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The Role of Ultrasound in the Assessment of Inflammatory Bowel Disease

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Topics for Discussion

1. Anatomy and Pathology of IBD
2. Methods of Bowel Investigation
3. Role of Ultrasound in Inflammatory Bowel Disease
4. Technique of Bowel Ultrasound
5. Normal Bowel Appearances
6. Ultrasound Pathology in Inflammatory Bowel Disease
7. Interesting cases

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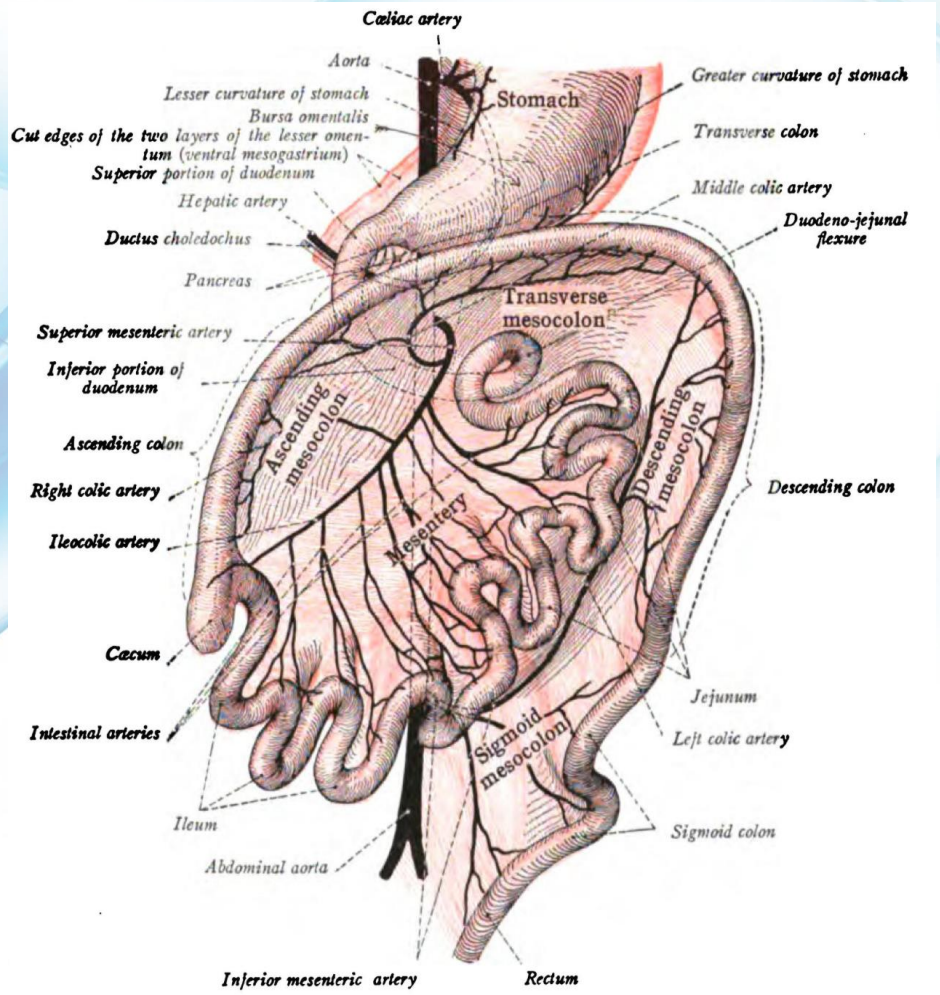
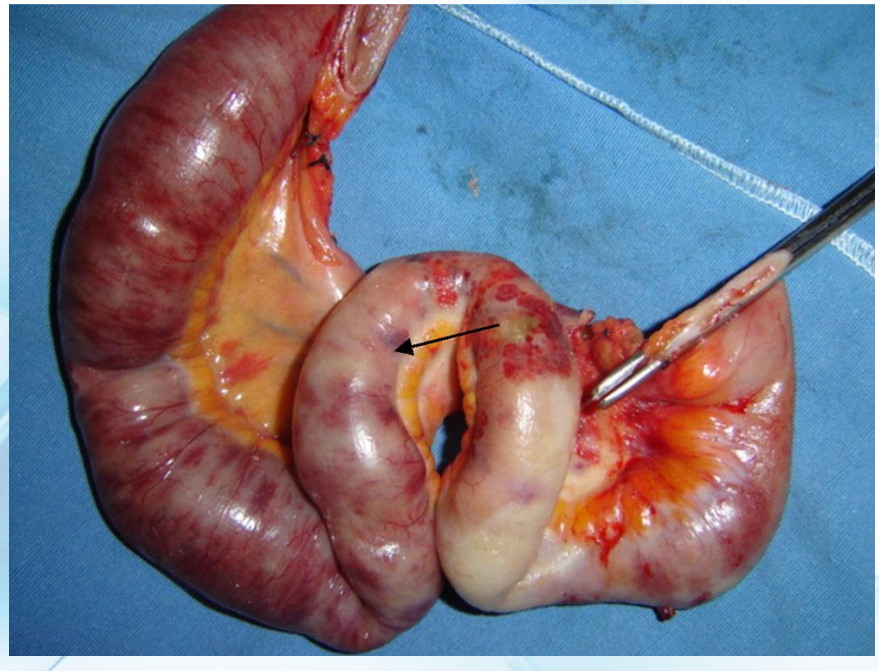
1. Anatomy and Pathology of Inflammatory Bowel Disease

Anatomy

- Colon 1.5m
  - Caecum / Ileocaecal junction
  - Ascending, transverse, descending, sigmoid colon.
- Small Bowel
  - Duodenum: 20 -25 cm long
  - Jejunum: 2.5 m long
  - Ileum: 3 m long
- Suspended on Mesentery
  - SMA
  - IMA
- Appendix

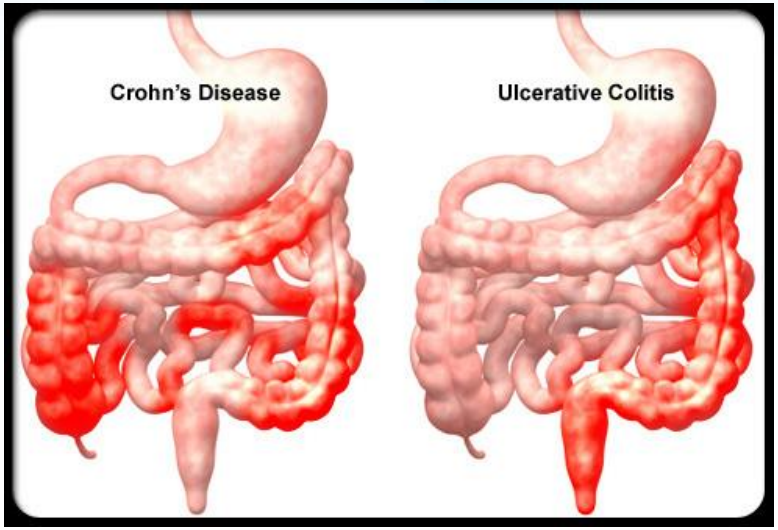


Bowel Inflammation

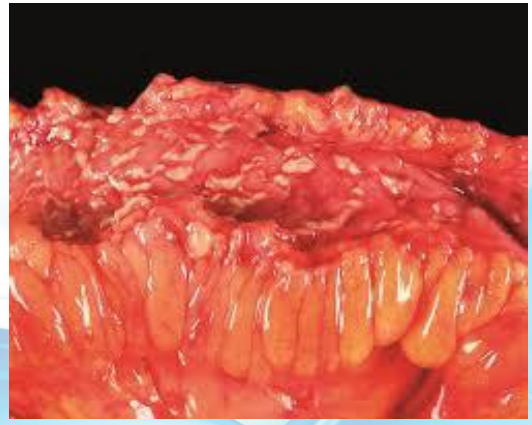


- Colitis / Enteritis
  - Aetiology
    - Infection
      - Yersinia
      - Campylobactera
      - C.Difficile Toxin
    - Vasculitis
    - Ischaemia
    - Radiation enteritis/colitis
    - Chemotherapy
    - Diverticulitis

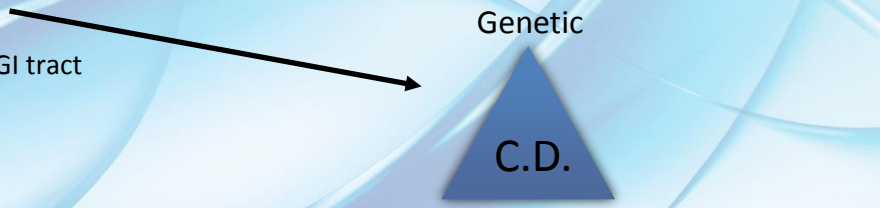
  - Inflammatory Bowel Disease
    - Crohns disease
    - Ulcerative Colitis

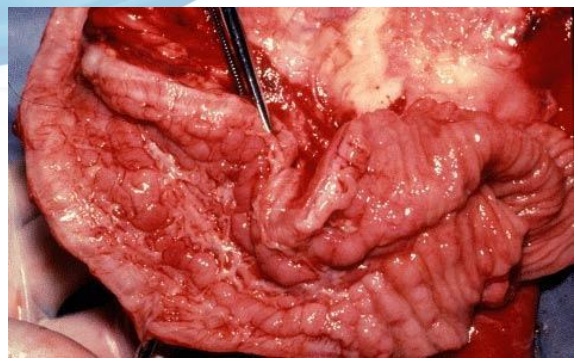


Crohns Disease



- Chronic relapsing inflammatory condition
  - Histological characterisation : Non-caeseating granulomas
- Unknown aetiology
- Can affect any part of the GI tract
  - Ileocaecal (45%)
  - Terminal Ileum (20%)
  - Colon (25%)
  - Extensive small bowel involvement (5%)
  - Anorectal, oral, gastroduodenal (5%)
- Skip lesions



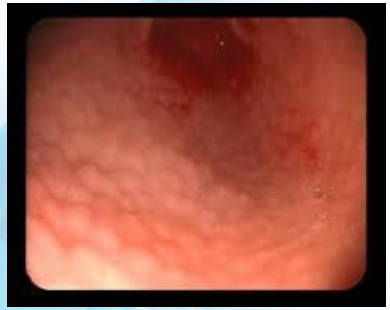


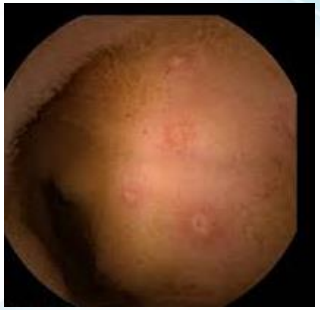
- **Epidemiology**
  - On the increase
  - Western prevalence
  - Slight female predominance
  - 145/100,000
  - Bi-modal age distribution
    - 20 -40 yrs
    - 60 -80 yrs

Crohns Disease: Inflammatory Pathology

Superficial Inflammation

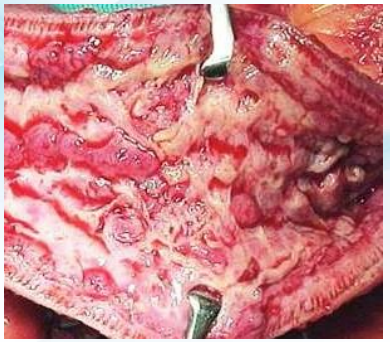
- Lymphoid hyperplasia
- Apthous Ulceration





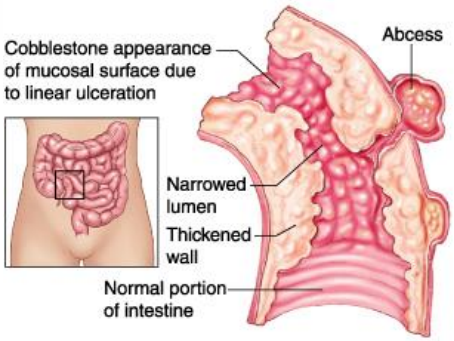
Transmural Inflammation

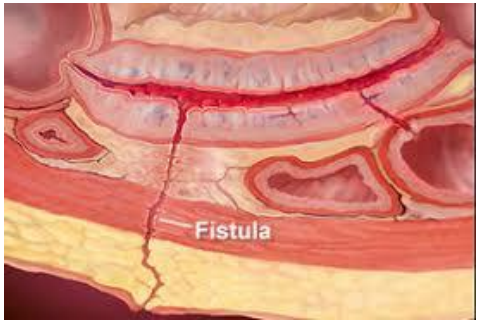
- Longitudinal and horizontal ulceration
- Transmural Ulceration, mucosal islands "Cobble Stoning"



Extramural Disease

- Peri-enteric Abscess
- Sinuses
- Fistulas





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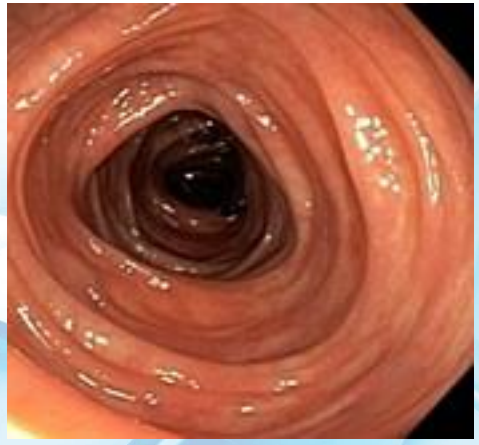
2. Methods of Bowel Investigation

Investigating the Bowel

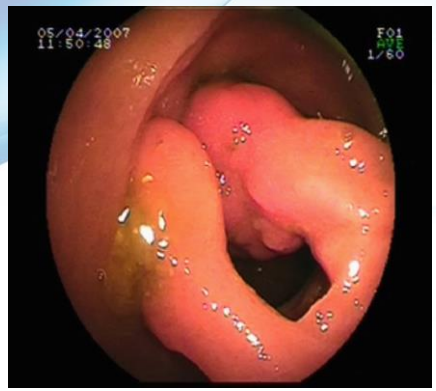
- **Endoscopic Evaluation**
  - Colonoscopy and terminal Ileoscopy
  - OGD
  - Capsule Endoscopy
  - Double Balloon Enteroscopy
- **Radiological Evaluation**
  - Plain Film
  - Barium Meal/Follow through/Enteroclysis
  - CT Enteroclysis
  - MR Enteroclysis/ Enterography
  - Ultrasound

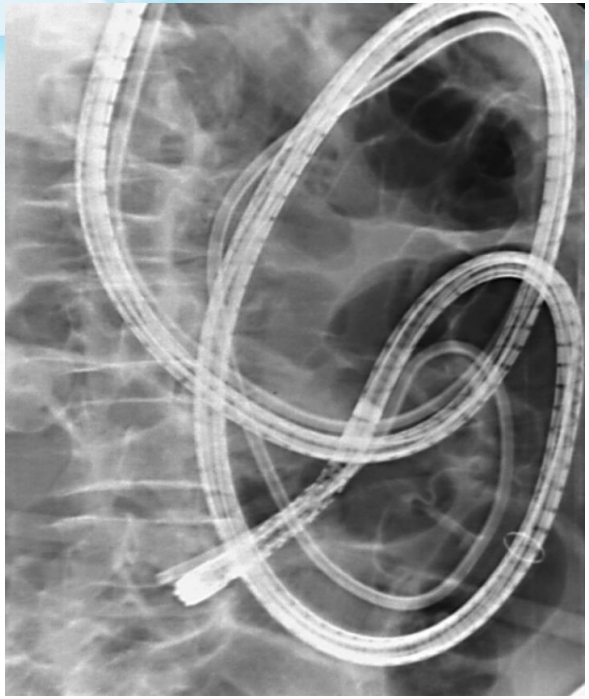
BMUS Endoscopic Evaluation of the Bowel

Capsule Endoscopy

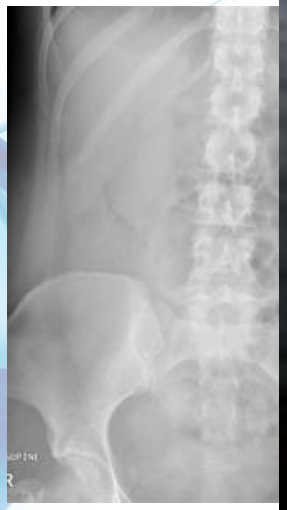


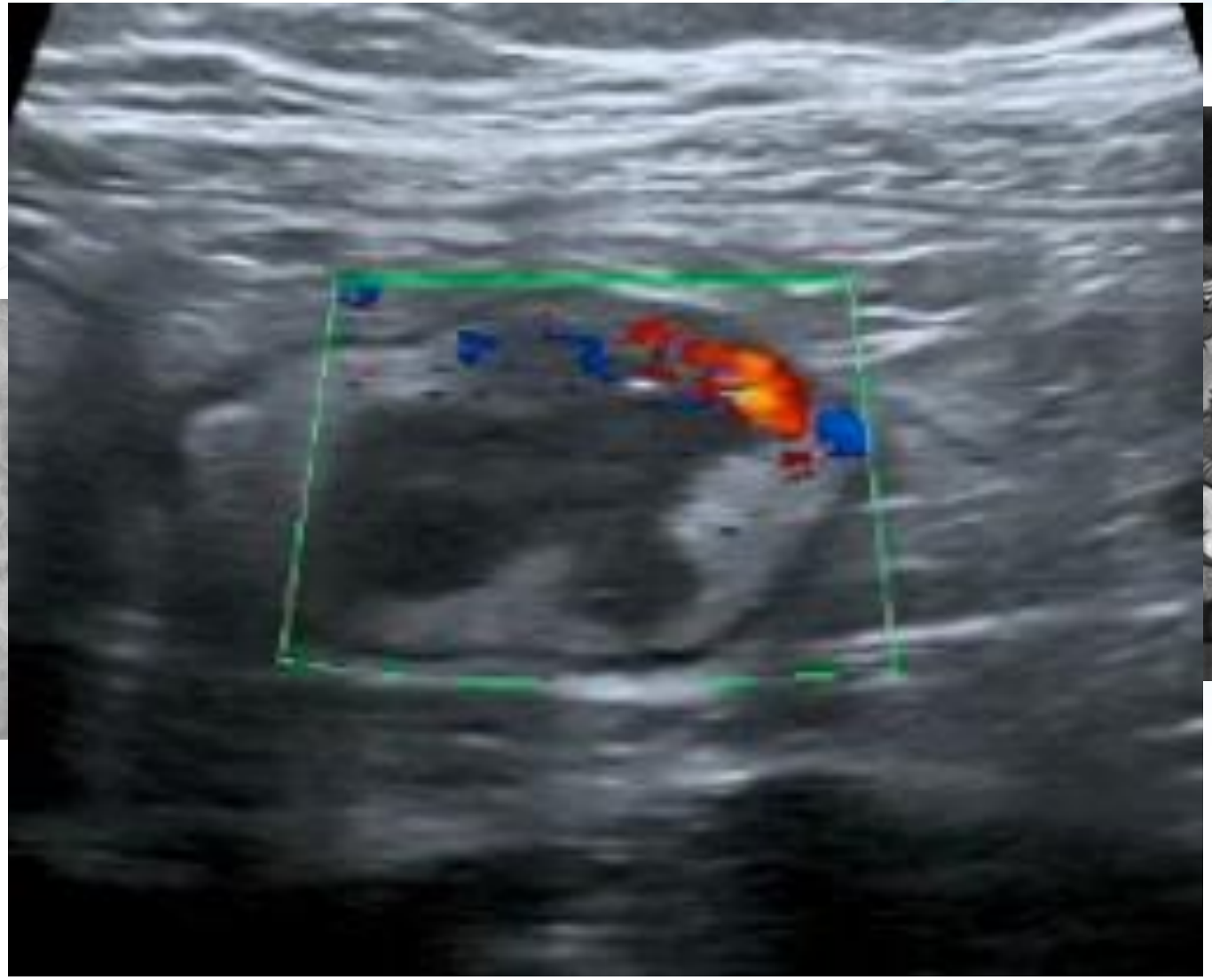

Double Balloon Enteroscopy

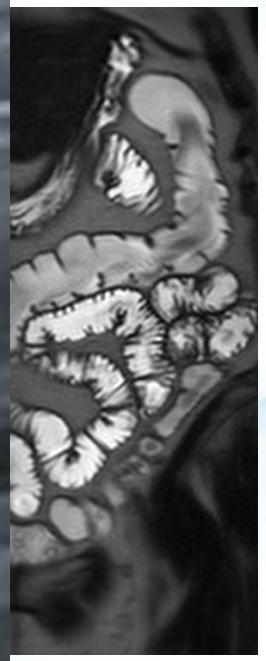




Radiological Evaluation







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3. Role of Ultrasound in Inflammatory Bowel Disease

Why Bowel Ultrasound ?

- No Radiation
- Relatively low cost
- Dynamic test
- Increasing in use (Europe), clinic setting
- Complimentary test (MRE/endoscopy)

	2016-17 Tariff - Unbundled Services		
HRG code	HRG name	Tariff (including cost of reporting) (£)	Cost of reporting (£)
RA16Z	Contrast Fluoroscopy Procedures, less than 20 minutes	76	-
RA05Z	Magnetic Resonance Imaging Scan, two to three areas, with contrast	211	29
RA12Z	Computerised Tomography Scan, two areas with contrast	107	28
RA23Z	Ultrasound Scan, less than 20 minutes	43	-

The Problem with Bowel Ultrasound

- Operator dependent
- Steep learning curve
- The sub-optimal image
  - Patient habitus
  - Bowel gas
  - Stomas and surgery
  - Deep pelvic sepsis

BMUS The Role of Imaging in Crohn's Disease

Initial Diagnosis

– **Diagnostic Features**

- **Mural thickeninig**
- ***Mesenteric fat wrapping***
- Ulceration - Apthous -Fissures - Cobblestoning
- ***Skip lesions***
- Fistulation
- **Mesenteric Lymph Nodes**
- Mesenteric plethora (Comb Sign)
- Disease Extent

Disease Management

- **Monitoring Disease Activity**
  - Acute v chronic
- Identify fibrotic segments
- Can I use immunomodulation ?
- Does the patient need surgery ?

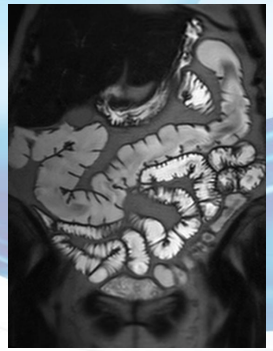
Imaging techniques for assessment of inflammatory bowel disease: Joint ECCO and ESGAR evidence-based consensus guidelines

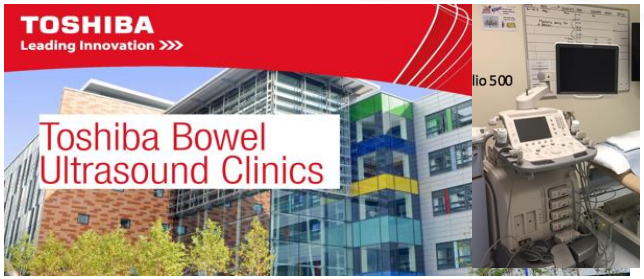
J. Panes [a,*], Y. Bouhnik [b], W. Reinisch [c], J. Stoker [d], S.A. Taylor [e], D.C. Baumgart [f], S. Danese [g], S. Halligan [h], B. Marincek [i], C. Matos [j], L. Peyrin-Biroulet [k], J. Rimola [l], G. Rogler [m], G. van Assche [n], S. Ardizzone [o], A. Ba-Ssalamah [p], M.A. Bali [q], D. Bellini [r], L. Biancone [s], F. Castiglione [t], R. Ehehalt [u], R. Grassi [v], T. Kucharzik [w], F. Maccioni [x], G. Maconi [y], F. Magro [z], J. Martín-Comín [aa], G. Morana [ab], D. Pendsé [ac], S. Sebastian [ad], A. Signore [ae], D. Tolan [af], J.A. Tielbeek [d], D. Weishaupt [ag], B. Wiarda [ah], A. Laghi [r]

Investigating Suspected IBD – The Portsmouth Experience

IBS - IBD

- FBC
- CRP
- Calprotectin





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4. Bowel Ultrasound Technique

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Bowel Ultrasound - Technique

EFSUMB Recommendations and Guidelines for Gastrointestinal Ultrasound

Part 1: Examination Techniques and Normal Findings (Long version)

EFSUMB-Empfehlungen und Leitlinien des Gastrointestinalen Ultraschalls

Teil 1: Untersuchungstechniken und Normalbefund (Langversion)

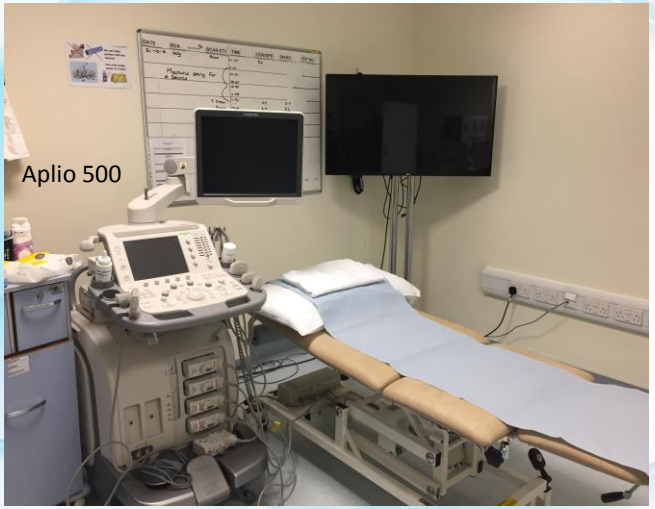
Authors K. Nylund[1], G. Maconi[2], A. Hollerweger[3], T. Ripolles[4], N. Pallotta[5], A. Higginson[6], C. Serra[7], C. F. Dietrich[8], I. Sporea[9], A. Saftoiu[10], K. Dirks[11], T. Hausken[12], E. Calabrese[13], L. Romanini[14], C. Maaser[15], D. Nuernberg[16], O. H. Gilja[17]

Affiliations Affiliation addresses are listed at the end of the article.

European Federation of Societies for Ultrasound in Medicine and Biology

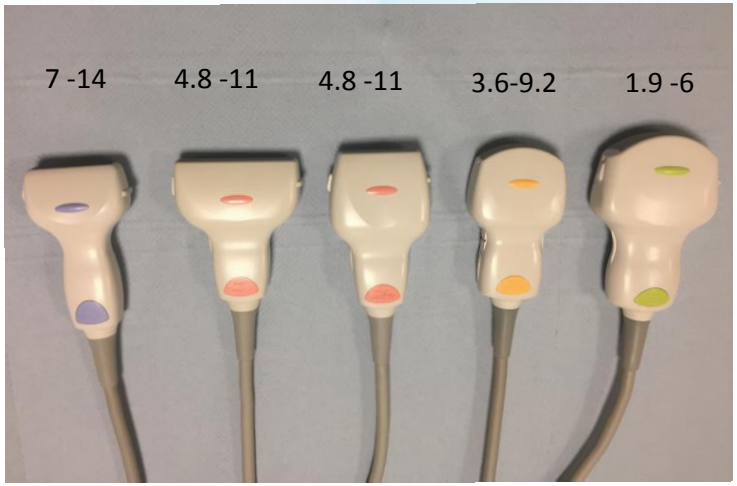
BMUS Bowel Ultrasound-Equipment

- Need capability to resolve structures in the bowel wall
- Resolution ~ Probe frequency, speed of sound in tissue and number of cycles in US pulse
- Compromise between resolution and depth



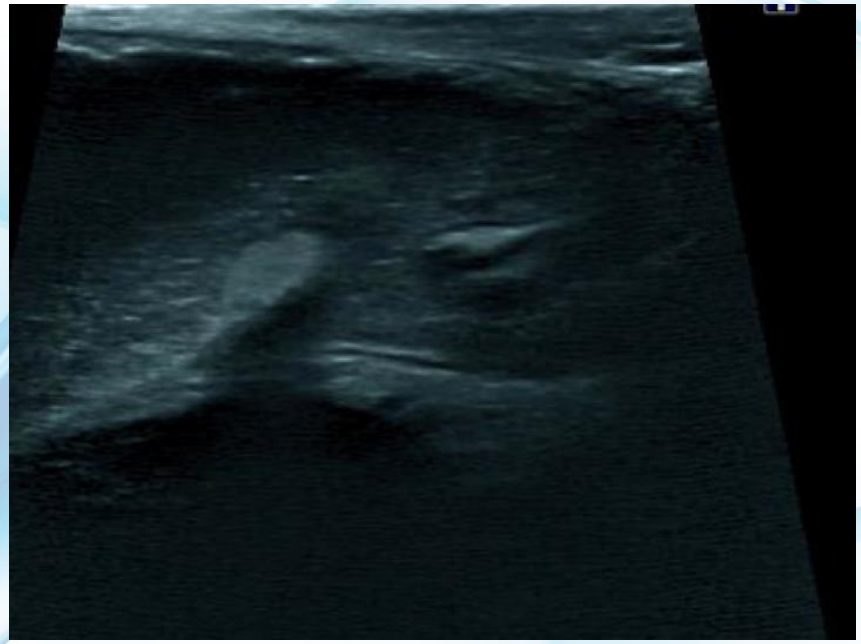
Recommendations:

1. For a complete examination of the bowel both a low and high resolution probe are needed, LoE 5, GoR C, Strong consensus 13/13
2. A probe with a frequency above 5 MHz should be used when measuring wall thickness, LoE 4, GoR B, Strong consensus 13/13



Bowel Ultrasound Technique

- Patient Preparation
  - Fasted 4 - 6 hours
    - Laxatives and anti-flatulence drugs does not improve the images
    - Fullish bladder
  - Oral fluids (Hydrosonography, SICUS)
    - Stomach - Water very useful
    - Hydrocolonic instillation
    - Hyperosmolar agents for small bowel (PEG)
  - Patient and Probe Movement
    - Graded compression
    - Left lateral position



Recommendation:

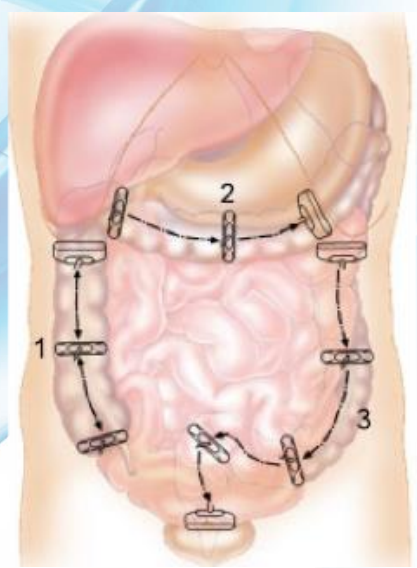
11. Oral fluid contrast can improve visualisation of small bowel disease, LoE 1b, GoR A, Strong consensus 12/12

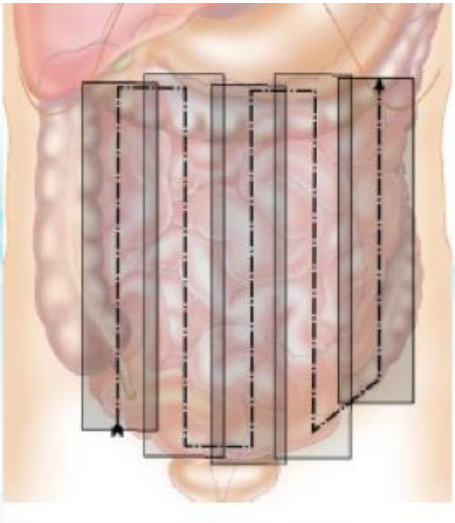
Recommendations:

7. A standard examination of the intestine does not need specific preparation, LoE 4, GoR B, Strong consensus 12/12
8. Fasting > 6 hours is recommended before measuring splanchnic blood flow, LoE 4, GoR B, Strong consensus 12/12
9. Overnight fasting is recommended before assessing gastrointestinal motility, LoE 5, GoR C, Strong consensus 12/12

Bowel Ultrasound Technique

- Solid abdominal Viscera (3.5 Hz Curvilinear)
  - Overview of gut and mesentery
- Colon 'Picture Frame' (High Frequency linear)
  - Sigmoid Colon @ Left iliac Fossa
  - Ileocaecal junction @ Right Iliac Fossa
    - » Terminal ileum and appendix
- Ileum > Mowing the Lawn
- Jejunum
- Stomach/Duodenum/Oesophagus
- SMA and central small bowel mesentery





Recommendations:

10. The scanning of the intestines must involve a systematic approach, LoE 5, GoR C. Strong consensus 12/12

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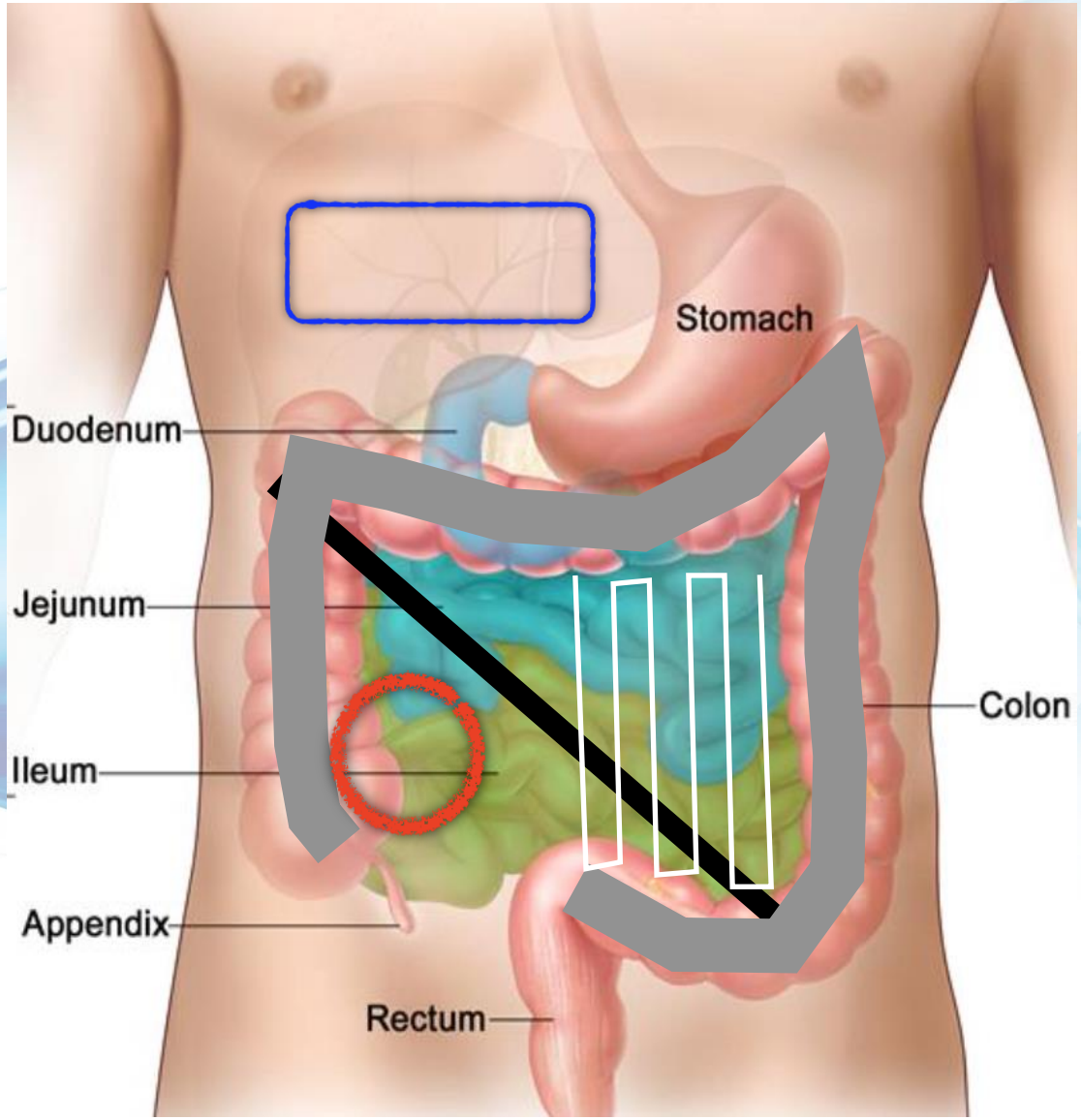

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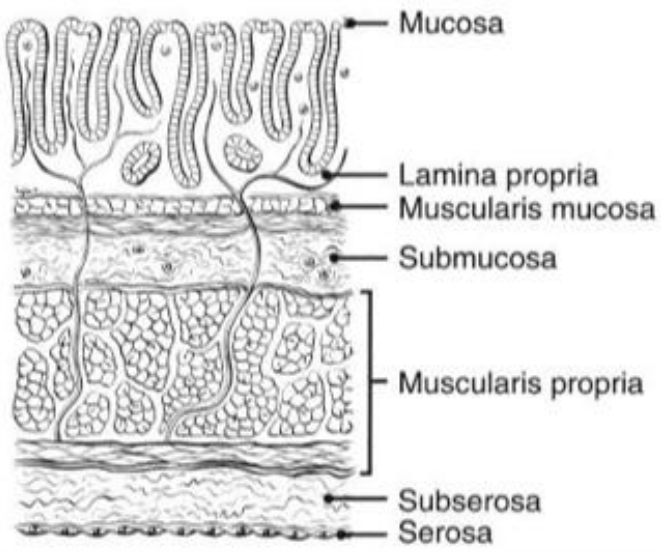
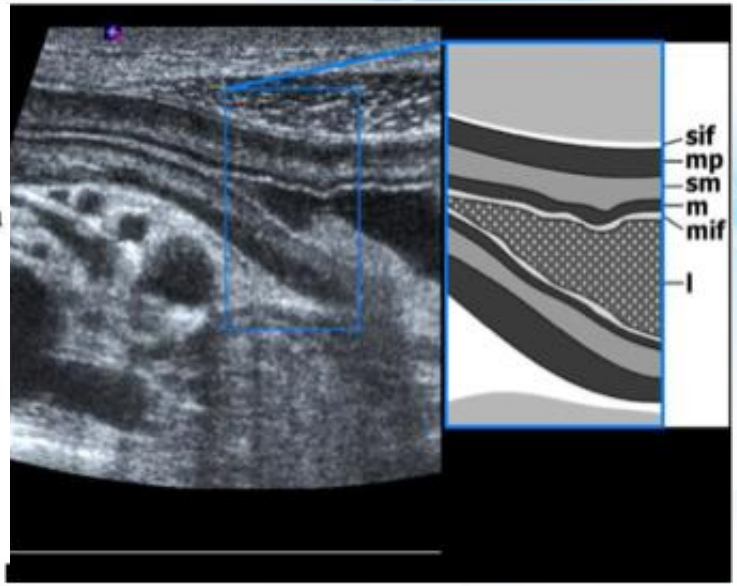
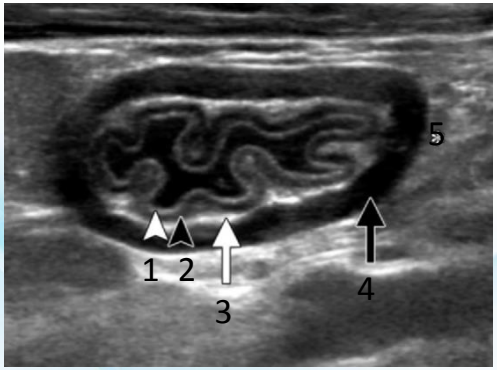
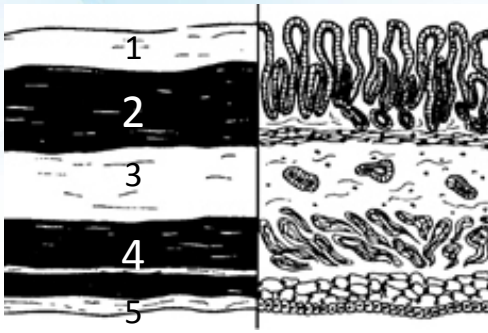
5. Normal Sonographic Appearance of the Bowel

BMUS The Normal Gut Signature

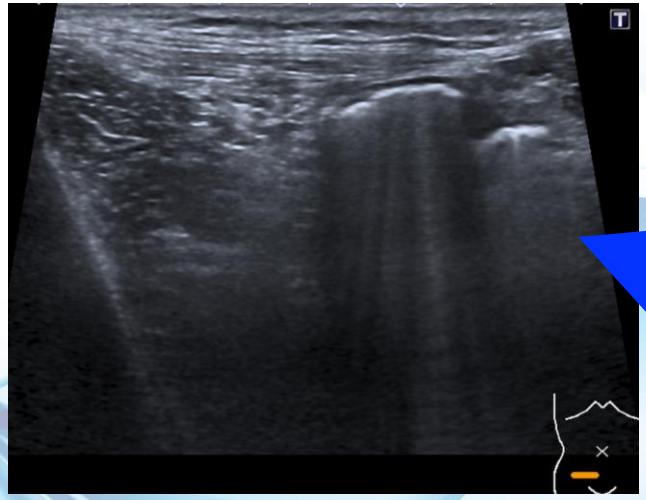


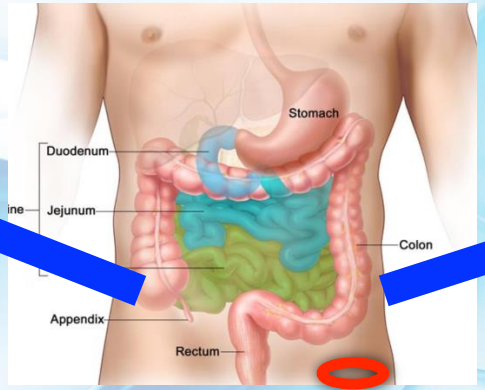


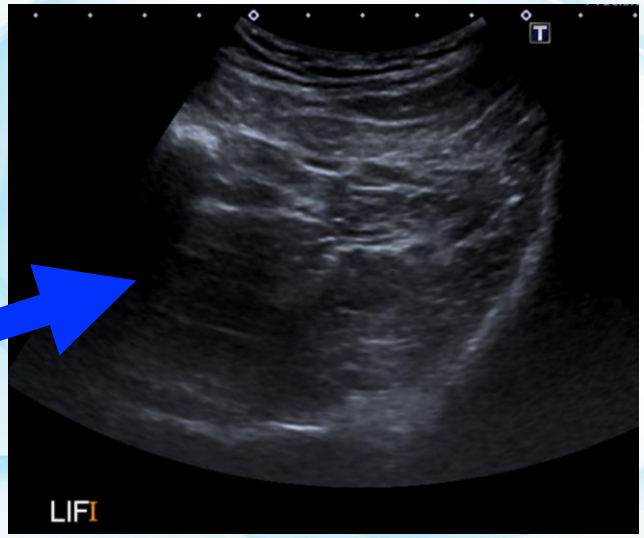


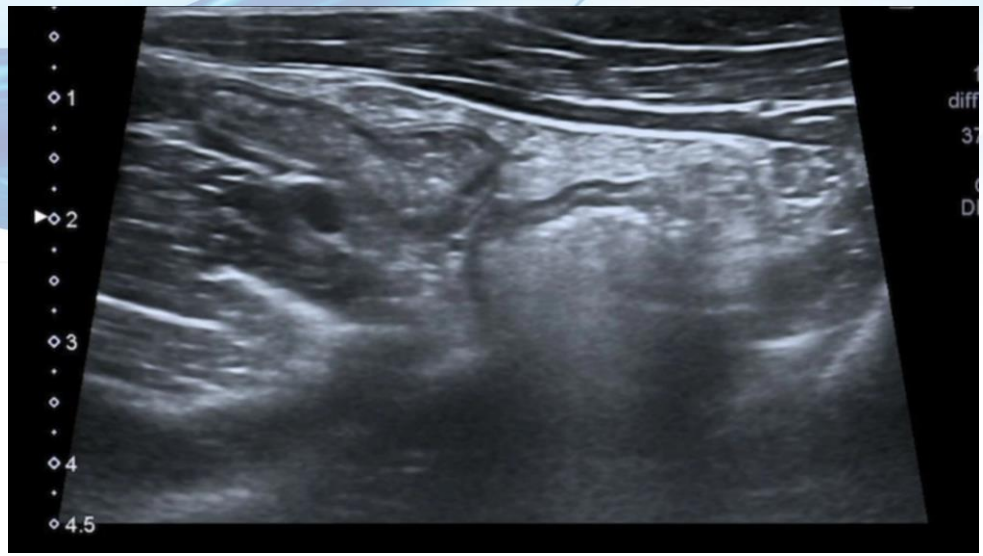


The Colon Picture Frame

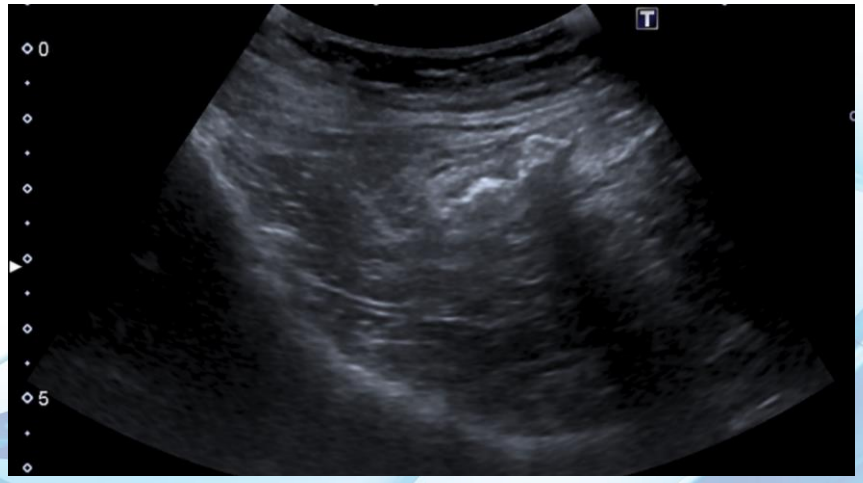


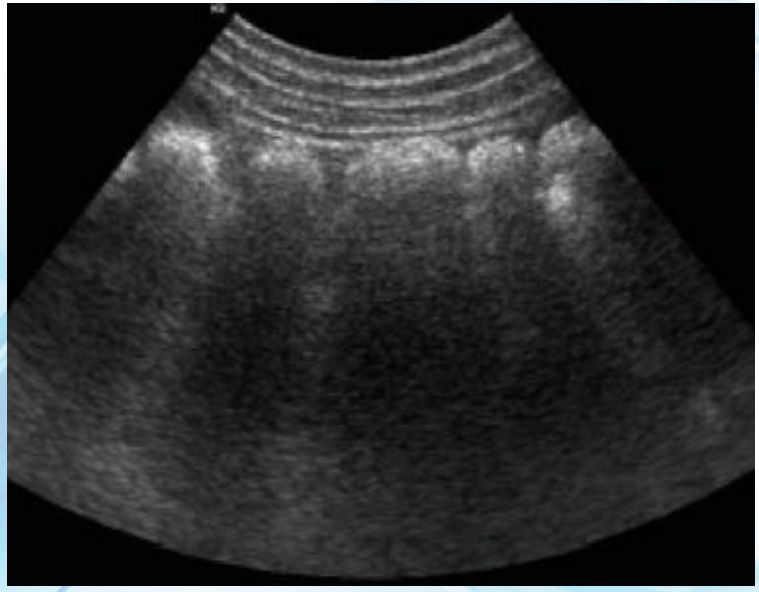


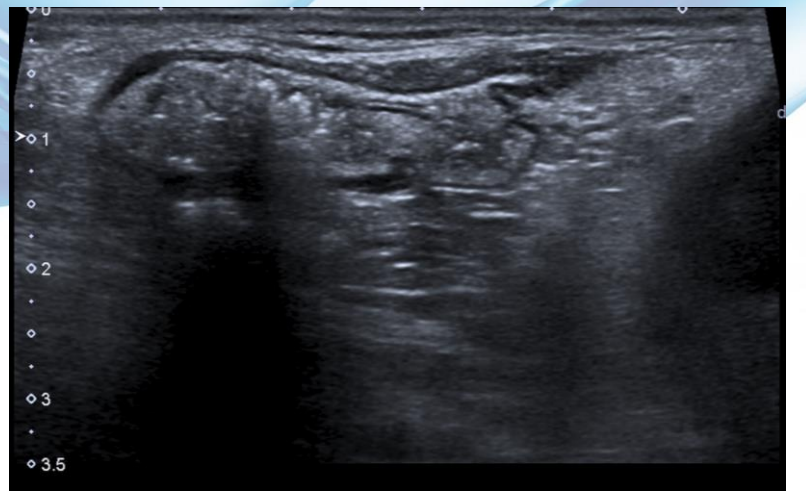


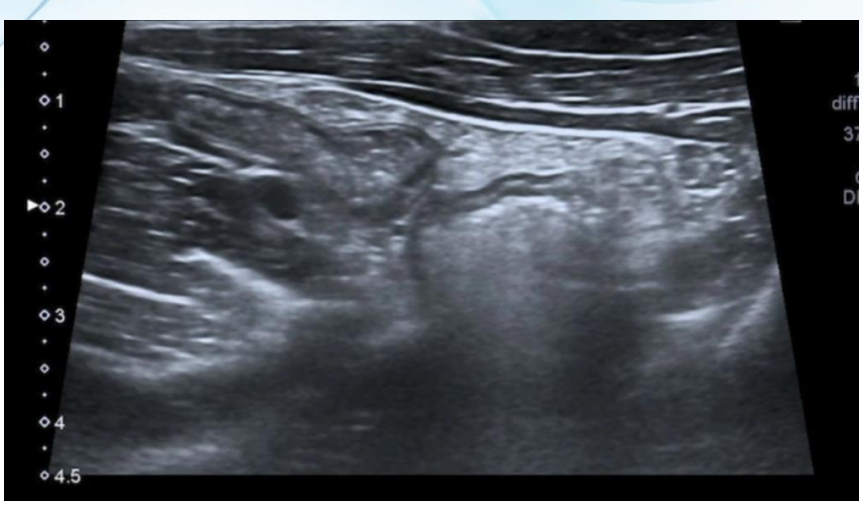


Normal Colonic Appearances

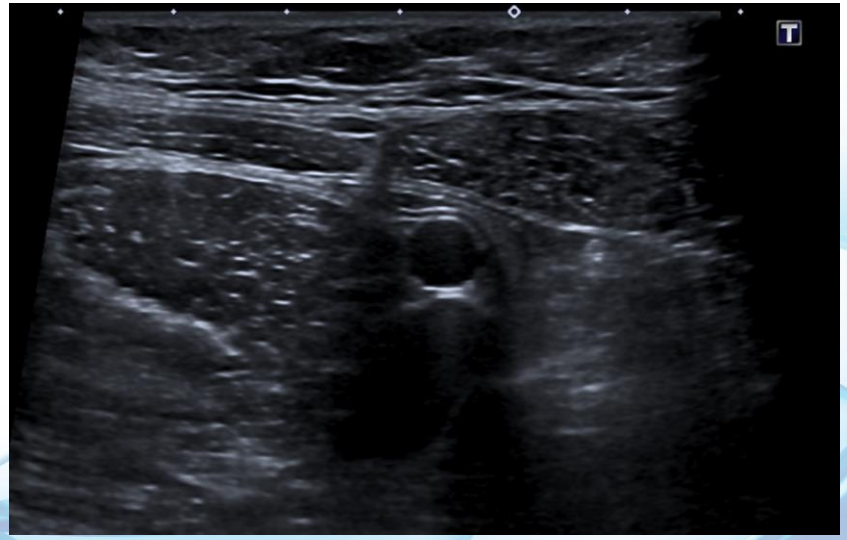


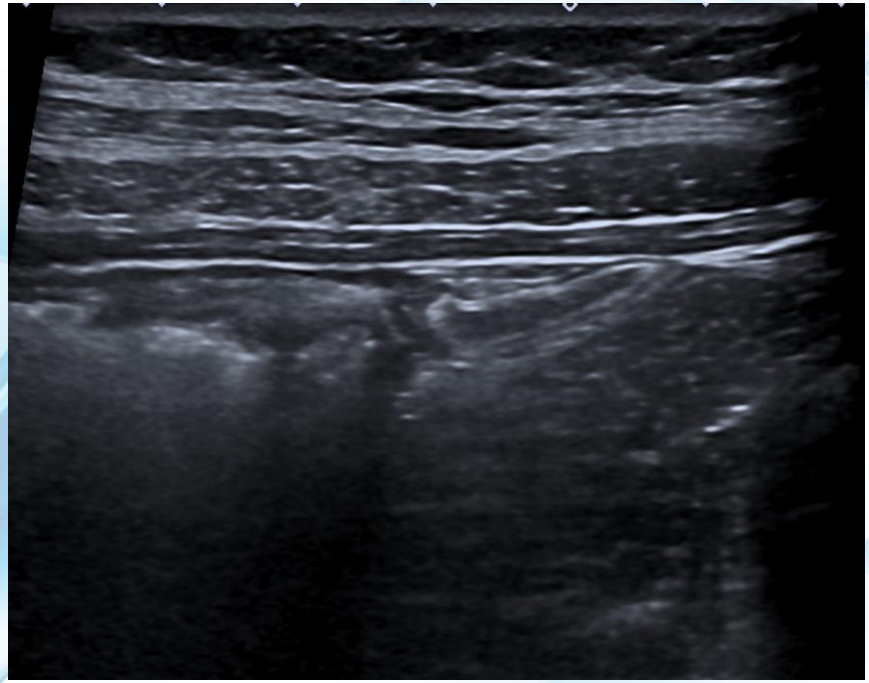


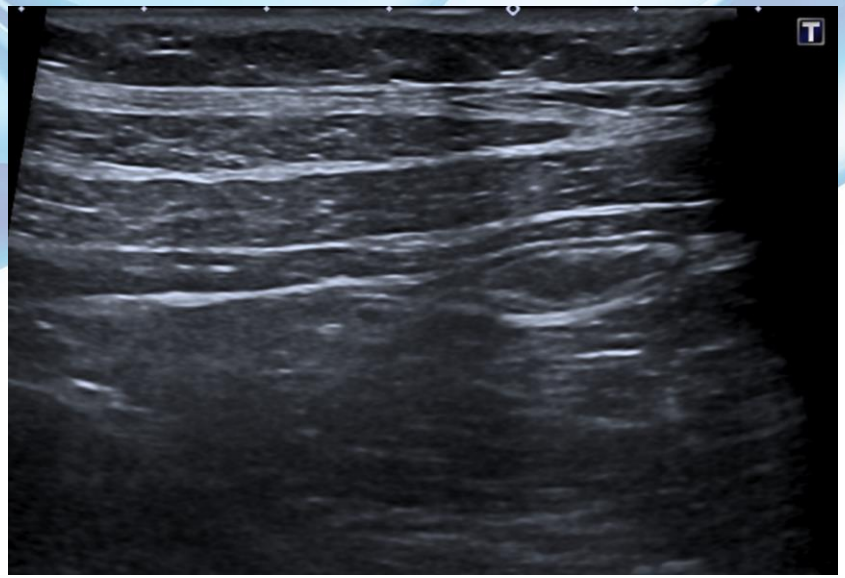


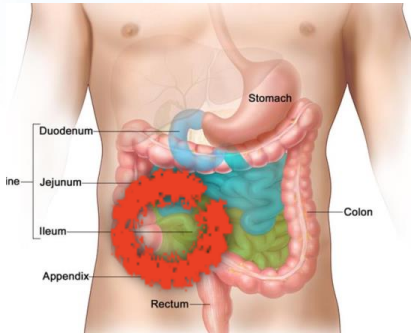


Ileocaecal junction and Terminal Ileum

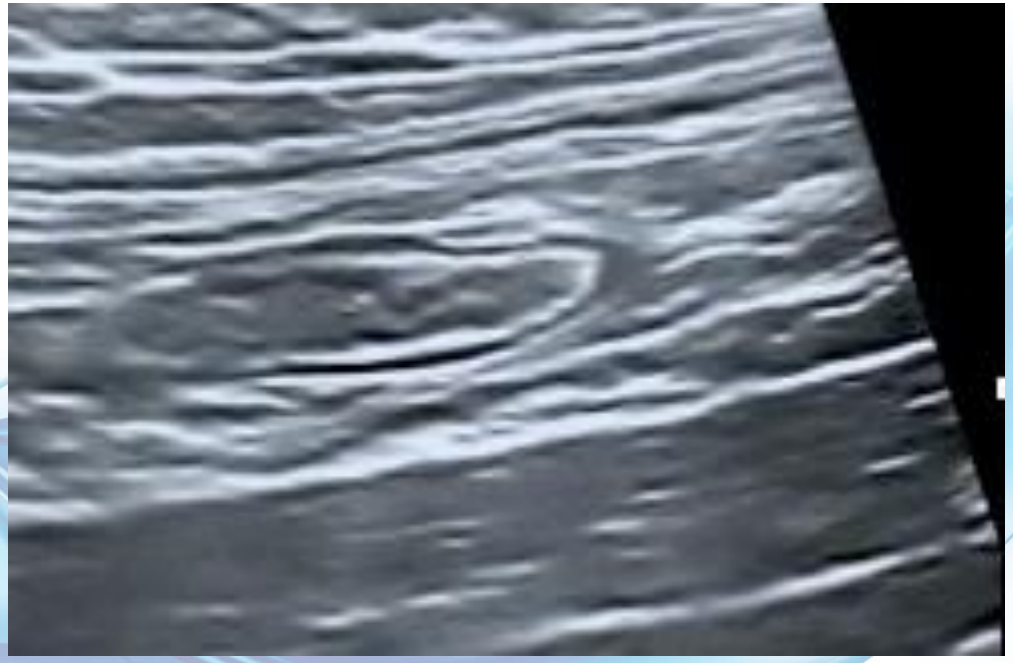


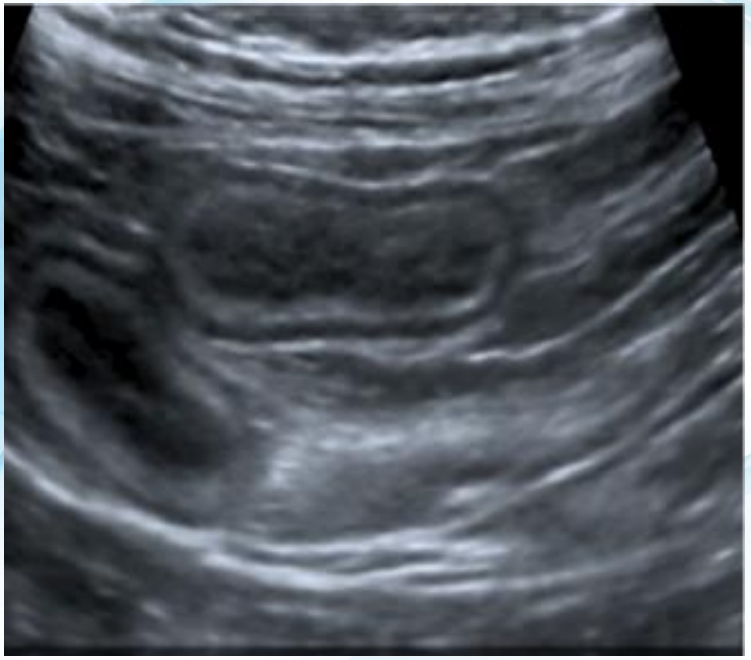


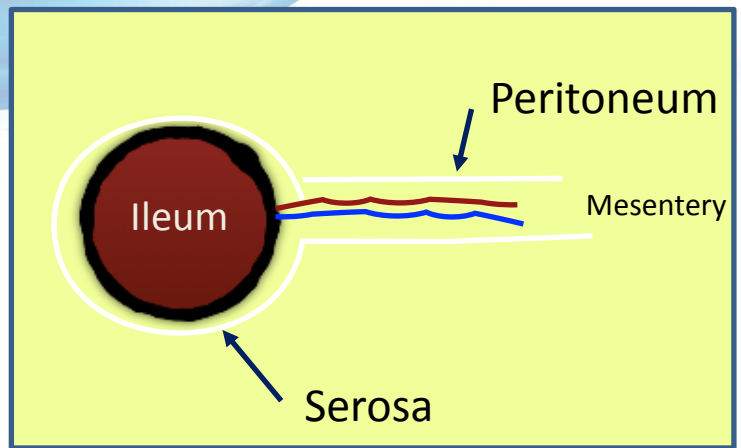




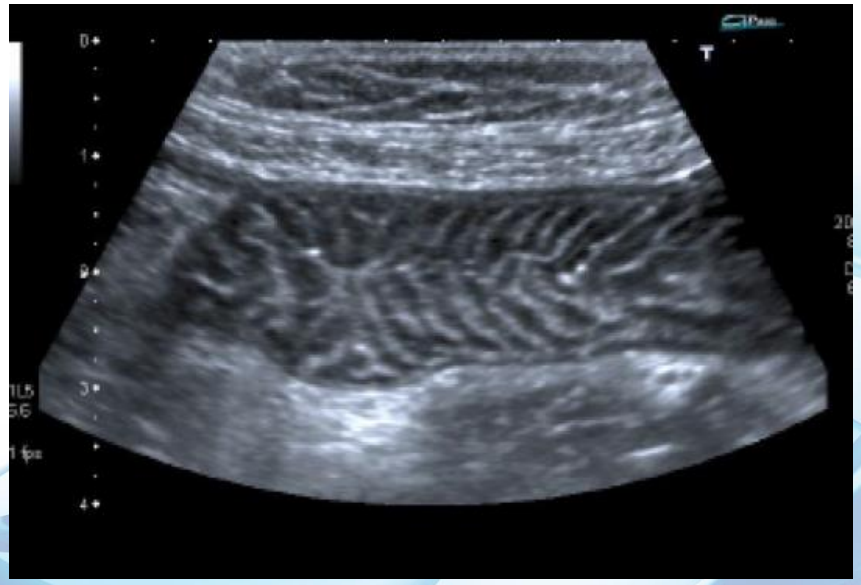
Ileum and Mesentery

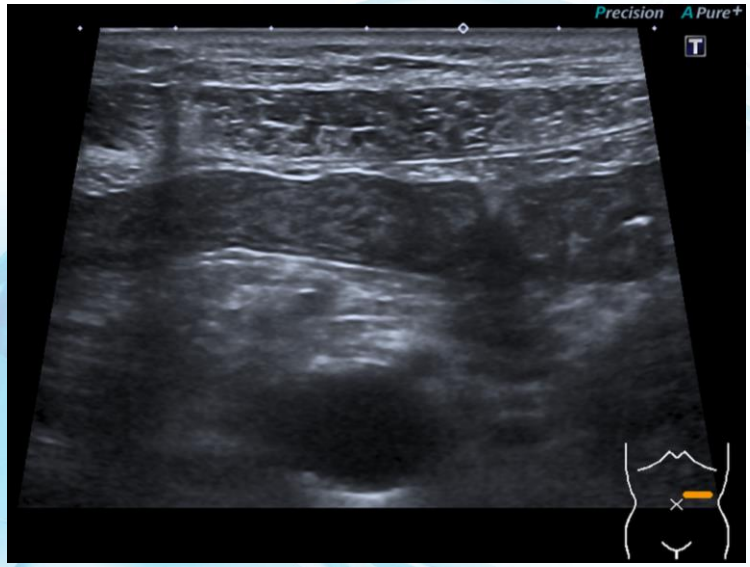






Jejunum

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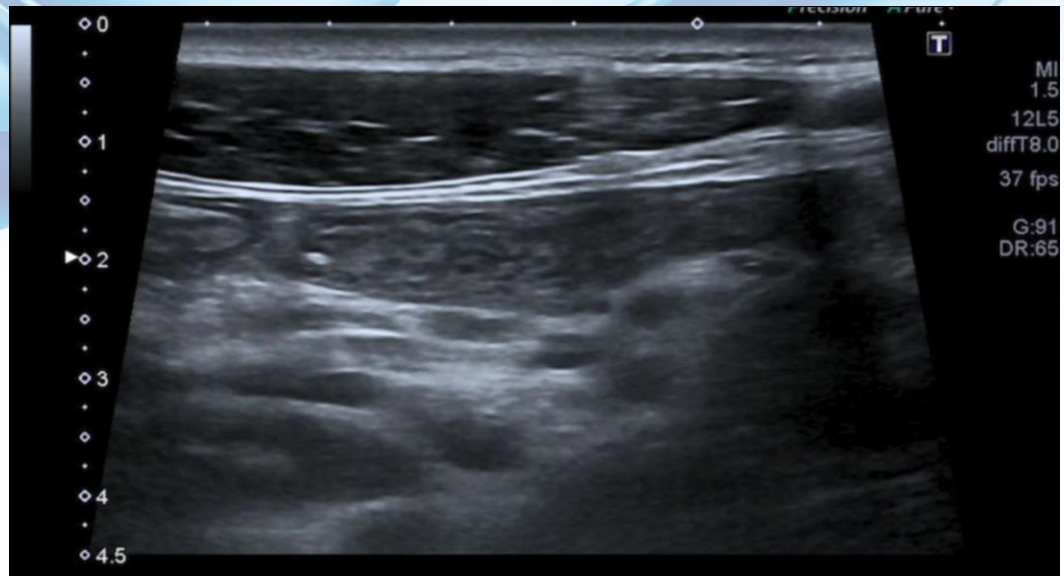
A Pure+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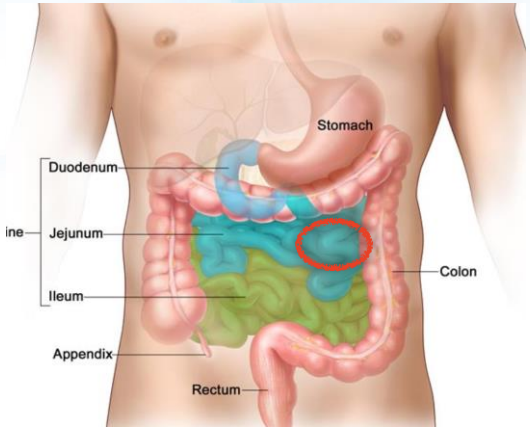
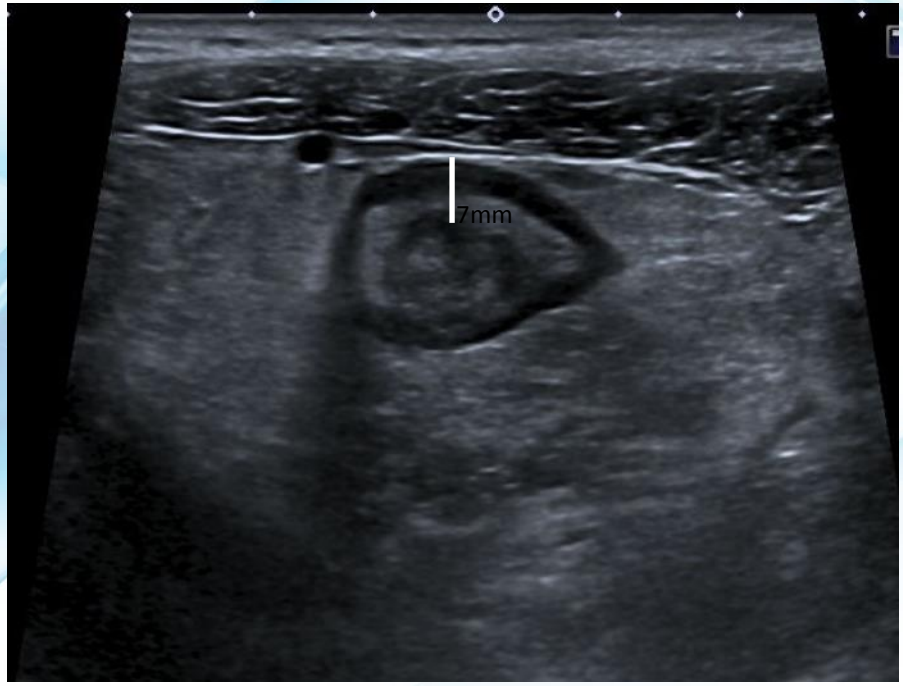

Stomach
Duodenum
Jejunum
Ileum
Colon
Appendix
Rectum

BMUS

6. Ultrasound Pathology in Inflammatory Bowel Disease

BMUS Bowel Wall (Mural) Thickening

- Try to get true-axial orientation
- Measure from inner inner black line to outer outer black line
- Repeat
- Threshold 3- 4mm



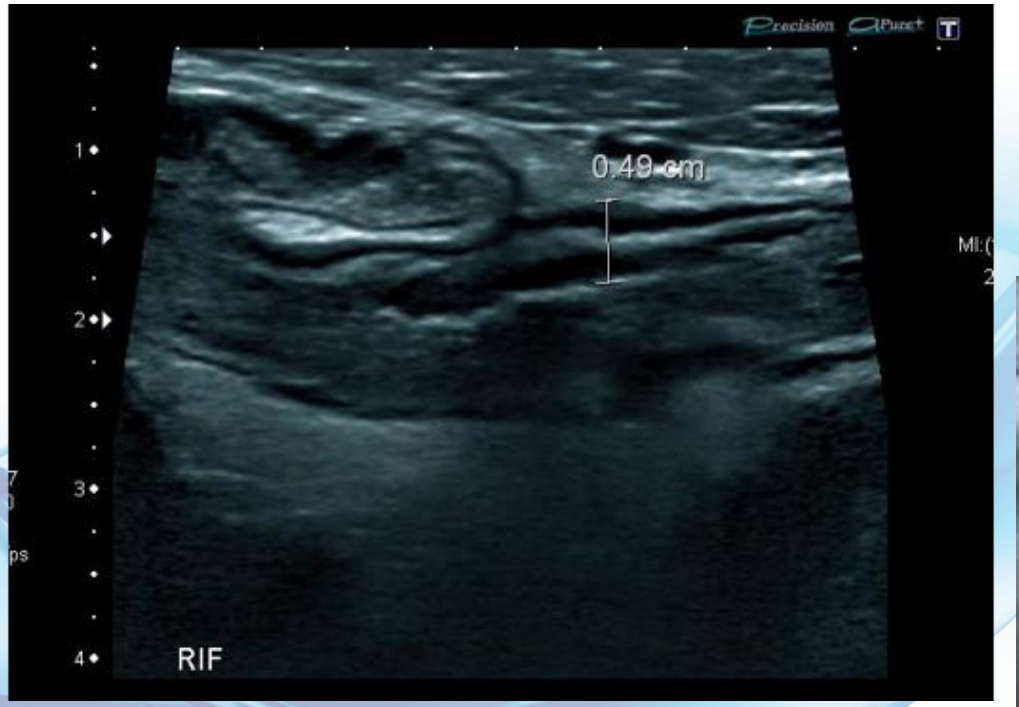
Recommendations:

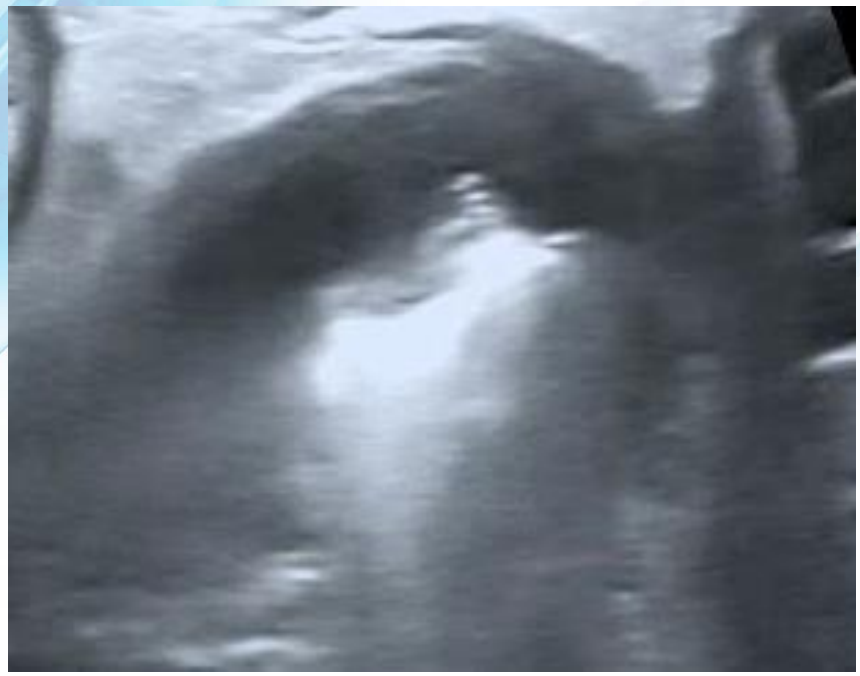
12. A bowel wall thickness less than 2 mm (not the cut-off value for pathology) could be considered as normal, when measured in the normal filling state except in the duodenal bulb and rectum, LoE 4, GoR B, Majority consensus 9/12

Recommendations:

13. Bowel wall thickness should be measured perpendicular to the wall from the interface between the serosa and proper muscle to the interface between the mucosa and the lumen. LoE 4, GoR B, Strong consensus 10/10

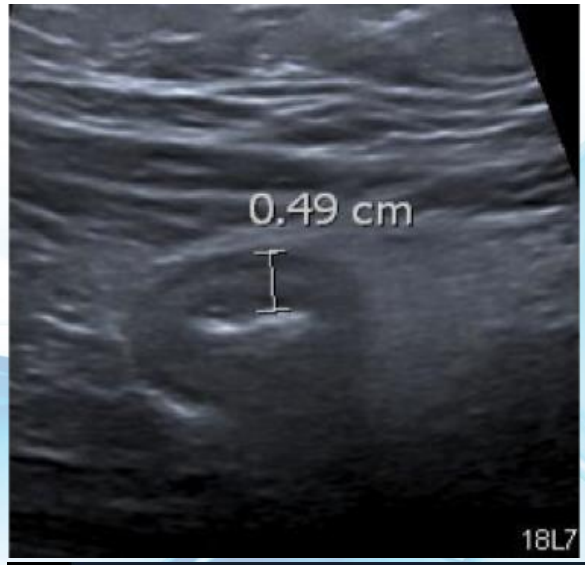
BMUS Mucosal Thickening and Ulcers

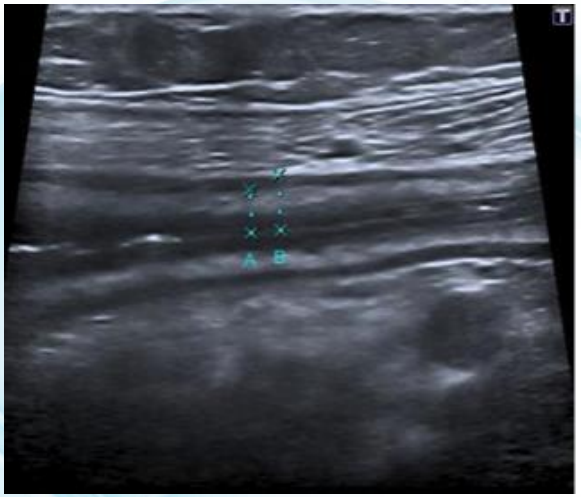


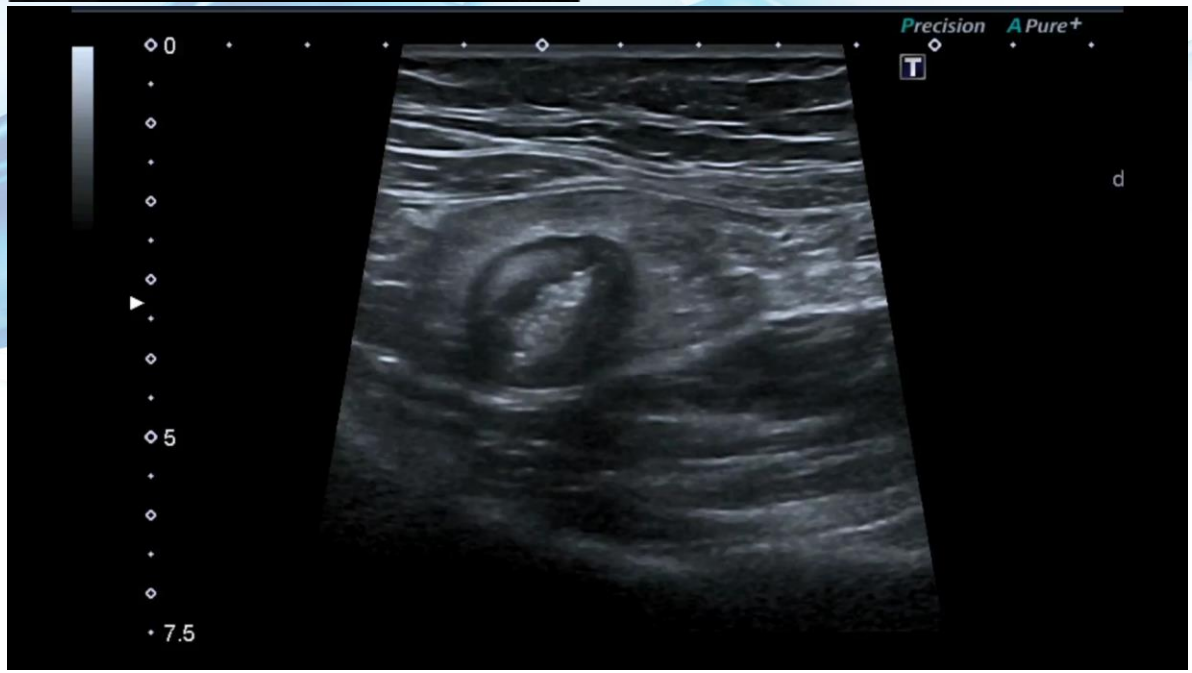


Loss of Normal Gut Signature

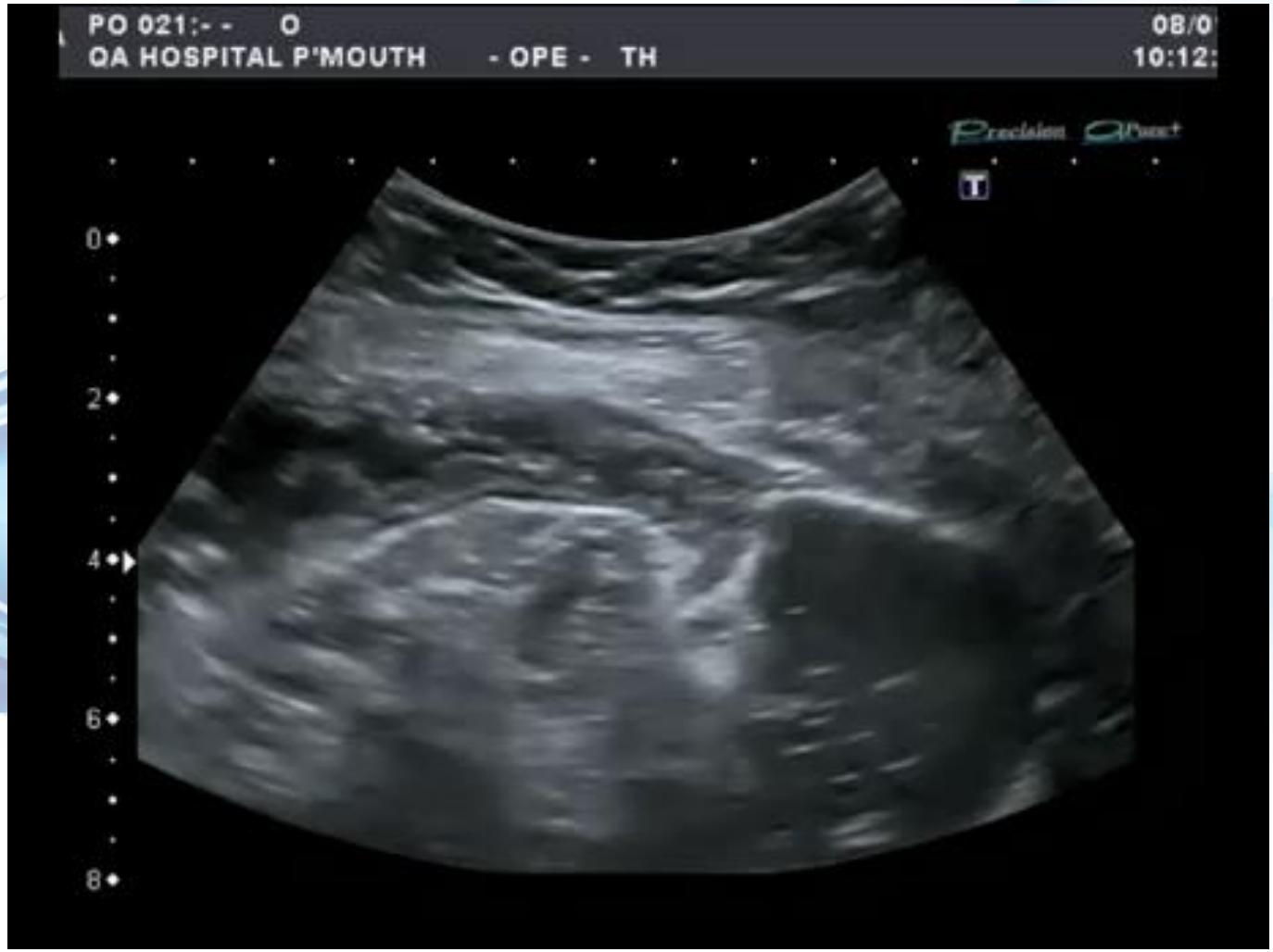
- Complete loss of stratification
- Thickened with Maintained Stratification
- Focal Interruption





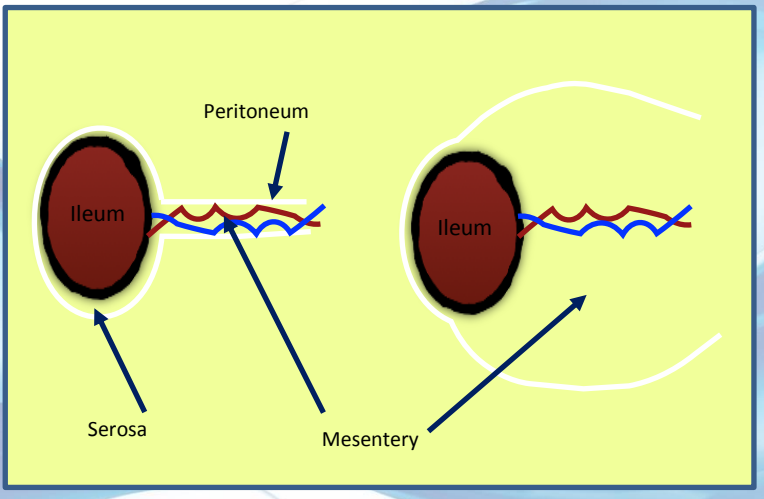


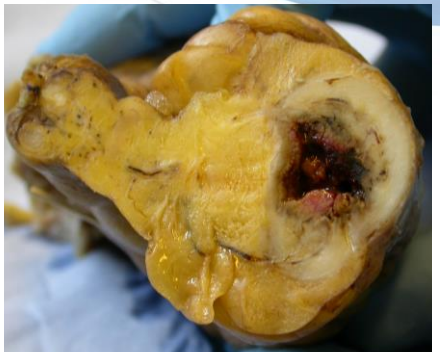
Pre-stenotic Bowel Dilatation

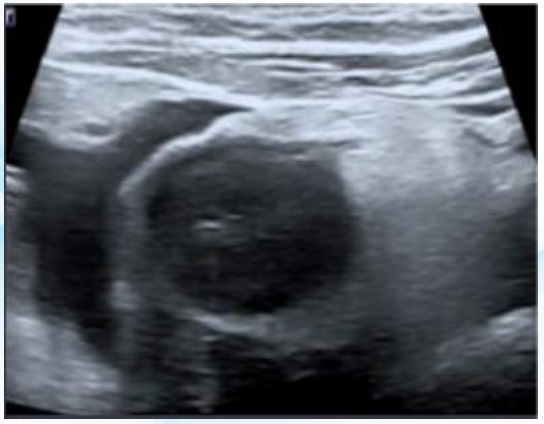


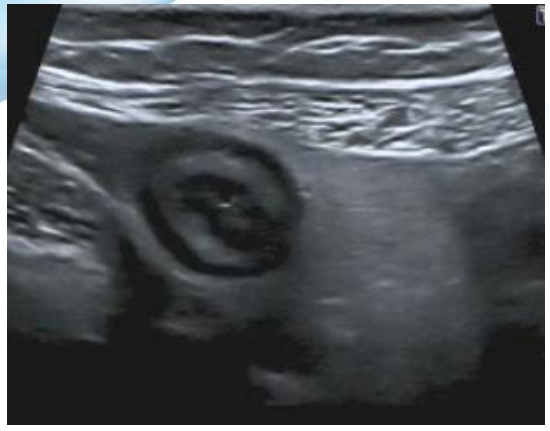
Mesenteric Changes

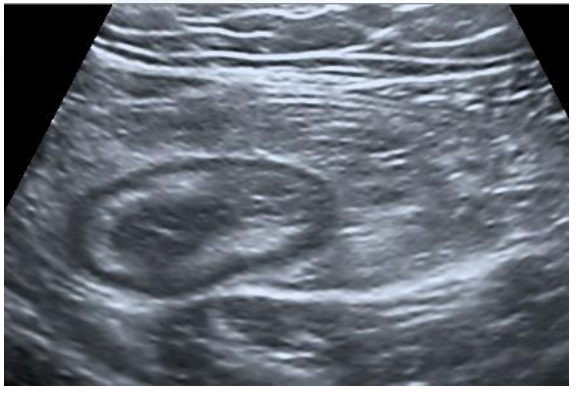
- Increased mesenteric fat producing a mass effect
- Expands and separates the peritoneal layers and lifts the serosa -fat wrapping
- Pathognomonoic of Crohn disease
- Best seen on US



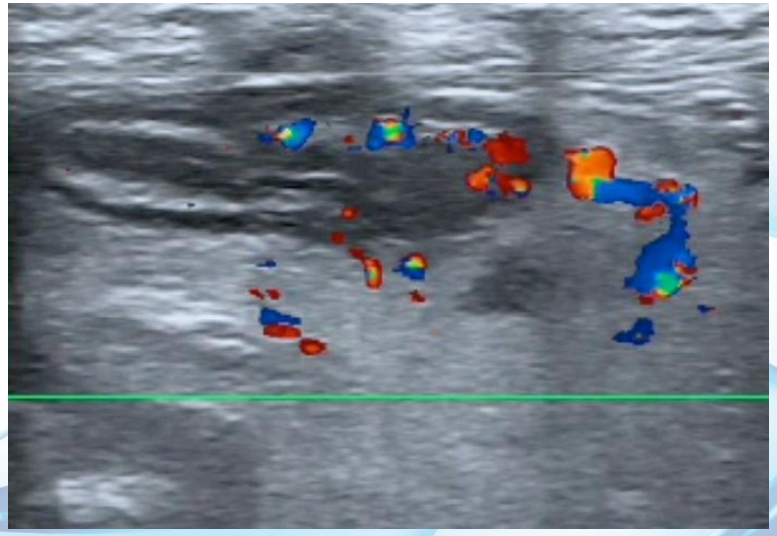


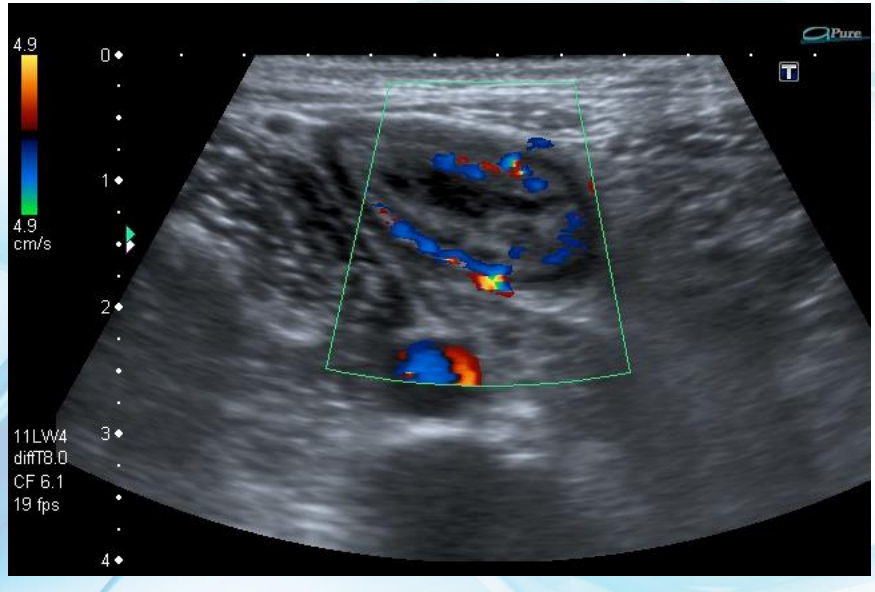


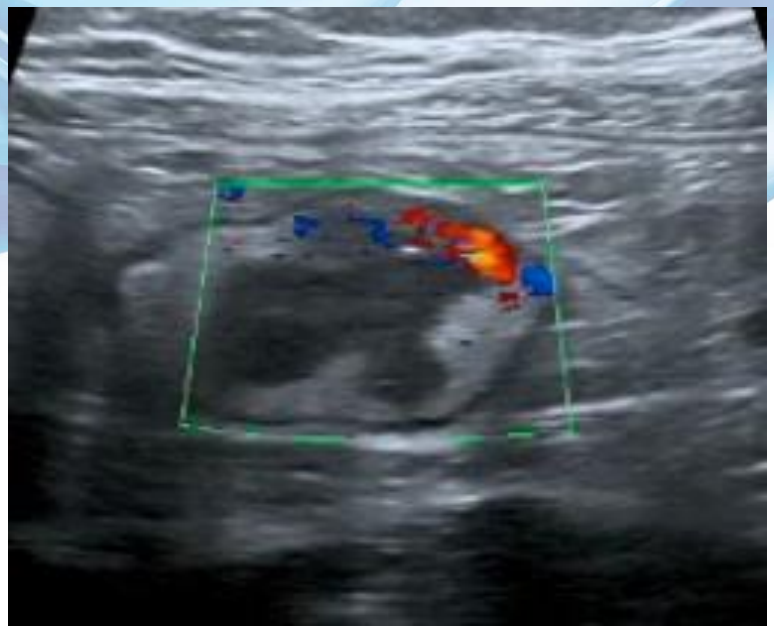


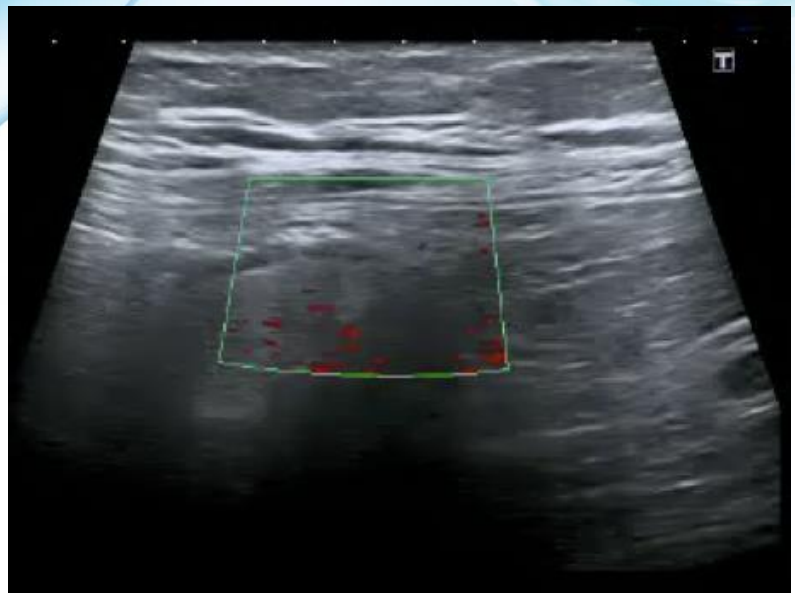


Doppler Vascular Patterns

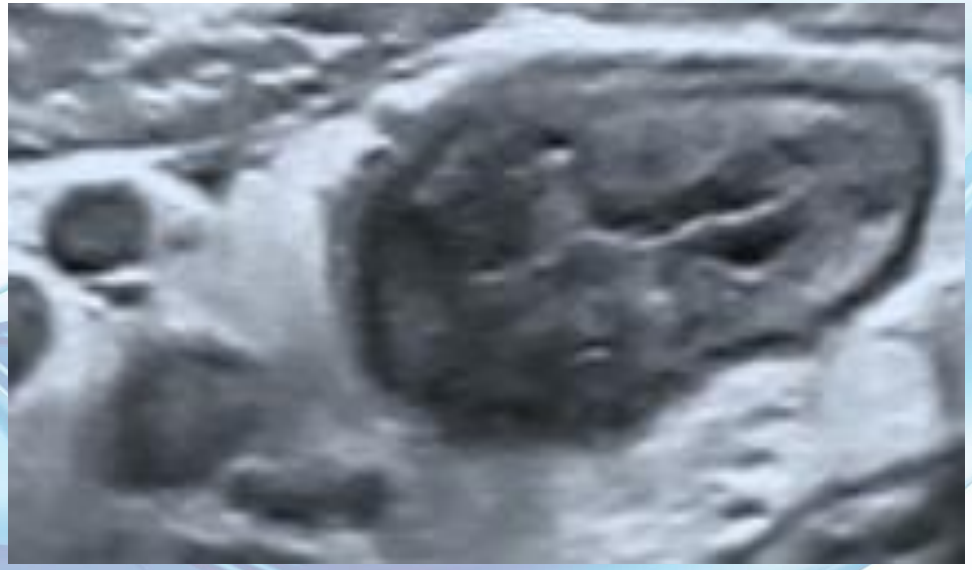


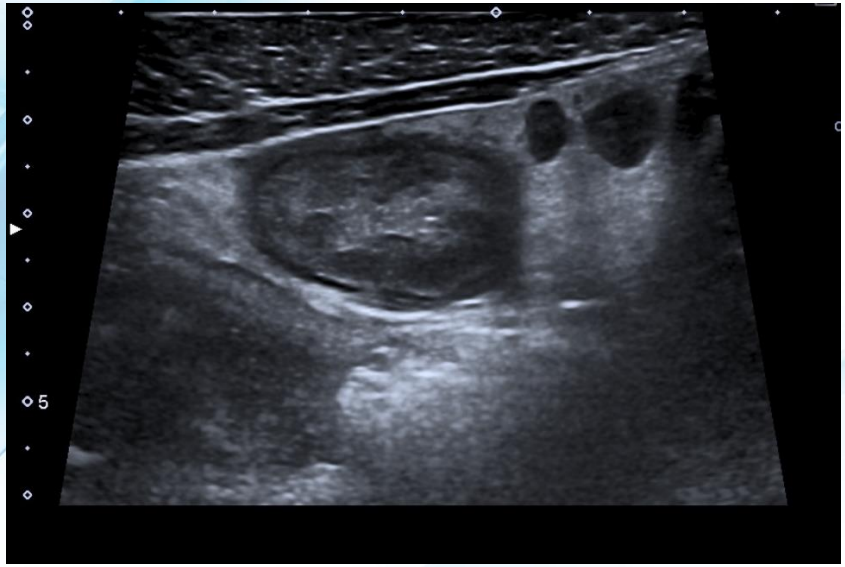






BMUS Mesenteric Lymphadenopathy

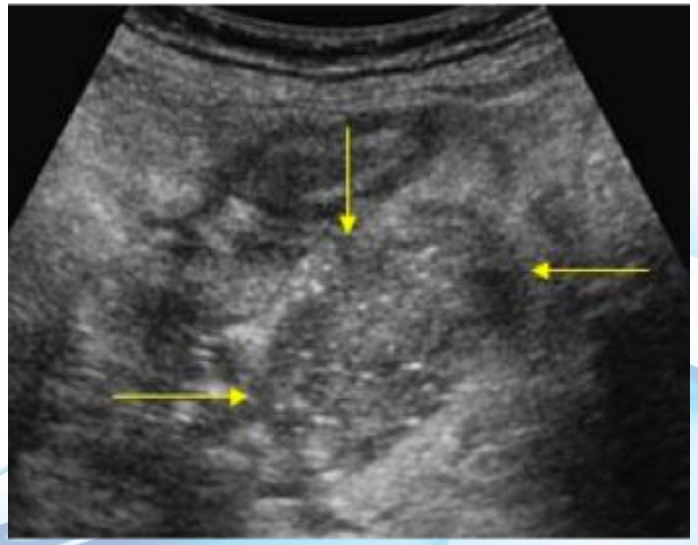


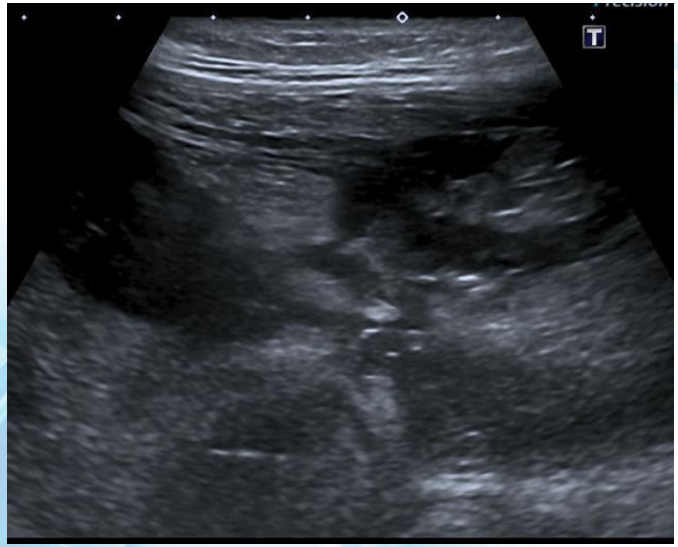


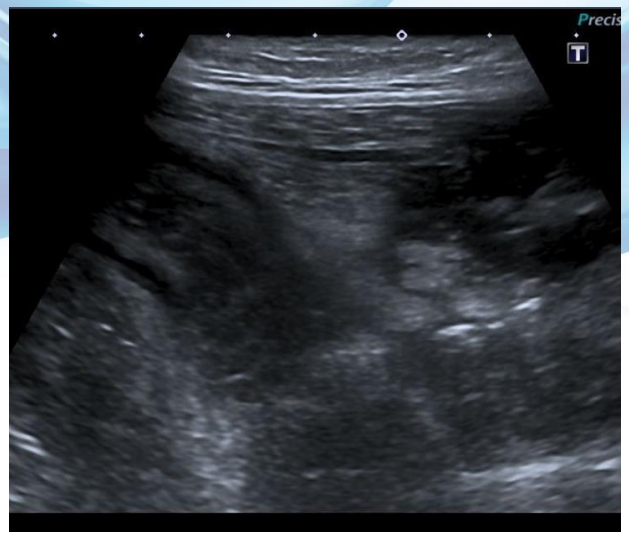
Recommendations:

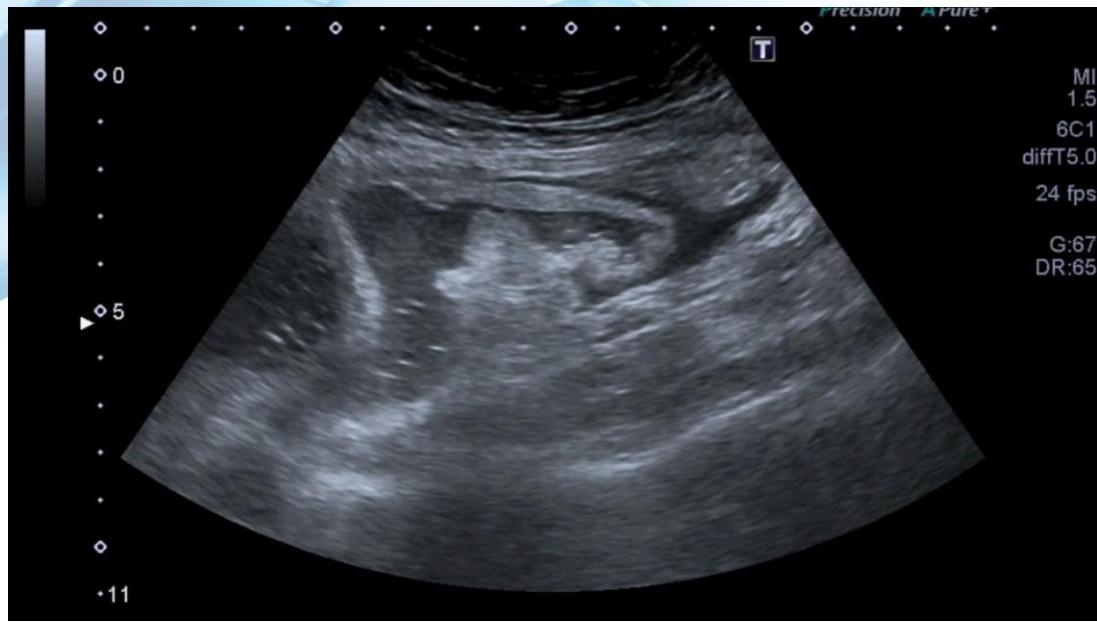
18. Ultrasound can assess lymph nodes and mesenteric tissue. LoE 4, GoR B, 4, Strong consensus 10/10

Transmural Disease – Abscess and Fistulae









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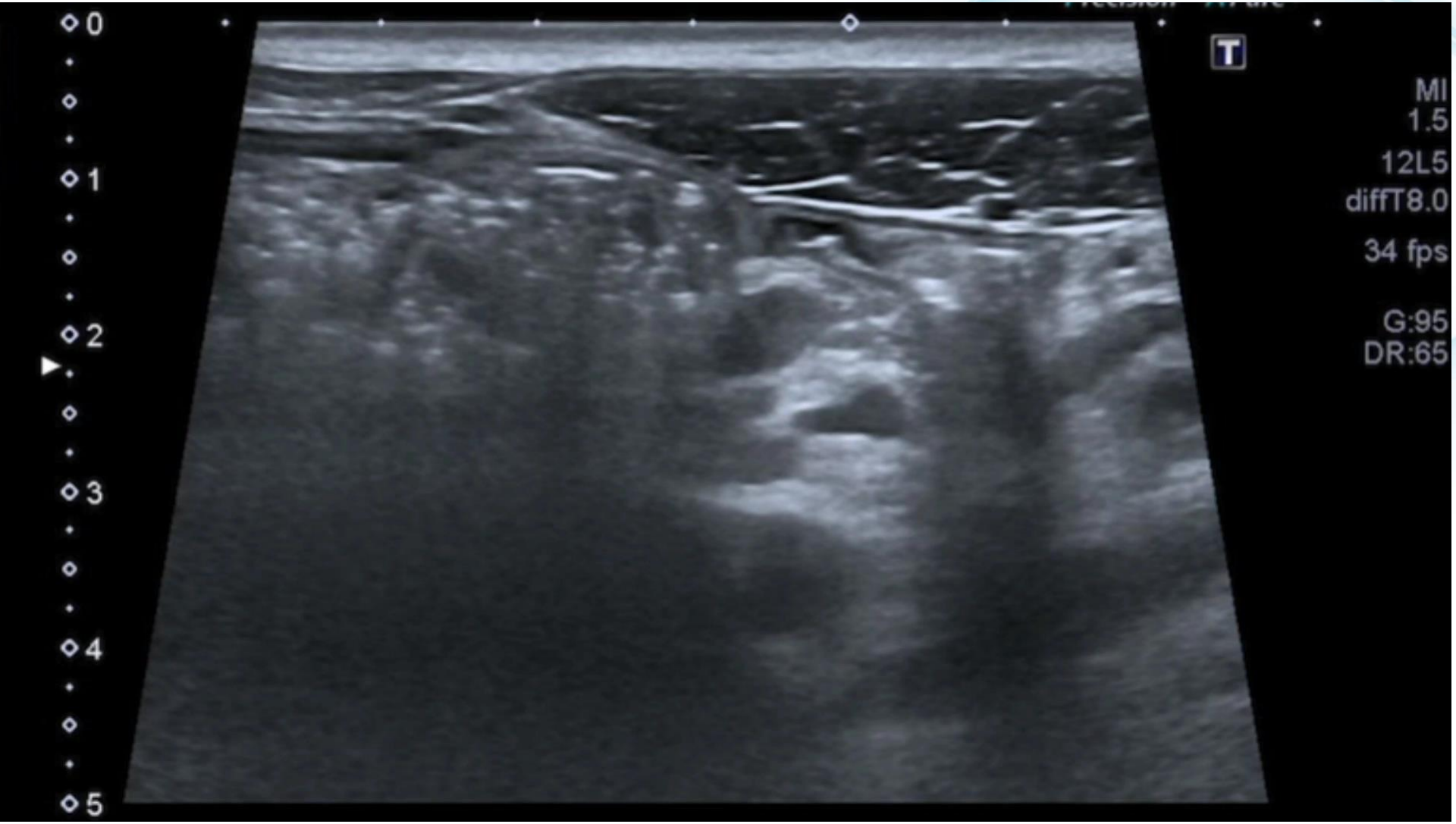
7. Interesting Cases

Case Example

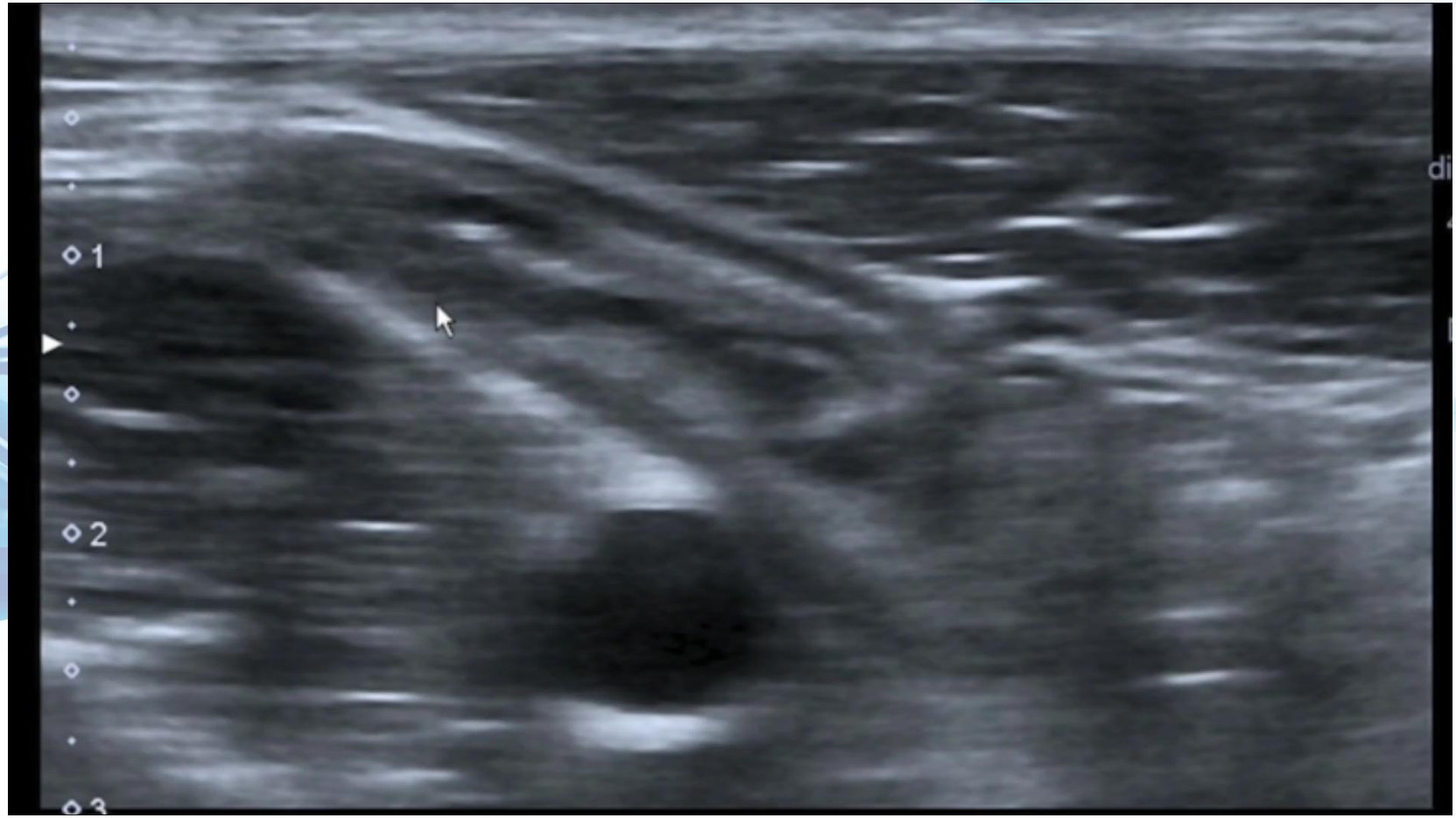
- 23 year old male
- Abdominal cramps
- Variable bowel habit
- Unable to maintain weight

- CRP rasied.
- ? IBD v IBS

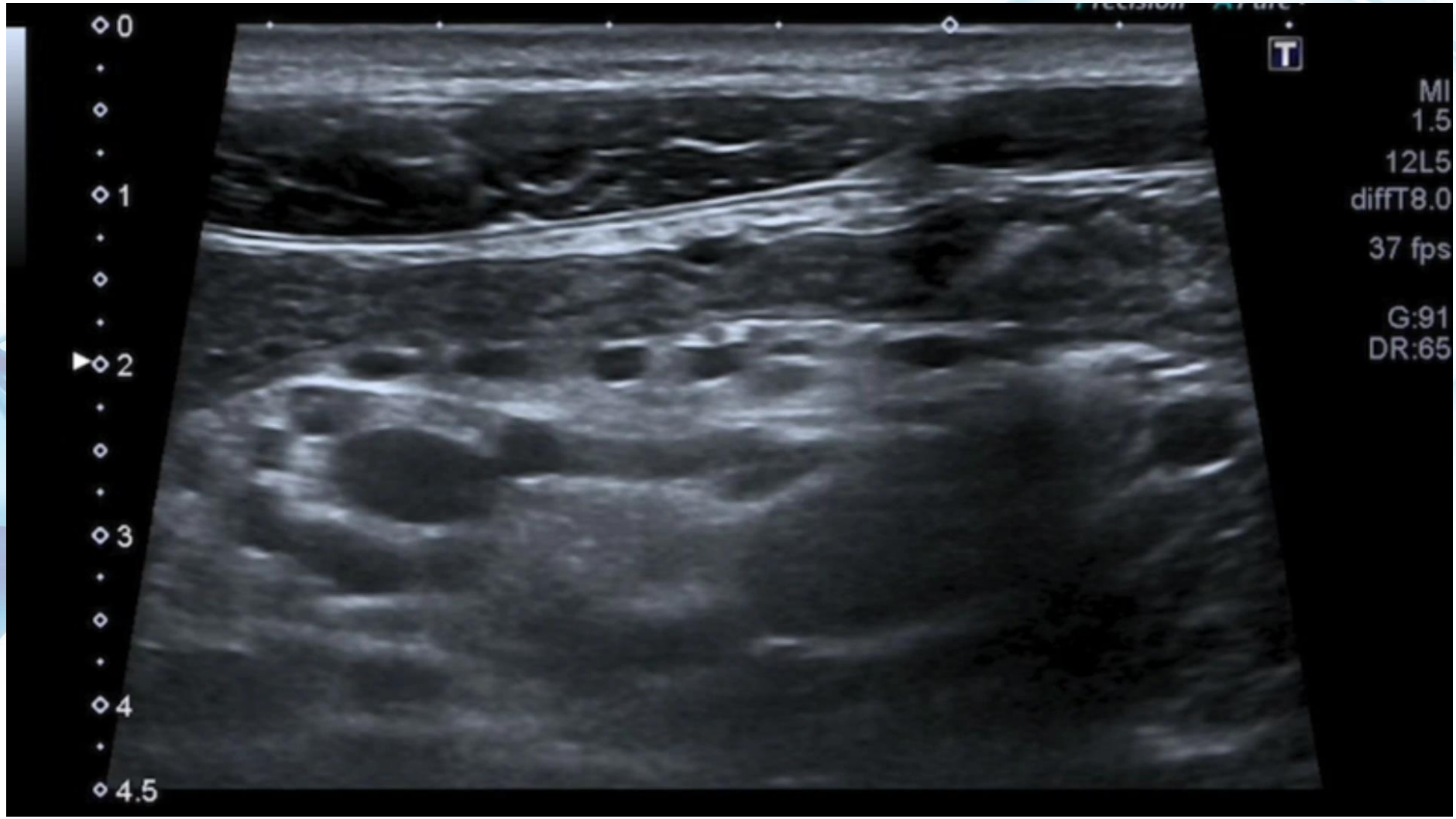
Ileocaecal region



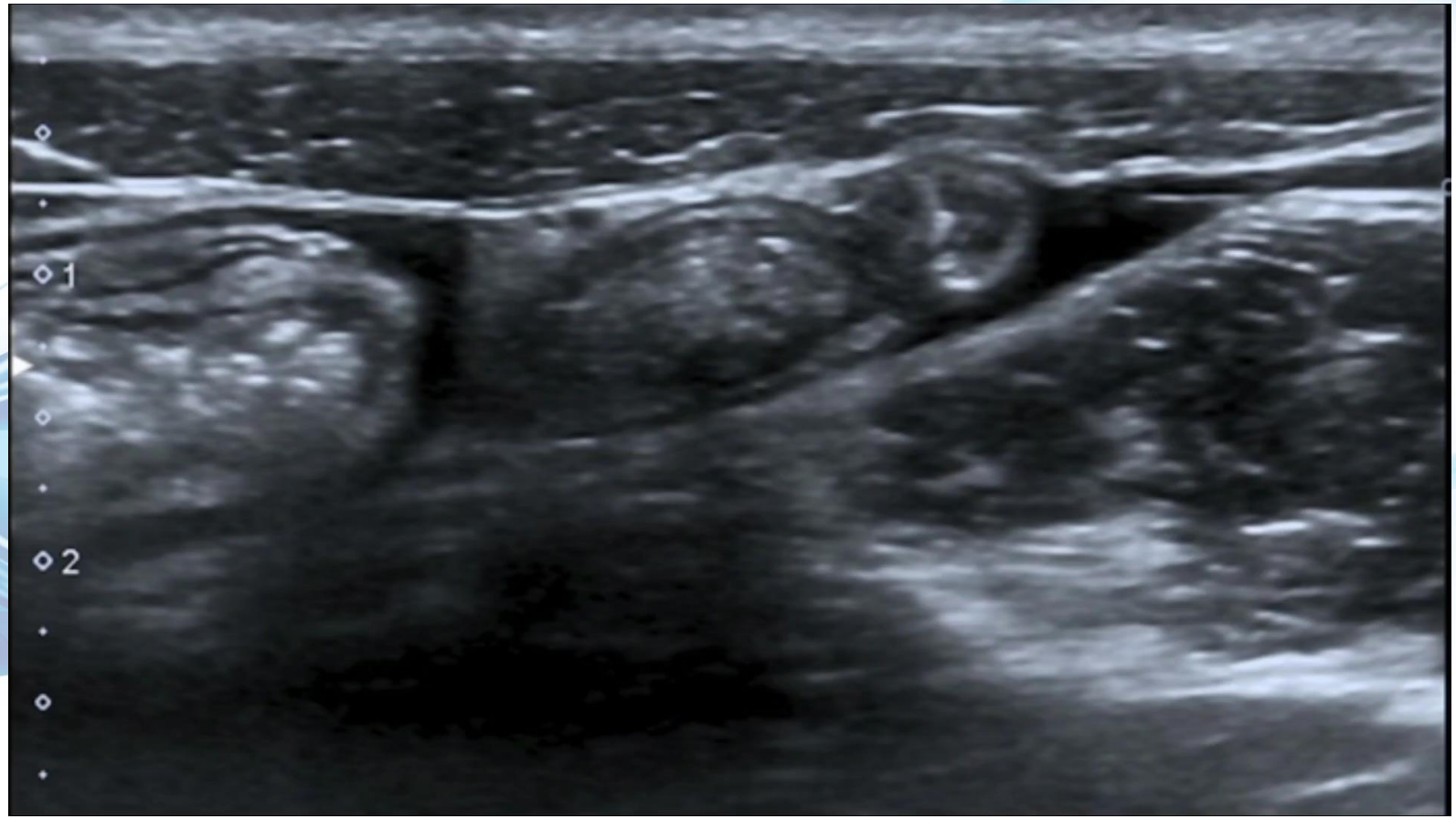
RIF - Illeum



LUQ – Jejunum (Subtle)



RIF - Appendix



Diagnosis

- Diffuse Crohns disease
  - Predominant mucosal disease
  - Skip lesions
  - Active inflammation
  - No disease complications
    - Obstruction
    - Abscess
    - Fistulae

Interesting Case

- 35 year old
- Known Crohns patient , well controlled
- Presents with acute right iliac fossa pain
- Fever, now peritonitic
- WCC and CRP rasied.

- Crohns flare ? – Abscess/ perforation??

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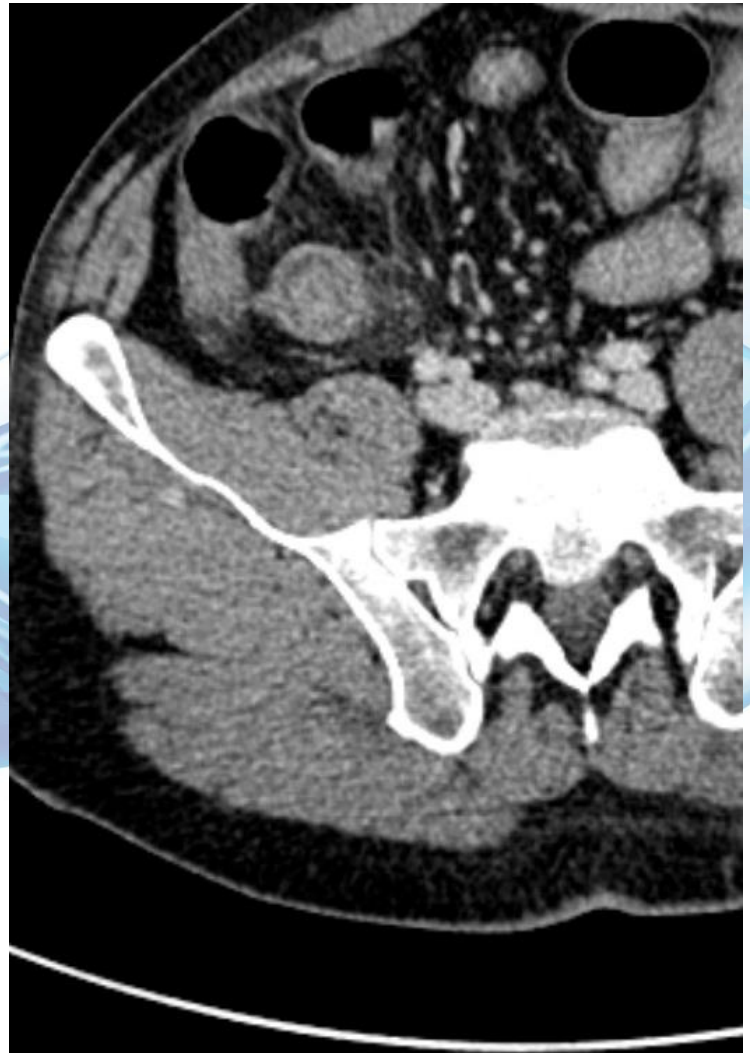
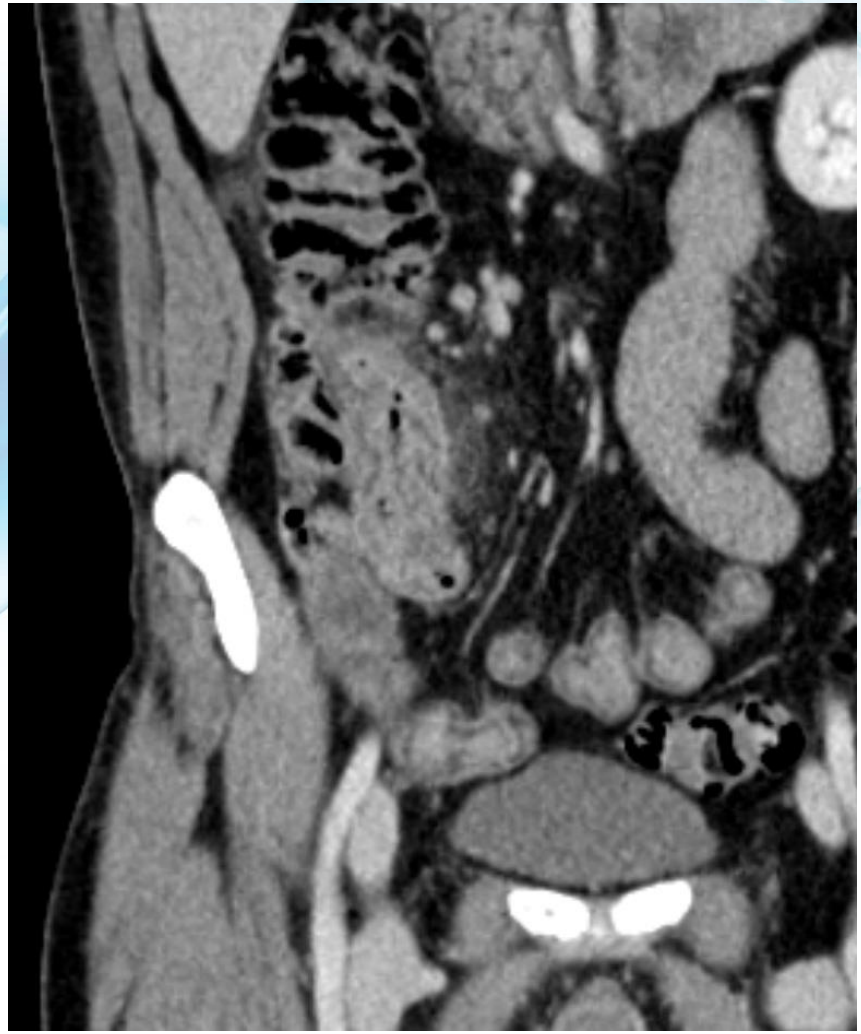
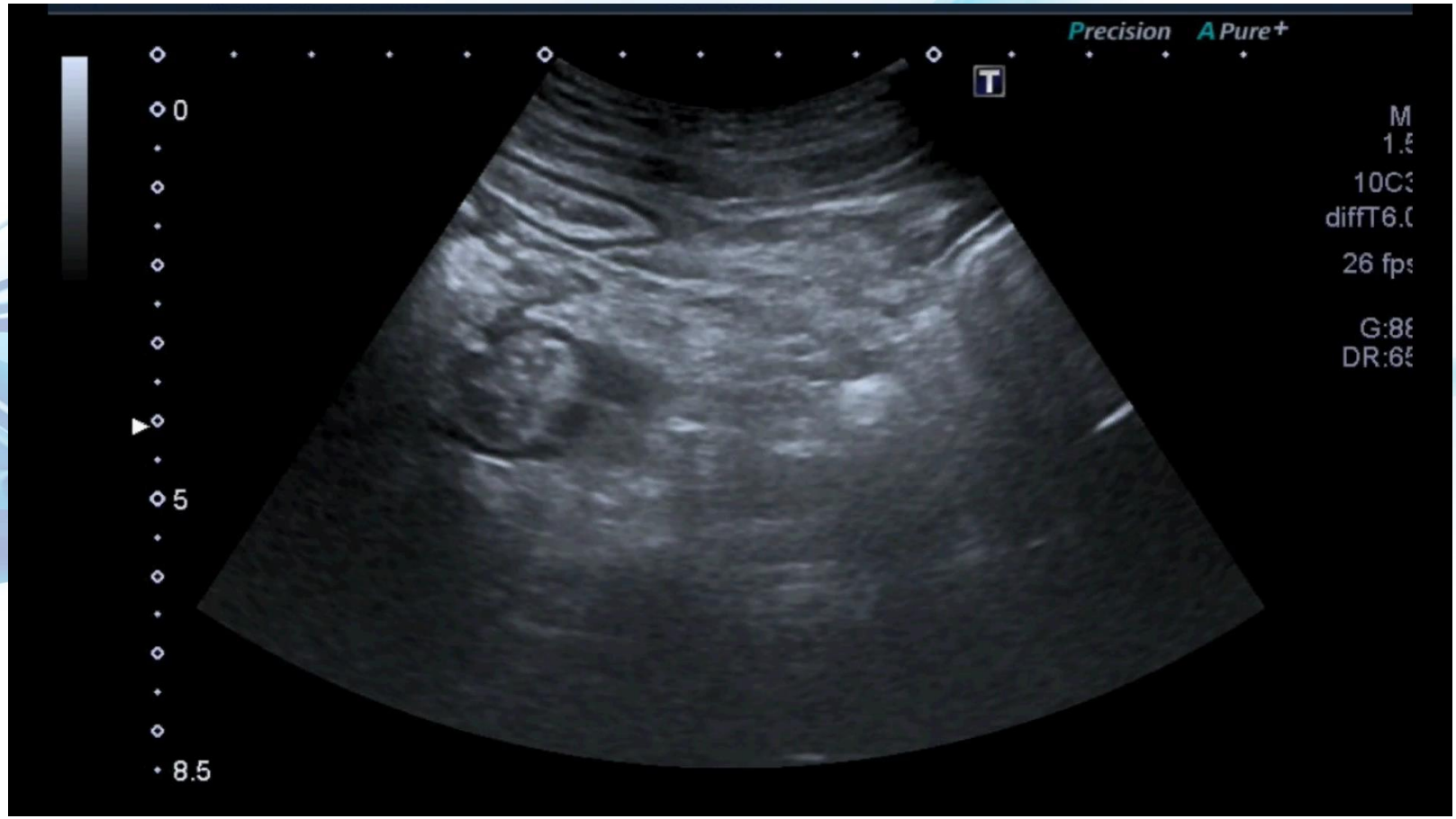
Crohns ??





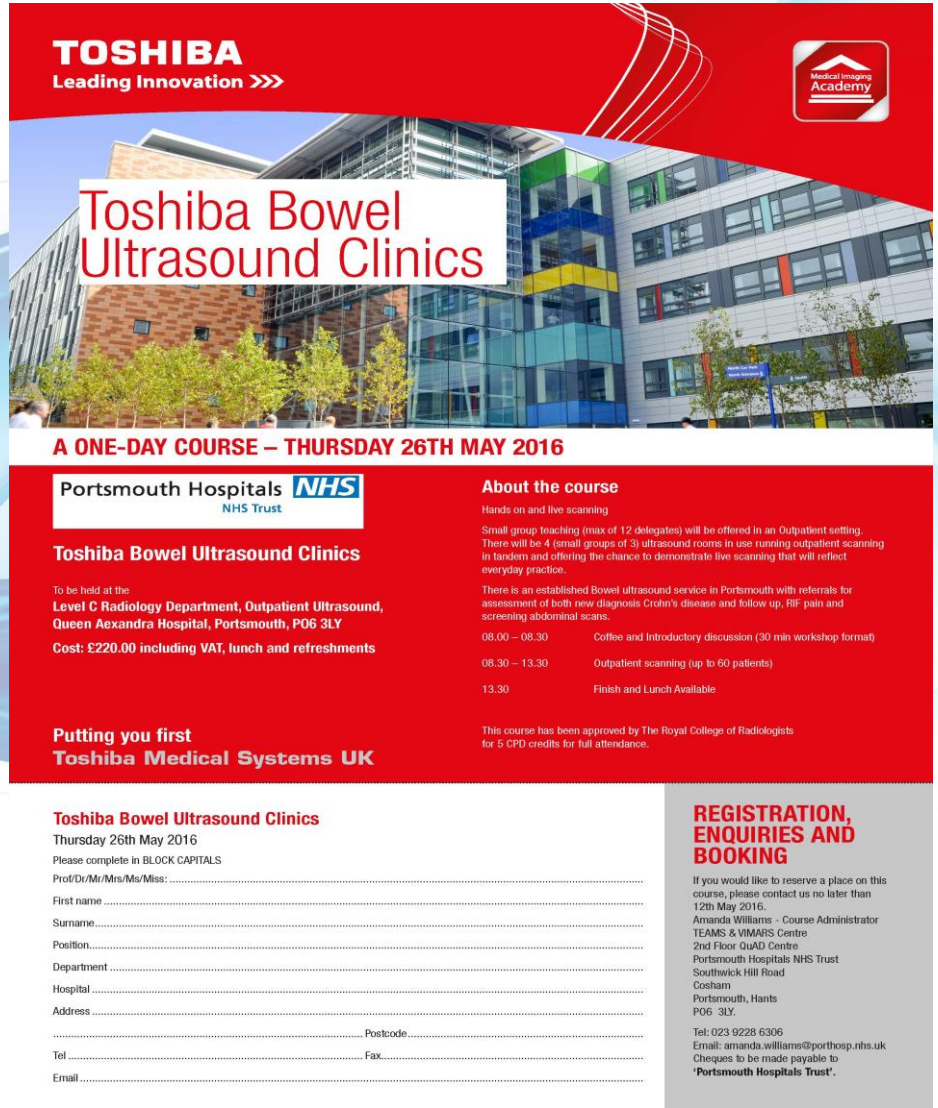
Ultrasound RIF



LATEX
LATEX

BMUS

Thankyou……..



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Medical Imaging Academy

Toshiba Bowel Ultrasound Clinics

A ONE-DAY COURSE – THURSDAY 26TH MAY 2016

Portsmouth Hospitals NHS
NHS Trust

Toshiba Bowel Ultrasound Clinics

To be held at the
Level C Radiology Department, Outpatient Ultrasound, Queen Aexandra Hospital, Portsmouth, PO6 3LY

Cost: £220.00 including VAT, lunch and refreshments

Putting you first
Toshiba Medical Systems UK

About the course

Hands on and live scanning

Small group teaching (max of 12 delegates) will be offered in an Outpatient setting. There will be 4 (small groups of 3) ultrasound rooms in use running outpatient scanning in tandem and offering the chance to demonstrate live scanning that will reflect everyday practice.

There is an established Bowel ultrasound service in Portsmouth with referrals for assessment of both new diagnosis Crohn's disease and follow up, RIF pain and screening abdominal scans.

08.00 – 08.30	Coffee and Introductory discussion (30 min workshop format)
08.30 – 13.30	Outpatient scanning (up to 60 patients)
13.30	Finish and Lunch Available

This course has been approved by The Royal College of Radiologists for 5 CPD credits for full attendance.

Toshiba Bowel Ultrasound Clinics
Thursday 26th May 2016

Please complete in BLOCK CAPITALS

Prof/Dr/Mr/Mrs/Ms/Miss: .....

First name .....

Surname .....

Position .....

Department .....

Hospital .....

Address .....

..... Postcode .....

Tel ..... Fax .....

Email .....

REGISTRATION, ENQUIRIES AND BOOKING

If you would like to reserve a place on this course, please contact us no later than 12th May 2016.
Amanda Williams - Course Administrator
TEAMS & VIMARS Centre
2nd Floor QuAD Centre
Portsmouth Hospitals NHS Trust
Southwick Hill Road
Cosham
Portsmouth, Hants
PO6 3LY.

Tel: 023 9228 6306
Email: amanda.williams@porthosp.nhs.uk
Cheques to be made payable to
'Portsmouth Hospitals Trust'.