international bowel ULTRASOUND GROUP

KUWAIT GASTROENTEROLOGY ASSOCIATION
رابطة الجهاز الهضمي والكبد الكويتية

Guide to setting up the machine

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Intended Learning Outcomes

By the end of this session, the learner will be able to:

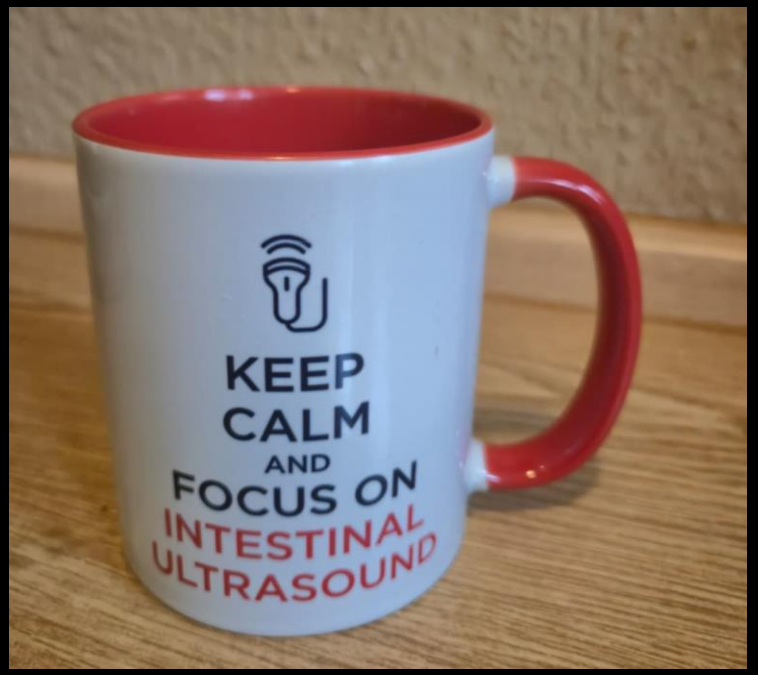
1. Recall the piezoelectric principle and its role in ultrasound transduction, including the generation and reception of sound waves in medical imaging applications.
2. Describe the relationship between ultrasound frequency and its impact on resolution and depth of penetration in imaging various anatomical structures.
3. Describe and define key ultrasound principles, including:
    - Frequency
    - Depth
    - Gain
    - Resolution
    - Doppler
4. Classify the advanced principles of Doppler imaging and differentiate between their use in intestinal ultrasound (IUS).
5. Understand the concept of amplitude and acoustic tissue properties (e.g., impedance, absorption, reflection, elasticity) in ultrasound imaging and explain their significance in interpreting tissue characteristics, density variations, and artefacts.
6. Identify common ultrasound artifacts and their potential impact on image interpretation.
7. Explain how patient body habitus, bowel gas, and operator experience can affect IUS image quality.
8. Explain how to use ultrasound machine controls proficiently to optimize image quality during IUS examinations.
9. Describe the scenarios where IUS might be less reliable and require complementary imaging.
10. Discuss the impact of IUS limitations on its clinical utility compared to other imaging modalities in the IBD diagnostic pathway.

Disclosure

No specific disclosures

Intestinal ultrasound… is the machine different?

The same ultrasound equipment available in the radiology department



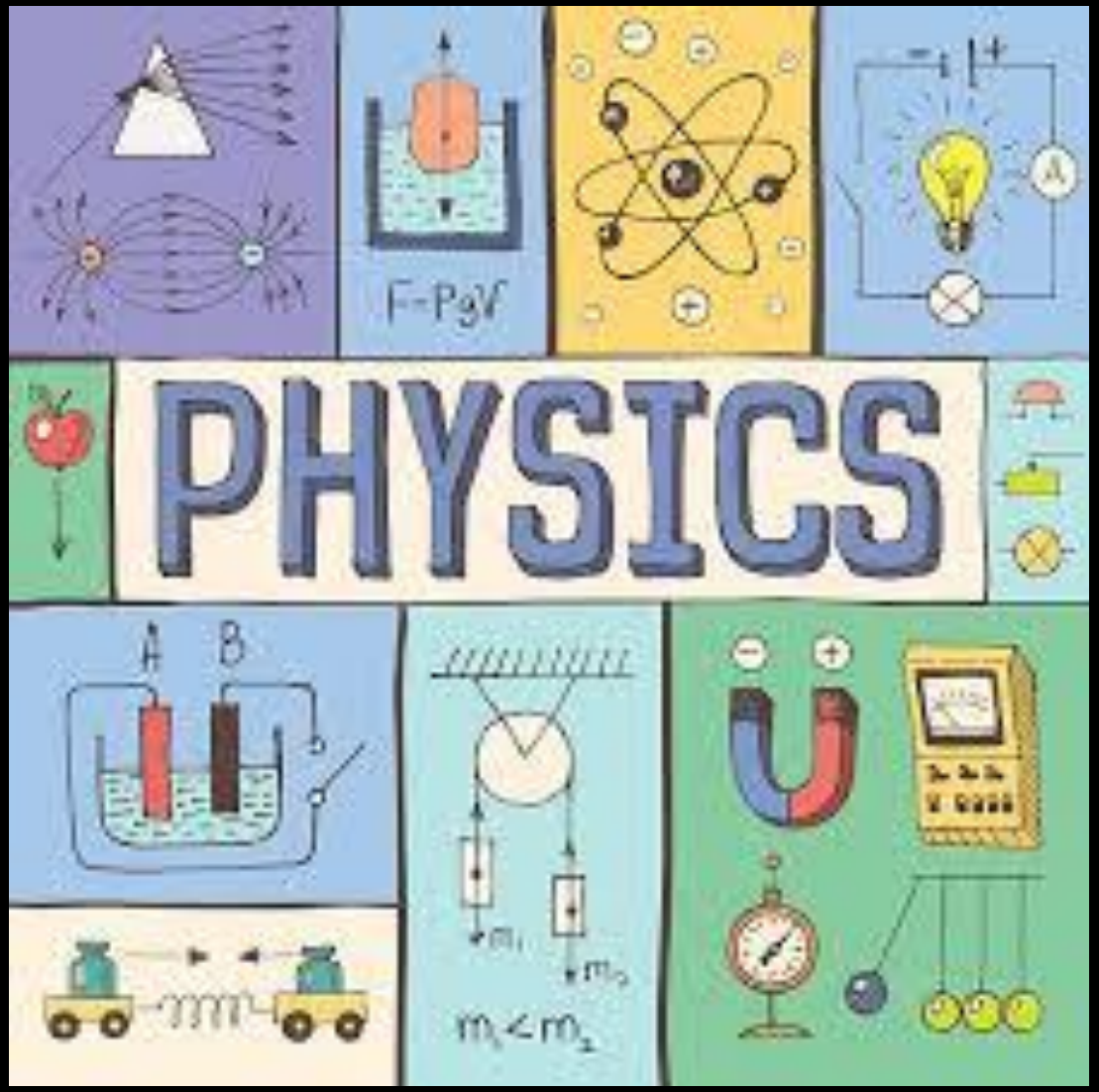
Machine quality

Machine Quality

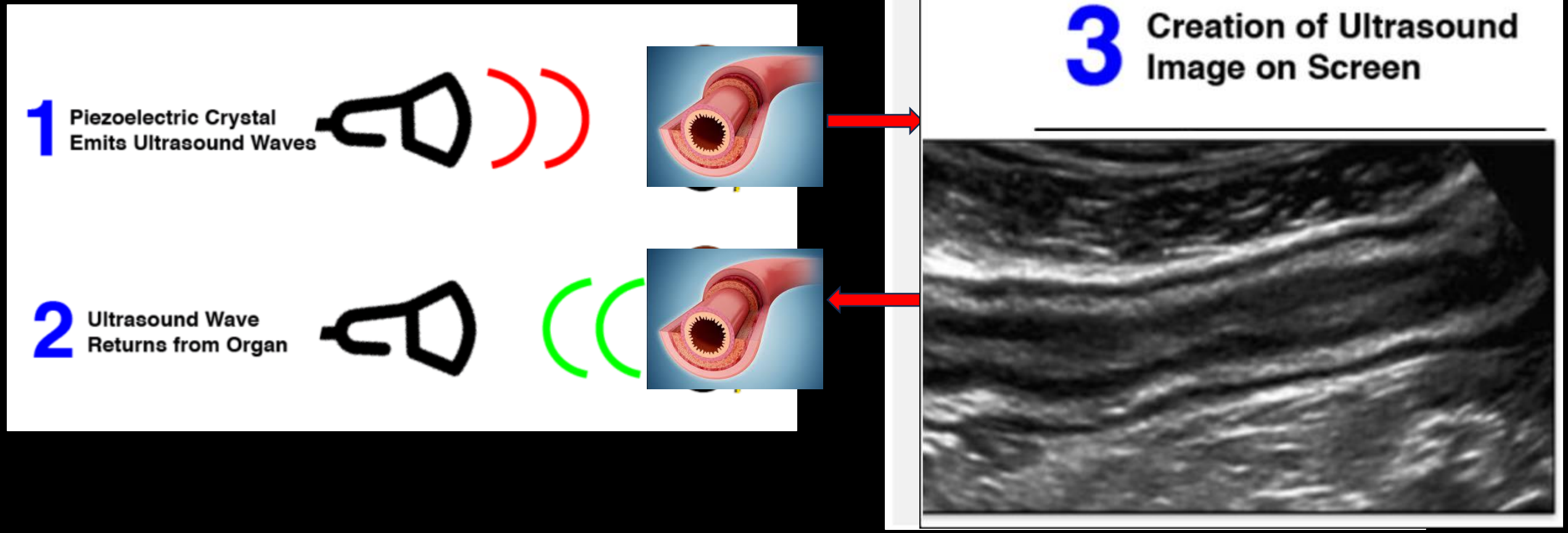
- High end to mid-range machine (not point of care)

- Machine settings optimized for intestinal ultrasound
- Grey scale and Tissue harmonics are set for intestinal scanning

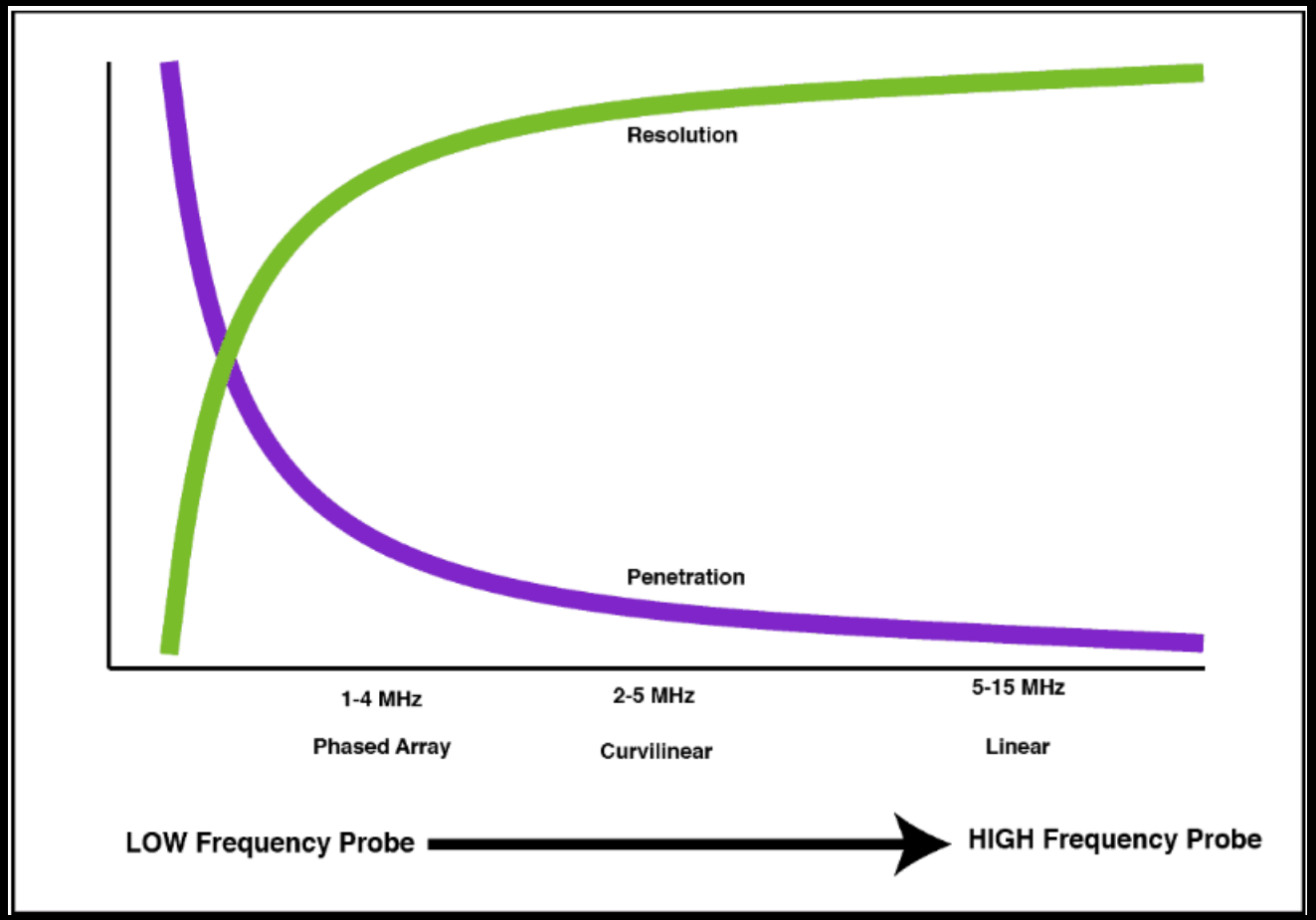
Know your machine representative


F=PgV
PHYSICS
A
B
$m_1 < m_2$

Piezo-electric effect of ultrasound



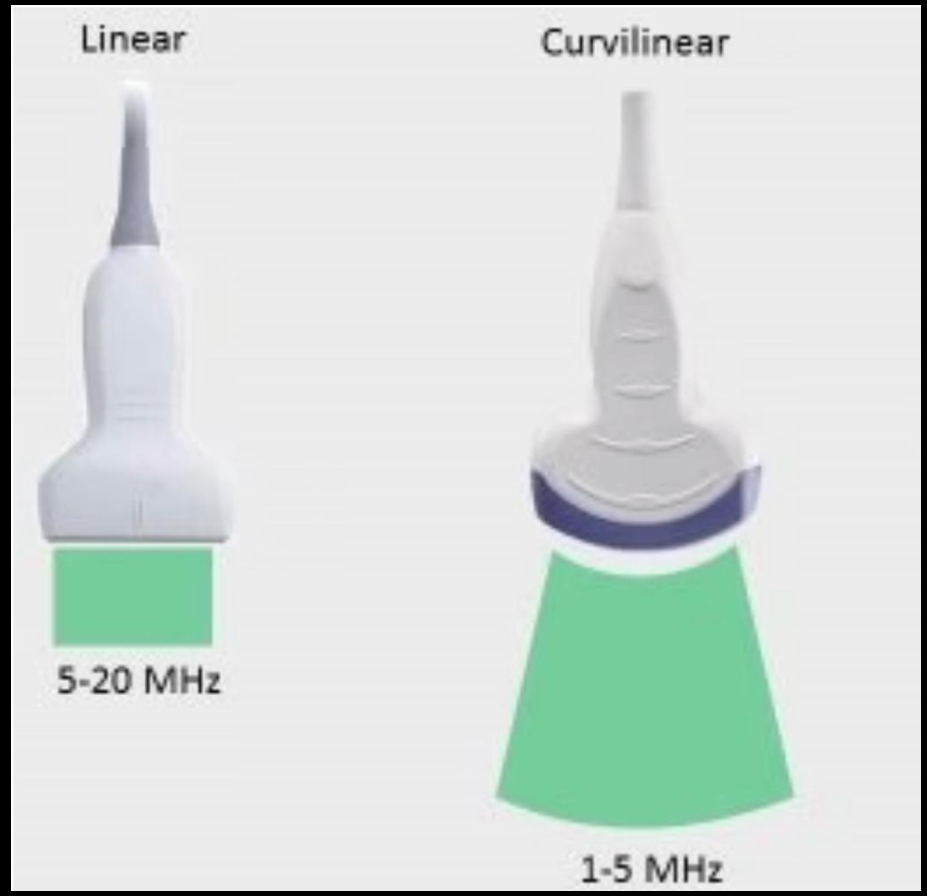
Frequency: Resolution and penetration



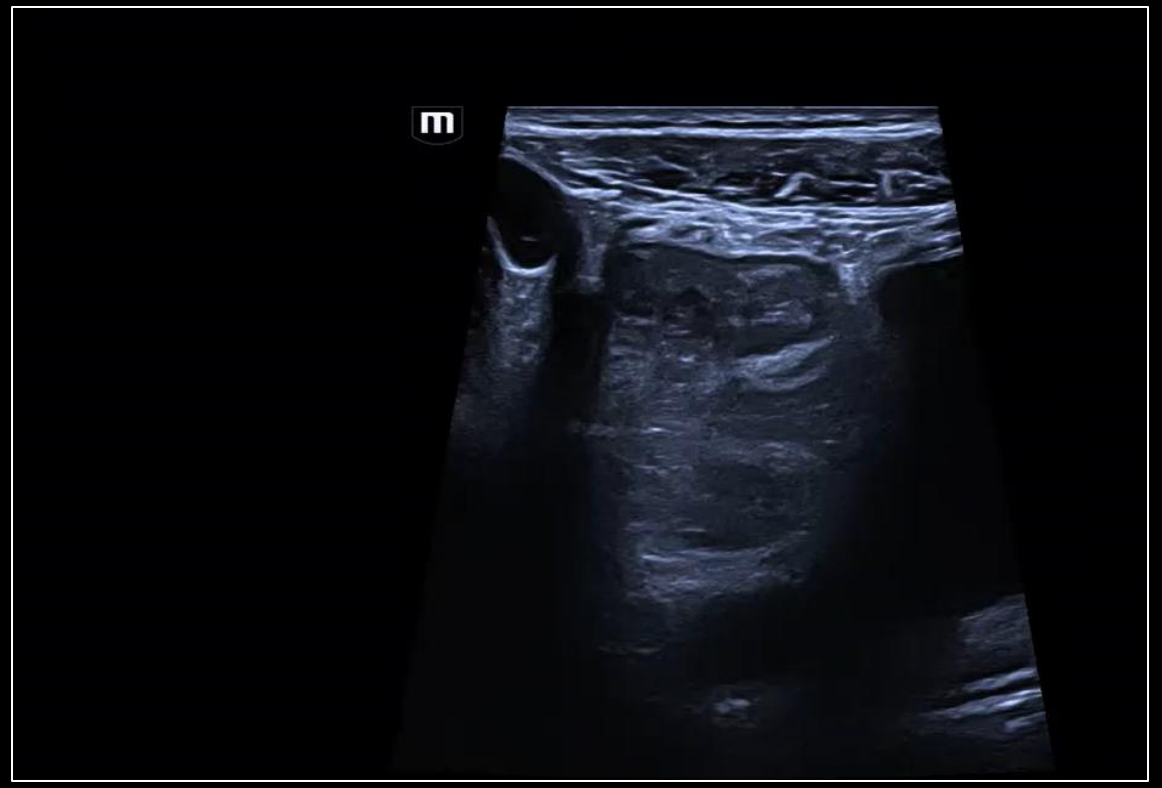
Machine requirements - Probes

- **Curved array 3-5 mHz**
  - Low frequency = Deeper penetration but low resolution
  - General overview, detection and extension of pathology

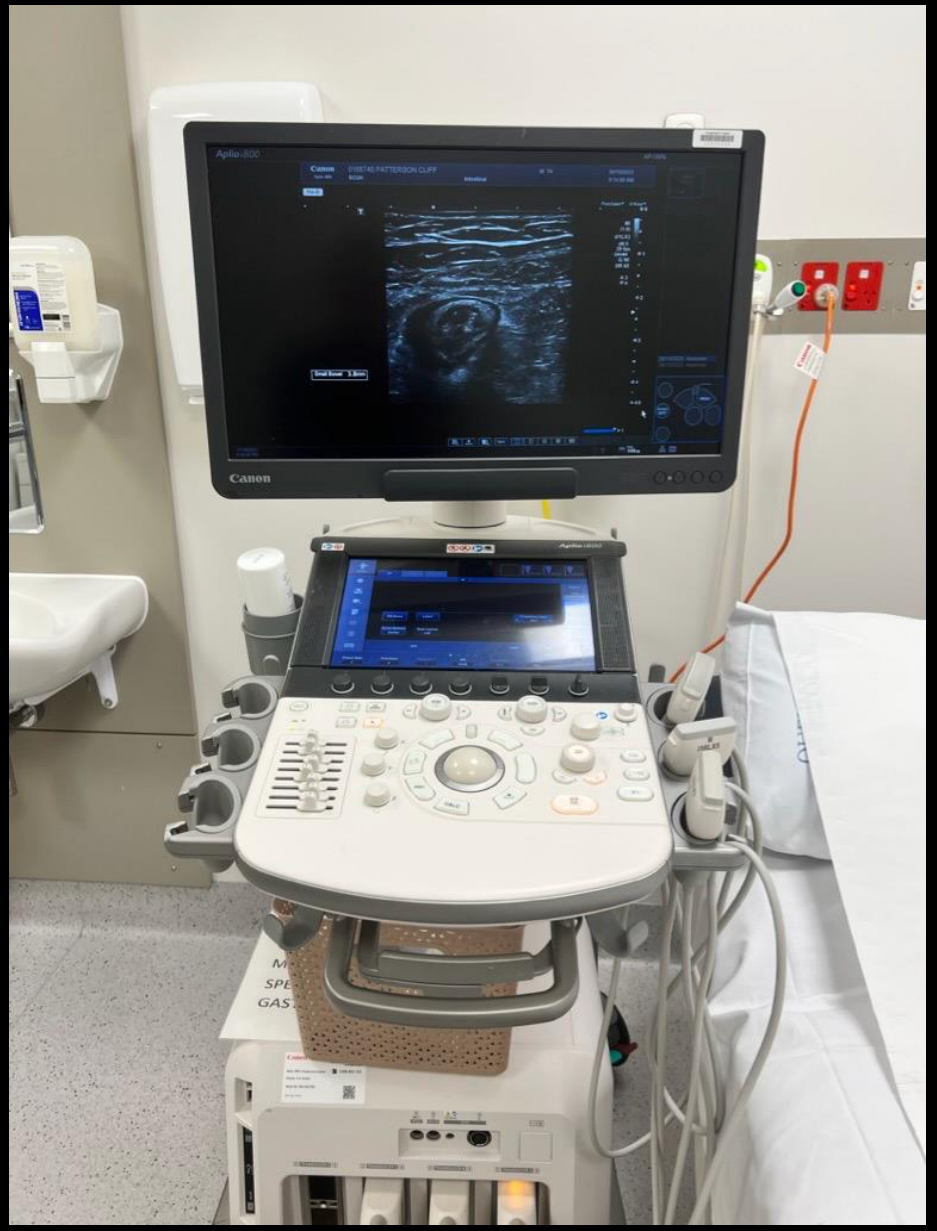
- **Linear array 5-12mHz**
  - High frequency = Shallow penetration but higher resolution
  - Measurement of BWT, stratification of wall layers



Low frequency probe



High frequency probe


Aplio i800
Canon
Canon

Environment Requirements

- **Room lighting**
  - Dim where possible
- **Machine position**
  - Left of patient. **Right hand** for scanning, **Left hand** for machine
- **Patient position**
  - Supine, relaxed, legs uncrossed, supported knees
- **Your position**
  - Neutral shoulders
  - Sitting or standing
  - Adjust bed height accordingly
- **Gel warmer**
- **Machine and hand hygiene**

Understanding the test

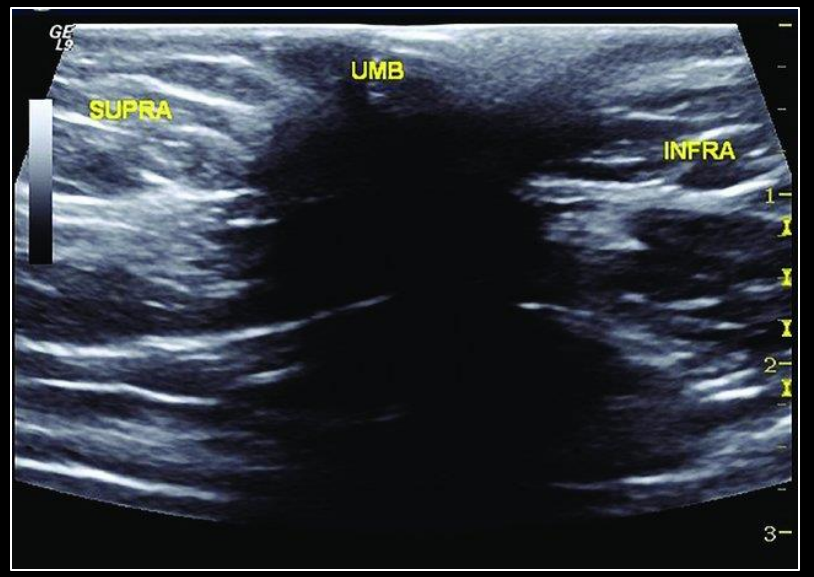
- **Doctor**
  - Indication
  - Patient disease phenotype, current therapies, past surgeries

- **Patient**
  - Transabdominal, non-invasive
  - Intestinal scan only
  - Verbal Consent
  - Preparation – No fasting.
  - Full bladder useful for rectal views, may hinder TI views.

Image optimisation

- **Ensure adequate gel and probe pressure on abdominal wall**

- Gel is a coupling medium that allows the transmission of the acoustic waves and eliminates interference from the air

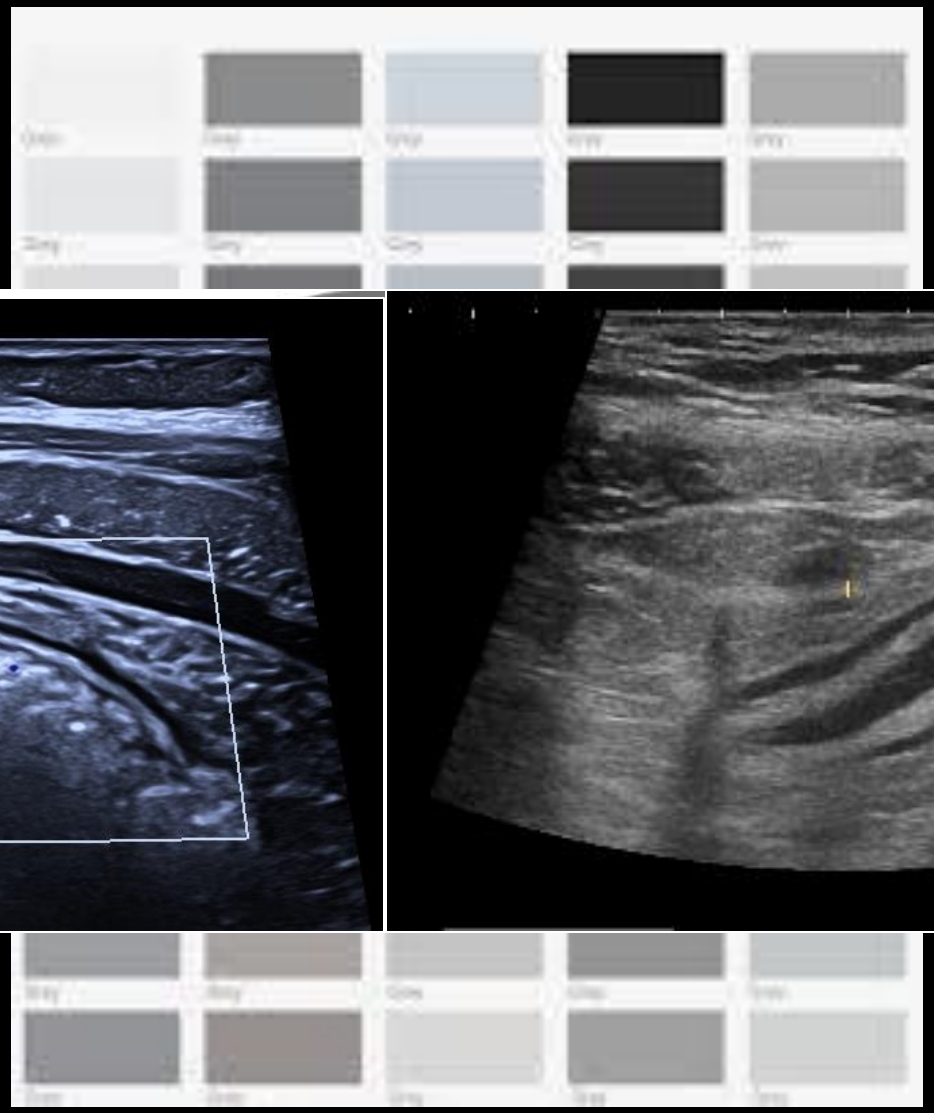


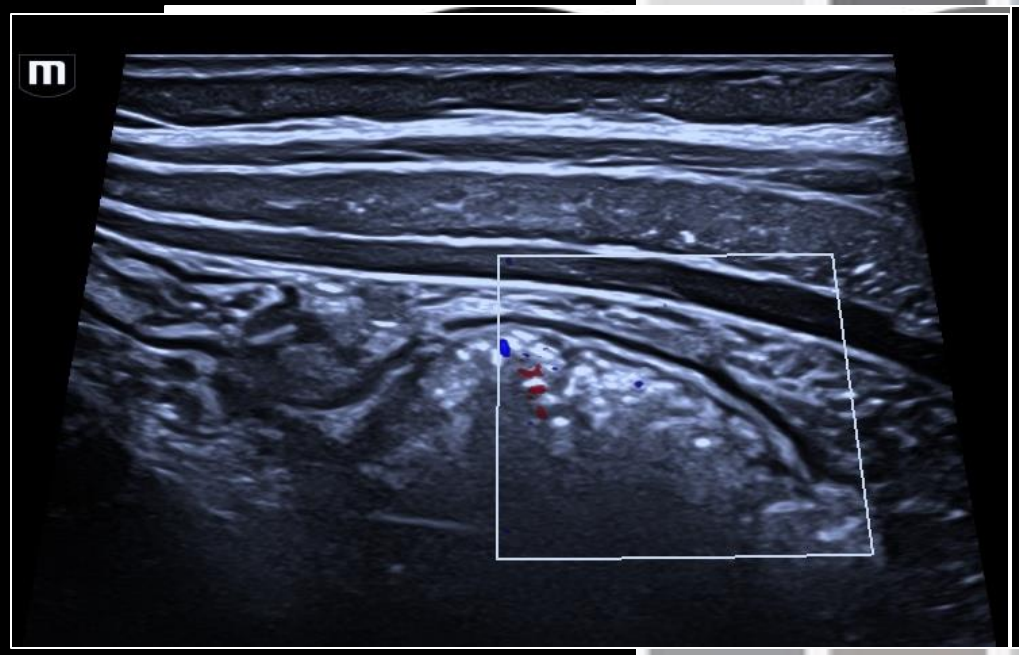
Knobology… No rocket science!

Modes on USG

- A mode
- M Mode
- **B mode**
- **Colour doppler**
- Power doppler
- Duplex imaging

B-mode





Doppler mode

Presence, direction and speed of flow in a vessel

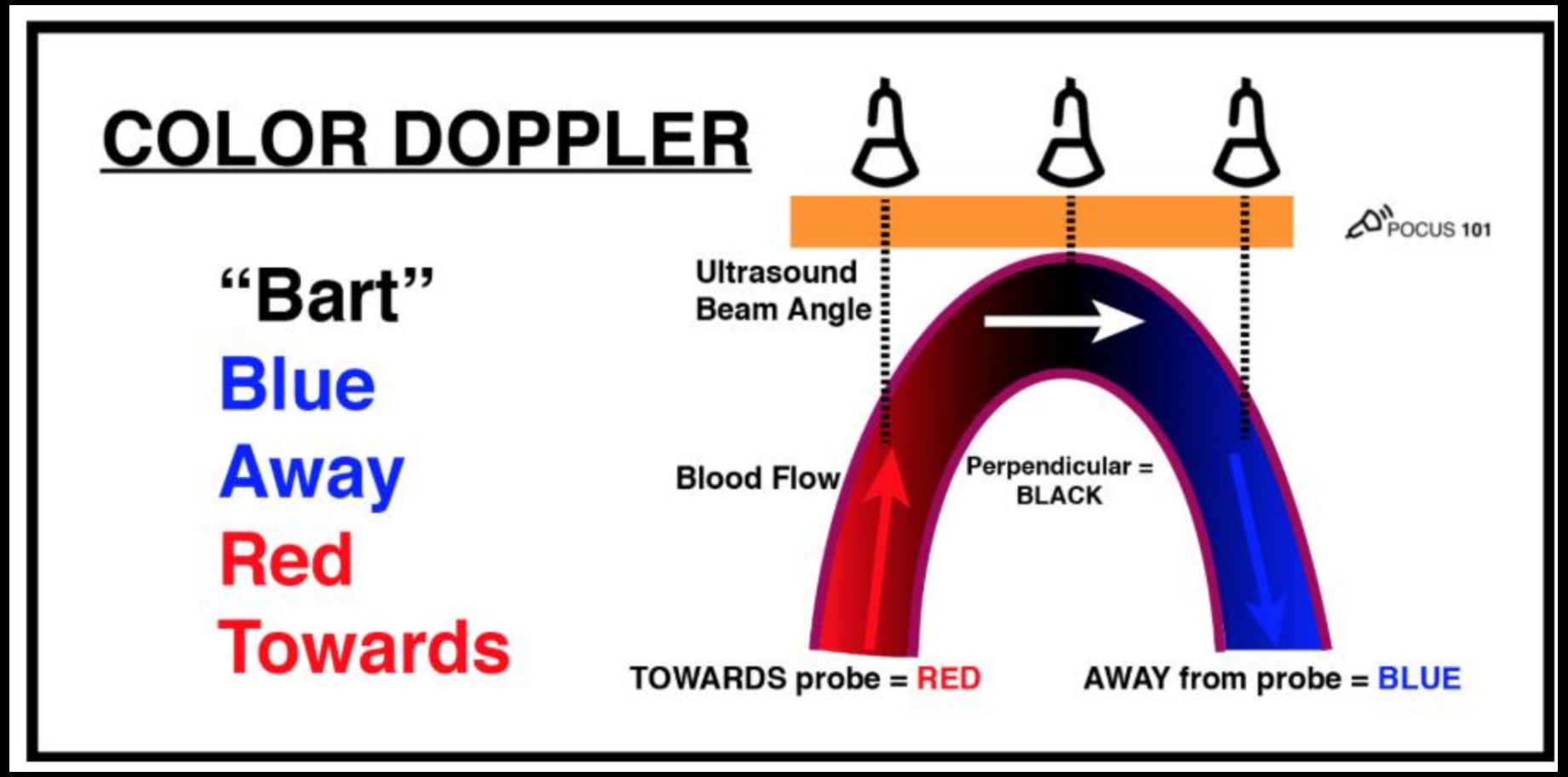


Image optimisation – B Mode

So many buttons! Need to know:

1. Depth dial
2. Gain dial
3. Focus wheel (if not automatic)
4. Freeze image
5. Trackball
6. Store button for still image
7. Store button for cine loops
8. Calipers, image labelling/keyboard

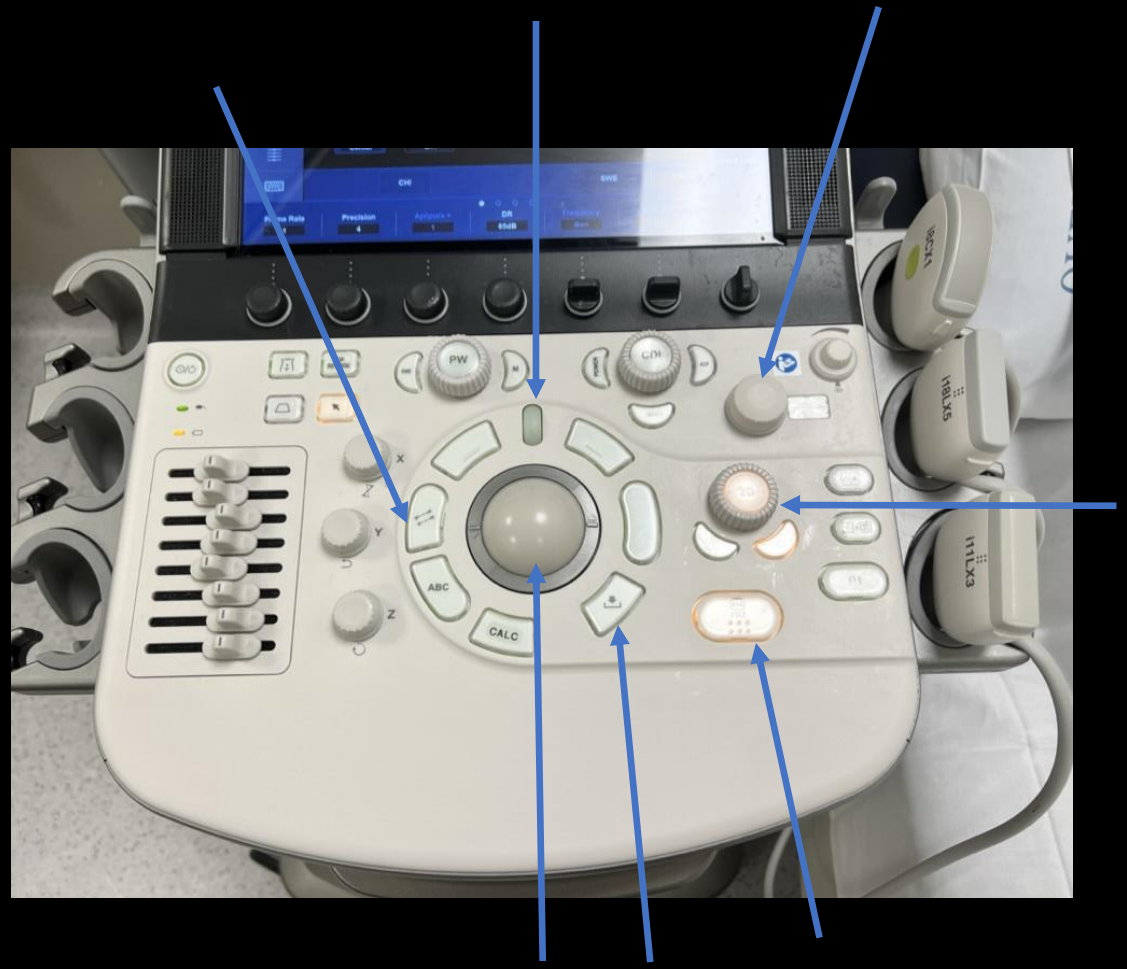
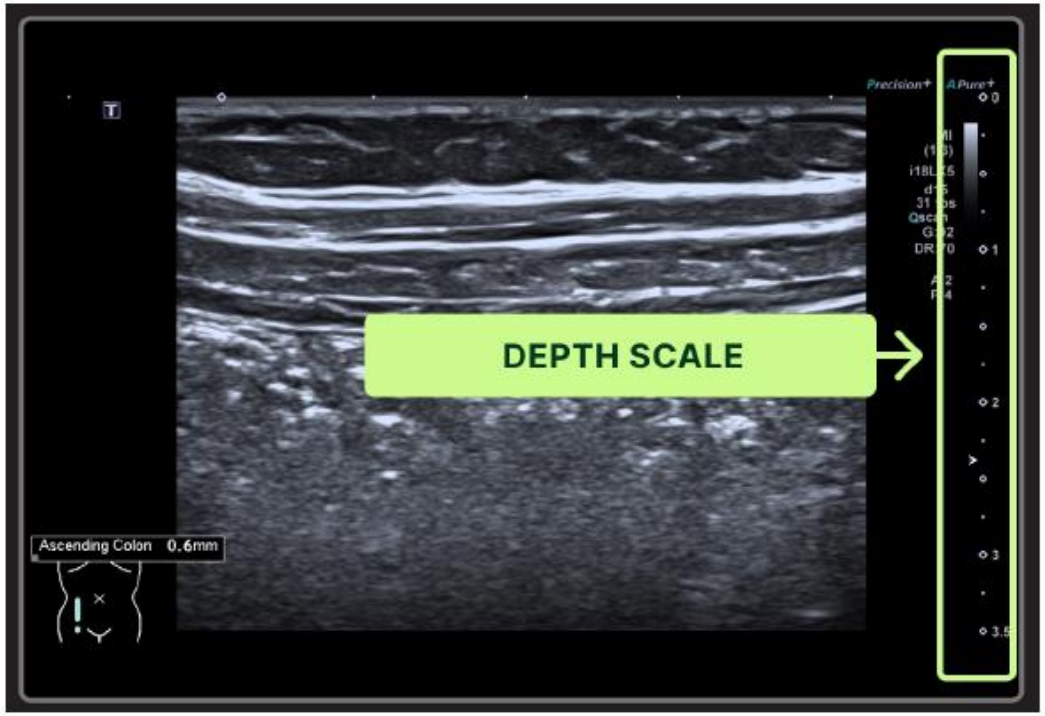
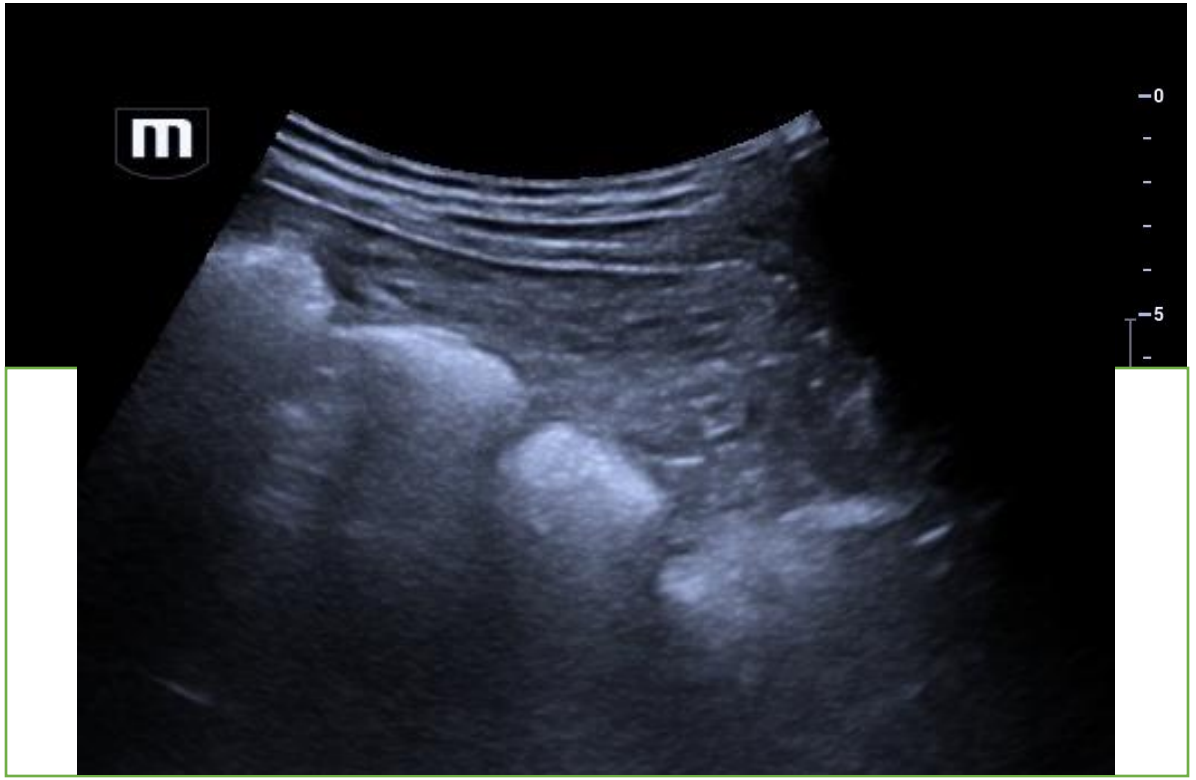
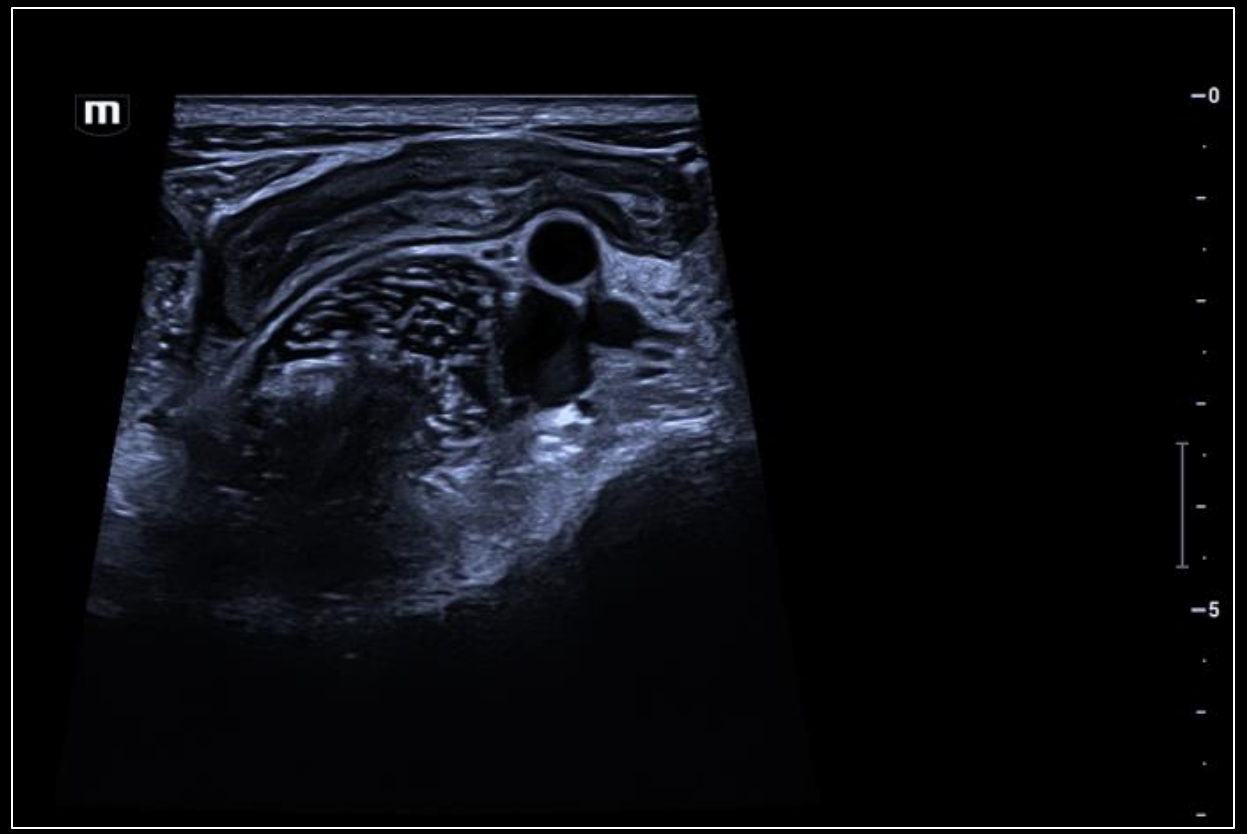


Image optimisation: Depth






m
0
5

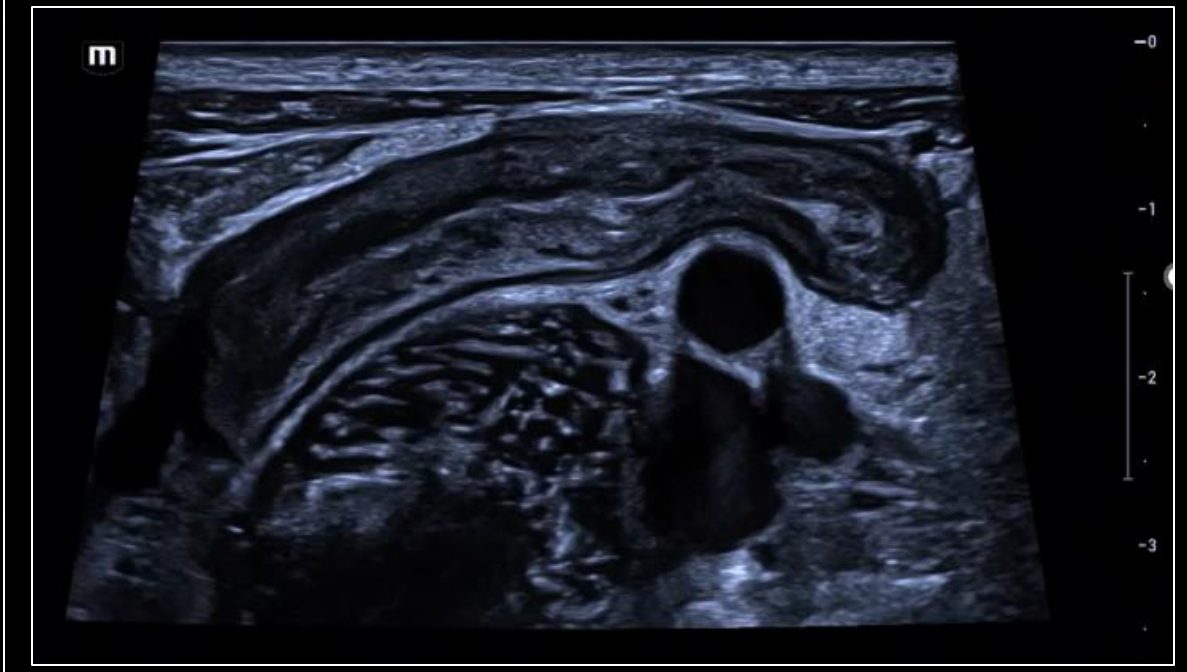
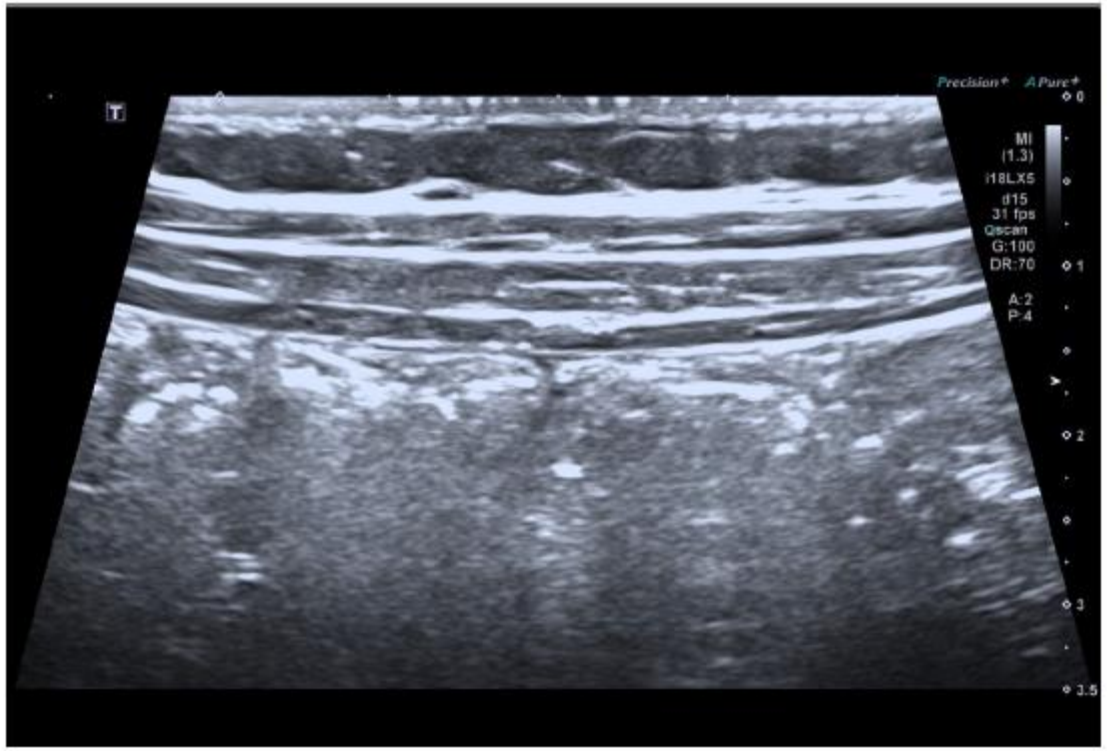
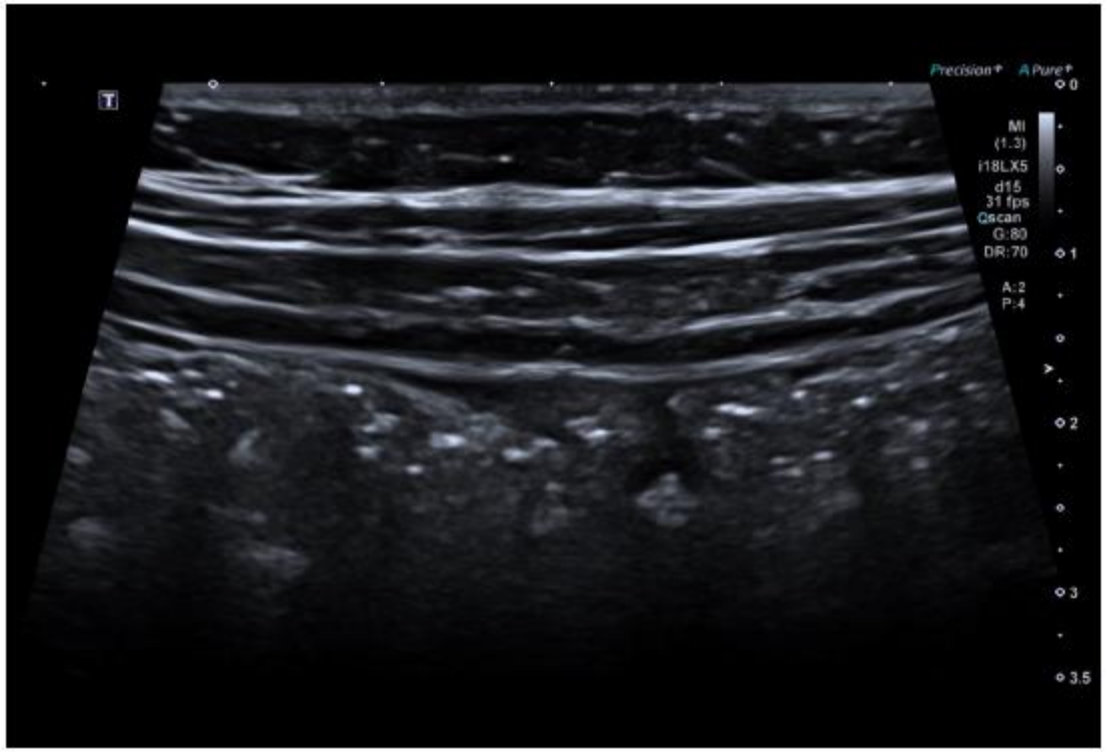

m
0
1
2
3

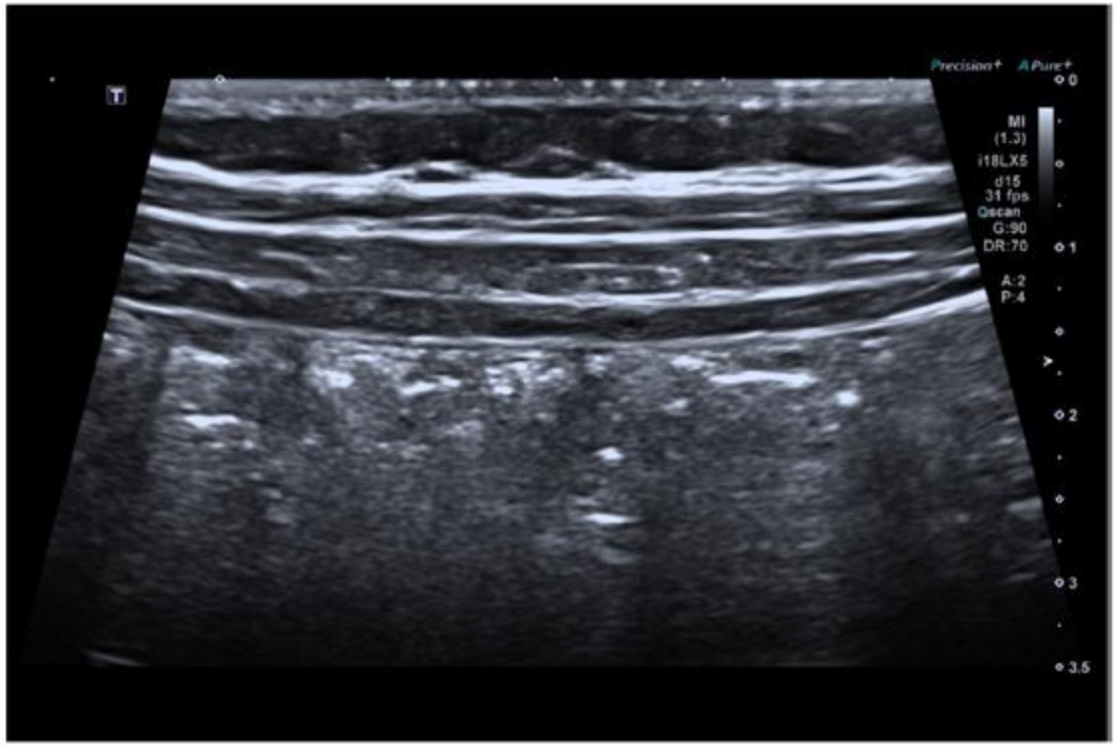
Image optimisation - Gain



Too high

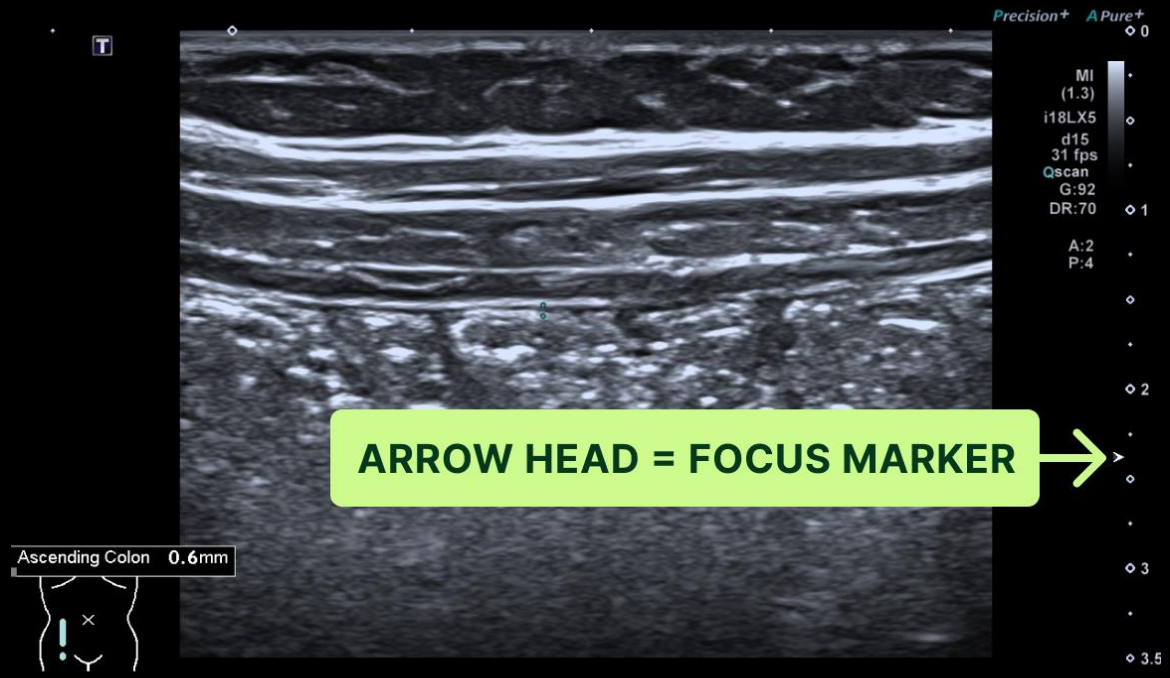


Too low


Precision+
AIPure+
MI
(1.3)
i18LX5
d15
31 fps
Qscan
G:90
DR:70
A:2
P:4
0
1
2
3
3.5

Just right

Image optimisation – Focus



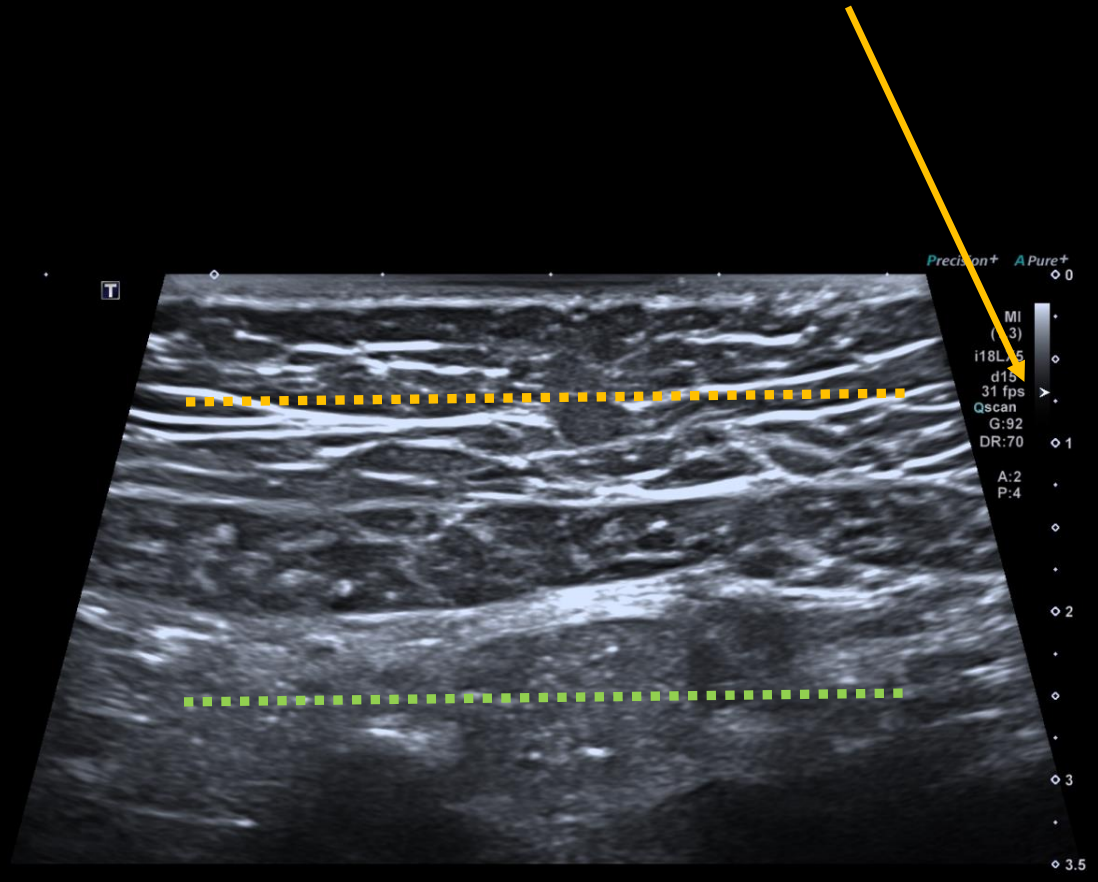
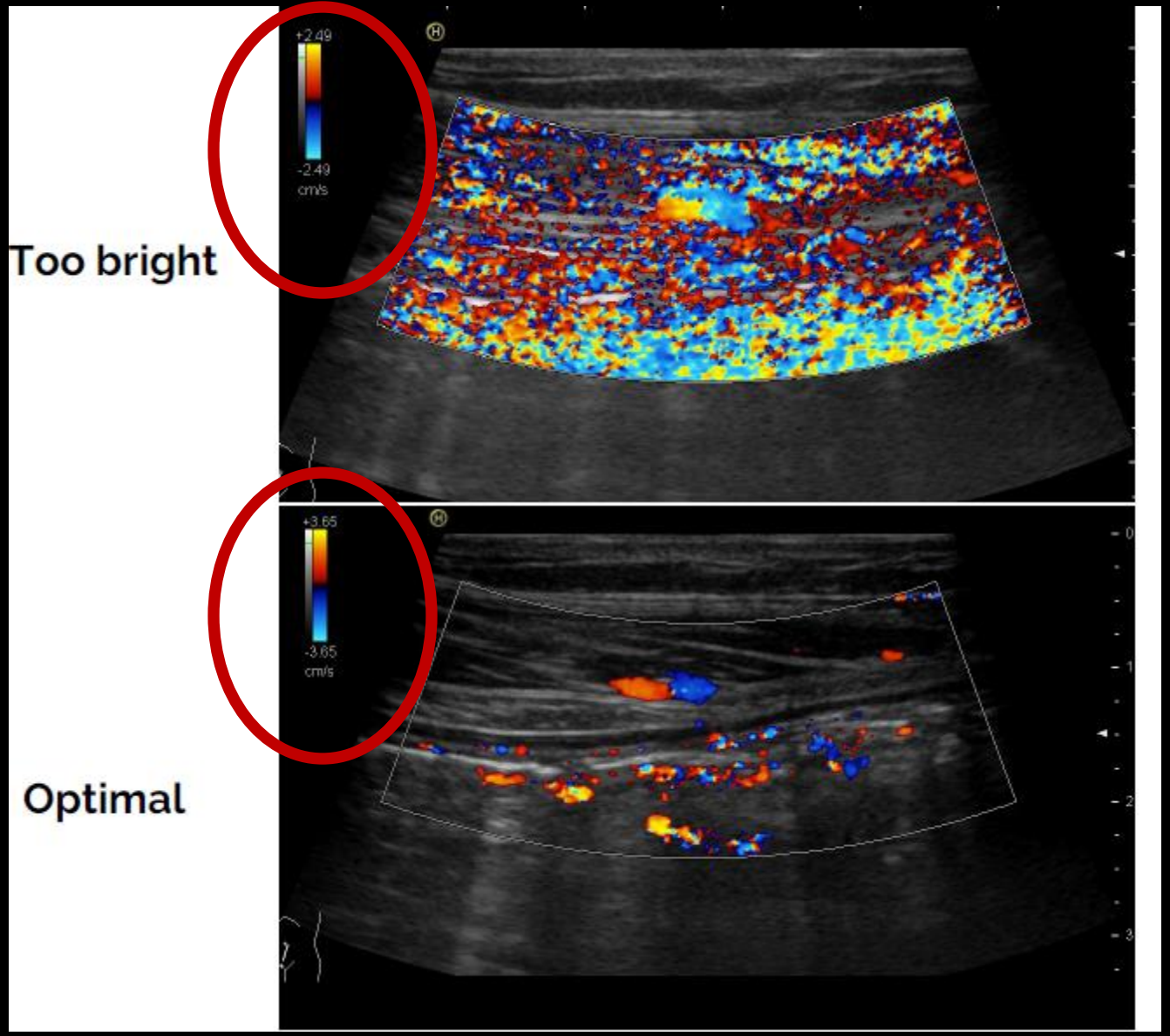
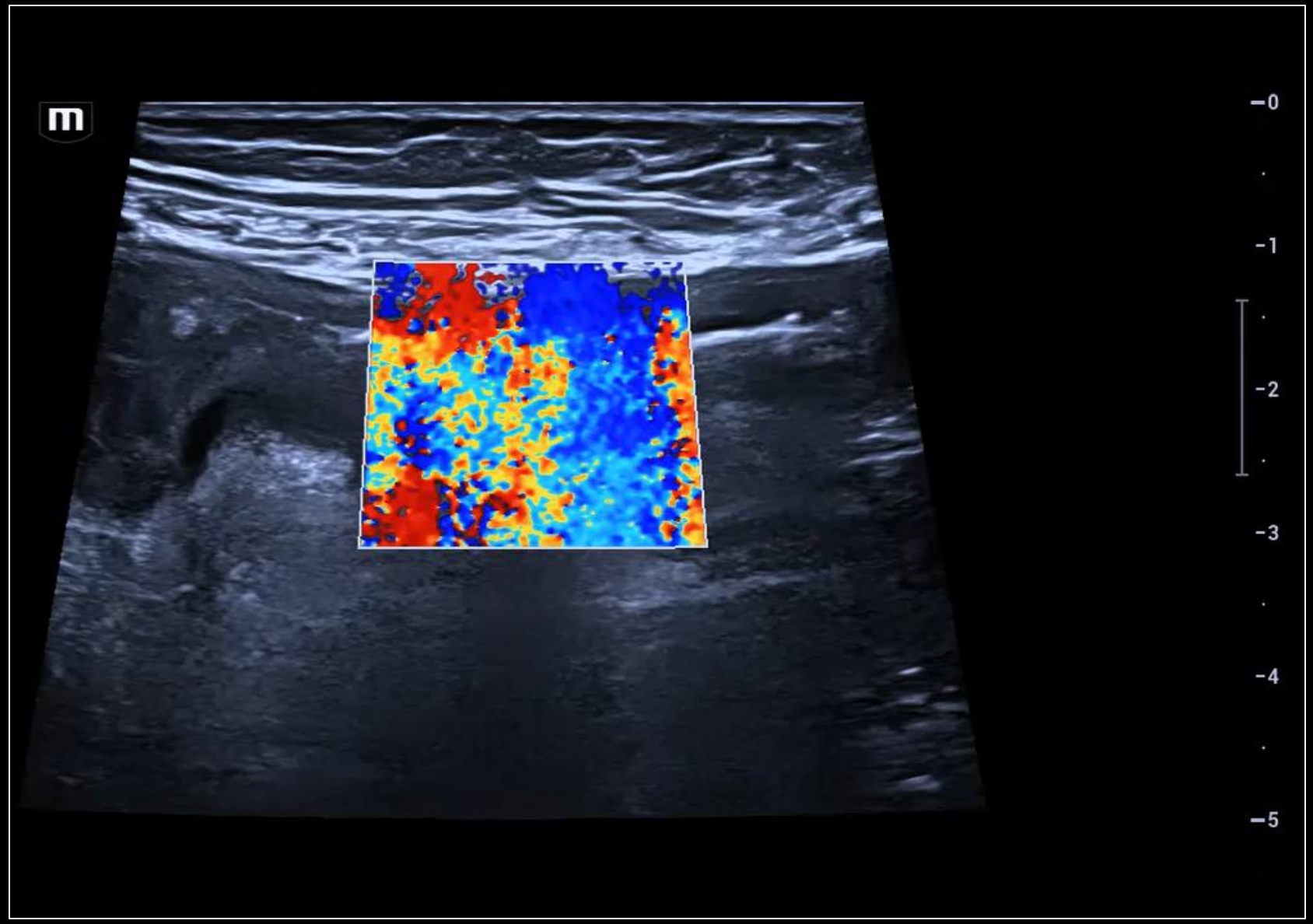


Image optimisation – Colour Doppler

- Optimize the colour Doppler for bowel wall interrogation
- **2-7cm/s optimal**
- **Reduce velocity to the lowest point where a signal is detected but noise is eliminated**
- Optimise the gain (brightness)


Too bright
+2.49
-2.49
cm/s
Optimal
+3.65
-3.65
cm/s


0
1
2
3
4
5

Freeze

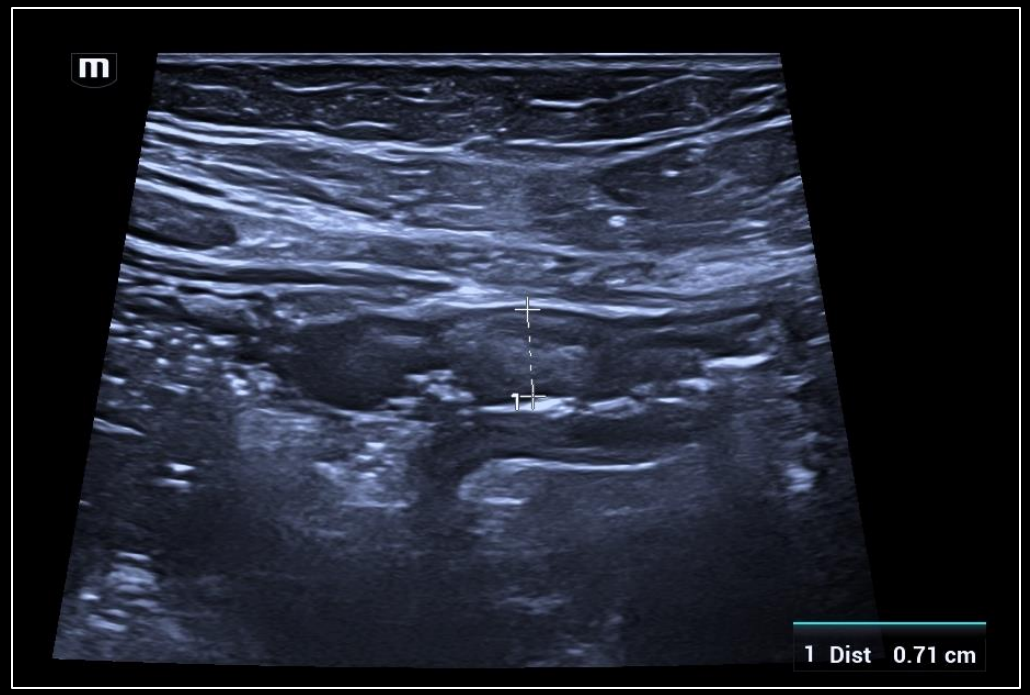
Freeze image on screen

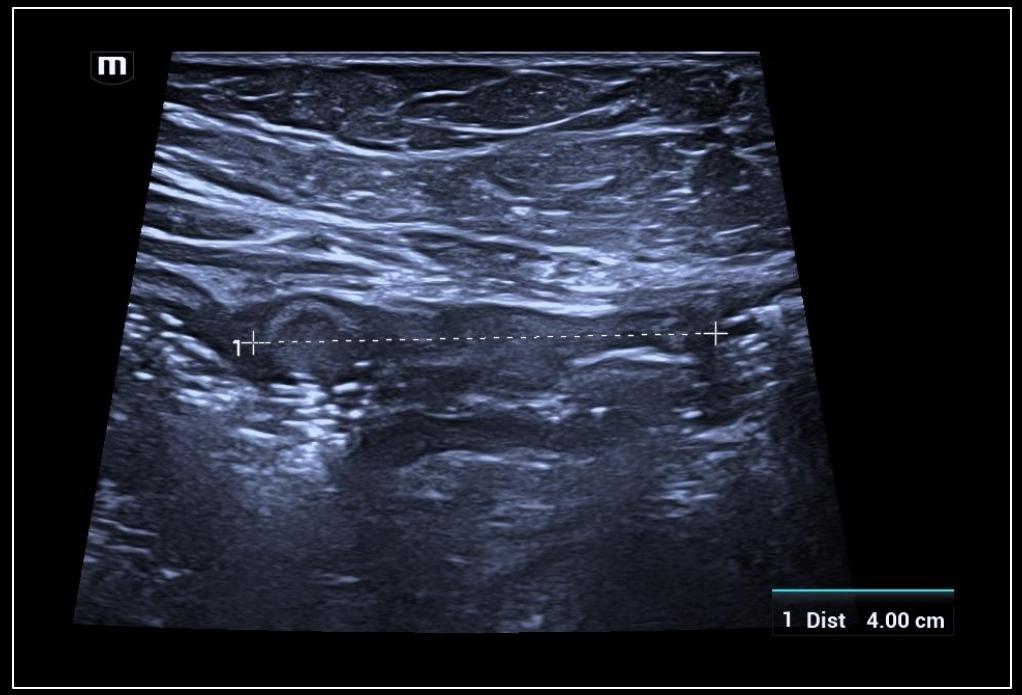
Use trackball to find best

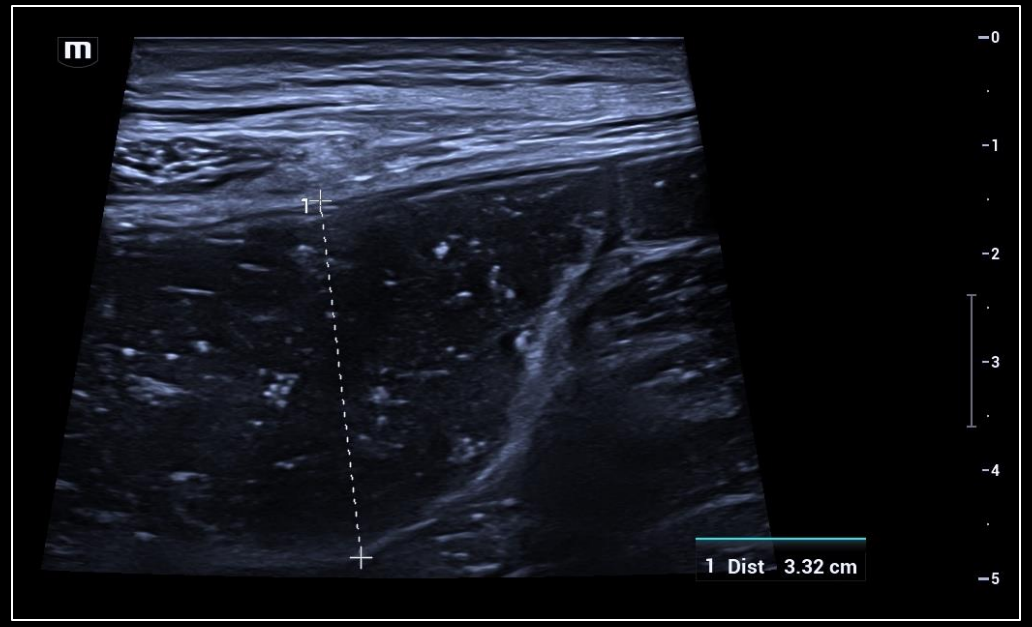
Understand cine loop storage settings

Image interrogation – Calipers

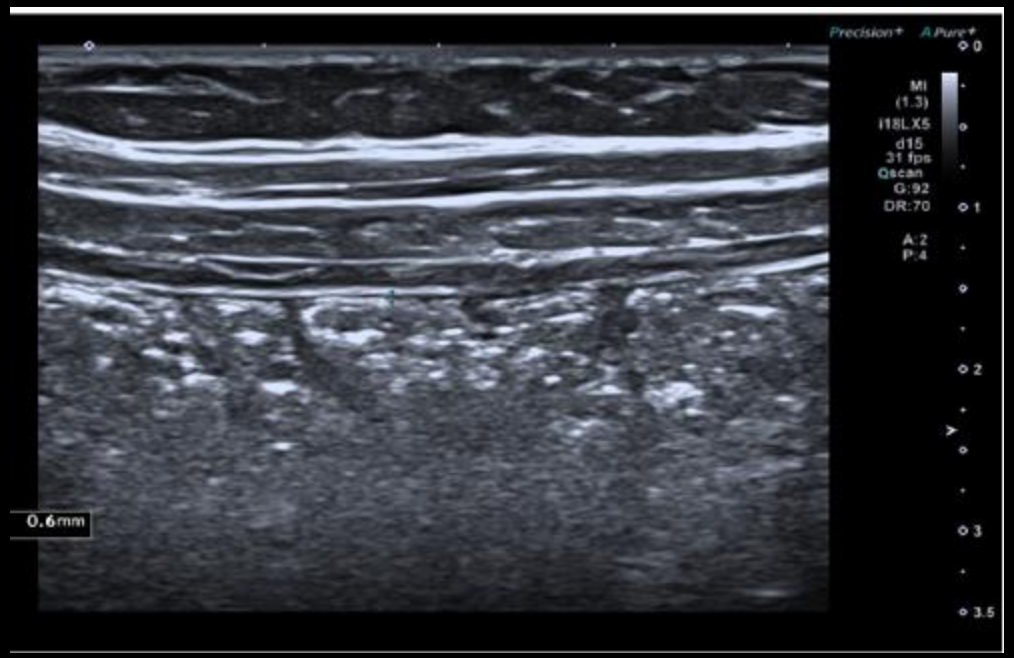
- Bowel wall thickness
- Length of stricture
- Luminal diameter

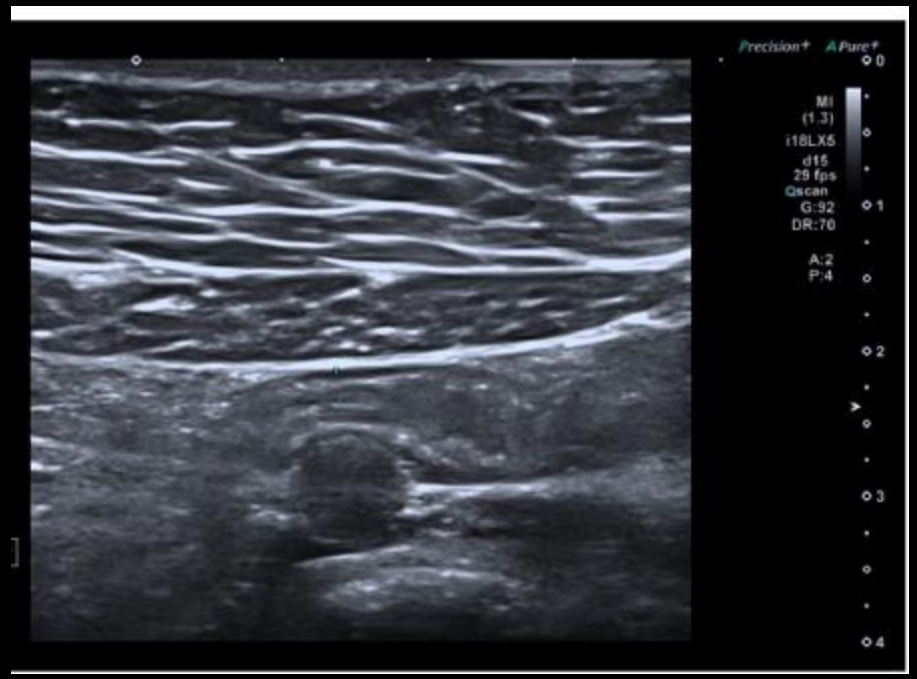

1
1 Dist 0.71 cm


1
1 Dist 4.00 cm


1
1 Dist 3.32 cm
0
1
2
3
4
5

Optimal images





Depth
Gain
Focus ✓

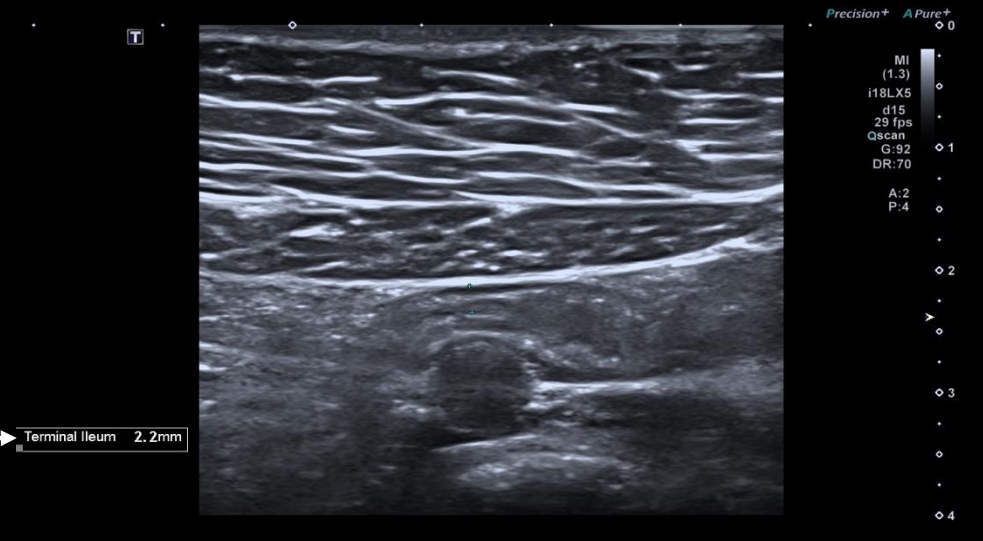
Anything Missing ?

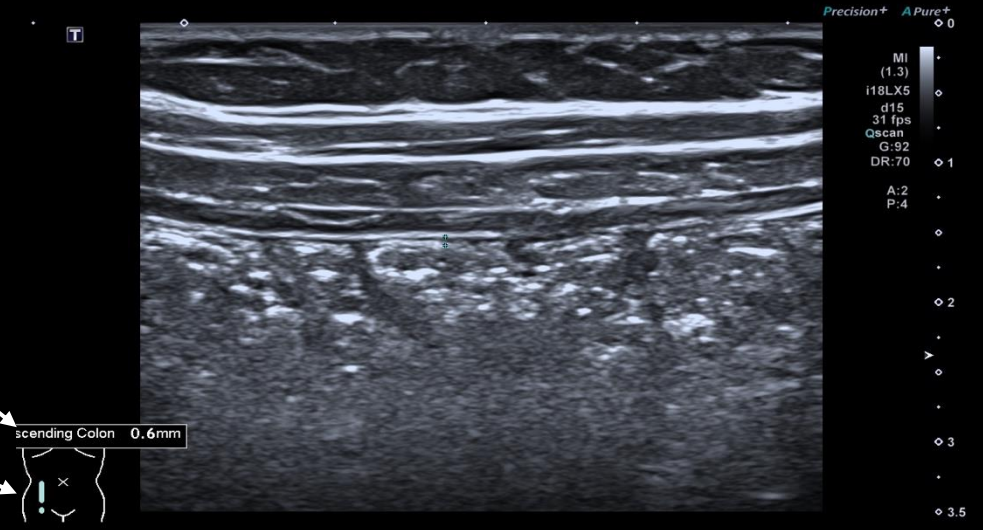
Image labelling

Segment labelling

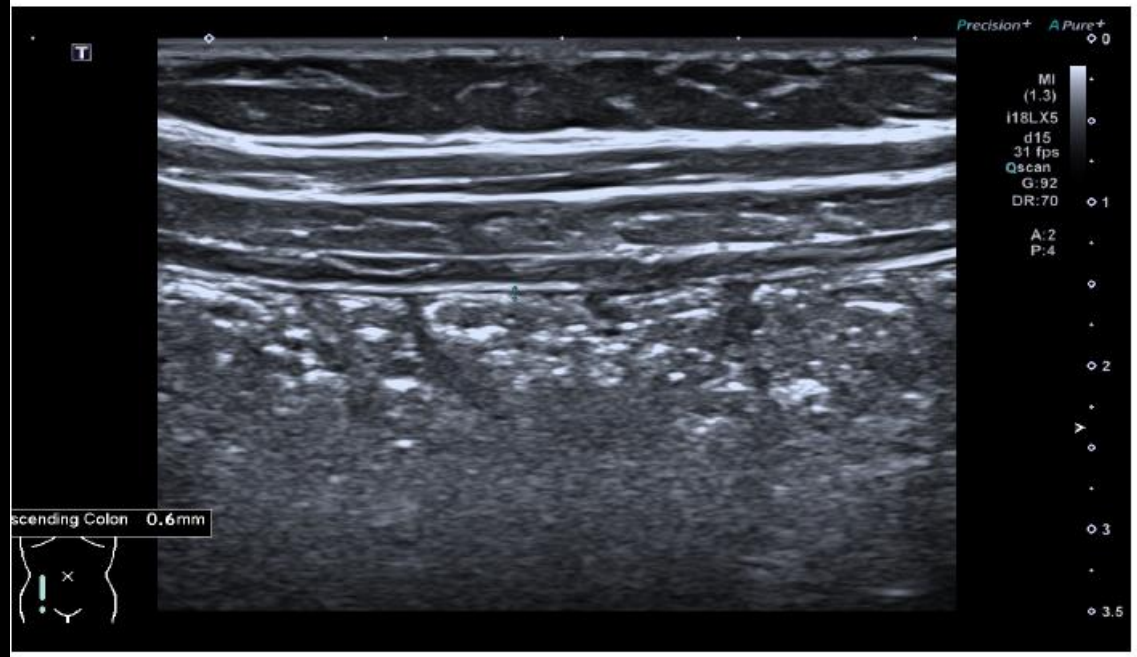
Body position marker

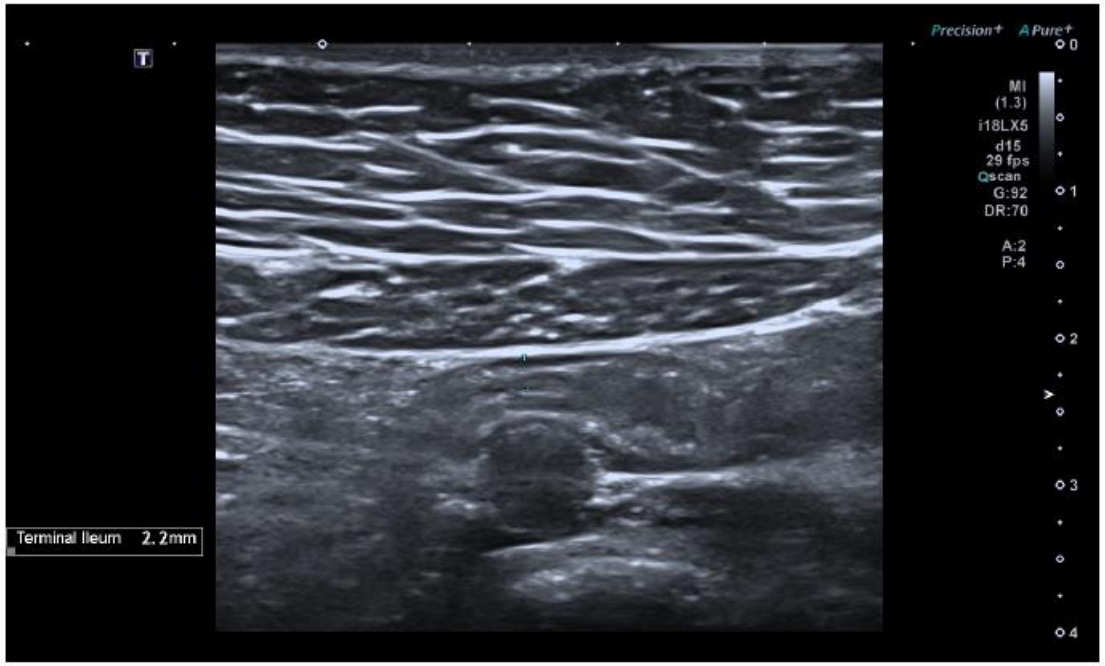
Probe orientation marker





Optimal images





In conclusion….

- Know your machine, probes and clinical information
- Look after yourself

- **Take some great pictures:**
- Optimise depth, gain, focus
- Freeze
- Use trackball to choose best frame
- Label image with words/body marker
- Measure with calipers
- Store image and/or cine loop
- When using colour Doppler – optimise velocity and gain

Use your camera (IUS) to see the intestines better!