of Groot Schuur Hospital for permission to publish the case material.

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Obstruction-strangulation of post-traumatic diaphragmatic hernia — delayed diagnosis and fatal outcome

A report of 9 cases

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Summary

The radiological and clinical features of 9 cases of obstructed post-traumatic diaphragmatic hernia are reviewed. In none of these patients was the diagnosis of a diaphragmatic hernia considered before radiography, all cases being clinically diagnosed as 'acute abdomen', most frequently pancreatitis or perforated peptic ulcer. Even after radiographs had shown opacity at the left base in all 9 cases, together with a distended proximal bowel in 6, the correct diagnosis was made in only 4. Through lack of correct radio-logical diagnosis, there was a delay of at least 1 day between admission and operation in 6 patients, and 3 of the 4 deaths occurred in this group. Obstruc-tion-strangulation of diaphragmatic hernia should be considered as a possible cause of 'acute abdomen' in the presence of a left basal abnormality, especially in patients from areas with a high incidence of assault. Confirmatory contrast studies should be done only if they can be done immediately and quickly. Pregnancy can cause hernias to become obstructed and strangulated, but this can be averted by obtaining a history of previous trauma early in the pregnancy.

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Because post-traumatic diaphragmatic hernias show nonspecific features on chest radiographs, the diagnosis is frequently missed unless the examiner is sufficiently aware of the possibility of this condition to request contrast studies of the stomach and colon.[1,2] Correct diagnosis can avert the later complication of obstruction-strangulation, which is a not uncommon cause of 'acute abdomen' in patients from violence-prone communities. This complication is lethal without rapid diagnosis and surgical intervention.

This survey deals with the diagnostic problems presented by patients with obstruction-strangulation and shows that, even when this emergency occurs, the correct diagnosis is frequently delayed. This is due to the nonspecific nature of the clinical presentation, the failure to consider diaphragmatic hernia as a diagnosis, and the failure to recognize the possible significance of radiographic abnormalities at the left chest base in association with an 'acute abdomen'.

Patients and methods

As part of a continuing study of the radiological features of traumatic diaphragmatic hernia, information was collected on 9 cases of obstruction of such hernias during a 21-month period at one of the above institutions and an 18-month period at the other. The series included all those cases in which strangulation had produced a non-viable, herniated bowel but probably excluded some cases of partial obstruction with still viable hernial contents. The material collected consisted of a history of previous trauma, symptoms and physical signs of the present illness, the clinical diagnosis of the present illness before radiography, the radiological report and diagnosis made on plain radiographs and any contrast studies, a retrospective review of all the relevant radiographs, the operative findings, and the postoperative outcome.

There were 7 men, aged between 19 and 30 years and 2 women, aged 24 and 25 years, in the survey. All the hernias were on the left side; 1 contained only stomach and the rest were colonic with 1 of these also containing small bowel.

Results

Evidence of causative trauma

Five men gave a history of and revealed scars from knife wounds to the left lower thorax which had been inflicted between 1 and 6 years earlier. One man gave a history of assault leading to bladder rupture 5 years previously. Another, who was in an acutely alcoholic state, could give no history but a left diaphragmatic hernia situated very much to the side and midway between the anterior and posterior chest walls was clearly of traumatic origin.

One of the female patients had been involved in an automobile accident 4 years before and at operation her left diaphragmatic defect was clearly of traumatic origin. The other woman gave no history of trauma and it was only after operation, when a small scar was noticed after elevating her left breast, that she recalled a childhood stab wound inflicted before her breasts had developed and hidden the scar.

Clinical diagnosis before plain radiography

Five patients with obstructed colonic hernias had predominant clinical features of epigastric pain and tenderness, which radiated to the back in 3, and in 1 it was eased by bending forward. Three of these patients had been drinking heavily before admission. In 4 of these 5 cases the clinical diagnosis made was acute pancreatitis, perforated peptic ulcer or acute gastritis; in the other, who had been transferred from another hospital, the clinical diagnosis before radiography was not known.

The 3 other patients with obstructed colonic hernias had more generalized abdominal pain and tenderness. In 1, a nonspecific diagnosis of 'acute abdomen' was made. In 1, who also had bilateral flank pain, the differential clinical diagnosis ranged between renal calculus, acute pancreatitis and an
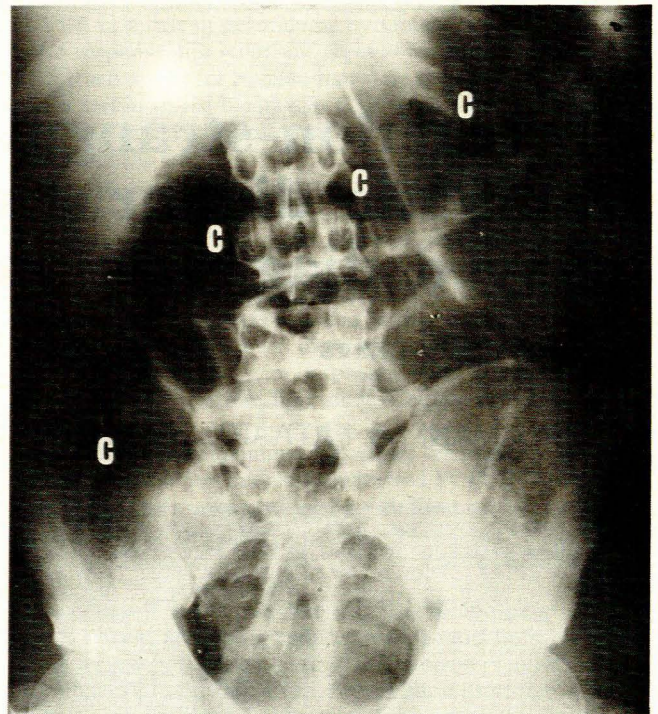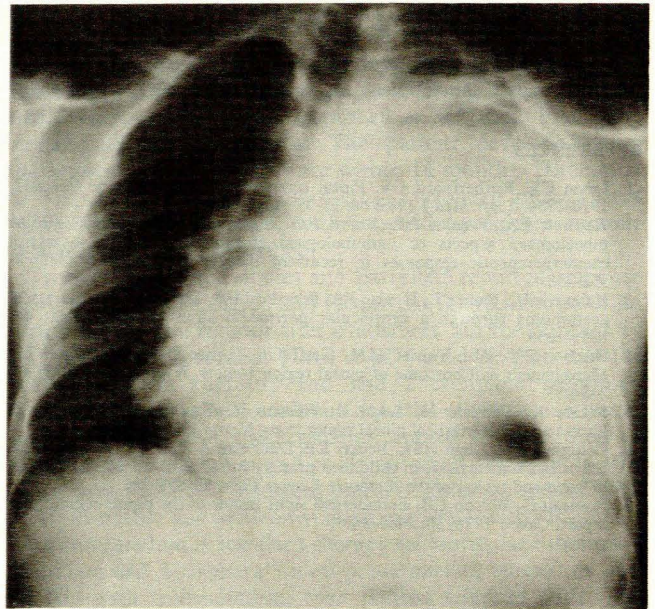

Fig. 1. Case 1. Pre-radiography clinical diagnosis: pancreatitis or peptic ulcer. Post-radiography diagnosis: strangulated colonic hernia. Operation: strangulated gangrenous colonic hernia. The patient survived. Top: Pleural effusion opacifying whole of left hemithorax with gas-fluid collection due to hernia at left base. Bottom: Supine view shows distension proximal to distal transverse colon (C = distended transverse and ascending colon; the other bowel lucencies are all due to distended small intestine).

inflammatory process in the right iliac fossa. In the third patient, who was 34 weeks pregnant, the clinical diagnosis was irritable uterus and premature labour, but her condition was not relieved after delivery.

The only patient with pain and tenderness predominantly on the left side of the abdomen, with radiation to the flank and shoulder, had gastric herniation, which was clinically diagnosed as renal colic or infection.

Diagnosis after plain radiography (Figs 1 - 7)

All 9 patients showed a radiographic abnormality at the base of the left hemithorax. In 6 both a pleural effusion and a basal domed opacity containing gas and fluid (representing the actual obstructed hernia) were separately identifiable in retrospect (Figs 1 (top), 2, 3 (top left), 4); however, in only 4 were the radiographs reported at the time to suggest and be compatible with an obstructed hernia. In the remaining 3 the left basal appearances were nonspecific even in retrospect and the correct diagnosis was not made (Figs 5 (top), 6 (top), 7).

Five patients with obstructed colonic hernia showed distended bowel proximal to the level of the distal transverse colon (Figs 1 (bottom), 5 (bottom)), and a sixth showed a distended ascending colon only (Fig. 3 (bottom)). Even though all 6 also showed an abnormality at the left chest base, the correct diagnosis was made in only 3. In 2 further patients with obstructed colonic hernia, the abdominal radiographic findings were less specific and localizing, and the correct diagnosis was made in neither even though both had obvious left basal opacities; in 1 of these a retrospective review indicated gas in the mesenteric veins (Fig 6 (bottom)). The patient with a strangulated gastric hernia had a normal abdominal radiograph.

To sum up: the correct diagnosis was made in only 4 patients after plain radiography, even though all 9 showed a left basal abnormality and 6 of the 8 with obstructed colonic hernia showed bowel distension proximal to the hernia. The range of incorrect or nonspecific comments that was offered after the plain radiographs consisted of: eventrated or paralysed hemidiaphragm (Fig. 2); 'colon cut-off' sign due to pancreatitis with infection at left base (Fig. 5); 'acute abdomen' with pleural effusion (Fig. 6); and nonspecific opacification at left base (Fig. 7).

Contrast examinations

In 3 of the 4 patients correctly diagnosed on the basis of plain radiography, further confirmation was immediately obtained by a single-contrast enema (Fig. 3 (top right)); the other patient went straight to the operating theatre. In only 1 other patient was the correct diagnosis made before laparotomy and this was obtained by a follow-through study of orally administered barium.

Clinical outcome

Two patients underwent operation on the day of admission as a result of correct diagnosis; both survived in spite of their strangulated colonic hernias, 1 extensively gangrenous (Fig. 1), the other with a small area of gangrene. A third patient diagnosed on the day of admission, died suddenly before he could be operated on (Fig. 3).

The diagnosis was delayed in 6 patients who were therefore not operated on for between 1 and 5 days after admission. Of the 3 who survived, 2 had viable colonic hernias (Fig. 5) and 1 a gangrenous gastric hernia (Fig. 2). Three patients with gangrenous colonic hernias died within a day of operation (Figs 4, 6, 7).

Discussion

It is an axiom of medical practice that an obstructed hernia should be regarded as strangulated and therefore treated by emergency operation. Either strangulation is the primary cause of the obstruction, or the obstruction has already or will soon lead to strangulation. Strangulation produces, in rapid succession, ischaemic non-viability, gangrene and perforation.[3-5]
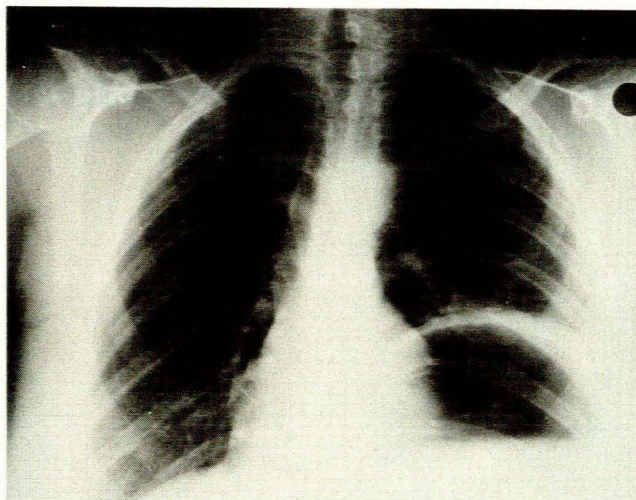

Fig. 2. Case 2. Pre-radiography clinical diagnosis: left renal colic or infection. Abdominal radiograph normal (not illustrated). The left basal abnormality on this chest radiograph, reported as due to eventrated or paralysed hemidiaphragm, was shown at operation to be due to a strangulated, gangrenous, perforated gastric hernia. The patient survived.

The diagnosis of an obstructed internal hernia, such as one through the diaphragm cannot, however, be established by clinical methods alone because the acutely diseased hernia is neither visible nor palpable. Thus 5 of our patients with obstructed colonic hernia presented with clinical features of 'acute abdomen' predominantly localized to the epigastrium, leading in at least 4 cases to a clinical diagnosis of pancreatitis, perforated peptic ulcer or gastritis. These diagnoses were supported in 3 patients by a history of recent heavy drinking. The social groups most at risk from assault and hence of post-traumatic diaphragmatic hernia, are also highly susceptible to alcohol abuse.

Three further patients had more generalized features leading to clinical diagnoses respectively of: 'acute abdomen'; irritable uterus and premature labour; and renal calculus, pancreatitis or right iliac fossa inflammation. Only 1 patient had predominantly left-sided features and she was clinically diagnosed as having renal colic or infection. Our 9 cases show an even more predominantly abdominal presentation than those in previous clinical series.[6,7]

The nonspecific and mimicking nature of the clinical features leads to inappropriate clinical diagnoses, which then mislead the radiologist. In spite of all 9 of our patients having a radiographic abnormality at the left base, and 6 also having distended bowel behind the hernial obstruction of the distal transverse colon (Figs 1 (bottom), 3 (bottom), 5 (bottom)), the radiologist drew the correct conclusion in only 4 cases. A particularly tempting radiological misdiagnosis in the clinical context of acute epigastric pain and heavy drinking is that of acute pancreatitis causing 'colon cut-off' and pleural effusion (Fig. 5). However, if the radiologist maintains an objective attitude towards the radiographs, he is better able to consider the possibility of obstructed post-traumatic hernia than the clinician because he has more information at his disposal. He should ensure that the patient is immediately examined for old stab wounds on the left side and should enquire about a history of trauma.

Although radiological recognition of the diagnosis is easier in some patients because the hernia appears as a separately identifiable domed abnormality at the left base (Figs 1 (top), 2, 3 (top left), 4), it is important to remember that the left basal abnormality may be much less specific and suggestive in
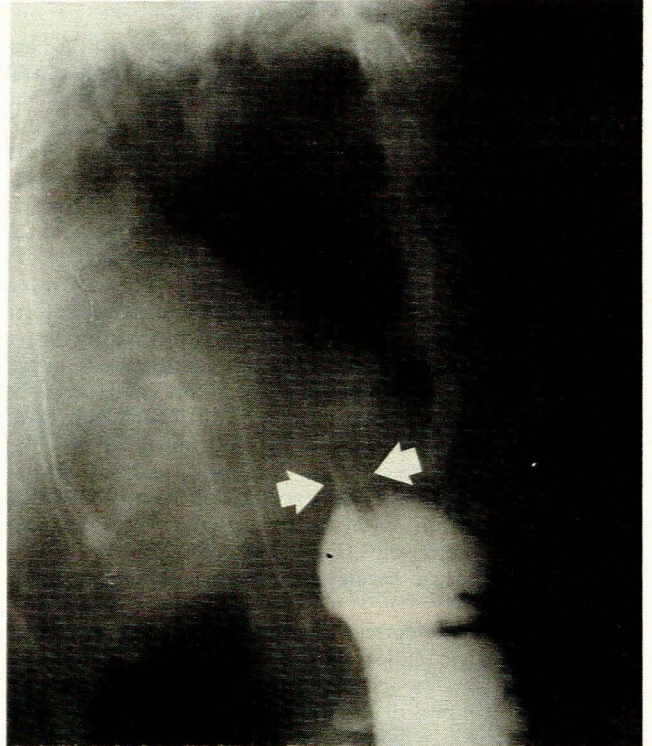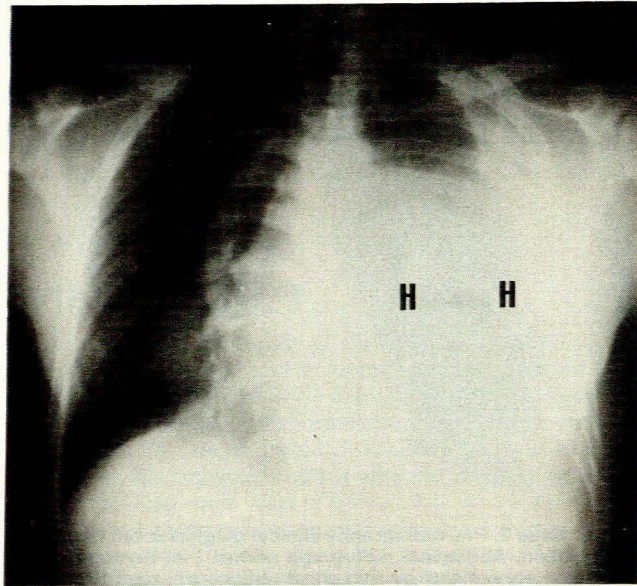
Fig. 3. Case 3. Pre-radiography clinical diagnosis: pancreatitis. Post-radiography diagnosis: strangulated colonic hernia. The patient died before operation. Radiograph (top left) shows large pleural effusion with gas-fluid collection representing the hernia (H). Bottom: strangulated hernia (H) with colon (C) dilated proximal to it; normal stomach gas bubble (S). Top right: typical barium enema appearance of obstructed colonic herniation through diaphragm (arrows).

appearance (Figs 5 (top), 6 (top), 7) and also variable in extent, ranging from the massive (Fig. 1 (top)) down to the apparently insignificant (Fig. 5 (top)).

Pleural effusions occur in strangulated post-traumatic diaphragmatic hernias because they are not invested with a sac; the serosanguinous fluid which oozes from the congested bowel wall runs directly into the pleural space.[8] Although a pleural opacity at the left base may simply be the residue of haemothorax from the original trauma, radiographic features of a fresh effusion in a compatible clinicoradiological context should arouse suspicion of a strangulated hernia. In only 1 of our cases was there no definite evidence of a pleural effusion (Fig. 5) and this was 1 of the 2 cases with still viable herniated bowel.
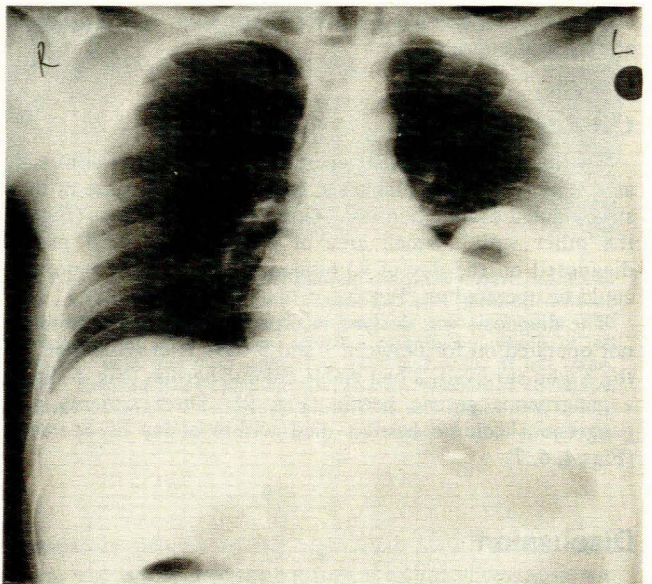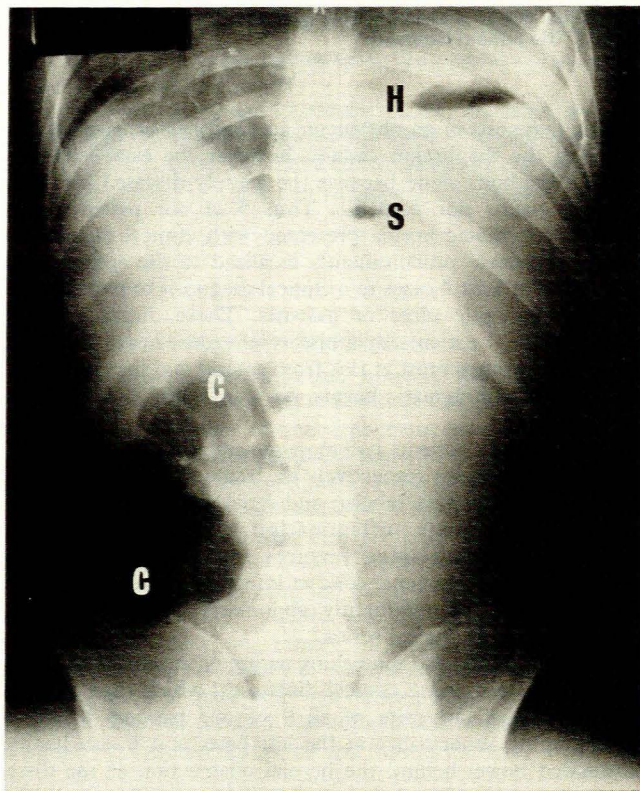

Fig. 4. Case 4. Pre-radiography clinical diagnosis unknown. Post-radiography diagnosis: strangulated colonic hernia. Operation: strangulated, gangrenous colonic hernia. The patient died postoperatively. This chest radiograph shows a large, domed gas-fluid collection at left base due to the hernia, with pleural effusion.
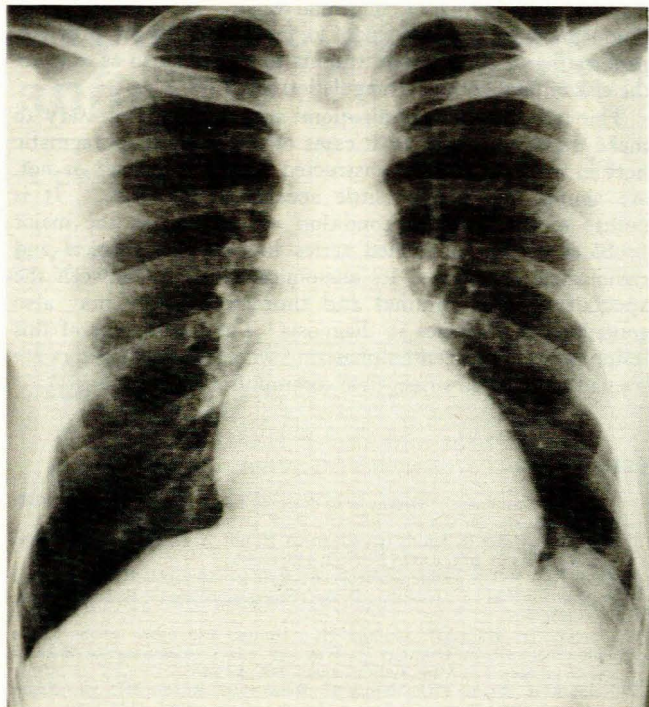
Fig. 5. Case 5. Pre-radiography clinical diagnosis: pancreatitis or gastritis. The radiographs were reported to be consistent with the 'colon cut-off' sign of pancreatitis together with infection at the left base. Operation: obstructed viable colonic hernia. The patient survived. Top: small non-specific abnormality can be seen at the left base. Bottom: dilated transverse colon containing a little fluid.
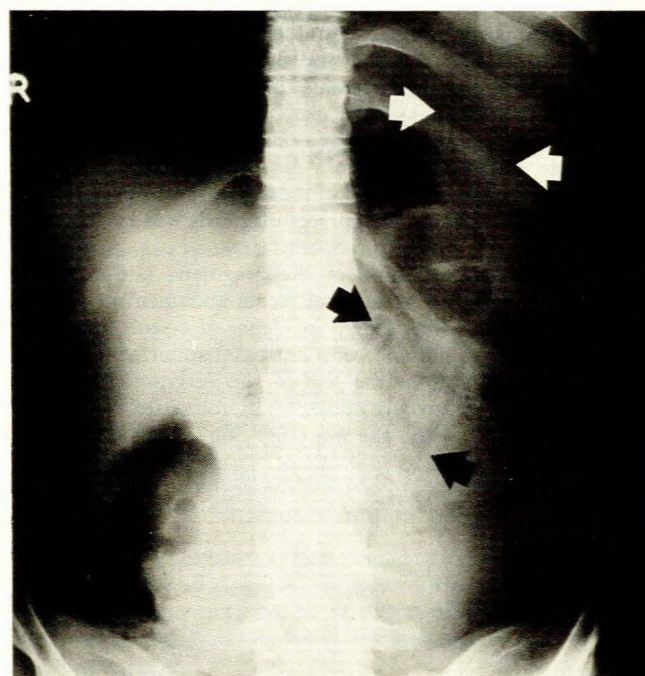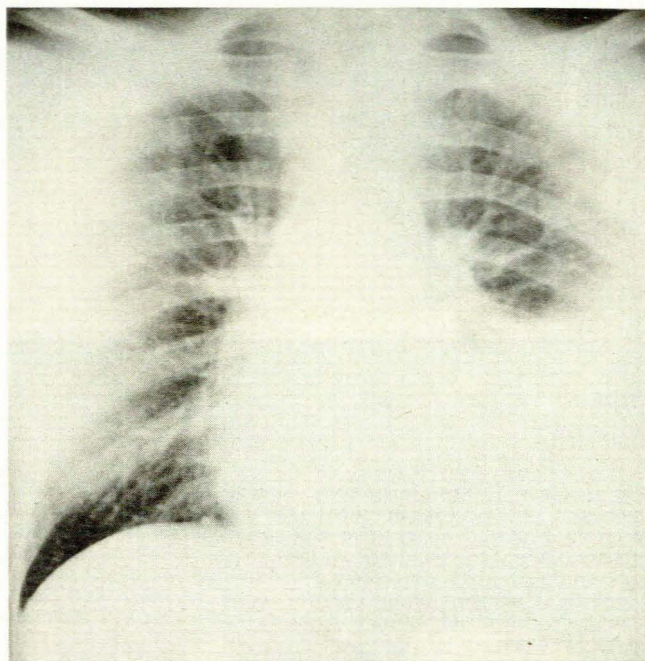

Fig. 6. Case 6. Pre-radiography clinical diagnosis: renal calculus, pancreatitis or inflammation in right iliac fossa. No specific diagnosis offered on the radiographs. Operation: long section of gangrenous colon and small intestine in hernia. The patient died postoperatively. Top: radiograph shows nonspecific opacification at left base. Bottom: parallel lucent streaks coming down from the hernia, probably due to gas in mesenteric veins.

Linear lucent streaks in or below the left basal opacity, as in 1 of our cases (Fig. 6 (bottom)), should also increase suspicion of ischaemic bowel as they may represent gas within the bowel wall[9] and/or veins.[10]

Further confirmation of the diagnosis can be obtained with an immediate single-contrast examination of the colon and/or stomach, depending on which organ is thought to have herniated (Fig. 3 (top right)). It must be remembered, however, that small bowel can herniate through the traumatized diaphragm on its own,[11-13] and would therefore be missed by emergency contrast studies.

The importance of early diagnosis is shown by the fact that 6 patients already had gangrenous hernias at operation and 3
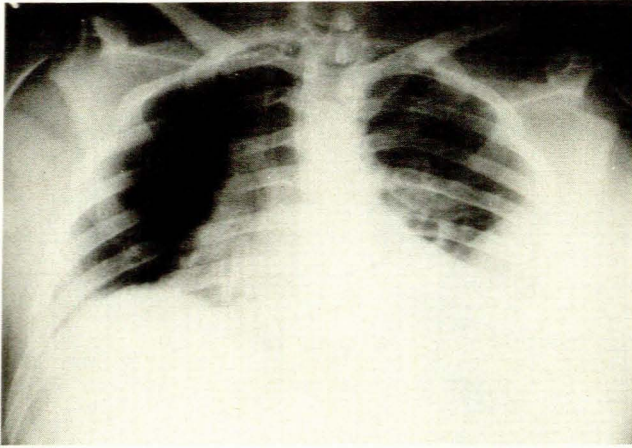
Fig. 7. Case 7. Pre-radiography clinical diagnosis: left basal pneumonia in 34-weeks pregnant patient with irritable uterus and premature labour. No specific diagnosis offered on the radiographs. Operation: gangrenous, perforated colonic hernia. The patient died postoperatively. Abdominal radiograph (not illustrated) showed dilated bowel loops in upper and right abdomen. This chest radiograph shows nonspecific opacification at the left base.

of these died postoperatively. Another death occurred suddenly before the patient reached the operating theatre, almost certainly also due to a gangrenous colonic hernia (Fig. 3). Both patients with viable colonic hernias survived, as did the patient with a gangrenous gastric hernia (Fig. 2). Looked at another way, there was a delay of 1 to 5 days between admission and operation in 6 patients, and 3 of these died postoperatively; of the 3 patients in whom the correct diagnosis was made on the day of admission, 1 died (pre-operatively).

Obstruction-strangulation of diaphragmatic hernia should always be considered in cases of 'acute abdomen' in patients from communities with a high incidence of assault (especially by knife), and the presence of a left basal abnormality should bring this condition to the top of the diagnostic list. The patients are usually young adults — in our series between 19 and 30 years old — and the mortality rate is high if gangrene has already appeared as in 4 out of 7 patients in this survey. Since pregnancy tends to increase the degree of herniation and risk of obstruction in post-traumatic[14-16] as well as in

diaphragmatic hernias of congenital origin,[17] antenatal consultation should include attention to the possibility of previous penetrating or compressive trauma to the trunk so as to avert the risk of fatal hernial strangulation (Fig. 7).[15-17]

The radiographic examinations and findings necessary to make the diagnosis in most cases of traumatic diaphragmatic hernia, whether already obstructed and strangulated or not, are simple and require little specialized expertise.[1,2] It is failure to think of the condition which remains the major problem despite published series in both the surgical and radiological literatures. Its anatomical situation between the specialties of abdominal and thoracic surgery may also contribute to mistakes in diagnosis.[7] The importance of this lesion appears to need emphasizing when medical doctors are trained for work in susceptible communities.

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