Hypertrophic pyloric stenosis — an overview

H Grove
Nat. Cert. Rad. Ultrasound

Department of Paediatric Radiology, Red Cross War Memorial Children's Hospital, University of Cape Town and Institute of Child Health

Definition

The term hypertrophic pyloric stenosis (HPS) refers to hypertrophy of the circular muscle of the pylorus that can cause obstruction (HPO).

Clinical findings

Clinical findings include the following: (*i*) non-bilious projectile vomiting; (*ii*) peristaltic waves that can be seen travelling across the left upper quandrant to the right and terminating beyond the midline;[1] (*iii*) a palpable 'olive' (pseudotumour) over an empty stomach;[2] (*iv*) age typically 2 - 8 weeks; (*v*) male-to-female ratio 5:1; (*vi*) uncommon in black patients; (*vii*) often the male offspring of an affected mother; (*viii*) gastric residual > 10 ml;[3] and (*ix*) an association with oesophageal atresia.[4]

Plain film findings

Plain film findings include the following: (*i*) gastric dilatation; (*ii*) paucity of small bowel and colonic air; (*iii*) frothy gastric contents; (*iv*) absence of an air-filled duodenal bulb; (*v*) gastric pneumatosis; and (*vi*) normal appearance.

Ultrasound technique

A high frequency transducer (7 MHz) is used, preferably a linear or vector probe (Acuson 128 XP/10). With the patient in the supine position start off scanning in the longitudinal section until the gall bladder is located.[5] The 'olive' of the hypertrophied musculature should be located medial to it. Visualisation is good when the 'olive' has a foreshortened appearance (Fig. 1).

The transducer now has to be rotated and angled so that it is aligned with the long axis of the channel (Fig. 2). On this view, the beak sign can be identified as on a contrast meal.

If the stomach is too full, the channel is distorted and accurate measurements won't be possible. In such a case a nasogastric tube can be passed to empty some of the contents.

Once the long axis is obtained, one should note the position of the transducer and turn it 90 degrees. This way the bull's eye of the pyloric channel can be identified end-on (Fig. 3).

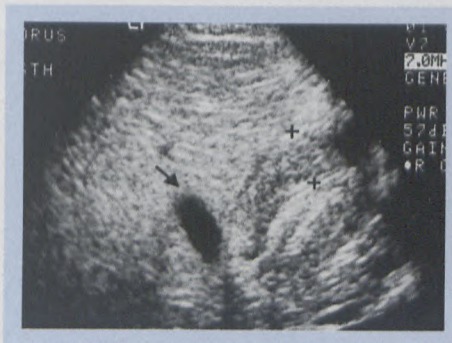

Fig. 1. Obvious foreshortening of the pyloric channel (cursors indicate the superior muscle thickness adjacent to the gall bladder) (arrow).

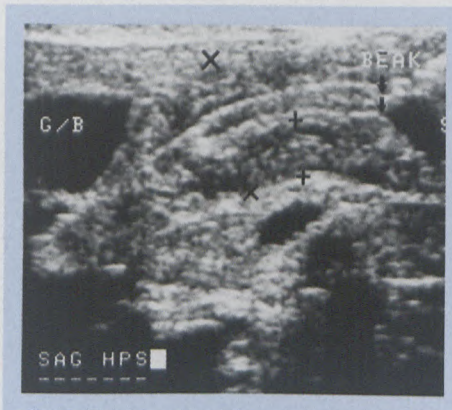

Fig. 2. The long axis of the pyloric channel is the longest length that should be obtained. (G/B = gall bladder, ST = stomach, X's define the pyloric diameter, +'s define the muscle wall thickness).

Measurements

At the Red Cross War Memorial Children's Hospital the following measurements are used: (*i*) > 4 mm muscle thickness; (*ii*) > 12 mm diameter (this includes two muscle walls and mucosa); and (*iii*) > 14 mm length (up to 26 mm).

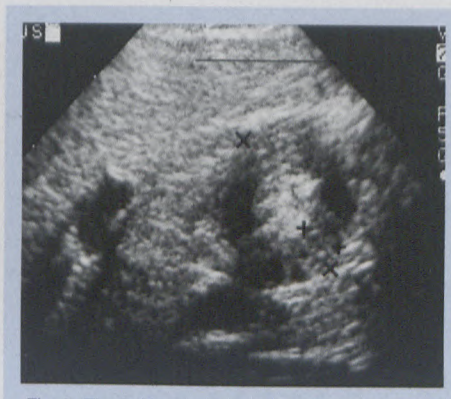

Fig. 3. The bull's eye view of the pyloric channel in its short axis (X's define the pyloric diameter, +'s define the muscle thickness).

The rule of thumb is 5, 15 and 20 mm. If there is uncertainty the pyloric index can be worked out.

Pyloric index

The pyloric index may be calculated as follows:

$$\text{pyloric index} = \frac{\text{wall thickness} \times 2 \times 100}{\text{maximum diameter}}$$

Values greater than 50% and wall thickness 4 mm or more indicate HPS.

Values less than 35% and wall thickness 1 - 3 mm indicate the absence of HPS.

Values greater than 50% and wall thickness 3 - 4 mm are equivocal for HPS and should be followed up.

Recommendations

Although the patient can be scanned in the decubitus position, right side down,[5] we have been performing the study in a supine position at our institution. Glucose water can be given to evaluate antral emptying, but we haven't been finding this necessary.

Conclusion

While the upper gastro-intestinal (UGI) series has been found to be less expensive than ultrasound,[6,7] the latter does not involve ionizing radiation and is a way of examining the pyloric muscle directly, rather than indirectly as in the UGI series.

References

1. VW Hilton S, Edwards DK. *Practical Pediatric Radiology.* 2nd ed. Philadelphia: WB Saunders, 1994: 303.
2. White MC, Langer JC, Don S, de Baun M. Sensitivity and cost minimization analysis of radiology versus olive palpation for the diagnosis of hypertrophic pyloric stenosis. *J Pediatr Surg* 1998; 33: 913-917.
3. Finkelstein MS, Mandell GA, Tarbell K. Hypertrophic pyloric stenosis: volumetric measurement of nasogastric aspirate to determine the image modality. *Radiology* 1990; 177: 759-761.
4. Kilic N, Gurpinar A, Kiristioglu I, Dogruyol H. Association of oesophageal atresia and hypertrophic pyloric stenosis. *Acta Paediatr* 2000; 89 (1):118-119.
5. Teele RL, Share J. Gastro-duodenal ultrasonography. In: Bradlaw L, ed. *Ultrasonography of Infants and Children.* Philadelphia: WB Saunders, 1991: 351.
6. Olson AD, Hernandez R, Hirschl RB. The role of ultrasonography in the diagnosis of pyloric stenosis: a decision analysis. *J Pediatr Surg* 1998; 33: 76-681.
7. Hulke F, Campbell JR, Harrison MW, Campbell TJ. Cost-effectiveness in diagnosing infantile hypertrophic pyloric stenosis. *J Pediatr Surg* 1997; 32: 1604-1608.