

TRAUMATIC DIAPHRAGMATIC RUPTURE AND HERNIA

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In these days of high speed traffic, impact injuries are becoming increasingly common. In this type of injury, it is widely recognized that beneath the deceptively intact abdominal wall there may be a ruptured spleen, a torn mesentery, a transected intestine, a ruptured bladder or a traumatized kidney. Among the less frequent sequelae, however, is rupture of the diaphragm.

Rupture of the diaphragm is often overlooked on initial examination of the injured patient. The condition may be surprisingly latent and is often shadowed by the multiple concurrent body injuries. Suspicion is subsequently aroused when herniation of abdominal organs into the thorax presents its manifestations. The latent phase may last over 25 years (1, 2).

A early diagnosis of traumatic diaphragmatic hernia may be made if that possibility is kept in mind. The opacity in the chest should not all be taken to be hemothorax or atelectasis, both of which have their characteristic roentgenographic appearance. The air-filled stomach in the chest on X-rays is usually not typical of a pneumothorax. When bowel sounds are heard over the chest, the diagnosis is obvious. However, the absence of such a finding by no means excludes the condition. Liu et al (3) called attention to the paradoxical respiratory motion of the upper abdominal wall on the side of the diaphragmatic rupture.

CASE REPORT (A-17471)

The patient was a 70-year-old Chinese male, who was admitted initially to the orthopaedic service of the Singapore General Hospital on December 20, 1962, with multiple fractures sustained in an auto accident. He was found to have a left intertrochanteric fracture of the hip, a left comminuted Colle's fracture and a fracture of the left 7th rib. The patient appeared to be in a fair condition and showed no respiratory distress. An admission chest film (Fig. 1) disclosed a shadow in the left lower chest. The following day, dyspnea occurred and progressed to a severe degree. On examination, the left hemithorax showed poor respiratory movement, and breath sounds were greatly diminished on that side. On percussion, however, the left chest was resonant. No bowel sounds were heard over the chest. The abdomen was essentially non-tender and not distended. A chest

film (Fig. 2) revealed opacity of the left chest extending to the upper part. 100 c.c. of air was introduced into the stomach through a gastric tube, and a repeat film (Fig. 3) demonstrated air-fluid level in the left chest.

The patient was operated upon the same day with the diagnosis of diaphragmatic rupture and hernia. A left thoracotomy was performed through the 7th intercostal space. A greatly distended stomach filling most of the left chest cavity, together with the greater omentum, the spleen and the splenic flexure colon, was found herniating through a three-inch tear in the posterolateral part of the diaphragm. It was necessary to decompress the stomach before reduction of the organs could be achieved. About 1,500 c.c. of fluid was aspirated from the stomach. The spleen showed a small capsular tear. A splenectomy was performed. The diaphragmatic defect was closed with strong nylon interrupted sutures. An intercostal chest tube was inserted and the chest closed.

Post-operatively, the patient did quite well. The left lung became fully expanded. The chest tube was removed on the 3rd day. On the 7th day, he was transferred for further management of his fractures. Two days later, however, he died rather suddenly. A post-mortem examination showed bronchopneumonia to be the cause of death.

DISCUSSION

This case illustrates the characteristic initial latency of traumatic diaphragmatic rupture. The opacity in the left lower chest as shown on the admission chest film (Fig. 1) had the appearance of the splenic flexure colon. The chest film (Fig. 2) on the following day was highly suggestive of the stomach being present in the left chest. The opacity lacked the meniscus level of a hemothorax. The air-fluid level in the stomach (Fig. 3) shown after the introduction of air through a gastric tube made the diagnosis apparent.

NATURE OF TRAUMA

Traumatic dehiscence of the diaphragm may be produced by either a direct penetrating wound or an indirect blunt injury not involving penetration of the thorax or the abdomen. From several reviews and reports covering 200 cases

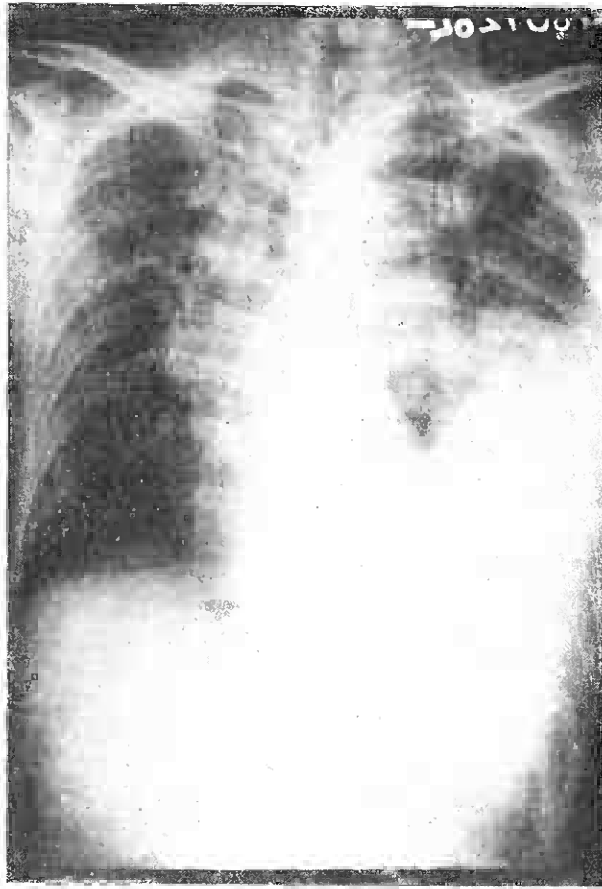


Fig. 1. Shadow in left lower chest has the appearance of splenic flexure colon.



Fig. 2. Opacity in left chest suggestive of herniation of abdominal viscera.

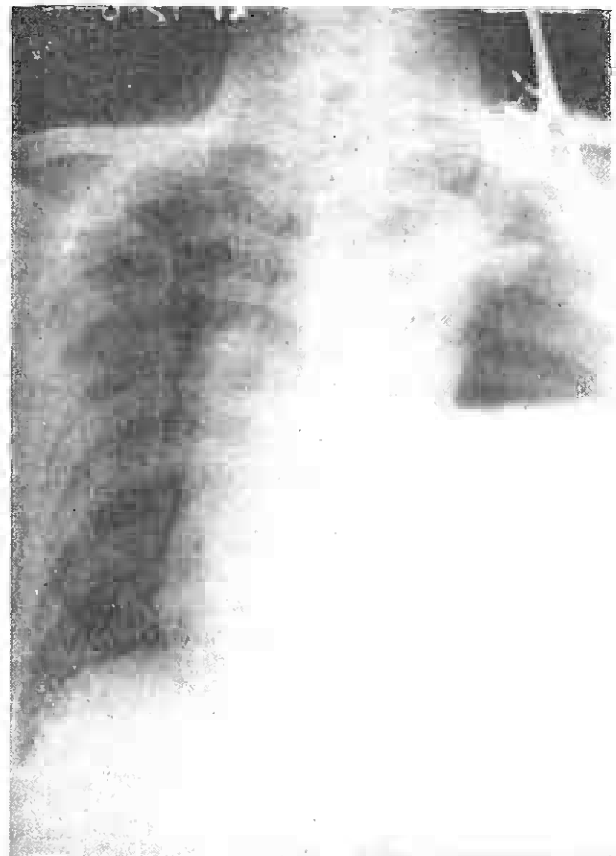


Fig. 3. Air-fluid level in left chest after introduction of air into stomach.

in the literature (1, 4, 5, 6, 7), indirect blunt injury is the commoner cause by far. It is in this type of injury that the condition is likely to go undetected for a long period of time. The patient with indirect trauma often has severe concomitant injuries, to which the surgeon directs his attention primarily.

CONCOMITANT INJURIES

Fractures of ribs, the pelvis, the spine, the fibula, the radius and the ulna are the commonest concomitant injuries. It is significant to note that the abdominal viscera are infrequently injured, with the exception of the spleen (1, 4, 5, 6, 7, 8).

HERNIATED ORGANS

Traumatic diaphragmatic rupture usually occurs on the left side (1, 4, 5, 6, 7, 8, 9). The contents found in the chest at operation are usually the stomach, the greater omentum, the spleen, and the colon. Herniation of the pancreas and of the sigmoid colon has been reported (1). In right-sided rupture, the right lobe of the liver, the right kidney, and the colon may be found in the chest. Pericardial diaphragmatic rupture is rare. Moore (10) in 1959 reported one case and found 4 cases in the literature.

COMPLICATIONS

The complications of herniation, in addition to direct respiratory embarrassment, are mediastinal shift, hemorrhage, bowel obstruction, strangulation and perforation (11). Strangulation of the stomach or intestine is not too common. However, Carter and Giuseffi (12), in reporting 4 cases in 1948, were able to find 39 cases in the English literature.

MECHANISM OF RUPTURE

It is interesting to surmise on the mechanism of diaphragmatic rupture in blunt trauma. Two possible mechanisms may be considered.

1. WHIPLASH EFFECT

The diaphragm is attached peripherally to the chest wall and is relatively fixed centrally by the attachment of the pericardium and the splinting action of the esophagus and the big vessels. During a sudden compression of the lower chest wall followed by an abrupt rebound, as must occur in an impact to that area, there is created a whiplash effect on the diaphragm. The sudden folding and stretching of a part of the diaphragm may cause it to rupture. The infrequency of right-sided diaphragmatic rupture may be due to the presence of the liver, which buffers the effect of such a mechanism.

2. ABRUPT UPTHURST

Marchand (13) has shown that there is normally a pleuroperitoneal pressure gradient due to the negative pressure in the pleural cavity and the positive pressure in the peritoneal cavity. The pressure gradient normally varies between 7 and 20 cm. of water. Childress and Grimes (1) postulated that during an impact injury there might be a sudden great increase of pleuro-peritoneal pressure gradient thrusting the diaphragm upward to produce a rupture. However, it is difficult to imagine how the pressure could be increased to such a magnitude, save a frontal crushing impact on the abdomen or a force aimed almost directly at the diaphragm through the abdominal wall. The infrequency of concomitant injuries of the abdominal viscera tends to refute the postulate. Nevertheless, the pleuro-peritoneal pressure gradient undoubtedly causes herniation of abdominal organs after diaphragmatic rupture has occurred.

TREATMENT

Reduction of the herniated organs and repair of the diaphragmatic rupture may be accomplished by either the transthoracic or the transabdominal route. The thoracic approach appears to be superior. Combined thoraco-abdominal approach has added mortality and morbidity. The abdominal approach may have the following disadvantages: 1. The exposure may be inadequate for the repair of diaphragm. 2. It may be very difficult to reduce by traction the distended stomach and intestine from the chest. 3. The spleen may be injured during reduction, and a splenectomy cannot be readily accomplished with the organ still in the chest. On the other hand, the abdominal approach enables the surgeon to take care of concomitant injuries in the abdomen. The thoracic approach gives good exposure of the diaphragm, affords greater ease of reduction and facilitates a quick splenectomy if it has been injured. Splenectomy is absolutely indicated if there is a rupture or a capsular tear. It should also be performed if the spleen is in any way contused. The possibility of delayed rupture of the spleen is well recognized. It may, indeed, be safer to perform splenectomy routinely if it is herniated.

SUMMARY

1. A case of traumatic diaphragmatic rupture and hernia diagnosed pre-operatively is reported.
2. The significant features of the condition based on a review of the literature are presented.

3. A whiplash mechanism producing rupture of the diaphragm in blunt trauma is postulated.

4. The surgical treatment is discussed.

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