DIAPHRAGMATIC HERNIAE

ESSAY

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BY

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The Candidate

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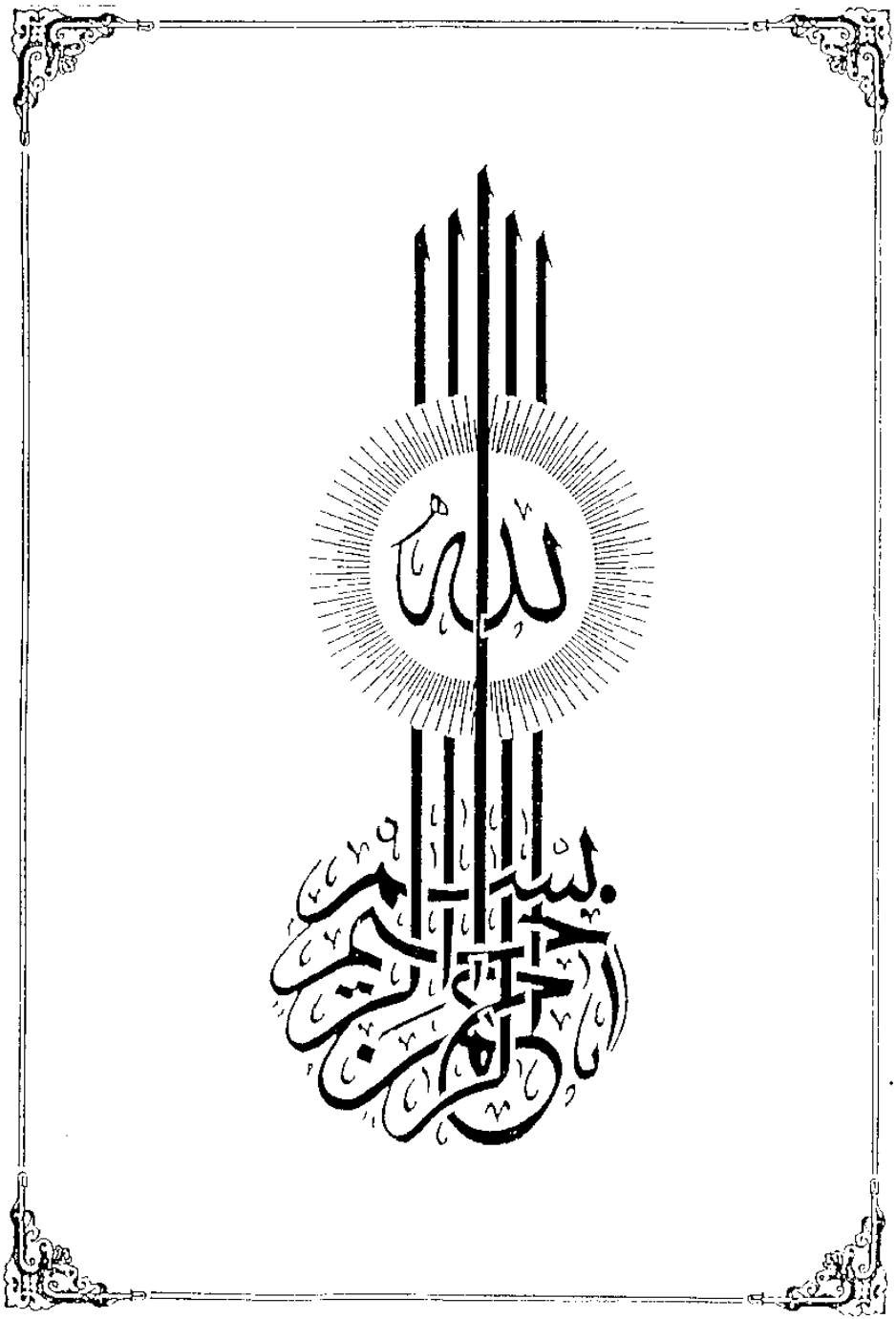

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INTRODUCTION AND HISTORY

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Hernia is the abnormal protrusion of an organ or apart of it through structurs normally containing it.

Diaphragmatic hernia is the abnormal protrusion of an abdominal organ or apart of it through an aperature in the diaphragm whether this aperature is a congenital defect, natural opening or a traumatic rupture.

The first description of diaphragmatic hernia in adults was given by Ambriose Pare in 1575. It was of traumatic origin (Bray, 1975).

In 1853, Bowditch was the first American to describe some of the classic antemortem findings such as mediastinal shift, dullness to percussion in the left lung base, and bowel sounds in the chest associated with diaphragmatic hernia.

In 1886, Riolfio was the first to repair penetrating traumatic diaphragmatic hernia and in 1889, Walker was the first to repair blunt traumatic diaphragmatic hernia.

Benet described the first congenital diaphragmatic hernia in an anatomical tome written in 1679 (Anderson, 1986). The pathology of the malformation was discussed in some details by Giovanni Battista morgagni, a pupil of Valsalva, and a professor of Padua, in 1761, who described a patient with retrosternal hernia that now bears his name. A hernia through this foramen is sometimes called after the name of Dominique-Jean Larrey, Napoleon's

great military surgeon.

In 1804, Astley Cooper not only described the pathology and clinical presentation of the condition in some details, but also gave a classification of the various diaphragmatic hernia which is still valid today (Rickham, 1970).

In 1848, Vincent Alexander Bochdalek, professor of Anatomy in Prague, described a congenital hernia through the postero-lateral part of the diaphragm.

In 1888, Naumann of Sweden made the first recorded attempt at laparotomy for reduction of a congenital hernia, but without success. O'Dwyser of New York in 1890 reported the first, although unsuccessful, attempt at repair of a strangulated congenital diaphragmatic hernia in an infant. L. Heidenhain (not the Physiologist Rudolph Heidenhain) on March 6, 1902, performed the first successful operation for congenital diaphragmatic hernia in a child. The operation was performed as a laparatomy, the stomach reduced, and the diaphragm sutured. This was reported in 1905. Operative treatment as the treatment of choice for congenital diaphragmatic hernia did not become generally accepted untill Ladd and Gross published their successful series in 1940. The first patient to survive operative correction of a Bockdalek hernia in the newborn period was operated on by Gross in 1946. In 1953, in a series of 63 infants and children, in three of them the cause of death was due to associated anomalies (Anderson, 1986).

Oesophageal hiatal herniae are not only the most common hernias of the diaphragm but also are among the more common abnormalities affecting the upper gastro-intestinal tract. In general there are two types of oesophageal hiatal hernia. The most common (about 85%) is the sliding type in which there is displacement of the oesophago-gastric junction and portion of the proximal part of the stomach through the oesophageal hiatus into the posterior medmediastinum. Although such herniation's are known to move in and out of the thorax with changes in intra-thoracic and intra-abdominal pressures, the term "sliding" is applied not because of this activity but because the herniation has a partial peritoneal sac, the stomach forming the other wall of hernial sac.

The second type (about 10%) is paraoesophageal hiatal hernia, in which a portion or all of the stomach is displaced into the thorax through a diaphragmatic defect immediately adjacent to but not necessarily continuous with the oesophageal hiatus. Because of the location of this defect, the oesophagogastric junction is held in its usual position while the fundus and successively greater portions of the remainder of the stomach ascend into the thorax

The Thrid type (Type III) hiatal hernia is the mixed type (about 5%) carries the character of both.

Type IV hiatal hernia is the complicated type with a large sac.

The sliding oesophageal hiatal hernia is of interest not only because of its great frequency but particularly because it is the most common cause of gastro-oesophageal reflux. In 1951, Allison, clearly described the clinical problem of gastro-oesophageal reflux with its symptoms and complications. He noted the frequent association of reflux with hiatal hernia and emphasized the importance of phreno-oesophageal membrane abnormalities in both conditions. Allison described a method of hiatal hernia repair involving reattachment of the phreno-oesophageal membrane, which he hoped would correct the problem of gastro-oesophageal reflux as well. The Allison repair recieved wide trials, but prior to his death. Allison recognized that the incidence of persistance of reflux following repair was too high. It has not been the answer of the problem of gastro-oesophageal reflux.

Shortly after Allison's report, Belsey, (1955) and Nissen (1956) independtly and almost simultaneously developed more effective anti-reflux operations. They recognized the differences in symptoms-caused by reflux compared with those caused by hiatal hernia alone. Although surgical methods for effectively controlling reflux have been known for about 30 years, the factors that control reflux in normal human beings have not been well understood.

New advances are introduced to establish different types of diaphragmatic hernia. Unexpectedly low amniotic fluid lecithin/sphingomyelin (L/S) ratio raises the suspicion of congenital diaphragmatic hernia which needs confirmation by ultrasound and

Fetography to diagnose prenatal congenital diaphragmatic hernia (Touloukian and Hobbins, 1980). Radionuclide scintigraphy, C.T. scan, laparoscopy, peritoneography, gastro-oesophageal roentgenography using a nasogastric tube, lower oesophogeal sphincter pressure studies.... etc. are very helpful in the diagnosis of diaphragmatic herniae and gastro-oesophageal reflux (Blumenthal et al., 1984).

In the management of diaphragmatic hernia, extra corporeal membrane oxygenation (ECMO) introduced in 1979, may prove to be a useful means of supporting infants with persistent fetal circulation (PFC) untill more effective ventilatory and pharmacologic methods become available. Intra-operative measurement of lower oesophogeal sphincter pressure has been used by Lucius D. Hill (reported in March, 1978 and begun 3½ years before) to improve results in operative management of gastro-oesophogeal reflux and achalasia. Supradiaphragmatic correction of gastro-oesophageal reflux and stricture is reported by Pennell in May, 1981 and proves to be as effective as subdiaphragmatic fundoplication, an operation which represents a good solution for diaphragmatic hernia with short oesophagus. The Belsey Mark V procedure is a new approach in transthoracic diaphragmatic hernia repair using small Teflon felt pledge to buttress each mattress suture in the plication procedure to avoid the potential weak point in the Belsey Mark IV partial fundoplication operation for sliding hiatus hernia and reflux oesophagitis by placement of the plicating mattress suturs in the oesophageal muscle.

In Feb. 1979 Jean-Pierre Angelchik reported a new surgical procedure for treatment of gastro-oesphageal reflux and hiatal hernia using a ring shaped prosthesis made of silicone elastomer shell filled with highly cross linked silicone gel provided with a dacron tie strap fixed to the prosthesis. Although Angelchik prosthesis proved to be a safe, simple, effective treatment for symptomatic reflux oesophagitis and sliding hiatal hernia yet, Condon in March, 1983 reported more misadventures with oesophageal collar like disruption and migration of the prosthesis discourging its use encouraging fundoplication

EMBRYOLOGY

EMBRYOLOGY OF THE DIAPHRAGM

The formation of the diaphragm takes place between the fourth and the eighth weeks of embryonic life, when major growth and changes in position are occurring in the heart and intestinal tract.

During the fourth week of gestation, the intraembryonic coelom starts to divide to form the different body cavities, pericardial, pleural, and peritoneal, through the development of a mesodermal partition to occupy the position of the future diaphragm in the adult (Gray's, 1973).

This mesodermal partition is formed through the union of four developmental parts: Ventral, dorsal, right and left lateral parts (Cunningham, 1972).

The two lateral parts are called the pleuro-peritoneal folds. When these are developed completely, the pleuro-peritoneal canals become completely obliterated, separating the pleural and peritoneal canals completely, except at the aortic, caval and oesophageal hiatus (Hamilton et al., 1972).

The left pleuro-peritoneal canal closes a little later than the right (Anderson, 1986). The last portion to be closed on either side is the posterior portion, a triangular area known as the pleuro-peritoneal canal which represents a weak point through which a congenital hernia may occur, the Bockdalek hernia (Ravitch, 1978).

These two lateral parts will finally form part of the costal margin of the diaphragm (Wells, 1954).

The dorsal part has a disputed embryological origin. It may be formed from the mesoderm surrounding the dorsal mesentery of the foregut (Gray's, 1973), But Botha in 1962 showed that it originates from two elongated muscle masses derived from the cervical myotomes. These muscle masses will finally form the crura On the other hand, Last in 1978 states that the crura are derived from the prevertebral muscles.

The Ventral part is actually the largest contribution to this mesodermal partition and is called the septum transversum, attached to the xiphisternum, forming the central tendon of the diaphragm and the central part of the muscle back to the oesophagus (Boema, 1943 and Wells, 1954).

The septeum transversum is a mass of mesoderm that grows from the ventral body wall, and separates the pleuro-pericardial cavities from the peritoneal cavity. It is however, an incomplete septum, since the pleuro-peritoneal canals lie posterolaterally on each side. It is formed in the neck in the third week of gestation by the fusion of the myotomes of the third, fourth and fifth cervical segments, and then moves caudally to reach the normal position of the diaphragm at about eight weeks, and joins the pleuro-peritoneal folds and the dorsal mesentery to complete the development of the diaphragm at about the seventh week (Paul, F. Nora, 1980).

THE DEVELOPMENT OF THE DIAPHRAGM

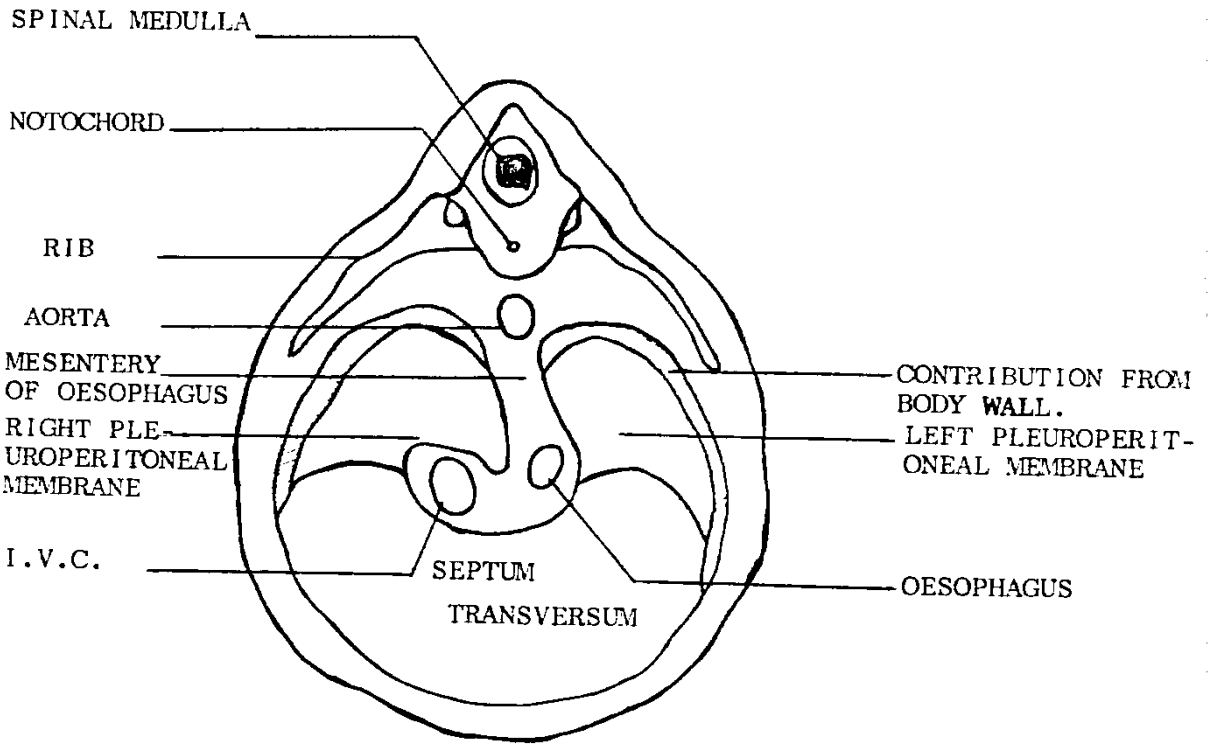

Fig. (1)

A Diagram Showing the Four Contributory Elements:

- Septum Transversum.
- Dorsal Mesentery of the Oesophagus.
- Body Wall.
- Pleuro-Peritoneal Membrane.