I. PYLORIC STENOSIS

II. Patient Preparation:

III. Equipment: Performed with real-time scanner using a linear, curved linear, or sector transducer with a frequencies ranging from 5.0 MHz to 7.5 MHz.

IV. Procedure Protocol:

A. **Supplies:**

1. Bottled water and nipple.
2. Pacifier

B. Patient Position:

1. Infant placed in right lateral decubitus position.
2. If no fluid is seen in the gastric antrum, with radiologist approval, feed infant water and re-examine.
3. Consider slight incline of infant on pillow.

C. **Observation Time:**

1. Observe pylorus for approximately 10 minutes for signs of pyloric relaxation and passage of gastric contents into duodenum.
2. Observation preferably made in long axis view.

D. **Imaging/Measurements:**

COMMENT - All measurements/calculations must be made from long axis view of pyloric channel.

Positive diagnosis of Hypertrophic Pyloric Stenosis Include:

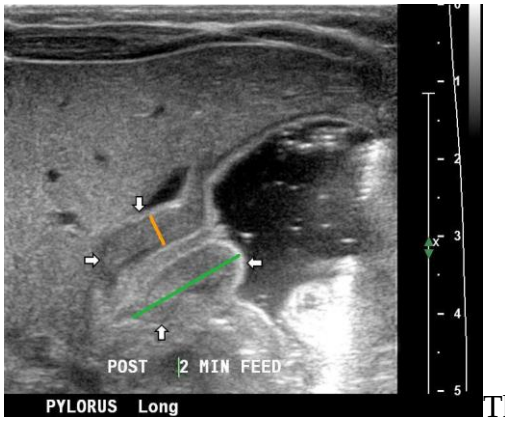
1. Pyloric Canal Length - greater than or equal to 2.0 cm is considered definitely abnormal while a length greater than or equal to 1.8 cm is most likely abnormal; a pyloric length of less than 1.4 cm is considered normal, and a length of 1.4-1.8 cm is in the gray zone. (a normal canal length may be much shorter and often impossible to measure- this will be seen as a small region between a normal gastric antrum and duodenum)
2. Hypoechoic Muscle Thickness - greater than or equal to 4 mm considered positive for HPS; measurements of 3-4 mm a gray zone
3. Pyloric Diameter (PD) - used to calculate pyloric volume; note that the PD is obtained only when the lumen is collapsed - if this is not possible during observation time, then subtract the lumen diameter from the PD.
4. Pyloric Volume - greater than or equal to 1.4 ml using the following formula: $^{1}/4$PI x Pyloric Diameter (mm) x Pyloric

Length (mm)

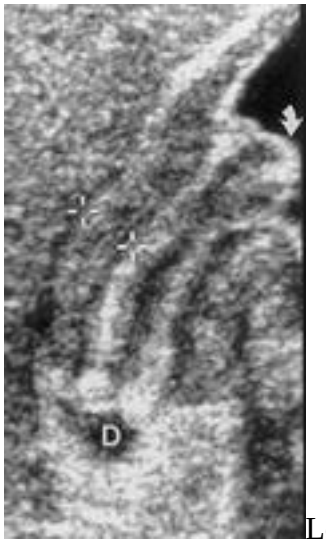
5. If pylorus is normal, assess celiac axis and mesenteric vessels as malrotation is a differential diagnosis for IHPS.

E. **General Guidelines**

1. Nonvisualized Pylorus: An US exam is technically nondiagnostic when the pyloric region is inadequately visualized. If the US exam remains nondiagnostic due to technical factors, an UGI can be suggested.
2. Borderline measurements: Cases with borderline pyloric size measurements by US may represent pylorospasm or HPS in evolution. Persistent pyloric muscular thickening and functional gastric outlet obstruction suggests HPS. If pyloric muscular thickening and gastric outlet obstruction are transient , pylorospasm is implied.
3. Inconclusive: Despite careful attention to pyloric size measurements and pyloric function by real-time US observation, some US exams may be inconclusive, particularly those with borderline size measurements. Patients with an inconclusive US exam may undergo an UGI or may be followed closely clinically with repeated physical exams and/or additional imaging studies as indicated. Follow-up is highly recommended as some of these cases may progress to frank HPS, with reported time periods ranging from a few days to greater than one month

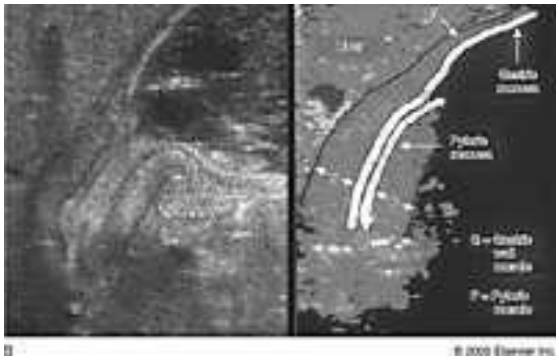


The length (green line) was 16mm (upper limit of normal 14mm), and the muscle thickness (orange line) was 4mm (upper limit of normal 3mm). This image also shows the “antral nipple sign” – redundant pyloric mucosa protruding into the gastric antrum, and the “cervix sign” – indentation of the pylorus into the fluid-filled antrum. The most telling sign, however, was that no gastric contents were seen to pass through the pylorus at any time during the examination



Longitudinal sonogram shows anterior thickened muscle (cursors). Double layer of crowded and redundant mucosa fills the channel and protrudes into fluid-filled antrum (arrow). D = fluid-filled duodenal cap


Cross-sectional sonogram shows circumferential muscular thickening (cursors) surrounding the central channel and filled with mucosa



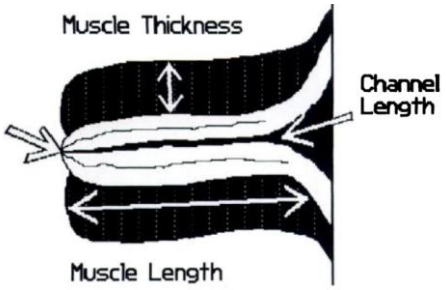
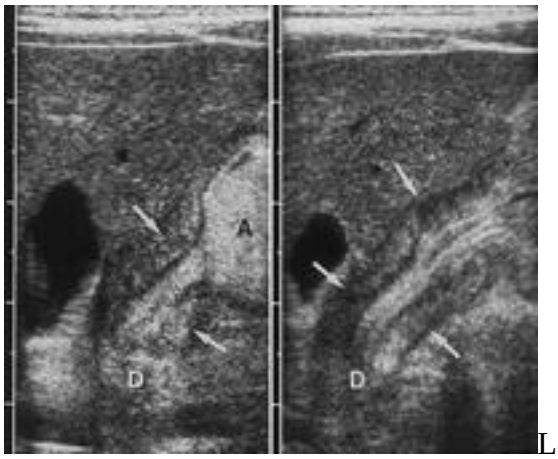


Fig. 2.—Diagram of a sonogram with plane of section through long axis of pyloric channel. Muscle thickness is measured from base of echogenic submucosa to outer edge of hypoechoic muscle layer. Muscle length was measured between point of transition from normal gastric muscle to thickened antropyloric muscle and end of thickened muscle at pylorus. When muscle layer was not thickened, its length was measured along persistently contracted portion of pylorus. Channel length was measured along elongated, narrowed portion of lumen of gastric outlet.



Longitudinal sonograms obtained within a few minutes of each other show peristaltic activity and changes in pyloric anatomy in a patient with Idiopathic Hypertrophic Pyloric Stenosis (IHPS). Note the shorter canal in image on left and subsequent elongation coincident with peristaltic activity in image on right. There is failure of relaxation of the pyloric channel, and persistent obliteration of the lumen. Also note that on the left image, the gastric contents and pyloric mucosa have similar echogenicity, falsely suggestive of unimpeded passage of gastric contents through the canal. A = antrum, D = duodenal cap, arrows = outer muscular layer.

References:

Carol M. Rumack, Stephanie R. Wilson, J. William Charboneau, Diagnostic Ultrasound Second Edition (Mosby, 1998), pp. 1719 - 1723.

Literature Review Summary from 1997 Annual AIUM Convention " Meet the Professor Session-Pediatric Ultrasound"