ULTRASOUND 'DOUBLE BUBBLE' SIGN IN THE DIAGNOSIS OF DUODENAL ATRESIA

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Duodenal atresia is a relatively uncommon condition in neonates presenting with recurrent vomiting after feeds. Its incidence is approximately 1 in 10,000 live births. Typically, vomiting starts in the postnatal period, although signs may be delayed for several days after birth whilst gastric secretions accumulate. Plain abdominal radiographs typically display the so-called 'double bubble' sign which reflects the presence of air-fluid levels within both the body of the stomach and the dilated blind-ending first part of duodenum.

We present a patient in whom the typical plain film 'double bubble' was misleadingly absent on plain film, but was nevertheless unequivocally *present on ultrasound*.

CASE HISTORY

The patient was a female neonate born at 35 weeks' gestation following emergency caesarian section for fetal distress. The pregnancy had been complicated by polyhydramnios, and upper GI tract obstruction was suspected in the baby. At delivery, her abdomen was noted to be very distended, and a nasogastric tube was passed – with difficulty – to 10cm. Plain chest and abdominal radiographs were obtained, which showed a complete absence of abdominal gas (Figures 1a and 1b).

A diagnosis of probable upper oesophageal atresia without a co-existent tracheo-oesophageal fistula was made. This failed to explain the obvious abdominal distension, and the labour ward discharge summary note acknowledged the likelihood of '…other unknown intra-abdominal pathology resulting in abdominal distension and ascites'.

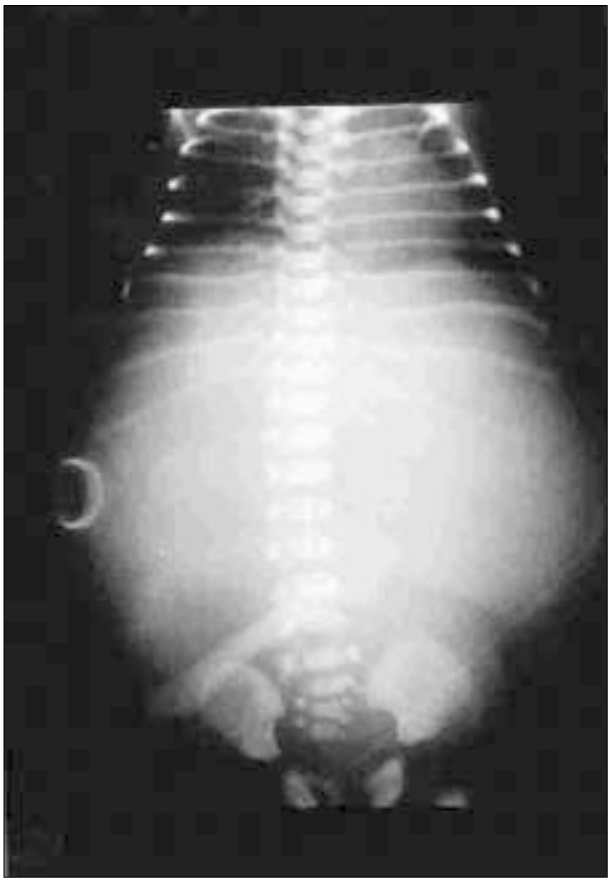


FIGURE 1A

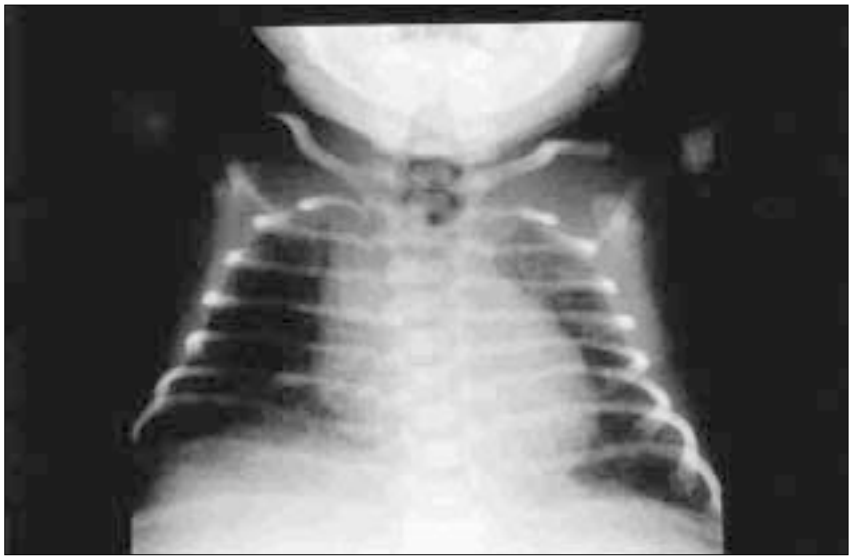
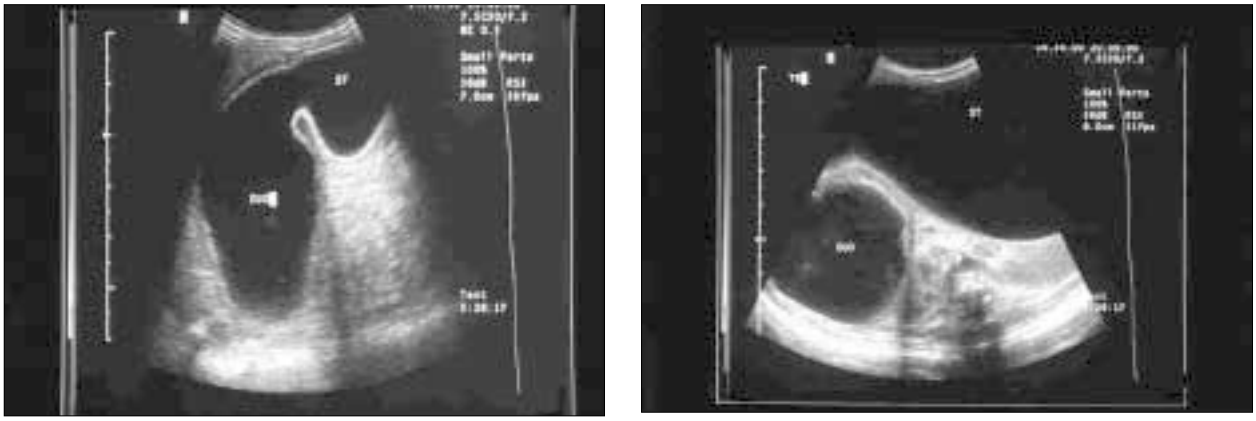


FIGURE 1B

FIGURES 1A AND 1B
AXR and CXR. Note complete absence of bowel gas and fluid level in upper oesophagus.



FIGURES 2A AND 2B
Selected ultrasound images showing a dilated fluid-filled antrum of stomach (ST) in continuity with a distended blind-ending duodenal cap (DUO).

An urgent ultrasound examination was sought, which did not demonstrate ascites but clearly demonstrated the '…other…intra-abdominal pathology…' (Figures 2a and 2b).

The ultrasound images elegantly demonstrated the 'double bubble' sign due to distension of the isolated section of GI tract – the stomach and duodenal cap – with fluid secretions.

The child went to theatre 36 hours after delivery, where a side-to-side duodenostomy was performed to relieve the duodenal obstruction. The co-existent oesophageal atresia proved to be of the 'long gap' type, and repair was delayed several months. In the interim, a feeding gastrostomy was placed to permit adequate enteral nutrition. This surgical management plan is widely accepted, and is known as the 'feed, wait and grow' approach.[1]

Just under four months later a radiological contrast study was performed in order to estimate the length of the gap between proximal and distal oesophageal segments (Figure 3). Following this, a full thickness repair of the oesophagus was successfully performed (Figure 4).

DISCUSSION

This case demonstrates a classic radiological sign, which, however, did not appear in an entirely classical manner. This was due to the presence of two pathologies, the first initially masking the presence of the second.

Duodenal atresia is thought to be due to the failure of the fetal intestine to recanalise *in utero*. In 80% of cases, the atresia occurs just distal to the ampulla of Vater thus resulting in bilious vomiting. It is usually readily diagnosed after plain film examination of the abdomen, due to the classic

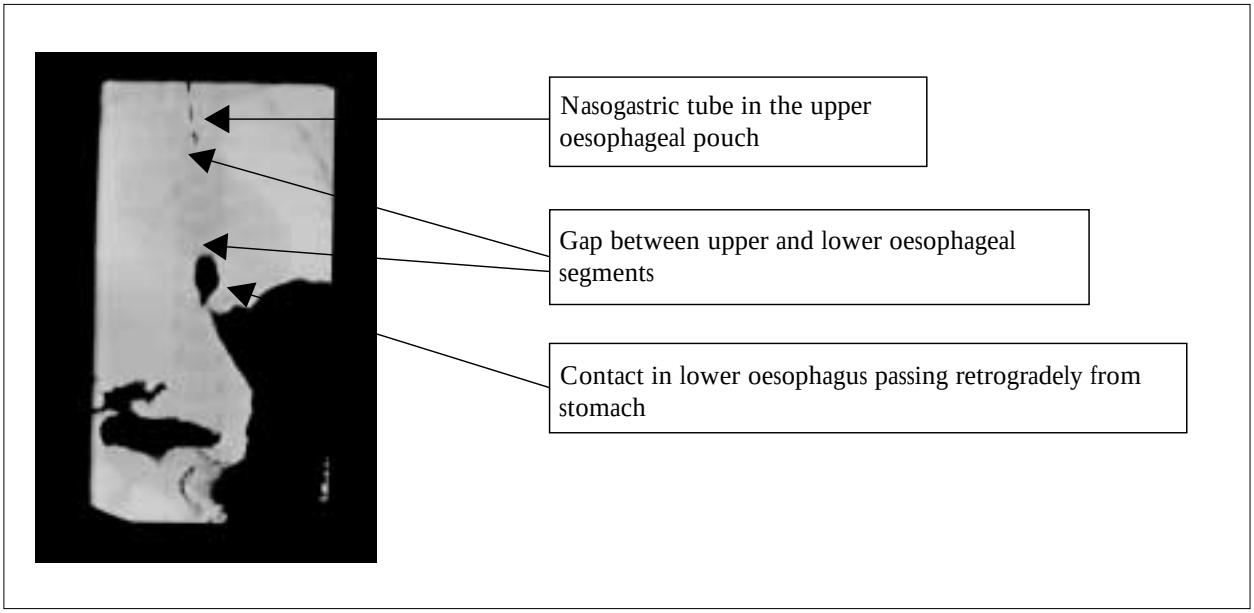


FIGURE 3
Contrast study to assess length of the gap between upper and lower oesophageal segments (contrast has been introduced retrogradely via the gastrostomy tube).

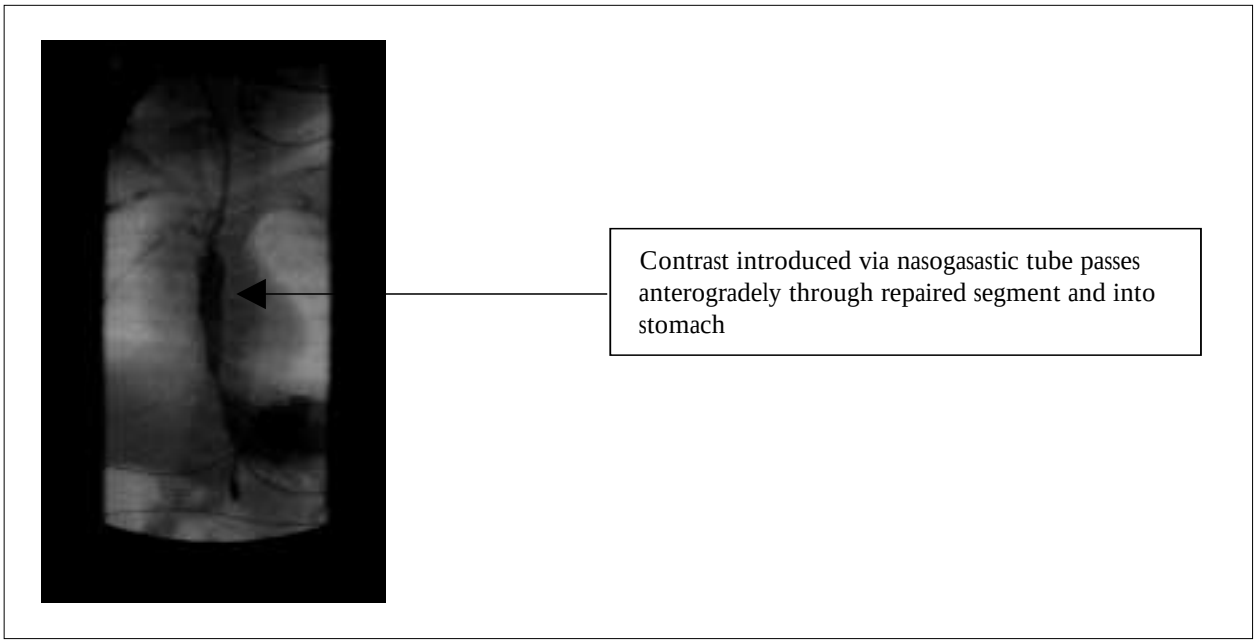


FIGURE 4
Contrast study performed following operative repair of the oesophagus.

'double bubble' seen as a result of air-fluid levels within both the gastric antrum and the duodenal cap (Figure 5).

However, this sign was absent – on plain film – in this child, because of the co-existent oesophageal atresia, which was of a relatively uncommon type. In over 90% of cases of oesophageal atresia there is an associated fistula between the trachea and the distal oesophageal segment which therefore allows air to reach the stomach and beyond.[2] In this child, no such fistula was present leading to a misleading absence of the 'double bubble' on plain abdominal X-ray examination. The ultrasound examination revealed the 'double bubble' and the diagnosis was made.

Duodenal atresia is, in fact, often associated with other congenital abnormalities (Table 1).[3]

A high mortality is associated with this condition, due not only to co-existent pathology but also to prematurity and low birth weight. The combination of oesophageal and duodenal atresia is particularly lethal, with mortality rates ranging from 67–94%.[4] Such high mortality often reflects a failure to recognise the second abnormality preoperatively,[5] with consequent dehydration and electrolyte loss resulting in profound metabolic alkalosis.

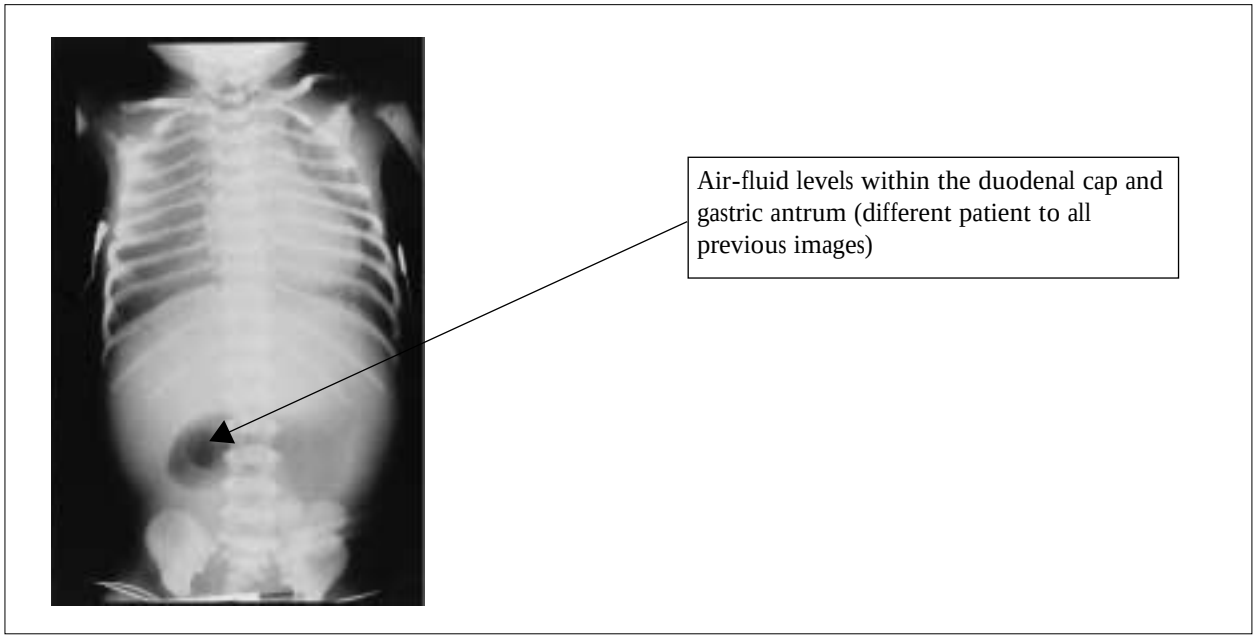


FIGURE 5
The classic 'double bubble' appearance of uncomplicated duodenal atresia. Commonly – as shown here – the bubbles are seen one superimposed upon the other.

TABLE 1
Association of duodenal atresia with other congenital malformations.

Down's syndrome	28%
Malrotation	19%
Congenital heart disease	19%
Oesophageal atresia	9%
Urinary tract abnormalities	9%
Anorectal anomalies	6%

CONCLUSION

Duodenal atresia is a potentially life-threatening condition that should be considered whenever a neonate presents shortly after birth with recurrent (and usually) bile-stained vomiting. If the typical 'double bubble' sign is not seen on the plain abdominal film, the possibility of an associated oesophageal atresia without distal tracheo-oesophageal fistula needs to be entertained. In such circumstances, ultrasound examination will rapidly relieve diagnostic uncertainty by demonstrating the unequivocal presence of a fluid-filled 'double bubble'.

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