th costal artilage) ***(Shimi, 2002).***

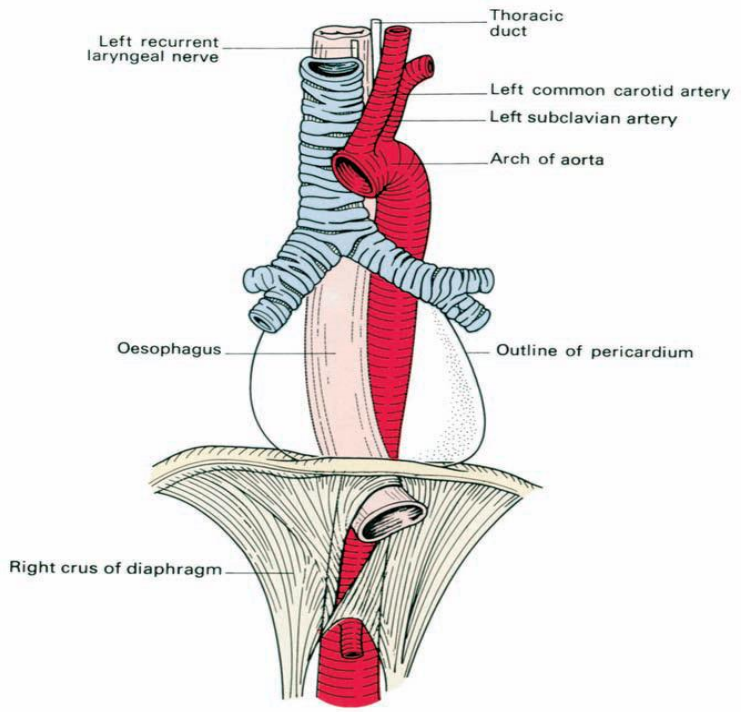

Fig.1. Anatomy of the oesophagus.

Development of the oesophagus:

The oesophagus develops from the distal part of the primitive fore-gut. From the floor of the fore-gut also differentiate the larynx and trachea, first as a groove (the laryngotracheal groove) which then converts into a tube, a bud on each side of which develops and ramifies into the lung ***(Skandalakis and Ellis, 2000)***

ANATOMY

The oesophagus is the narrowest segment of the gastro intestinal tract, other than the appendix. It is a delicate organ that is able to expand and to permit solid food to enter the stomach. From an embryologic and anatomic standpoint, the oesophagus may be divided into two surgical units: (1) the proximal, from the pharyngo-oesophageal junction to the carina, and (2) the distal, from the carina to the gastric cardia, but the distal surgical unit should include the proximal two thirds of the stomach ***(Skandalakis and Ellis, 2000)***.

The most useful reference point during upper gastro-intestinal tract endoscopy is the upper incisors, which are approximately in adult 14 cm above the pharyngo-oesophageal junction, 25 cm above the tracheal bifurcation, and 38 to 44 cm above the gastric opening ***(Peters and DeMeester, 1997)***.

DISTAL OESOPHAGUS

Immediately below the tracheal bifurcation the oesophagus follows the curvature of the spine and remains in close contact with the vertebral bodies. From the eighth thoracic vertebra downward, it moves vertically away from the spine to pass through the hiatus of the diaphragm at the level of the tenth thoracic vertebra to become the abdominal oesophagus which includes a portion of the lower oesophageal sphincter and ends at the gastro-oesophageal junction, leveled with the eleventh thoracic vertebra ***(Sinnatamby, 1998)***.

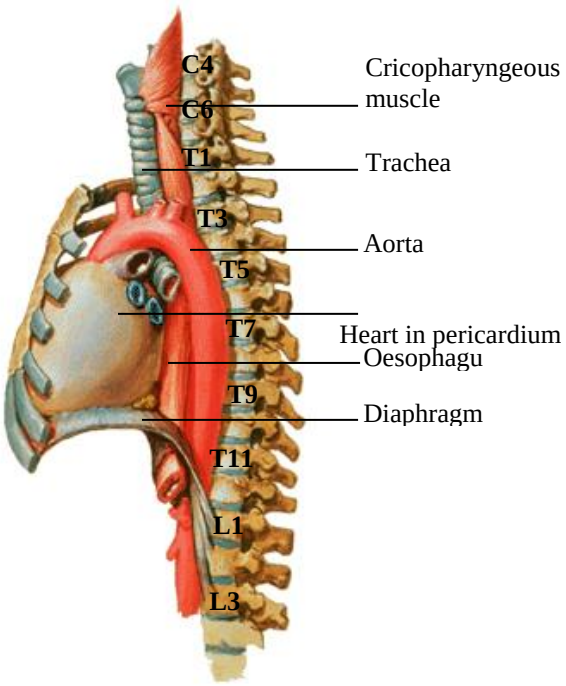

Fig.2. Vertebral landmarks of oesophagus ***(Ferner and Staubesand, 1974)***.

In the thorax the pericardium, together with the underlying left atrium and the left vagal trunk, form the close anterolateral limit of the oesophageal wall. Dorsally and toward the right, the azygos vein, the thoracic duct, and the right vagus nerve lie parallel to the oesophagus. The thoracic duct crosses from the right to the left just above the arch of the azygos, at the level between the fourth and the fifth thoracic vertebrae. The descending aorta and hemiazygos veins are dorsal and to the left ***(Liebermann-Meffert and Duranceau, 1994)***. The right pleura is in contact with the lower part of the oesophagus, almost to the diaphragmatic hiatus ***(Skandalakis and Ellis, 2000)***.

ABDOMINAL OESOPHAGUS

The abdominal oesophagus is often described as an inverted funnel or cone, which inclines to the left before joining the stomach at an angle called cardiac angle or angle of His. The abdominal oesophagus is said to be 0.5 to 2.5 cm in length ***(Skandalakis and Ellis, 2000)***.

In its short abdominal portion, the oesophagus lies to the left of the midline at the level of the 11^{th} or 12^{th} thoracic vertebra. It is partially covered by peritoneum infront and on its left lateral wall. The oesophageal impression of the left lobe of

the liver applied to the anterior surface of the abdominal oesophagus and to its right the caudate lobe ***(Polk, et al., 1999)***.

The abdominal oesophagus maintains a close proximity to many important structures, including the left and right vagus nerves, which travel laterally to the oesophagus as far as the lower thoracic region, where they rotate to anterior and posterior positions, respectively. On mobilization of the distal oesophagus care must be taken not to damage the anterior vagal trunk during the dissection of the peritoneal covering. It is palpable as a thin cord closely adherent to the anterior surface of the oesophagus, and as it passes inferiorly it crosses to the right ***(Polk, et al., 1999)***. Posteriorly, the abdominal oesophagus is related to the left inferior phrenic artery and vein when it drains into the inferior vena cava, and one or both crura of the diaphragm separate it from the aorta ***(Skandalakis and Ellis, 2000)***.

GASTRO-OESOPHAGEAL JUNCTION

The gastro-oesophageal junction constitutes a complex anatomic and functional entity that drives its importance from its anatomic situation at the bounds of the thorax and abdomen and from its role in prevention of gastro-oesophageal reflux. It is ill defined because the internal histologic junction does not

coincide with the external junction ***(Atkins and Pappas, 2004 and Boyce, 2000)***.

The external junction lies in the abdomen just below the diaphragm at the lower sheet of the phreno-oesophageal membrane ***(Skandalakis and Ellis, 2000)***. The only reliable and constant anatomical landmark of this junction is made by the sling or oblique muscle fibers of the stomach, but this cannot be identified endoscopically ***(Shimi, 2002)***.

The internal junction between the oesophagus and stomach, which is known as the squamocolumnar junction, shows an abrupt change in appearance from the smooth white, opaque, parchment like mucous membrane of the oesophagus to the mammillated, pink, mucous covered lining the stomach. This line of the junction appears endoscopically as a serrated line, which called "Z-line" ***(Boyce, 2000)***. In a living adult, ***Shimi (2002)*** reported that this line of union situated within one to four cm of the anatomical junction.

By endoscopy the SCJ normally lies at or below the diaphragmatic hiatus. With intraluminal inflation during endoscopy, cephalad migration of this junction occurs as the mucosal folds of the gastric cardia moves to the level of the hiatus and cephalad for lower oesophageal sphincters less than 2 cm above the level of the hiatus. Proximal displacement of

the upper margin of these folds 2 cm or more above the hiatus is an endoscopic criterion for diagnosis of a hiatal hernia ***(Boyce, 2000)***.

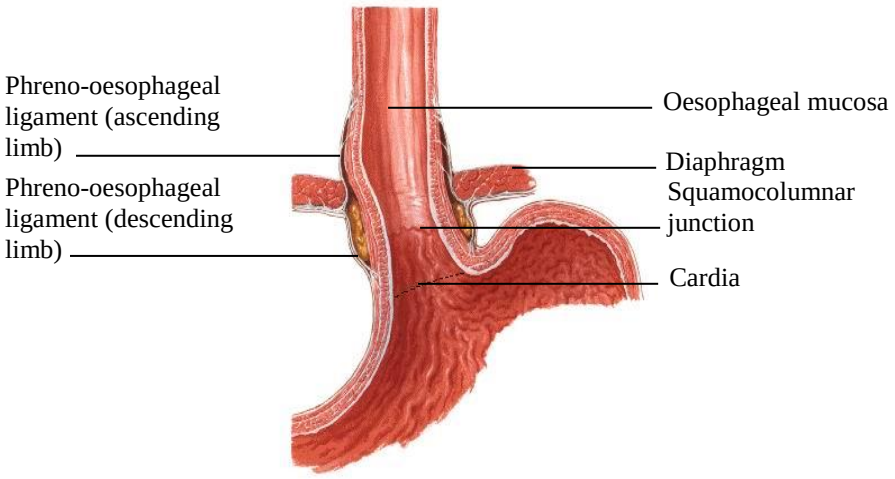

Fig.3. Anatomy of the gastro-oesophageal junction
(Ferner and Staubesand, 1974).

The gastro-oesophageal junction is subdivided into the supradiaphragmatic portion, the inferior oesophageal constriction, the vestibule and the cardia. Radiologically, the supradiaphragmatic portion consists of an ampulla and the empty segment just distal to it. The ampulla is not an anatomical dilatation, and during barium swallow it appears to momentarily expand just before the lower oesophageal sphincter relaxes. The inferior oesophageal constriction consists of a concentric narrowing of the oesophageal lumen, present at the level of the diaphragmatic hiatus about 2 cm from the GOJ.

It is not synonymous with the lower oesophageal sphincter, although the later extends to include this region. The vestibule is the intra-abdominal segment of the oesophagus. The cardia denotes the junction between the oesophagus and the stomach ***(Shimi, 2002)***.

LOWER OESOPHAGEAL SPHINCTER

Because one may stand on ones head without losing the gastric contents, it follows that a sphincter like mechanism that normally permits swallowing but not reflux exists in vicinity of the cardiac orifice of the stomach. Since no specialized muscular ring such as found at the pylorus guard this orifice, the discovery in 1950 and subsequent study of a zone of high pressure at the lower part of the oesophagus quickly led to the idea that a true physiologic sphincter (the lower oesophageal sphincter) regulates precisely and predominantly the function of this region ***(Skandalakis and Ellis, 2000).***

Several other structures have been held responsible for closing the cardia, they include: the angle of His; pinchcock action of the right crus of the diaphragm; a plug of loose oesophageal mucosa (the mucosal rosette); the phreno-oesophageal membrane; and the sling of oblique fibers of the gastric musculature ***(Skandalakis and Ellis, 2000).***

Lerche (1950) described a slight thickening of the circular musculature of the distal oesophagus. He found that a muscular thickening of the inner circular coat is formed at the posterior oesophageal wall, 2 or 3 cm just above the gastro-oesophageal junction, which they call the "oblique gastro-oesophageal ring". From this ring the fibers arranged in semicircular bundle and continue down the lesser curvature of the stomach approximately 2.5 cm. These semicircular bundle are designated by the authors as the "Clasps of Liebermann-Meffert".

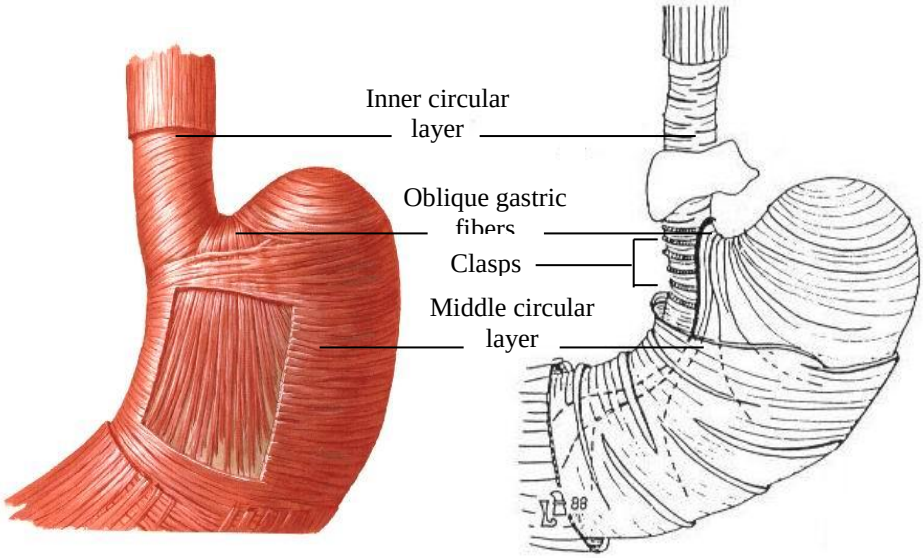

Fig.4. Architecture of the muscle layers at the gastro-oesophageal junction (longitudinal layer not viewed)

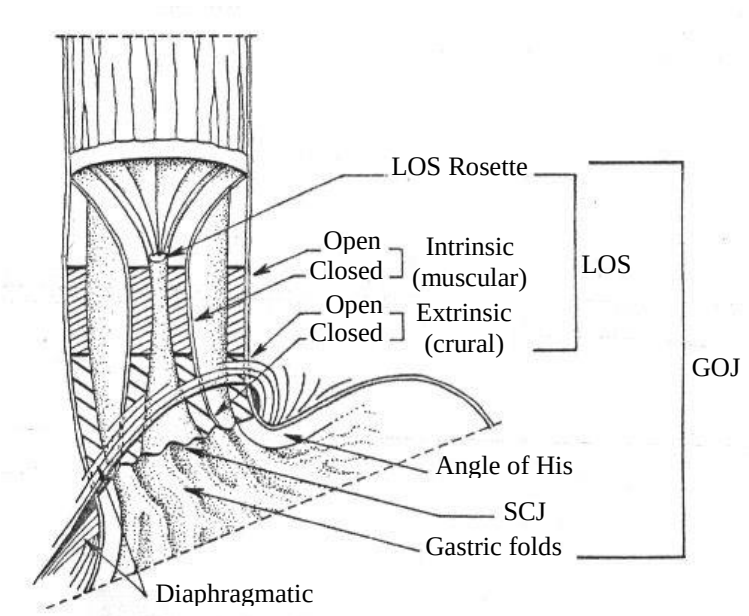

Fig.5. Structures augmenting the action of LOS

The angle of His varies between 30° and 70° in healthy subjects. It is lined with a mucosal valve (Goubarov's valve). On the other hand, the sling or oblique fibers of the stomach arranged in a C-shaped fashion, with its closed side located on the greater curvature. This conformation of muscle fibers together with the mucosal valve result in a flap valve mechanism by which pressure in the gastric fundus creates a flap that presses against the lower end of the oesophagus, augmenting the lower oesophageal sphincter pressure ***(Mann, et al., 1964)***.

GASTRIC FUNDUS

The fundus of the stomach can be arbitrarily defined as the segment of the stomach above an imaginary line drawn horizontally through the point of the angle of His. Its height above this point is 2 to 5 cm. The configuration of the fundus is usually round but occasionally it is short and conical, which makes manipulations such as fundoplication difficult. The fundus is incompletely covered with peritoneum on the posterior surface. The extent of this bare area is 0 to 40 cm square; a large bare area can be also a limiting factor in mobilization of the fundus ***(Martin, 2002)***.

HISTOLOGY OF THE OESOPHAGUS

The esophagus consists of four layers:

The fibrous adventitia is irregular, and consists of loose areolar connective tissue cotaining elastin fibers. The looseness permits considerable movement of the oesophagus during swallowing. The muscular layer is composed of an outer thickened longitudinal and an inner circular layer. The longitudinal fibers surround the whole length of the oesophagus with a continous coat except postero-sueriorly where the longitudinal fibers separate and sweep round to the anterior