



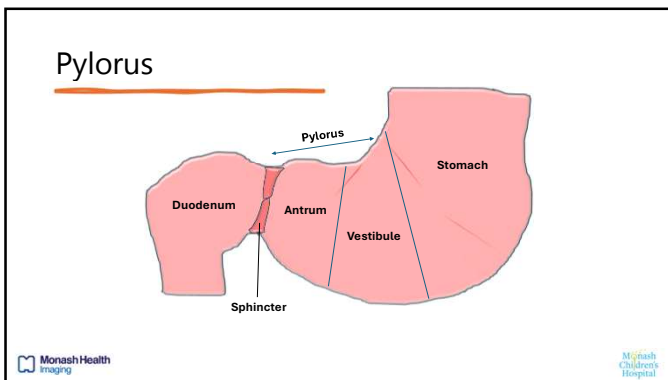
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Objectives

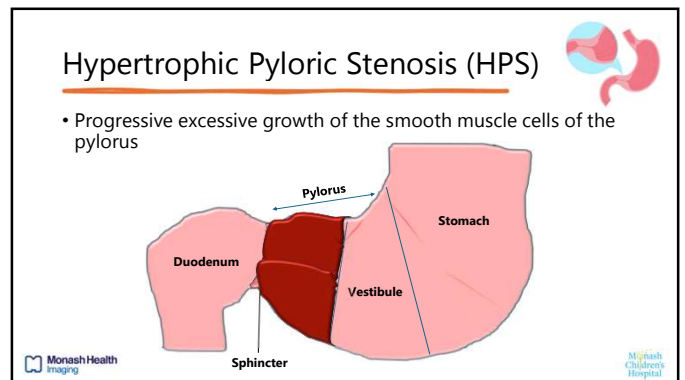
- Pylorus - what and where
- Ultrasound technique
- Evolving HPS
- Post-pyloromyotomy
- Hypertrophic pyloric stenosis (HPS) Background Presentation
- HPS criteria
- Cases

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Background

- Infants 2-12 weeks
- Males > Females (4:1)
- 2-5 per 1000 live births (Peters et. al. 2014; Hernanz-Schulman 2009)
- Poorly understood aetiology
 - 2-4 increased risk of developing HPS when bottle fed (Peters et. al. 2014)

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Clinical Presentation

- Projectile vomiting
 - Non-bilious vomit
 - After every feed
- Palpable mass "olive"
- Weight loss
- Dehydration


https://www.osmosis.org/learn/Pyloric_stenosis_Clinical_sciences

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US Technique

- Micro-convex array transducer (C4-9)
- High frequency linear transducer (L4-18 or L3-12)
- Give patient ~30ml sterile water
- Warm gel

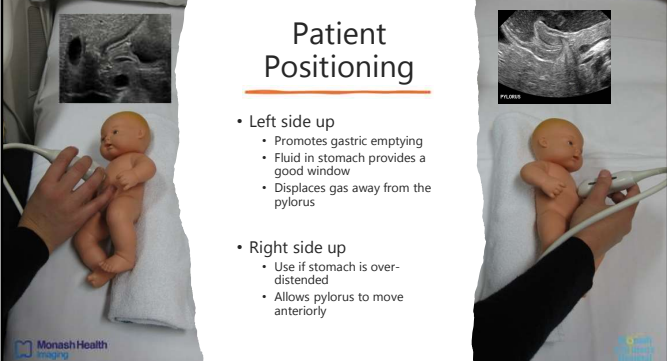


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Patient Positioning

- Left side up
 - Promotes gastric emptying
 - Fluid in stomach provides a good window
 - Displaces gas away from the pylorus
- Right side up
 - Use if stomach is over-distended
 - Allows pylorus to move anteriorly




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Ultrasound: Identifying the Pylorus

- Probe positioned transverse along the midline
- Gentle sustained compression
- Landmarks:
 - Gallbladder
 - Head of pancreas

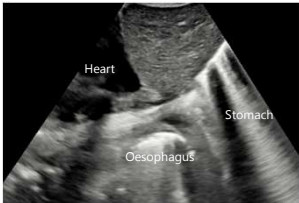


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Identifying the Pylorus – Pitfall

- Gastro-oesophageal junction




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Assessment of HPS

1. Muscle wall thickness
2. Length of closed canal
3. Transit of fluid through pylorus




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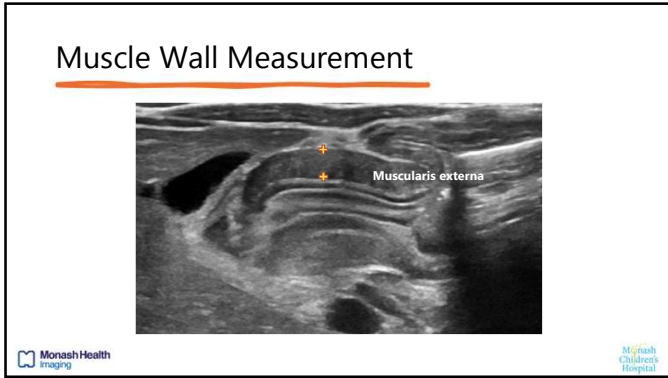
1. Muscle Wall Thickness

- Mid-longitudinal plane
 - Or transverse (ensure not oblique)
- Most reliable measurement across literature
- Hypochoic outer muscle wall

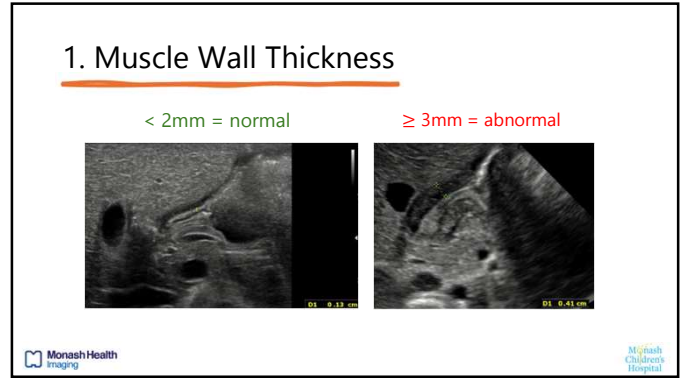


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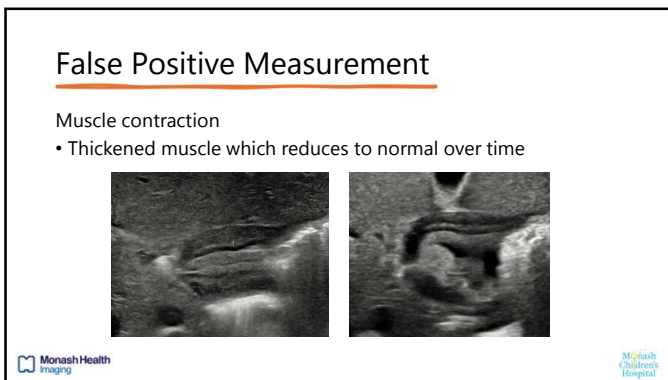
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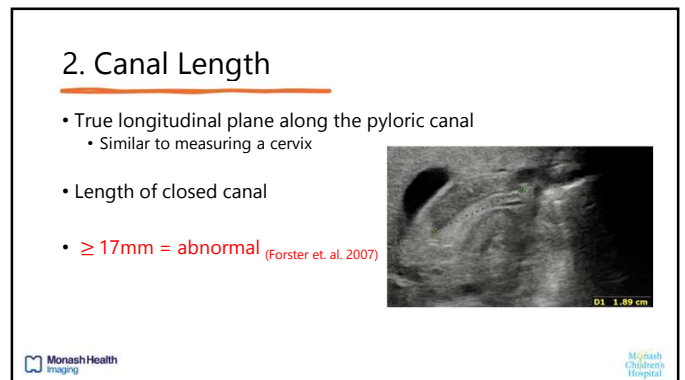
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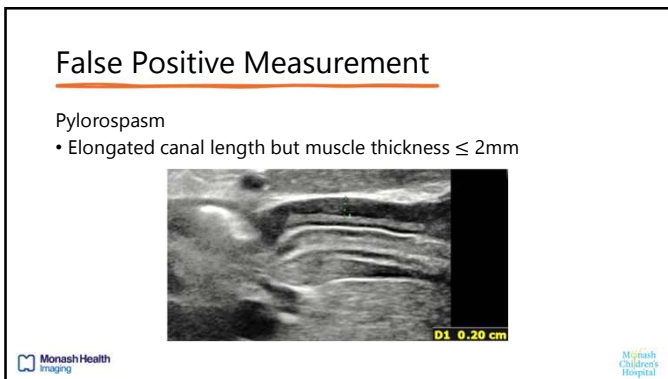
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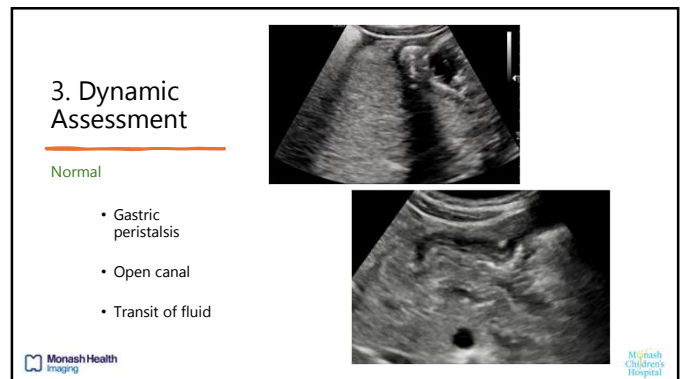
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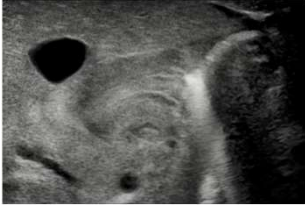


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3. Dynamic Assessment

Abnormal

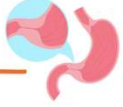
- Pyloric canal fails to open
- Very little or no transit of fluid



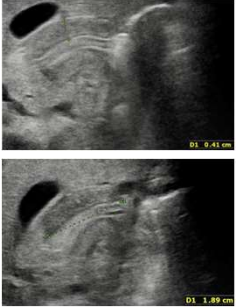
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HPS Criteria



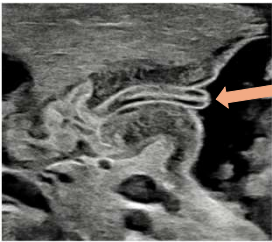
1. Muscle wall thickness $\geq 3\text{mm}$
 - Sensitivity 91%, Specificity 85%
2. Pyloric canal length $\geq 17\text{mm}$
 - Sensitivity 76%, Specificity 86% (Forster et. al. 2007)
3. No transit of fluid



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Other Sonographic Features of HPS



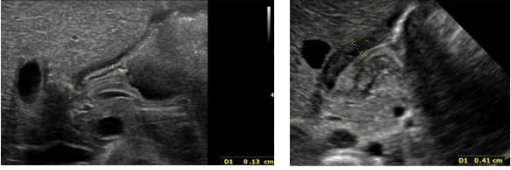
ANTRAL NIPPLE SIGN

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1. Muscle Wall Thickness

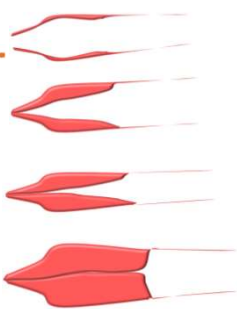
$< 2\text{mm} = \text{normal}$ $\geq 3\text{mm} = \text{abnormal}$



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Evolving HPS



Clearly normal

?


Borderline

Clearly abnormal

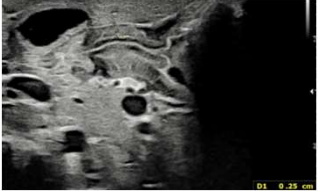
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Muscle Wall Thickness



★ Borderline = 2 – 3mm



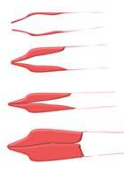
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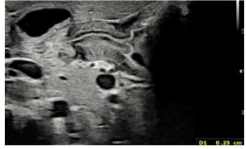
Borderline HPS

Borderline = 2 – 3mm

- 10-30% can become abnormal (Forster et. al. 2007; O'keefe et. al. 1991)



- Pyloric stenosis develops over time
 - Consider repeat study in a few days



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Case Study #1


HPS Criteria:

- Muscle wall thickness $\geq 3\text{mm}$
- Pyloric canal length $\geq 17\text{mm}$
- No transit of fluid

- 3-week old boy
- Presented to ED with vomiting after each feed

- 4.2mm muscle wall thickness
- 14.3mm canal length
- Minimal transit of fluid

- Borderline HPS



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Case Study #2

HPS Criteria:

- Muscle wall thickness $\geq 3\text{mm}$
- Pyloric canal length $\geq 17\text{mm}$
- No transit of fluid

- 17-day old girl
- Vomiting
- AXR – dilated stomach + collapsed small intestine

- US findings:
 - Muscle wall thickness: 2mm
 - Pyloric canal length: 14-17mm
 - Trickle flow seen



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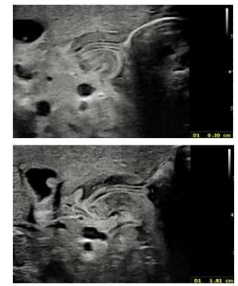
Case Study #2

HPS Criteria:

- Muscle wall thickness $\geq 3\text{mm}$
- Pyloric canal length $\geq 17\text{mm}$
- No transit of fluid

- Re-scanned 1 day later

- US findings:
 - Muscle wall thickness: 3.0mm
 - Pyloric canal length: 18mm
 - No transit of fluid seen throughout the 20min scan
 - Antral nipple sign



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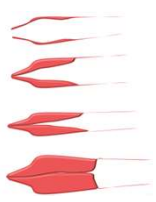
Equivocal Cases

HPS Criteria:

- Muscle wall thickness $\geq 3\text{mm}$
- Pyloric canal length $\geq 17\text{mm}$
- No transit of fluid

- Equivocal can evolve into HPS
- If we don't have completely normal results
 - Muscle wall thickness $< 2\text{mm}$
 - Canal length $< 17\text{mm}$
 - Good transit of fluid

Repeat scan



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2021 Audit

HPS Criteria:

- Muscle wall thickness $\geq 3\text{mm}$
- Pyloric canal length $\geq 17\text{mm}$
- No transit of fluid

- 10yr audit period
- Equivocal
 - Diagnostic criteria not met vs. technique
- 713 examinations
 - Positive for HPS: 149 (20%)
 - Negative for HPS: 523 (73%)
 - Equivocal: 41 (6%)**

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2021 Audit

HPS Criteria:

- Muscle wall thickness $\geq 3\text{mm}$
- Pyloric canal length $\geq 17\text{mm}$
- No transit of fluid

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(51%)


Equivocal HPS Criteria

Length $< 17\text{mm}$ or wall $< 3\text{mm}$
Trickle flow through pylorus

20
(49%)

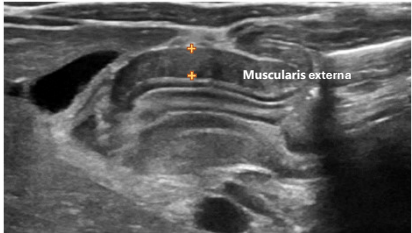
Technique

Measurement technique (3)
Technical difficulty (15)
Gastro oesophageal junction (2)




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Muscle Wall Measurement

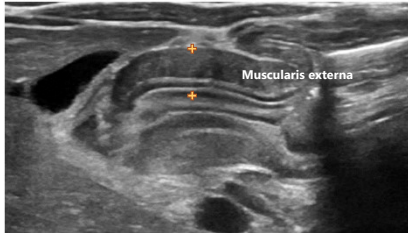


Muscularis externa




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Muscle Wall Measurement

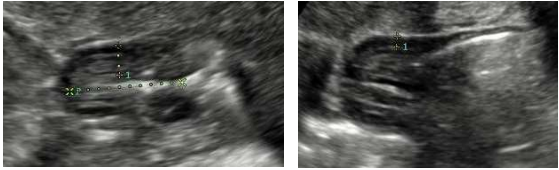



Muscularis externa



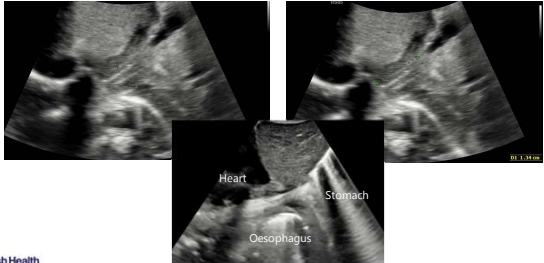
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Learning Case #1





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Learning Case #2





Heart
Stomach
Oesophagus



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Treatment

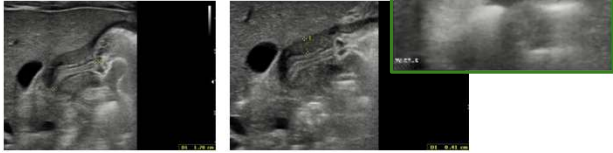
- Ramstedt pyloromyotomy (1912)
- Longitudinal splitting of the smooth muscle layer
- Open surgery or via laparoscope depending on the surgeon

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Post-Pyloromyotomy Scan

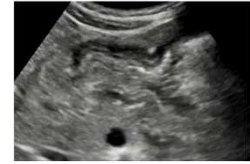
- Not worried about muscle thickness
- Is there good transit through?



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Take Home Messages

- Muscle wall thickness is the most reliable measurement
- Assess for good transit through the pylorus
- Be aware of developing HPS
 - Repeat study



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Thank you!

- Special thanks to:
- Keith VanHaltren
 - Monash Health Sonographers

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