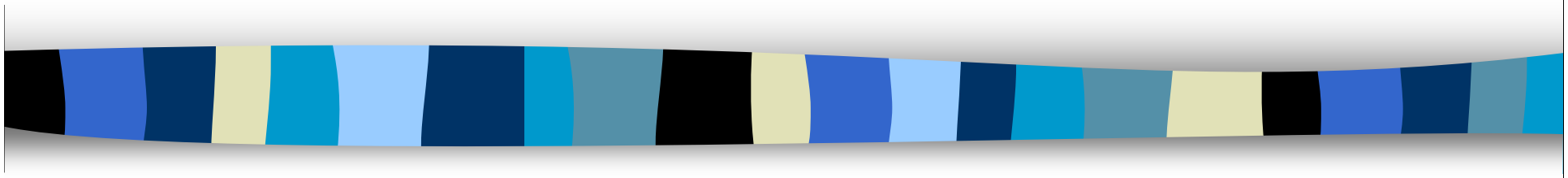
Focused Abdominal Sonography for Trauma



FAST

FAST

- Portable
- Rapid
- Non-invasive
- Repeatable
- Cost-effective

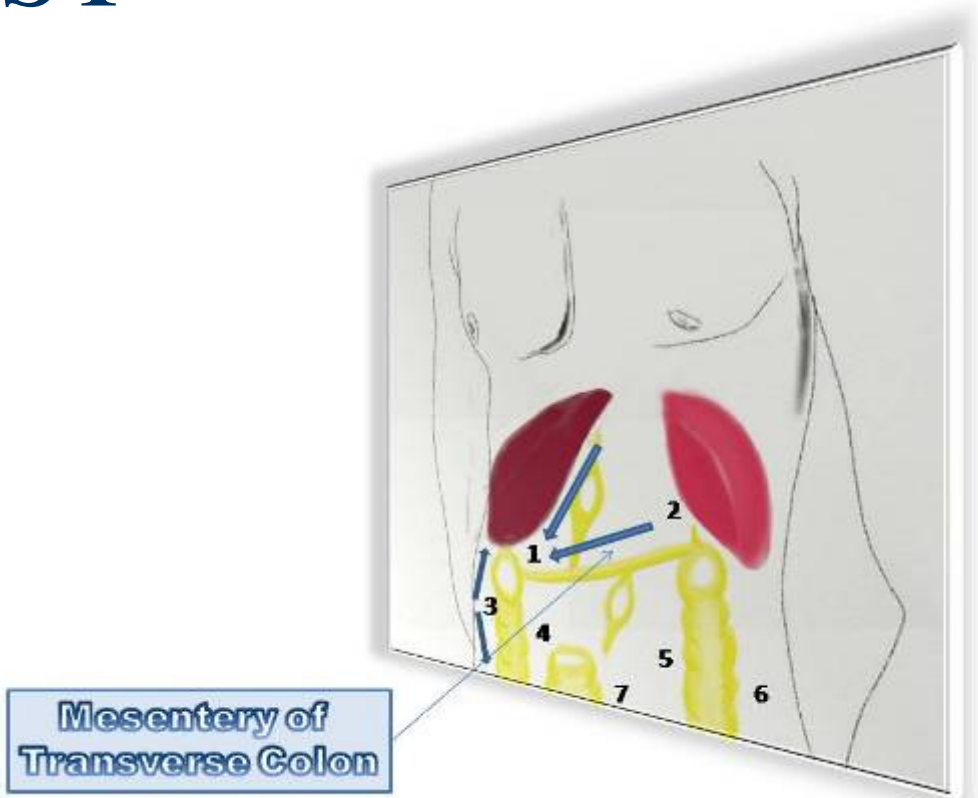
FAST

- Minimal amount of fluid in abdomen detectable by USG ~ 200 - 650ml
- High sensitivity in detecting haemoperitoneum (63 - 100%)
- High specificity in detecting haemoperitoneum (96 - 99%)
- Low sensitivity in detecting specific organ lesions (<50%)
- Sensitivity may improve with contrast

FAST

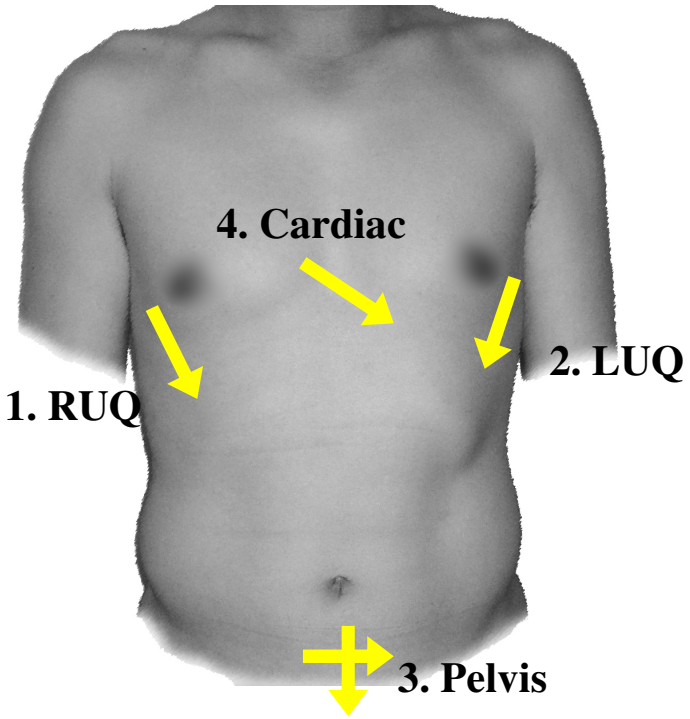
- 4 views
  - RUQ
  - Pelvis
  - LUQ
  - Subcostal cardiac - for haemoperitoneum

FAST



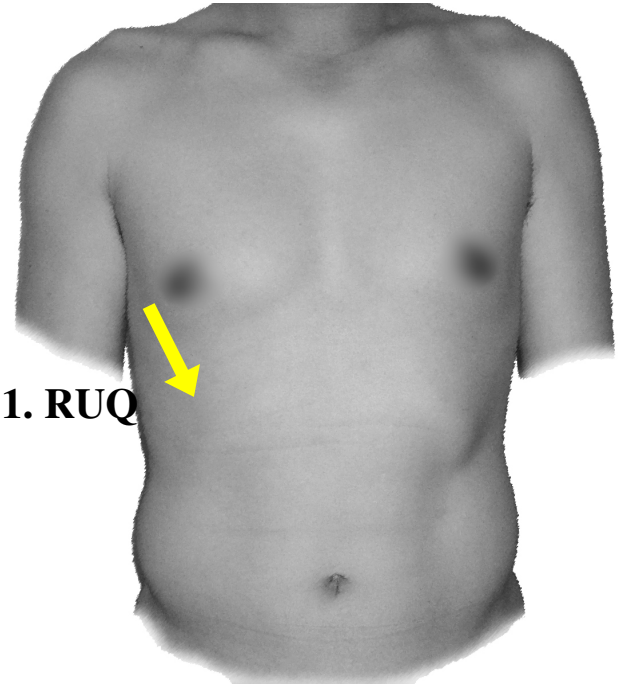
Posterior peritoneum and reflections, indicating potential sites of intra-abdominal fluid localization and spread.

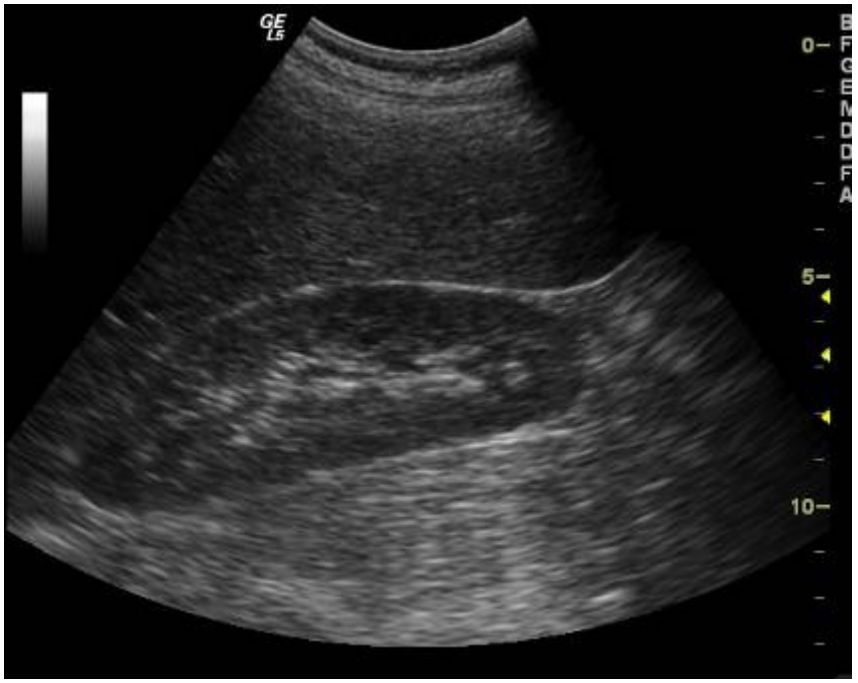
FAST



Location of probe placement for the trauma examination.

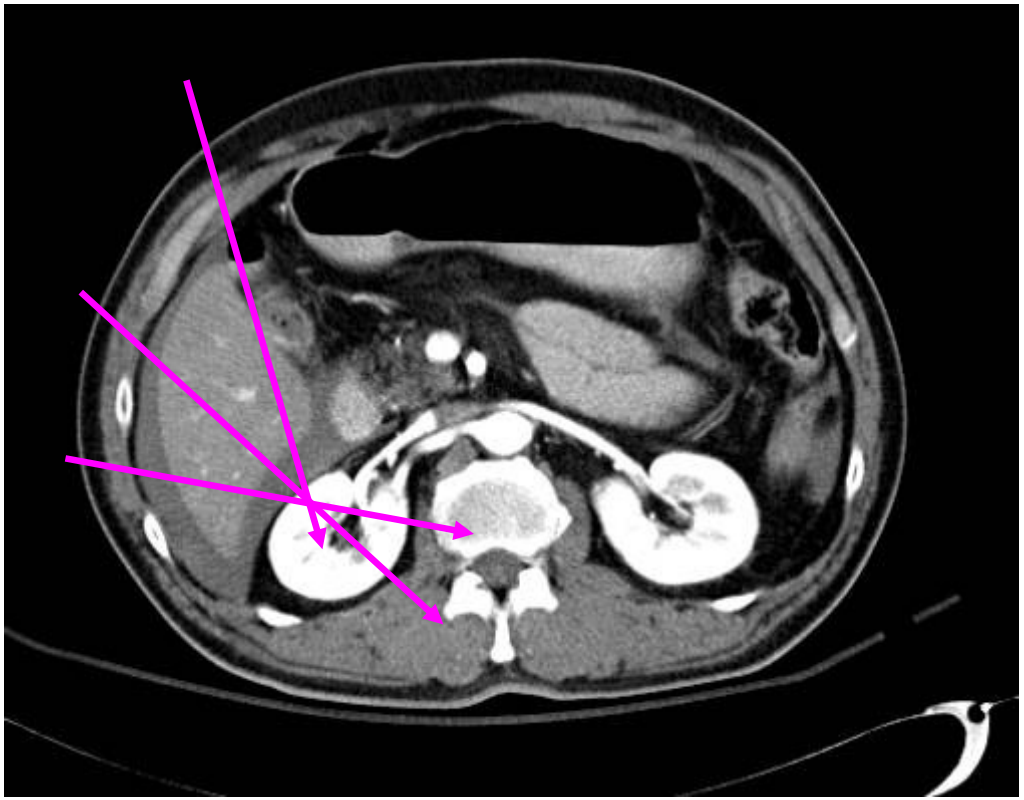
FAST





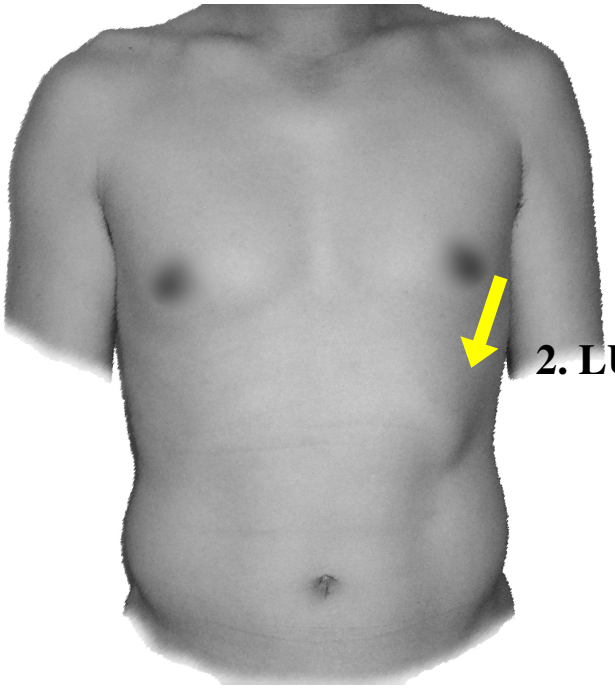
Normal RUQ scan

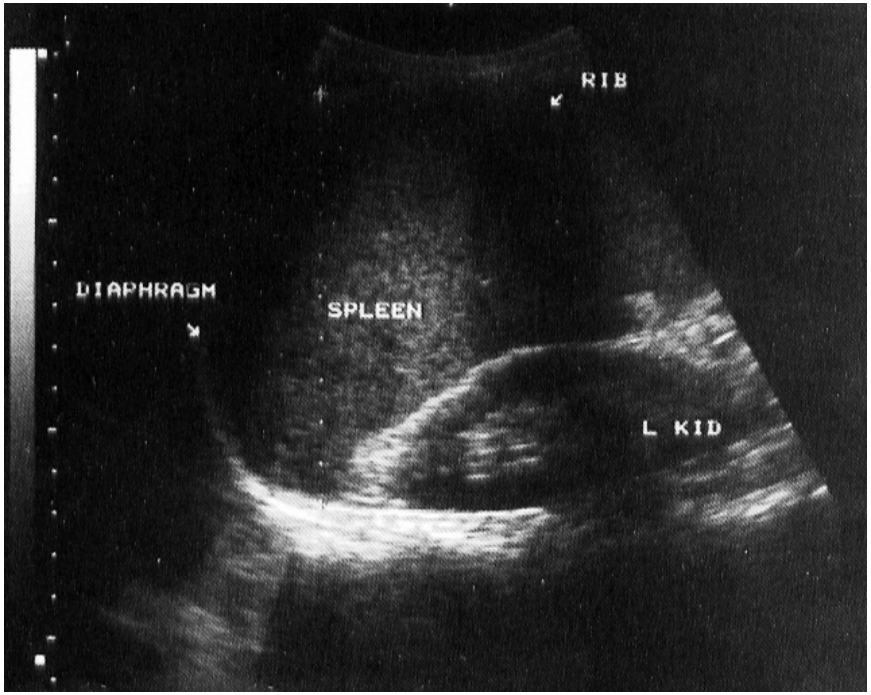
FAST



Abdominal CT with fluid in Morison's pouch, demonstrating the ultrasound beam planes for different body placement sites.

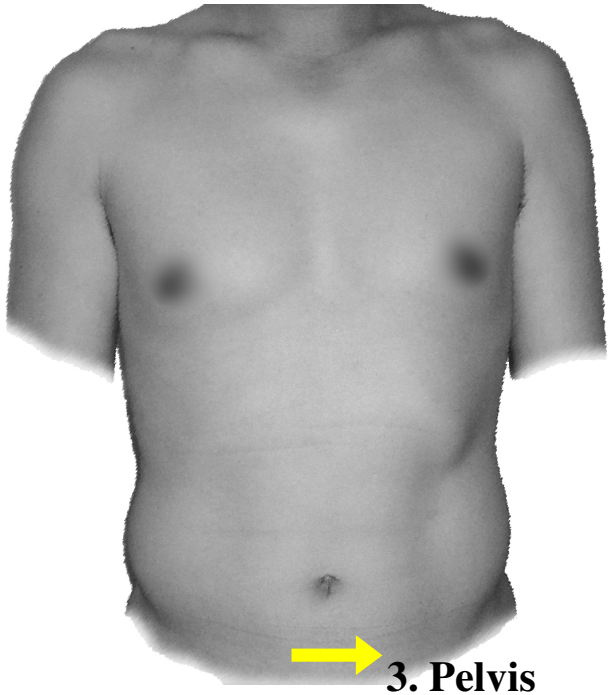
FAST



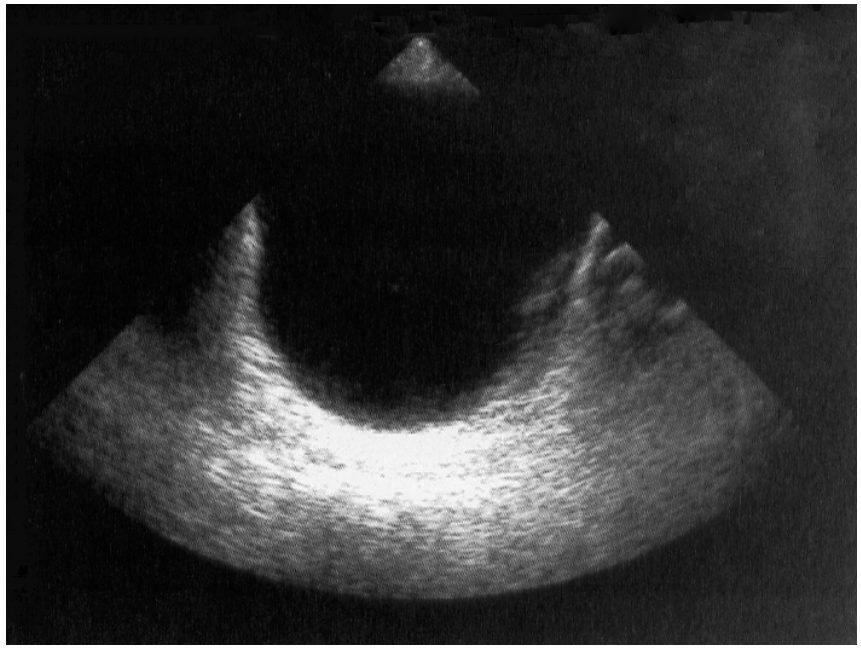


Normal LUQ scan

FAST

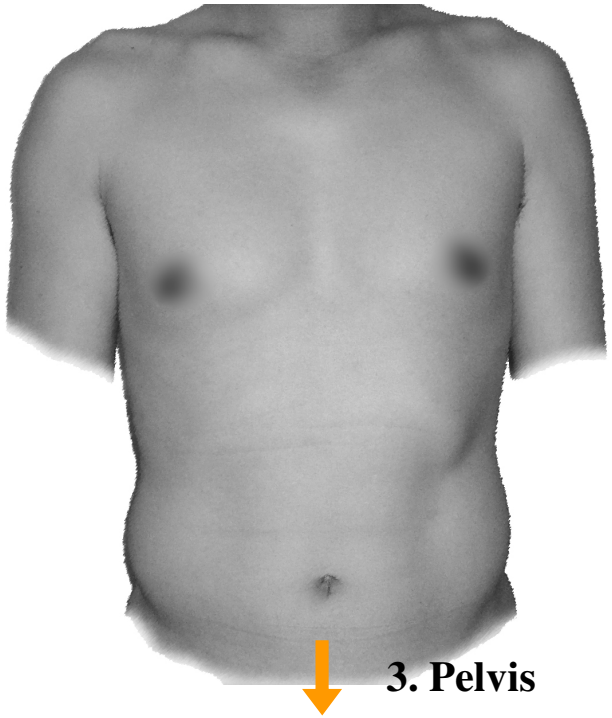


3. Pelvis

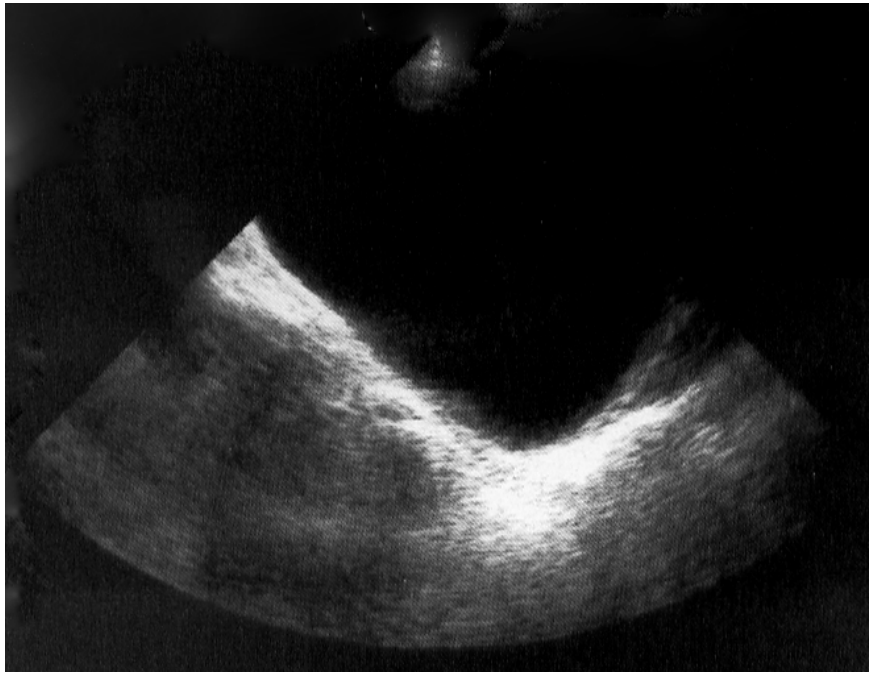


Normal male pelvis, transverse view

FAST

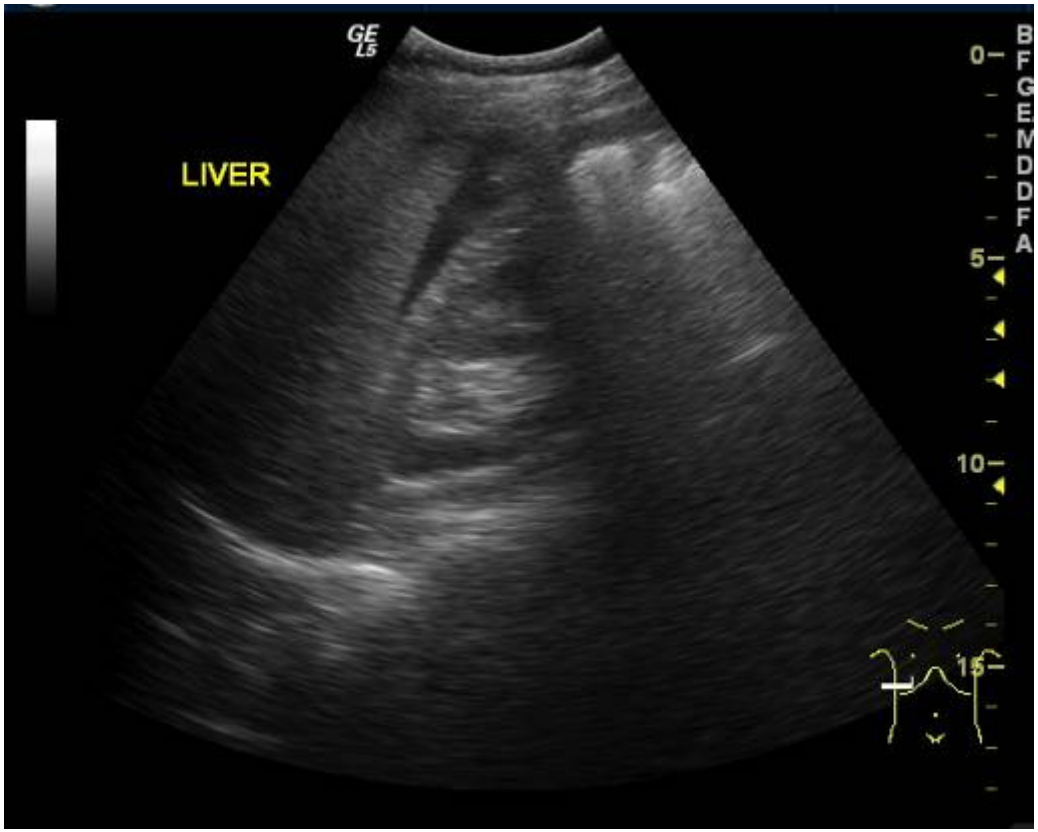


3. Pelvis



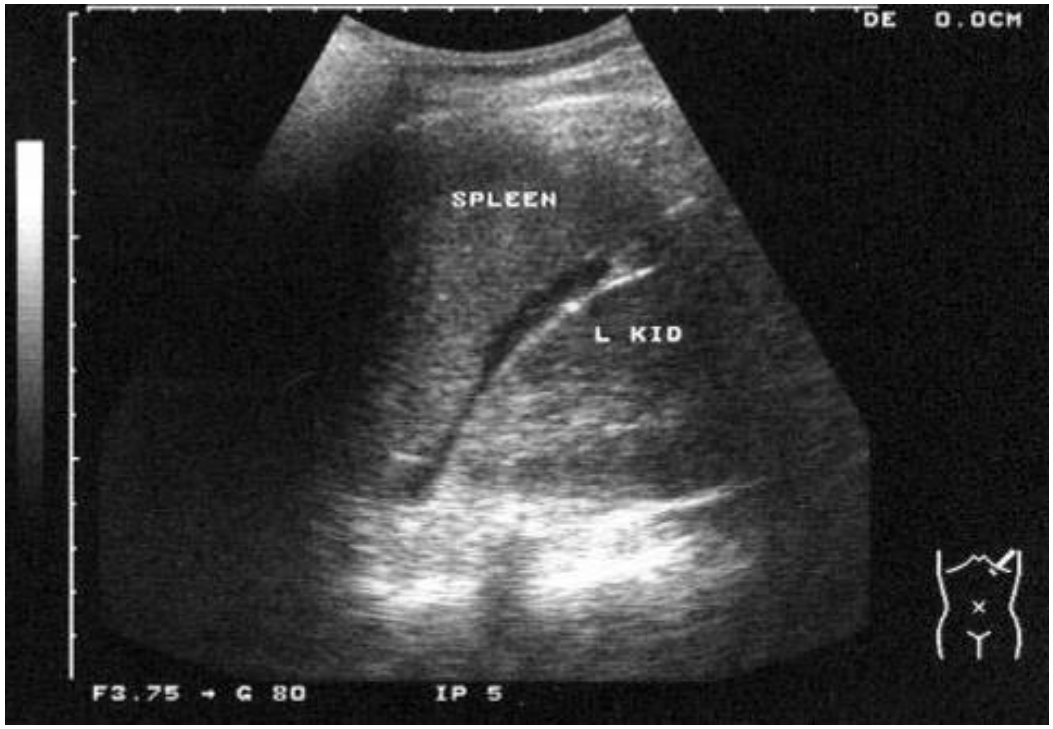
Normal male pelvis, longitudinal view

Haemoperitoneum - RUQ



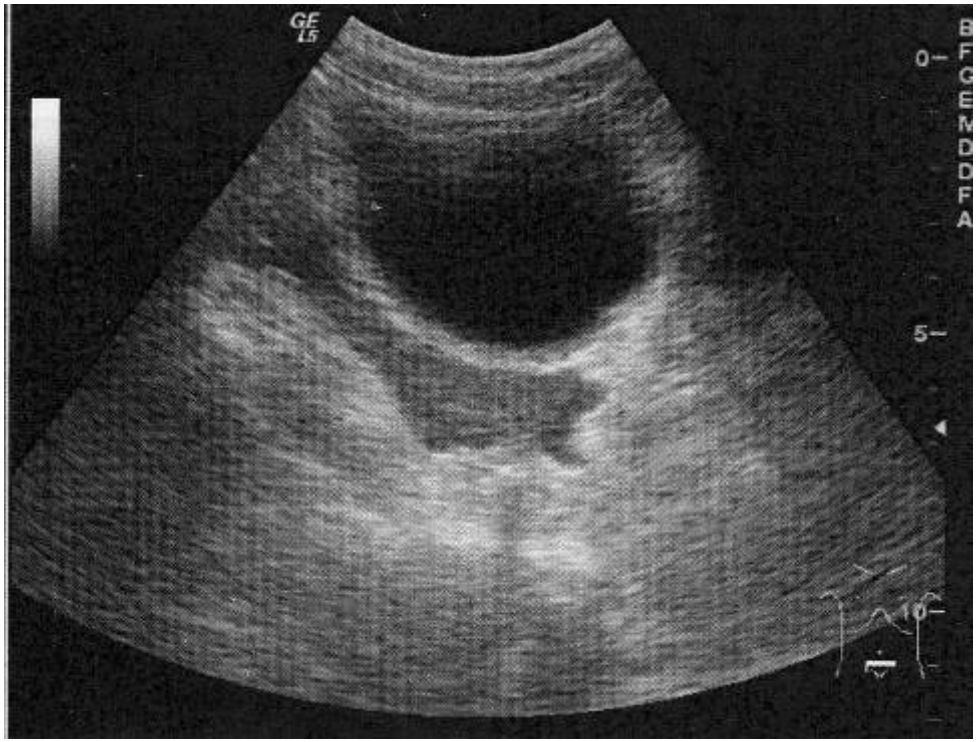
Small wedge of hypoechoic blood between liver and kidney.

Haemoperitoneum - LUQ



Free fluid (blood) in spleno-renal recess

Haemoperitoneum - Pelvis



Transverse pelvic view demonstrating a small amount of blood in the Pelvis

Sonographic Pitfalls

- Free fluid in pelvis will often be missed without a full bladder
  - Sensitivity improved from 63% to 79% with full-bladder technique (McGahan et al)

Sonographic Pitfalls

- Sonography can miss important organ injury that will require surgery
  - Dolich et al reported 43 patients with false-negative sonographic findings, of which 10 (33%) required surgery
  - Shanmuganathan et al: 467 patients with organ injuries; 157 (34%) had no free fluid on USG; 26 of these 157 required surgery
  - USG: triage for unstable patient
  - CT still needed if intra-abdominal injury (IAI) is suspected

Sonographic Pitfalls

- Sonography is limited or unable to show certain types of injuries
  - Spinal and pelvic fractures
  - Diaphragmatic ruptures
  - Vascular injuries
  - Pancreatic injuries
  - Adrenal injuries
  - Some bowel and mesenteric injuries

Free Fluid Scoring Systems

- Huang at al:
  - each '>2mm fluid pocket' score 1;
  - score $\geq$ 3 = surgery
- McKenney et al:
  - vertical height of fluid in cm added
  - score > 3 = $\uparrow$ need of surgery

Free Fluid Scoring Systems

- Sirlin et al: fluid in each anatomic region = 1 point

Score	IAI (%)	Surgery (%)
0	1.4	0.4
1	59	13
2	85	36
3	83	63

- Conclusion: an increase in the amount of free fluid raises the likelihood of major IAI

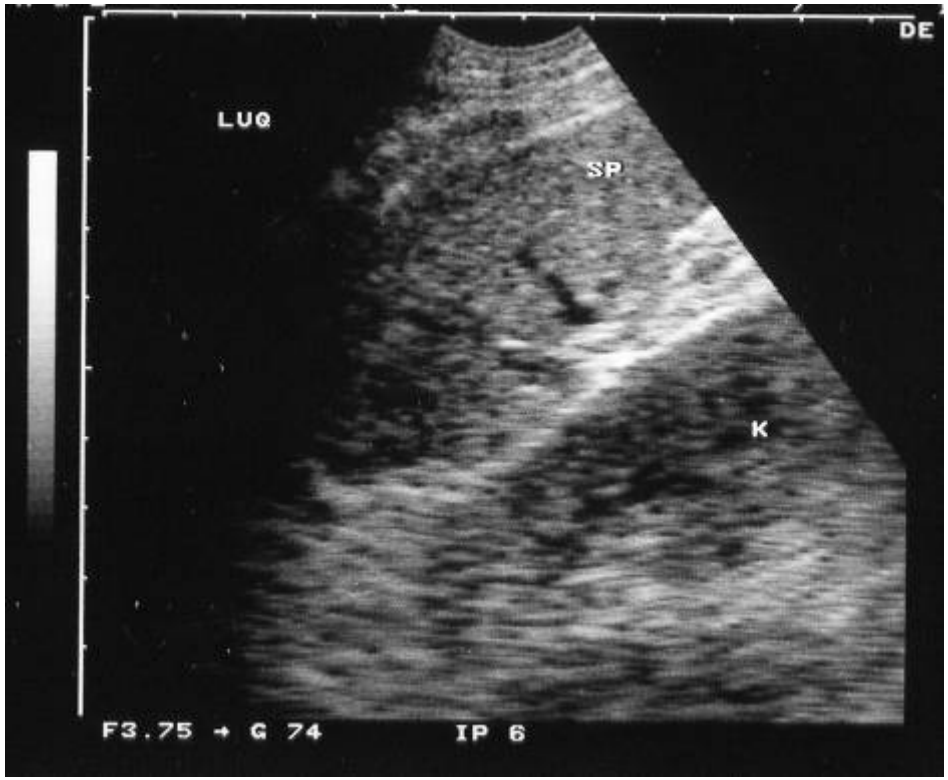
Solid-Organ Injuries

- Rothlin et al reported sensitivity of 41.4%
- McGahan et al reported sensitivity of 41%
- Stengel et al showed that injuries were more easily detected with a 7.5 MHz linear probe than with a 3.5 MHz convex probe

Solid-Organ Injuries

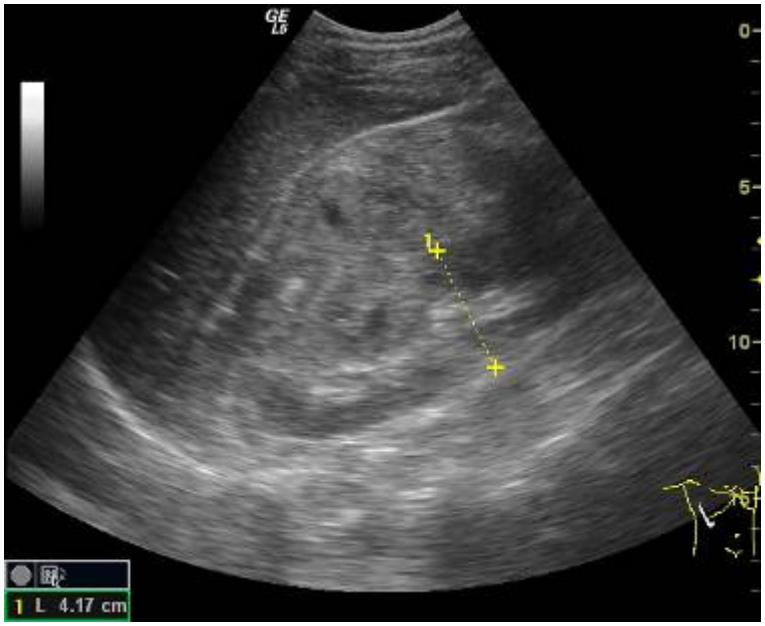
- A diffuse heterogeneous pattern predominant in splenic lacerations
- A discrete hyperechoic pattern most often in hepatic lacerations
- Subcapsular splenic haematomas are shown as either hyperechoic of hypoechoic rims
- Severe kidneys injuries show a completely disorganized pattern

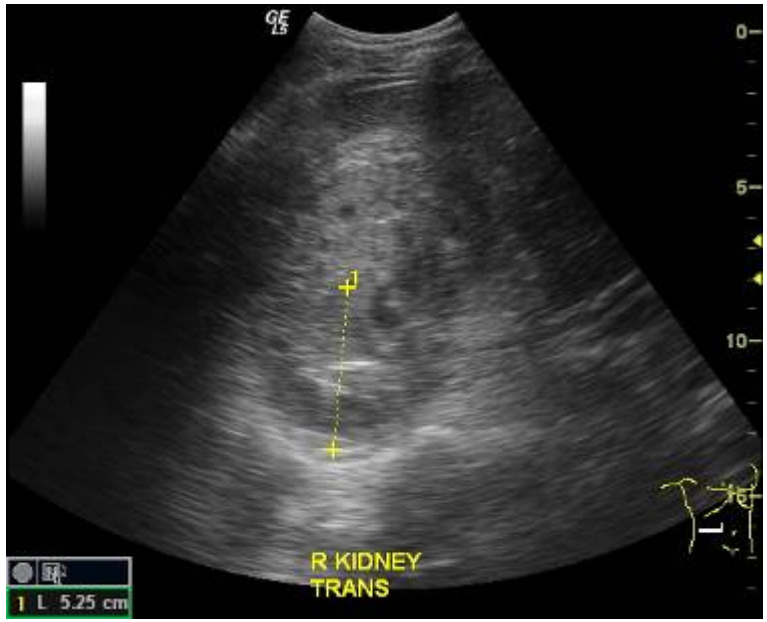
Splenic Laceration



Sonography of LUQ shows splenic lacerations confirmed by CT

Renal Laceration





A renal laceration at the mid-pole of Right Kidney with huge anterior perinephric haematoma

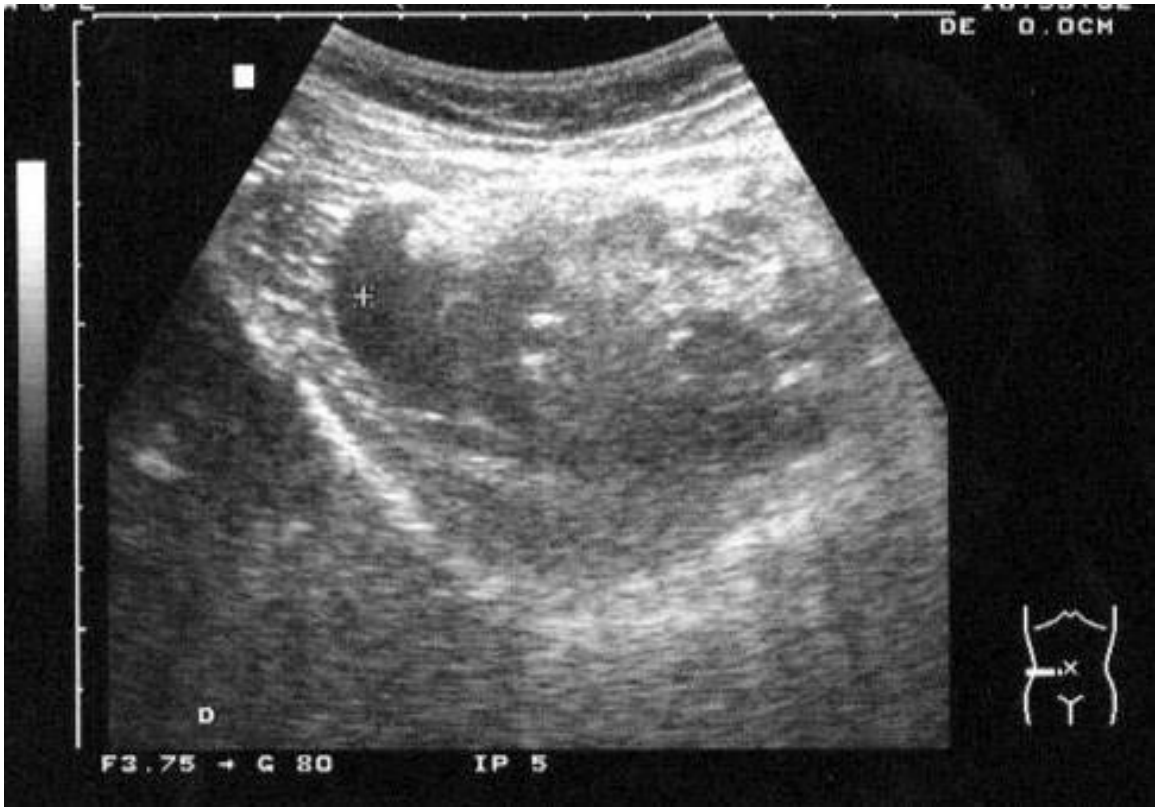
Clinical PEARLS

- Trendelenberg's position
- Scan the liver tip for small volume haemoperitoneum
- Repeat the scan if suspicious
- Fill the bladder by foley
- Lower the gain for pelvic scan
- Clot can be echogenic
- Look for acute angles = free fluid

Paracolic Gutters Views

- Time consuming
- Skill & experience demanding
- Minimal increase in sensitivity

Paracolic Gutters Views



Transverse right paracolic gutter scan demonstrating free fluid

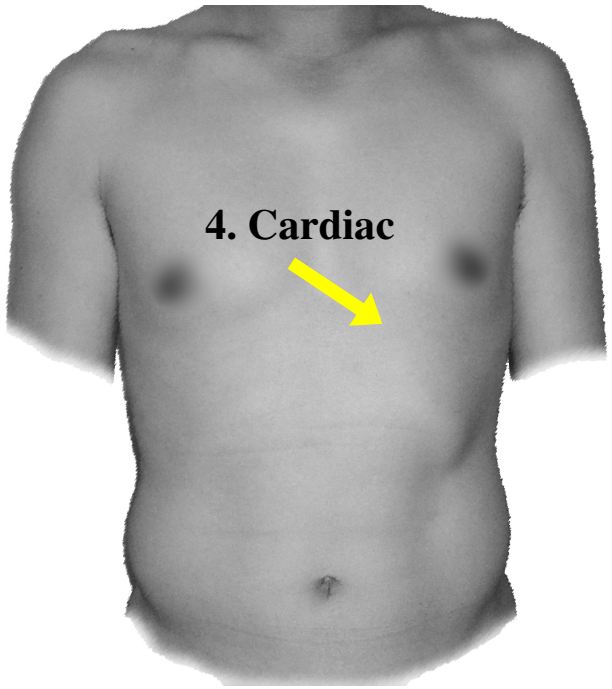
Paracolic Gutters Views

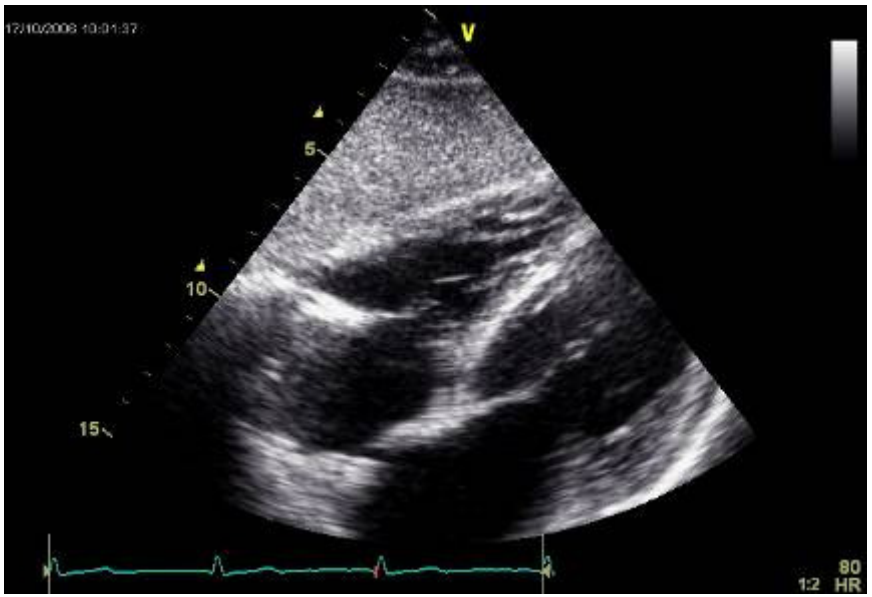
Transverse right paracolic gutter scan demonstrating free fluid

What if USG -ve?

- Is CT needed?
- Sirlin 2002
  - 4000 patients
  - 3680 USG -ve
  - if Fracture or Haematuria → CT
    - 11% to OR
  - if no Fracture and no Haematuria → no CT
    - only 0.1% to OR

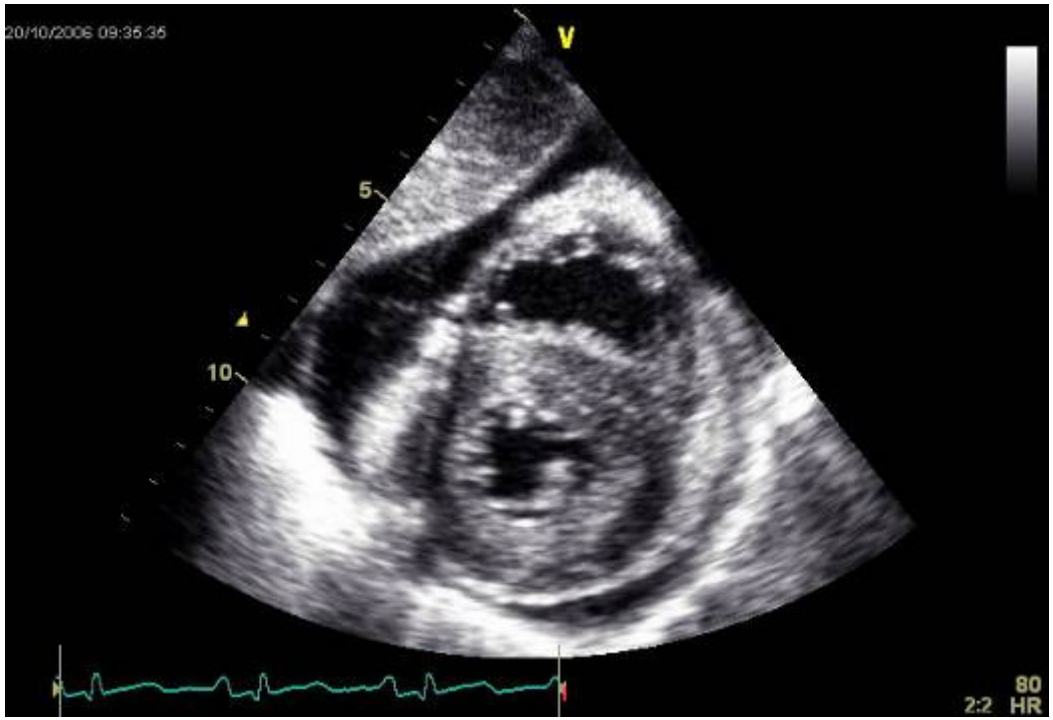
FAST





Normal Subcostal scan

Pericardial Effusion

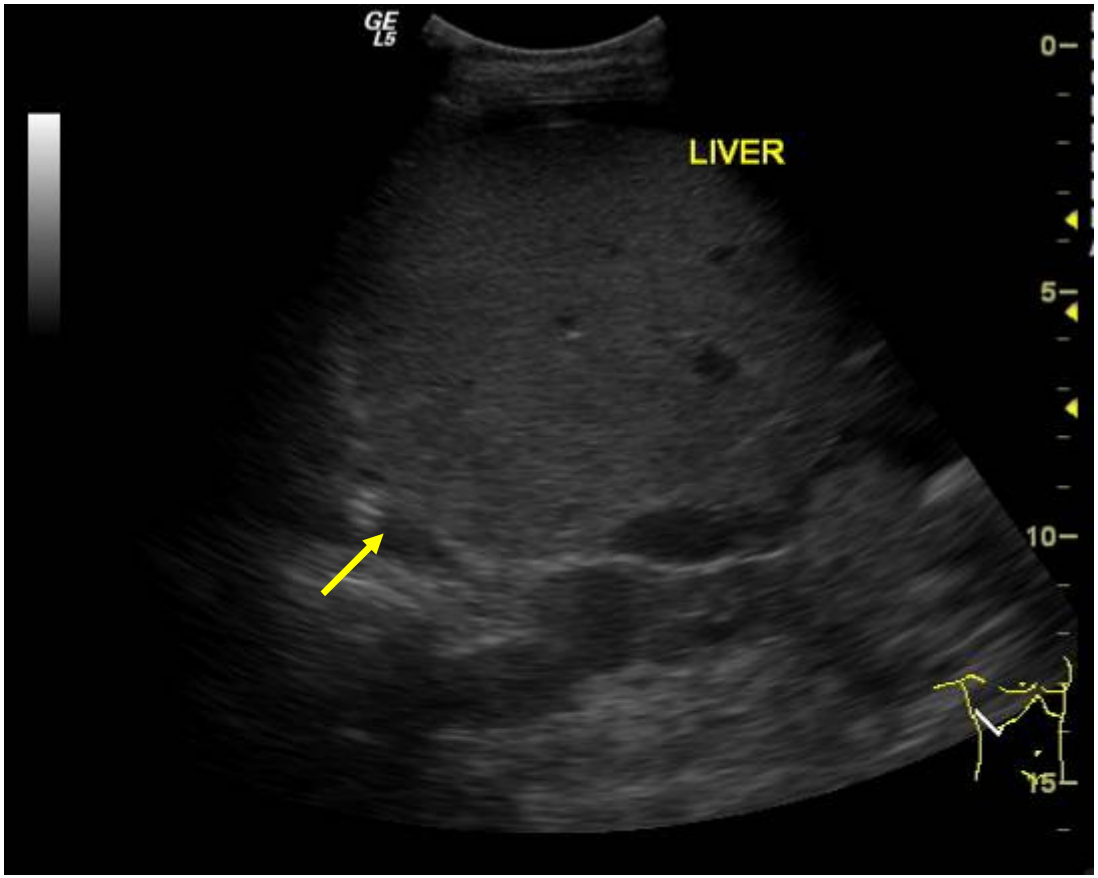


Subcostal short axis with pericardial effusion

Additional Utilization

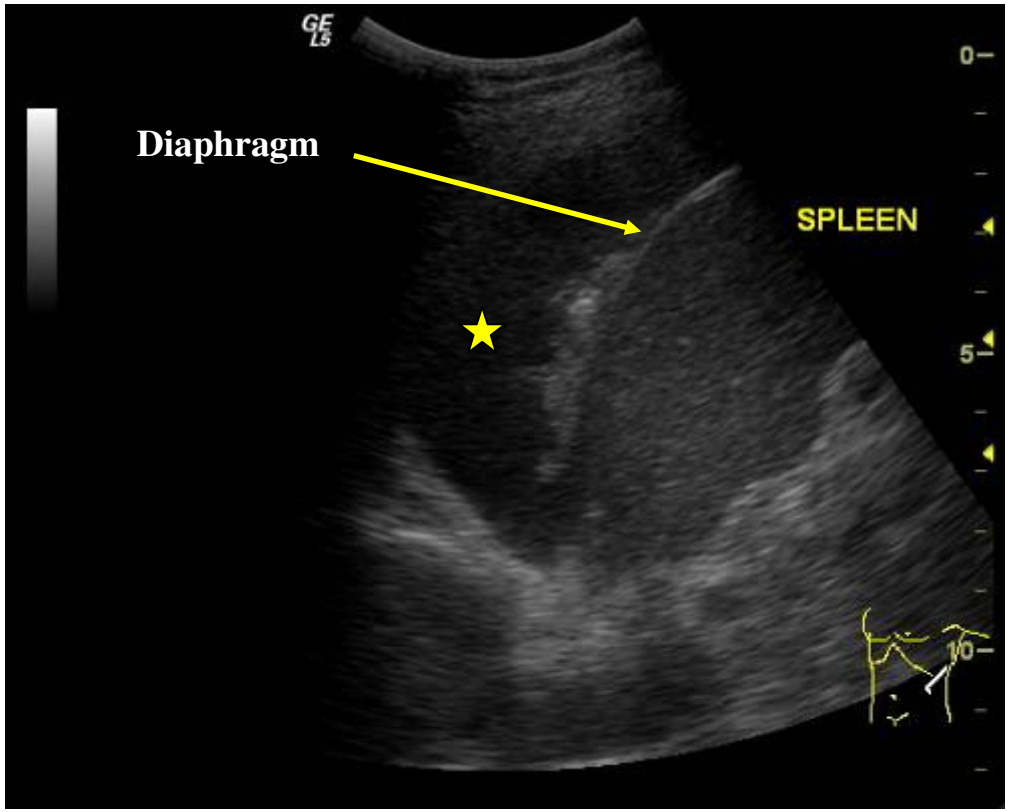
- Haemothorax
  - anechoic areas above diaphragm
  - high sensitivity & specificity
  - reverse Trendelenberg or sitting improve sensitivity
  - as little as 20 ml may be detected

Haemothorax



Small right pleural collection

Haemothorax



Large left haemothorax

Additional Utilization

- Pneumothorax
  - lost of ‘sliding’ sign
  - lost of reverberation artifact
  - other artifacts: ring-down artifact; ?comet tail artifact
  - M-mode and Power Doppler may help
- Rib fracture
  - disruption of cortex

The End