TRAUMATIC HIATUS HERNIA

BY

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The symptoms produced by herniation of the stomach through the oesophageal hiatus of the diaphragm are clearly defined and accurate diagnosis is consistently possible. As a result, hiatus hernia ranks among the common conditions referred for surgical opinion. Laymen commonly believe that hernias are produced traumatically, describing them as ruptures, and it is not surprising that when told they have a diaphragmatic hernia they should search their memories for a causative injury. Claims under the terms of Workmen's Compensation Acts, Third Party Insurance Acts, or the institution of legal actions are becoming frequent. The courts and insurance companies look to the medical profession for guidance, and doctors involved in this type of litigation sometimes find themselves in the embarrassing position of expressing diametrically opposite views.

Harrington (1952) states that of 397 of his cases of hiatus hernia, 19 (5%) were traumatic. Robb (1954) considers that 13 of his 138 cases (10%) were due to injury. He lists the nature of the trauma, but neither author describes the immediate symptomatology, nor their criteria for regarding injury as the basic cause. Friedman (1960) has described the histories of two cases where trauma was immediately followed by symptoms of reflux dyspepsia. Apart from this, I can find no reference in the recent medical literature dealing specifically with this subject.

Hiatus hernia is such a common disease that there must be people with established lesions who are involved in an accident and who later relate the hernia to the trauma. Hurst (1934) found that 8% of patients undergoing gastro-intestinal investigation were suffering from hiatus hernia. Brick's (1948) experience was similar, his incidence being 8.9%. These, of course, were patients with dyspeptic symptoms, but some people have symptomless hernias or suffer from habitual mild dyspepsia and never seek medical advice. Ritvo (1930) found 14 symptomless cases in a series of 60. Moersch (1938) found 19 people without symptoms among 246 patients; Shanks (1948) thinks that 20% of cases are symptomless in the early stages of the disease. Approaching the question of symptomless hernias differently, Brick (1948) examined 1,000 apparently normal people and found that 13 had hernias, and Cernock (1953) studied 200 asymptomatic individuals over the age of 50 and found three with hiatus hernias. With such cases the occurrence of an accident before the development of obtrusive symptoms would constitute a *prima facie* case for considering the hernia to be of traumatic origin. In addition there are unscrupulous people who hide the fact of their prior dyspepsia in order to gain greater compensation for an industrial or civil accident. It is the doctor's unenviable task to advise upon these problems, and in this he has a duty to both the patient and the assessor.

In evaluating a case of hiatus hernia one would expect guidance from the laws which have evolved from the vast industrial experience with inguinal hernia. It

is obvious, however, that it has been impossible to formulate rules which cover all contingencies. Kessler (1931) remarks: "Workmen's Compensation Legislation, at least in this country [U.S.A.], represents a compromise between the forces of labour and capital." He describes the postulates laid down by certain States in the U.S.A. which had to be fulfilled before an inguinal hernia could be regarded as compensable. These include among others: (1) There was an injury resulting in the sudden appearance of the hernia. (2) Such prostration occurred that the employee stopped work immediately. (3) The fact was communicated to the employer and doctor within 24 hours. (4) The patient had to agree to surgical treatment so that the operative findings could be used in assessing the aetiology.

These postulates presuppose that traumatic hernias are produced only by extreme violence, and they convey the spirit of the law to pay as little as possible for industrial hernias. However, in most progressive countries such rigid criteria have been modified towards an acceptance of Mock's (1919) concept of compensable hernias. These include not only the violent traumatic hernias but all cases of accidental hernias so long as the force causing their development was the result of an unnatural occupational hazard. Imbert (1923) divides industrial inguinal hernias into two types. The hernia "de force" and the hernia "de faiblesse." The hernia de force is one produced by an unusual effort beyond that required for routine work or which occurs with the injured in an unfavourable position to assume the effort. The injured suffers severe pain and malaise and is obliged to cease work immediately. The traumatic hernia de faiblesse is one which occurs through an abdominal wall that is already weak or defective. In such cases the injury might not be severe and the signs and symptoms are not necessarily dramatic. This appears to be a reasonable and equitable concept which should be applicable to hiatus hernia. In this paper an attempt is made to evaluate the role of trauma in the aetiology of hiatus hernia and to determine the value of the history of injury and symptomatology in assessing responsibility in industrial and legal disputes.

Material

Since 1955 I have recorded all my cases of hiatus hernia on printed forms. One heading deals with the history of trauma, another with the patient's opinion of why the hernia developed. I have analysed the cases where the patient considered that an accident, effort, or strain was responsible or where the symptoms followed an accident. During these six years 238 patients were referred for treatment: 22 were infants or young children and the hernias were obviously congenital in origin. In 24 of the 216 adults there were at least some grounds for contending that injury or strain was responsible. My opinion has also been sought with six industrial cases and three cases of civil litigation. These were not part of routine practice and are not included in the series of 216 cases. There are therefore two groups under discussion: 24 patients referred for surgical opinion who had no ulterior motive in asserting that trauma was responsible, and a potentially compensable group of nine whose prime interest was to establish the traumatic origin of their hernias.

Clinical Group.—Of the 216 adults from which this group is derived, 118 were women and 98 were men. Of the 24 patients in whom a traumatic cause was

suspected 13 were men and 11 were women. The average age of the total series was 59, and of the selected group 52.

The role of trauma in hiatus hernia must be almost entirely assessed from the history given by the victim. Amongst the clinical patients there has presumably been no intentional misrepresentation of the facts. It is convenient to list the cases according to the nature of the injury sustained.

1. Long-continued Strain

Many patients believe that carrying weights and hard manual labour cause hiatus hernias. In this series 13 people (six women and seven men) thought that the rigours of their lives were responsible. Two of the women were professional nurses and two others cared for aged and infirm relatives. They thought that lifting and turning their charges was responsible. In no instance was there a clear-cut incident which marked the onset of dyspepsia. The other women worked hard at their domestic chores, fetching, carrying, and polishing. Five men were labourers who believed that heavy manual work had caused their hernias. Again there was no definite incident, no clear recollection of when the dyspeptic symptoms had begun. They could recall that certain activities such as digging, bending forwards, or lifting weights aggravated the dyspepsia or caused chest discomfort, but these surely were only the effects of posture in precipitating gastro-oesophageal reflux. One patient was an amateur weight-lifter and another had been a Rugby forward; but both, while holding the belief that their exertions had caused their hernias, admitted that dyspepsia corresponded with the decline of their physical fitness and the accession of weight.

Analysis of these patients in terms of ideal weight, pregnancies, and body build shows that all of them were the type of person liable to develop hernias naturally (Marchand, 1959). All the women had been pregnant, and all were above ideal weight. The men were heavily built, overweight, and over 50 years of age.

It was felt that these 13 patients were destined to develop hernias whether or not they had been subjected to prolonged physical strain. There were other patients who had worked hard but did not blame their labours either because it did not occur to them or because their symptoms had preceded the periods of physical stress. It has been shown that when a person deliberately lifts a heavy weight or when he strains at stool both the intrapleural and intraperitoneal pressures rise. Even with considerable controlled straining the pleuro-peritoneal pressure gradient may not exceed 10–20 mm.

Hg, which is less than that produced by deep inspiration. It is only when the straining effort is sudden and severe that the peritoneal pressure outstrips that within the pleura (Marchand, 1957). This implies that when weights are lifted there is no great tendency for the stomach to be forced into the oesophageal hiatus, because the peritoneal pressure is cushioned by the rise in the pleural pressure. In this way forces acting on the diaphragm differ from those exerted upon the external hernial sites. These observations support the contention that controlled exertion plays a lesser part in the aetiology of hiatus hernia than with other abdominal hernias. Of course it is not possible to deny entirely that long-continued physical stress is blameless in the causation of hiatus hernias, but at most its part is trivial.

2. Isolated Sudden Strain

Four patients were able to relate the appearance or aggravation of symptoms to an isolated instance of effort or strain. They could clearly recall the nature of the strain and the symptoms which followed. The history of injury and of the immediate and delayed symptoms are so similar that only one case history need be given. The relevant details of these cases are summarized in Table I.

Case 1.—A male clerk aged 33 had suffered from dyspepsia since the age of 22. Epigastric pain occurred with an empty stomach and was relieved by meals. Nocturnal discomfort was common and was eased by drinking milk. Heartburn and eructations were not a feature of the dyspepsia. A diagnosis of duodenal ulcer had been made and over the years he had been under intermittent but poorly sustained medical treatment. In November, 1959, soon after a large meal, he was digging in his garden. The spade met with resistance, and he placed his right foot on the blade, bent well forwards, and suddenly and forcibly jerked the handle towards his body. He immediately felt a sudden snap beneath his xiphisternum, and this was accompanied by an acute pain followed by vomiting. Vomiting persisted throughout the night, and the pain inhibited respiration and remained for about 10 days. He recalls that he was puzzled and troubled by continuous pain in his left shoulder. Towards the end of the second week he became conscious of heartburn, acid regurgitation, and belching, and these slowly became worse. A hiatus hernia was diagnosed in March, 1960, and after a preliminary period of weight reduction operation was performed on May 3. At operation, through an abdomino-thoracic incision, a typical sliding hiatus hernia was found. The local appearances did not differ from those usually found in this type of hernia. A chronic duodenal ulcer was present and the condition was dealt with by a standard Allison's repair combined with bilateral vagotomy and a limited Billroth I gastrectomy.

TABLE I.—*Cases of Traumatic Hiatus Hernia Following a Sudden Isolated Strain*

Case No.	Age and Sex	Pregnancy	Height		Weight		Pre-traumatic Dyspepsia	Nature of Strain	Post-traumatic Symptoms		
			ft. in.	cm.	lb.	kg.			Immediate	Irritation of Diaphragm	Hiatus Hernia Symptoms
1	33 M	—	5 7	170	180	81.6	Duodenal ulcer	Digging in garden	Snap under xiphisternum. Pain in epigastrium. Vomiting	Inspiratory pain. Left shoulder-tip pain	Reflux dyspepsia 14 days after trauma
2	47 M	—	5 9	175	198	89.8	Nil	Changing motor-car wheel	Tearing pain beneath xiphisternum. Vomiting	Inspiratory pain	Reflux dyspepsia within 7 days
3	55 F	2	5 2	157	175	79.4	Pregnancy dyspepsia. Fullness after meals after age 48	Bout of coughing during bronchitis attack	Tearing substernal pain. Winded	Inspiratory pain. Left shoulder pain	Reflux dyspepsia within 7 days
4	47 F	2	5 0	152	140	63.5	Pregnancy dyspepsia	Moving a wardrobe	Tearing substernal pain. Vomiting. Dyspnoea. Palpitations	Hiccup. Left shoulder pain	Reflux dyspepsia within 7 days. Dysphagia 6 weeks

3. Major Trauma

Seven patients relate their hernias to some form of major trauma. A case is described here, and the others are summarized in Table II.

Case 7.—A 2-para aged 66 had experienced moderate dyspepsia during her pregnancies. These symptoms disappeared after parturition. At the age of 50 she gradually gained weight but had no dietary discomfort apart from a mild sense of fullness after meals. In 1956 she was involved in a motor accident and sustained a fracture of the lower sternum. She had no recollection of the accident or of the immediate symptoms. In the ambulance she vomited repeatedly and noticed that her vomitus was stained with fresh blood. She was in hospital for four weeks and suffered continuous chest pain and repeated bouts of hiccup. About four months after the accident she still had the "sick" feeling in her upper abdomen. Acid regurgitation, heartburn, and eructations had started while in hospital and vomiting was frequent. The sick feeling and dyspepsia were aggravated by tight garments and recumbency. Because of the occurrence of constricting chest pain she underwent cardiac investigation; this was negative, but a barium-meal examination showed a large sliding hiatus hernia. This was repaired on October 6, 1956, through a thoracic incision. The findings did not differ from those usually encountered with a hiatus hernia. Her symptoms have been cured by the operation.

Comment

Out of the series of 216 adults with hiatus hernia there were 11 (5%) in whom trauma apparently played a part in precipitating herniation. Analysis of these case histories indicates that the following features provide a guide to assessing whether a particular accident or strain was responsible for producing the hernia.

Nature of Trauma.—The nature of the injury has varied from more or less physiologically strenuous effort to serious crush injury of the chest and abdomen. The only common feature has been that the force has occurred suddenly. The effect of this has been to increase the intraperitoneal pressure. In most cases there appears to have been pre-existing weakness of the hiatus and its ligaments. It has not always been possible

to analyse the mechanism whereby the intraperitoneal pressure was increased. Recollections of body posture or the site of impact during the incident were often clouded and inexact. The injury was not necessarily severe, but it was definite and clearly etched in the victim's memory, if not for its severity, then for the effects which it provoked.

Immediate Symptoms.—A clear picture of the immediate post-traumatic symptoms has emerged. Where the injury has neither impaired consciousness nor been so overwhelming as to mask localized sensations, a sudden painful epigastric or low substernal sensation has been felt. This has been variously described as a "snap," a "tearing pain," an "agonizing pain," or a "painful sick feeling." Every patient not otherwise seriously injured described this immediate symptom. Vomiting has commonly accompanied the pain. A feeling of being winded, similar to that produced by a blow in the solar plexus, was twice mentioned. Symptoms of diaphragmatic irritation such as shoulder-tip pain, hiccup, and inhibition of inspiration were common. In one case palpitations were produced, and these could feasibly have been due to the sudden development of a hernia. It is possible that the epigastric pain and the winded sensations are due to rupture of the muscular attachments of the crurae and of the ligaments which anchor the cardia to the hiatus (Marchand, 1959). The vomiting may be partly of reflex origin, and, in view of the haematemesis which occurred twice, partly due to gastric trauma. The symptoms of diaphragmatic irritation could be due to rupture of the anterior decussating hiatal fibres and to ligamentous injury.

Appearance of Symptoms of Hiatus Hernia.—In this respect, too, a reasonably clear picture emerges. With the exception of Case 8 the patients experienced the beginnings of their permanent hiatus hernia symptoms while still recovering from the acute injuries. The one exception experienced reflux dyspepsia some three months after the accident, when he had begun to gain weight and resume strenuous work. Not all developed symptoms of reflux dyspepsia, but it must be remembered that between 10% and 20% of all hiatus hernias

TABLE II.—Cases of Traumatic Hiatus Hernia Following Major Trauma

Case No.	Age and Sex	Pregnancy	Height		Weight		Pre-traumatic Dyspepsia	Nature of Injury	Post-traumatic Symptoms		
			ft.	in.	lb.	kg.			Immediate	Irritation of Diaphragm	Hiatus Hernia Symptoms
5	68 F	5	5	4	166	75.2	Pregnancy dyspepsia. Flatulence and fullness after meals at age 40	Fell down stairs landing on back. Fractured spine	Agonizing pain in epigastrium. Winded	Inspiratory pain	Reflux dyspepsia within 30 days. Oesophagitis
6	51 F	1	5	3	120	54.4	Pregnancy dyspepsia	Motor accident. Body-bruising. Fractured arm	No recollection	No recollection	Epigastric pain on admission to hospital. Reflux dyspepsia within 7 days
7	66 F	2	5	8	190	86.2	Pregnancy dyspepsia. Fullness after meals from age 55	Motor accident. Fractured sternum	Haematemesis. Unconsciousness	Hiccup	"Sick" feeling. Reflux dyspepsia from time of injury
8	33 M	—	5	8	173		Nil	Motor accident. Lost right leg	Unconscious 48 hours	Shoulder pain, painful inspiration	Reflux dyspepsia 3 months later on beginning to work
9	41 M	—	5	9	175	82.5	„	Crushed by steel girder. Fractured ribs and vertebra	Epigastric pain	Hiccup several days later	Reflux dyspepsia. Constricting chest pain. Oesophagitis from time of injury
10	60 M	—	5	6	155	70.3	„	Motor accident. Diffuse bruising	Epigastric pain. Winded	Painful inspiration. Hiccup	Reflux dyspepsia from time of accident
11	54 M	—	5	11	180	88.0	„	Motor accident. Fractured ribs. Fractured vertebra. Haemothorax	Winded. Severe upper abdominal pain. Haematemesis	Respiratory pain	Reflux dyspepsia from date of accident

are symptomless (Moersch, 1938; Brick, 1948; Shanks, 1948), while in other cases the predominant or only symptom may be dysphagia, precordial chest pain, haemorrhage, or anaemia (Table III).

Pre-traumatic Dyspepsia

Proof of pre-traumatic dyspepsia might cast doubts upon the contention that injury caused the hernia. Four of the five women had experienced discomfort during their pregnancies. I believe that severe pregnancy dyspepsia is a forewarning of the development of hiatus hernia and that it denotes weakness of the structures on which the stability of the cardia depends (Marchand, 1955). These symptoms cleared after parturition, but recurred to some extent in two patients when they later gained weight. These women were probably predisposed to hiatus hernia and would have developed them spontaneously with the passage of time. However, in the cases discussed, trauma appears to have precipitated herniation even if only to the extent of hastening the inevitable. All the men were overweight for their ages and body builds, but only one had dyspepsia prior to the accident. In this case a duodenal ulcer had been proved and its existence was confirmed at operation. In this case, and probably also with the others, hiatal weakness preceded the injury, and only because of this was the trauma sufficient to cause the hernias.

It has already been mentioned that hiatus hernia may be symptomless, but it is equally true that reflux dyspepsia can be produced by conditions other than hiatus hernia—for example, by obesity, cholecystitis, peptic ulceration, etc. (Marchand, 1958). Also, Donnelly (1953) presented evidence which suggested that habitual gastro-oesophageal reflux may in itself weaken the

TABLE III.—List of Symptoms Experienced by a Random Sample of 100 Patients with Sliding Hiatus Hernias and 50 with Rolling Hernias. All Patients in These Groups were Referred for Surgical Opinion, Consequently All Had Symptoms

	Sliding Hernia	Rolling Hernia
Epigastric discomfort	91	38 (76%)
Heartburn	91	15 (30%)
Erections	82	33 (66%)
Acid regurgitation	77	12 (24%)
Postural aggravation of dyspepsia	77	8 (16%)
Constricting chest pain	64	8 (16%)
Vomiting	45	7 (14%)
Dysphagia	44	38 (76%)
Backache	28	2 (4%)
Haemorrhage	10	25 (50%)
Anaemia	8	21 (42%)
Hiccup	10	18 (36%)
Palpitations	6	13 (26%)
Cough	0	12 (24%)

"sphincter" mechanism of the hiatus and so promote hiatus hernia. The pre-traumatic presence of symptoms of reflux dyspepsia does not therefore necessarily imply that the hernia preceded the trauma, and in fact their presence, by indicating hiatal weakness, may make it more possible that a relatively mild injury would finally disrupt the resisting structures and produce herniation. It would appear from the present analysis that this is a not uncommon sequence, but when it does occur the immediate symptoms produced are very definite and often out of proportion to the trauma responsible. When there is no such definite reaction to the trauma the pre-existence of dyspeptic symptoms is important and can probably be taken to indicate that a hernia had already formed.

Potentially Compensable Group

Nine people are included in this group (eight men and one woman). They were assessed on the grounds already outlined. My views were that trauma was responsible in six of the cases. Three case histories are given because their details are of interest and add to the overall picture of traumatic hiatus hernia. The symptoms of the others are summarized in Table IV.

Cases Where Trauma was Thought Responsible

Case 12.—A 2-para aged 30 admitted that she had symptoms of reflux dyspepsia during her second pregnancy. She had no discomfort for four years after her confinement. On November 28, 1959, she was involved in a motor accident in which her eldest child was killed. She has no recollection of the accident. Her first memory is of pain beneath the xiphisternum. She experienced difficulty with breathing and vomited many times. No fractures were shown on x-ray examination. She was in hospital for two weeks and complained continuously of epigastric and low precordial pain and also of left shoulder-tip pain. The hospital records confirm the shoulder pain and describe upper abdominal rigidity and vomiting. Rupture of a viscus was suspected. She claimed that heartburn was severe during this period, but no record of this was made. After discharge from hospital her dyspeptic symptoms continued, and in May, 1960, six months after the accident, a hiatus hernia was demonstrated.

Comment.—The nature of the injury, the presence of upper abdominal and substernal pain on recovery of consciousness, the bouts of vomiting, and the signs of diaphragmatic irritation support the view that the hiatus had ruptured. She dates the symptoms of reflux dyspepsia from the time of her accident. One therefore felt that there was clear evidence in support of her claim.

TABLE IV.—Cases of Hiatus Hernia Involved in Legal Dispute and Accepted as being Traumatic

Case No.	Age and Sex	Preg-nancy	Height		Weight		Pre-traumatic Dyspepsia	Nature of Injury	Post-traumatic Symptoms		
			ft. in.	cm.	lb.	kg.			Immediate	Irritation of Diaphragm	Hiatus Hernia Symptoms
12	30 F	2	5 4	163	126	57.2	Pregnancy dyspepsia	Motor accident. Soft-tissue injury	Unconsciousness. Epigastric pain awakening	Shoulder-tip pain	Reflux dyspepsia from time of injury
13	54 M	—	5 7	170	185	83.9	Duodenal ulcer 14 years before	Lifting a 180-lb. (82-kg.) weight	Tearing substernal pain. Haematemesis		Reflux dyspepsia from time of injury
14	42 M	—	5 10	178	184	83.5	Nil	Forceful strain attempting to loosen a bolt with a large spanner	Epigastric pain	Shoulder-tip pain. Painful inspiration	Constipation from time of injury. ? vagus nerve injury. No dyspepsia
15	58 M	—	5 7	170	154	69.9	„	Struck forcibly across upper abdomen by a spanner handle	Winded. Haematemesis	Painful inspiration	Abdominal colic and vomiting since injury
16	56 M	—	5 8	173			„	Forcibly adjusting a hanging steel structure to its mounting	Sudden epigastric pain	Pain aggravated by cough. Shoulder pain	No symptoms
17	49 M	—	5 11	180	202	91.6	„	Crushed by rock fall. No fractures	Winded. Epigastric pain. Vomiting	Shoulder pain. Hiccup	Reflux dyspepsia from time of injury

Case 13.—A carpenter aged 54 was discharged from the Army in 1944 because of duodenal ulceration. He claimed that this was cured medically and he had experienced no discomfort for 14 years prior to 1959. On February 3, 1959, he attempted to move a 180-lb. (82-kg.) log of wood off the ground. He immediately felt a tearing substernal pain. While still at the factory he vomited blood, collapsed, and lost consciousness. He was removed to hospital and was given 2 pints (1,140 ml.) of blood. He complained of a dull ache in the upper abdomen and beneath the lower sternum. The pain eased over the course of five days. The hospital notes confirm the history and a tentative diagnosis of bleeding duodenal ulcer was made. He complained of belching and heartburn and of constant epigastric fullness which was relieved by vomiting. A barium x-ray examination on February 28 showed a large incarcerated hiatus hernia. No duodenal ulcer was shown. On March 4 an oesophagoscopy showed that acute oesophagitis was present. Operation was performed on March 15, only 40 days after the injury, but the anatomical findings did not differ from those usually found with hiatus hernia. An abdomino-thoracic incision was used and no ulceration of the stomach or duodenum was felt.

Comment.—This case is of interest because of the short interval between injury and diagnosis and repair of the hernia. The history of injury, the immediate symptoms, and the sudden occurrence of reflux dyspepsia, all independently recorded, point to this being a traumatic hernia. The patient's claim for workmen's compensation was challenged because of the history of duodenal ulceration and the diagnosis of bleeding peptic ulcer on admission to hospital. His claim was accepted when the x-ray and operative findings were reported to the commissioner. Though one accepts that this was a traumatic hernia, the absence at operation of haematoma or fibrosis in the region of the hiatus is disconcerting. The only explanation is that the hiatus was already weakened and that only a few fibres, which had maintained the size and shape of the hiatus, ruptured. The actual damage caused was slight even though the effects were cataclysmic. This view is supported by the fact that no unusual anatomical features have been found in any case operated upon.

Case 15.—A diamond driller aged 58 had spent many years prospecting in Africa and had never been troubled by dyspepsia. On April 16, 1959, he was screwing a casing down a borehole, using a 36-in. (91-cm.) spanner to steady the casing and another to do the turning. One of the spanners slipped and struck him forcibly across the epigastrium. He was winded by the blow and fell down. He was taken to camp by car and there he vomited some blood. The pain persisted for a week and during this time inspiration was painful. It was not possible to transport him to the nearest town some 80 miles (129 km.) away because of heavy rains, and he did not get to hospital until a week later. A radiograph taken in August, 1959, showed a hiatus hernia. He stated that since the injury he has had a blown-up feeling and a burning epigastric pain. He gets relief by sleeping with a number of piled pillows and the symptoms are aggravated by bending forwards. Attacks of vomiting and colicky abdominal pain recur frequently. X-ray examination on February 22, 1961, showed a large hiatus hernia which had undergone partial volvulus.

Comment.—This case was accepted as being of traumatic origin. The nature of his injury and the immediate post-traumatic symptoms were typical, and the close association between the injury and the onset of dyspeptic symptoms was strongly in favour.

Cases Where Injury was not Thought Responsible

Case A.—A coal-miner, aged 50—height 5 ft. 9 in. (175 cm.), weight 194 lb. (88 kg.)—had never suffered from

dyspepsia. Three years previously he was crawling along a mine tunnel when he experienced severe precordial chest pain. This was gripping in character and radiated to either side of his neck and down his left arm. It was not aggravated by coughing or deep breathing. He was admitted to hospital, where he was treated as a case of coronary thrombosis though the electrocardiogram was negative. At frequent intervals since then he has had a second attack while sitting in a lounge chair, a third when in bed, and a fourth during a meal. These attacks were similar to the first but lasted a shorter time. He had no epigastric discomfort, no heartburn or acid eructations, but experienced slight dyspnoea on exertion and attacks of sneezing. In January, 1960, a small sliding hiatus hernia was discovered.

Comment.—His claim for compensation was rejected on the following grounds: (1) There was no sudden injury or strain. (2) It was a high, not a low, substernal pain, and it seemed probable that his first attack was not due to the production of a hernia but was caused by gastro-oesophageal reflux due to the posture of his body at the time. (3) There were no immediate symptoms of diaphragmatic irritation.

Case B.—An architect aged 57—height 5 ft. 6 in. (167.5 cm.), weight 150 lb. (68 kg.)—admitted having had dyspeptic symptoms for about five years after the war but did not suffer from these after 1950. On June 15, 1958, he was involved in a motor accident. He was struck over the lower sternum by the steering-wheel of his car. He felt a little pain, he was not winded, and he got out of his car and talked with the people who gathered around. He was taken home, and there he felt a bruised sensation over his sternum but was otherwise well. He stayed away from work for two days because of his bruised chest and a "shaken" feeling. He went on holiday three weeks later, and during the second week he woke up one morning with a feeling of nausea. He vomited several times and once blood was present in the vomitus. He curtailed his holiday because of continuing discomfort and returned home. He began to experience epigastric discomfort, heartburn, and eructations. Two months after the injury a hiatus hernia was diagnosed.

Comment.—On the whole I thought the injury sustained was not responsible for the hernia. This opinion was based upon the following reasons: (1) There was a history of dyspepsia prior to the accident though there had been no symptoms for 10 years prior to the injury. Alone this point is of little importance, but it gained significance when combined with other arguments. (2) The injury was a localized blow to the mid-body of the sternum. He denied that any part of the impact was taken by his abdomen or xiphisternum. It was felt that this was unlikely to cause a rise of the intraperitoneal pressure. (3) He experienced none of the symptoms of rupture of diaphragmatic muscle fibres or of the oesophago-phrenic ligament. (4) There was no symptom of diaphragmatic irritation. It was difficult to explain why the symptoms of hiatus hernia came on so soon after the accident, but on balance one felt that this case did not satisfy sufficient criteria to be accepted.

Case C.—A shop-owner, aged 53—height 5 ft. 11 in. (180 cm.), weight 200 lb. (90.7 kg.)—experienced considerable dyspepsia while in the Army. He was discharged as "ulcer prone" in 1945 after liberation from a German P.O.W. camp, and for this received a pension. An ulcer was never proved radiologically. These symptoms continued for several years, but he claimed that they were relieved after an appendicectomy in 1955. He continued to take sodium bicarbonate, purchasing this regularly from the same chemist for many years. One day in July, 1959, he bought some "medical bicarbonate" from his chemist and took a heaped teaspoonful in a cup of water. It transpired that the contents were

sodium fluoride which had been incorrectly labelled. He immediately experienced a burning pain in the chest and began to vomit. Violent vomiting continued for 24 hours. He became very ill with acute fluoride poisoning and developed a widespread body rash, diarrhoea, paraesthesiae, and intense substernal burning. These persisted for about a month but then gradually improved. About 12 months after the accident he became aware of epigastric discomfort, heartburn, and acid regurgitation. A hiatus hernia was diagnosed, and this was added to the list of disabilities for which he sought compensation. His claim was that the hernia had been produced by the violent vomiting after ingestion of the fluoride.

Comment.—I felt unable to support this unfortunate man's claim for the following reasons: (1) There seemed little doubt that he had suffered from dyspepsia prior to the poisoning. (2) At the time of the mishap he did not complain of symptoms of diaphragmatic irritation. The abdominal pain and vomiting were clearly due to the ingestion of the corrosive. (3) He only became aware of the symptom of reflux dyspepsia a year after the accident.

Summary and Conclusions

Out of a series of 216 adult cases of hiatus hernia seen in the course of routine practice there have been 11 (5%) where a traumatic incident precipitated herniation of the stomach through the oesophageal hiatus. The injury has not necessarily been a severe one, though in seven cases serious crush injuries were responsible. Even though the force may have been comparatively mild the effects were dramatic. The victim feels an immediate tearing pain beneath the xiphisternum often accompanied by a feeling of being "winded" and followed by vomiting and prostration. Symptoms of diaphragmatic irritation such as shoulder-tip pain and hiccup soon develop. At this stage the diagnosis of a ruptured viscus or of diaphragmatic pleurisy is suggested. The symptoms attributable to the hernia—reflux dyspepsia, precordial chest pain, backache, dysphagia, etc.—generally start within a month of injury. With serious injuries the immediate symptoms may feature less prominently in the history either because the patient is rendered unconscious or because the widespread nature of the injuries overshadows the local manifestations. However, in other respects the effects are similar and a reasonably constant syndrome appears to characterize traumatic hernias. This has assisted in assessing nine legal or quasi-legal cases of hiatus hernia. The reasons for the opinion that six of these hernias were attributable to trauma are given.

The assessment of the importance of trauma must be based upon the history given by the patient. There does not appear to be anything characteristic about the local examination or the oesophagoscopy or radiological findings. At the time of diagnosis the hernias may have been small or large, sliding or rolling. Oesophagitis has been present soon after the injury. At operation no characteristic appearances which would serve to differentiate this type of hernia from one which had occurred spontaneously were found.

The people with traumatic hernias fell into a younger age-group than the average for the whole series (49 against 59). Also the sex ratio was reversed (11 males to 6 females as against 98 to 118 in the total series). In other respects the type of person with a traumatic hiatus hernia does not differ from the type with a spontaneous hernia. All the women had had children. Most of them were fat and all were above their usual or ideal

weight. The males were powerfully built men who had run to seed and were well above ideal weight. This and other evidence indicates that at the time of injury the hiatus and the stabilizing ligaments were already weakened.

Fortunately it is not the physician's task to apportion degrees of responsibility, for it is obvious that in most cases the pathological processes which culminate in hiatus hernias were already established at the time of the injury. This explains why, in some instances, relatively minor body strain sufficed to rupture the hiatus. With a stable hiatus a crush injury would probably rupture a leaf of the diaphragm rather than the oesophageal hiatus. In the six years during which the eight crush traumatic hiatus hernias here described were seen I have treated 14 cases of traumatic rupture of the diaphragm following similar injuries. I have never heard of a case of rupture of a leaf of the diaphragm due to muscular effort. In this paper nine hiatus hernias are described which became manifest after such injuries.

A doctor who becomes involved in contentious legal actions should have some basis on which to found his views. An attempt has been made here to formulate principles arising from an experience of cases where no ulterior motives were present. These constitute an aid to the formation of a reasoned opinion, but I am fully aware of the fact that all that can be offered is an opinion: proof is far more elusive.

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The Rivers and Drainage Committee of the London County Council says that the Pippard Committee, set up in 1951 to consider and report on pollution of the tidal Thames, and the Thames Survey Committee "have gone a very long way towards indicating a solution to the problem of the prevention of pollution in a most complicated estuary. They have shown that its condition is inherently predictable and that a positive method of control can be devised. The Pippard Committee states that four sewage works are responsible for about nine-tenths of the sewage effluent discharged directly into the tidal Thames and that just over half the polluting load is contributed by the Council's Northern Outfall Works, Beckton, Essex, and Southern Outfall Works, Erith. Considerable improvement in the condition of the middle and lower reaches of the estuary followed the completion of the extensions at Northern Outfall Works, and a similar improvement is expected to result when work now in progress at Southern Outfall Works is completed. The medical officer of health and the chief engineer will report on the state of the river within three years from the time the new extensions at Southern Outfall Works are brought into operation." (L.C.C. Agenda for March 6.)