

the intercostal drain. The cardiac surgeons were called at this stage but on their arrival, the patient suffered a cardiorespiratory arrest with obvious clinical signs of tamponade. Through an emergency left anterior thoracotomy the pericardium was opened to relieve gross tamponade. A 1.5 cm laceration in the left ventricular wall was controlled digitally and repaired with two pledgetted, prolene sutures. The entry site into the heart was adjacent to a flap-like communication between the pleura and pericardium anteriorly. The patient made a complete recovery and was discharged on day 10.

Comment

The high incidence of cardiac injury with penetrating wounds of the chest medial to the midclavicular lines is well recognised.² However, 80-90% of wounds lateral to this can be managed conservatively, and thoracotomy reserved for those bleeding in excess of 20% of their blood volume.^{1 3}

The apparent normality of the chest radiograph, though the weapon clearly traversed the pleural cavity, is surprising. A flap-type mechanism must have decompressed the pericardial blood into the pleural cavity. The normality of the first radiograph would seem to contradict the frequently cited "six hour rule," which states that "asymptomatic patients with stab wounds of the chest do not have delayed complications if the x rays of the chest taken six hours after the injury are normal."^{1 4} However, the delay in catastrophic bleeding is not surprising when one considers the self sealing nature of the muscular walls of the left ventricle. The initial injury may only have involved the epicardium, the catastrophic bleeding occurring when this had extended to involve the full thickness of the myocardium. The inability of echocardiography to detect such gross injury may have been due the blood discharging into the pleura

before the examination. Furthermore, to recognise the difference in contrast between myocardium and clot by echocardiography requires skill and experience, and generally only junior staff are available during the hours of presentation of these injuries.

In our experience, the only definitive method of excluding intrapericardial blood is by direct examination of this cavity through a limited subxiphoid incision in the operating theatre.⁵ This should be done when there is uncertainty about whether cardiac injury has occurred in a clinically stable patient. A short midline vertical incision is performed from the xiphisternum to the linea alba. This is continued through the linea alba and a finger insinuated under the xiphisternum, which is divided vertically with scissors. A self retaining retractor is inserted under each rectus sheath and a hand held retractor used to elevate the sternum proximally. The pericardium is visualised and opened. If blood or clots are seen, the incision can easily and rapidly be converted into a full median sternotomy. Otherwise the wound can readily be closed.

In conclusion, a high index of suspicion must be maintained when chest injuries are managed conservatively. The lack of early symptoms or signs of cardiac tamponade cannot guarantee the absence of serious cardiac damage. If doubt exists, a subxiphoid pericardial window may allow cardiac injury to be excluded.

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Conservative management of gastric rupture following scuba diving

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Abstract

Gastric rupture is an uncommon surgical problem which normally presents with an acute abdomen and peritonism. An unusual case following underwater ascent and its conservative management is presented.

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Keywords: gastric rupture; scuba diving; barotrauma

Case report

A 35 year old diver was air swallowing underwater because of an upper respiratory tract infection. Following a fairly rapid ascent from a depth of 23 m he developed upper abdominal pain and distension. Gastric rupture was suspected, and both the chest x ray (fig 1) and the abdominal x rays revealed a large amount of free intraperitoneal gas. A water soluble contrast study of the upper gastrointestinal tract showed no evidence of

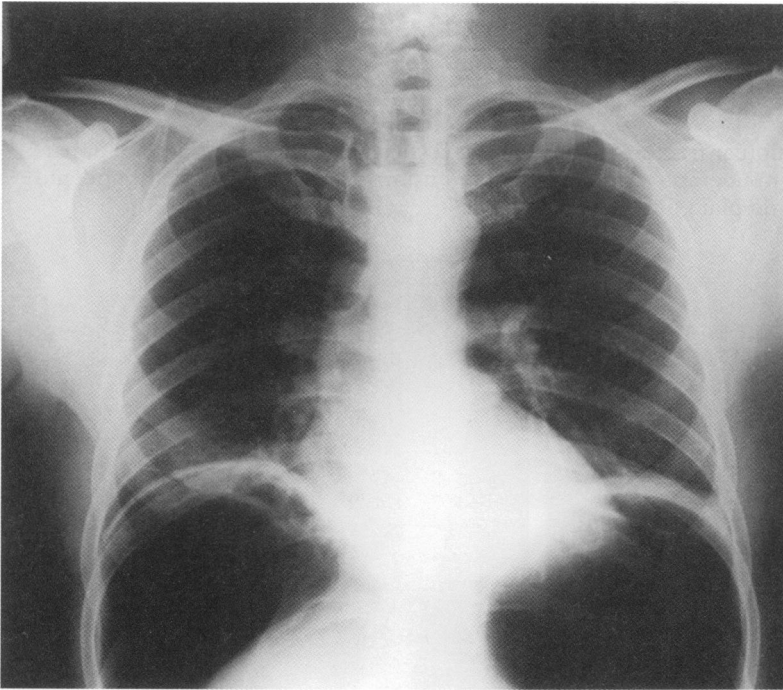


Figure 1 Chest radiograph showing a large volume of free intraperitoneal gas below both hemidiaphragms.

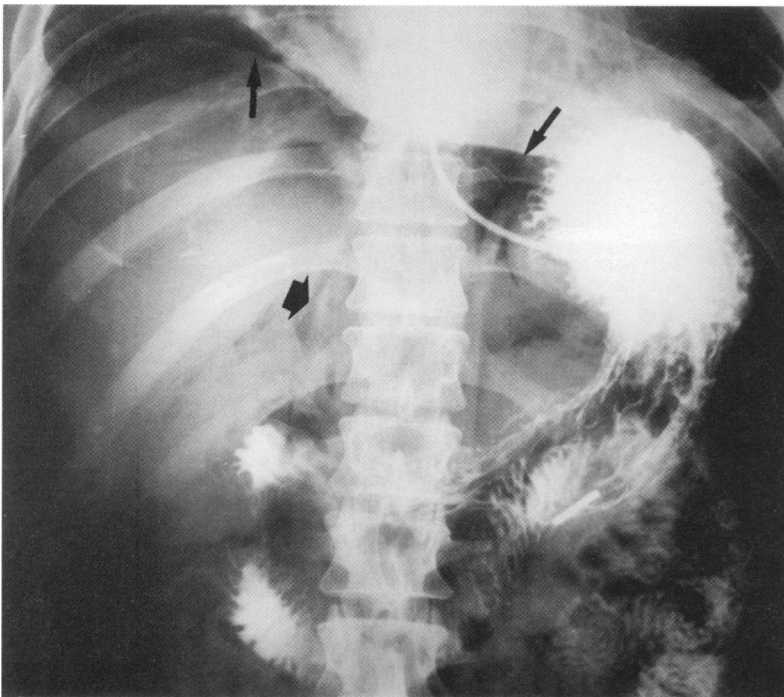


Figure 2 Water soluble contrast meal and follow through show no evidence of leakage of contrast from the stomach. Free intraperitoneal gas (long black arrows) and retroperitoneal gas (black arrowhead) are still present.

continuing leak (fig 2) Abdominal ultrasound showed a small amount of free intra-abdominal fluid. In the absence of peritonism the patient was managed conservatively, and recovery was uneventful.

Discussion

Gastric rupture is uncommon and normally follows blunt abdominal trauma while the stomach is distended.¹ Gastrointestinal barotrauma occurs because the volume of the intraluminal bowel gas doubles for each 10 metres of ascent (Boyle's law). Clinical signs and symptoms are normally limited to eructation, abdominal fullness, colicky pain, and flatus expulsion.² It is as a result of its potential to become a closed system with cardiospasm and pylorospasm that the stomach is the site of gastrointestinal rupture in the most severe cases.³ Gastric rupture secondary to barotrauma is very rare, with only 12 cases reported to date.⁴

Ten of the 12 cases described were treated surgically, although patients may show little evidence of peritoneal irritation.⁴ This approach has been taken as rupture following blunt abdominal trauma is associated with a high rate of infectious complications and a mortality of nearly 50%.⁵ In these cases, however, the stomach was usually distended with acid and food residue, rupture resulting in chemical and bacterial peritonitis. In contrast, gastric rupture in divers is secondary to gaseous distension, with the stomach frequently empty.

The diagnosis is dependent on the demonstration of free intraperitoneal gas, and a water soluble contrast meal will show whether the rupture has sealed spontaneously. Ultrasound gives an indication of the amount of free intraperitoneal fluid. In the absence of signs of peritonism, and with demonstrable spontaneous closure, we recommend conservative management.

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