radiologically, it may be difficult to convince oneself that a trivial act like coughing could inflict such a serious injury. Radionuclide bone scanning has been found to be effective in highlighting the fracture sites as regions of abnormal accumulation of activity.⁹

Final diagnosis

Cough-induced rib fractures.

Keywords: cough fracture of ribs

- 1 Roberge RJ, Morgenstern MJ, Osborn H *et al.* Cough fracture of the ribs. *Am J Emerg Med* 1984; 2: 513–7.
- 2 Richardson EC. Indirect fracture of the rib in pulmonary tuberculosis. *JAMA* 1936; 106: 1543.
- 3 Wynn-Williams N. Cough fracture of the ribs unassociated with pulmonary tuberculosis. *BMJ* 1951; 2: 1494.
- 4 Chodosh S, Segal MS. Chronic bronchitis. *N Engl J Med* 1982; 270: 894.
- 5 Ginsburg M. Spontaneous fracture of the first rib as a complication of status asthmaticus. *Ann Allergy* 1947; 5: 488.
- 6 Kopscanyi I, Laczay A, Nagy L. Cough fracture of the ribs in infants with dyspnea. *Acta Paediatr Acad Sci Hung* 1969; 10: 93.
- 7 Mitchell JB. Cough fracture. *BMJ* 1951; 2: 1492.
- 8 Wynn-Williams N, Young RD. Cough fracture of ribs including one complication. *Tubercle* 1959; 40: 47.
- 9 Suga K, Nishigauchi K, Fujita T, *et al.* Bone scintigraphy in two cases with cough related stress fractures of rib. *Kaku-Igaku. (Jpn J Nuclear Med)*. 1992; 29: 495.

Gastric outlet obstruction – with a difference

Dayalan Clarke, Anup K Sharma, K Shute

A 64-year-old man presented with a six-week history of upper abdominal distension and vomiting, exacerbated after meals, with a recent loss of weight. On examination, the only abnormal finding was some fullness in the epigastrium. Oesophagogastroduodenoscopy, abdominal ultrasound scan and a barium enema were normal. Barium meal and hypotonic duodenography revealed narrowing at the duodenojejunal flexure, possibly due to extrinsic compression but computed tomography (CT) revealed no masses. At laparotomy, the clinical diagnosis was confirmed and a gastrojejunostomy performed. Post-operatively the patient continued to vomit, necessitating a second laparotomy two-weeks later. Following a second procedure, the patient made a good recovery and was reviewed six months later, having gained weight and being symptom free.

Questions

- 1 What was the diagnosis?
- 2 What is the treatment of this condition?
- 3 Why was a second laparotomy needed?
- 4 What was the second procedure performed?

Department of
Surgery, Royal
Gwent Hospital,
Newport, Gwent
NP9 2UB, UK
D Clarke
AK Sharma
K Shute

Correspondence to
Mr K Shute

Accepted 6 May 1997

Answers

QUESTION 1

The diagnosis was superior mesenteric artery (SMA) syndrome or Wilkie's syndrome. The condition was first described in 1861 by Von Rokitansky and presents with intermittent compression of the third part of the duodenum against the aorta by the overlying SMA.¹ Predisposing factors include rapid weight loss, growth spurt, prolonged supine positioning, immobilisation in a spinal orthosis, and decreased abdominal tone. The symptoms are those of gastric outlet obstruction with nausea, vomiting, abdominal distension and pain, increasing postprandially.²

The SMA arising from the aorta at the level of the first lumbar vertebra, runs ventrally and caudally in the root of the mesentery over the third part of the duodenum. This places the horizontal segment of the duodenum between the vertically oriented SMA and aorta. Retroperitoneal fat and lymphatic tissue elevate the mesenteric root away from the aorta, the normal angle between the two varying between 38° and 65° in an erect posture. A decrease in this angle can result in compression of the duodenum, described as the 'nutcracker effect'.³ Rapid weight loss decreases the protective layer of periduodenal areolar tissue. Spinal hyperextension and increased lumbar lordosis which occur with a spinal orthosis, push the duodenum ventrally against the SMA. A flaccid abdominal wall with visceroptosis exerts downward traction on the mesenteric pedicle and SMA. All these result in a decrease in the aorto-mesenteric angle.

Diagnostic investigation includes contrast radiography and CT, which show dilatation of the first and second part of the duodenum with an abrupt extrinsic compression of the third part of the duodenum and a delay in transit through the gastroduodenal region. Angiography may be used to measure the aorto-mesenteric angle.

- 1 Fagge CH. Acute dilation of the stomach. *Guys Hosp Series* 3 1873; 18: 1–2.
- 2 Hines JR, Gone RM, Ballantyne GH. Superior mesenteric artery syndrome; Diagnostic criteria and therapeutic approaches. *Am J Surg* 1984; 148: 630–2.
- 3 Marchant EA, Alucar DT, Fagelman KM. True clinical entity of vascular compression of the duodenum in adolescence. *Surg Gynaecol Obstet* 1989; 168: 81–386.

QUESTION 2

Management is usually conservative, when there is a known predisposing factor. Small frequent meals and positioning the patient on the side (lying or knee-elbow position) after meals, and administration of metoclopramide is usually successful.

In patients where the above have failed or when no predisposing factors are found, surgical intervention is needed. Gastrojejunostomy, duodenojejunostomy, lysis of the ligament of Trietz and derotation of the small bowel and right colon being the described procedures.³

QUESTION 3

The results of a gastrojejunostomy are not always satisfactory as the duodenal obstruction is not completely relieved. The biliary and pancreatic secretions still collect in the duodenum causing recurrent symptoms, blind loop and marginal ulceration.⁴

QUESTION 4

The second procedure performed was a duodenojejunostomy which, by decompressing the duodenum, is probably a better operative option.⁵

Conclusion

This case illustrates the failure of a widely used form of surgical intervention⁵ necessitating the use of a secondary procedure. This suggests that duodenojejunostomy should be employed in preference to a gastrojejunostomy for SMA syndrome.

Final diagnosis

Superior mesenteric artery syndrome

Keywords: superior mesenteric artery syndrome

- 4 Puliyodil AP. Superior mesenteric artery syndrome: an unusual cause of intestinal obstruction in brain-injured children. *Brain Injury* 1992; 6: 351–8.
- 5 Gustafson L, Falk A, Luke PJ, Gamklon R. Diagnosis and treatment of superior mesenteric artery syndrome. *Br J Surg* 1984; 71: 499–501.