RADIOLOGICAL CASE

CLINICS IN DIAGNOSTIC IMAGING (13)

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CASE REPORT

A 40-week-old, 2790g, Chinese baby boy was delivered by vacuum extraction because of prolonged second stage during labour. There was no known antenatal history of polyhydramnios. He developed repeated bile-stained vomiting during the first 12 hours after birth. Meconium was passed within 24 hours. On examination, the baby had no dysmorphic features nor dehydration. Except for slight distension of the epigastrium. Other parts of the baby's abdomen were soft and no abnormal mass was palpable. Bowel sounds were not increased on auscultation.

Full blood count, Astrup, renal and liver function tests were normal. What do the plain abdominal radiograph (Fig 1) and water soluble contrast meal and follow-through (Fig 2) show? What is the diagnosis?

Fig 1 – Frontal radiograph of the abdomen taken shortly after commencement of vomiting.

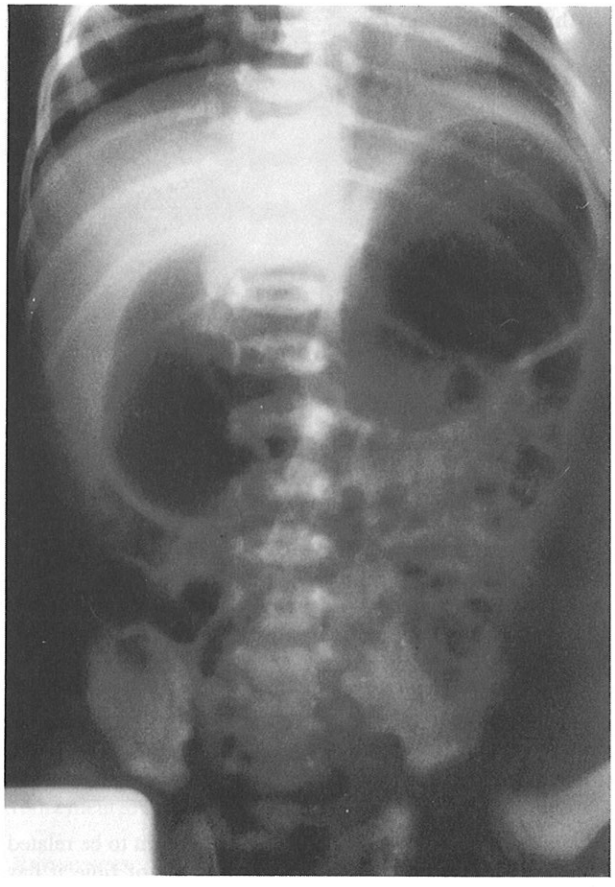

Fig 2 – Water soluble contrast meal and follow-through

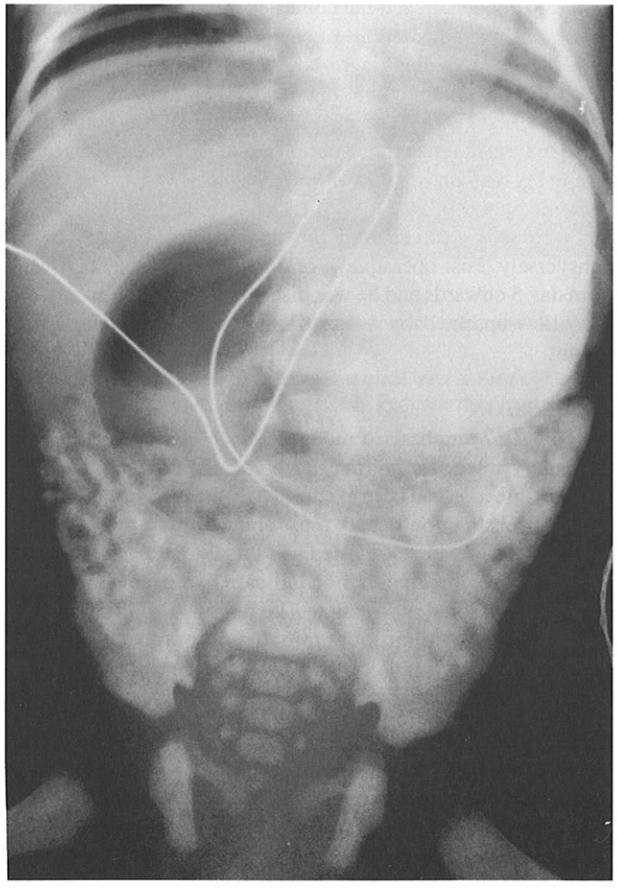

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IMAGE INTERPRETATION

Plain radiograph (Fig 1) showed a "double bubble" configuration which was caused by gas in the distended stomach and proximal duodenum. There was also gas in the bowel distal to the duodenum indicative of incomplete obstruction. No bony abnormality was noted in the vertebrae which may be an association in patients with congenital duodenal obstruction.

The upper gastrointestinal series (Fig 2) showed obstruction in the second portion of the duodenum with a rounded configuration of the dilated duodenum immediately proximal to the point of obstruction. The distal small bowel, although filled with contrast, was rather small in calibre. The bowel loops were evenly distributed in the abdomen with no evidence of malrotation.

DIAGNOSIS

Congenital duodenal obstruction

CLINICAL COURSE

The patient underwent operation the day after birth. At surgery, a constriction was present at the junction between the dilated proximal duodenum and the collapsed distal second part of the duodenum (Fig 3). After full Kocherization of the second part of the duodenum, a diaphragm could be felt at the site of the constriction. A longitudinal duodenotomy was made between stage stitches where presence of the diaphragm was confirmed. It had a 2mm diameter fenestration which allowed passage of a probe (Fig 4). The ampulla of Vater was located 1 cm proximal to the diaphragm (Fig 5). With care not to damage the papilla, the web was excised and the duodenotomy was closed transversely. Post-operatively, oral feeding was tolerated well from day 5 onwards and he was discharged for home on day 15. On follow-up, the baby was feeding normally and was gaining weight.

DISCUSSION

Ladd in 1937 emphasised the importance of investigating the alimentary tract in vomiting newborn infants where cerebral injury or infection had been excluded[1]. In the neonatal age group, intestinal obstruction occurs most commonly at the duodenal level, causes of which are listed in Table I[2].

Extensive imaging is not indicated in a newborn with suspected intestinal obstruction. The radiological investigation of choice is the plain abdominal radiograph, sometimes supplemented by simple contrast studies. A lack or paucity of air entering or passing through the upper gastrointestinal tract is highly suggestive of proximal obstruction such as oesophageal atresia, gastric outlet or duodenal obstruction[3]. As the gut contains no air at birth, knowledge of the exact time of birth is essential in order to gauge when air is expected in various parts of the bowel. Air should reach the stomach within minutes, upper small bowel within half an hour, entire small bowel within 3 hours and sigmoid colon within 9 hours[4].

Depending on the amount of gas in the stomach, plain radiographs of the abdomen may be unremarkable or as in our patient, show the "double bubble" sign. It is not absolutely diagnostic, but duodenal atresia or stenosis is the commonest condition producing this sign, which may also be seen in patients with annular pancreas, malrotation with congenital bands and preduodenal portal vein. A complete absence of air in the distal bowel implies duodenal atresia (Fig 6). Associated anomalies include annular pancreas (20%), Down's syndrome (30%), and other gastrointestinal tract abnormalities (60%)[2].

The contrast meal demonstrates obstruction in the second portion of duodenum, with a rounded configuration at the point

Fig 3 – Operative photograph showing the dilated second portion of the duodenum. The forceps is pointing at a constriction (arrows).

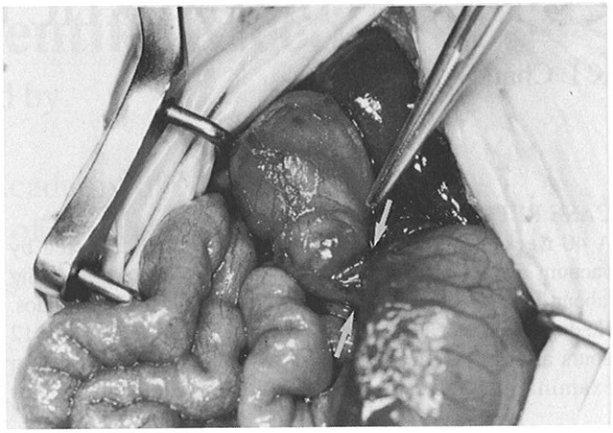


Fig 4 – Operative photograph showing a longitudinal duodenotomy between stage stitches. A probe is passed through the fenestration of the diaphragm (arrows).

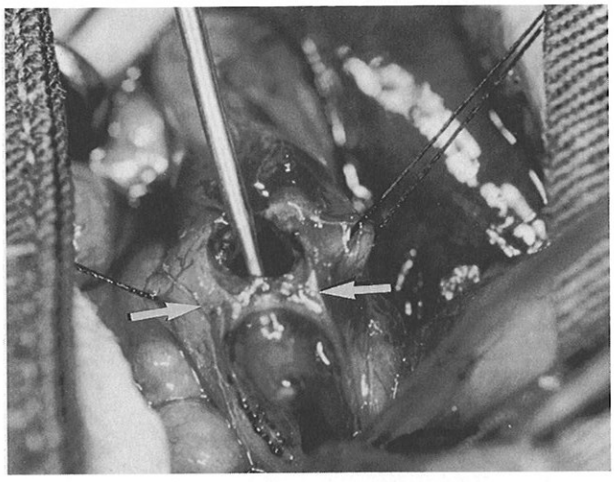


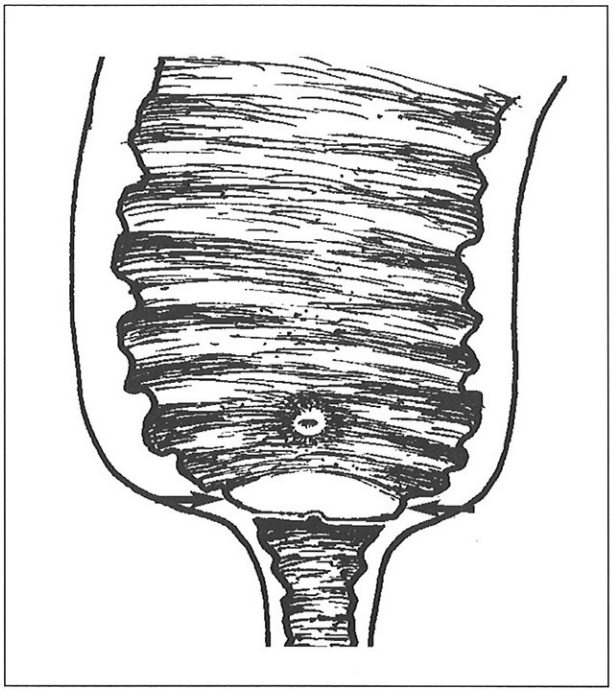
Table I – Causes of neonatal duodenal obstruction

1.	Stenosis / atresia
2.	Annular pancreas
3.	Duodenal diaphragm
4.	Congenital fibrous band of Ladd
5.	Choledochal cyst
6.	Preduodenal portal vein

of obstruction. The degree of dilatation is thought to be related to the severity of obstruction and the length of time it has persisted. If both the proximal and distal surfaces of the diaphragm are outlined by contrast, the diagnosis may be made pre-operatively[4,5]. Cremin and Solomon (1987) reported the use of abdominal real-time ultrasound, with the aid of 50 mL of water injected down a nasogastric tube, in the detection of duodenal diaphragm[6].

In most situations of neonatal gastrointestinal obstruction, surgery is the only possible treatment and must often be performed as an emergency procedure. Survival for congenital duodenal obstruction in infants has improved over the years. Bailey et al (1993) reported a 93% survival rate in a 32-year review and attributed the improvement to aggressive, timely operative management and post-operative nutritional support[7].

Fig 5 – Surgeon's sketch showing the relationship between the diaphragm (arrows) and the ampullary papilla in the second part of the duodenum.

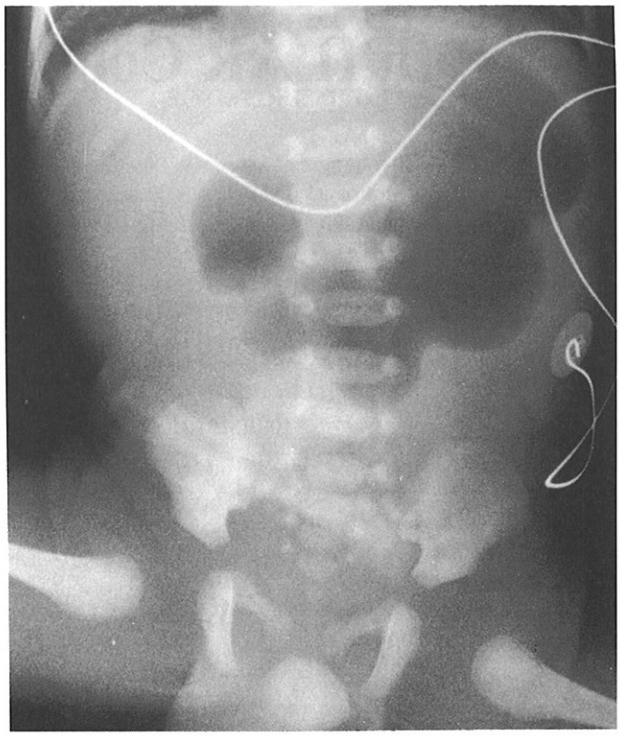


The operation for duodenal diaphragm may be complicated by the presence of situs inversus, multiple congenital anomalies, double obstruction and additional extrinsic compression. In order to make a duodenotomy accurately at the diaphragmatic level, one has to look for an indentation in the duodenum which can be exaggerated by inserting an intraluminal catheter to stretch the diaphragm (Fig 3).

Before the excision of the diaphragm, one has to identify the ampulla which can be located proximally, as in our patient, or distally. Sometimes, it may also be at the medial aspect of the diaphragm. The use of a small catheter will often indicate and protect the course of the duct. The subsequent use of a bigger catheter, advanced to the jejunum, has a role in ruling out the presence of a second diaphragm[8]. The duodenotomy is then closed transversely to prevent narrowing of the duodenal lumen. Sometimes, duodeno-duodenostomy is another option when the ampulla is in danger of being damaged[9].

Endoscopic membranectomy has also been reported as another option[10]. However, available flexible endoscopes, for example the Olympus XP10 (Japan), are too big for newborn infants. This technique will be useful only when there is further refinement to the design of flexible endoscopes for newborn use.

Fig 6 – Frontal abdominal radiograph of another newborn baby showing dilated air-filled stomach and proximal duodenum, with absence of gas in the rest of the intestinal tract. Diagnosis of duodenal atresia was later confirmed at surgery.



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ABSTRACT

A newborn Chinese baby boy presented with repeated bile-stained vomiting. Plain radiograph showed a "double-bubble" shadow. Upper gastrointestinal series demonstrated, in addition to a dilated stomach, rounded dilatation of the second part of duodenum with partial obstruction. At operation, a diaphragm was found at duodenotomy over the waist of the proximal duodenal constriction. Excision of the diaphragm and transverse closure of the duodenotomy produced relief of the obstruction. The role of imaging and the surgical approach to duodenal diaphragm are discussed.

Keywords: *newborn baby, vomiting, duodenal obstruction, duodenal diaphragm, intestinal obstruction*