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## Radiographic diagnosis of hiatus hernia

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**THE RADIOGRAPHIC DIAGNOSIS OF HIATUS HERNIA**

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## INTRODUCTION

Hiatus hernia is a perplexing problem. Its presence is not often suspected on the basis of history and physical examinations. Its manifestations are many and varied. Often it produces no symptoms at all. Treatment becomes a problem of judgment as to what part of a patient's symptomatology is due to the hiatus hernia or whether the entire picture is due to another co-existing disease.

In 1769, Morgagni was first to recognize herniation of the stomach through the esophageal hiatus of the diaphragm. That the lower end of the esophagus appears and acts differently from the rest of the esophagus, is generally accepted. The structure of the normal lower esophagus has been subject to much confusion in the past century. In 1838, Arnold described the lower esophagus as consisting of a pouch with two furrows on either end. This pouch was called the "vormagen" or anterior stomach. In 1851, Luscka described two types of lower esophagus. One type consisted of one pouch and was the same as Arnold's, except that he called it the "cardiac antrum". The second type consisted of two pouches, the upper one was Arnold's "vormagen" and the lower one was the "cardiac antrum". It is interesting that Lerche, about a hundred years later, did exactly the same thing using different terms. The upper pouch he called the "phrenic ampulla" (now an established term used by all radiologists) and the lower one he termed the "vestibule".

Today radiologists recognize only one pouch on radiologic

examination and it is known as the phrenic ampulla. This corresponds to the pouch Lerche called the ampulla. The pouch he called the vestibule is hard to find even on his original illustrations, and is not recognised at all today.<sup>36</sup>

Hiatus hernia is a disease which symptomatically mimics many other diseases. In less than 25% of the patients with symptoms, can the presence of hiatus hernia be suspected clinically. Often it produces no symptoms at all. Therefore, it is necessary that a good routine of radiologic examination be adopted so that hiatus hernia may be discovered. Then the clinician must judge from the whole clinical, laboratory and radiologic picture what part of the patient's complaints are due to hiatus hernia and proceed with treatment. According to Hofter, hiatus hernia is the third most common cause of upper G.I. disturbances.<sup>13</sup>

## NORMAL ANATOMY OF THE LOWER ESOPHAGUS

The lower esophagus may be divided anatomically into two parts; the thoracic portion and the abdominal portion. These two areas are under different environmental pressures. The negative pressure in the thoracic cavity imparts a negative pressure to the thoracic portion of the esophagus. The abdominal cavity, being under positive pressure presents a positive pressure to the abdominal portion of the esophagus and to the stomach. Thus, the stomach is under a higher pressure than the thoracic portion of the esophagus and it would seem that stomach contents would be forced up the esophagus were it not for the presence of some sort of a mechanism to prevent reflux.

It would seem logical that there be a sphincter at the junction of the esophagus with the stomach in order to prevent reflux. In many old anatomic drawings, such a sphincter can be seen. However, recently when dissections were carried out specifically to find this sphincter, it was not located in all cases. Turco, et.al. prepared 38 anatomic dissections of the lower third of the esophagus so that the circular fibers could be seen.<sup>39</sup> In this way, he detected three different varieties:

- 1) The existence of a specific circular muscle condensation or bundle in the lower third of the esophagus from 5 to 20 mm. above the z-line of the esophagegastric mucosal junction. In 18 cases, there was a condensation of

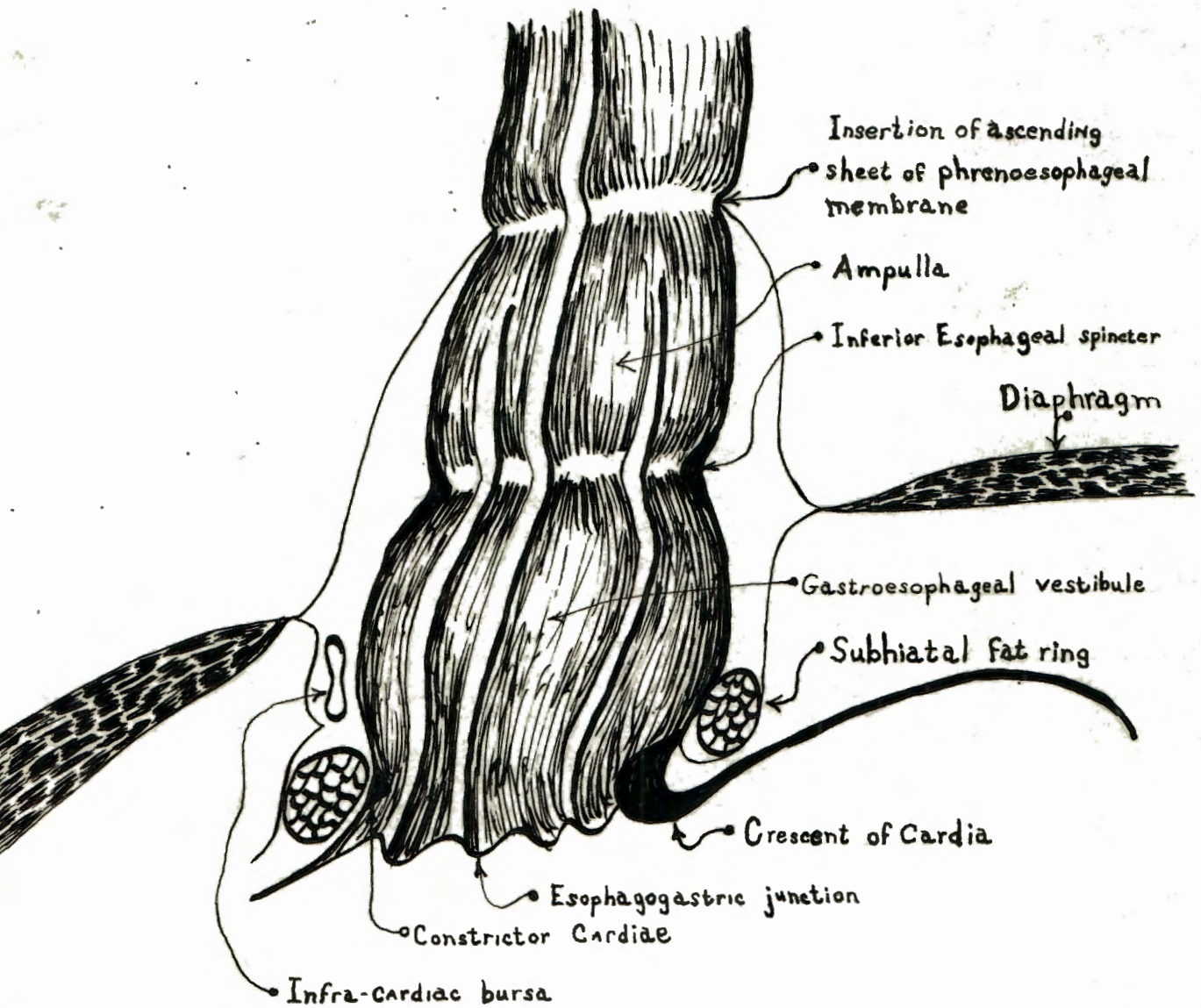
fibers and in 15 cases, a definite muscle bundle was present. This accounted for over 84% of the dissections.

2) The existence of progressively increasing numbers of circular muscle fibers from the lower segment down to within a few millimeters of the transition zone.

3) No identifiable concentration of muscle bundles at all.

Thus, in most cases there is some kind of muscular structure which acts to prevent reflux. In addition to this, if this segment is in the abdominal cavity, its sphincter action is reinforced by the positive abdominal pressure. However, if this region should be displaced upwards above the diaphragm, whatever force the sphincter has, is weakened by the opposing negative pressures found in the thorax. By measuring the intraluminal pressures in the normal esophagus at various levels, one can demonstrate a zone of high pressure between the stomach and the upper esophagus.

Also, it has been found that the lower portion of the esophagus functions differently physiologically than does the upper. Peristalsis progresses down the esophagus to terminate just above the high pressure zone. The high pressure zone responds to swallowing by relaxation, followed by contraction of the whole high pressure zone as a unit.<sup>37</sup> This zone corresponds to the vestibule. On x-ray films taken during continuous swallowing, it is common to see another contractile area at the junction of the tubular esophagus with the vestibule. This area is 0.5 to 1.0 cm.



## The Normal Anatomy of the Lower Esophagus<sup>2</sup>

Fig. 1



in length and is about 5 cm. above the esophagegastric mucosal junction.<sup>41</sup> This corresponds to the "inferior esophageal sphincter" as described by Lerche and as illustrated in Palmer's book.<sup>23</sup> (See Figure 1, Page 5)

Thus, the structures encountered as you progress downward are: tubular esophagus, ampulla, inferior esophageal sphincter, vestibule and cardia with its sphincter.

#### ALTERATIONS OF NORMAL ANATOMY IN HIATUS HERNIA

Hiatus hernia is simply a herniation of the stomach, or a part thereof, through the hiatus of the diaphragm into the thoracic cavity. In the case of a large herniation, diagnosis presents no problem and is easily accomplished by x-ray with the aid of a barium meal. However, not infrequently, a minimal hiatal herniation will produce as much or more discomfort for the patient as the larger ones do. As the symptomatology is not always characteristic, the correct diagnosis often hinges on the ability of the radiologist to demonstrate minimal hiatal herniation on a routine upper G.I. series. This problem is intensified because there is a great deal of disagreement as to just exactly what constitutes a minimal hiatus hernia; and in fact, whether or not such herniations should be reported. The latter problem will be discussed in a later section, while here we will concern ourselves with the problem of defining a hiatus hernia.

In many patients it is very difficult to define the point at which the esophagus ends and the stomach begins. There are three structures which, theoretically, may be used to denote the junction of the esophagus and the stomach. One may be the abrupt enlargement of the tubular lumen of the esophagus into the stomach. However, in many cases this is not an abrupt enlargement, but rather, a gradual enlargement down to the stomach. If part of this conical enlargement is located above the diaphragm, some people may want to call it a hiatus hernia. In cases where the cardia is evident this may not correspond to the junction of the squamous and gastric mucosa. This junction normally forms a zigzag line which may interdigitate as much as a centimeter. Some authors say that the upward displacement of this line is what constitutes a hiatus hernia.<sup>41</sup> Wolf states that the most important anatomic feature of a hiatus hernia is the location of gastric mucosa above the hiatus of the diaphragm. But he qualifies this by saying that as long as a short tubular segment of the esophagus is present below the hiatus of the diaphragm, the exact level of the mucosal change is not significant. Complications of esophagitis, ulceration and stricture occur in the squamous epithelium above the level of its junction with gastric mucosa. Occasionally, a columnar type of epithelium lines the esophagus, in part, for a considerable distance. However, this is a persistence of the foetal type of epithelium and not functional gastric mucosa. Isolated islands of true gastric mucosa along the esophagus are extremely rare. Barrett concurs in this

opinion.<sup>4</sup> It has been suggested by Templeton that small hiatus hernias and the ampulla might actually be the same, but appearing different because of poorly understood physiologic and anatomic processes.<sup>36</sup>

Barrett defines three principal varieties of hiatus hernia and believes they should be differentiated because they produce different pathological changes.

1) Paraesophageal hernia in which the cardia is normally placed and the greater curvature herniates through the esophageal hiatus into a peritoneal sac in the mediastinum. The esophagus is normal. This type often produces cardiac pain.

2) Sliding hiatus hernia. This is ten times more common than the paraesophageal variety. In this, the cardia herniates through the esophageal hiatus shortening and/or displacing the esophagus. This type produces incompetence of the cardia and all the complications of erosive esophagitis.

3) "Mixed" or "rolling" hiatus hernia is a combination of the above and has features of both.

The term "short esophagus" has been used to describe the shortening of the esophagus that is seen with hiatus hernias. Although, at one time, it was thought that the hiatus hernia occurred as a result of shortening of the esophagus, it is now generally believed that the reverse is true. The sequence of events leading to the production of a short esophagus by a hiatus hernia is reflux, inflammation, spasm or fibrosis, shortening and

stricture. A short esophagus is an irreversable displacement of the esophagogastric junction above the hiatus of the diaphragm.

Hiatus hernia is a condition which is most often acquired but may be congenital on rare occasions. The majority of sliding hiatus hernias are small, seldom extending upwards more than 5 cm. above the hiatus.

#### CLINICAL PICTURE OF HIATUS HERNIA

The classical symptom complex of hiatus hernia is epigastric and/or substernal burning pain aggravated by recumbancy and relieved by assumption of the upright position. Palmer recently made a study of patients with hiatus hernias in an effort to determine what symptoms are produced by a hiatus hernia.<sup>24</sup> The study showed that only 13% of patients with hiatus hernia had the classical clinical picture just described. Poe found that symptoms were aggravated by recumbancy in 22% of patients. A great many symptomatic patterns were found to be produced by hiatus hernias, some of which were "classical" for other diseases.

A difficult problem is thus created for the clinician in recognizing hiatus hernia on the basis of the subjective complaints produced by the hernia or its complications. Less than one sixth of the patients whose complaints are due to hiatus hernia can be diagnosed by subjective means. Therefore, if the true nature of the patient's illness is to be ascertained, it is necessary that

the diagnosis be made objectively, that is, by x-ray, esophagoscopy, etc. A broad clinical formula is needed to identify, not the patient with a hiatus hernia, but rather the hiatus hernia patient whose troubles are due to that condition.

Inspection of Palmer's data on the varied symptomatic features reveals that 79 out of 197 symptomatic patients or 40% had the following symptoms at least in part:<sup>24</sup>

- 1) epigastric and/or substernal burning pain or fullness aggravated by recumbancy,
- 2) epigastric and/or substernal pain without relationship to position, aggravated by meals,
- 3) vague and complex dyspepsia with belching, bloating, variable distress, pyrosis, regurgitation and perhaps occasional vomiting.

About one quarter of the patients were sick because of a complication of hiatus hernia. Thus, bleeding was due to erosive gastritis or erosive esophagitis. Esophagitis or stricture was always found in the presence of dysphagia. Burning pain and pyrosis are always present when there is a motility disorder or tonal disturbance in the lower esophagus. Texter and Bundersen agree, saying that heartburn and substernal pain has been correlated with non-peristaltic motor activity.<sup>37</sup> Dysphagia, they state, was always found in the presence of an abnormal deglutition pressure gradient in the lower third of the esophagus. This phenomenon is usually seen in the presence of some degree of stricture. Barrett insists

that 10% of patients with esophagitis have anemia severe enough to produce symptoms. Massive hematemesis or melena are rare, in fact, due to the intermittent nature of the bleeding in esophagitis, occult blood in the stool is rarely detected. The paraesophageal type of hiatus hernia is often the cause of cardiac pain or arrhythmias; also the stomach in the mediastinum may develop gastric ulcer or carcinoma. Some hernias are completely silent. On the other hand, heartburn may occur in the normal individual without demonstrable hernia. Others have radiographically demonstrable reflux without any complaints referable to the esophagus. The size of a hernia bears no relationship to the severity of the complications or the symptoms it can produce. Barrett says that small hernias require treatment as urgently as the larger. In fact, Palmer makes the observation that especially in those patients with heart mimicking syndromes, the smaller hernias tend to produce the more pronounced symptoms.<sup>24</sup> Often patients with large hernias in the chest are aware of no problem. This type usually makes its presence known by way of a complication. This peculiar relationship of size to symptoms leaves the clinician in a quandry because the most severe cardiac symptoms may be produced by a hernia which is very difficult to demonstrate. Seven percent of Palmer's group of 214 patients fell into this heart mimicking category and were hospitalized with their particular cardiac diagnosis.

Peters says that 29% of hiatus hernia patients taken to autopsy had associated lesions, such as, gastric ulcer, duodenal ulcer

or cholecystitis.<sup>28</sup> This points up necessity for a thorough evaluation of the patient to find all lesions present and a good deal of clinical judgment to determine what part each contributes to the total clinical picture. This is imperative before embarking on treatment which may be difficult and dangerous.

As might have been expected, the most common associated diseases were gall stones and diverticulosis coli, the combination which is known as Saint's Triad.<sup>24</sup> This combination was seen in 12% of the patients. Diverticulosis of one or more of the gastrointestinal organs was frequently found (24%). The organs most frequently involved were the colon, then the duodenum, the esophagus and less frequently other organs. The high incidence of peptic ulcer in association with hiatus hernia was striking. Twenty-eight percent of patients with hiatus hernia also had peptic ulcer. Duodenal ulcer was the most common but there was almost an equal number of gastric ulcers. However, only three of the sixty one patients with an ulcer had it in the herniated portion of the stomach. It has been said that esophagogastric malignancy is unaccountably rare in patients with hiatus hernia, however, Palmer found two gastric and one esophageal carcinoma in his series.

It would seem that the only way to make a correct diagnosis of hiatus hernia is to maintain a high index of suspicion in all cases characterized by epigastric and/or substernal burning pain. This together with a good routine for demonstrating hiatus hernias on upper G.I. series should produce the correct diagnosis in most cases.

## THE RADIOGRAPHIC DIAGNOSIS

The radiographic diagnosis of frank hiatal herniation presents little or no problem. However, small hiatal hernias are often very elusive and hard to demonstrate on x-ray. The fact that small hiatal hernias can produce as much symptomatology as the larger ones necessitates good radiological methods so that they will not go undetected. Stein and Finkelstein have recently published their technique for demonstrating hiatus hernia and their criteria for classifying hiatus hernia.<sup>33</sup>

Their technique consists of three cardinal points. First, the position, which is prone oblique. The right arm is at the patient's side and the left is resting comfortably above his head. The left knee and hip are flexed so that side of the body is elevated 10-30 degrees. The head is turned to the left. This position is RAO for bucky and LPO for fluoroscopy. They claim that the Trendelenburg position is of no additional help. Wolf, however, recommends a slight degree of Trendelenburg and reasons that this is not too far removed from physiologic conditions.<sup>41</sup> Templeton says that swallowing uphill is very unphysiologic and may cause the esophagus to balloon out and give the appearance of a hiatus hernia.<sup>36</sup> When peristalsis meets with a resisting force, it fades out proximal to the resistance and becomes ineffectual and the esophagus dilates. Carmichael advocates the use of the toe-touch position with the exposures being taken during the act of bending over so that the



intra-abdominal pressure is the greatest.<sup>5</sup> The patient is standing and bending over. The effect of gravity on the viscera is a counter force to prevent herniation and therefore, this method may be considered physiologic. The author claims that 20% more hiatus hernias were picked up in his series by the use of this method as contrasted with the Trendelenburg position. I would think that this method would have many technical difficulties in trying to hit a moving target on spot films during the act of bending over.

The second part of the technique of Stein and Finklestein is concerned with the timing of the exposures so that they occur during the act of swallowing. They say that a short pause is necessary so that the exposure catches the bolus of barium as it passes through the lower esophagus into the stomach. The diagnosis cannot be made if only residual barium remains in the esophagus after the main bolus has gone through.

The third feature of their exam consists of multiple exposures of the cardioesophageal region made in various stages of respiration. The first and third exposure was made during deep inspiration in order to take advantage of the closing mechanism of the lower esophagus. The alternate exposures were made with respirations stopped about halfway between normal inspiration and expiration because occasionally hernias are better demonstrated in this manner. Exposures were not taken during full expiration because most patients cannot hold their breath in this stage.

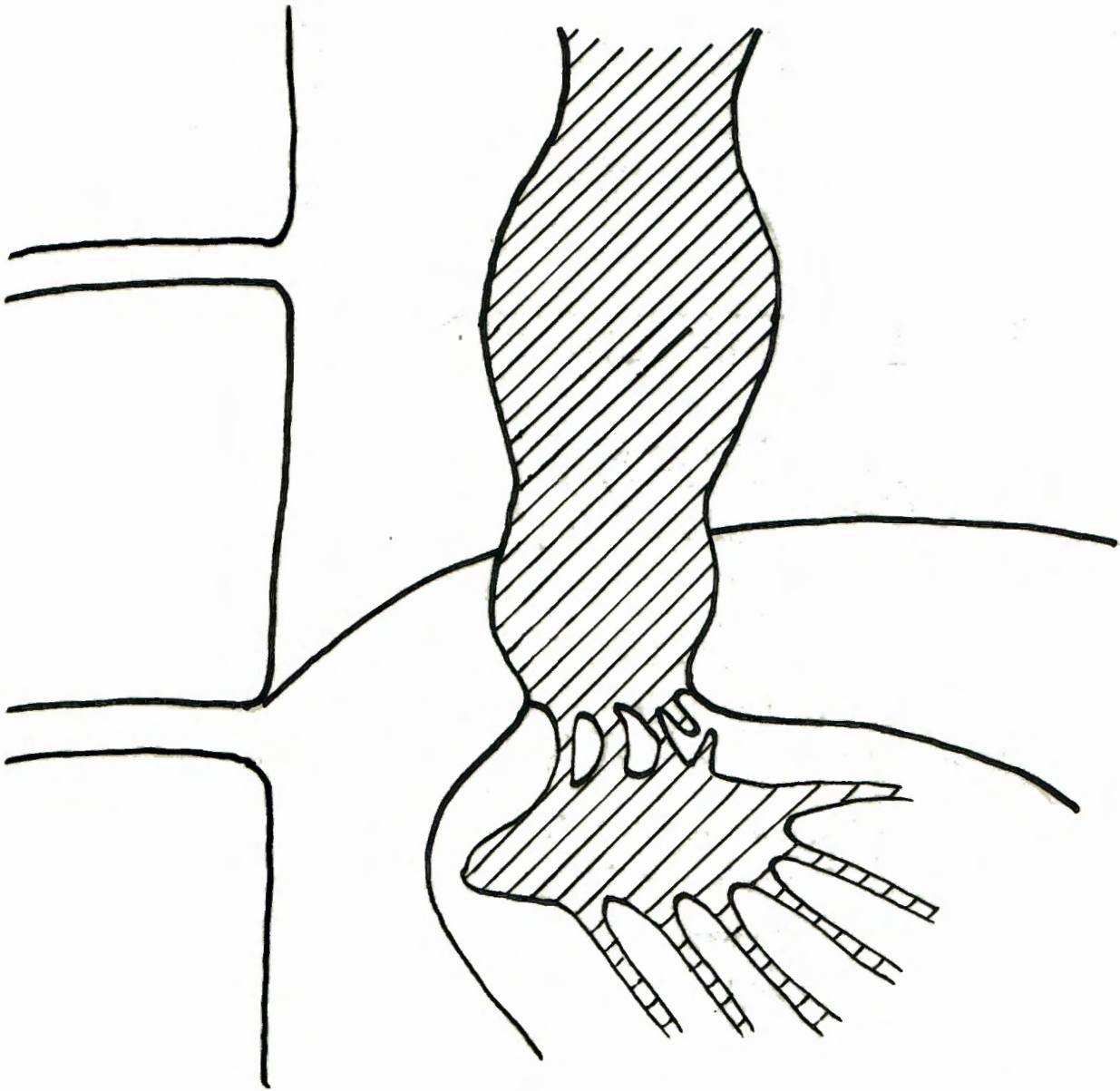
Their routine exam consists of two sets of the above serialogic

exposures. Occasionally spot films are necessary if the gastroesophageal area is not adequately demonstrated on the routine exposures. Also, if the passage of barium is too fast or too slow to permit accurate timing of the bolus, spot films may be necessary.

Stein and Finkelstein set forth criteria for classifying hiatus hernia by degree of herniation. They divide hernias into three classes:

The first degree hernia is herniation of the gastroesophageal vestibule alone. This is a highly controversial classification which the author justifies by the following four reasons:

- 1) According to Lerche and his authoritative anatomic studies, the gastroesophageal vestibule in the normal individual lies completely or almost completely below the diaphragm.<sup>18</sup>
- 2) The gastroesophageal vestibule is lined completely or almost completely with gastric epithelium. In fact, ulcerations in this area resemble gastric ulcers histologically.
- 3) The authors claim that they have followed patients with small hiatal hernias of the first degree who, when x-rayed again several years later had hiatal hernias of moderate size of the second or third degree.
- 4) Regurgitation of gastric contents into the esophagus is uncommon where there is no hiatus hernia. The authors go on to say that regurgitation is as common in first degree hernias as it is in second and third degree hernias. (Fig. 2, Page 16)



First Degree Hiatus Hernia<sup>33</sup>  
(Drawing from a radiograph)

fig 2

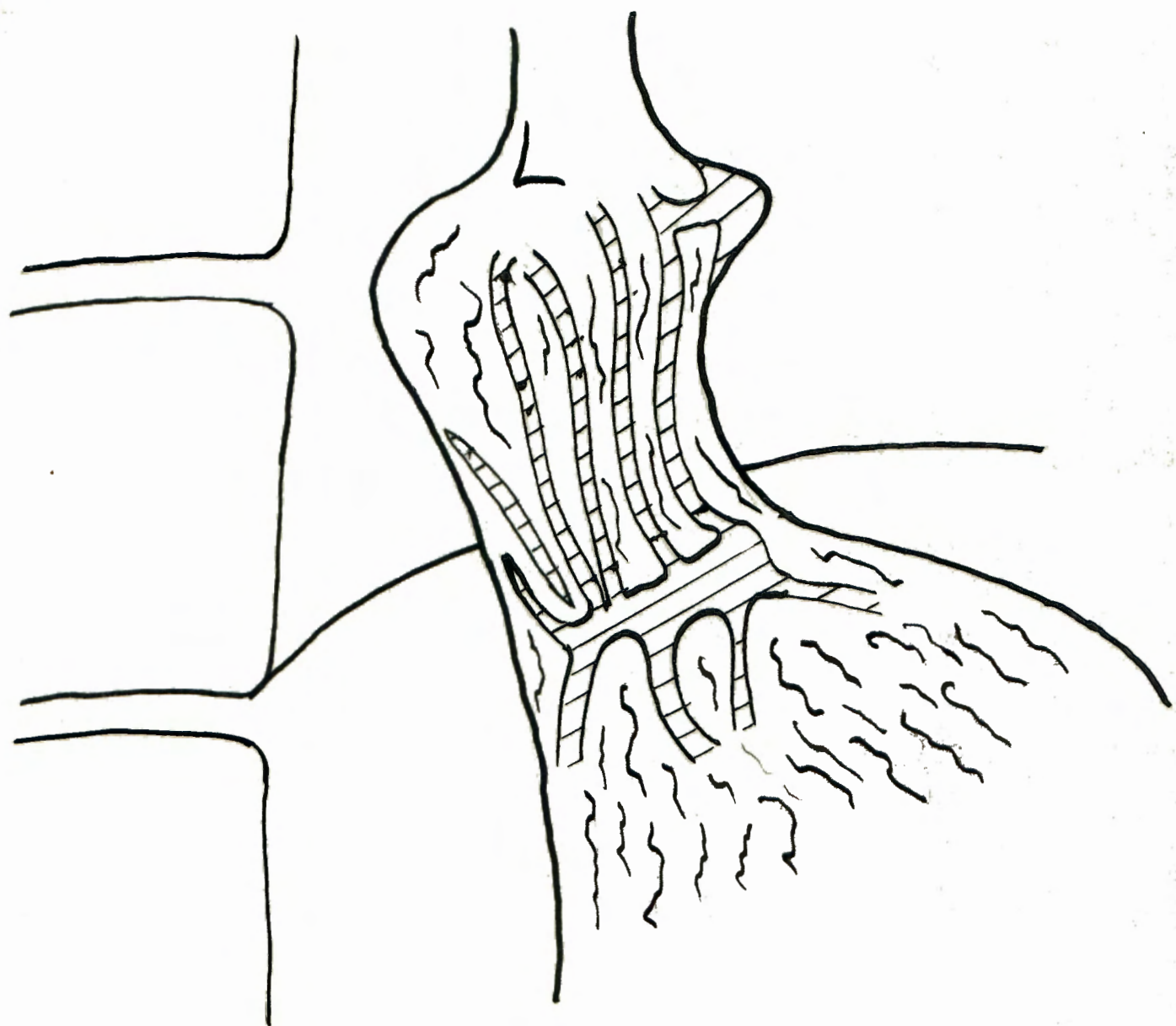
Wolf wrote a criticism of this classification in an editorial in which he agreed with Stein and Finkelstein in their statements that at least half of adults have some degree of hiatal herniation and that small hiatal hernias may be clinically significant.<sup>41</sup> However, he was in sharp disagreement with their classification of first degree herniation as a true hernia. He does not believe that a significant number of small hernias increase in size over a period of years. He also disagrees with their statement that reflux is as common in small hernias as in larger ones.

He goes on to suggest other criteria of diagnosis which will be considered later.

Texter and Bundesen also wrote a criticism of their classification of hiatus hernias.<sup>37</sup> They ask if herniation of the vestibule alone constitutes a true hernia and if such a hernia can be distinguished from the normal individual. They claim that the x-rays of Stein and Finkelstein correspond very closely to the diagrammatic sketches by Evans which he termed hiatal insufficiency.<sup>9</sup>

Sprofka, Azad and Boronofsky agree that small hernias may in time progress to form larger ones.<sup>32</sup> They reported that 58% of 19 patients followed for six years or more demonstrated progression from small to large hernias.

Stein and Finkelstein go on to classify second degree hernias as herniation of the gastroesophageal vestibule plus about 2-3 cm. of the cardiac end of the stomach. There seems to be general agreement that this is a true hernia. (Fig. 3, Page 18)



Second Degree Hiatus Hernia<sup>33</sup>  
(Drawing from a radiograph)

fig. 3

(18)



Third Degree Hiatus Hernia<sup>33</sup>  
(Drawing from a radiograph)

Fig. 4

(19)

In their third degree hernia at least 4-5 cm. of the cardiac end of the stomach lie above the diaphragm. (Fig. 4, Page 19)

Wolf described three methods used in the radiographic diagnosis of hiatal hernia. In his first method, he establishes the diagnosis on the presence of a structure he calls the "lower esophageal ring". He says this is a thin ring about 2 mm. in length which encircles the esophagogastric region. This ring can be seen in people with small hiatal hernias if the esophagogastric region is sufficiently distended while swallowing barium, but is usually not evident in the normal individual when the esophagogastric region is located below the diaphragm. He believes this is the single most useful landmark available to radiologists for identification of the junction between the esophagus and stomach and therefore, for the diagnosis of small hiatal hernias.

#### REFLUX OF GASTRIC CONTENTS

Wolf's second method concerns reflux of gastric contents into the esophagus. He insists that reflux will occur in most individuals if intra-abdominal pressure is increased over intrathoracic by 100 cm. of water or more. He also says that many patients with undoubted hiatal hernia will not show reflux by simple methods, i.e., Trendelenburg on bending over to touch the toes. A valuable test for reflux would be one which demonstrated it only in the presence of hiatus hernia. Wolf uses a moderate Trendelenburg position as he

thinks this is not too removed from normal circumstances. He terms reflux in this position as "free reflux" and regards it with more significance than the presence of small hiatus hernias. His justification is that this type of reflux is nearly always symptomatic whereas small hiatal hernias are not.

Stein and Finkelstein comment that regurgitation of the barium meal during examination can occasionally produce symptoms of pyrosis and angina-like pain.<sup>33</sup>

Texter and Bundesen state that regurgitation is common when the stomach is overdistended or when special procedures are used to increase intra-abdominal pressure. They report regurgitation in 50% of patients with grade 1 hernia, who are symptomatic and in only 20% of asymptomatic grade 1 hernias.<sup>37</sup> Conway-Hughes support this, saying that 30 out of 32 patients with hiatal hernia had regurgitation and only 20% of patients without hiatal hernia regurgitated.<sup>6</sup>

Templeton talks about reflux in the type of esophagus that gradually funnels into the stomach. This type of esophagus differs from normal ampulla in that the diaphragmatic hiatus is larger than normal. In this case, barium is easily forced into this dilatation by filling the stomach with barium and increasing the intra-abdominal pressure. He thinks that this structure is not really a hiatus hernia but a variation of the normal ampulla produced by relaxation of the esophageal diaphragmatic hiatus. The author goes on to say that if the mucosa is susceptible to the action of acid gastric juice, there will be symptoms due to esophagitis ulcer or stricture, but



on the other hand, if the mucosa is not susceptible or if there is no acid, there will be no symptoms.

Wangensteen and Leven (1949) have demonstrated that perfusion of the lower esophagus with acid pepsin will result in all the changes we now recognize as esophagitis.<sup>40</sup> In animals, the mucosa is destroyed and perforation occurs in a few hours. In man, however, the process is less drastic due to the intermittent nature of the insult. They also showed that physiologic strengths of hydrochloric acid alone causes no damage, but the secretions normally present in the duodenum are harmful. The damaging effects produced by a duodenal fistula to the skin of the body wall are well known, and demonstrate what occurs in the esophagus.

The normal esophagus is irreplaceable. Any damage to it by anatomic displacement, chemical damage or impairment of motor function results eventually in esophagitis, stricture, ulcer or any of the other complications associated with hiatus hernia. Barrett says that one can assume that with any stricture in the lower two to three inches of the esophagus, the mucosa below it will be columnar and the mucosa above it, squamous.<sup>4</sup> This is to say that stricture produced by regurgitation involves the squamous epithelium just above the esophagogastric junction.

A stricture produced by carcinoma or a swallowed corrosive will not necessarily have gastric epithelium below it. A stricture produced by reflux is, in effect, the body's attempt to produce a sphincter to prevent further reflux of gastric contents into the

esophagus. However, being composed of scar tissue, it also hinders the passage of ingested materials to the stomach. Strictures are caused by repeated episodes of esophagitis which produce inflammation and scarring. This is usually a progressive disease. With repeated attacks, inflammation and scarring extend deeper into the muscular coats eventually replacing them and forming a mass which greatly narrows the lumen. Dilation of the strictures usually allows further reflux, esophagitis and scarring above the stricture, thus extending the process further proximally. Ballinger, et.al., states that in the majority of cases, esophageal hiatus hernia produces symptoms due to the development of reflux esophagitis.<sup>2</sup> The complications of esophagitis are usually stenosis, hemorrhage or perforation.

#### INTRALUMINAL PRESSURE STUDIES

Texter and Bundesen, in an article published last year described their findings in intraluminal pressure studies of the esophagus.<sup>37</sup> They attempted to determine what abnormalities of motor function were associated with the presence of hiatal hernia. In doing this they recorded intraluminal pressures simultaneously from the fundus of the stomach at the level of the diaphragm, in the herniated stomach, at the esophagogastric junction, and higher in the esophagus during resting and deglutative activity. They correlated the pressure changes with the roentgen phenomena by means of simultaneous

fluorocinematography. They found two abnormalities to be characteristic of patients with hiatus hernia.

First, consider dysfunction of the esophagogastric closing mechanism. The normal "high pressure zone", which usually has a pressure higher than the stomach, was displaced upwards. Its displacement into the negative pressure of the thoracic cavity decreased its pressure so that it was often equal to the fundic pressure in the herniated stomach, thus providing no barrier to gastroesophageal reflux.<sup>57</sup> Atkinson, et.al., also reported this phenomenon.<sup>1</sup>

The characteristic physiologic behavior of the high pressure zone was observed in only 20% of patients with hiatus hernia. Normally, this zone relaxes during swallowing and subsequently contracts. Due to the negative intrathoracic pressure, displacement of the high pressure zone into the thorax causes a lowering of the pressure in the so-called "high pressure zone" resulting in some degree of incontinence. During inspiration, when intrathoracic pressure is the lowest, only the infradiaphragmatic portion has a pressure which exceeds fundic pressure and prevents reflux. The closing mechanism of the gastroesophageal junction was incompetent in 80% of patients with hiatus hernia as determined by the absence of a zone of high pressure between the high fundic pressure and the negative intrathoracic pressure.

The second abnormality is abnormal motor activity in patients with hiatus hernia. The deglutation complexes of the lower esophagus were frequently unphysiologic. These complexes resembled, some-

what, the low amplitude, prolonged duration complexes that are normally recorded from the ampullary area. Frequent rhythmic non-peristaltic contractions occurred in the absence of swallowing, which often exceeded the amplitude of the primary peristaltic wave.<sup>37</sup> Creamer et.al., reported 12 out of 14 patients with diffuse spasm of the esophagus also had a roentgen diagnosis of hiatus hernia.<sup>7</sup>

Olsen, et.al., say that the diagnosis of hiatus hernia can be made in patients whose x-rays are normal by demonstrating abnormal motor activity in the lower esophagus.<sup>21</sup> They even claim that measurement of the pressure in the esophagus and at its sphincters affords a means of distinguishing symptomatic from asymptomatic hiatal hernias and to distinguish between substernal pain of esophageal origin and that of cardiac origin. However, they do not elucidate how this distinction is made.

Templeton describes the physiological motor functions of the lower esophagus as follows. He describes the high pressure zone of the lower esophagus as preventing reflux from the stomach into the relatively lower pressures of the esophagus. He believes that during inspiration, the barrier is about 1.5 cm. long and about 2 cm. long during expiration.<sup>36</sup>

Esophageal peristalsis slows and eventually ceases about 2-4 cm. above the diaphragm. Templeton states that this segment may not contract, but may balloon out and resemble a small hiatus hernia. In other patients, the lower segment may contract completely leaving a long narrow channel. Factors which play a part in this phenomenon

are contraction of the diaphragm with the Valsalva test, swallowing uphill in the Trendelenburg position and increasing the intra-abdominal pressure by obesity, pregnancy or external pressure. These maneuvers have been used by some to demonstrate hiatus hernia. If the above is true, then the incidence of hiatus hernia is not as great as others suggest.<sup>33,41,37,4,24,16</sup>

Templeton also describes the lower esophageal ring as a permanent structure seen in the distended esophagus. He says it is a sharp, narrow band in the esophagus about 3 to 4 cm. above the diaphragm, and that it is seen more frequently in patients when they are in the steep Trendelenburg position rather than while standing or horizontal. He says that the ring often marks the site at which esophageal peristalsis ceases. The section between the ring and the cardia is the phrenic ampulla and contracts as a unit after it has been filled by a peristaltic wave. Any resistance to peristalsis results in a fading of the peristaltic wave so that it stops some distance above the obstruction. The dilated section thus produced is bisected by the ring. If resistance is removed, peristalsis will again continue to the ring. In true hiatus hernia, there is a narrowing between the esophagus and the herniated portion of the stomach. This, he feels, is not the same as the lower esophageal ring, and in fact, he says the ampulla cannot be demonstrated. He says the fact that peristalsis comes down to the herniated pouch suggests that the ampulla has been absorbed into the stomach.

Keyting and others differ substantially from this viewpoint

saying that they unreservedly support the concept that the lower esophageal ring is the cardio esophageal junction and that therefore, when it is located above the diaphragm, a hiatus hernia is present.<sup>16</sup> They base their opinion, that the ring is the esophago-gastric junction, on an article by Gould and Barnhard in 1957 where this view was expressed.<sup>11</sup> MacMahon, Schatzki and Gary reported a case with histologic autopsy findings supporting this view.<sup>19</sup> Keyting and others, in their article also had one case with autopsy findings. This view, then, is based on opinion confirmed by only two cases with histological proof. This is not sufficient proof in my estimation. He goes on to say that with proper technique and effort, the ring can be demonstrated in about 13% of normal people. This is less than the percentage of rings demonstrated by Templeton and is about the same as his estimates of the incidence of hiatus hernia. Perhaps these two groups are using the same term to describe two different structures. Palmer said that there was an incidence of hiatus hernia in about 14% of a group of asymptomatic people used as controls, which figure is identical to Keyting's in patients with no gastrointestinal complaints.<sup>24, 16</sup> He also makes the statement that the presence or absence of hiatus hernia on x-ray is far less significant than the presence or absence of reflux.<sup>24</sup> This, I think, is possibly a key to the mystery of hiatus hernia.

#### SYMPTOMATIC VS. ASYMPTOMATIC HIATUS HERNIA

In the majority of diseases, a diagnosis is most often made

by careful study of the important facts presented in the history and physical examinations. It is only supported or confirmed by laboratory tests, x-rays or special studies. Textbooks describe classical or typical clinical pictures for hiatus hernia.<sup>12</sup> The most common complaint is high epigastric or low midthoracic pressure or a pain which may radiate along the left costal margin to the top of the left shoulder or down the arms. There is a marked amount of belching. Symptoms are characteristically precipitated by eating and aggravated by recumbency. However, they go on to say that the diagnosis cannot be made on pure clinical grounds but must be confirmed radiologically.

Hiatus hernia is probably notorious for being able to mimic other conditions. The clinical picture may produce classical "symptoms of anginal pectoris, peptic ulcer and myocardial infarction." The high incidence of association with peptic ulcer (36%) may complicate the picture considerably.<sup>24</sup>

When the doctor is confronted with a patient having symptoms suggestive of a hiatus hernia, the diagnosis is a simple matter if the hernia is demonstrable radiologically. However, this should not be the end of the diagnostic effort as other conditions which could conceivably produce the patient's clinical picture should and must be systematically looked for and ruled out. Only when all other possible causes have been ruled out can one be moderately certain that the symptoms are, in fact, due to hiatus hernia.

Stein and Finkelstein stress that when a hiatus hernia is pre-

sent it can only be considered clinically significant in so far as it can be related to the patients symptoms.<sup>35</sup> Thus, the opposite side of the problem becomes apparent. It must be remembered that, as stated previously, hiatus hernia can occur in people who are apparently perfectly healthy. In controls used in various studies, the presence of hiatus hernia was discovered in about 14% of asymptomatic patients.<sup>24, 16</sup> Therefore, it becomes apparent that hiatus hernia can exist in the presence or absence of symptoms. Since this is true, it seems possible that we are in error in ascribing any symptoms at all to the mere presence of a hiatus hernia. However, the fact that surgical correction of the hernia can result in alleviation of symptoms leaves little support for this idea. Notwithstanding, the big question is; why are some hernias symptomatic and others of the same size or larger, asymptomatic? There must be some other factor which accounts for this. This factor, most probably, is one of altered physiological function.

Most authors agree that reflux of gastric contents into the esophagus is very significant as far as producing symptoms. A few state that the presence of reflux is far more important than the presence of a hiatus hernia. This seems to be a logical answer to the problem. It seems incredulous that the mere presence of a dilatation of the esophagogastric junction or a displacement of stomach parts into the thorax in themselves could be responsible for such symptoms as substernal pain or pyrosis. It is more logical to assume that hiatus hernia or, more properly, incompetence of the



lower esophageal sphincter mechanism predisposes to reflux of gastric contents into the esophagus. This, in turn, by repeated and recurrent insult to the lining of the esophagus, causes a condition called erosive esophagitis which in turn, causes symptoms. In the presence of any degree of esophagitis, it seems logical that a given bout of reflux could produce sudden acute symptoms as has been reported.

The next problem, then, is one of differentiation of the hiatus hernia which is producing symptoms from that which is not. Take, for instance, an example of a patient who is found to have hiatus hernia, peptic ulcer, and gall stones coexistent. The problem is not to decide which of the lesions is responsible for the symptoms, but rather one of ascribing to each its percentage of blame for the total clinical picture. This might largely be arbitrary, but some authors have proposed means of determining how much each contributes to the total clinical picture. In order to determine how much of the picture is due to hiatus hernia, many radiologists attempt to demonstrate what is called "free reflux". This is reflux which can be produced by wild maneuvers not far removed in effect from daily activities. Often patients will complain of symptoms while such maneuvers are being carried out. Others feel that measurement of intraluminal pressures is a good means. It is found that in symptomatic hiatus hernias, the "zone of high pressure" in the lower esophagus is displaced upward where it becomes less effective as a sphincter under the influence of negative intrathoracic pressure.

The size of a hiatus hernia seems to bear little relationship

to the question of whether or not it can be the cause of the symptoms. There are cases reported in which very large hiatus hernias are asymptomatic and very small ones are symptomatic as proven by alleviation of symptoms following surgical repair.

This differentiation becomes particularly important when the nature of the surgical procedure needed for repair is considered. The lower esophagus is not easy to reach surgically. The transthoracic approach is preferred by many unless there is some coexisting abdominal condition needing repair. Before subjecting a patient to such a procedure, one must be absolutely sure in his own mind that the hiatus hernia is producing symptoms which are particularly bothersome and that it is necessary to prevent such complications as hemorrhage, stricture or ulceration.

#### REPORTING OF HIATUS HERNIAS

It has often been said that the diagnosis of hiatus hernia should not be made too often by the radiologists because an excessive number of patients may be subjected to operation. I mention this only to condemn it. The judgement as to whether or not a patient should have an operation to affect a cure belongs to the surgeon. I do not believe there are many surgeons who feel that the mere presence of a hiatus hernia is enough indication for subjecting a patient to an operation. In view of the seriousness of the type of operation needed for its repair, it is not lightly accepted by

either patient or physician. If there has been abuse in this manner in the past, the responsibility for preventing unnecessary surgery lies with the surgeons.

According to the literature, all sizes, even the smallest, can produce symptoms and, likewise, are susceptible to the complications. The aim of surgery is twofold: to alleviate symptoms and to prevent complications. Therefore, it follows that if a hiatus hernia is small and producing symptoms which are intractable,<sup>30</sup> or if there is an anemia from chronic blood loss,<sup>41</sup> surgical correction is as much indicated as if the same circumstances were present with a larger hernia. Conversely, it follows that if there is a large hernia without symptoms, or with symptoms which are easily controlled on medical management, surgery is not indicated. Many hiatus hernias which are productive of mild symptoms can be easily controlled with antacids, bland foods and taking of frequent small meals rather than three large ones. There were a few authors who advocated surgical correction in cases in which symptomatic hiatus hernia was the only indication.<sup>2</sup> This opinion forms quite a minority in the literature.

Since there is a high incidence of associated diseases in which the symptomatology may be the same or closely so, it becomes important to make the complete diagnosis of all the diseases present and to judge what part each plays in the total picture. This is extremely important when contemplating surgical treatment because the symptomatology may be due totally or in part to some other condition.

Saints' Triad is an example in which the major portion of the symptoms may be due to either gall stones or hiatus hernia. Surgical correction of the asymptomatic component will not result in alleviation of the symptoms.

#### SUMMARY

Hiatus hernia was first recognized in 1769. It is defined as a herniation of the stomach or a part thereof, through the esophageal hiatus of the diaphragm and into the thoracic cavity. It has been found that the size of a hernia bears little or no relationship to its production of symptoms. A small hernia can produce symptoms as much as a larger one and conversely, a large hernia may be asymptomatic. Some authors say that all hernias will produce symptoms in time, but this is controversial. I do not believe that mere increase in size is the factor making a hernia symptomatic. I believe a change in function must take place so that the lower esophagus becomes incompetent and reflux occurs. It is possible, however, that larger hernias may produce symptoms by possibly a reflex mechanism.

There are three main types of hiatus hernia: paraesophageal, sliding and mixed. The sliding type is ten times more common than the paraesophageal and produces symptoms of dysphagia, heart burn, etc. as compared with cardiac symptoms produced by the paraesophageal type.

Subjective diagnosis is hampered by the fact that hiatus hernia produces symptoms which mimic many other conditions, many of which

not uncommonly accompany a hiatus hernia. It is a problem of judgement and careful evaluation of all conditions present to decide how much each contributes to the total symptomatology. This is especially important if any surgical procedure is contemplated.

The radiographic diagnosis of moderate to large hiatus hernias with a barium meal examination presents little problem to the radiologists. However, the classification and diagnosis of small hernias is another problem. There is wide diversity of opinion as to the significance of small hiatus hernias. Some deny that small hiatus hernias can produce symptoms. Others state emphatically that they can and do. Still others claim that in time, small hernias progress to form larger ones and still others suggest that all hernias should be operated because of future progression. A few authors who apparently have made a fairly exhaustive study say that the presence of reflux is far more significant than the mere presence of a small hiatus hernia. I believe that small hiatus hernias exist and can be symptomatic; most authors concur with this. However, I believe that operative intervention should be reserved for those hernias which have intractable symptoms. The operation is too serious to subject a patient to it merely on the theory of future progression to larger size and possible production of symptoms. There are numerous complicated methods in the literature for demonstration of small hiatus hernias on x-ray. I believe that merely looking at a barium filled stomach is not enough. In order to demonstrate small hiatus hernias, exhaustive study of the cardioesophageal region is

necessary. It is highly desirable that there be barium in the terminal esophagus at the time of exposure; residual barium will not show up a small hernia. I believe a small hernia which does not show moderately free reflux has not near the significance as one which does.

I believe that radiologists should report all hiatus hernias seen as only the clinician has enough knowledge of the patient to make an accurate evaluation of whether its presence is significant or not. In cases where the clinician cannot be sure, other procedures such as, esophagoscopy and measurement of intraluminal pressures at various levels are helpful.

Truely hiatus hernia is a problem of many facets, each of which deserves special and careful study. Snap diagnosis has no place in the evaluation of a possible hiatus hernia.

#### CONCLUSION

1. The subjective diagnosis of hiatus hernia is very difficult and often impossible. When hiatus hernia is present, it produces classical symptoms in only 13% of patients.
2. Hiatus hernia is well known for its ability to mimic other conditions, many of which may be co-existent with it. It has been reported to produce classical symptoms of myocardial infarction, angina pectoris and duodenal ulcer.
3. Hiatus hernia may be asymptomatic. Some authors say that most

hernias will progress and in time, produce symptoms. I do not believe probable progression is sufficient indication for operative repair.

4. The radiographic diagnosis of moderate to large hiatus hernias is fairly easy. Small hiatus hernias are often difficult to demonstrate. Some authors claim that herniation of the vestibule alone is a small or Grade I hiatus hernia. I feel that a Grade I hernia is much more likely to produce symptoms of dysphagia, regurgitation or heart burn if "free reflux" is demonstrable.

5. Where hiatus hernia is particularly suspect, a thorough radiographic examination with multiple exposures of the barium filled lower esophagus is indicated. The presence of only residual barium in the esophagus does not rule out small hiatus hernia.

6. Many authors advocate such procedures as: demonstration of reflux, demonstration of upward displacement of the lower esophageal ring, esophagoscopy or measurement of intraluminal pressures at various levels adjuncts to making the diagnosis. These are of definite benefit when there is a radiographically demonstrable hernia which cannot definitely be implicated in the etiology of the patient's symptoms.

7. Should all hiatus hernias be operated? Although some people say yes, I think a more practical approach is to reserve surgery for those who have severe intractable symptoms and who are judged to be in danger of developing complications of hemorrhage, stricture or ulceration.

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## BIBLIOGRAPHY

1. Atkinson, M. and Others, The Esophagogastric Sphincter in Hiatus Hernia, *Lancet* 2:1138, 1957.
2. Ballinger, W.F. and Others, The Complications of Esophageal Hiatus Hernias, *Penn. Med. J.* 63:51-6 (Jan.) 1960.
3. Barrett, N.R., Hiatus Hernia, *Brit. Med. J.* 5194:247-52 (July) 1960.
4. \_\_\_\_\_, Hiatus Hernia: Review of Some Controversial Points, *Brit. J. Surg.* 42:231, 1954.
5. Carmichael, J.H.E., An Evaluation of the Toe Touch Position in the Diagnosis of Hiatus Hernia, *Brit. J. Radiol.* 379:479-82 (July) 1959.
6. Conway-Hughes, J.H.L., Esophageal Reflux: Analysis of 453 Consecutive Barium Meal Examinations, *Brit. J. Radiol.* 29:331, 1956.
7. Creamer, B. and Others, Pattern of Esophageal Motility in Diffuse Spasm, *Gastroenterology* 34:782, 1958.
8. de Lorimier, A.A., Warren, J.P., Prolapse of the Mucosa at the Esophagogastric Junction, *Am.J. Roentgenol., Rad. Therapy & Nuclear Med.* 84:1061 (Dec.) 1960.
9. Evans, J.A., Sliding Hiatus Hernia, *Am. J. Roentgenol.* 68:754 1952.
10. Fleischner, F.G., Hiatal Hernia Complex, *J.A.M.A.* 162:183, 1956.
11. Gould, D.M. and Barnhard, H.J., Changing Concepts in Structure Function and Disease of the Lower Esophagus, *Am.J.M.Sc.* 233:581, 1957. Cited by: Keyting, W.S. and Others, The Lower Esophagus, *Am.J.Roentgenol., Rad. Therapy & Nuclear Med.* 84:1070 (Dec.) 1960.
12. Harrison, T.R. and Others, ed., *Principles of Internal Medicine*, New York, McGraw-Hill, 1958, p.1214.
13. Hoffer, Ernest, Hiatal Hernia, Its Diagnosis and Clinical Significance, *Am.J.Digest. Dis.* 3:901, 1958.
14. Holmes, G.W. and Wichowski, W.A., Diaphragmatic Hernias: Diagnosis and Treatment, *Med. Clin. N. Amer.* 197 (Jan.) 1958.

15. Ingelfinger, F.J. and Kramer, P., Dysphagia Produced by a Contractile Ring in the Lower Esophagus, Gastroenterology 23:419, 1953.
16. Keyting, W.S. and Others, The Lower Esophagus, Am.J. Roentgenol., Rad. Therapy & Nuclear Med. 84:1070 (Dec.) 1960.
17. Lam, G.R. and Kenney, L.J., The Problem of the Hiatus Hernia of the Diaphragm, J. Thoracic Surg. 27:1, 1954.
18. Lerche, W., Esophagus and Pharynx in Action, Study of Structure in Relation to Function, Springfield, Ill., Thomas, 1950.
19. Mac Mahon, H.F. and Others, Pathology of the Lower Esophageal Ring; Report of Cases with Autopsy, Observed for Nine Years New England J. Med. 259:1, 1958. Cited by: Keyting, W.S. and Others, The Lower Esophagus, Am. J. Roentgenol., Rad. Therapy & Nuclear Med. 84:1070 (Dec.) 1960.
20. Nuzum, F.R., Radiographic Examination of the Alimentary Tract, J. Radiol. 5:124 (April) 1924.
21. Olsen, A.M. and Others, Role of Motility Patterns in the Diagnosis of Esophageal Disease, J.A.M.A., 172:319, 1960.
22. Palmer, E.D., An Attempt to Localize the Normal Esophagogastric Junction, Radiology 60:825, 1953.
23. \_\_\_\_\_, The Esophagus and its Diseases, New York, Hoeber, 1952 p.9, Fig. 5.
24. \_\_\_\_\_, Hiatus Hernia in the Adult, Am.J. Digest. Dis. 3:45-58 (Jan.) 1958.
25. \_\_\_\_\_, Hiatus Hernia: The Problem of Diagnosis, J. Thoracic Surg. 27:271, 1954.
26. \_\_\_\_\_, A Note on the Brain Glip as an Aid in Esophageal Diagnosis, Am.J. Roentgenol. 69:294, 1953.
27. \_\_\_\_\_, Saint's Triad (Hiatus Hernia, Gall Stones and Diverticulosis Coli)
28. Peters, P.M., The Congenital Short Oesophagus, Thorax 10:269, 1958.
29. Pee, W.D., The Problem of Hiatus Hernia, Virginia Med. Monthly 87:324-9 (June) 1960.

30. Sanders, L.G. and Farrar, T., Hiatus Hernia, Am.J. of Gastroenterol. 33:38-42 (Jan.) 1960.
31. Schatzki, R. and Gary, J.E., Dysphagia Due to Diaphragm-like Localized Narrowing in the Lower Esophagus (Lower Esophageal Ring), Am. J. Roentgenol. 70:911, 1953.
32. Sprafka, J.L. and Others, Fate of Esophageal Hiatus Hernia: A Clinical and Experimental Study, Surgery 36:519, 1954.
33. Stein, G.N. and Finkelstein, A., Hiatal Hernia, Am. J. Digestive Dis. 5:77-87 (Feb.) 1960.
34. Stiennon, O.A., Prolapse of the Antral Mucosa, A Clinical-Radiologic Entity?, Am. J. Roentgenol., Rad. Therapy & Nuclear Med. 84:1142 (Dec.) 1960.
35. Sycamore, L.K., Radiologic Diagnosis of Hiatus Hernia, Gastroenterology 31:169, 1956.
36. Templeton, F.E., Gastrointestinal Radiology, Am.J. Digest. Dis. 4:661-81, 1959.
37. Texter, E.C., and Bundesen, W.E., Diagnosis of Hiatal Hernia, Am. J. Digest. Dis. 5:493-6 (May) 1960.
38. \_\_\_\_\_, and Others, Hiatal Hernia and Related Disorders of the Esophagogastric Junction, J.A.M.A. 160:830 (Mar.) 1956.
39. Turco, N.B. and Others, A Note on the Muscular Structure of the Lower Third of the Esophagus, Am. J. Digest. Dis. 4:749-52 (Sept.) 1959.
40. Wangenstein, O.H., and Leven, N.L., Gastric Resection for Esophagitis and Stricture of Acid-peptic Origin, Surg. Gynec. Obstet. 88:560, 1949.
41. Wolf, B.S., The Definition of a Sliding Hiatus Hernia: A Radiologist's Point of View, Am. J. of Digest. Dis. 5:168-73 (Feb.) 1960.
42. \_\_\_\_\_, and Others, The Gastroesophageal Vestibule on Roentgen Examination: Differentiation From the Phrenic Ampulla and Minimal Hiatal Herniation, J. Mt. Sinai Hosp. 25:167, 1958.
43. \_\_\_\_\_, and Others, The Incidence of Hiatus Hernia in Routine Barium Meal Examinations, J. Mt. Sinai Hosp. 26:598, 1959.

44. \_\_\_\_\_, The Roentgen Diagnosis of Minimal Hiatal Herniation, J. Mt. Sinai Hosp. 23:90, 1956.
45. \_\_\_\_\_, And Guylielmo, J., Method for Roentgen Demonstration of Minimal Hiatal Herniation, J. Mt. Sinai Hosp. 23:738, 1956.
46. Zaino, Costantino and Others, The Lower Esophageal Vestibular Complex, An Anatomic-Roentgen Study, Am. J. Roentgenol. Rad. Therapy & Nuclear Med. 84:1045 (Dec.) 1960.