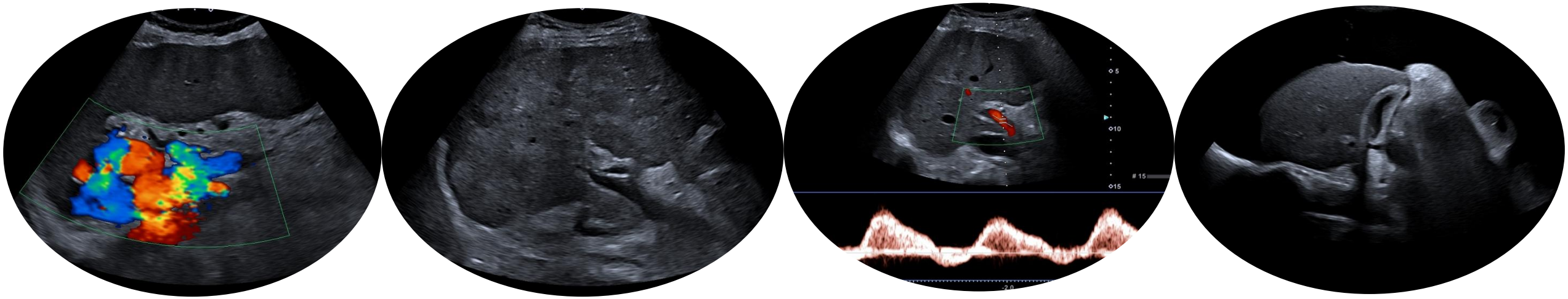
ULTRASOUND IN DIFFUSE LIVER DISEASE



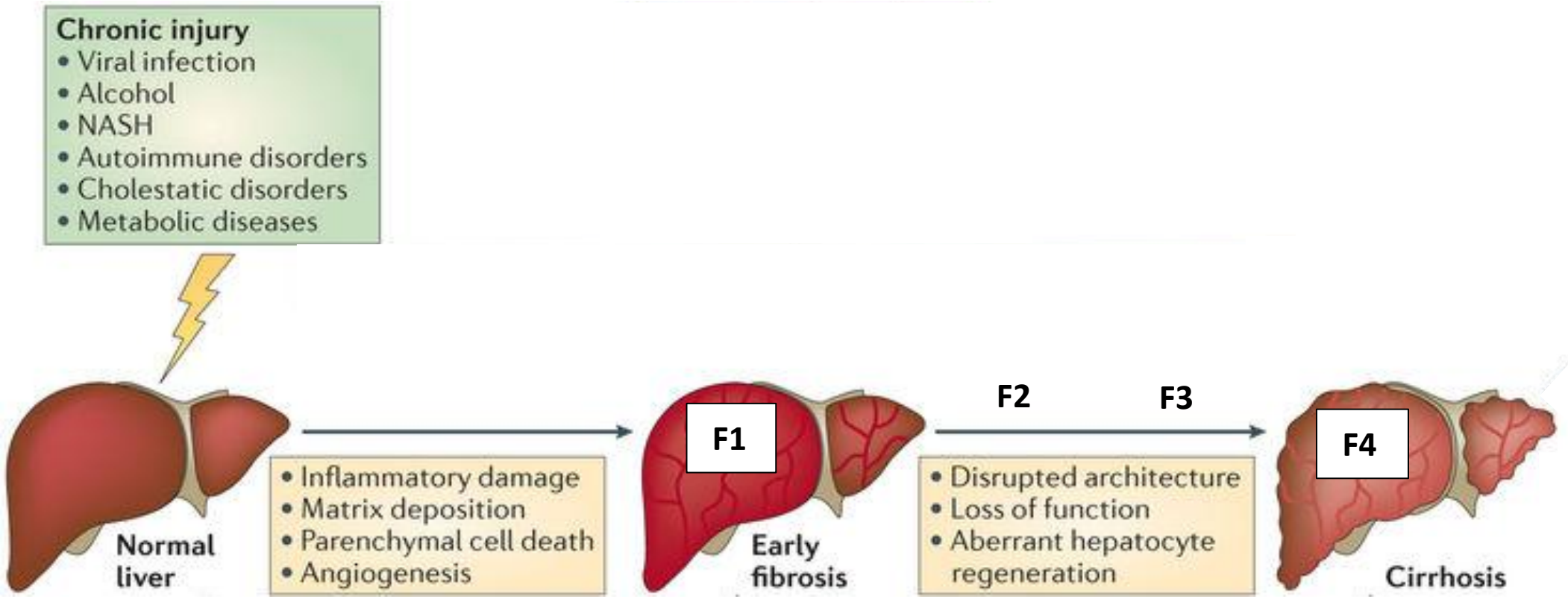
INTERNATIONAL HEPATOLOGY ULTRASOUND COURSE

26-28.02.2026

University College London, Royal Free Hospital

Matteo Rosselli MD PhD FRCP

CHRONIC LIVER DISEASE



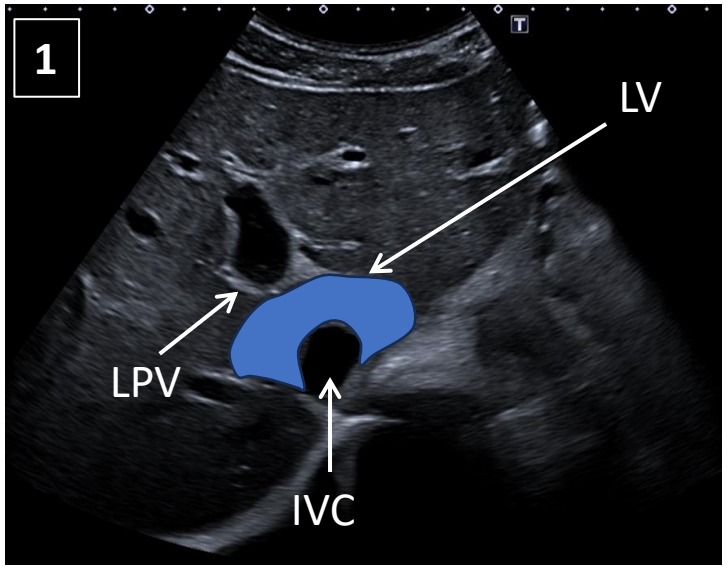
Adapted from Pellicoro et al. *Nature Reviews, Immunology. 2014;* 14: 181–94

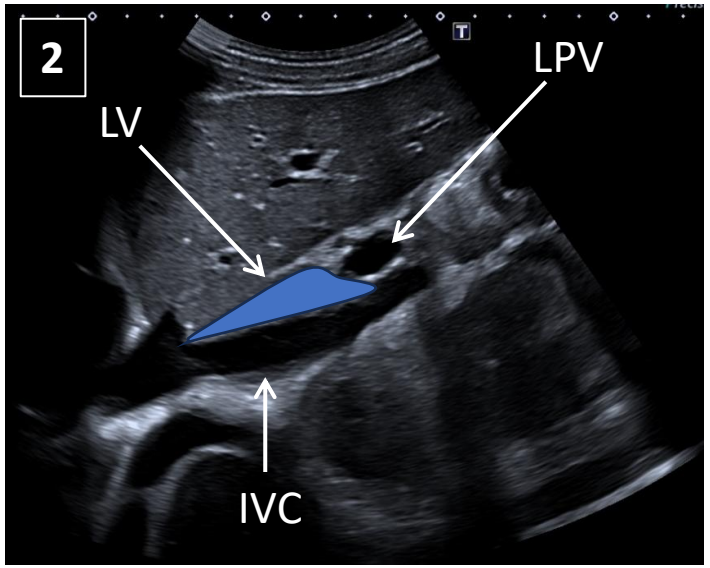
ULTRASOUND SIGNS OF CHRONIC LIVER DISEASE

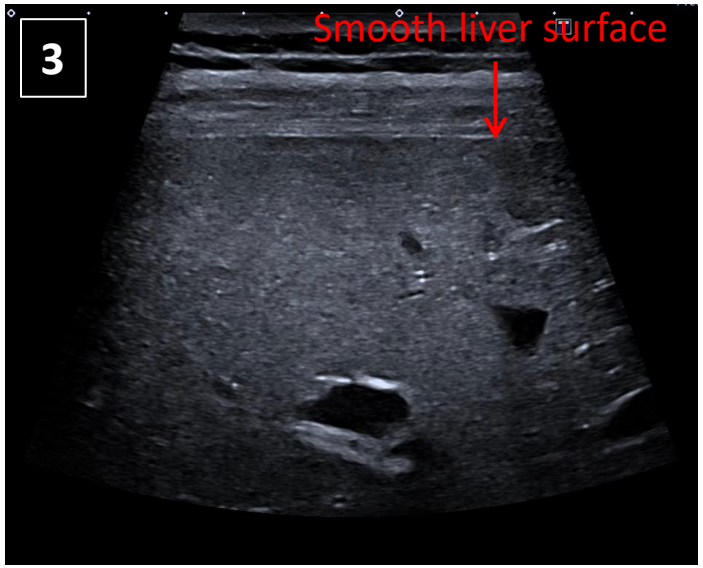
- Normal liver
  - Homogeneous echotexture
  - Smooth outline
  - Sharp margines
  - Balanced morphology unless anatomical variants

- Chronic liver disease
  - Heterogeneous echotexture
  - Irregular outline (surface, hepatic veins, gallbladder)
  - Rounded margins
  - Morphological changes (caudate lobe hypertrophy)

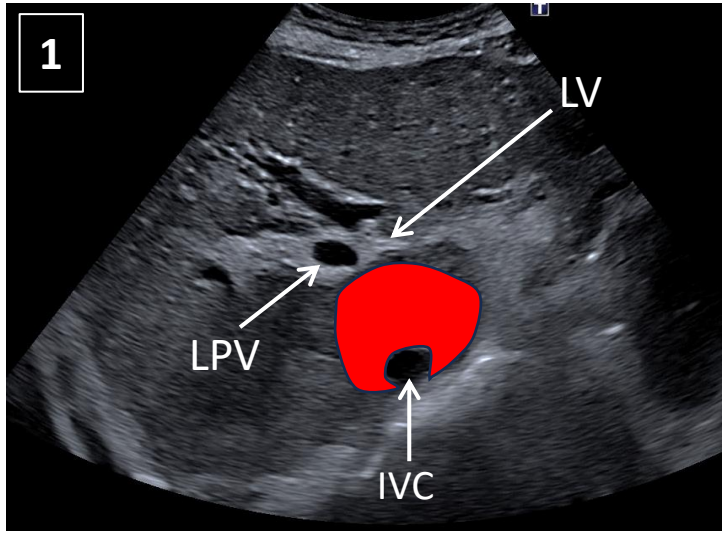
NORMAL LIVER

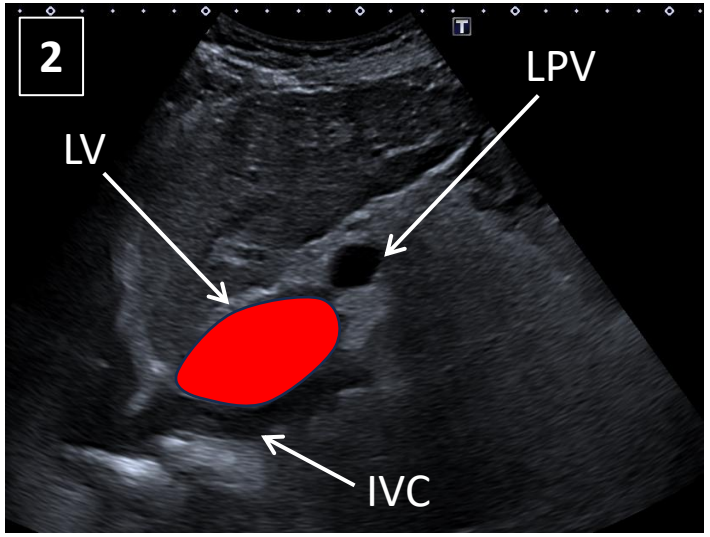


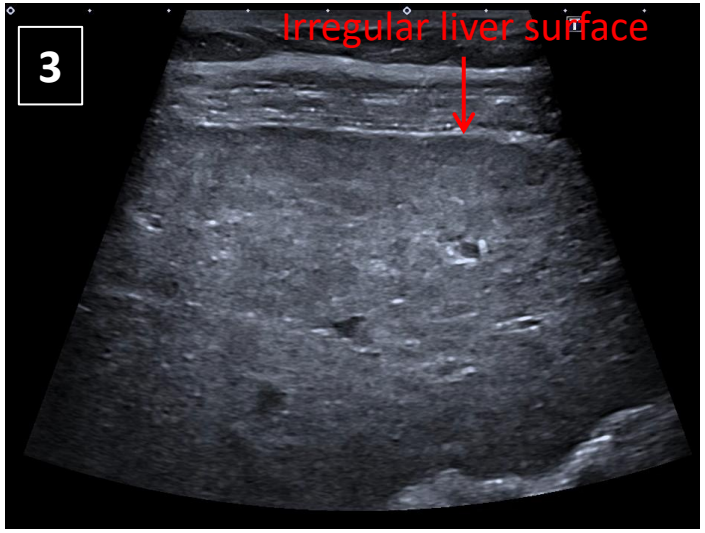




CIRRHOTIC LIVER

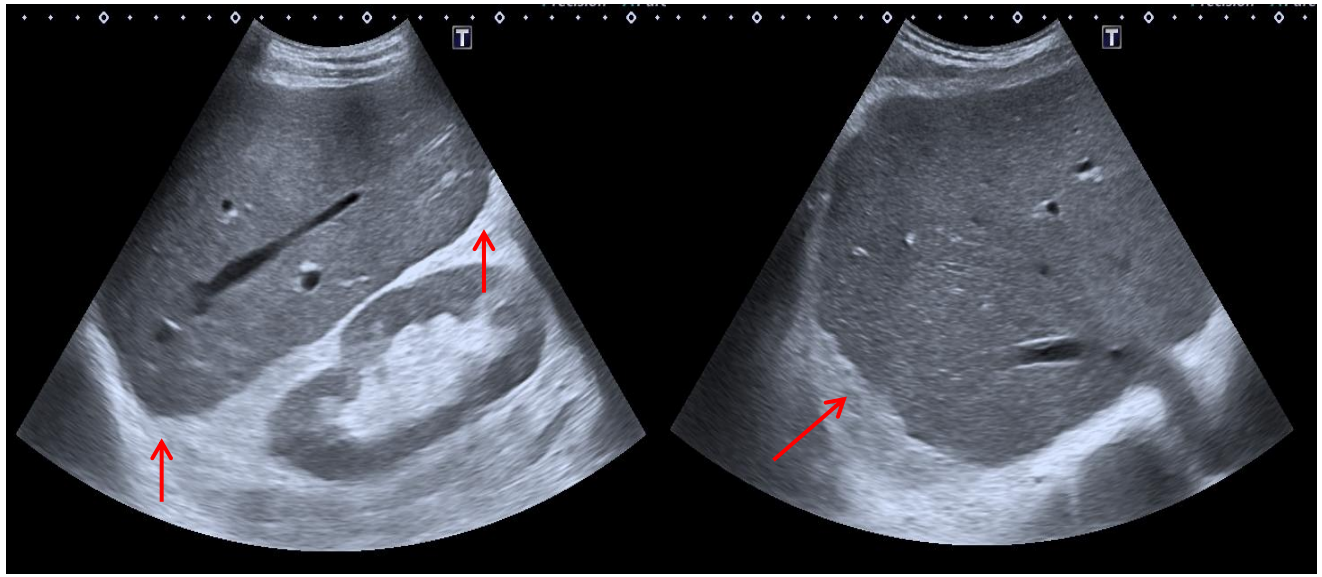


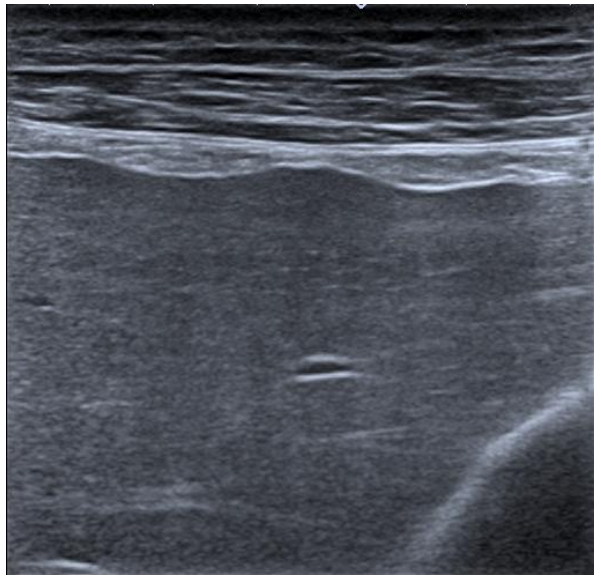


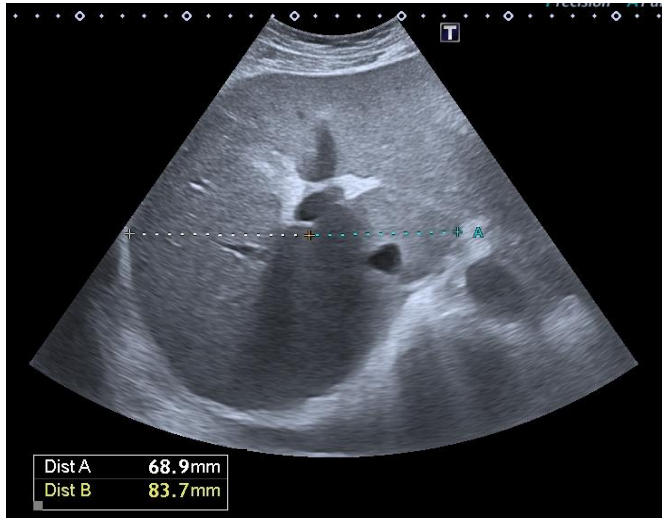


Left portal branch (LPV); Legamentum Venosum (LV); Inferior vena cava (IVC)

ULTRASOUND ASSESSMENT OF CHRONIC LIVER DISEASE

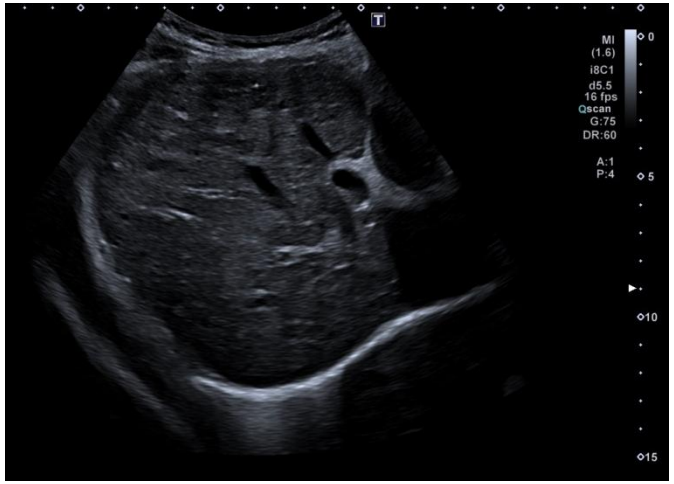


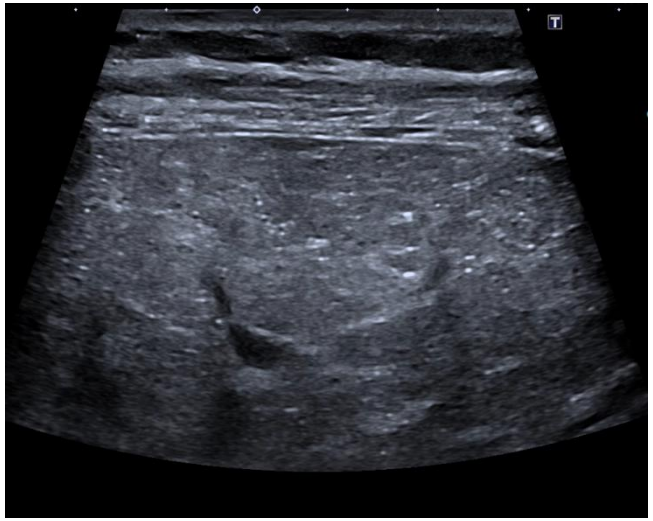




- ✓ Slightly therogeneous echotexture
- ✓ Rounded margins
- ✓ Irregular outline
- ✓ Morphology
  - Dysmorphic
  - Caudate lobe hypertrophy (CL/RLL > 0.65)

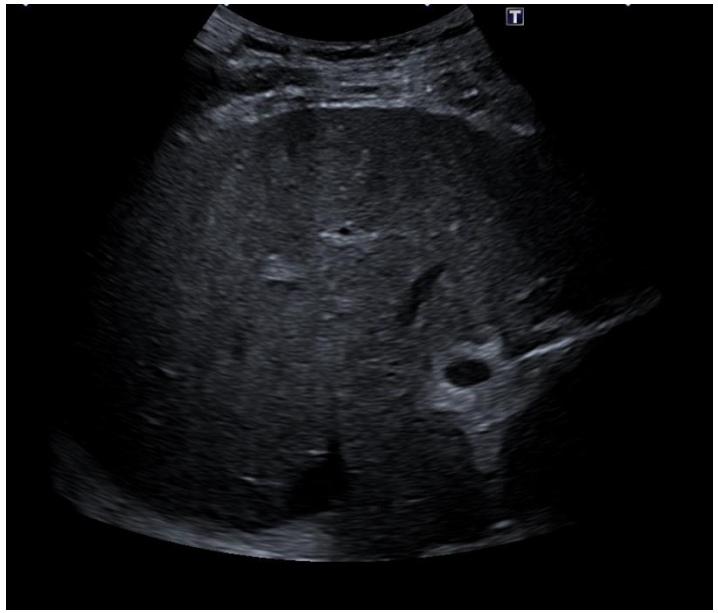
ULTRASOUND ASSESSMENT OF CHRONIC LIVER DISEASE





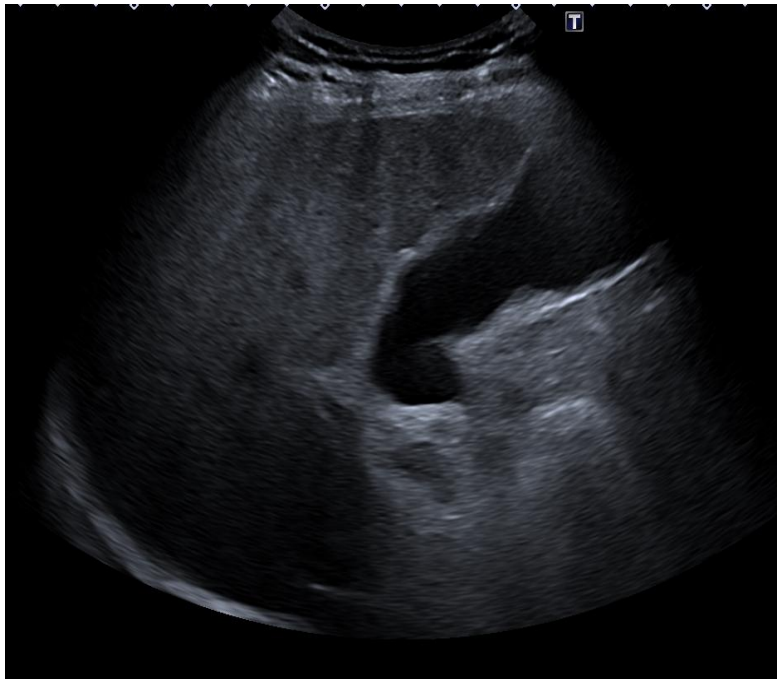
- ✓ Heterogeneous echotexture
- ✓ Rounded margins
- ✓ Outline: close look to hepatic parenchyma to further evaluate possibile signs of fibrosis and nodular regeneration

ULTRASOUND ASSESSMENT OF CHRONIC LIVER DISEASE



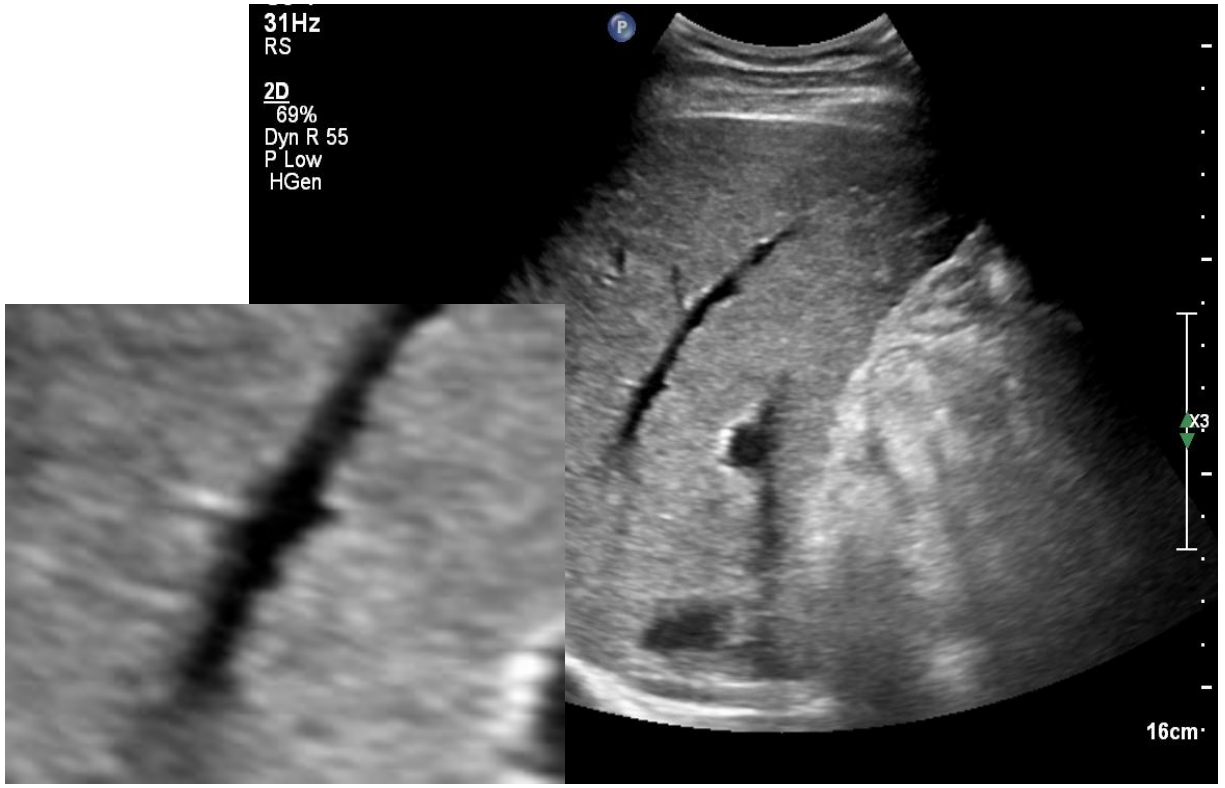
- ✓ Echotexture
- ✓ Margins
- ✓ Outline: close look to hepatic parenchyma to further evaluate possibile signs of fibrosis and nodular regeneration

ULTRASOUND ASSESSMENT OF CHRONIC LIVER DISEASE

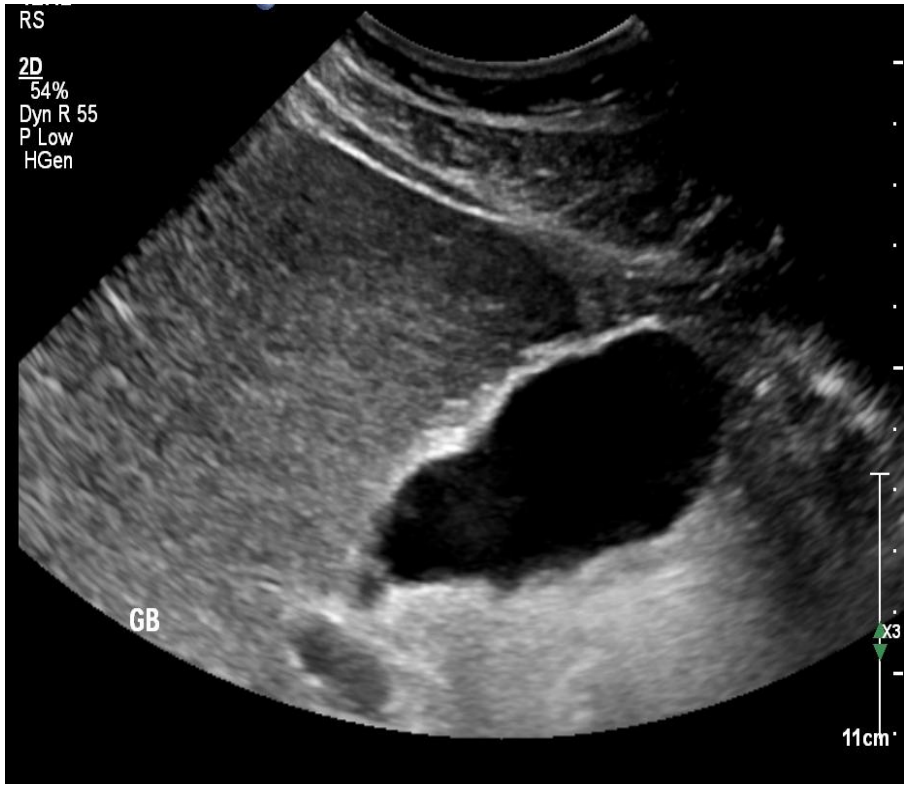


- ✓ Echotexture
- ✓ Margins
- ✓ Outline: close look to hepatic parenchyma to further evaluate possibile signs of fibrosis and nodular regeneration
- ✓ Irregular gallbladder outline due to liver parenchymal fibrotic changes

ULTRASOUND ASSESSMENT OF CHRONIC LIVER DISEASE

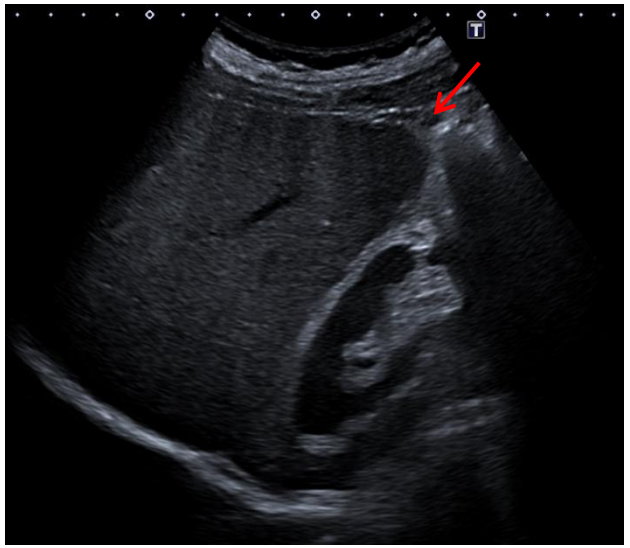


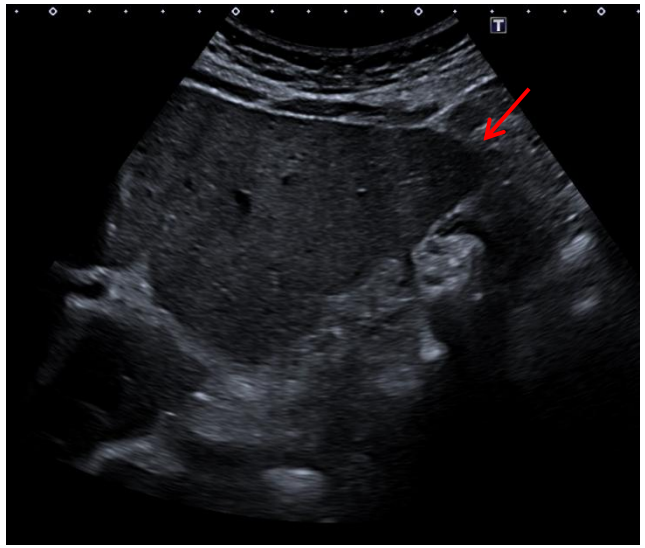
- ✓ Heterogeneous echotexture
- ✓ Irregular outline of the hepatic veins

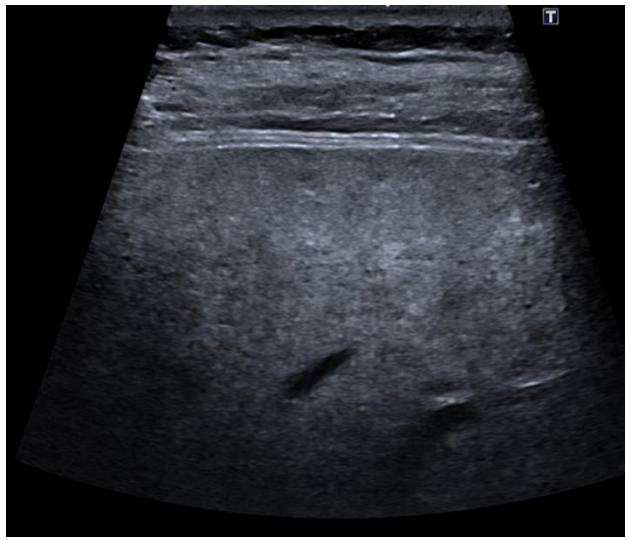


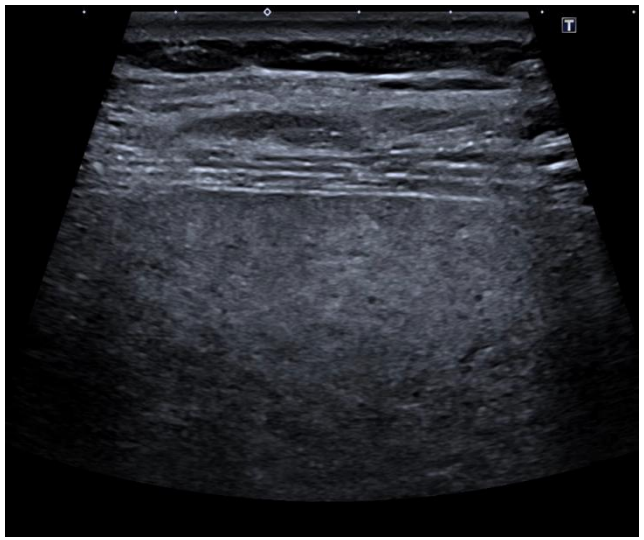
- ✓ Heterogeneous echotexture
- ✓ Irregular outline of the gallbladder

ULTRASOUND ASSESSMENT OF CHRONIC LIVER DISEASE



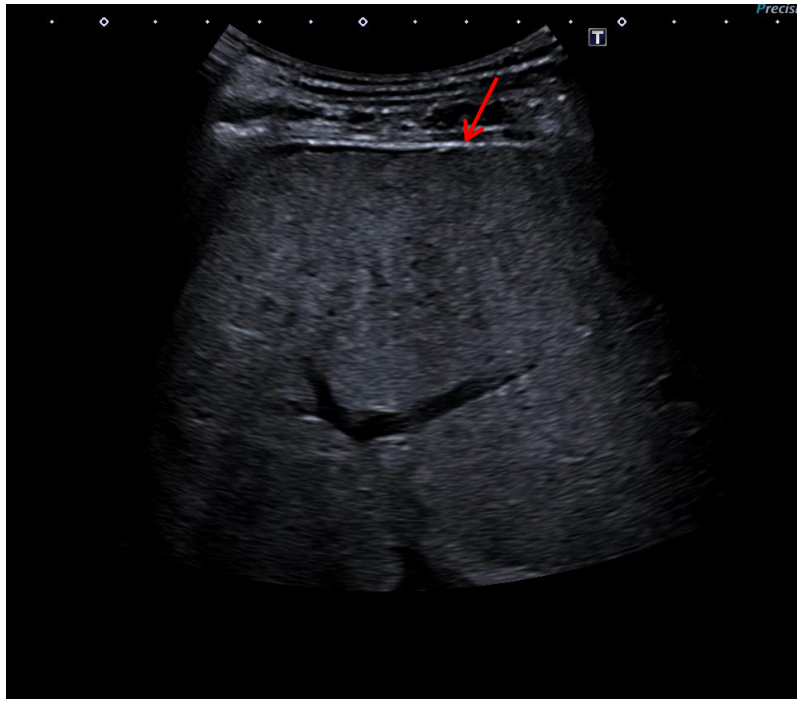






- ✓ Heterogeneous echotexture
- ✓ Rounded margins
- ✓ Irregular outline: use high frequency transducer to give a close look to hepatic parenchyma to highlight possibile signs of fibrosis and nodular regeneration

ULTRASOUND ASSESSMENT OF CHRONIC LIVER DISEASE

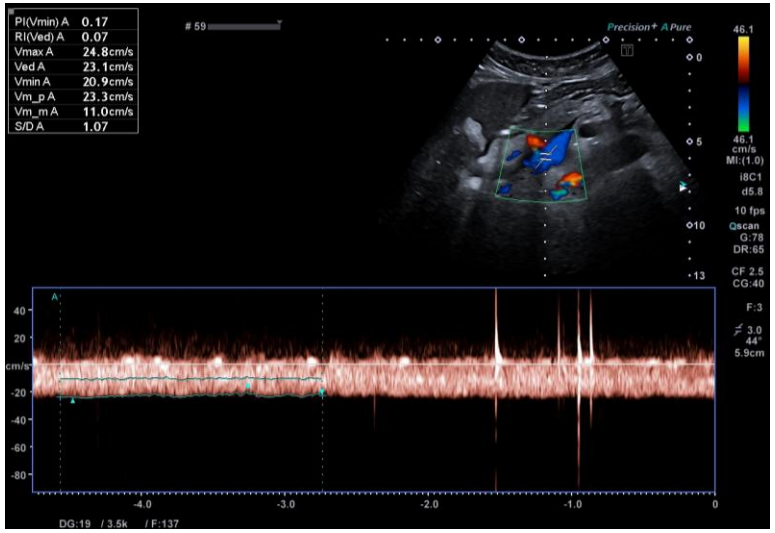


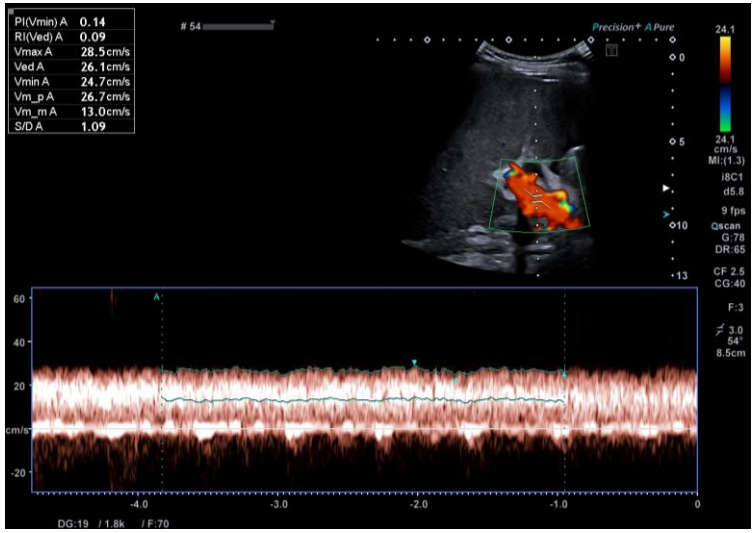
- ✓ Heterogeneous echotexture
- ✓ The outline appaears initially smooth
- ✓ Use a high frequency transducer to give a close look and highlight highlight possibile signs of fibrosis and nodular regeneration

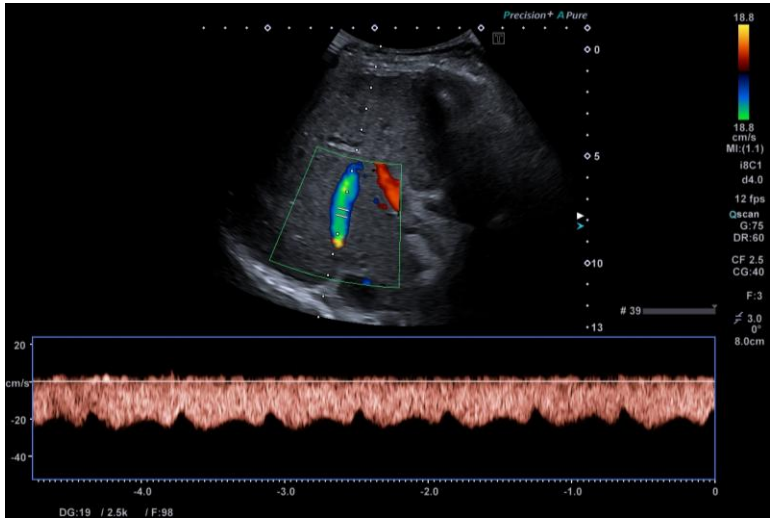
ULTRASOUND SIGNS OF PORTAL HYPERTENSION

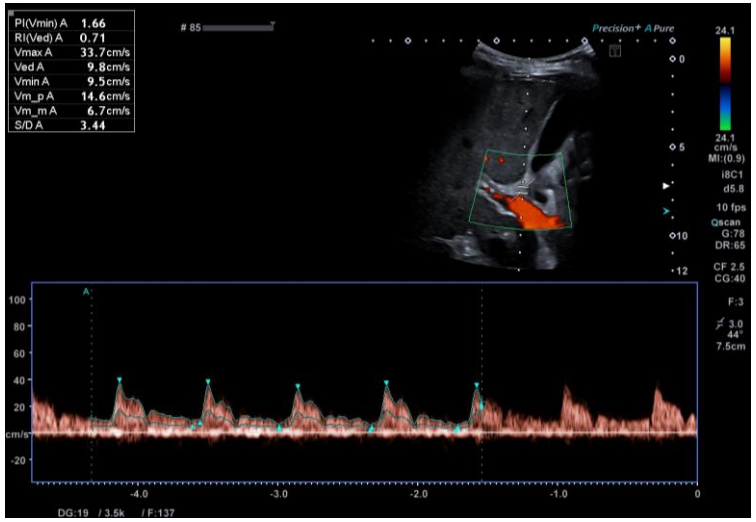
- Portal flow velocity: < 21 cm/sec; <14-16 cm/sec in CSPH
- Splenomegaly (>12 in female; >13 in male). Note that splenomegaly is not alway present despite portal hypertension)
- Portal vein diameter ≥13 mm (this is not always present despite portal hypertension).
- Splenic and superior mesenteric vein diamiter ≥ 11mm
- **Porto-systemic collateral circulation**
- **Inversion of portal venous flow**

ULTRASOUND SIGNS OF PORTAL HYPERTENSION

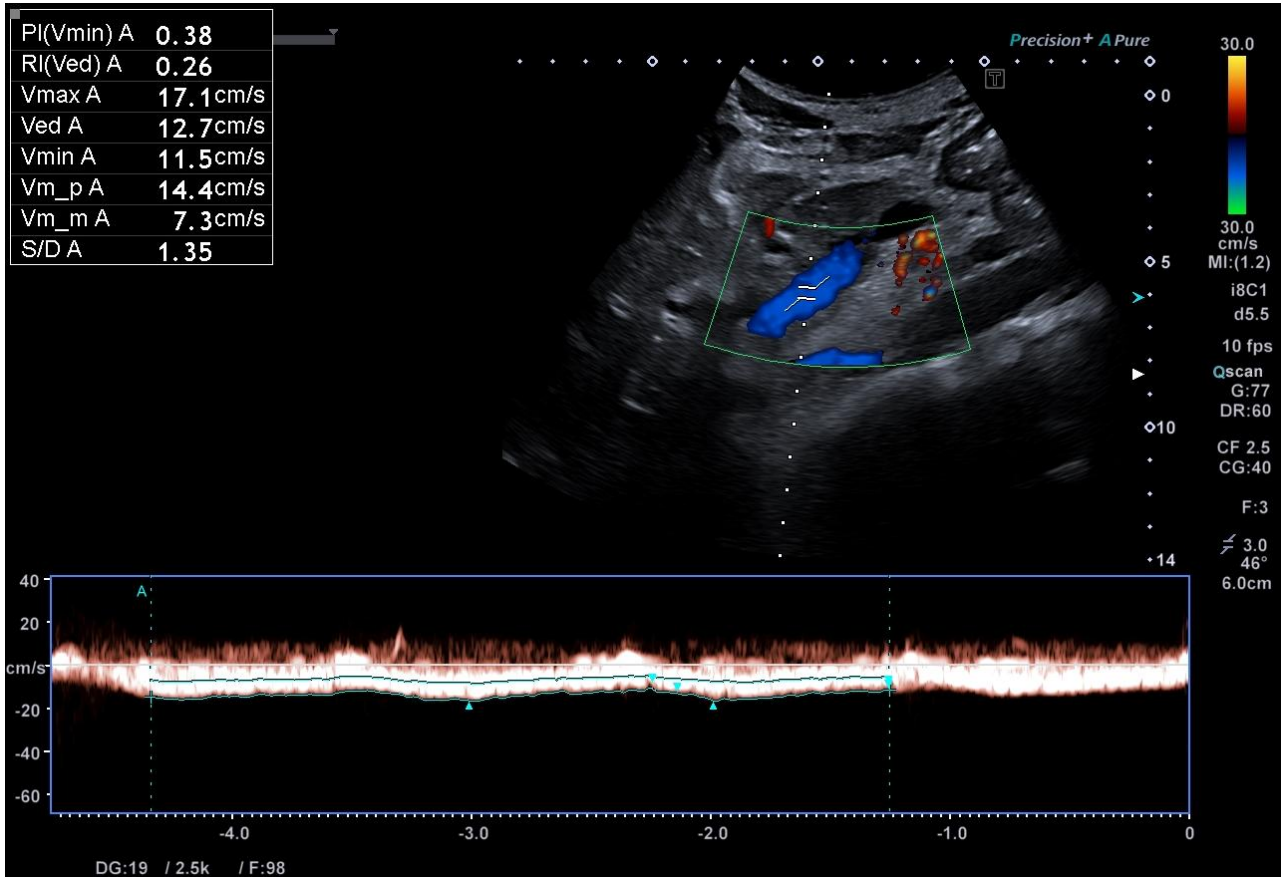




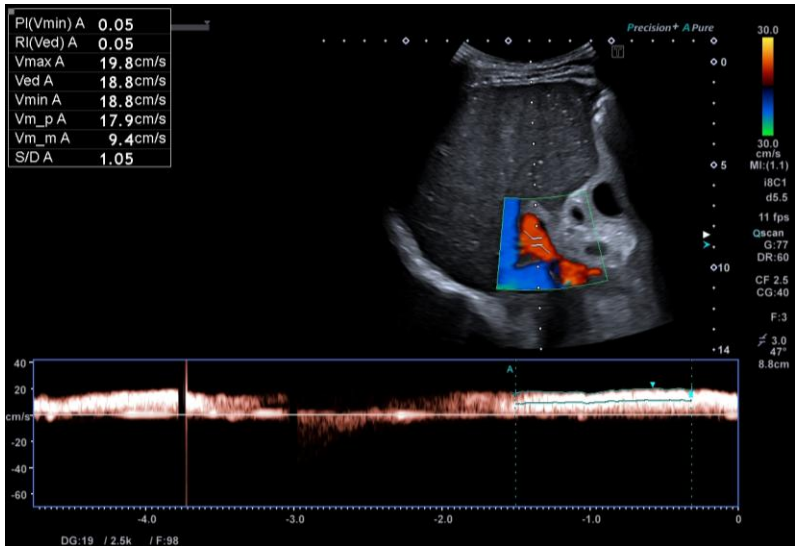


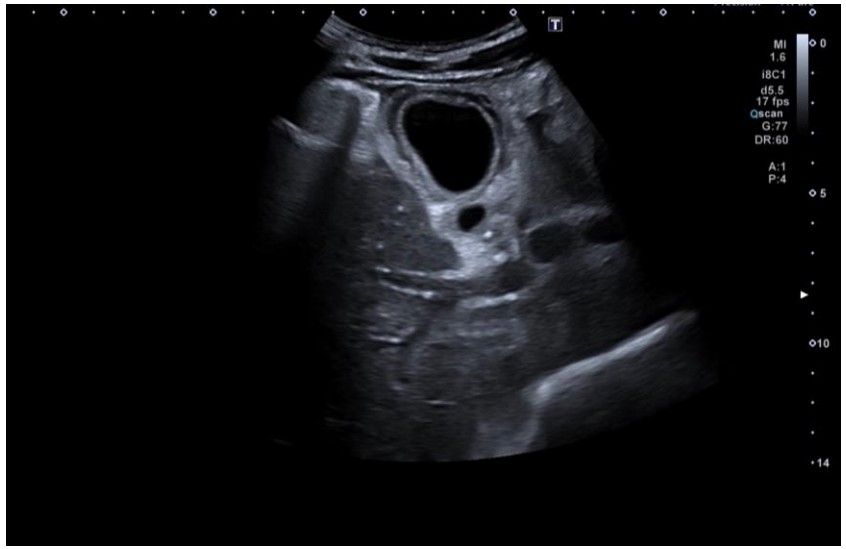


ULTRASOUND SIGNS OF PORTAL HYPERTENSION



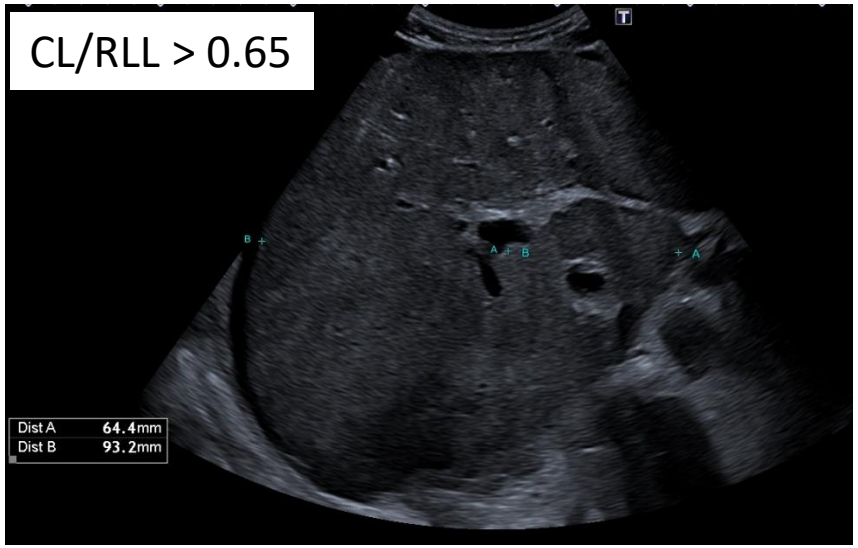
ULTRASOUND SIGNS OF PORTAL HYPERTENSION

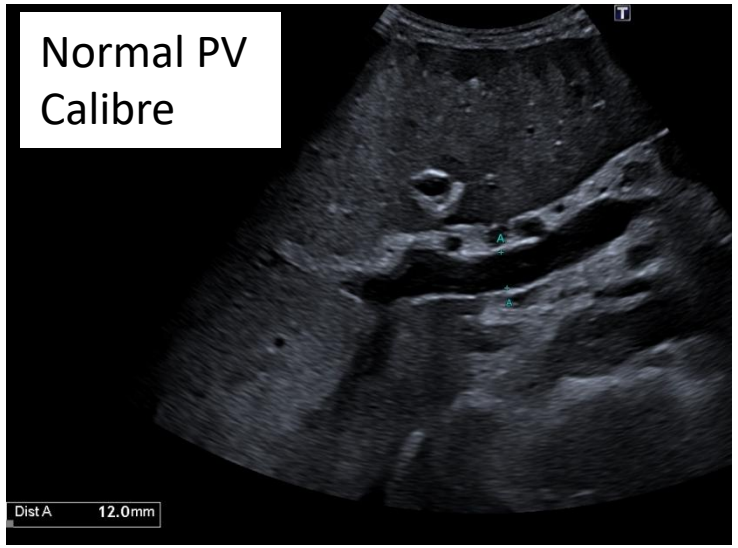


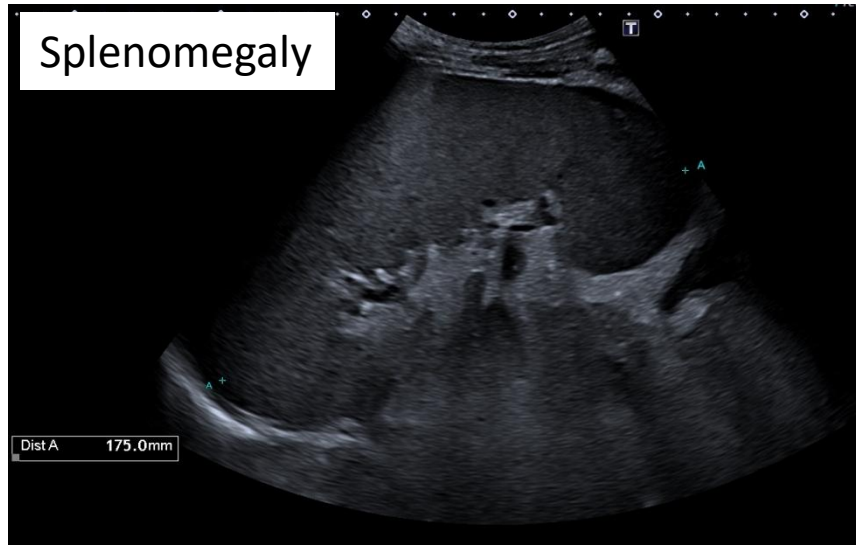


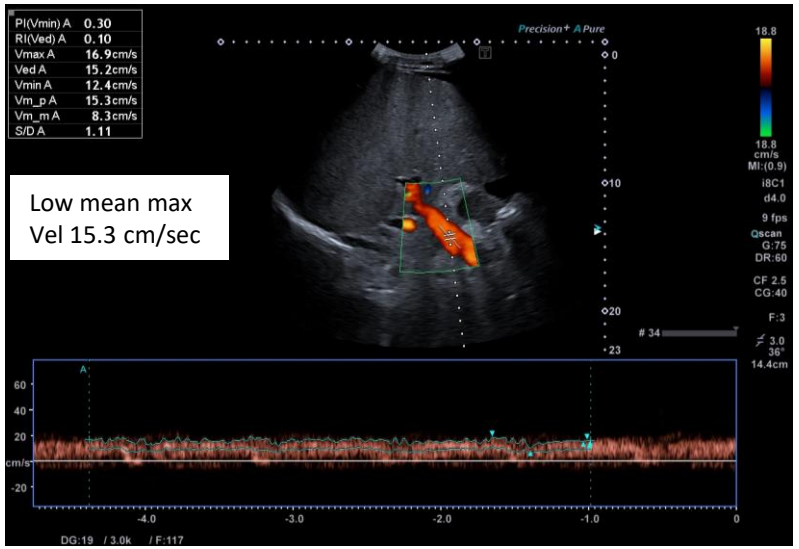
- ✓ Mean max velocity is low (17.9 cm/sec)
- ✓ The gallbladder is thickened
- ✓ The spleen despite these findings in not significantly enlarged (bipolar diameter of 124 mm)

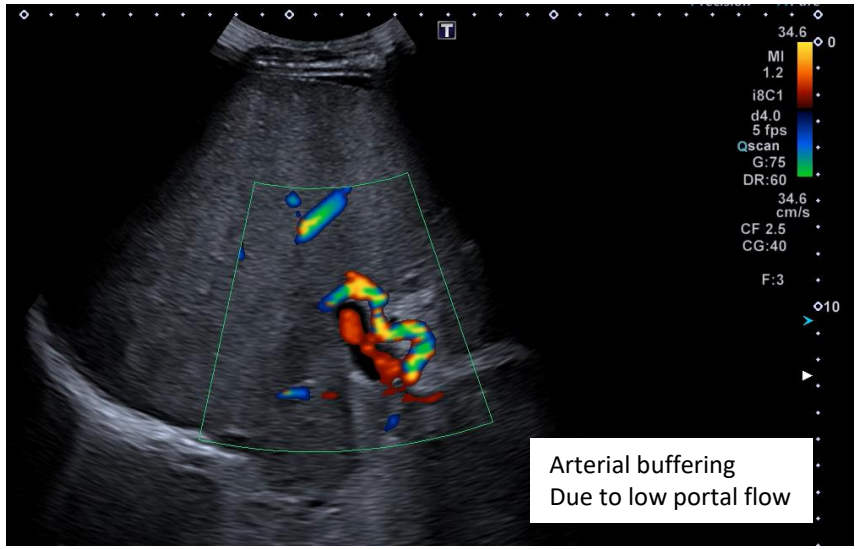
ULTRASOUND SIGNS OF PORTAL HYPERTENSION

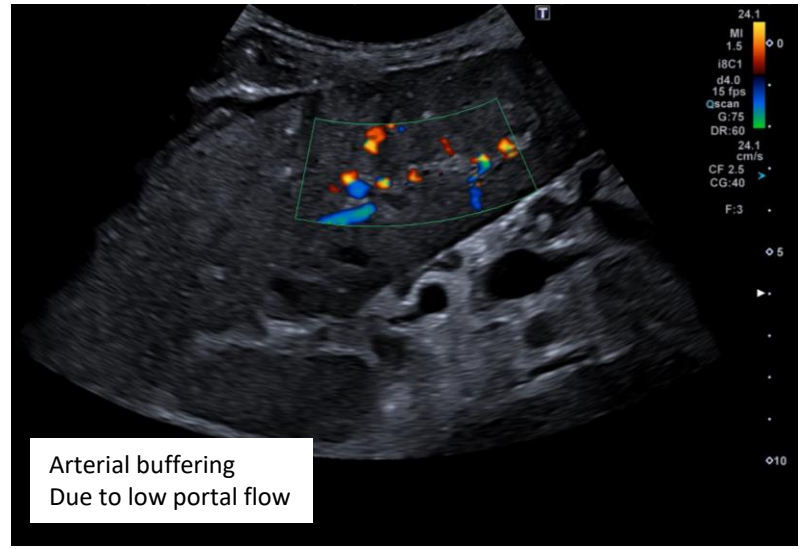




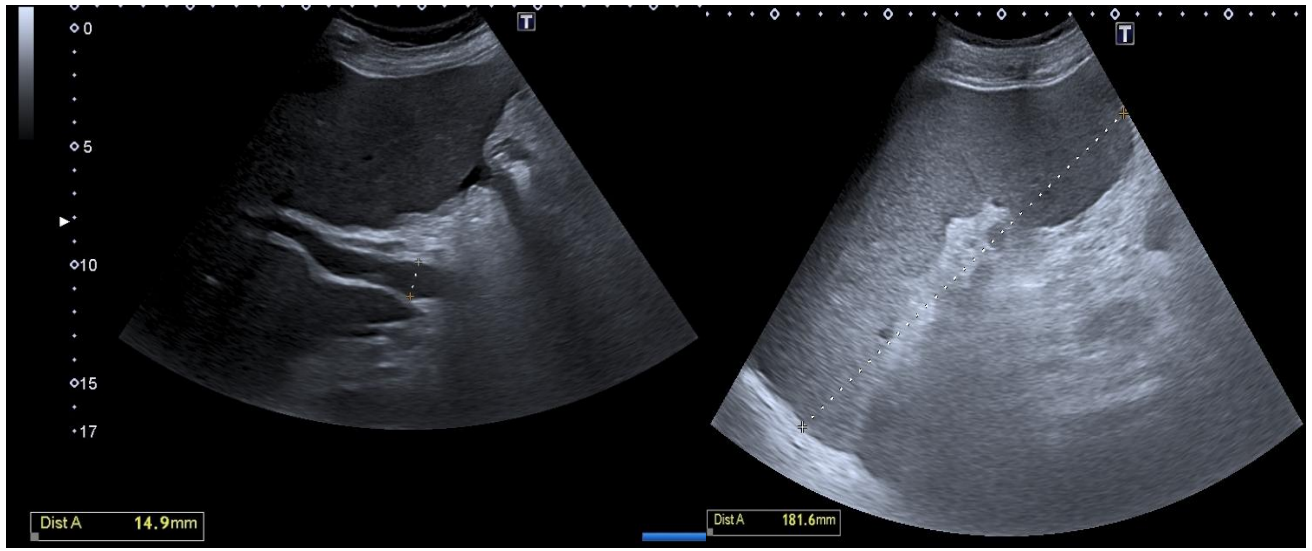




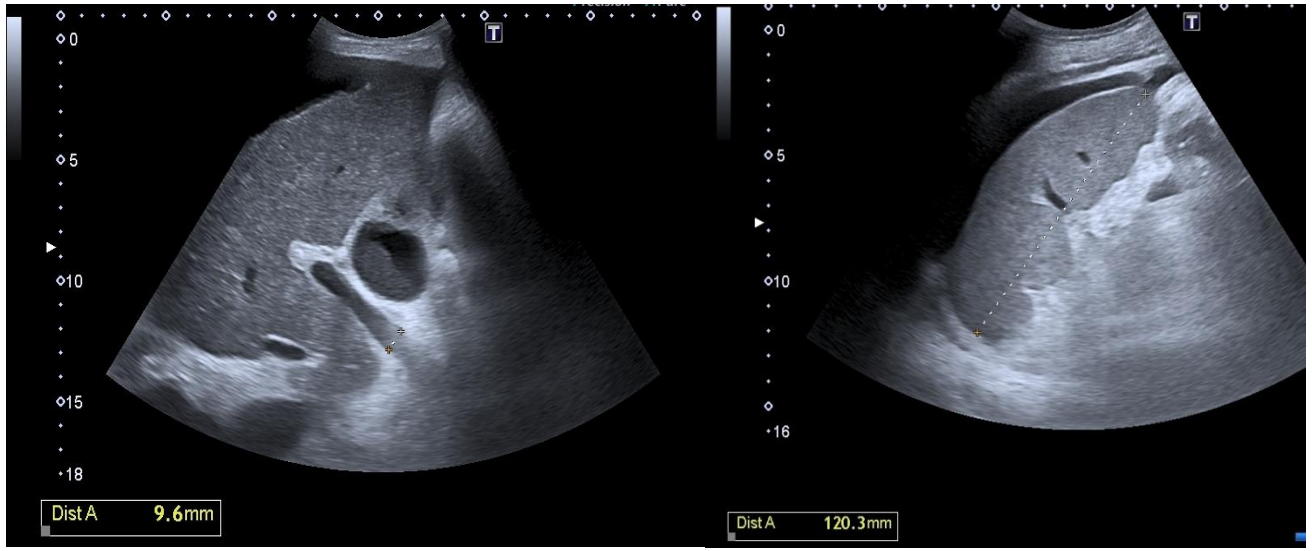




ULTRASOUND SIGNS OF PORTAL HYPERTENSION

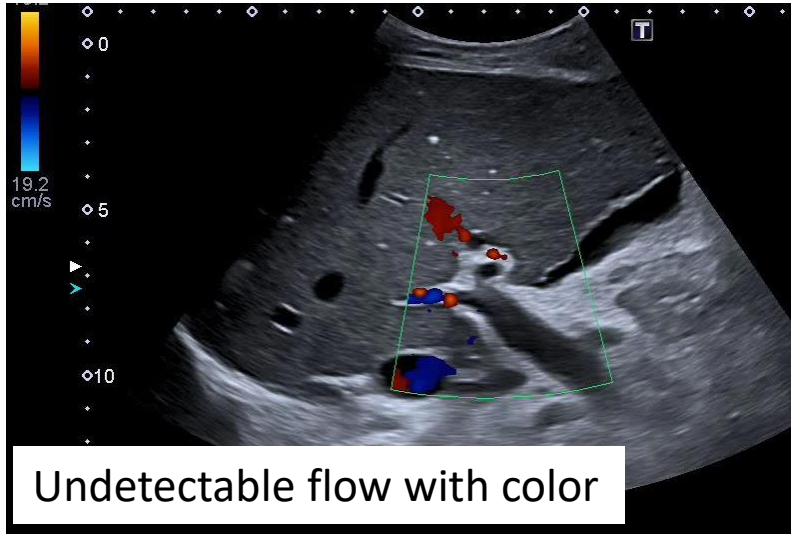


- Portal hypertension, increased spleen size, increased portal venous calibre

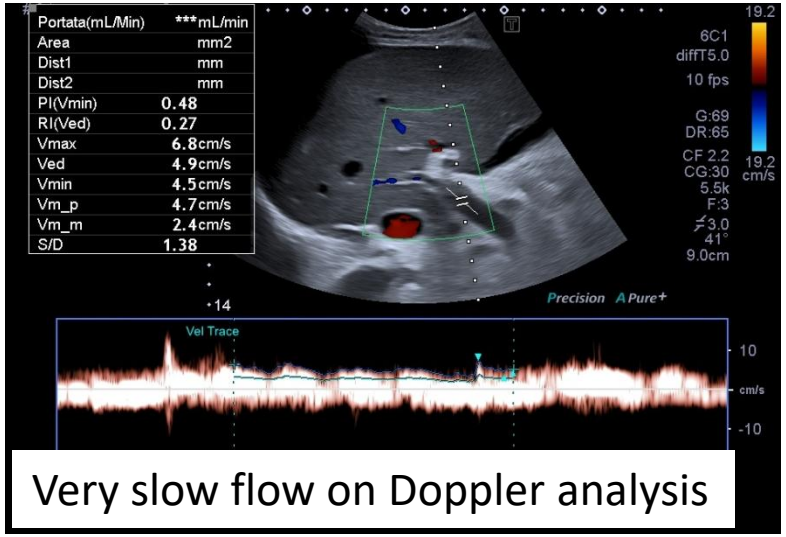


- Portal hypertension, normal sized spleen, normal/reduced portal vein calibre

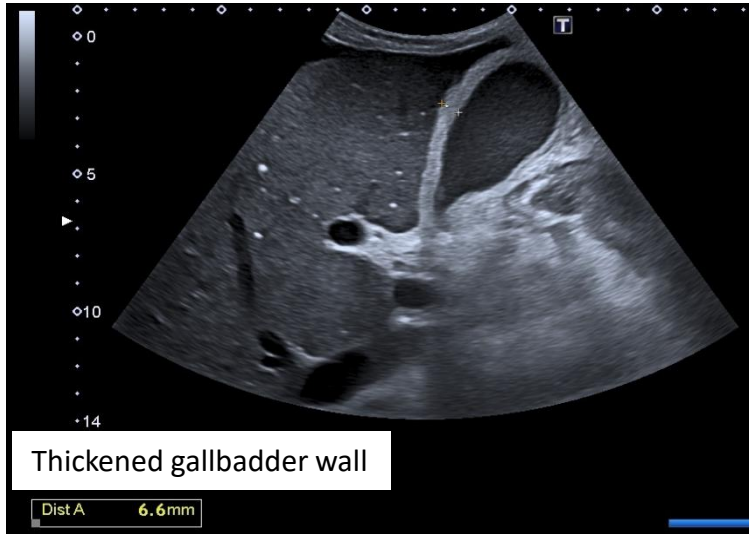
ULTRASOUND SIGNS OF PORTAL HYPERTENSION



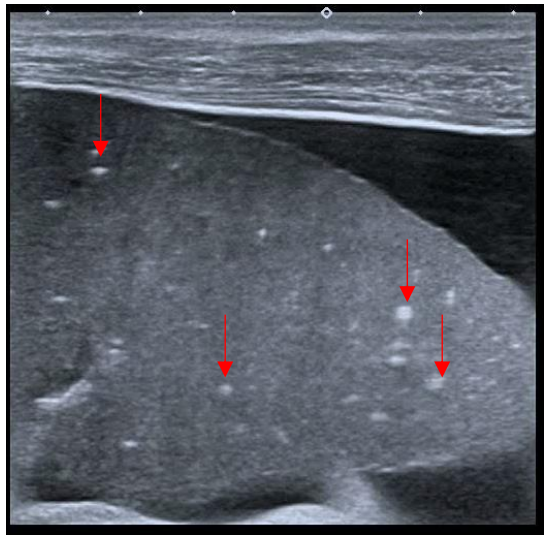
Undetectable flow with color



Very slow flow on Doppler analysis

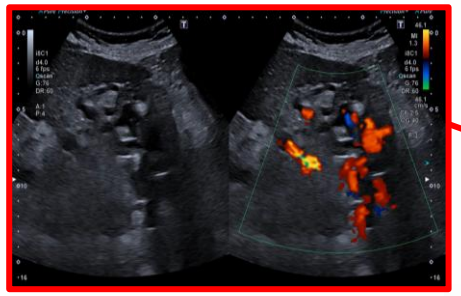


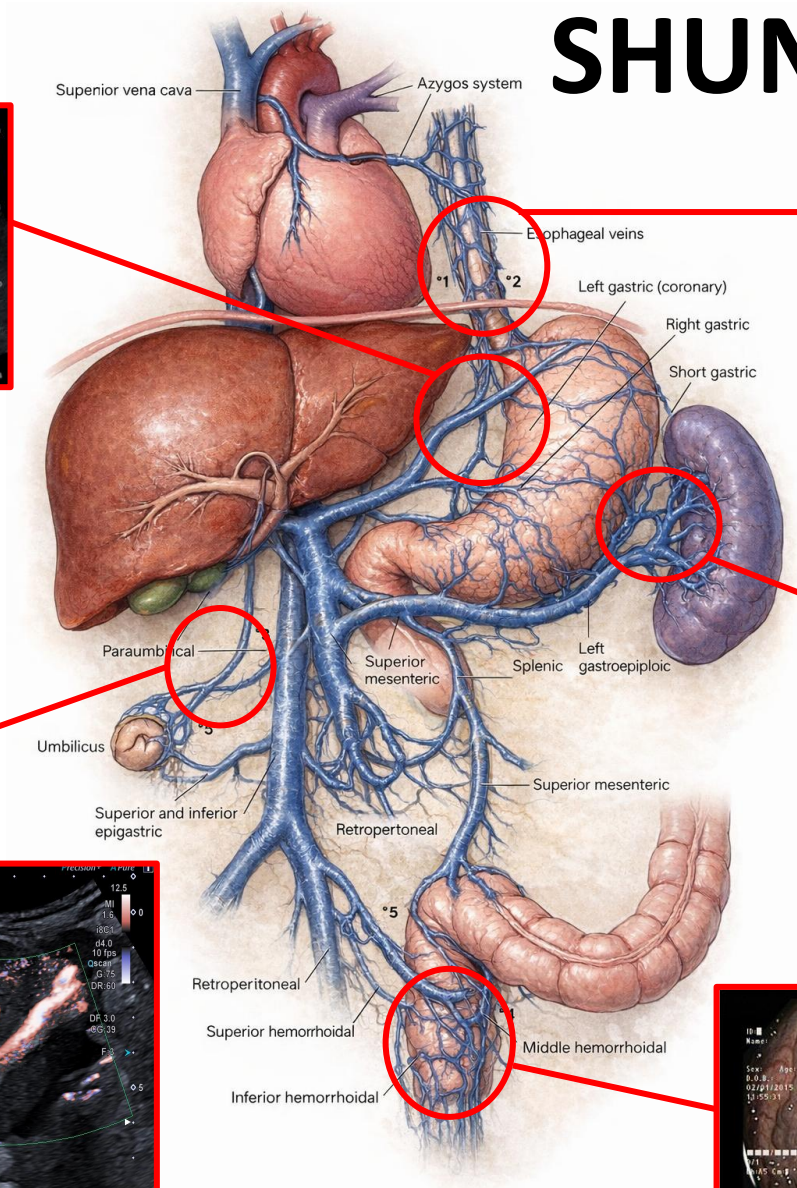
Thickened gallbadder wall

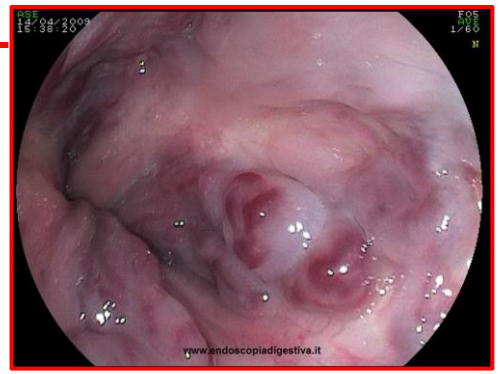


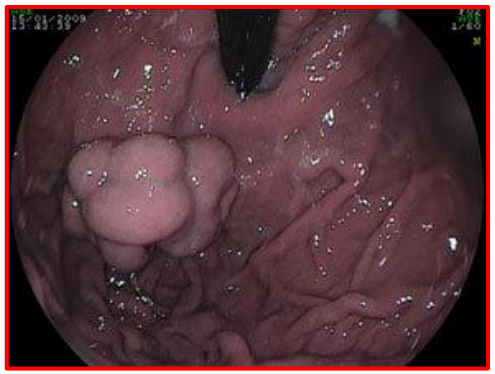
Splenic hyperechoic foci are in keeping with parenchymal deposits of hemosiderin (Gamna Gandy bodies) as a consequence of microhaemorrages, often seen as a sign of severe longstanding portal hypertension.

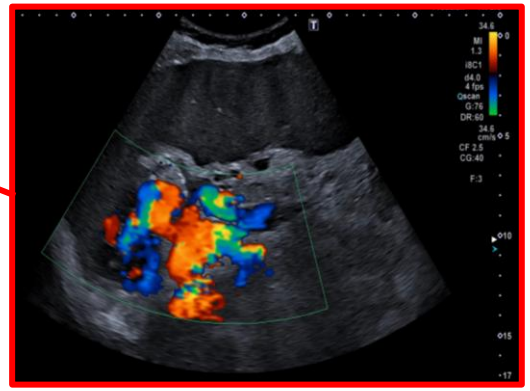
PORTAL HYPERTENSION AND PORTO-SYSTEMIC SHUNTING

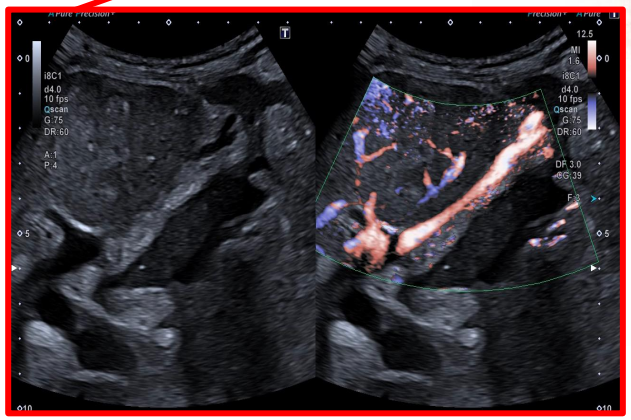










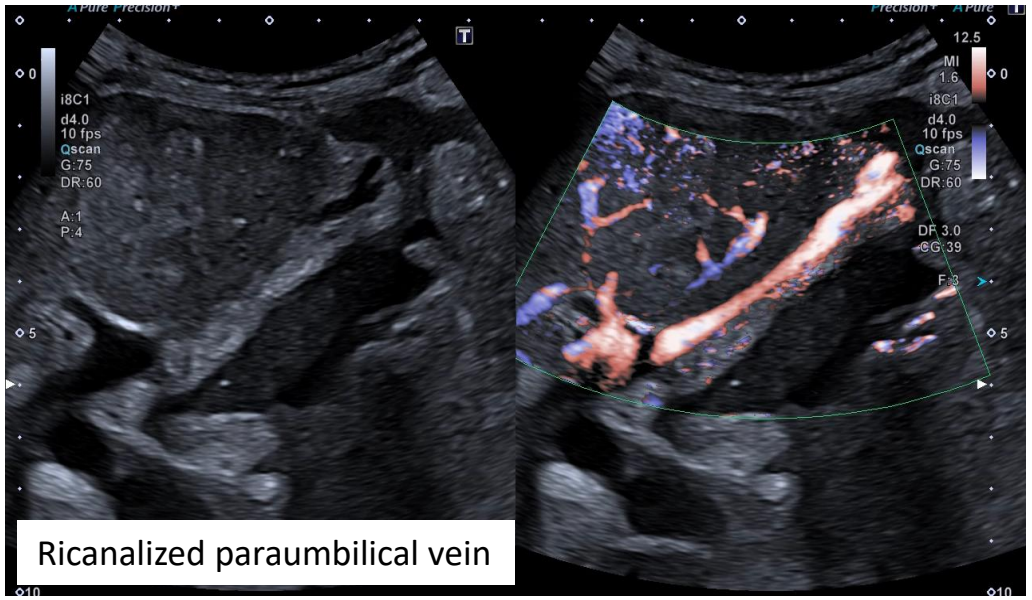


- Identifying ligament teres is impotant since it’s ricanalisation is a sign of severe portal hypertension

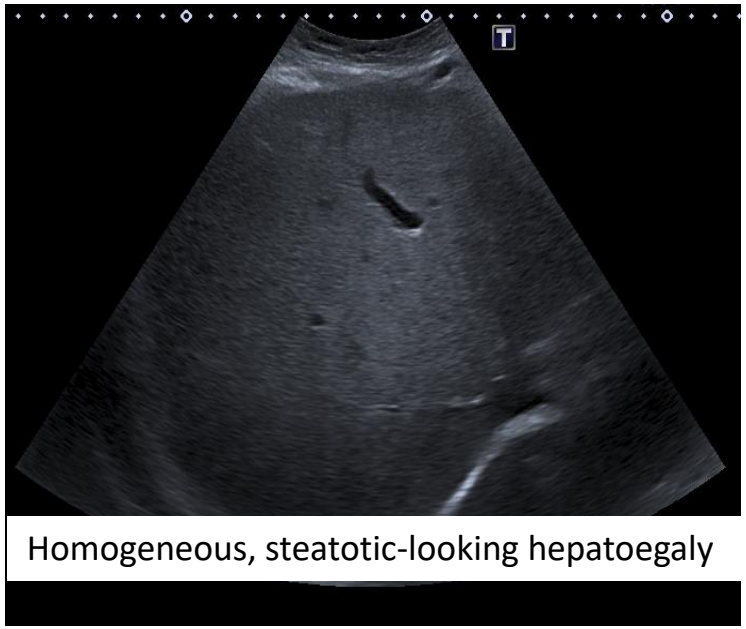
➢ Once the left branch of the portal vein is identified follow the ligament teres that is a round/ovalar/triangular hyperechoic region

➢ Scan the ligament on two ortogonal planes in order to see its both transverse and longitudinal aspect

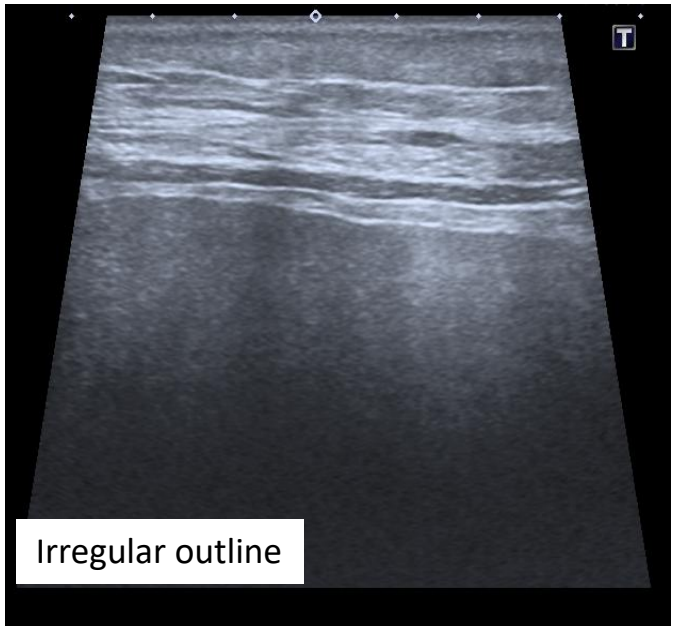
ULTRASOUND SIGNS OF PORTAL HYPERTENSION



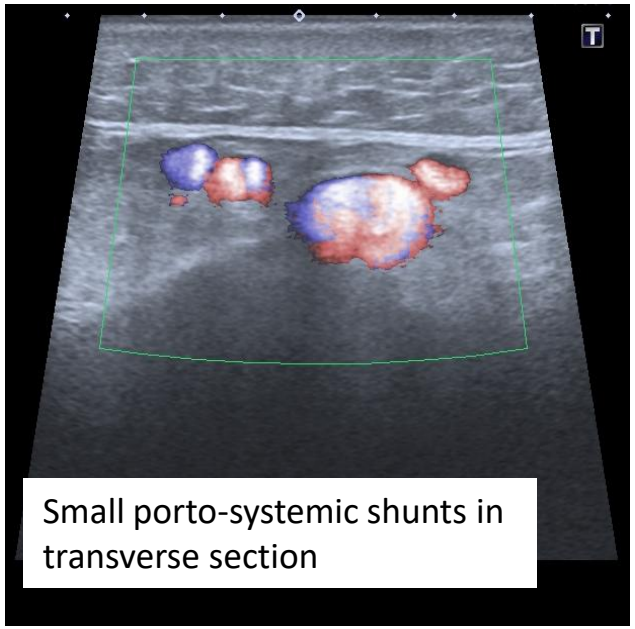
Ricanalized paraumbilical vein



Homogeneous, steatotic-looking hepatoegaly

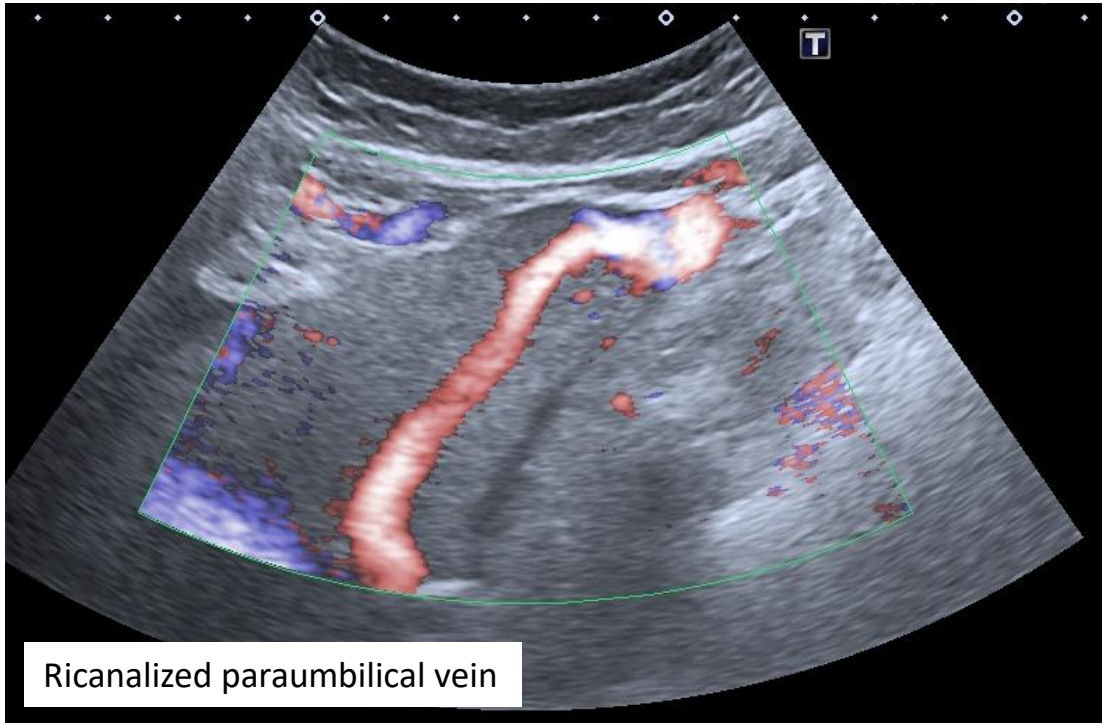


Irregular outline



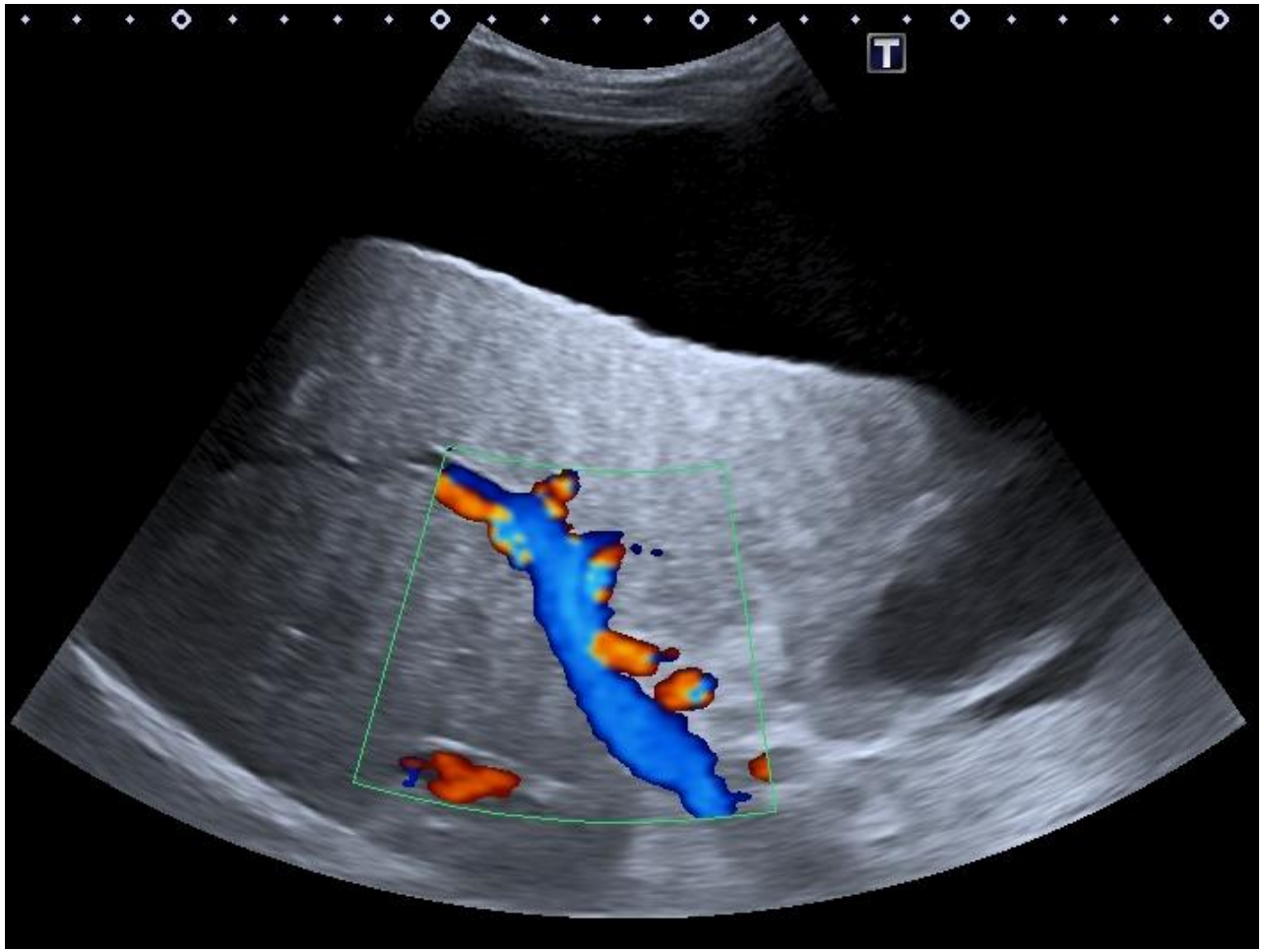
Small porto-systemic shunts in transverse section

Splenomegaly.
Note is made of a small accessory spleen



Ricanalized paraumbilical vein

ULTRASOUND SIGNS OF PORTAL HYPERTENSION



- Heterogeneous echotexture
- Irregular outline
- Ascites
- Thickened gallbladder wall
- Inversion of the portal flow

Table 3 Main reported US and Doppler US signs of portal hypertension in patients with chronic liver diseases. Accuracy in other populations including patients with another relevant comorbidity (cardiac disease, hematological diseases) is unknown.

		refs	sensitivity	specificity
portal venous system	dilatation of portal vein (≥ 13 mm)	[51, 54]	< 50 %	90 – 100 %
	reduction of portal vein blood flow velocity (time averaged mean vel. < 14 – 16 cm/sec[2])	[70, 71]	80 – 88 %	80 – 96 %
	reversal of portal vein blood flow	[55]	not reported; sign prevalence: 8.3 % of unselected pts	100 %
	increased portal vein congestion index (≥ 0.08)	[59, 71[3]	67 – 95 %	100 %
	dilatation of splenic vein (SV) and superior mesenteric vein (SMV) (≥ 11 mm)	[72, 73]	72 %	100 %
	reduction of respiratory variation of diameter in SV or SMV (< 40 %)	[54]	79.7 %	100 %
spleen	splenomegaly (diameter > 12 cm and/or area ≥ 45 cm[2])	[52][2]	93 %	36 %
splenic artery	increased Doppler resistive index or impedance index of the intraparenchymal branches (RI ≥ 0.63, PI ≥ 1.00)	[74]	84.6 %	70.4 %
hepatic artery	increased Doppler resistive index of the intrahepatic branches (> 0.78)	[66, 69]	50 %	100 %
renal artery	increased Doppler resistive index of the right interlobar renal artery (≥ 0.65)[4]	[74][2]	79.5 %	59.3 %
SMA	decreased Doppler pulsatility index (≤ 2.70)	[74][2]	85.7 %	65.2 %
presence of porto-systemic collateral circulation		[36]	83 %	100 %

[1] These values of mean velocity (measured in the quoted studies) correspond to approximately 20 – 24 cm/sec when assessed as time averaged maximal velocity.

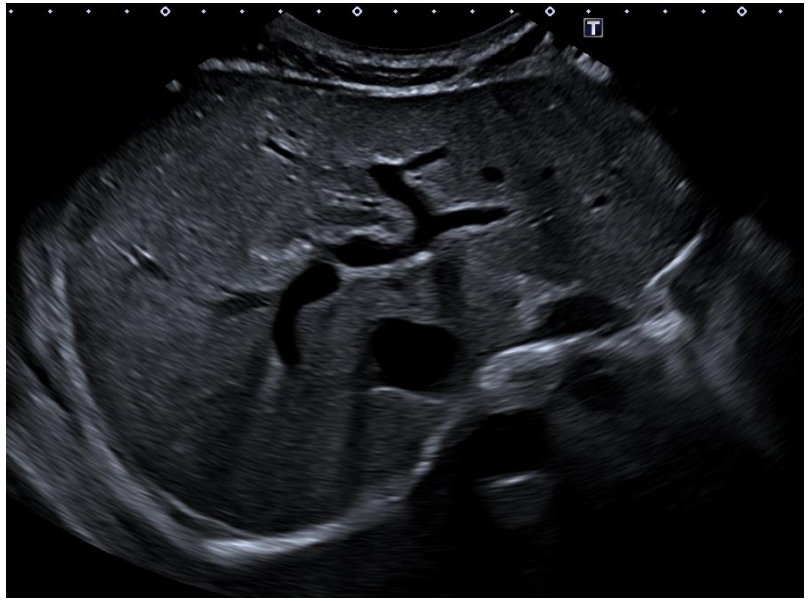
[2] Gold standard for PH diagnosis: HVPG measurement or direct measurement; sensitivity refers to patients with HVPG [3] 12 mmHg.

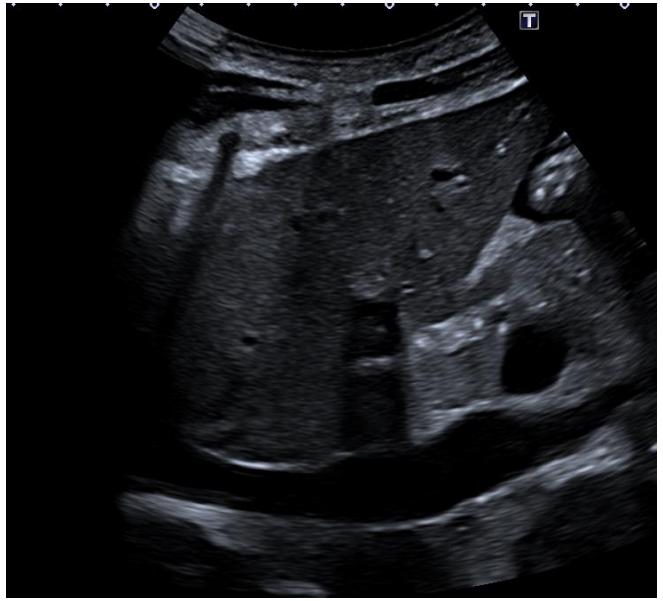
Berzigotti A, Piscaglia F. Ultraschall in Med 2011; 32: 548–571

ULTRASOUND IN ACUTE HEPATITIS AND LIVER FAILURE

- ULTRASOUND ASSESSMENT IS CRUCIAL IN EVERY PATIENT WITH ACUTE HEPATITIS AND LIVER FAILURE
  - EXCLUDE CHRONIC LIVER DISEASE
  - EXCLUDE OBSTRUCTIVE JAUNDICE
  - EXCLUDE OTHER CAUSES OF LIVER DYSFUNCTION (VASCULAR EMERGENCIES)
  - EXCLUDE INFILTRATIVE DISEASE
  - ASSESS DYNAMIC CHANGES OF LIVER STRUCTURE

ULTRASOUND IN ACUTE LIVER FAILURE - DILI





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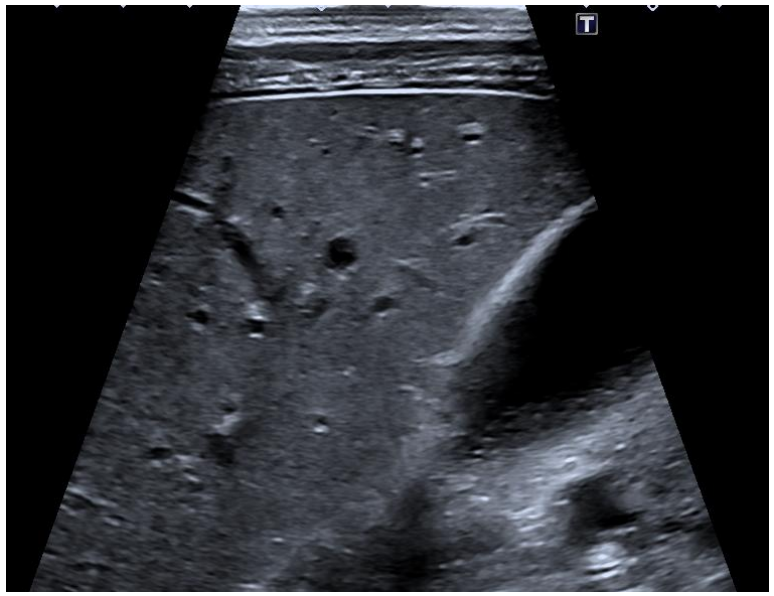

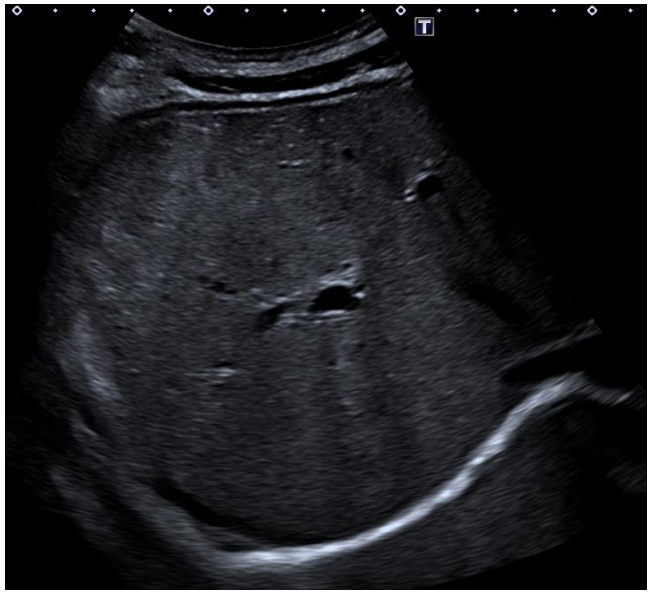

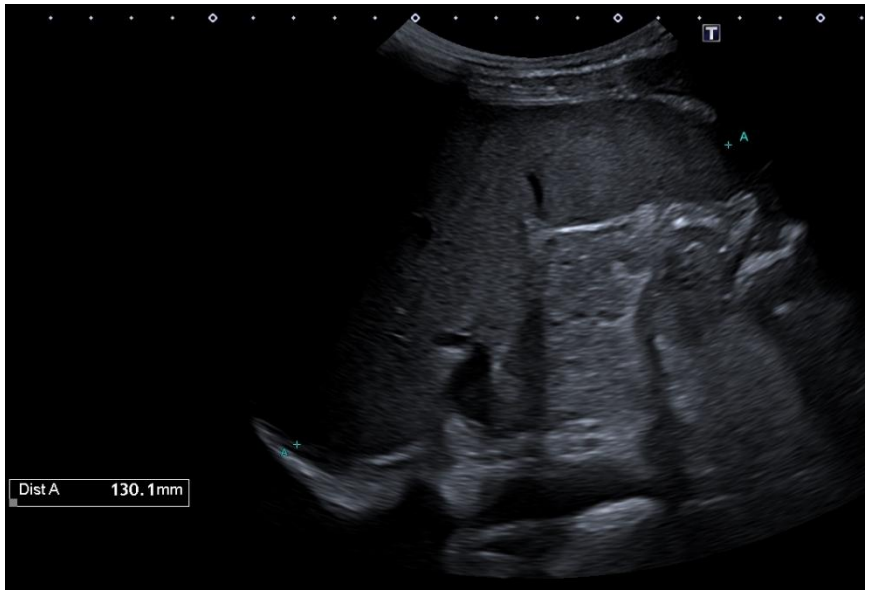

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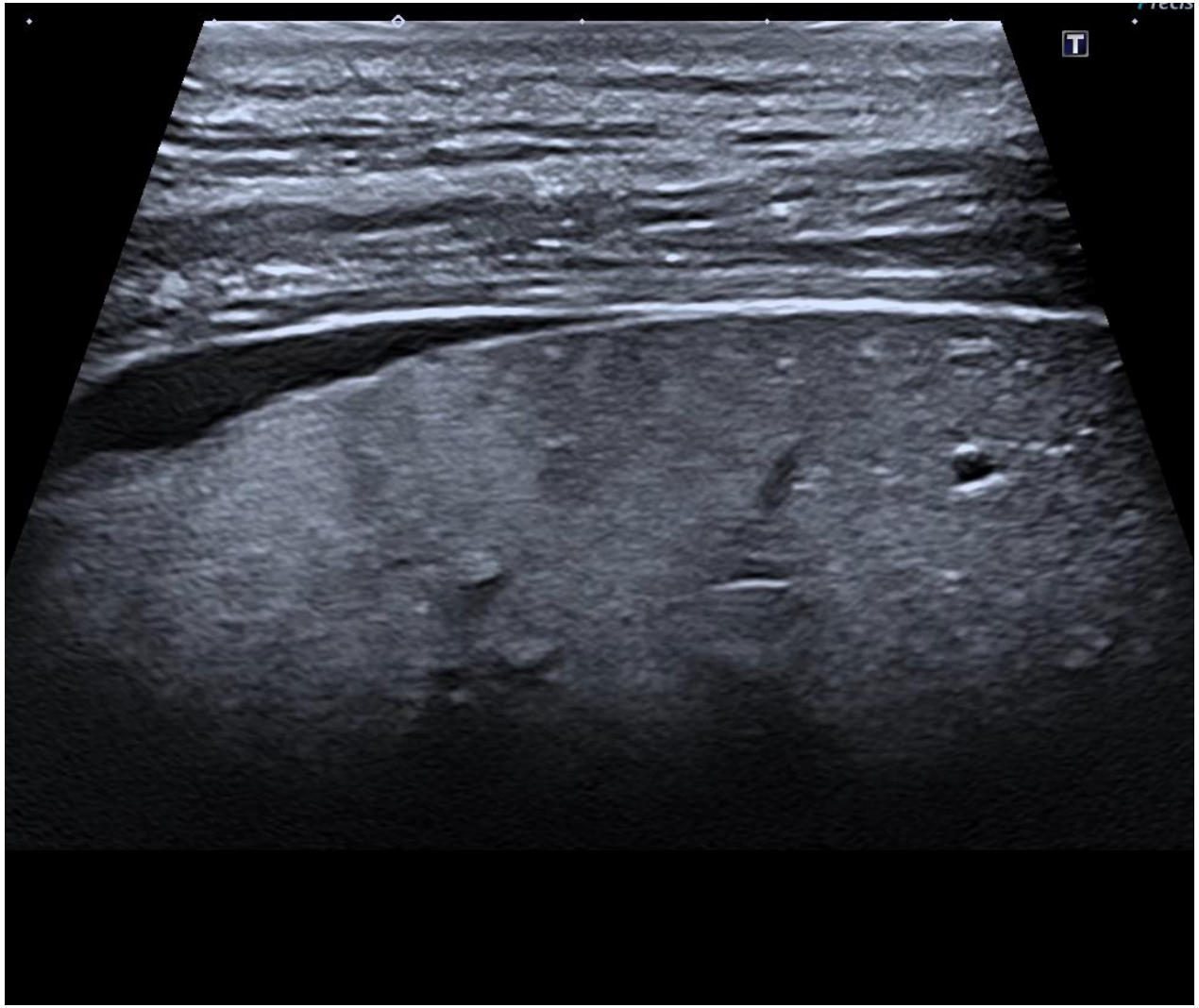
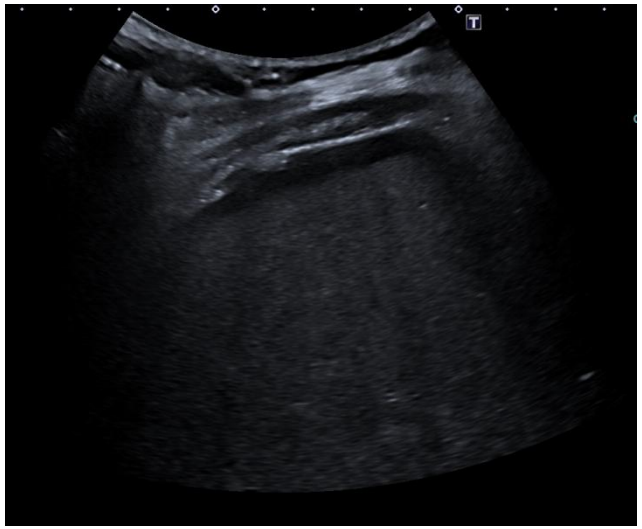
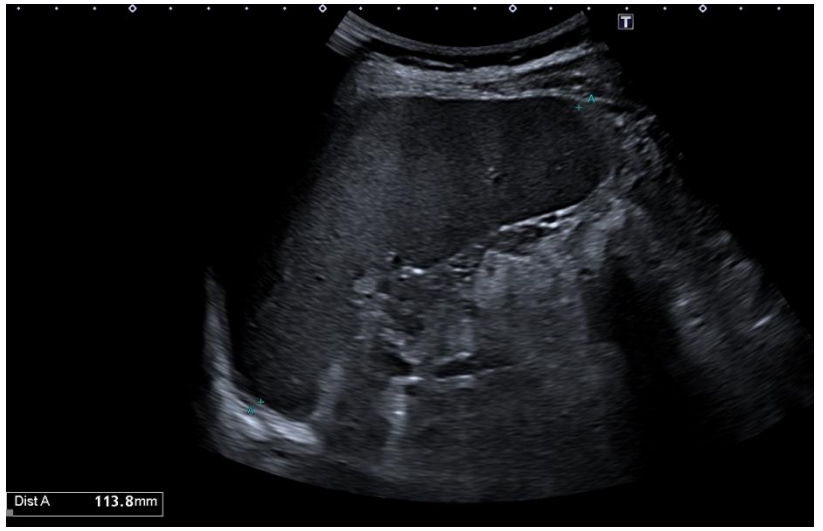
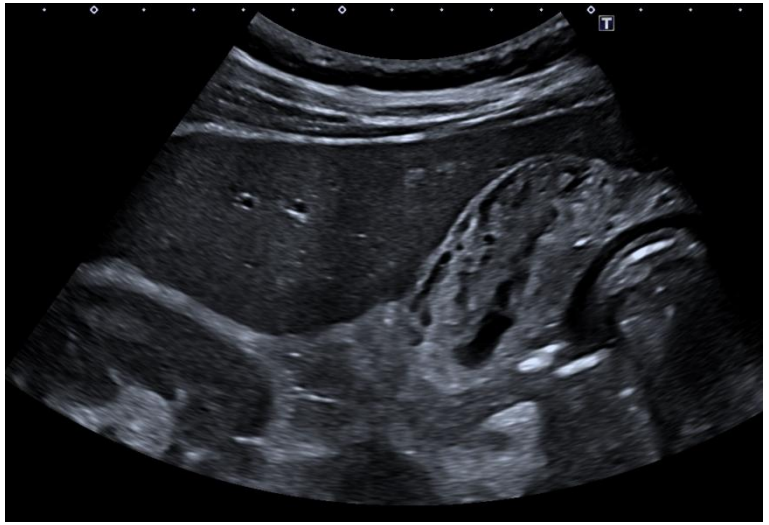


ACUTE HEPATITIS A







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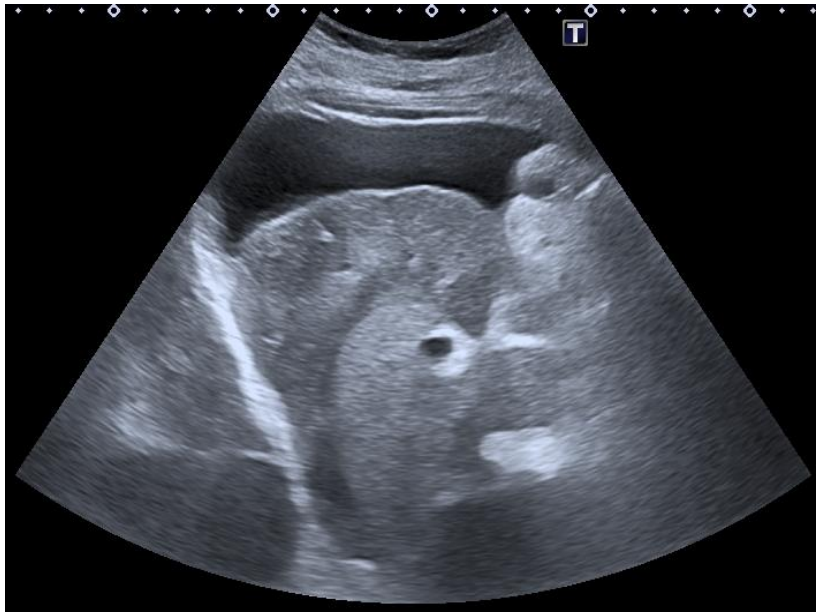
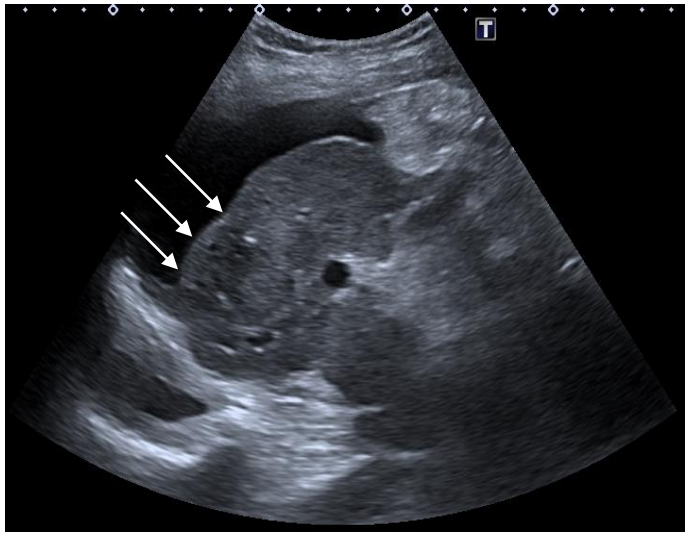
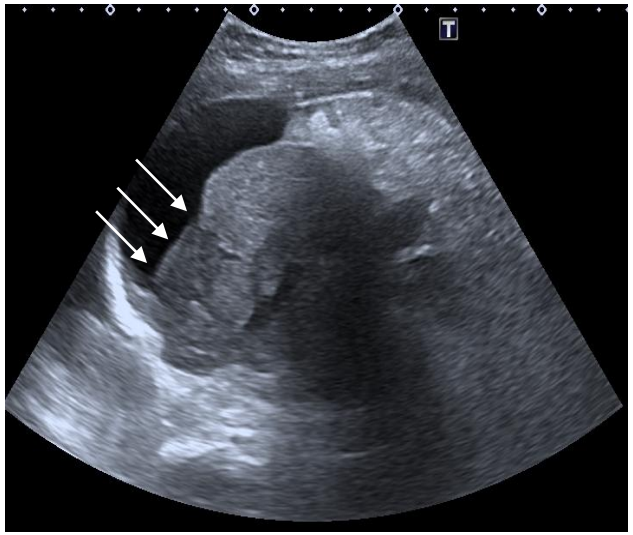
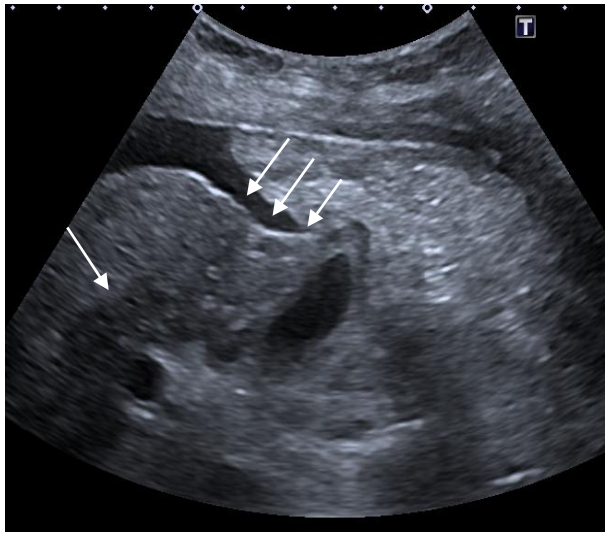
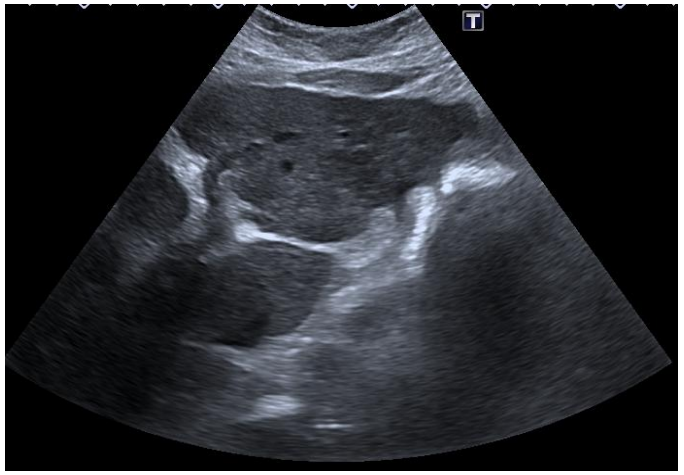


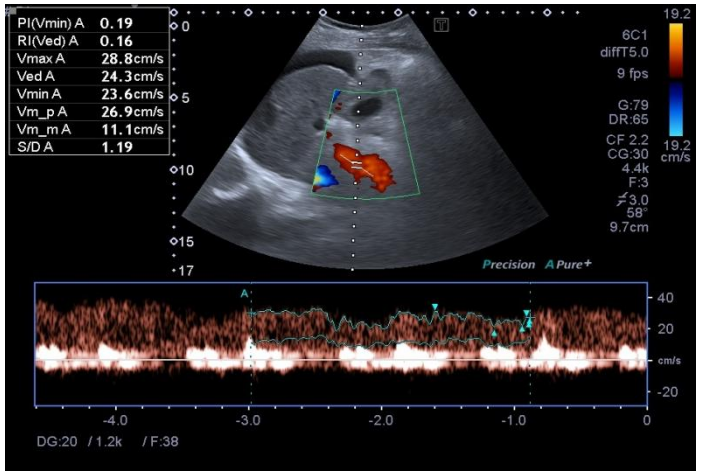
SUBACUTE LIVER FAILURE - DILI

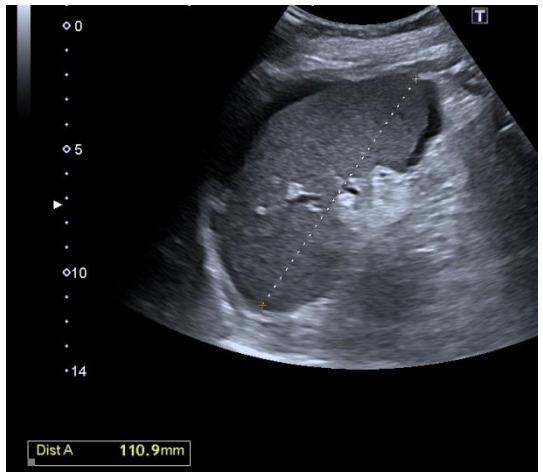




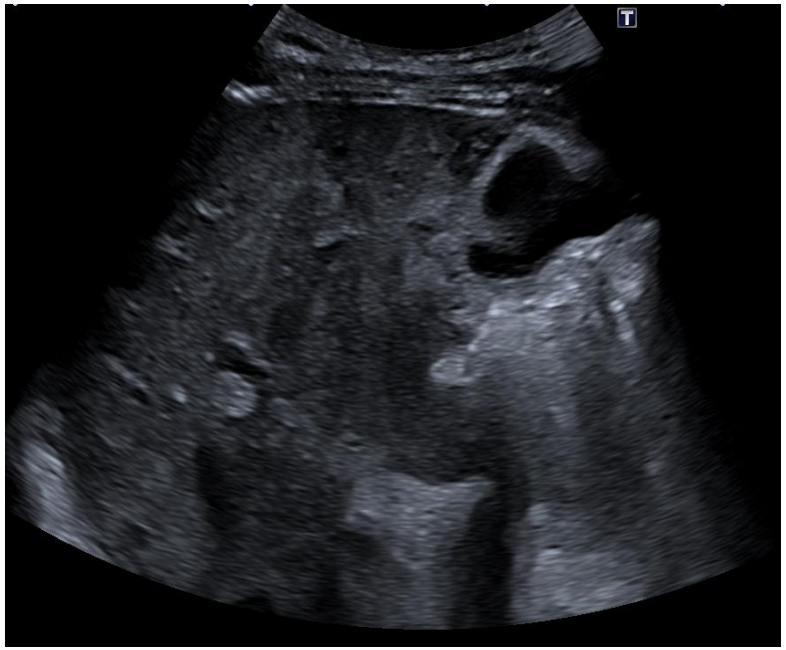




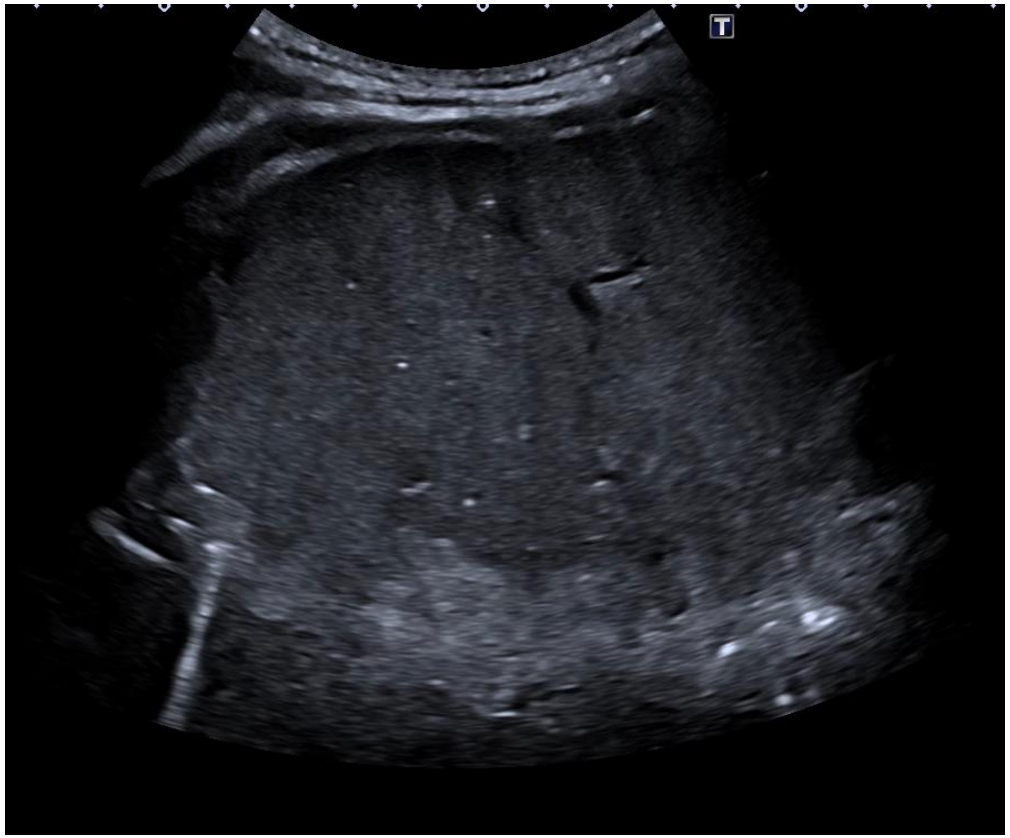


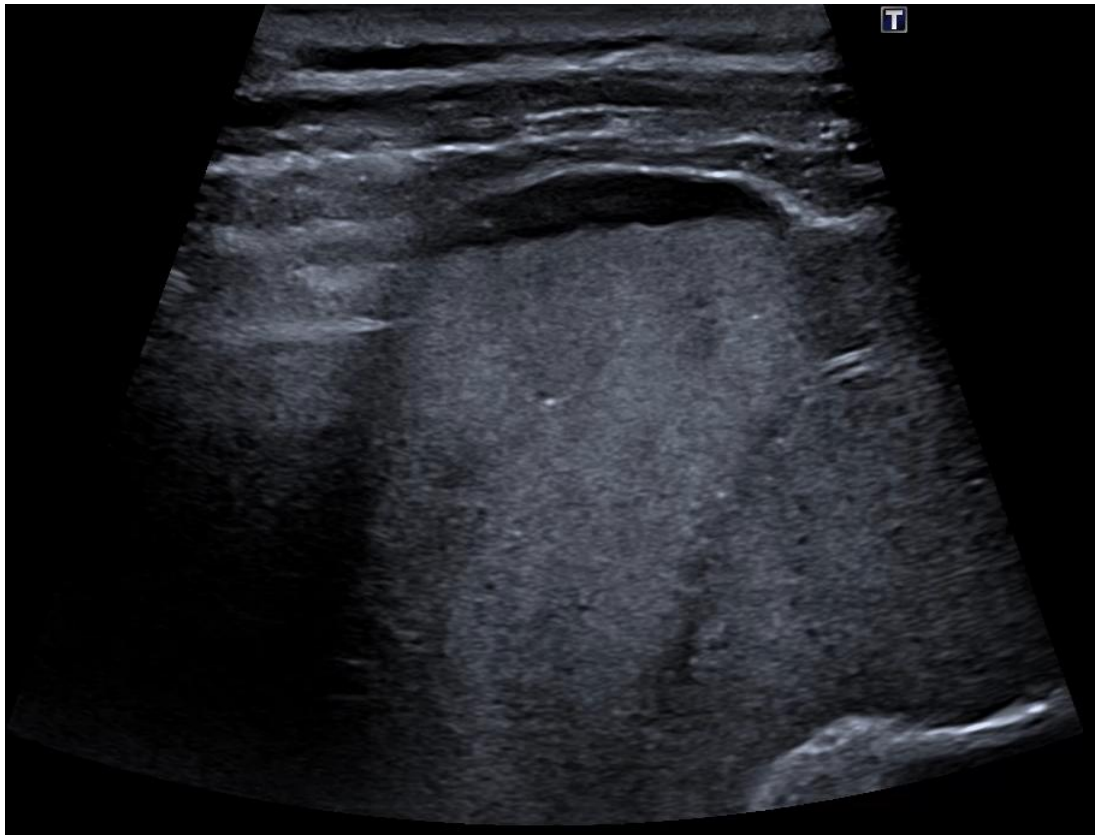


SEVERE ACUTE AUTOIMMUNE HEPATITIS

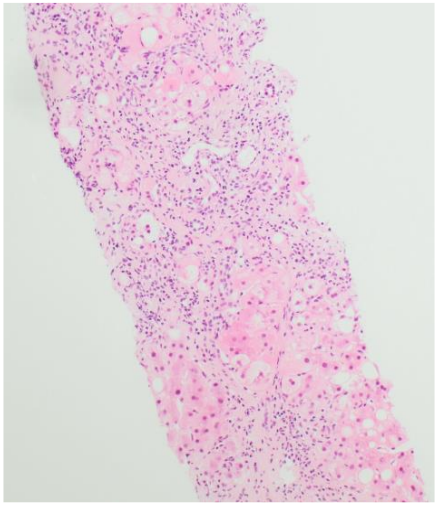


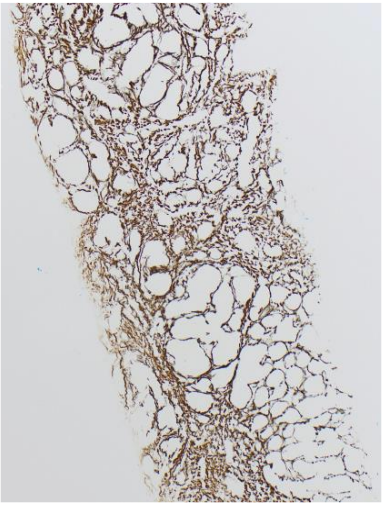
SEVERE ACUTE AITOIMMUNE HEPATITIS

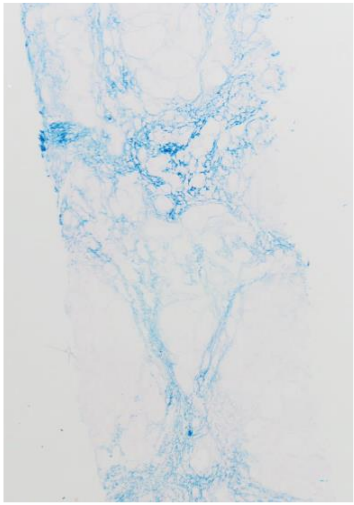




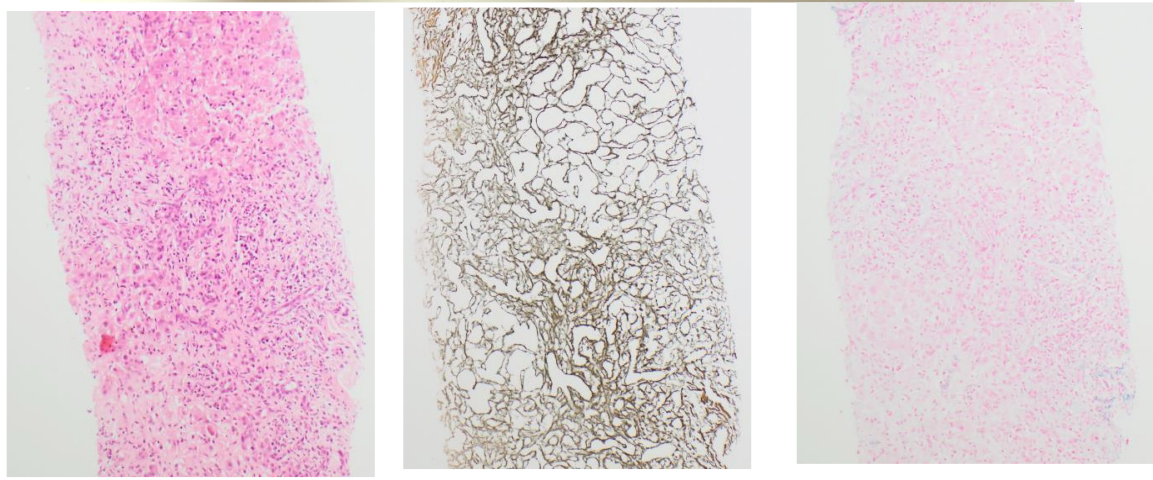
A DIFFICULT DIFFERENTIAL DIAGNOSIS BASED ON IMAGING





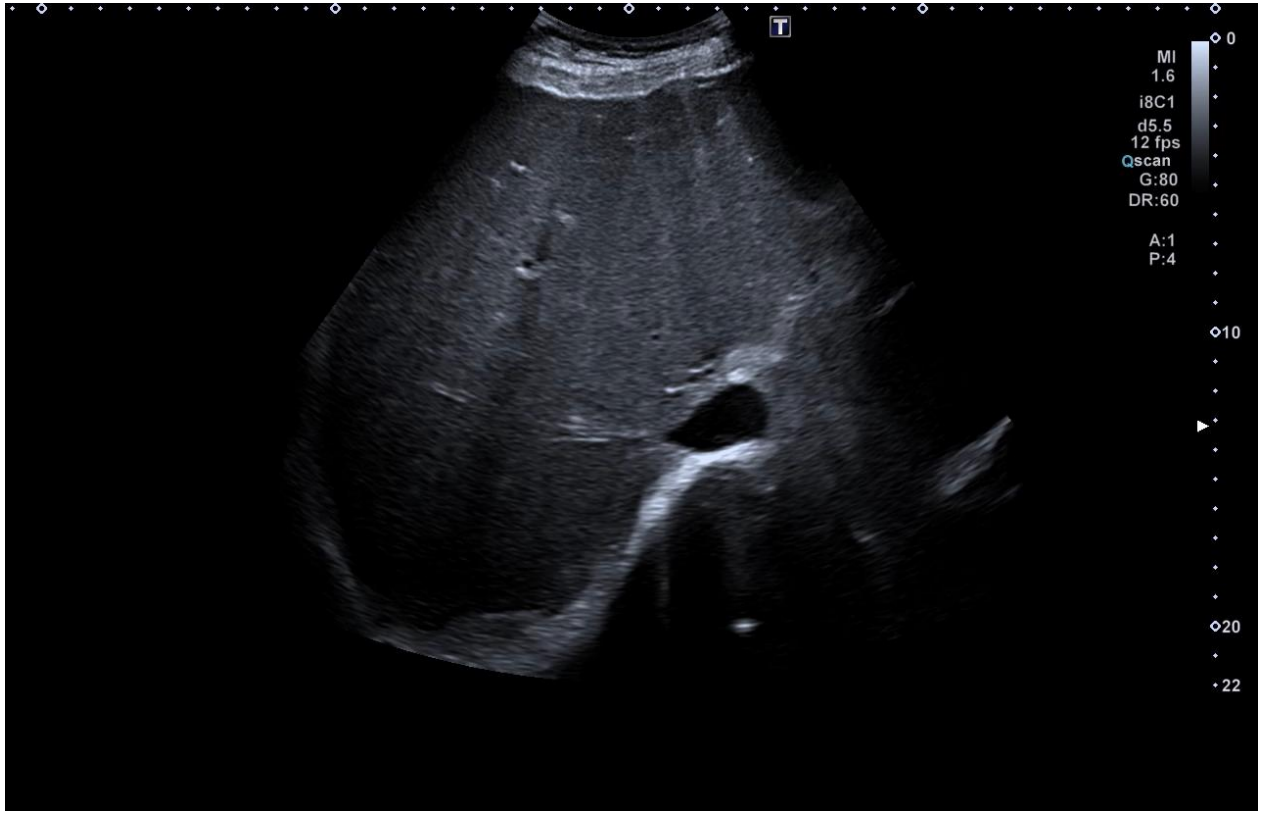


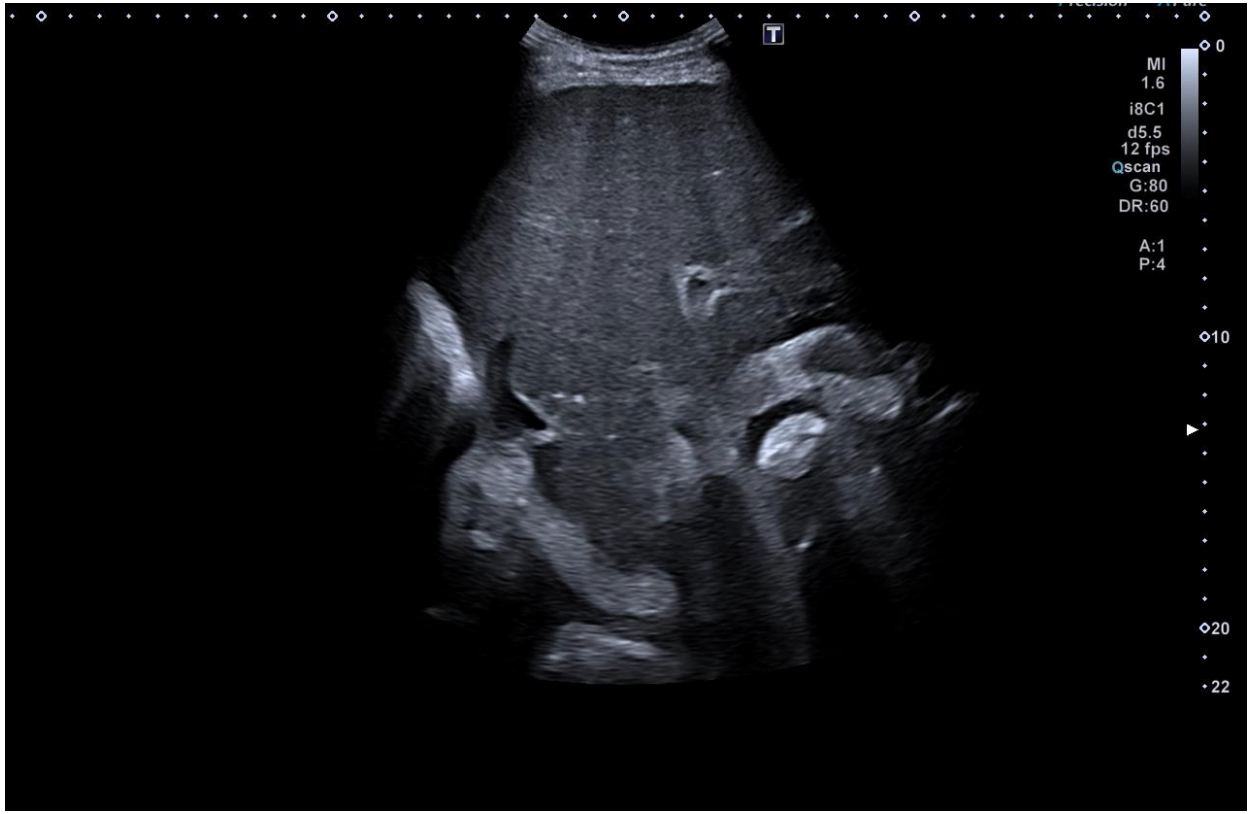
ALD cirrhosis: nodular appearance with Victoria Blue + fibrous septa



Severe acute hepatitis with massive necrosis: nodular appearance on HE and reticulin, but negative on VB

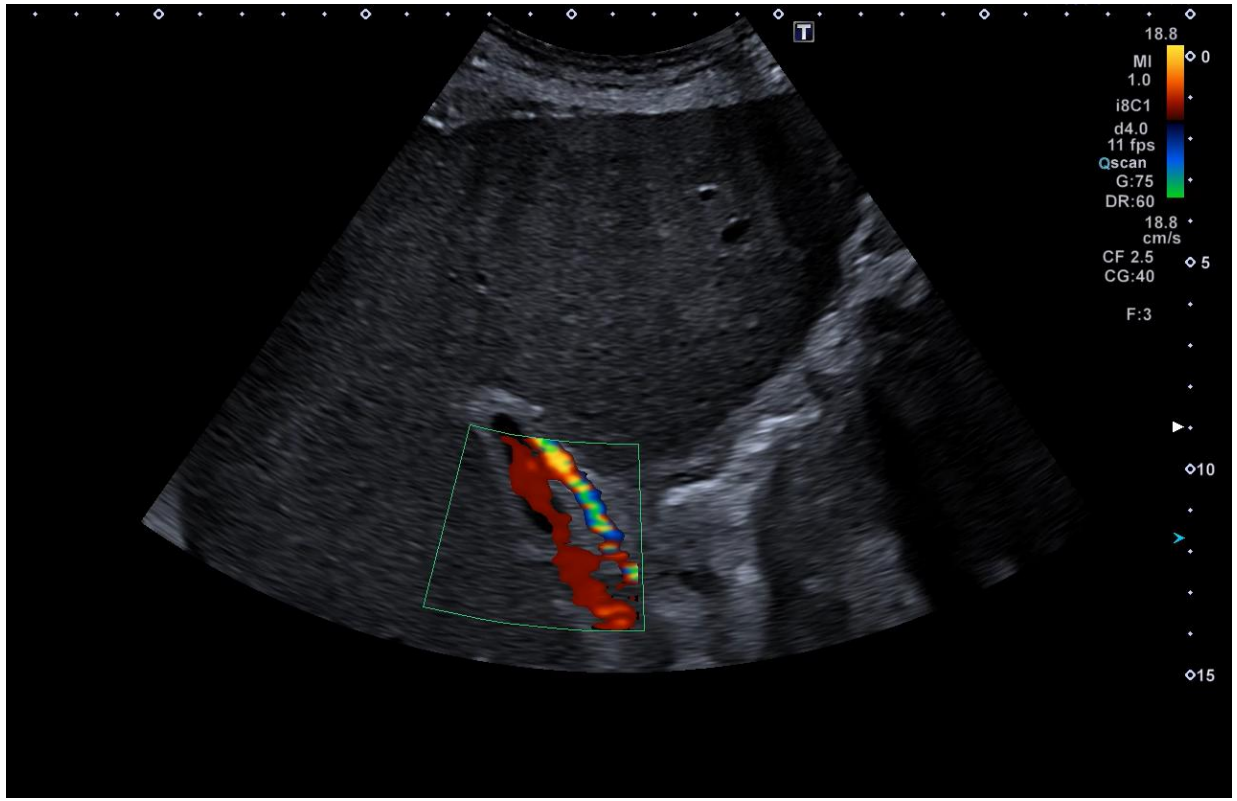
CASE PRESENTATION OF ACUTE LIVER FAILURE

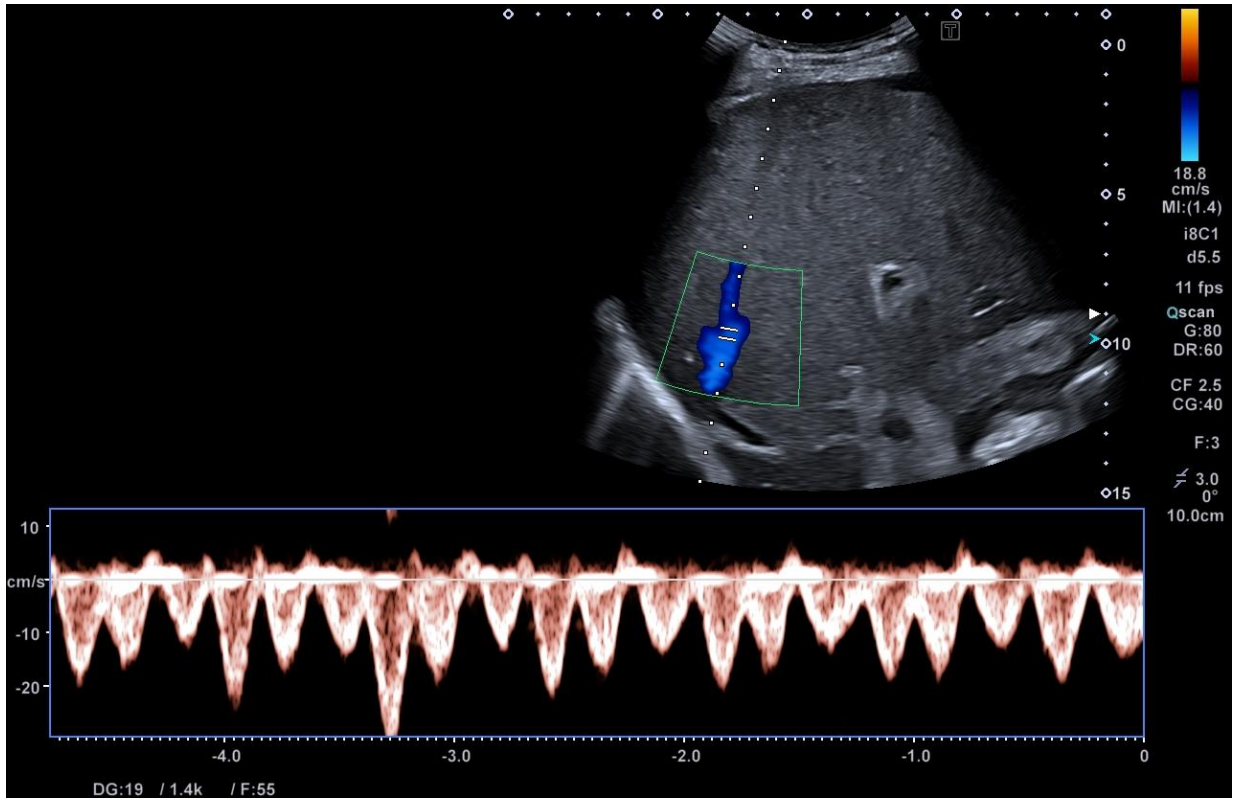




Slightly heterogeneous echotexture and slightly irregular outline. The hepatic veins are narrow, almost threaded as a sign of severe hypovolemia

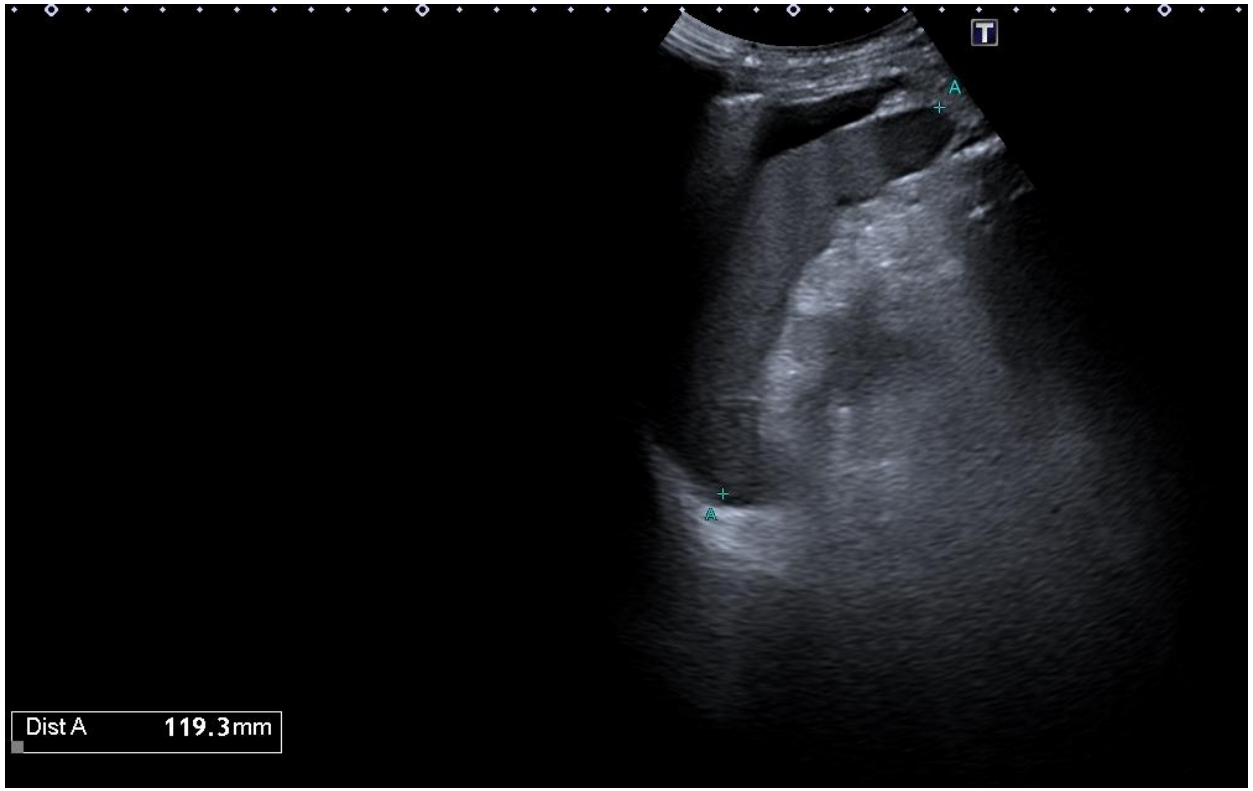
LIVER FAILURE





The portal flow is slow and pulsatile and there are signs of arterial buffering. As we can see from the hepatic vein Doppler trace the patient is tachycardic with no major abnormality.

LIVER FAILURE



- The spleen is normal in size
- There are multiple target-like nodularities scattered in the liver parenchyma in keeping with liver metastasis

THE CAUSE OF LIVER FAILURE IN THIS PATIENT WAS DIFFUSE HEPATIC METASTATIC INFILTRATION

ULTRASOUND ASSESSMENT OF DIFFUSE LIVER DISEASE

- Hepatic parenchyma heterogeneicity
- Dysmorphism (segmental atrophy, hypotrophy, caudate lobe hypertrophy)
- Irregular outline, nodularities
- Signs of portal hypertension
- Ascites
- Dynamic changes over a short period of time (ALF)

TAKE HOME MESSAGES CHRONIC LIVER DISEASE

- ULTRASOUND IS SENSITIVE IN DETECTING HETEROGENEICITY OF HEPATIC PARENCHYMA THE LIVER IRREGULAR ARCHITECTURE AFFECTS THE LIVER CONTOUR, VESSELS AND GALLBLADDER OUTLINE

- IN THE PRESENCE OF PORTAL HYPERTENSION
  - The portal flow will be signifincantly reduced
  - The gallbladder can be thickened
  - The spleen is usually enlarged (can also be normal)
  - The portal vein calibre is usually increased (but can also be normal)
  - Presence of porto-systemic collateral circulation
  - Portal venous flow inversion

TAKE HOME MESSAGES IN ACUTE/SUBACUTE LIVER FAILURE

- THE APPEARANCE ON ULTRASOUND AND IN GENERAL ON IMAGING IN CASE OF LIVER FAILURE WILL BE DIFFERENT ACCORDING TO THE SEVERITY AND ONSET OF THE HEPATIC INJURY

- IN CASE OF ACUTE/SUBACUTE LIVER FAILURE
  - Normal/ Hypoechoic
  - Heterogeneous: hypoechoic irregular areas of liver parenchyma where the portal triads stand out can be alternated with apparently normale areas of liver parenchyma
  - Heterogeneous with increased periportal thickening
  - Ascites can be present especially in the presence of a subacute process
  - Gallbladder is often thickened
  - The portal vein calibre is usually normal
  - The portal flow is usually normal and very rarely it can be reduced
  - The spleen is usually normal in size
  - No signs of porto-systemic collateral circulation

ULTRASOUND DIFFERENTIAL DIAGNOSIS OF CIRRHOSIS AND ACUTE LIVER FAILURE

	CHRONIC LIVER DISEASE	ACUTE/SUBACUTE LIVER FAILURE
HETEROGENEOUS ECHOTEXTURE	YES	YES/NO ILL-DEFINED HYPOECHOIC AREAS
IRREGULAR SURFACE	YES	YES
ROUNDED MARGINS	YES	YES/NO
ASCITES	YES IN PORTAL HYPERTENSION	YES
SPLENOMEGALY	YES/NO	NO
INCREASED PORTAL VEIN CALIBRE	YES/NO	NO
REDUCED PORTAL FLOW VELOCITY	YES IN PORTAL HYPERTENSION	USUALLY NO/ RARELY IN SEVERE PARENCHYMAL INFLAMMATION
GALLBLADDER WALL THICKENING	YES IN PORTAL HYPERTENSION	YES
PORTAL SYSTEMIC SHUNTS/PORTAL FLOW INVERSION	YES IN SEVERE PORTAL HYPERTENSION	NO