

MANAGEMENT OF OESOPHAGEAL MOTILITY DISORDERS

An Essay

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BY
EHAB AHMED MOHAMED HAFEZ

Supervised by
Ass. Prof. M. ALAA OSMAN
Assistant Professor of General Surgery
Faculty of Medicine
Ain Shams University



Assistant Supervisor
Dr. KHALED GAWDAT
Lecturer of General Surgery
Faculty of Medicine
Ain Shams University

FACULTY OF MEDICINE
AIN SHAMS UNIVERSITY



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TABLE OF CONTENT

	PAGE
INTRODUCTION	
1- ANATOMY OF THE ESOPHAGUS	1 - 8
2- PHYSIOLOGY OF THE ESOPHAGUS	9 - 22
3- PATHOPHYSIOLOGY OF THE ESOPHAGEAL MOTILITY DISORDERS	23 - 37
4- DIAGNOSIS OF THE ESOPHAGEAL MOTILITY DISORDERS	38 - 55
5- MANAGEMENT OF THE ESOPHAGEAL MOTILITY DISORDERS	56 - 104
6- CONCLUSION AND SUMMARY	
7- REFERENCE	
8- ARABIC SUMMARY	

INTRODUCTION

INTRODUCTION

Esophageal motility is a unique problem, its importance arises from careful history and diagnosis.

Primary motility disorders can be caused by diffuse spasm, nutcracker esophagus and commonly by achalasia. Oropharyngeal dysfunction also causes a motility disorder. Diagnosis of these disorders depend mainly on the manometric study. Surgical management is the major therapy for these motility disorders.

The aim of this essay is to spot light on different views like : Anatomy, physiology of esophagus, pathology, diagnosis and treatment of the esophageal motility disorders.

ANATOMY OF THE ESOPHAGUS

Anatomy of the Esophagus

The esophagus is the narrowest tube of the alimentary tract. It ends by widening into its most voluminous part, the stomach. At rest the upper and middle parts of the esophagus are flat with a diameter of 2.5 by 1.6 cm., while the lower part is rounded with a diameter of 2.5 by 2.4 cm., (Duranceau and Mefert, 1991).

The esophagus begins in the neck at the caudal border of the cricoid cartilage, opposite the sixth cervical border where it is continuous with the pharynx passing anterior to the vertebral column and pierces the diaphragm level at the tenth thoracic vertebra, (Warwick, et al., 1989).

In adults, the length of the esophagus ranges from 22 to 28 cm, of which 2 to 6 cm are located in the abdomen. However, the length of the esophagus is related to height rather than to sex, (Duranceau and Mefert, 1991).

Anatomically there are four sites of constrictions, first at its commencement about 15 cm from the incisor teeth, second site is about 22.5 cm from the incisor teeth where it is crossed by the aortic arch, third constriction is few from the incisor teeth about 27.5 cm as it is crossed by the left principal bronchus and the last site where it pierces the diaphragm 40 cm from the incisors, (Fig. 1-1). Clinically these sites are important with the passage of instruments along the esophagus, (Warwick, et al., 1989).

Functionally there are two constrictions, the upper and the lower esophageal sphincters and by manometric study the upper sphincter lies between 14 and 16 cm from the incisors and the lower one is between 40 and 45 cm from the incisors, (Duranceau and Mefert, 1991).

The upper esophageal sphincter is formed of cricopharyngeus muscle, which is the lower transverse part of the inferior constrictor muscle. It extends uninterruptedly from one side of the cricoid arch to the other around the pharynx without any raphe but the upper oblique part of the inferior constrictor arises from the oblique line of the thyroid cartilage to the midline raphe and it is called thyropharyngeus. The cricopharyngeus muscle prevents air from being sucked into the upper esophagus when intrathoracic pressure falls, (McMinn, 1990).

During swallowing thyropharyngeus muscle propels the contents downwards while cricopharyngeus muscle relaxes. Incoordination of this action, with failure of the cricopharyngeus to relax will increase the pressure in the pharynx resulting in a pharyngoesophageal diverticulum, (Bremner, 1986).

This diverticulum protrudes through a potentially weak point in the posterior pharynx, (Fig. 1-2), between the oblique fibres of the thyropharyngeus and the more horizontal fibres of the cricopharyngeus forming the boundaries of Killian's triangle, (Orringer, 1991).

Killian observed that a pharyngeal diverticulum always pouches above and never below the cricopharyngeus muscle, (McMinn, 1990).

The general direction of the esophagus is vertical, so it is median at its commencement then it inclines slightly to the left side at the root of the neck. At the level of the fifth thoracic vertebra, it passes again to the median plane. Then it deviates to the left at the seventh thoracic vertebra and lastly it turns anteriorly to the esophageal opening in the diaphragm, (Warwick, et al., 1989).

The cervical part of the esophagus is better approached via a left sided cervical incision because the left border of the esophagus extends beyond the trachea, (Bremner, 1986).

Anson and Mc Vay, 1984, said that the thoracic part of the esophagus is approached from the right side and the azygos vein is the only structure that impedes exposure of the esophagus on the right side and this can be divided while the arch of the aorta presents a major obstacle on the left, (Fig. 1- 3).

The thoracic duct crosses behind the esophagus from 7th to 5th thoracic vertebrae and then continues up along its left border and care must be taken not to injure it during dissection of the esophagus otherwise its ends should be tied, (Bremner, 1986).

The posterior part of the abdominal esophagus has a serous coat which is not firmly attached and is stripped up slightly when the abdominal esophagus elongates, (McMinn, 1990).

It has been found that there is a slight thickening of the circular musculature of the distal esophagus, which is not a true anatomical sphincter but it guards the cardiac orifice. However, there is a variety of other structures which are responsible for closing the cardia like the angle of His at which the esophagus enter the stomach, the pinch - cock action of the diaphragm, a plug of loose esophageal mucosa (mucosal rosette), the phrenoesophageal membrane, (Fig. 1-4), and finally, the sling of oblique fibres of the gastric musculature which has received the greatest support, sometimes it is called the loop of Willis or the collar of Helvetius but the muscle arrangement at the gastroesophageal junction had been called by the term spiral constrictor. It was believed that the pressure of the lower esophageal sphincter is the most important factor in preventing reflux in the unoperated patient, (Skandalakis et al., 1983).

Bremner, 1986, said that the acute angle of entry of the esophagus into the stomach act as a flap valve in preventing reflux. Also, he evaluate an intra-abdominal segment of the esophagus measuring at least 2 cm which is flaccid and is compressed on all sides like a flutter valve by an increase in intra-abdominal pressure and so it acts as a barrier to reflux.

The esophagus is attached to the diaphragm at the hiatus by a strong, flexible and air tight seal known as phrenoesophageal ligament, (Fig. 1-4). The pleura and peritoneum ensure that the seal is air tight, while the collagen and elastic connective tissue fibres provide the strength and the flexibility. There are leaf of fibres that arise from the endoabdominal fascia passing through the hiatus and insert in the adventitia and intermuscular connective tissue of the esophagus 1 or 2 cm above the hiatus. A second leaf of the fascia turns downwards and

inserts into the adventitia of the abdominal esophagus and stomach, (Fig. 1-5). A much weaker and less constant component arises from the endothoracic fascia and passes upwards to join the fibres of the endoabdominal fascia which allows about 2 cm of vertical movement of the esophagus, (Skandalakis et al., 1983).

Arterial supply :

The cervical part of the esophagus is supplied by the superior and inferior thyroid arteries but the thoracic part is supplied by the aortic arch through the tracheobronchial arteries. At the esophagogastric junction the left gastric artery supplies the lateral and ventral surfaces but the splenic artery supplies the posterior wall of the abdominal part of the esophagus, (Fig. 1-6). The phrenic arteries or intercostal arteries are essential nutritional vessels. It appears that the branches of the major vessels are small and so when torn, will have the benefit of contractile hemostasis. When hemorrhage occurred after stripping of the esophagus, it occurred from the site of adhesions, (Duranceau and Mefert, 1991).

The rough handling or wide mobilization of the esophagus may imperil its blood supply, especially over its main extent, (Fig. 1-7), because the aortic branches are distributed in a segmental manner, (Bremner, 1986).

Venous drainage :

The veins of the cervical esophagus drain into the inferior thyroid veins and then the brachiocephalic veins. The veins on the left side of the thoracic esophagus drain into the brachiocephalic vein via the left hemiazygos system but on the right side drainage is through the azygos system into the superior vena cava, (Fig. 1-6). At the cardioesophageal junction venous drainage of the esophagus may be into the coronary, splenic, retroperitoneal and inferior phrenic veins, (Bremner, 1986).

Lymph drainage :

The lymphatic drainage of the cervical part is the postero-inferior group of deep cervical lymph nodes near the origin of the inferior thyroid artery. The middle part of the esophagus drains into preaortic nodes of the posterior mediastinum along the esophageal arteries and then to the tracheobronchial group and mediastinal lymph trunks. The lower part drains along the left gastric artery to the preaortic nodes of the coeliac group, (McMinn, 1990).

There is a clinically important suggestion that the lymph draining from areas above the tracheal bifurcation will mostly drain cranially toward the thoracic duct, where as draining lymph from below the carina is toward the cisterna chyli through the lower mediastinal, left gastric and coeliac lymph nodes, (Fig. 1-8), but in the area of the tracheal bifurcation the flow is bidirectional, (Duranceau and Mefert, 1991).

Nerve Supply :

The upper part of the esophagus is supplied by the recurrent laryngeal nerve and by sympathetic fibres from the cell bodies in the middle cervical ganglion, (Fig. 1-9). The lower half of the tube is supplied from the esophageal plexus. The parasympathetic constituents of this plexus are the two vagi, (McMinn, 1990).

The fibres of the vagus that supply the striated musculature of the pharynx and esophagus arise in nucleus ambiguus while the parasympathetic fibres that supply the smooth muscle arise in the dorsal vagal nucleus. The moving ring of contraction pass without interruption although this variation of nerve supply. There are ganglia located between the longitudinal and the circular muscle layers (Auerbach's plexus) and in the submucosa (Meissner's plexus). They are interconnected by a mesh work of fibres that reach the adventitial plexus. The Auerbach's plexus is scattered within the entire esophagus but the concentration of the ganglion cells is greatest in the terminal esophagus and at the gastroesophageal junction, (Duranceau and Mefert, 1991).

The vagi are the motor nerves to the esophagus. In the body of the esophagus there are only cholinergic receptors and vagal stimulation results in contraction while in the lower esophageal sphincter there are both cholinergic and adrenergic but innervation is largely adrenergic and vagal stimulation results in relaxation of the sphincter, (Bremner, 1986).

There are two vagal trunks on the right, as it is double, but there is only one on the left. The two right nerves join the coeliac plexus and the left passes on the anterior surface of the stomach to the gall bladder and liver, (McMinn, 1990).

Afferent visceral pain impulses pass along the sympathetic nerves which are closely related to the somatic sensory fibres of the phrenic and intercostal nerves in the posterior horn of the spinal cord and may thus overflow into adjacent somatic neurons in the posterior horn to give pain referred to the neck, arm, chest or back. Some pain fibres must be carried in the vagus nerves because sometimes esophageal pain is referred to the ear via auricular branch of the vagus, (Bremner, 1986).

Progress of the wave in the esophagus is caused by sequential activation of its muscles initiated by efferent vagal nerve fibres arising in the swallowing center. Continuity of the esophageal muscle is not necessary if the nerves are intact, so if the muscles (but not the nerves) are cut across the pressure wave begins distally below the cut as it fades at the proximal end above the cut. This mode of function allows a sleeve resection of the esophagus to be done without destroying its normal function, (Demeester, et al., 1991).