

## DIAPHRAGMATIC HERNIA

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In differential diagnosis in the presence of atypical symptoms referable to the upper abdomen or cardiorespiratory system, diaphragmatic hernia must be given serious consideration by clinicians and roentgenologists. This condition, which is not now an uncommon finding during the roentgen examination of the gastro-intestinal tract, may or may not give rise to clinical signs and symptoms. It is interesting to note that previous to 1923, Pancoast and Boles<sup>1</sup> were able to find only 47 cases in the literature, whereas, in recent years many reports containing long series of cases have appeared. In our own series, there are 31 cases which were found during the routine examination of 2,213 stomachs, an incidence of 1.4 per cent.

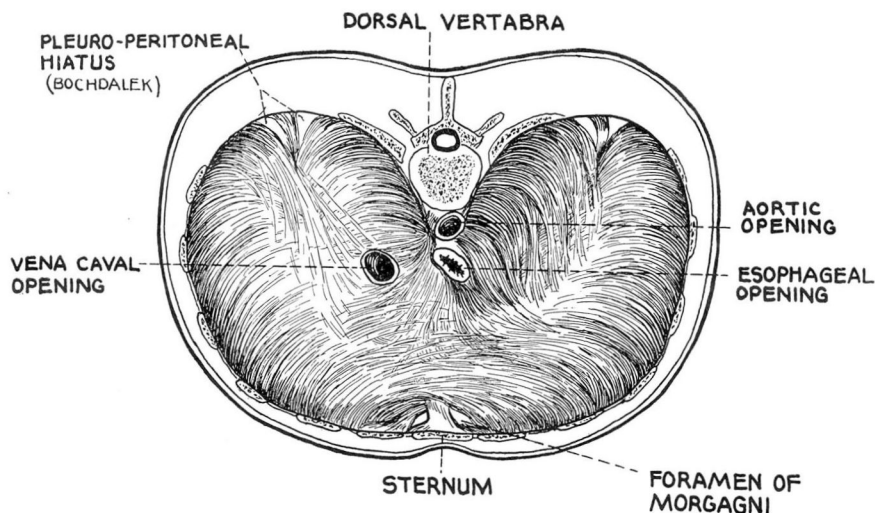


FIGURE 1: Schematic drawing showing foramina of Bochdalek formed by the failure of fusion of the pars lumbalis and pars costalis, and foramina of Morgagni formed by failure of fusion of the pars costalis and pars sternalis. These openings give rise to congenital diaphragmatic hernia.

### CLASSIFICATION

For the purpose of clarifying the classification of diaphragmatic hernia, it will be well to include associated conditions commonly accepted as herniae. Although many classifications have been presented and are of interest, insofar as determining whether the hernia is true or false, congenital or acquired, etc., many give little aid in determining the type of treatment that is to be given the patient. Probably one of the most practical classifications is the following one presented by

Marks,<sup>2</sup> and which we feel gives the clinician the maximum amount of information from the roentgen examination.

1. Thoracic stomach.  
    Esophagus very short  
    Entire stomach in the thorax above the diaphragm
2. Diaphragmatic hernia with short esophagus.  
    Part of the stomach above the diaphragm with a congenitally short esophagus
3. Hiatus hernia—esophagus of normal length.  
    Esophagus not forming part of the hernia (para-esophageal)  
    Esophagus forming part of the hernia
4. Congenital hernia.  
    Other parts of the gastro-intestinal tract—the colon or small intestine—are usually involved. Most common through foramen of Bochdalek and Morgagni (Fig. 1).
5. Traumatic hernia.
6. Congenital absence of the diaphragm.

Two conditions are listed above, namely, thoracic stomach and diaphragmatic hernia with short esophagus, which in the true sense are not herniae since the displaced organs have never been in the abdominal cavity, but have always been either entirely or partly in the thorax. They are, however, commonly considered as herniae and hence are classified as such for practical purposes. Another condition, eventration of the diaphragm, is occasionally classified with diaphragmatic hernia and certainly must be considered in the differential diagnosis of lesions of the diaphragm.

*Thoracic stomach* is a rare condition and one that is a developmental anomaly. When this occurs, the esophagus is usually very short and the stomach may be entirely within the thorax. In some of the cases which have been reported, however, a portion of the distal end of the stomach has been below the level of the diaphragm. The stomach may be surrounded by a serous sac which communicates with the peritoneal cavity, and, as a rule, is the only organ involved in the abnormal position. Thoracic stomach may give rise to very few symptoms, and longevity of life is not incompatible with such a condition since in some of the reported cases the patients have lived beyond the age of seventy.

*Diaphragmatic hernia with short esophagus* is another developmental anomaly but one which may not be as obvious to the examiner as those in the preceding group. In this type, the esophagus is likewise short but generally terminates a short distance above the diaphragm; hence a part of the pars cardiaca of the stomach is above the level of the diaphragm. It is very important to differentiate herniae in this group from the hiatus hernia since surgery, here, if contemplated, would do little good, due

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to the shortness of the esophagus and the impossibility of placing all of the stomach within the abdominal cavity.

Since it is not reducible, this hernia may be apparent during the roentgen examination while the patient is in the upright position. In contour, the upper portion of the stomach is usually pointed and the esophagus empties into this upper or peaked portion. The supine position should, of course, be employed in the examination of every suspected



FIGURE 2: Diaphragmatic hernia with short esophagus. The esophagus empties into the most superior portion of the pars cardiaca; a pointed contour is produced.



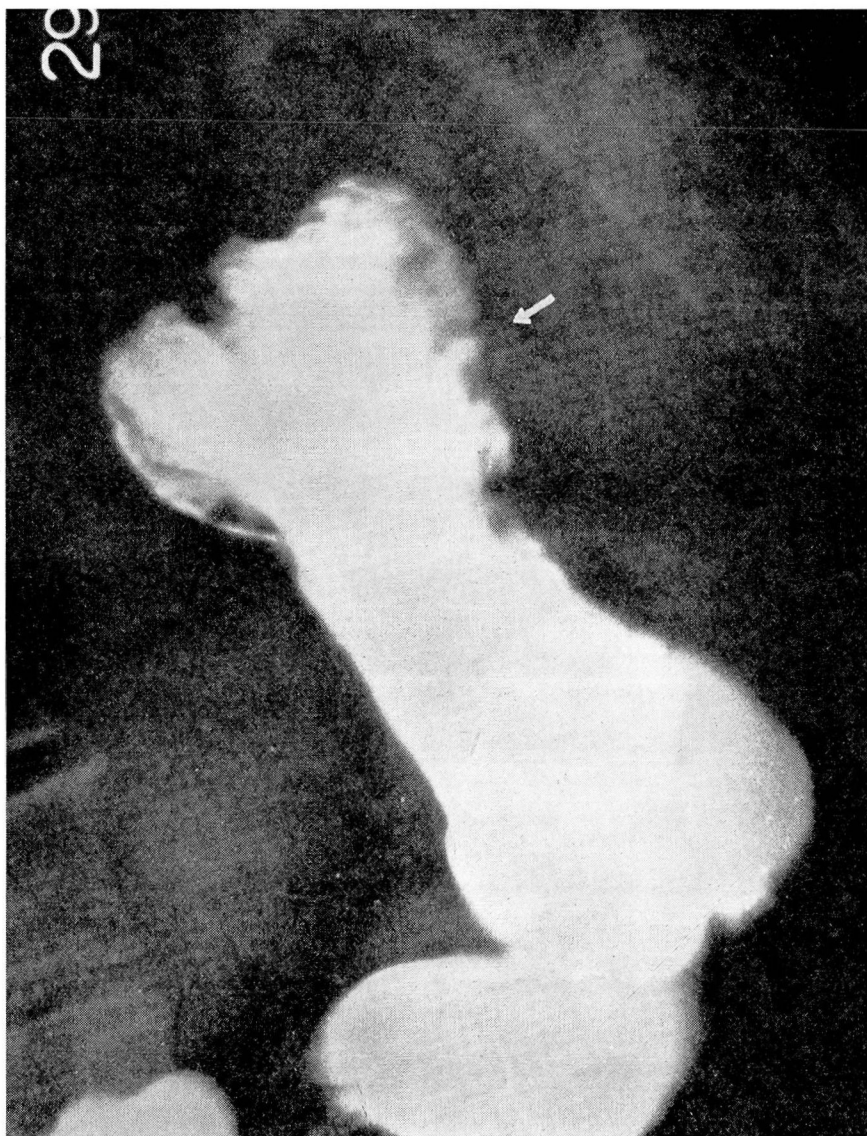


FIGURE 3: Hiatus hernia. Contour of stomach is round in upper portion.

diaphragmatic lesion and careful observation made with the fluoroscope during the swallowing of the opaque meal. A typical example of diaphragmatic hernia with short esophagus is shown in figure 2. In this illustration, the characteristic peaked contour of the intrathoracic pars cardiaca is quite apparent.

*Diaphragmatic hernia of the hiatus type* is perhaps encountered more commonly than any other. In this series, 29 cases or approximately 93

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per cent of the total number were of this type. This is a higher percentage than is generally reported but it may be accounted for partly by the fact that the majority of our gastro-intestinal examinations have been made in ambulatory adults. The esophageal hiatus is a muscular one and it is conceivable that there occurs some relaxation of the ring as the age periods are more advanced. In table I is given the age incidence as well as the sex of those in whom we have found herniae. It will be noted that the greater number of patients have been in the decades from 50 to 70 years.

TABLE I  
Age and Sex Incidence of Diaphragmatic Hernia

Age in years	30—40	40—50	50—60	60—70	70—80	80—90	Total
Male	1	2	3	5	3		14
Female	1	2	5	6	2	1	17

Although this group has not been subdivided in many classifications, we have tried to establish two subgroups. This, of course, is of no value from a therapeutic viewpoint but is chiefly of interest from the point of diagnosis. We have designated the para-esophageal class as those in which the esophagus remains fixed below the diaphragm and does not form a part of the hernia. The other class under this general group comprises those in which the esophagus forms a part of the hernia. Typical examples of these are seen in figures 3 and 4. In the illustration of para-esophageal hernia (Fig. 4), the esophagus may be seen in its normal position not forming a part of the hernia. The number of this type that we found in this series was six, or approximately 20 per cent of the total number of herniae.

One of the characteristic features of the *hiatus* group from the roentgen viewpoint is the rounded contour of the herniated part of the pars cardiaca. This, it will be noted, is quite different from the contour seen in the preceding group in which the superior portion of the pars cardiaca is generally pointed. Another feature is the finding that the distal end of the esophagus enters the stomach in its normal position. Since this type of hernia is amenable to surgical treatment, it is important to determine whether or not the esophagus is of normal length, thereby classifying the hernia as one of the hiatus group.



The *congenital herniae* are usually found in infants and children and are due to failure of fusion of the segments of the diaphragm. They occur most commonly on the left side and through the foramen of Bochdalek. The less common form of congenital hernia will be through the foramen of Morgagni, either on the right or left side. In the congenital hernia, organs other than the stomach are generally involved—both the small

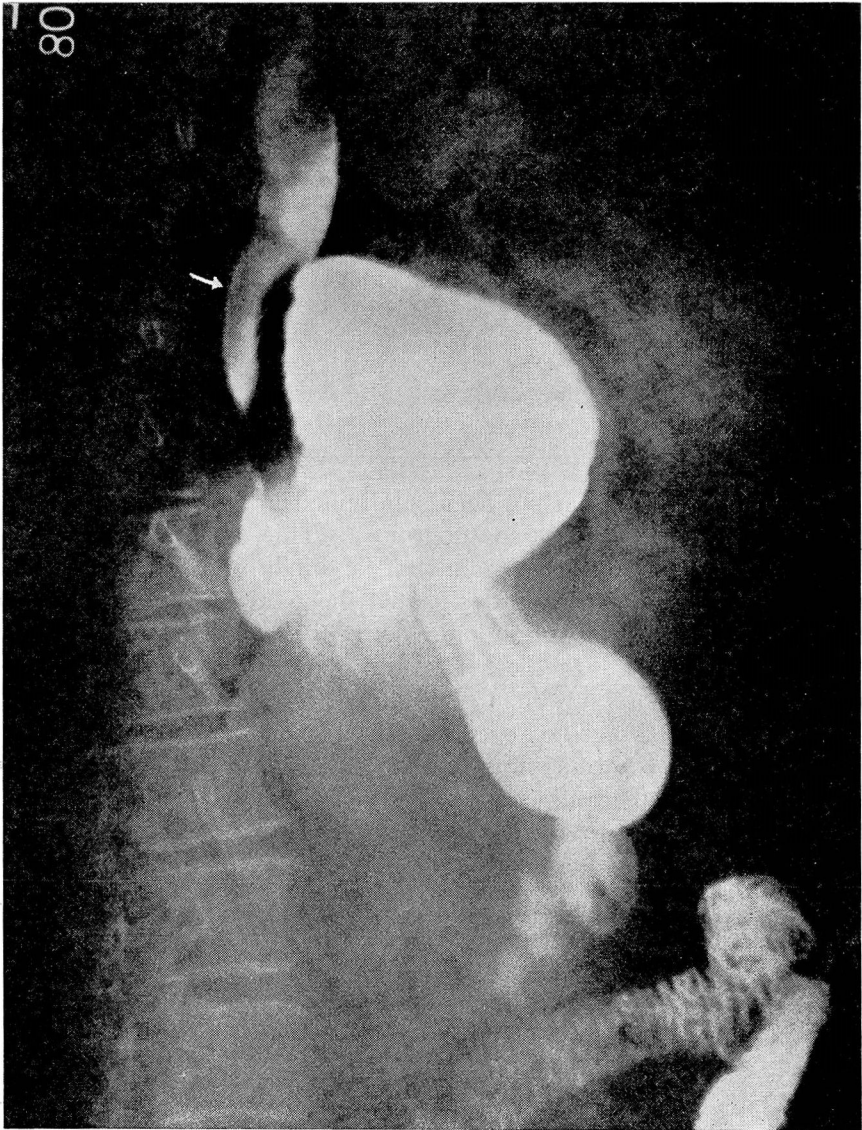


FIGURE 4: Hiatus hernia of para-esophageal type. Esophagus does not form a part of hernia and can be seen in its normal position.



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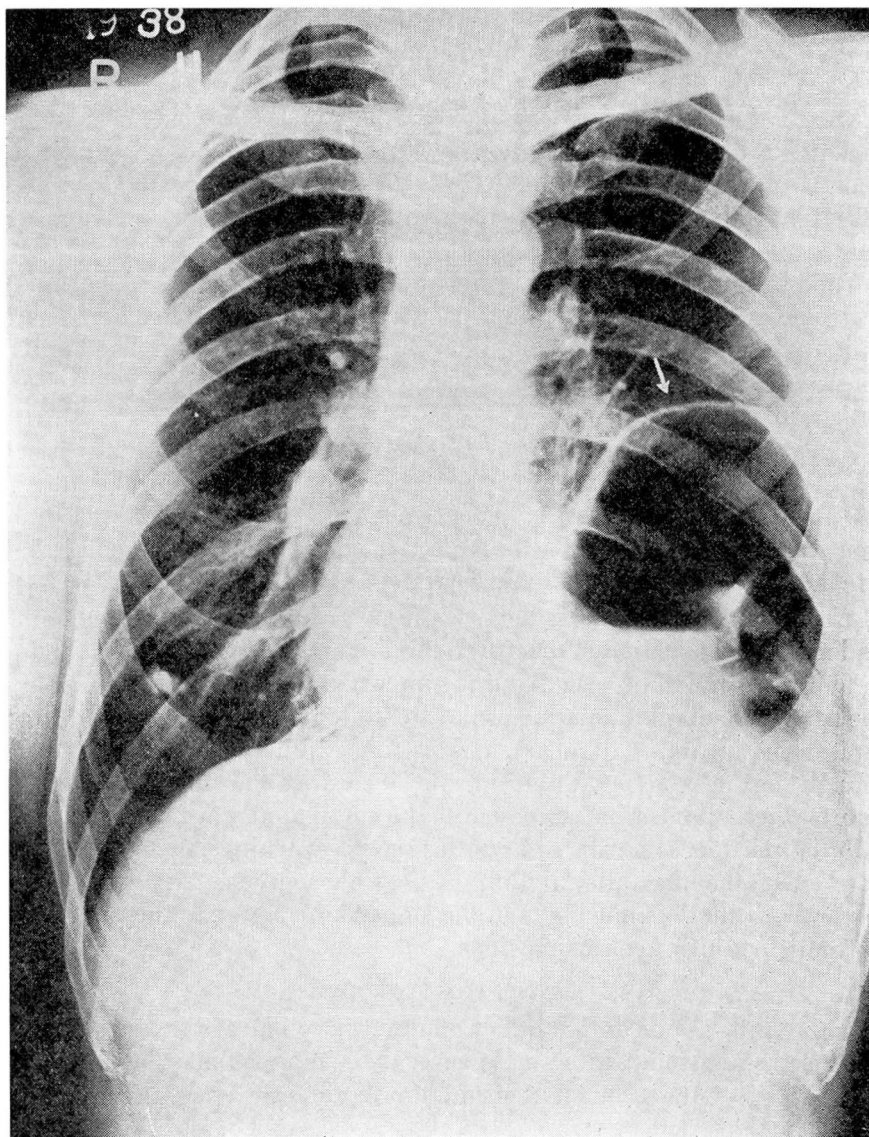


FIGURE 5: Traumatic diaphragmatic hernia as it appears in chest film. Fluid level can be seen in the stomach.

and large intestine, omentum, spleen, and the left lobe of the liver. Early death is the rule in these cases, due either to asphyxia or intestinal obstruction. The diagnosis is, of course, obvious following a few swallows of barium solution. No case of this type occurred in our series.

*Trauma* is thought by some observers to be responsible for one-third of all diaphragmatic herniae. In this series, there is only one case but

this is probably due to the type of patients examined, as noted previously. Hernia due to trauma may follow penetrating injuries, the most common cause, or falls and crushing injuries. While they may occur in any part of the diaphragm, they are far more common on the left side. The actual lesion is a tear in the diaphragm which usually runs radially from the central tendon and may extend from the dome to the periphery. The initial injury may be relatively small, as from a bullet wound, but gradual enlargement of the opening is the rule. The herniated parts may be any portion of the gastro-intestinal tract and associated organs. A hernia of this type is seen in figures 5 and 6. In this case, the stomach and part of both the small and large intestine were within the thorax. The herniae due to trauma may be repaired by surgery although such procedures are rather formidable.

*Congenital absence of the diaphragm* is a rare condition which may be associated with other congenital anomalies such as absence of the lung on the affected side. Generally the patient with this condition succumbs early although cases have been reported in which they have reached adult life and, strangely enough, had very few symptoms.

*Eventration of the diaphragm*, while not a hernia, may resemble one and must be considered in the differential diagnosis. Such a case is shown in figure 7. It will be seen that this somewhat resembles the chest film of the traumatic diaphragmatic hernia illustrated in figure 5. The demonstration of an intact diaphragm is at times quite a difficult task even though one uses all available means, including the opaque meal and fluoroscopy. It has been suggested that a small amount of air be injected into the peritoneal cavity in doubtful cases, watching it rise to be held in place by the intact diaphragm. A possible source of error may arise, however, if there is much gas in the stomach or bowel as they may produce misleading or confusing signs.

#### SYMPTOMATOLOGY

The symptoms of diaphragmatic hernia may be cardiac, respiratory, and gastro-intestinal. In a single case, the symptoms may be attributed to all these systems, but it is usual for those from one system to predominate.

In cases in which there is dysphagia, the clinician's attention is directed early toward the esophagus, and he is apt to think of cardiospasm or carcinoma of the esophagus, requesting roentgen examinations with these lesions in mind. Dysphagia occurs chiefly in the herniae with a short esophagus but it also may be present with other types. The dysphagia is usually the intermittent, not the progressive, type seen with carcinoma of the esophagus, and frequently it occurs only at the end of a heavy meal. Patients observe that they do not have symptoms if they eat a "light diet." Relief from dysphagia follows vomiting. Four of our



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TABLE II

Patients with Diaphragmatic Hernia Having Symptoms

	No.	Average Age	Sthenic	Normal Habitus	As-thenic	Average Duration of Symptoms	Cardio-respiratory Symptoms	Gastro-Intestinal Symptoms		
								Dysphagia present	Simulating ulcer	Simulating gall-bladder disease
Males	7	58.4	4	3	0	3.3 yrs.	4	2	3	0
Females	5	59.4	4	1	0	11 yrs.	0	2	2	3

twelve patients who had symptoms complained of dysphagia as shown in table II.

Patients with diaphragmatic hernia frequently have symptoms that simulate peptic ulcer or the hyperacidity syndrome. As shown in the table, five of our patients experienced such symptoms. The most prominent clinical features are epigastric distress, pain, or cramps occurring one-half to one hour after meals and made worse by food and relieved by vomiting. Relief may also be obtained by a bowel movement, passing flatus, belching, or taking an enema, these measures tending to change the intra-abdominal pressure. The symptoms may occur intermittently, they may be present after only one meal such as the evening meal which is usually the heaviest, or they may be present only when the patient eats before retiring. One of our patients, a fifty-six year old woman who had symptoms very suggestive of peptic ulcer, had had two episodes of hematemesis. Careful roentgen examination revealed a moderate sized hiatus hernia but no evidence of peptic ulcer. It is probable that the hemorrhages were due to erosions of the gastric mucosa at the site of the constricting ring of the hernia.

Diaphragmatic hernia at times causes symptoms which lead the clinician to think of chronic disease of the gallbladder. The patients complain of pain in the upper right quadrant radiating at times to the epigastrium or to the back. The attacks of pain come on during the course of a heavy meal or after the meal is eaten. Nausea and vomiting may follow later, usually relieving the discomfort. The distinguishing feature is the fact that with diaphragmatic hernia simulating cholecystitis there is usually no residual tenderness in the upper right quadrant after the pain passes. Drainage of the gallbladder will reveal normal findings, cholecystography shows normal findings, and the roentgen studies of the

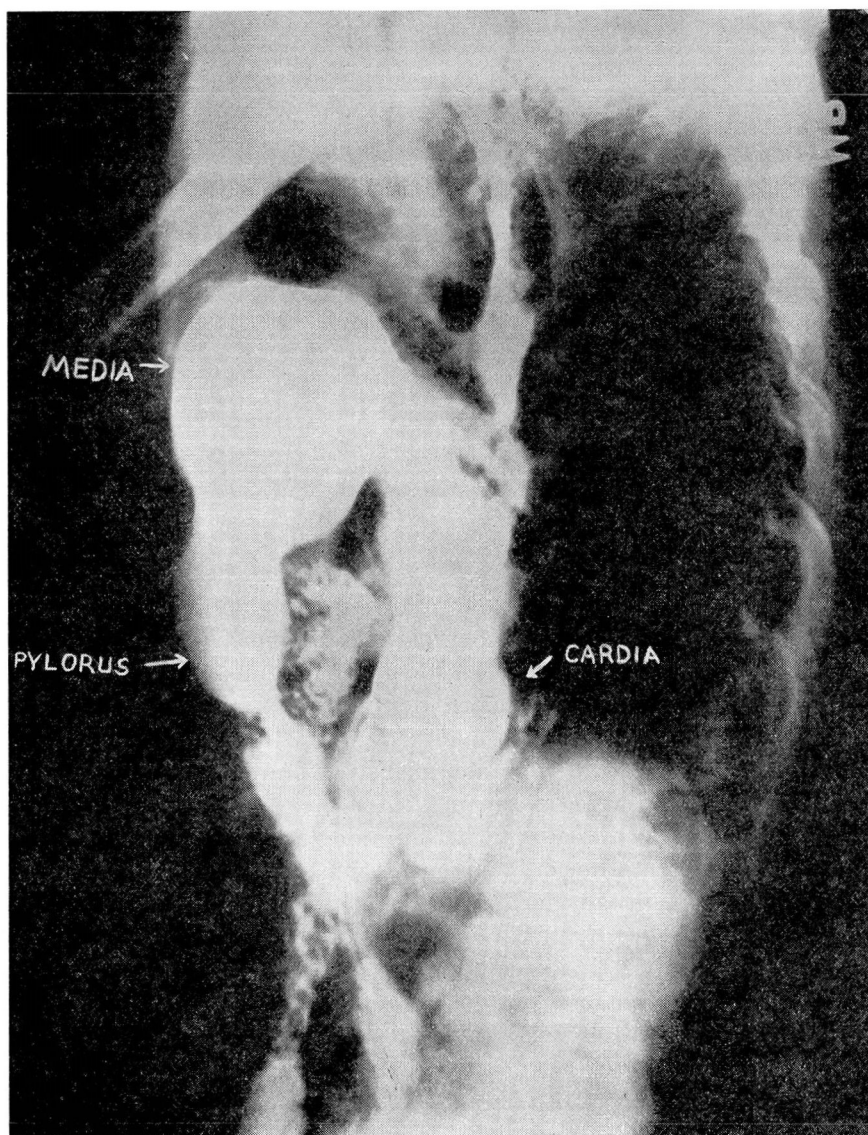


FIGURE 6: Stomach in thoracic position with pylorus pointing downward.

gastro-intestinal tract reveal the hiatus hernia. Table II shows that three of our patients, all women, had symptoms that led the clinician to make a diagnosis of gallbladder disease.

Symptoms of cardiorespiratory disease must be distinguished carefully from those produced by diaphragmatic hiatus hernia. The patients may complain of symptoms which very closely simulate angina pectoris; there may be pain beginning in the precordium or in the epigas-



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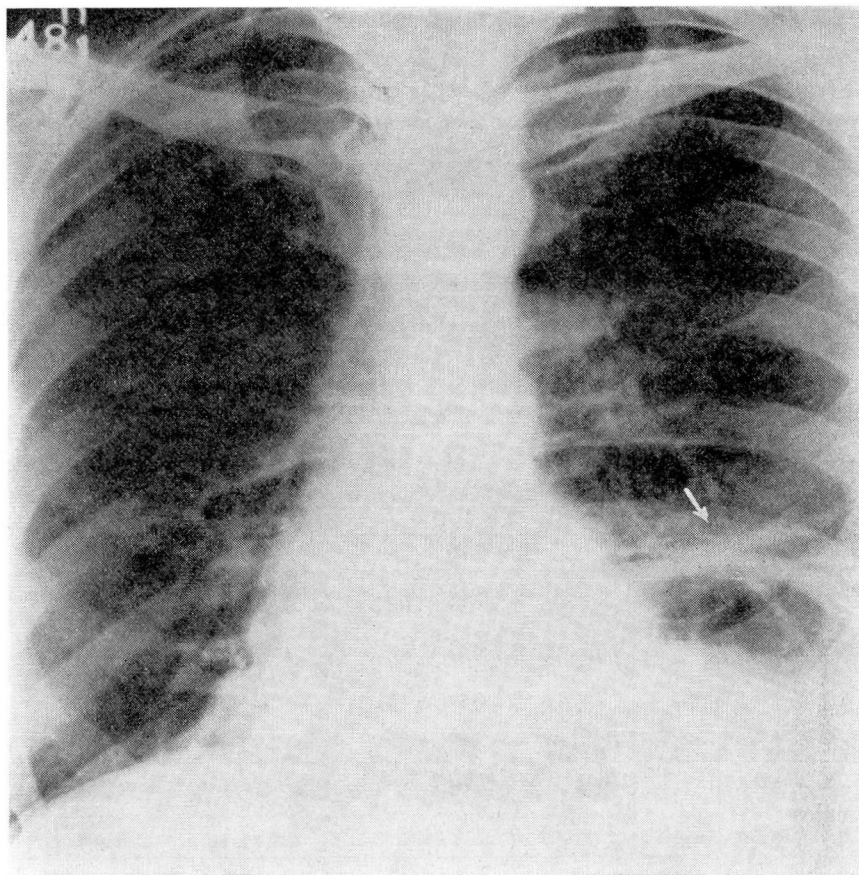


FIGURE 7: Eventration of diaphragm showing resemblance to traumatic hernia in figure 4.

trium and radiating to the left shoulder or down the left arm occasionally. To distinguish these cases from those of true angina pectoris, the relationship of the pain to exertion, the electro-cardiographic tracings, and roentgenograms of the stomach and esophagus must be carefully evaluated. One of our patients who had symptoms simulating angina pectoris due to a small diaphragmatic hernia also had true angina pectoris.

Some patients complain of pain in the region of the ensiform cartilage, severe dyspnea, and cyanosis while eating or shortly after eating. One such patient had attacks very frequently and always obtained relief when he could feel the food pass from the thoracic portion of his stomach to the abdominal portion. Another patient who, while eating, had severe dyspnea and pain in the region of the ensiform cartilage, obtained relief by vomiting, belching, or passing flatus. As shown in table II four of our

12 patients with symptoms had complaints referable to the cardiovascular system.

Strangulation or complete obstruction of the hernia may occur. The symptoms of these complications are sudden severe pain in the left upper epigastrium which is only slightly relieved by morphine. Severe and persistent vomiting soon ensue. Physical examination reveals rigidity of the upper part of the abdomen.

Many cases of diaphragmatic hernia are asymptomatic. Nineteen of our thirty-one patients had no symptoms which might be ascribed to the hernia. The herniae were either discovered during the course of a complete clinical laboratory survey or were found to be incidental to some other gastro-intestinal disease. In table III is shown the frequency with

TABLE III  
Patients with Diaphragmatic Herniae that Were Asymptomatic

	No.	Average Age	Sthenic	Normal Habitus	Asthenic	Associated diverticulosis	Associated gallbladder disease	Cancer elsewhere in body
Males	7	60.7	5	2	0	2	4	1
Females	12	61	6	6	0	5	2	1

which other pathologic states occurred in these patients with asymptomatic diaphragmatic hernia. The demonstration of a diaphragmatic hernia must not deter the roentgenologist and the clinician from a thorough investigation of the remainder of the gastro-intestinal tract. Seven of the patients who had asymptomatic diaphragmatic hernia had diverticulosis of the colon as an associated roentgen finding and in one case there was a large diverticulum of the third portion of the duodenum. Six cases showed either nonvisualization of the gallbladder with the cholecystographic dye or cholelithiasis, or both.

#### PHYSICAL SIGNS

Only with the large hiatus herniae will physical signs of diaphragmatic hernia be evident. The examiner may encounter asymmetry of the chest with the ribs more widely separated on the affected side and a flare of the costal margin that is noticeable on the affected side. Percussion may reveal a tympanitic note which may be limited to the base of the lung or may be elicited higher toward the axilla. Shifting the position of the



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patient may cause a marked change in the physical findings—from tympanitic to dull—if fluid replaces air in the area being examined. Percussion may also reveal failure of the left diaphragm to descend. On auscultation of the chest, a high-pitched tinkling sound may be heard, or gurgling and splashing sounds may be audible.

### DIAGNOSIS

The diagnosis of diaphragmatic hernia is almost entirely dependent upon the roentgen examination. The existence of the condition may be suspected from a film of the chest, but for accurate diagnosis it is necessary to employ the opaque meal and both the fluoroscopic and radiographic techniques. During this examination, it is essential that the patient be observed in the supine position with head lowered as well as the upright and prone positions, since it is by means of the first named position that the majority of herniae will be discovered. Particular attention should be devoted to determining the length and position of the esophagus as noted in the foregoing paragraphs on the classification of the various types of herniae.

The mere presence of a hernia may be determined at the time of a laparotomy by palpating the esophageal opening in the diaphragm. The type of hernia cannot be determined by this method although the amount of relaxation can be accurately noted by the number of fingers that can be passed through the relaxed ring. This procedure has its greatest value, of course, after the presence and type of hernia has been determined by means of the roentgen examination.

Physical examination alone is not of great value in the diagnosis of this condition. While large herniae may be found to be present by physical findings, the majority of cases would be missed, since by far the greater number of herniae are small or of only moderate size. The history is often suggestive of such a condition, but it usually simulates other pathological conditions such as ulcer or gallbladder disease. Hence, to make a diagnosis from the history alone would be quite hazardous.

### TREATMENT

In the medical management of patients with diaphragmatic hernia, the patient should be instructed to eat small meals frequently and to maintain an erect posture for a period of several hours after meals. It is inadvisable for the patients to eat before retiring at night and even with these precautions, some patients will find it more comfortable to sleep in a semirecumbent position.

If the gastro-intestinal symptoms are not sufficiently relieved following medical management, if there are frequent and severe attacks of cardiorespiratory symptoms, or if there is danger of obstruction or strangulation, surgery must be resorted to. Reduction of the hernia

and repair of the diaphragm may be made either by a thoracic or abdominal approach. In some cases, it is advisable to do a preliminary phrenicotomy. Obviously, cases with a short esophagus cannot be helped by surgery.

#### SUMMARY

Diaphragmatic hernia is a condition which is being recognized with increasing frequency. In this group, 31 herniae were discovered during the course of 2,213 consecutive roentgen examinations of the stomach—an incidence of 1.4 per cent.

The majority of herniae so found are incidental and asymptomatic, only 12 of this group having symptoms that could be ascribed to the hernia.

Diaphragmatic hernia presents no characteristic symptoms. The most important in this group were dysphagia and symptoms simulating cardiorespiratory disease, hyperacidity syndrome, and gallbladder disease.

In the diagnosis of diaphragmatic hernia, the roentgen examination is the most important procedure, with emphasis placed upon the supine position with the head of the patient lowered.

#### REFERENCES

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2. Marks, J. H.: Diaphragmatic hernia and associated conditions, *Am. J. Roent.*, 37:613-632, (May) 1937.