Physical Signs

Volvulus of the stomach – an unusual cause of pulsus paradoxus

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Summary: A patient with a strangulated diaphragmatic hernia presented as an emergency and was noted to have pulsus paradoxus. The mechanism of this physical sign, previously unrecorded in association with an intrathoracic hernia, is discussed.

Introduction

We report an unusual presentation of gastric volvulus, to our knowledge not previously described, which illustrates several useful lessons.

Case report

A 48 year old man was referred to the Cardio-Thoracic Unit with a provisional diagnosis of an acute aortic dissection. He gave a history of sudden onset of severe upper abdominal pain radiating to the left shoulder, and had vomited twice. On initial questioning there was no history of trauma, recent or remote, but he had undergone vagotomy and pyloroplasty 12 years previously for duodenal ulcer.

When first examined he was pyrexial (38°C) with clammy extremities and a sinus tachycardia of 120/minute with a marked pulsus paradoxus (Figure 1). His central venous pressure (CVP) was 10 cm H₂O, heart sounds and blood pressure were normal, and all peripheral pulses were palpable. Clinically there was a left-sided pleural effusion, generalized abdominal tenderness with absent bowel sounds, and a negative peritoneal lavage. Investigations revealed a haemoglobin of 15.7 g/dl, white cell count of $18 \times 10^9/l$, normal electrolytes, glucose and amylase. Chest X-ray confirmed a left pleural effusion with mediastinal displacement and possible cardiomegaly (Figure 2). Abdominal X-ray was unremarkable.

A naso-gastric tube was passed, though only a small amount of clear fluid was obtained. In view of the pulsus paradoxus, raised CVP and X-ray findings, a pericardial aspiration was attempted, and 500 ml of heavily blood-stained fluid aspirated, resulting in an

Figure 1 Arterial pressure recording demonstrating pulsus paradoxus.

abrupt fall in the CVP to 1 cm of H₂O. He was subsequently transferred to Wythenshawe Hospital, where an urgent aortogram was performed and found to be normal. The possibility of a strangulated diaphragmatic hernia was raised and thoracotomy performed.

At operation over 1000 ml of blood-stained fluid was present in the left pleural cavity with collapse of the left lung. A large strangulated hernia presented through a defect in the central tendon measuring 3 × 2 cm lying 3 cm anterior to the oesophageal hiatus. The sac contained almost the entire stomach and greater omentum, which had rotated anteriorly on its long axis, and was largely necrotic. A gastrectomy was performed, leaving a residual cuff of viable fundus. There was no evidence of intra-pericardial fluid at operation.

Figure 2 Radiological appearance, with pleural effusion and possible cardiomegaly. The clue to the correct diagnosis lies in the lateral view (b).

Post-operative recovery was uneventful. On subsequent questioning the patient recalled being involved in a road traffic accident 17 years previously at which time he had fractured his pelvis. Furthermore, the surgeon who performed the vagotomy and pyloroplasty 5 years later had informed him of a tear of the diaphragm which he had attempted to repair. He remains well some 3 years after his total gastrectomy.

Discussion

Volvulus of the stomach is a rare condition, and although it may occur primarily as a result of laxity of the fixed points around the stomach, it is usually secondary to a congenital or acquired defect of the diaphragm (Wastell & Ellis, 1971). The commonest example is that associated with a large para-oesophageal hiatus hernia (Tanner, 1968), though traumatic diaphragmatic herniae are a significant cause. The diaphragmatic injury is commonly the result of blunt trauma to the trunk, particularly in association with pelvic fractures (Brearley & Tubbs, 1981; Robb *et al.*, 1966). Moreover, it is unlikely that a tear of the diaphragm heals spontaneously (Estrera *et al.*, 1979) and therefore complications related to the

defect may occur many years after injury (Dudley *et al.*, 1979).

Gastric volvulus may present in a chronic or recurrent form, or as an acute emergency. In the former, symptoms may be minimal with epigastric discomfort or fullness after meals mimicking peptic ulceration or gall-bladder disease (Tanner, 1968). When acute volvulus occurs, the patient typically has epigastric pain and distension, makes fruitless efforts to vomit, and attempts to pass a naso-gastric tube are unsuccessful (Borchardt's Triad). At surgery a variable degree of gastric herniation is present, often with the entire organ lying in the chest. The rotation is usually organo-axial, that is, occurring around the long axis of the stomach, most commonly in an anterior direction such that the transverse colon comes to lie in front of the stomach (Wastell & Ellis, 1971). Mesenteroaxial rotation occurs less commonly, the axis lying between the centre of the greater curve and the porta hepatis.

Pulsus paradoxus is evident clinically when the systolic blood pressure falls by at least 10 mm Hg during inspiration (Dornhurst *et al.*, 1952). It is well-known in association with constrictive pericarditis, cardiomyopathies and cardiac tamponade, and also in patients suffering from asthma (Chang Siu, 1978).

Three possible mechanisms have been proposed to explain the phenomenon: (1) During inspiration there is an increase in right ventricular filling, which increases intra-pericardial pressure, and hence tends to hinder filling of the left ventricle (Dornhurst *et al.*, 1952); (2) During inspiration the descent of the diaphragm causes traction on an already tense pericardium (Dock, 1961); (3) Pericardial fluid under tension causes an inspiratory pressure gradient between the pulmonary veins and the left atrium, thus impairing left ventricular diastolic filling (Sharp *et al.*, 1960).

In our patient a large, heavy, fluid-filled sac containing necrotic stomach and omentum was found com-

pressing the pericardium. This may have caused pulsus paradoxus by impaired diastolic filling as a result of direct compression, as well as accentuating downward movement of the diaphragm. Pre-operative aspiration of the hernial sac, wrongly thought to be pericardial fluid, resulted in a dramatic reduction in the central venous pressure.

The importance of previous trauma, in particular pelvic fractures, in the aetiology of acquired diaphragmatic herniae, and the considerable time interval that may elapse before presentation, long enough for the patient to forget and deny any previous trauma, are well exemplified by this report.

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