

Diagnostic Imaging Pathways - Paediatric, Vomiting

Population Covered By The Guidance

This pathway provides guidance on the imaging of paediatric patients with recurrent vomiting of uncertain aetiology.

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Quick User Guide

Move the mouse cursor over the **PINK** text boxes inside the flow chart to bring up a pop up box with salient points.

Clicking on the **PINK** text box will bring up the full text.

The relative radiation level (RRL) of each imaging investigation is displayed in the pop up box.

SYMBOL	RRL	EFFECTIVE DOSE RANGE
	None	0
	Minimal	< 1 millisieverts
	Low	1-5 mSv
	Medium	5-10 mSv
	High	>10 mSv

Pathway Diagram

Date reviewed: July 2014
 Please note that this pathway is subject to review and revision

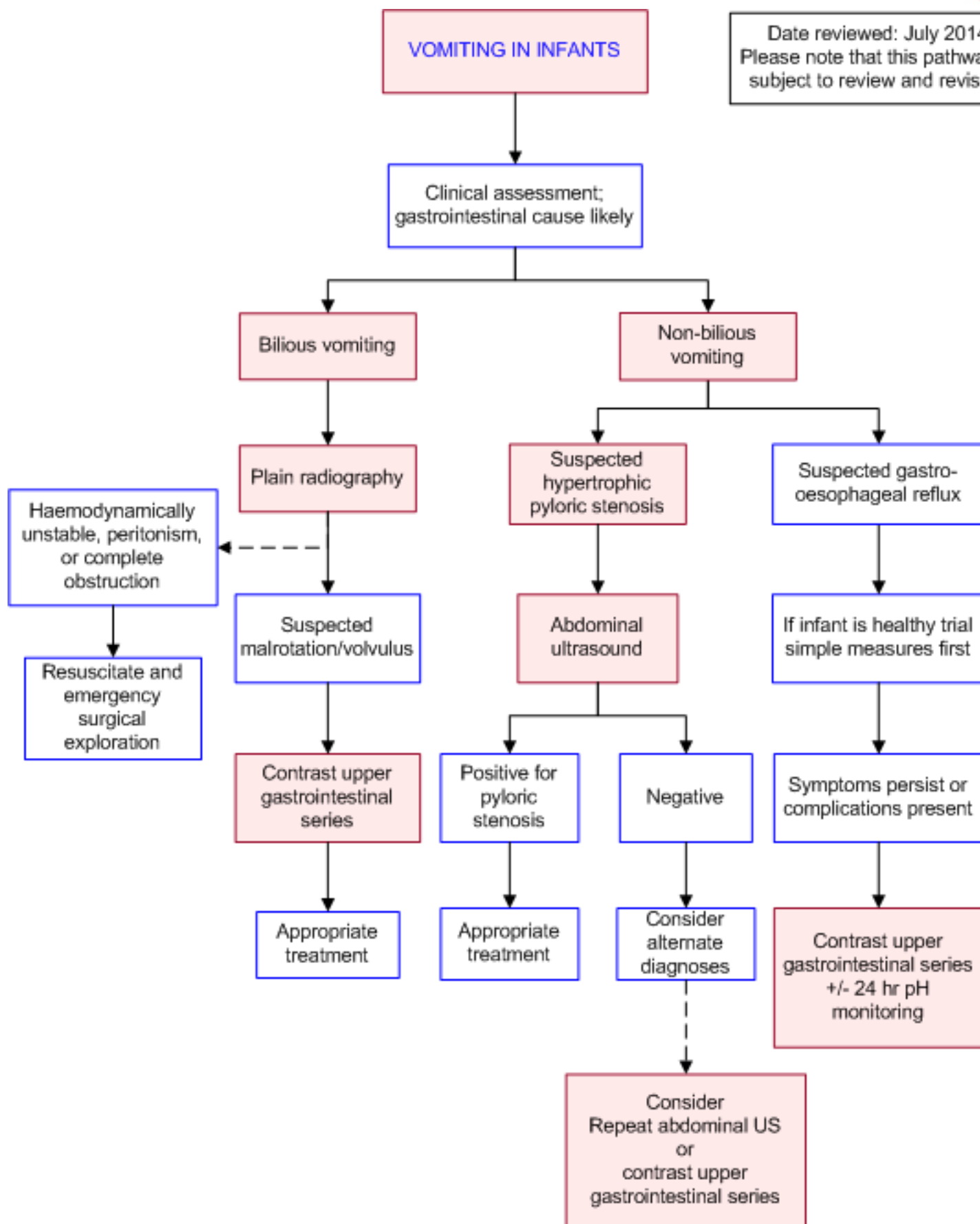


Image Gallery

Note: These images open in a new page

1



Malrotation

Image 1 (Upper GI Contrast Study): There is a spiral or corkscrew appearance of the lower duodenum and proximal jejunum consistent with malrotation.

2a



Hypertrophic Pyloric Stenosis

Image 2a and b (Ultrasound): The pylorus is enlarged, measuring 22mm in length, 13mm in width and the muscle thickness is almost 5mm. The appearance is consistent with significant hypertrophic pyloric stenosis.

2b



Teaching Points

- The character of the vomitus and the relationship to meals should be determined. A thorough clinical history and examination should be performed
 - Infants with bilious vomiting should be considered to have intestinal obstruction. Plain radiography and an upper GI contrast study should be considered
 - Infants with non-bilious vomiting and suspected of having hypertrophic pyloric stenosis, should undergo ultrasonography

Contrast Upper Gastrointestinal Series

- The imaging study of choice to evaluate bilious vomiting in neonates and infants. Exceptions include critically ill patients who require urgent surgical intervention and suspected complete duodenal obstruction [4,17](#)
- Involves the use of a contrast agent, usually barium to evaluate the stomach, duodenum and position of the duodeno-jejunal junction. Contrast can be administered orally or via a nasojejunal tube
- Upper GI contrast studies are primarily used to diagnose malrotation/volvulus and detect other obstructive lesions of the upper GI tract [18](#)

- **With malrotation/volvulus the ligament of Treitz (duodenojejunal junction) is typically located below and to the right of normal [5,17,19,20](#)**
- **A spiral or corkscrew appearance of the duodenum with early filling of the small intestine, or a tapered, 'beaked' appearance of the bowel at the point of obstruction is suggestive of midgut volvulus. With complete obstruction, contrast may not enter into the involved bowel loops [4,19,20](#)**
- **Compared to dual probe 24-hour oesophageal pH monitoring, upper GI contrast studies are not as sensitive (42%-86%) or specific (21%-57%) for diagnosing gastroesophageal reflux primarily due to their short duration of observation [21,22](#)**
- **Ultrasound rather than upper GI contrast studies is the preferred means for diagnosis of pyloric stenosis if appropriately skilled operators are available**

Hypertrophic Pyloric Stenosis (HPS)

- **Is a condition that involves hypertrophy and elongation of the pylorus with eventual progression to gastric outlet obstruction**
- **Onset is typically sudden in previously thriving infants between 2 to 6 weeks of age**
- **The incidence is higher in males and in firstborn children [1](#)**
- **Vomiting is usually immediately postprandial and is typically projectile and non bilious [2](#)**
- **The main differential diagnoses include gastro-oesophageal reflux, pylorospasm and gastroenteritis and these may be difficult to distinguish on history alone**
- **Palpation of an 'olive' type mass in the right upper quadrant is highly suggestive of HPS [3](#)**

Ultrasound

- **Patients with non-bilious vomiting should have ultrasonography as the initial radiological investigation [6](#)**
- **Generally considered the initial investigation of choice for the investigation of hypertrophic pyloric stenosis (HPS)**
 - **Measurements of the pyloric muscle thickness and the length of the pyloric canal are used to make the diagnosis of HPS, but must be considered in the context of other sonographic information including lack of opening of pyloric channel and exaggerated antral peristalsis [7-11](#)**
 - **Although there have been a lack of studies directly comparing ultrasound to an upper gastrointestinal series, the former is generally**

preferred as the first line investigation for HPS because it is highly sensitive and specific, involves no ionising radiation, and is widely available

- **As pyloric stenosis is a progressive condition, a repeat ultrasound may be helpful in equivocal cases**
- **There are features on ultrasound that may suggest a diagnosis of malrotation/volvulus including inversion of the normal relationship between the superior mesenteric artery and vein; or the 'whirlpool' sign of a side-by-side arrangement of superior mesenteric vessels with opposite flow directions. However, these signs are neither sensitive nor specific and if there is clinical suspicion of malrotation/volvulus, an upper GI contrast study is indicated [6](#), [12-16](#)**

Plain Radiography

- **Plain films are appropriate in neonates or infants who present with bilious vomiting as it can help to differentiate proximal from distal bowel obstruction. It may also suggest specific diagnoses such as volvulus or duodenal atresia [4](#)**
- **Separation of adjacent bowel loops; bowel-wall thickening; and intramural gas may be present owing to volvulus-induced ischaemia [4,5](#)**

References

References are graded from Level I to V according to the Oxford Centre for Evidence-Based Medicine, Levels of Evidence. [Download the document](#)

- [1.](#) **Papdakis K, Chen EA, Luks FI, et al. The changing presentation of pyloric stenosis. Am J Emerg Med. 1999;17:67-9. (Level III evidence)**
- [2.](#) **Gibbs MK, Van Hernden JA, Lynn HB. Congenital Hypertrophic pyloric stenosis. Surgical experience. Mayo Clin Proc 1975;50:312-6. (Level IV evidence)**
- [3.](#) **Hernanz-Schulman M, Sells LL, Ambrosino MM, et al. Hypertrophic pyloric stenosis in the infant without a palpable olive: accuracy of sonographic diagnosis. Radiology. 1994;193:771-6. (Level IV evidence)**
- [4.](#) **Strouse PJ. Disorders of intestinal rotation and fixation ("malrotation"). Pediatr Radiol. 2004;34:837-51. (Review article)**
- [5.](#) **McAlister WH, Kronemer KA. Emergency gastrointestinal radiology of the newborn. Radiol Clin North Am. 1996;34:819-44. (Review article)**
- [6.](#) **Hernanz-Schulman M. Infantile hypertrophic pyloric stenosis. Radiology.**

- 2003;227:319-31. (Review article)**
- 7. Stunden RJ, LeQuesne GW, Little KE. The improved ultrasound diagnosis of hypertrophic pyloric stenosis. *Pediatr Radiol.* 1986;16:200-5. (Level II evidence). [View the reference](#)**
 - 8. Wilson DA, Vanhoutte JJ. The reliable sonographic diagnosis of hypertrophic pyloric stenosis. *J Clin Ultrasound.* 1984;12:201-4. (Level IV evidence)**
 - 9. Cohen HL, Zinn HL, Haller JO, et al. Ultrasonography of pylorospasm: findings may simulate hypertrophic pyloric stenosis. *J Ultrasound Med.* 1998;17:705-11. (Level III evidence)**
 - 10. Haller JO, Cohen HL Hypertrophic pyloric stenosis: diagnosis using US. *Radiology.* 1986;161:335-9. (Review article)**
 - 11. O'Keeffe FN, Stansberry SD, Swischuk LE, Hayden CK Jr. Antropyloric muscle thickness at US in infants: what is normal? *Radiology.* 1991;178:827-30. (Level III evidence)**
 - 12. Zerin JM, DiPietro MA. Superior mesenteric vascular anatomy at US in patients with surgically proved malrotation of the midgut. *Radiology.* 1992;183:693-4. (Level III evidence)**
 - 13. Dufour D, Delaet MH, Dassonville M, Cadranel S, Perlmutter N. Midgut malrotation, the reliability of sonographic diagnosis. *Pediatr Radiol.* 1992;22:21-23. (Level III evidence)**
 - 14. Shimmanuki Y, Aihara T, Takano H, et al. Clockwise whirlpool sign at color Doppler US: an objective and definite sign of midgut volvulus. *Radiology.* 1996;199:261-4. (Level III/IV evidence)**
 - 15. Hayden CK, Boulden TF, Swischuk LE, Lobe TE. Sonographic demonstration of duodenal obstruction with midgut volvulus. *AJR Am J Roentgenol.* 1984;143:9-10. (Level IV evidence)**
 - 16. Weinberger E, Winters WD, Liddell RM, Rosenbaum DM, Krauter D. Sonographic diagnosis of intestinal malrotation in infants: importance of the relative positions of the superior mesenteric vein and artery. *AJR Am J Roentgenol.* 1992;159:825-8. (Level III evidence)**
 - 17. Buonomo C. Neonatal gastrointestinal emergencies. *Radiol Clin North Am.* 1997;35:845-64. (Review article)**
 - 18. Jolley SG. Gastroesophageal reflux disease as a cause for emesis in infants. *Semin Pediatr Surg.* 2005;4:176-89. (Review article)**
 - 19. Alford BA, McIlhenny J. The child with acute abdominal pain and vomiting. *Radiol Clin North Am.* 1992;30:441-53. (Review article)**
 - 20. Torres AM, Ziegler MM. Malrotation of the intestine. *World J Surg.* 1993;17:326-31. (Level III evidence). [View the reference](#)**
 - 21. Al-Khawari HA, Sinan TS, Seymour H. Diagnosis of gastro-oesophageal reflux in children. Comparison between oesophageal pH and barium examinations. *Pediatr Radiol.* 2002;32:765-70. (Level IV evidence)**
 - 22. Seibert JJ, Byrne WJ, Euler AR, Latture T, Leach M, Campbell M. Gastroesophageal reflux - the acid test: scintigraphy or the pH probe. *AJR Am J Roentgenol.* 1983;140:1087-90. (Level III evidence). [View the reference](#)**



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