OESOPHAGEAL HIATUS HERNIA

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ACADEMISCH PROEFSCHRIFT TER VERKRIJGING VAN DE GRAAD VAN DOCTOR IN DE GENEESKUNDE AAN DE UNIVERSITEIT VAN AMSTERDAM, OP GEZAG VAN DE RECTOR MAGNIFICUS, DR M. W. WOERDEMAN, HOOGLERAAR IN DE FACULTEIT DER GENEESKUNDE, IN HET OPENBAAR TE VERDEDIGEN IN DE AULA DER UNIVERSITEIT OP DONDERDAG 19 MAART 1959 DES NAMIDDAGS TE 4 UUR

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ON OESOPHAGEAL HIATUS HERNIA IN GENERAL

Chapter 1

HISTORICAL NOTES ON HIATUS HERNIA

The disorder of hiatus hernia was practically unknown until the turn of the last century. A little more than 25 years ago, there was still considerable doubt in the minds of authorities as to whether "oesophageal orifice hernia", as it was then known, existed at all. The small percentage of irreducible hiatus hernias had probably been mistaken at autopsy for congenital shortening of the oesophagus, while the reducible hernias were missed altogether, as they would, of course, leave little trace of their existence after death. Before the discovery of X-rays the condition was therefore seldom, if ever, diagnosed.

In 1882 *Thoma,* a pathologist, collected 290 diaphragmatic hernias from the literature, only three of which were through the oesophageal hiatus. Consequently he believed this type to be very rare.

Until 50 years ago, the clinical diagnosis of diaphragmatic hernia was extremely difficult. Of 690 cases reviewed by *Giffin* in 1912, for instance, only 15 had been diagnosed clinically. With the advent of diagnostic radiology the disease became increasingly better known, however.

As early as 1900 fluoroscopy was mentioned as potentially useful for the detection of diaphragmatic hernia. In that year *Hirsch* and *Mertens* found the first case revealed by radiological examination. They reproduced a film of the barium-coated, air-distended stomach containing a recoiled catheter filled with mercury. It made history, even though the autopsy performed years later disclosed an eventration. *Eppinger* was actually the first to diagnose a hiatus hernia on X-ray films in 1904. This was a large irreducible para-oesophageal hernia.

Between the years 1910 and 1920, *Morrison* and *Healy* made a careful roentgenological study of the fundus of the stomach, hoping to determine some method whereby malignancy could be diagnosed earlier. Their attention was attracted to the varying shapes of the barium-filled fundus in the upright, prone, supine, lateral and oblique positions. Following these observations, Morrison in 1922, in a paper read before the New England Roentgen Ray Society, reported 12 cases of "congenital hernia of a portion of the fundus of the stomach through the oesophageal hiatus". He pointed out the necessity of employing the recumbant position to demonstrate these

hernias. His number of cases was later increased to 32 and finally to 53, which proved that the condition was not an uncommon finding. *Akerlund*, 4 years later, reached similar conclusions and in a systematic review of the subject developed a classification of hiatus hernia which is still in use.

Today it is accepted that no roentgenological examination of the stomach is decisive unless both the erect and the recumbant positions are employed and a careful search made for evidence of diaphragmatic hernia. Of all hiatus hernia cases now on record, the vast majority were revealed by X-ray. The high incidence, moreover, is unanimously accepted.

With the advent of oesophagoscopy, the knowledge of hiatus hernia was further extended. This investigation became recognized not only as a means of diagnosis, but led to the discovery that hiatus hernia may be the cause of serious oesophageal disease.

Chronic peptic ulcer of the oesophagus was regarded until 1929 as a pathological curiosity. In 1906 *Tilestone* could collect only 44 cases from the literature. *Hurst* and *Stewart*, 23 years later, collected 11 more cases. They personally observed only one oesophageal ulcer in over 10,000 consecutive post-mortem examinations.

Jackson, however, in 1929 published a remarkable series of cases examined by oesophagoscopy. During the course of 42 years he had seen 21 active ulcers and 67 scars of healed ulcers in 4,000 oesophagoscopic examinations. He thought that the routine use of the oesophagoscope in cases of slight dysphagia, pain behind the sternum and haematemesis of obscure origin, would show that the condition was much less rare than commonly believed. *Friedenwald, Feldman* and *Zinn* (1929) arrived at the same conclusion when they published the records of 13 of their own cases in which the diagnosis of oesophageal ulcer was confirmed by X-rays and oesophagoscopy.

It was not before 1934, however, that the relation between oesophageal ulceration and hiatus hernia was demonstrated. In that year *Haroen* and *Gerlings* reported a case of chronic oesophageal ulcer associated with hiatus hernia. *Dick* and *Hurst* (1935) and *Dunhill* (1935) published further cases of oesophageal ulcer in "diaphragmatic hernia associated with short oesophagus". *Winkelstein* in the same year pointed out for the first time that "peptic oesophagitis" is caused by regurgitation of stomach contents into the gullet. *Johnstone* (1941) agreed and stated that "the most important factor in the aetiology of peptic ulceration of the oesophagus appears to be the frequent regurgitation of acid gastric juice". *Benedict* (1946), *Allison* (1948—1952) and *Barrett* (1950—1954) fully described the morbid anatomy and clinical manifestations of reflux oesophagitis.

The knowledge that many hiatal hernias cause reflux into the oesophagus, stimulated further study of the closing mechanism between oesophagus and stomach. As a result of extensive investigations during the past 10 years by *Dornhorst* and *Leathart* (1952), *Fyke* et al (1956), *Atkinson* et al

(1957) and *Botha* (1958), more information on the normal and disturbed function of the cardiac region has become available. Today it is generally accepted that rational surgical therapy for hiatus hernia must be directed not only at correction of the anatomical deformity but also at reinstatement of the disturbed gastro-oesophageal closing mechanism.

Medical treatment has never occupied an important place in the management of hiatus hernia. As early as 1853 *Bowditch*, a visiting physician at the Massachusetts General Hospital, suggested that surgery might be tried in the treatment of this disease considering the "poor results obtained by the use of emetics, leeches, cathartics, venesection, bathing and ether". The surgical staff of that hospital did not react on this suggestion immediately. According to *Bowen*, the first operation was not performed there until 1898 and then inadvertently, with the true diagnosis unsuspected pre-operatively.

Before the advent of diagnostic radiology, few cases presented for treatment. Later, however, when the diagnosis was frequently made, surgery became recognized as the only effective treatment for the symptoms and complications of hiatus hernia.

Since 1930 an outstanding clinical authority on the surgical therapy of all types of diaphragmatic and also of hiatal hernia, has been *Harrington* in the United States. In 1955 he published the results of 489 cases treated by surgery. The popularity of the abdominal approach up to a decade ago, was largely due to his clinical stature and influence. With the maturing of thoracic surgery, following the discovery of antibiotics and the development of modern anaesthesia, there was a steady swing towards the transthoracic approach. The popularity of this surgical route reached complete dominance largely due to the techniques developed by *Allison* in England and *Sweet* in America.

During the last few years many surgeons have reverted to the abdominal route, probably because of the poor results obtained by the trans-thoracic procedures. In 1955 *Boerema* suggested gastropexy of the lesser curvature as means of treatment. The promising results of his original cases were later confirmed by a larger series as well as by other authors who have adopted his technique.

ON THE ANATOMY OF THE OESOPHAGEAL HIATUS

In 1955 *Carey* and *Hollinshead* remarked that "in the surgical treatment of hernia in any location, accurate knowledge of the regional anatomy and of the structural defect occurring with herniation is fundamental to success. This is equally true of herniae through the oesophageal hiatus." In the older textbooks the anatomical details of this region are sketchy and incomplete. With the development of surgical treatment for hiatus hernia, a more detailed knowledge of the regional anatomy was required.
Collis et al (1954), *Carey* and *Hollinshead* (1955), *Lam* and *Kenney* (1954), *Madden* (1956) and *Botha* (1957) carried out detailed dissection of the oesophageal hiatus on specimens obtained from adults of all ages. The following discussion of the anatomy of this region is based largely on the work of these authors.

Muscular Relations of the Hiatus

The oesophagus passes from the thorax into the abdomen through the oesophageal hiatus, an opening situated in the muscular part of the diaphragm at the level of the tenth thoracic vertebra. This opening is placed above, in front, and a little to the left of the aortic opening. It transmits not only the oesophagus but also the vagus nerves and the oesophageal branches of the left gastric artery with the accompanying veins.

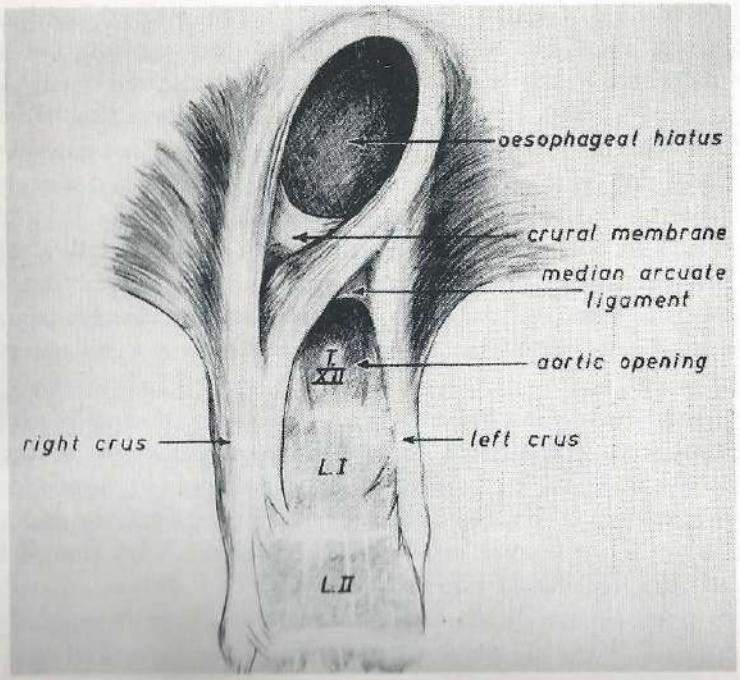


Fig. 1
Muscular relations of the oesophageal hiatus

The boundaries of the hiatus are formed by the crura of the diaphragm (Fig. 1). These muscular fibres of the diaphragm arise by stout tendinous bands from the antero-lateral surfaces of the first three or four lumbar vertebrae and their intervening fibro-cartilages. At their origin the crura are tendinous in structure, and blend with the anterior longitudinal ligament of the vertebral column. The upper end of the abdominal aorta and its first main anterior branches, the coeliac and superior mesenteric arteries, clearly separate the muscular bundles of the right and left crus. Carey and Hollinshead found a well-marked *median arcuate ligament,* or tendinous rim, uniting the medial tendinous margins of the crura to form an arch across the front of the aorta.

The right crus takes origin from the upper three lumbar vertebrae and intervertebral discs and is considerably longer, thicker and more tendinous than the left. As the right crus ascends, it separates into superficial and deep muscle layers to form the entire muscular rim of the oesophageal hiatus. The thin superficial layer ascends to form the right margin of the hiatus and the thick deeper muscle layer inclines obliquely to the left, crossing the anterior surface of the abdominal aorta just cephalad to the coeliac axis, to form the left margin of the hiatus. From their positions lateral to the oesophagus, medial fibres of the two large muscular bundles continue anterior to the hiatus to complete the muscular collar, while lateral ones are inserted in a fan-shaped manner into the central tendon of the diaphragm. In no instance did the anterior muscular rim, separating the oesophagus from the central tendon, measure more than 1.5 cm.

The left crus takes origin from the upper two lumbar vertebrae and intervertebral discs and ascends vertically to abut against, but usually not to contribute to the muscular collar of the hiatus, and finally to pass to the central tendon. Madden found no instance where the left crus of the diaphragm participated in the formation of the oesophageal hiatal ring. Carey and Hollinshead found small but sturdy muscular bundles from the left crus crossing to the right side to form part of the right rim of the hiatus in only 2 of the 25 specimens. Furthermore only 2 of their cases demonstrated a true bilateral origin of the hiatal fibres. This decussation of fibres of the right and left crura, routinely depicted in anatomical illustrations of the oesophageal hiatus, was never observed by Madden in his series.

When viewed from above the diaphragm and oblique downwards from the head of the cadaver specimen, the thick deep muscle layer of the right crus, the left margin of the hiatus, is superficial to and crosses the superficial muscle layer of the right crus, the right margin of the hiatus. The right margin of the oesophageal hiatus is therefore always formed by the right crus, the left margin usually by the right crus with occasional added elements from the left. When the hiatus is narrowed in the surgical repair of a hiatus hernia, the sutures approximate the superficial and deep

muscle layers of the right crus of the diaphragm, and not the right and left crura, as is commonly stated. Furthermore, as emphasized by *Allison* (1951), the approximation is best made in a vertical plane posterior to the oesophagus, as this is the normal anatomical axis of the hiatal opening. It is of surgical significance that an anatomically weak area exists behind the oesophagus. The posterior aspect of the hiatus is notably free of any firm structure. Lam and Kenney found that this area directly posterior to the oesophagus consisted of a triangular space, that was bridged by a thin areolar membrane which they designated as the *crural membrane.*

The muscular ring of the hiatus fits snugly around the lower oesophagus. There appears to be some variation in the size of the hiatus, however. *Harrington* (1955) for many years examined the hiatus during the course of other abdominal operations. In some patients one finger, in others two or three fingers, could be inserted through the opening along the side of the oesophagus. In each case where the hiatus admitted three fingers, and in some where it admitted two fingers, subsequent roentgenograms of the stomach were made and an occasional small herniation of the cardia was found. He draws the conclusion that a hiatus which will admit one or two fingers may be considered normal if there is no infolding of the peritoneum into the mediastinum. In all cases in which the hiatus admits three fingers, however, the possibility of a hernia should be considered.

Fascial Relations of the Hiatus

The muscular ring of the normal oesophageal hiatus encircles the lower end of the oesophagus but is not directly attached to it. Fixation of the diaphragm to the lower oesophagus is obtained through a fascial structure which originates in the fascial coverings on the abdominal side of the diaphragm.

The diaphragmatic fascia is loosely attached to the muscle by thin connective tissue septa; at the central tendon it is so firmly attached that it cannot be easily dissected away. As it passes over the margins of the oesophageal hiatus, it ascends through the hiatus out of the abdomen to be attached about the entire circumference of the lower end of the thoracic oesophagus, 2—3 cm. above the oesphago-gastric juncture. According to Carey and Hollinshead, it is whitish and ridged in the region of its insertion into the lower part of the oesophagus. According to Harrington, it is inserted not only into the lower 2 or 3 cm. of the oesophagus but also into the upper 1.5—2 cm. of the stomach, in a fanlike manner. This fascia from the diaphragm to the oesophagus is usually called the *phreno-oesophageal ligament* (also phreni-oesophageal ligament or diaphragmatico-oesophageal ligament). This elastic and fibrous "cone", being composed of tough yet resilient collagenous tissue, allows considerable play in the movements of the oesophagus in the hiatus during

respiration and swallowing, at the same time maintaining the normal anatomical relationships between oesophagus and diaphragm. The ligament is covered on its undersurface anteriorly and laterally with peritoneum. In the formation of a hiatus hernia this structure, together with its peritoneal covering, is stretched. Together they make up the wall of the hernial sac. The strength of the phreno-oesophageal ligament lies in its oesophageal attachment, where it acts as an antagonist to the longitudinal muscle fibres of the oesophagus, preventing these muscles from pulling the cardia of the stomach through the hiatus.

On the thoracic side of the diaphragm, there is a loose layer of connective tissue underlying the pleura. This continuation of the endo-thoracic fascia is reflected from the muscular diaphragm over the oesophagus and aorta. In contrast to the true phreno-oesophageal ligament, this layer, as it is reflected onto the oesophageal wall, is thin and poorly defined.

Peritoneal Relation of the Hiatus

The peritoneum of the stomach is firmly attached to most of the body of that organ except at the curvatures. Two to three cm. from the oesophago-gastric junction, however, the peritoneum becomes quite loose anteriorly and separated from the wall of the stomach by a variable amount of fatty tissue (Carey and Hollinshead). It is this laxity of peritoneum which allows the surgeon to invaginate his finger for a short distance through the hiatus during abdominal exploration. This laxity is also a further preparation for the normal free-sliding mechanism at the cardia.

Anterior to the hiatus the peritoneum is reflected onto the diaphragm where it becomes more firmly attached. It then ascends over the left lobe of the liver, forming the inferior layer of the double fold of peritoneum called the *left lateral* or *left triangular ligament of the liver*. Posteriorly the peritoneum is fused with the serous covering of the stomach up to about 3 cm. from the oesophagus, where it becomes loosely attached. It is then reflected over the abdominal aorta to form, inferiorly, the posterior peritoneum of the omental bursa. Laterally and to the left, a small peritoneal fold extends from the fundus of the stomach to the diaphragm and is called the *gastro-phrenic ligament*. It contains a variable amount of fatty tissue, and like so many other ligaments of the stomach, is not ligamentous in structure nor probably in function. The major extension of peritoneum from the upper part of the greater curvature, is to the spleen, forming the *gastro-splenic ligament*. Medially, to the right of the hiatus, the peritoneum extends as a double layer, the so-called *gastro-hepatic ligament* or *lesser omentum*, towards the hilum of the liver. In the regions of the cardio-oesophageal juncture this mesentery contains the left gastric artery and vein and their oesophageal branches, accompanying lymphatic structures and parts of both vagal trunks.

Note that the abdominal portion of the oesophagus is loosely covered with peritoneum on its anterior and left aspects only.

Bloodvessel Relations of the Hiatus

In addition to the oesophagus and the vagi, the hiatus transmits the oesophageal branches of the left gastric artery with the accompanying veins.

These vessels communicate here with the oesophageal branches of the aorta and vena cava. This is one of the sites where portal and systemic circulations communicate.

The *inferior phrenic arteries* which may have a single or double origin as the first branches of the abdominal aorta, or may arise from the coeliac artery itself within 3—5 cm. of the inferior margin of the hiatus, course across the crura. The left inferior phrenic artery runs a gently curved course under the diaphragmatic fascia, only 1—2 cm. distant from the left lateral margin of the hiatus and may send twigs to the oesophagus before continuing anteriorly over the central tendon. The right phrenic artery runs a course farther from the hiatus to pass behind the inferior vena cava. The inferior phrenic vein runs from left to right in close proximity to the anterior margin of the hiatus to join the inferior vena cava.

The Vagus

Both vagi pass through the hiatus with the oesophagus. The left vagus passes through the anterior angle of the oval, the right vagus through the posterior angle. The left vagus is anterior because it is going to supply the antero-superior surface of the stomach, whereas the right vagus is destined for the postero-inferior surface.

Aortic Opening

Posteriorly the hiatus is related to the aortic opening in the diaphragm, which lies at the level of the lower border of the twelfth thoracic vertebra. Here the aorta passes through the diaphragm with the thoracic duct which lies to the right. The vena azygos major may also pass through the aortic opening on the right side of the cisterna chyli. Occasionally it passes deep to the lateral border of the right crus of the diaphragm or it may pierce the crus.

The Phrenic Nerves

The right phrenic pierces the central tendon of the diaphragm on the

lateral side of the inferior vena cava. Its posterior division passes downwards and medially under the central tendon to the right crus. It supplies all of the crus to the right of the oesophagus and also that part of the diaphragm attached to the lumbo-costal arches. The left phrenic nerve pierces the diaphragm about one cm. to the left of the pericardium and 3 cm. in front of the central tendon. The posterior division runs backwards, downwards, and slightly medially under the central tendon, to be distributed to all the crural fibres to the left of the oesophagus, and also fibres of the diaphragm arising from the lumbo-costal arches. The crural fibres supplied include the part of the right crus on the left side of the oesophagus and the left crus proper. From the dissections of *Collis* et al (1954) and *Botha* (1957) it is clear that all muscle fibres from the right half of the central tendon are innervated by the right phrenic nerve, while those arising from the left half are supplied by the left phrenic nerve.

The Vena Caval Opening

This is situated at the level of the disc between the eighth and ninth thoracic vertebrae. It pierces the central tendon anteriorly and to the right of the hiatal opening. It transmits the inferior vena cava and half of the right phrenic nerve.

Other Organs

The left adrenal gland lies only 3—4 cm. inferior and lateral to the oesophageal hiatus on the medial lumbo-costal arch.
From the thoracic side the heart and pericardium overhang the hiatus anteriorly and to the right. The lower part of the thoracic aorta forms the lower part of the avenue of approach from this direction.

Chapter III

ON THE ANATOMY AND FUNCTION OF THE CARDIA

The anatomy and physiology of the oesophagus, as well as that of the stomach, have been fully investigated and documented. The same cannot be said, however, for that area where these two organs meet. Even today, it is difficult from a study of the literature to form a clear picture of what is known as the "cardia", of its exact localization and physiology. About the very word "cardia" there is still confusion. Thus some authors see the cardia as the histological point where oesophageal and gastric mucosa meet. Others consider it a purely anatomical term for the macroscopic point where the oesophagus enters the stomach. This is confusing, as the histological and anatomical cardia do not usually correspond. Some authors have stated that the mucosal junction is freely movable, whereas *Botha* (1958) maintains that "the junction of squamous and glandular epithelium is above the cardia in most people".
The term cardia is often used in a physiological sense, indicating the functional unit which forms the closing mechanism between oesophagus and stomach. There is no unanimous agreement, however, that this mechanism is situated at the anatomical cardia. Investigators not only disagree about the exact localization of the physiological cardia, but also whether its nature is muscular or mechanical and whether its action is sphincteric or valvular.
These problems are of great practical importance. Every disorder which causes disturbance of the intricate closing mechanism at the cardia, may result in backflow of gastric contents into the oesophagus, often with serious effects. Thus reflux oesophagitis is the most common complication of sliding hiatus hernia.
As a result of extensive investigation during the past 10 years, more information on the normal and disturbed function of this region has become available. Understanding of the physiology of the cardia has now a firmer basis and treatment of hiatus hernia, particularly as regards surgical technique, can be designed more rationally.
Numerous theories exist to explain the closing mechanism between oesophagus and stomach. Some authors seek the explanation in forces acting on the cardia from the outside; others believe that the function depends

on some intrinsic mechanism. These theories can therefore be divided into two main groups.

I *Extrinsic Mechanism*

As the terminal oesophagus passes through the muscular ring of the hiatus before entering the stomach, it seemed rational that the muscle fibres of the crura compress the cardia, thus acting as an external sphincter mechanism. The observation that barium does not pass through the cardia on deep inspiration, seemed to confirm this theory. Thus *Jackson* in 1922 spoke of the "pinchcock action of the diaphragm".

A serious objection to this theory was that the hiatal margin is only muscular on the anterior and lateral sides, so that the diaphragm could not possibly act as a circular sphincter. *Neumann* (1933) pointed out, however, that the crural fibres form a loop around the oesophagus, exerting a pull on the cardia in the direction of their fibres; i.e. obliquely backwards from left to right. Numerous authors agreed with him that contraction of these fibres would close off the lumen of the oesophagus. *Allison* (1948, 1951) developed these theories further. He maintained that when the organs are in a normal position in the body, the angle between oesophagus and stomach, the cardiac notch, is lassoed by the fibres of the right crus and hitched down to the lumbar spine. During inspiration the negative suction force of the chest increases and the positive pressure in the abdomen increases. At this time, therefore, there is a tendency for the cardia to be drawn up into the mediastinum, or alternatively for stomach contents to pass up into the gullet. But, Allison states, it is at this time that the fibres contract round the lower end of the oesophagus, preventing reflux by closing its lumen in the manner of a pinchcock. Simultaneously the cardiac notch is pulled down and deepened, thus preventing herniation. An external sphincter is therefore produced, its action being comparable to that of the pubo-rectalis muscle.

Barrett (1952) pointed out, however, that this mechanism could only be effective as a pinchcock during fairly deep inspiration. This being true, some other factor, capable of preventing reflux during expiration and the early stages of inspiration, must exist.

There are other serious objections to the theory of an external sphincter. Anatomically the cardia is not situated *in* the hiatus, as suggested by Allison, but usually *below* it. On careful dissection of cadavers, and in life during operations on this area, the gastro-oesophageal junction is seen to lie below the hiatus. *Botha* (1958), after fixation of a metal clip to the anterior hiatal margin, could radiologically demonstrate the cardia lying many centimeters below the hiatus in normal persons.

The terminal oesophagus is therefore an abdominal organ; known to the older anatomists as the "pars abdominalis oesophagi". Allison's lasso mech-

anism must therefore act, not on the cardia itself, as suggested by him, but somewhat higher up. This would fail to protect the abdominal oesophagus from the effects of regurgitation.

Braasch and *Ellis* (1956) discounted the importance of external factors by experiments in dogs. They created a fixed abdominal oesophagus by attaching the hiatus to a point 2—3 cm. above the gastro-oesophageal junction. Oesophagitis did not develop in the terminal oesophagus, which suggested that something other than the diaphragm protected the distal part of the oesophagus from reflux in these dogs. *Friesen* and *Miller* (1956) bypassed the oesophago-gastric junction in dogs, leaving the oesophageal stump either above or below the diaphragm. In their dogs oesophagitis developed above the new oesophago-gastric anastomosis, but the oesophageal stump remained entirely free from disease. *Meiss* (1958) found that oesophagitis does not occur in dogs when the diaphragmatic pinchcock is removed by complete transsection of the crura.

The operation of gastropexia geniculata anterior provides further proof that the diaphragm plays no active part in gastro-oesophageal closure. Here the cardia stays competent while lying free in the abdominal cavity. In cases of sliding hiatus hernia where the closing mechanism is defective, normal function is restored by pulling the cardia into a position many centimeters below the hiatus.

From these points it seems obvious that if the cardia can maintain its function independent of the diaphragmatic muscle, some intrinsic mechanism must be involved.

II *Intrinsic Mechanism*

Numerous theories exist to explain the nature of such a mechanism.

On the theory of an acute cardiac notch. Braune (1875) and later *Von Gubaroff* (1886) ascribed a valvular action to the oblique entry of the oesophagus into the stomach. These authors found a mucosal fold, the so-called "plica cardiaca" where the lateral oesophageal wall meets the medial wall of the fundus. As the entry of the oesophagus is oblique in the normal person, the angle between oesophagus and fundus is usually acute. This sharp angle was first described by *Heister* in 1752 and later called the "incisura cardiaca" by *His* (1903). Modern authors usually refer to it as the "cardiac notch" or "angle of His".

What appears on the outside as a sharp angle of His, forms on the inside the mucosal flap described by Braune and Von Gubaroff. Many authors, notably *Barrett* (1954) and *Marchand* (1955), contend that this flap plays an important role in closure of the cardia. Its action is said to depend on the difference between intragastric and intra-oesophageal pressure. The stomach is subjected to positive intra-abdominal pressure and the oesophagus to negative intra-thoracic pressure. *Barclay* (1933) demonstrated

that variations in intra-thoracic pressure are automatically transmitted to the lumen of the oesophagus. *Dornhorst* and *Leathart* (1952) confirmed that the intra-luminal pressure of the oesophagus reflects accurately the intra-thoracic pressure and that both are negative during expiration and become, of course, more negative during inspiration. The higher intra-gastric pressure will cause closure of the cardia by pressing the mucosal flap against the medial oesophageal wall.

The valve opens when, during swallowing, the oesophageal pressure becomes positive following peristaltic contractions. The food can then enter the stomach. Thus a valve mechanism is produced which is dependent on the oblique entry of the oesophagus into the stomach. If the angle of His enlarges or disappears altogether, as for instance in the case of a sliding hiatus hernia, the mucosal flap will no longer exist and the cardia becomes incompetent. *Lortat Jacob* and *Robert* in 1953 described cases of incompetence of the cardia where no hiatus hernia could be demonstrated. They consider this to be the result of "malposition cardio-tubérositaire". They postulated that the cardiac valve may allow reflux of gastric contents if it so happens that the oesophagus opens into the stomach in an abnormally high position. Their patients had no evidence of sliding hiatal hernia at operation, or by any means of investigation; nevertheless they complained of symptoms due to oesophagitis. They have cured such cases by sewing the top of the greater curvature to the side of the lower oesophagus in the abdomen, thus re-establishing the normal relationship between these two structures. In some ways the theory of a valve at the incisura cardiaca seems most satisfactory. It does not explain, however, as *Dornhorst* et al pointed out in 1954, how such a "mechanical" valve could allow occasional flow in the reverse direction, as for instance with belching or vomiting. Here the abdominal pressure is increased even further, and yet the valve opens. It seems improbable, therefore, that the closing mechanism can depend on a mechanical valve which *by its very structure* can only allow passage in one direction.

Hoag et al (1954) furthermore demonstrated experimentally that as long as a small rim of stomach is left distal to an intact oesophago-gastric junction, partial resection of the stomach is not followed by oesophagitis, even though the acute gastro-oesophageal angle was eliminated. *Meiss* et al (1958) confirmed these findings.

Theories of an internal muscular sphincter. During the past 10 years numerous anatomical, physiological and radiological investigations have been performed to examine old beliefs that some kind of physiological sphincter exists at the cardia.

Laimer in 1883, in a discussion on the anatomy of the oesophagus, mentioned a circumscribed thickening of the inner muscle layer approximately 1—3 cm. above the diaphragmatic hiatus, which he referred to as the

"lower physiologic constrictor". *Reich* (1927) and *Anders* et al (1932) likewise attributed a sphincter function to the circular muscle fibres of the terminal oesophagus. *Lerche* (1950) found a similar thickening of the circular muscle layer and speaks of an "inferior oesophageal sphincter". Most workers have been unable to demonstrate any important increase of the circular muscle of the terminal oesophagus, however. *Lendrum* (1937) examined more than 150 human cardias microscopically with multiple sections and stains. These specimens covered the whole range from foetal life to advanced senility. In none of the specimens was any special band of circular muscle seen in the terminal oesophagus. Both circular and longitudinal muscles appear to be absolutely continuous from the oesophagus into the stomach. In no case was there any localized muscular thickening which resembled sphincter muscle. Thus, anatomically, a true "internal sphincter" has never been conclusively demonstrated.

Experimental evidence that an area of increased pressure exists at the cardia has, however, accumulated during the past few years. *Dornhorst* et al (1956) found a segment of high pressure interposed between oesophagus and stomach which "has all the physiologic characteristic of a sphincter". *Atkinson* et al (1957), by means of intraluminal pressure readings combined with fluoroscopy, confirmed the findings of the previous workers. A segment of increased pressure at the cardia was constantly present in normal individuals. During a swallow the pressure in this segment fell to about the general intra-oesophageal level, indicating that the segment of higher pressure represented a tonically contracted "sphincter", which relaxed as part of the swallowing reflex. The fall in pressure of the segment takes place seconds before the peristaltic wave reaches it. This transient fall in pressure was found to correlate radiographically with the time during which the oesophago-gastric junction is open.

A segment of increased pressure at the cardia was also demonstrated in patients with a large fixed hiatus hernia. Here the segment was situated several centimeters above the level of the diaphragm. A sphincter mechanism must therefore be present at the cardia, acting independently of the diaphragm.

On the combination of muscular and valvular factors. We must accept that closure of the cardia depends on an intrinsic mechanism, situated at the cardia itself. This seems to have most of the physiological characteristics of a sphincter.

Dornhorst et al (1954), however, pointed out that while there is a very small resistance to forward pressure, this region has the ability to resist retrograde flow in spite of large inverse pressures. This behaviour is unlike that of known smooth muscle sphincters and favours the existence of some form of flap or funnel valve. The valve, as we have already

observed, must be capable of active opening for eructation of gas and for vomiting. To explain the co-existence of a localized region of increased pressure and a valvular mechanism at the cardia, Dornhorst proposed the theory that the muscularis mucosae, which *Thomlinson* (1953) found well-developed in this region, pulls the lax mucosa into a valvular form. Thus a valve is formed which depends for its efficacy on the normality of the muscularis mucosae which moves the mucous membrane and causes it to pout into the orifice.

Nauta (1955), on dissection of the human cardia, could demonstrate no mucosal lip or fold as described by Braune and von Gubaroff. Such a fold was also absent in the living when the cardia was viewed through a stomach fistula. However, a rosette of stomach mucosa seemed to exist, its folds bending in the direction of the oesophagus. This stomach mucosal rosette seemed to form a barrier to regurgitation of gastric contents. Alone, however, it does not supply an explanation for the active valve mechanism which must exist. Nauta considers the valve action to be dependent on the oblique entry of the oesophagus into the stomach, the latter being supported by the oblique fibres and the diaphragm.

Muller Botha (1958) also carried out a series of anatomical, physiological and radiological investigations. Like Nauta he comes to the conclusion that occluding mucosal folds of varying size, shape and position exist at the cardia. The majority resemble a rosette. On direct examination of the gastro-oesophageal junction in anaethetized animals, these folds were seen to possess functional activity and appeared to have active independent tone. Botha considers this to be dependent on the muscularis mucosae. These folds alone are too weak to withstand any substantial strain, however, and are supported by a physiological sphincter. He concludes that "the mucosal folds and the internal sphincter act together in perfectly balanced harmony".

Botha considers the cardiac angle a characteristic organ which is quite incidental to the problem of the cardia closing mechanism. To prove this, he states that embryonal development of the stomach fundus takes place long before the oblique fibres are developed. He considers these fibres to be the result of the asymmetrical development of the organ and not primarily a sphincter. Yet he does not deny that these fibres may assist in approximating the greater and the lesser curve wall of the orifice, thus narrowing the upper portion of the stomach.

Lendrum in 1937 had pointed out that in spite of the absence of an anatomical sphincter, there is one respect in which the circular fibres at the cardia differ from those in the remainder of the oesophagus. This concerns the relationship of the circular fibres to the oblique muscles of the stomach.

The oblique fibres are to be regarded as a special group of inner circular fibres of the stomach. They form a U-shaped band, the curve of the U

being the loop which passes over the cardiac incisura, and the arms of the U being the bands which extend down the lesser curvature on either side of the "Magenstrasse". The dissections of Lendrum revealed that the oblique fibres loop up into the oesophagus for as far as 1 cm. and blend with the circular muscle on the left aspect of the cardia. At this point the circular and oblique muscles have approximately the same direction and merge sufficiently so that they usually are not readily distinguished in miscroscopic sections. Lendrum concluded: "What practical significance these facts may have I cannot say".

Ton (1958) considers the answer to the whole problem of gastro-oesophageal competence to lie in the presence of these fibres. He agrees that the final waterproof closure of the cardia is produced by the mucosa and that opening and closure of the mucosal valve is regulated by an intrinsic muscular mechanism. He maintains, however, that the latter mechanism depends primarily on contraction of the sling of oblique fibres which swoop up to encircle the cardia. The tonic contraction of these fibres, he states, exerts a force which can be analysed into two components. The one force acts downwards, parallel to the lesser curvature. This maintains a sharp cardiac notch, at the same time producing a mucosal flap in the lumen at this site. The other component of the force approximates the flap thus produced, against the medial oesophageal wall. The cardia is thus kept tonically closed. During the act of swallowing, the longitudinal muscle fibres of the oesophagus, which are inserted into the lesser curvature of the stomach, contract. This, according to Ton, elevates the lesser curvature, at the same time shortening the effective length of the collar fibres, so that they become slack. The mucosal flap, released from the tonic contraction of the oblique fibres, opens and food enters the stomach. Immediately afterwards the longitudinal muscle fibres relax, so that the opening is again closed by the collar fibres.

In the case of sliding hernias, the fixation of the cardia is defective. The longitudinal muscles of the oesophagus, no longer opposed by the phreno-oesophageal ligament, not only pull the cardia through the hiatus, but, according to the above theory, produce incompetence of the cardiac mechanism by elevation of the lesser curvature. This nullifies the closing action of the collar fibres.

Conclusion

Many theories have been propounded to explain the intricate closing mechanism between oesophagus and stomach. After extensive anatomical, physiological and radiological study of the cardia during the past ten years, the solution of this problem seems near.

The investigation of the area has presented with serious technical difficulties. Post mortem examination of the cardia, for instance, is unsatis-

factory due to changes in the functional anatomy. The mucosal folds, which in life appear to have definite funtional activity, become smooth, glazed and flabby after death. Similarly, radiological examination of the region presents with difficulties; an "empty segment" is the most outstanding radiological feature at the lower end of the oesophagus. Experimentally, pressure changes in the region of the cardia have been recorded by means of thin tubes introduced into the oesophagus. Yet an objection to this method has always been that the recording tube might act as a foreign body and cause sustained contractions of the lower oesophagus, thus giving false readings. Another method of investigation has been to attach small metal markers to various parts of the cardia and then to study their movements radiologically during swallowing, belching, vomiting, respiration etc. These movements are minute, however, and difficult to interpret. Direct visual observation of the cardia in experimental animals also gives disappointing results, as the movements during swallowing are so rapid that it is impossible for the human eye to comprehend fully what is happening.

In spite of these technical difficulties, great advances have been made recently in the study of this problem. Thus it has now been demonstrated with certainty that the cardia can maintain its function independent of the diaphragm. Closure must depend on factors *intrinsic* to the cardiac region. As there is normally no oesophagitis or demonstrable reflux into the abdominal oesophagus, the intrinsic mechanism must be situated at the gastro-oesophageal junction itself.

Most authorities today agree that the final watertight closure between oesophagus and stomach is produced by mucosal folds at the cardia. These folds are approximated by an intrinsic muscular mechanism. Manometric and cineradiographic investigations have pointed to the presence of a segment of increased pressure at the cardia. These findings suggest that a sphincter exists, if not in the palpable anatomical sense, certainly in the all-important functional sense. This sphincter, then, draws together the mucosal folds of the cardia, closing off the top of the stomach.

Gastro-oesophageal closure depends therefore on both a valvular and muscular mechanism.

There is still no unanimous agreement on the action of the internal sphincter; whether it depends on circular muscle fibres in the terminal oesophagus or on the oblique muscle fibres of the stomach. Only when the nature of this sphincter has been conclusively established, will the problem of gastro-oesophageal closure be finally solved.

Chapter IV

ON THE AETIOLOGY OF HIATUS HERNIA

Hernia Hiatus Oesophagi can be defined as *the herniation of an abdominal viscus, usually the stomach, through the oesophageal hiatus of the diaphragm, into the chest.* Normally this herniation is prevented by a number of very important anatomical factors. These will be discussed first.

In the normal individual there exists a snug approximation of the crura around the oesophagus. This prevents the herniation of abdominal viscera into the chest. A wide hiatus predisposes to herniation. Many surgeons consider this to be the most important causal factor in the development of hiatus hernia and direct a large part of the surgical therapy at narrowing of the hiatus.

A second important anatomical structure which prevents herniation is the phreno-oesophageal ligament. It allows some oesophageal mobility during swallowing and respiration but secures the cardia below the diaphragm, at the same time preventing herniation next to the oesophagus by closing off the space between the gullet and the rim of the hiatus.

The left gastric artery may similarly play a part in preventing the upward shift of the stomach and has been called the "anchor of the stomach". The duodenum is also mentioned by some authors as anchoring the stomach in its normal position. That the gastro-splenic and gastro-phrenic ligaments, which are merely reflections of peritoneum, can have any important effect on stabilizing the stomach, seems less likely.

These anatomical factors are opposed by three important forces working in the upward direction. The longitudinal muscle fibres of the thoracic oesophagus exert a constant traction on the abdominal oesophagus and cardia, tending to pull the stomach through the hiatus. A second upward force is produced by the negative intra-thoracic pressure. This is increased with each inspiration and tends to "suck" the stomach into the thorax. The positive intra-abdominal pressure exerts a strong force on the stomach from below the diaphragm.

Normally these antagonistic forces are in equilibrium, providing a delicate mechanism for the fixation of the oesophagus in the hiatus, allowing the passage of food with swallowing and the movement of the diaphragm with respiration, but preventing the herniation of abdominal organs through the hiatus.

The equilibrium is disturbed when the factors preventing herniation are interfered with. In all series of cases the majority of patients fall in the age group above the 4th decade. This uniformity is undoubtedly of aetiological importance. The hiatus widens with the atrophy of muscle which accompanies the process of aging. There is a reduction of subperitoneal fat and a loss of elasticity of the hiatal tissues. The fine adjustment of the muscular ring around the oesophagus is disturbed. The phreno-oesophageal ligament which is sufficiently strong during the prime of life to protect the opening, loses its elasticity, atrophies and weakens, so that the stomach protrudes through the enlarged hiatus to a position above the diaphragm. It is probable that most hiatus hernias of elderly people result from such acquired incompetence of the hiatal structures. Increased abdominal pressure is another important factor inducing changes in the oesophageal hiatus. With obesity, pregnancy, large abdominal tumors and ascites, the intra-abdominal pressure is grossly and constantly raised. Child-bearing has a definite relationship to the development of hiatus hernia. *Rigler* and *Eneboe* (1935) demonstrated 25 hiatus hernias on routine examination of 125 women in the 3rd trimester of pregnancy. This high incidence is probably due to intra-abdominal pressure changes, because 7 out of 10 proved cases showed no evidence of herniation on recheck after delivery. *Nicholson* (1952) agrees and states that "sliding hernias probably develop during pregnancy and reduce themselves after confinement; to recur with the next pregnancy . . . . . I believe that, if we had barium meal examinations as a routine during the eighth month of pregnancy, hiatal hernia would be found as common as umbilical hernia at that time."

Chronic coughing or frequent episodes of retching or vomiting or chronic straining at stools, may similarly predispose to hiatal hernia by increasing the intra-abdominal pressure. At the same time it is conceivable that these episodes may stretch and possibly tear the tissues at the hiatal orifice (*Gilbert* et al 1946; *Brick* 1949). It has also been suggested that a sudden increase of intra-abdominal pressure with trauma might initiate a hernia.

In all the above instances it must therefore be assumed that the differential pressure between abdomen and thorax plays an important role in the production of a hernia.

Lastly, there is the factor of upward traction on the cardia by the longitudinal muscle fibres of the oesophagus. *Von Bergman* (1932) suggested that hiatus hernias may be due to traction from above by an oesophagus shortened in response to a vago-vagal reflex, initiated by some stimulus originating in the upper abdominal viscera. The longitudinal fibres of the lower portion of the oesophagus are continuous with the muscle fibres of the stomach and are innervated by the vagus nerve. Any shortening of the fibres would tend to pull the stomach into the chest.

Kuckuck, quoted by von Bergman, stimulated the vagal trunk in the neck of the rabbit and was able to demonstrate a shortening of the oesophagus which in some cases resulted in the traction of the cardiac end of the stomach through the hiatus. *Gilbert* et al (1945) repeated the work of Kuckuck. Metal clips were attached to the lower end of the oesophagus and to various parts of the stomach wall. After control X-rays, with the subject at rest, the vagal trunk was stimulated electrically in the neck. The oesophagus was seen to be shortened and the stomach to be pulled up to, but not through, the hiatal opening. In other experiments on dogs the lengthening and shortening of the oesophagus was recorded on a revolving drum by a lever fastened to the oesophagus. Irritation of the peritoneum by scratching with a sharp, pointed instrument, manipulation of the lobes of the liver, distension of the gallbladder by isotonic solution of sodium chloride, distension of the cystic duct or manual stretching of the stomach wall, all caused shortening of the oesophagus and a pulling up of the stomach to, and in some cases through, the hiatal orifice. The reflex was abolished by vagal section or by administration of atropine. In 1946 Gilbert gave 48 patients with hiatus hernia a complete X-ray examination of the gastro-intestinal tract and gallbladder. They had an average age of 56 2/3 years. In 27 patients a source of vago-vagal reflex could be demonstrated (cholelithiasis, duodenal ulcer, oesophageal diverticula, duodenal diverticula, carcinoma of the stomach and a tumor involving the diaphragm). This factor may be responsible for the frequent observation that symptoms and the roentgenological finding of oesophageal hiatal hernia appear and disappear over varying periods of time and in response to certain conditions.

When a sliding hernia has once occurred, the elastic recoil of the oesophagus, together with the positive abdominal and negative thoracic pressure, tend to keep the cardia in the mediastinum at all times. The herniation produced may be complicated by a reflux of stomach contents into the oesophagus. The resultant peptic oesophagitis provides a further stimulus to the contraction of the longitudinal muscles. Thus a vicious cycle is established.

The process may ultimately become irreversible. The longitudinal fibres of the oesophagus may, with extension of the inflammatory process through all layers of the oesophagus, be involved in the formation of scar-tissue. The presence of extensive ulceration and fibrosis may of itself so shorten the oesophagus as to produce further herniation of the stomach or render a sliding hernia irreducible. The process is then irreversible and may be likened to cicatricial shortening of the duodenum, as a similar manifestation of acid-pepsin disease, or to the production of a "purse-bag" stomach from the longitudinal healing of an ulcer on the lesser curvature.

Finally, it can be debated whether developmental factors play a part in

the aetiology of hiatus hernia. In the past much has been written about congenital weakness of the hiatus and about congenitally short oesophagus.

If during descent of the stomach though the posterior mediastinum, the diaphragm closes around the stomach before it is completely descended, a wide hiatus may result, according to many authors. The stomach may continue its descent until it lies below the diaphragm, but a large oesophageal hiatus may persist and in some instances also abnormal attachments of the phreno-oesophageal membrane and of the ligaments from the stomach to the diaphragm and spleen. This explains those hernias already present at birth. An abnormal enlargement of the hiatus and imperfect fixation of the stomach, may also explain the tendency in some cases to herniation in later life.

Congenitally short oesophagus, where the descent of the stomach is incomplete and where most of the stomach remains in the thorax, is very rare. In these rare cases one cannot speak of a true hernia as the stomach has never reached the abdomen. In most cases of hiatus hernia in infants the descent of the stomach has been complete, however, as at operation the stomach can be fully reduced into the abdomen.

In conclusion, therefore, one can divide the permanently short oesophagus, from an aetiological standpoint, into two groups: Those cases where the oesophagus is congenitally short, which occurs very rarely, and secondly, those where inflammation and ulceration have caused contraction of the lower end of the oesophagus.

Chapter V

ON THE TYPES OF HIATUS HERNIA

Akerlund in 1926 suggested the following classification of hiatus hernias, based on the length and position of the oesophagus in relation to the herniated abdominal viscera:

a. Hiatus hernia due to a congenitally short oesophagus.
b. Para-oesophageal hiatus hernia. — Here the hernia enters the chest alongside an oesophagus which is of normal length.
c. The remaining hiatus hernias. — Here the oesophagus is not congenitally shortened, but its distal end moves up into the chest to form part of the hernial contents.

Today the term "sliding hernia" is used for the third type of hernia described by Akerlund. A fourth type, which is a mixture of the second and third types has been added, but basically the classification of Akerlund remains unaltered.

I therefore propose to classify the hiatus hernias into the following groups:

1. Congenitally short oesophagus
2. Para-oesophageal hiatus hernia
3. Sliding hiatus hernia
4. Mixed type of hiatus hernia

1. *Congenitally short oesophagus*

Hiatus hernia associated with short oesophagus, as we have stated, may be congenital or acquired. True congenitally short oesophagus is an abnormality due to faulty embryonal development. The theory holds that the normal descent of the stomach during embryonal development is delayed, so that at birth the stomach lies partly or wholly above the diaphragm and remains largely an intra-thoracic organ. The oesophagus, which has not lengthened normally, keeps the stomach suspended in the posterior mediastinum above the diaphragm.

A large majority of hiatus hernias appear to be associated with a short oesophagus on roentgenological examination. At operation it is almost

Fig. 3
Para-oesophageal hiatus hernia. Lateral view

Fig. 2
Para-oesophageal hiatus hernia. Antero-posterior view

invariably possible, however, to replace the cardia below the level of the diaphragm. The shortening of the oesophagus is therefore usually acquired and has taken place secondarily to herniation of the stomach through the hiatus. True congenitally short oesophagus is therefore extremely rare.

In a recent article on the embryology of congenital diaphragmatic hernia, *Kleitsch* (1958) furthermore refutes the validity of the term "congenitally short oesophagus" on embryonic evidence or lack of it. He recalls that the foregut runs from the oral plate to the papilla of Vater, and that these are two unalterable, fixed points. The pharynx, oesophagus, stomach and duodenum develop out of this fixed length of bowel; obviously then, he argues, one cannot shorten one of these components without lengthening the others. A short oesophagus (on a developmental basis) would require a long stomach, duodenum or pharynx. This is in direct contrast to the descriptions in the reported cases, where the stomach is almost always found to be small and contracted. Furthermore, if the stomach can actually be conceived to have developed above the diaphragm, one must also expect to find its mesentery above the diaphragm, and in the mesentery the spleen and pancreas. Therefore in the so-called "congenitally short oesophagus", Kleitsch finds the presence of the spleen and pancreas in their proper, subphrenic locations ample proof that the stomach also developed subphrenically and was displaced upwards, secondarily, as a hernia.

A few cases have, however, been described in the literature where the oesophagus in infants was actually short on an anatomical basis, and could not be elongated sufficiently to place the cardia below the diaphragm. *Harrington* (1955), who prefers the term "congenitally short oesophagus with partially thoracic stomach", found these cases in 5% of his series of 489 hiatus hernias treated surgically. *Sweet* (1952) found 4 cases of congenitally short oesophagus of the 87 patients, where X-ray examination indicated that the oesophagus was short. In the remaining 83 patients the oesophagus could be restored to an anatomically normal length at operation. *Allison* (1951) in a series of 204 patients, had only one patient with a congenitally short oesophagus and incomplete descent of the stomach.

True congenitally short oesophagus must therefore be a very rare abnormality. In our series of 94 cases treated surgically, we had no case where reposition of the stomach below the diaphragm was impossible.

2. *Para-oesophageal hiatus hernia*

In para-oesophageal hiatus hernia, the oesophagus is of normal length and the cardia remains secured below the diaphragm. The stomach, and occasionally other abdominal viscera, herniate alongside the oesophagus into the posterior mediastinum (Fig. 2—3). The herniated abdominal viscus is usually a portion of the fundus but the entire greater curvature may

Fig. 5

Another example of an "upside-down stomach". Here the entire stomach is situated in the thorax. Only the cardia and pylorus, lying next to each other, remain below the diaphragm. Note the loops of large bowel drawn into the left chest with the stomach

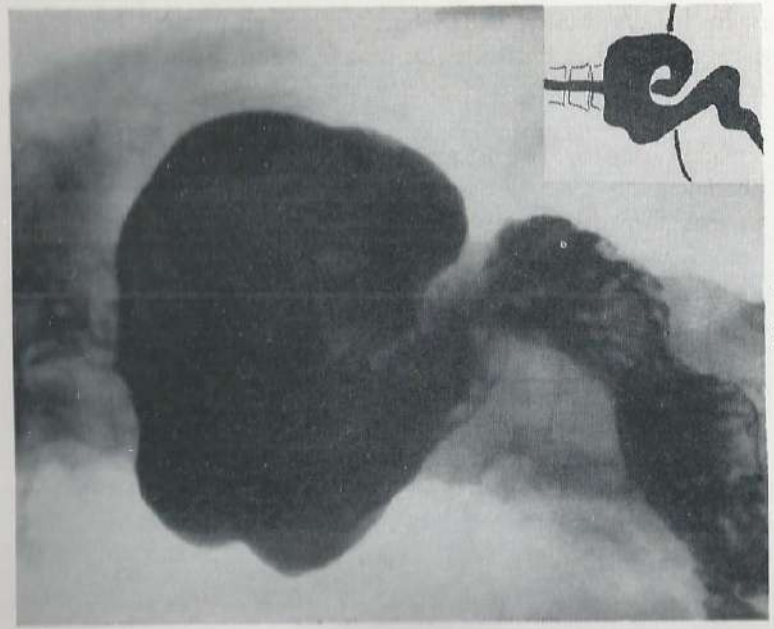


Fig. 4

Very large para-oesophageal hernia with nearly the entire greater curvature lying in the chest, giving the typical appearance of an "upside-down stomach"

be involved, as well as other viscera such as the colon, small bowel, spleen or pancreas.

The hernia may enter the chest through the hiatus in front, to the left or behind the oesophagus. *Allison* (1951) states that para-oesophageal hernias practically always occur in front of the oesophagus and that herniation behind the oesophagus is extremely rare. Probably the most frequent finding is that the anterior wall of the fundus of the stomach hernias practically always occur in front of the oesophagus and that (Fig. 2—3). This situation prompted Allison to describe it as the "rolling" type of hiatus hernia.

As more stomach enters the sac, the greater curvature may tilt upwards so that ultimately the organ has the appearance of being upside-down (Fig. 4—5). Hence the term "upside-down stomach" used by some authors to describe the very large para-oesophageal hernias. Roentgenologically the cardia and pylorus may be seen lying side-by-side in extreme cases. This is the result of the upward pull upon the duodenum produced by the ascent of the stomach, the cardia meanwhile remaining in its usual location. The gastro-colic omentum may cause the transverse colon to follow the stomach into the chest (Fig. 5).

Sweet (1952) maintains that para-oesophageal hernias occur through an independent aperture in the diaphragm beside the hiatus and that there is always a small strand of tissue, comprising often only a few fibres from the edge of the oesophageal hiatus, which remains undisturbed by the herniation and separates the hernia from the oesophagus. According to Sweet this thin margin of hiatus which remains intact, protects the integrity of the hiatus in which the oesophagus lies. For this reason he finds it appropriate from the standpoint of accuracy to designate these hernias as "para-hiatal" rather than para-oesophageal. *Buchanan* et al (1957) also prefer the term para-hiatal hernia and state that "this hernia is beside and not through the hiatus."

In our series of cases treated surgically, we never encountered this margin of tissue separating hernia and oesophagus. After reposition of the stomach in the case of para-oesophageal hernias, we always observed only the single widened hiatus. We therefore still consider these hernias para-oesophageal.

In the literature the incidence of para-oesophageal hernias varies from 5%—15%.

3. *Sliding hiatus hernia*

In this type of hernia the abdominal oesophagus moves upwards through the widened hiatus to form part of the contents of the hernial sac. It is followed by the cardia itself which forms the apex of the herniated stomach. In contrast to congenitally short oesophagus, the lesion is usually acquired and not due to faulty embryonal development.

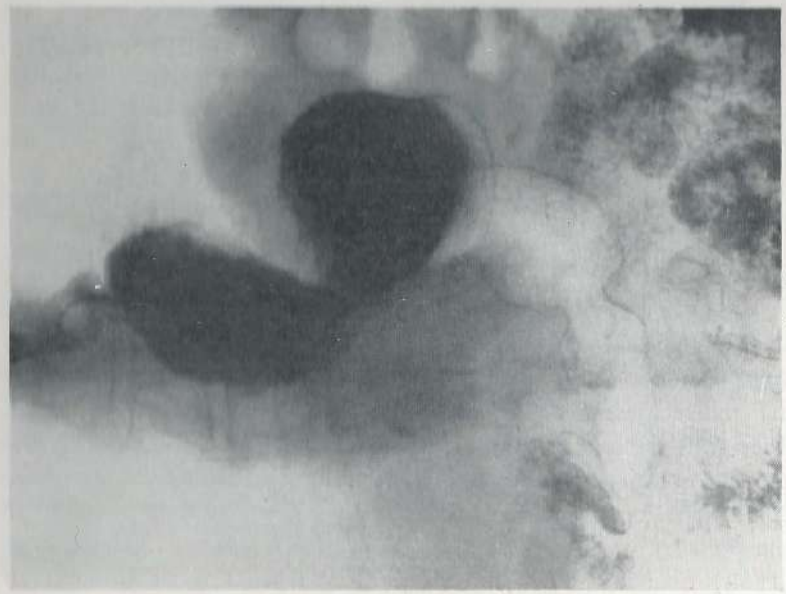


Fig. 7
The same patient in Trendelenburg position. Note the relatively narrow hiatus and the tortuous distal oesophagus.

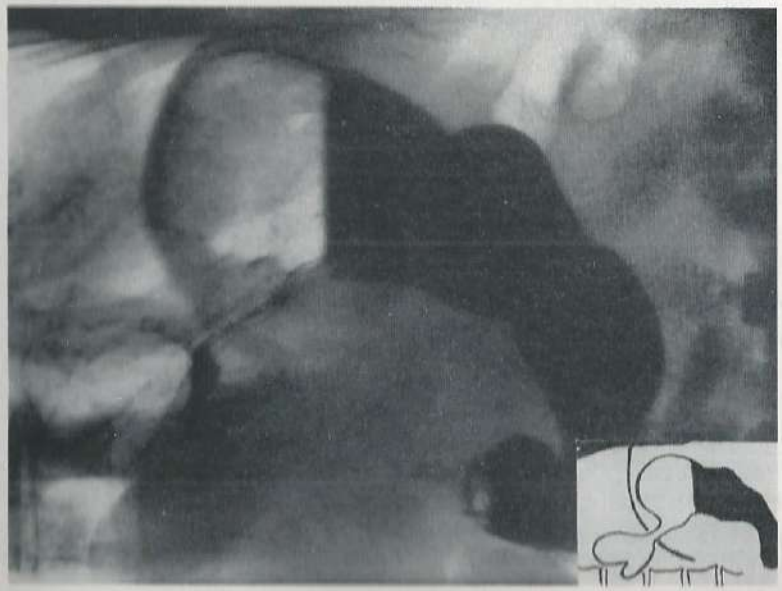


Fig. 6
Large irreducible sliding hiatus hernia with patient in the erect position.

These hernias are commonly encountered in elderly people and are probably attributable to atrophy of the elastic fibres of the phreno-oesophageal ligament, together with relaxation of the muscular collar of the hiatus. An incompetent hiatus results. The phreno-oesophageal ligament and also the peritoneum, which at the hiatus is reflected anteriorly and laterally from the stomach onto the diaphragm, is pulled up into the chest with the cardia, to form the sac of the hernia. Since part of the wall of the sac is made up of viscus, the term "sliding hernia" is appropriate. The hernia thus becomes comparable to a sliding hernia of the inguinal canal where one wall of the peritoneal sac consists of an abdominal viscus.

The oesophagus is of normal length but its abdominal part is displaced upwards. The inherent elasticity of the oesophagus may take up the slackness to produce an acquired "short oesophagus". Sometimes this does not happen and the gullet is seen roentgenologically as a tortuous tube above the hernia. As early as 1926 *Åkerlund* remarked on this "geschlängelten Verlauf" of the oesophagus. Hernias of this type may be of any size and often become very large (Fig. 6—8, 14—15).

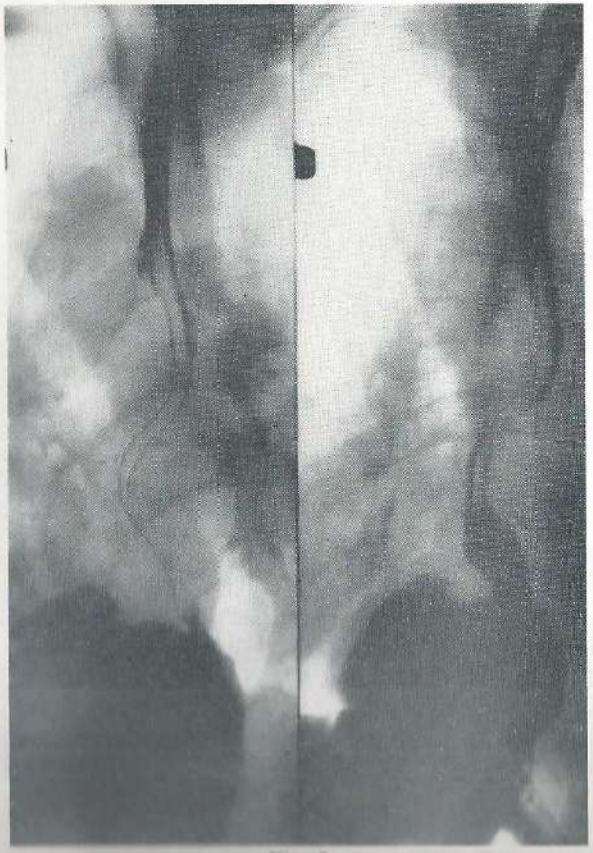


Fig. 8
Large sliding hiatus hernia with tortuous distal oesophagus

This type of hernia is not uncommonly associated with complications. The cardia, abnormally situated in the chest, often cannot maintain its normal function. The closing mechanism between oesophagus and stomach becomes incompetent and reflux of gastric contents into the oesophagus results. (See Chapter XIII). Oesophagitis is therefore a common complication of these hernias.

In the larger series of cases reported in the literature, this type has by far the highest incidence. *Allison* (1951) saw 170 sliding hernias in a series of 204 patients, which gives and incidence of 83%.

Harrington (1955) found that they constituted about 67% of his series of 489 cases treated operatively. Most of the postoperative recurrences, as well as failures to attain complete relief of symptoms after operation, occurred in this group.

4. *Mixed type of hiatus hernia*

On radiological examination of some hiatus hernias one can clearly discern both a para-oesophageal and sliding component (Fig. 9—10).

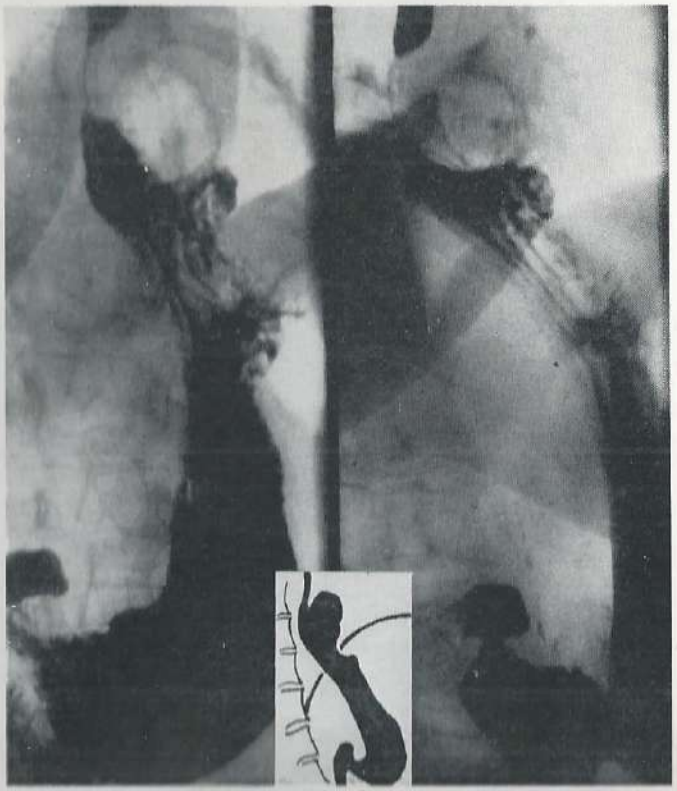


Fig. 9

Mixed hiatus hernia. Note that the hernia is largely para-oesophageal but that the cardia is also situated above the diaphragm

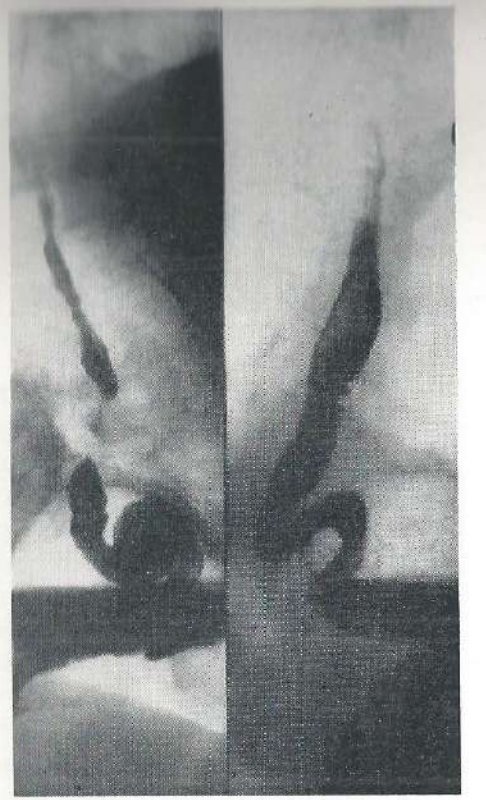


Fig. 10

Mixed hiatus hernia. Note the tortuous distal oesophagus

Usually there is a large para-oesophageal pouch which predominates. On screening the patient in various positions, however, the cardia is also seen in the mediastinum above the diaphragm. These patients can therefore also present with incompetence of the gastro-oesophageal closing mechanism. (See Chapter XIII). *Allison* (1951) found 6 of these cases in 204 patients with hiatus hernia.

Chapter VI

ON THE SYMPTOMS AND SIGNS OF HIATUS HERNIA

Hedblom in 1931 stated that "the aetiology of diaphragmatic hernia is often obscure, its pathologic anatomy diversified, and its clinical manifestations manifold".

The symptomatology of hiatus hernia is indeed extremely varied. Patients complain of a large variety of symptoms, situated in the upper abdomen, in the chest, under the sternum, and of anginal pains, anaemia etc. An important clinical consideration with reference to oesophageal hiatus hernia, is the frequency with which the symptoms simulate other organic disease of the abdomen and chest. *Harrington* (1955) calls hiatus hernia the "masquerader of the upper abdomen". In a series of 489 cases in which he performed operations for hiatal hernia, approximately three previous erroneous diagnoses had been made in each case before the correct diagnosis was established. The erroneous diagnoses, in order of frequency were: cholecystitis, cholelithiasis, gastric ulcer, duodenal ulcer, hyperacidity, secondary anaemia, cardiac disease, carcinoma of the cardia, stricture of the oesophagus, intestinal obstruction, appendicitis and thoracic tumor. Thirty-seven of his patients had been operated on, without relief of symptoms, for other conditions, the most common of which were gallbladder disease, gastric and duodenal ulcer, and intestinal obstruction. On repair of the hernia, however, their symptoms were relieved. Hiatus hernia, furthermore, commonly accompanies other gastro-intestinal lesions. *Brick* (1949) in an analysis of the roentgenologic findings in hiatus hernia, found that one out of every four cases had a roentgenologic diagnosis of an associated gastro-intestinal lesion; diverticuli, peptic ulcer etc. (See also Chapter VII).

Hiatus hernia may also be present without causing any symptoms. Thus it may be a coincidental finding during roentgenological examination of the stomach for other disease.

In addition, there is no correlation between the size of the hernia and the severity of symptoms. Large hernias are occasionally symptomless, whereas small ones can cause severe complaints.

In spite of the diversity of complaints, however, there is usually a definite pattern to the symptoms of hiatus hernia. Thus it is often possible from

the history alone to strongly suspect its presence. Two of our cases were operated for hiatus hernia on clinical evidence alone, after repeated roentgenological examination had been negative. At operation the diagnosis was confirmed.

There are two peaks in the age incidence of hiatus hernia, one in infancy and early childhood, and the other in adults over the age of 40 years. As the manifestations of hiatus hernia differ somewhat in infants and in adults, the clinical picture will be discussed separately.

Hiatus Hernia in Infants

Until a few years ago it was thought that hiatus hernia occurred only in adults over the age of 40. Since recently, however, it is known to be not uncommon in children.

Otherwise normal babies may present with the symptoms of hiatus hernia immediately after birth. *Carré* et al (1952) who studied the medical histories of 112 children with sliding hiatus hernia, found that vomiting was the principal and invariable symptom, dating from birth or from the neonatal period in 90% of cases. The vomit consisted of most or all of the feed and always contained much mucus; rarely it was bile-stained. Blood was often present, usually only as a few flecks. "Except on a few occasions, the blood was not bright red but altered in appearance and often not recognized by the parents — an important point to remember in history-taking."

Serious haematemesis is rare. Often, however, there is loss of blood which is occult, but of a degree that causes anaemia.

The babies may show a dislike of certain foods, for example fruit juice, crumby foods such as bread or biscuits, and sometimes thick porridge. The general condition always suffers. Failure to gain weight is universal. On examination the children are nearly always under-developed, thin and pale. They sometimes have slight temperature, possibly as a result of oesophagitis. In severe cases there may be moderate dehydration. Examination of the blood may reveal an anaemia, usually a microcytic, hypochromic anaemia. This is explained by the chronic loss of blood and dietary insufficiency.

Veeneklaas (1953) remarks that other congenital abnormalities may be present. In his 12 patients he saw two who were mentally backward.

On roentgenological examination two main features are observed: the hernia is nearly always of the sliding variety and there is always gastro-oesophageal reflux. Sometimes the thoracic part of the stomach is evident at a glance, but often it is only filled completely for very fleeting periods. Not infrequently a correctly timed radiograph is unobtainable. This emphasizes the importance of careful fluoroscopy. Occasionally several examinations have to be made before the diagnosis is established.

Reflux is more easily detected and practically always present. If severe, the barium moves in and out of the stomach synchronously with respiration. At oesophagoscopy, oesophagitis is a frequent finding. Ulceration may be present.

The prognosis for complete recovery is poor in these cases. According to Veeneklaas, the abnormality may very occasionally disappear completely with conservative treatment in babies less than a few months of age. Rarely, symptoms disappear but a hernia remains present roentgenologically. As a rule, however, the symptoms and the X-ray picture persist for years.

Stenosis of the oesophagus may develop as a result of oesophagitis. Carré finds the chances of stenosis few, as seen in 112 young patients in his follow-up over a period of some years. He states that "only a very small proportion of all affected children eventually develop a stricture — probably less than 10%". Most authorities maintain, however, that the likelihood of such a stenosis developing is great.

Husfeldt (1952) followed up 14 of these cases for "many years" before surgical treatment was instituted. None of the children were symptomfree, one had died, and in only two cases had the symptoms improved significantly. He states that some children succumb to intercurrent disease due to a state of chronic debility. Others, who develop severe stenosis, are no doubt often erroneously labelled as corrosive strictures. He describes such a case where the history of corrosion seemed subject to considerable doubt.

Hiatus hernia in infancy is therefore a serious abnormality. Without treatment the development of the child may be seriously retarded and there is always a possibility of ultimate irreversible oesophageal damage.

Hiatus Hernia in the Adult

Although hiatus hernia occurs in early childhood, most cases are adults over the age of 40. The greatest number of cases seem to fall in the fifth decade. Most authors agree that the condition is more common in women, the sex incidence given varies from 2—1 to 4—1. The higher female incidence may be attributable to factors mentioned in the chapter on the aetiology of hiatus hernia, i.e. the influence of pregnancy, a greater tendency to obesity etc.

Brick analysed the reports of all barium studies of the upper gastro-intestinal tract in the radiology department of the Boston City Hospital during 1945 and 1946. Examination in the prone and Trendelenburg position had been done routinely. In 8.93% of 3448 patients with gastro-intestinal symptoms, a hiatus hernia was found. After duodenal ulcer (20.41%), hiatus hernia constituted the second most frequent diagnosis made. *Nuzum* (1947) had found an incidence of 12.27% in patients with

gastro-intestinal symptoms. Gilbert (1948) examined 107 patients with anginal pain and found a 17% incidence of hiatus hernia.
Brick and *Amory* (1950) examined 300 symptomless volunteers over the age of 50 years and found only 4 hiatus hernias. This gives an incidence of 1.3% and confirms the work of *St. John* et al who in 1944 had found an incidence of 1% in a similar group comprising more than 2,000 persons.
It appears therefore that the incidence of hiatus hernia in asymptomatic persons is small (1%), even in the age group where hiatus hernia occurs most frequently. This suggests that the finding of a hiatus hernia in patients with symptoms cannot be treated lightly. Brick and Amory state that "even when another lesion is found one should not be too prone to dismiss the hiatus hernia as being of little significance in view of its much greater incidence in patients with symptoms".
Oesophageal hiatus hernia may produce symptoms in a number of ways. It may produce discomfort by its mere presence as an abnormal organ above the diaphragm, therefore as space-occupying mass in the chest. This group of symptoms can be produced by both sliding and para-oesophageal hernias or by the mixed variety.
Symptoms may also develop as a result of incompetence of the cardiac mechanism. Thus there is a distinct symptom complex produced by the reflux of gastric contents into the oesophagus and by the resultant oesophagitis. Gastro-intestinal haemorrhage complicating the hernia causes a third symptom complex. Lastly, patients may present with symptoms referred to distant organs along a variety of nerve pathways.

1. *Symptoms produced by the hernia as space-occupying lesion*

This symptom complex is by far the most common as it can be produced by any of the various types of hiatus hernia.
After meals the patient experiences *discomfort*, *distension* or a *"full feeling"* in the epigastrium and under the lower sternum. This is felt especially after the main meal of the day. It may vary from slight discomfort to acute pain. The mechanism of its production is uncertain but it is probably associated with overdistension of the herniated portion of the stomach by ingestion of food, or by gas.
This discomfort is aggravated by the patient lying down or bending forwards after a meal, or by any factor which increases the intra-abdominal pressure and forces more stomach contents into the hernia. The wearing of a tight corset will therefore increase the discomfort.
Nausea and *vomiting* may follow meals and also excessive *belching*. Both vomiting and belching relieve the symptoms by easing the distention of the herniated stomach.
The patient may complain of *difficulty in swallowing*. This may take a very

mild form, the patient only complaining of a sensation as if the food "sticks" momentarily under the lower sternum before passing into the stomach. Occasionally patients complain of serious dysphagia. Both the mild and serious forms may be the result of pressure of the hernial mass on the lower oesophagus. This delays the bolus of food in its passage down the gullet. Some patients describe the bolus of food as causing an "air lock" which is relieved by belching. The dysphagia is always more marked for solid foods than for liquids.
In the case of large hernias, pressure on the lungs and interference with the motion of the diaphragm may cause dyspnoea. This may also be relieved by belching.

2. *Symptoms produced by Incompetence of the Cardiac mechanism*

In those hernias complicated by incompetence of the cardiac machanism, the clinical picture is characterized by a different set of symptoms. These are produced by the regurgitation of gastric contents into the oesophagus. This may take place in all hernias where the cardia itself herniates through the hiatus, therefore in all cases with a "sliding" component.
The patient experiences a burning discomfort under the sternum which may be described as mild *heartburn*. Often it takes a much more serious form and with the advent of oesophagitis becomes a severe, sometimes excrutiating, *burning pain* in the epigastrium and behind the lower part of the sternum. It may rise up the chest into the neck, to the angles of the jaw and to the ears. It may radiate through to the back between the shoulder blades or down the arms.
When these patients complain of heartburn, which is related to posture, it indicates that *regurgitation* of acid into the lower end of the oesophagus is taking place. In some, this regurgitation rises into the upper end of the gullet or even into the throat. In the more extreme degrees, the gastric contents may come up into the mouth to be swallowed again or expelled. The reflux of gastric contents is promoted by the patient lying down or bending forwards and by all factors increasing the intra-abdominal pressure. It comes on especially with exertion, or bending forwards while scrubbing the floor, leaning over the washtub, poking the fire, fastening shoe laces etc. It usually comes on with lying down after a meal. The patient may wake up at night with burning substernal pain. This is relieved by standing or sitting up or by taking a glass of milk or an alkaline mixture. The patient may discover that sleeping sitting-up prevents the onset of pain. Often patients have more trouble when sleeping on the right side. This position facilitates the reflux of gastric contents into the oesophagus.
As oesophagitis develops the throat becomes dry and burning. When the patient swallows she may be conscious of the passage of food down the gullet. It may cause a painful sensation and may sometimes lodge in the

vicinity of the lower end of the sternum, causing pain which is immediately relieved as the bolus passes into the stomach. The *dysphagia* with hiatus hernia may therefore be caused by the hernial mass itself hindering the passage of the food bolus or by the fact that it has to pass through an inflamed oesophagus. Excessive *belching* is another common symptom of cardiac incompetence.

Once oesophagitis is established, the pain becomes more constant although still aggravated by the patient lying down or stooping, which causes further reflux of acid into the lower end of the inflamed oesophagus. This *relation to posture* remains a constant factor. In the terminal stages of oesophagitis, a more boring type of pain is experienced. It radiates through to the back between the shoulder blades and is often aggravated by flexion of the spine. The pain is produced by deeper penetration of the inflammation or by frank ulceration into the oesophagus wall and surrounding mediastinal tissues.

A note on "intractable heartburn of pregnancy"

Heartburn is fairly common during the latter months of pregnancy. It can usually be relieved by alkalies and sedation. A group of patients, however, have more constant and more severe symptoms, not relieved by any known treatment. *Evans* and *Bouslag* in 1940 designated this group as having "intractable heartburn of pregnancy". The syndrome usually begins about the 20th or 25th week and continues with increasing severity until delivery. The patient has severe heartburn along the entire course of the oesophagus. There is effortless regurgitation, not necessarily accompanied by vomiting sensations or belching. As pregnancy continues and with the progressive increase of intra-abdominal pressure, the only relief obtainable is by the maintaining of an upright or semi-upright position. Many patients are unable to assume the recumbant position for several months before term without severe suffering.

All symptoms increase in severity until labour is completed. Following delivery, relief is complete unless there had been symptoms in the previous non-pregnant state.

Evans and Bouslag found a sliding hiatus hernia in all these cases. They ascribe the symptoms to regurgitation of acid gastric contents into the oesophagus. The inability to obtain relief from antacids and ulcer types of diet is accounted for by the steadily increasing intra-abdominal pressure.

Rigler and Eneboe (1935), as we have mentioned, found 25 hiatus hernias on routine examination of 125 women in the third trimester of pregnancy. Seven out of ten proved cases showed no evidence of herniation on recheck after delivery. Sliding hernias may therefore develop during pregnancy and reduce themselves after confinement, to recur with the next pregnancy.

We have found, in addition, that women suffering from hiatus hernia, often ascribe the onset of symptoms to pregnancy.

3. *Symptoms due to Gastro-Intestinal Haemorrhage*

Oesophageal hiatus hernia may produce haemorrhage, occult or manifest, in a number of ways.

With oesophagitis there may be loss of blood from the inflamed and swollen oesophageal mucosa. In the later stages of oesophagitis, ulceration may follow. These oesophageal ulcers may cause sudden and sometimes severe haematemesis. More often they cause chronic, occult loss of blood.

Ulcers may form in the herniated portion of the stomach as a result of constriction as the neck of the hernia and may also be present in the fundus of the herniated stomach, possibly as a result of ischaemic changes following interference with the bloodsupply (Fig. 19—20). Bleeding may occur from the engorged vessels of a partially strangulated stomach.

Patients may therefore come for medical attention for the first time, with haematemesis. This may occur in the absence of other gastro-intestinal complaints. Moreover, an apparently causeless secondary anaemia may exist, the hernia being discovered only after careful examination of the gastro-intestinal tract. These patients present with the symptoms of anaemia.

4. *Referred Pain with Hiatus Hernia*

Stimuli which arise at the hiatus due to mechanical factors or inflammatory changes produced by oesophagitis, may be referred to other organs via the vagus, the phrenic or the spinal nerve pathways. Patients may therefore, in addition to the typical hiatus hernia symptoms, complain of pain in the chest, which radiates down the arms, closely simulating angina pectoris. Referred pain via the vagus pathways is also occasionally felt in the ears or in the throat.

The differential diagnosis between hiatus hernia and angina pectoris is of great practical importance since they occur with increasing frequency in the same age group.

It has long been known that hiatus hernia may produce pain in the chest, which can simulate angina pectoris due to coronary artery disease.

Master et al (1949) state that the phrenic, vagus, and spinal nerve pathways are much the same for the diaphragm, the lower end of the oesophagus and the stomach and that the painful sensations, arising from distension of the oesophagus or herniated portion of the stomach or from the diaphragm, are transitted through these visceral afferent fibres to the upper thoracic spinal segments, from which they are referred to the praecordium and the left arm.

Coronary artery disease may, on the other hand, produce gastro-intestinal

symptoms. Conversely, an attack of angina pectoris may be precipitated by a large meal. The incidence of anginal pain following the ingestion of food, has been commented on by most of the writers on angina pectoris. The symptoms produced may be common to both conditions, i.e. epigastric or substernal pain, radiating to the left shoulder, aggravated by exertion and food and relieved by belching. They may both cause "indigestion", vomiting and other gastric symptoms. Nitroglycerine and other antispasmodics will relieve the pain of both lesions.

The two conditions may also co-exist, therefore the finding of one does not exclude the other (*Groedel*, 1945; *Radloff* and *King*, 1947; *Nuzum*, 1947). Master et al made a complete study of the cardiac status of 57 consecutive patients with proved hiatus hernia of the stomach. Evidence of organic heart disease was found in almost two-thirds of his cases. Six patients, however, had thoracic pain suggestive of angina pectoris but no organic coronary disease could be demonstrated, which suggested that the hiatus hernia may have been the only factor initiating the pain in the chest through reflex pathways. The history alone, therefore, is not a safe means of differentiating hiatus hernia from angina pectoris due to coronary disease. Nevertheless the history may be helpful, for the occurrence of epigastric or substernal discomfort in the recumbant position, which is relieved on standing, is characteristic of hiatus hernia. The constant relation to effort, however, and prompt relief by the use of nitro-glycerine, is more suggestive of coronary artery disease. *Jones* (1941) found no case of hiatus hernia in which exertion invariably produced pain. In no case was the relief of symptoms following the use of nitro-glycerine as regular as that noted in typical anginal attacks.

Objective tests, especially electrocardiography, are of prime importance in differentiating the two conditions. Uncomplicated hiatus hernia gives no objective evidence of coronary artery disease. If a patient with a known hiatus hernia experiences angina on effort, coronary disease should be suspected and will, according to Master et al, be confirmed by electrocardiographic examination.

Although it is not generally accepted that hiatus hernia can produce any disturbance in the coronary circulation in the presence of normal coronary arteries, it is accepted that it may act as a trigger mechanism in precipitating angina pectoris when the coronary arteries are sclerotic.

It has been known for a long time that reflexes arising from the diaphragm, oesophagus, stomach or gallbladder, either normal or diseased, may produce cardiac signs and symptoms and affect the coronary circulation. This applies particularly to hiatus hernia.

The substernal pain of hiatus hernia, as we have stated, may radiate up to the base of the neck, to the angles of the jaw or up to the ears. Patients with hiatal hernia may, however, present with ear pain as the chief symptom (*Malherbe* 1958). The mechanism of its production can be explained on an anatomical basis.

The vagus nerve, after leaving the skull through the jugular foramen, gives off an auricular branch, which is distributed to the external auditory meatus and to a small area of skin over the mastoid process (Fig. 11). Various "reflexes" are known in connection with this branch of the vagus.

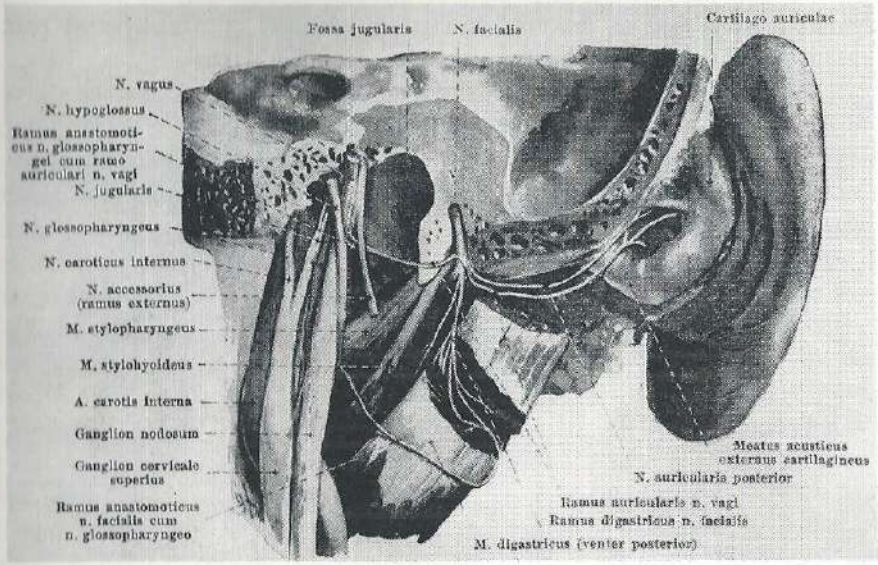


Fig. 11

Anatomy of the auricular branch of the vagus nerve (Spalteholz)

The "ear cough" is mentioned by Gray's Anatomy as one of the most common. A plug of wax in the external auditory meatus may, by irritating the filaments of the auricular branch, be responsible for a persistent cough. Syringing the auditory meatus may similarly produce coughing. In children, vomiting is not uncommon as a result of such a procedure; moreover in people with weak hearts syringing the ear has been responsible for a sudden fatal syncope, by reflex irritation of the cardiac branches.

The phenomenon of otalgia with oesophageal hiatal hernia can be explained as a referred pain along these vagus pathways. Irritation of the oesophageal filaments produce stimuli which are centrally misinterpreted as coming from the auricular branch. Thus a painful, itchy sensation in the external auditory meatus results. The vagus or its oesophageal branches may be irritated by pressure on the nerve in the hiatus, by stretching of the nerve over the hernial mass in the case of a large hernia, or by inflammation where the hiatal hernia is complicated by oesophagitis.

In the three cases in our series where the hiatal hernia was surgically

repaired, it was noted that the ear-ache disappeared immediately after the operation. The irritation of the vagus nerve was therefore probably caused by stretching or compressing of the nerve by the hernia.

Patients with a persistent, painful, itchy sensation in the external auditory meatus, for which no local explanation can be found, and who may, or may not, have associated abdominal or substernal complaints, should be examined for the presence of oesophageal hiatus hernia.

Patients may also complain of pain in the throat. This may be an isolated symptom, like pain in the ears. It is then probably due to referred pain along the pharyngeal or laryngeal branches of the vagus.

Chapter VII

ON THE DIAGNOSIS OF HIATUS HERNIA

Until the advent of diagnostic radiology, the condition of hiatus hernia was practically unknown. With the discovery in 1922 bij *Morrison* and *Healy*, that these hernias of the stomach can be demonstrated by barium examination in the recumbant position, the disease became increasingly better known. Hiatus hernias of the reducible, sliding type, had probably been missed frequently as barium meals were only carried out in the upright position. This was largely due to the fact that it was natural for the patient to drink in this position. The upright apparatus was constructed for barium meals and the horizontal table for barium enemata. *Brian Donnelly* (1953) states that "the modern tilting table has undoubtedly been responsible, to some extent, for the more frequent diagnosis of hiatus hernia, and it has greatly simplified the investigation".

Today examination of the stomach in Trendelenburg position is an integral part of every complete gastro-intestinal study. A clinical impression of hiatus hernia which cannot be substantiated by roentgenological examination, is usually not considered sufficient to justify surgery.

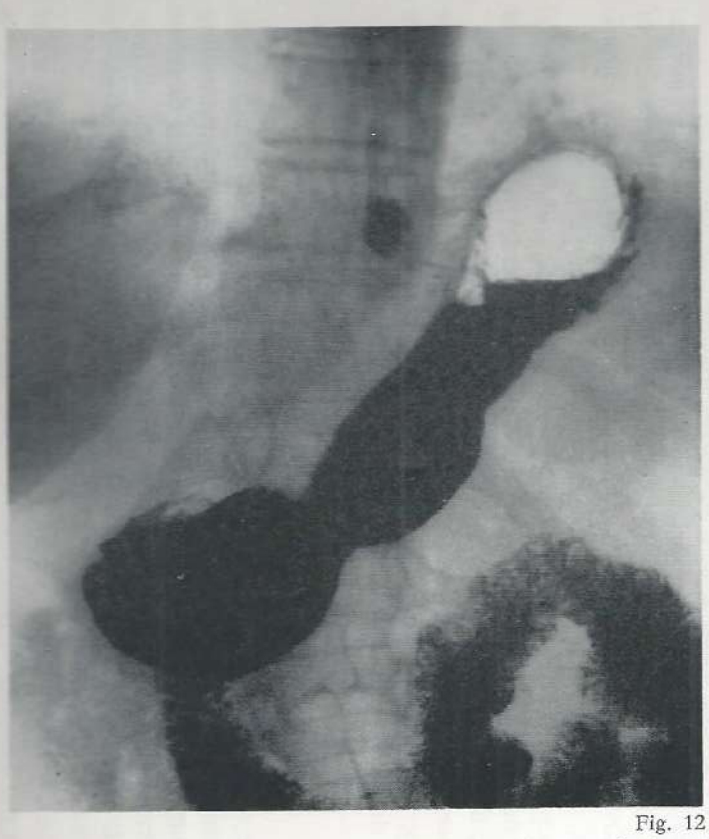
Oesophagoscopy provides another valuable diagnostic aid. It is employed not only to confirm the diagnosis, but affords the only positive means of detecting oesophagitis and oesophageal ulceration.

Where, on clinical examination, the presence of a hiatus hernia is therefore suspected, these two special investigations should be employed to confirm the diagnosis and to detect any possible complications.

1. RADIOLOGY OF HIATUS HERNIA

The radiological diagnosis of hiatus hernia is largely based on anatomical features. This constitutes the recognition of part of the stomach protruding through the oesophageal hiatus of the diaphragm. The patient is therefore given barium and then examined in Trendelenburg position. The diagnosis is made when the barium-filled stomach fundus slides through the hiatus into the chest.

The early case, however, appears as a small dilatation, only slightly wider than the oesophagus, lying directly above the diaphragm. It often presents



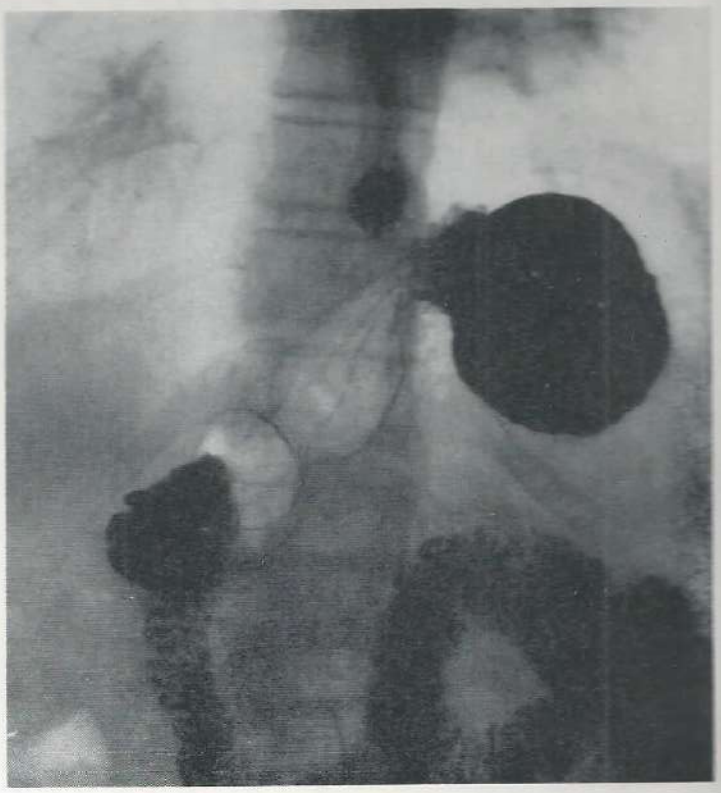


Fig. 12 & Fig. 13

Ampulla epiphrenica with the patient erect and in Trendelenburg position.

Fig. 14

Small sliding hiatus hernia

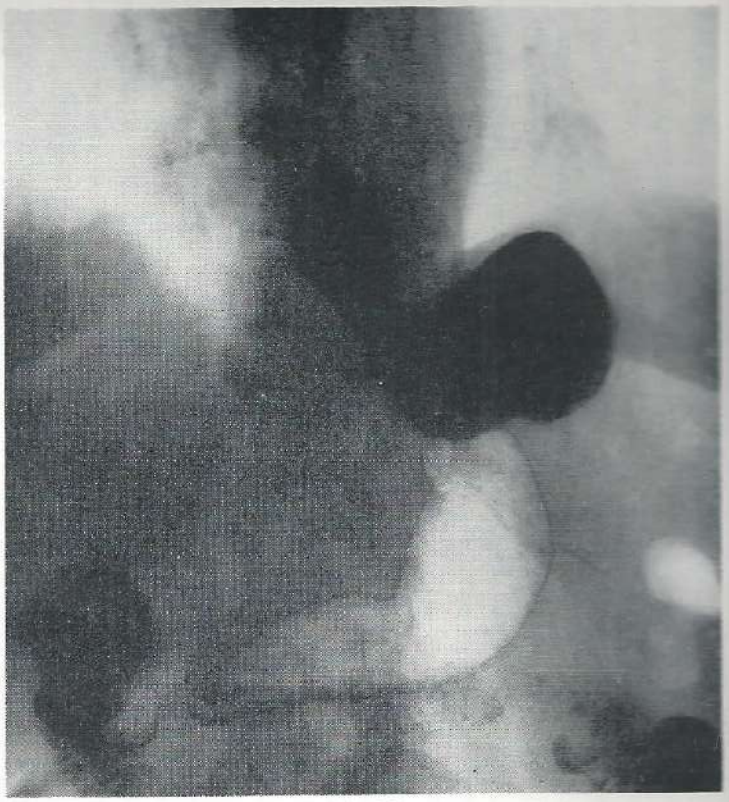


Fig. 15

Larger sliding hiatus hernia

difficult diagnostic problems, as in the normal person there may roentgenologically be a small dilation above the diaphragm during swallowing. For over a hundred years anatomists have argued that the oesophagus is not a simple tube of uniform calibre, but may have either one or two dilatations, or pouches, at the lower end. According to Johnstone, *Arnold* in 1883 described one in the last 3 cm., which he termed the "Vormagen". Subsequently this became known as the *cardiac antrum*. Some twenty years later *Luschka* found, in addition to Arnold's pouch, another variation in which there were two pouches. The one above the diaphragm later became known as the *ampulla epiphrenica* or *phrenic ampulla*. In radiological studies of the living, the infra-diaphragmatic portion of the oesophagus is seldom demonstrable. Radiologically the oesophagus and stomach fuse at the lower margin of the hiatus (*Johnstone* 1952).

A dilatation of the terminal oesophagus immediately above the diaphragm, corresponding to the anatomists' phrenic ampulla, can be demonstrated in normal subjects. It is caused by a peristaltic ring, travelling down the oesophagus pushing a bolus before it. A pouch develops in the segment immediately above the diaphragm. The dilatation increases until the pressure within it equals the force of the wave. The bolus then passes into the stomach. If the diaphragm is held in sustained contraction while barium is swallowed, as with maintained deep inspiration, the peristaltic ring will relax after a momentary pause and the barium flows back into the upper end. Usually there is a segment .5—2 cm. long, which is not filled by barium and which lies between the oesophageal pouch and the fundus of the stomach.

The presence of an epiphrenic ampulla may lead to diagnostic difficulties, as it may resemble a sliding herniation of the stomach (Fig. 12—15). Differentiation between these conditions will depend upon examination of the mucosal pattern. Oesophageal mucosa is represented by three or four fine longitudinal lines, whereas gastric folds are thicker and coarser. Gastric folds often run transversely or branch off giving a varicose appearance. The mucosal junction between oesophagus and stomach is not always clearly defined radiologically in the normal individual. Where, however, a pouch is present above the diaphragm, the character of its mucosa will be an aid in distinguishing an epiphrenic ampulla from a hiatus hernia. When gastric mucosa is seen clearly running through the hiatus into the supra-diaphragmatic pouch, the diagnosis of hernia is confirmed radiologically.

Another helpful point is the angle of entry between the terminal oesophagus and the fundus. This angle, also termed the "cardiac angle" or "angle of His", is usually sharp in normal individuals. As the cardiac end of the stomach herniates through the hiatus, in the case of a sliding hernia, the sharp angle disappears and the oesophagus and fundus appear as one straight tube. If, therefore, there is a supra-diaphragmatic pouch with a

large, or non-existent cardiac angle, the presence of hiatus hernia is probable.

A third important point in the diagnosis of hiatus hernia, is the presence of reflux. As sliding hernias cause incompetence of the cardiac mechanism, reflux of barium from the stomach back into the oesophagus is suggestive of hiatus hernia. In normal persons the cardiac valve can prevent reflux in Trendelenburg position even during deep inspiration or on mild abdominal pressure. In the case of sliding hernias, an incompetent valve will allow free reflux. Often there is reflux in the horizontal position and occasionally the barium will be seen to flow back into the oesophagus with deep breathing or straining, even in the upright position.

The above points then, are important in the differential diagnosis of hiatus hernia and the commonly occurring epiphrenic ampulla. Another source of confusion, although not nearly as common, may arise if the central tendon is weak and bulges under stress, in the manner of the abdominal wall in a direct inguinal hernia. Where the stomach lies adjacent to the tendon, it may therefore bulge into the thorax during inspiration, mimicking a sliding hernia. The differential diagnosis of circumscribed elevation, or so-called *eventration of the diaphragm*, and hiatus hernia may therefore be very difficult.

The various *diverticula of the oesophagus* and stomach may also provide confusion. Of these, diverticula of the distal oesophagus are the most common. They may originate from the oesophagus above and below the diaphragm. The subphrenic forms are extremely rare; the epiphrenal types are slightly more common. When present the epiphrenal diverticula will cause a barium-filled bubble immediately above the diaphragm. It may only fill in Trendelenburg position, simulating the appearance of a hiatus hernia (Fig. 16—18). These conditions can only be differentiated by photographing the patient in various supine positions. Thus one can fill the diverticulum, and by projecting it free from the oesophagus, demonstrate what it communicates with.

Åkerlund in 1926 gave the first classification of hiatus hernias on their radiological appearance. This classification in modified form is used in Chapter V.

The first type, which comprises those cases of congenitally short oesophagus, is recognized by the large amount of stomach which is situated above the diaphragm. The oesophagus, as a result of faulty embryonal development, has not attained its full length. It appears as a straight tube above the intra-thoracic stomach.

True congenitally short oesophagus cannot always be roentgenologically distinguished from a sliding hernia. The only point of differentiation may be the tortuous course of the distal oesophagus in the case of large sliding hernias. The differential diagnosis is important from the surgical point of view, as in the congenitally too short oesophagus the cardia

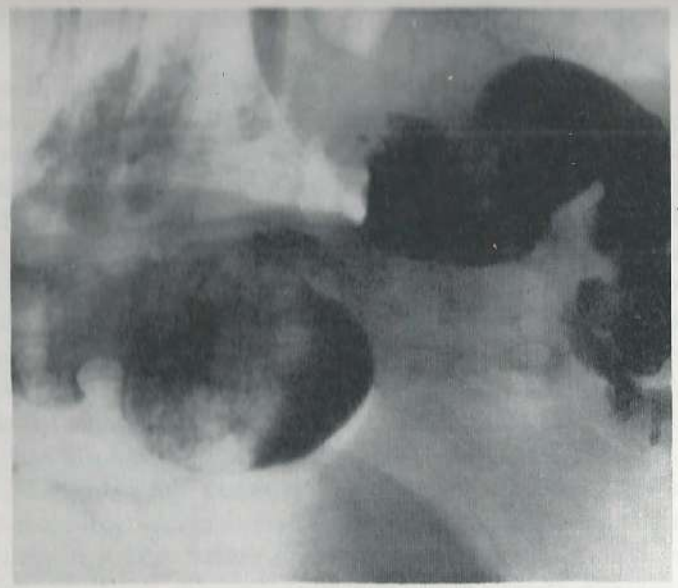


Fig. 17 & Fig. 18
Post-operative views of the same patient indicating that the pre-operative appearance had been produced by saccular oesphageal diverticula. No hiatus hernia present

Fig. 16
Dilated oesophagus and what appears to be a large hiatus hernia (case 35)

cannot be brought down to the normal position below the diaphragm. These cases are extremely rare however.

Para-oesophageal hernias enter the posterior mediastinum on either side, in front of, or occasionally behind the oesophagus. The cardia is seen to lie below the diaphragm.

Sliding hernias may vary in size from a small protrusion of the cardiac end of the stomach through the hiatus to very large herniations of nearly the entire stomach. With small herniations the hernia may be missed the first time and may only be diagnosed after repeated examination in Trendelenburg position. Of help are the points already discussed — the mucosal pattern in the cardiac area, the larger cardiac angle, the presence of reflux and the tortuous distal oesophagus above the hernia.

Sliding hernias may be associated with oesophagitis. The milder forms of oesophagitis are usually not roentgenologically recognizable. With prolonged severe oesophagitis, definite abnormalities appear. These abnormal roentgenological findings are essentially of two varieties — changes in distensibility and changes in the mucosal pattern. In severe cases the lack of distensibility may be so marked as to produce a long segment of considerable narrowing, involving the lower third of the oesophagus. The junction between the moderately dilated oesophagus above and the narrowed portion below, is gradual and symmetrical. The mucosal pattern throughout the narrowed segment is distorted and may have a hazy irregular appearance. The margins of the narrowed segment may show a fine serration. Coarser irregularities are not common. The involved segment usually shows no evidence of peristaltic activity.

Although a positive radiological diagnosis of hiatus hernia can only be made by barium examination of the cardiac region, its presence may sometimes be suspected on a straight chest X-ray. If a supra-diaphragmatic fluid level, a gas bubble or a rounded opacity is visualized through the heart shadow or protruding into either cardio-phrenic angle, it is suggestive of hiatus hernia. The deformed heart shadow may contain a large air pocket with horizontal fluid level or only a faint air bubble or an elongated homogenous density. This finding was first described by *Eppinger* in 1904. It must be differentiated from many similar appearances such as due to mega-oesophagus, oesophageal diverticula, aortic aneurysm, neurofibroma, other varieties of diaphragmatic hernia, ecchinococcus, lower lobe atalectasis, mediastinal abscess or tumor, etc. A useful clue is the absence of a stomach bubble or magenblase below the left diaphragm. This finding was common to nearly all the cases found by *Froman* (1954).

Straight X-ray examination of the chest may therefore provide the first indication of the presence of a hiatus hernia. When the above signs are sought for, cases of hiatus hernia may even be discovered during routine, mass chest X-rays. The number of hernias detected is insignificant however. *Trial* et al discovered 13 hernias in 250,027 mass chest X-ray examinations;

Gould, 11 in 442,252; *Spencer and Schaeffer*, 1 in 10,661; *O'Loughlin*, 1 in 24,615. *Froman* (1954) found a larger number of cases however. He discovered 53 diaphragmatic hernias among 17,076 persons examined by routine chest X-ray. This represents a rate of 31 per 10,000 persons examined. Of these, 98% were oesophageal hiatus hernias. Note that these hernias were present in the upright position. The findings are therefore only present when the hernia does not reduce in the standing position.

On the Technique of Examination: On consideration of the above factors, it becomes clear that misinterpretation of the radiological appearances at the lower end of the oesophagus can lead to a great deal of confusion. The prodecure employed in the examination of the cardiac area must be directed at demonstrating a hiatal hernia if present and in distinguishing it from those dilatations which may exist in the normal oesophagus. The examination must also provide an indication of the function of the cardiac valve and detect reflux into the oesophagus when present. We have found the following procedure to give the best results.

The patient is first examined in the upright position. He is given half a glass of fluid barium sulphate and screened while swallowing it slowly. During the examination the passage through the distal oesophagus is studied. Any obstruction to the flow of barium, above or at the cardia, whether due to stricture or spasm or to pressure from the outside by a large, irreducible hernia, is noted. In the case of irreducible, sliding hernias, the oesophagus enters the herniated stomach *above* the diaphragm.

The patient is then given another half a glass of barium. When this has passed into the stomach, the patient is asked to take a deep breath and to blow forcefully on the back of his hand. The intra-abdominal pressure is thereby increased and in some cases of hiatus hernia reflux may be seen even in the upright position.

The table is then slowly tilted to a 10° Trendelenburg position. The cardia is studied during inspiration and expiration for the presence of herniation or reflux. With increased intra-abdominal pressure, a hernia if present will be produced. Radiographs are taken with the patient lying on his back and also on his abdomen. He is then turned on his right side and given a mouthful of thick barium sulphate suspension. The passage of the thick paste is studied. When the whole length of the oesophagus is visible, a radiograph is taken during full inspiration and another during full expiration. These provide further evidence as to the type of hernia present. In the case of a para-oesophageal hernia, the cardia is seen to lie below the diaphragm, so that the distal oesophagus passes around the hernia to enter the stomach below the level of the diaphragm. In sliding hernias, the cardia itself lies above the diaphragm.

In the lateral and oblique positions, the terminal oesophagus can be projected free from the hernia so that it is possible to study closely any

irregularities in the mucosal pattern. This is of special value if oesophagitis or ulceration is suspected and in localizing an obstruction, if present. Various manoeuvres have been described to increase the intra-abdominal pressure during the examination. Some workers maintain that deep inspiration is sufficient. Others increase the pressure by manual compression of the abdomen. Some have even devised abdominal compressors (*Marchand* 1952; *Donnelly* 1953). In this clinic we ask the patient to take a deep breath. Then, placing the back of his hand tightly against his mouth, the patient is instructed to blow forcefully, thereby puffing out the cheeks. This manoeuvre can easily be imitated, even by small children.

Associated Radiological Findings: Muller (1948) first discussed the association of gallstones, hiatus hernia and diverticula as a triad, with a description of three cases. He named these three entities *Saint's triad*. Muller's introductory paragraph reads as follows: "During last year Prof. Saint of Cape Town mentioned to me during a discussion about double pathology, the association of hiatus hernia, sacculi of the colon and gall stones. Its prognostic importance in the wide differential diagnosis from a host of pulmonary, cardiac and abdominal conditions, makes the triad of practical as well as of academic interest." *Brombart* et la mentioned three cases in 1950. *Palmer* in 1951 reviewed the records of 31 patients with hiatus hernia. In each of these patients the investigation included the gallbladder, upper gastro-intestinal tract and the colon. Among these he found five cases of Saint's triad. *Wissmer* (1951), *Berardinelly* (1952), *Delannoy* (1954) and *Jaffe* et al (1956) reported further cases. *Palmer* in 1955 reported 24 cases of Saint's triad in 170 patients with hiatus hernia. Eighteen of these cases were treated surgically. In 16 of the patients, the first surgical effort was directed at the gallbladder. Only one patient was cured; nine obtained no relief at all from the cholecystectomy. All these underwent a second operation, seven for repair of the hiatus hernia. This time six were cured or improved. Palmer considered it significant that disease of the gallbladder was first suspected, first looked for, first diagnosed and first treated, yet seemed only infrequently the cause of the patients' symptoms. The symptomatic results of cholecystectomy were very poor. He concludes that "it certainly appears that if a patient with hiatus hernia has either gallstones or diverticulosis, there is a very good chance that the third lesion is also present".

2. OESOPHAGOSCOPY

Oesophagoscopy is a valuable, if not essential, investigation in the diagnosis of hiatus hernia. It may confirm a dubious roentgenological diagnosis. Its most important use, however, is in the detection of oesophagitis. This serious complication of hiatus hernia can be suspected on clinial exami-

nation but can only be positively diagnosed by oesophagoscopy. Oesophageal ulceration and stricture formation can, in addition, be visualized directly and if necessary biopsy taken to exclude malignancy.

During examination of the patient with hiatus hernia, the oesophagoscopist will notice the following typical features.

The oesophagoscope glides easily down into the stomach. During examination of an anatomically normal oesophagus, the patient's head must be depressed and moved to the right to allow the oesophagoscope to pass forwards and to the left into the stomach. In patients with a sliding hernia the picture is quite different, for in the absense of stenosis, the instrument is passed down from oesophagus to stomach without impediment or deflection.

The viscus is lined with oesophageal mucosa at one level and with gastric at the next. This level is higher than would be anticipated normally and varies with the degree of herniation. *Allison* (1948) quotes a case where it was seen at 24 cm. from the alveolar margin in a patient in whom the normal level would have been about 39—40 cm. The cardia is lax and patulous and although the gastro-oesophageal junction is first encountered at a higher level than normal, the instrument tends to push it down before it. As the oesophagoscope is withdrawn, however, the cardia is seen to follow it upwards and may ultimately be left behind 4—5 cm. above the level at which it was first encountered. In these extreme examples there is no difficulty in making a diagnosis, but in the minimal degrees of herniation, where the change in mucosa is found at 38 or 39 cm., the diagnosis is more difficult.

Oesophagitis may be encountered in various degrees of severity.

Fischer and *Johnson* (1957) divide peptic oesophagitis into 4 classes:

Class I: Erythema only, of moderate degree.

Class II: Severe erythema with bleeding on mild trauma, together with oedema of the mucous membrane.

Class III: Ulceration.

Class IV : Cicatrization with stenosis.

The first two classes occur frequently and are of a transient nature, thus being easily reversible. The last two result from persistent regurgitation of gastric juice, causing permanent changes of a serious nature.

In the mild, transient form of oesophagitis, the changes seen may be very slight. The mucous membrane is coloured pink with swollen mucosal folds. It bleeds easily on contact with the instrument. These changes are most marked distally. Even in the lower oesophagus, changes in the mucous membrane may be slight, however, and only determined with certainty by histological examination.

In the more severe cases, there is obvious erythema, with much thickening and congestion of the mucous membrane. Small erosions are frequently observed, either brilliantly red or covered with a yellowish membrane.

Between these small ulcers, which are usually 2—3 mm in diameter, the mucosa is sodden and thickened. There may be single or multiple small discrete ulcers or extensive denudation. The ulcers appear usually as pale, yellowish-grey areas surrounded by a well-defined bright pink margin. When the fibrino-purulent membrane is removed by a swab, the whole surface of the ulcer shows the same bright colour as the margin and oozing of blood readily occurs. The distal oesophagus is usually involved but the oesophagitis may spread upwards to involve the entire oesophagus to a lesser degree. There is marked narrowing of the lumen in the lower oesophagus which can be traversed by the oesophagoscope, since it is usually due to spasm.

With continued reflux of gastric contents onto the inflamed mucosa of the oesophagus, the condition may become irreversible. Ultimately the patient presents with chronic ulceration and cicatricial stenosis.

Allison in 1948 gave a classical description of the last stage of oesophagitis. There is usually a moderate collection of mucus and occasionally of food residue in the oesophagus, but this is never gross as in the case of cardiospasm. The mucosa of the oesophagus shows congestion all the way down. This becomes more intense at the lower end. Approximately 2—3 cm. above the stenosis, the mucous membrane shows acute congestion, often with denudations. These usually have fingerlike processes passing up between the pale areas of thickened, sodden oesophageal mucous membrane and below into the stricture, to become continuous with the chronic ulcer. The acute superficial changes immediately above the stenosis are an important diagnostic feature, for they usually indicate a simple rather than a malignant lesion. They occur in the length of the oesophagus. On the radiograph the gullet appears as a funnelshaped narrowing immediately above the main stricture. The stricture seen through the oesophagoscope is usually centrally placed and is situated above the chronic ulcer, so that the ulcer itself may not be visible. A little granulation tissue may be seen through the stricture, or a superficial ulcer may pass through the stenosis.

The stricture itself is formed during the first stages by inflammatory infiltration of the oesophageal wall around the ulcer. If the process is long-standing, scar tissue forms, so that ultimately a fibrous stricture results. When a bougie is passed into the stricture, oozing of blood occurs from the ulcer. The stenosis feels soft and uniform as distinct from the bumpy feeling so often found in a malignant lesion. Allison states that "where only a short stricture is present, it may be possible to see the ulcer itself after oozing of blood has ceased, and the pouting, oedematous folds of gastric mucous membrane may show through, but in the larger strictures only a dark recess lined by bleeding granulation tissue may be visible." In those patients, who on X-ray examination show a picture suggestive of carcinoma, oesophagoscopic examination will show this to be produced

by extensive ulceration with much granulation tissue. The oesophagoscopic examination of a healed ulcer is that of a simple fibrous stenosis covered with pale, shiny mucous membrane.

Where the macroscopic appearance resembles carcinoma and where the oesophagoscopist is in doubt as to the differential diagnosis, a punch biopsy should be taken to obtain histological proof that the lesion is a simple ulcer. If the biopsy is taken from the ulcer surface, it may show only simple granulation tissue with or without fibrous, purulent, necrotic material. Sometimes, however, where the lining of the ulcer has been wiped away by the passage of the bougies, the histological picture may be of a small fragment of dense collagenous fibrous tissue, infiltrated by lymphocytes, polymorphs and eosinophil leucocytes or of a strip of smooth muscle and chronic inflammatory tissue. A fragment from higher up will show stratified squamous epithelium with prolongation of the rete pegs and thickening of the malphigian layer. Some of the superficial cells may be vacuolated and there may be hyperkeratinization. Beneath and between the pegs there is chronic inflammatory cell infiltration of the gastric mucosa.

The dangers of pre-operative oesophageal biopsy are discussed in Part II under the heading "Operative Complications".

3. A TECHNIQUE WHICH COMBINES RADIOLOGY AND OESOPHAGOSCOPY

A technique has been described to aid in the diagnosis of small hiatus hernias which are difficult to demonstrate radiologically and where oesophagoscopy does not confirm the diagnosis. *Allison* (1951) and *Palmer* (1952, 1953) recommend the use of Cushing brain clips, which are applied to the oesophago-gastric mucosal junction through the oesophagoscope, so that the movement of the cardia may be followed roentgenologically. The junction of squamous and gastric epithelium is seen and grasped with forceps. It is gently lifted up into the lumen of the oesophagoscope in the form of a tent. The special forceps carrying the brain clip are passed alongside the grasping forceps until they can be seen and felt against the edge of the tented membrane. The handles are then approximated and the clip squeezed into position. The piece grasped by the grasping forceps is now submitted for histological examination. The specimen should contain both gastric and oesophageal mucosa.

The patient is now X-rayed in the upright and Trendelenburg positions, the latter after a swallow of barium. The movements of the clip are studied. If the clip, which indicates the position of the cardia, moves significantly upwards, the existence of a hiatal hernia can be assumed, according to these authors.

Botha (1957) expresses serious doubt as to the value of this examination. He studied the accuracy of the generally accepted radiological concept that

the diaphragm, as seen in an antero-posterior radiograph, coincides with the level of the oesophageal hiatus. He selected 20 patients who had benign lesions, who were in good general condition and were found at laparotomy to have a normal anatomy around the gastro-oesophageal junction. In these patients he marked the hiatus with a metal clip at operation and postoperatively examined the clip radiologically in relation to the diaphragm. He concludes that "there can be little doubt that, in most people at least, the anterior margin of the hiatus is situated above the line that indicates the diaphragm radiologically". This corresponds with the work of *Monges* et al (1955) who applied clips to the anterior hiatal margin and to both crura in one patient. Postoperative X-ray examination showed all three clips above the diaphragm.

The hiatus, therefore, is not radiologically situated at the level of the diaphragm, but somewhat above it and no conclusions can be drawn from minor upward movements of the mucosal clip.

Chapter VIII

ON THE COMPLICATIONS OF HIATUS HERNIA

Hiatus hernia is usually not considered a fatal or even incapacitating disease. There is a popular concept that it is an innocuous ailment capable only of dyspepsia and other trivial symptoms. This idea is as erroneous as it is widespread. In reality the symptoms of hiatus hernia may be distressing and the complications serious and occasionally fatal. Any hernia that is unreduced is subject to complications — the hiatus hernia is no exception.

Whereas the various inguinal herniations contain an assortment of viscera, hiatus hernia consists almost exclusively of stomach and omental fat. For this reason the symptoms and the resultant complications are usually associated with disturbed gastric physiology. The complications of hiatus hernia may be classified into the following groups:

1. OESOPHAGITIS
   - a. Haemorrhage
   - b. Stenosis and stricture formation
   - c. Perforation

2. ULCERATION IN THE HERNIATED STOMACH
   - a. Haemorrhage
   - b. Perforation

3. VOLVULUS, OBSTRUCTION, INCARCERATION AND STRANGULATION OF THE HERNIATED VISCERA

1. OESOPHAGITIS AND ITS COMPLICATIONS

In the case of sliding hiatus hernia, the cardiac mechanism becomes incompetent. The normal barriers to reflux of gastric contents become ineffective and the lower oesophagus is bathed in acid fluid. This frequently leads to peptic inflammation.

Sliding hernias may, however, be completely symptomless as pointed

out by *Akerlund* as early as 1926. It is well known that reflux may take place in patients of all ages without causing any symptoms. *Allison* (1951) describes a group of patients with sliding hernia who regurgitate gastric contents into the mouth and then swallow or expell it. He describes this event as "rumination". One of his patients, such a "ruminator", had been afflicted for 50 years. This woman had swamped her gullet with acid gastric juice for 50 years without producing oesophagitis. This raises the question why some patients react violently to gastric juices in the gullet and others do not. It is possible that the amount and character of the saliva, the mucus secreted by the oesophagus and the strength of the digestive juices, all play a part. Other constitutional factors about which little are known may be involved. *Husfeldt* in 1952, while commenting on this, remarked that the solution may lie in the fact that the gastric contents may be less corrosive in the case of elderly patients. There may be complete achlorhydria.

Usually, however, the oesophageal mucosa is very sensitive to the peptic action of the gastric contents. Many cases with sliding hiatus hernia will therefore complain of the typical symptoms of oesophagitis.

Oesophagitis remains the most serious complication of hiatus hernia. Of *Allison's* (1951) 176 patients with sliding hiatus hernia, 73 had macroscopic, superficial oesophagitis with ulceration. Sixty-three cases had chronic oesophageal ulcers with stenosis. *Schmidt* (1954) at the Mayo clinic found that among 170 patients with benign regurgitant ulceration at the oesophago-gastric junction, 158 had a sliding type of hiatal hernia. It is therefore by far the most common cause of this type of oesophagitis.

Effler and *Groves* (1957) point out that in the normal process of digestion the gastric mucosa possesses secretory properties that vary with the major anatomic divisions of the stomach. The normal oesophagus has little secretory ability and does not reflect chemical changes within the stomach during the active process of digestion. The duodenum contains alkaline secretion and by reflux into the pylorus may have an appreciable effect in buffering the extensive acid secretion that normally follows ingestion of food. The combination of mucin, alkaline secretion and food, buffers gastric contents to produce a pH compatible with the chemical resistence of the gastric mucosa. Were it not for this normal buffering mechanism, the highly acid secretion of the fundus and cardiac portions of the stomach would reduce the pH to a level low enough to produce chemical gastritis or actual ulceration.

Gastric herniation primarily involves the fundus and cardia. Therefore the area of greatest acid secretion is usually the part situated above the diaphragm. The partial constriction produced by the normal oesophageal hiatus gives an hour-glass contour to the stomach. Actually there has been no disturbance in the secretory capabilities of the normal stomach;

in effect the only change is an incomplete partition of the stomach into two segments, one above and the other below the diaphragm. The thoracic stomach contains gastric mucosa capable only of acid secretion. This, added to the fact that there is inadequate mixture with the more alkaline contents of the more distal stomach, explains why the fluid which flows back into the oesophagus is so acid and therefore so dangerous to the oesophageal mucosa.

At oesophagoscopy the inflamed mucosa has a typical appearance. In the first stages the mucosa is red and swollen and bleeds easily. In a more advanced stage multiple, small, superficial ulcers develop between which the mucosa is sodden and thickened. During this stage, healing may occur, but if the hernia is not treated, recurrent acute oesophagitis follows. Eventually the condition becomes chronic with recurrent acute ulceration. One of the superficial ulcers may enlarge and become chronic, slowly penetrating the whole thickness of the oesophageal wall.

With medical treatment, i.e. with prevention of regurgitation by correct positioning of the patient after meals and at night and by the use of diet and alkalies, the oesophagitis and superficial ulceration may heal without leaving any traces of the previous inflammation. Even in untreated cases the condition often shows periodical remissions.

When ulceration occurs, however, it may be attended by the complications well known to peptic ulceration in any site.

a. *Haemorrhage*

This may be a complication of oesophagitis, both in the stage of acute congestion with superficial erosions and in the chronic ulceration stage. The bleeding may be acute, taking the form of frank haematemesis or chronic with occult blood loss.

Haemorrhage whether acute or chronic constitutes as ominous a symptom as bleeding from a peptic ulceration elsewhere in the gastro-intestinal tract. Especially in patients over 40, severe or repeated gastro-intestinal haemorrhage should be considered a positive indication for surgical treatment.

(I) *Acute Haemorrhage:* Acute bleeding associated with hiatus hernia is not unknown. A few of our patients had to be treated after fairly severe haematemesis. Occasionally there was melaena of sudden onset, of a degree which necessitated bloodtransfusion.

(II) *Chronic Haemorrhage:* This is much more common. The bleeding is usually occult and may occur with or without hiatus hernia symptoms. The patient may present with an unexplained anaemia, the cause only being demonstrated when barium examination of the stomach is performed in Trendelenburg position. In all cases of unexplained anaemia the diagnosis of hiatus hernia must be kept in mind, even in the absence of gastro-intestinal symptoms.

b. *Stenosis and Stricture formation*

The late result of neglected, long-standing oesophagitis with ulceration may be stenosis and stricture.

In the first stages of oesophagitis shallow ulcers may appear in the inflamed oesophagus. These involve only the mucosa. A state of subacute digestion and ulceration of the mucosa can exist for a long time with areas of regeneration, side by side with new patches of acute necrosis, without involving the deep layers of the oesophagus, and if the patient is successfully treated, complete return to normal can occur. On the other hand, if the cause persists and digestion continues, the inflammation spreads beyond the submucosa. Dense fibrous tissue forms in the musculature of the gullet. In children, as *Brown Kelly* (1939) and *Allison* (1948) have emphasized, the scar can spread up the oesophagus, producing the condition they refer to as "ascending fibrosis". Alternatively, the inflammation may burrow through the muscle coats and beyond, so that the affected part of the gullet becomes contracted and strictured both in its longitudinal and transverse directions. It becomes fixed by dense adhesions and lymphadenitis to adjacent structures in the mediastinum.

Allison states that less important factors which may play a part in the formation of the stenosis are polypoidal granulation tissue, muscle spasm and enlarged lymphatic glands on the outside of the oesophagus at the site of the ulcer. These glands are always present and may form quite a large mass when the oesophagus is viewed from the outside. Whether they contribute to the stenosis is difficult to determine, but it seems likely that they may have played a part in patients where the stricture is eccentric. He observed this particularly in children.

If the strictured gullet is excised and examined, certain features will be evident. The mucosa of the oesophagus, situated above the stricture, is normal. The stricture itself forms the top of the abnormal zone and, as *Barrett* (1950) points out, it is nature's way of protecting the proximal oesophagus from further excoriation.

The stricture may be long or short. It is caused by scar tissue in the muscularis and the sub-mucosa, and it often reduces the lumen to a chink. The condition is now irreversible (Fig. 19—20). The slight dysphagia seen with acute oesophagitis becomes progressively worse until the patient can only swallow fluids and eventually nothing at all. There is progressive loss of weight and if no treatment is instituted the condition ultimately leads to death.

c. *Perforation*

Oesophageal ulcers complicating hiatus hernia have been known to perforate. This is not as common as with perforation of peptic ulceration

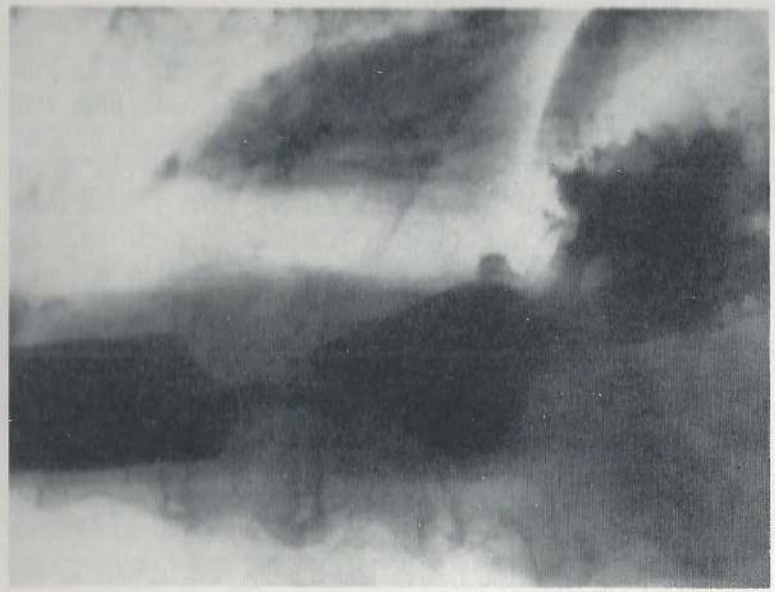


Fig. 20
The same patient 4 years later. Note marked oesophageal stenosis with dilated oesophagus. Ulcer niche still present (2-10-1957)

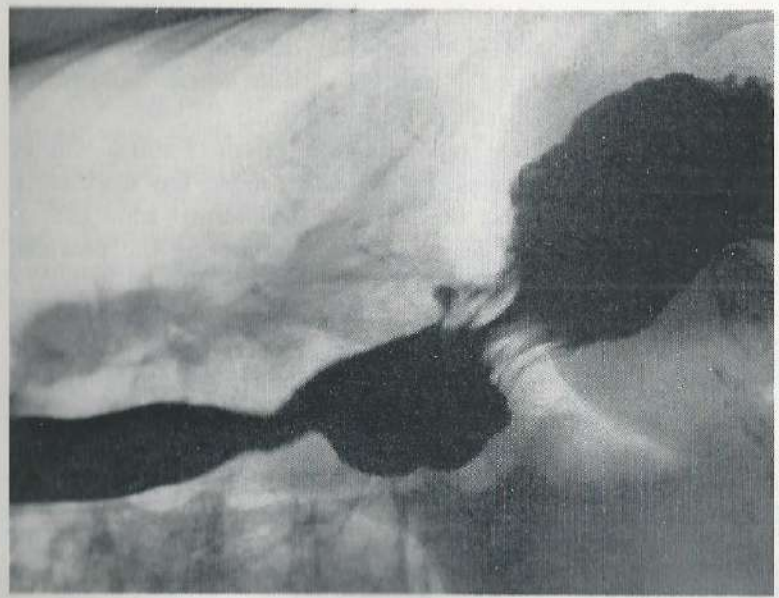


Fig. 19
Sliding hiatus hernia with ulcer niche in herniated stomach and a stenosis forming in distal oesophagus (20-9-1953) Case 10

elsewhere, however. *Effler* and *Ballinger* in 1951 saw three cases with perforation of the ulcer into the mediastinum. One of these, a sealed perforation, involved the pericardium and another had penetrated the medial segment of the right lower lobe.

When perforation does occur, the effects are usually not as sudden as in the case of a gastric or duodenal ulcer. The oesophagus is intimately surrounded by other structures in the posterior mediastinum. Furthermore it is normally an empty organ, so that perforation is never as dramatic as in the case of the stomach or duodenum where an amount of gastro-intestinal content is suddenly liberated into the free peritoneal cavity. It usually takes place gradually. While the ulcer is slowly burrowing through the oesophageal wall, the inflammation also involves those organs which closely surround the oesophagus in the posterior mediastinum, so that when perforation does take place, the site has already been sealed off.

2. ULCERATION IN THE HERNIATED STOMACH

As we have described in Chapter VI, ulceration may occur in the herniated portion of the stomach (Fig. 19—20). The various factors which play a part in the aetiology of ulceration have been discussed. These ulcers may be attended by the following complications:

a. *Haemorrhage:* Acute massive haemorrhage may result from an ulcer in the herniated stomach. More often the loss of blood is chronic and occult. The patient may have epigastric complaints or present with an unexplained anemia.

b. *Perforation:* These ulcers may theoretically perforate, but this seems to be a very rare complication of hiatus hernia.

3. VOLVULUS, OBSTRUCTION, INCARCERATION AND STRANGULATION OF THE HERNIATED VISCERA

Hiatus hernias are sometimes incarcerated, in the sense that they cannot be reduced by any manoeuvre during barium examination. This may be due to the small size of the hernial opening, in the case of a large hernia, or to adhesions which have formed between the hernial contents and the sac.

Strangulation, although a common occurrence in most forms of hernia, is a rare complication of herniation through the diaphragm. When it does occur it is more likely to be found in the traumatic varieties than in the oesophageal hiatal group. In 1933 *Harrington* stated: "I have never seen a stomach that was strangulated as a result of hernia, nor do I believe that it is possible because of the powerful musculature and rich blood supply of the gastric wall". *Frank* and *Hamilton* in 1941 remarked that hiatus hernias should be treated symptomatically in most cases, "since

the stomach is usually the only viscus involved and it is too thick-walled and powerful to become obstructed or strangulated".

Soutter (1947) does not mention strangulation among his indications for surgery, although he does state that partial gastric obstruction was found in 9 of his 72 patients. *Sweet* (111 cases) in 1952 operated upon 12% of his cases for obstruction. The hernias were all of unusually large size, the majority being of the para-oesophageal type with torsion of the stomach. *Hamilton and Philips* in 1949 treated two cases of strangulated diaphragmatic hernia with gangrene of the stomach and collected three more from the literature. *Pearson* (1953) treated a case with gangrene of the entire stomach with the exception of 2 cm. of the pylorus. *Hoffman* et al (1954) reported a seventh case of gangrene of the stomach with hiatus hernia.

Hurley (1953) reports a further two cases of strangulated hiatus hernia. Both were successfully operated. One had an area of gangrene of the greater curvature which had to be excised. This appears to be the first reported recovery of a case of gangrene of the stomach occurring in a hernia through the oesophageal hiatus. Hurley concludes that these cases are probably more common than the literature would suggest, as many patients die unrecognized on account of too late intervention or without operation or without ever getting to hospital. *Sellors* in 1955 reported a further case successfully operated.

When a hiatus hernia becomes strangulated the condition constitutes a major catastrophy. Sellors gives the mortality of patients not operated upon as approaching 90%. Although a rare complication, it is therefore important to recognize those cases that may strangulate, i.e. where there is a large amount of stomach incarcerated in the hernia with a relatively small neck. Secondly, it is important to diagnose the condition early when it occurs and to have a definite plan of treatment once the diagnosis has been established. Of great use is a previous roentgenological diagnosis of hiatus hernia. Also helpful is a history of typical hiatal hernia symptoms.

The onset of strangulation is generally acute. It is marked by vomiting and pain in the epigastrium radiating to the chest and left shoulder. Hiccup and sudden shortness of breath may occur but neither is usually severe enough to draw attention to the impending disaster.

Abdominal signs are minimal when only the stomach is strangulated, although there will be the classical signs of intestinal obstruction if the small gut or colon is involved. In general the picture is more suggestive of a chest condition than an abdominal one. Within a short time the impacted and strangulated intra-thoracic bulb distends and at the same time a bloodstained effusion develops within the pleural sac. This may give rise to diminished movement of the chest and hyper-resonance on percussion until the signs of effusion obscure the tympanic note. When

the chest is aspirated at this point, bloodstained fluid is obtained. At a later stage aspiration of dark stomach contents provides an obvious sign of gangrene. The mediastinum is often displaced by the pressure of the strangulated mass within the chest. Difficulty in breathing and a rapid pulse characterize the cardio-respiratory embarrassment. The general condition deteriorates rapidly and efforts at retching and acute epigastric discomfort become obvious. Severe shock and prostration are associated with the increasing distress and shortness of breath.

When these signs occur in a case of known hiatal hernia one must assume the occurrence of strangulation. When they occur in a patient not known to have a hiatus hernia but who has had the typical symptoms, one must also assume the occurrence of strangulation until otherwise proved.

The diagnosis can be confirmed by roentgenological examination. On the straight chest X-ray, the hernia may be visualized as an air-containing loculus. Later there is the appearance of fluid in one half of the thorax, ultimately with shift of the mediastinum to the opposite side. A large effusion may obscure the presence of the loculus. The most satisfactory clue to the diagnosis is, however, given by a definite history of hiatus hernia, particularly if there has been radiological confirmation before operation. A barium meal during the acute stage, confirms the diagnosis but is attended with danger.

Hoffman et al mention a possible aetiological factor producing incarceration of the hernia. He states that the complication usually follows heavy eating or drinking, physical exertion or straining at stool.

Kleitsch in 1952 described a case of strangulation of the omentum which must be considered a medical rarity. The patient, a male aged 57, developed a sudden choking sensation during a meal, after which he was unable to eat. Each attempt at swallowing resulted in a feeling of smothering. At operation the omentum was found to be incarcerated within the hernial sac, from which it could be removed only by moderate traction. A thickened end of omentum, the size of a hen's egg and the cause of the oesophageal obstruction, was amputated and the hiatus narrowed. The patient recovered completely.

Surgery is the only treatment of strangulated hiatal hernia. The hernia must be reduced and the hiatal defect repaired. Should gangrene of the stomach be present, the gangrenous portion must be resected, until a zone of healthy, freely bleeding stomach wall is reached.

Chapter IX

ON THE INDICATIONS FOR TREATMENT IN HIATUS HERNIA

We have stated in a previous chapter that hiatus hernia may be a coincidental finding during the roentgenological examination of the upper gastrointestinal tract. This is observed more frequently in the group of patients over the age of 40. In these cases, if the patient is entirely symptom-free, no treatment is indicated. Most authorities agree on this. Thus the discovery of a hiatus hernia by chance, is no indication for surgical treatment. *Harrington* (1955) and *Woodruff* (1957) state that these patients should be regularly controlled, however, for increase in size of the hernia. We do not consider periodical radiological control necessary, but these patients should be checked for the development of symptoms. In addition, it is wise to eliminate the factors which increase intra-abdominal pressure, such as overweight, tight corsets, constipation, etc.

In all cases where typical symptoms of hiatus hernia are present, surgical repair is indicated in order to prevent oesophagitis and its serious sequelae. These symptoms should be characteristic, however, and undoubtedly due to hiatus hernia. It is important to note that the complaints, even when mild and intermittent, usually form a definite pattern, as described in Chapter VI. When the patient complains of vague non-specific abdominal symptoms, the discovery of an uncomplicated hiatus hernia may be of no significance. A thorough search for other physical or, if indicated, psychical, disturbances should be made. If further examination is negative, these patients with slight indefinite symptoms should be treated conservatively. All patients with definite symptoms should be operated, however. In our experience the majority of these patients welcome an operation.

The question arises whether medical treatment should be tried first in those cases where operation is indicated. Many authors (*Merendino* et al 1949; *Nuboer* 1949) believe that medical treatment should be attempted first in *all* cases, surgery being only justified where medical measures have failed. We do not agree. Only in very young babies is there a possibility of the hiatus hernia disappearing altogether with conservative measures. Once a hiatus hernia is present in the adult, these measures cannot correct the anatomical defect which already exists. Only surgical repair can restore

the normal hiatal anatomy and function. Thus the symptoms will recur whenever the medical regime is relaxed or whenever any of the factors, which produced the hernia in the first place, are aggravated. Any increase in weight or a further pregnancy or the development of a cough etc. may cause recurrence of symptoms.

One must, therefore, conclude with *Kleitsch* (1952): "Most patients can exist on a medical regimen if the physician and patient are satisfied with a chronic state of semi-invalidism. It must be agreed, however, that as far as treatment of the hernia is concerned medical management must be considered to be procrastination". The only specific permanent cure can be provided by surgery.

The presence of oesophagitis is an absolute indication for operation. Medical measures may bring temporary improvement and even complete reversal of the endoscopic appearance. We have observed this with the pre-operative medical treatment of some of our cases. The improvement is temporary, however, and with renewed reflux, oesophagitis will recur. Thus *Burford* et al in 1956 wrote: "We have frequently observed the inexorable sequence of worsening, beginning with mild inflammation, progressing to marginal ulceration and ending in stenosis while the patient was co-operatively following an expertly managed medical regime."

In conclusion, therefore, the management of hiatal hernia depends on the findings in each individual case, but in general the patients may be divided into the following three groups.

The first group consists of those cases where a small herniation is coincidentally found during roentgenological examination of the stomach and oesophagus. These patients have no subjective symptoms and no treatment is indicated.

In the second group of cases there are definite symptoms related to hiatus hernia not associated with complications. In this group, surgery is indicated.

In the third group, where complications are present, surgical repair becomes urgent. Oesophagitis, endoscopically observed, is always an indication for surgical repair, as is associated ulceration or stenosis. Haemorrhage, acute and massive or occult and symptomless, forms another urgent indication. The rare cases of incarceration of the hernia should be acutely operated.

Chapter X

ON THE MEDICAL TREATMENT OF HIATUS HERNIA

When the operative repair of hiatus hernia is contra-indicated on account of old age, another disease, or other factors, conservative treatment must be employed. In addition, medical measures are occasionally used pre-operatively. After the operation patients should follow a medical regime for some months.

During the past ten years we have had occasion to treat a number of infants with hiatus hernia. These children were admitted for surgery after prolonged periods of conservative treatment elsewhere. In some, irreversible oesophageal changes had already occurred. As the results of poorly directed medical treatment are extremely serious, we include a separate section on the medical treatment of hiatus hernia in infants.

Medical Treatment in the Adult

In our experience the following measures usually give relief of symptoms. All factors increasing intra-abdominal pressure should be eliminated. Very obese patients are put on a strict reducing diet. This applies also as pre-operative measure in obese patients. Tight corsets should be avoided. Constipation is treated to prevent the increased intra-abdominal pressure of straining at stools. If a cough is present, it should be treated. Patients with a chronically overdistended bladder may be relieved of their gastric symptoms by prostatectomy.

Another essential factor is the prevention of gastro-oesophageal reflux as far as possible. The main meal should be taken at midday, and afterwards the patient should remain upright. Exercise immediately after a meal should be avoided. In the evening the patient should have a light meal and nothing to eat or drink for at least three hours before going to bed. The patient should sleep in a sitting position.

Some authors advise a strict regime, similar to that for peptic ulcer, starting with a Sippy diet. This seems unnecessarily drastic. We have found a smooth bland diet, with frequent small meals, satisfactory. Rough and coarse vegetables are to be avoided, also gas-forming vegetables such as cabbage or sauerkraut.

We prescribe alkalis to lower gastric acidity. Useful long-acting antacids are the aluminium compounds in combination with magnesium trisilicate. The alkaline mixture is taken after meals, preceded by a few ounces of water which the patient drinks standing up, so as to flush through the oesophagus. A further dose should be taken at bedtime. One may add antispasmodics, for instance atropine sulphate and belladonna, to hasten gastric emptying.

If there is marked oesophagitis on endoscopy in a patient who is admitted for surgical repair of the hernia, pre-operative medical treatment is instituted. This will prevent complications during the operation and will enhance the success of the repair (See Part II). We give such patients a milk-alkali drip through a Ryle's tube, introduced into the proximal oesophagus. Through this tube a continuous, 24 hour drip bathes the diseased oesophagus in alkaline fluid and neutralizes the gastric contents. After a few days the oesophagitis, as seen endoscopically, has usually disappeared or is markedly improved. The drip may then be removed by day, but should be continued at night until the day before operation.

During the postoperative hospital phase, the patient should follow the diet and positional directions given above. It is wise to continue with these measures for the first few months after operation.

Medical Treatment in Infants

Carré et al (1952), who have treated a large number of infants with hiatus hernia, state that medical treatment often gives satisfactory results, when commenced early in infancy. The basis of such therapy is to prevent gastro-oesophageal reflux by maintaining the baby, day and night, in as nearly an upright position as possible. Elevation of the head of the cot has been found inadequate, so that a specially constructed harness is used. In our wards we use a small plaster-of-Paris "chair" to which the baby can be strapped in a sitting position.

Feeds to meet the infant's full nutritional requirements are introduced cautiously over several days, as too rapid an increase tends to cause diarrhoea. Carré et al recommend thickening of the feed with cornflour or "Bengers Food" as a valuable additional measure. They found home treatment fully satisfactory if the mother is sensible and co-operative.

Veeneklaas (1953) stresses that one should not continue too long with conservative treatment. His objection is that these babies get spine or chest deformities from staying in the chair too long. This occurred in one of our cases, an infant aged 1½ years (Case 86) after only six weeks in the sitting position.

On the whole Veeneklaas finds conservative treatment disappointing and states that it is "very rare" for both the symptoms and the roentgenological abnormalities to disappear. This is only seen in very young babies.

We agree with the latter view and advise operation if the symptoms do not improve after a few months conservative therapy. Apart from the danger of chest or spine deformities, it is clear that continual vomiting in itself is bad for the growing child. Besides, there is always the risk of a stenosis developing.

Chapter XI

ON THE OPERATIVE TREATMENT OF HIATUS HERNIA

A large variety of surgical procedures have been described for the treatment of hiatus hernia. In this chapter a short description is given of the best known techniques, with a brief note on their advantages and disadvantages.

1. INTERRUPTION OF THE PHRENIC NERVE

Sauerbruch in 1925 advocated phrenic crushing in cases of diaphragmatic hernia in infancy and in old age where definite evidence of incarceration, strangulation and obstruction were present and where the general condition of the patient precluded a formal repair operation. This was regarded purely as a temporary measure. Later *Harrington* (1927, 1929) and *Overholt* (1933) went a step further and reported cases in which phrenic crushing was used in diaphragmatic hernias, also hiatus hernias, with only moderate obstructive symptoms. Subsequently various authors advocated left phrenic nerve interruption in hiatus hernia with or without obstruction. Patients over the age of 50 were not considered suitable subjects for surgical repair unless a complication urgently indicated surgical intervention.

Failure of medical treatment often resulted in a trial of left diaphragmatic paralysis. Thus *Pickhardt* et al (1950) employed interruption of the phrenic nerve as a means of treatment in 29 hiatus hernia patients who had not responded to medical treatment. They found simple phrenic crushing the method of choice. As most of these patients were elderly and some had associated cardio-vascular disease, the mildest form of phrenic avulsion was preferred. The only complication encountered, "and this was infrequent", was atalectasis of the left lung which cleared up spontaneously. In 6 of the 29 patients phrenic crush had to be repeated for return of symptoms. Only one patient in this series obtained no relief.

The improvement of symptoms can be explained as follows. The stomach rises with the elevation of the paralysed left diaphragm, simultaneously pulling the herniated cardia back into the abdomen. This may be exaggerated. *Amendola* (1955) describes a case where phrenic avulsion caused such a degree of elevation of the stomach that acute angulation of the

oesophagus at the hiatus occurred, producing oesophageal obstruction and difficulty in swallowing.

Most authors found the results of the procedure disappointing, however. Not only are the immediate results unpredictable, but it stands to reason that with mere crushing of the nerve the pre-operative state will return when the diaphragm functions again after 3—6 months. The procedure is furthermore not without danger as the effects of paralysis of the diaphragm in older patients are often deletrous and sometimes disastrous.

Improvements in anaesthetic technique, availability of bloodtransfusion and other modern safeguards of surgery, have made crushing or cutting of the phrenic nerve, as solitary means of surgical treatment for hiatal hernia, almost obsolete.

Temporary paralysis of the nerve, however, is still advocated by some authors as an auxiliary measure to other operative procedures. *Petterson* (1952) in a discussion on the surgical treatment of hiatus hernia in children, advocates left-sided phrenic crush followed some weeks later by hiatal repair according to the technique of Allison. In the three youngest patients of his series, all less than a year old, he found that vomiting had disappeared immediately after the phrenic crush and roentgenological control showed the cardia to be competent. For this reason subsequent repair of the hiatus was deemed unnecessary.

Harrington (1955) similarly advocates phrenic crush as a preliminary to further repair. He crushes the left phrenic in the cervical region preliminary to abdominal repair of the hiatal hernia and states that the procedure relaxes the diaphragm, so that the oesophageal hiatus permits closure of the hernial opening without tension. When normal function of the diaphragm is re-established after 3—6 months, healing of the repair has occurred.

Nicholson (1952) crushes the phrenic in cases where he has difficulty in the mobilization of the oesophagus. *Merendino* (1949), *O'Neill* (1951), *Sweet* (1952), *Effler* et al (1957) and others all crush the phrenic nerve as part of the operative procedure. *Allison* (1951), *Madden* (1956), *Johnsrud* (1956) and others, however, find the period of paralysis of the phrenic nerve unnecessarily long and inject procaine into the phrenic nerve during the operation. This produces a transient paralysis of a few days only. We do not, as we will prove later, consider closure of the muscular ring of the hiatus absolutely essential for the success of the operation. We do not believe therefore that this procedure, which decidedly increases the chances of postoperative lung complications, is ever indicated as an adjuvant to other surgical procedures. It cannot replace surgical repair of the hernia, so that it should never be used as solitary means of treatment in patients who are fit enough to undergo repair of the hernia. Where radical surgical treatment is contra-indicated because of the patient's general condition,

medical treatment should be instituted. It is especially in these cases that phrenic crushing is too risky as palliative procedure.

2. TRANS-THORACIC HERNIAL REPAIR

A. *The Operation of Allison*

The best-known technique of hiatus repair through the chest is that developed by *Allison* (1948, 1951). This procedure is employed in various clinics throughout the world. The technique is as follows.

The left side of the chest is opened through the bed of the 8th or 9th rib. The lung is retracted and the posterior mediastinum, phrenic nerve and solar plexus are infiltrated with local anaesthetic. The posterior mediastinal pleura is then incised down to the top of the diaphragm over the anterior margin of the hiatus. The oesophagus is now isolated above the cardia and a tape passed around it for traction. The vagus nerves are left intact. A radial incision, about 6 cm. long, is made in the diaphragm and through this the coverings are incised around the front and two sides of the stomach. The tape around the oesophagus is now passed through the hiatus into the abdomen and again through the diaphragmatic incision into the chest. Traction on the tape reduces the hernia.

Via the incision in the diaphragm the cut edges of peritoneum and phreno-oesophageal ligament, together with intervening tissue, are caught up by 4 or 5 interrupted silk sutures and fixed to the under aspect of the diaphragm in front and on the left side of the cardia.

The tape is now removed and the oesophagus displaced forwards. The crural fibres are cleaned and approximated behind the oesophagus with at the most two silk sutures. Allison stresses that these ligatures should be tied very lightly. The fascia and pleura are now closed over the hiatus. The diaphragmatic incision is closed with interrupted silk sutures. The chest is closed with a drain in situ.

In 1951 Allison published a series of 33 cases of sliding hiatus hernia repaired by this technique. There was one death from coronary thrombosis, one recurrence of the hernia and one patient with postoperative oesophagitis and an incompetent cardia without anatomical recurrence of the hernia. Thirty patients had relief of symptoms with the stomach normally placed and with no roentgenological evidence of gastric regurgitation. Allison does not mention the time elapsed between operation and follow-up.

Lam and *Kenney* (1954) advise the following modification of Allison's operation. Instead of incising the diaphragm widely, a small incision is made through which a long clamp is passed to grasp the tape around the oesophagus. Traction on the tape maintains reduction while the crural fibres are approximated. The phreno-oesophageal ligament is not stitched

separately. The hiatal sutures pass through "all layers of the diaphragm, including the diaphragmatic pleura", however. These sutures, according to the authors, correspond to those which Allison recommends for the fixation of the phreno-oesophageal ligament. The oesophageal musculature is attached to the oesophageal hiatus by means of three or more mattress sutures.

The authors found 17 of their 20 patients asymptomatic 6 months after operation. Two cases had persistance of dysphagia from pre-existing oesophagitis and improved following dilatation. One case had to later undergo cholecystectomy for cholelithiasis. One patient had a large haemo-thorax which was infected after a number of paracentesis. Drainage of the empyema by rib resection was necessary.

Another variation of Allison's technique is employed by *Johnsrud* (1956). To repair the phreno-oesophageal ligament, the entire hernial sac is sutured to the under-surface of the diaphragm. The sac is inverted into the abdomen by placing the index and middle fingers of the left hand into it from above. Johnsrud does not open the sac as he found that when this is done, it often becomes frayed and torn and has insufficient substance to hold sutures.

Madden (1956) opens the diaphragm according to Allison, so as to be able to reduce the hernia fully. He incises the hernial sac on the thoracic side, however, and then restores the phreno-oesophageal ligament by suturing the cuff, which is left attached to the oesophagus, to the top of the diaphragm and not to the under-surface. This presents less technical difficulties and, according to Madden, accomplishes the same results.

Deloyers et al (1958) prefer to make a larger incision in the diaphragm and then to approximate the crura on the abdominal side. Afterwards they repair the phreno-oesophageal ligament as described by Allison.

B. *Trans-thoracic Repair without Incision of the Diaphragm*

A number of authors advocate trans-thoracic repair of the hernia without opening the diaphragm. These authors mobilize the oesophagus in the hiatus and then, after reduction of the hernia, narrow the hiatus in various ways. They rely largely on careful approximation of the crura, omitting Allison's step of reconstructing the phreno-oesophageal ligament abdominally. In some procedures an attempt is also made to remove the hernial sac.

Sweet has the largest experience (i.e. 111 cases) of a technique based on these principles. In his procedure, the accent is placed on narrowing of the enlarged hiatus and on elimination of the hernial sac. Thus, the mediastinal pleura is incised and the lower end of the oesophagus, the vagi and the hernial sac mobilized. Ablation of the peritoneal sac is accomplished without opening the diaphragm by plication and inversion of the sac, by excision, or by a combination of both methods. When the sac is small, it is

inverted into the abdomen by means of a series of plication sutures placed in the peritoneum and retroperitoneal fascia. Where the sac is so large that a redundant portion remains in the mediastinum after the stomach has been replaced within the abdomen, it is excised. Occasionally it was difficult to maintain the reduction of the hernia during the process of excising a large hernial sac, however. Here Sweet found it necessary to make a counter-incision in the diaphragm. Through this an assistant maintains the reduction. In these cases "it is more convenient to excise the sac from the abdominal side with closure of the resulting opening in the peritoneum by mattress sutures of silk".

As a second step in the correction of the hernia, Sweet reduces the size of the oesophageal hiatus by means of sutures of heavy silk placed in the diaphragmatic muscle on either side of the oesophagus. If the tissues of the diaphragm are so fragile that the sutures might tear out, the closure of the hiatus is reinforced with one or two strips of fascia lata obtained by an assistant from the left thigh of the patient.

In all cases the phrenic nerve is crushed "to secure the benefits of inactivity of the left half of the diaphragm during the course of the operation and also in the first postoperative few months".

Sweet sometimes found it desirable to explore the abdomen in order to inspect the stomach, duodenum, gallbladder or pancreas. In a series of 111 cases a counter-incision in the diaphragm was employed in 8 patients merely for the purpose of abdominal exploration. In a further 13 cases the diaphragm was incised to assist in repair.

Some authors who rely only on narrowing of the hiatus, secure the oesophagus in the hiatal ring in an attempt to prevent recurrence.

Nuboer (1949) stitches the oesophagus to the edges of the hiatus after repair of the hernia through the chest. In one year 35 cases were operated in this way. No details of the follow-up are given, the results being specified as "very good". *Buchanan* et al (1957) use the approach of Allison but do not open the diaphragm and make no attempt at repairing the phreno-oesophageal ligament. After approximation of the crural fibres the oesophago-gastric junction is fixed to the edges of the hiatus. Of 9 patients operated in this way, 3 had recurrence of symptoms.

Gertz et al in 1951 discussed a series of 54 patients treated on these principles. The hiatus had been closed with 2 or 3 silk sutures behind and one in front of the gullet; the two nearest to the oesophagus including its wall. The results on careful follow-up examination were discouraging. With the sliding hernias not more than 25% could be called completely cured. No less than 50% showed a recurrence on the X-ray examination. The author concludes that "in our experience one cannot rely on the fixation, in the hiatus, because the muscular wall of the oesophagus is so frail and easily tears." In a subsequent series of cases these authors used a different technique whereby the diaphragm was opened and the fundus

of the stomach attached to its under-surface to provide better fixation of the cardia. At the same time the fundus was stitched to the subdiaphragmatic oesophagus, thus reconstructing the acute angle between these two organs "to prevent further regurgitation". The hiatus was narrowed but the oesophagus was not stitched to it. The results were much more satisfactory.

Stenstrud (1954) found radiological recurrence in 9 of 13 patients treated by trans-thoracic narrowing of the hiatus with fixation of the oesophagus to the hiatal ring. Six patients treated by Allision's operation showed no recurrence, however, so that he also deduces that recurrence of the hernia is prevented by repair of the phreno-oesophageal ligament.

C. *Displacement of the Hiatus*

Singleton, in discussing a paper by Harrington, stated in 1942 that he had repaired two hiatus hernias by anterior displacement of the oesophagus. *Merendino* et al in 1949 published a series of 13 cases treated by this method. Thoracotomy is done via the 9th intercostal space on the left. The phrenic nerve is then crushed at its entrance into the diaphragm. The hernial sac is incised and the edge of the hernial ring freshened. The stomach and oesophagus are mobilized. An incision is made through the anterior hiatal ring into the anterior portion of the left leaf of the diaphragm. The oesophago-gastric junction is then displaced into the most anterior corner of the incision and the diaphragm closed posteriorly to it. The stomach, immediately distal to the oesophago-gastric junction, is sutured to the edges of the new hiatus with fine silk sutures. Thus the gastro-oesophageal junction comes to lie immediately above the diaphragm. The above procedure, according to the authors, is indicated whenever the quality of the tissue posterior to the hernia is unsatisfactory for suture or when a satisfactory approximation of the diaphragmatic crura behind the oesophagus cannot be made readily. In a follow-up study, 5—36 months after operation, there were no recurrences in this series.

Effler and *Ballinger* (1951) used a similar technique in case of sliding hernia. Their incision is more radical so that the "new hiatus" becomes situated in the highest point of the tendinous dome of the paralysed diaphragm. The stomach comes to lie intra-abdominally. The terminal oesophagus is carefully attached with silk mattress sutures to the tendinous diaphragm "to prevent sliding". The abdominal cavity is thus lengthened on the left and the thoracic space shortened. In 10 cases operated the results are stated to be "uniformly good". No further specification of follow-up examination is given. In 1957 *Effler* and *Groves* report a further 20 cases with oesophageal shortening "of such a degree that the stomach could not be reduced by the routine mobilization of the oesophagus", so that the above technique was applied. All these patients are stated to be significantly relieved of their symptoms. One had to be

re-operated for an omental hernia in the tendinous portion of the diaphragm.

It is interesting to note that these authors found the oesophagus too short for the conventional repair in more than 10% of the patients they operated upon for hiatus hernia. In our series of 94 cases we never once encountered a case where the cardia could not be reduced into the abdomen with relative ease.

Nicholson in 1952 in a discussion on the treatment of hiatus hernia states: "In some of my earlier cases, I found so little to stitch behind the oesophagus that I deliberately cut right across the anterior hiatal ring and displaced the oesophagus forward. This unphysiologic procedure was invariably accompanied by a phrenic crush or phrenicectomy. I do not advocate this operation; I merely record it. I am surprised that the results have not been bad."

What seems an even less physiological procedure was advocated by *Cohn* and *Heaton* (1949) and later by *Gardner* et al (1952). Instead of closing the diaphragm snugly about the oesophagus and enclosing the stomach in the abdominal cavity, the oesophageal hiatus is enlarged antero-laterally in the direction of the muscular fibres of the diaphragm for a distance of some 5—7 cm. The stomach bulges upwards into the incision and is sutured to the margin of the diaphragmatic defect by interrupted non-absorbable sutures.

The authors developed this technique because of the great recurrence rate seen in the literature and in their own cases with the conventional trans-thoracic means of repair. They emphasize that it is the oesophageal shortening which mitigates against the stability of the conventional reduction and repair. They feel that the symptoms of hiatus hernia are due to the fact that the hiatal ring narrows the stomach at one point leaving a pouch above the diaphragm, which can collect food and gastric juices. Consequently gastritis results, which is taken as the cause of the symptoms. The above technique was developed to combat this.

Cohn and Heaton based their operation on the observation that patients with thoracic stomachs after oesophageal resection were "asymptomatic". Today it is known that these cases are especially prone to oesophagitis. No adequate follow-up is available of the three cases operated by Cohn and Heaton, but two of the eight patients treated by Gardner et al retained their symptoms and one of these patients developed an oesophageal ulcer "which was later successfully cared for by oesophageal resection and oesophago-gastrostomy".

3. TRANS-ABDOMINAL HERNIAL REPAIR

A. *The Operation of Harrington*

Harrington of the Mayo Clinic probably has the largest experience in

the treatment of the various forms of diaphragmatic hernia. Since the 1920's he has published a series of articles on the operative treatment of hiatus hernia. He prefers the abdominal route and in 1955 published the results of 450 cases treated by his method of trans-abdominal repair. This technique has become as well-known as Allison's repair through the chest and as many variations on the original operation have been suggested by other authors.

An oblique incision, extending to the xiphoid process, is made in the left rectus muscle and peritoneum. Adequate exposure of the oesophageal hiatus is obtained by cutting the suspensory ligament of the left lobe of the liver and retracting it to the right. The herniated stomach is replaced into the abdomen. The hernial sac is excised but remnants of it are left attached to the stomach. Very large hernial sacs, extending high into the thoracic cavity, are left in the thorax after multiple incisions through the sac to prevent the accumulation of serum.

The diaphragm is usually repaired to the left of the stomach but in some cases also to the right. The muscle of the diaphragm surrounding the hernial opening is overlapped, so that it closely approximates the oesophagus. The overlapped margins of the diaphragm are stabilized in this position with interrupted linen sutures. Fascia lata is then woven into the overlapped diaphragmatic muscle by continuous sutures and fixed into these tissues with interruped linen sutures. After the hiatus has been reconstructed the cardia of the stomach is fixed to the diaphragm. This is accomplished by suturing the remnants of the hernial sac, which were left attached to the stomach, to the diaphragm. In some instances the omentum of the greater curvature can be utilized for attaching the stomach to the diaphragm.

This type of repair is employed by various authors. As in the transthoracic method, the terms "hernial sac" and "phreno-oesophageal ligament" are used for the same material. Thus *Carver* (1954), who basically follows the technique of Harrington, speaks about suturing the phreno-oesophageal ligament to the diaphragm.

Merendino et al (1949), who usually prefer the trans-thoracic route, go through the abdomen when other intra-abdominal pathology is suspected. In these cases they follow the technique of Harrington. When the material posterior to the hiatus is not of sufficiently good quality, however, they displace the oesophagus forwards and to the left by an incision in the hernial ring, as described in the previous section.

Many authors who use Harrington's technique vary only slightly in the type of abdomial incision made. Thus *Tanner* (1955) and *Woodruff* et al (1957) prefer a right paramedian incision with retraction of the rectus to the right. Many surgeons simultaneously resect the xiphoid process to facilitate the procedure. Wangensteen, Tanner and others have even advocated splitting of the sternum in difficult cases to obtain better

exposure. The sternum is divided up into each 4th intercostal space. The two halves are retracted and the anterior diaphragm incised upwards, taking care not to open the pericardium. This method is advocated for the deep-chested and for those patients with a high diaphragm. We have never found this rather drastic procedure necessary.

B. *Partial Gastrectomy*

Wangensteen in 1939 resected a stomach for a duodenal ulcer and effected a cure in an associated stenosing oesophagitis. This led to further investigation. In 1949 with *Leven* he published the case histories of six patients presenting with clinical evidence of oesophagitis, oesophageal stricture or both, in which relief of the oesophageal obstruction followed gastric resection. Three of these patients had associated duodenal ulcer and one had a gastric ulcer. After Billroth II-Hofmeister partial gastrectomy all these cases were relieved of their oesophagitis symptoms. In none was a hiatus hernia demonstrated. The authors considered this strong evidence suggesting that oesophagitis is a manifestation of "ulcer disease". Partial gastrectomy was advocated as treatment. It reduces the acid secretion and increases the gastric outflow. *Cornell* and *Winkelstein* in 1950 also successfully treated a case of oesophageal ulcer by means of a high subtotal gastrectomy.

Others have applied partial gastrectomy as means of treatment in cases of oesophagitis clearly associated with hiatal hernia in the absence of peptic ulceration of stomach or duodenum. Thus *Franklin* (1952) treated 8 cases by means of a Billroth I partial gastrectomy. After the operation two patients expressed themselves as completely normal and a further four, as very pleased with the result. The remaining two were improved. Franklin suggested that the operation owes its success not only to the diminution of gastric acidity but to the fact that a Billroth I gastrectomy tends to prevent the stomach passing up into the chest. *Barrett* (1954) believes, in addition, that by shortening the stomach the cardia is held down in such a position that the fundus can balloon out effectively and so reconstitute the "flap valve". *MacLean* and *Wangensteen* (1956) treated four cases of oesophageal stricture associated with hiatal hernia by means of subtotal or tubular gastric resection. The symptoms of these patients were improved. After oesophageal dilation the strictures were likewise improved.

Fischer and *Johnson* (1957), as we have stated in the chapter on the aetiology of hiatus hernia, believe that it is another manifestation of acid-pepsin disease involving the stomach. They consider this theory supported by the common occurrence of both duodenal and gastric ulcer together with hiatal hernia and peptic oesophagitis. They agree with Wangensteen, and Cornell and Winkelstein that subtotal gastrectomy may

benefit all three conditions. They treated seven cases of hiatal hernia associated with oesophagitis by a high Billroth II partial gastrectomy. Postoperatively a hiatus hernia could be demonstrated in only two instances on re-examination. In all other cases, in spite of the fact that the hiatus had not been interfered with in any way, the herniation of the stomach into the chest had disappeared. This finding led the authors to believe that hiatus hernia may not be a condition of pulsion hernia but one of traction by a shortened oesophagus due to the inflammatory process existing in it. They believe that the hiatus need only be repaired "if it will admit more than three fingers or measure more than 1½ inches in diameter" at operation.

Wells and *Johnston* (1955) found the recurrence rate of their patients treated by Allison's operation so high that they changed to a partial gastrectomy. They accept the incompetent cardia but seek to prevent regurgitation by securing rapid emptying of the stomach. They were disappointed, however, with the results of simple partial gastrectomy because the patients often developed vomiting of bile, oesophagitis often persisted and there was profuse regurgitation of bile on recumbancy or stooping. They advocate vagotomy, partial gastrectomy and re-anastomosis by the Roux-Y method. Hereby achlorhydria is produced and the bile and pancreatic stream diverted so that if regurgitation persists, it can do no harm. Their early results in 12 consecutive cases were satisfactory. It was too soon to judge whether these patients would develop microcytic iron-deficiency anaemia or disturbances of normal digestion and absorption and whether they would develop a deficiency type of post-gastrectomy syndrome. Most patients gained weight however.

We feel that partial gastrectomy is not indicated in the treatment of hiatus hernia uncomplicated by duodenal or gastric ulcer. Reduction of the hernia with repair of the hiatus gives better results than the rather mediocre results of gastrectomy quoted above. Gastrectomy cannot replace hernial repair, as the anatomical defects remain basically unaltered. In our series we operated three patients with severe symptoms due to hiatus hernia, where a partial gastrectomy had previously been done elsewhere without success.

Where the hiatus hernia is complicated by peptic ulceration of the stomach or duodenum, however, partial gastrectomy certainly has a place in the treatment. The success of the operation depends in the various factors we have already briefly touched on. Not only are the effects of gastro-oesophageal reflux diminished by the reduction of acid secretion, but the gastric outflow is hastened. The stomach rest empties itself rapidly through the gastro-jejunal anastomosis. Thus there is never a great quantity of gastric content to regurgitate into the oesophagus. It is also conceivable that the shortened gastric stump may act as an anchor or gastropexy, preventing herniation. And if it is true that the hiatus hernia

is caused by traction of the longitudinal muscles of the oesophagus in response to vagus stimulation by some irritative focus in the abdomen, then is seems feasible that curing the duodenal or gastric ulcer will curb the tendency to recurrence.

C. *Pyloroplasty*

Burford and *Lischer* (1956) after a series of experiments felt that a well-placed gastro-enterostomy or a wide open pyloroplasty offered some protection for the canine oesophagus when the cardia was rendered incompetent. This stimulated their interest in the pyloric factor in hiatus hernia with transcardial reflux and oesophagitis. In their experience it was rare to find a marked gastric hyperacidity in the sliding hiatus hernias unassociated with gastric or duodenal ulcer. Therefore they do not agree with Wangensteen and Leven who state that reduction of the acid secretion by means of gastric resection is as important as increasing the gastric outflow. They decided that correction of the reflux of acid-pepsin should be a matter of balancing the resistance at the pylorus. This, they reasoned, should result in continuous downward gastric outflow with marked decrease or complete cessation of transcardial reflux.

A Finney pyloroplasty was therefore performed in 16 adults, all with marked symptoms as a result of hiatus hernia with oesophagitis seen at oesophagoscopy. Fifteen of these cases attained improvement, although ten still complained of occasional "heartburn". Only 3 were re-examined endoscopically. They were found to be "clear of the gross evidence of oesophagitis". In one patient the pyloroplasty failed to result in any improvement.

D. *Gastropexy*

Gastropexy has been used for some years as means of treatment for hiatus hernia. We have mentioned that some authors attach the fundus of the stomach to the dome of the diaphragm or the hiatal ring after repair of the hiatus. *Nissen* in 1955 described his experiences with gastropexy of the greater curvature as a method of treatment for para-oesophageal hernias. According to his technique the larger curvature is attached under tension either to the left costal margin using a strip of fascia prepared from the rectus sheath or directly to the anterior abdominal wall, the stitches including the posterior rectus sheath. The author considered operative treatment in the case of sliding hernias only indicated in the presence of oesophagitis, in which case he advised Allison's technique of hernial repair. In the case of penetrating peptic ulcer he advised gastro-oesophageal resection with vagotomy.

Boerema and *Germs* in 1955 introduced a new technique of gastropexy

for the treatment of sliding hiatus hernia. They were not satisfied with the results of narrowing the hiatus whether by the trans-thoracic or by the known trans-abdominal procedures. Gastropexy of the greater curvature to the diaphragm for sliding hernia had also been tried without success. All these techniques failed to restore the anatomy of the hiatus to a degree of normality which excluded recurrence of the hernia. Neither was the physiology of the cardia restored and in a large percentage of cases reflux continued. A new technique, which they termed "Gastropexia Geniculata Anterior", was therefore developed. This consists in essence of the reduction of the hernia and the fixation of the *lesser curvature* under tension to the upper anterior abdominal wall.

The promising results which they reported in 1955 in the first 23 cases operated, are confirmed by this study which concerns a group of 77 cases treated by gastropexia geniculata anterior. The technical details of the operation are described in the next chapter.

In 1956 Nissen also reported three cases of sliding hernia successfully treated by gastropexy of the lesser curvature under tension to the anterior abdominal wall. *Uebermuth* (1957) similarly expressed his satisfaction with the results of two patients treated by this method.

Chapter XII

ON THE OPERATIVE TECHNIQUE OF GASTROPEXIA GENICULATA ANTERIOR

A median upper abdominal incision is made from the xiphoid process to the umbilicus, opening the abdomen through the linea alba. The xiphoid process is completely resected (Fig. 21). This improves the exposure and facilitates the approach to the hiatus, especially as many of these patients

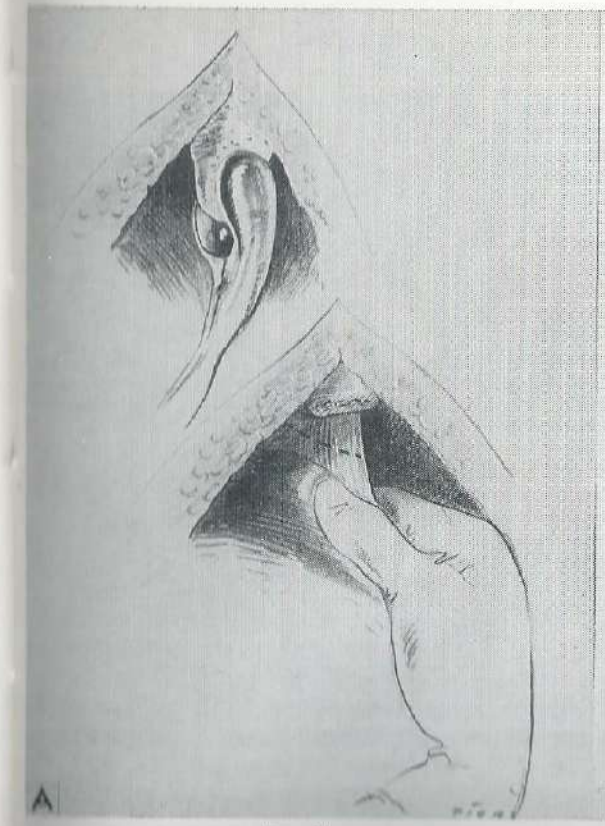


Fig. 21
Median upper abdominal incision. Xiphoid process resected and triangular ligament of left liver lobe divided

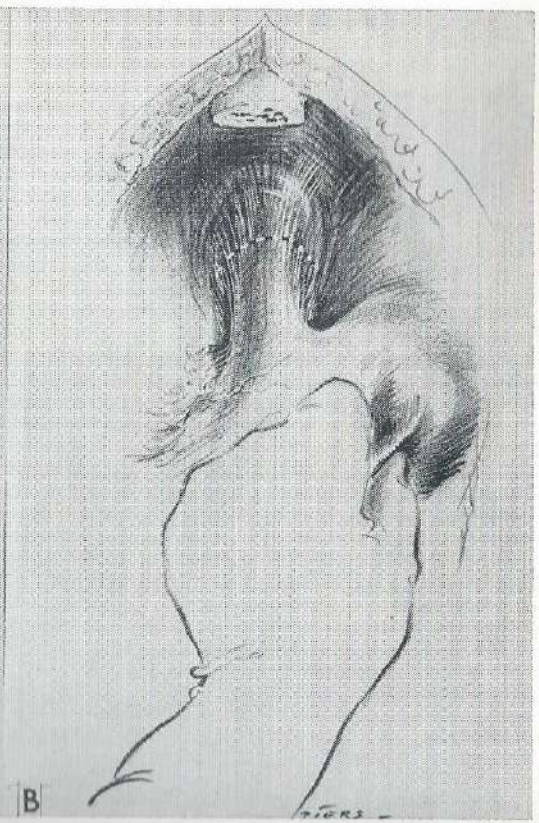


Fig. 22
The left liver lobe has been retracted to the right. Stomach retracted downwards. Stretched peritoneum and phreno-oesophageal ligament incised transversely at the hiatus

are rather obese. After preliminary palpation of the hiatus to confirm the diagnosis, the rest of the abdomen is thoroughly examined for other abnormalities, which are dealt with immediately or at a subsequent operation, depending on the nature of the pathology.

The triangular ligament of the liver is divided, so that the left lobe can be retracted out of the way towards the right, thus leaving a free approach to the hiatus (Fig. 21). If the left liver lobe is large, it is carefully folded upon itself and then held out of the way towards the right. The surgeon now has free access to the hiatus. The hernia is reduced by traction on the stomach and the hernial coverings incised transversely at the hiatus (Fig. 22). We prefer to use scissors for this procedure. The distal oesophagus with the two vagus nerves is then mobilized by blunt dissection. Traction on a thin rubber tube, passed around the oesophagus, facilitates the process of mobilization. The distal oesophagus is freed of its peritoneal and ligamentous attachments. The two vagus nerves are left intact. Using the above technique, it is possible to fully mobilize the gullet in the hiatus and to pull a few centimeters of thoracic oesophagus into the abdomen.

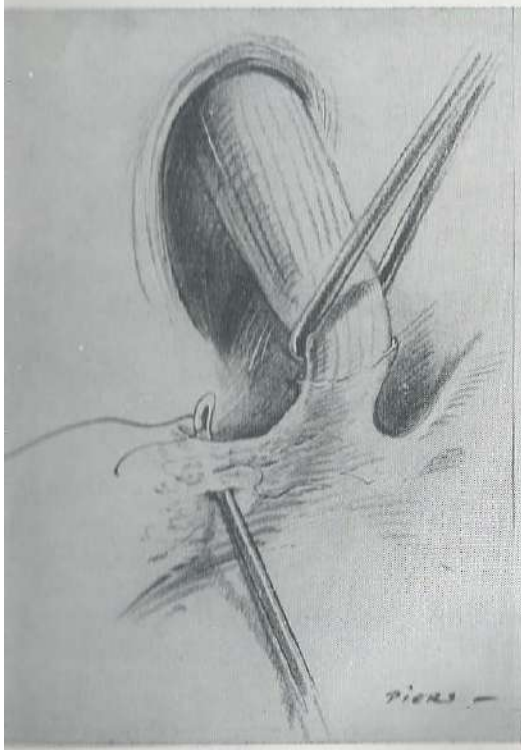


Fig. 23

...ophagus mobilized in the hiatus. Smaller omentum ligated and divided until lesser curvature is quite mobile

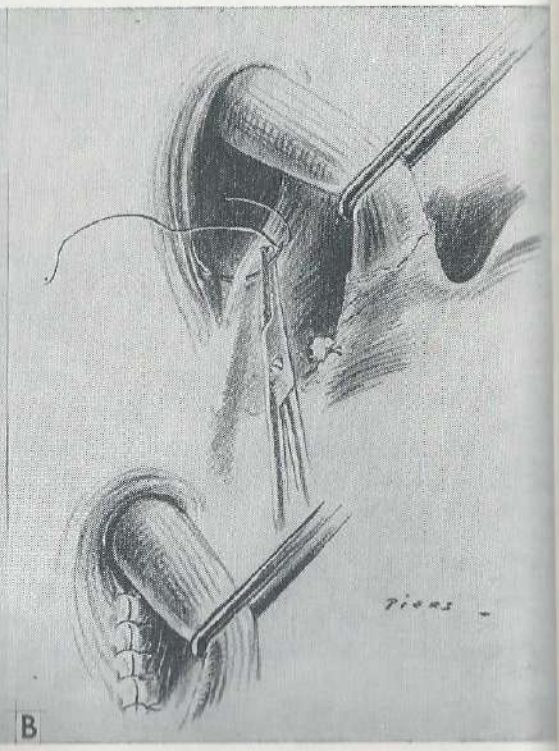


Fig. 24

Fibres of right crus approximated behind the oesophagus with interrupted silk sutures

The crural fibres behind the oesophagus are now exposed. This process is facilitated by ligation and division of the upper branches of the left gastric artery, at the same time dividing the proximal attachment of the smaller omentum from the lesser curvature (Fig. 23). The cardia, thus mobilized, is pulled forwards and to one side. The crural fibres are carefully cleaned and then approximated behind the oesophagus with interrupted silk sutures (Fig. 24). As these sutures approximate muscle fibres, they should be tied lightly, working anteriorly towards the oesophagus. When the last suture is placed, the hiatus should still admit one finger alongside the gullet. This procedure requires extra long instruments, including needle holder and scissors.

This concludes the actual repair of the hiatus. Superfluous hernial sac is removed but, as we have mentioned previously, no further attempt is made to repair the sac or the phreno-oesophageal ligament. If the gallbladder contains stones, or is obviously diseased, it is removed at this stage.

Before proceeding to the gastropexy, the surgeon should make sure that

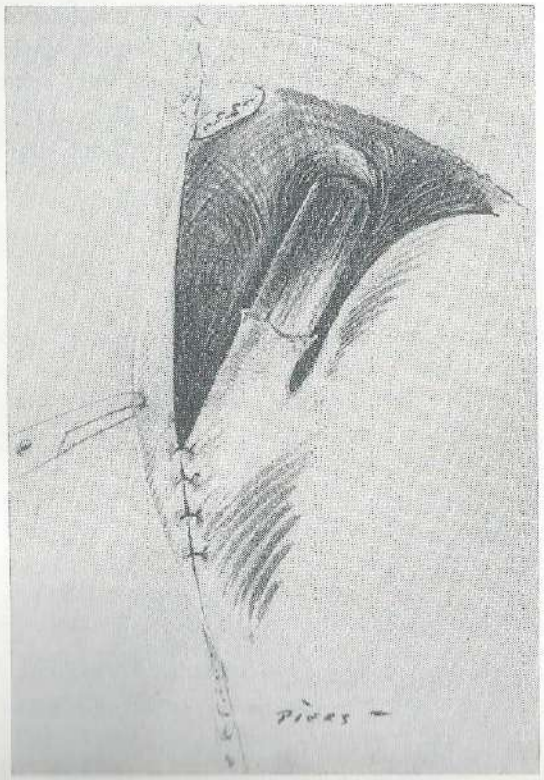


Fig. 25

Lesser curvature attached under tension to the anterior abdominal wall, the sutures passing through peritoneum and posterior rectus sheath

the nasal tube enters the stomach. After gastropexy introduction of the tube is difficult owing to the sharp forward bend which the oesophagus makes at the hiatus.

The left liver lobe is returned to its normal position and the oesophagus and lesser curvature brought along its undersurface towards the anterior abdominal wall. This is done under strong traction so that some centimeters of thoracic oesophagus are pulled into the abdomen. The lesser curvature is then attached to the posterior rectus sheath at a point chosen to the right of the midline incision, fairly close to the right costal margin. While an assistant maintains strong traction on the stomach, the lesser curvature is stitched to peritoneum and the posterior rectus sheath with 4 or 5 interrupted silk sutures. The abdominal portion of the oesophagus and its prolongation, the lesser curvature, should now form a tight cord, running straight forwards and somewhat caudal from the hiatus to the upper anterior abdominal wall (Fig. 25). This is the essential part of the operation and should be meticulously performed.

After fixation of the lesser curvature, the stomach will fall backwards, the fundus coming to lie against the dome of the left diaphragm. In the past it was stitched into position here. Lately we consider this unnecessary, as after fixation of the lesser curvature the fundus spontaneously takes up its natural position next to the oesophagus, thus assuring the sharp angle of entry between oesophagus and stomach (Fig. 25).

The abdomen is closed in the usual manner without drainage.

Chapter XIII

ON THE RATIONALE OF GASTROPEXIA GENICULATA ANTERIOR

In Chapter XI we summarized the technical details of a number of operations which have been described for the treatment of hiatus hernia. The results of these operations have been reported in large series of cases. *Harrington* (1955) reported a series of 450 cases operated according to his technique. He states that only 13 cases presented with recurrence but does not mention whether follow-up examination was performed in all cases. *Allison* (1951) reported 33 cases of sliding hernias operated by his technique. Of these, 30 patients had relief of symptoms and were classified as successful. No details of a follow-up examination are given. *Sweet* (1952) published a series of 111 cases operated by his technique. Although a postoperative roentgenological examination was done in all patients just before discharge from hospital, no subsequent roentgen studies were made except of the patients who were not completely relieved of symptoms. In only 2 of these cases was a recurrence discovered.

Although the authors of these techniques have, therefore, indicated that in their hands the procedures have not been associated with an important recurrence rate, others have reported a discouraging number of failures. The following authors performed complete follow-up examinations of their cases operated according to the techniques of Harrington, Allison and Sweet:

	Complete Success	*Recurrence*
Anderson (42 cases)	30.9%	23.8%
Buchanan et al (21 cases)	50%	40%
Gertz et al (42 cases)	25%	50%
Husfeldt (42 cases)	57%	43%
Soutter (25 cases)	16%	40%
Stensrud (21 cases)	43%	43%
Tanner (25 cases)	48%	44%

These results are extremely disappointing and several authors have, in fact, advised that attempts at definitive repair are not worth while and

that it is preferable to enlarge, rather than diminish, the hernial orifice, so that the stomach is not constricted. A similar defeatist attitude is represented by those who recommend interruption of the phrenic nerve as solitary surgical treatment.

The perplexity of the general practitioner, or internist, who has to advise the patient, can therefore be understood. That the patient is often advised to "forget it" or to change his habits of eating and sleeping and to take palliative drugs in an attempt to make the situation more tolerable, is not surprising. *Obviously what is needed is a standard, curative operation, which not only corrects the anatomical deformity but restores the normal physiology.*

In the case of sliding hiatus hernia, the anatomical deformity is the result of three basic structural defects. There is, in the first place, atrophy with a stretching and distortion of the muscular collar of the hiatus, so that the hiatal opening which normally fits snugly around the oesophagus, becomes widened and enlarged. At operation the hiatus may admit three or four, or even more, fingers next to the oesophagus.

The second structural defect is a disturbance of those factors maintaining the cardia in its normal position below the diaphragm. The most important of these is the phreno-oesophageal ligament, which originates in the fibrous tissue on the underside of the diaphragm, spans the hiatus and is attached to the entire circumference of the oesophagus approximately 2—3 cm. above the gastric junction. This structure, which normally secures the cardia below the diaphragm, becomes lax and stretched and can no longer function as an anchoring mechanism.

The third defect is the presence of a redundant peritoneal sac which extends through the hiatus and is located on the antero-lateral aspects of the upper part of the stomach and terminal oesophagus. This sac is relatively constant in position but varies in size. It does not pass entirely around the underlying organs. A part of the hernial wall is formed by the viscus itself, so that the term "sliding hernia" is of course appropriate. The wall of the sac is made up of peritoneum and stretched phreno-oesophageal ligament.

In the case of para-oesophageal hernias, there are only two structural defects. The cardia remains anchored below the diaphragm by a functionally intact phreno-oesophageal ligament. The herniation takes place through a widened hiatal ring into a sac alongside the cardia. With this type of hernia, mere closure of the widened hiatus after reposition of the hernia will give good results. This can be achieved by plicating the muscular collar itself, either on the left side, or on the right side, or anteriorly, or by co-apting the margins posteriorly. Anatomically the most satisfactory reconstruction of the muscular collar seems to be the approximation of the bundles of the right crus in the direction of the fibres behind the oesophagus.

As, in these cases, it is the fundus of the stomach which usually herniates through the hiatus, fixation of the greater curvature to the costal arch, as advocated by *Nissen* (1955) or to the diaphragm, may help to prevent recurrence. Excision of the sac, if large, provides an extra safeguard. In the case of sliding hernias, however, the ideal repair involves correction of all three structural defects. The normal anatomy has to be restored, not only by narrowing of the hiatus and removal of the redundant sac, but by reinstatement of the factors securing the cardia below the diaphragm. This has been attempted both by the trans-thoracic and trans-abdominal routes.

Many surgeons prefer approaching the hernia through the chest. Thus *Maurer* (1957) states that "with the transthoracic approach, the operating time is definitely shorter, early ambulation is possible and the convalescence appears to be smoother and more rapid". Undoubtedly this approach gives the most rapid exposure of the hiatus. The first defect, that of the widened hiatal ring, can therefore be readily corrected by the trans-thoracic route. It is not sufficient, however, to rely only upon the narrowing of the hiatus, as many authors have found. Thus *Gertz* et al (1951) in a series of sliding hernias treated by careful narrowing of the hiatus, found that not more than 25% of the patients could be called completely cured and no less than 50% showed recurrence on the X-ray examination.

There are many reasons for this failure. The problem is to repair the hernia through a flat sheet of muscle at the same time creating a reasonably elastic opening through which the oesophagus and vagus nerves can pass. The hiatus cannot be closed too tightly about the oesophagus or the patient will have dysphagia. Often the crural fibres have to be closed with some tension so that one gets the impression that the sutures may eventually cut through the soft muscular tissue and, in this manner, defeat the purpose for which they were originally placed. Frequently there is a scarcity of tissue of sufficiently good quality to close the defect satisfactorily. It is not surprising, therefore, that the hernia often recurs if the surgeon relies entirely on the stitching of a few muscle fibres, which in many instances are stretched and often extremely thin. Some of our cases where careful suturing of the hiatus had been done elsewhere, were re-operated in our clinic because of recurrence. At operation we found the hiatus wide and the crural fibres as if no suturing had ever been done.

Mere narrowing of the hiatus, therefore, cannot prevent recurrence. The other structural defects have to be corrected as well; the phreno-oesophageal ligament has to be repaired and the redundant hernial sac removed. In many techniques this is combined by an excision of the redundant sac and resuturing the reduced portion to the diaphragm. As the phreno-oesophageal ligament arises from the underside of the

diaphragm, this reconstruction is best performed by repairing the ligament on the abdominal side. Allison, who employs the thoracic approach, makes a separate incision through the diaphragm to accomplish this. He incises the sac circumferentially and sutures the cuff, which remains attached to the oesophagus, to the underside of the diaphragm, to restore the phreno-oesophageal ligament. Madden has stated that the cuff could be sutured to the top of the diaphragm with less technical difficulty and still accomplish the same result. This does not anatomically restore the phreno-oesophageal ligament, however, and cannot anchor the cardia *below* the diaphragm, as well as in the technique employed by Allison. Neither can the alternative method of simply plicating the sac into the abdomen, as advocated by Sweet, provide adequate anchorage.

Some authors have tried to fix the oesophagus itself in the narrowed hiatus with sutures passing through its wall. The oesophageal wall is weak, however, and not covered by peritoneum so that it does not hold sutures well.

It is clear therefore that only two of the defects can be repaired through the trans-thoracic route. The exposure of the hiatus is good and the redundant hernial sac can be adequately removed, but repair of the phreno-oesophageal ligament is impossible without entering the abdomen through a separate incision in the diaphragm. This renders the operation technically more difficult and increases the chances of postoperative complications.

Another disadvantage of the trans-thoracic approach concerns the diagnosis. The degree of herniation can be judged a great deal more accurately from below the diaphragm. In fact, as Tanner has pointed out, it is practically impossible to measure minor degrees of herniation from the thorax and the surgeon must operate on the strength of his pre-operative diagnosis alone. Opening of the chest during an intra-thoracic operation removes its negative pressure so that there is less tendency for the stomach to enter the hernial sac. Inadequate operations may be carried out through the thorax on this account.

An important advantage of the abdominal approach is that associated intra-abdominal pathology can be dealt with. The simultaneous occurrence of hiatus hernia with gallbladder disease or peptic ulcer or diverticulosis had been mentioned by various authors and discussed in Chapter VII. *Beretta* et al (1957) found a 50% incidence of associated pathological conditions during trans-abdominal repair of hiatus hernia. *Tanner* (1955) found that over 20% of his hiatal hernia cases required an operation on the gallbladder or stomach in addition. In our series of 94 cases of hiatus hernia, treated surgically, we performed cholecystectomy for gallbladder disease 23 times. Cholecystectomy may be carried out simultaneously with the hernial repair without significantly increasing the operative risk.

Perhaps one of the greatest advantages of the abdominal approach, however, is the fact that it calls considerably less on the patient's reserves and leads to fewer postoperative pulmonary and cardiac complications. As many of these patients are elderly, the easier postoperative course is an important consideration.

By means of the abdominal route, it is possible to repair all three structural defects accompanying the hiatal hernia. The crura arise from the lateral surfaces and intervertebral fibrocartilages of the first three or four lumbar vertebrae. It is obvious therefore that this is an abdominal rather than thoracic structure and most clearly defined from the abdominal aspect.

The hernial sac, moreover, is easily dealt with through the abdominal route. The excess sac may either be excised according to the original technique of Harrington or dealt with according to the variations on his procedure as described in Chapter XI. The phreno-oesophageal ligament, in the form of the remaining cuff, may then be sutured to the under-surface of the diaphragm.

Theoretically therefore, the abdominal route provides the possibility of repair of all three structural defects. And yet the recurrence rate of hiatus hernias repaired through this route remains high. This is probably because the material which has to prevent recurrence of the hernia is not of sufficient quality. Not only are the hiatal margins distorted and stretched and often thinned, but the phreno-oesophageal ligament which is utilized as retentive structure, is often infiltrated with fat, stretched and tenuous. If the sac is opened this structure becomes frayed and torn and has insufficient substance to hold sutures.

Johnsrud (1956) observes that "the carefully prepared cuff described by Allison ends up as a few shreds of peritoneum and areolar tissue". These hernias, after all, are probably attributable to atrophy and relaxation of the muscle fibres surrounding the oesophageal opening, together with slackening of the elastic fibres of the phreno-oesophageal ligament.

The repair is, therefore, often not sufficiently strong to counteract the powers forcing the stomach back into the chest, i.e. the negative intra-thoracic pressure, the positive intra-abdominal pressure and the pull on the cardia exerted by the longitudinal muscle fibres of the oesophagus. On exposure of the hernial sac from the abdominal aspect, one is struck by the remarkably strong pull into the chest. If the stomach is reduced into the abdomen, it requires constant firm traction to prevent it from returning into the sac. Despite repair, the weakened structures of the hiatus often cannot prevent the cardia from slipping back into the posterior mediastinum. Thus one must look elsewhere for a means of securing the cardia in the abdomen.

To accomplish this we attempted gastropexy of the greater curvature to

the left dome of the diaphragm. Of seven sliding hernias operated in this way, four recurred however. The diaphragm, a mobile muscular structure, is not ideal as fixing-point. Neither is there a suitable structure in the posterior abdomen to which the stomach can safely be attached. The idea was therefore conceived of suturing the stomach under tension to the anterior abdominal wall. The lesser curvature is employed as it constitutes the direct prolongation of the abdominal oesophagus. The upward pull on the cardia is therefore efficiently counteracted.

The oesophagus, pulled down into the abdomen, will now bend fairly sharply at the hiatus towards the anterior abdominal wall. When the technique of the operation was first described by *Boerema* and *Germs* in 1955, it was called "Gastropexia Geniculata Anterior", to indicate the forward bend of the gastropexy (Fig. 26).

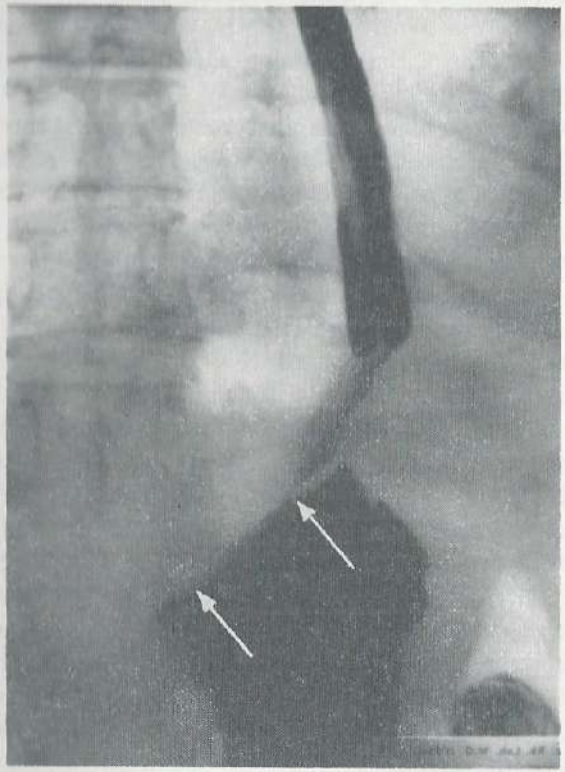


Fig. 26

Antero-posterior view after Gastropexia Geniculata Anterior. Arrows indicate line of attachment of lesser curvature to anterior abdominal wall. Note length of intra-abdominal oesophagus and forward bend at the hiatus

The high tension on the lesser curvature and the abdominal portion of the oesophagus prevents the cardia sliding upwards into the mediastinum again. With the negative pressure in the thorax increased during inspiration,

the upward pull on the cardia is greatest so that the tendency to herniation becomes maximal. Simultaneously, however, the costal arch and upper anterior abdominal wall, to which the lesser curvature has been attached, are elevated so that the downward traction on the cardia becomes stronger (Fig. 27—28).

While reduction is maintained by gastropexy, there is adherence between the hiatal wall and the denuded raw oesophageal surface. Thus the fibrous connection between the undersurface of the diaphragm and the oesophageal wall is restored, closing off the abnormal opening between abdomen and thorax. Where possible, of course, the hiatal opening should be restored to its normal size, thereby further enhancing the latter process.

We are most satisfied with the anatomical results of the gastropexy. But even more important is the fact that the symptoms are relieved by the operation.

With para-oesophageal hernia the complaints are produced by the pressure of an abnormal hernial mass in the thorax. The cardiac mechanism remains undisturbed. Reduction of the hernia and narrowing of the hiatus will prevent recurrence and relieve the symptoms completely. In the case of sliding hernias, however, it is evident from the literature that no definite parallel between the success of anatomical repair and the relief of symptoms exists. Thus *Gertz* et al (1951) reported that as many as 25% of their patients with sliding hernias continued to have symptoms after an anatomically successful repair of the hernia.

In our series, sliding hernias constitute by far the largest number of cases. The majority of symptoms with these hernias are produced by incompetence of the cardiac mechanism and reflux of gastric contents into the oesophagus. It follows therefore that the success of an operation for sliding hernias will depend not only on an adequate anatomical repair, but also on correction of the disturbed cardiac mechanism.

In Chapter III we discussed the physiology of the closing mechanism between oesophagus and stomach. The cardia, as we pointed out, can maintain its function independent of the diaphragm. Closure depends on factors intrinsic to the cardiac region. Furthermore, as there is no oesophagitis or demonstrable reflux into abdominal oesophagus, the intrinsic mechanism must be situated at the gastro-oesophageal junction itself. Most authorities agree that the final watertight closure between oesophagus and stomach is produced by mucosal folds at the cardia. These folds are approximated by an intrinsic muscular mechanism. Manometric and cineradiographic investigations have pointed to the presence of a segment of increased pressure at the cardia. These findings suggest that a sphincter exists which draws together the mucosal folds of the cardia, closing off the top of the stomach. It has not been conclusively demonstrated whether this sphincter depends for its action on circular

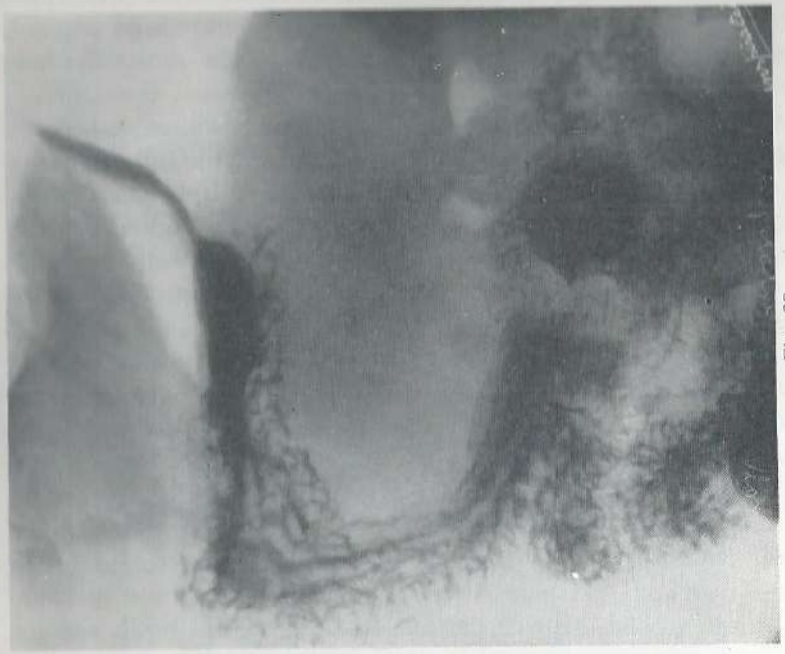


Fig. 28
The same patient during inspiration. Note that the lesser curvature is drawn upwards and forwards. This efficiently counteracts the greater tendency to herniation during inspiration

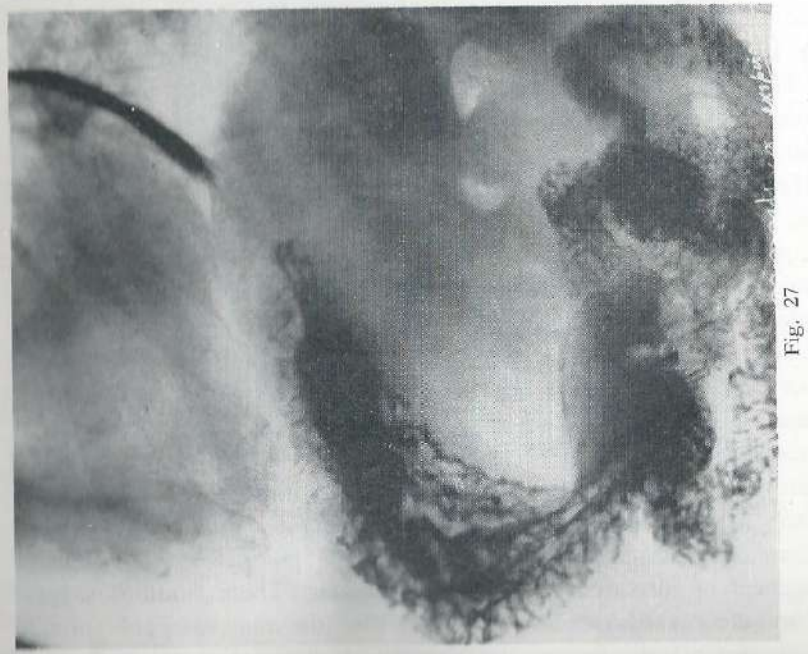


Fig. 27
Lateral view of patient after Gastropexia Geniculata Anterior during expiration

muscle fibres in the terminal oesophagus or on the oblique muscle fibres of the stomach.

It seems clear, however, that gastro-oesophageal closure depends on both a valvular and muscular mechanism. This mechanism normally prevents reflux of gastric contents into the oesophagus in all positions; also on lying down or bending forwards and even with a marked increase of intra-abdominal pressure as for instance during deep inspiration, coughing, sneezing, defaecation, etc. During roentgenologic examination of the normal stomach, reflux does not occur in Trendelenburg position, not even during deep inspiration or with manual pressure on the abdomen.

In Chapter IV we discussed the various factors which prevent the herniation of abdominal viscera through the hiatus. These factors, notably the snug approximation of the crura around the gullet and the firm attachment of the phreno-oesophageal ligament to the oesophagus, prevent herniation into the chest by counteracting the strong upward force exerted by the positive intra-abdominal pressure, the negative intra-thoracic pressure and the upward pull of the longitudinal muscle fibres of the oesophagus. Normally these antagonistic forces are in equilibrium, providing a delicate mechanism for the fixation of the oesophagus in the hiatus, allowing the passage of food with swallowing and the movement of the diaphragm with respiration, but preventing herniation of abdominal organs through the hiatus.

Para-oesophageal herniation takes place as a result of disturbance of this equilibrium. The crural margins, which normally fit snugly around the oesophagus, become lax and widened and allow the herniation of a part of the stomach into the chest alongside the oesophagus. The hernia is forced into the chest through the widened hiatus whenever the patient bends forwards or increases the intra-abdominal pressure. This process is comparable to the way a "blow-out" of the inner tube takes place through a defect in the outer tubing of a motor car tyre.

Para-oesophageal hernias are not usually associated with reflux of gastric contents into the oesophagus. This is because the cardia remains in position below the hiatus and is never subjected to any gross increase of pressure on bending forwards or with exertion (Fig. 29. The hollow arrow indicates the flow of gastric contents). The closing mechanism can therefore maintain its function unhindered. Operative reduction of the hernia and narrowing of the widened hiatus restores normality.

In the case of sliding hiatus hernias the cardia itself slides into the chest through the widened hiatus whenever the intra-abdominal pressure is increased or when the patient bends forwards. The gastric contents are then directed, as if into a funnel, against the herniated cardia (Fig. 30). The internal sphincter, whether this depends on the circular muscle fibres of the terminal oesophagus or on the oblique fibres of the stomach, becomes unable to approximate the mucosal folds and to close off the top of the

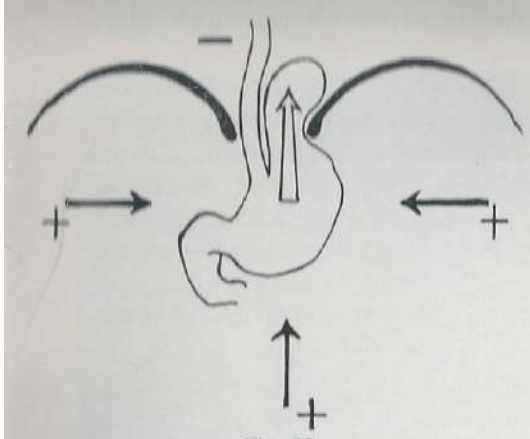


Fig. 29

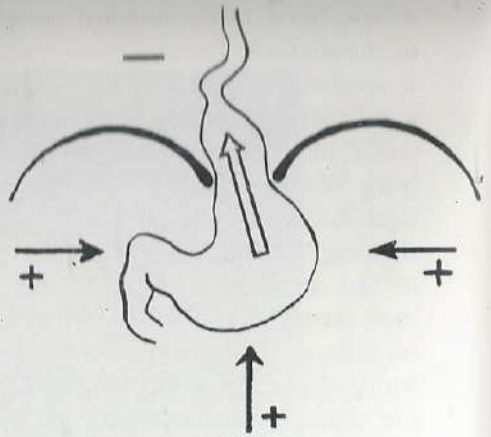


Fig. 30

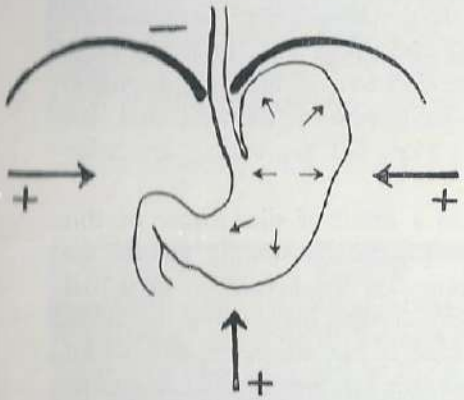


Fig. 31

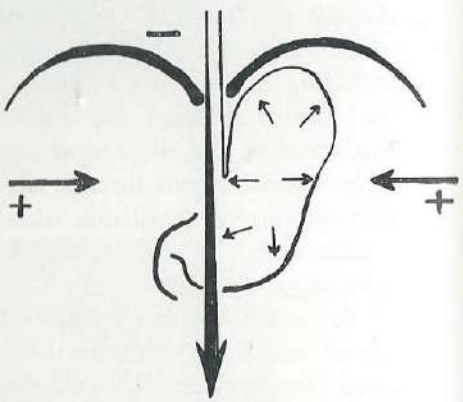


Fig. 32

stomach. The cardia becomes incompetent and reflux results. Thus reflux oesophagitis is the most common complication of this type of hernia.

With the normal anatomy undisturbed, the pressure is equally distributed to all parts of the stomach so that the cardiac mechanism is not interfered with (Fig. 31). The most important point in the operative repair of sliding hiatus hernias is therefore to create an abdominal oesophagus of sufficient length in order to restore the normal pressure distribution in the stomach. The cardia, no longer situated at the apex of the hernia will then be able to resume its normal function.

This correction can only be achieved by the operation of Gastropexia Geniculata Anterior where the oesophagus, after being mobilized in the hiatus, is pulled into the abdomen for many centimeters, the lesser curvature then being attached under tension to the anterior abdominal wall (Fig. 32).

From this it follows that although the acute angle of His, as we have already proved in Chapter III, probably plays no active role in gastric closure, it is always an indication of normally distributed intra-gastric pressure. A sharp angle of His, therefore, indicates that the cardiac function can take place unhampered by an abnormal pressure relationship.

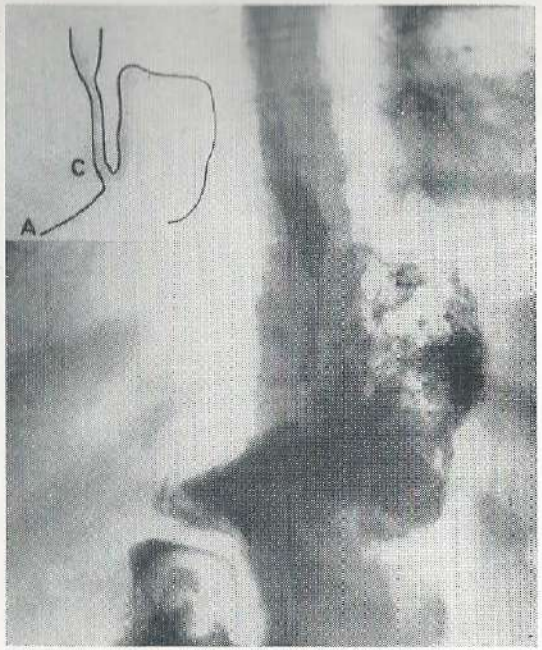


Fig. 33

Antero - posterior view of patient after gastropexia geniculata anterior. The line A—C indicates attachment to anterior abdominal wall.

PART II

ON 94 CASES OF HIATUS HERNIA OPERATED IN THIS CLINIC

In the following pages 94 cases of oesophageal hiatus hernia treated surgically during the 12 years from 1947 to 1958, are discussed. Six cases operated by Prof. Boërema in private practice are included. The study concerns the pre-operative clinical picture, the nature of the various operations performed, and the results of these procedures as seen on follow-up examination. Certain conclusions are drawn.

AGE

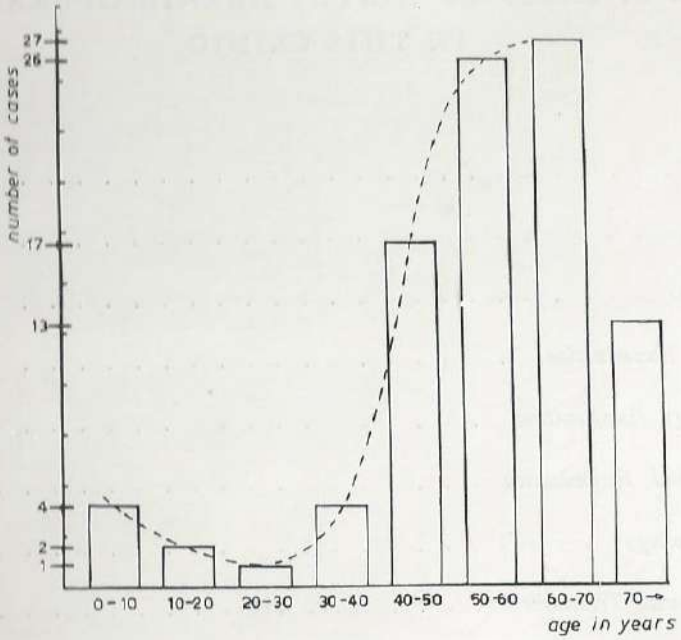


Fig. 34

Only 7 of the total number of 94 patients were less than 30 years old. Four of these patients were less than 10 years old. The youngest was a baby of 9 months. In all these cases the hiatus hernia was probably due to congenital weakness of the hiatal region.

The majority of patients, 86%, were adults over the age of 40 years. Of all cases, 55% were between 50 and 70 years, and 13 patients were over the age of 70. The oldest patient was 79.

SEX

There is a striking preponderance in the female. Our series includes 70 females and 24 males, thus giving a ratio of 3—1.

SYMPTOMS

	Number of Patients
Definite relationship of symptoms to postural changes	61
Epigastric pain	46
Substernal pain	37
Heartburn	48
Belching	33
Vomiting	33
Dysphagia	31
Haematemesis	23
Regurgitation	16
Fullness after meals	13
Nausea	13
Melaena	12
Anaemia	10
Coughing	4
Earache	3
Angina Pectoris	3

Pain is the most constant single symptom, situated either in the epigastrium (46 patients) or under the lower sternum (37 patients) or in both sites simultaneously. In 72% of cases the patient complained of this type of pain, which was usually of a burning character and came on after meals. In 65% of cases there was a definite *relationship to postural changes*. Thus the pain was aggravated by lying down or bending forwards. Often patients woke up at night with pain, which was relieved by sitting up or walking about.

Thirteen of our patients denied the presence of actual pain but prefered to speak of a discomfort in the epigastrium or substernally. This was experienced as a *fullness after meals* and was also affected by postural changes.

Lying down or bending forwards aggravated other symptoms as well. In 51% of cases, the patient complained of *heartburn*, which varied in intensity from mild to very severe, in which case it amounted to substernal pain. *Belching* (35%) was a symptom experienced by many patients. It often relieved pain.

Seventeen per cent of our cases complained of effortless *regurgitation* of fluid into the mouth on lying down or bending forwards. The fluid was sometimes tasteless, but more often sour-tasting and associated with heartburn. In 35%, the patient complained of *vomiting*, usually of food just taken. As this was associated with nausea in only 14% of cases, it was often difficult to distinguish from effortless regurgitation, thus indicating gross cardiac incompetence.

Another common symptom was *dysphagia*. One third of our patients complained of a sensation as if food "sticks" momentarily under the lower sternum. This symptom may be due to pressure of the herniated stomach on the oesophagus or to oesophagitis. In the latter cases, swallowing was often painful. Dysphagia was only severe or progressive in those cases with associated ulceration or stricture.

Haemorrhage, both manifest and occult, occured from lesions in the herniated stomach or from oesophagitis, with or without ulceration. There was *haematemesis* in 24% of patients, usually taking the form of streaks in blood in the vomitus. Severe haematemesis occurred occasionally. Thirteen per cent of our patients gave a history of recurrent *melaena* and 11% complained of dizzyness, fainting spells and other typical symptoms of marked *anaemia*.

Four patients suffered from fits of *coughing*. In two patients, Cases 14 and 20, both in the 6th decade of life, the coughing occurred when lying down after meals. Both had fits of coughing at night and in Case 14 it was associated with burning substernal pain. In both cases it disappeared after repair of the hernia. The symptom can be explained by pressure of the hernial mass on the lungs or by a vago-vagal reflex involving the pulmonary plexus.

The other two cases suffering from fits of coughing were infants, both of whom had chronic coughing which was probably due to the overflow of oesophageal contents into the bronchi. Case 15, a boy aged 9 months, had a large sliding hernia with free reflux. Case 86, an infant girl, had an oesophageal stenosis caused by reflux oesophagitis.

Three of our cases (57, 65 and 78) had *ear symptoms*. An unpleasant itchy or painful sensation was experienced either in the left or right ear, usually coming on simultaneously with the abdominal symptoms and influenced by postural changes. Repair of the hernia relieved the symptom in all cases. Ear-ache, as we have stated in Chapter VI, is explained as a referred pain along the auricular branch of the vagus nerve.

Three of our patients had been treated for *angina pectoris* elsewhere before being admitted for repair of the hernia. Only one of these was relieved by the operation (Case 45). Her pre-operative electrocardiogram had shown no signs of ischaemia. A large, irreducible, sliding hernia had therefore caused the angina-like symptoms. Both the other patients (Cases 47 and 81), although relieved of all abdominal symptoms, still require treatment for angina pectoris. In these two cases one must accept the diagnosis of both coronary artery disease and hiatus hernia. Case 81 had mild signs of ischaemia on the E.C.G.

Of the 94 patients, more than half (56%) had symptoms of at least 5 years duration. Of this group, 18 had complaints of more than 20 years standing while 3 patients claimed to have suffered from symptoms for more than 35 years. There were 5 children under the age of 12 years, of which

four had symptoms since birth. The fifth was an infant, aged 13 months, with marked symptoms since the 7th month.

MEDICAL TREATMENT ELSEWHERE

Many of our patients had been treated conservatively elsewhere, without lasting success. Diet and alkalies had given only temporary relief of symptoms. Fifteen patients had been treated on repeated ulcer regimes without lasting improvement of symptoms.

CLINICAL EXAMINATION

GENERAL EXAMINATION

The general examination presented no diagnostic features. The only factor which may be of significance is that 30 of our patients are described in the clinical notes as being "obese". This represents nearly one third of the total number of patients. Obesity may, therefore, have played a part in the aetiology of the hernia (See Chapter IV).

EXAMINATION OF THE ABDOMEN

Hiatus hernia presents few abdominal signs. Occasionally the upper abdomen was slightly tender on palpation but otherwise the clinical examination was usually negative.

LABORATORY EXAMINATION

The haemoglobin, white blood count and erythrocyte sedimentation rate were routinely determined. A fractional test meal was also done in nearly all patients, as well as an occult blood test.

HAEMOGLOBI

We have already discussed the frequency of haemorrhage, both manifest and occult, in this series. Of our patients, 11% complained of symptoms due to marked anaemia and 15% had a haemoglobin level of less than 11 gm.%. Many of these patients required repeated blood-transfusion to bring the haemoglobin back to normal level. Four patients had a haemoglobin level of less than 7.8 gm.%.

LEUCOCYTES

There was a mild leucocytosis, not exceeding 12,000 per c.mm., in only 5 of our patients. In one case this may have been caused by associated gallbladder disease. None of these patients suffered from oesophagitis. It is important to note that, contrary to what some authorities have stated, we found no leucocytosis in any of our 29 cases of serious oesophagitis.

ERYTHROCYT SEDIMENTA-TION RATE

There were only 8 patients with a slightly raised erythrocyte sedimentation rate, of which 3 had concomitant gallbladder disease. Only 2 of the 29 cases with marked oesophagitis had a raised E.S.R.

FAECES OCCULT BLOO TEST

Of the 94 patients, there were 26 with occult blood in the faeces. Of these 50% had demonstrable oesophagitis. The remainder probably had bleeding from a lesion in the herniated stomach (See Chapter VIII).

A fractional test meal was performed in 76 patients. In 22.4% the total acid was found to be raised above 70 (c.c. N/10 HCL) and the free acid above 40 (c.c. N/10 HCL). Of the patients with oesophagitis, only 25% had a raised level of acidity. Hyperacidity is not therefore an essential

factor in reflux oesophagitis. One patient (Case 53), a woman of 74 years with a sliding hernia associated with free reflux, had severe oesophagitis and yet her total acid amounted to only 10, and she had no free HCL.

RADIOLOGICAL EXAMINATION

In 90 of the 94 patients the diagnosis of hiatus hernia could be confirmed by radiological examination. In 2 cases the clinical impression could not be confirmed by roentgenography. Hiatus hernia was mistakenly diagnosed in a further two cases.

We detected the following types of hiatus hernia in our series of 94 patients:

Congenitally short oesophagus	:	0
Para-oesophageal hernia	:	6
Sliding hernia	:	79
Mixed type of hernia	:	5
TOTAL	:	90
No hernia detected	:	2
Hiatus hernia mistakenly diagnosed	:	2
TOTAL	:	94

We found no instance of a true congenitally too short oesophagus. It was possible during trans-abdominal operation, to pull the cardia below the diaphragm in all cases, even where roentgenologically the cardia was situated up to a hand's breadth above the diaphragm.

There were 6 patients with para-oesophageal hernias in this series. These hernias varied greatly in size, but on the whole they were fairly large, the average size being that of a mandarin. One patient, Case 5, had an enormous para-oesophageal hernia, with the stomach and colon lying in the chest. The cardia and pylorus were situated next to each other below the diaphragm, producing the typical picture of an upside-down stomach (Fig. 5).

In this group the symptoms are produced by the abnormal mass in the thorax. Patients complained of discomfort after meals, often amounting to epigastric or substernal pain, which is aggravated by lying down or bending forwards. The symptoms of reflux were absent and none of the patients had roentgenological reflux or oesophagitis on endoscopy.

By far the largest number of patients (87.8%) had sliding hiatus hernias on radiological examination. The majority of these had associated incompetence of the cardia with gastro-oesophageal reflux. Twenty-seven patients, one third of the total number of sliding hernias, had oesophagitis on endoscopic examination.

The size of the hernia varied greatly (Fig. 6—8, 14—15). In some cases

there was a small herniation, often only intermittently present and difficult to demonstrate roentgenologically. The larger hernias could be demonstrated more easily. Occasionally the hernia was very large with half or more of the stomach lying in the chest. In these cases the oesophagus, which normally takes up the slack and actually appears shortened, lay curved and tortuous above the hernia.

Occasionally the hernia was only demonstrable after repeated examination in Trendelenburg position. In two cases a dubious sliding hernia was confirmed by radiological examination after attaching a metal clip to the cardia at oesophagoscopy. In other cases very large hernias were present, sometimes irreducible and visible even in the upright position.

The size of the hernia did not seem to be in direct proportion to the severity of the complaints. Some patients with small hernias had severe symptoms and oesophagitis, whereas the very large sliding hernias sometimes produced only mild symptoms.

Symptoms are produced both by the presence of an abnormal mass in the thorax and by the occurrence of reflux. The patients therefore complained of all the symptoms mentioned in the previous section.

MIXED TYPE OF HERNIA

Five cases of the mixed variety of hiatus hernia were operated. In all of these cases the hernia appeared to be largely para-oesophageal but the cardia itself was also situated above the diaphragm (Fig. 9—10). The patients complained of symptoms related both to reflux and to the presence of an abnormal mass in the thorax. Two patients had marked oesophagitis on oesophagoscopy.

In two cases a hiatal hernia could not be demonstrated radiologically, although the symptoms strongly suggested its presence. At operation, however, its existence was confirmed.

Case 57, a woman aged 55, presented with epigastric discomfort after meals, aggravated by bending forwards. Solid foods seemed to become lodged behind the lower sternum. For years she had also suffered from a painful, itchy sensation in the right ear for which no local explanation could be found by the Ear, Nose and Throat specialist. Although all symptoms suggested the presence of a hiatus hernia, repeated examination in Trendelenburg position was negative. The only positive finding was a solitary stone in the gallbladder, which could hardly account for all the symptoms. At operation the gallbladder was found to contain a solitary stone but appeared otherwise normal. Cholecystectomy was performed. The hiatus admitted four fingers and the cardiac end of the stomach could be made to slide up into the chest. The hiatus was narrowed and gastropexia geniculata anterior performed with complete relief of both the abdominal and ear symptoms.

Case 83, a female aged 51, presented a rather similar problem. She had gallbladder pathology associated with epigastric symptoms suggestive of hiatus hernia. Again no hernia could be demonstrated radiologically. At

operation the gallbladder was found to be diseased and there was an obvious hiatus hernia present. Cholecystectomy was performed and gastropexia geniculata anterior. All symptoms were relieved by the operation.

In two cases a diagnosis of hiatus hernia, which had been made on the history and seemed to be confirmed by radiological examination, subsequently proved mistaken.

The first case (67) concerns a woman of 45 years who presented with a history of cramplike pains under the lower sternum which came on especially at night. For 3 months the patient had complained of progressive dysphagia with occasional regurgitation of food into the mouth. On radiological examination the distal oesopagus appeared slightly dilated and there was a somewhat delayed passage of barium through the cardia. This appearance suggested cardiospasm. At oesophagoscopy there were signs of diffuse oesophagitis, however, and re-examination in Trendelenburg possibly indicated a small hiatus hernia. The aetiology of the condition was therefore not clear.

At laparotomy the hiatus admitted 2 fingers for a distance of 3—4 cm. Although the diagnosis was still not absolutely certain, it was decided to treat the patient as a case of hiatus hernia because, firstly, the presence of marked oesophagitis and the operative findings seemed to confirm the diagnosis, and secondly, a Heller operation is contra-indicated with hiatus hernia whereas gastropexy is not harmful in the case of cardiospasm.

Gastropexia geniculata anterior did not, however, relieve the symptoms. One year later the patient was re-admitted with severe dysphagia. Now the diagnosis of cardiospasm was radiologically absolutely clear. No hiatus hernia could be demonstrated. A Heller operation was performed with good result.

The second patient, Case 35, a woman aged 59 years, complained of attacks of colicky upper abdominal pain radiating through to the back. She also complained of fullness after meals and occasional heartburn. On radiological examination the gallbladder function was seen to be disturbed. There was a wide distal oesophagus and what appeared to be a very large hiatus hernia (Fig. 16). At oesophagoscopy there was evident oesophagitis in the distal gullet.

The diagnosis of cholecystopathy and sliding hiatus hernia with reflux oesophagitis seemed clear. At operation the gallbladder was found to contain stones and cholecystectomy was performed. The hiatus was not abnormally wide, however, and no hernial sac could be demonstrated. On the strength of the radiological and endoscopical diagnosis, gastropexia geniculata anterior was performed.

Nearly five years later the patient is completely symptom-free. What on radiological re-examination at first seemed to be an orange-sized recurrence of the hernia, proved to be a large oesophageal diverticulum of the distal oesophagus (Fig. 17—18). There was no herniation or reflux.

This patient, therefore, never had a hiatus hernia. The symptoms had been produced by cholelithiasis and a large oesophageal diverticulum, associated with stasis and oesophagitis. The success of the gastropexy is probably explained by traction on the distal oesophagus and improvement of the emptying of the diverticulum. The differential diagnosis between hiatus hernia and a diverticulum of the distal oesophagus can therefore be very difficult. It can only be made, as we have pointed out in Chapter VII, by photographing the patient in various oblique and lateral positions.

OESOPHAGOSCOPY

Oesophagoscopy was not performed in every case. Its value as a means of detecting oesophagitis was at first not fully realized. Where the roentgenological diagnosis was clear, no oesophagoscopy was done, even in the case of associated haemorrhage or other complications. Lately it has become evident that oesophagitis should be treated pre-operatively in order to prevent complications during operation and to increase the possibility of a successful repair. In most of the later cases oesophagoscopy was performed, particularly in those cases where the history suggested oesophagitis or where occult blood was present in the faeces.

In the series of 94 cases oesophagoscopy was performed 45 times and marked oesophagitis diagnosed in 29 cases. All these patients had at least Class II oesophagitis (See Chapter VII) with severe erythema and bleeding on mild trauma, together with oedema of the mucous membrane. Cases with Class I oesophagitis, where there is only mild erythema and where the changes seen are often very slight and only recognized by the very experienced endoscopist, are not included. Our series included 29 cases of Class II or more severe oesophagitis. Many of these had diffuse superficial ulceration, while two patients had chronic oesophageal ulceration (Cases 64 and 82). In both these patients a chronic ulcer niche was seen at the cardia and the diagnosis of benign chronic inflammation confirmed by biopsy. In each case the ulcer was palpable at operation.

HEIGHT OF THE CARDIA

The height of the cardia varied from 30 cm. to 40 cm. One patient (Case 3), a woman aged 55 years with a large hiatus hernia, had a cardia situated at 27 cm. Occasionally the cardia was encountered at a normal level in patients who had definite herniation roentgenologically. This may be due to the fact that no herniation was present at the time of examination or to the cardia being pushed down in front of the oesophagoscope. A cardia situated at an abnormally high level confirms the diagnosis, however, especially when associated with free reflux of gastric juice into the oesophagus.

PRE-OPERATIVE TREATMENT

All cases operated were given pre-operative breathing exercises and, whenever possible, the patient was kept ambulant till the day of operation.

Where complications were present, the following special pre-operative treatments were given.

In 5 cases of sliding hernia associated with severe oesophagitis and ulceration, the patients were treated pre-operatively with a continuous milk-alkali drip through a Ryle's tube left in the proximal oesophagus. This bathes the inflamed oesophagus with alkaline fluid, while neutralizing the gastric contents which are regurgitated. In Case 26 oesophagoscopy was repeated after 12 days treatment and the oesophagitis was seen to have cleared up remarkably. Case 86, a female infant with an oesophageal stricture associated with marked oesophagitis and spasm, was treated for 2 weeks with a slow continuous drip. Prior to treatment the child had vomited all food. Gradually she became able to swallow fluids and mashed foods again. The increased oesophageal diameter could be clearly seen radiologically as the spasm subsided.

Seven patients with gross anaemia were given pre-operative blood transfusion. There was one child (Case 15), an infant aged 9 months, who had blood-stained vomiting since birth. The other 6 patients were all adults. All these cases had chronic bloodloss in the faeces and had occasionally noticed tarry stools. Two cases (72 and 76) had also had serious haematemesis on a number of occasions.

It is important to note that two cases (30 and 40) sought medical advice because of general malaise and inertia and were found to have a serious iron-deficiency anaemia. Only on thorough examination was a hiatus hernia detected. Both patients had very mild dyspeptic symptoms.

There was one mixed type of hernia (Case 48) in this group, whereas all the other patients had sliding hernias. Three had oesophagitis on oesophagoscopy and complained of severe symptoms.

On follow-up examination at least 6 months after operation none of these patients had any signs of anaemia. In all cases the faeces occult blood test was negative.

OPERATION

I *Types of Operation Performed*

The earlier cases in this series were operated via the thorax whereas nearly all the later cases were operated through the abdomen.

The operations performed can be divided into the following groups:

Operations performed through the thorax

		No. of cases
(a)	Cases operated in this clinic :	3
(b)	Cases admitted after transthoracic hernial repair elsewhere :	3
	TOTAL :	6

		No. of cases
(a)	Hiatus narrowed and oesophagus attached to the hiatal margins :	2
(b)	Hiatus narrowed and greater curvature of stomach attached to left dome of diaphragm :	7
(c)	Hiatus narrowed. Oesophagus attached to hiatal margins. Greater curvature of stomach attached to left dome of diaphragm. :	5
(d)	Hiatus narrowed. Oesophagus attached to hiatal margins. Greater and lesser curvatures attached to diaphragm. :	3
(e)	Gastropexia geniculata anterior :	77
	TOTAL :	94

TOTAL NUMBER OF OPERATIONS PERFORMED :		
Transthoracic	:	6
Transabdominal	:	94
		100

II *Findings at Operation*

SIZE OF THE HIATUS

The hiatus admitted one finger in 3% of cases and 2 fingers in 18% of cases. In 79% of cases the hiatus therefore admitted 3, or more, fingers.

ASSOCIATED PATHOLOGY

(I) *Gallbladder disease:* This was by far the most common associated finding during operation. At least one third (33 patients) of the 94 patients with hiatus hernia had associated gallbladder pathology. In 32% of the 77 cases where gastropexia geniculata anterior was performed, the gallbladder was removed simultaneously.

(II) *Peptic ulcer:* In one of our cases the hernia was associated with a duodenal ulcer. At operation, Case 11, a 49-year-old male, was found to have a duodenal ulcer which had penetrated into the pancreas. A partial gastrectomy (Billroth II) was performed. The hiatus was narrowed and the fundus of the stomach attached to the left dome of the diaphragm. At follow-up examination, 8 years after the operation, the patient was found to be completely symptom-free. Roentgenologically there was no recurrence of the hernia, no reflux, neither were other abnormalities detected. Our series includes no cases of gastric ulcer.

In three of our cases admitted with severe symptoms due to hiatus hernia, partial gastrectomy had been done elsewhere. In Case I, a 45-year-old

female, partial gastrectomy had been performed elsewhere, 10 years before admission, after repeated haematemesis and epigastric pain which was not relieved by conservative "ulcer treatment". She was operated, the hiatus narrowed and the oesophagus secured in the hiatus with silk sutures. Postoperatively all her symptoms recurred, however. Seven years later, in 1954, gastropexia geniculata anterior was performed with complete relief of symptoms.

Case 53, a 74-year-old woman, presented with severe symptoms due to hiatus hernia. Billroth II partial gastrectomy had been done elsewhere, 15 years before admission. All symptoms had recurred soon after the operation, however, and the patient was admitted to our clinic with severe symptoms and marked oesophagitis. During trans-abdominal operation, an oesophago-gastric resection had to be performed as the result of an operative complication.

The third case was a male aged 32 years (Case 73), who had suffered from lower substernal pain after meals for many years. A partial gastrectomy had been performed elsewhere without relief of symptoms. Here gastropexia geniculata anterior was also performed with relief of all symptoms. At follow-up examination there was no recurrence of the hernia and no reflux.

Although, as we have stated in Chapter XI, partial gastrectomy can relieve the symptoms of hiatus hernia by a reduction of acid secretion and by rapid gastric emptying, it does not correct the anatomical deformity at the hiatus, nor does it restore the normal cardiac function. It is not surprising, therefore, that there is frequent recurrence of symptoms, as seen in the above cases.

(III) *Diverticulosis Coli:* We did no routine X-ray examination of the colon. On account of the very common association of hiatus hernia with gallbladder pathology, cholecystography was performed routinely, whereas the colon was only examined in patients with large bowel complaints. In 3 cases there was roentgenological evidence of diverticulosis coli. Case 50 had the combination known as Saint's Triad, i.e. hiatus hernia, diverticulosis and cholelithiasis. It is probable that more cases of Saint's Triad would have been discovered had examination of the colon been carried out in all patients.

(IV) *Small intestinal diverticula:* Three of our cases had additional diverticula of the duodenum, and one patient (Case 28) had multiple diverticula of the jejunum. These were all left in situ.

(V) *Kyphoscoliosis:* Four cases (42, 84, 89, 90) had marked kyphoscoliosis. This may have played a part in the aetiology of the hernia as the anatomy of the hiatus was found to be seriously deformed at operation. In two cases the hiatus admitted 4 fingers and in one patient (Case 90), the whole hand. In the case of gross scoliosis, the hiatal opening was situated transversely from left to right.

RUPTURE OF THE OESOPHAGU

In three cases the oesophagus was ruptured at operation. Case 4, a woman aged 44 years, was admitted with recurrence of a sliding hiatus hernia after a transthoracic hernial repair four years previously. At trans-abdominal operation the oesophagus was found to be adherent in the mediastinum as a result of the previous operation and could only be mobilized with great difficulty. On freeing the oesophagus from the anterior hiatal margin, a longitudinal tear resulted in the distal gullet. Consequently, a portion of the injured gullet had to be resected and a tubular stomach constructed. This was brought up into the chest and anastomosed end-to-end to the oesophagus.

Case 53, a woman of 74 years, had a sliding hiatus hernia complicated by severe oesophagitis. She was given no pre-operative treatment for the oesophagitis but operated directly. During mobilization of the severely inflamed oesophagus, it tore off completely at the cardia. The cardiac region was resected and the continuity restored by means of a tubular stomach, as in Case 4.

Case 91, a male aged 72 years, had a large sliding hernia complicated by severe oesophagitis. During endoscopy a number of biopsies were taken to confirm the diagnosis of oesophagitis. At operation a small tear resulted in the distal oesophagus during mobilization, as a result of the oesophagitis or the biopsies which had been taken. Postoperatively the patient developed a small fistula in the abdominal wound, probably originating at the ruptured oesophagus. This had healed spontaneously at discharge. This patient had also not been treated pre-operatively for oesophagitis.

The latter two cases illustrate the need for thorough pre-operative medical treatment when severe oesophagitis is diagnosed. Furthermore, it is important to note that the biopsy may have contributed to the complication during operation in Case 91. Biopsy should not be taken unless malignancy is suspected. It should never be done routinely merely to obtain histological confirmation of oesophagitis. Where biopsy has been taken, operation should be postponed for at least a week.

RUPTURE THE STOM

In two patients a small tear resulted in the stomach fundus during transabdominal operation. Case 10, a woman aged 66 years, had a large sliding hernia associated with severe oesophagitis, for which no pre-operative treatment was given. During trans-abdominal repair, a small perforation appeared in the fundus. The surgeon throught this to be due to gastritis in the herniated portion. The perforation was closed and there were no postoperative abdominal complications.

In another patient (Case 65) a similar tear resulted in the fundus. It was closed with catgut and interrupted silk sutures and gastropexia geniculata anterior was performed. Postoperatively the patient had diarrhoea, treated with sulphathaladine. The recovery was otherwise uncomplicated.

On the whole the postoperative course in the 94 cases was smooth. Complications, when they occurred, were mild and transient.

Cases operated via the Thorax

In two of the three cases operated via the chest in this clinic, there were postoperative complications. Case 4 had a mild thrombosis in the left leg, which was treated on anticoagulants and cleared up completely. Case 5 had a collapse of both lower lung lobes, postoperatively, and was treated in an oxygen tent for a period of 14 days. On discharge the patient still had a poorly expanded lower lobe on the left. The third patient, Case 54, had an uneventful postoperative course.

Cases operated via the Abdomen (Gastropexy cases excluded)

In the 17 cases of this group, mild postoperative complications occurred twice. One patient had transient signs of venous thrombosis in the calf and the other had a wound infection.

Gastropexia geniculata anterior

		No. of Cases
Uneventful postoperative course	:	62
Postoperative complications	:	14
Postoperative death	:	1
TOTAL	:	77

In the series of 77 cases, 80% of patients had a completely uneventful postoperative recovery. The nasal tube was removed on return of peristalsis, usually 24—48 hours after operation. They were nursed sitting up in bed and given postoperative breathing and leg exercises. We mobilize patients between the first and second week, depending on their reaction to the operation. Most patients are discharged around the second week.
Mild postoperative complications, as enumerated below, occurred in 18% of cases.

		No. of Cases
Mild venous thrombosis in the legs	:	4
Mild pulmonary embolism	:	3
Thrombophlebitis in the legs	:	2
Unexplained pyrexia	:	2
Bronchopneumonia	:	1
Retention of urine (with subsequent prostatectomy)	:	1
Wound infection	:	1

These complications were not serious and did not significantly lengthen the period in hospital. The three cases with pulmonary embolism were not dyspnoeic and required no oxygen. As in the case of patients with venous thrombosis in the legs, they were treated on anticoagulants and

made a rapid recovery. Two cases had unexplained pyrexia postoperatively. This subsided spontaneously. The patient with bronchopneumonia, Case 54, recovered completely on antibiotics. One patient, a 63-year-old male (Case 40), developed retention of urine postoperatively and was given an indwelling catheter. A trans-urethral prostatic resection was later successfully performed.
Many of our patients complained of slight dysphagia after operation. In most cases this subsides after a few days and has disappeared by the time the patient is discharged from hospital. The complaint is probably due to postoperative oedema of the hiatal margins. In a few of our patients the symptom persisted slightly longer and gradually disappeared after three or four weeks. In this instance it was possibly affected by the sharp angulation of the oesophagus at the hiatus, towards the anterior abdominal wall.
There was one postoperative death. A 79-year-old male (Case 59) was admitted with severe symptoms, caused by a sliding hernia complicated by oesophagitis. At operation the hiatus was narrowed and gastropexia geniculata anterior performed. Since directly after operation the patient's condition deteriorated. Within a few days he developed signs of generalized peritonitis. Subsequently an absces developed in the left upper abdomen which later perforated to form a bowel fistula. Ultimately the patient became comatose and died on the 17th postoperative day.
At autopsy a perforation of the fundus was found at the site of attachment to the left dome of the diaphragm. There were signs of generalized peritonitis and bilateral bronchopneumonia.

FOLLOW-UP

All 94 cases operated in this series were called up for clinical and radiological re-examination. Of these patients, only 7 could not come for the follow-up. One patient, Case 5, had died 4 years after the operation, of cancer of the uterus. From the Out-patient department notes, she is known to have had recurrence of all pre-operative symptoms directly after the operation. Another patient, Case 23, has left the country. The remaining 5 could not come for re-examination for various reasons. They all replied by letter that they were free of symptoms. One patient, Case 88, came for clinical re-examination but refused radiological re-examination. It was therefore possible to carry out a complete follow-up of 91.5% of the patients.
The minimum period of time between operation and follow-up examination was 6 months. This is quite adequate, as will be proved later.
A detailed history was taken of all patients to determine whether they were free of pre-operative symptoms. Special attention was directed to the presence of epigastric or substernal pain, heartburn, vomiting and

regurgitation, and if present, whether these complaints were aggravated by postural changes.
The patient was then clinically examined. In cases where there had been haemorrhage or anaemia pre-operatively, the blood picture was re-examined.
Thereafter the patient was radiologically examined according to the technique described in Chapter VII. Special attention was paid to recurrence of the hernia and the presence of reflux.

RESULTS OF THE OPERATIVE PROCEDURES EMPLOYED

I *Trans-thoracic Procedures*

Case	*Procedure employed*	*Clinical recurrence*	*Radiological recurrence*
4	Hiatus narrowed. Fundus attached to underside of diaphragm. Phrenic crush.	Yes	Yes
5	Hiatus narrowed. Fundus attached to underside of diaphragm.	Yes	Yes
54	Hiatus narrowed and oesophagus attached to hiatal margins.	Yes	No
51	Trans-thoracic repair done elsewhere	Yes	Yes
62	Trans-thoracic repair done elsewhere	Yes	Yes
87	Trans-thoracic repair done elsewhere	Yes	Yes
TOTAL NUMBER OF CASES: 6		6	5

In 3 of our early patients the repair had been done through the chest. Three further patients, where trans-thoracic repair had been done elsewhere, were admitted to our clinic later with recurrence of symptoms. The results in this group are extremely poor. All 6 patients had return of symptoms immediately after operation. Five of them had radiological recurrence of the hernia with gastro-oesophageal reflux in Trendelenburg position.

II *Trans-abdominal Procedures*

(1) Hiatus narrowed and oesophagus attached to the hiatal margins:

Case		*Clinical recurrence*	*Radiological recurrence*
1	(Phrenic crush in addition)	Yes	Yes
17		Yes	Yes
TOTAL NUMBER OF CASES: 2		2	2

(2) Hiatus narrowed and greater curvature attached to left dome of diaphragm:

Case	*Clinical recurrence*	*Radiological recurrence*
2	Yes	Yes
3	No	No
8	No	No
10	Yes	Yes
11	No	No
12	Yes	Yes
13	Yes	Yes
TOTAL NUMBER OF CASES: 7	4	4

(3) Hiatus narrowed. Oesophagus attached to hiatal margins and greater curvature to left dome of diaphragm:

Case	*Clinical recurrence*	*Radiological recurrence*
6	No	No
7	Yes	Yes
9	No	No
14	Yes	Yes
15	No	No
TOTAL NUMBER OF CASES: 5	2	2

(4) Hiatus narrowed. Oesophagus attached to hiatal margins. Both greater and lesser curvatures attached to diaphragm:

Case	*Clinical recurrence*	*Radiological recurrence*
18	No	No
26	Yes	Yes
27	Yes	Yes
TOTAL NUMBER OF CASES: 3	2	2

If all cases operated via the abdomen using the above techniques are considered together, the results are very poor. Only 41% of the patients are symptom-free.

Total number of cases	*Symptom-free*	*Clinical recurrence*	*Radiological recurrence*
17	7	10	10

(5) Gastropexia geniculata anterior:

No. of Cases	*Symptom-free*	*Improved*	*Recurrence of Symptoms*	*Mortality*
77	67	5	4	1

Of the 77 patients treated by gastropexia geniculata anterior, 67 were completely symptom-free on follow-up examination. All these patients had neither recurrence, nor reflux on radiological re-examination. The operation was therefore a complete success in 87% of cases treated by this method. All these patients were most satisfied with the operation.

On radiological examination the cardia was always seen to lie well below the hiatus. On the lateral photos the abdominal oesophagus and lesser curvature appeared tautly stretched to the anterior abdominal wall. There was a marked difference between expiration and inspiration. During inspiration when the tendency to hernation is usually greatest, the lesser curvature was pulled even more taut by elevation of the costal margin and upper abdomen (Fig. 27—28). The cardia remained competent in Trendelenburg position on increase of intra-abdominal pressure.

One of our patients, Case 37, had been operated several times elsewhere for recurrent small bowel obstruction due to adhesions. On re-operation in our clinic, excessive adhesions were found in the vicinity of the hiatus, so that no attempt was made to narrow it. Careful gastropexia geniculata anterior was performed. At follow-up examination this patient was completely free of hiatal hernia symptoms and had no recurrence or reflux on radiological re-examination.

Five cases, on follow-up examination, stated themselves improved by the operation but not symptom-free. None had recurrence of the hernia on repeated examination in Trendelenburg, but two cases still had gastro-oesophageal reflux.

Case 52, a woman aged 35 years, still has abdominal symptoms. These complaints are vague, however, and not typical of hiatus hernia. The pre-operative symptoms of epigastric pain and belching, aggravated by postural changes, are no longer present. No recurrence or reflux could be demonstrated radiologically. The patient has unhappy home circumstances — possibly these complaints have a psychological background.

Case 54 was improved after gastropexy but still complained of vague upper abdominal symptoms. On radiological re-examination elsewhere, 3 months after operation, the patient seemed to have a recurrence of the

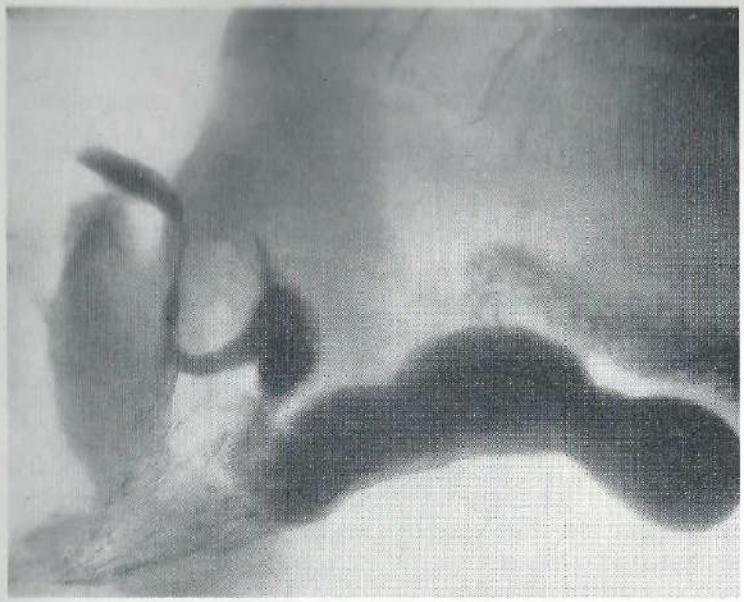


Fig. 36

Lateral view of same patient disclosing a rather high gastropexy. The part of the stomach which is secured to the anterior abdominal wall projects above the diaphragm on the antero-posterior view, thus simulating a recurrence of the hernia

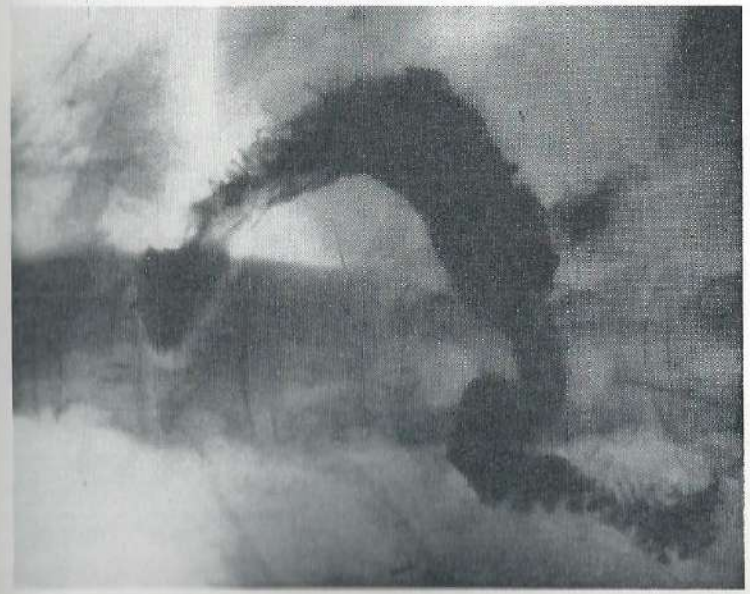


Fig. 35

Antero-posterior view after Gastropexia Geniculata Anterior. Part of the stomach appears to lie above the diaphragm

hernia. At subsequent thoracotomy no sign of a hernia could be detected, however, and after freeing the crura, the hiatus admitted the tip of a finger with difficulty. When the left dome of the diaphragm was opened and the undersurface of the hiatus examined, again no sign of herniation was detected. Postoperative radiological re-examination showed no recurrence of the hernia and no reflux.

In a number of patients where the lesser curvature was attached to a point high up on the anterior abdominal wall, this part of the stomach appeared to lie above the diaphragm on the antero-posterior X-ray views during deep inspiration in Trendelenburg position. Thus a recurrence of the hernia may be mistakenly diagnosed unless the patient is also examined in the lateral position (Fig. 35—36).

Case 54 showed the above picture on radiological re-examination. This explains why a recurrence had been diagnosed on the antero-posterior radiograph made elsewhere. This patient has subsequently been fully re-examined by a physician. No explanation for his abdominal symptoms could be found.

The third patient, Case 69, a 54-year-old male, has been completely relieved of pre-operative heartburn and vomiting and has had no recurrence of haematemesis. He still complains of attacks of epigastric pain, however. On admission to the department of Internal Medicine, 1½ years after the operation, no abnormalities could be detected. Repeated radiological examination of the oesophagus and stomach revealed no abnormalities. The conclusion on discharge of this patient was: "Abdominal complaints for which no organic basis can be detected. Neurotic personality".

Case 62 states herself to be improved by the operation. She still suffers from heartburn, however, and although no hernia could be demonstrated, there still is reflux into the oesophagus. Case 78 is also improved and has no recurrence of the hernia but similarly still has gastro-oesophageal reflux. In both these patients the cardia still forms the apex of the stomach. The roentgenological picture is that of a "malposition cardio-tubérositaire". The gastropexy has not succeeded in pulling the abdominal oesophagus far enough into the abdomen.

Both these patients will be controlled regularly as they are candidates for recurrence and oesophagitis.

AL RENCE	*Case*	*Clinical recurrence*	*Radiological recurrence*	*Reflux*
	26	Yes	Yes	Yes
	28	Yes	Yes	Yes
	72	Yes	Yes	Yes
	67	Yes	*Typical picture of cardiospasm*	

Case 26, 28 and 72 already had recurrence of symptoms on discharge from hospital. At the time all three cases showed a small recurrence of the hernia on radiological control. There was free reflux of barium into the oesophagus even at an angle of 45°. The lesser curvature in all cases did not appear taut to the anterior abdominal wall, as usually seen after the gastropexy. The cardia was situated above the diaphragm at the apex of the sliding hernia recurrence and seemed to be completely incompetent.

In Case 67, where the pre-operative differential diagnosis between hiatus hernia and cardiospasm had been difficult, the main symptom of dysphagia was not relieved by the gastropexy. While the patient was under regular control of the Out-patient department, the radiological picture of a cardiospasm became evident. The previous diagnosis of hiatus hernia had therefore been erroneous. The patient has subsequently been re-admitted and a Heller operation performed. This presented with technical difficulties as the lesser curvature was firmly adherent to the anterior abdominal wall. The cardia was found to lie at least 10 cm. in the abdomen. There was dense adhesion of the oesophagus to the hiatal margins. After mobilization of the oesophagus in the hiatus, it was possible to perform a Heller operation with good result.

SUMMARY OF OPERATIVE RESULTS

	No. of Cases	*Symptom-free*	*Improved*	*Clinical Recurrence*	*Radiological Recurrence*	*Mortality*
I. TRANS-THORACIC REPAIR	3	0	0	3	2	0
II. TRANS-ABDOMINAL PROCEDURES (GASTROP. GEN. ANT. EXCLUDED)	17	7	0	10	10	0
TOTAL:	20	7 (35%)	0	13 (65%)	12 (60%)	0
III. GASTROPEXIA GENICULATA ANTERIOR	77	67 (87%)	5 (6.5%)	4 (5.2%)	4 (5.2%)	1 (1.3%)

CASE 1

H.M. 6584. Female, aged 45 years. *First Admission:* 2-5-47 — 16-6-47. *Second Admission:* 17-5-54 — 25-6-54.

First Admission

History: At the age of 15 years, patient had haematemesis for which she was admitted elsewhere. Put on ulcer regime. After discharge recurrence of symptoms. Epigastric pain after meals, heartburn and numerous haematemeses. Repeated admissions for conservative "ulcer treatment". Operated on at the age of 26 years. Well during the next 5 years but with first pregnancy patient had recurrence of epigastric pain after meals, heartburn and excessive belching. Symptoms aggravated by bending forward and lying down. Recurrence of haematemesis. Re-operated on two further occasions. With last operation, 10 years before admission, a Billroth II partial gastrectomy was done. Patient was symptom-free for a time but after third pregnancy, developed similar symptoms.
Examination: Thin, rather frail female. Anaemic. General examination: NAD. Abdomen: Scars of previous operations, otherwise NAD. Hb: 68%* W.B.C: 5900. E.S.R: 19.** No occult blood in the faeces.
Radiological examination: Sliding hiatus hernia, which varies in size and does not reduce completely in the erect position. Billroth II partial gastrectomy.
Oesophagoscopy: Cardia at 30 cm. No signs of oesophagitis.
Conclusion: Sliding hiatus hernia with severe symptoms, treated conservatively and later operated thrice without lasting success.
Operation (16-5-47): Left phrenic nerve crushed in the neck. Abdominal incision made below and parallel to left costal margin. Adhaesions freed in upper abdomen. Peritoneum incised in the hiatus. Herniated stomach mobilized and pulled into the abdomen. Hiatus admits at least 2 fingers. Hiatus narrowed with interrupted silk sutures anteriorly to the oesophagus. Oesophagus attached in the hiatus with two silk sutures.
Postoperative Course: Uneventful.

Second Admission

History: Fairly wel after discharge. With next pregnancy, 8 months later, patient had recurrence of all symptoms, however.
Examination: General condition better than with previous admission. Abdomen: Scars of previous operations. Otherwise NAD. Hb: 87. No occult blood in the faeces. Fractional test meal: 58/47.
Radiological examination: Recurrence of small sliding hiatus hernia.
Oesophagoscopy: No oesophagitis. Cardia at 45 cm.
Conclusion: Recurrence of sliding hiatus hernia with severe symptoms.
Operation (3-6-54): Old median upper abdominal incision opened. Xiphoid process removed. Numerous adhaesions freed. Left liver lobe mobilized and retracted to the right. Hiatus admits only one finger next to the oesophagus and can therefore hardly be considered too wide. Oesophagus again mobilized after incision of the peritoneum in the hiatus. Crura approximated behind the oesophagus with interrupted silk sutures.
Gastropexia geniculata anterior.
Postoperative Course: On the third postoperative day, an attempt was made to remove the stomach tube. This failed, however. On oesophagoscopy a few days later the tube appeared to be immoveably stuck in the stomach. On the 19th day the tube could be pulled out without effort. It had a piece of silk ligature, 12 cm. from its end, where it had probably been caught by one of the gastropexy ligatures.
Follow-up: Patient is completely symptom-free.
Radiological re-examination: No recurrence. No reflux.

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* In all patients the oxy-haemoglobin level was determined by means of an electro-photometric method, the value of 100% being equal to a haemoglobin level of 15.6 gm.%.

** Erythrocyte Sedimentation Rate (Westergren) read after one hour.

CASE 2

H.M. 6660. Female, aged 56 years. *First Admission:* 13-6-47 — 21-7-47. *Second Admission:* 20-9-57 — 19-10-57.

First Admission

History: Upper abdominal complaints since 15 years before admission.
Substernal and epigastric pain after meals and occasional vomiting. Sensation as if food sticks under lower sternum. No abnormalities detected at laparotomy in 1943.
Examination: Healthy-looking woman. General examination: NAD. Abdomen: Scar of previous operation, otherwise NAD. Hb: 60. W.B.C: 5600. E.S.R: 8.
Radiological examination: Sliding hiatus hernia, orangesized.
Conclusion: Sliding hiatus hernia with severe complaints.
Operation (25-6-47): Incision under left costal margin. A third of the stomach lies in the thorax through a very large hiatal opening, which admits the whole hand. Stomach reduced with ease. Peritoneum incised in the hiatus. Greater part of hernial sac removed. At this stage the phrenic nerve is crushed on the left side in the neck. Crural fibres approximated behind the oesophagus. Greater curvature of stomach attached to left dome of diaphragm and lesser curvature to triangular ligament of the liver.
Postoperative Course: Uneventful

Second Admission

History: Recurrence of all symptoms shortly after the operation. Readmitted with typical symptoms of burning pain under lower sternum with heartburn and regurgitation of acid-tasting fluid into the mouth. All symptoms aggravated by bending forward.
Examination: Rather obese 67-year-old woman. General examination: Mild diabetes; treated with insulin. Abdomen: Scars of previous operations, otherwise NAD. Hb: 87. W.B.C: 7800. E.S.R: 10. No occult blood in the faeces. Fractional test meal: 115/105.
Radiological examination: Plumsized sliding hiatus hernia with reflux. Gallbladder: Poor function and stones.
Oesophagoscopy: Reflux of gastric contents. No signs of oesophagitis.
Conclusion: Recurrence of sliding hiatus hernia with severe symptoms.
Cholelithiasis.
Operation (30-9-57): Median upper abdominal incision with removal of xiphoid process. Adhesions present in upper abdomen. Hiatus admits at least two fingers. Oesophagus mobilized in the hiatus. Crural fibres frail and extremely thin and poor material for repair. Approximated with a few silk sutures behind the oesophagus. Cholecystectomy. Gastropexia geniculata anterior.
Postoperative Course: Uneventful.
Follow-up: Patient is symptom-free. Very satisfied with second operation.
Radiological re-examination: No recurrence. No reflux.

CASE 3

H.M. 6928. Female, aged 55 years. *Admitted:* 13-11-47. *Discharged:* 8-1-48.

History: Till two years before admission, completely symptom-free. Then, without warning, painless, fairly large haematemesis. Admitted elsewhere. Treated on ulcer regime for three months. Soon after discharge from hospital, patient developed progressive dysphagia for solids, with sensation as if food "sticks" below the lower sternum. Frequent vomiting, some time after meals. Often regurgitation of thin, watery fluid into the mouth. Belching and heartburn. All symptoms markedly aggravated by lying down.
Examination: Rather obese, middle-aged female. General examination: NAD. Abdomen: NAD. Hb: 78. W.B.C: 9600. E.S.R: 12. No occult blood in the faeces. Fractional test meal: 45/35.
Radiological examination: Large sliding hernia. Tortuous oesophagus. Cardia about 5 cm above the diaphragm.
Oesophagoscopy: Bleeding oesophagitis. Gastric mucosa at 27 cm.
Conclusion: Large, sliding hiatus hernia with oesophagitis.
Operation (24-11-47): Abdominal incision in left upper quadrant parallel to left costal cartilage. Hiatus admits three fingers. Stomach reduced into the abdomen. Hiatus narrowed by approximation of crura with silk sutures. Fundus of stomach attached to left dome of the diaphragm.
Postoperative Course: Small wound infection. Otherwise uncomplicated postoperative course.
Follow-up: Patient is symptom-free.
Radiological re-examination: No recurrence. No reflux.

CASE 4

H.M. 8006. Female, aged 44 years. *First Admission:* 16-5-49 — 22-6-49. *Second Admission:* 15-1-53 — 7-3-53.

First Admission

History: Since ten years before admission burning pain under lower sternum which comes on during meals and persists until patient has vomited a small quantity of food. This relieves the pain. Pain aggravated by lying down or bending forward. Wakes up with pain at night, especially when sleeping on the left side. Haematemesis on three occasions.
Examination: Healthy-looking woman. General examination and examination of abdomen: NAD. Hb: 69. W.B.C: 5100. E.S.R 22. Faeces occult blood test positive. Fractional test meal: 38/25.
Radiological examination: Large sliding hiatus hernia.
Operation (20-5-49): Thorax opened by resection of 9th rib. Orangesized hernial mass in lower mediastinum. Hernial contents, consisting of stomach, omentum and colon, reduced by traction through separate incision in left dome of diaphragm. Hernial sac totally removed. Through the separate incision, fundus of stomach is attached to underside of diaphragm in order to maintain the reduction. Left phrenic nerve crushed. Separate incision in diaphragm closed. Hiatus narrowed behind the oesophagus. Mediastinum and thorax closed.
Postoperative Course: Mild thrombosis in left leg. Treated on anticoagulants.

Second Admission

History: Recurrence of all symptoms soon after discharge.
Examination: Healthy-looking, 48-year-old woman. General examination and examination of abdomen: NAD. Hb: 81. W.B.C: 5000. E.S.R: 15. No occult blood in the faeces. Fractional test meal 30/20.
Radiological examination: Large sliding hiatus hernia, which does not reduce completely in the erect position.
Conclusion: Recurrence of sliding hiatus hernia with severe symptoms.
Operation (5-2-53): Median upper abdominal incision with removal of xiphoid process. Hiatus admits four fingers. Left liver lobe mobilized and retracted to the right. Peritoneum incised in the hiatus. Oesophagus, adherent in the mediastinum, probably as result of the previous operation, is mobilized with difficulty. On freeing the oesophagus from the anterior hiatal wall, a longitudinal tear results in the distal gullet. As a result of this, a portion of the injured oesophagus has to be resected.
A large portion of the lesser curvature of the stomach is removed with the cardia. Pylorotomy performed. The gallbladder contains stones and is removed. Abdomen closed. Thoracotomy 8th intercostal space on the left. Oesophagus freed from excessive mediastinal adhesions. Stomach brought into the thorax and end-to-end anastomosis with oesophagus made. Mediastinum and thorax closed.
Postoperative Course: Initially uneventful. Before discharge a stricture of the anastomosis had to be dilated.
Follow-up: Complains of excessive heartburn especially at night. Frequently vomits after meals. Stricture at anastomotic site is still delated at intervals.
Radiological re-examination: Satisfactory passage of barium at site of anastomosis. Reflux of gastric contents into the oesophagus.

CASE 5

H.M. 8345. Female, aged 76 years. *Admitted:* 31-10-49. *Discharged:* 31-12-49.

History: Since 7 years before admission, fullness after meals with epigastric discomfort and belching. Frequent nausea. Occasional vomiting. Complaints aggravated by lying down.

Examination: Obese woman. General examination: NAD. Abdomen: NAD. Hb: 96. W.B.C 7300. E.S.R: 11. No occult blood in the faeces. Fractional test meal: No free acid. E.C.G: NAD. Radiological examination: Enormous para-oesophageal hernia. "Upside-down stomach". Hernial sac seems to contain loops of large bowel, in addition.
Conclusion: Very large para-oesophageal hiatus hernia with severe symptoms.
Operation (6-12-49): Resection of the 9th rib on the left. Hernial sac, the size of an orange, found at the hiatus next to the oesophagus. Hernial sac opened. The contents, made up of stomach, omentum and colon, reduced into the abdomen. Hernial sac dissected free, excised and the peritoneum closed. Diaphragm incised on the left and via this opening the stomach is pulled laterally and the fundus stitched to the left dome of the diaphragm. Diaphragm closed. Thorax closed.
Postoperative Course: Marked dyspnoea. Periodically cyanotic. On x-ray examination, collapse of both lower lobes. Treated in oxygen tent for a period of 14 days. At time of discharge, patient still had poorly expanded lower lobe on the left.
Follow-up: According to Out-patient department notes, patient had recurrence of all pre-operative symptoms soon after operation. Died 4 years later of cancer of the uterus.
Radiological re-examination: Not possible.

CASE 6

H.M. 7750. Male, aged 69 years. *Admitted:* 29-12-49. *Discharged:* 23-3-50.

History: Since six weeks before admission progressive dysphagia for solids. Food sticks behind lower sternum. Patient then belches, after which he feels the food passing down. Patient had always had excessive heartburn after meals, aggravated by exertion and bending forward.
Examination: Thin, elderly male. General examination: NAD. Abdomen: NAD. Hb: 86. W.B.C: 5200. E.S.R: 17. Faeces occult blood test positive.
Radiological examination: Oesophagus: Irregular mucosal pattern above the cardia. Stomach and duodenum: Normal. Examination in Trendelenburg not done.
Oesophagoscopy: Mucosa of lower third of oesophagus irregularly raised and knobbly. Bleeds easily. Lumen slightly narrowed in lower third. Pathological report on biopsy specimen from mucosa of lower oesophagus: "No definite abnormalities seen".
Conclusion: Progressive dysphagia, possibly due to oesophageal neoplasm.
First Operation (2-1-50): Median upper abdominal incision. No tumor of cardia found. Witsel-Jejunostomy made.
Postoperative Course: Uneventful. Two weeks after the operation barium examination was done in Trendelenburg. Sliding hiatus hernia found. Oesophagoscopy repeated. Findings unchanged.
Diagnosis: Sliding hiatus hernia with oesophagitis.
Second Operation (31-1-50): Median upper abdominal incision re-opened. Left liver lobe mobilized and retracted to the right. Peritoneum incised in the hiatus. Cardia of stomach mobilized and pulled into the abdomen. The hiatus admits three fingers next to the oesophagus, which appears to have thickened walls. Hiatus closed with interrupted silk ligatures on the left of the hiatus. Oesophagus fixed in the hiatus. Greater curvature of stomach attached to the left dome of the diaphragm. Lesser curvature attached with two silk ligatures to undersurface of liver.
Postoperative Course: Dysphagia for solid foods. After three weeks oesophagoscopy done. Slight stricture of distal oesophagus, dilated with bougies. At discharge still slight dysphagia.
Follow-up: Patient is now 77 years of age. Symptom-free. No dysphagia.
Radiological re-examination: No recurrence of hiatus hernia. No reflux. Smooth passage of barium into the stomach. No abnormality of distal oesophagus seen.

CASE 7

H.M. 8503. Female, aged 63 years. *Admitted:* 11-2-50. *Discharged:* 17-3-50.

History: Vague pain in the epigastrium and right upper quadrant for at least 30 years. Heartburn, belching and fullness after meals. Often the sensation that food sticks under the lower sternum. For many years typical attacks of gallstone colic.
Examination: Rather obese, elderly woman. General examination: NAD. Abdomen: NAD. Hb: 77. W.B.C: 6400. E.S.R: 3. No occult blood in the faeces. Fractional test meal: 78/67.
Radiological examination: Sliding hiatus hernia. Gallbladder: Does not concentrate the dye. No gallstones seen.

Oesophagoscopy: No signs of oesophagitis. Gastric mucosa at 33 cm.
Conclusion: Typical symptoms of sliding hiatus hernia and cholelithiasis.
Operation (24-2-50): Median upper abdominal incision with removal of xiphoid process. Hiatus admits four fingers. Gallbladder contains stones. Peritoneum incised in the hiatus. Stomach pulled into the abdomen with ease, so that at least 3 cm. of oesophagus lies in the abdomen. Hiatus narrowed with silk sutures. Oesophagus stitched to crural margins with silk sutures. Fundus of stomach fixed to diaphragm on the left with one silk suture. Cholecystectomy done. The common bile duct, which is abnormally dilated, is opened and multiple small stones are removed. Drainage of choledochus.
Postoperative Course: Uneventful. At radiological re-examination before discharge, the hiatus hernia was found to be still present, if somewhat smaller.
Follow-up: Still epigastric discomfort after meals and at night when lying on the right side. Patient is short of breath on exertion and gets attacks of angina pectoris. Improved on amyl nitrite. Is on weight reducing diet for obesity.
Radiological re-examination: Recurrence of sliding hernia with reflux.

CASE 8

H.M. 8692. Female, aged 42 years. *Admitted:* 18-5-50. *Discharged:* 22-6-50.

History: Since one year before admission, burning pain in the epigastrium after meals, which is relieved by belching. Occasional nausea and vomiting. On X-ray examination in the Out-patient department, a hiatus hernia was found and a bed booked for the patient. On 18-5-50 the patient had an acute attack of continuous upper abdominal pain with vomiting. Acute admission was arranged on the diagnosis of an incarcerated hiatus hernia. Half an hour after admission the pain and vomiting subsided, however.
Examination: Healthy-looking woman. Complains of mild pain in epigastrium. Temperature normal. Pulse: 80 per min. B.P: 135-85. General examination: NAD. Abdomen: Not distended. Minimal pain on palpation in the epigastrium. Normal peristalsis. Hb: 84. W.B.C: 12500. E.S.R 13. After a few days when the pain had subsided completely, full examination was commenced. Fractional test meal: 37/28. No occult blood in the faeces.
Radiological examination: Sliding hiatus hernia, reduces in upright position.
Conclusion: Sliding hiatus hernia with severe symptoms. Possibly one episode of incarceration.
Operation (2-6-50): Median upper abdominal incision. Xiphoid process removed. Left liver lobe mobilized and retracted to the right. Peritoneum incised in the hiatus. Oesophagus mobilized and pulled into the abdomen. Crura approximated with silk sutures behind the oesophagus. Fundus of stomach fixed under tension to the dome of the left diaphragm far laterally. About one inch of the distal oesophagus now remains in the abdomen. Abdomen closed in layers.
Postoperative Course: Uneventful.
Follow-up: Patient is symptom-free.
Radiological re-examination: No recurrence. No reflux.

CASE 9

H.M. 8751. Female, aged 43 years. *Admitted:* 19-6-50. *Discharged:* 20-7-50.

History: Epigastric pain since two years before admission. Pain comes on about half an hour after meals and is never colicky. Heartburn and belching. All symptoms aggravated by lying down or bending forward.
Examination: Rather obese, middle-aged woman. General examination: NAD. Abdomen: NAD. Hb: 87. W.B.C: 5400. E.S.R: 4. No occult blood in the faeces. Fractional test meal: 38/25.
Radiological examination: Sliding hiatus hernia. Gallbladder: Does not concentrate the dye well. No gallstones seen.
Conclusion: Sliding hiatus hernia with severe symptoms.
Operation (7-7-50): Median upper abdominal incision with removal of the xiphoid process. Left liver lobe mobilized and retracted to the right. Hiatus admits three fingers. Peritoneum incised in the hiatus. Oesophagus mobilized. Hiatus closed horizontally on the left side of the oesophagus with interrupted silk ligatures. One ligature on the right of the oesophagus. Oesophagus attached in the hiatus with two silk ligatures. Fundus of stomach attached to

left dome of diaphragm with five silk ligatures, so that the greater curvature is stretched tightly from the hiatus along the undersurface of the diaphragm.
Postoperative Course: Uneventful.
Follow-up: Patient is symptom-free.
Radiological re-examination: No recurrence. No reflux.

CASE 10

H.M. 8853. Female, aged 66 years. *First Admission:* 7-8-50 — 15-9-50. *Second Admission:* 10-8-51 — 24-9-51.

First Admission

History: Burning pain behind the lower sternum on bending forward or lying down since 15 years before admission. Pain radiates to both shoulder blades. Heartburn and belching. Frequent regurgitation of acid fluid into the mouth. In addition since two years sensation as if food sticks behind lower sternum. Often abdominal discomfort during meals which is only relieved by vomiting.
Examination: Thin, elderly woman. General examination: NAD. Abdomen: NAD. Hb: 87. E.S.R: 5. Faeces occult blood test positive. Fractional test meal: 30/20.
Radiological examination: Large sliding hiatus hernia. Gallbladder: Multiple stones.
Oesophagoscopy: Cardia at 36 cm. Marked oesophagitis of distal oesophagus.
Conclusion: Large sliding hiatus hernia. Oesophagitis.
Operation (15-8-50): Median upper abdominal incision with removal of xiphoid process. Gallbladder contains stones. Hiatus admits three fingers. Stomach pulled into the abdominal cavity. Hiatus narrowed by approximation of the crura with silk sutures the oesophagus. During this procedure a small perforation appears in the fundus of the stomach, possibly as a result of gastritis in the herniated portion. The perforation is closed with 4 silk sutures. Fundus attached to diaphragm with silk sutures. Cholecystectomy.
Postoperative Course: Thrombosis in left calf on 9th postoperative day. Treated with dicumacyl. Recurrence of all pre-operative symptoms: substernal pain, heartburn, belching and dysphagia. All symptoms aggravated by lying down or bending forwards. Postoperative X-ray examination: Recurrence of hiatus hernia. Patient discharged on antacids and advised to sleep in a sitting position.

Second Admission

History: Symptoms unchanged. No improvement on conservative treatment.
Examination: Findings as on previous admission.
Radiological examination: Irreduceable hiatus hernia as large as before the operation. Ulcer in the thoracic part of the stomach.
Conclusion: Recurrence of sliding hiatus hernia.
Operation (4-9-51): Old median scar excised. Surgeon confronted with so many adhesions in the abdomen, obliterating the approach to the hiatus, that no attempt is made to expose the hiatus. Abdomen closed without further treatment.
Postoperative Course: Uneventful. Radiological re-examination before discharge: Irreduceable hiatus hernia. Ulcer seen in thoracic stomach.
Follow-up: Patient is now 74 years of age. Very thin and frail. Still much pain in the epigastrium and substernally, which comes on after meals and radiates through to the back. Aggravated by bending forward or lying down. Wakes up with pain in the early hours of the morning. Dysphagia for all solids. Only eats minced and mashed food. Regurgitation of fluid into the mouth on lying down or bending forwards.
Radiological re-examination: Large sliding hiatus hernia. Ulcer in thoracic stomach still present and somewhat larger than on the previous X-rays. Above the hernia is a smooth stenosis in the oesophagus, measuring 2—3 cm in length. The amount of stenosis has increased markedly since an examination in 1953 and the lumen appears to be not more than ½ cm in diameter. Delayed passage of thick barium through this area. There is free reflux from the abdominal stomach into the thoracic part. No reflux through the stenosis. Patient refuses oesophagoscopy and readmission for further examination and treatment. Prefers to continue conservative treatment.

CASE 11

H.M. 8309. Male, aged 49 years. *Admitted:* 25-9-50. *Discharged:* 13-10-50.

History: Abdominal complaints of at least 30 years standing. Recurrent haematemesis. Treated on ulcer regime. Lately epigastric pain, associated with nausea and vomiting. Large haematemesis shortly before admission.
Examination: Well-built, middle-aged male. Anaemic. Abdomen: NAD. Hb: 65. W.B.C: 4500. E.S.R: 8. Occult blood in the faeces. Fractional test meal: 113/107.
Radiological examination: Sliding hiatus hernia. Duodenal ulcer.
Conclusion: Sliding hiatus hernia and duodenal ulcer.
Operation (2-10-50): Median upper abdominal incision. Duodenal ulcer found, penetrated into the pancreas. Hiatus admits three fingers. Partial gastrectomy (Billroth II-Schoemaker) done. Hiatus narrowed round the oesophagus. Fundus of stomach attached to right dome of diaphragm.
Postoperative Course: Uneventful.
Follow-up: Patient is symptom-free.
Radiological re-examination: No recurrence. No reflux. Stomach and anastomosis: NAD.

CASE 12

H.M. 9032. Female, aged 51 years. *Admitted:* 29-11-50. *Discharged:* 20-12-50.

History: For the past 24 years recurrent attacks of right abdominal colicky pains with nausea and vomiting. Since 10 years before admission also periods of continuous epigastric and substernal pain with much belching and heartburn.
Examination: Fairly obese, middle-aged woman. General examination: NAD. Abdomen: NAD. Hb: 86. W.B.C: 4800. E.S.R: 10. No occult blood in the faeces. Fractional test meal: 68/50. E.C.G: NAD.
Radiological examination: Large sliding hiatus hernia. Gallbladder: Poor function. Several stones.
Conclusion: Typical symptoms of both sliding hiatus hernia and cholelithiasis.
Operation (5-12-50): Incision in the right upper quadrant parallel to costal margin and lengthened into the median line. Left lobe of liver mobilized and retracted to the right. Peritoneum incised in the hiatus. Hiatus admits three fingers. Oesophagus mobilized. Hiatus narrowed posterior to the oesophagus. Fundus of stomach stitched to left dome of diaphragm. Gallbladder with stones removed.
Postoperative Course: Uneventful.
Follow-up: Recurrence of symptoms soon after operation. Heartburn and belching with epigastric and substernal discomfort after meals. Also slight dysphagia for both solids and liquids. No more colicky pains. Radiological re-examination: Recurrence of sliding hiatus hernia. Patient refuses re-operation.

CASE 13

H.M. 9100. Female, aged 42 years. *First Admission:* 12-1-51—16-2-51. *Second Admission:* 4-2-52 — 3-3-52. *Third Admission:* 11-2-57 — 22-3-57.

First Admission

History: Cholecystectomy in 1951 after long standing gallbladder complaints. Soon after operation, upper abdominal complaints of a different nature. Burning pain under lower sternum, aggravated by lying down or bending forward. Has to sleep sitting up otherwise severe pain. Often nausea and vomiting after meals. Sensation as if food sticks under lower sternum.
Examination: Healthy-looking female. General examination: NAD. Abdomen: NAD. Hb: 85. W.B.C: 5700. E.S.R: 5. No occult blood in the faeces. Fractional test meal: 43/30.
Radiological examination: Plumsized sliding hiatus hernia.
Conclusion: Sliding hiatus hernia with severe symptoms.
Operation (2-2-51): Median upper abdominal incision. Many adhesions in upper abdomen. Left liver lobe mobilized. Hiatus admits three fingers. Oesophagus mobilized in the hiatus. Crura approximated behind the oesophagus. Fundus attached to diaphragm.
Postoperative Course: Uneventful.

Second Admission

History: Recurrence of all symptoms directly after discharge.
Examination: Similar findings as on previous admission.
Radiological examination: Plumsized hiatus hernia of sliding type.
Possibly ulcer niche on lesser curvature.
Conclusion: Recurrence of sliding hiatus hernia.
Operation (15-2-52): Median upper abdominal incision. Excessive adhesions present. Suspected ulcer proves to be adhesion of lesser curvature to the liver. This is freed. Gastrotomy. done and mucosa of stomach inspected. No abnormality detected. Abdomen closed.
Postoperative Course: Uneventful.

Third Admission

History: Symptoms unchanged after operation. Have become progressively worse.
Examination: General examination: NAD. Abdomen: Scars of previous operations otherwise NAD. Hb: 96. W.B.C: 5500. E.S.R: 1. No occult blood in the faeces. Fractional test meal: 35/15.
Radiological examination: Recurrence of sliding hiatus hernia.
Oesophagoscopy: No abnormalities detected.
Conclusion: Recurrence of sliding hiatus hernia with severe symptoms.
Operation (28-2-57): Median upper abdominal incision. Multiple, dense adhesions in upper abdomen. Left liver mobilized and retracted to the right. Hiatus admits three fingers. Crura of hiatus wide apart as if no repair had ever been done. Crura approximated behind the gullet after mobilization of the oesophagus. Gastropexia geniculata anterior.
Postoperative Course: Signs of thrombosis in the right leg. Treated on anticoagulants. Symptom-free on discharge.
Follow-up: Initially fairly severe dysphagia, which took rather longer than usual to disappear. Eighteen months after the operation the patient is completely symptom-free.
Radiological re-examination: No recurrence. No reflux.

CASE 14

H.M. 9241. Female, aged 60 years. *Admitted:* 16-4-51. *Discharged:* 9-5-51.

History: Abdominal complaints since at least 20 years before admission. Upper abdominal discomfort after meals and severe heartburn. Often vomiting after meals, which relieves the abdominal discomfort. Three months before admission patient was treated elsewhere for haematemesis. Put on ulcer regime for six weeks. After discharge from hospital patient had recurrence of all symptoms. Heartburn, substernal pain as well as non-productive coughing. Symptoms aggravated by bending forward. On lying down at night, burning substernal pain, nearly always accompanied by fit of coughing. Sometimes accompanied by vomiting of acid fluid. During the past few months, the patient had also had palpitations and dyspnoea on exertion.
Examination: Healthy-looking, rather obese, elderly female. General examination: NAD. Abdomen: NAD. Hb: 82. E.S.R: 9. No occult blood in the faeces. Fractional test meal: 52/48. B.P. 125/95. E.C.G: NAD.
Radiological examination: Orange-sized, sliding hiatus hernia. Chest: NAD.
Conclusion: Large sliding hiatus hernia with severe symptoms. One episode of haematemesis.
Operation (26-4-51): Median upper abdominal incision with removal of the xiphoid process. Left liver lobe freed from the diaphragm and retracted to the right. Hiatus admits three fingers and contains upper third of stomach. Peritoneum incised in the hiatus. Stomach and oesophagus mobilized and pulled into the abdomen. Crural fibres narrowed with silk ligatures. Oesophagus stitched to the medial crural wall with two silk sutures. Fundus stitched to diaphragm with three silk sutures.
Postoperative Course: Uneventful.
Follow-up: Symptoms slightly better than before the operation. Still complains of heartburn and epigastric discomfort after meals. Occasional vomiting. Has not had recurrence of haematemesis. Does not cough.
Radiological re-examination: Large sliding hiatus hernia recurrence with marked reflux into the oesophagus.
(Refuses re-operation).

CASE 15

H.M. 8745. Boy, aged 9 months. *Admitted:* 12-4-51. *Discharged:* 27-5-51.

History: Vomited immediately after meals since directly after birth. Vomits feed just taken. Occasionally stained with red blood. During first few months vomiting was sometimes projectile. Mother noticed that the more solid foods produced less symptoms. Chronic non-productive cough. Growth of the child retarded.
Examination: General condition better than was expected from history. Clinically anaemic however. Otherwise no abnormalities found. Abdomen: NAD. Hb: 58. W.B.C: 12200. Diff. W.B.C: NAD. Occult blood in the faeces. Radiological examination: Large, sliding hiatus hernia. Third of stomach in thorax. Free reflux. Thorax: NAD.
Conclusion: Large, sliding hiatus hernia with symptoms since birth.
Complicated by haematemesis and anaemia.
Pre-operative Treatment: Repeated blood transfusion until Hb was 75.
Operation (2-5-51): Median upper abdominal incision to xiphoid process and past it. Small opening accidentally produced in diaphragm and pleura. This closed with two silk sutures. Left liver lobe mobilized and retracted to the right. Peritoneum incised in the hiatus, after which the intrathoracic stomach and lower oesophagus could be pulled into the abdomen with ease. Hiatus closed with silk sutures, anterior to the oesophagus. Oesophagus stitched to the diaphragm with silk and the fundus attached to the left lobe of the diaphragm — also with silk sutures. The lesser curvature attached to the undersurface of the liver with one silk suture. Abdomen closed in layers.
Postoperative Course: Uneventful.
Follow-up: Since directly after the operation, completely symptom-free.
Is a normal, healthy, eight-year-old boy.
Radiological re-examination: No recurrence. No reflux.

CASE 16

Private patient of Prof. Boerema. Mrs. v. A-L. Female, aged 49 years.
Admitted: 8-7-51. *Discharged:* 3-8-51.

History: Epigastric pain after meals of many years standing. Occasional vomiting. Severe heartburn. Symptoms aggravated by lying down or bending forward. Ulcer suspected two years before admission. Treated elsewhere on ulcer regime without success.
Examination: Middle-aged woman of normal build. General examination: NAD. Abdomen: NAD.
Radiological examination: Large sliding hiatus hernia.
Conclusion: Sliding hiatus hernia with severe symptoms.
Operation (21-7-51): Median upper abdominal incision. Peritoneum incised in the hiatus. Oesophagus mobilized. Crura approximated behind the gullet with silk sutures. Gastropexia geniculata anterior.
Postoperative Course: Uneventful.
Follow-up: Patient is completely symptom-free.
Radiological re-examination: Not done.

CASE 17

H.M. 9419. Female, aged 35 years. *First Admission:* 25-7-51— 13-8-51. *Second Admission:* 15-2-57 — 13-3-57.

First Admission

History: Burning pain behind lower sternum after meals of two years duration. Heartburn and belching. Twice on ulcer diet because of "blood in the stools". Symptoms always recurred.
Examination: Healthy-looking woman. General examination and examination of abdomen: NAD. Hb: 78. E.S.R: 5. Faeces occult blood test positive.
Radiological examination: Small sliding hiatus hernia.
Conclusion: Sliding hiatus hernia with severe symptoms.
Operation (31-7-51): Median upper abdominal incision with removal of xiphoid process. Left liver lobe mobilized. Hiatus admits two fingers. Oesophagus mobilized in the hiatus. Crural

fibres approximated around the oesophagus with silk sutures, which also include the muscular coat of the oesophagus.
Postoperative Course: Uneventful.

Second Admission

History: All symptoms recurred within three weeks after operation. All symptoms especially bad since the last two years.
Examination: Healthy-looking woman. General examination and examination of abdomen: NAD. Hb: 96. W.B.C: 6000. E.S.R: 3. Fractional test meal: 35/25.
Radiological examination: Small sliding hiatus hernia with reflux.
Oesophagoscopy: Signs of oesophagitis in the distal oesophagus.
Conclusion: Recurrence of sliding hiatus hernia. Oesophagitis.
Operation (26-2-57): Median upper abdominal incision. Left liver lobe adherent to stomach and hiatus; dissected free with some difficulty. Hiatus admits four fingers. Oesophagus mobilized and pulled into the abdomen.
Crural fibres approximated behind the oesophagus. Gastropexia geniculata anterior.
Postoperative Course: Uneventful.
Follow-up: Patient is completely symptom-free. Most satisfied with the second operation.
Radiological re-examination: No recurrence. No reflux.

CASE 18

H.M. 9621. Male, aged 62 years. *Admitted:* 25-3-52. *Discharged:* 12-4-52.

History: Epigastric discomfort after meals since four months before admission. This discomfort is relieved by belching. It improves on walking but is markedly aggravated by lying down. No heartburn. Has always been rather constipated.
Examination: Short, thickset, middle-aged male. General examination: NAD. Abdomen: NAD. Hb: 78. W.B.C: 6000. E.S.R: 6. Faeces occult blood test positive. Fractional test meal: Repeated attempts to pass stomach tube unsuccessful.
Radiological examination: Orange-sized, para-oesophageal hiatus hernia, which does not reduce completely in erect position. Half of the stomach is in the thorax.
Conclusion: Large, para-oesophageal hiatus hernia with marked symptoms.
Operation (31-3-52): Median upper abdominal incision with resection of the xiphoid process. Left liver lobe mobilized and retracted to the right. Herniated portion of the stomach reduced with ease into the abdomen by light traction on the stomach. Hiatus admits five fingers. Peritoneum incised in the hiatus and oesophagus mobilized and pulled into the abdomen. Hiatus narrowed by approximation of the crura behind the oesophagus with interrupted silk sutures. The oesophagus is now attached in the hiatus with two silk ligatures through its muscular layer. Lesser curvature attached under tension to the anterior undersurface of the diaphragm. Fundus also stretched out and attached under tension to the anterior undersurface of the diaphragm, towards the left.
Postoperative Course: Uneventful.
Follow-up: Patient is symptom-free.
Radiological re-examination: No recurrence. No reflux.

CASE 19

H.M. 9790. Female, aged 49 years. *Admitted:* 7-5-52. *Discharged:* 23-5-52.

History: Burning epigastric pain of twelve years standing, aggravated by bending forward or lying down. Especially bad at night. Nausea and vomiting when pain is severe. Vomitus sometimes contains fresh red blood in streaks. Heartburn.
Examination: Obese woman. General examination: NAD. Abdomen: NAD. Hb: 76. W.B.C: 12000. E.S.R: 28. Faeces occult blood test positive. Fractional test meal: 24/14.
Radiological examination: Large sliding hiatus hernia. Gallbladder: Does not concentrate the dye.
Conclusion: Large sliding hiatus hernia with severe symptoms.
Operation (9-5-52): Median upper abdominal incision with removal of xiphoid process. Left lobe of the liver mobilized and retracted to the right. Peritoneum incised in the hiatus and

oesophagus mobilized. Hiatus admits four fingers. Crura approximated behind the oesophagus. Gallbladder, which contains stones, is removed. Gastropexia geniculata anterior.
Postoperative Course: Uneventful.
Follow-up: Patient is symptom-free.
Radiological re-examination: No recurrence. No reflux.

CASE 20

Private patient of Prof. Boerema. Mrs. J. v. M. D. Female, aged 67 years. *Admitted:* 2-5-52. *Discharged:* 25-5-52.

History: Dysphagia since four years before admission. Sensation as if food sticks behind lower sternum. Fits of coughing at night.
Examination: General examination: NAD. Abdomen: NAD.
Radiological examination: Sliding hiatus hernia. Chest: NAD.
Conclusion: Sliding hiatus hernia.
Operation (9-5-52): Median upper abdominal incision. Oesophagus mobilized in the hiatus and crura approximated behind the oesophagus. Gastropexia geniculata anterior.
Postoperative Course: Uneventful.
Follow-up: Patient is completely symptom-free. No recurrence of dysphagia or coughing.
Radiological re-examination: Not done.

CASE 21

H.M. 9861. Female, aged 49 years. *Admitted:* 7-5-52. *Discharged:* 26-5-52.

History: Upper abdominal complaints for at least 25 years. It consists of epigastric pain, half an hour after meals.
Examination: Healthy-looking, middle-aged woman. General examination: NAD. Abdomen: NAD. Hb: 78. W.B.C: 5300. E.S.R: 10. No occult blood in the faeces.
Radiological examination: Large para-oesophageal hiatus hernia.
Conclusion: Para-oesophageal hernia with severe symptoms.
Operation (12-5-52): Median upper abdominal incision. Left lobe of the liver mobilized and retracted to the right. Hiatus admits three fingers. Peritoneum incised in the hiatus. Oesophagus mobilized. Hiatus narrowed in the typical manner posterior to the oesophagus. Gastropexia geniculata anterior.
Postoperative Course: Uneventful.
Follow-up: Patient is symptom-free.
Radiological re-examination: No reflux. No recurrence.

CASE 22

Private patient of Prof. Boerema. Mrs. M. P-V. Female, aged 54 years. *Admitted:* 17-7-52. *Discharged:* 4-8-52.

History: Epigastric pain after meals since 14 years of age. Pain is aggravated by lying down or bending forward. Since two years sensation as if food sticks behind lower sternum.
Examination: General examination: NAD. Abdomen: NAD.
Radiological examination: Large sliding hiatus hernia. Gallbladder contains multiple stones.
Conclusion: Sliding hiatus hernia. Cholelithiasis. Severe symptoms.
Operation (22-7-52): Median upper abdominal incision. Gallbladder contains stones. Oesophagus mobilized in the hiatus and crura approximated behind the gullet with silk sutures. Cholecystectomy. Gastropexia geniculata anterior.
Postoperative Course: Uneventful.
Follow-up: Patient is symptom-free.
Radiological re-examination: No recurrence. No reflux.

CASE 23

H.M. 110072. Female, aged 44 years. *Admitted:* 10-9-52. *Discharged:* 1-10-52.

History: Since six years before admission regurgitation of food into the mouth on lying down. Worse with liquids. No other complaints.

Examination: Healthy-looking female. General examination: NAD. Abdomen: NAD. Hb: 90. W.B.C: 4500. Fractional test meal: 18/0.
Radiological examination: Large, sliding hiatus hernia with reflux.
Conclusion: Large, sliding hiatus hernia with symptoms of regurgitation .
Operation (15-9-52): Median upper abdominal incision. Left liver lobe mobilized and pulled to the right. Peritoneum incised in the hiatus. Oesophagus mobilized. Hiatus admits four fingers. Hiatus narrowed with interrupted silk ligatures. Gastropexia geniculata anterior.
Postoperative Course: Uneventful.
Follow-up: Patient has emigrated to Surinam. Reports by letter that she is completely symptom-free.
No radiological re-examination possible.

CASE 24

H.M. 10153. Female, aged 63 years. *Admtted:* 31-10-52. *Discharged:* 29-11-52.

History: Attacks of gallstone colic since 25 years before admission. Since 9 months burning pain under lower sternum, which comes on after meals and is aggravated by bending forward or lying down. Wakes up at night with pain. Heartburn and belching.
Examination: Healthy-looking woman. General examination: NAD. Abdomen: NAD. Hb: 74. W.B.C: 6700. E.S.R: 12. No occult blood in the faeces. Fractional test meal: 60/48.
Radiological examination: Very large sliding hernia. Nearly half of the stomach in the thorax. Gallbladder: Numerous stones. Does not concentrate the dye.
Conclusion: Very large sliding hiatus hernia with severe symptoms.
Cholelithiasis.
Operation (11-11-52): Median upper abdominal incision with removal of xiphoid process. Left liver lobe mobilized and retracted to the right. Hiatus admits whole hand. Peritoneum incised in the hiatus. Oesophagus mobilized and pulled into the abdomen. Crural fibres approximated behind the oesophagus with silk sutures. Gastropexia geniculata anterior.
Cholecystectomy.
Postoperative Course: Uneventful.
Follow-up: Patient is symptom-free.
Radiological re-examination: No recurrence. No reflux.

CASE 25

H.M. 10197. Male, aged 58 years. *Admitted:* 7-11-52. *Discharged:* 1-12-52.

History: Since many years periodically burning pain under lower sternum. Since two years before admission, pain progressively worse. Pain radiates through to the back and is always aggravated by lying down. Especially bad at night.
Examination: Thin, middle-aged male. General examination: NAD. Abdomen: NAD. Hb: 95. W.B.C: 5900. E.S.R: 7. No occult blood in the faeces. Fractional test meal: 65/55.
Radiological examination: Small, sliding hiatus hernia. Duodenum: Two diverticula of pars descendens.
Conclusion: Sliding hiatus hernia with severe symptoms.
Operation (17-11-52): Median upper abdominal incision with removal of xiphoid process. Left liver lobe retracted to the right. Hiatus admits four fingers. Peritoneum incised in the hiatus and oesophagus mobilized. Crura approximated behind the oesophagus with silk sutures. Gastropexia geniculata anterior.
Postoperative Course: Uneventful.
Follow-up: Patient is symptom-free.
Radiological re-examination: No recurrence. No reflux.

CASE 26

H.M. 10181. Female, aged 58 years. *First Admission:* 17-11-52 — 19-12-52. *Second Admission:* 4-10-57 — 8-11-57.

First Admission

History: Upper abdominal complaints of at least 25 years standing. Epigastric and substernal

pain after meals, aggravated by bending forward or lying down. Regurgitation of acid fluid into the mouth on bending forward. Cholecystectomy, three years before admission. Symptoms unchanged. Lately sensation as if food lodges beneath lower sternum on swallowing.
Examination: Middle-aged woman of normal build. General examination: NAD. Abdomen: Cholecystectomy scar, otherwise NAD. Hb: 90. W.B.C: 6200. E.S.R: 5. No occult blood in the faeces. Fractional test meal: 40/32.
Radiological examination: Small sliding hiatus hernia.
Conclusion: Sliding hiatus hernia with severe symptoms.
Operation (25-11-52): Median upper abdominal incision with removal of xiphoid process. Hiatus admits three fingers. Oesophagus mobilized in the hiatus. Crural fibres approximated behind the oesophagus. Oesophagus attached to hiatal margins with silk sutures. Greater and lesser curvatures attached to the diaphragm.
Postoperative Course: Uneventful.

Second Admission

History: Recurrence of all symptoms soon after operation.
Examination: Patient has lost weight. General examination and abdomen: NAD. Hb: 78. W.B.C: 5200. E.S.R: 4. No occult blood in the faeces. Fractional test meal: 35/17.
Radiological examination: Sliding hiatus hernia with free reflux, even at an angle of 45°. Oesophagoscopy: Oesophagitis present. Cardia at 36 cm.
Conclusion: Sliding hiatus hernia recurrence, complicated by oesophagitis.
Pre-operative treatment: Continuous milk-alkali drip. After 12 days oesophagoscopy repeated and definite improvement of oesophagitis seen.
Operation (23-10-57): Median upper abdominal incision. Excessive adhesions in upper abdomen. These are freed. Hiatus admits two fingers. Oesophagus mobilized in the hiatus. Crural fibres approximated behind the oesophagus. Gastropexia geniculata anterior.
Postoperative Course: Uneventful.
Follow-up: Recurrence of all symptoms soon after discharge.
Radiological re-examination: Marked reflux still present. Small hernia recurrence.
Patient re-admitted for further treatment.

CASE 27

H.M. 2914. Male, aged 55 years. *Admitted:* 24-11-52. *Discharged:* 15-12-52.

History: Abdominal complaints of 20 years duration. Epigastric pain after meals. Occasional vomiting after meals. Excessive belching.
Examination: Healthy-looking male, rather obese. General examination: NAD. Abdomen: NAD. Hb: 82. W.B.C: 4200. E.S.R: 5. No occult blood in the faeces. Fractional test meal: 70/58.
Radiological examination: Eggsized sliding hiatus hernia.
Conclusion: Sliding hiatus hernia with severe symptoms.
Operation (1-12-52): Median upper abdominal incision with removal of xiphoid process. Left liver lobe mobilized and retracted to the right. Hiatus admits three fingers. Crura dissected free and approximated behind the oesophagus. Oesophagus attached to the hiatus with silk sutures. Greater curvature attached to the undersurface of the diaphragm towards the left. The lesser curvature stitched anteriorly to the diaphragm.
Postoperative Course: Uneventful.
Follow-up: Recurrence of all pre-operative symptoms within one month of discharge.
Radiological re-examination: No recurrence of hiatus hernia. No reflux.

CASE 28

H.M. 10246. Female, aged 67 years. *Admitted:* 22-12-52. *Discharged:* 13-1-53.

History: Since three years before admission retrosternal and epigastric discomfort after meals. Heartburn. Frequent acid regurgitation into the mouth. Occasional nausea. All symptoms aggravated by bending forward or lying down. Often wakes up at night with heartburn and acid regurgitation. With swallowing, sensation as if food sticks momentarily under the lower sternum.

Examination: Healthy-looking elderly woman. General examination: NAD. Abdomen: NAD. Hb: 94. W.B.C: 6600. E.S.R: 21. No occult blood in the faeces. Fractional test meal: 46/28. Radiological examination: Large sliding hiatus hernia; half of stomach above diaphragm. Gallbladder: Concentrates the dye well. Multiple stones.
Conclusion: Large sliding hiatus hernia with severe symptoms.
Operation (30-12-52): Median upper abdominal incision with excision of xiphoid process. Three finger hiatus. Left lobe of the liver freed from the diaphragm and retracted to the right. Peritoneum incised in the hiatus. Oesophagus mobilized. Hiatus narrowed by approximating crura behind the oesophagus with three silk sutures. Gallbladder with stones removed. Multiple small diverticula of the jejunum found (size: Pea to hazelnut). These are situated on the mesenterial side, are filled with gas and can be emptied with ease. No signs of inflammation. These left in situ. Gastropexia geniculata anterior.
Postoperative Course: Uneventful.
Follow-up: All symptoms improved by the operation. No epigastric discomfort after meals. Seldom heartburn. Patient has to sleep in sitting position, however, otherwise she wakes up at night with regurgitation of bitter-tasting fluid into the mouth. During the day occasional regurgitation of fluid into the mouth on bending forward. Otherwise well during the daytime.
Radiological re-examination: Small recurrence of the hernia with greatly widened angle of His. Marked reflux of barium; with deep inspiration even at angle of 45°. In Trendelenburg most of the barium in the stomach flows freely back into the oesophagus.

CASE 29

H.M. 10305. Male, aged 55 years. *Admitted:* 12-12-52. *Discharged:* 10-3-53.

History: Difficulty in swallowing solids since one year before admission. This had become progressively worse. On admission patient could only swallow fluids and mashed food. Continuous burning pain behind the sternum. This was especially bad at night but improved on rising in the mornings. Excessive belching. No vomiting but occasional regurgitation of food into the mouth. During the month before admission, frequently black stools.
Examination: Rather obese, middle-aged male. General examination and examination of the abdomen: NAD. Hb: 88. W.B.C: 7700. E.S.R: 10. No occult blood in the faeces. Fractional test meal: 35/25.
Radiological examination: Small sliding hiatus hernia. Irregular appearance of mucosa, especially dorsally, suggesting neoplasm.
Oesophagoscopy: At 39 cm. the mucosa is irregularly raised dorsally.
Bleeds easily on contact. Biopsy taken.
Pathological report on Biopsy from oesophageal tumor: "The tissue segment is covered with squamous epithelium. Chronic inflammatory tissue subendothelially with occasional mitoses. No definite evidence of malignancy. No definite diagnosis can be made."
Conclusion: Small sliding hiatus hernia with oesophagitis. Possibly carcinoma.
Operation (8-1-53): Thoraco-abdominal incision. Liver: no metastases. Tumor the size of golfball felt in distal oesophagus. Diaphragm incised in the hiatus. Distal oesophagus and cardia of stomach mobilized. Large triangle of stomach excised from the lesser curvature so that the greater curvature forms a tube continuous with the oesophagus. Diaphragm closed. Abdomen closed. Distal oesophagus mobilized through the thorax. Tumor and 4 finger length of oesophagus above it, resected. End-to-end anastomosis with stomach tube brought into the chest. Thorax closed in layers.
Postoperative Course: Initially complicated by vomiting after meals, probably due to pylorospasm. Improved gradually. On discharge symptom-free.
Radiological re-examination: Passage good. Wide anastomotic stoma. Pathological report: "Raised ulcer 1½ cm. in diameter in distal oesophagus. No signs of malignancy. Chronic inflammatory changes in adjacent submucosa with overlying small shallow ulcers."
Follow-up: Back at work as instrument maker. General condition good. No dysphagia. Eats 3 normal meals per day. Only complaint is regurgitation of clear, sour-tasting food into the mouth at night. Sleeps sitting-up to remedy this.
Radiological re-examination: No abnormalities seen in area of anastomosis.
Epicrisis: Male, aged 61 years. Small sliding hiatus hernia with mucosa of distal oesophagus irregularly raised. Distal oesophagus resected on suspicion of carcinoma. Pathological report: Benign ulceration. Final diagnosis: Sliding hiatus hernia with oesophagitis and oesophageal ulceration.

CASE 30

H.M. 10295. Female, aged 64 years. *Admitted:* 14-1-53. *Discharged:* 11-2-53.

History: Quite well until 4 months before admission. Since then general weakness and shortness of breath. Often feels faint. Has become very pale. Vague abdominal discomfort. No haematemesis. Melaena stools.
Examination: Rather obese elderly woman. Anaemic. General examination: otherwise NAD. Abdomen: NAD. Hb: 40. W.B.C: 6000. E.S.R: 23. Faeces occult blood test strongly positive. Fractional test meal: 83/55.
Bloodsmear: Microcytic, hypochromic. E.C.G: NAD.
Radiological examination: Large sliding hiatus hernia.
Conclusion: Large sliding hiatus hernia with melaena and marked anaemia.
Pre-operative Treatment: Repeated blood transfusions.
Operation (27-1-53): Median upper abdominal incision with removal of the xiphoid process. Hiatus admits at least four fingers. Left liver lobe mobilized and retracted to the right. Peritoneum incised in the hiatus. Oesophagus mobilized and pulled into the abdomen. Hiatus closed behind the oesophagus by approximation of the crura with silk ligatures. Oesophagus then fixed in the hiatus with 4 silk ligatures. Gastropexia geniculata anterior.
Postoperative Course: Uneventful. At the time of discharge the Hb. was 77 and there was no longer occult blood in the faeces.
Follow-up: Patient is completely symptom-free. No occult blood in the faeces. Hb: 93.
Radiological re-examination: No recurrence. No reflux.

CASE 31

H.M. 10340. Female, aged 49 years. *Admitted:* 11-2-53. *Discharged:* 5-3-53.

History: Burning epigastric pain since 20 years before admission. Worse after meals. Aggravated by lying down or bending forward. Heartburn. Often nauseous and occasional vomiting. Food sticks under lower sternum. Last six months also constricting feeling across the chest, especially on lying down at night. Pain radiates down both arms. Improves when sitting up in bed. Two years before admission cholecystectomy elsewhere. Symptoms unchanged after operation. Radiological examination repeated and hiatus hernia found.
Examination: Obese, middle-aged woman. General examination: NAD. Abdomen: NAD. Hb: 96. W.B.C: 7400. E.S.R: 3. No occult blood in the faeces.
Fractional test meal: 38/23.
Radiological examination: Small, sliding hiatus hernia.
Conclusion: Sliding hiatus hernia with severe symptoms.
Operation (20-2-53): Median upper abdominal incision. Removal of xiphoid process. Hiatus admits two fingers. Left liver lobe mobilized and retracted to the right. Oesophagus mobilized after incision of the peritoneum in the hiatus. Crura approximated posterior to the oesophagus. Oesophagus attached to the hiatus with three silk sutures. Gastropexia geniculata anterior.
Postoperative Course: Uneventful. Radiological re-examination before discharge: Hiatus hernia no longer demonstrable.
Follow-up: Patient is very obese. Short of breath on exertion. Otherwise symptom-free. No anginal pains.
Radiological re-examination: No recurrence. No reflux.

CASE 32

H.M. 10763. Male, aged 54 years. *Admitted:* 10-6-53. *Discharged:* 26-6-53.

History: Upper abdominal complaints since 1951, consisting of fullness after meals and heartburn. Duodenal ulcer found elsewhere in 1951. Ulcer diet; no improvement of symptoms.
Examination: Middle-aged male of normal build. General examination: Blood pressure: 200/110. Otherwise NAD. Abdomen: Painful in epigastrium on palpation. Otherwise NAD. Hb: 93. W.B.C: 7200. E.S.R: 2. No occult blood in the faeces. Fractional test meal: 95/75
Radiological examination: Small sliding hiatus hernia. Duodenum: NAD.
Gallbladder: Multiple stones.
Conclusion: Sliding hiatus hernia. Cholelithiasis.

Operation (12-6-53): Median upper abdominal incision with removal of xiphoid process. Gallbladder contains stones. Duodenum: No signs of ulceration. Hiatus admits two fingers. Left liver lobe mobilized and retracted to the right. Peritoneum incised in the hiatus and oesophagus mobilized. Crural fibres approximated behind the oesophagus with silk sutures. Cholecystectomy. Gastropexia geniculata anterior.
Postoperative Course: Uneventful.
Follow-up: Patient is symptom-free.
Radiological re-examination: No recurrence. No reflux.

CASE 33

H.M. 11122. Male, aged 59 years. *Admitted:* 13-11-53. *Discharged:* 4-1-54.

History: Completely healthy until two years before admission. Since then heartburn with on occasions severe, burning, substernal pain. Pain comes on at night or on lying down after meals. Often nauseous after meals. Excessive belching.
Examination: Healthy-looking male. General examination: NAD. Abdomen: NAD. Hb: 100. W.B.C: 6300. E.S.R: 3. Faeces occult blood test positive. Fractional test meal: 60/45.
Radiological examination: Large, hiatus hernia of the mixed variety, which does not reduce in the erect position.
Oesophagoscopy: No abnormal findings.
Conclusion: Large hiatus hernia of the mixed type with severe symptoms.
Operation (30-11-53): Median upper abdominal incision. Removal of xiphoid process. Hiatus admits four fingers. Left liver lobe mobilized and retracted to the right. Hernia reduced with ease. Peritoneum incised in the hiatus and oesophagus mobilized. Crura approximated behind the oesophagus. Gastropexia geniculata anterior.
Postoperative Course: Mild pulmonary embolism on the 10th postoperative day. Treated with anti-coagulants. Rapid recovery. Discharged in good condition.
Follow-up: Completely symptom-free.
Radiological re-examination: No recurrence. No reflux.

CASE 34

H.M. 11307. Male, aged 33 years. *Admitted:* 18-1-54. *Discharged:* 19-2-54.

History: Fell from a 18 ft. wall onto the right shoulder, about 6 months before admission. Since 6 weeks after the fall, pain in epigastrium and under lower sternum. Pain seldom worries the patient during the day but becomes severe at night on lying down. It is aggravated by bending forward. Heartburn and belching.
Examination: Well-built young man. General examination: NAD. Abdomen: NAD. Hb: 97. No occult blood in the faeces. Fractional test meal: 50/40.
Radiological examination: Plum-sized, hiatus hernia of sliding type. Oesophagoscopy: Normal oesophagus. No oesophagitis. No reflux seen. Cardia at 40 cm.
Conclusion: Sliding hiatus hernia with severe symptoms.
Operation (4-2-54): Median upper abdominal incision. Left liver lobe mobilized and retracted to the right. Hiatus admits two fingers. Peritoneum incised in the hiatus and oesophagus mobilized. Oesophagus pulled into abdominal cavity. Hiatus narrowed posterior to the oesophagus by approximating the crural fibres with two silk sutures. Gastropexia geniculata anterior.
Postoperative Course: Uneventful.
Follow-up: Patient is symptom-free. Does hard manual work.
Radiological re-examination: No recurrence. No reflux.

CASE 35

H.M. 10882. Female, aged 59 years. *Admitted:* 20-1-54. *Discharged:* 10-4-54.

History: Since July 1953 attacks of upper abdominal pain, starting in the epigastrium and radiating to the right and through to the back. This is usually of a colicky nature. Fullness after meals, especially after fatty meals. Occasional heartburn.
Examination: Healthy-looking woman. General examination: NAD. Abdomen: NAD. Hb: 90. E.S.R: 26. No occult blood in the faeces. Fractional test meal: 30/0.

Radiological examination: Gallbladder: Does not concentrate the dye. Orangesized hiatus hernia. Wide distal oesophagus.
Oesophagoscopy: Distal oesophagus wide and contains much food residue.
Evident oesophagitis.
Conclusion: Cholecystopathy. Hiatus hernia, complicated by oesophagitis.
Operation (12-2-54): Median upper abdominal incision with removal of xiphoid process. The gallbladder contains stones. Hiatus inspected. No hernial sac present. Oesophagus mobilized in the hiatus. Crural fibres approximated behind the oesophagus. Cholecystectomy. Choledochus explored and no abnormalites found. Gastropexia geniculata anterior.
Postoperative Course: Pleural effusion on the left. Treated with repeated aspiration. Symptom-free on discharge.
Follow-up: Completely symptom-free. No recurrence of attacks of pain. Radiological re-examination: What at first seems orangesized recurrence of the hernia, proves to be large oesophageal diverticulum of distal oesophagus. No hiatus hernia; no reflux.

CASE 36

H.M. 10983. Female, aged 56 years. *Admitted:* 24-3-54. *Discharged:* 21-4-54.

History: Attacks of colicky pain in the right upper abdomen, since nine months before admission. In between attacks regurgitation of food into the mouth on lying down at night. Sometimes manifest vomiting after evening meal. Heartburn and belching. No dysphagia.
Examination: Rather obese, middle-aged woman. General examination: NAD. Abdomen:NAD. Hb: 81. No occult blood in the faeces. Fractional test meal: 80/55.
Radiological examination: Large, para-oesophageal hiatus hernia in Trendelenburg. Gallbladder: Poor function and stones.
Oesophagoscopy: Gastric mucosa at 30 cm. No oesophagitis. No reflux.
Conclusion: Large, para-oesophageal hiatus hernia. Cholelithiasis.
Operation (6-4-54): Median upper abdominal incision with removal of xiphoid process. Gallbladder with stones. Hiatus admits four fingers. Left liver lobe mobilized and retracted to the right. Peritoneum incised in the hiatus. The hernia reduced with ease into the abdomen. Hiatus narrowed behind the oesophagus by approximation of the crura with silk sutures. Oesophagus attached in the hiatus. Large curvature attached to the diaphragm. Gallbladder removed. Gastropexia geniculata anterior.
Postoperative Course: Uneventful.
Follow-up: Patient is symptom-free.
Radiological re-examination: No recurrence. No reflux.

CASE 37

H.M. 11027. Female, aged 56 years. *Admitted:* 24-4-54. *Discharged:* 22-7-54.

History: Hysterectomy 14 years before admission. Since then recurrent small bowel obstruction caused by adhesions. Operated 6 times elsewhere. For many years also epigastric discomfort after meals. Severe heartburn. Occasional vomiting after meals. Belching.
Examination: Very nervous, thin, adult woman. General examination: NAD. Abdomen: Numerous scars. Otherwise NAD. Hb: 96. Faeces occult blood test positive. Fractional test meal: 110/90.
Radiological examination: Small sliding hiatus hernia.
Oesophagoscopy: Cardia at 40 cm. No signs of oesophagitis.
Conclusion: Recurrent small intestinal obstruction. Sliding hiatus hernia with severe symptoms.
Operation (13-5-54): Median upper abdominal incision with removal of xiphoid process. Incision lengthened to the right of the navel into lower abdomen. Numerous adhesions between small and large intestine, liver, stomach and anterior abdominal wall. Adhesions around the hiatus freed as far as possible. A number of perforations are produced in the bowel. A small segment of small bowel is resected where an entero-anastomosis had formed. Left liver lobe mobilized and retracted to the right. The hiatus admits two fingers. Because of excessive adhesions in the vicinity, no attempt at closure of the hernial opening is made. The small bowel is sutured in zig-zag loops according to the technique described by Noble. Finally gastropexia geniculata anterior.
Postoperative Course: Two weeks after operation, when patient had already been mobilized, she developed signs of peritonitis in the left lower abdomen. Abdomen reopened in left

lower quadrant on 31-5-54. Oedematous peritoneum. Small amount of yellow pus. Intestines seemed intact. Abdomen drained. Postoperatively patient developed small bowel fistula through drain wound. This gradually closed spontaneously. At discharge patient was in good general condition.
Follow-up: Has had recurrence of small intestinal obstruction. Reoperated for ileus elsewhere. No recurrence of hiatal hernia symptoms, however. Radiological re-examination: No recurrence of hernia. No reflux.

CASE 38

H.M. 11031. Female, aged 57 years. *Admitted:* 28-4-54. *Discharged:* 23-6-54.

History: Upper abdominal complaints of approximately 9 months duration. Fullness after meals. Often severe heartburn. Sensation as if food lodges momentarily behind lower sternum. One attack of gallstone colic, 1½ years before admission.
Examination: Very obese woman. General examination: NAD. Abdomen: NAD. Hb: 88. Faeces occult blood test positive. Fractional test meal: 53/36.
Radiological examination: Small sliding hiatus hernia which does not reduce in the erect position. Gallbladder: Poor function. No stones seen.
Oesophagoscopy: Cardia at 40 cm. Signs of mild oesophagitis.
Conclusion: Sliding hiatus hernia with severe symptoms. Oesophagitis.
Operation (18-5-54): Median upper abdominal incision with removal of xiphoid process. Gallbladder contains stones. Hiatus admits four fingers. Left liver lobe mobilized and retracted to the right. Peritoneum incised in the hiatus. Oesophagus mobilized. Crural fibres approximated behind the oesophagus. Cholecystectomy. Gastropexia geniculata anterior.
Postoperative Course: Mild episode of pulmonary embolism on tenth postoperative day. Treated on anticoagulants. Completely recovered on discharge.
Follow-up: Patient is symptom-free.
Radiological re-examination: No recurrence. No reflux.

CASE 39

H.M. 11190. Female, aged 75 years. *Admitted:* 21-7-54. *Discharged:* 27-8-54.

History: Attacks of gallstone colic since 5 years before admission. Since 7 weeks also epigastric pain after meals, which radiates through to the back. Diabetic; on insulin.
Examination: Healthy-looking elderly woman. General examination and examination of abdomen: NAD. Hb: 88. E.S.R: 18. Faeces occult blood test positive. Fractional test meal: 15/0.
Radiological examination: Plumsized sliding hiatus hernia. Duodenal diverticula. Gallbladder: Does not concentrate the dye. Contains stones.
Conclusion: Sliding hiatus hernia. Cholelithiasis. Severe symptoms.
Operation (13-8-54): Median upper abdominal incision. Gallbladder contains stones and has thickened walls. Duodenal diverticula; no signs of inflammation. Has a broad base and is left in situ. Hiatus admits three fingers. Left liver mobilized. Peritoneum incised in the hiatus. Oesophagus mobilized. Crural fibres approximated behind the oesophagus. Cholecystectomy. Gastropexia geniculata anterior.
Postoperative Course: Uneventful.
Follow-up: Patient, who is now 79, is too weak to come for examination. Reports by letter that she is free of abdominal symptoms and very satisfied with the operation.

CASE 40

H.M. 11774. Male, aged 63 years. *Admitted:* 9-8-54. *Discharged:* 23-10-54.

History: Since four years before admission burning pain behind lower sternum and in epigastrium after meals. Belching relieves the pain. Vomiting occasionally. Has on a few occasions vomited small quantities of fresh, red blood. Faeces sometimes tarry black. During the past few months progressive dysphagia for solids.

Examination: Rather frail-looking, elderly male. Enlarged prostate on rectal examination. Otherwise NAD. Abdomen: Slightly painful epigastrium on palpation. Otherwise NAD. Hb: 80. W.B.C: 3600. E.S.R: 2. Faeces occult blood test positive. Fractional test meal: 36/28.
Radiological examination: Orangesized sliding hiatus hernia, which only partially reduces in the erect position.
Oesophagoscopy: No abnormalities detected. Cardia at 40 cm.
Conclusion: Large sliding hiatus hernia with severe symptoms. Haematemesis. Melaena.
Operation (25-8-54): Median upper abdominal incision. Hiatus admits four fingers. Left liver lobe mobilized and retracted to the right. Peritoneum incised in the hiatus. Hernia reduced with ease. Oesophagus mobilized in the hiatus. Hiatus narrowed by approximation of the crura behind the oesophagus with silk sutures. Gastropexia geniculata anterior.
Postoperative Course: Retention of urine. Treated with indwelling catheter. Without the catheter patient kept complete retention of urine. Transurethral prostatic resection done on 14-10-54. Subsequent postoperative course uneventful.
Follow-up: 14 months after the operation an incisional hernia in the abdomenal scar was repaired elsewhere. Since then completely symptom-free.
Radiological re-examination: No recurrence. No reflux.

CASE 41

H.M. 5490. Male, aged 61 years. *Admitted:* 17-8-54. *Discharged:* 14-10-54.

History: Repeated attacks of colicky pain in the right upper abdomen. In between attacks also vague epigastric pain, aggravated by lying down. Gallstones found on radiological examination. A small hiatus hernia had been found elsewhere, but could not be demonstrated here. Cholecystectomy done and gallbladder with stones removed on 4-6-54. Hiatus considered to be of normal size. Postoperative course uneventful. Seen one month later in the outpatient dept. again with epigastric pain, aggravated by lying down. Excessive belching. On radiological re-examination sliding hiatus hernia now clearly demonstrable.
Examination: Strongly built adult male. General examination: NAD. Abdomen: Scar of cholecystectomy. Otherwise NAD. Hb: 81. E.S.R: 2. No occult blood in the faeces. Fractional test meal: 25/10.
Radiological examination: Small, sliding hiatus hernia.
Oesophagoscopy: Mucosa normal. Cardia at 35 cm.
Conclusion: Sliding hiatus hernia with severe symptoms.
Operation (30-9-54): Median upper abdominal incision with removal of xiphoid process. Adhesions between liver and anterior abdominal wall divided. Hiatus admits three fingers. Left liver lobe mobilized and retracted to the right. Peritoneum incised in the hiatus. Oesophagus mobilized. Crural fibres approximated with silk sutures behind the oesophagus. In front and laterally the oesophagus is sutured to the hiatus, taking the sutures through the muscular coat of the oesophagus. Gastropexia geniculata anterior.
Postoperative Course: Uneventful. Radiological re-examination before discharge: No recurrence or reflux seen.
Follow-up: Initially slight dysphagia for solids. This disappeared completely. Since then symptom-free.
Radiological re-examination: No recurrence. No reflux.

CASE 42

H.M. 11569. Female, aged 60 years. *Admitted:* 14-2-55. *Discharged:* 22-3-55.

History: Upper abdominal complaints of many years standing. Burning epigastric and lower substernal pain, aggravated by coughing or bending forward. Wakes up night with heartburn. Hiatus hernia diagnosed three years before admission. Patient treated conservatively without success. At oesophagoscopy elsewhere, two years ago, the oesophagus was perforated resulting in mediastinitis. Four months in hospital. Identical symptoms after discharge. One year before admission here, the left phrenic nerve was divided in the neck without any improvement in the symptoms.
Had poliomyelitis at the age of 1½ years which left her with partial paralysis of spinal muscles. Deformity of spine as a result.
Examination: Rather frail, elderly woman. General examination: Severe kypho-scoliosis of

thoracic and lumbar spine. Abdomen: NAD. Hb: 80. W.B.C: 4000. E.S.R: 36.
Radiological examination: Small sliding hiatus hernia with reflux.
Conclusion: Sliding hiatus hernia with severe symptoms.
Operation (18-2-55): Median upper abdominal incision with removal of xiphoid process. Left liver lobe mobilized and retracted to the right. Hiatus admits four fingers. Peritoneum incised in the hiatus and oesophagus mobilized. Crura approximated behind the oesophagus. Gastropexia geniculata anterior.
Postoperative Course: Small pulmonary embolism, right lower lobe, on 12th postoperative day. Treated on anticoagulants. Otherwise uneventful recovery.
Follow-up: No recurrence of hernial symptoms.
Radiological re-examination: No recurrence. No reflux.

CASE 43

H.M. 12321. Male, aged 73 years. *Admitted:* 23-2-55. *Discharged:* 18-3-55.

History: Epigastric discomfort after meals with nausea and occasional vomiting since two years before admission. Belching. Admitted elsewhere one year previously with haematemesis and melaena. Hiatus hernia found. Patient treated conservatively and discharged after five weeks in fairly good condition. Immediately afterwards, all symptoms recurred, however.
Examination: Rather obese, elderly male. General examination: NAD. Abdomen: NAD. Hb: 81. W.B.C: 11000. E.S.R: 16. Faeces occult blood test positive. Fractional test meal: 45/20. E.C.G: NAD.
Radiological examination: Orangesized, sliding hiatus hernia, which does not reduce in the erect position. Colon: Diverticulosis of descending colon.
Oesophagoscopy: No oesophagitis or ulceration seen.
Conclusion: Large, irreducible, sliding hiatus hernia with severe symptoms. Melaena.
Operation (4-3-55): Median upper abdominal incision. Hiatus admits four fingers. Left lobe of the liver mobilized and retracted to the right. Peritoneum incised in the hiatus. Hernial contents reduced with ease. Oesophagus and crura dissected free. Crural fibres approximated behind the oesophagus with silk sutures. Gastropexia geniculata anterior.
Postoperative Course: Uneventful.
Follow-up: Patient is now 76 years of age. Completely symptom-free. Still works full-time as carpenter.
Radiological re-examination: No recurrence. No reflux.

CASE 44

H.M. 11615. Female, aged 43 years. *Admitted:* 14-3-55. *Discharged:* 30-3-55.

History: Completely healthy until the last few months of her first pregnancy, 15 years ago. Then vomited after meals. Sometimes a small quantity of blood in the vomitus. Heartburn. Similar complaints with following two pregnancies. With the last pregnancy, 5 years before admission, the symptoms of vomiting and heartburn were especially severe. Twice large haematemesis, necessitating blood transfusion. Between pregnancies and since birth of last baby, patient had burning substernal pain after meals, aggravated by bending forward. Wakes up at night with severe retrosternal burning pain. Has slight dysphagia for solids.
Examination: Healthy-looking, adult woman. General examination: NAD. Abdomen: NAD. Hb: 80. E.S.R: 7. No occult blood in the faeces.
Radiological examination: Egg-sized, sliding hiatus hernia, which does not reduce completely in upright position. Chest: NAD.
Conclusion: Sliding hiatus hernia with severe symptoms and complicated by repeated haemateneses.
Operation (16-3-55): Median upper abdominal incision with removal of xiphoid process. Hiatus admits 4 fingers with ease. Left liver mobilized and retracted to the right. Peritoneum incised in the hiatus and oesophagus mobilized. A length of oesophagus, approximately three fingers wide, pulled into the abdomen. Hiatus narrowed behind the oesophagus by approximation of the crura with interrupted silk ligatures. Gastropexia geniculata anterior.
Postoperative Course: Uneventful. On discharge, still slight difficulty in swallowing.
Follow-up: Patient is symptom-free.
Radiological re-examination: No recurrence. No reflux.

CASE 45

H.M. 11607. Female, aged 69 years. *Admitted:* 9-3-55. *Discharged:* 7-4-55.

History: Upper abdominal pain after meals since three years before admission. Pain comes on in attacks, which last about an hour, and radiates through to the back. Pain is continuous and never colicky. Frequent vomiting, which relieves the pain to a certain extent. Pain is aggravated by lying down after a meal. Severe heartburn. Treated for hypertension and "anginal attacks" by her general practitioner.
Examination: Elderly woman in fairly good general condition. General examination: Blood pressure 200/110. Heart somewhat enlarged to the left. Otherwise NAD. Abdomen: NAD. Hb: 76. W.B.C: 5500. E.S.R: 25. No occult blood in the faeces. Fractional test meal: 50/30. E.C.G: Signs of left ventricular enlargement. Otherwise NAD. No signs of ischaemia.
Radiological examination: Mandarinsized sliding hiatus hernia which does not reduce in the erect position. Chest: Heart enlarged to the left. Otherwise NAD.
Oesophagoscopy: Cardia at 35 cm. No signs of inflammation.
Conclusion: Irreducible sliding hiatus hernia with angina-like symptoms.
Operation (23-3-55): Median upper abdominal incision with removal of xiphoid process. Hiatus admits four fingers. Stomach reduced with ease into the abdomen. Peritoneum incised in the hiatus. Oesophagus mobilized in the hiatus. Hiatus narrowed behind the oesophagus by approximation of crura with silk sutures. Gastropexia geniculata anterior.
Postoperative Course: Uneventful.
Follow-up: Patient is symptom-free. No angina-like pains since the operation.
Radiological re-examination: No recurrence. No reflux.

CASE 46

H.M. 11756. Female, aged 69 years. *Admitted:* 6-6-55. *Discharged:* 11-7-55.

History: For the past 20 years upper abdominal complaints, consisting of epigastric discomfort which comes on after meals and is increased by wearing a corset. At night patient wakes up with pain in the epigastrium which is relieved by sitting up and also by taking a little warm milk. Often has the sensation as if food sticks behind the sternum. Dislikes fatty foods. Has never had colicky pains.
Examination: Rather obese, elderly woman. General examination: NAD. Abdomen: NAD. Hb: 110. W.B.C: 4500. E.S.R 5. No occult blood in the faeces. Fractional test meal: 65/50.
Radiological examination: Small sliding hiatus hernia. Gallbladder: Does not concentrate the dye. No stones seen.
Conclusion: Small sliding hiatus hernia with severe symptoms.
Operation (20-6-55): Median upper abdominal incision with removal of the xiphoid process. Hiatus admits three fingers. The gallbladder contains stones. Left liver lobe mobilized and retracted to the right. Oesophagus mobilized in the hiatus after incision of the peritoneum in the hiatus. Stomach pulled into the abdomen. Hiatus narrowed behind the oesophagus with silk ligatures. Cholecystectomy. Gastropexia geniculata anterior.
Postoperative Course: Uneventful.
Follow-up: Patient is symptom-free.
Radiological re-examination: No recurrence. No reflux.

CASE 47

H.M. 12133. Female, aged 67 years. *Admitted:* 15-12-55. *Discharged:* 13-1-56.

History: Attacks of gallstone colic since 1951. Icteric on one occasion. Since many years also fullness after meals, associated with vague pain in left upper quadrant. Often excessive heartburn. Is on salt-free diet for hypertension. Angina pectoris; treated with Amyl Nitrite.
Examination: Obese, elderly woman. Blood pressure: 160/100. General examination otherwise NAD. Abdomen: NAD. Hb: 86. W.B.C: 5400. E.S.R:12. No occult blood in the faeces. Fractional test meal: 95/80. E.C.G: NAD.
Radiological examination: Small sliding hiatus hernia. Gallbladder: Contains multiple stones. Poor function.
Conclusion: Sliding hiatus hernia. Cholelithiasis. Symptoms of both.

Operation (23-12-55): Median upper abdominal incision with removal of xiphoid process. Gallbladder contains stones. Hiatus admits three fingers. Left liver lobe mobilized and retracted to the right. Peritoneum incised in the hiatus. Oesophagus mobilized. Crural fibres approximated behind the oesophagus. Cholecystectomy. Gastropexia geniculata anterior.
Postoperative Course: Initially unexplained pyrexia. Subsided spontaneously. Otherwise uncomplicated recovery.
Follow-up: Still under treatment for angina pectoris. Completely free of abdominal symptoms. Radiological re-examination: No recurrence. No reflux.

CASE 48

H.M. 12336. Female, aged 56 years. *Admitted:* 26-3-56. *Discharged:* 14-4-56.

History: Admitted elsewhere in January 1956 for treatment of varicose veins and thrombophlebitis of the left leg. On blood examination a serious secondary anaemia was discovered. Hb: 38. Erythrocyte count: 3.3 mil. Anisocytosis. Mild poikilocytosis and polychromasia. Hypochromic red blood cells. No megalocytosis. Normal white cell picture. On account of these findings a thorough clinical examination was done. On careful history-taking it appeared that the patient had had mild dyspepsia of many years standing. On occasions she experienced epigastric fullness after meals. This discomfort was increased by leaning backwards in a chair or lying down. Occasionally troubled by heartburn and belching. She had on occasions noticed dark-coloured stools. X-ray examination revealed a hiatus hernia. Transferred to our clinic.
Examination: Short, obese woman. Anaemic. Heart enlarged to the left with a systolic murmur at the apex. Abdomen: NAD. Blood pictures: as above. E.S.R: 3. Faeces occult blood test positive. Fractional test meal: 65/30.
Radiological examination: Large para-oesophageal hiatus hernia. The cardia, however, also lies above the diaphragm so that this is a mixed type of hernia. Reflux of barium in Trendelenburg position.
Pre-operative Treatment: Repeated blood transfusions. Iron given orally and by intravenous injection. Directly pre-operatively the haemoglobin had risen to 91.
Conclusion: Large hiatus hernia of the mixed type, complicated by melaena and severe anaemia.
Operation (28-3-56): Median upper abdominal incision with removal of xiphoid process. Duodenum and gallbladder: NAD. The hiatus admits four fingers. Left liver lobe mobilized. Peritoneum incised in the hiatus. Oesophagus mobilized. Hiatus narrowed by approximation of the crura behind the oesophagus. Gastropexia geniculata anterior.
Postoperative Course: Uneventful.
Follow-up: Completely healthy and symptom-free. Hb: 104.
Radiological re-examination: No recurrence. No reflux.

CASE 49

H.M. 12321. Female, aged 42 years. *Admitted:* 16-3-56. *Discharged:* 14-4-56.

History: Abdominal complaints of at least 25 years standing, consisting of burning pain under lower sternum and in epigastrium. Radiates through to the back. Heartburn. Occasional nausea. Excessive belching. Complaints aggravated by bending forward. Twice treated in sanatoria for pulmonary tuberculosis.
Examination: Appears healthy. Lungs: Dullness on percussion over left lower lobe. Abdomen: NAD. Hb: 81. W.B.C: 5100. E.S.R: 8. No occult blood in the faeces. Fractional test meal: 40/25.
Radiological examination: Chest: Trachea, mediastinum and heart retracted to the left. Left diaphragm elevated. Signs of healed tuberculosis of left lower lobe. Oesophagus/Stomach: Large sliding hiatus hernia.
Oesophagoscopy: Excessive reflux of stomach contents into the oesophagus. No signs of oesophagitis.
Conclusion: Sliding hiatus hernia with severe symptoms.
Operation (31-3-56): Median upper abdominal incision with removal of xiphoid process. Hiatus admits four fingers. Hernia can be reduced by light traction on the stomach. Peritoneum incised in the hiatus.
Oesophagus mobilized and pulled into the abdomen for approximately 10 cm. The pulmonary

disease has therefore not affected the mobility of the oesophagus. Crural fibres approximated behind the oesophagus. Gastropexia geniculata anterior.
Postoperative Course: Uneventful.
Follow-up: Patient is symptom-free.
Radiological re-examination: No recurrence. No reflux.

CASE 50

Private patient of Prof. Boerema. Mrs. A. H-D. Female, aged 78 years. *Admitted:* 2-5-56. *Discharged:* 26-5-56.

History: Stones removed from the gallbladder many years previously. Lately fullness after meals sometimes associated with vomiting. Coronary infarction on two occasions.
Examination: Frail elderly woman. General examination: No contra-indications to operation. Abdomen: NAD.
Radiological re-examination: Small sliding hiatus hernia. Chest: NAD. Diverticulosis coli.
Conclusion: Sliding hiatus hernia with severe symptoms.
Operation (7-5-56): Median upper abdominal incision. Gallbladder which contains stones is left in situ. Oesophagus mobilized in the hiatus. Crura approximated behind the oesophagus. Gastropexia geniculata anterior.
Postoperative Course: Uneventful.
Follow-up: Patient is free of abdominal symptoms.
Radiological re-examination: Not done.

CASE 51

H.M. 13371. Male Child, aged 13 months. *Admitted:* 15-5-56. *Discharged:* 16-6-56.

History: Admitted elsewhere, 7 months before admission here, with vomiting and anaemia (Hb: 50). Diaphragmatic hernia found. At operation (9-1-56) a 2½ finger defect was found in the left diaphragm. A hernial sac was removed and the defect closed. Hereafter the hiatal opening seemed wider than normal, however, and admitted one finger next to the oesophagus. The surgeon then attached the oesophagus with silk sutures to the edges of the hiatus. Shortly after operation symptom of vomiting after meals recurred. Admitted in our clinic.
Examination: Healthy-looking child. General examination: NAD. Abdomen: NAD. Hb: 76. No occult blood in the faeces.
Radiological examination: Plumsized sliding hiatus hernia.
Conclusion: Recurrence of sliding hiatus hernia with severe symptoms.
Operation (28-5-56): Median upper abdominal incision with removal of xiphoid process. Left liver lobe mobilized and retracted to the right. Hiatus admits a thumb next to the oesophagus. Oesophagus mobilized. Crura of diaphragm approximated behind the oesophagus. Gastropexia geniculata anterior.
Postoperative Course: Uneventful.
Follow-up: Patient is symptom-free. Healthy normal two-year-old.
Radiological re-examination: No recurrence. No reflux.

CASE 52

H.M. 122440. Female, aged 35 years. *Admitted:* 18-5-56. *Discharged:* 18-6-56.

History: Upper abdominal complaints since 14 years before admission, consisting of epigastric pain and belching. Symptoms aggravated by bending forward. No abnormalities detected at laparotomy in 1946.
Examination: Very obese woman. General examination: NAD. Abdomen: NAD. Hb: 90. W.B.C: 5000. E.S.R: 4. Faeces occult blood test positive.
Fractional test meal: 52/36.
Radiological examination: Small sliding hiatus hernia.
Oesophagoscopy: No abnormalities detected.
Conclusion: Sliding hiatus hernia with severe symptoms. Melaena.
Operation (4-6-56): Median upper abdominal incision with removal of xiphoid process. Left liver lobe mobilized and retracted to the right. Hiatus admits three fingers. Crural fibres approximated behind the oesophagus. Gastropexia geniculata anterior.
Postoperative Course: Uneventful.

Follow-up: Patient still has vague abdominal complaints, consisting mainly of fullness after meals. Pre-operative epigastric pain and belching no longer present. Patient appears nervous. Has been prescribed sedatives by general practitioner. Unhappy home circumstances — divorced from husband, and son convicted for juvenile delinquency. On examination: Very obese, otherwise healthy-looking. Abdomen: NAD.
Patient therefore improved but not completely symptom-free.
Radiological re-examination: No recurrence. No reflux.

CASE 53

H.M. 12513. Female, aged 74 years. *Admitted:* 29-6-56. *Discharged:* 6-8-56.

History: In 1941, after 18 years of upper abdominal complaints, a Billroth II gastrectomy was done elsewhere. One year later recurrence of all symptoms, consisting of burning pain under lower sternum on bending forward or lying down and vomiting after meals. Vomitus sometimes contains streaks of blood. Sensation as if food lodges momentarily under lower sternum. Loss of weight.
Examination: Thin, elderly woman. General examination: NAD. Abdomen: NAD. Hb: 85. E.S.R: 26. No occult blood in the faeces. Fractional test meal: 10/0.
Radiological examination: Signs of healed tuberculosis at both lung apices. Plum-sized sliding hiatus hernia with reflux.
Oesophagoscopy: Severe oesophagitis of distal oesophagus with reflux of gastric contents into the oesophagus.
Conclusion: Sliding hiatus hernia with severe oesophagitis.
Operation (17-7-56): Median upper abdominal incision with removal of xiphoid process. Left liver lobe mobilized and retracted to the right. Hiatus admits four fingers. Peritoneum incised in the hiatus. With traction on the oesophagus, during mobilization, it suddenly tears off completely at the cardia. This is probably due to weakening of the wall as a result of oesophagitis. Stomach provisionally closed and its proximal part freed from omental attachments. Abdomen closed.
The chest is now opened through the 8th intercostal space on the left. Lower mediastinum opened and distal oesophagus mobilized. Stomach brought into the chest. End-to-side anastomosis made of oesophagus to greater curvature of the stomach. Mediastinum and chest closed.
Postoperative Course: Uneventful.
Follow-up: Patient has severe symptoms of nausea, vomiting and burning pain behind the sternum. At oesophagoscopy there is evident oesophagitis above the anastomosis. Much regurgitation of gastric contents.
Patient is on paliative conservative treatment.
Radiological re-examination: Wide oesophagus-stomach anastomosis with much reflux.

CASE 54

H.M. 13576. Male, aged 42 years. *Admitted:* 6-8-56. *Discharged:* 23-8-56.

History: Vague upper abdominal complaints of many years duration. Epigastric pain associated with heartburn and belching. Complaints improved by lying down. Diagnosis of hiatus hernia made. Gastropexia geniculata anterior elsewhere on 28-3-56. Postoperatively the patient was improved but still complained of vague abdominal symptoms. On radiological examination elsewhere, there seemed to be a recurrence of the hernia.
Examination: Healthy-looking adult male. General examination: NAD. Abdomen: NAD. Hb: 102.
Radiological examination: Done elsewhere.
Conclusion: Recurrence of hiatus hernia after gastropexia geniculata anterior.
Operation (9-8-56): Thoracatomy through 9th intercostal space on the left. Mediastinum opened above the diaphragm. Oesophagus completely adherent in the hiatus. No sign of hiatus hernia. After freeing of the crura, the hiatus admits tip of a finger with difficulty next to the oesophagus. Left dome of diaphragm opened and undersurface of hiatus examined. Again no sign of herniation detected. Diaphragm closed. Crura again approximated on the thoracic side. Mediastinum and chest closed.
Postoperative Course: Uneventful.
Follow-up: Symptoms unchanged. Has attacks of epigastric pain relieved by lying down.
Radiological re-examination: No recurrence. No reflux.

CASE 55

H.M. 12616. Girl, aged 12 years. *Admitted:* 31-8-56. *Discharged:* 5-10-56.

History: Vomiting after meals since the age of three months. This occurred only after large meals and development of the child was not retarded. Vomitus occasionally contained blood. After the age of eight years the complaints improved. Lately the only complaint has been nausea after meals. As a result of positive tuberculin skin test at school, the patient was X-rayed. Shadow seen in left lower lobe. Patient admitted for examination elsewhere. Shadow proved to be caused by large hiatus hernia.
Examination: Healthy-looking girl. General examination: NAD. Abdomen: NAD. Hb: 82. E.S.R: 7. No occult blood in the faeces. Fractional test meal: 42/25.
Radiological examination: Very large sliding hiatus hernia. Half of stomach in thorax. Reflux.
Oesophagoscopy: Signs of mild oesophagitis. Reflux.
Conclusion: Sliding hiatus hernia with mild oesophagitis.
Operation (18-9-56): Median upper abdominal incision. Hiatus admits three fingers. Left liver lobe mobilized and retracted to the right. Peritoneum incised in the hiatus. Stomach reduced into the abdomen with ease. Crura poorly developed and extremely thin. These approximated behind the oesophagus with silk sutures. Gastropexia geniculata anterior.
Postoperative Course: Uneventful.
Follow-up: Normal, healthy 14-year-old girl. Completely symptom-free.
Radiological re-examination: No recurrence. No reflux.

CASE 56

H.M. 12694. Female, aged 64 years. *Admitted:* 12-10-56. *Discharged:* 29-11-56.

History: Upper abdominal complaints of many years duration. Epigastric pain, which comes on approximately an hour after meals, associated with nausea. Complaints aggravated by bending forward. This is often accompanied by regurgitation of acid fluid into the mouth. One attack of colicky pain in the right upper abdomen, two months before admission. This was associated with transient jaundice.
Examination: Very obese woman. General examination and examination of abdomen: NAD. Hb: 83. W.B.C: 7000. E.S.R: 6. No occult blood in the faeces. Fractional test meal: 55/45.
Radiological examination: Large para-oesophageal hiatus hernia.
Oesophagoscopy: No abnormality detected.
Conclusion: Large para-oesophageal hiatus hernia with severe symptoms. Cholelithiasis.
Operation (29-10-56): Median upper abdominal incision with removal of xiphoid process. Hiatus admits four fingers. Left liver lobe retracted to the right. Peritoneum incised in hiatus oesophagus mobilized. Crura approximated behind the oesophagus with silk sutures. Cholecystectomy. Common bile duct opened and stone removed. Gastropexia geniculata anterior.
Postoperative Course: Initially unexplained fever which subsided spontaneously.
Follow-up: Patient is symptom-free.
Radiological re-examination: No recurrence. No reflux.

CASE 57

Private patient of Prof. Boerema. Mrs. J. M. J. A.-v. V. Female, aged 55 years. *Admitted:* 3-11-56. *Discharged:* 10-12-56.

History: Epigastric discomfort after meals and occasional heartburn, of ten years duration. Slight dysphagia for solid foods, which seems to stick behind the lower sternum. Abdominal discomfort increased by bending forward and by exertion. For years painful, itchy sensation in right ear. No abnormality detected by Ear, Nose and Throat specialists.
Examination: Healthy-looking middle-aged woman. General examination: NAD. Abdomen: NAD.
Radiological examination: Chest: NAD. Gallbladder: Concentrates the dye well. Contains solitary stone. Oesophagus/Stomach: NAD. No hiatus hernia could be demonstrated.
Conclusion: Symptoms suggestive of hiatus hernia. Cholelithiasis.

Operation (9-11-56): Median upper abdominal incision with removal of xiphoid process. Gallbladder contains solitary stone, otherwise normal. Hiatus admits four fingers. Cardiac end of stomach can be made to slide up through the hiatus. Oesophagus mobilized in the hiatus. Crural fibres approximated behind the oesophagus. Cholecystectomy. Gastropexia geniculata anterior.
Postoperative Course: Uneventful.
Follow-up: Patient is completely symptom-free. She is a singer and resumed singing exercises shortly after operation.
Radiological re-examination: No recurrence. No reflux.

CASE 58

H.M. 12738. Female, aged 63 years. *Admitted:* 7-11-56. *Discharged:* 20-12-56.

History: Upper abdominal complaints of ten years duration. Fullness after meals, aggravated by bending forward or lying down. Symptoms worse after hot, fatty meals. Occasionally tarry stools. Acute admission after small haematemesis.
Examination: Very obese woman. Anaemic. Abdomen: NAD. Hb: 60. W.B.C: 8700. E.S.R: 2. Tarry, melaena stools. Fractional test meal: 45/35.
Radiological examination: Very large para-oesophageal hiatus hernia.
Third of stomach in thorax. Does not reduce in the erect position.
Gallbladder: Functions well but contains multiple stones.
Conclusion: Very large para-oesophageal hernia, complicated by haematemesis and melaena.
Operation (3-12-56): Median upper abdominal incision with removal of xiphoid process. Difficult exposure of hiatus due to excessive obesity of the patient. Incision lengthened to the right of the navel. The hiatus admits a whole hand. Left liver lobe mobilized and retracted to the right. Peritoneum incised in the hiatus and the oesophagus mobilized. Crural fibres approximated behind the oesophagus with silk sutures. Cholecystectomy. Gastropexia geniculata anterior.
Postoperative Course: Uneventful.
Follow-up: Patient is symptom-free.
Radiological re-examination: No recurrence. No reflux.

CASE 59

H.M. 13301. Male, aged 79 years. *Admitted:* 16-11-56. *Died:* 27-12-56.

History: Poor appetite since 6 months before admission. Since some months also burning pain under lower sternum on swallowing. Much heartburn and belching, which are aggravated by lying down. Often vomiting after meals. Loss of weight. First admitted for treatment in April 1956 when, at oesophagoscopy, severe oesophagitis was detected. At 30 cm. a smooth stenosis was evident. On radiological examination of the oesophagus this narrowing appeared to lie 5 cm. above the diaphragm. No hiatus hernia seen; patient not examined in Trendelenburg. Patient discharged on conservative treatment. No improvement of symptoms. Patient readmitted 16-11-56.
Examination: Robust, elderly man. General examination: NAD. Abdomen: NAD. Hb: 88. E.S.R: 5. No occult blood in the faeces. Fractional test meal: 33/20.
Radiological examination: Sliding hiatus hernia demonstrated in Trendelenburg. Narrowing seen at previous examination, proves to be the cardia.
Oesophagoscopy: No stenosis seen. Cardia at 30 cm. Oesophagitis.
Conclusion: Sliding hiatus hernia, complicated by oesophagitis.
Operation (10-12-56): Median upper abdominal incision with removal of xiphoid process. Hiatus admits three fingers. Left liver lobe mobilized and retracted to the right. Peritoneum incised in the hiatus and oesophagus mobilized. Crural fibres approximated behind the oesophagus with silk sutures. Gastropexia geniculata anterior.
Postoperative Course: Condition of patient progressively worse. Pyrexia. Distended abdomen with signs of peritonitis. Abscess in left upper abdomen which subsequently perforated to the outside and released large quantities of B. coli infected fluid. Treated with various antibiotics without improvement. Patient ultimately comatose. Died 27-12-56.
Autopsy Report: Perforation of fundus at site of attachment to left dome of diaphragm. Signs of generalized peritonitis. Bilateral bronchopneumonia.

CASE 60

H.M. 13822. Male, aged 15 years. *Admitted:* 19-11-56. *Discharged:* 4-1-57.

History: Abdominal complaints since the age of 8 years. Food seems to lodge momentarily under lower sternum during meals. Occasional vomiting after meals, sometimes containing blood. No abnormalities found during repeated admissions elsewhere.
Examination: Rather thin boy. General examination: NAD. Abdomen: NAD. Hb: 98. E.S.R: 4. Faeces occult blood test positive. Fractional test meal: 73/50.
Radiological examination: Flow of barium through the oesophagus unobstructed. Slight narrowing of the oesophagus approximately 5 cm. above the diaphragm. No hiatus hernia demonstrated in Trendelenburg.
Oesophagoscopy: Evident oesophagitis immediately above the cardia. Metal clip attached to gastro-oesophageal junction (Site verified by biopsy). At radiological re-examination the clip appeared to lie above the diaphragm in extreme Trendelenburg examination.
Conclusion: Oesophagitis probably due to hiatus hernia.
Operation (11-12-56): Median upper abdominal incision with removal of xiphoid process. The hiatus is wide and admits at least three fingers. The cardia can be made to slide through the hiatus into the chest. Oesophagus mobilized in the hiatus. Crural fibres approximated behind the oesophagus with silk sutures. Gastropexia geniculata anterior.
Postoperative Course: Uneventful. Slight dysphagia on discharge.
Follow-up: Dysphagia continued for some months after discharge. Although there was no narrowing seen on radiological examination of the oesophagus, there was some difficulty in passing the cardia with the oesophagoscope.
A series of oesophageal dilatations carried out. Patient is now completely symptom-free.
Radiological re-examination: No recurrence. No reflux. Completely normal aspect of oesophagus and gastro-oesophageal region.

CASE 61

H.M. 12824. Female, aged 62 years. *Admitted:* 2-1-57. *Discharged:* 25-1-57.

History: Epigastric pain after meals since three years before admission. Aggravated by bending forward and lying down. Wakes up with pain at night. Heartburn. Occasional vomiting. Food sticks under lower sternum.
Examination: Healthy-looking, elderly woman. General examination: NAD. Abdomen: NAD. Hb: 102. W.B.C: 7400. E.S.R: 5. No occult blood in the faeces. Fractional test meal: 35/15.
Radiological examination: Small sliding hiatus hernia. Duodenal diverticula.
Conclusion: Sliding hiatus hernia with severe symptoms.
Operation (8-1-57): Median upper abdominal incision with removal of xiphoid process. Hiatus admits at least four fingers. Left liver lobe mobilized and retracted to the right. Peritoneum incised in the hiatus. Crura approximated behind the oesophagus with silk sutures. Gastropexia geniculata anterior.
Postoperative Course: Uneventful.
Follow-up: Patient is symptom-free.
Radiological re-examination: No recurrence. No reflux.

CASE 62

H.M. 12805. Female, aged 53 years. *Admitted:* 18-12-56. *Discharged:* 28-1-57.

History: In 1953 cholecystectomy elsewhere. Six months after the operation again attacks of upper abdominal pain, now localized in epigastrium and under lower sternum. Heartburn and regurgitation of acid fluid into the mouth on bending forward. Occasional vomiting after meals. In October 1954 operated elsewhere via thoracotomy for hiatus hernia. All symptoms recurred immediately after the operation.
Examination: Thin, middle-aged woman. General examination: NAD. Abdomen: Scar of previous operation, otherwise NAD. Hb: 98. W.B.C: 5300. E.S.R: 4. No occult blood in the faeces. Fractional test meal: 100/85.
Radiological examination: Plumsized sliding hiatus hernia.
Oesophagoscopy: No abnormality detected.
Conclusion: Recurrence of sliding hiatus hernia with severe symptoms.

Operation (10-1-57): Median upper abdominal incision with removal of xiphoid process. Hiatus admits three fingers. No signs of previous hernial repair. Oesophagus mobilized. Crural fibres approximated behind the oesophagus. Gastropexia geniculata anterior.
Postoperative Course: Uneventful.
Follow-up: Complaints improved by operation. Still gets heartburn, however, and regurgitation on bending forward. No recurrence of the severe substernal pain.
Radiological re-examination: No recurrence of the hernia could be demonstrated. There is still reflux into the oesophagus. Large angle of His.

CASE 63

H.M. 12884. Female, aged 53 years. *Admitted:* 29-1-57. *Discharged:* 27-2-57.

History: Since two years before admission, dysphagia. Food, especially at the beginning of a meal, seems to lodge momentarily behind the lower sternum. After meals, heartburn and excessive belching. Heartburn aggravated by bending forward or lying down.
Examination: Rather obese, middle-aged woman. General examination and examination of abdomen NAD. Hb: 79. W.B.C: 6400. E.S.R: 14. No occult blood in the faeces. Fractional test meal: 30/10.
Radiological examination: Plumsized sliding hiatus hernia.
Oesophagoscopy: Cardia at 33 cm. Severe oesophagitis in distal oesophagus.
Conclusion: Sliding hiatus hernia, complicated by oesophagitis.
Operation (12-2-57): Median upper abdominal incision. Hiatus admits three fingers. Left liver lobe mobilized and retracted to the right. Peritoneum incised in the hiatus. Oesophagus mobilized. Crural fibres approximated behind the oesophagus. Gastropexia geniculata anterior.
Postoperative Course: Uneventful.
Follow-up: Patient is symptom-free.
Radiological re-examination: No recurrence. No reflux.

CASE 64

H.M. 12918. Female, aged 72 years. *Admitted:* 15-2-57. *Discharged:* 11-3-57.

History: Burning pain under lower sternum since 10 years before admission. Pain radiates through to the back and is aggravated by lying down or bending forward. Severe heartburn. Sensation as if food sticks behind lower sternum.
Examination: Healthy-looking elderly woman. General examination: NAD. Abdomen: NAD. Hb: 76. W.B.C: 6000. E.S.R: 17. No occult blood in the faeces. Fractional test meal: 90/70.
Radiological examination: Sliding hiatus hernia which does not reduce in the erect position. Oesophageal ulcer immediately above the cardia, dorsally. Strong reflux in Trendelenburg position.
Oesophagoscopy: Marked oesophagitis of distal oesophagus. Ulcer niche seen at 30 cm. in posterior oesophageal wall.
Pathological report on biopsy from ulcer: Chronic inflammation.
Conclusion: Sliding hiatus hernia complicated by oesophagitis and oesophageal ulcer.
Operation (19-2-57): Median upper abdominal incision with removal of xiphoid process. Hiatus admits four fingers. Left liver lobe mobilized and retracted to the right. Oesophagus mobilized in the hiatus. Site of ulcer feels hardened on palpation. Vagotomy performed. Crura approximated behind the oesophagus with silk sutures. Pylorotomy performed. Gastropexia geniculata anterior.
Postoperative Course: Phlebitis of left lower leg which cleared up spontaneously.
Follow-up: Patient is completely symptom-free.
Radiological re-examination: No recurrence. No reflux. No ulcer seen.

CASE 65

H.M. 4776. Female, aged 75 years. *Admitted:* 15-3-57. *Discharged:* 24-4-57.

History: Abdominal complaints of at least 30 years standing. Laparotomy done in 1944.

Duodenal diverticula and appendix removed, without improvement of abdominal symptoms. Admitted in 1957 with burning pain in epigastrium and under lower sternum, radiating through to the back. Heartburn and regurgitation of acid fluid into the mouth. Symptoms aggravated by lying down or bending forward. Slight dysphagia. For years unpleasant, painful itching sensation in left ear, coming on simultaneously with substernal pain.
Examination: Rather obese, elderly woman. General examination: Multiple extrasystoles. Mild signs of left heart failure. Abdomen: Scar of previous operation; otherwise NAD. Hb: 83. W.B.C: 6400. E.S.R: 24. Fractional test meal: No free acid. E.C.G: NAD.
Radiological examination: Large sliding hiatus hernia.
Conclusion: Large sliding hiatus hernia with severe symptoms.
Operation (23-3-57): Median upper abdominal incision with removal of xiphoid process. Peritoneum incised in the hiatus, which admits two fingers. With traction on the stomach, a small tear occurs in the stomach fundus. This is closed with catgut and interrupted silk sutures. Crural fibres approximated behind the oesophagus. Gastropexia geniculata anterior.
Postoperative Course: Diarrhoea, treated with sulphathaladine. Otherwise uncomplicated postoperative course.
Follow-up: Patient completely free of abdominal symptoms. Still short of breath on exertion. No ear symptoms.
Radiological re-examination: No recurrence. No reflux.

CASE 66

H.M. 14101. Male, aged 26 years. *Admitted:* 11-3-57. *Discharged:* 5-4-57.

History: Since 15 months before admission, pain under lower sternum and in upper abdomen coming on approximately an hour after meals. Pain especially bad at night. Symptoms relieved by milk and alkalies. Twice admitted elsewhere with haematemesis and treated on Sippy diet with the diagnosis of duodenal ulcer. Symptoms always recurred.
Examination: Rather nervous young man. General examination: NAD. Abdomen: NAD. Faeces occult blood test positive. Fractional test meal: 65/50.
Radiological examination: Small sliding hiatus hernia. Somewhat deformed duodenal bulb.
Conclusion: Sliding hiatus hernia. Possibly duodenal ulcer. Severe symptoms. Haematemesis.
Operation (23-3-57): Median upper abdominal incision with removal of xiphoid process. No signs of duodenal ulceration. Pylorotomy. Pyloric antrum and proximal duodenum inspected. No abnormality detected. Hiatus admits two fingers. Left liver lobe mobilized and retracted to the right. Peritoneum incised in the hiatus and oesophagus mobilized. Crura approximated behind the oesophagus. Gastropexia geniculata anterior.
Postoperative Course: Uneventful.
Follow-up: Patient is symptom-free.
Radiological re-examination: No recurrence. No reflux.

CASE 67

H.M. 12985. Female, aged 45 years. *Admitted:* 25-3-57. *Discharged:* 24-4-57.

History: Since 1½ years before admission, cramplike pains under lower sternum which come on especially at night. Since three months progressive dysphagia especially for fluids. After meals occasional regurgitation of food just taken, into the mouth. Loss of weight.
Examination: Rather thin, middle-aged woman. General examination: NAD. Abdomen: NAD. Hb: 87. W.B.C: 5600. E.S.R: 6. No occult blood in the faeces. Fractional test meal: 35/0.
Radiological examination: Distal oesophagus somewhat wider than normal. Delayed passage of barium through the cardia. Appearance suggestive of cardiospasm. No hiatus hernia demonstrated on first examination in Trendelenburg. On second examination, possibly small hiatus hernia.
Oesophagoscopy: Much retention of saliva. Diffuse oesophagitis, more marked distally.
Conclusion: Progressive dysphagia. Oesophagitis. Aetiology not clear: cardiospasm or sliding hiatus hernia.
Operation (8-4-57): Median upper abdominal incision with removal of xiphoid process. The liver is larger than normal but has otherwise normal aspect. Left liver lobe mobilized and retracted to the right. The hiatus admits two fingers for a distance of 3—4 cm. The oesophagus feels somewhat firmer than normal in the region of the cardia. Although the diagnosis of hiatus hernia is not absolutely certain, it is decided to treat the patient for this condition

because(1) the presence of marked oesophagitis and the operative findings seem to confirm the diagnosis and (2) the Heller operation is contra-indicated with hiatus hernia whereas gastropexia is not harmful in the case of cardiospasm. Oesophagus therefore mobilized and the crural fibres approximated behind it.
Gastropexia geniculata anterior.
Postoperative Course: Dysphagia not improved by the operation. On discharge unchanged symptoms.
Follow-up: Dysphagia has become progressively worse. No other symptoms.
Radiological re-examination: Typical picture of cardiospasm.
The patient has subsequently been readmitted and a Heller operation performed with good result.

CASE 68

H.M. 14183. Male, aged 45 years. *Admitted:* 12-4-57. *Discharged:* 24-5-57.

History: Since 1953 upper abdominal pain associated with heartburn and belching. No improvement on ulcer regime. Since one year before admission pain very much worse. Aggravated by lying down and bending forward.
Examination: Thin, middle-aged male. General examination: NAD. Abdomen: NAD. Hb: 92. W.B.C: 4000. E.S.R: 6. No occult blood in the faeces. Fractional test meal: 60/48.
Radiological examination: Small sliding hiatus hernia. Colon: Diverticulosis.
Oesophagoscopy: No abnormalities detected.
Conclusion: Sliding hiatus hernia with severe symptoms.
Operation (9-5-57): Median upper abdominal incision with removal of xiphoid process. Hiatus admits three fingers. Left liver lobe retracted to the right. Oesophagus mobilized. Crura approximated behind the oesophagus. Gastropexia geniculata anterior.
Postoperative Course: Uneventful.
Follow-up: Patient is symptom-free.
Radiological re-examination: No recurrence. No reflux.

CASE 69

H.M. 14241. Male, aged 54 years. *Admitted:* 8-5-57. *Discharged:* 5-6-57.

History: Upper abdominal complaints since 7 years before admission. Attacks of burning epigastric pain which come on approximately 1½ hours after meals. Severe heartburn. Occasional vomiting after meals. Haematemesis six months before admission. No improvement on ulcer regime.
Examination: Healthy-looking adult male. General examination: NAD. Abdomen: NAD. Hb: 92. E.S.R: 1. No occult blood in the faeces. Fractional test meal: 40/27.
Radiological examination: Small sliding hiatus hernia.
Conclusion: Sliding hiatus hernia. Severe symptoms.
Operation (21-5-57): Median upper abdominal incision with removal of xiphoid process. Hiatus admits three fingers. Left liver lobe mobilized and retracted to the right. Oesophagus mobilized in the hiatus. Crura approximated behind the gullet with sutures. Gastropexia geniculata anterior.
Postoperative Course: Bronchopneumonia which cleared up on antibiotics. Otherwise uneventful recovery.
Follow-up: Symptoms improved by the operation. No longer troubled by heartburn. Still complains of attacks of epigastric pain. Admitted departement of Internal Medicine in August 1958 for examination. No abnormalities detected.
Conclusion on discharge: "Abdominal complaints for which no organic basis can be detected. Neurotic personality".
Radiological re-examination: No recurrence or reflux on repeated examination in Trendelenburg.

CASE 70

H.M. 13080. Female, aged 62 years. *Admitted:* 15-5-57. *Discharged:* 7-6-57.

History: Epigastric pain, associated with regurgitation of acid fluid into the mouth, of ten

years duration. Heartburn. Symptoms aggravated by bending forward. Last two years all complaints progressively worse. Since two years also typical attacks of gallstone colic.
Examination: Obese woman. General examination and examination of abdomen: NAD. Hb: 90. W.B.C: 5100. E.S.R: 13. No occult blood in the faeces.
Fractional test meal: 30/10.
Radiological examination: Sliding hiatus hernia with reflux. Gallbladder: Concentrates the dye well. Multiple small stones.
Conclusion: Sliding hiatus hernia. Cholelithiasis. Severe symptoms.
Operation (23-5-57): Upper median abdominal incision with removal of xiphoid process. Very thick fat layer. Hiatus admits three fingers. Gallbladder contains multiple stones. Left liver lobe mobilized in the hiatus. Crura, extremely thin and frail, approximated behind the oesophagus. Cholecystectomy. Gastropexia geniculata anterior.
Postoperative Course: Uneventful.
Follow-up: Patient is symptom-free.
Radiological re-examination: No recurrence. No reflux.

CASE 71

H.M. 13133. Female, aged 66 years. *Admitted:* 11-6-57. *Discharged:* 2-7-57.

History: Pain under lower sternum since 30 years before admission. Associated heartburn and belching. All complaints aggravated by bending forward. Small haematemesis two months before admission. Occasionally melaena stools.
Examination: Frail elderly woman. General examination: NAD. Abdomen: NAD. Hb: 67. W.B.C: 6700. No occult blood in the faeces.
Radiological examination: Gallbladder: Concentrates the dye well. Multiple stones. Egg-sized, sliding hiatus hernia.
Conclusion: Cholelithiasis. Sliding hiatus hernia with severe symptoms. Haematemesis.
Operation (27-6-57): Median upper abdominal incision with removal of xiphoid process. Gallbladder contains stones. Hiatus admits three fingers. Left liver lobe mobilized and retracted to the right. Peritoneum incised in the hiatus. Oesophagus mobilized. Crural fibres approximated behind the oesophagus. Cholecystectomy. Gastropexia geniculata anterior.
Postoperative Course: Uneventful.
Follow-up: Patient is symptom-free.
Radiological re-examination: No recurrence. No reflux.

CASE 72

H.M. 13172. Female, aged 74 years. *Admitted:* 2-7-57. *Discharged:* 19-9-57.

History: Burning epigastric pain since three years before admission. Pain comes on during meals and is aggravated by bending forward or lying down. Wakes up at night with epigastric and substernal pain, which is relieved by a glass of milk. Regurgitation of acid fluid into the mouth on bending forward. This sometimes contains blood. Since February 1957 repeated haematemesis and melaena for which she was admitted elsewhere and treated with blood transfusion and ulcer regime.
Examination: Rather obese, elderly woman. Anaemic. General examination otherwise NAD. Abdomen: NAD. Hb: 57. W.B.C: 4900. E.S.R: 29. Faeces occult blood test strongly positive. Fractional test meal: 50/30.
Radiological examination: Mandarinsized sliding hiatus hernia which does not reduce in the upright position. There is free reflux of barium into the oesophagus not only in the horizontal position, but also in the upright position with every slight increase of intra-abdominal pressure.
The cardiac mechanism seems to be completely incompetent.
Oesophagoscopy: Severe oesophagitis in distal gullet. Free reflux of gastric contents into the oesophagus. Oesophagus is filled with bloodstained fluid.
Conclusion: Large sliding hiatus hernia complicated by severe oesophagitis, haematemesis and melaena.
Pre-operative Treatment: Repeated blood transfusion.
Operation (18-7-57): Median upper abdominal incision with removal of xiphoid process. Hiatus admits whole hand. Left liver lobe mobilized and retracted to the right. Peritoneum incised in the hiatus. Hernia reduced with ease and oesophagus mobilized. The crura are

thin and frail especially on the left side. These are approximated behind the oesophagus. Gastropexia geniculata anterior.
Postoperative Course: On the tenth postoperative day, when the patient was already mobilized, she again complained of epigastric pain which persisted during the next few days. Vomited after meals. Three weeks after the operation patient again had haematemesis; blood transfusions given. At radiological re-examination there was still marked reflux into the oesophagus.
Oesophagoscopy was repeated and patient still found to have oesophagitis. Treated with continuous milk-alkali drip on which condition of patient slowly improved. On discharge patient could eat normally. Hb: 88.
Follow-up: Patient has had no recurrence of pain or heartburn. No vomiting. Still has regurgitation into the mouth on bending forward, however.
Radiological re-examination: Small sliding hiatus hernia still present, with large angle of His. Free reflux, even at an angle of 45°.

CASE 73

H.M. 14211. Male, aged 32 years. *Admitted:* 5-8-57. *Discharged:* 29-8-57.

History: Since many years before admission, burning pain below sternum which is aggravated by bending forward or lying down. Comes on during or directly after meals. For these complaints partial gastrectomy done elsewhere in 1955. Symptoms unchanged after the operation. Laparotomy done in 1956; no abnormalities detected. Slight dysphagia for solid foods.
Examination: Rather thin adult male. General examination: NAD. Abdomen: Scars of previous operations, otherwise NAD. Hb: 95. E.S.R: 6. No occult blood in the faeces.
Radiological examination: Presence of hiatus hernia suspected in Trendelenburg position. Confirmed on repeated examination and by means of metal clip, placed at the cardia during oesophagoscopy. Gastrectomy stomach (Billroth I).
Oesophagoscopy: No abnormalities seen.
Conclusion: Sliding hiatus hernia with severe symptoms.
Operation (13-8-57): Median upper abdominal incision with removal of xiphoid process. Multiple adhesions. Hiatus admits three fingers. Peritoneum incised in the hiatus and oesophagus mobilized. Crural fibres approximated behind the oesophagus. Gastropexia geniculata anterior.
Postoperative Course: Uneventful.
Follow-up: No recurrence of hernial symptoms.
Radiological re-examination: No recurrence. No reflux.

CASE 74

H.M. 5413. Female, aged 44 years. *Admitted:* 12-8-57. *Discharged:* 6-9-57.

History: Since 1½ years before admission pain behind lower sternum after meals, associated with heartburn and much belching. Wakes up at night with pain.
Examination: Healthy-looking woman. General examination: NAD. Abdomen: NAD. Hb: 87. W.B.C: 5600. E.S.R: 5. No occult blood in the faeces. Fractional test meal: 40/20.
Radiological examination: Mandarinsized sliding hiatus hernia.
Oesophagoscopy: Cardia at 38 cm. Reflux of gastric contents into the oesophagus. Oesophagitis.
Conclusion: Sliding hiatus hernia complicated by oesophagitis.
Operation (19-8-57): Median upper abdominal incision with removal of xiphoid process. Hiatus admits four fingers. Left liver lobe mobilized and retracted to the right. Oesophagus mobilized in the hiatus. Crural fibres approximated behind the oesophagus. Gastropexia geniculata anterior.
Postoperative Course: Uneventful.
Follow-up: Patient is symptom-free.
Radiological re-examination: No recurrence. No reflux.

CASE 75

H.M. 13242. Female, aged 59 years. *Admitted:* 19-8-57. *Discharged:* 11-9-57.

History: Tired and listless due to unexplained anaemia. Treated with iron preparations. Also

complains of heartburn and regurgitation of acid fluid into the mouth on bending forward. Wakes up at night with severe heartburn. Slight dysphagia for solid foods since one month before admission. On account of this X-ray examination done and hiatus hernia found.
Examination: Pale, middle-aged woman. General examination: Anaemic, otherwise NAD. Abdomen: NAD. Hb. 42. W.B.C: 5100. E.S.R: 10. Bloodsmear: Microcytic hypochromic. Faeces occult blood test positive. Fractional test meal: 43/26.
Radiological examination: Very large hiatus hernia of the mixed type with marked reflux into distal oesophagus.
Oesophagoscopy: Marked oesophagitis starting at 20 cm. Bleeding superficial ulceration. Reflux of gastric contents through the cardia.
Conclusion: Large hiatus hernia of mixed type complicated by oesophagitis and anaemia.
Pre-operative Treatment: Milk-alkali nasal drip into proximal oesophagus. Repeated blood transfusion.
Operation (28-8-57): Median upper abdominal incision with removal of xiphoid process. Hiatus admits whole hand. Peritoneum incised in the hiatus and oesophagus mobilized. Redundant edges of hernial sac excised. Crura approximated behind oesophagus with five silk sutures. Gastropexia geniculata anterior.
Postoperative Course: Uneventful.
Follow-up: Patient is symptom-free. Hb: 91.
Radiological re-examination: No recurrence. No reflux.

CASE 76

H.M. 14436. Boy, aged 6 years. *Admitted:* 2-9-57. *Discharged:* 19-9-57.

History: Symptoms since directly after birth. Vomited after every feed. Vomitus often streaked with blood. Strongly retarded growth as a result of deficient diet. Treated for hypochromic anaemia. Later hiatus hernia detected elsewhere. Treated conservatively. No improvement of symptoms of anaemia. Continued to have occult blood in the faeces.
Examination: Mentally retarded child, frail, and small for his age. General examination: Signs of aorta stenosis (confirmed by cardiological examination). Anaemic. Abdomen: NAD. Hb: 66. W.B.C: 6700. Faeces occult blood test strongly positive.
Radiological examination: Sliding hiatus hernia with reflux. Hernia reduces in the erect position.
Oesophagoscopy: Reflux of gastric contents into the oesophagus. Marked oesophagitis with superficial ulceration.
Conclusion: Sliding hiatus hernia, complicated by severe oesophagitis. Anaemia.
Pre-operative Treatment: Repeated blood transfusion until Hb: 88. Oesophagitis treated with continuous milk-alkali drip.
Operation: (5-9-57): Median upper abdominal incision. Hiatus admits two fingers. Oesophagus mobilized in the hiatus. Crural fibres approximated behind the oesophagus. Gastropexia geniculata anterior.
Postoperative Course: Uneventful. Completely symptom-free on discharge.
Follow-up: Robust-looking, seven-year-old. Completely free of abdominal symptoms. Eats normally. No anaemia.
Radiological re-examination: No recurrence. No reflux.

CASE 77

H.M. 13290. Female, aged 62 years. *Admitted:* 20-9-57. *Discharged:* 9-11-57

History: Burning pain behind lower sternum and in the epigastrium of 13 years standing. Radiates up into the neck. Worse after meals and aggravated by bending forward. Regurgitation of frothy fluid into the mouth on occasions.
Examination: Healthy-looking female. General examination: NAD. Abdomen: NAD. Hb: 80. W.B.C: 6400. E.S.R: 16. No occult blood in the faeces. Fractional test meal: 35/25.
Radiological examination: Small, sliding hiatus hernia with reflux.
Oesophagoscopy: No abnormal findings.
Conclusion: Sliding hiatus hernia with severe symptoms.
Operation (19-10-57): Median upper abdominal incision with removal of xiphoid process. Left liver lobe retracted to the right. Hiatus admits three fingers. Peritoneum incised in the

hiatus. Oesophagus mobilized. Crural fibres approximated behind the oesophagus. Gastropexia geniculata anterior.
Postoperative Course: Uneventful.
Follow-up: Patient is symptom-free.
Radiological re-examination: No recurrence. No reflux.

CASE 78

H.M. 13340. Female, aged 66 years. *Admitted:* 11-12-57. *Discharged:* 10-1-58.

History: Since 1952 burning pain under lower sternum which radiates to the neck. Pain comes on after meals and is aggravated by lying down or bending forward. Pain periodically radiates to the right ear. Occasionally regurgitation of fluid into the mouth. Immediately before admission to our clinic, patient was treated in the department of Gynaecology for adnexitis.
Examination: Rather obese, eldery woman. General examination: NAD. Abdomen: NAD. Hb: 94. W.B.C: 11900. E.S.R: 9. No occult blood in the faeses. Fractional test meal: 33/15. Radiological examination: Large sliding hiatus hernia. Reflux. Oesophagoscopy: Mild oesophagitis.
Conclusion: Sliding hiatus hernia with severe symptoms.
Operation (16-12-57): Median upper abdominal incision with removal of xiphoid process. Hiatus admits four fingers. Left liver lobe mobilized and retracted to the right. Peritoneum incised in the hiatus and oesophagus mobilized. Crura approximated behind the oesophagus with silk sutures. Gastropexia geniculata anterior.
Postoperative Course: Uneventful apart from slight phlebitis of left leg.
Follow-up: Symptoms greatly improved by operation. No longer gets substernal or ear pain. Still occasionally regurgitation on bending forward, however.
Radiological re-examination: No recurrence. Still reflux in Trendelenburg position.

CASE 79

H.M. 13368. Female, aged 61 years. *Admitted:* 9-12-57. *Discharged:* 22-1-58.

History: Since 1950 epigastric pain approximately one hour after meals. Heartburn. Occasional vomiting. Symptoms aggravated by bending forward or lying down. Cholecystectomy in 1952 after two attacks of gallstone colic. Epigastric symptoms not relieved by the operation. At laparotomy, which was also done elsewhere, no abnormalities were detected. Lately symptoms progressively worse.
Examination: Thin, elderly woman. General examination: NAD. Abdomen: Scars of previous operations. Incisional hernia in epigastric scar. Hb: 80. W.B.C: 4800. E.S.R: 2. No occult blood in the faeces. Fractional test meal: 80/70.
Radiological examination: Sliding hiatus hernia with reflux.
Oesophagoscopy: No abnormalities detected.
Conclusion: Sliding hiatus hernia with severe symptoms.
Operation: (17-12-57): Median upper abdominal incision. Sac of incisional hernia removed. Multiple adhesions in upper abdomen. Left liver lobe mobilized and retracted to the right. Hiatus admits two fingers with ease. Oesophagus mobilized in the hiatus. Crura extremely thin and frail. Crural fibres approximated behind the oesophagus. Gastropexia geniculata anterior.
Postoperative Course: Signs of thrombosis in the right calf. Treated wi th anticoagulants. Otherwise uneventful recovery.
Follow-up: Patient is symptom-free.
Radiological re-examination: No recurrence. No reflux.

CASE 80

H.M. 13369. Female, aged 58 years. *Admitted:* 9-12-57. *Discharged:* 8-1-58.

History: Epigastric discomfort of 14 years standing. Much troubled by heartburn. Symptoms aggravated by bending forwards.

Examination: Rather obese middle-aged woman. General examination: NAD. Abdomen: NAD. Hb: 73. W.B.C: 5500. E.S.R: 4. No occult blood in the faeces. Fractional test meal: 33/10.
Radiological examination: Plum-sized, sliding hiatus hernia with reflux. Gallbladder: Concentrates the dye well. Multiple stones. Oesophagoscopy: No abnormal findings.
Conclusion: Sliding hiatus hernia with severe symptoms. Cholelithiasis.
Operation: (20-12-57): Median upper abdominal incision with removal of xiphoid process. Gallbladder contains multiple stones. Hiatus admits three fingers. Left liver lobe mobilized and retracted to the right. Peritoneum incised in the hiatus. Oesophagus mobilized. Crural fibres approximated behind the oesophagus with silk sutures. Cholecystectomy. Gastropexia geniculata anterior.
Postoperative Course: Mild signs of thrombosis in the right calf on tenth postoperative day. Patient treated with anticoagulants. Further postoperative course uneventful.
Follow-up: Patient is symptom-free.
Radiological re-examination: No recurrence. No reflux.

CASE 81

H.M. 13419. Female, aged 64 years. *Admitted:* 5-1-58. *Discharged:* 29-1-58.

History: Since 10 years before admission angina pectoris, responding favourably to glyceryl trinitrate. Since one year attacks of colicky pain in the right upper abdomen; once associated with jaundice. Between attacks, continuous epigastric pain, which is aggravated by bending forward.
Examination: Obese elderly woman. Cardiovascular system: NAD. Abdomen: NAD. Hb: 77. W.B.C: 6300. E.S.R: 33. No occult blood in the feaces. Fractional test meal: 45/24. E.C.G: Signs of mild ischaemia, otherwise NAD. Radiological examination: Chest: NAD. Gallbladder: Functions poorly. Contains multiple stones. Small, sliding hiatus hernia.
Oesophagoscopy: Cardia at 32 cm. Signs of mild oesophagitis.
Conclusion: Angina pectoris. Cholelithiasis. Sliding hiatus hernia with oesophagitis.
Operation (31-1-58): Median upper abdominal incision with removal of xiphoid process. Gallbladder contains stones. Hiatus admits two fingers. Left liver lobe mobilized and retracted to the right. Peritoneum incised in the hiatus. Oesophagus mobilized. Crural fibres approximated with silk sutures behind the oesophagus. Cholecystectomy. Gastropexia geniculata anterior.
Postoperative Course: On the second postoperative day patient developed auricular flutter. Treated with digoxin. Otherwise uneventful recovery. On discharge, normal pulse.
Follow-up: Patient still suffers from angina pectoris. No abdominal symptoms.
Radiological re-examination: No recurrence. No reflux.

CASE 82

Private patient of Prof. Boerema. Mrs. H. G. K. M-B. Female, aged 58 years. *Admitted:* 11-1-58. *Discharged:* 5-2-58.

History: Since four years before admission, sensation as if food sticks under lower sternum. Ulcer regime three years ago after melaena. A year before admission large haematemesis. Hiatus hernia and duodenal ulcer found on admission elsewhere. Ulcer regime, again without success. Has subsequently had another haematemesis.
Examination: Rather obese woman. General examination: NAD. Abdomen: NAD. Hb: 85 W.B.C: 5600. E.S.R: 30. Faeces occult blood test positive. Fractional test meal: 70/53.
Radiological examination: Grapefruitsized sliding hiatus hernia. Ulcer niche in the cardia. Oesophagoscopy: Signs of oesophagitis. Ulcer seen at the cardia.
Conclusion: Large sliding hiatus hernia complicated by oesophagitis and oesophageal ulcer.
Operation (15-1-58): Median upper abdominal incision. Hiatus admits four fingers. Oesophagus mobilized in the hiatus. No external signs of ulceration detected. Crura approximated behind the oesophagus. Gastropexia geniculata anterior.
Postoperative Course: Uneventful.
Follow-up: Patient is completely symptom-free.
Radiological re-examination: Not done.

CASE 83

H.M. 13413. Female, aged 51 years. *Admitted:* 3-1-58. *Discharged:* 6-2-58.

History: Since 20 years before admission recurrent attacks of gallstone colic, twice associated with jaundice. In addition, since one year epigastric pain; worse after meals. Was often nauseous but did not vomit. Occasional heartburn.
Examination: Healthy-looking middle-aged female. General examination: NAD. Abdomen: NAD. Hb: 81. W.B.C: 5200. E.S.R: 9. No occult blood in the faeces.
Radiological examination: Chest: NAD. Straight X-ray abdomen: Multiple calcified opacities in upper abdomen. Gallbladder: Functions poorly, contains stones. Oesophagus and Stomach: NAD. No hiatus hernia detected.
Conclusion: Cholelithiasis. Unexplained epigastric symptoms.
Operation (17-1-58): Incision under right costal margin. The gallbladder contains numerous stones and is surrounded by adhesions. The hiatus admits three fingers and the stomach can be displaced approximately three inches into the thorax. Small, white nodules on the surface of the liver. No other abnormalities detected. Incision lengthened medially to the xiphoid process, which is removed. Peritoneum incised in the hiatus. Hiatus narrowed behind the oesophagus by approximation of the crura with silk sutures. Cholecystectomy. Biopsy taken of nodule on liver surface. Gastropexia geniculata anterior.
Postoperative Course: Uneventful. Pathological report on calcified nodule: Calcified, healed, miliary tuberculosis.
Follow-up: Patient is symptom-free.
Radiological re-examination: No recurrence. No reflux.

CASE 84

H.M. 14845. Male, aged 70 years. *Admitted:* 8-3-58. *Discharged:* 27-3-58.

History: Since six years before admission, burning pain under lower sternum which radiates through to the back. Swallowing induces pain. Excessive heartburn. Admitted elsewhere in 1955 after large haematemesis. Hiatus hernia and oesophagitis diagnosed. Patient considered not fit for operation due to marked kyphoscoliosis and severe emphysema. Treated conservatively without success.
Examination: Thin, elderly male with marked kyphoscoliosis of lumbar and thoracic spine. Emphysema of the lungs. Abdomen: NAD. Hb: 78. Faeces occult blood test positive. Fractional test meal: 90/53.
Radiological examination: Large sliding hiatus hernia which does not reduce in the erect position. Kyphoscoliosis and emphysema of the lungs.
Oesophagoscopy: Signs of marked oesophagitis.
Conclusion: Sliding hiatus hernia with severe oesophagitis.
Pre-operative Treatment: Continuous milk-alkali drip.
Operation (13-3-58): Median upper abdominal incision with removal of xiphoid process. Left liver lobe mobilized and retracted to the right. Hiatus admits three fingers next to the herniated stomach. As a result of the kyphoscoliosis the crural fibres run in a completely transverse direction. Peritoneum incised in the hiatus. Stomach reduced into the abdomen and oesophagus mobilized in the hiatus. Crural fibres approximated behind the oesophagus. Gastropexia geniculata anterior.
Postoperative Course: Uneventful.
Follow-up: Patient is completely symptom-free.
Radiological re-examination: No recurrence. No reflux.

CASE 85

H.M. 13520. Female, aged 51 years. *Admitted:* 10-3-58. *Discharged:* 8-4-58.

History: Since three years before admission, attacks of gallstone colic. In between attacks also burning pain under lower sternum radiating through to the back.
Examination: Middle-aged woman of normal build. General examination: Hypertension, otherwise NAD. Abdomen: NAD. Hb: 84. W.B.C: 3600. E.S.R: 16. No occult blood in the faeces. Fractional test meal: 75/55.
Radiological examination: Mandarinsized sliding hiatus hernia with reflux.
Gallbladder: Multiple stones. Concentrates the dye well.

Oesophagoscopy: Oesophagitis of distal gullet. Reflux.
Conclusion: Sliding hiatus hernia, complicated by oesophagitis. Cholelithiasis.
Operation (21-3-58): Median upper abdominal incision with removal of xiphoid process. Gallbladder contains stones. Hiatus admits four fingers. Oesophagus mobilized in the hiatus. Crural fibres approximated behind the oesophagus with silk sutures. Cholecystectomy. Gastropexia geniculata anterior.
Postoperative Course: Uneventful.
Follow-up: Patient is symptom-free.
Radiological re-examination: No recurrence. No reflux.

CASE 86

H.M. 13501. Female infant, aged 1½ years. *Admitted:* 26-2-58. *Discharged:* 2-5-58.

History: In hospital elsewhere since birth. Vomiting after feeds since immediately after birth. Vomitus sometimes streaked with blood and often projectile. At age of one month, laparotomy done elsewhere; no abnormalities detected. Condition progressively worse. At the age of 9 months gastrostomy made, through which the child was fed. General condition improved somewhat and gastrostomy could be closed two months before admission here. Vomiting recurred, however, and child was admitted in very poor general condition.
Examination: Thin, under-developed child. Continual coughing. Abdomen: Upper abdominal scar, otherwise NAD. Hb: 76. E.S.R: 5. Faeces occult blood test positive.
Radiological examination: Plumsized sliding hiatus hernia. Dilated distal oesophagus, ending in an acute narrowing above the cardia, which allows only a small quantity of very thin barium to pass.
Oesophagoscopy: Evident oesophagitis with stenosis terminally, which does not admit the smallest bougie.
Conclusion: Sliding hiatus hernia complicated by oesophagitis and probably oesophageal stricture.
Pre-operative Treatment: Continuous milk-alkali drip for two weeks.
Infant could gradually swallow fluids and mashed food without vomiting.
Operation (31-3-58): Median upper abdominal incision. Left liver mobilized. Hiatus admits at least two fingers. Peritoneum incised in the hiatus. Cardia reduced into the abdomen. At this stage it is not possible to pass a tube through the oesophagus into the stomach, thus confirming the presence of an organic stenosis directly above the cardia. It was decided to resect the diseased portion of the oesophagus. Lesser curvature removed with the terminal oesophagus and cardia. Greater curvature formed into tubular stomach. Pylorotomy. Abdomen closed.
5th intercostal space opened on the left. Mediastinum opened. Terminal oesophagus with stenosis resected. End-to-end anastomosis between dilated oesophagus and tubular stomach. Mediastinum and chest closed.
Pathological report on resected specimen: "Stenosis, ½ cm. in length in terminal oesophagus. Diameter approximately 2 mm. This is followed by 1 cm. of oesophagus before terminating in the cardia. The stenosis is therefore situated in the oesophagus itself, and is formed by scar tissue through all layers of the oesophagus. No signs of acute inflammation."
Postoperative Course: Uneventful. Normal meals on discharge.
Follow-up: Child is now two years of age. General appearance markedly improved. Eats normally.
Radiological re-examination: Unobstructed passage through anastomosis.

CASE 87

H.M. 13552. Female, aged 74 years. *Admitted:* 28-3-58. *Discharged:* 1-5-58.

History: Since many years burning epigastric pain after meals, associated with heartburn and belching. In 1951 hiatus hernia repaired elsewhere through the chest. All symptoms recurred immediately after the operation, however. Now admitted with burning epigastric and substernal pain, aggravated by bending forward and lying down. Slight dysphagia for solid foods.
Examination: Thin, elderly woman. General examination: NAD. Abdomen: NAD. Hb: 92. W.B.C: 5600. E.S.R: 22. No occult blood in the faeces.
Fractional test meal: 35/20.
Radiological examination: Sliding hiatus hernia. Reflux.

Oesophagoscopy: Oesophagitis in distal gullet.
Conclusion: Recurrence of sliding hiatus hernia complicated by oesophagitis.
Operation (4-4-58): Median upper abdominal incision with resection of xiphoid process. Left liver lobe mobilized and retracted to the right. Hiatus admits two fingers. Peritoneum incised in the hiatus and oesophagus mobilized. Crura approximated behind the oesophagus. Gastropexia geniculata anterior.
Postoperative Course: Uneventful.
Follow-up: Patient is symptom-free.
Radiological re-examination: No recurrence. No reflux.

CASE 88

H.M. 13706. Female, aged 66 years. *Admitted:* 24-4-58. *Discharged:* 10-5-58.

History: Attacks of substernal pain since pregnancy 37 years ago. Pain has burning character and comes on with meals. In addition sensation as if food sticks behind the lower sternum. Symptoms aggravated by lying down or bending forward.
Examination: Healthy-looking elderly woman. General examination: NAD. Abdomen: NAD. Hb: 85. W.B.C: 4500. E.S.R: 23.
Radiological examination: Sliding hiatus hernia.
Conclusion: Sliding hiatus hernia with severe symptoms.
Operation (26-4-58): Median upper abdominal incision with removal of xiphoid process. Hiatus admits 4 fingers. Left liver lobe mobilized and retracted to the right. Oesophagus mobilized in the hiatus. Crura approximated behind the oesophagus with silk sutures. Gastropexia geniculata anterior.
Postoperative Course: Uneventful.
Follow-up: Patient is symptom-free.
Radiological re-examination: Not done.

CASE 89

H.M. 13621. Female, aged 68 years. *Admitted:* 2-5-58. *Discharged:* 29-5-58.

History: Since two years before admission, progressive complaints of pain under lower sternum after meals, which is aggravated by lying down or bending forward. Belching relieves the pain. Eventually had to take her meals standing.
Examination: Rather nervous, elderly woman. Thoracic kyphosis. Abdomen: NAD. Hb: 82. W.B.C: 6000. E.S.R: 7. No occult blood in the faeces.
Radiological examination: Orangesized hiatus hernia which does not reduce in the erect position. The hernia is largely para-oesophageal, but the cardia is also situated above the hiatus, therefore this is a hernia of the mixed type. On the lateral straight chest X-ray, an air bubble with fluid level is seen in the posterior thorax.
Oesophagoscopy: Oesophagitis of distal oesophagus. Reflux.
Conclusion: Large hiatus hernia of mixed type, complicated by oesophagitis.
Operation (14-5-58): Median upper abdominal incision with removal of xiphoid process. Gallbladder contains stones. Left liver lobe mobilized and retracted to the right. Hiatus admits four fingers. Stomach reduced into the abdomen with ease. Redundant hernial sac in front of the oesophagus removed. Crural fibres approximated behind the oesophagus with silk sutures. Gastropexia geniculata anterior.
Postoperative Course: Uneventful.
Follow-up: Patient is symptom-free.
Radiological re-examination: No recurrence. No reflux.

CASE 90

H.M. 13650. Female, aged 58 years. *Admitted:* 20-5-58. *Discharged:* 16-6-58.

History: Since 4 years before admission, general malaise, dizzyness and dyspnoea on exertion. On examination, general practitioner found marked anaemia. Patient treated on iron preparations. Since 2 years ago, also upper abdominal complaints. Epigastric and substernal pain,

aggravated by bending forward or lying down. Heartburn. Admitted elsewhere and put on ulcer regime. No improvement of symptoms. Lately melaena stools.
Examination: Rather obese woman. Anaemic. Marked kyphoscoliosis. Abdomen: NAD. Hb: 50. W.B.C: 3600. E.S.R: 11. Faeces occult blood test positive. Fractional test meal: 17/3.
Radiological examination: Orangesized sliding hiatus hernia which does not reduce in the erect position. Tortuous distal oesophagus. Reflux. Kyphoscoliosis of thoracic and lumbar spine.
Oesophagoscopy: No signs of oesophagitis.
Conclusion: Large sliding hiatus hernia. Anaemia.
Pre-operative Treatment: Repeated blood transfusion.
Operation (30-5-58): Median upper abdominal incision with removal of xiphoid process. Very large hiatus which admits the whole hand. Left liver lobe mobilized and retracted to the right. Peritoneum incised in the hiatus. Stomach reduced into the abdomen with ease. Oesophagus mobilized in the hiatus. Crural fibres extremely frail and thin and run obliquely from left to right as a result of the scoliosis. Crura approximated behind the oesophagus with silk sutures. The greater curvature is not attached to the diaphragm as a result of a somewhat enlarged spleen. Gastropexia geniculata anterior.
Postoperative Course: Uneventful.
Follow-up: Patient is symptom-free. No anaemia.
Radiological re-examination: No recurrence. No reflux.

CASE 91

H.M. 15053. Male, aged 72 years. *Admitted:* 28-5-58. *Discharged:* 26-6-58.

History: Upper abdominal complaints of at least 40 years standing, consisting of fulness after meals and severe heartburn. Symptoms aggravated by bending forward or lying down and also by exertion. Relieved by alkalis.
Examination: Healthy-looking, elderly male. General examination: NAD. Abdomen: Small epigastric hernia, otherwise NAD. Hb: 85. W.B.C: 6600. E.S.R: 10. Fractional test meal: 40/20.
Radiological examination: Large sliding hiatus hernia which does not reduce in the erect position.
Oesophagoscopy: Diffuse oesophagitis. Biopsies taken. (Pathological report: "No malignancy".)
Conclusion: Sliding hiatus hernia complicated by oesophagitis.
Operation (4-6-58): Median upper abdominal incision with removal of xiphoid process. Left liver lobe mobilized and retracted to the right. Hiatus admits four fingers. Oesophagus mobilized in the hiatus. Crural fibres approximated behiind the oesophagus. At this stage a small longitudinal tear is discovered in the distal oesophagus. This is closed with interrupted catgut and silk sutures. Gastropexia geniculata anterior.
Postoperative Course: On the 10th postoperative day, a small fistula developed in the abdominal wound, probably originating at the ruptured oesophagus. Fistula had closed spontaneously at discharge.
Follow-up: Initially troublesome dysphagia. This has gradually improved and has nearly disappeared completely. No recurrence of epigastric symptoms or heartburn. Very satisfied with the operation.
Radiological re-examination: No recurrence. No reflux. No narrowing of cardiac region as result of oesophageal rupture.
Post Script: Patient was recently re-admitted with small bowel obstruction caused by adhesions.

CASE 92

H.M. 8518. Female, aged 70 years. *Admitted:* 28-5-58. *Discharged:* 27-6-58.

History: Cholecystectomy in 1950. Since the operation still has upper abdominal complaints, no longer colicky but of continuous nature. Constant burning pain in the epigastrium, worse after meals. Aggravated by bending forward or lying down. Wakes up at night with pain. Much belching.
Examination: Rather obese elderly woman. General examination: NAD. Abdomen: NAD apart

from cholecystectomy scar. Hb: 82. W.B.C: 8600. E.S.R: 12. No occult blood in the faeces. Fractional test meal: 70/40.
Radiological examination: Small sliding hiatus hernia.
Oesophagoscopy: Marked oesophagitis of distal oesophagus. Reflux.
Conclusion: Sliding hiatus hernia complicated by oesophagitis.
Operation (11-6-58): Median upper abdominal incision. Hiatus admits three fingers. Left liver lobe mobilized and retracted to the right. Oesophagus mobilized in the hiatus. Crura of diaphragm approximated behind the oesophagus with silk sutures. Gastropexia geniculata anterior.
Postoperative Course: Uneventful.
Follow-up: Patient is symptom-free.
Radiological re-examination: No recurrence. No reflux.

CASE 93

H.M. 13683. Female, aged 57 years. *Admitted:* 13-6-58. *Discharged:* 15-7-58.

History: Fullness after meals since three years before admission. Dysphagia for solid foods; sensation as if food sticks behind lower sternum.
Examination: Obese middle-aged woman. General examination: NAD. Abdomen: NAD. Hb: 92. W.B.C: 6800. E.S.R: 7. No occult bloood in the faeces. Fractional test meal: 40/30.
Radiological examination: Orangesized hiatus hernia of mixed type.
Oesophagoscopy: Cardia at 38 cm. No signs of oesophagitis.
Conclusion: Hiatus hernia of mixed type with severe symptoms.
Operation (20-6-58): Median upper abdominal incision with removal of xiphoid process. Hiatus admits the whole hand. Stomach reduced with ease. Oesophagus mobilized in the hiatus. Crura approximated behind the oesophagus with silk sutures. Gastropexia geniculata anterior.
Postoperative Course: Signs of thrombosis in right leg on 14th postoperative day. Treated on anticoagulants. Complete recovery.
Follow-up: Patient is symptom-free.
Radiological re-examination: No recurrence. No reflux.

CASE 94

H.M. 13694. Female, aged 38 years. *Admitted:* 16-6-58. *Discharged:* 16-7-58.

History: Since ten years before admission, burning epigastric pain after meals, associated with nausea and occasional vomiting. Vomitus sometimes contains streaks of blood. Severe heartburn. All complaints aggravated by bending forward. Five years ago ulcer regime for possible duodenal ulcer. No relief of symptoms. Sliding hiatus hernia detected elsewhere.
Examination: Woman of normal build. General examination: NAD. Abdomen: NAD. Hb: 78. W.B.C: 5800. No occult blood in the faeces. Fractional test meal 45/30.
Radiological examination: No hernia could be demonstrated on repeated examination in Trendelenburg.
Oesophagoscopy: No abnormalities detected.
Conclusion: Sliding hiatus hernia with severe symptoms.
Operation (30-6-58): Median upper abdominal incision with removal of xiphoid process. Hiatus admits at least two fingers. No other intra-abdominal pathology detected. Oesophagus mobilized in the hiatus. Crura approximated behind the oesophagus with silk sutures. Gastropexia geniculata anterior.
Postoperative Course: Uneventful.
Follow-up: Patient is symptom-free.
Radiological re-examination: No recurrence. No reflux.

Oesophageal hiatus hernia can be defined as the herniation of an abdominal viscus, usually the stomach, through the oesophageal hiatus of the diaphragm into the chest.

Until the turn of the last century this disorder was practically unknown. With the discovery by *Morrison* and *Healy* in 1922 that these hernias of the stomach can be demonstrated by barium examination in the recumbant position, the disease became increasingly better known. *Akerlund* in 1926, in a systematic review of the subject, developed a classification of hiatus hernia which is still in use. Today, examination of the stomach in Trendelenburg position is an integral part of every complete gastro-intestinal study. The high incidence of the disease, moreover, is unanimously accepted.

With the advent of oesophagoscopy, the knowledge of hiatus hernia was further extended. This investigation became recognized, not only as a means of diagnosis, but led to the discovery that hiatus hernia may be the cause of serious oesophageal disease. Today reflux oesophagitis is recognized as the most common, and at the same time the most serious, complication of hiatus hernia.

The recognition of reflux oesophagitis as a complication of hiatus hernia stimulated the further study of the closing mechnism between oesophagus and stomach. As a result of extensive investigation during the past 10 years, more information on the normal anatomy and function of the cardiac region has become available (Chapters II & III).

The various factors which play a part in the aetiology of hiatus hernia are reviewed in Chapter IV. Where the hernia occurs in babies or young children, its presence seems to be the result of congenital defects at the hiatus. The majority of hernias occur after the fourth decade, however, probably as a result of structural atrophy in the hiatal region. Contraction of the longitudinal muscle fibres of the oesophagus in response to vago-vagal reflexes or secondary to oesophagitis, may be an additional aetiological factor.

In the next chapter the various types of hiatus hernia are classified and discussed.

Chapter VI concerns the symptomatology, both in infants and in adults. Symptoms are produced either by the presence of an abnormal space-occupying mass in the thorax, or as a result of incompetence of the cardiac mechanism and resultant oesophagitis. Gastro-intestinal haemorrhage may cause a third symptom complex. Patients may also present with symptoms referred to distant organs along a variety of nerve pathways.

If the presence of a hiatus hernia is suspected clinically, roentgenological examination and oesophagoscopy are employed to confirm the diagnosis and to detect possible complications (Chapter VII).

Not only are the symptoms of hiatus hernia often distressing, but serious and occasionally fatal complications may occur. These complications which are the result of oesophagitis or ulceration in the herniated stomach or obstruction at the hiatal ring, are discussed in Chapter VIII.

The treatment of oesophageal hiatus hernia when associated with typical symptoms should be surgical. When complications are present, surgical repair becomes urgent (Chapter IX).

Medical measures, as described in Chapter X, are only employed where operative repair is contra-indicated on account of old age, another disease or other factors. In addition, medical measures are occasionally used pre- or postoperatively.

In Chapter XI the technical details of a number of operations, which have been described for the treatment of hiatus hernia, are discussed. The results of these operations have been reported in large series of cases. Although the authors of these techniques have indicated that in their hands the procedures have not been associated with an important recurrence rate, others have reported a discouraging number of failures. In Chapter XIII Gastropexia geniculata anterior, as developed by *Boerema*, is justified as the only procedure which not only corrects the anatomical deformity, but restores the normal physiology of the cardia. The technical details of this operation are supplied in Chapter XII.

Part II concerns the results of a complete clinical and roentgenological follow-up examination of 94 oesophageal hiatus hernia cases operated in the surgical clinic of the Wilhelmina Gasthuis, Amsterdam (Head: Prof. I. Boerema). Only 7 of these patients were less than 30 years old, the majority, i.e. 86%, being older than 40 years. There was a striking preponderance in the female, the ratio of females to males being 3 : 1. The symptomatology confirmed the impression that although the complaints may be varied, the symptoms of hiatus hernia usually form a typical pattern. The most common symptom complex was that of epigastric or substernal pain, usually of a burning character and influenced by postural changes. Heartburn, belching and mild dysphagia are other characteristic features. Effortless regurgitation indicated gross cardiac incompetence. There may be haemorrhage, both manifest and occult. Referred pain is not uncommon.

Whereas the symptomatology was usually typical, physical examination rarely presented diagnostic features.

The diagnosis was confirmed by radiological examination in Trendelenburg position. There were no cases of true congenitally short oesophagus. By far the largest number of patients, i.e. 87.8% had sliding hernias, 6.7% had para-oesophageal hernias and 5.5% had hernias of the mixed variety.

Oesophagoscopy is an essential diagnostic procedure. It not only confirms the radiological diagnosis, but is the only positive means of detecting

oesophagitis. Twenty-nine of our patients had serious reflux oesophagitis. It is essential to treat these patients pre-operatively in order to prevent complications during operation and to enhance the success of the surgical repair.

Various operative procedures had been followed in this series and the hernia repaired by both the trans-thoracic and trans-abdominal routes. All patients operated trans-thoracically had recurrence of symptoms immediately after operation. Very poor results were also obtained trans-abdominally by narrowing of the hiatus and securing the oesophagus to the hiatal rim or attaching the stomach to the diaphragm.

The results of Gastropexia geniculata anterior were far more satisfactory, however. Only 5.2% of cases had recurrence of the hernia. This was manifest immediately after operation, the symptoms often returning before discharge and always within the first few postoperative weeks.

We found 87% of the 77 patients operated by the method of Gastropexia geniculata anterior, completely symptom-free on follow-up examination. None of these patients had recurrence of the hernia or reflux on roentgenological control. Both the anatomical deformity at the hiatus and the disturbed physiology of the cardia are therefore restored by the operation. As the procedure is a trans-abdominal one, it is possible to deal with concomitant abdominal pathology. Cholecystectomy was performed simultaneously with the hernial repair in 32% of cases, without significantly increasing postoperative morbidity.

There was one postoperative death, giving a mortality of 1.3%. The postoperative course was otherwise smooth and no complications of serious nature occurred.

The results of Gastropexia geniculata anterior are therefore excellent when compared to those of other techniques employed in this series and to the results quoted in the literature.

Hernia hiatus oesophagi kan gedefinieerd worden als de breuk van een buikorgaan, in de regel de maag, door de hiatus oesophagi van het diaphragma in de thorax.

De afwijking was feitelijk onbekend voor de eeuwwisseling. Na de ontdekking door *Morrison* en *Healy* in 1922, dat deze breuken aangetoond kunnen worden door barium onderzoek in liggende houding, werd de aandoening echter steeds meer bekend. In een overzicht over dit onderwerp van 1926 ontwikkelde *Akerlund* een indeling die heden nog in gebruik is. Tegenwoordig is onderzoek van de maag in Trendelenburg-houding een wezenlijk onderdeel van elk volledig maag-darm röntgenonderzoek. Dat deze afwijking vaak voorkomt wordt thans algemeen erkend. De kennis van de hiatus hernia werd verder uitgebreid met de invoering van oesophagoscopie. Dit onderzoek wordt niet alleen gebruikt om de diagnose te bevestigen, maar heeft tevens geleid tot de ontdekking dat hiatus hernia de oorzaak kan zijn van ernstige ziekten van de slokdarm. Thans wordt reflux oesophagitis aanvaard als de meest voorkomende en terzelfdertijd de meest ernstige complicatie van hiatus hernia.

De wetenschap dat hiatus hernia een oorzaak kan zijn van reflux oesophagitis heeft geleid tot verdere studie van het afsluitingsmechanisme tussen slokdarm en maag. Als resultaat van intensief onderzoek gedurende de afgelopen 10 jaar, is er nu veel meer bekend over de normale anatomie en physiologie van de cardia (Hoofdstuk II & III).

De factoren die een rol spelen in de aetiologie van de hiatus hernia worden in Hoofdstuk IV besproken. Wanneer de hernia voorkomt bij zuigelingen is haar bestaan waarschijnlijk een gevolg van aangeboren anatomische afwijkingen. De meerderheid der herniae komt echter na het 40ste jaar voor, waarschijnlijk als gevolg van atrofie in het hiatusgebied. Contractie van de longitudinale spiervezels van de slokdarm ten gevolge van vago-vagale reflexen of secundair aan oesophagitis, zou een bijkomstige oorzakelijke factor kunnen zijn.

In het volgende hoofdstuk worden de verschillende typen herniae behandeld.

In Hoofdstuk VI wordt de symptomatologie besproken bij zuigelingen en volwassenen. Klachten worden veroorzaakt hetzij door ruimtebeperking in de thorax, hetzij door insufficiëntie van het cardia mechanisme en reflux. Gastro-intestinale bloeding geeft een derde symptomen complex. De patiënten kunnen ook elders symptomen tonen gerefereerd langs verschillende zenuwbanen.

Wanneer de aanwezigheid van een hiatus hernia klinisch vermoed wordt, kunnen röntgenologisch onderzoek en oesophagoscopie de diagnose bevestigen en mogelijke complicaties aantonen (Hoofdstuk VII).

Niet alleen zijn de klachten van hiatus hernia dikwijls zeer onaangenaam,

er kunnen zich ernstige en zelfs dodelijke complicaties voordoen. Deze complicaties, die de gevolgen zijn van oesophagitis of van ulceratie van de in de thorax liggende maag of van obstructie door de hiatusring, worden in Hoofdstuk VIII besproken.

De behandeling van de hernia hiatus oesophagi met typische klachten is bij voorkeur operatief. Chirurgisch ingrijpen wordt dringend wanneer complicaties aanwezig zijn (Hoofdstuk IX).

De conservatieve behandeling, beschreven in Hoofdstuk X, wordt alleen toegepast wanneer er contra-indicaties zijn voor chirurgische therapie, bv. hoge ouderdom van de patiënt of andere ziekten. Interne middelen worden ook prae- of postoperatief gebruikt.

In Hoofdstuk XI wordt de techniek behandeld van de operatiemethoden in de literatuur aanbevolen voor de behandeling van de hiatus hernia. Hoewel de ontwerpers van deze methoden mededelen dat zij weinig gevallen van recidief zagen, vermelden anderen een ontmoedigend aantal mislukkingen. In Hoofdstuk XIII wordt de Gastropexia geniculata anterior, zo als ontwikkeld door *Boerema,* aangewezen als zijnde de enige methode die niet alleen de anatomische afwijking corrigeert maar ook de normale physiologie van de cardia herstelt. De techniek van de operatie wordt in Hoofdstuk XII beschreven.

In Deel II worden de resultaten besproken van een volledig klinisch en röntgenologisch na-onderzoek betreffende 94 gevallen van hernia hiatus oesophagi, geopereerd in de Chirurgische Universiteitskliniek van het Wilhelmina Gasthuis te Amsterdam (Hoofd: Prof. Dr. I. Boerema). Slechts 7 patiënten waren jonger dan 30 jaar; de meerderheid (d.w.z. 86%) was ouder dan 40 jaar. Hiatus hernia kwam drie maal zo vaak voor bij vrouwen als bij mannen.

De studie der symptomen heeft ons geleerd dat ondanks de grote verscheidenheid van klachten, er toch een duidelijk patroon bestaat. Het meest voorkomende symptomen complex was dat van pijn in het epigastrium of achter het borstbeen, gewoonlijk van brandend karakter, en duidelijk beïnvloed door houdingsveranderingen. Zuurbranden, opboeren en lichte dysphagie zijn andere typische klachten. Spontane regurgitatie wijst op ernstige cardia insufficiencie. Bloeding komt voor, zowel manifest als occult. Pijn buiten het gebied van de afwijking is niet zeldzaam.

Physisch onderzoek droeg weinig bij tot de diagnose. Deze werd bevestigd door röntgenonderzoek in Trendelenburg-houding. Er was geen enkel geval van congenitaal te korte oesophagus. Verreweg het grootste aantal patiënten, d.w.z. 87% had een sliding hernia, 6.7% een para-oesophageale hernia, terwijl 5.5% een hernia van gemengd karakter had.

Oesophagoscopie is noodzakelijk, deels omdat hierdoor de röntgenologische bevindingen bevestigd worden, maar vooral omdat het de enige wijze is om oesophagitis vast te stellen. Van onze patiënten bleken 29 ernstige reflux-oesophagitis te hebben. Zulke patiënten moeten intern worden voor-

behandeld om complicaties gedurende de operatie tè vermijden en het succes van de operatieve correctie te bevorderen.
Zowel transthoracale als transabdominale operatiemethoden zijn in deze serie gebruikt. Alle patiënten die transthoracaal werden geopereerd, hadden onmiddellijk na de operatie weer klachten. Ook werden onbevredigende resultaten verkregen door transabdominaal de hiatus te vernauwen en, òf de slokdarm aan de rand van de hiatus te bevestigen, òf de maag aan het diaphragma te fixeren.
Daarentegen zijn de resultaten van de Gastropexia geniculata anterior veel meer bevredigend. Slechts 5.2% van de gevallen had recidief van de hernia. Dit was gewoonlijk direct na de operatie al duidelijk; de klachten waren vaak teruggekeerd voor ontslag en altijd binnen de eerste weken na de operatie.
Wij vonden 87% van de 77 gevallen behandeld met Gastropexia geniculata anterior volledig vrij van symptomen bij na-onderzoek. Geen enkele patiënt toonde recidief van de hernia of reflux bij röntgenologisch na-onderzoek. Zowel de anatomische afwijking bij de hiatus als de verstoorde physiologie van de cardia waren dus hersteld door deze operatie.
Daar de gastropexie transabdominaal geschiedt, is het mogelijk tevens andere afwijkingen in de buik te behandelen. Cholecystectomie werd tegelijk met de hernia operatie verricht in 32% der gevallen, zonder de postoperatieve morbiditeit noemenswaard te vergroten.
Eén patiënt is na de operatie overleden, hetgeen een mortaliteit van 1.3% betekent. Het postoperatieve beloop was bij de overige gevallen gunstig; complicaties van ernstige aard kwamen niet voor.
De resultaten van de Gastropexia geniculata anterior zijn derhalve zeer bevredigend, vergeleken met die van andere technieken in deze serie gebruikt en in de literatuur vermeld.

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STELLINGEN

I

Door gastropexia geniculata anterior, verricht wegens hernia hiatus oesophagi, wordt zowel de afwijkende anatomie van de hiatus als de physiologie van de cardia hersteld.

II

Bij oorpijn, waarvoor geen locale oorzaak verantwoordelijk is te stellen, dient een gericht onderzoek op hernia hiatus oesophagi te worden verricht.

III

Het is niet juist de zogenaamde epileptische karakterveranderingen te beschouwen als een constitutioneel bepaald aspect van de genuine epilepsie.

IV

Bij toepassing van hypothermie in de chirurgische kliniek, verdient afkoeling met lucht de voorkeur boven andere methoden.

V

Bij rhinitis atrophicans foetida (ozaena) verdient het aanbeveling de neusholte te verkleinen door submuceuse implantatie van porseleinen pareltjes.

G. v. Schulthess
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VI

De mening, dat het risico van een operatie bij pasgeborenen gedurende de eerste drie levensdagen groter is dan er na, is niet juist.

VII

Retrosternaal zuurbranden tijdens de laatste weken van de graviditeit verdient meer aandacht dan veelal hieraan besteed wordt.

VIII

De acute phase van het syndroom van Paget-Schroetter dient conservatief te worden behandeld.

IX

Het extramedullaire plasmacytoom is een ander ziekteproces dan de ziekte van Kahler, hetgeen onder andere tot uiting komt in een betere prognose.

X

Die Afrikaanse letterkunde is in Nederland nie voldoende bekend nie.