

GI tracts

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先進與革新急症技術中心 / Advanced & Revolutionary Technology center



Core Applications (2023 ACEP Emergency Ultrasound Guidelines)
15項急診超音波核心應用

陳國智醫師

Aorta

DVT

Trauma

Thoracic/Airway

Cardia/HD assessment

Procedural Guidance

US-guided NB

Testicular

Ocular

Skin & Soft tissue

Hepatobiliary

Urinary tract

Pregnancy

Bowel

MSK

解剖

Anatomy

形態

Pattern

診斷

Diagnosis

HOLISTIC ULTRASOUND

Holistic medicine

Treatment that deal with the whole person,
not just the injury or disease

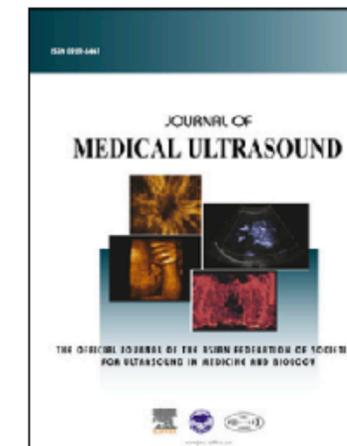


ELSEVIER

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EDUCATIONAL FORUM

Application of Gastrointestinal Tract Ultrasound in Emergency and Critical Medicine

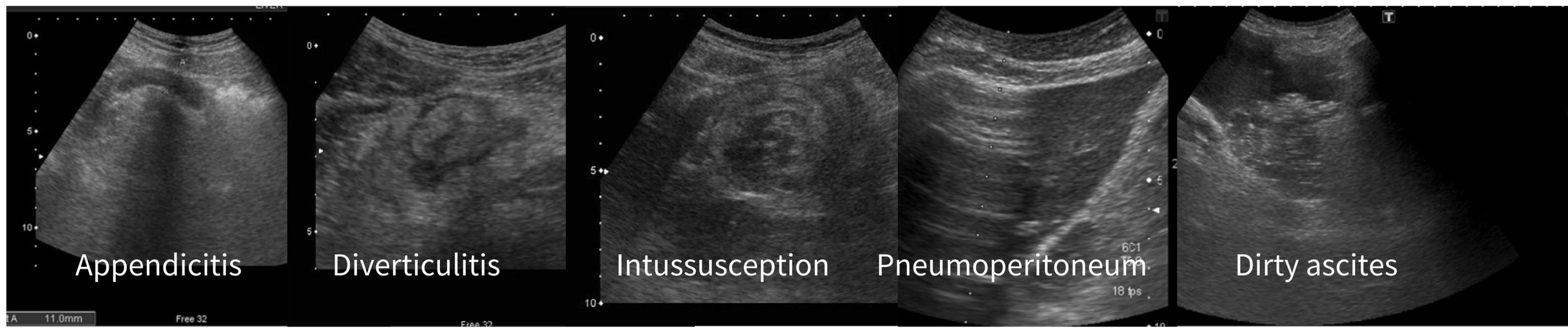
Layers: 5

Thickness: 5 mm

Size: 2.5 cm & 5 cm

Peristalsis

Jen-Tang Sun ¹, Wan-Ching Lien ², Hsiu-Po Wang ^{3*}



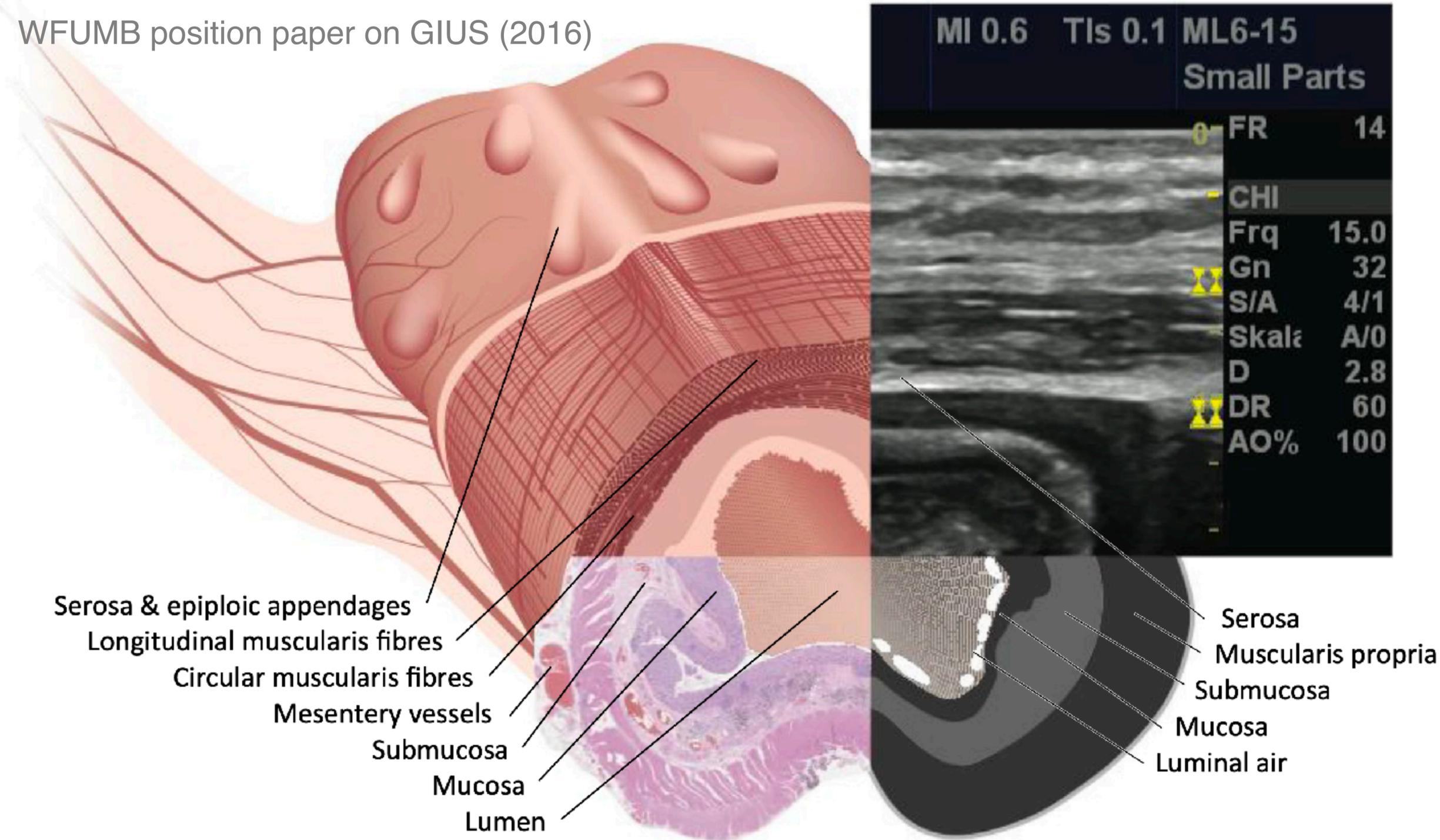
GI ULTRASOUND: PATHOLOGIC PATTERNS



1. **Diameter** distended (3cm & 5cm)
2. **Unable to compress** during examination
3. **Wall thickening** (>5mm/1cm for stomach)
4. **Wall stratification** disappeared
5. **Luminal content** decreased at lesion sites
6. **Peristalsis** decreased
7. **Associated findings** (LN, Fat, ascites, abscess)

SONOANATOMY OF BOWEL WALL LAYERS

WFUMB position paper on GIUS (2016)



Serosa & epiploic appendages
 Longitudinal muscularis fibres
 Circular muscularis fibres
 Mesentery vessels
 Submucosa
 Mucosa
 Lumen

Serosa
 Muscularis propria
 Submucosa
 Mucosa
 Luminal air

MI 0.6	TIs 0.1	ML6-15
Small Parts		
FR	14	
CHI		
Frq	15.0	
Gn	32	
S/A	4/1	
Skala	A/0	
D	2.8	
DR	60	
AO%	100	

5 LAYERS

>5 mm (wall thickening)

White – Serosa

Black – Muscularis propria

White – Submucosa

Black – Mucularis mucosa

White – Mucosa/lumen interface

POCUSAcademy©ChenKC

Liver



Precision

Head

Liver

Leg

longitudinal scan at subxyphoid area

Cranial - Longitudinal axis - Caudal

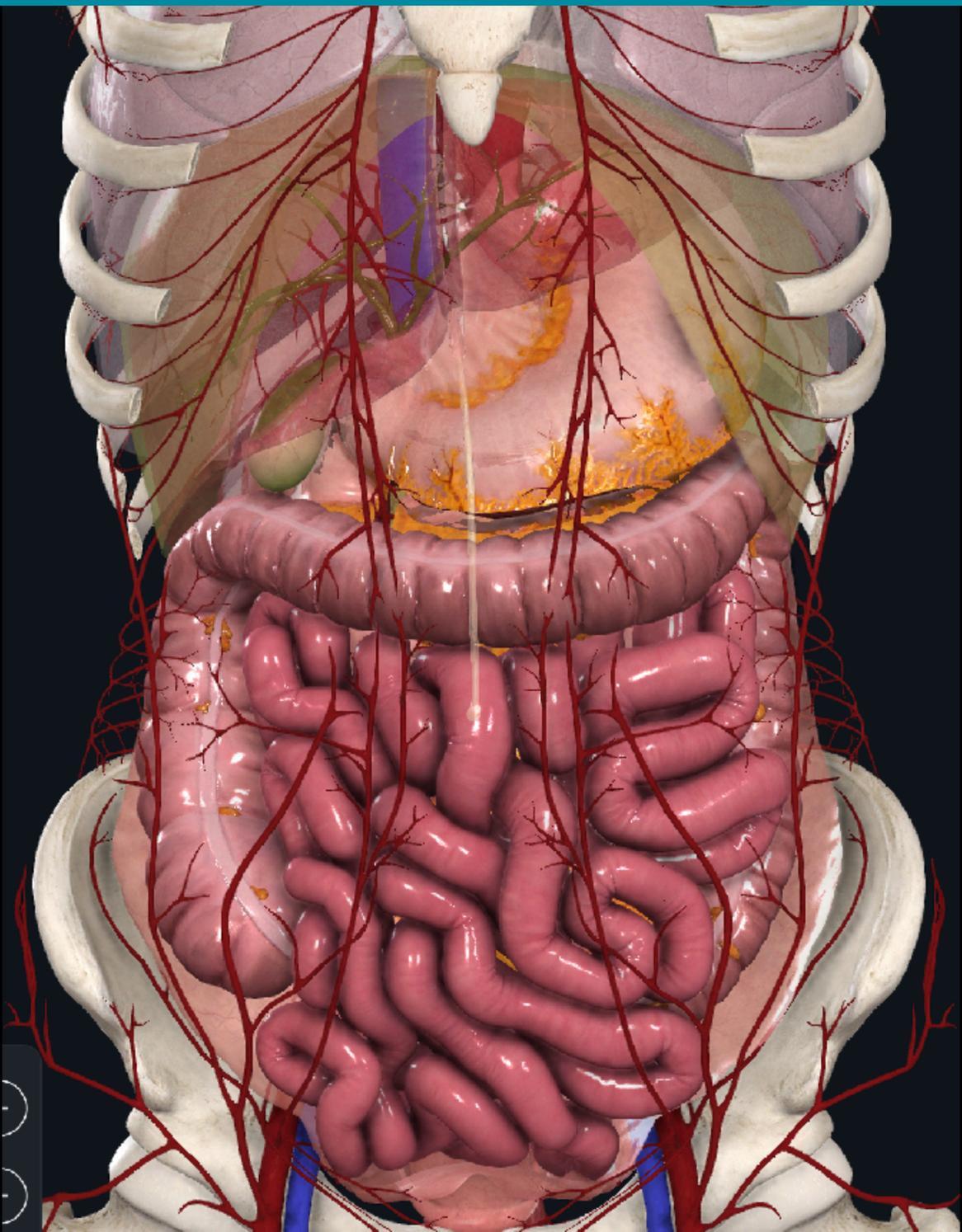
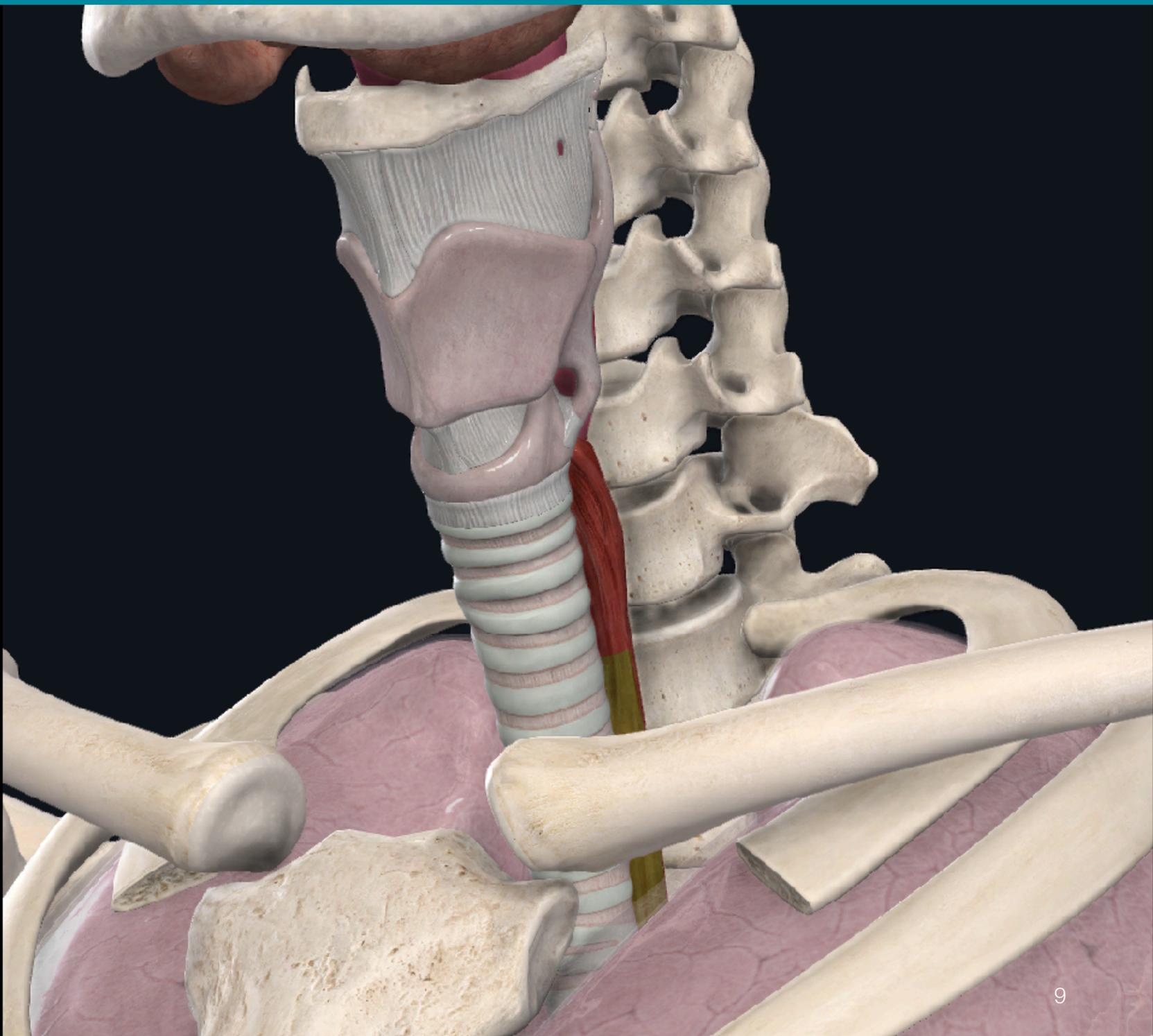


External landmarks

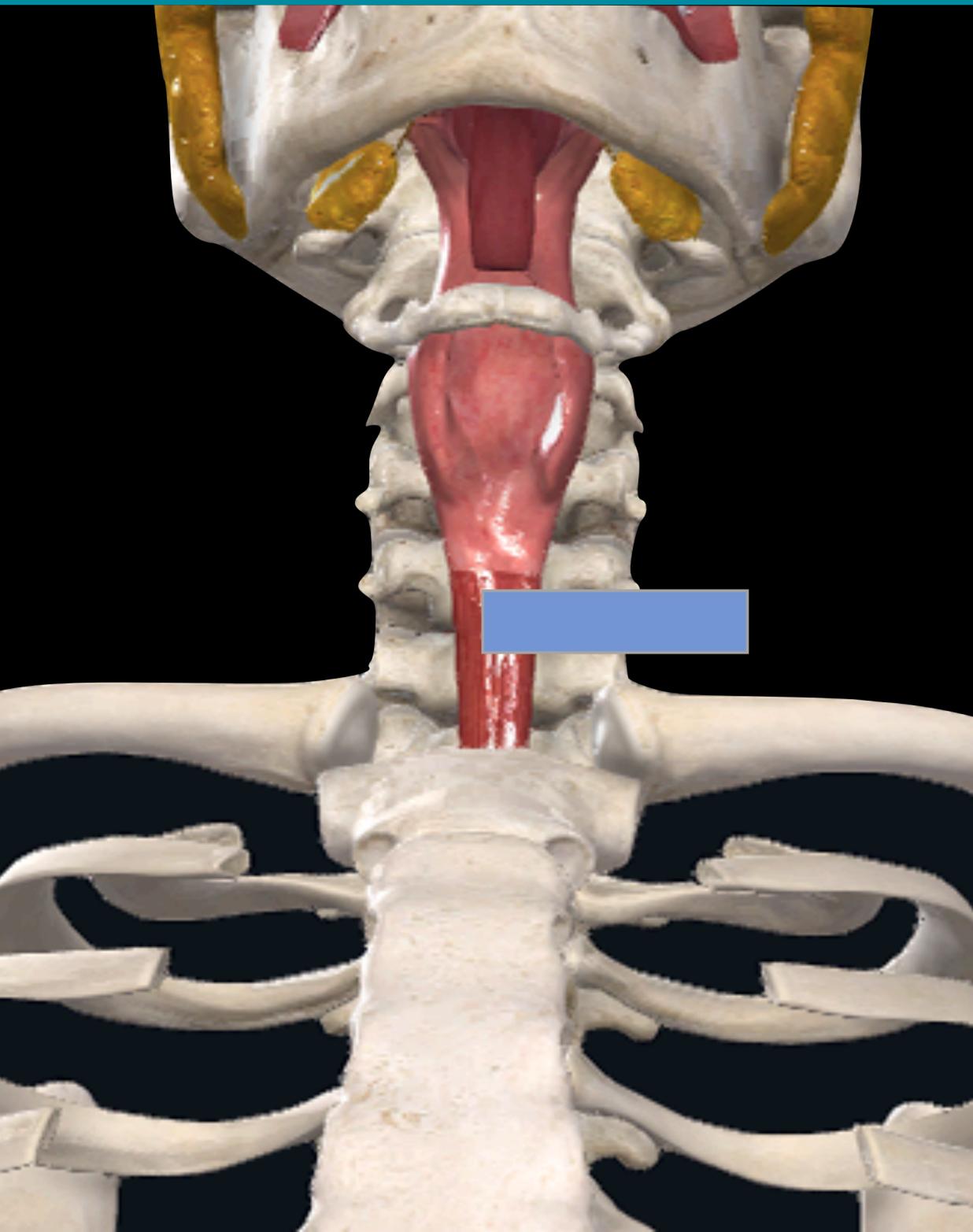
Find GI tracts
Recognize sonoanatomy

Fixed parts first

GI TRACTS



CERVICAL ESOPHAGUS



Superficial
L12-3
46 Hz
3.5cm

2D
Gen
Gn 91
C 35
3/2/1

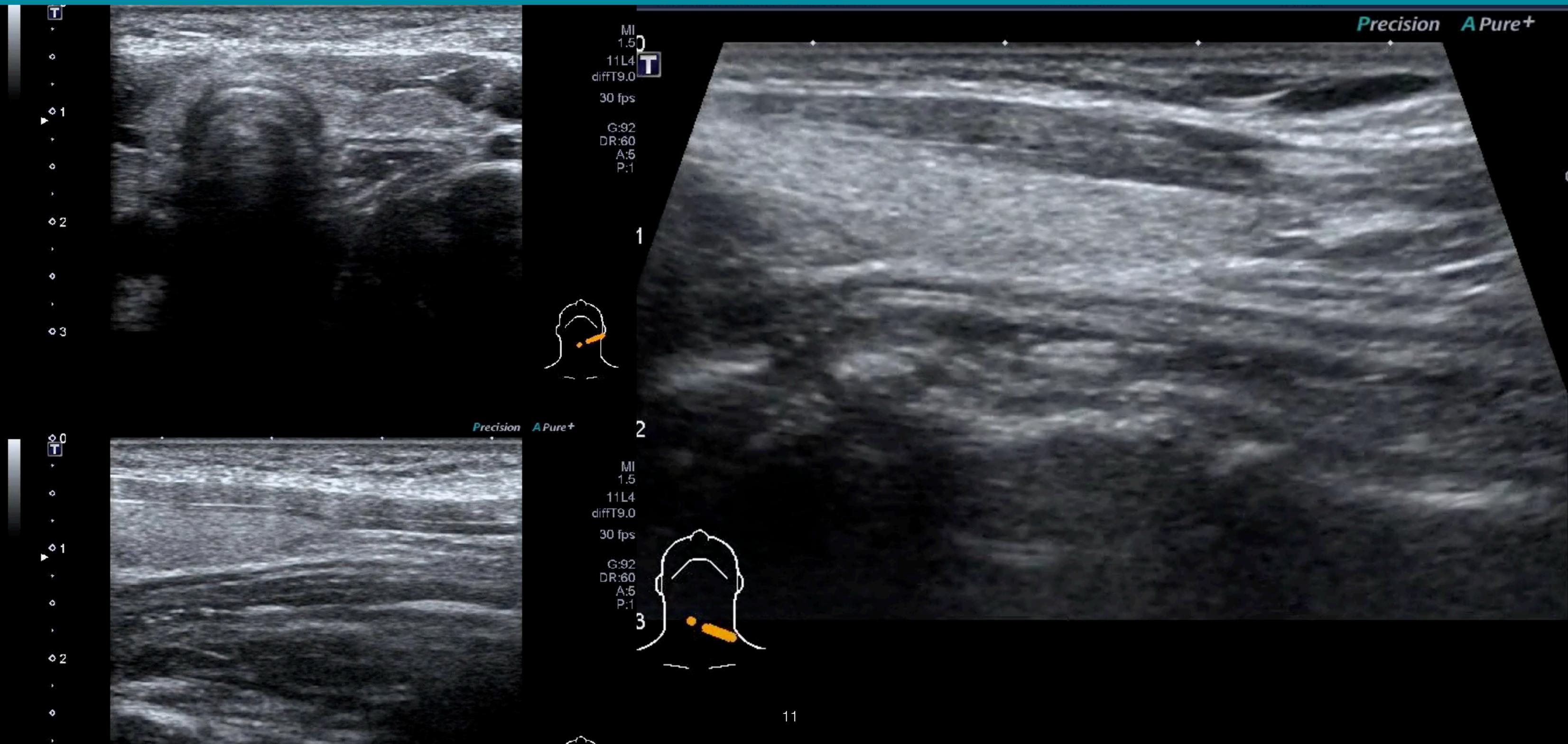
P



G
P R
3.0 12.0



CERVICAL ESOPHAGUS



T



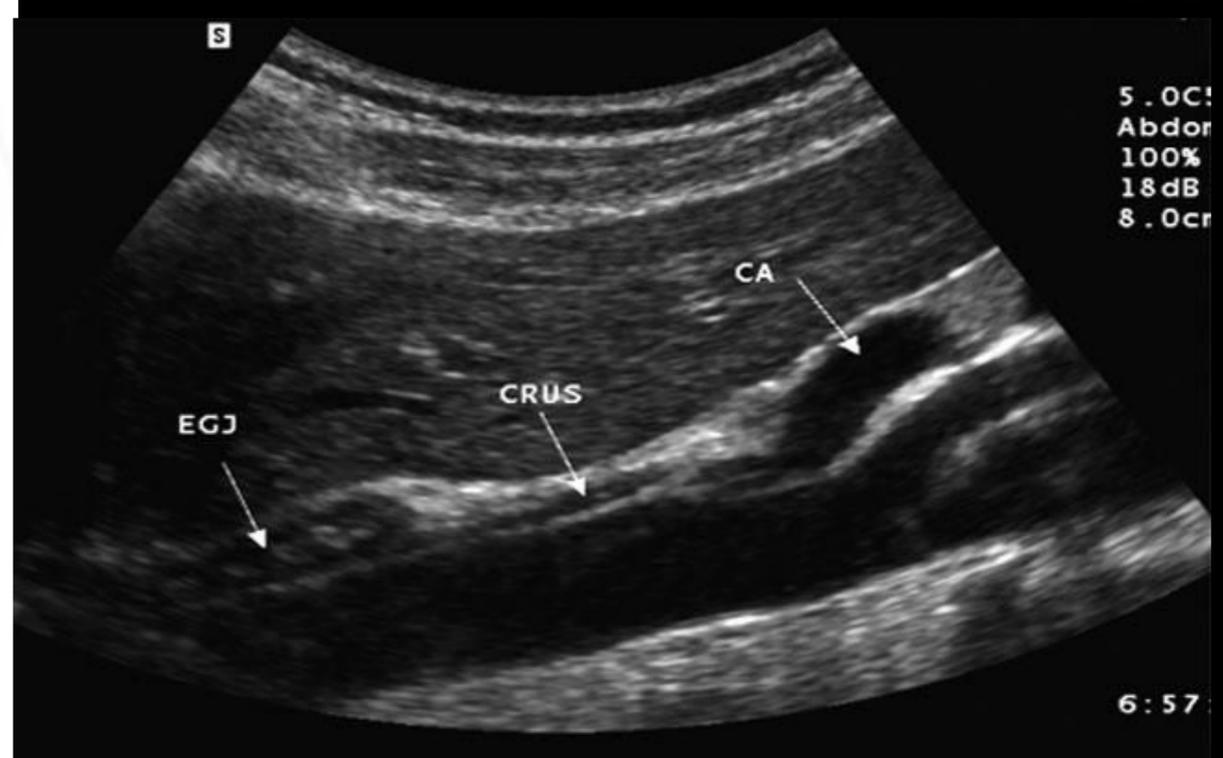
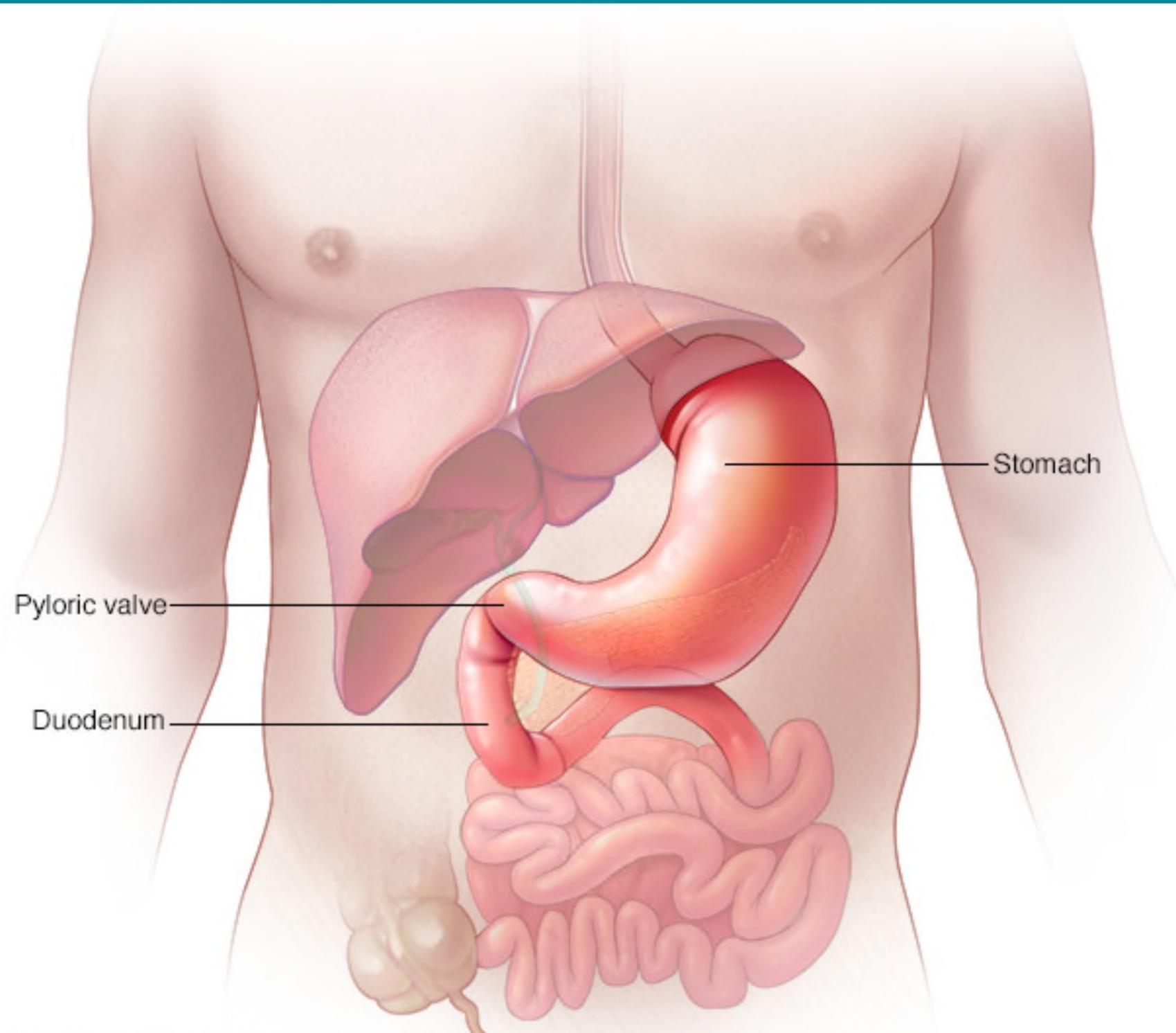
MI
1.5
11L4
diffT9.0
30 fps
Qscan
G:87
DR:60
A:5
P:1

0
1
2
3
4
5



ETT & NG confirmation

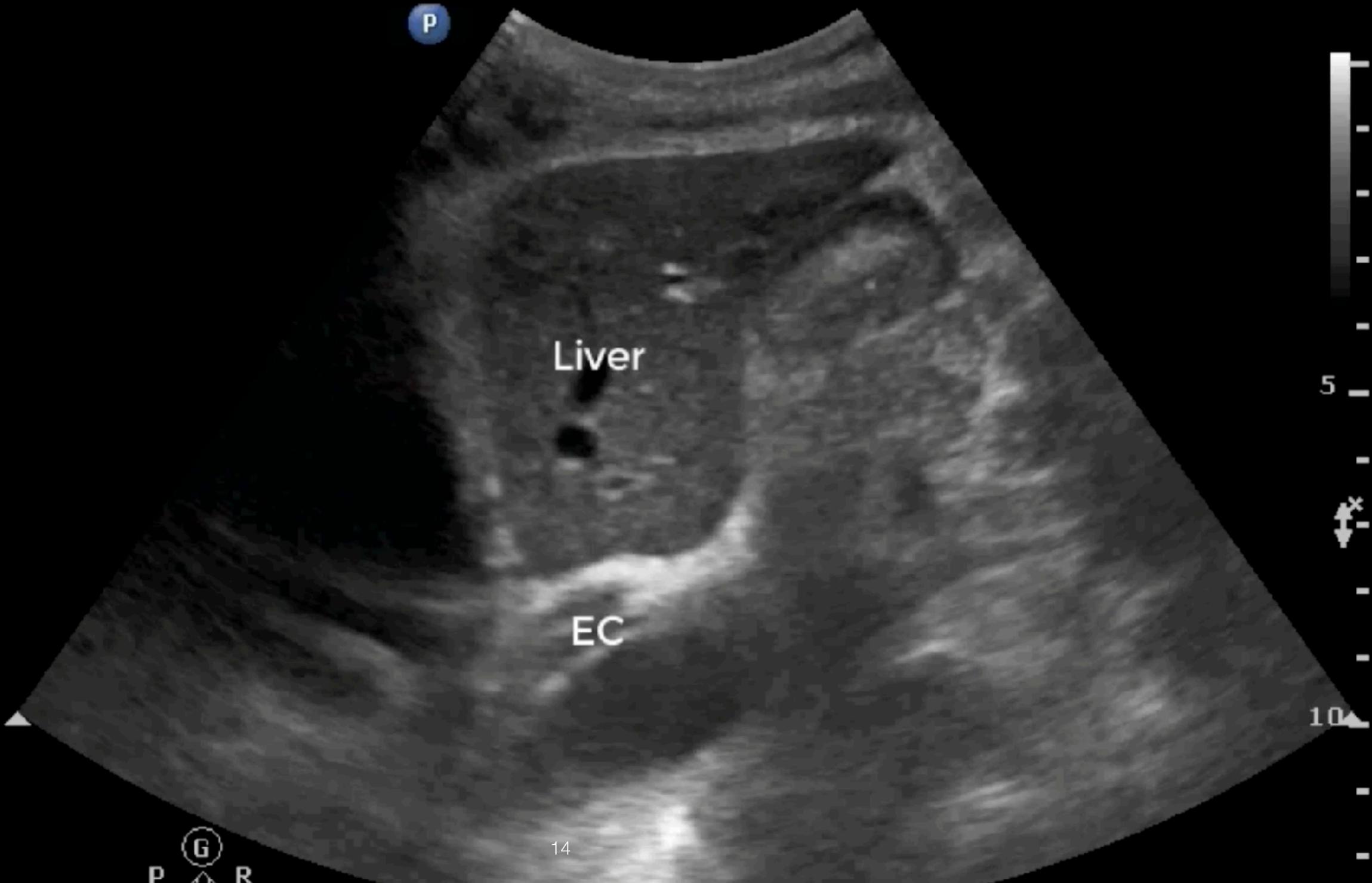
EC JUNCTION



EC JUNCTION

Abd Gen
C5-1
38 Hz
13.0cm

2D
HGen
Gn 76
C 56
3 / 3 / 3



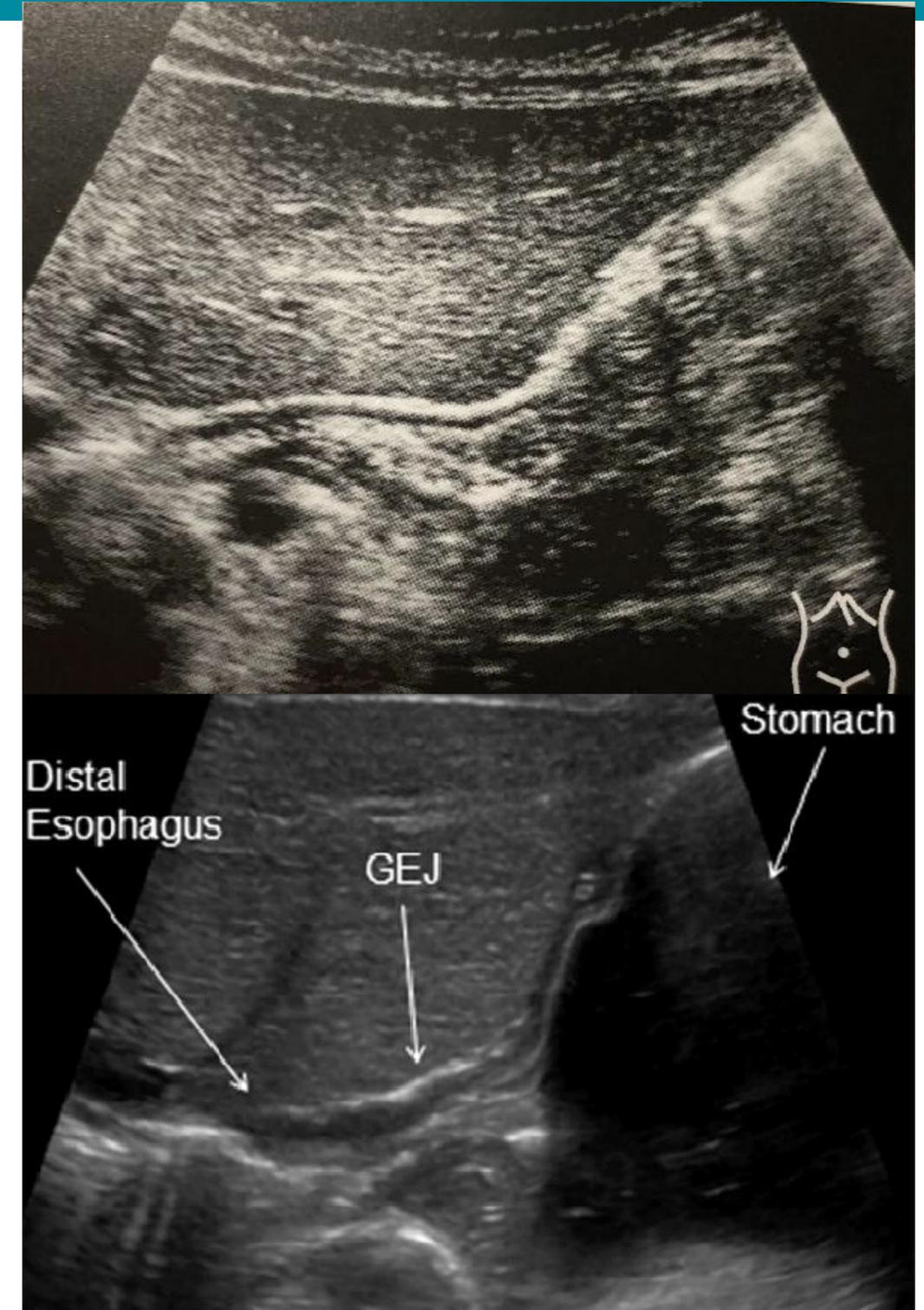
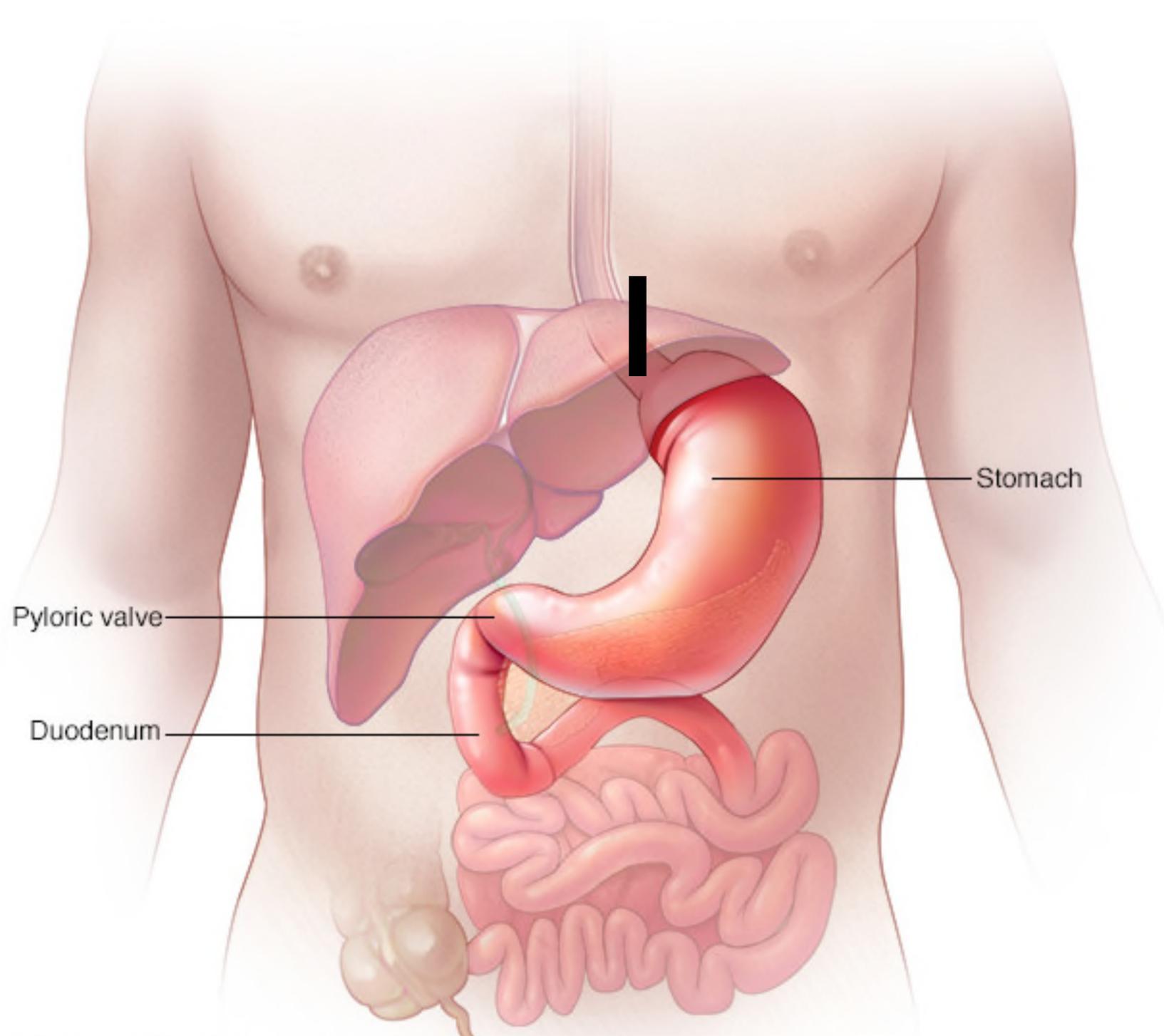
PNEUMOPERITONEUM LANDMARK

Abd Gen
C5-1
39 Hz
12.0cm

2D
HGen
Gn 100
C 56
3 / 3 / 3



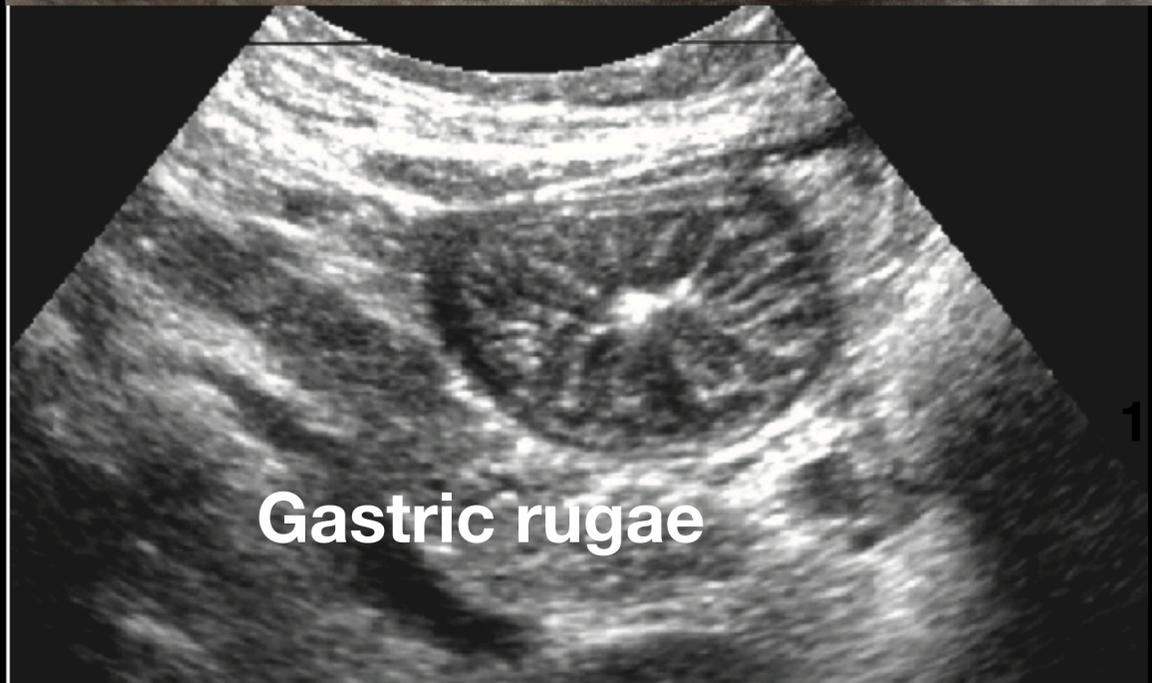
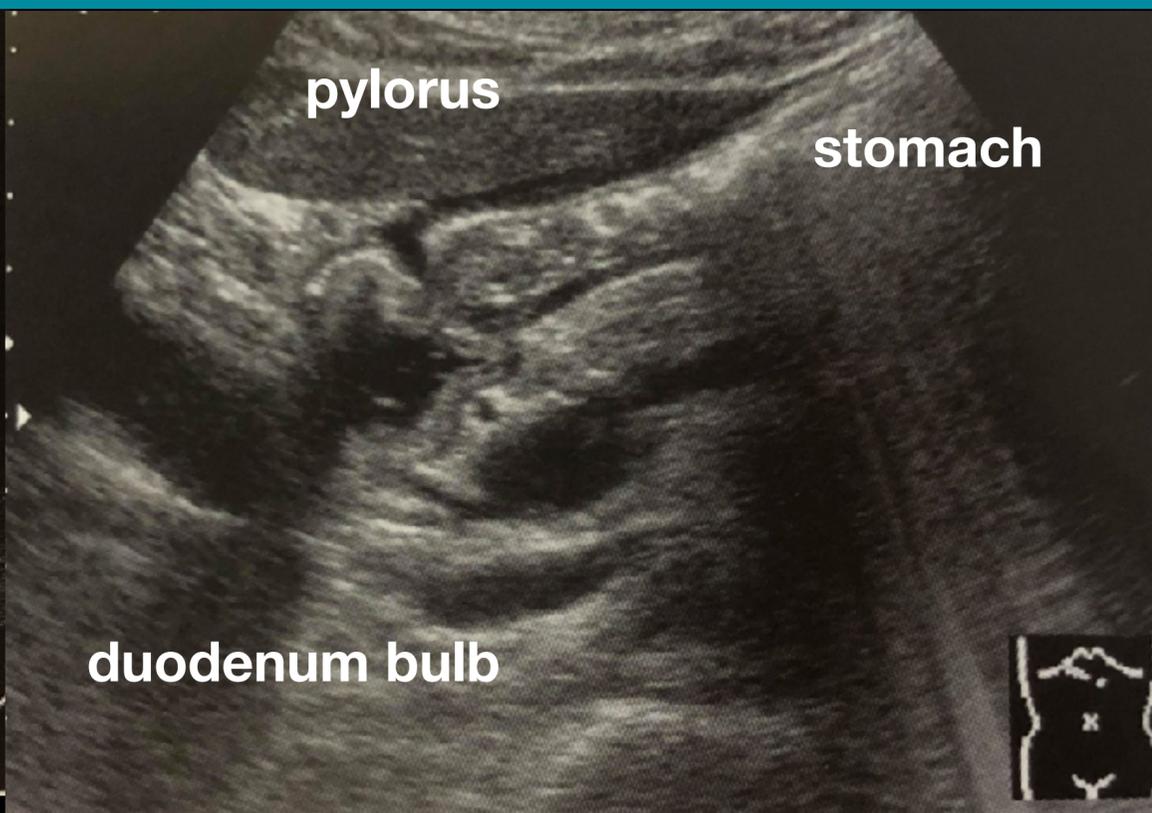
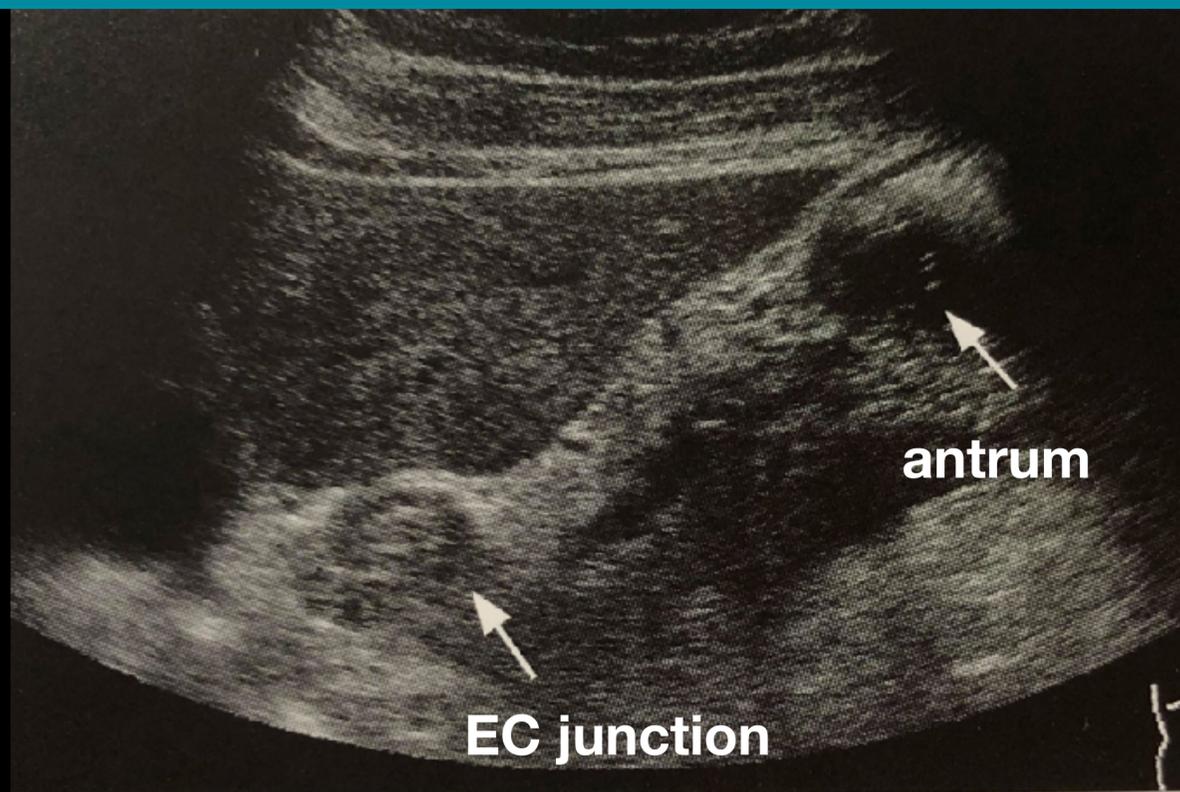
EC JUNCTION - STOMACH



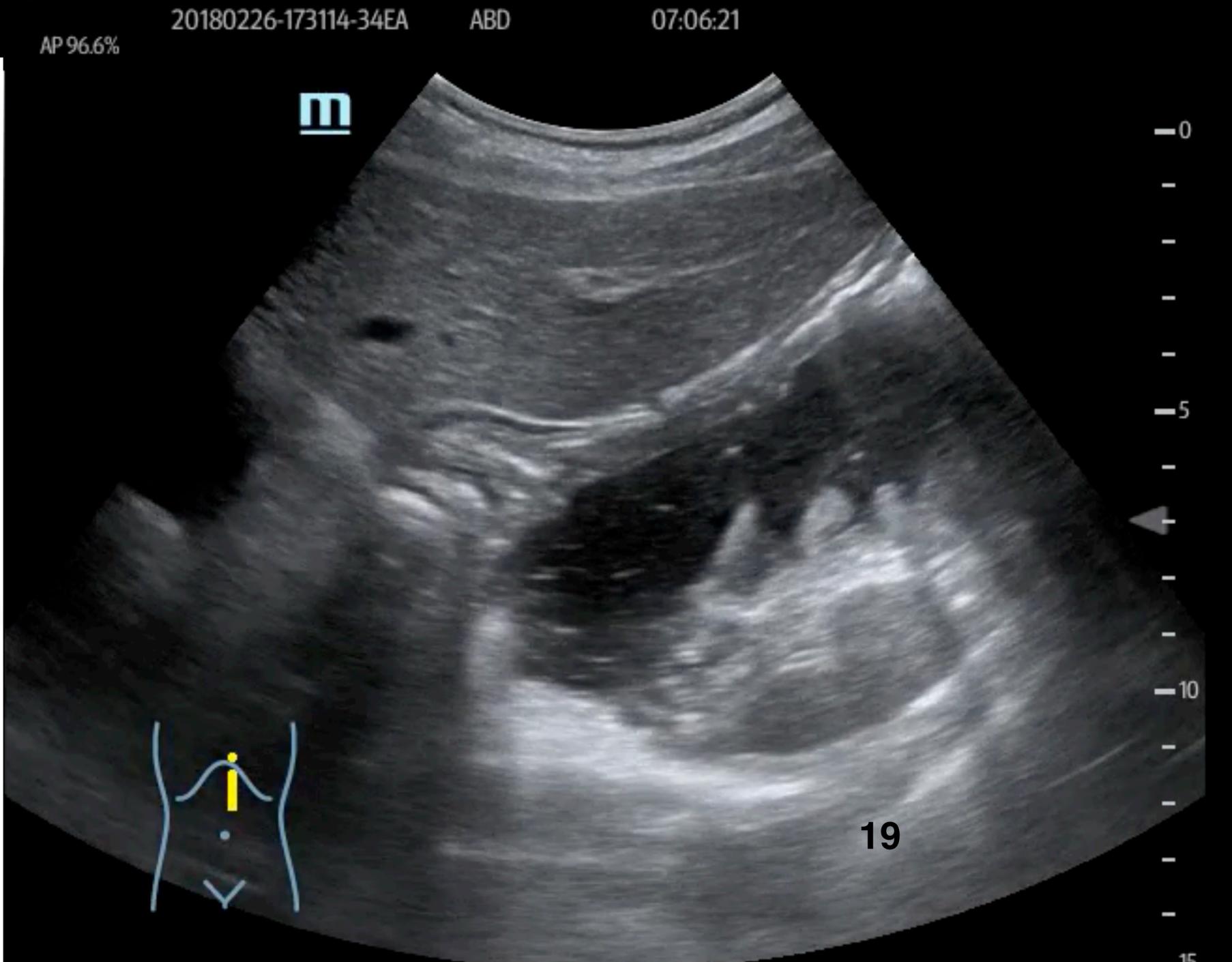
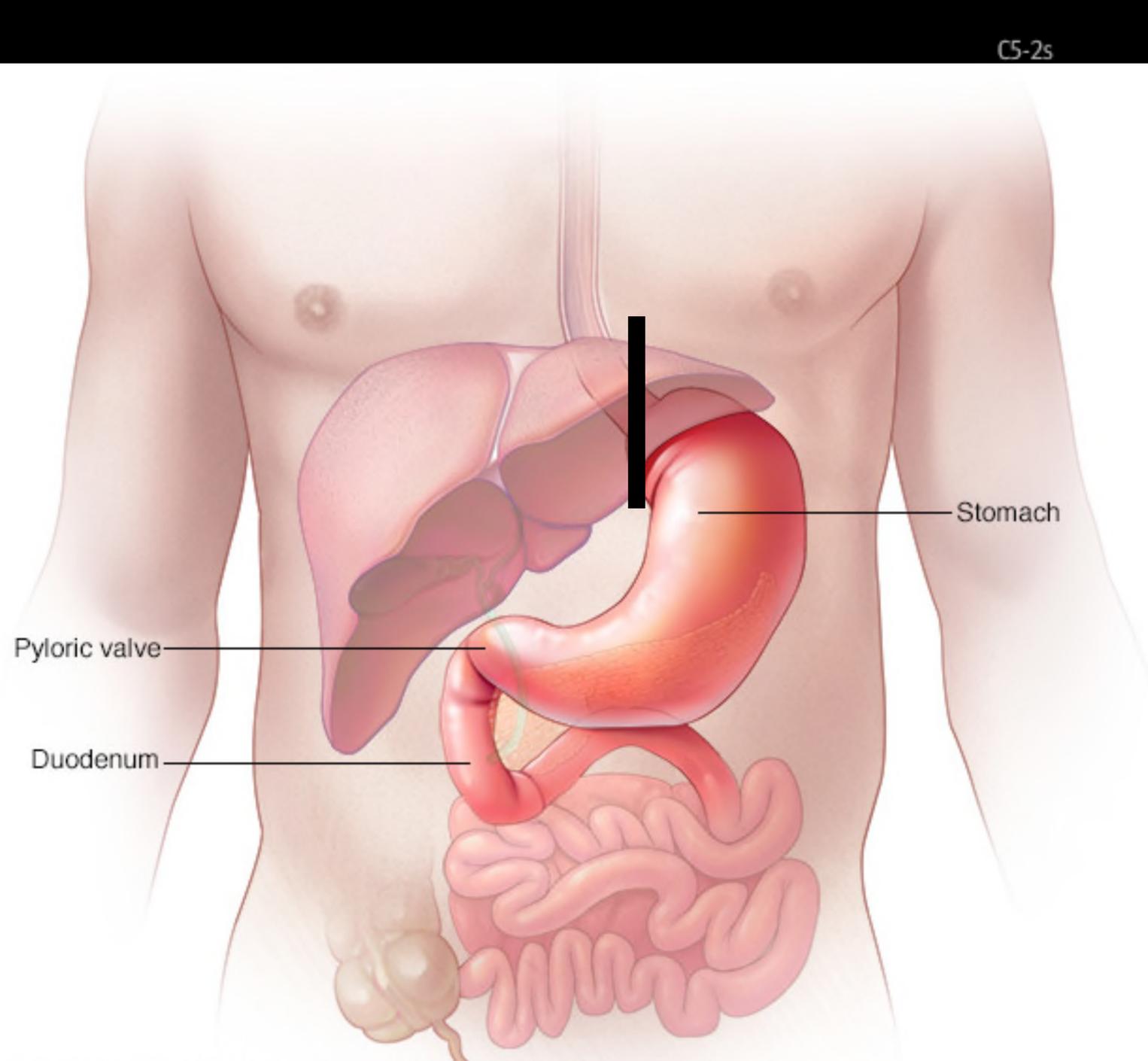
EC JUNCTION - STOMACH



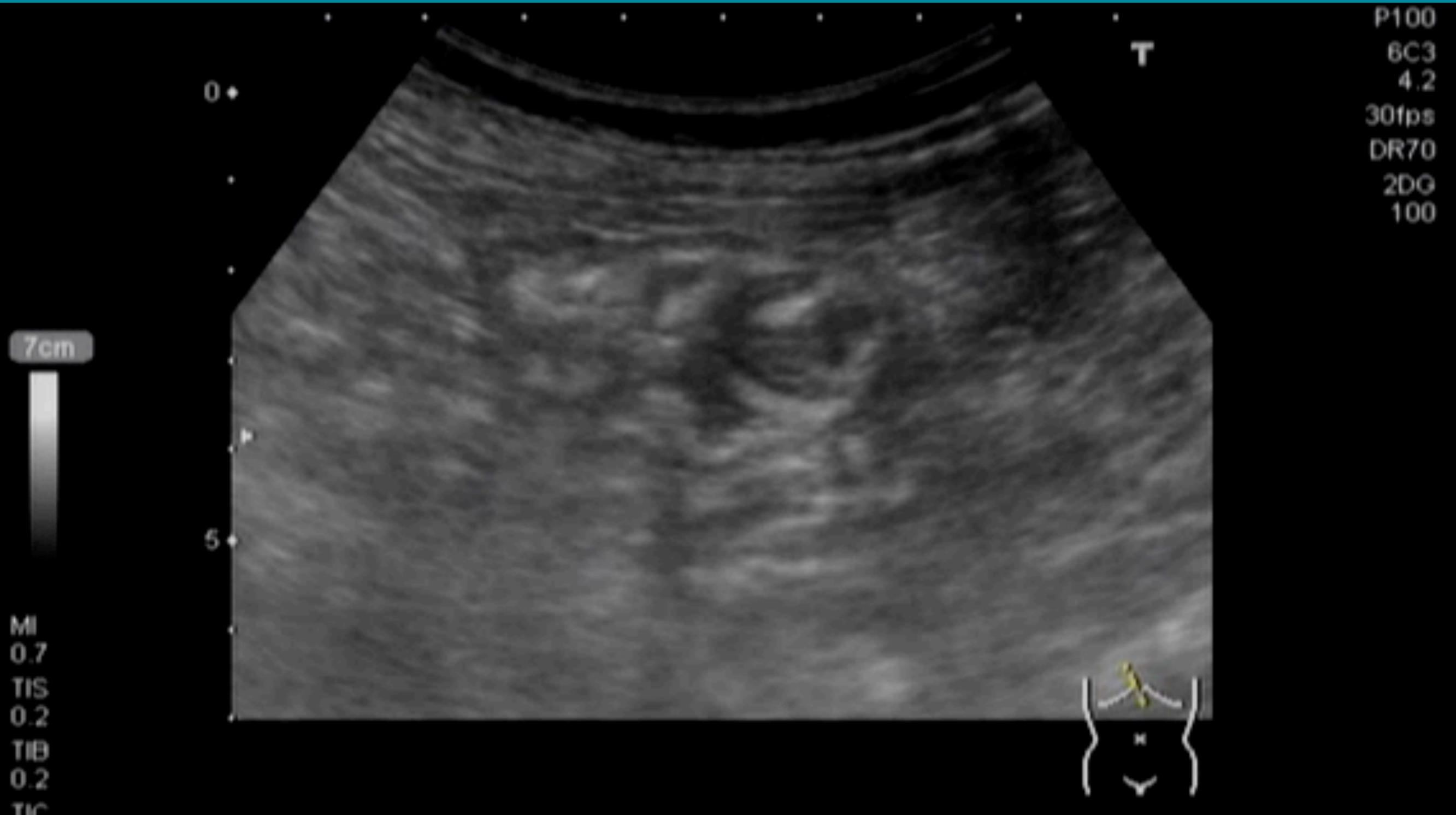
STOMACH



STOMACH



RUGAE



STOMACH-ANTRUM-DUODENUM



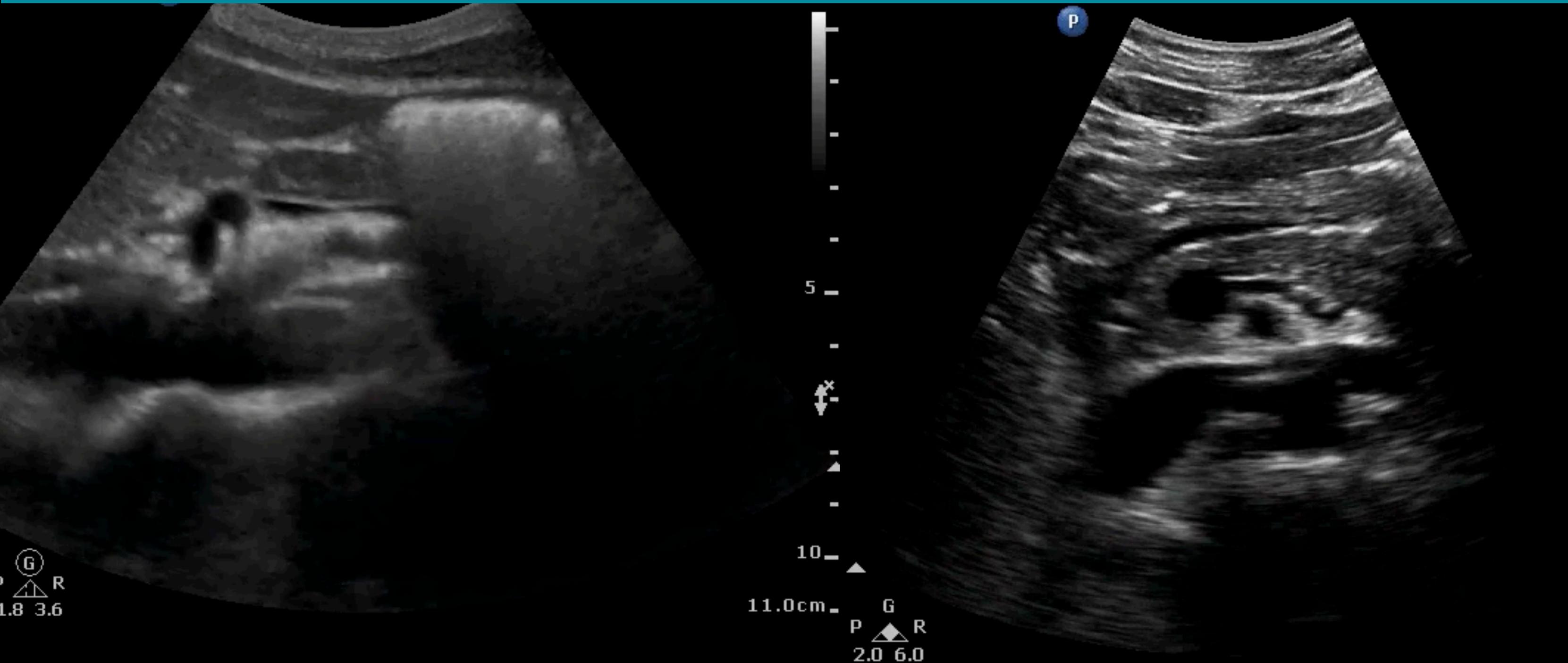
STOMACH

Abd Gen
C5-1
39 Hz
12.0cm

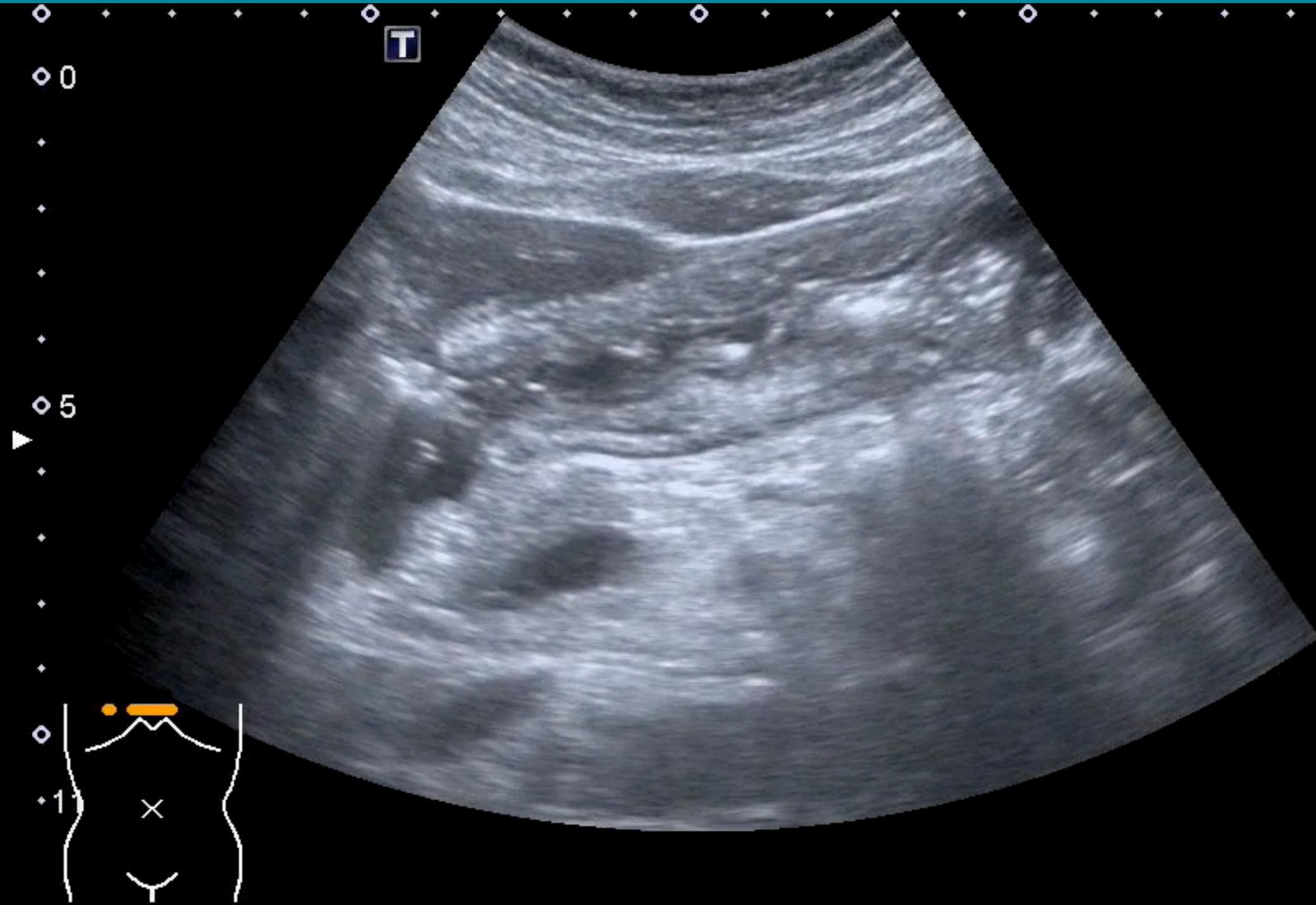
2D
HGen
Gn 100
C 56
3/3/3



ANTRUM



ANTRUM-DUODENUM

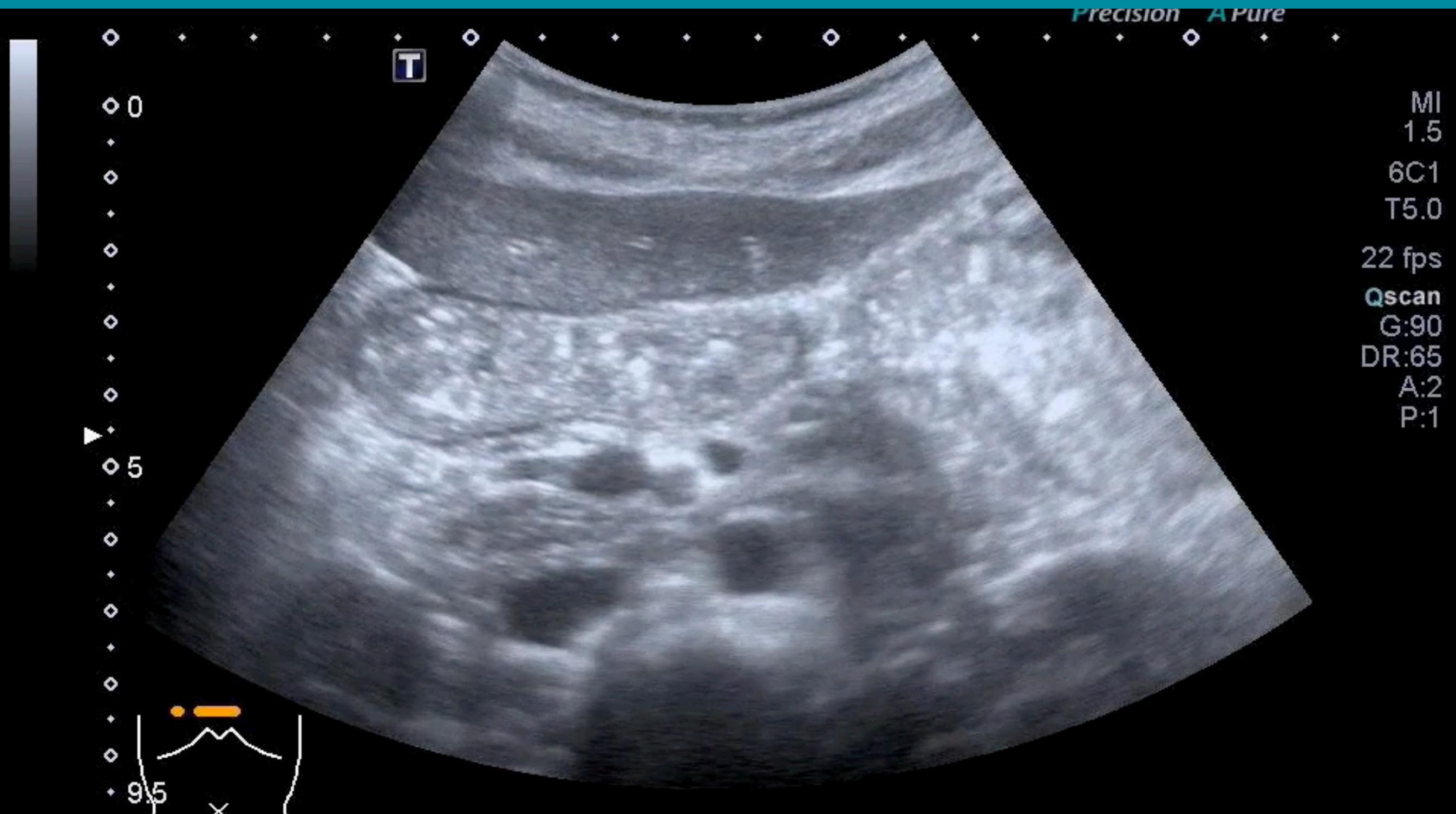


Precision A Pure
MI 1.5
BC1
T5.0
22 fps
G:85
DR:65
A:2
P:1

MI 1.5
BC1
T5.0
22 fps
G:85
DR:66
A:2
P:1

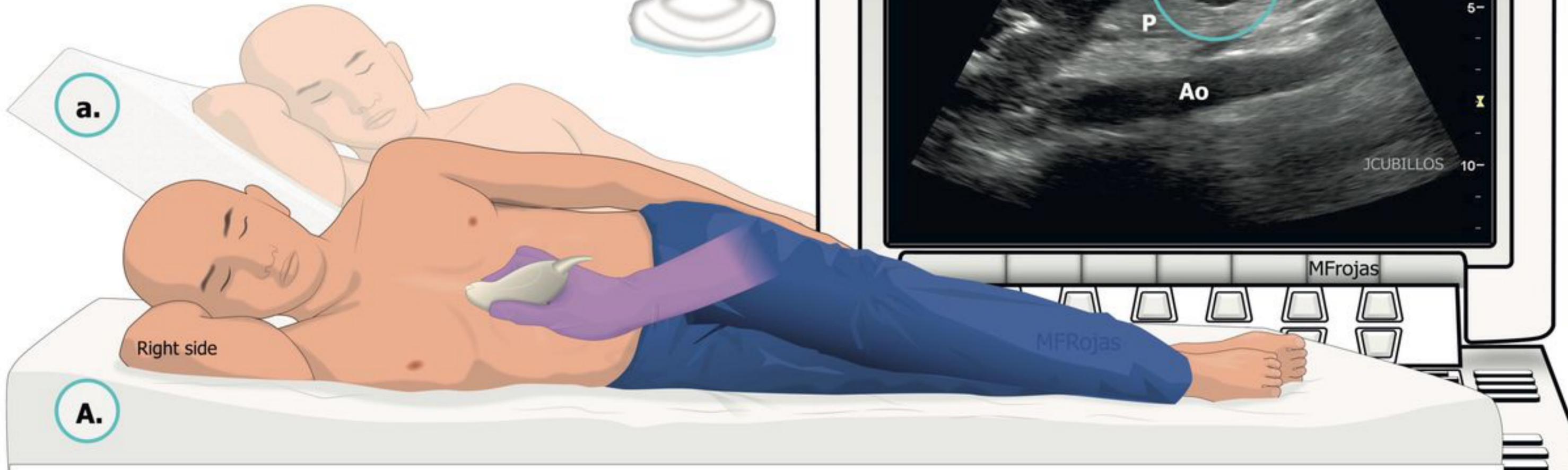


GASTRIC OUTLET OBSTRUCTION EVALUATION



GASTRIC ULTRASOUND

GASTRIC ULTRASOUND



a.

A.

E.

Right side

MFrojas

MFrojas

Cephalic

L

P

Ao

JCUBILLOS

5

10

GASTRIC ULTRASOUND

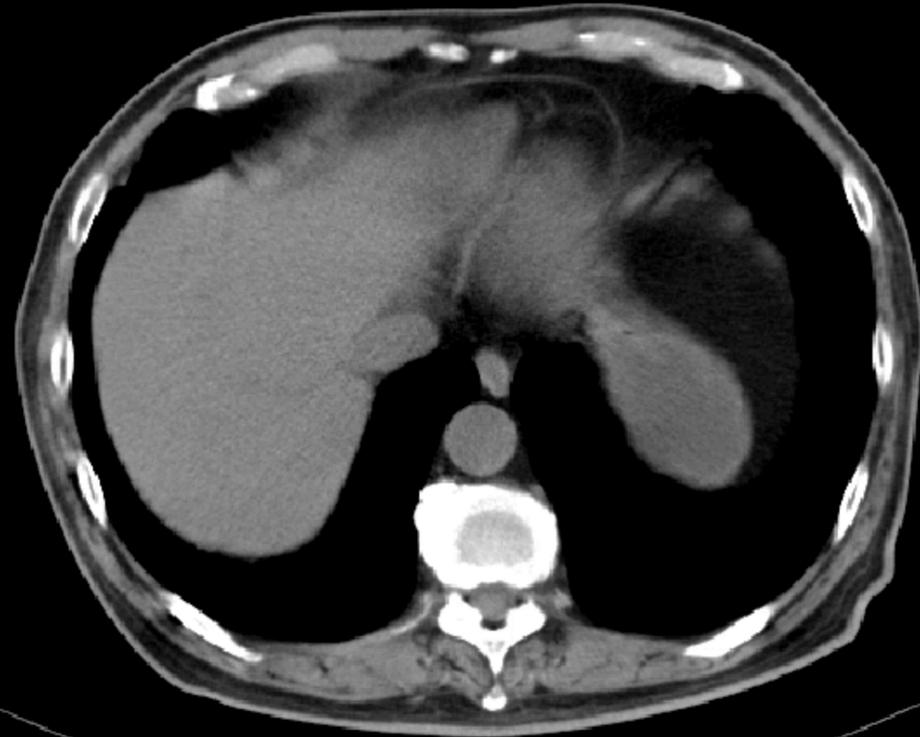
CEPHALAD

Table 1 Perlas gastric POCUS grading system to assess aspiration risk

Grade	Supine	Right lateral decubitus
0	Empty	Empty
1	Empty	Fluid
2	Fluid	Fluid
3	Thick fluid/solid content	Thick fluid/solid content

POCUS, point-of-care ultrasound.

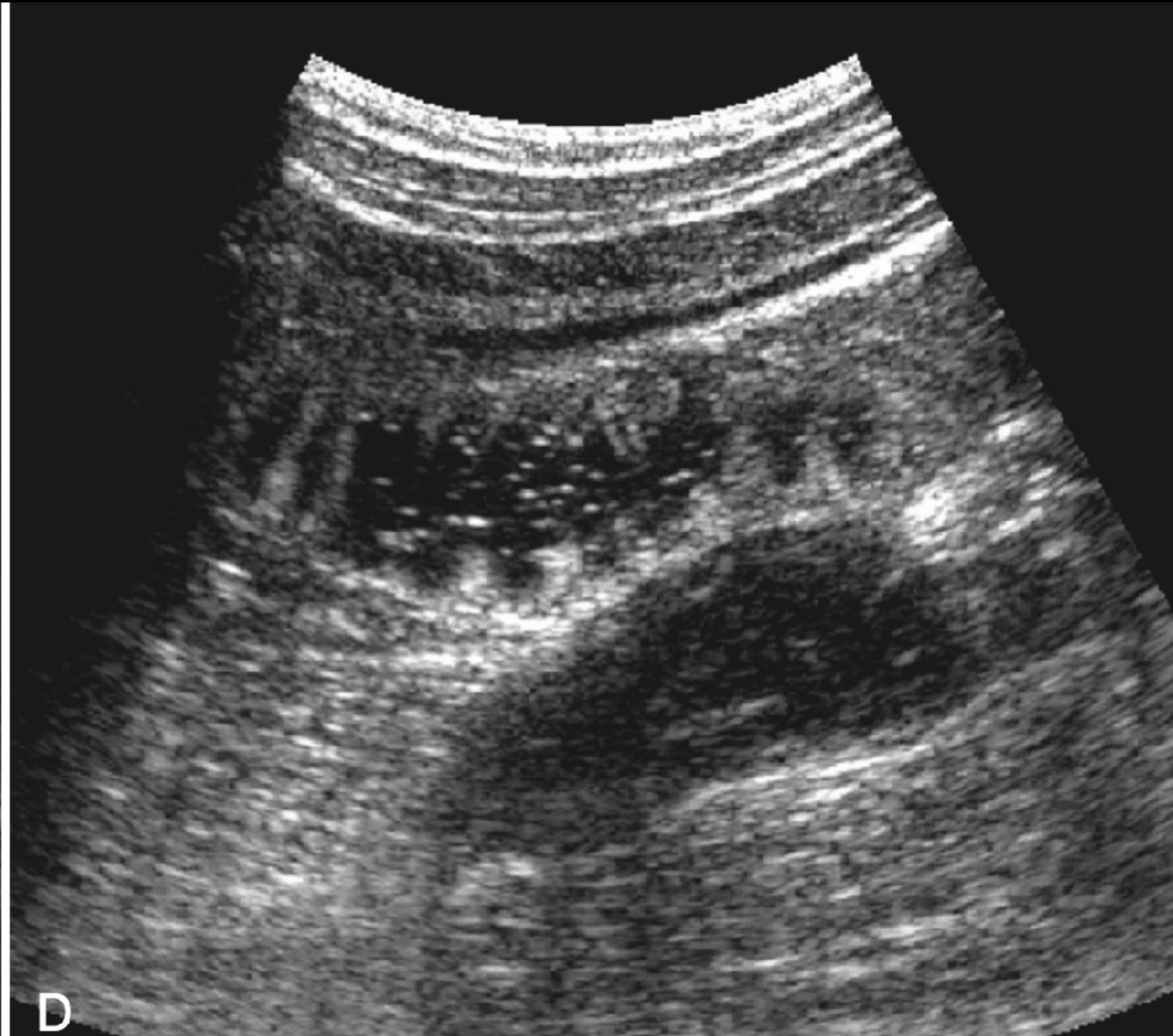
63M , EPIGASTALGIA



Duodenal adenocarcinoma

SMALL BOWEL

Fold of Kerckring (Valvulae conniventes)



SMALL BOWEL

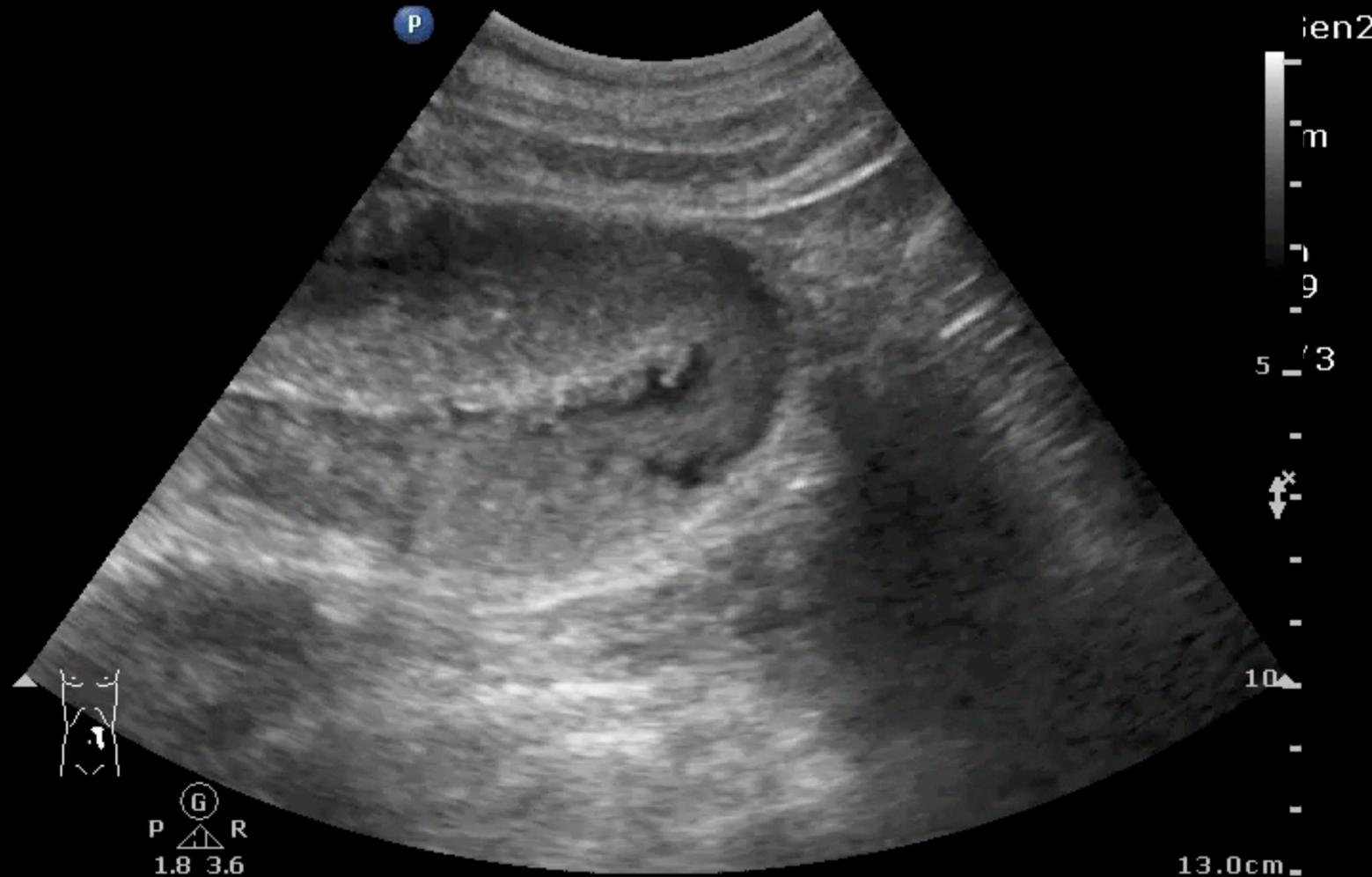
Fold of Kerckring (Valvulae conniventes)

Jejunum

Ileum

Abd Gen
C5-1
38 Hz
13.0cm

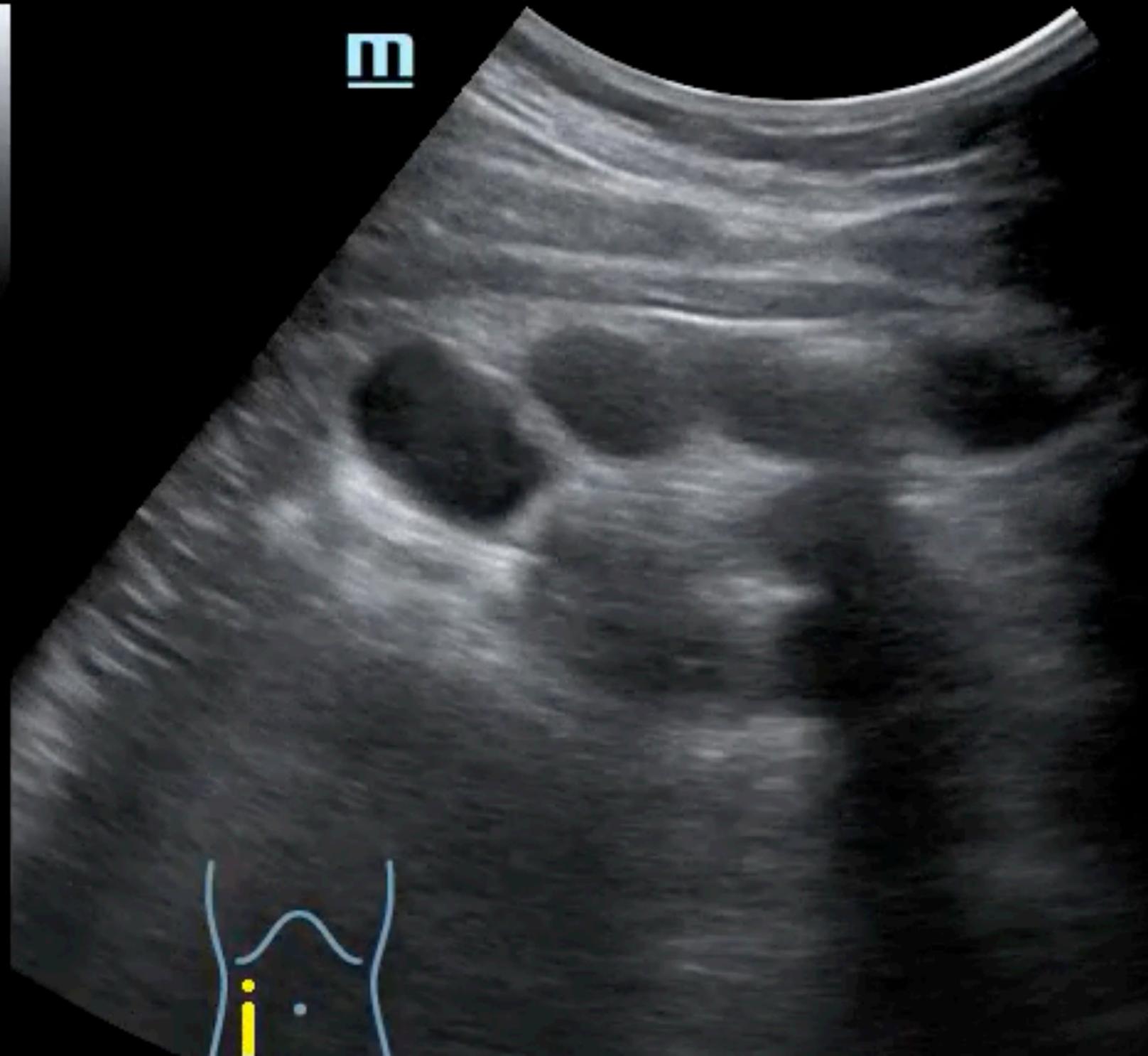
2D
HGen
Gn 80
C 56
3 / 3 / 3



SMALL BOWEL

M 0.9
TIS 0.7

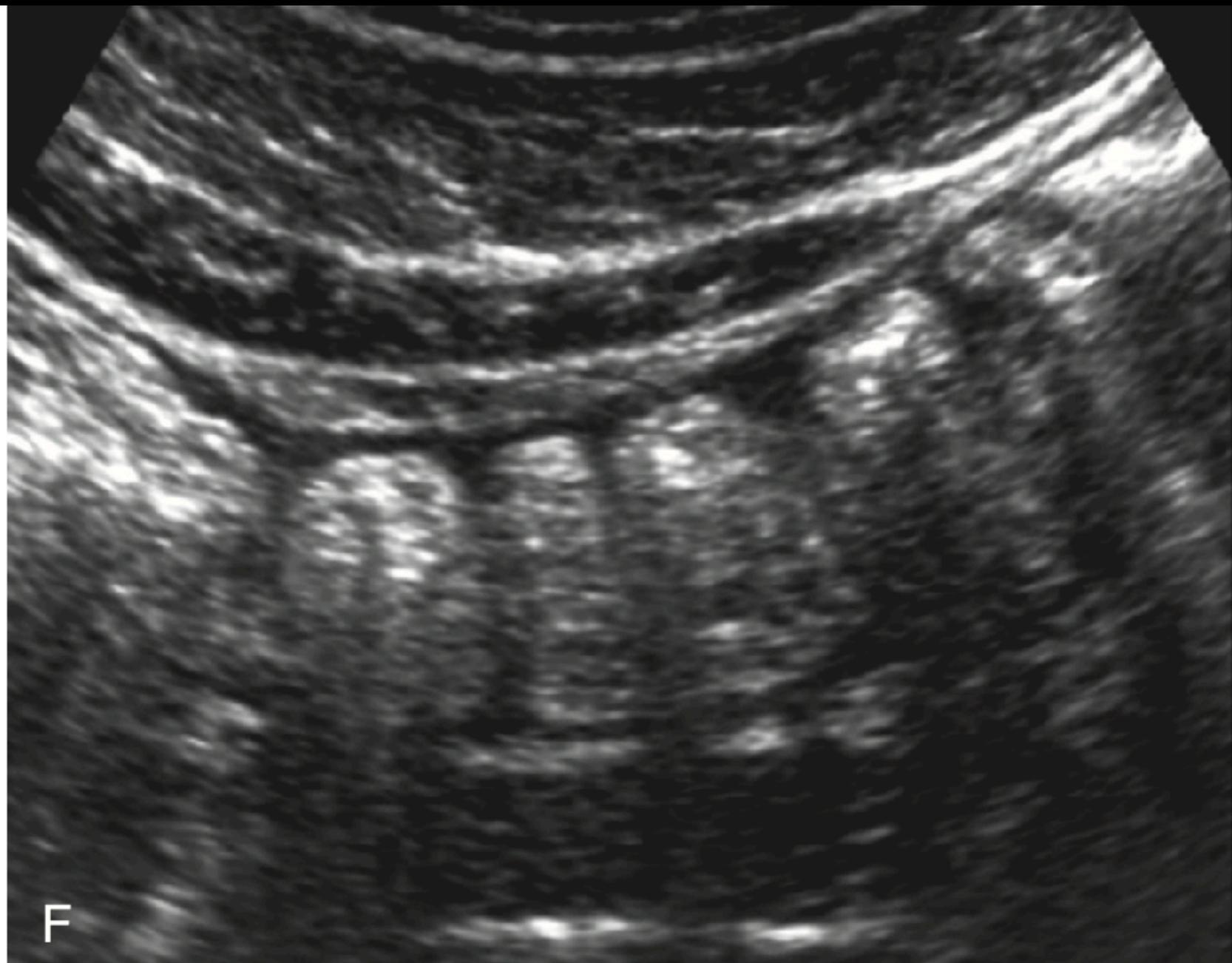
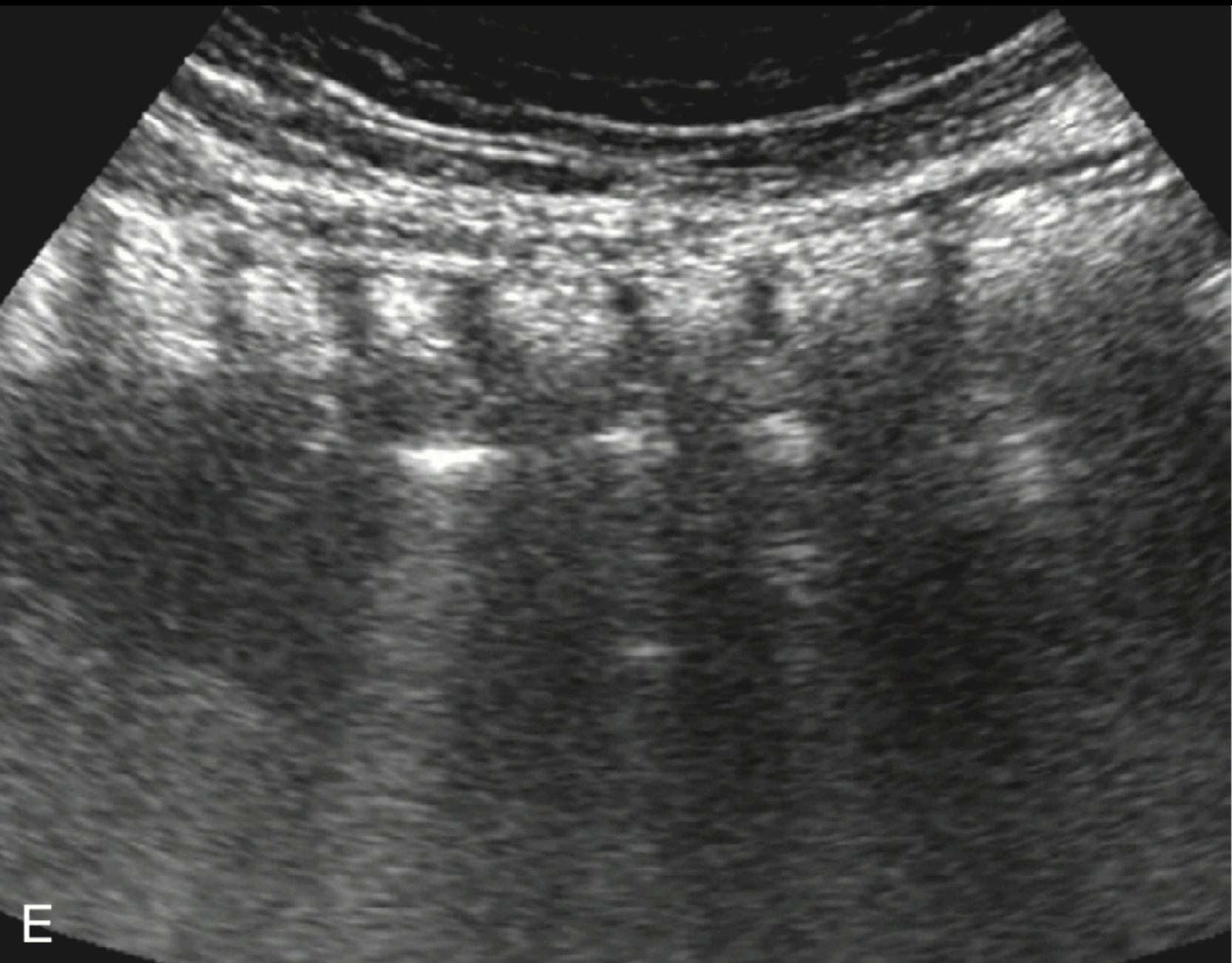
B
FH 5.0
DR 120
FR 26
D 12.0
G 50



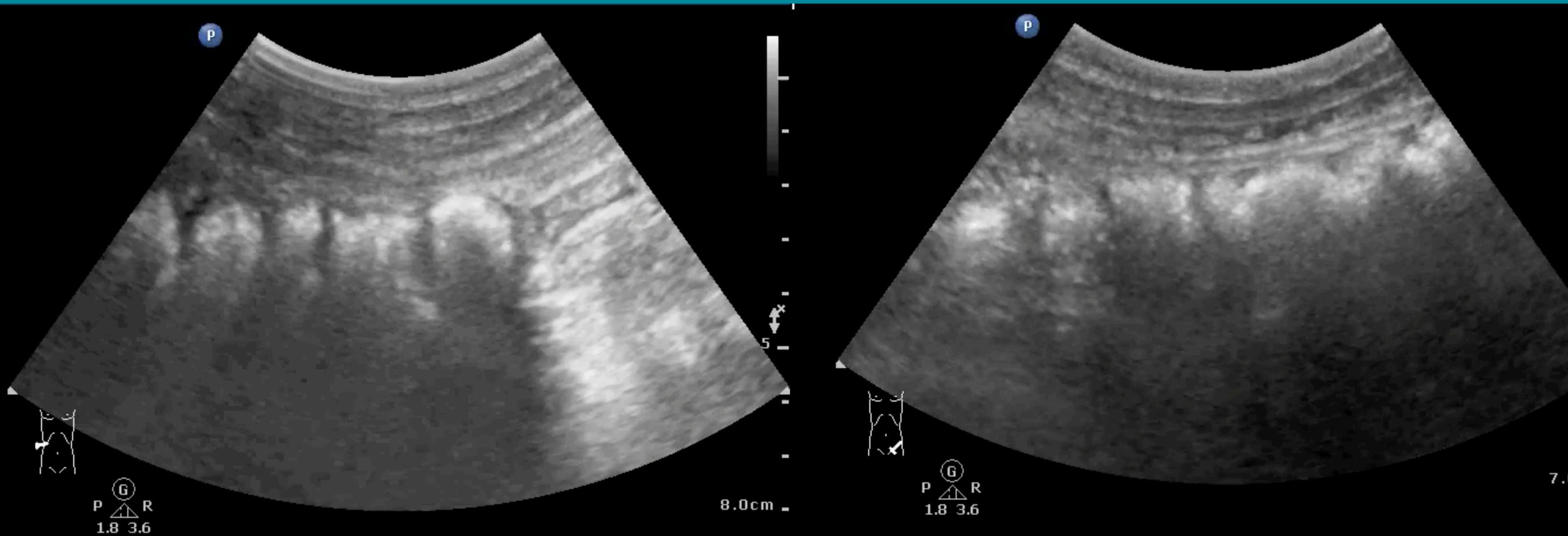
0
-
-
-
-
-
5
-
-
-
-
-
10



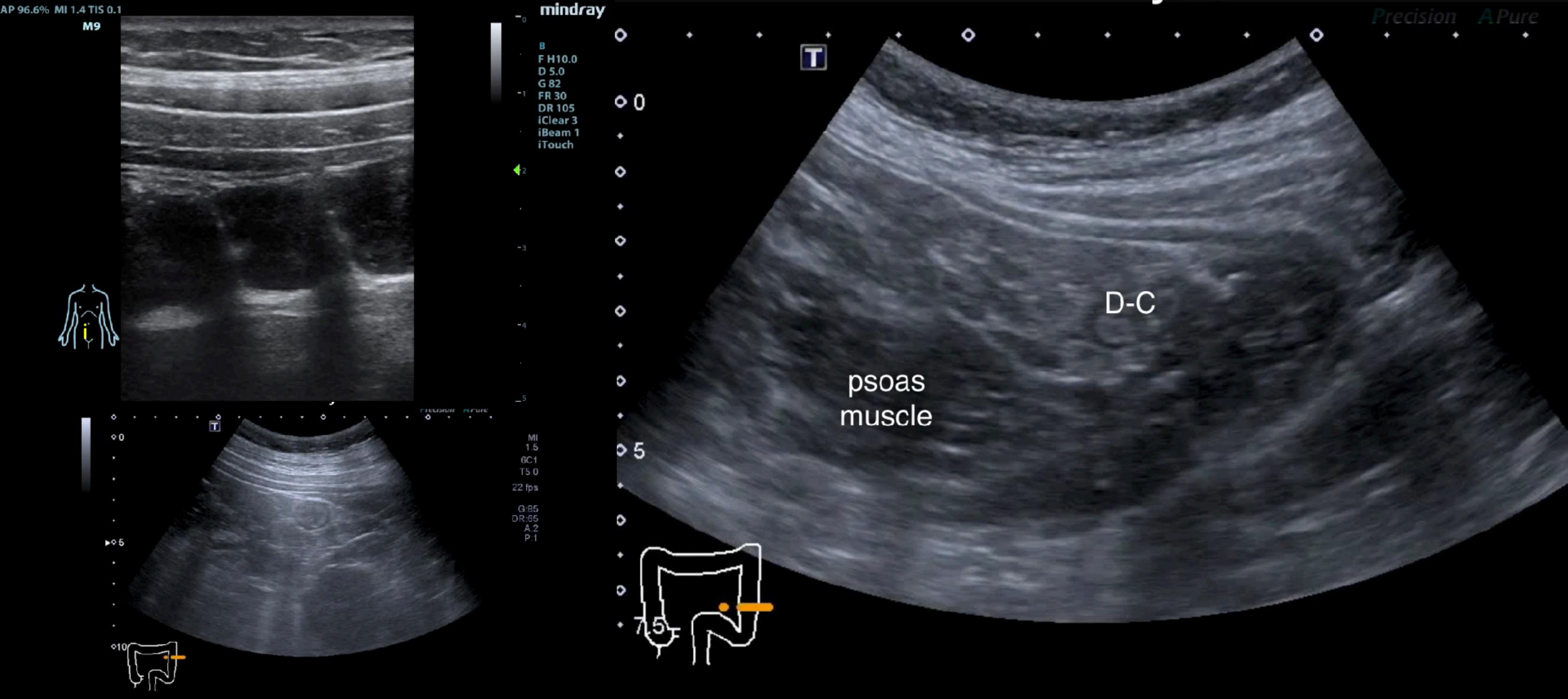
COLON-HAUSTRATION



COLON



COLON-HAUSTRATION



RECTUM

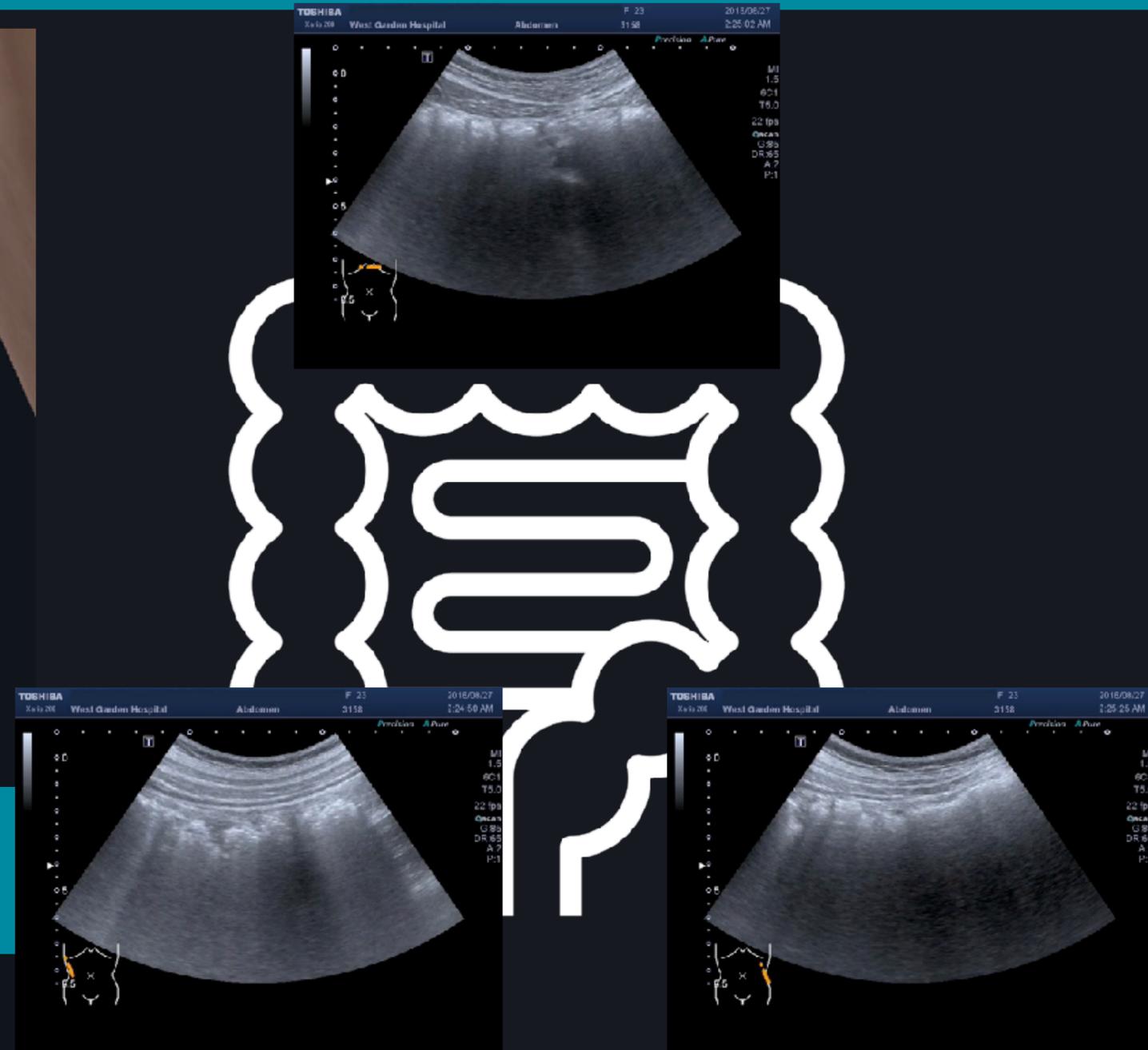
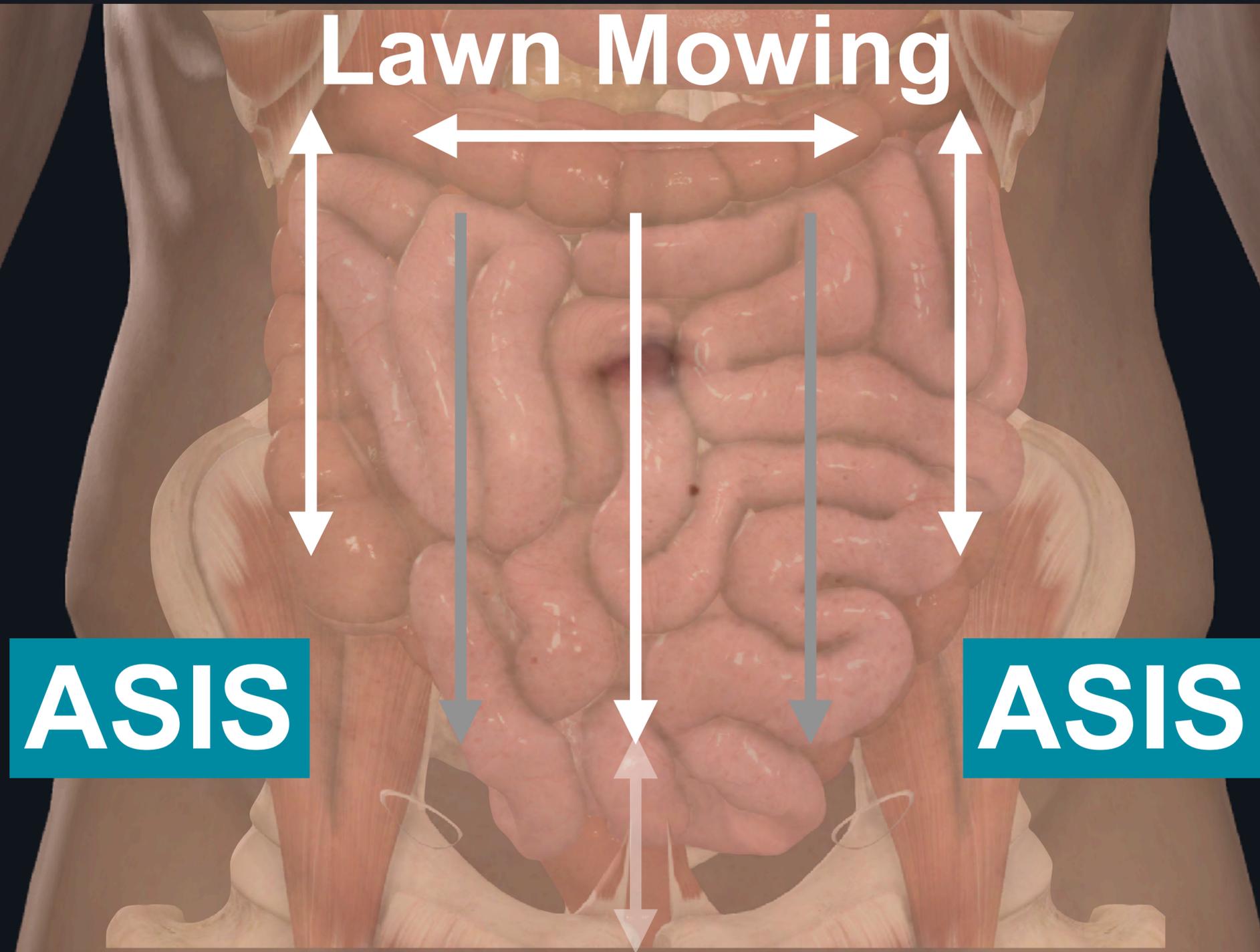
Abd Gen
C5-1
34 Hz
15.0cm

2D
HGen
Gn 55
C 56
3 / 3 / 3



FIXED PARTS FIRST

FOR SMALL & LARGE INTESTINE



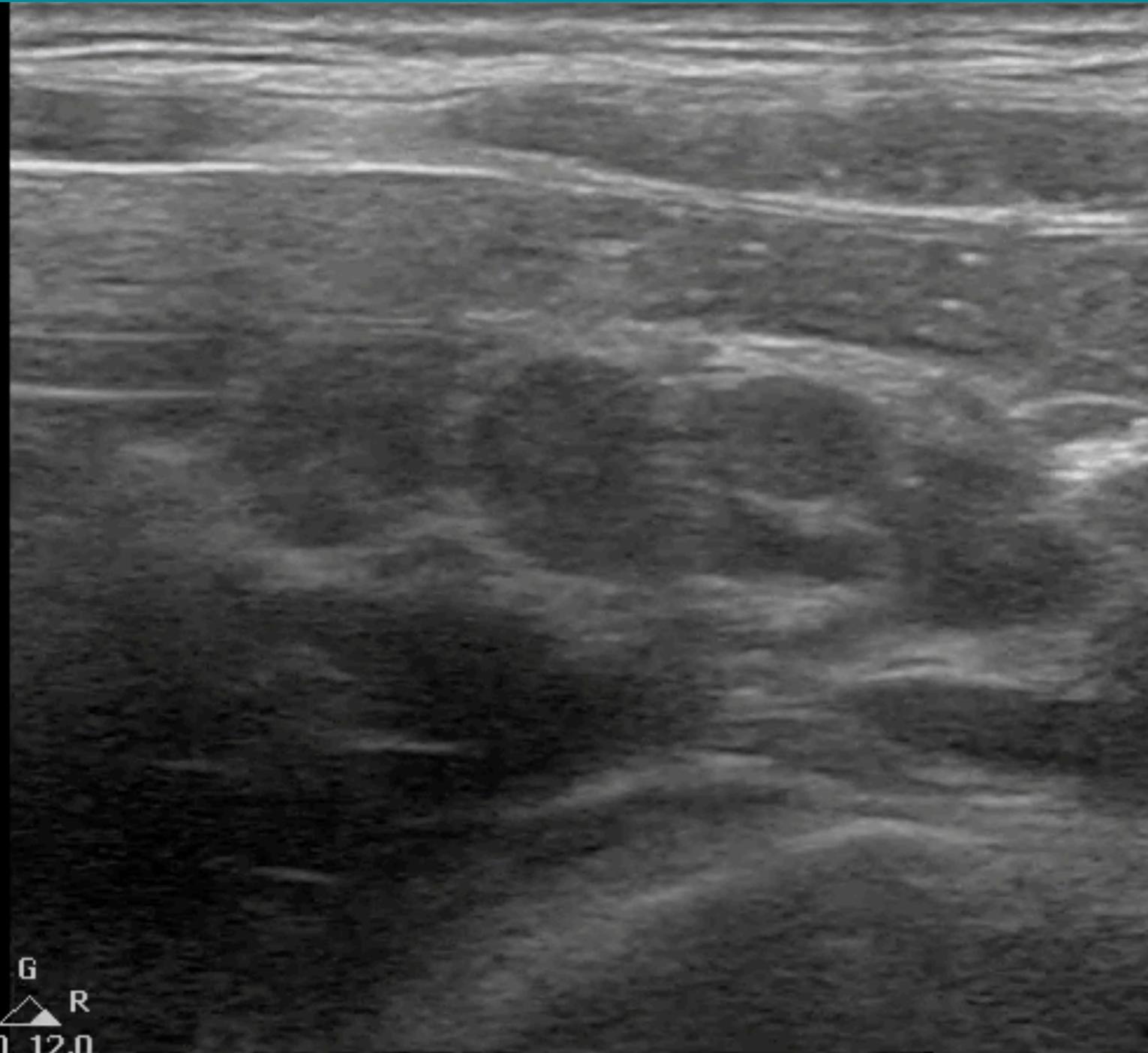
SMALL BOWEL / LYMPH NODES

Superficial
L12-3
46 Hz
3.5cm

2D
Res
Gn 100
C 56
3 / 2 / 1



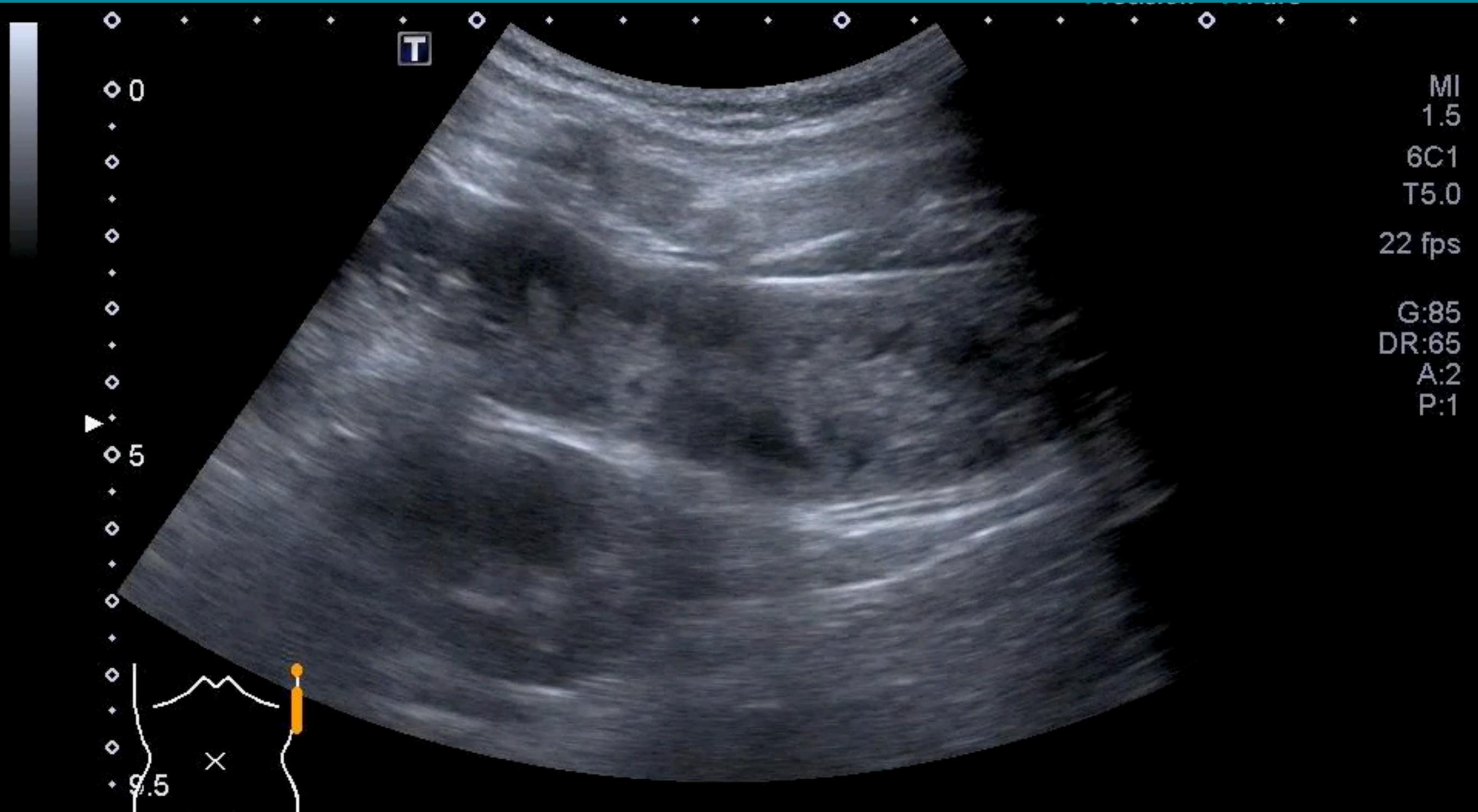
P G R
3.0 12.0



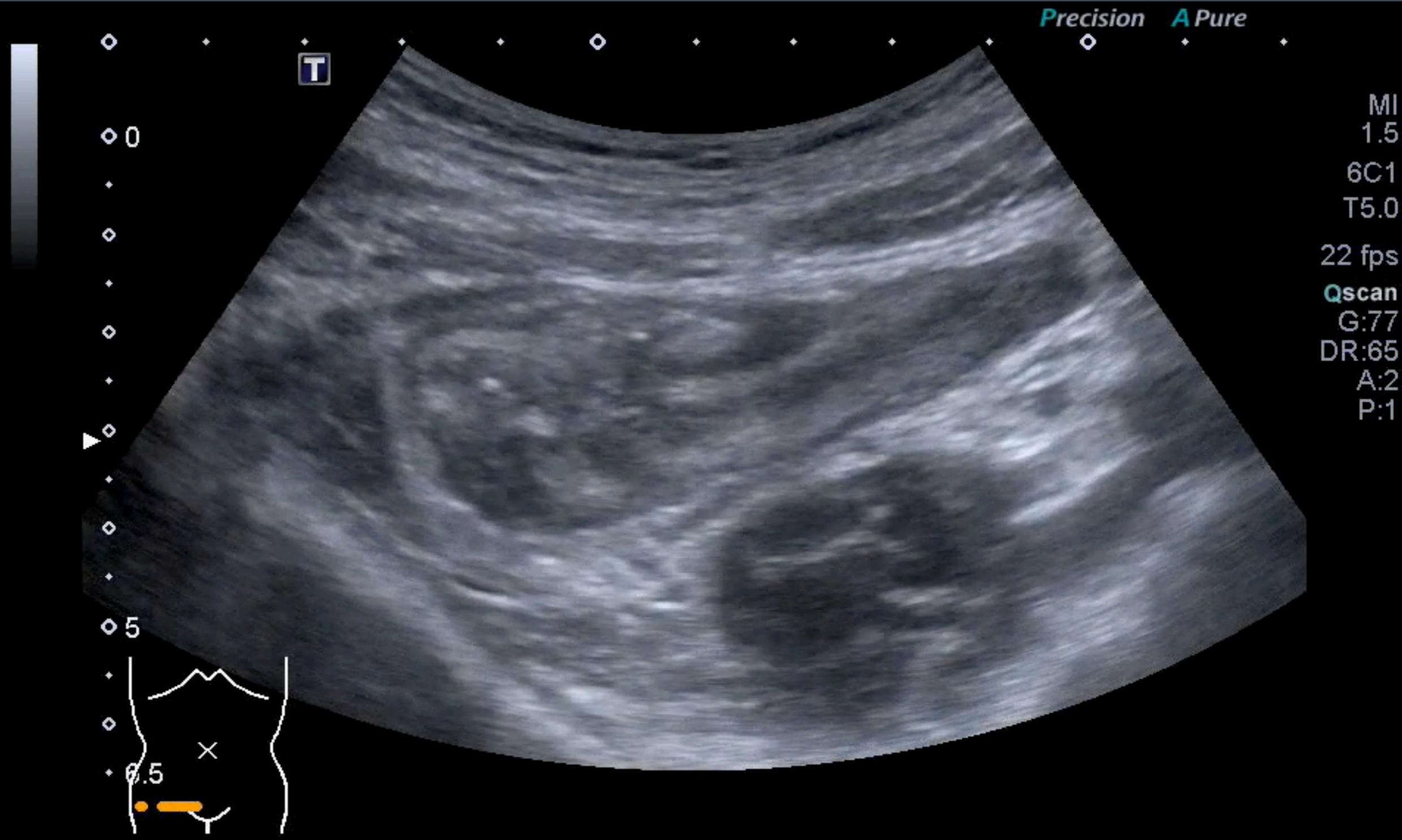
2

3.5cm

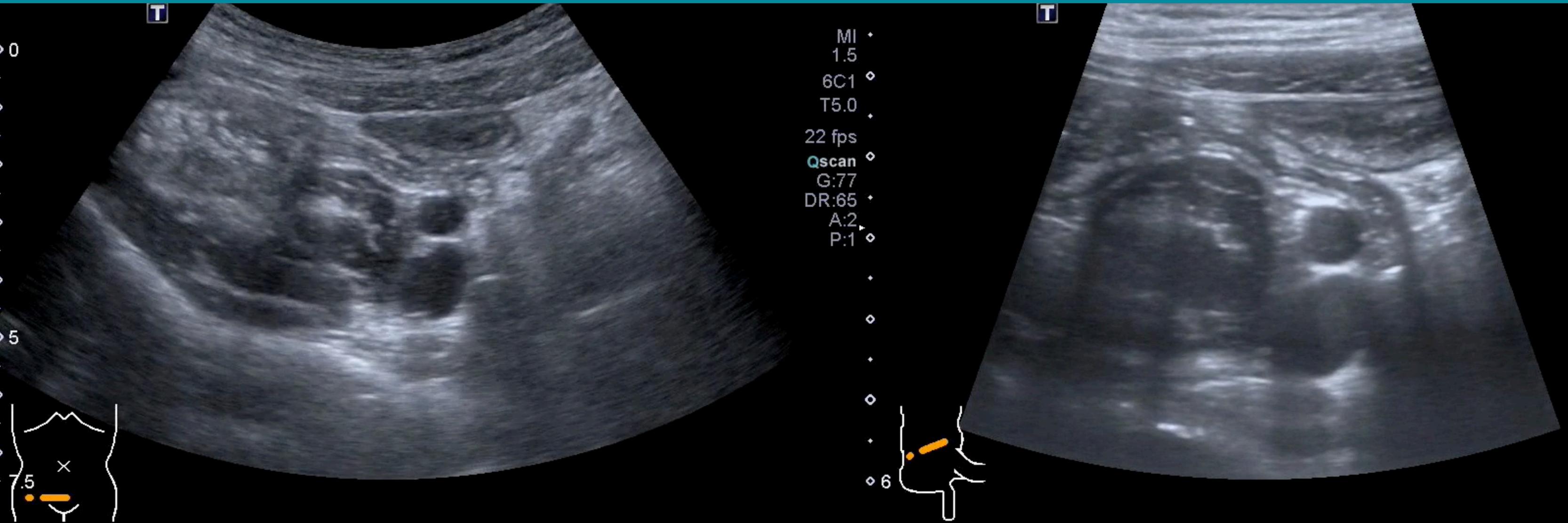
SMALL BOWEL



ILEOCECAL VALVE



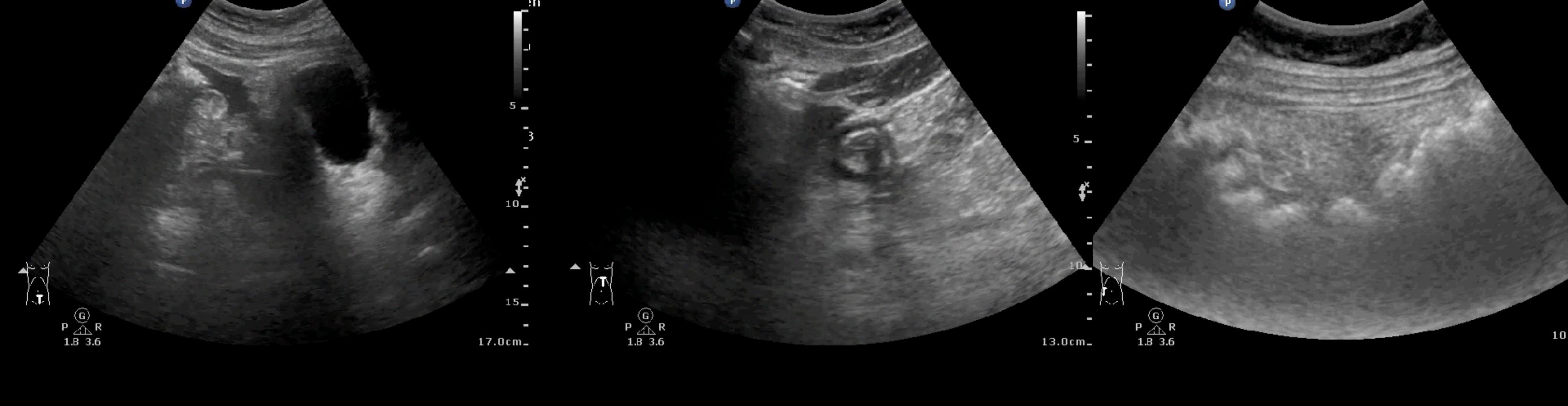
APPENDIX



GI ULTRASOUND: PATHOLOGIC PATTERNS



1. **Diameter** distended (3cm & 5cm)
2. **Unable to compress** during examination
3. **Wall thickening** (>5mm/1cm for stomach)
4. **Wall stratification** disappeared
5. **Luminal content** decreased at lesion sites
6. **Peristalsis** decreased
7. **Associated findings** (LN, Fat, ascites, abscess)



Ascites

Air

Fat

RECOGNIZE PATTERNS

ASCITES (DIRTY/ECHOGENIC)

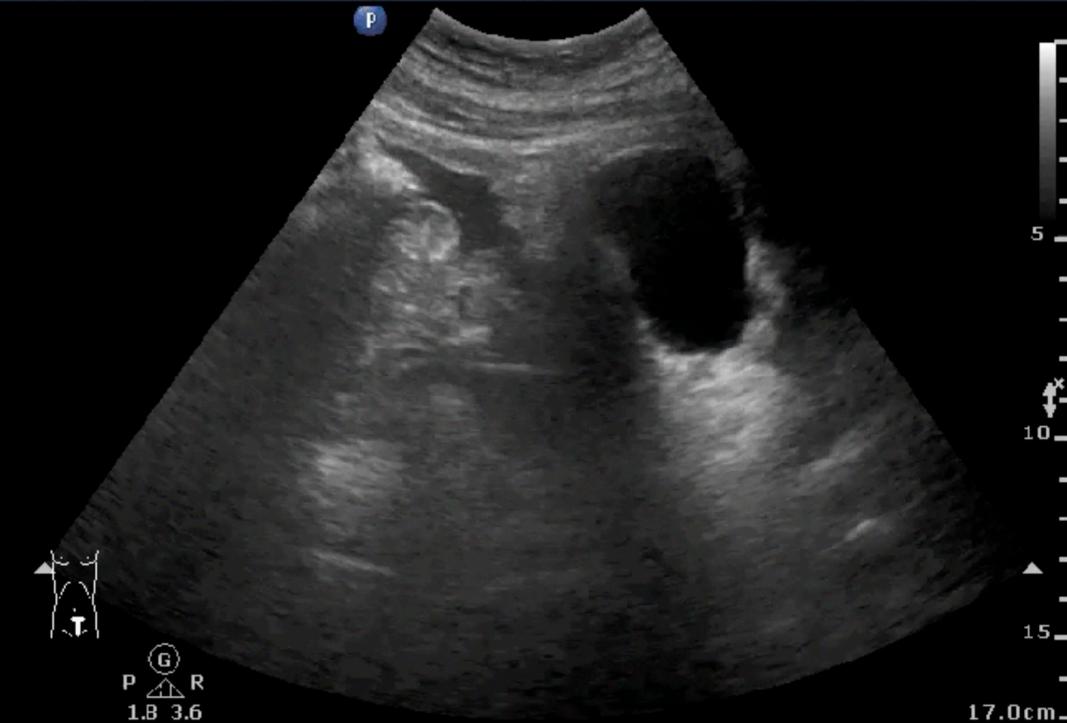
Around liver



Paracolic gutter



Pelvis

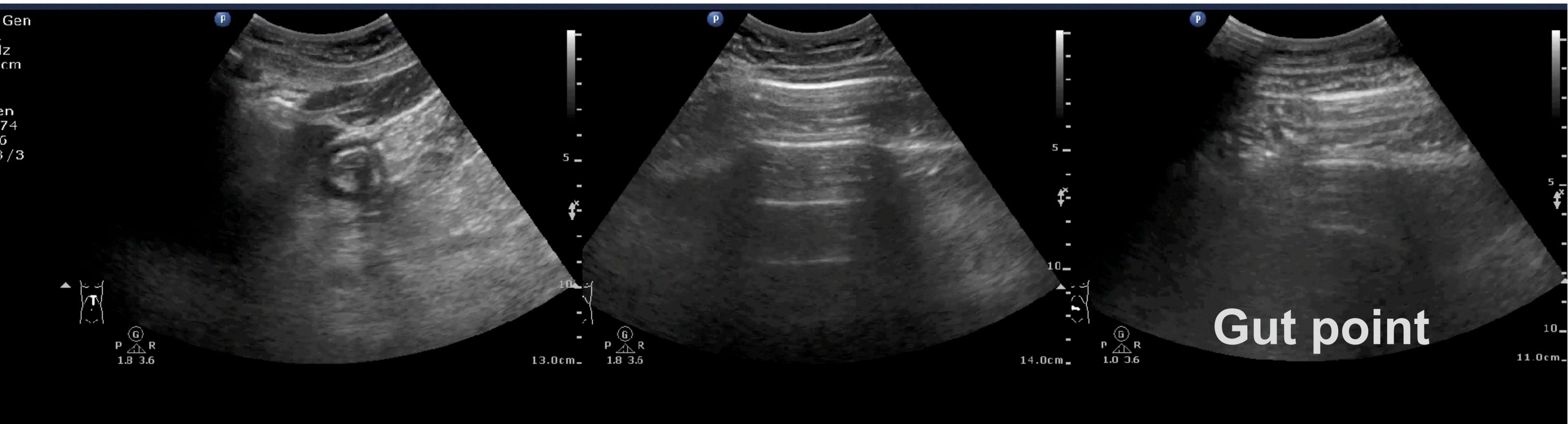


AIR (EXTRALUMINAL)

Liver surface

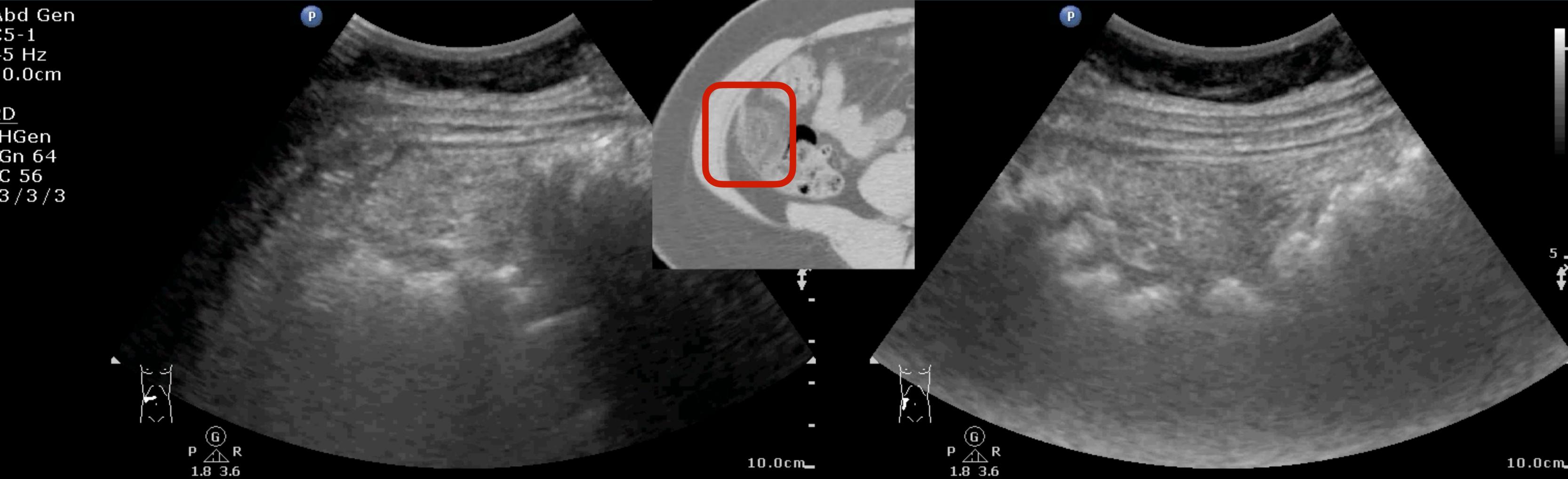
Curtain sign

EPSS



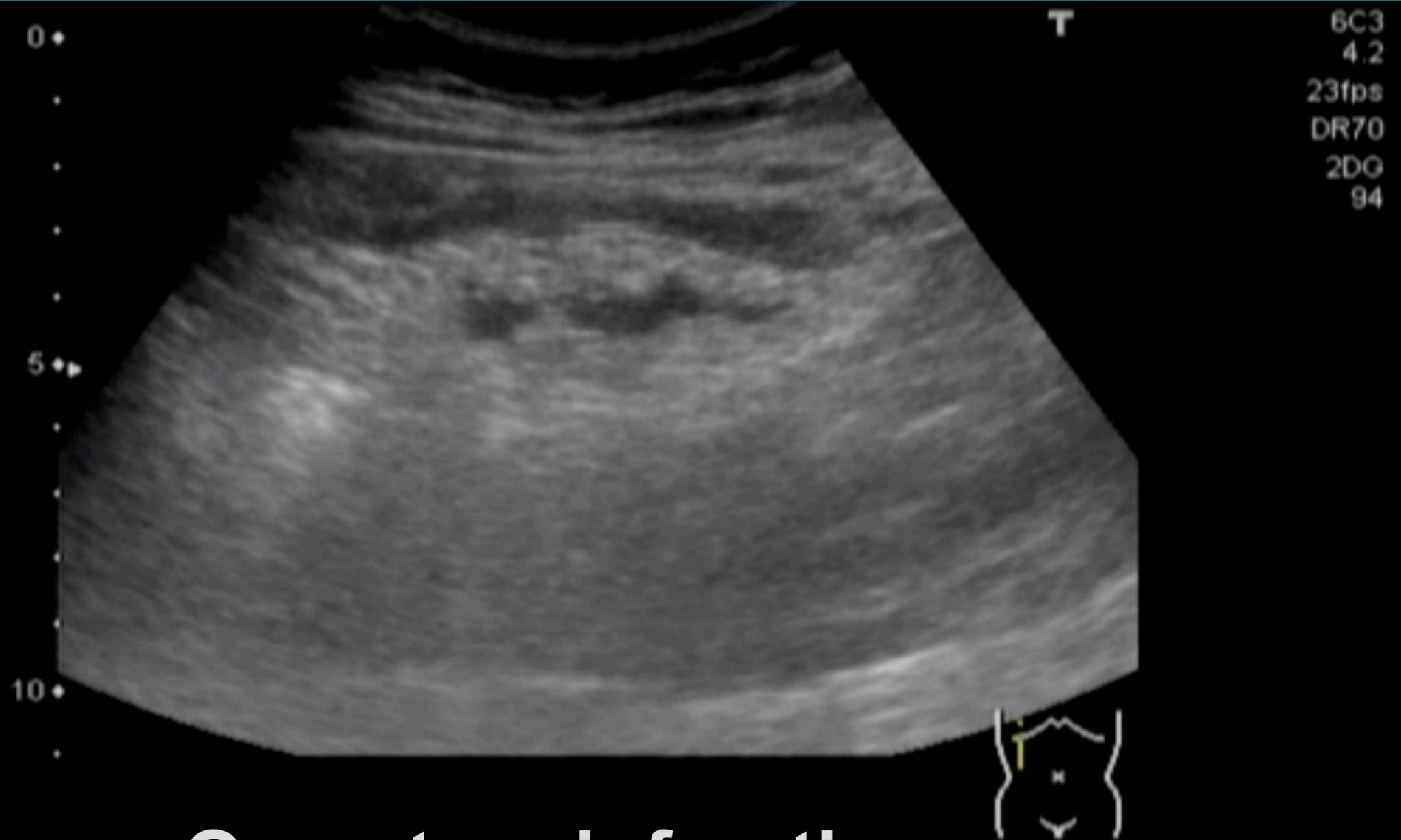
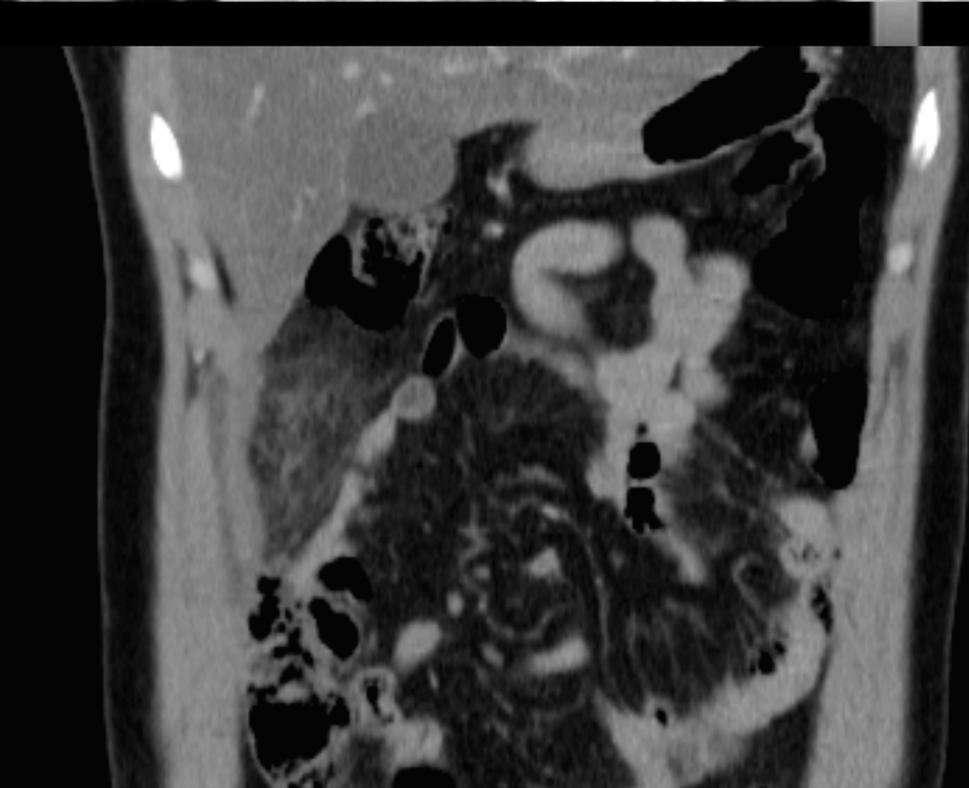
EPSS: Enhanced peritoneal strip sign

FAT (ECHOGENIC/INFLAMMATORY)



Epiploic appendagitis

FAT (ECHOGENIC/INFLAMMATORY)

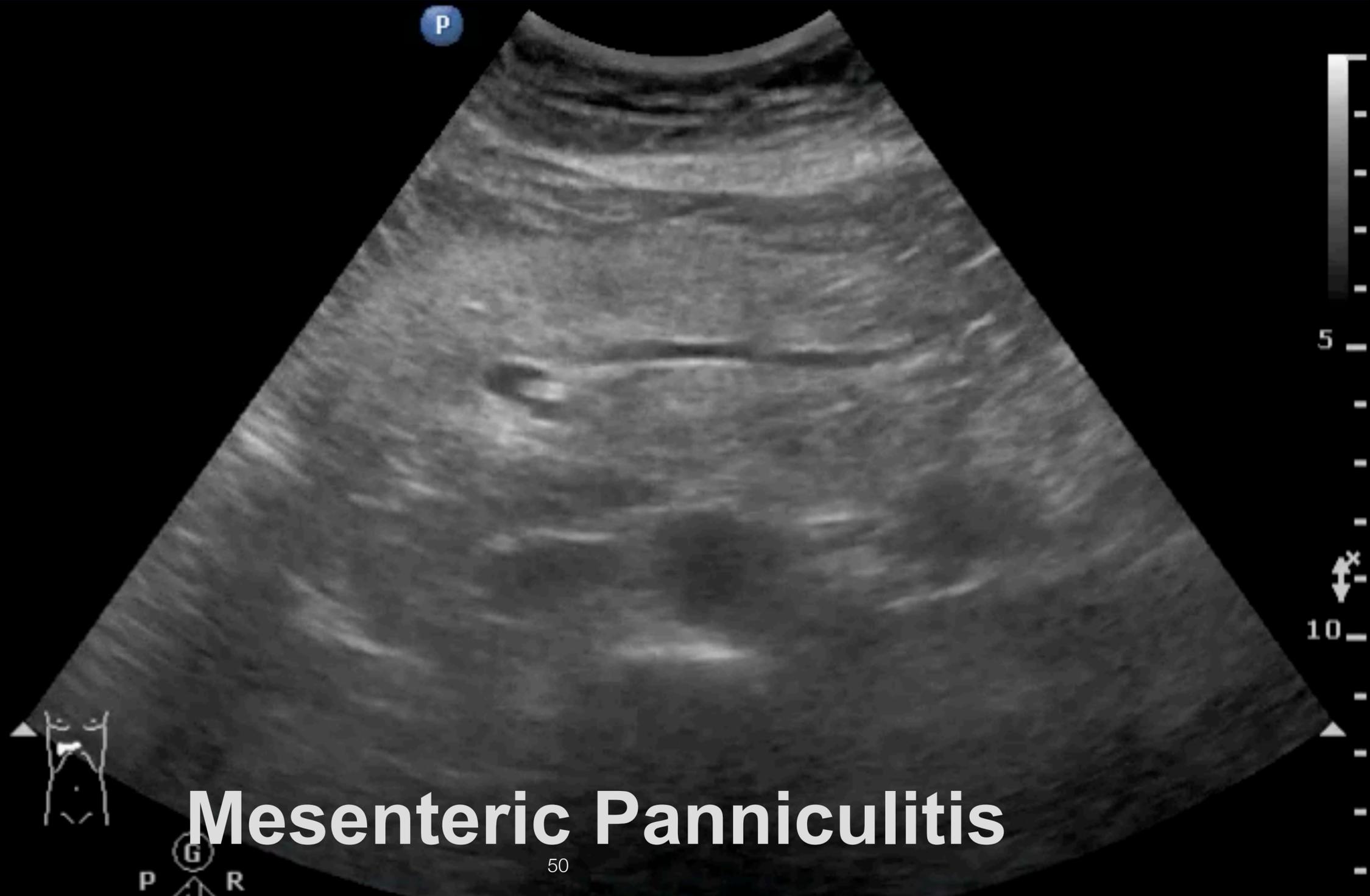


Omentum infarction

FAT (ECHOGENIC/INFLAMMATORY)

Abd Gen2
C5-1
34 Hz
15.0cm

2D
HGen
Gn 62
C 56
3 / 3 / 3



Mesenteric Panniculitis

RLQ PAIN: ASIS (ANTERIOR SUPERIOR ILIAC SPINE)

POCUSAcademy©ChenKC

Bone

Muscle

Vessel



INTUSSUSUSCEPTION (PED)? RUQ SCAN FIRST



Target sign



Pseudokidney sign

Superficial

L12-3

43 Hz

4.5cm

2D

Res

Gn 90

C 56

3 / 2 / 1

P



cranial

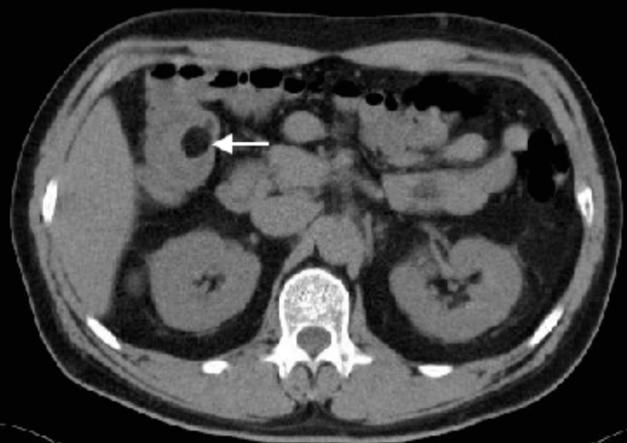
caudal



RUQ sagittal scan

4.5cm

51M, ABD PAIN AND TARRY STOOL



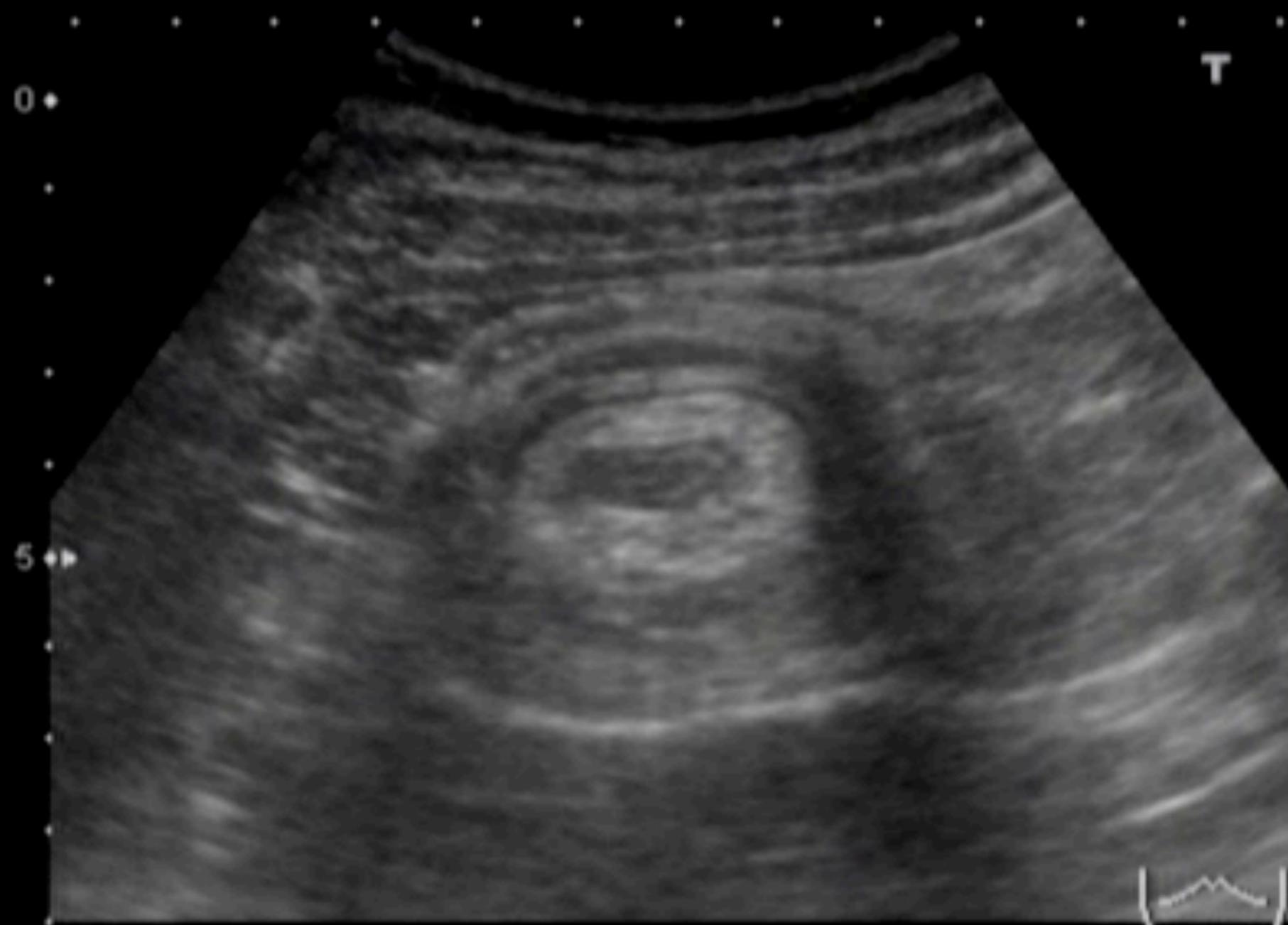
TOSHIBA

SHIN KONG MEMORIAL HOSPITAL

LIVER

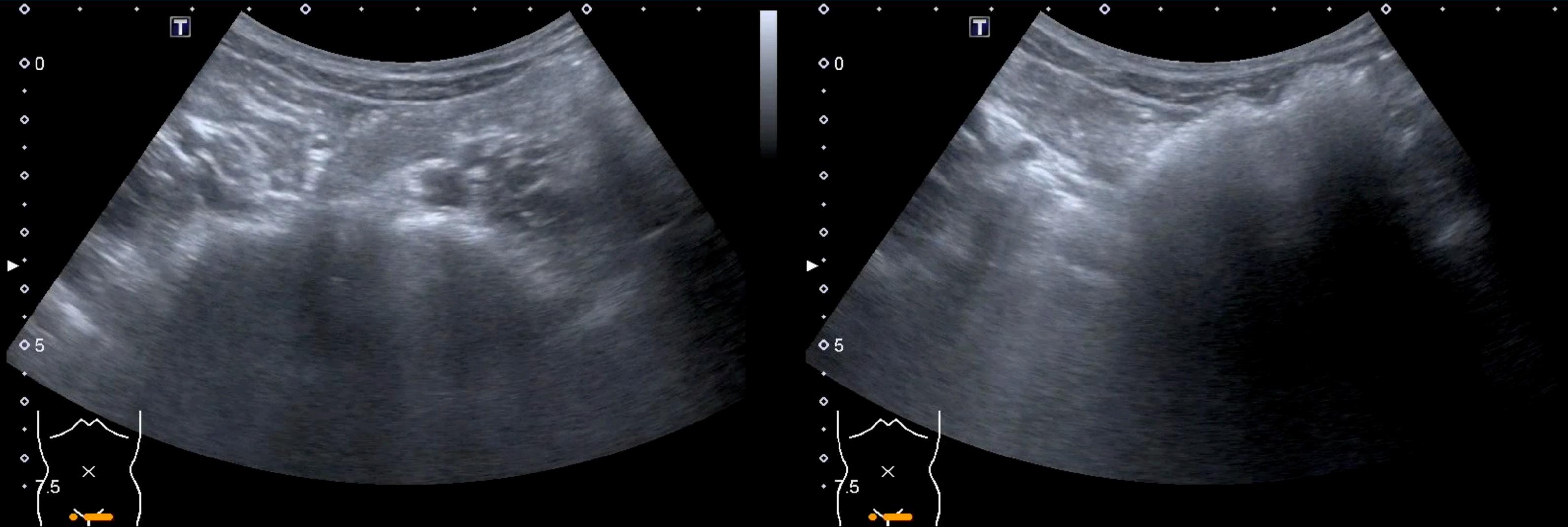
2014/05/09
08:47:12AM

P100
6C3
4.2
24fps
DR70
2DO
94



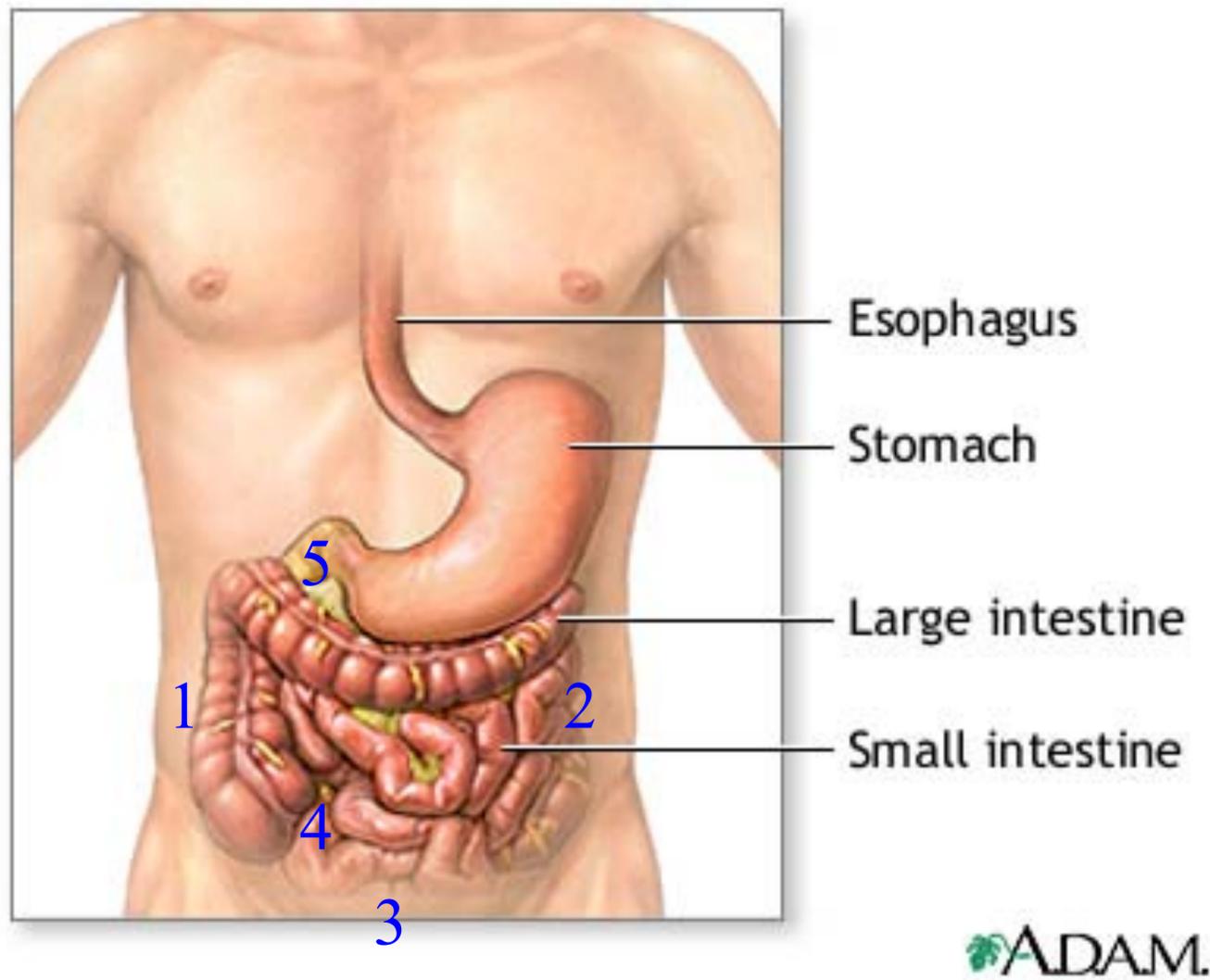
MI
0.7
TIS
0.2

7F, INTERMITTENT ABDOMINAL PAIN



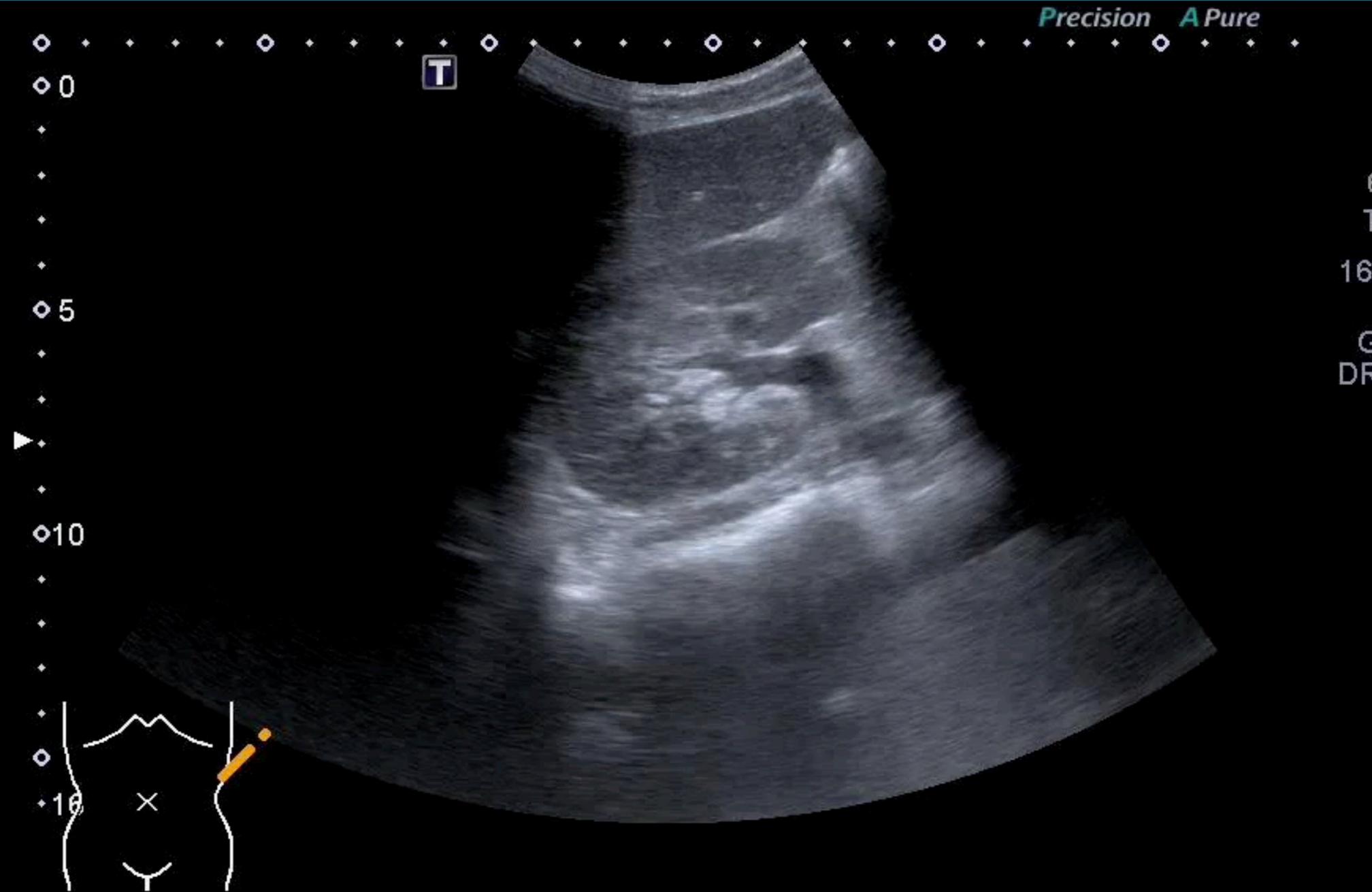
Transient intussusception

BISECTION APPROXIMATION METHOD FOR GI OBSTRUCTION



Location of US examination (From 1 – 5)					Possible lesion site
1. A-C	2. D-C	3. Rectum	4. IC region	5. Gastric outlet or duodenum	
Dilated	Collapsed				From 1-2
Dilated	Dilated	Collapsed			From 2-3
Collapsed	-	-	Dilated		From 1-4
Collapsed	-	-	Collapsed	Dilated	From 4-5
Collapsed	-	-	Collapsed	Collapsed	Above 5

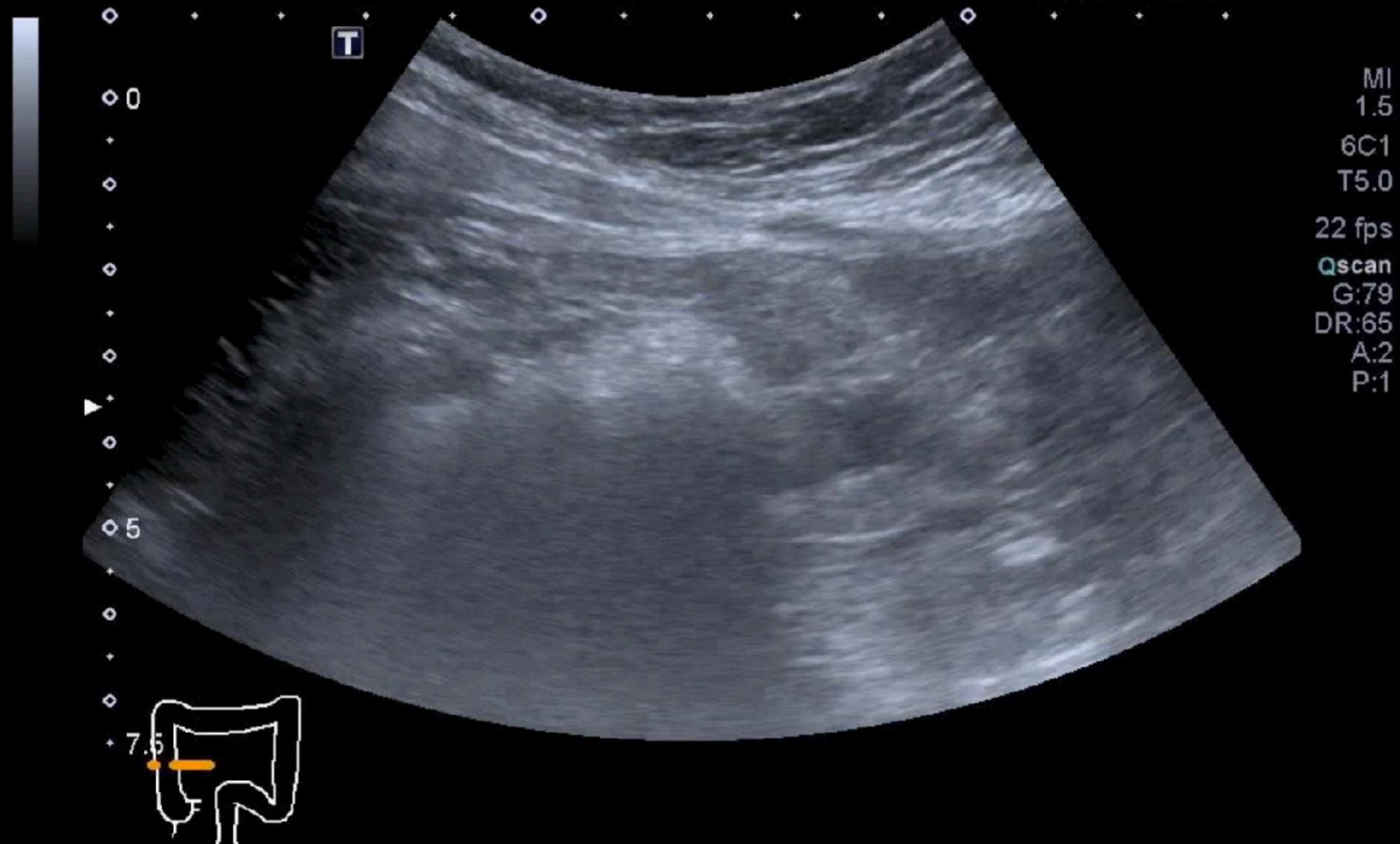
M/19, EPIGASTRIC PAIN & PERSISTENT VOMITING

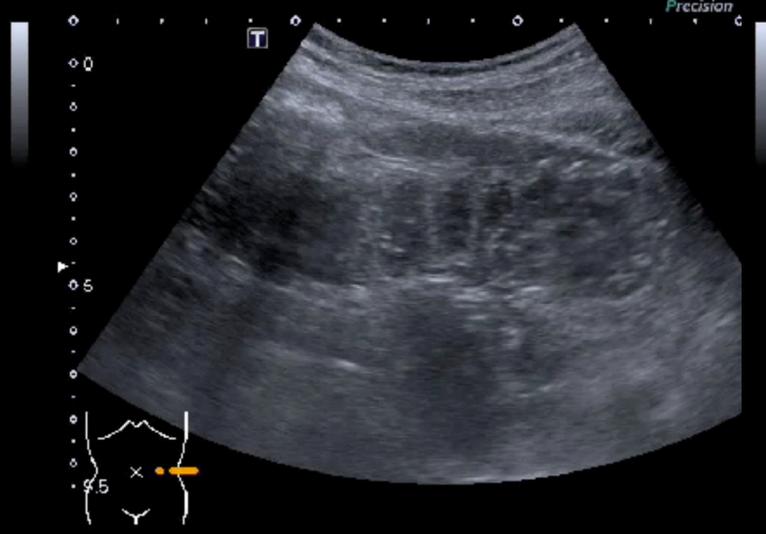


Gastric outlet obstruction

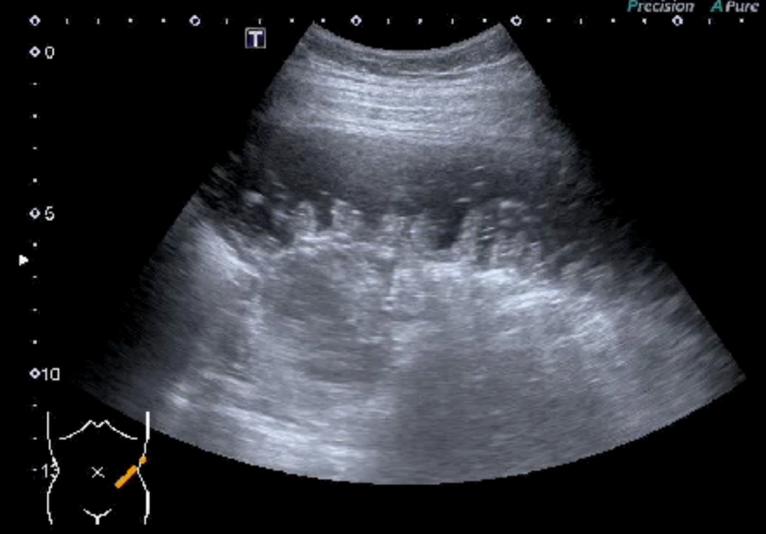
BOWEL OBSTRUCTION ? BAM METHOD FIRST

POCUSAcademy©ChenKC





To & Fro



Keyboard



String-of-beads

MI
1.5
6C:1
T5.0
22 fps
G:85
DR:85
A:2
P:1

Extremely helpful for gasless bowel obstruction

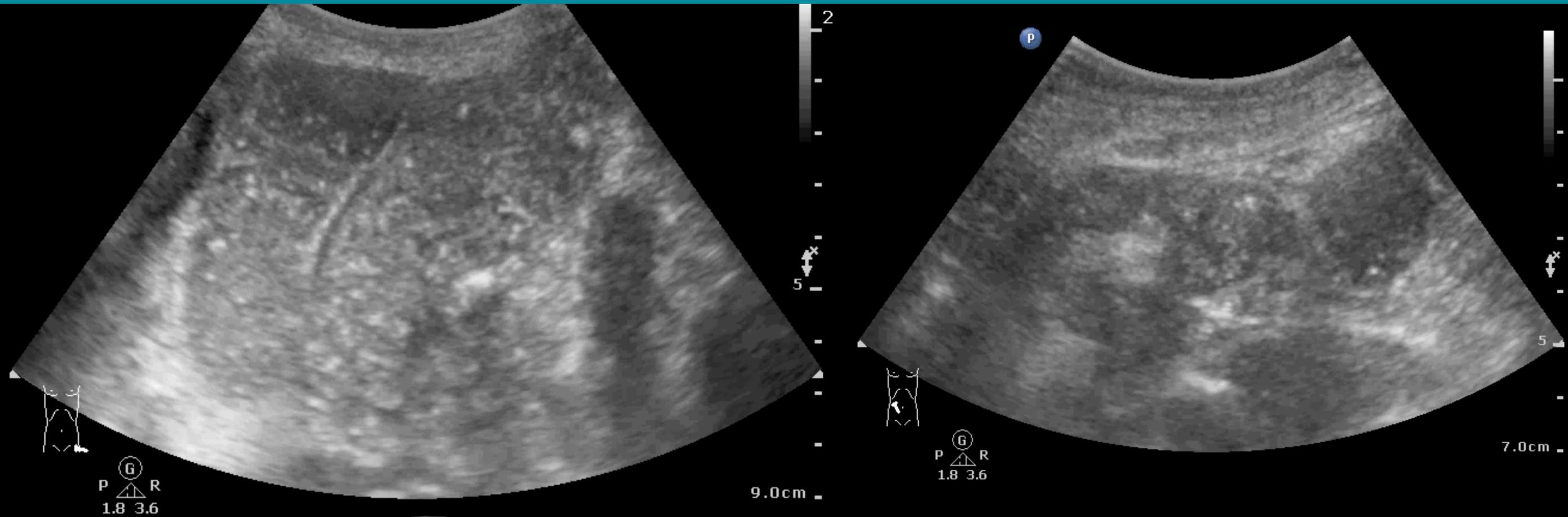


R



R
Standing

90M, RLQ PAIN 2D >> BAM METHOD



Cecal tumor

US FOR SBO DIAGNOSIS: LR + > 20

Cottlieb M, et al. AJEM 2017

TAKE-HOME MESSAGE

For trained operators, ultrasonography possesses sensitivity and specificity comparable to that of abdominal computed tomography (CT) for the diagnosis of small bowel obstruction.

Ultrasonographic Diagnosis of SBO	Specificity (95% CI)	Sensitivity (95% CI)	+LR (95% CI)	-LR (95% CI)	SROC AUC (95% CI)
Overall	0.97 (0.88–0.99)	0.92 (0.89–0.95)	27.5 (7.7–98.4)	0.08 (0.06–0.11)	0.96 (0.94–0.97)
ED	0.96 (0.86–0.99)	0.93 (0.89–0.95)	21.1 (6.5–68.9)	0.08 (0.05–0.12)	0.96 (0.94–0.97)
Non-ED	0.99 (0.60–1.00)	0.92 (0.85–0.96)	70.8 (1.5–3279.7)	0.08 (0.05–0.15)	0.96 (0.94–0.98)

CI, Confidence interval; +LR, positive likelihood ratio; -LR, negative likelihood ratio; SBO, small bowel obstruction; SROC, summary receiver operating characteristic; AUC, area under the curve.

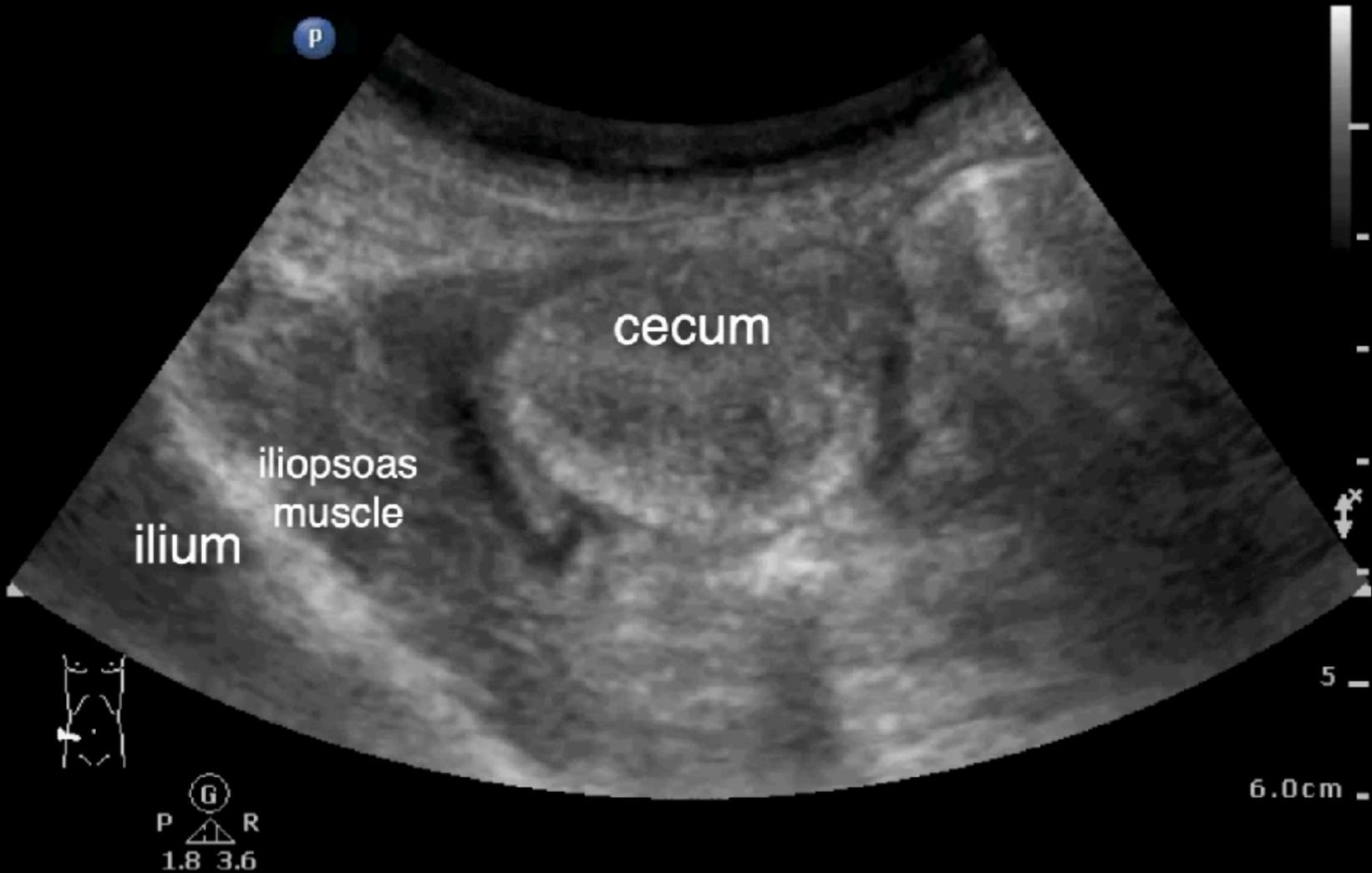
LANDMARK / TRANSVERSE / PAIN-ORIENTED

PHILIPS LEE 20628754 POCUSAcademy©ChenKC MT 1.0 11/7/2018 9:04:11 AM

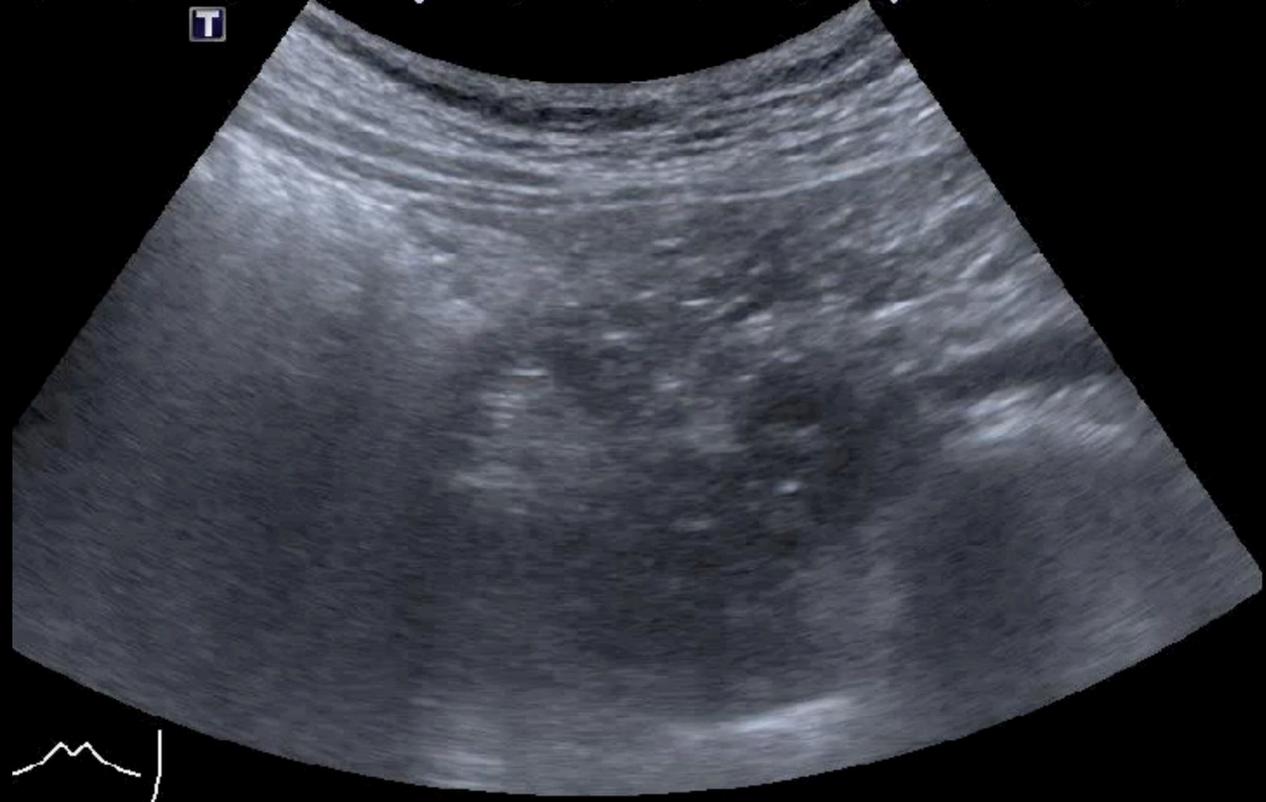
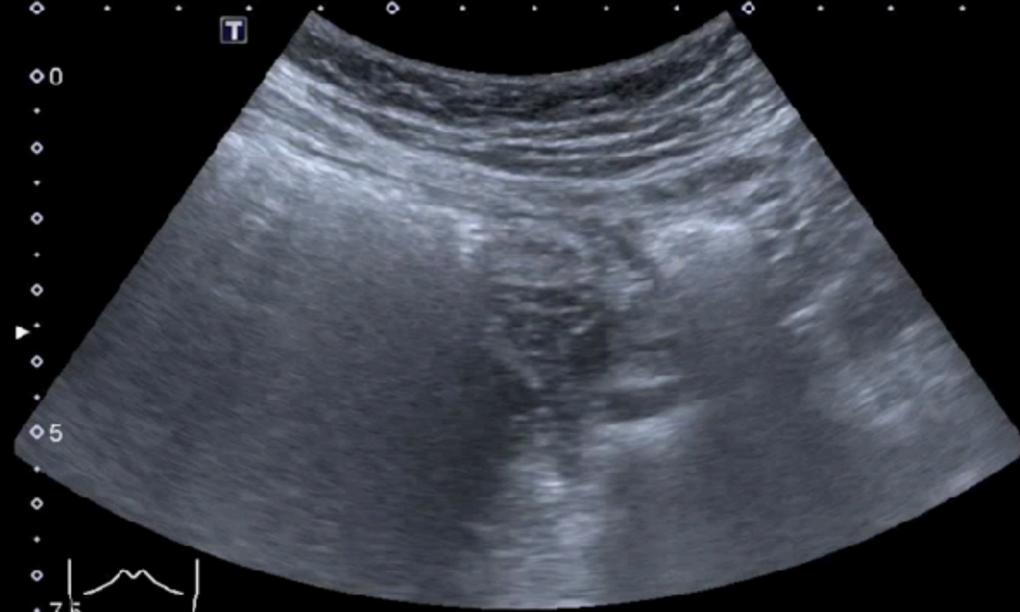
Abd Gen2
C5-1
58 Hz
6.0cm

2D
HGen
Gn 60
C 56
3 / 3 / 3

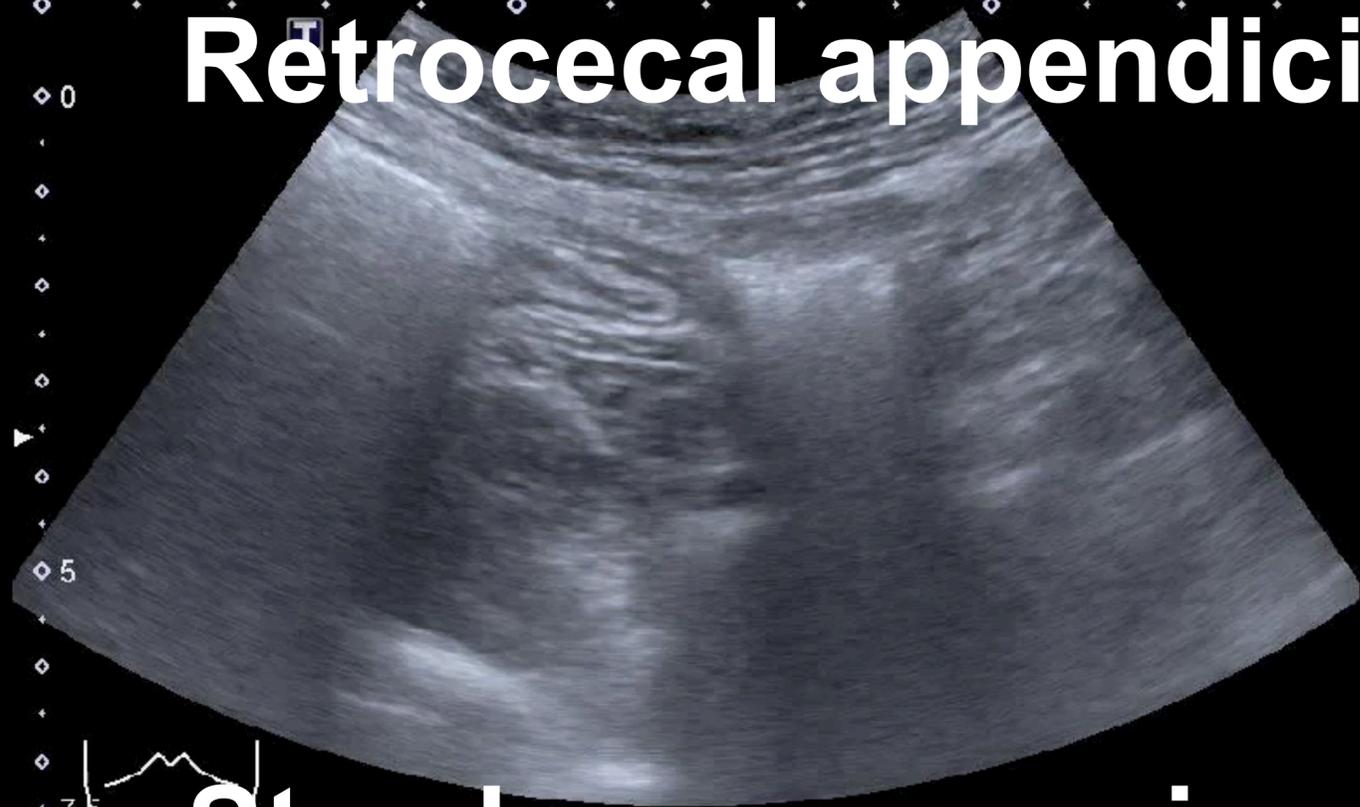
Appendicitis



Transverse scan over RLQ area

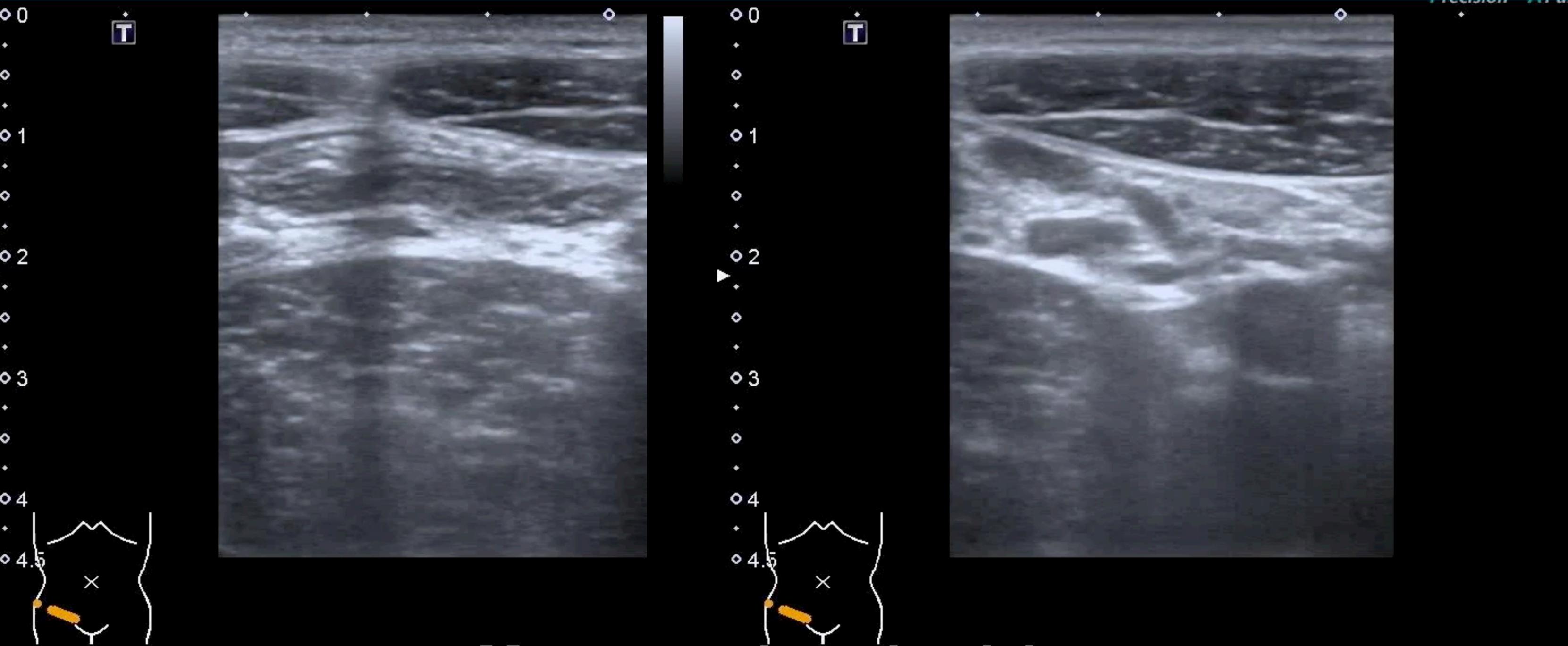


Retrocecal appendicitis



Steady compression

15M, RLQ PAIN & TENDERNESS



Mesenteric adenitis

P100
6C3
3.7
33fps
DR70
2DG
94



9cm

MI
0.4
TIS
0.1
TIB
0.1
TIC
0.3

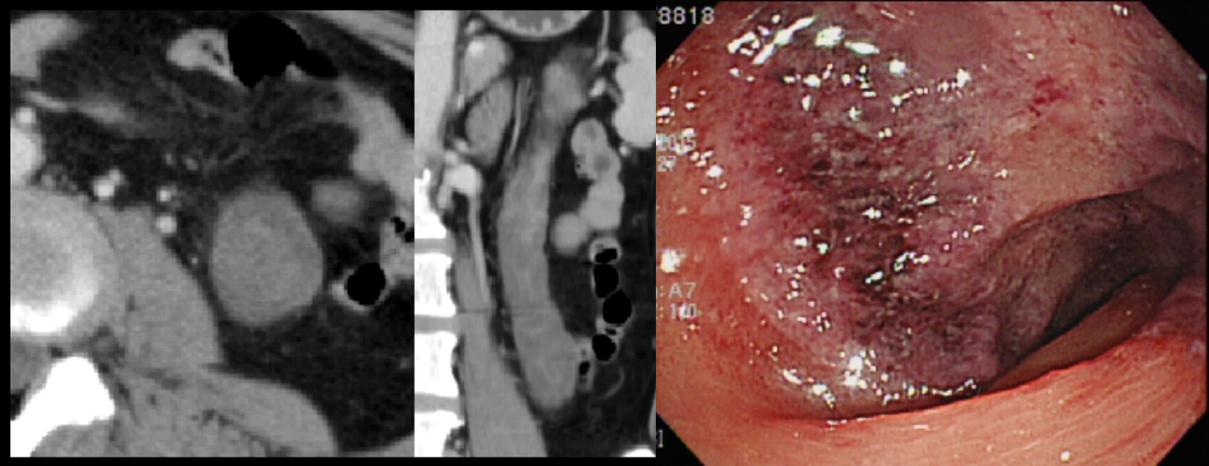
Symmetric wall thickening
Stratification (+)
Decreased luminal content
Infectious colitis

Free 8



Abd Gen
C5-1
51 Hz
8.0cm

2D
HGen
Gn 60
C 56
3 / 3 / 3



**Symmetric wall thickening
Stratification (-)
Luminal content decreased
Ischemic colitis**

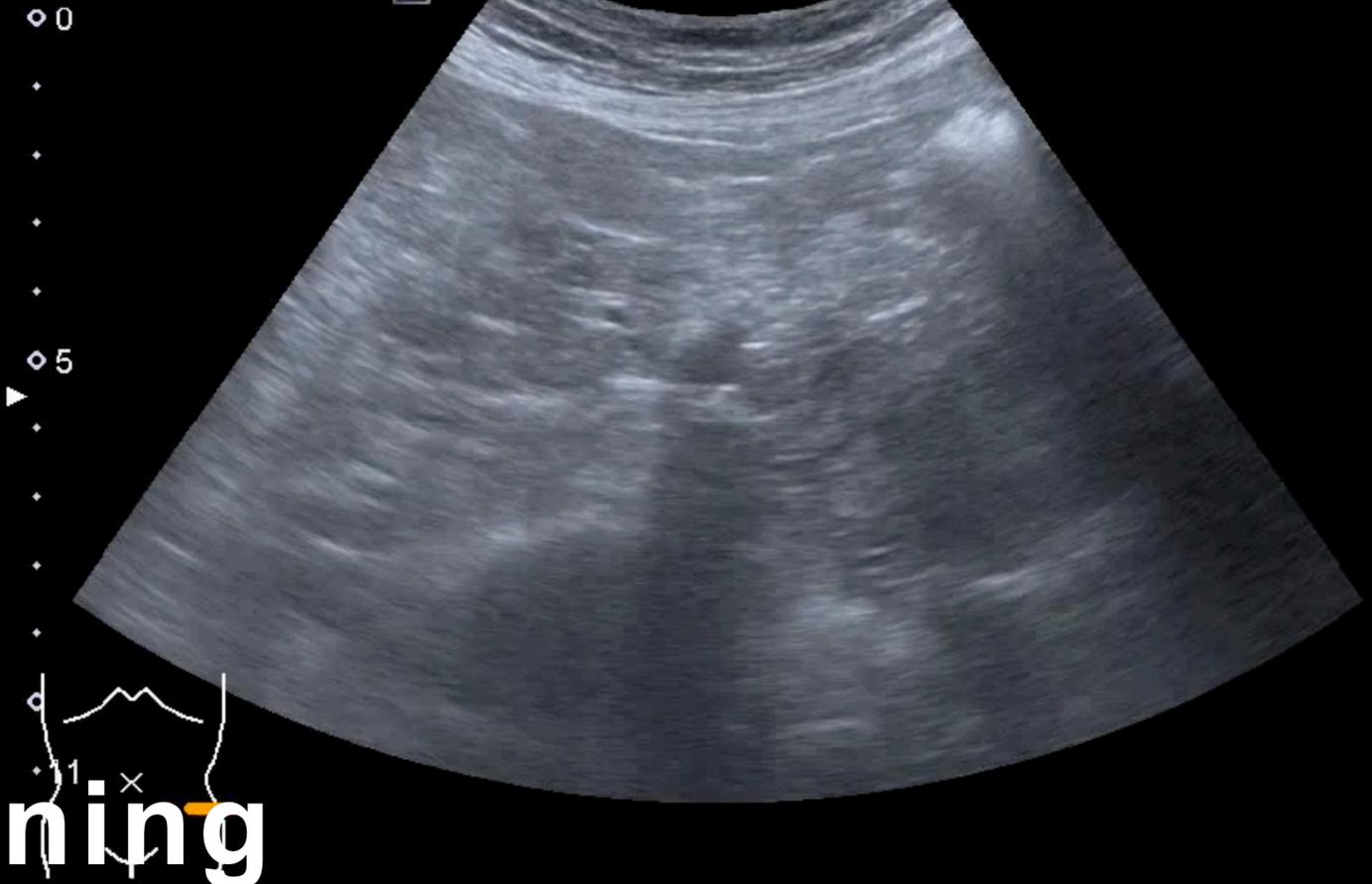
Abd Gen
C5-1
47 Hz
9.0cm

2D
HGen
Gn 76
C 56
3/3/3

MI
1.5
6C1
T5.0
22 fps
Qscan
G:83
DR:65
A:2
P:1



**Wall
thickening**



**Symmetric
Stratification (+)
Infectious colitis**

**Asymmetric
Stratification (-)
Sigmoid colon cancer**

WALL THICKENING

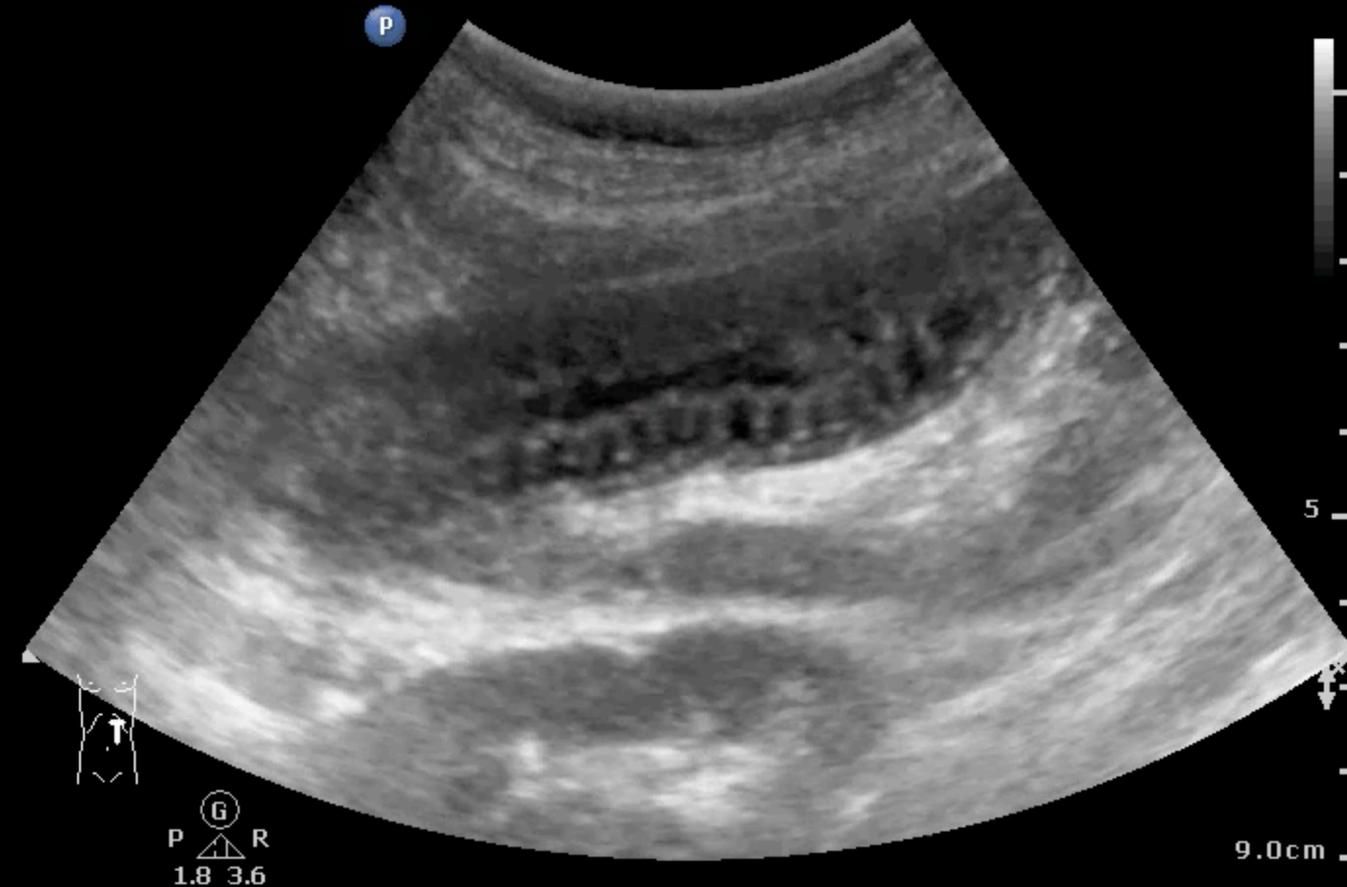
Abd Gen
C5-1
47 Hz
9.0cm

2D
HGen
Gn 68
C 56
3/3/3



Abd Gen
C5-1
47 Hz
9.0cm

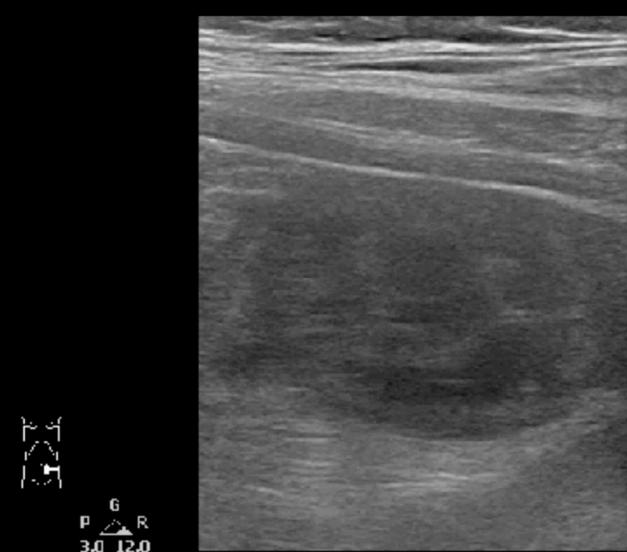
2D
HGen
Gn 60
C 56
3/3/3



Lupus mesenteric vasculitis

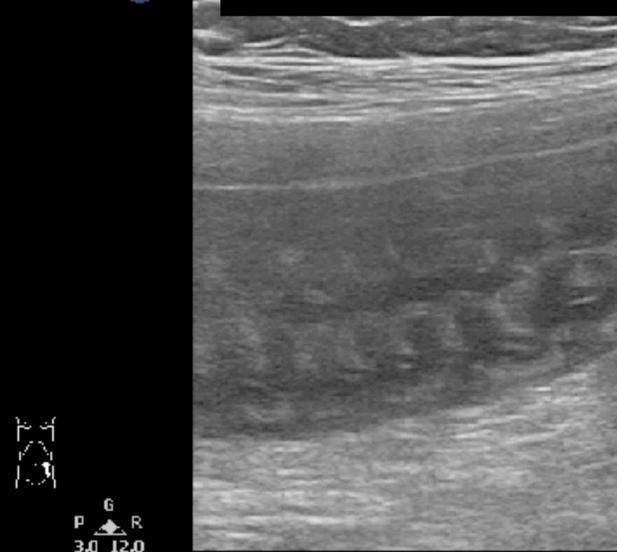
L1470
41 Hz
5.0cm

2D
Res
Gn 94
C 56
3/2/1

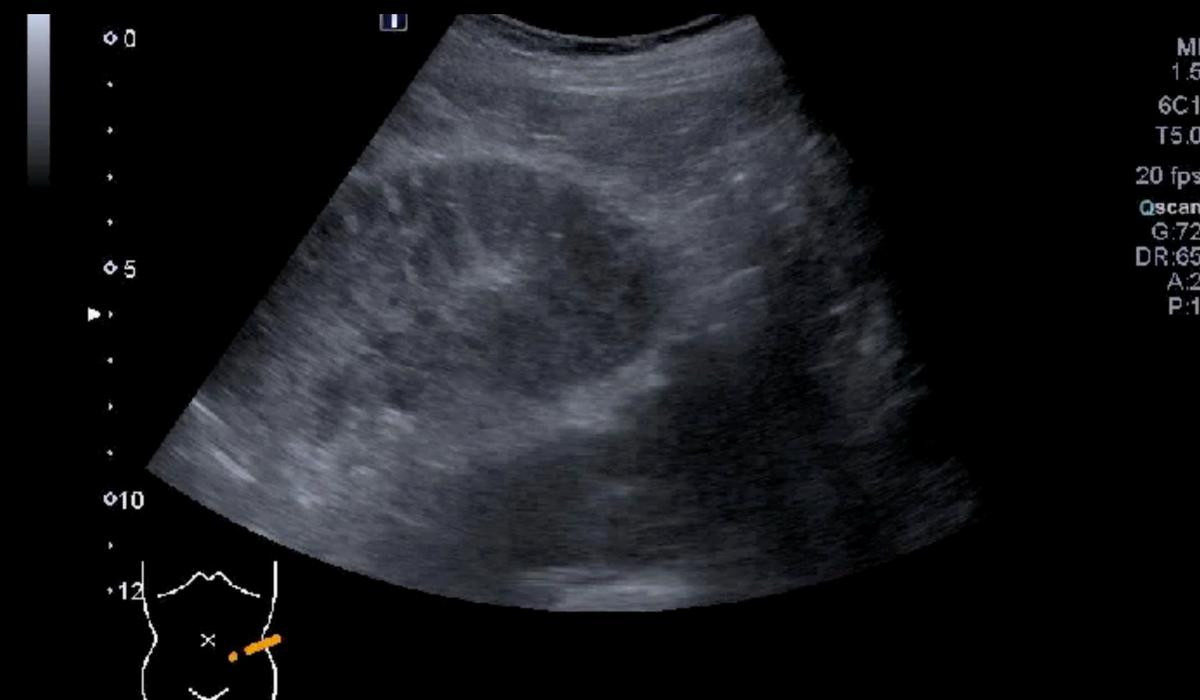
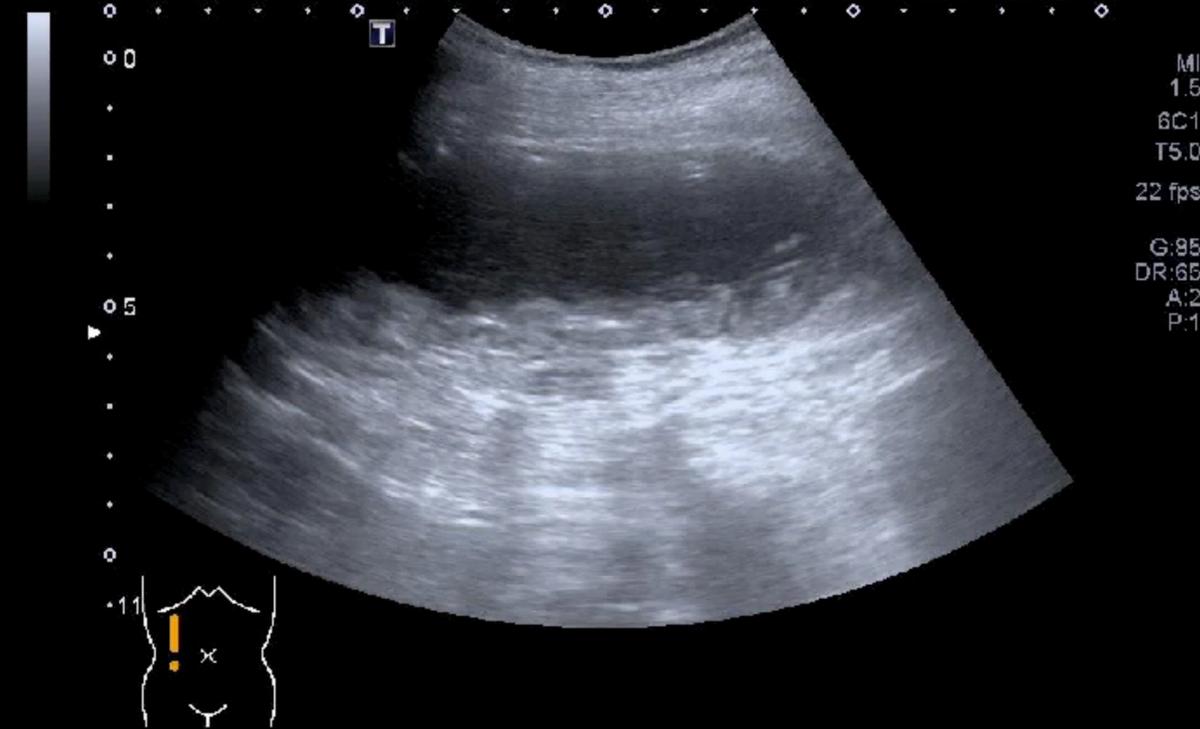


L1470
41 Hz
5.0cm

2D
Gen
Gn 94
C 56
3/2/1



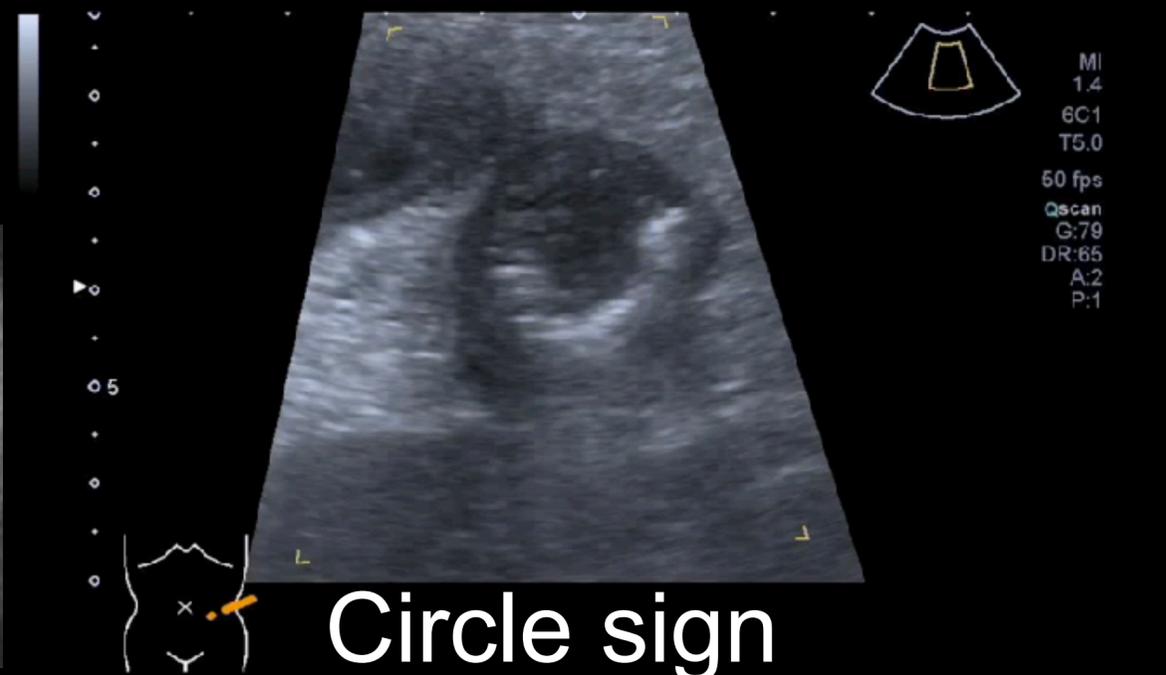
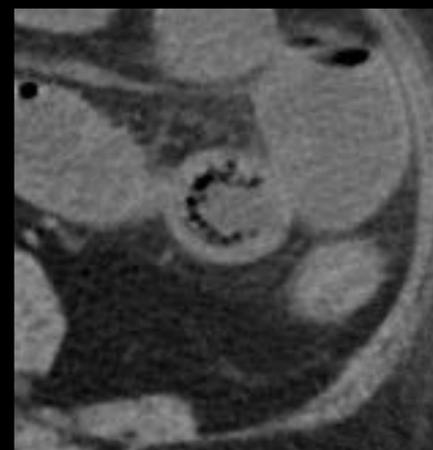
WALL THICKENING ? ABNORMAL GAS ?



WALL THICKENING ? ABNORMAL GAS ?



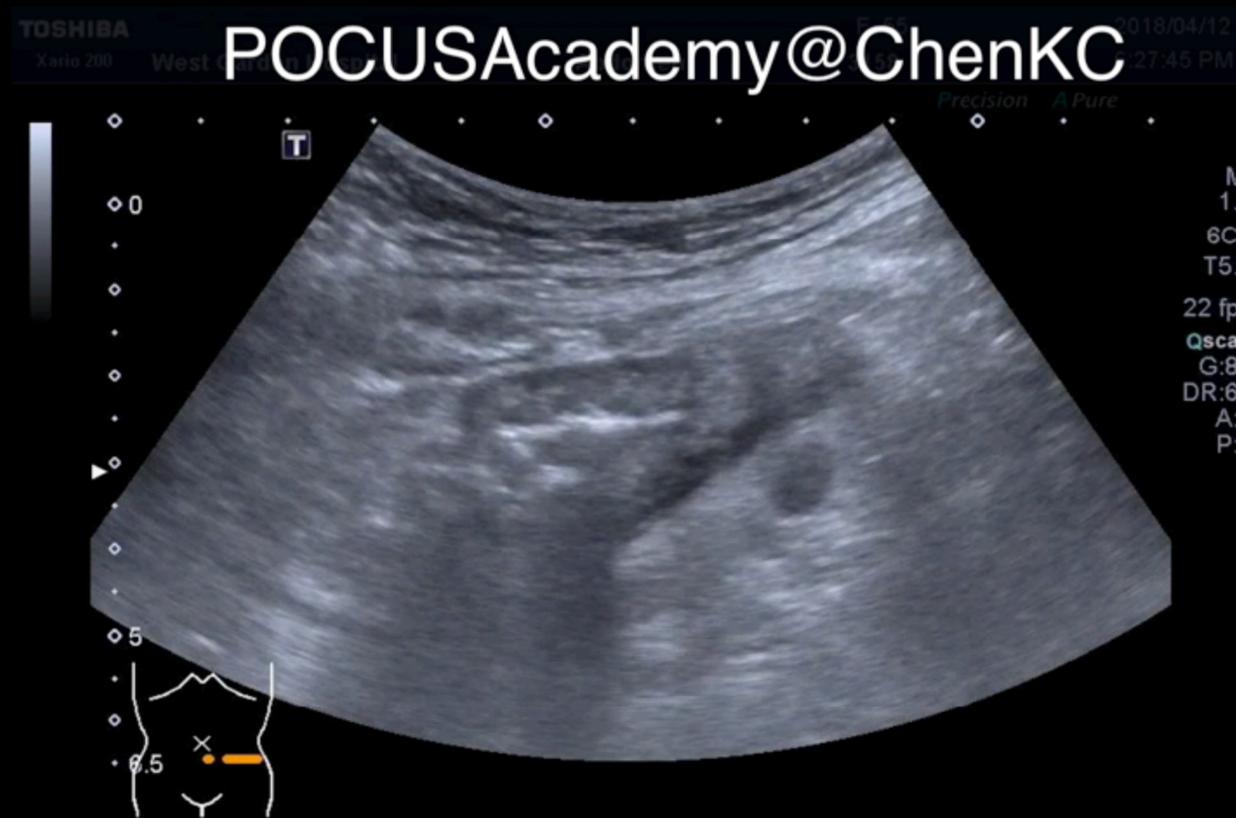
Pneumatosis intestinalis



Circle sign

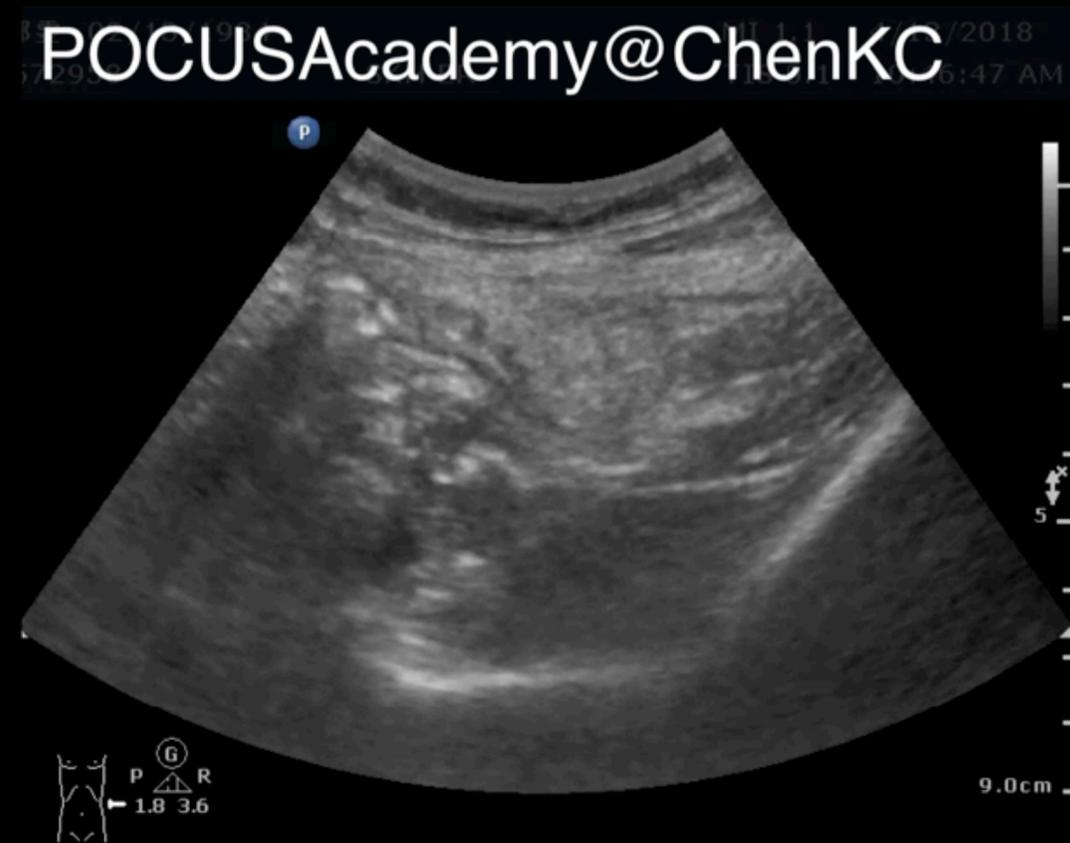
LLQ PAIN. NOTICE WALL THICKENING & ASSOCIATED FINDINGS

Asymmetric wall thickening
Echogenic fat
Dome sign



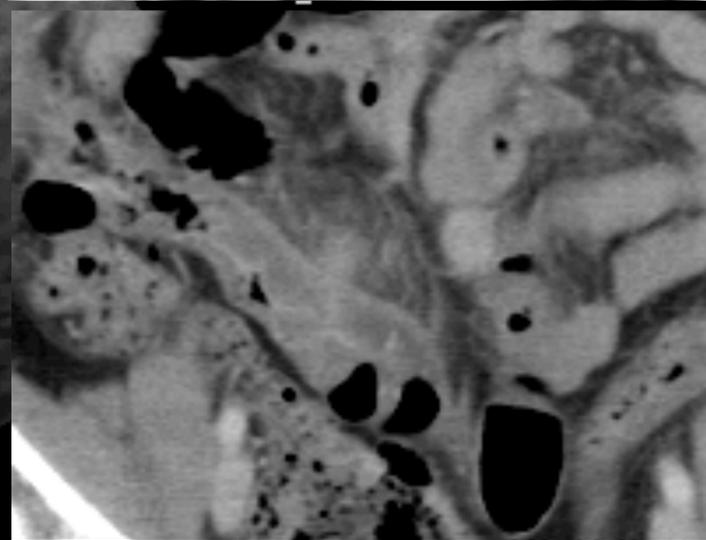
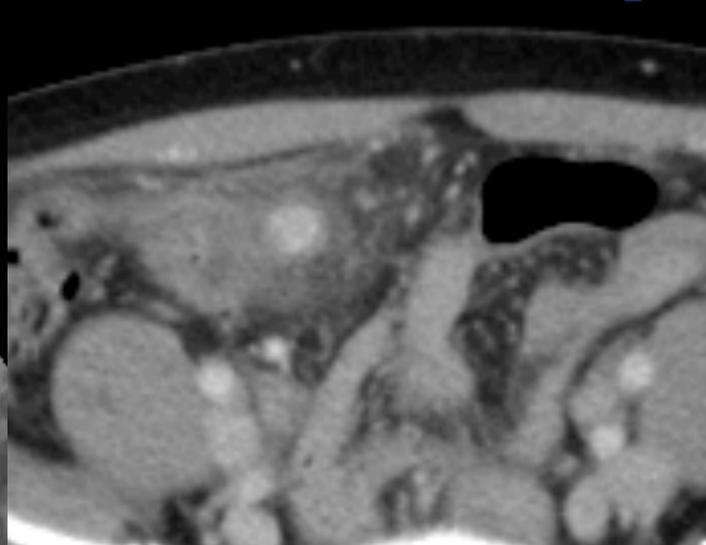
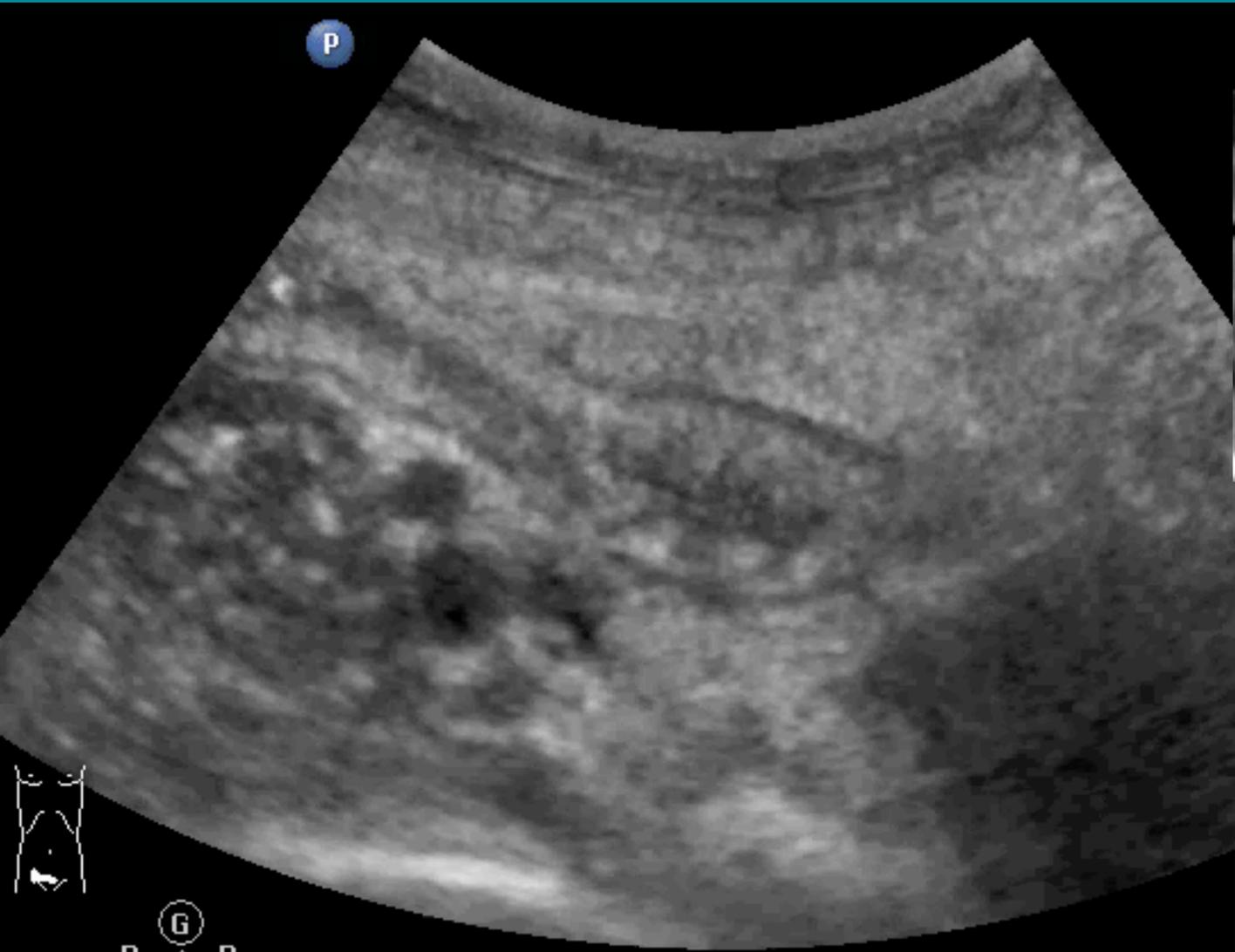
Diverticulitis

Normal bowel wall
Echogenic fat



Epiploic appendagitis

DIVERTICULITIS

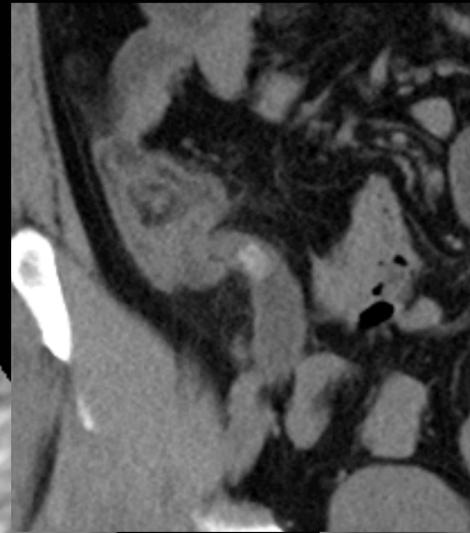


Asymmetric wall thickening
Echogenic fat
Dome sign

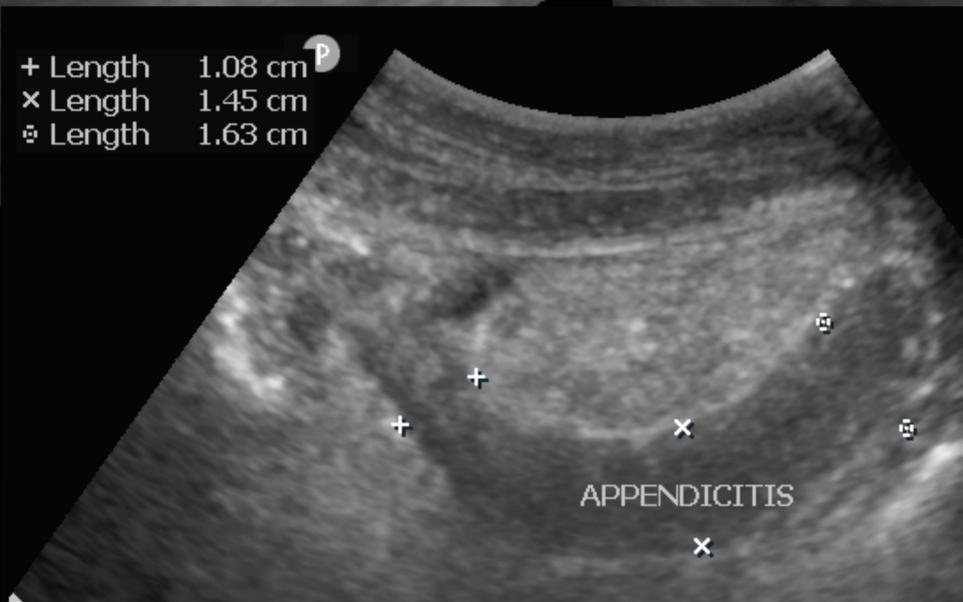
APPENDICITIS

(40M, EPIGASTRIC PAIN W/ RLQ TENDERNESS)

Diameter $>$ 6mm
Blind-end
Noncompressible



+ Length 1.08 cm
x Length 1.45 cm
⊖ Length 1.63 cm



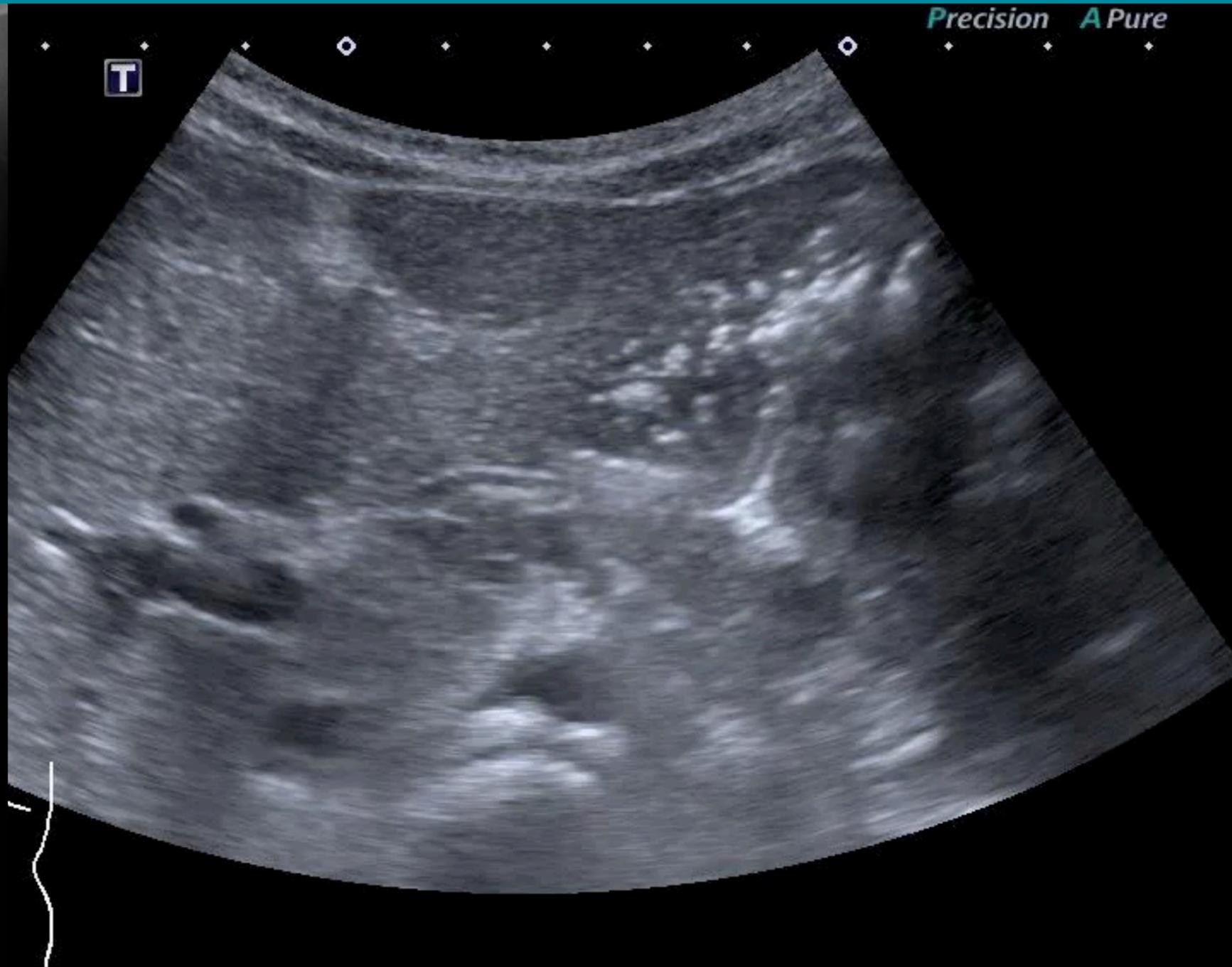
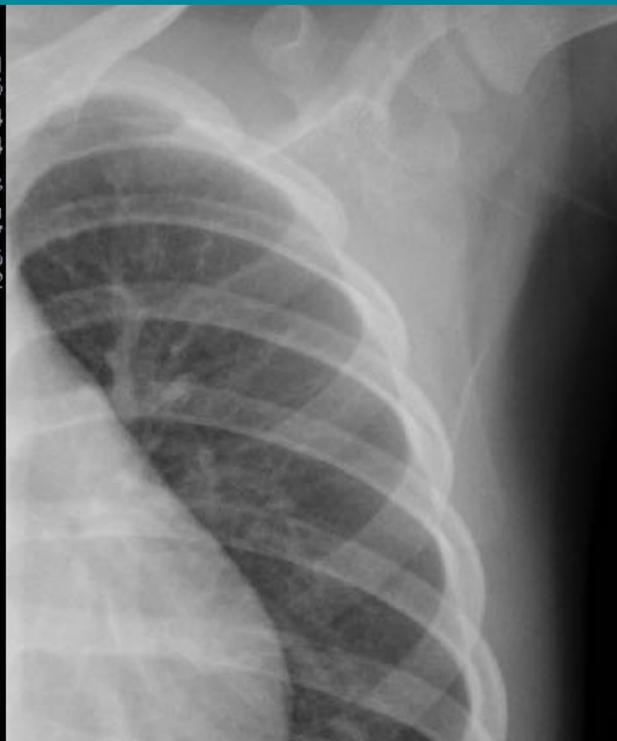
Echogenic fat



G
P R
1.8 3.6

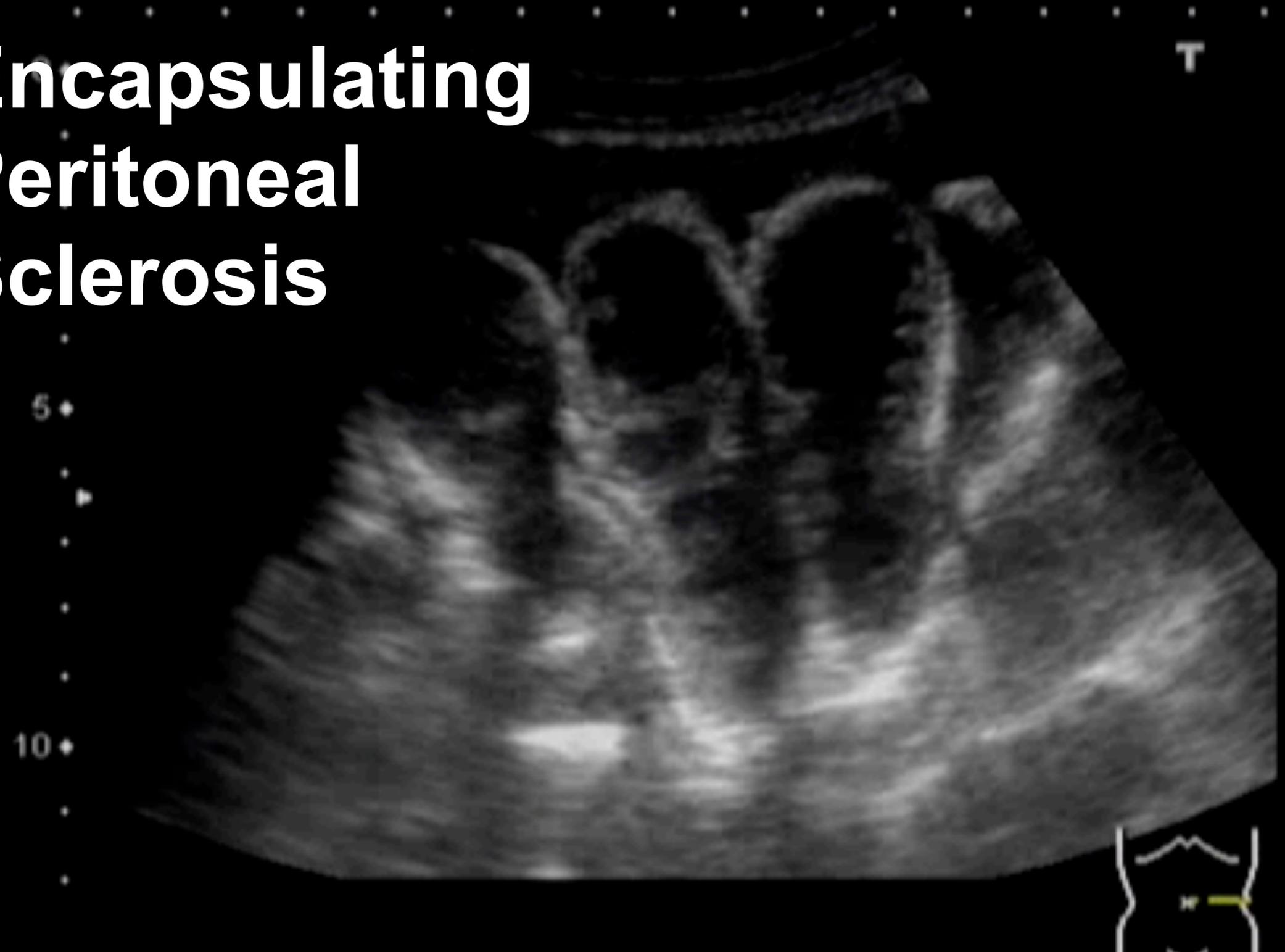
8.0cm

2F, COIN MIS-SWALLOWING



DIFFUSE ABDOMINAL PAIN

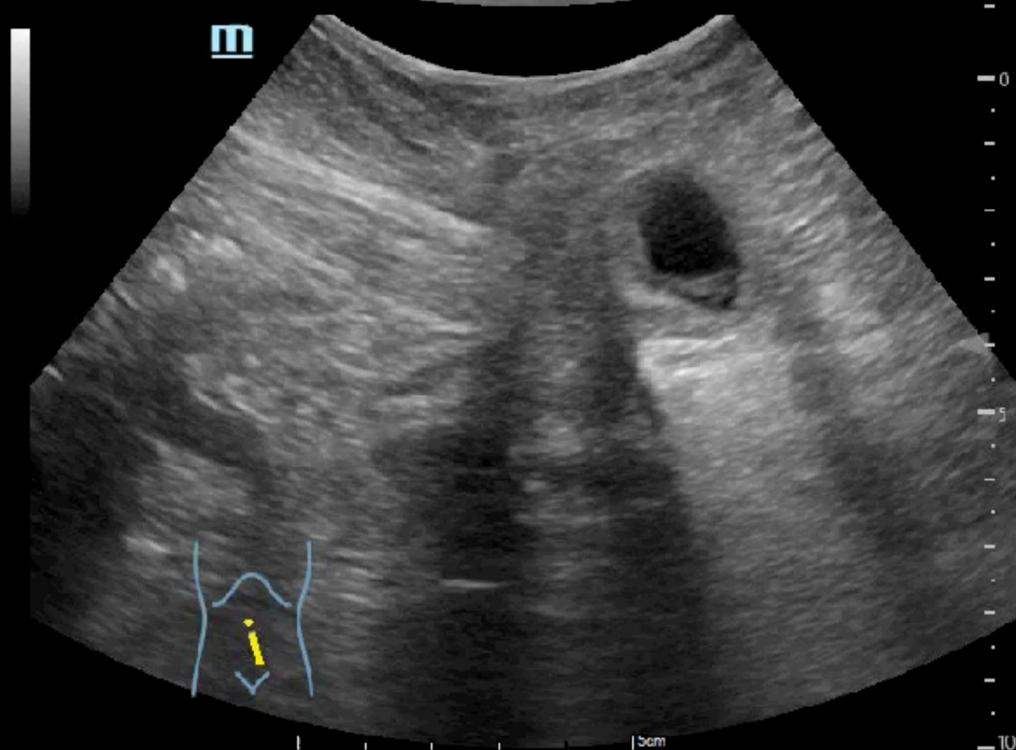
Encapsulating Peritoneal Sclerosis



ULTRASOUND GUIDED HERNIA REDUCTION

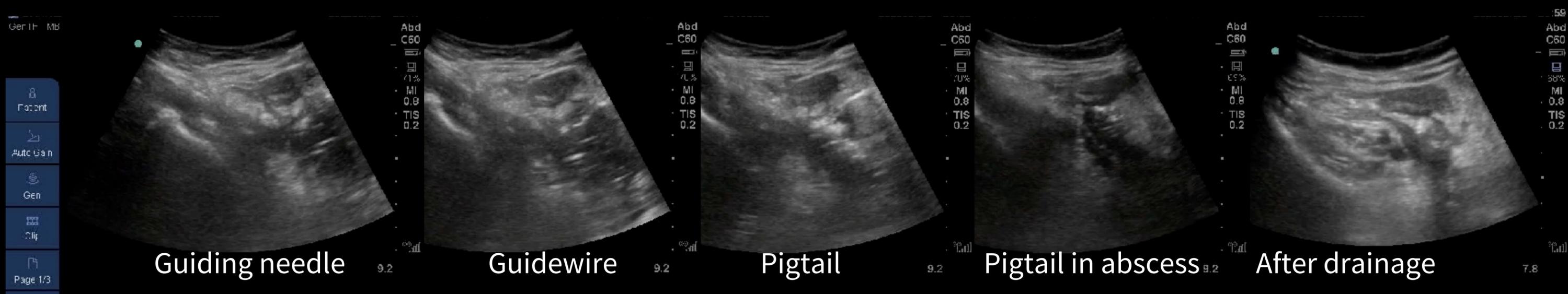
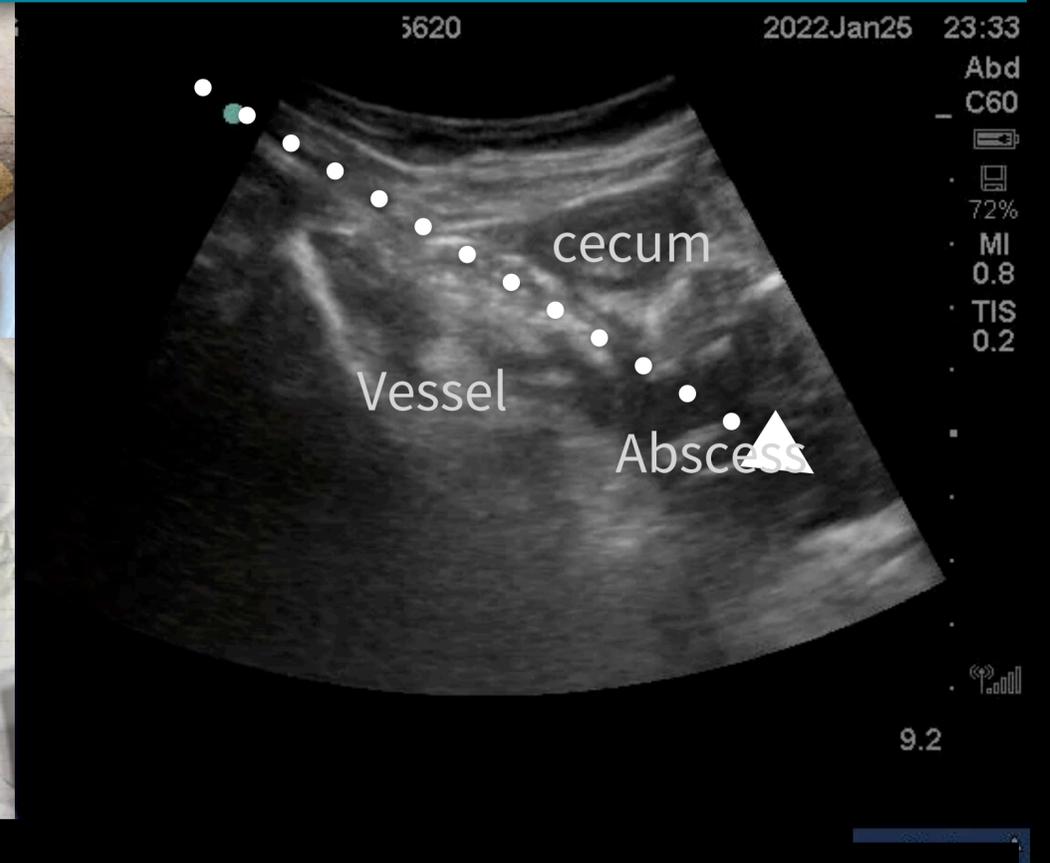


MI
1.5
6C1
T5.0
22 fps
G:85
DR:65
A:2
P:1



50F, RLQ pain for one week

Ultrasound guided pigtail for abscess drainage



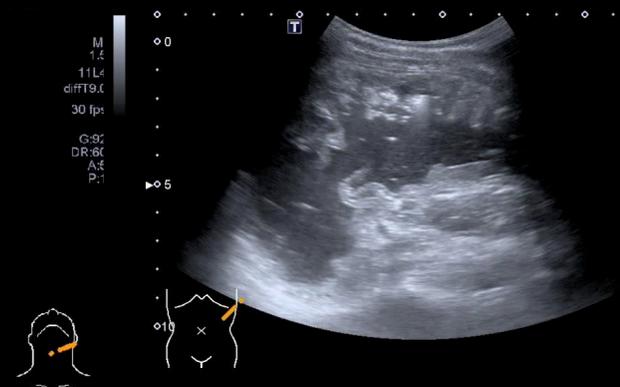
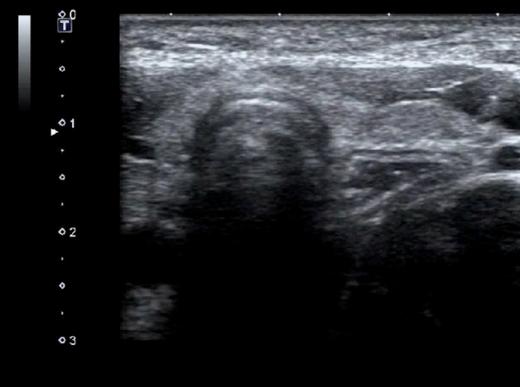
Guiding needle

Guidewire

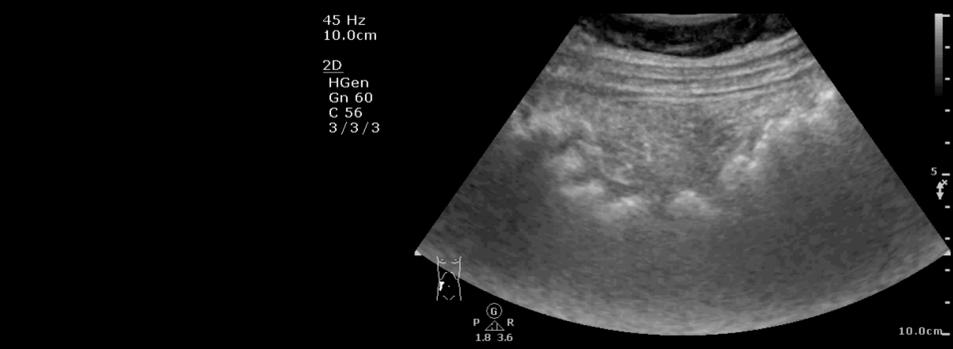
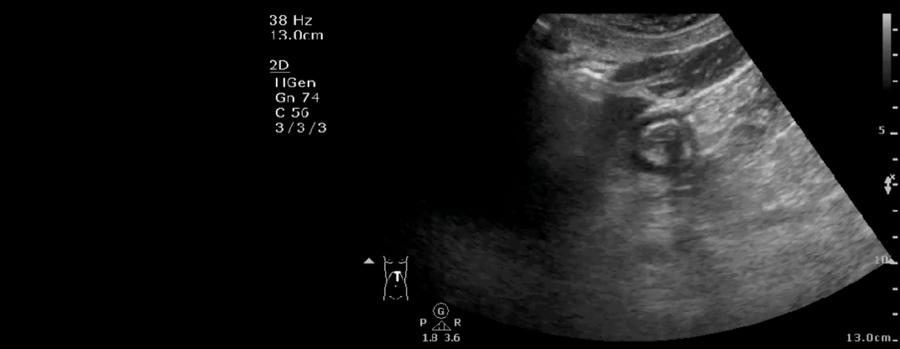
Pigtail

Pigtail in abscess

After drainage



Recognize GI tract Find patterns



Seeing your Gut feeling

to facilitate diagnosis & management



1. Recognize GI sonoanatomy
2. Start your scanning on landmarks
3. Scan transversely on targets
4. Compress steadily
5. Identify pathologic patterns
6. Size first then wall & layers
7. Pay attention to direct & indirect findings

GI TRACT

Cervical esophagus	Duodenum 2/3 parts	Colon-A
EC junction	Small bowel	Colon-T
Stomach (subxypoid)	I-C valvie	Colon-D
Stomach (LUQ)	Cecum	Colon-S
Gastric CSA	Appendix landmark	Rectum