RADIOLOGICAL ASPECTS OF HIATUS HERNIA

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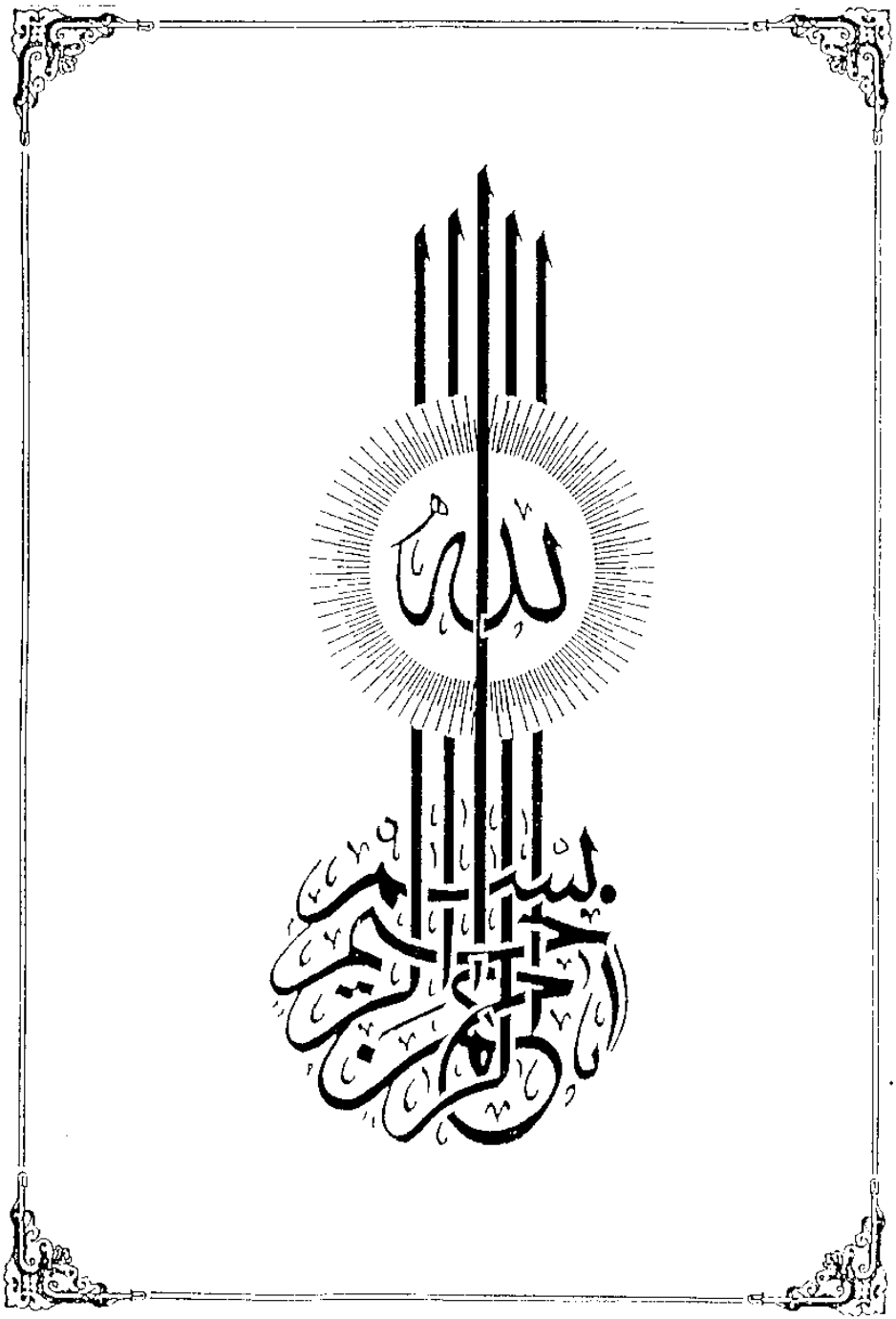

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INTRODUCTION

Hernia is an ancient malady, as old, presumably as man himself. It is probable, therefore, that it was among the first diseases to be recognized.

The earliest recorded mention of hernia is found in the Egyptian Ebers papyrus, which dates back to about 1500 B.C., but the information contained therein, according to its translator, B. Ebell, is much older. According to this authority, "the surgery of the ancient Egyptians must evidently have attained a rather high level, since they ventured to operate for such diseases as hernia and aneurysms".

The earliest detailed account of hernia is found in the writings of Celsus in the first century A.D. His descriptions are amazingly mature and far reaching, and display a broad knowledge of the nature and treatment of hernia.

The term "Hernia" gives no clue as to the ideas held by the ancients regarding its origin or nature. The word is derived from the Greek "hernios", meaning a branch or offshoot, and is merely descriptive of the swelling that the lesion produces. During the Roman era, it became a term of opprobrium. Now, it is usually defined as the "protrusion

of a loop or knuckle of an organ or tissue through an abnormal opening".

After the fall of Rome, Islam became the repository of western culture. The writings of Hippocrates, Celsus and Galen were saved from oblivion by translating it into Arabic. The Arabians developed burning to a fine art, and with it supplanted most of operative surgery, including that of hernia.

The renaissance of surgery in Europe began when the might of Arabia declined. In the eleventh century, the writings of Galen and Celsus and other authors of the golden periods of Greek and Roman civilizations found their way back to Europe. From the Arabic they were again translated into Latin.

Although, the succeeding centuries advanced the surgery of hernia but little, the basis for an intelligent approach was being laid. The nineteenth century brought anaesthesia, hemostasis and antisepsis, the three major discoveries that have made modern surgery possible.

The first descriptions of diaphragmatic hernia were recorded by Ambroise Paré (1510-1590), who reported several cases of the traumatic variety due to war wounds which were proven at post mortem examination.

Later, Jean Louis Petit (1674-1750) separated the congenital hernias from the acquired form, thus making the original effort at classifying these hernias.

Still later, in 1769, Morgagni published his monumental work in pathology which contained a discussion of diaphragmatic hernia, with a description of the parasternal type that still bears his name.

Guthrie, in 1853, added descriptions of various forms of traumatic hernia. He accepted the belief current at that time that the diaphragm would not heal if it was injured. Guthrie also described both medical and surgical management for these hernias.

In 1896, Steven Pajet suggested a transthoracic surgical repair of diaphragmatic hernias and reported two cases successfully treated by this surgical method.

The advent of diagnostic X-rays and esophagoscopy, and the improved ability to accomplish thoracic surgical procedures, lead to additional interest and improved management of these hernias.

It has been noticed that gastro-oesophageal reflux with or without hiatus hernia is probably the commonest cause of dyspepsia over the age of 40 and causes the greatest

discord between physicians and radiologists because of divergent views about what constitutes a hernia, what is its significance, and how it should be demonstrated. It is much the most important disorder of the diaphragm.

Symptoms from gastro-oesophageal reflux with or without herniation through the hiatus may occur in the subject's daily life, yet not always during a radiological examination, and conversely herniation or reflux may be demonstrated in a subject who does not suffer from it.

The aim of this work is to assess the value of the different techniques used for the demonstration of hiatus hernia and reflux and to show their relative incidence in routine barium studies in symptomatic patients. Also, to show the radiological changes of reflux oesophagitis.

ANATOMY AND PHYSIOLOGY

I. THE OESOPHAGUS

It extends from its junction with the pharynx at the level of the sixth cervical vertebra to its junction with the stomach opposite the body of the eleventh thoracic vertebrae.

In the adult, these points are located 15cm and 40cm from the upper incisor teeth, respectively, the oesophagus itself being 25cm in length. These distances vary little with sex or height.

The cervical oesophagus is elevated with swallowing and by extension of the neck, a maneuver useful radiologically to demonstrate an oesophageal foreign body which might be otherwise obscured by the heavy shadows of the chest and shoulders.

In the neck, the oesophagus lies in the midline immediately posterior to the trachea. After it enters the thorax, it curves slightly to the left behind the great vessels, returns to the midline at the level of the aortic arch, curves to the left behind the left atrium and then crosses the thoracic aorta to the left of the midline.

Its terminal portion curves more sharply to the left and anteriorly to reach the oesophageal hiatus of the diaphragm.

The lumen is narrowed at its superior and inferior ends and at the level of the aortic arch.

At its lower end the oesophagus twists about 90° in a clockwise direction. This rotation reflects the phase of development of the stomach in which the more actively growing dorsal border swings to a left lateral position to become the greater curvature and explains why at the cardia the left vagus trunk lies anterior and the right vagus trunk posterior.

The right wall of the oesophagus is continuous in a small curve with the lesser curvature of the stomach. The left wall forms an angle with the fundus, the cardiac incisura or angle of His, which varies between 80° and 175°, the former being the entry of greatest obliquity and the latter the entry of least obliquity. Obliquity is determined by the height of the left dome of the diaphragm. It is increased by sthenic habitus, expiration, paralysis of the left phrenic nerve, attenuation of muscle and tendon of the left dome of the diaphragm, fibrosis of the left lung or pleura, left lobectomy or pneumonectomy, and by pressure of intraabdominal mass or fluid. It is decreased by asthenic habitus, inspiration, left pulmonary emphysema, mass or fluid in the left hemithorax,

and abdominal visceroptosis. With a well-formed angle a flap of mucosa about 5mm in length is said to exist as a downward extension of the cardiac incisura and to act as a valve resisting reflux. Studies in the human subject indicate a greater competence of the mechanism of closure of the lower end of the oesophagus in cases of greater obliquity than in cases of lesser obliquity. This may explain why reflux oesophagus is less commonly associated with paraeosophageal than with sliding hiatus hernia. It has been suggested that the oblique bundle of gastric muscle known as the collar of Helvetius or sling of Willis which envelops all but the medial aspect of the oesophagus as it enters the stomach contributes to the sphincteric barrier mechanism, which prevents significant reflux chiefly by supporting the angle of His and thereby strengthening the so-called flap-valve mechanism. The importance of the angle of His has, however, been questioned. In man this angle is quite variable and is sometimes so obtuse as to be nonexistent. The mechanism which closes the lower end of the oesophagus between swallows and resists free reflux of gastric contents into the oesophagus has been a subject of controversy. The intraluminal pressure studies have demonstrated the existence of an intrinsic sphincteric mechanism in the terminal oesophagus which is considered to be of

paramount importance in preventing significant gastroesophageal reflux. The function of this sphincter may be assisted by the obliquity of the cardiac incisura and a flap-valve configuration at the cardia, the size of the hiatus, and possibly by a "pinch-cock" action of the diaphragm.

The esophagogastric junction is usually about 2cm below the diaphragm and is identified from the outside by the abrupt change in size of the two organs. A land-mark of value is the phrenoesophageal ligament, which is attached circumferentially to the esophagus about 3cm above the true esophagogastric junction. The location of the junction of the esophageal and gastric mucosa, in the infrahiatal esophagus, varies somewhat in different individuals. The line of demarcation between the pale esophageal epithelium and the crimson columnar gastric epithelium is 1 to 2cm higher than the esophagogastric junction as defined from the outside. The mucosal junction may be serrated and higher on one wall than the other. Although usually well defined, a sharp line of demarcation may be lacking; at esophagoscopy or on gross examination it may not be possible to say where esophageal mucosa ends and gastric mucosa begins. This may be determined by biopsy which reveals an abrupt change from stratified squamous epithelium to a form of gastric mucosa which consists of a single layer of

lamina propria. Adjacent to the epithelium the propria contains fibrous connective tissue, delicate elastic fibers, and lymphoid tissue; deeper lies a thin stratum of involuntary muscle, the muscularis mucosae. The muscularis mucosae is scanty in the upper esophagus but conspicuous in the lower end. The submucosa (tunica submucosa) is of considerable thickness and loose texture and allows the mucous membrane to move freely on the tunica muscularis. It contains the esophageal glands whose ducts penetrate the mucous membrane and discharge mucus protective against mechanical and chemical irritation. The submucosa contains networks of blood vessels, lymphatics, and nerves.

The muscle coat (tunica muscularis) of the esophagus differs from that of the remainder of the alimentary tract in several respects. It is relatively thicker: the outer longitudinal layer is thicker than the inner circular layer; both layers are composed in part of striated muscle; and there is no enveloping serosa. The superior fifth of the longitudinal layer is striated, the second fifth is mixed, and the inferior three-fifths is smooth muscle. In the circular layer the transitions from striated to mixed and from mixed to smooth muscle occur at levels about 2.5cm higher. In general terms this means that the substitution of smooth for striated muscle

commences at the level of the thoracic inlet and is completed at the level of the aortic arch. The semisolid bolus is propelled with extreme rapidity through the striated portion, at a reduced rate through the mixed segment, and at a leisurely uniform pace through the long, smooth muscle segment. Large or elongated swallowed foreign bodies tend to be forced to the level of the thoracic inlet before becoming stuck; smaller bodies tend to lodge in the region of the aortic arch where peristalsis is less powerful and the lumen is relatively smaller. The fibrous coat (tunica fibrosa) surrounding the muscle coat is composed of loose areolar tissue. Except for the small segment within the abdomen the esophagus is devoid of a serous coat, the covering so valuable in the healing of gastrointestinal anastomoses. The muscular coat is friable and will not hold sutures under tension.

The major function of the esophagus is to transport swallowed material from the pharynx to the stomach. This highly coordinated function has been studied by the use of pressure-sensitive transducers for recording intra-luminal pressures, radio telemetering capsules, high-speed cinefluorography, and simultaneous manometry and cineradiography. The very small size and high sensitivity of the transducer permit simultaneous pressure recordings to be taken at multiple

levels with minimal interference with the psychic and physiologic aspects of swallowing, not previously possible with balloon studies. Excellent analyses of esophageal motility have been published by Ingelfinger, and by Cohen and Wolf.

The lumen of the body of the esophagus is subject to the distending tendency of negative intrathoracic pressure. Intraluminal pressure studies, record a subatmospheric resting pressure. The upper end of the esophagus is guarded by a sphincter composed of the cricopharyngeus muscle and of esophageal elements. Simultaneous cineradiographic and manometric studies utilizing an intraluminal catheter have shown a resting high-pressure zone, above atmospheric level, 2.5 to 4.5cm long, beginning several millimeters below the pharyngeal air column and ending at the level of the C7 to T1 vertebral interspace. A shorter 1-cm-long zone of maximally elevated pressure within this high-pressure zone corresponds to the location of the cricopharyngeus muscle and the cricopharyngeal indentation, which may be seen radiologically. The resting zone prevents the easy access of atmospheric air between swallows. With swallowing, the sphincter is opened widely and gives no indication of its existence, assuming in conjunction with the pharynx and esophagus the form of a long funnel. It receives and transmits the bolus and returns to its resting