Ultrasound Of The Acute Abdomen – a survival guide

Alison McGuinness
Consultant sonographer
Mid Yorks Hospitals NHS Trust

Definition

- Rapid onset of severe abdominal pain usually requiring admission to hospital

Speed of diagnosis

- Stability of patient, site and severity of pain
- Trauma, non-traumatic
- Large proportion of patients will not have a diagnosis for their pain when they are discharged
- Ultrasound v CT v laparotomy

Patient Care

- Avoid delay.
- Assess patient condition, take a good history and above all LISTEN to what is not being said!!
- Use all information – biochemical and previous imaging
- Reassurance
- Ensure report delivered efficiently to appropriate point of referral for early patient management

History taking

- Demographic details, occupation, recent travel, history of recent abdominal trauma.
- Pain:
  - Onset (including whether new pain or previously experienced).
  - Site (ask the patient to point), localised or diffuse.
  - Nature (constant/intermittent/colicky).
  - Radiation.
  - Severity.
  - Relieving/aggravating factors (e.g., if worsened by movement/coughing, suspect active peritonitis; pancreatitis is relieved by sitting forward).

Associated symptoms

- Vomiting and the nature of vomitus (undigested food or bile suggests upper GI pathology or obstruction; faeculent vomiting suggests lower GI obstruction).
- Haematemesis or melaena.
- Stool/urine colour.
- New lumps in the abdominal region/groins.
- Eating and drinking - including when the patient's last meal occurred.
- Bowels - including presence of diarrhoea, constipation and ability to pass flatus.
- Fainting, dizziness or palpitations.
- Fever/rigors.
- Rash or itching.
- Urinary symptoms.
- Recent weight loss.

Trauma to the abdomen

Who provides the service?

Core and out of hours

- Paramedic
- Emergency medicine physician
- Sonographer
- Radiologist
- Trauma radiographer

Principles of Ultrasound in Emergency Medicine

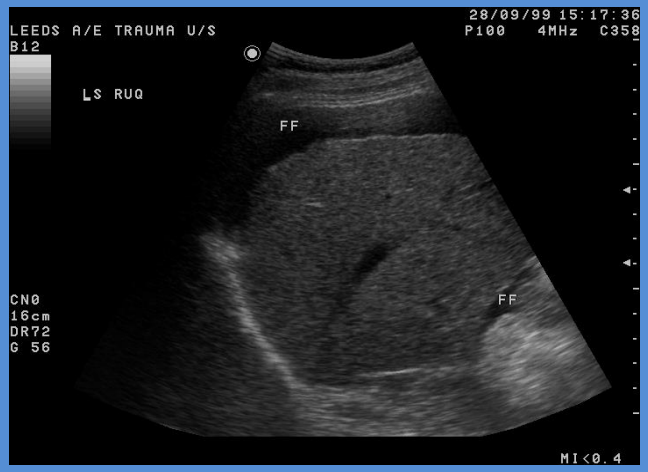
- Limited examination
- Focused
- Specific question
- ‘Rule in’
- Record images
- c.f. radiology departmental examination

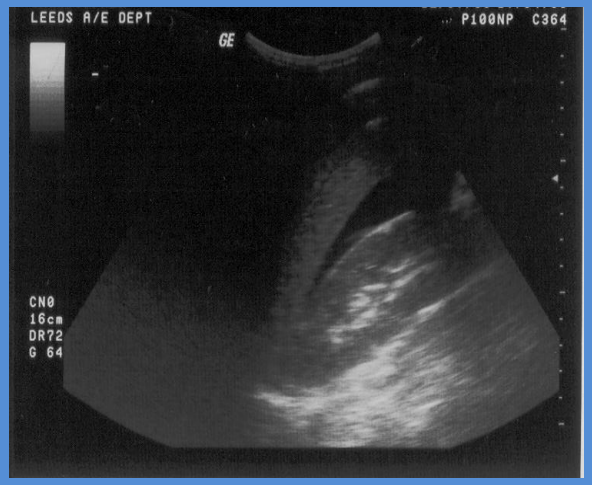
Free fluid: Fast(Focused Assessment with Sonography for Trauma)

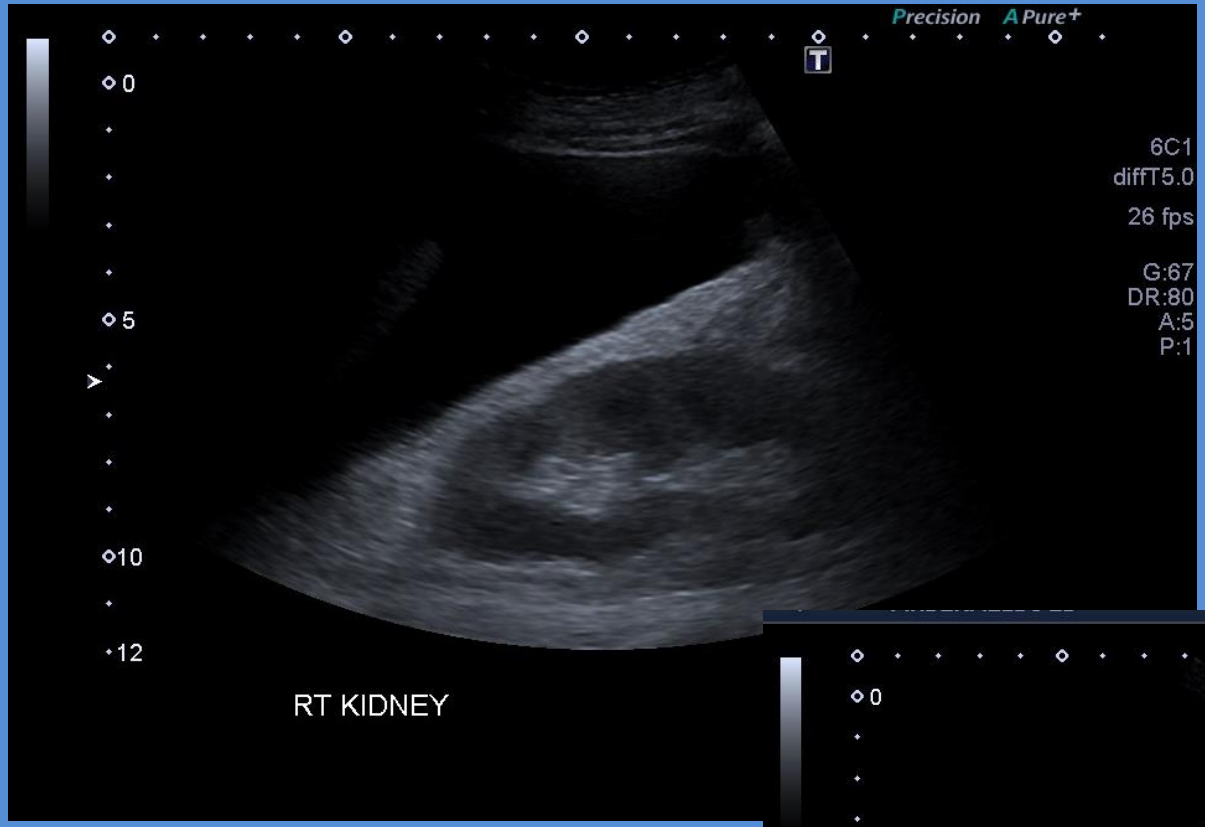
- Employed to answer a single rule-in question rather than specifically evaluate a system.
- Takes less than 5 minutes
- Can be performed during resuscitation
- Has replaced diagnostic peritoneal lavage (DPL) as the primary assessment of blunt abdominal trauma.

FAST

- Employs a limited 4-6 view of the abdomen to rule in free fluid.
  - Hepatorenal space (Morrison's pouch)
  - pericardial space
  - perisplenic space
  - suprapubic region
  - bilateral paracolic views
- 250ml of fluid

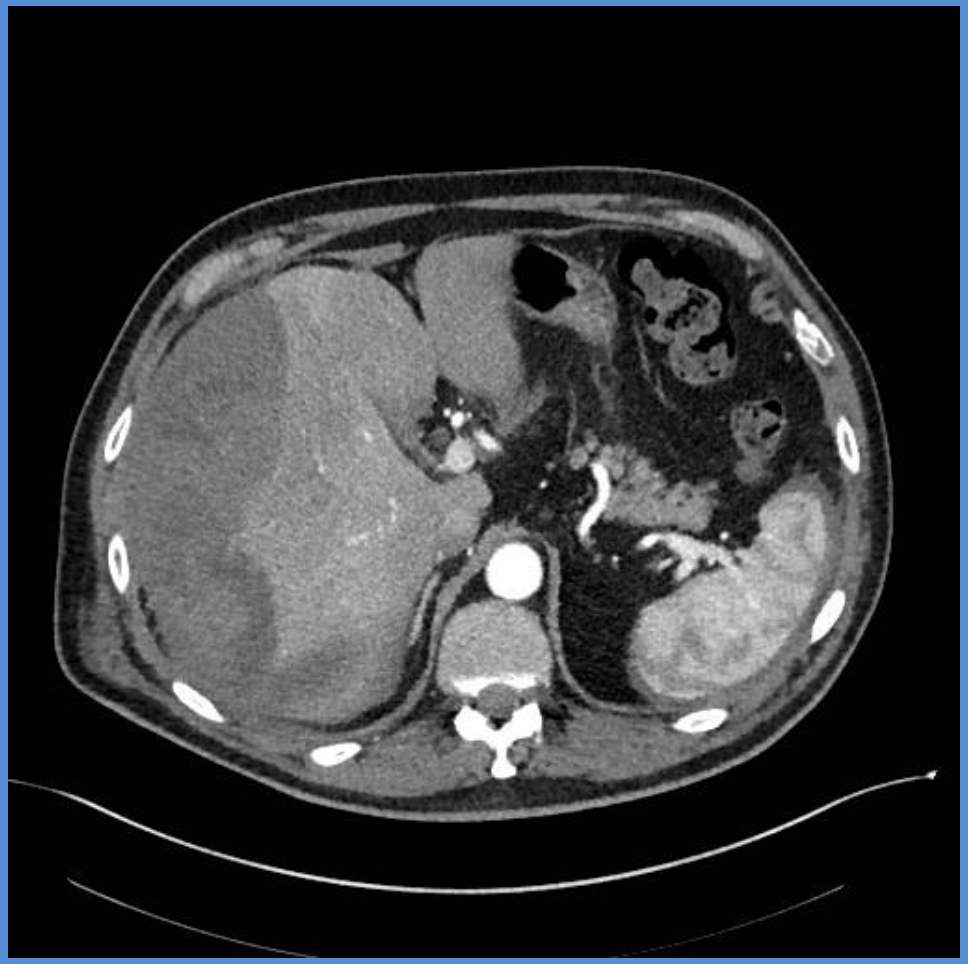





Precision
A Pure+
0
5
10
12
6C1
diffT5.0
26 fps
G:67
DR:80
A:5
P:1
RT KIDNEY

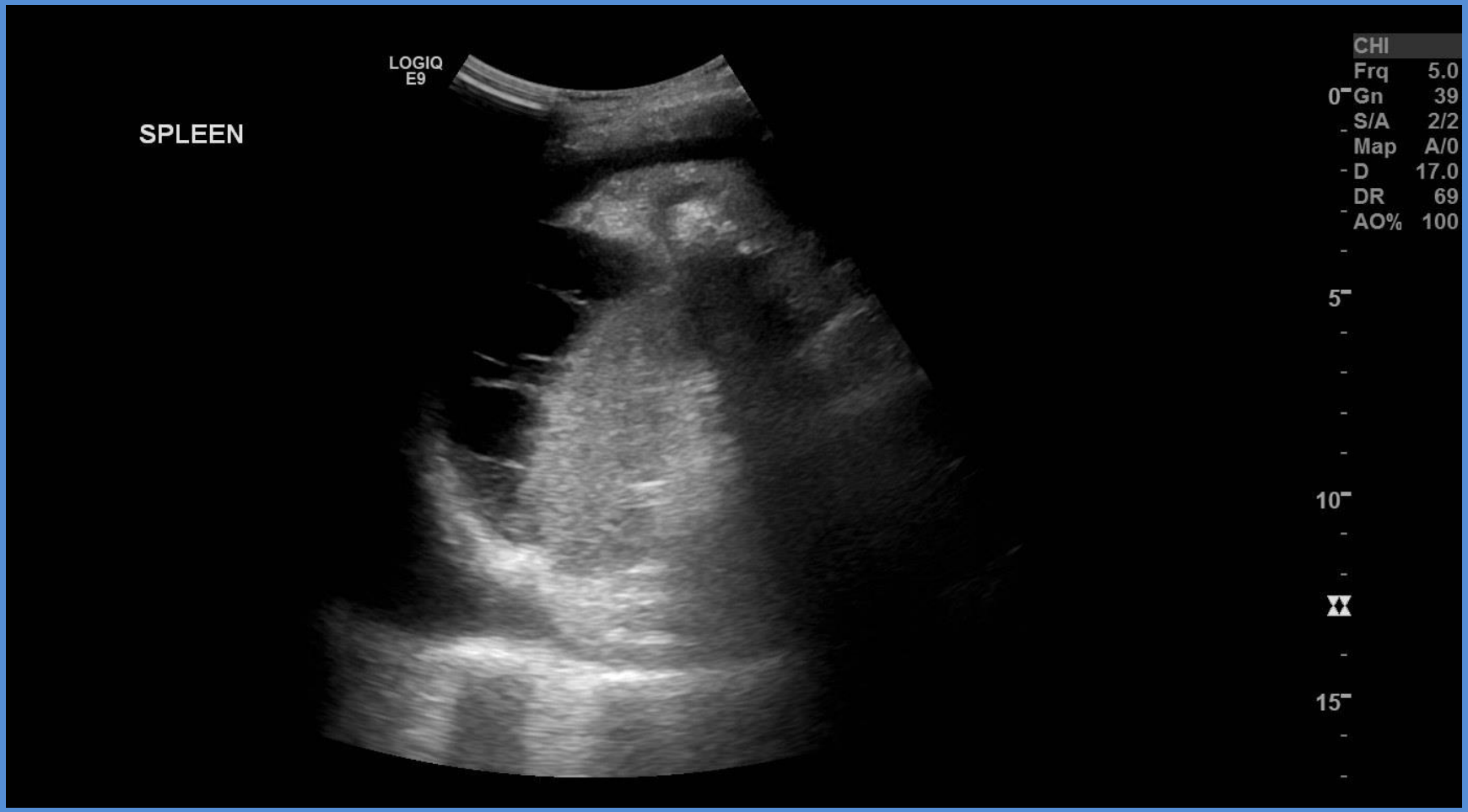

Precision
A Pure+
0
5
10
13
6C1
diffT5.0
21 fps
G:75
DR:80
A:5
P:1
LT KIDNEY
215

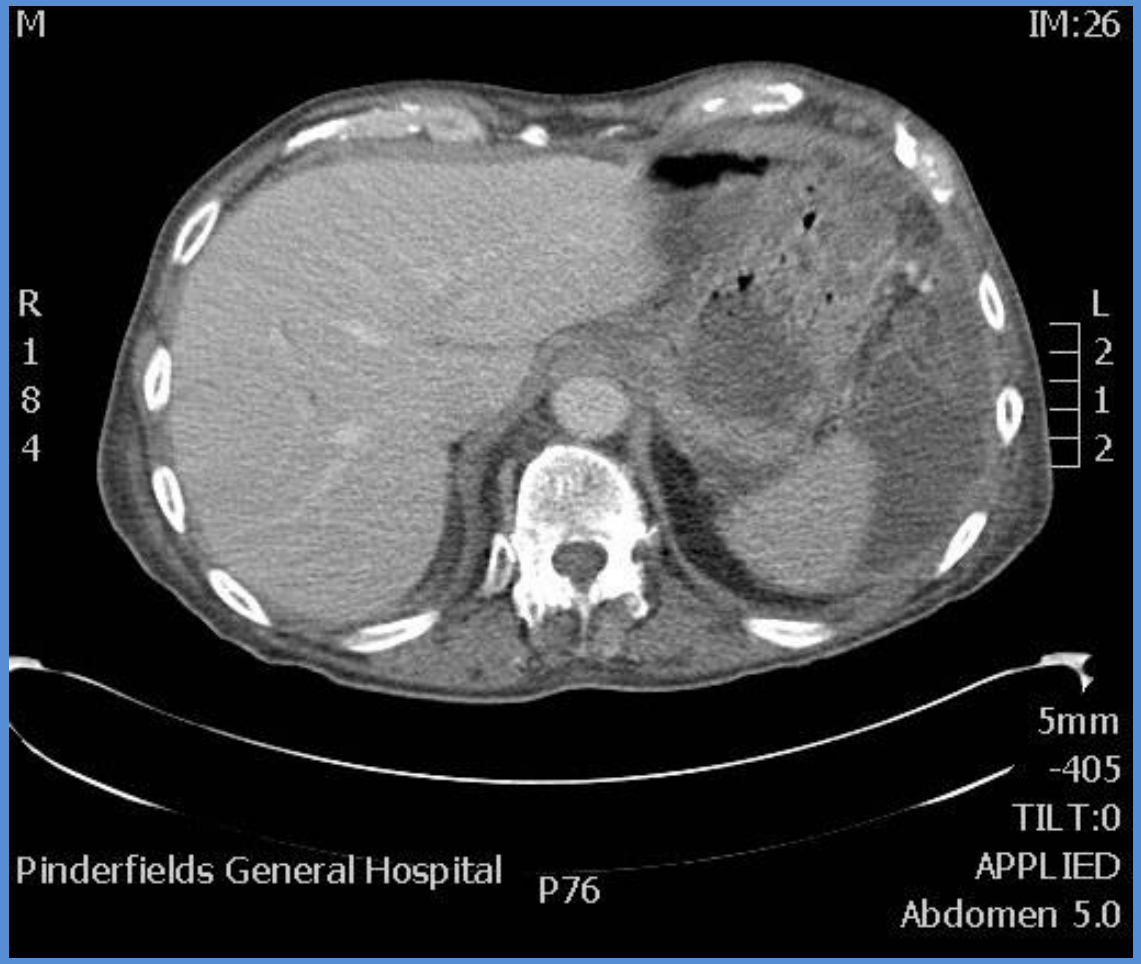
Liver Trauma



Renal trauma

Splenic collection




M
IM:26
R
1
8
4
L
2
1
2
5mm
-405
TILT:0
APPLIED
Abdomen 5.0
Pinderfields General Hospital
P76

Non-traumatic pain

Ultrasound Of The Acute Abdomen

Answer SIX basic questions:

- Is there blood (free fluid) in the peritoneal cavity?
- Is an abdominal aortic aneurysm (AAA) present?
- Is there evidence of obstructive uropathy?
- Is there evidence of biliary disease (cholelithiasis)?
- Is there evidence of a living intrauterine pregnancy?
- Is there a pericardial effusion?

» Brenchley J. Sloan J. 2000

Aetiology

- 34 % no cause for pain identified
- 28% appendicitis
- 10% acute cholecystitis
- 4% small bowel obstruction
- 4% acute gynae
- 3% acute pancreatitis
- 3% ureteric colic
- 3% perforated ulcer
- 11% others – vascular origin, aortic aneurysm, cardiac problems

AAA: Abdominal Pain And Hypotension

- Aortic dimensions can be easily measured and although leakage cannot be assessed, the presence of a dilated aorta in patients with circulatory instability significantly speeds up diagnosis of a leaking abdominal aortic aneurysm and vascular referral.
  - » BALLARD et al 1998

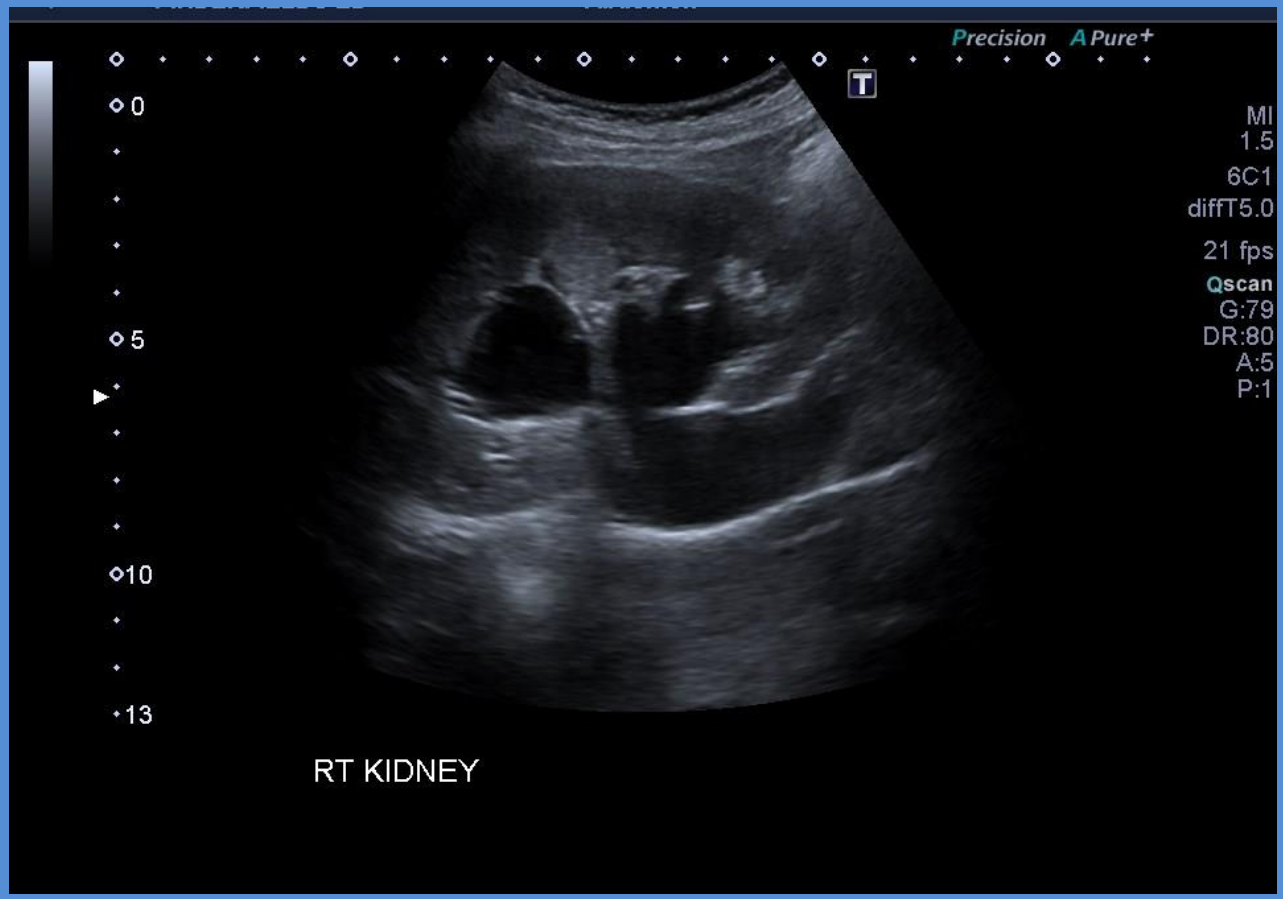
Kidneys

Renal colic

- Ultrasound – hydronephrosis, pyelonephritis – management pathway

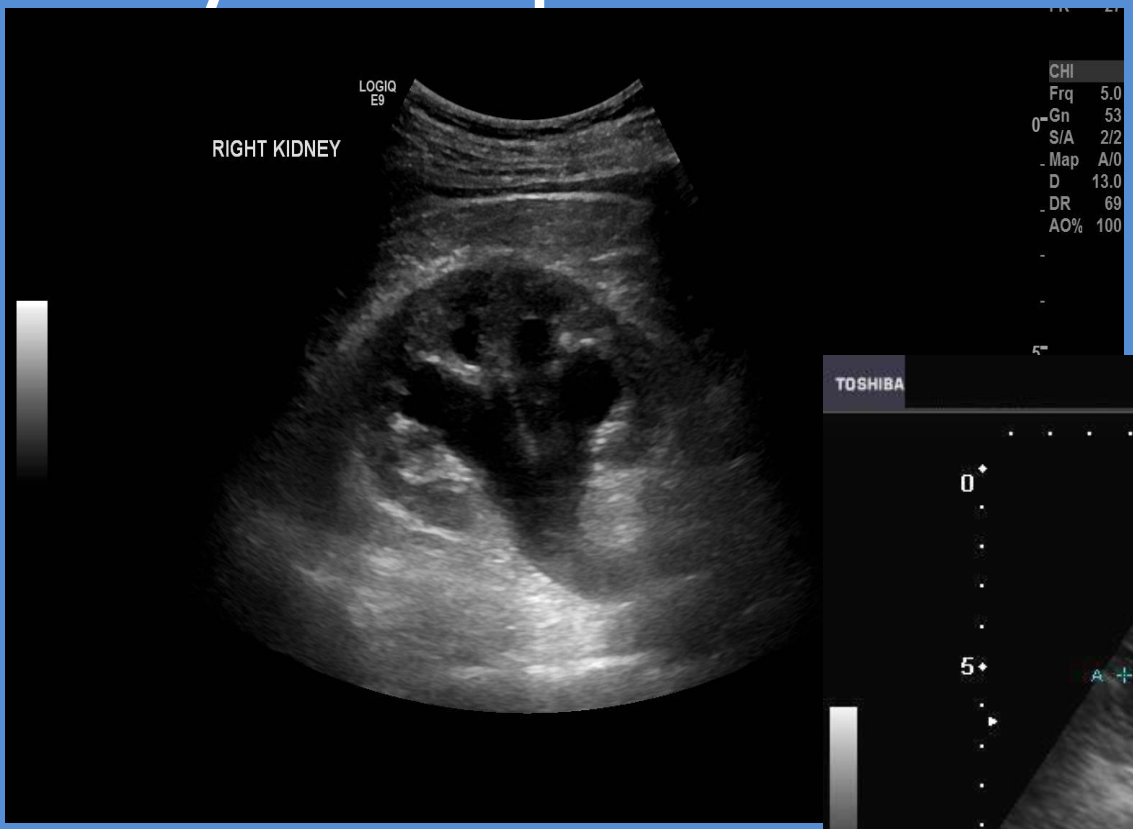
- CTKUB – stones (exception – females of child bearing age)

Hydronephrosis - pregnancy



Is it normal for gestation?

Hydronephrosis – chronic retention

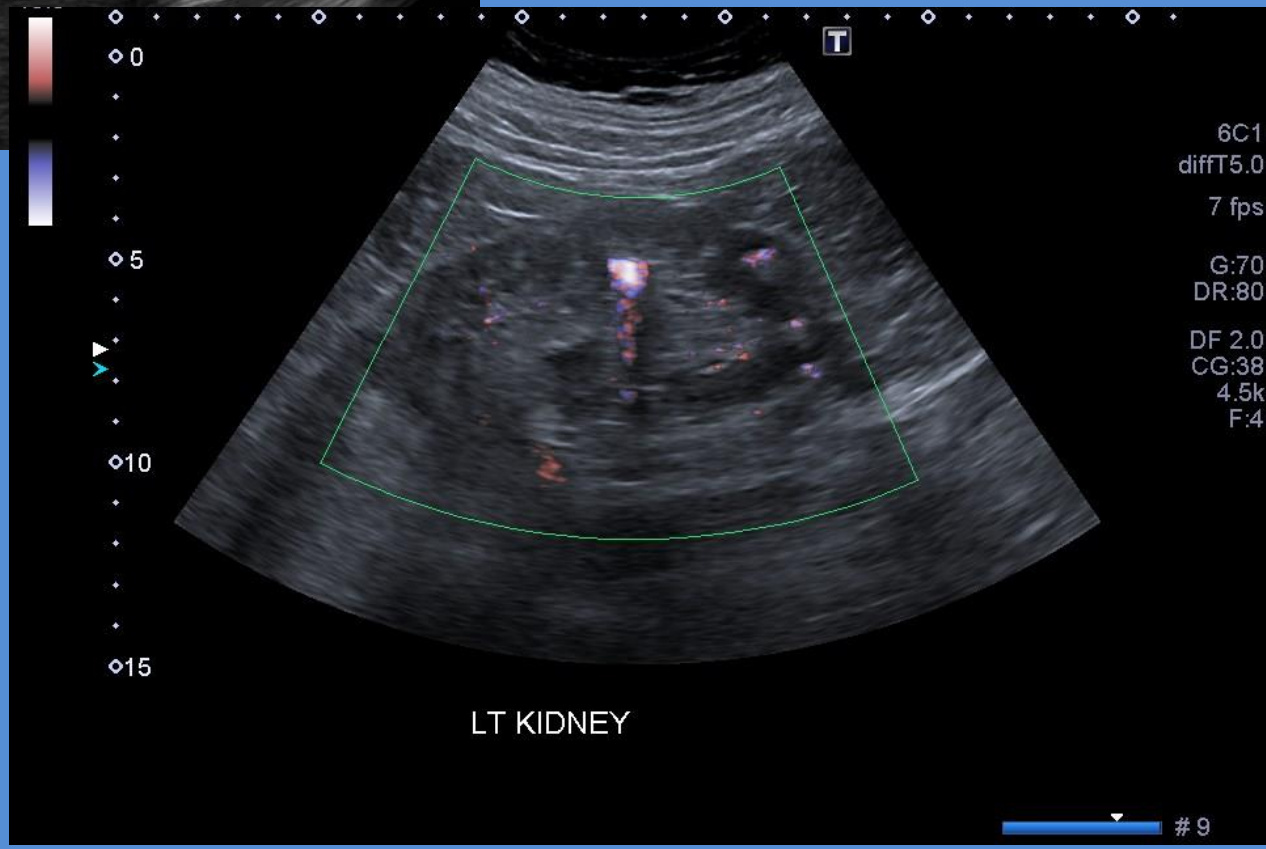


Cortical thickness?

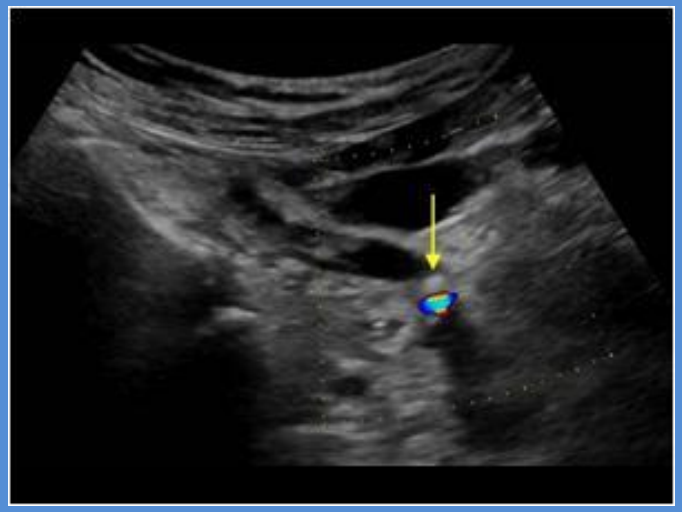
Renal calculi

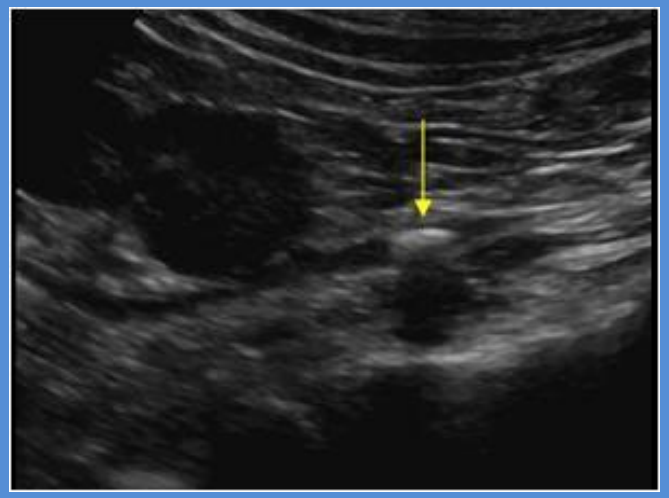
- Is it in the collecting system?
- Is it causing obstruction?
- Is it solitary?


RXF0437387
20/05/1938
130dB/C 4
Persist Med
Fr Rate Med
2D Opt:Res
L T K I D
IM:5
12.93cm
Pinderfields

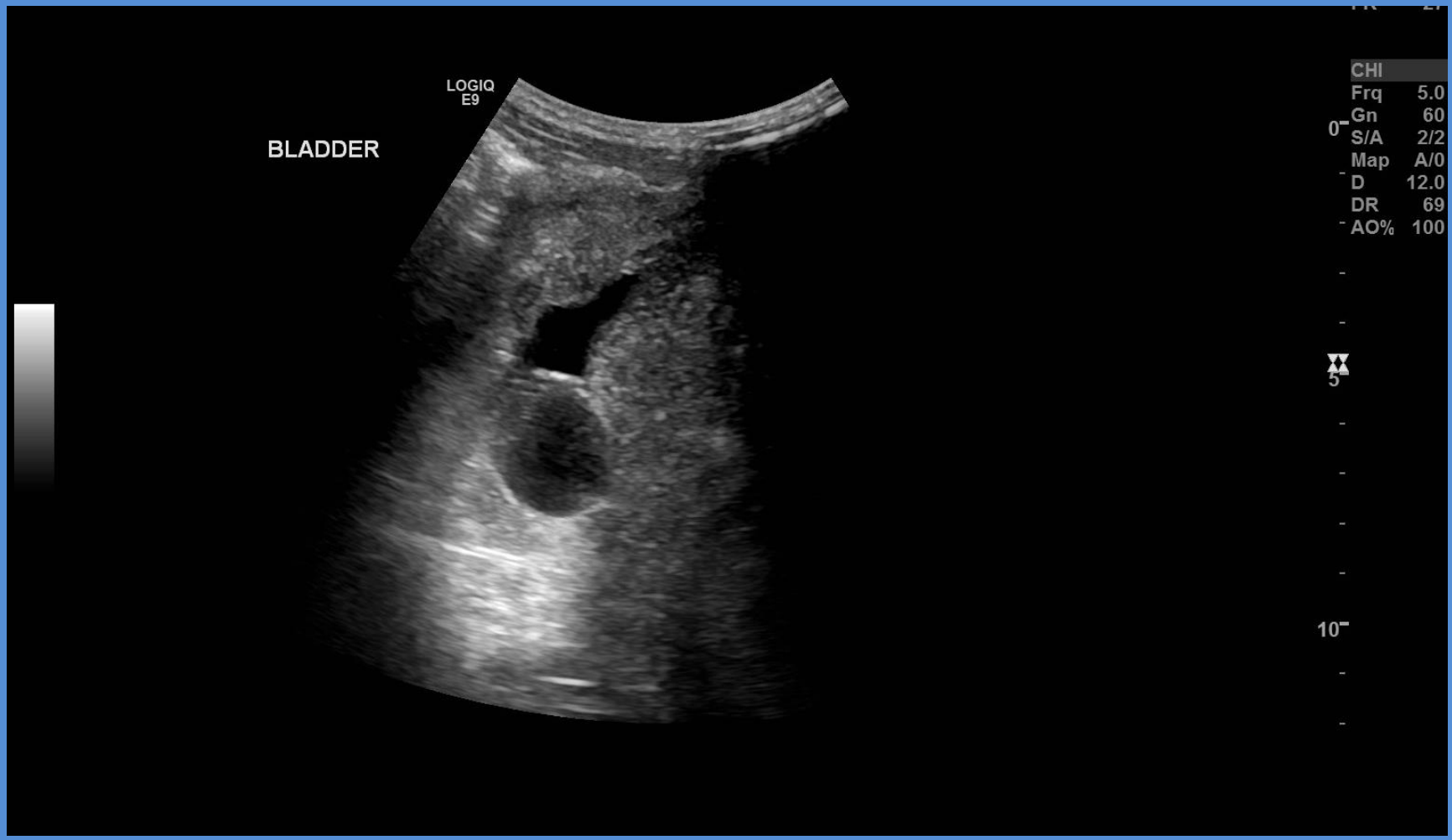

6C1
diffT5.0
7 fps
G:70
DR:80
DF 2.0
CG:38
4.5k
F:4
LT KIDNEY
9

Renal and ureteric stones
Hydronephrosis





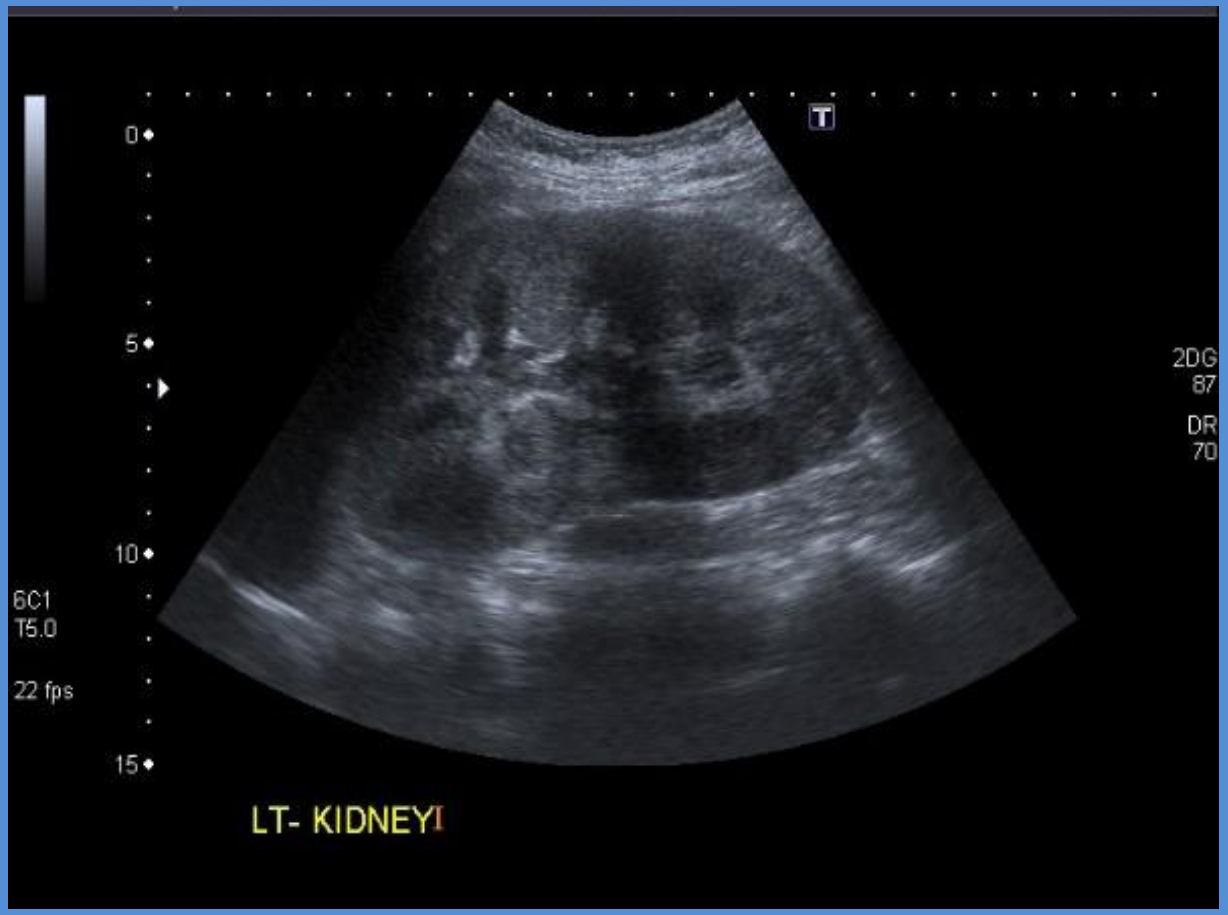
Hydronephrosis –pelvic mass


LOGIQ
E9
BLADDER
CHI
Frq 5.0
Gn 60
S/A 2/2
Map A/0
D 12.0
DR 69
AO% 100
0
5
10

Rhabdomyosarcoma

Pyelonephritis

- Often unilateral
- Discrepancy in size
- Focal echogenic area
- Hypervascularity



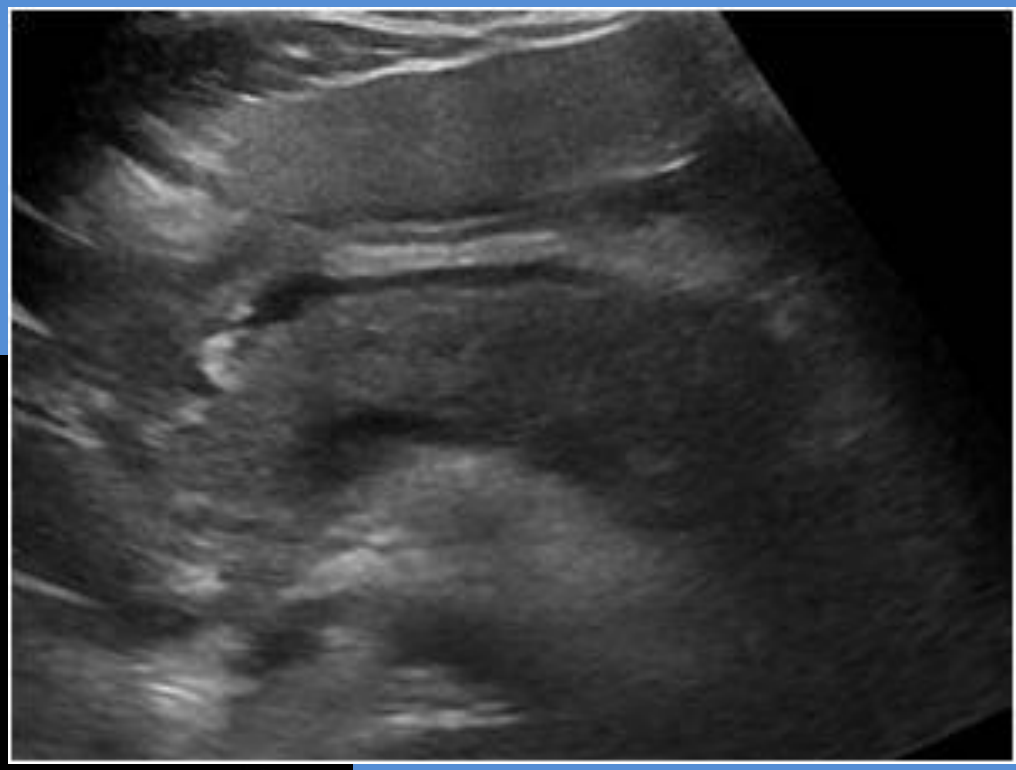
Increased cortico-medullary differentiation

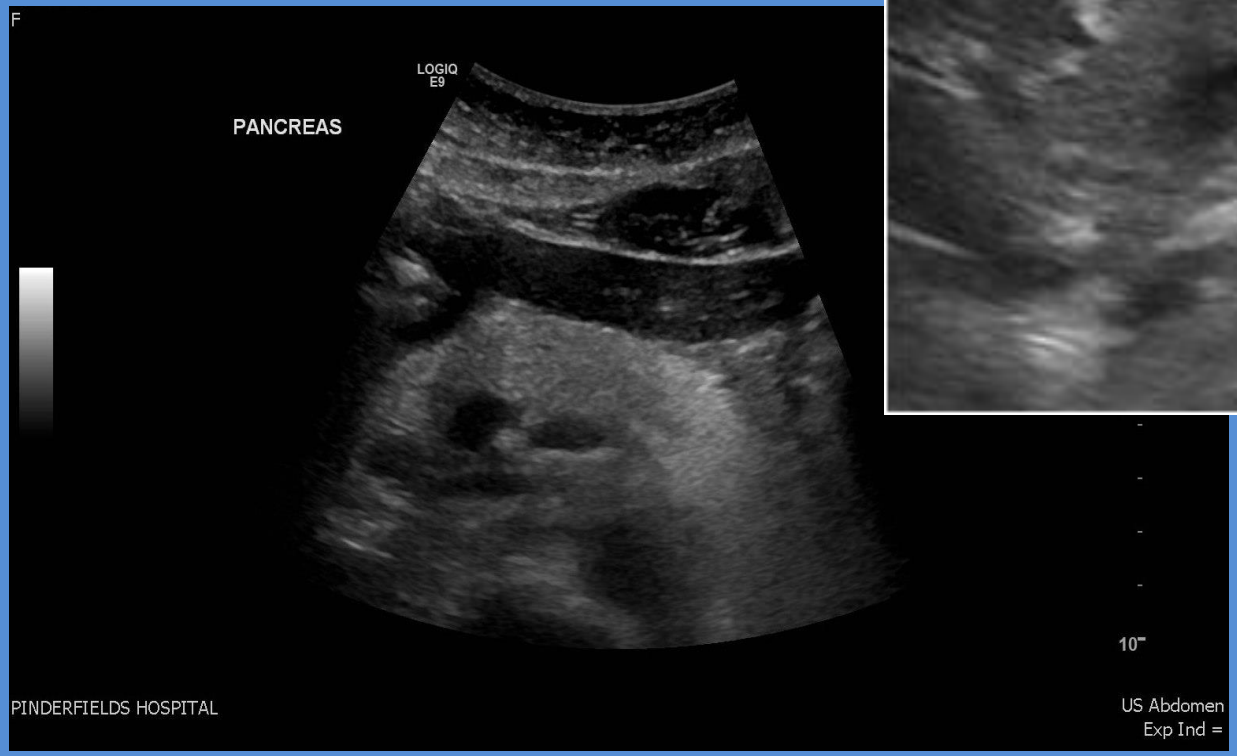
Pancreas

Acute Pancreatitis

- Oedematous inflammation of the pancreas with severe upper abdominal pain.
- Diagnosis made on clinical grounds with a serum amylase >1000 iu/l.
- Predisposing factors include alcoholism, gallstones and mild blunt, abdominal trauma.

Acute pancreatitis

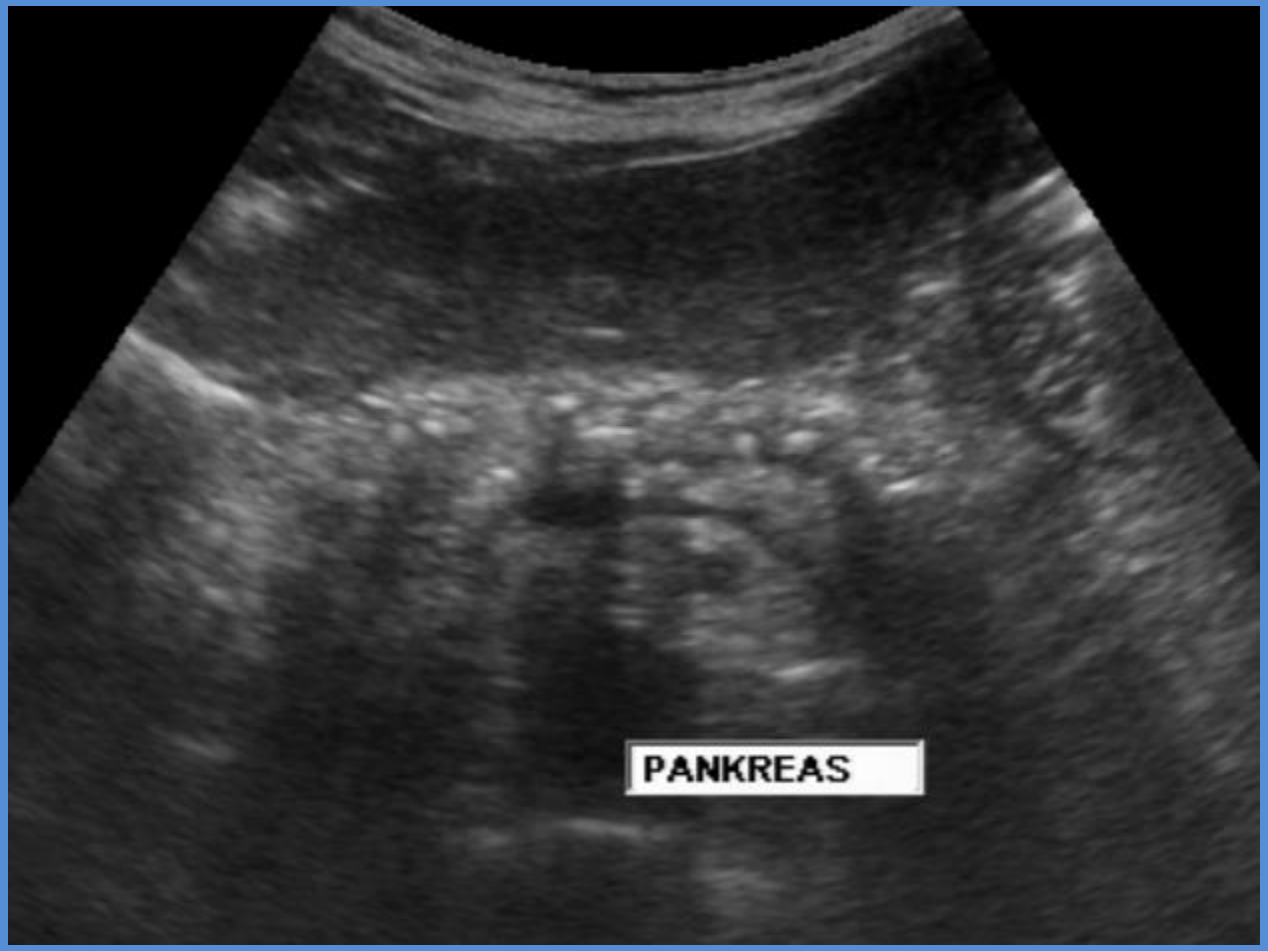




Chronic Pancreatitis

- Chronic changes due to recurrent bouts of inflammation with resultant fibrosis, stone formation and permanent damage.
- Patient presents with a similar pain to acute pancreatitis only more persistent and not as severe.
- Frequently occurs in alcoholics following multiple episodes of acute pancreatitis.

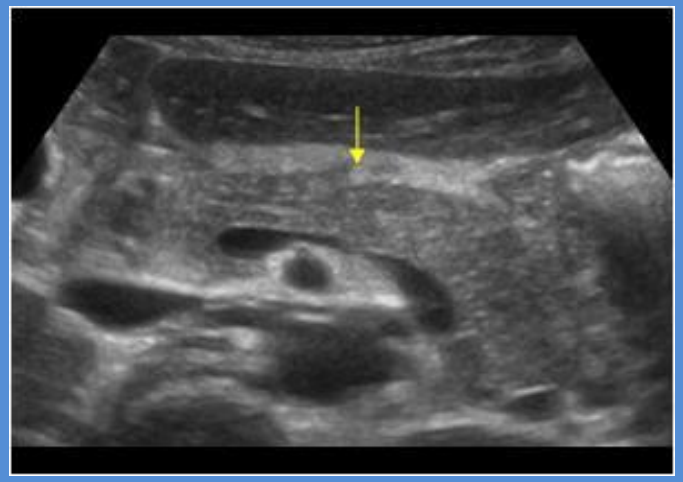
Chronic pancreatitis

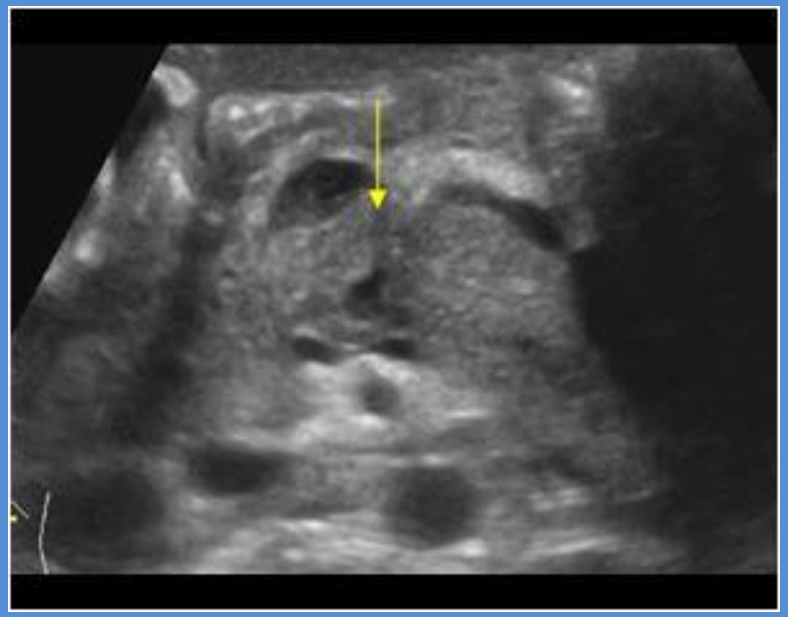


Traumatic Pancreatitis

- Severe trauma may disrupt the duct spilling pancreatic juices into the surrounding tissues resulting in the development of large pseudocysts.
- Neck of pancreas is most vulnerable, the duct rupturing when compressed between the aorta and the spine.
- Distal pancreatectomy is often necessary

Traumatic dissection pancreatic body





Biliary Tree

Abnormal LFTs

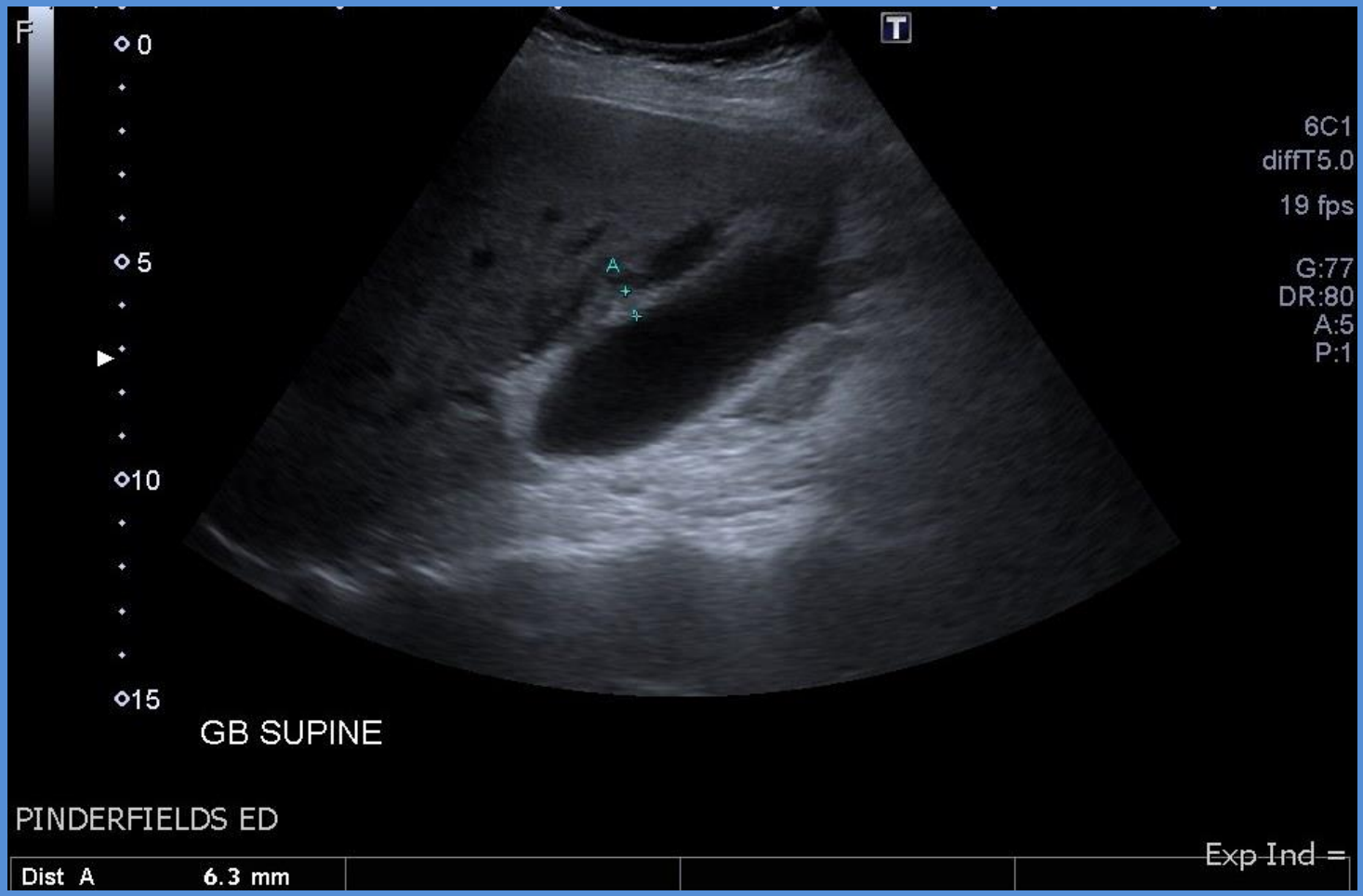
- Serum albumin and bilirubin levels used to provide a true measure of hepatic function
- Alanine aminotransferase (ALT) or asparate transaminase (AST) sensitive markers of hepatocyte injury –
  - raised in acute hepatitis but also in chronic liver disease.
  - Very high levels of ALT (> 1,000iU/l) can due to hepatic ischaemia or cholangitis due to biliary stones
- Gammo-glutamyl transpeptidase (GGT) is a marker for biliary tract disease
- GGT along with ALP used as a specific marker of alcohol misuse
- History and exam should include possible non hepatic causes of raised LFTs e.g. right sided heart failure, endocrine disorders, diabetes and thyroid dysfunction

Abnormal LFTs

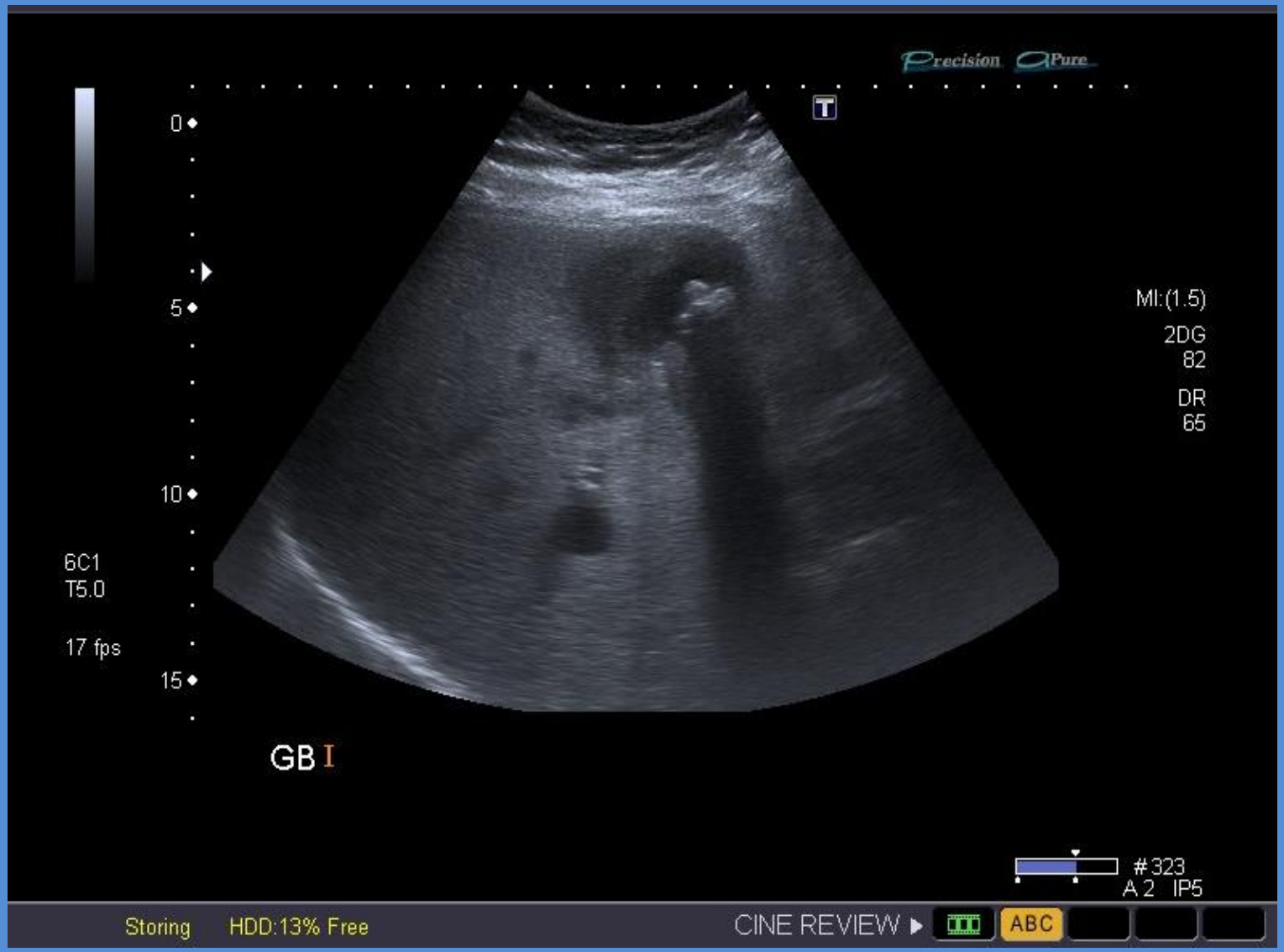
Liver Enzymes	Normal	Moderate	Severe
AST	under 40 IU/l	40-200	Over 200
ALP	under 40 IU/l	40-200	Over 200
GGT	under 60 IU/l	60-200	Over 200
Alk Phos	under 112 IU/l	112-300	Over 300
LFTs	Normal	Moderate	Severe
Bilirubin	under 1.2 mg/dl	1.2- 2.5	Over 2.5
Albumin	3.5-4.5 g/dl	3.0 -3.5	Under 3.0
Prothrombin time	Under 14 secs	14-17	Over 17

Chronic cholelithiasis

Acute cholecystitis



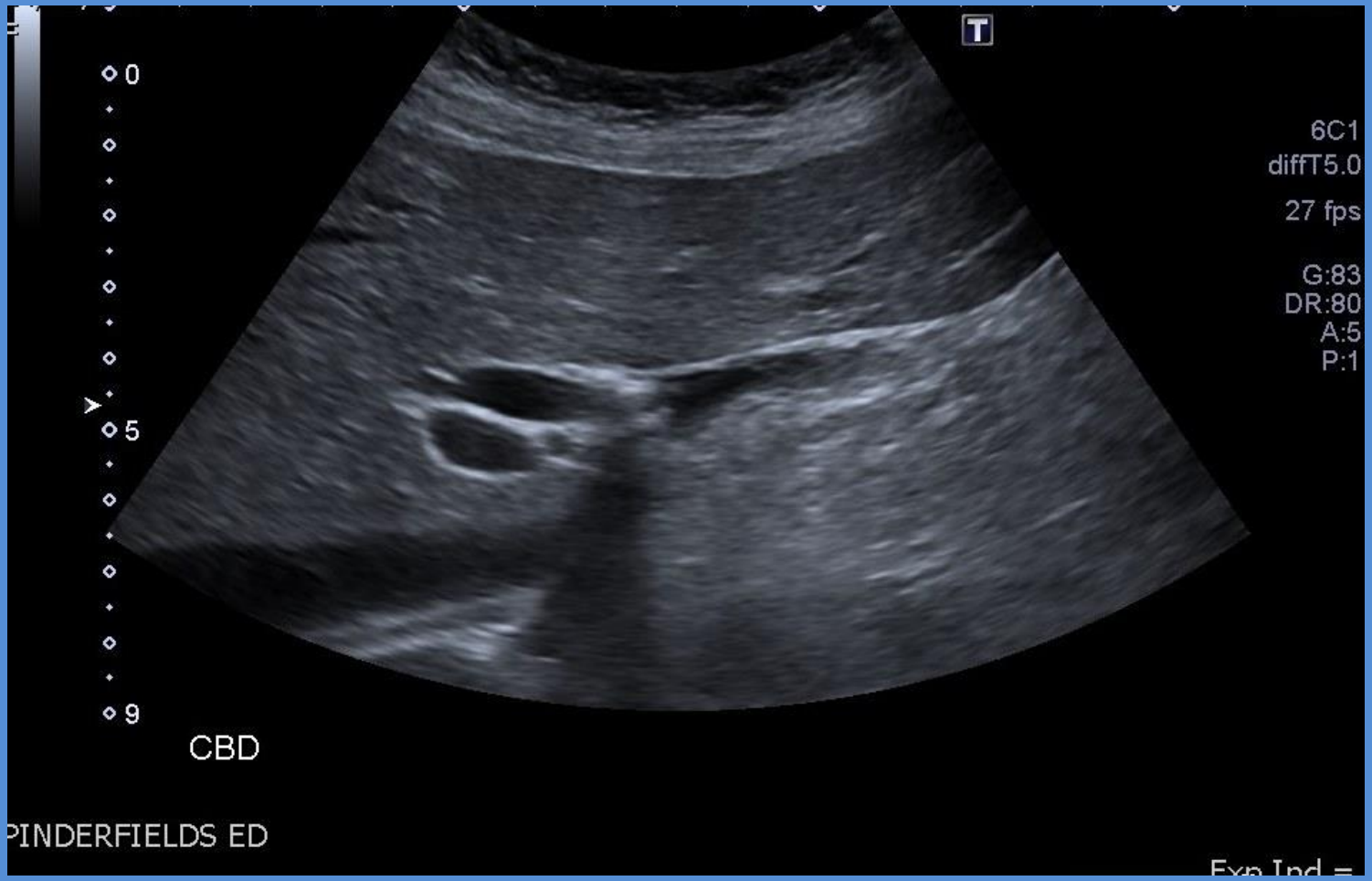
Acute cholecystitis



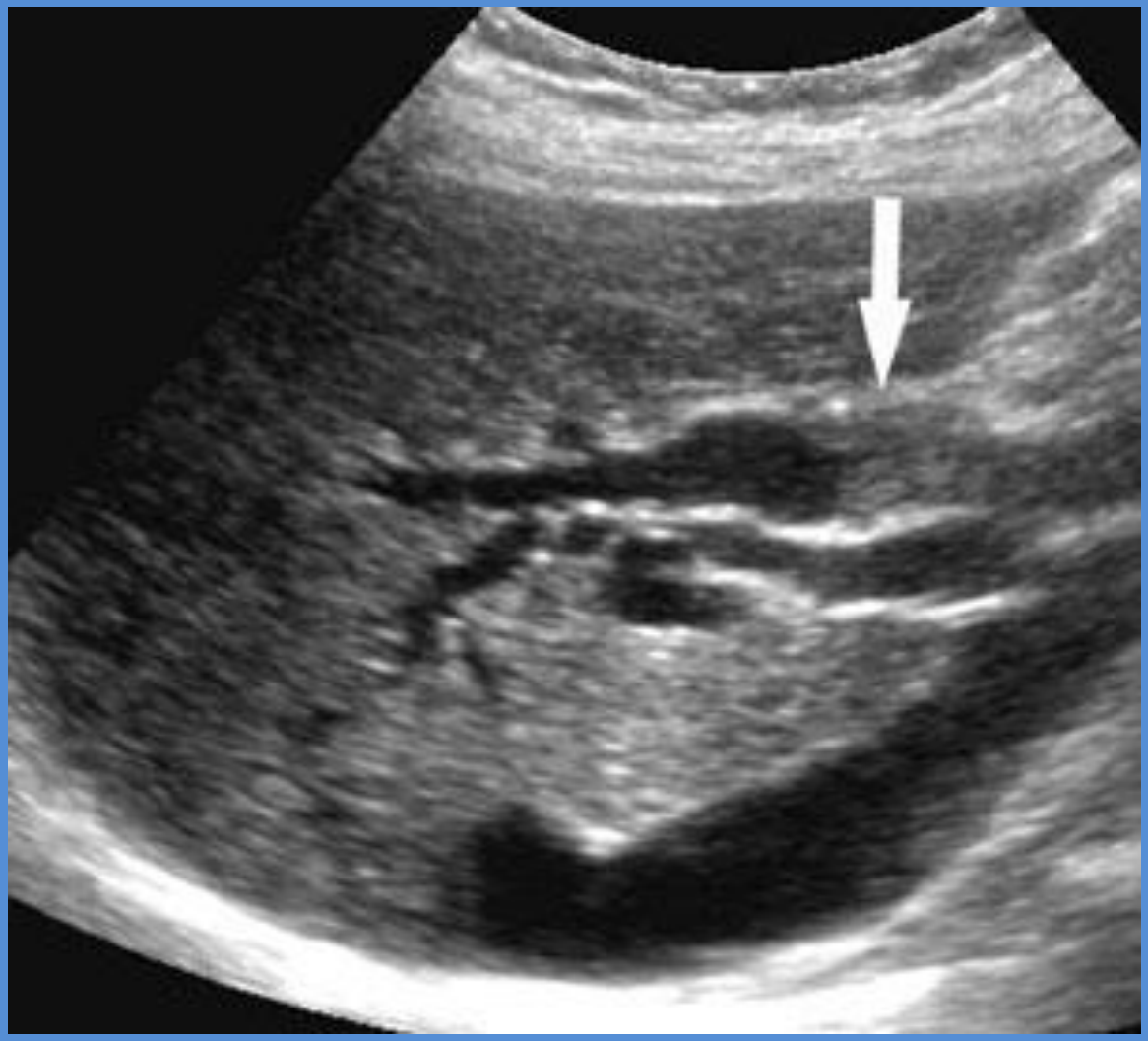
CBD dilatation

Biliary obstruction – IHD dilatation

Biliary obstruction - stones



Biliary obstruction – intra duct mass




LOGIQ
E9
PANCREAS
FR 25
CHI
Frq 5.0
Gn 44
S/A 2/2
Map A/0
D 14.0
DR 69
AO% 100
0
5
10

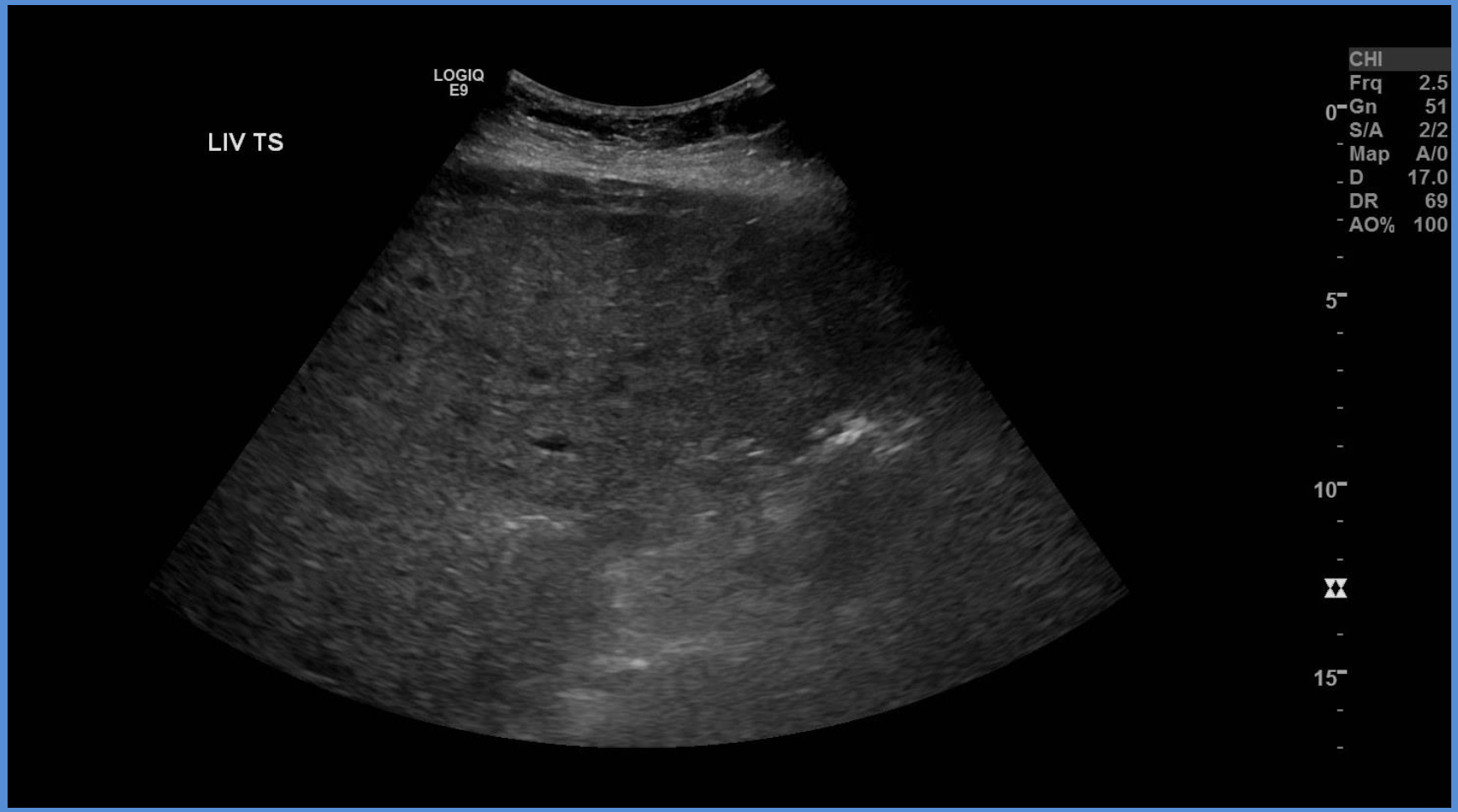

LOGIQ
E9
CBD
FR 25
CHI
Frq 5.0
Gn 44
S/A 2/2
Map A/0
D 14.0
DR 69
AO% 100
0
5
10

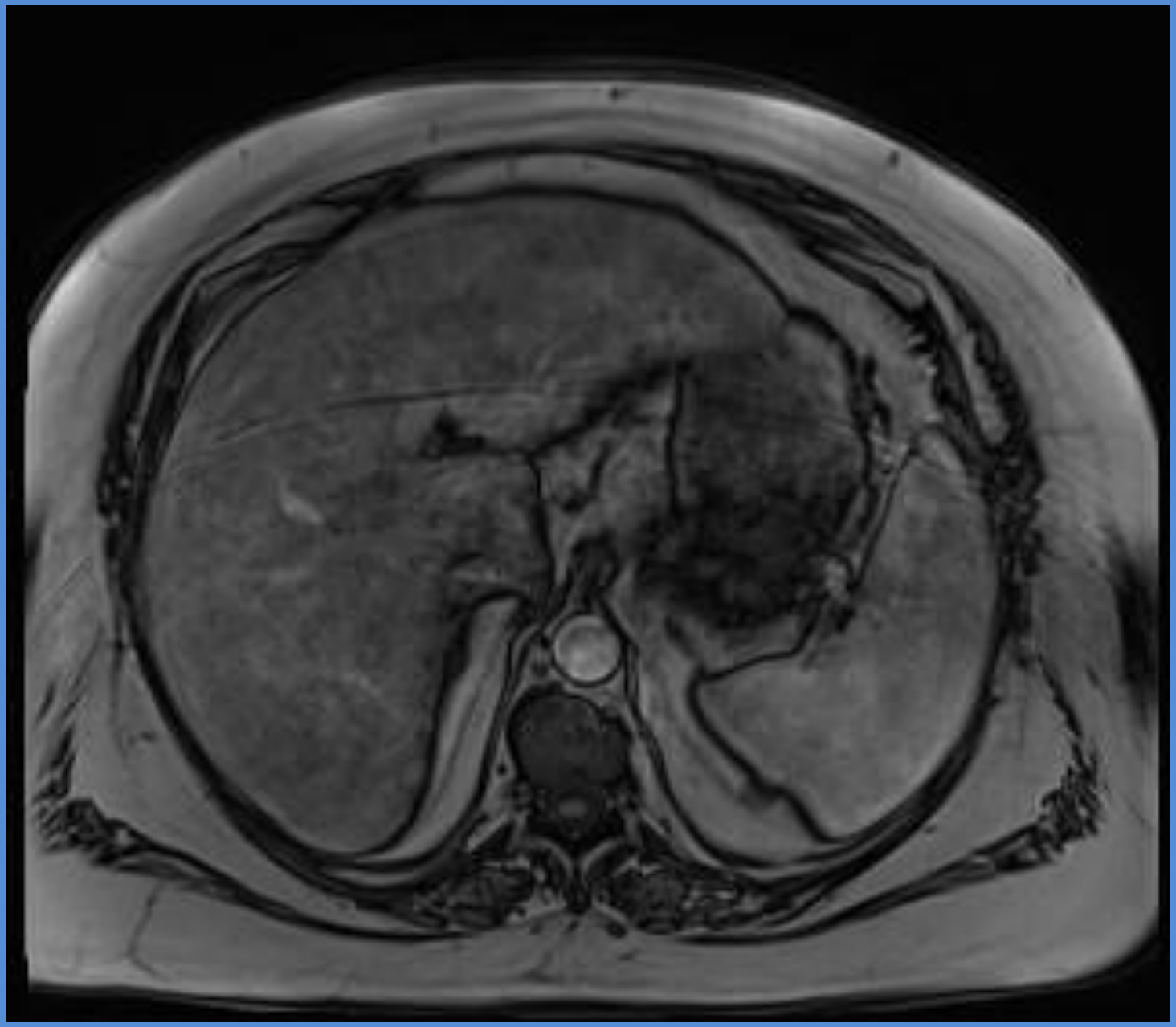
Cholangiocarcinoma

Liver

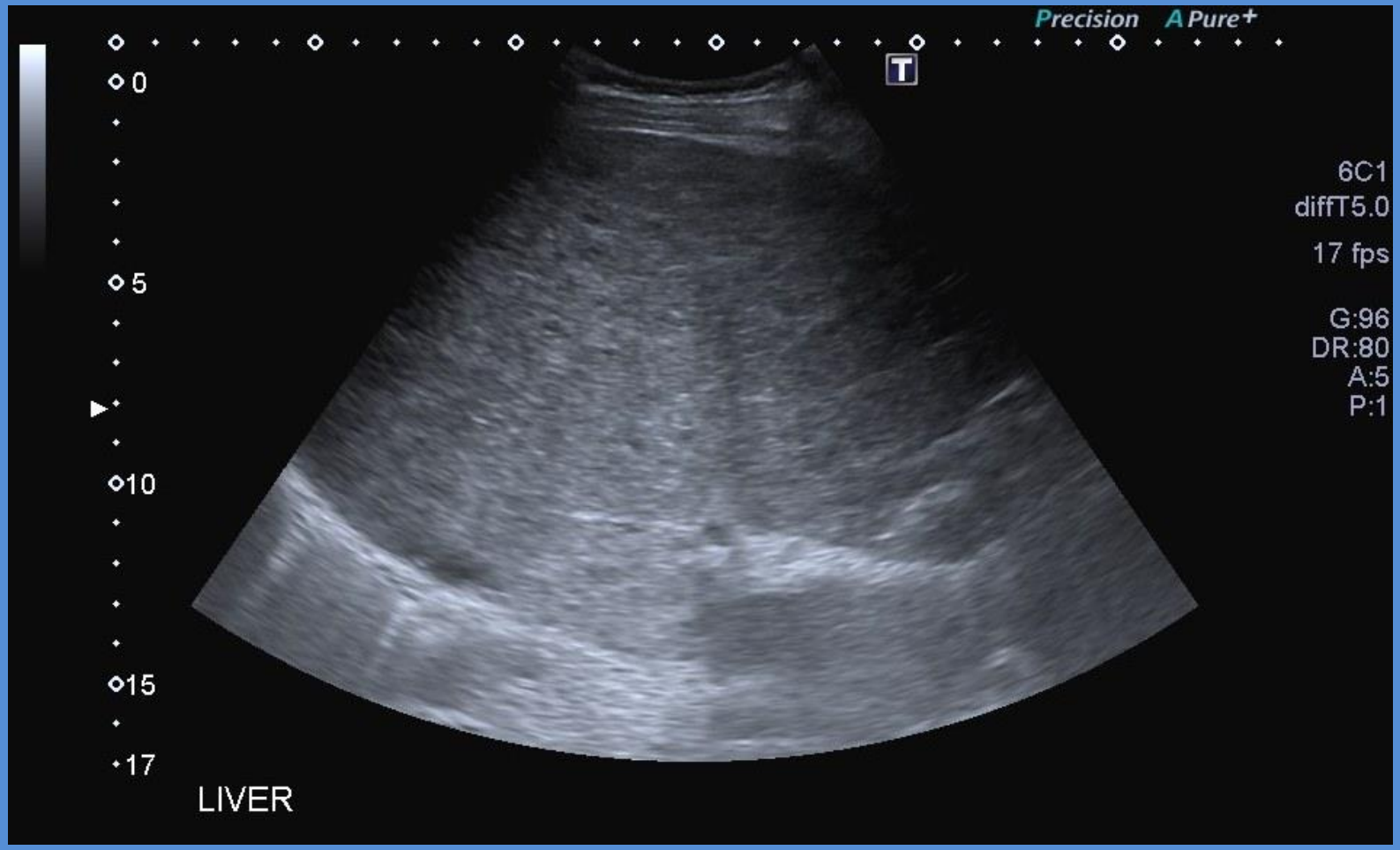
Liver Mets- previous H/o Ca

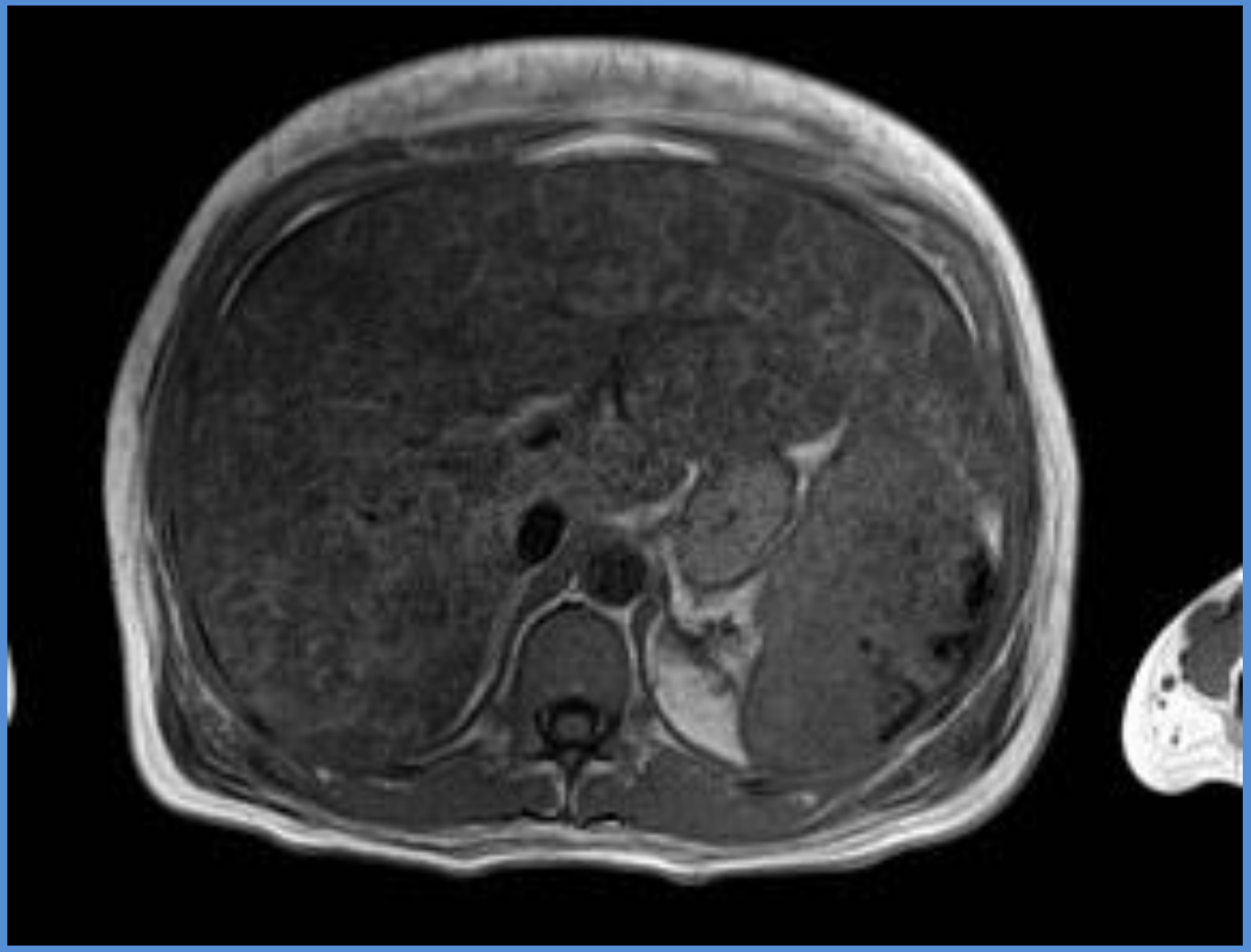
Acute left loin pain –no prev history



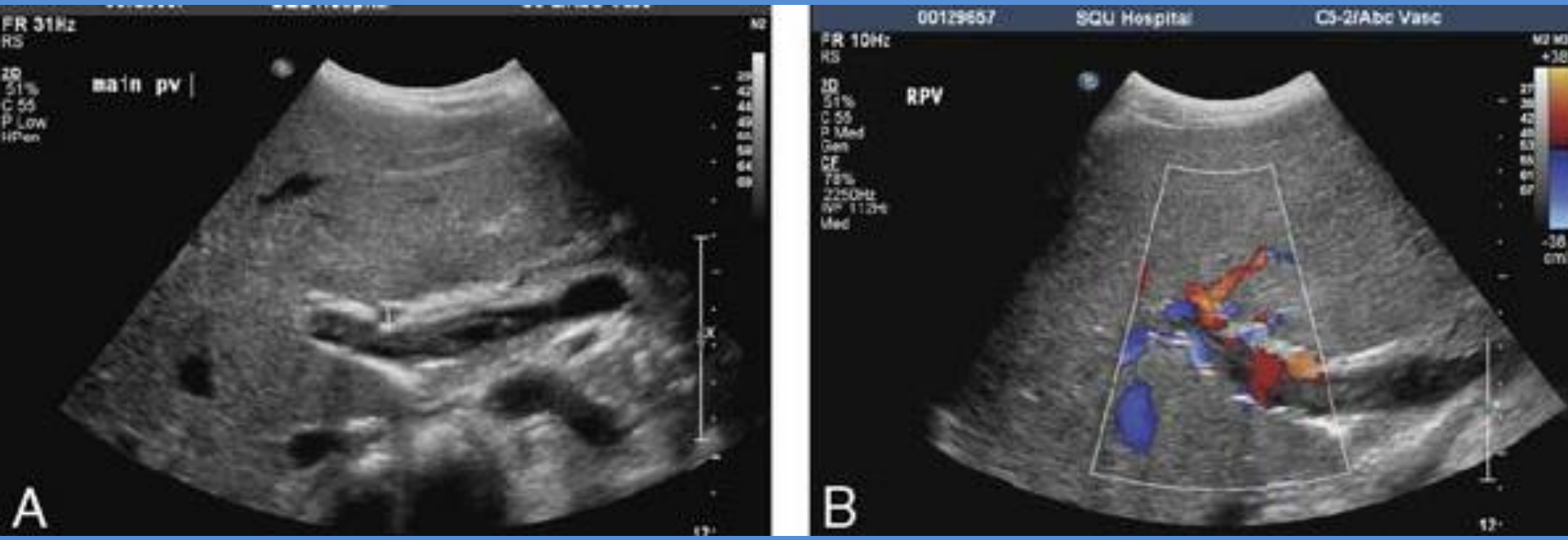


Acute RUQ pain and hepatomegaly

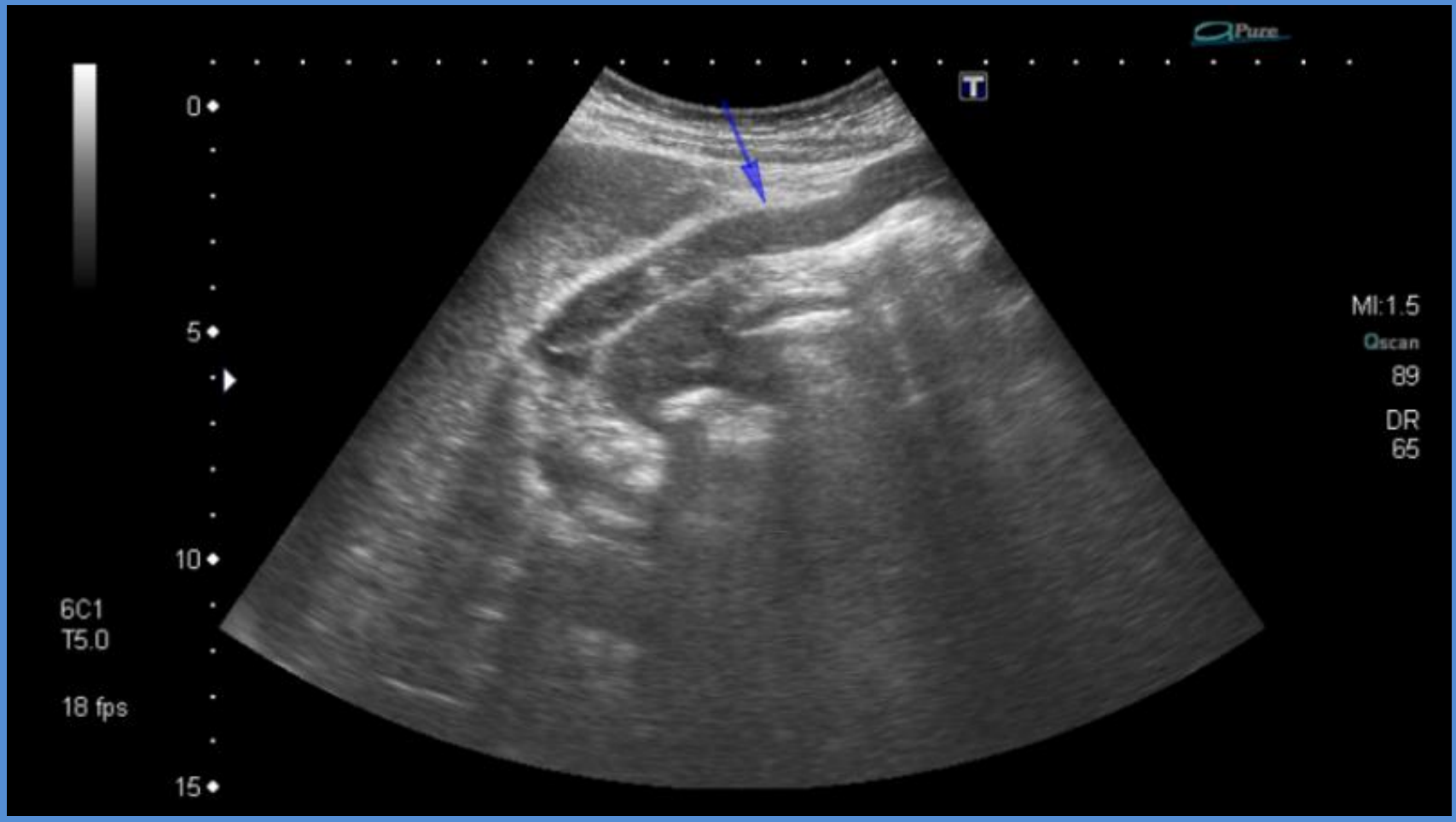




Portal vein patency



Check for thrombus in PV, varicosities and recannulised umbilical vein

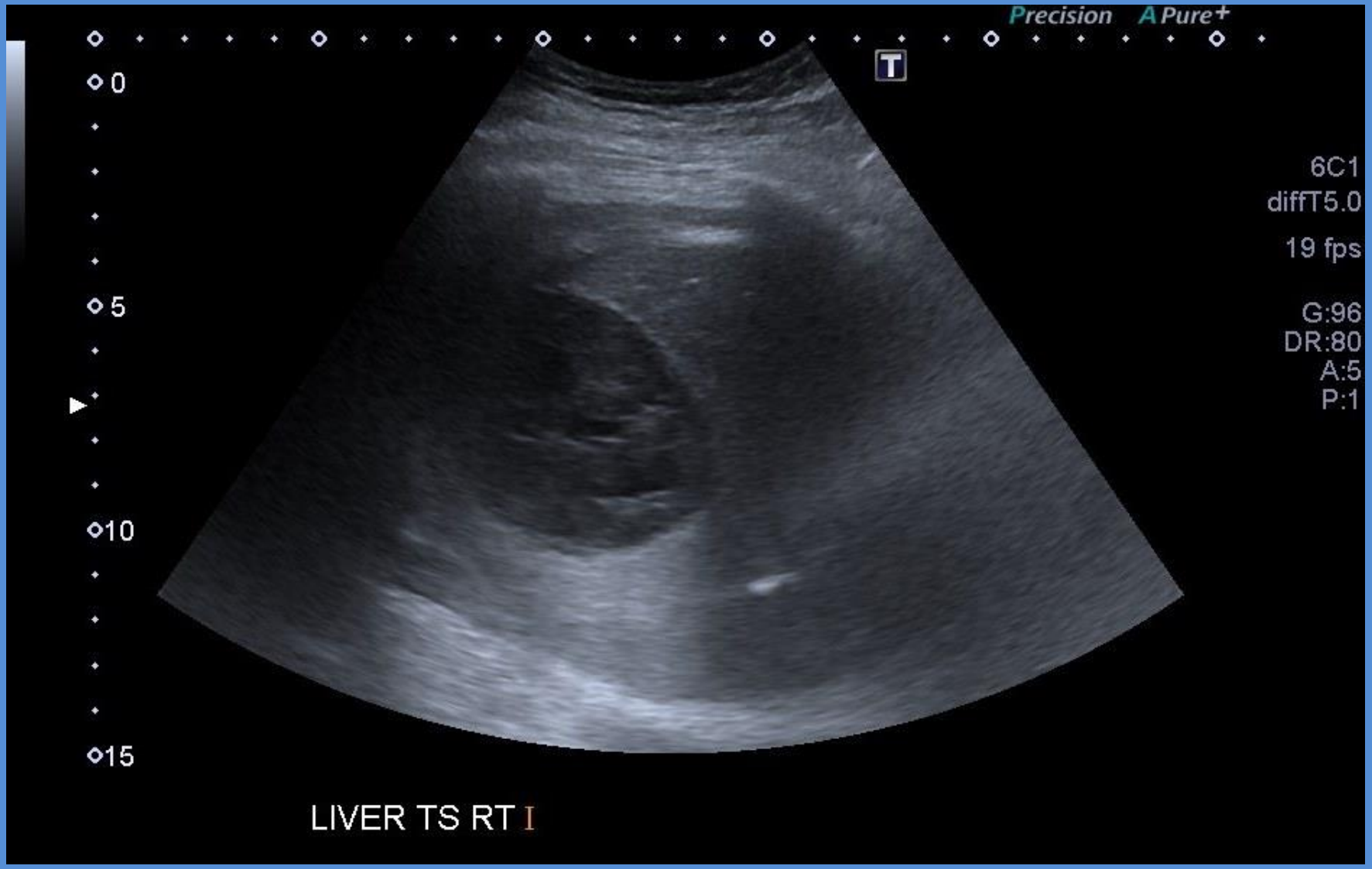


recannulised umbilical vein

Collections

Collections

RUQ pain, pyrexial, recent travel to Asia



H/o Cholecystectomy 10 years ago, RUQ pain

Biloma

Rectus sheath haematoma

Psoas muscle abscess

Psoas muscle abscess may present with fever, flank pain or abdominal pain

Primary: abscess occurs probably as a result of spread of an infectious process from an occult source in the body and can occur in patients with:

- diabetes mellitus
- intravenous drug abuse
- AIDS
- renal failure
- immuno suppression

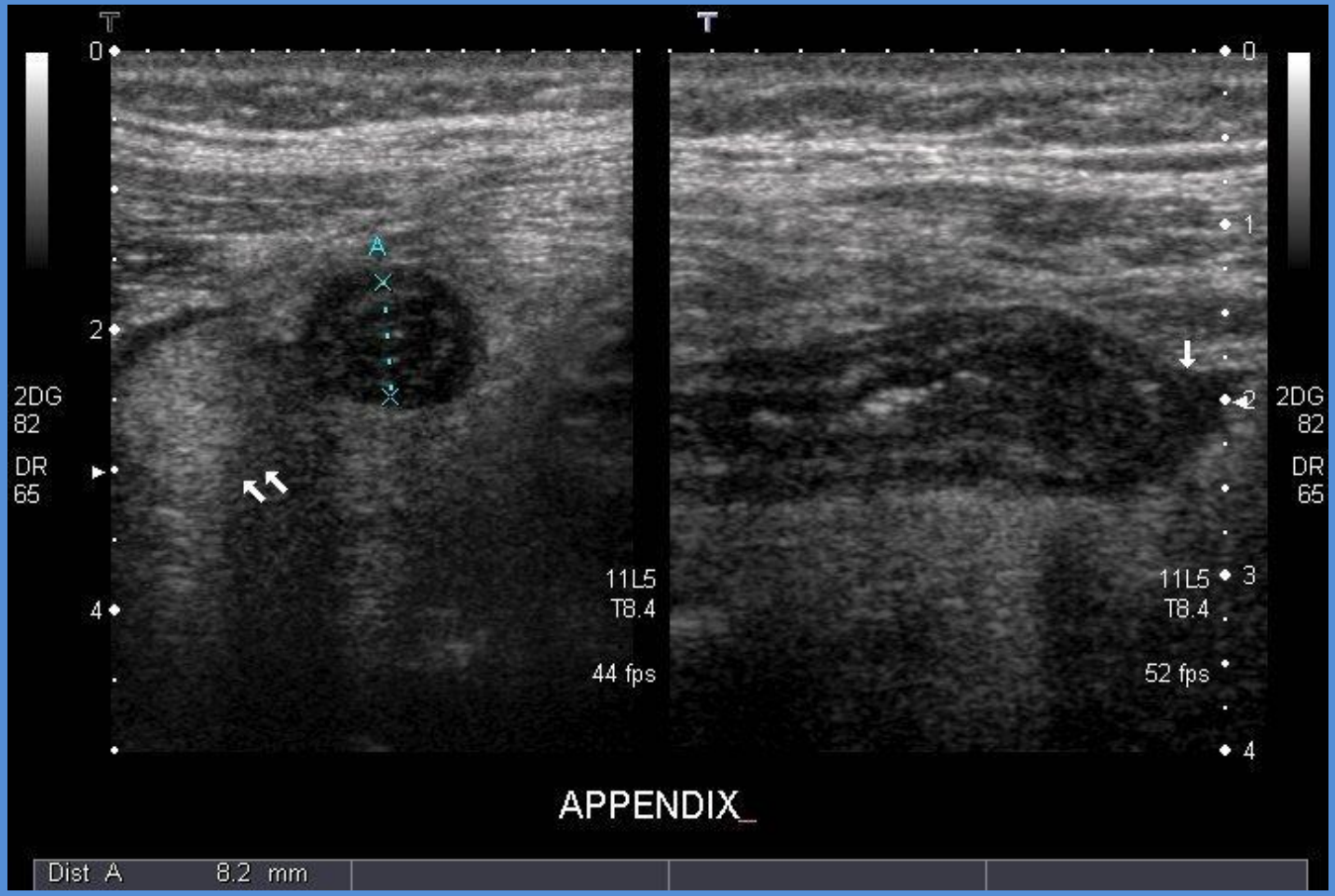
Secondary: spread of infection from gastrointestinal disease (e.g. appendicitis, Crohn's disease, diverticulitis)

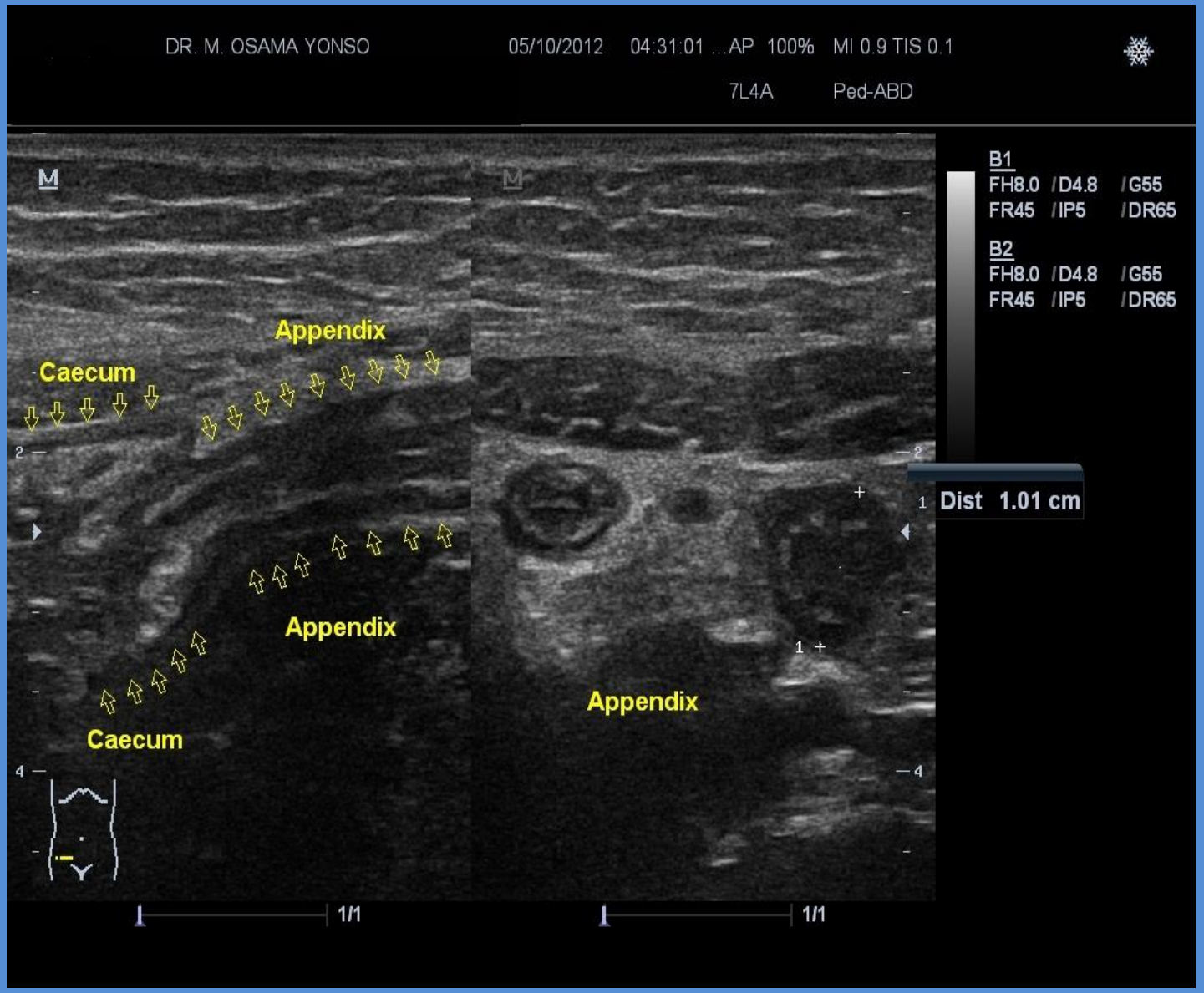
- Renal disease is the second most common source

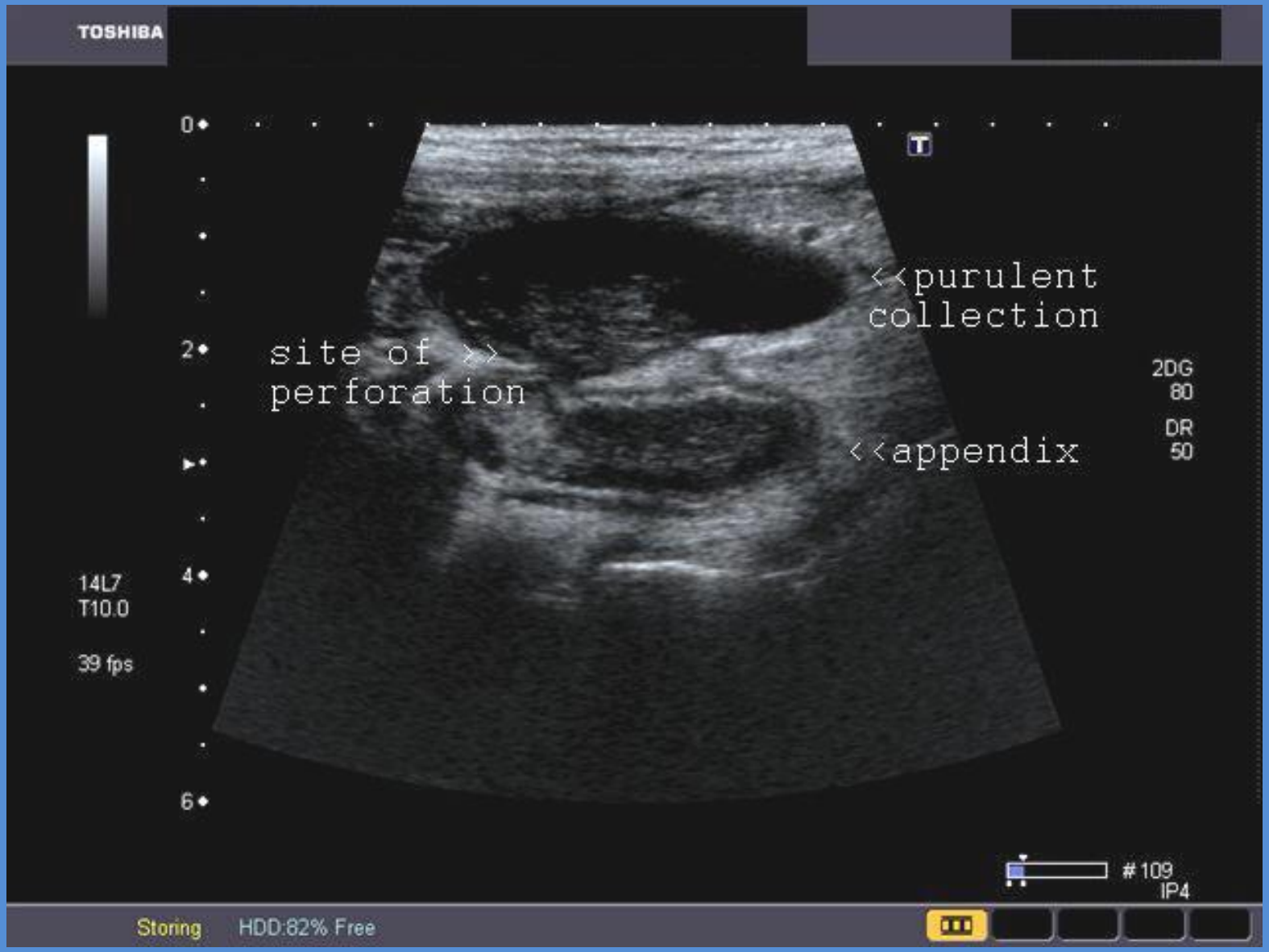
The rest

Acute Appendicitis

- Non-compressible sausage shaped structure, demonstrating no peristalsis.
- 75% lie behind the caecum and colon, making ultrasound access difficult.
- In cross section, it gives a target appearance >6mm in diameter, usually between 7 and 10 mm. The wall thickness can be 3mm or more.


T
0
2
4
A
2DG
82
DR
65
11L5
T8.4
44 fps
T
0
1
2
3
4
2DG
82
DR
65
11L5
T8.4
52 fps
APPENDIX_
Dist A 8.2 mm

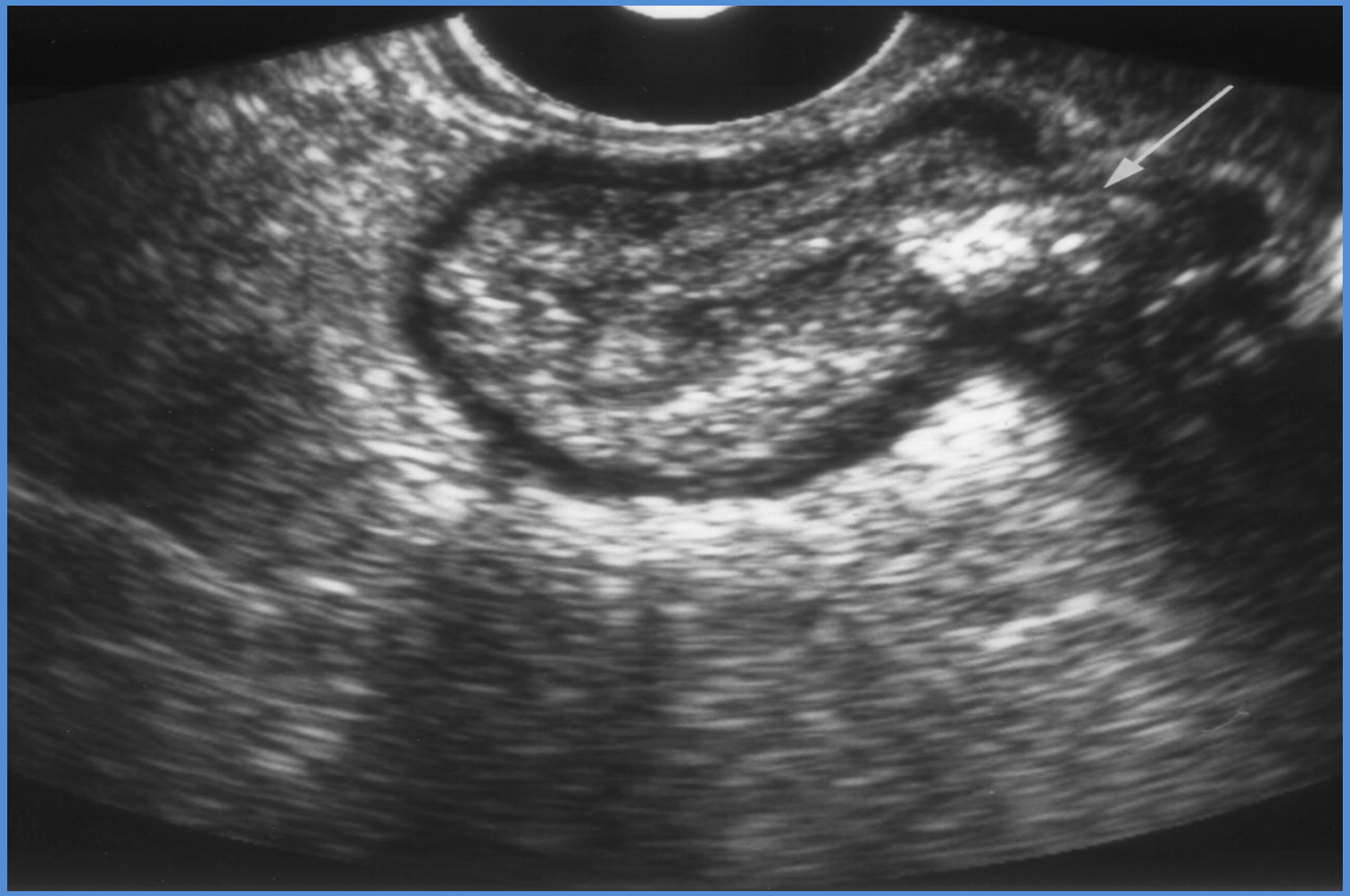

DR. M. OSAMA YONSO
05/10/2012 04:31:01 ...AP 100% MI 0.9 TIS 0.1
7L4A Ped-ABD
B1
FH8.0 /D4.8 /G55
FR45 /IP5 /DR65
B2
FH8.0 /D4.8 /G55
FR45 /IP5 /DR65
Appendix
Caecum
Appendix
Caecum
Dist 1.01 cm
Appendix
1/1
1/1

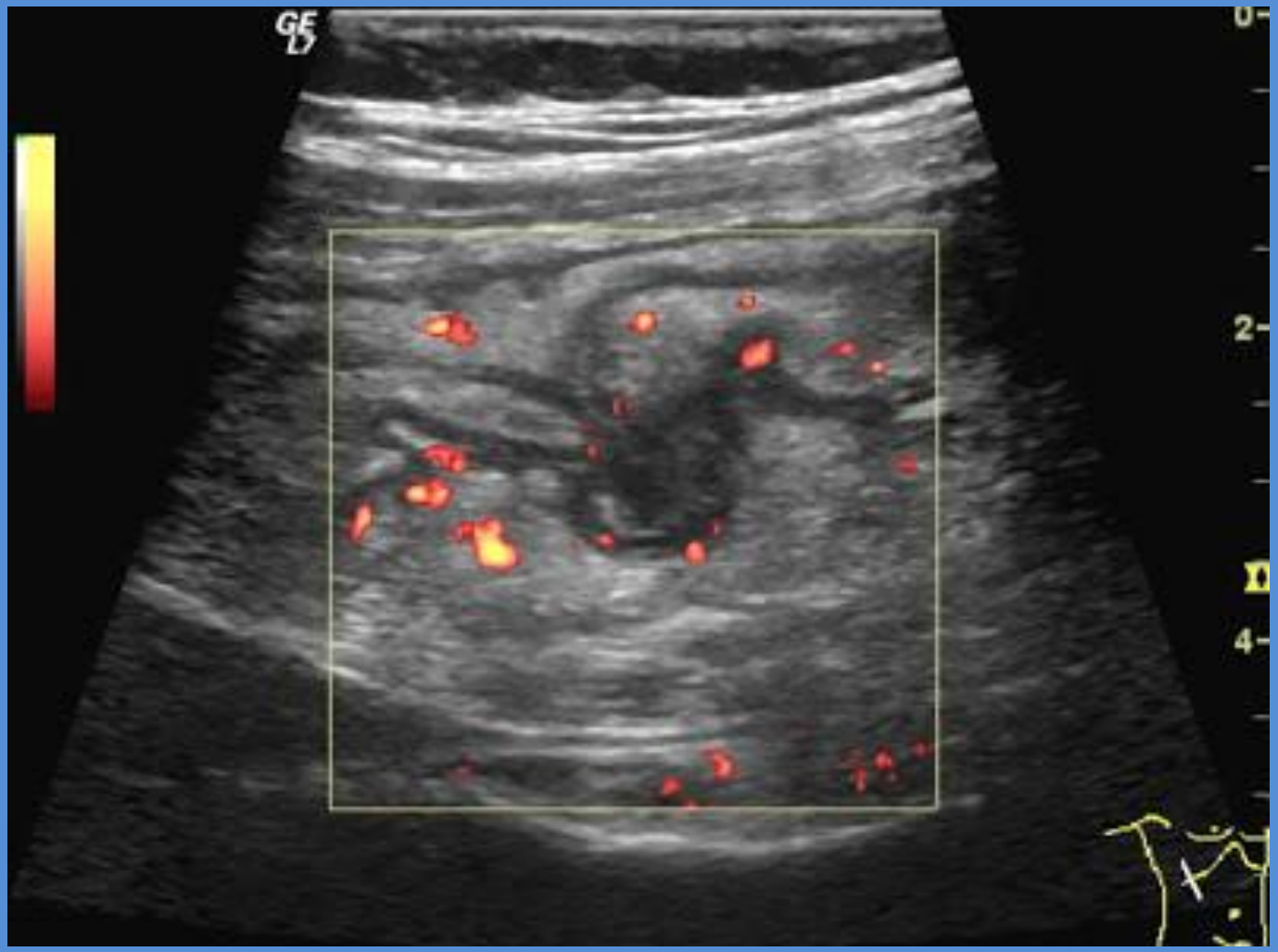

TOSHIBA
0
2
4
6
<<purulent collection
site of >> perforation
<<appendix
2DG
80
DR
50
14L7
T10.0
39 fps
#109
IP4
Storing
HDD:82% Free

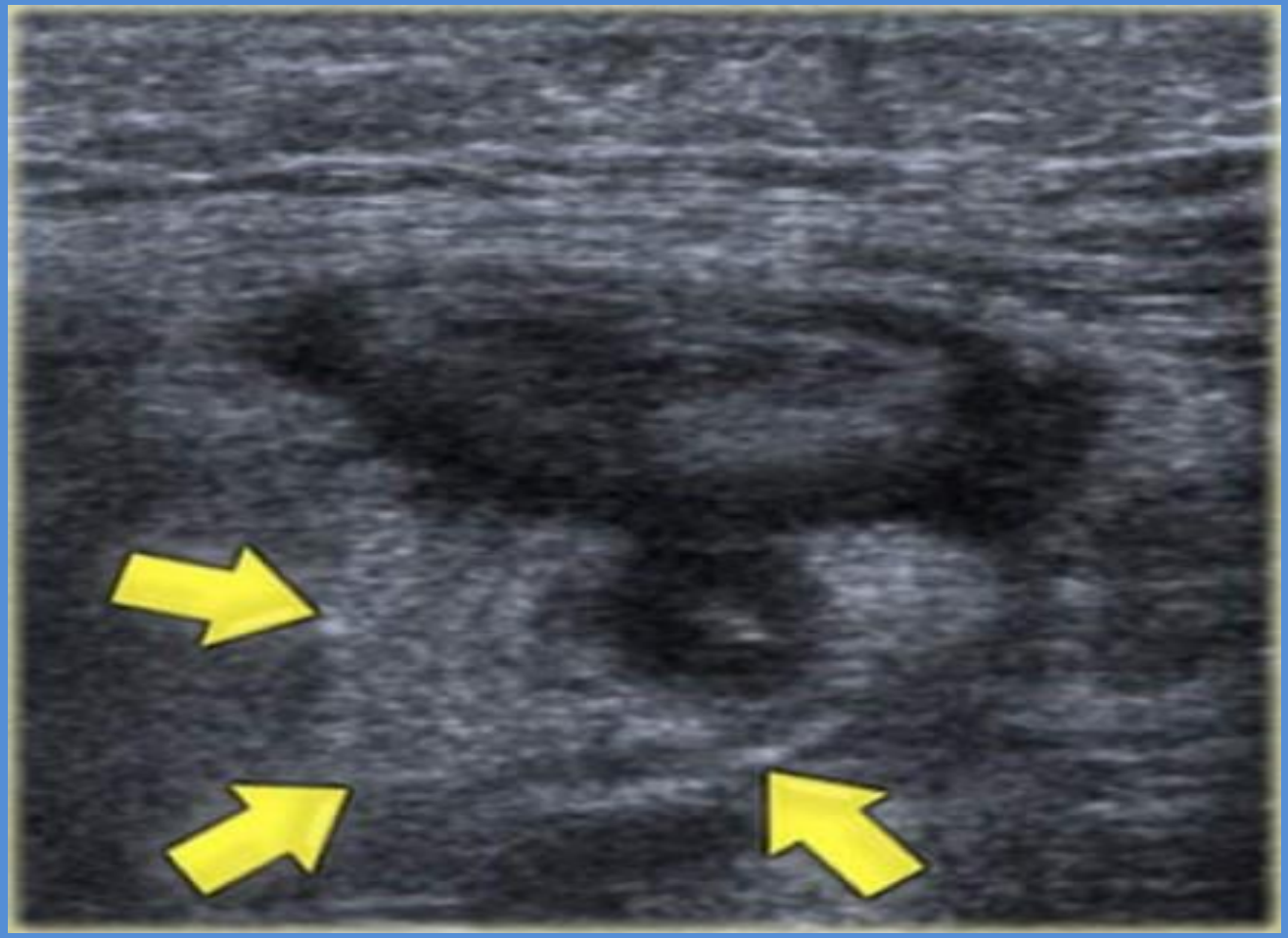
Right Sided Colonic Diverticulitis

- Self limiting, benign condition
- All ages
- Congenital
- Not so rare
- Clinically appendicitis
- In 40% unnecessary hemicolectomy performed.

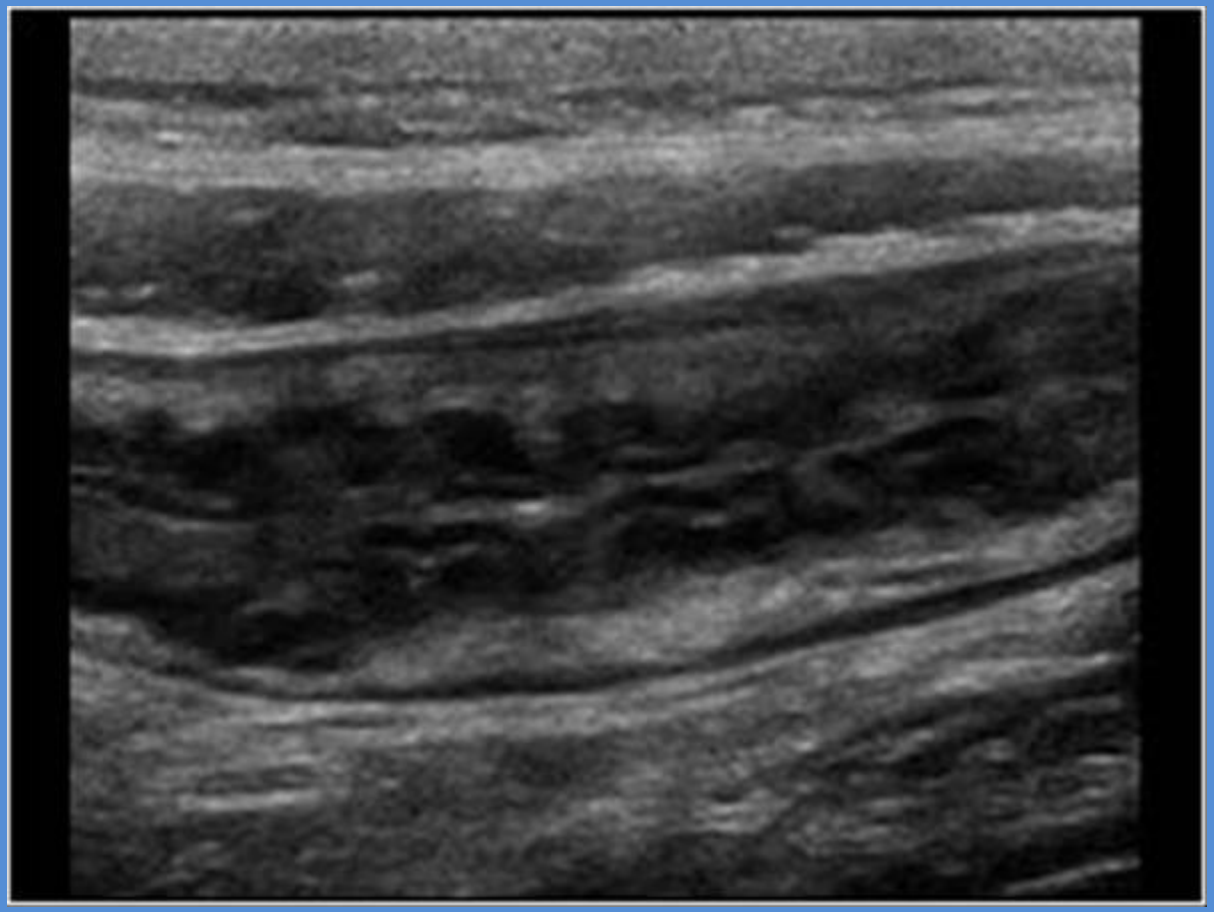
Diverticulitis



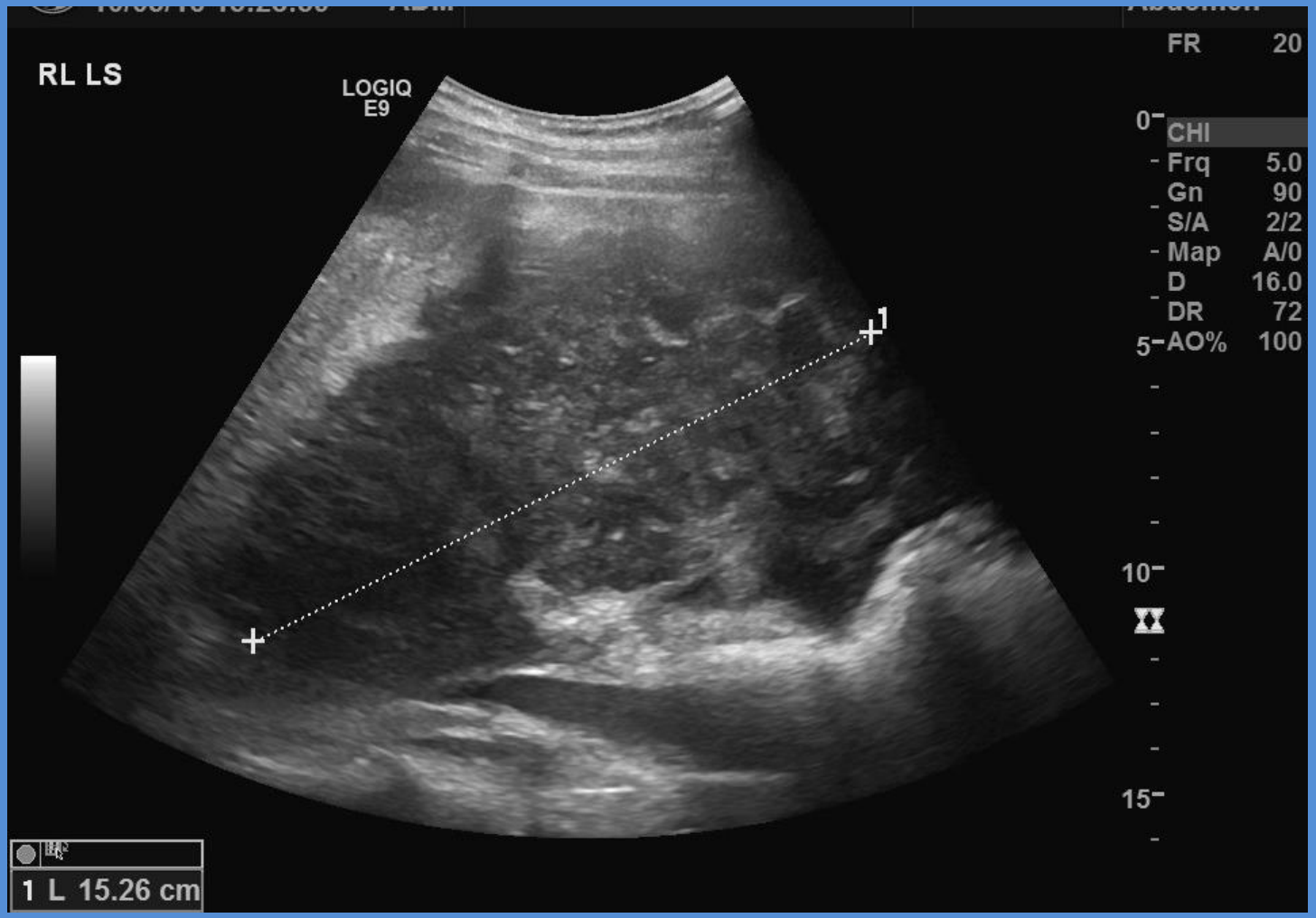

GE
0
2
4

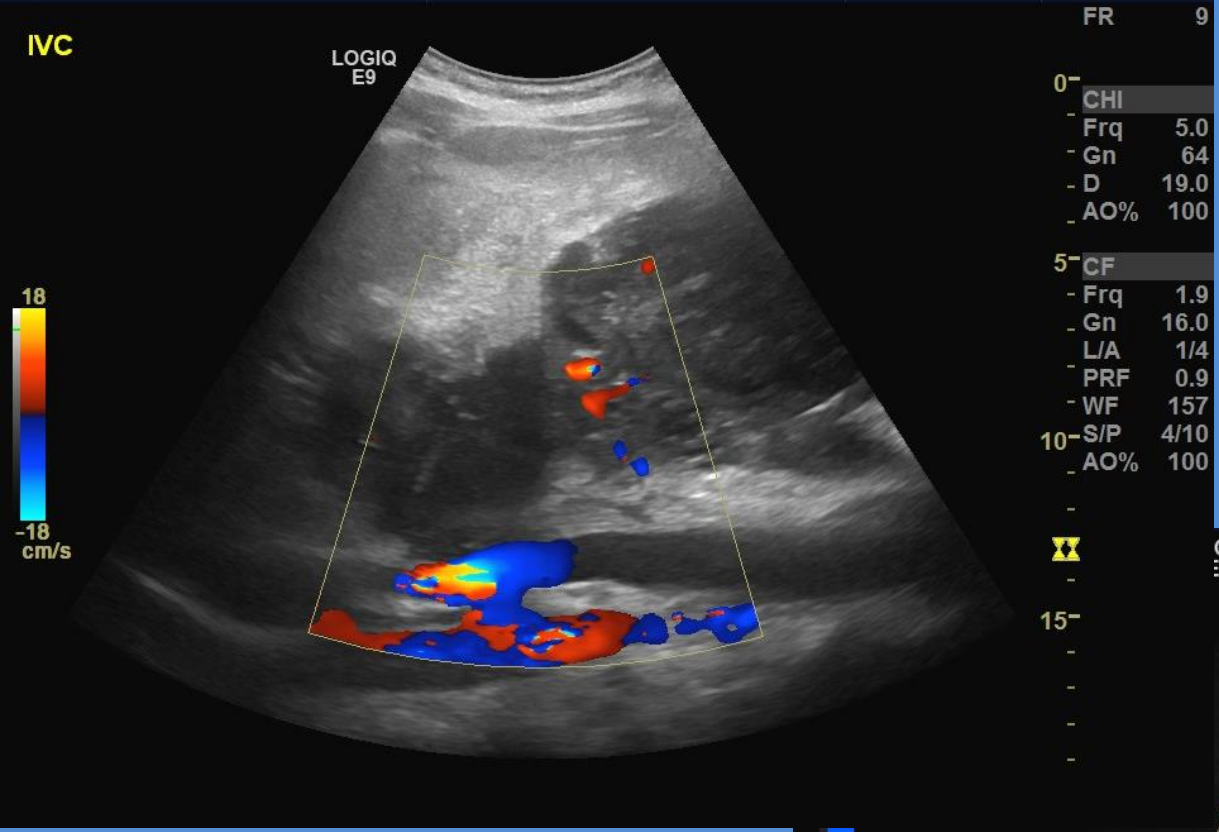


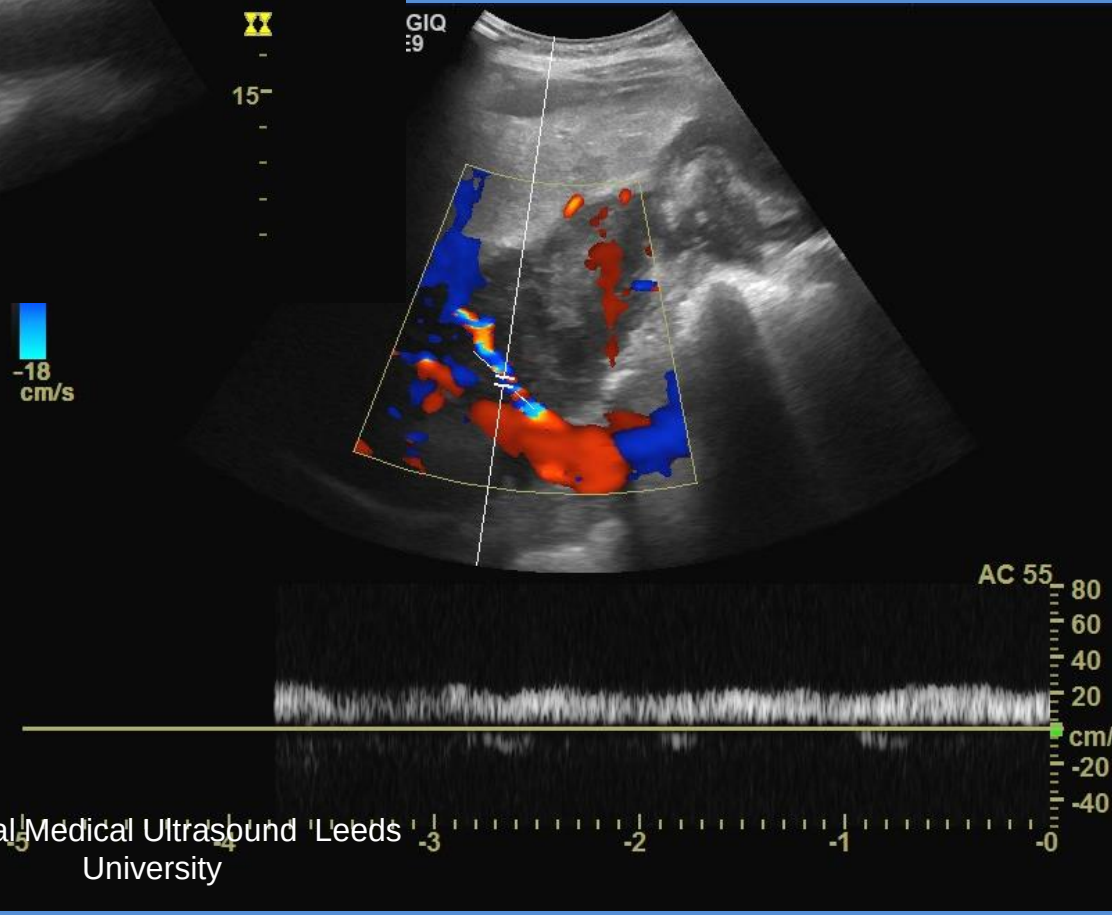
Crohn’s



Lymphoma


RL LS
LOGIQ
E9
FR 20
CHI
Frq 5.0
Gn 90
S/A 2/2
Map A/0
D 16.0
DR 72
AO% 100
0
5
10
15
1
1 L 15.26 cm


IVC
LOGIQ
E9
18
-18
cm/s
FR 9
CHI
Frq 5.0
Gn 64
D 19.0
AO% 100
CF
Frq 1.9
Gn 16.0
L/A 1/4
PRF 0.9
WF 157
S/P 4/10
AO% 100


-18
cm/s
AC 55
80
60
40
20
-20
-40
-3
-2
-1
-0

Conclusion

- Abdominal ultrasound is first line investigation in the assessment of suspected acute biliary colic, renal colic, acute colonic diverticulitis, appendicitis and abdominal masses. Requested for acute pancreatitis with limited success

- Patients with localised abdominal pain and tenderness are more likely to have a positive diagnosis on ultrasound.

- Raised WCC or an abnormal LFT in patients with acute abdominal pain is predictive of a higher yield of positive findings on ultrasound

- Only one third of children with appendicitis will present with classic symptoms. Pain initially in midline and extending to RIF with guarding, favourable for appendicitis. N.B. High or ectopic appendix may be seen.

Conclusion

- Use all the clinical history to make a diagnosis
- Avoid over diagnosis, gallstones and dilated CBD may be incidental findings.
- Cholecystitis has thickened GB wall and intermittent pain whereas pancreatitis continual pain.
- Check biochemical results to aid diagnosis
- Use colour doppler to check patency and hypervascularity
- Check all previous imaging before suggesting follow up

References

- Ballard RB. 1998. THE SURGEON'S USE OF ULTRASOUND IN THE ACUTE SETTING Surgical Clinics of North America. 78 (2) 337–364
- Brenchley J[1], Sloan JP, Thompson PK. 2000. Echoes of things to come. Ultrasound in UK emergency medicine practice. 17(3):170-5.
- Brenchley J, Walker A, Sloan J, et al. 2006. *Evaluation of focused assessment* J Accid Emerg Med. *with sonography in trauma by emergency physicians. Emerg Med J; 23:446–8.*
- El Sayed MJ and Zaghrini E. 2013. Prehospital Emergency Ultrasound: A Review of Current Clinical Applications, Challenges, and Future Implications. Emergency Medicine International 2013 ID 531674, http://dx.doi.org/10.1155/2013/531674
- *Puylaert* J. 2007. Acute Abdomen - Role of Ultrasound. Radiology Assistant. http://www.radiologyassistant.nl/en/p4613dde72e42c/acute-abdomen-role-of-ultrasound.html
- Raman S. 2004. Are we overusing ultrasound in non-traumatic acute abdominal pain? *Postgrad Med J 2004;80:177-179 doi:10.1136/pgmj.2003.0138*
- Snaith B, M. Hardy M, and Walker A. 2011. "Emergency ultrasound in the prehospital setting: the impact of environment on examination outcomes," *Emergency Medicine Journal*, 28 (12), 1063–1065
- White EK et al. 2014. Seeing past the appendix: the role of ultrasound in right iliac fossa pain *Ultrasound, 22 (2): 104-112*


Thank You