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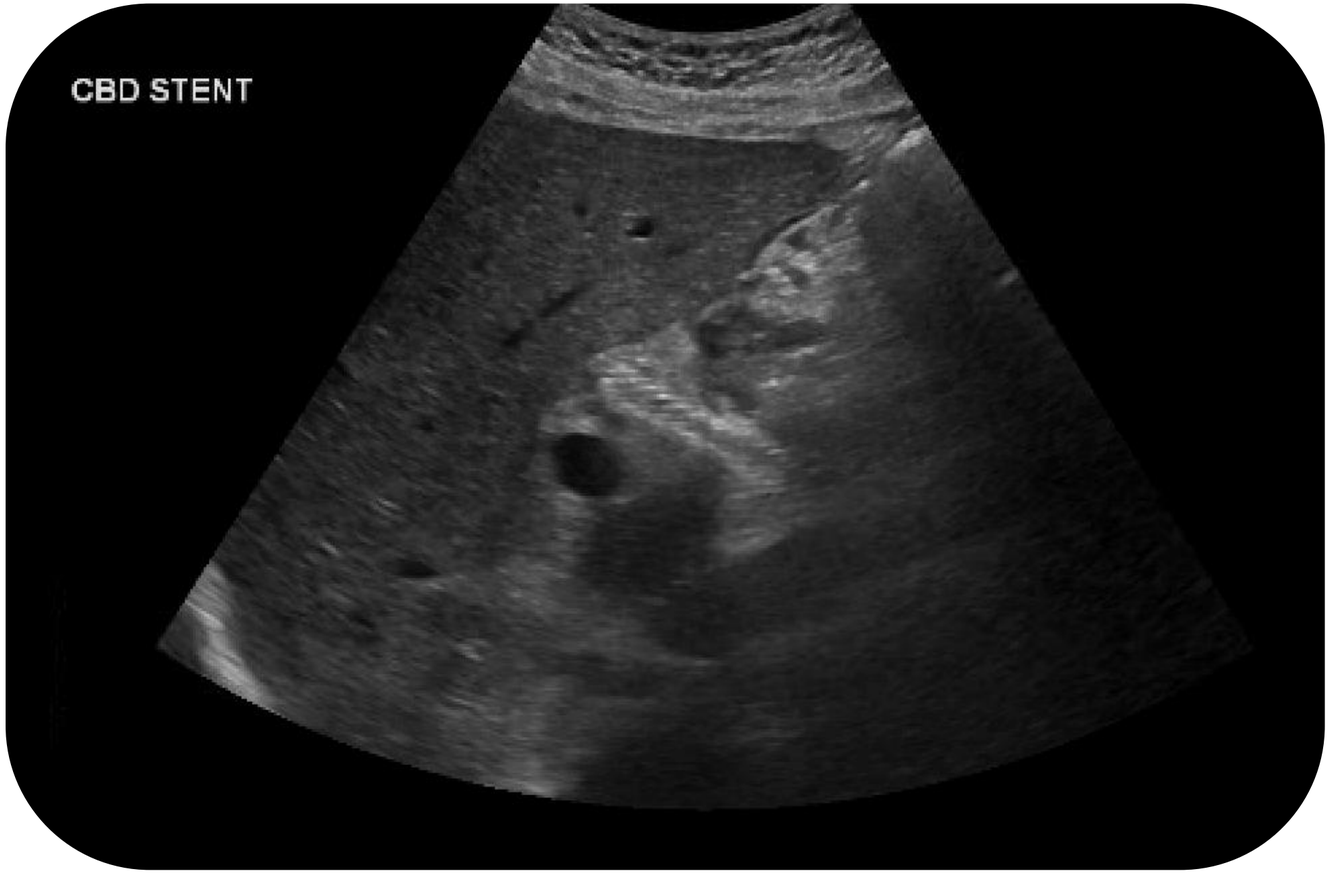
Post Transplant Ultrasound Assessment

Presented by : Dr Gayathri Yogarajah



NHS
Royal Free London
NHS Foundation Trust

ACKNOWLEDGEMENTS

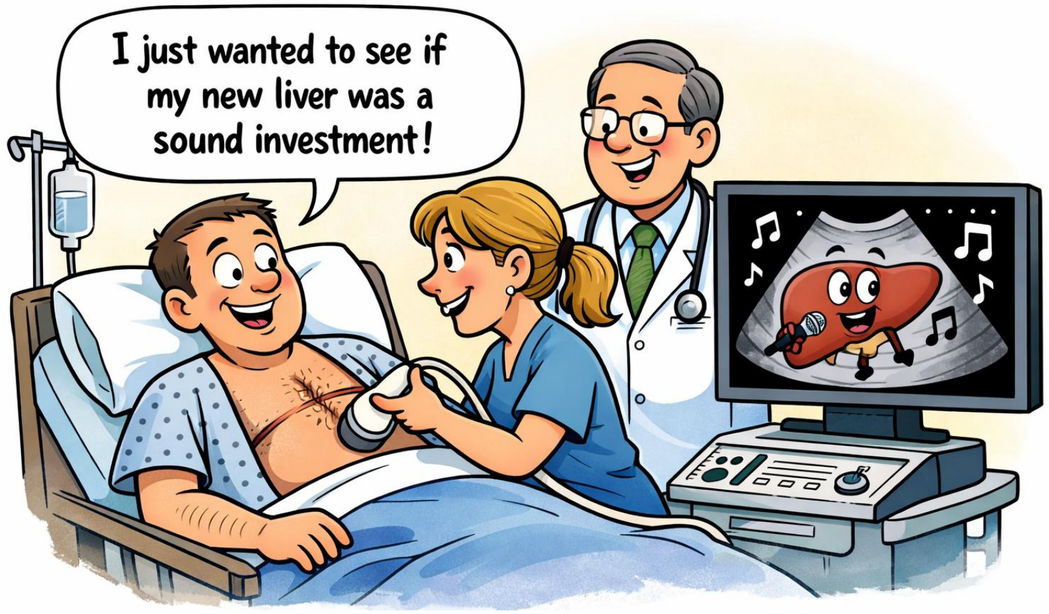
- Dr Dominic Yu

DISCLOSURES

- Nothing to declare

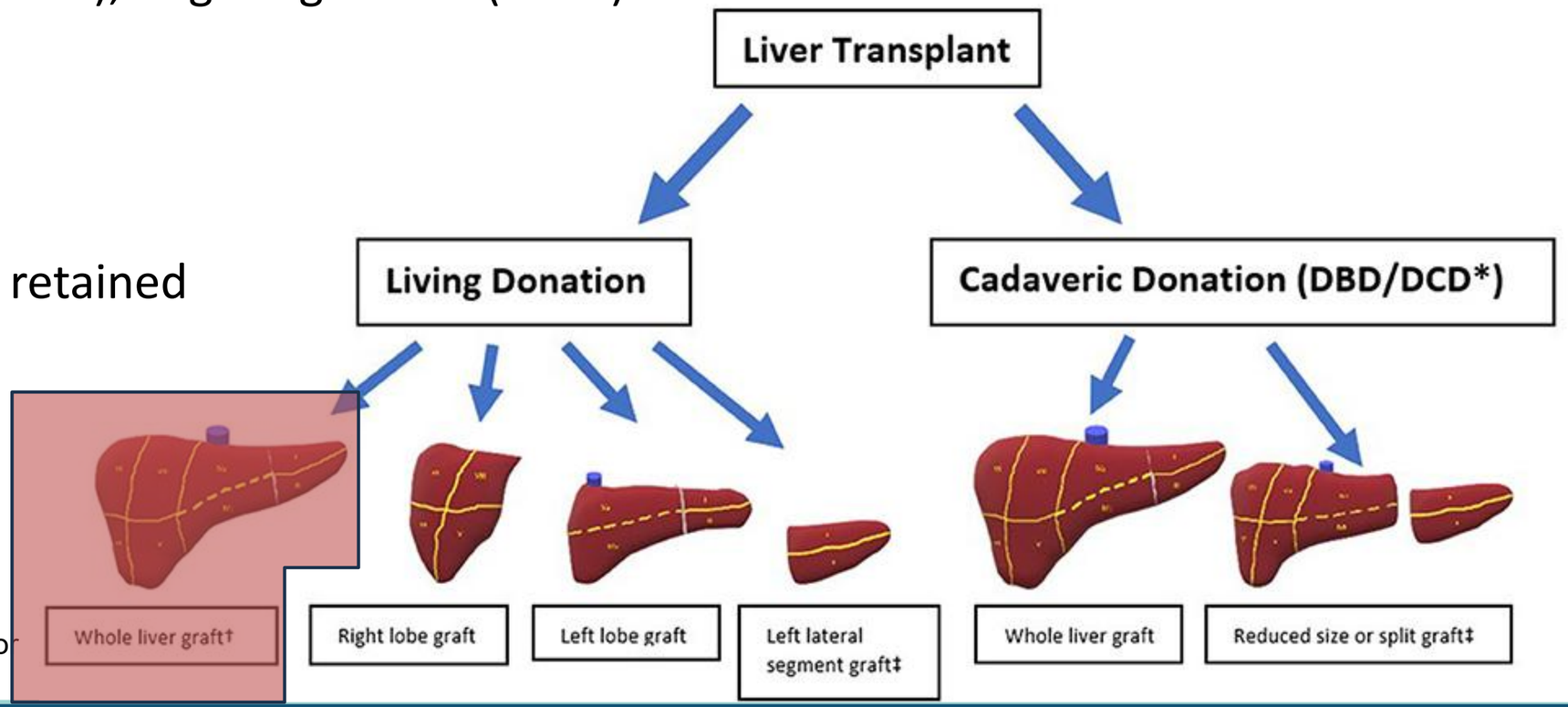
USES, BENEFITS & INDICATIONS

- Liver transplant – irreversible acute and chronic liver diseases
- Detection of complications
- Follow up of early and late complications
  - Vascular (PV/HA/IVC stenosis/thrombosis, pseudoaneurysms, ischaemia)
  - Biliary (leak, strictures, cholangitis)
  - Extrahepatic (collections – haematoma, abscess, seroma)
  - Malignancy
- Safe - no ionising radiation
- Dynamic, can be performed at bedside post-op



TYPES OF LIVER TRANSPLANT

- Orthotopic liver transplant (OLT) – most common, usually deceased donor (DBD/DCD)
  - "remove and replace"
- Split graft – smaller left lobe (child), larger right lobe (adult)
- Living donor
- Auxiliary – part of/native liver retained
  - "support and rescue"



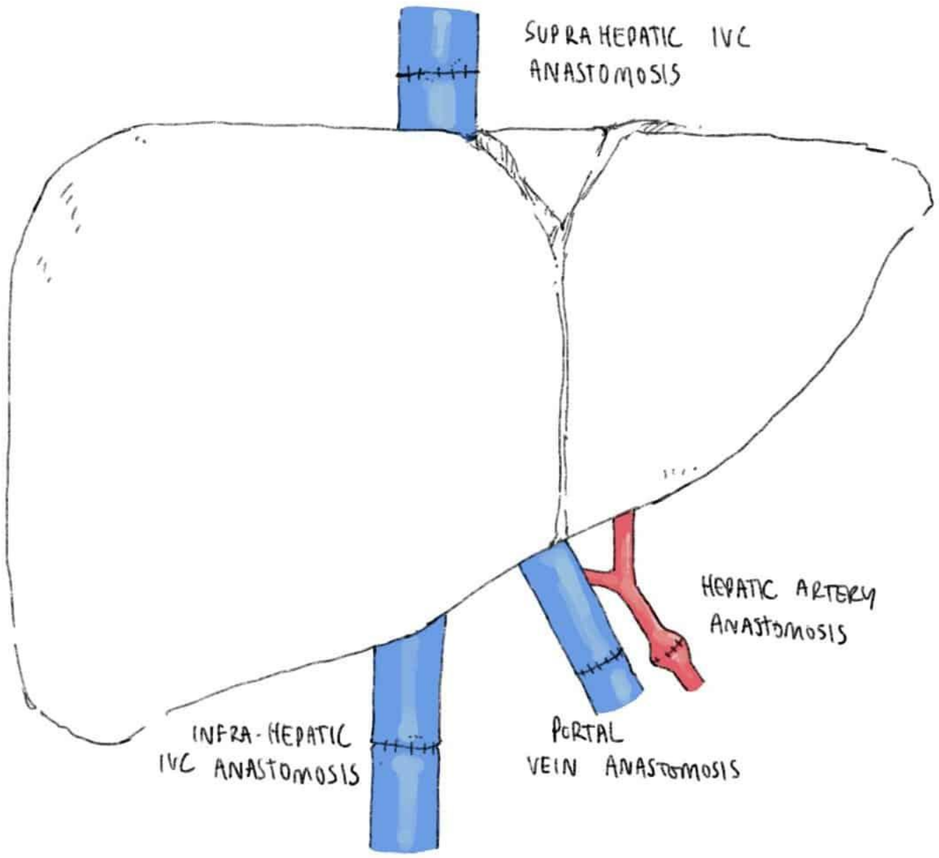
Different types of liver allografts. * DCD grafts not split. † Living donation of whole liver only possible with domino transplantation. ‡ Either of these grafts is suitable for an auxiliary transplant.

Images reproduced for educational purposes from: Hann A, et al *Front. Immunol.* 2020

LIVER TRANSPLANT SURGICAL ANATOMY

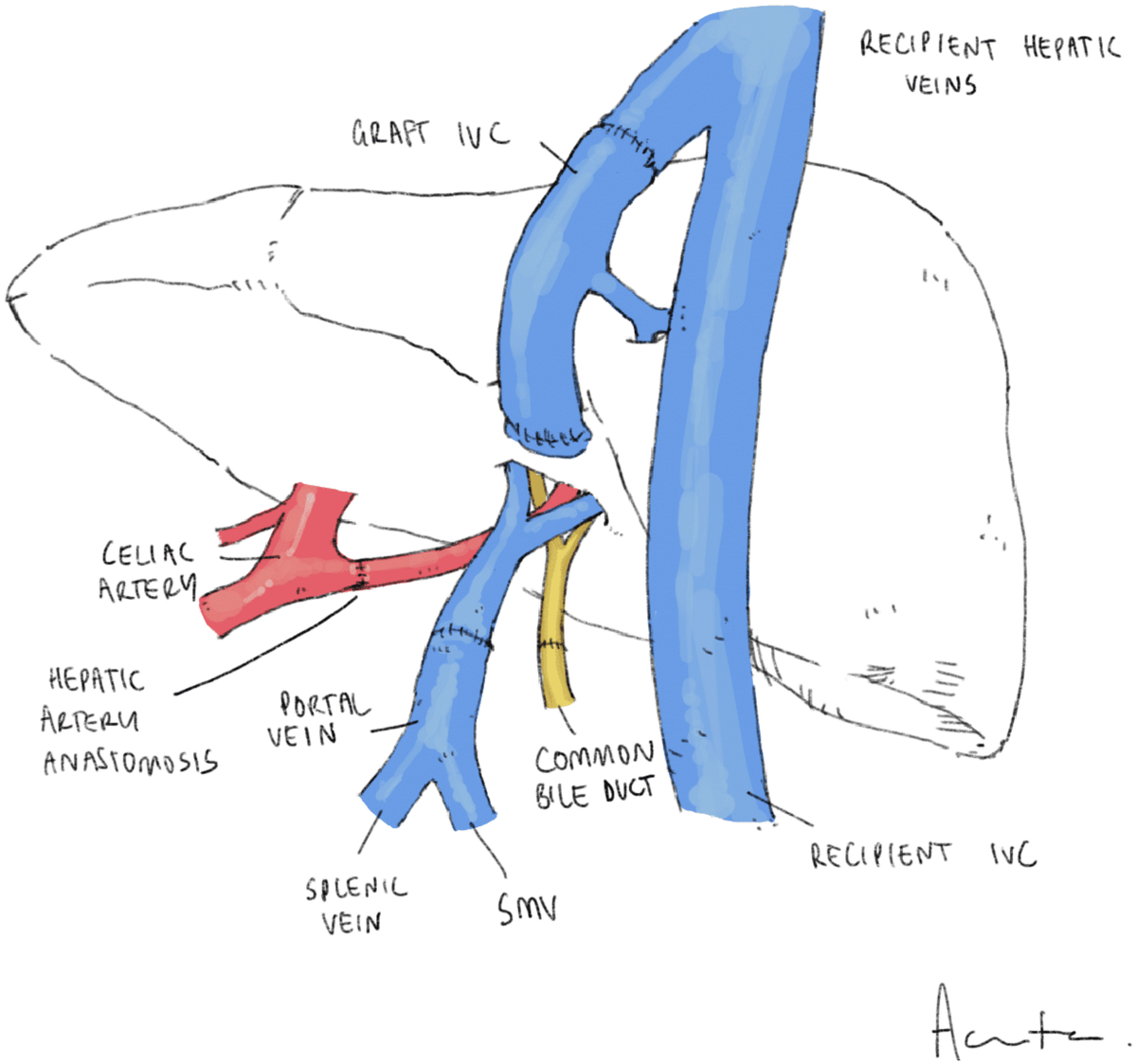
- Arterial anastomosis
- Portal venous anastomosis
- IVC anastomosis
- Biliary anastomosis

CLASSIC APPROACH OLT



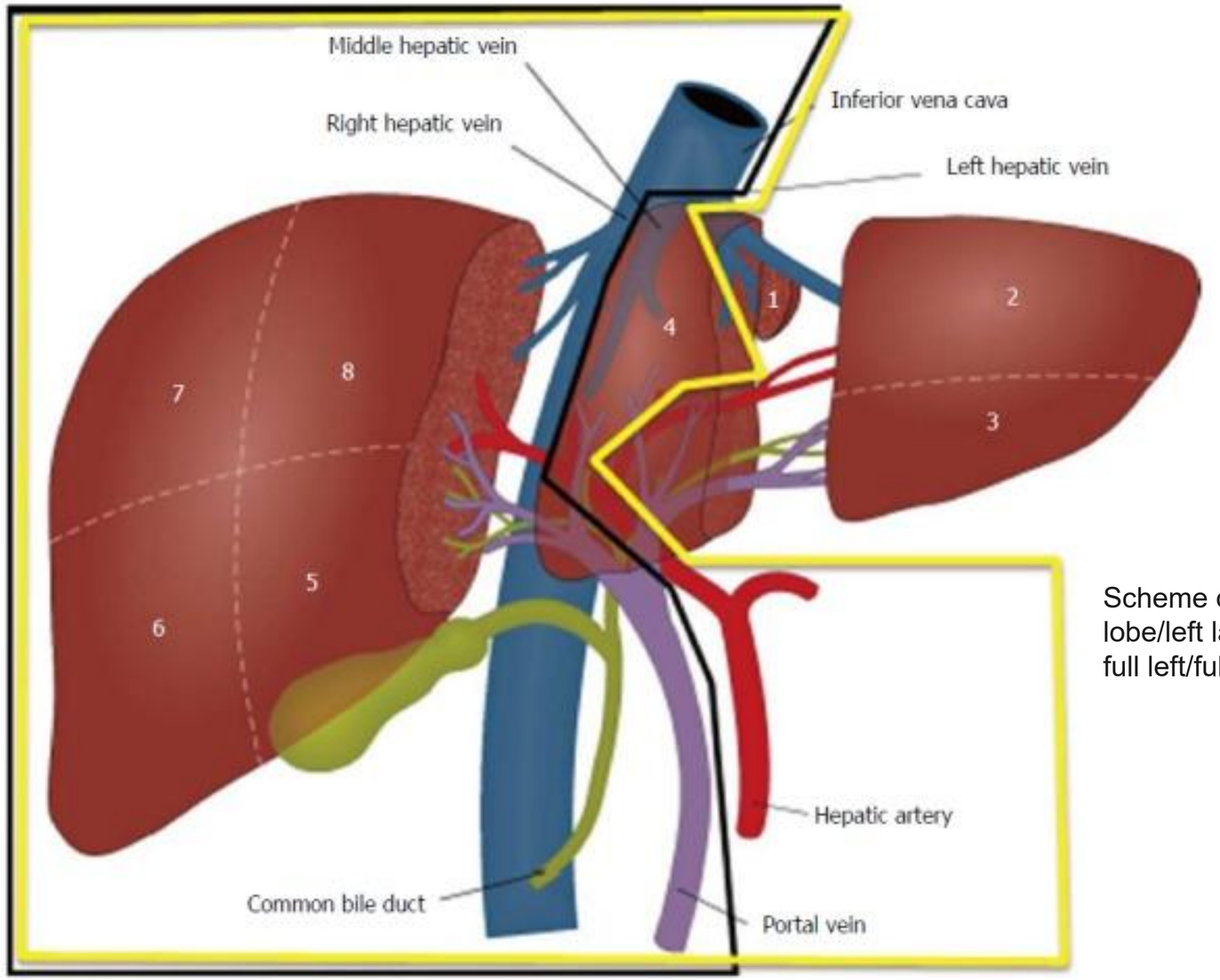
- Retrohepatic IVC removed *en bloc*
- Interruption of venous return when clamping IVC → resultant haemodynamic compromise to vital organs

PIGGYBACK TECHNIQUE



- Donor IVC attached to recipient IVC end-to-side or side-to-side. Venous cuff from recipient hepatic veins
- PV and HA – end-to-end
- Biliary – duct to duct or Roux-en-Y hepaticojejunostomy

SPLIT LIVER TRANSPLANTATION



Scheme of a “classical” extended right lobe/left lateral lobe split (yellow line) and a full left/full right split (black line).

Hackl C, et al. WJG. 2018. PMID: 30598576;

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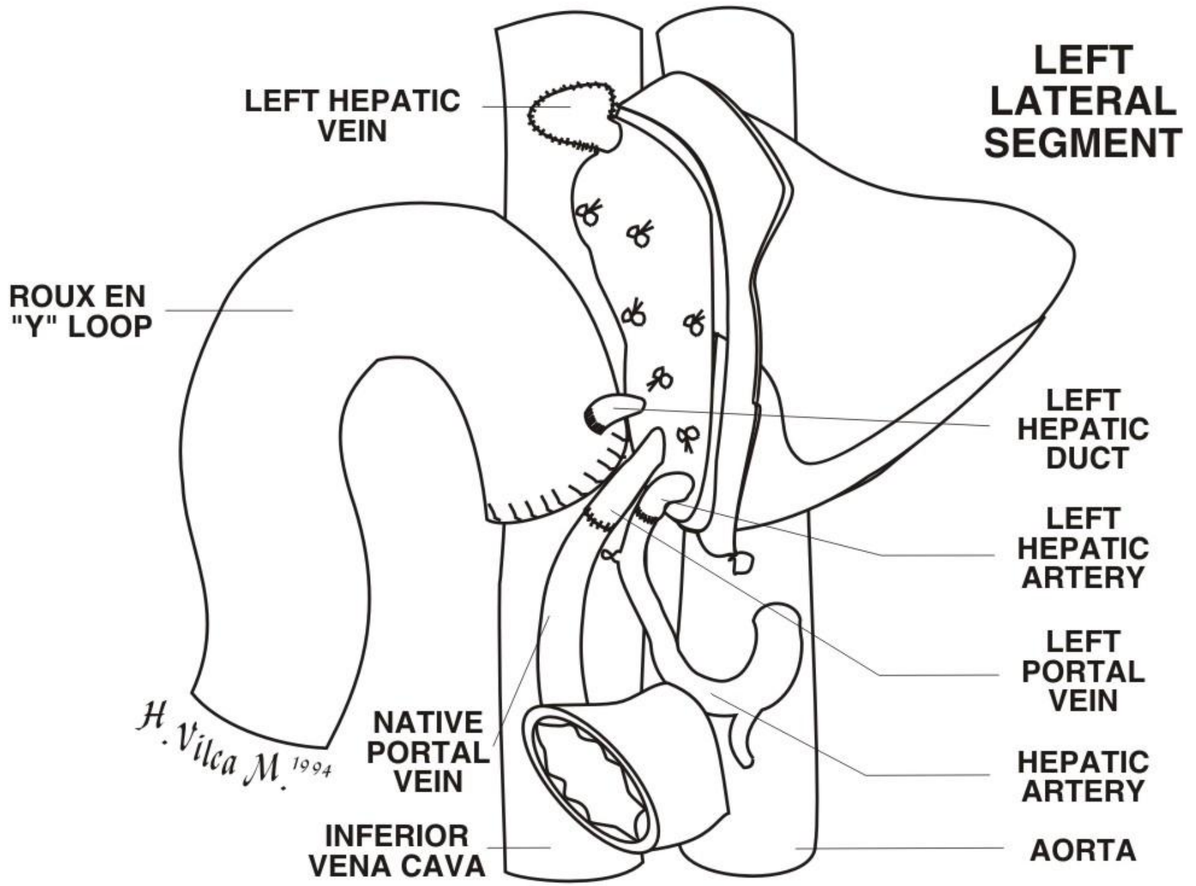
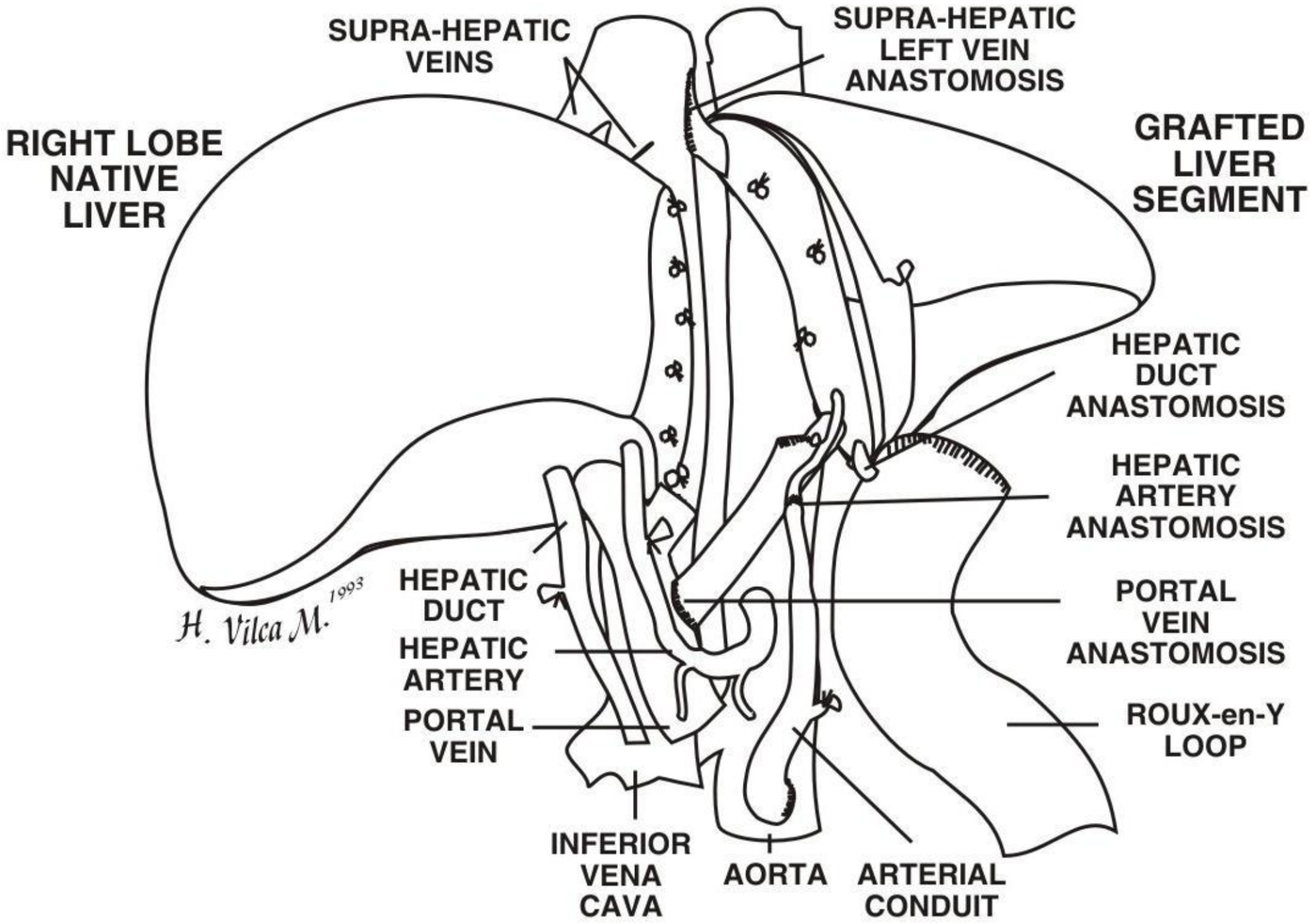
LEFT LATERAL SEGMENT LIVER TRANSPLANTATION

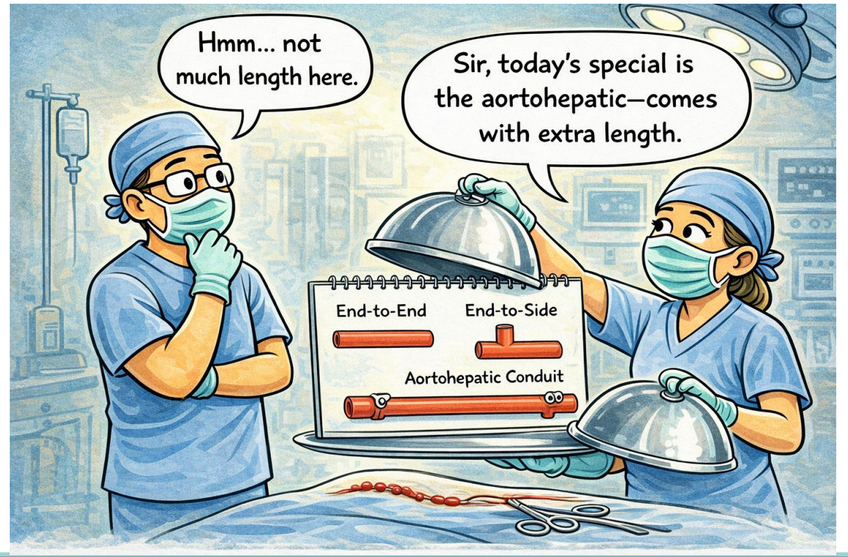


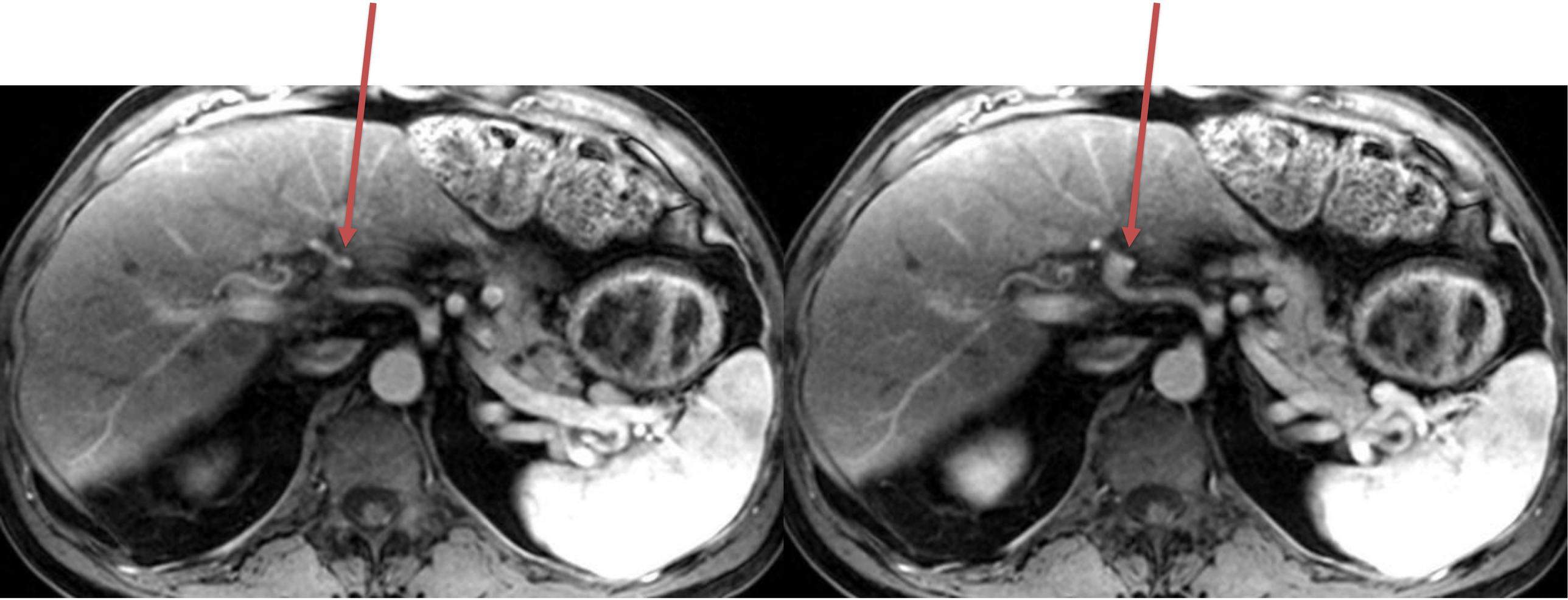
LEFT AUXILIARY ORTHOTOPIC LIVER TRANSPLANTATION



ARTERIAL ANASTOMOSIS

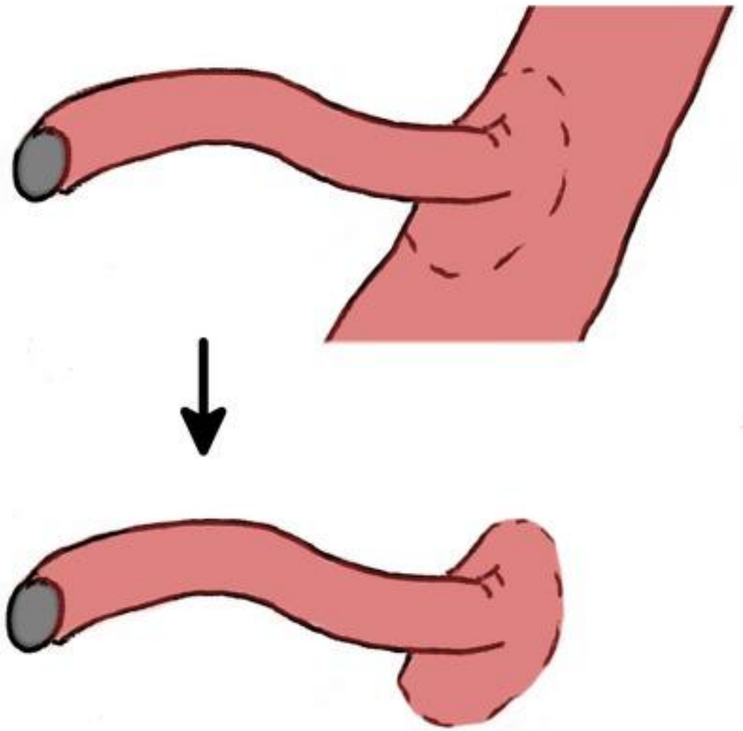
- End-to-end - Donor’s coeliac axis and recipient’s common hepatic artery
- End-to-side, back table reconstructions if anatomical variant
- Conduit – recipient aorta (aortohepatic conduit), viscerohepatic (e.g. splenohepatic conduit)





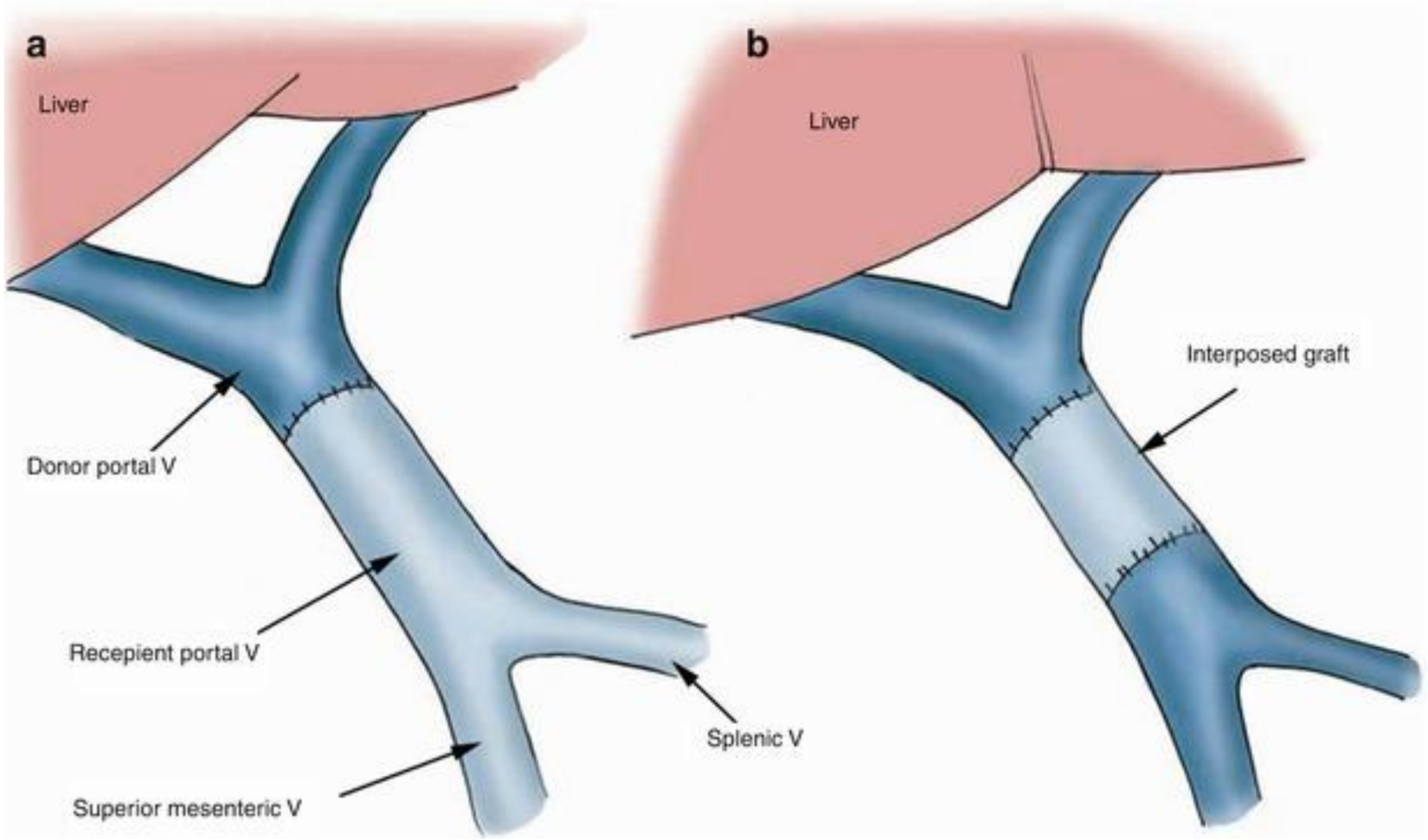
- Donor coeliac trunk patch anastomosed to recipient CHA/GDA branch point (end-to-side)

Carrel Patch

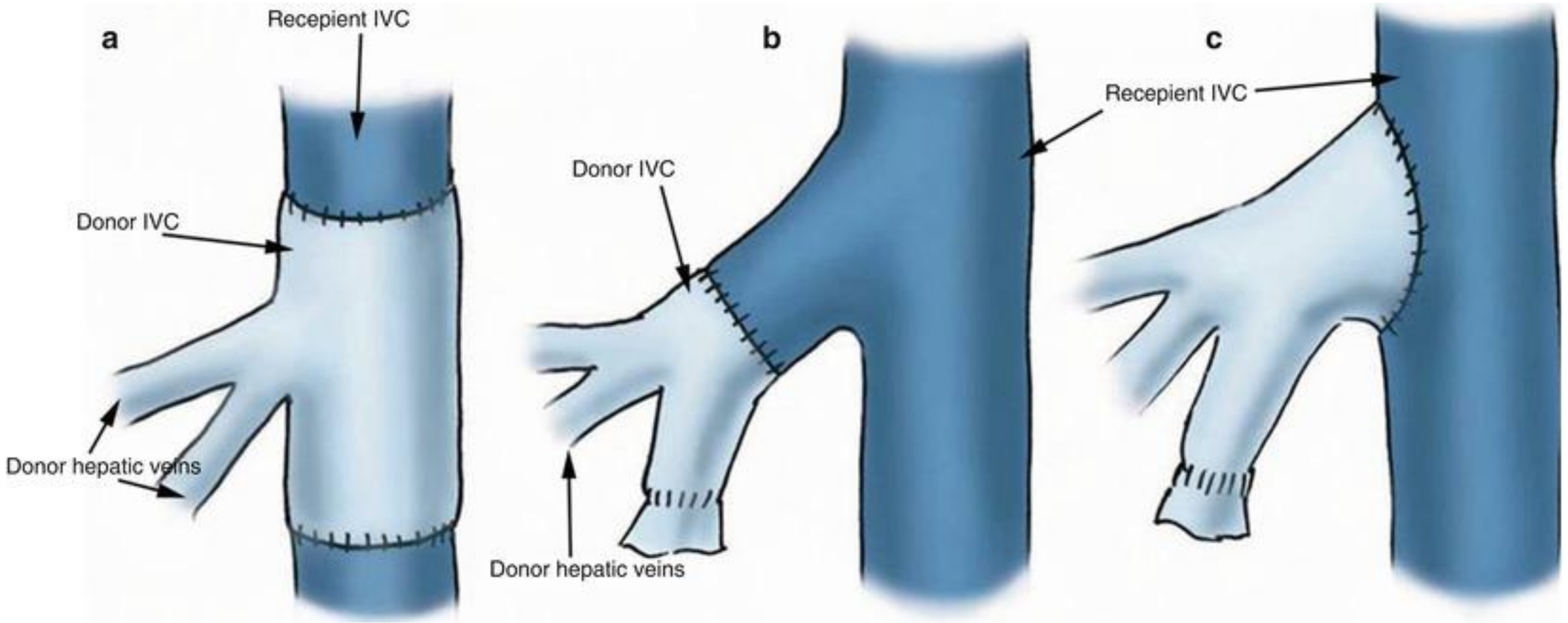


BGG

PORTAL VEIN ANASTOMOSIS



IVC ANASTOMOSIS



a) Intercaval connection

b) “Piggyback” connection

c) Cavoplasty patch onto recipient IVC

THE TRANSPLANT LIVER

- Hepatic artery provides the critical inflow – lacks collateral backup
- Bile ducts are reliant – PV supply does not adequately perfuse biliary tree
- Early arterial occlusion – graft may not survive
- Arterial complications: thrombosis, anastomotic stenosis, pseudoaneurysm
- Portal venous: thrombosis, anastomotic stenosis, portal hypertension
- Biliary complications (20/100)

NORMAL TRANSPLANT LIVER US

- Parenchyma: homogeneous or slightly heterogeneous
- Focal increased echogenicity may reflect contusion/haemorrhage
- No biliary duct dilatation
- If T-tube in situ - extrahepatic bile ducts may appear thick-walled
- Pneumobilia may be normal in bilioenteric anastomosis or if sphincterotomy performed
- Small volume perihepatic fluid can be normal in first 10 days

NORMAL TRANSPLANT LIVER US

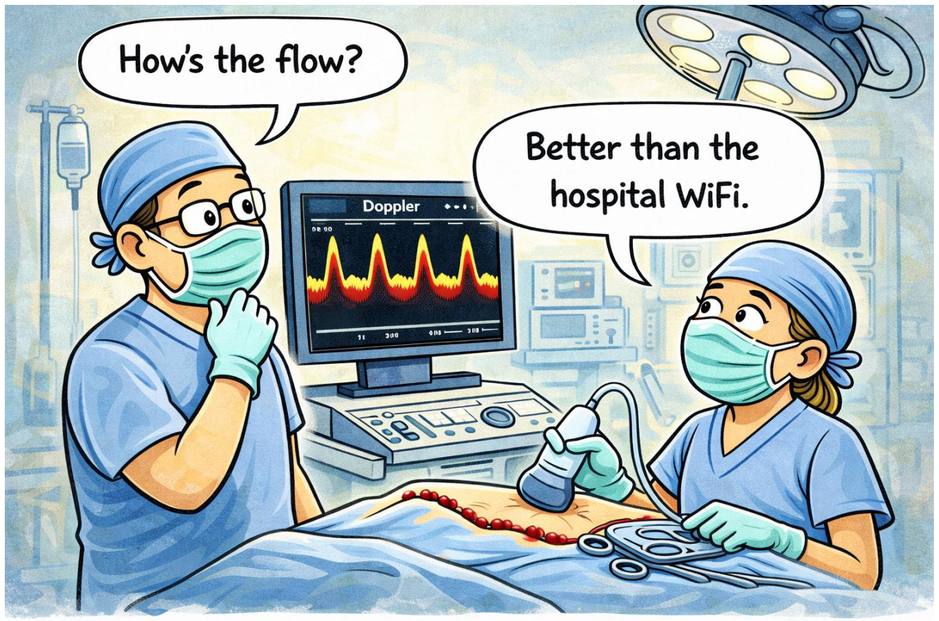
- Raised RI can be normal in first few days

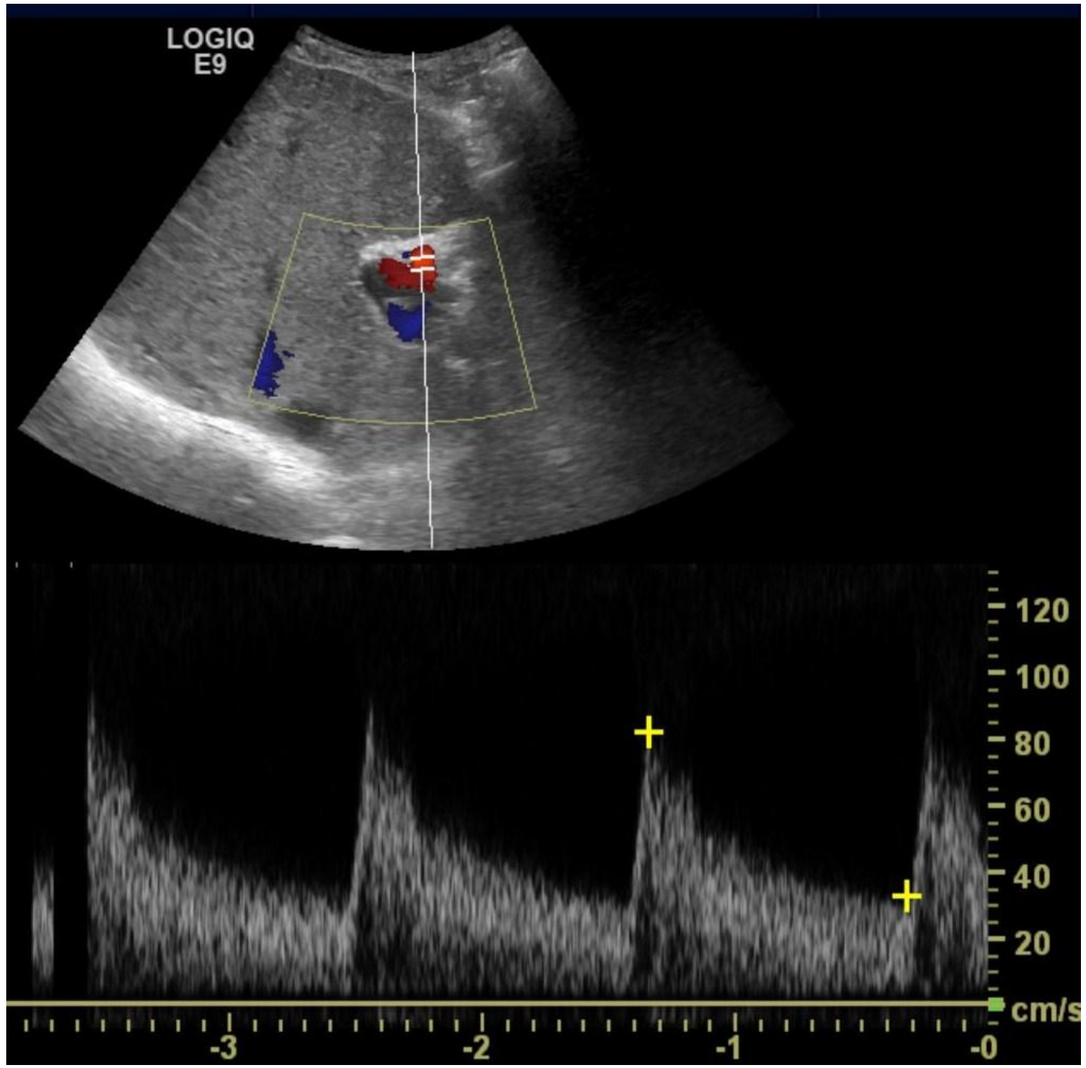
- Raised RI: vasospasm, post op oedema, increased portal flow, prolonged cold ischaemia time, advanced donor age

NORMAL HEPATIC ARTERY

- Rapid systolic upstroke with continuous diastolic flow

- RI: 0.5-0.8





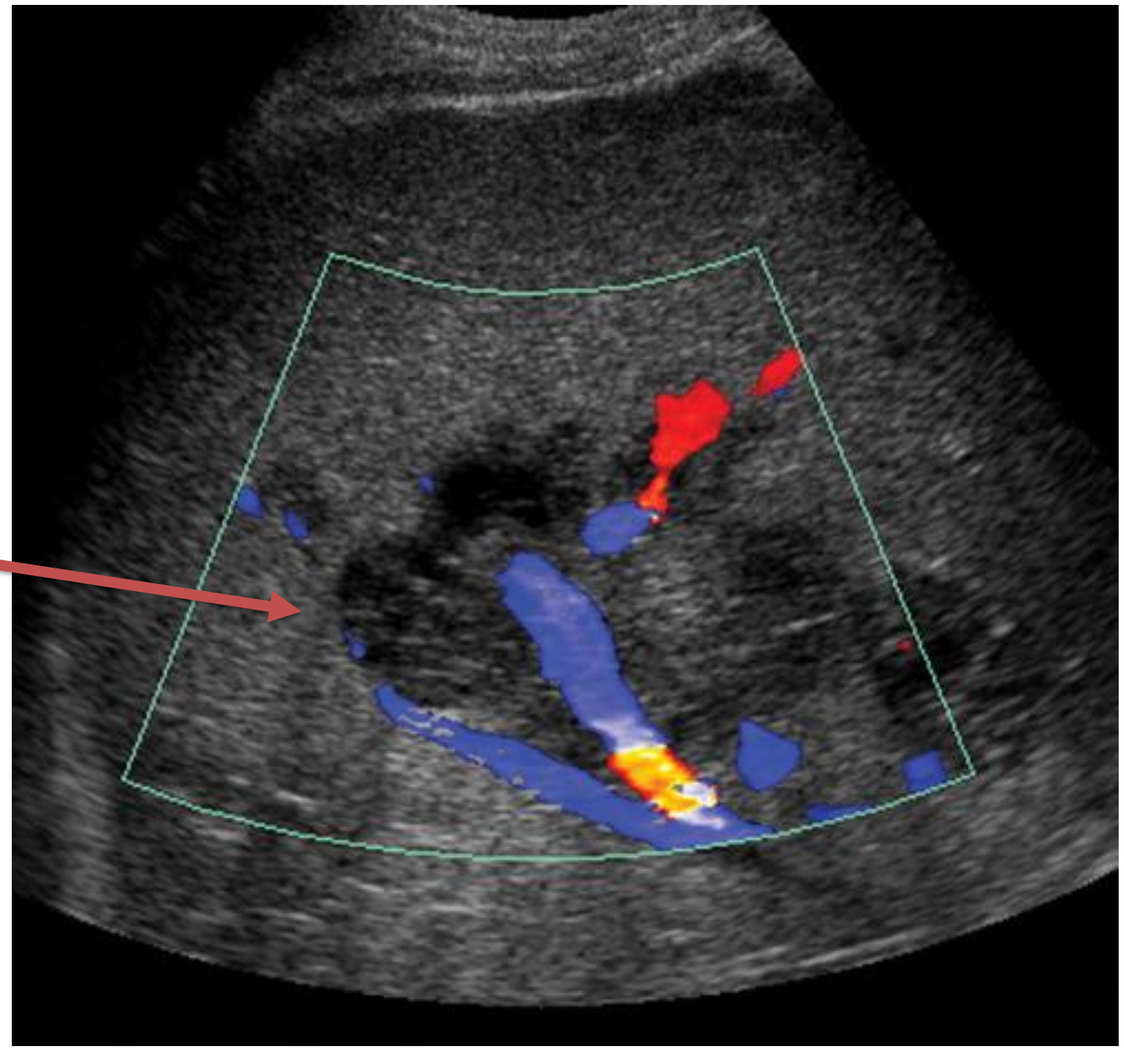
US Image source: US of Liver Transplants: Normal and Abnormal https://pubs.rsna.org/doi/10.1148/rg.235035031#F3A

HEPATIC ARTERY THROMBOSIS

- 8% transplants
- 60% of all vascular complications post tx
- 20-60% mortality
- Early thrombosis – first 15 days
- Delayed thrombosis – years – chronic rejection, sepsis
- Presentation: fulminant liver failure, delayed bile leak, bacteremia
- Mx: urgent revascularisation, may require re-transplant

HEPATIC ARTERY THROMBOSIS

- Absence of flow on Doppler
- Infarcts



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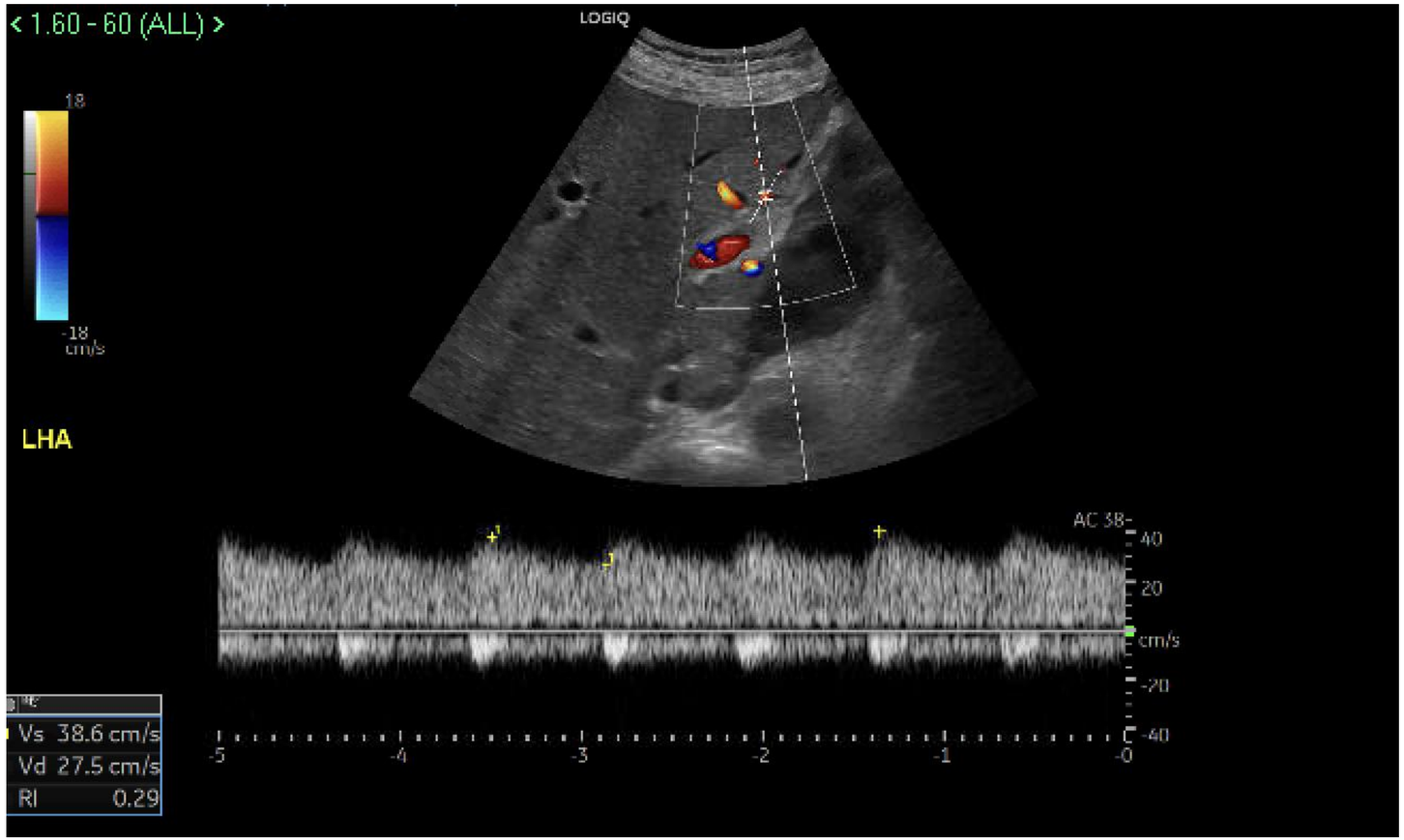
HEPATIC ARTERY THROMBOSIS

- Nolten and Sproat described “syndrome of impending thrombosis”:

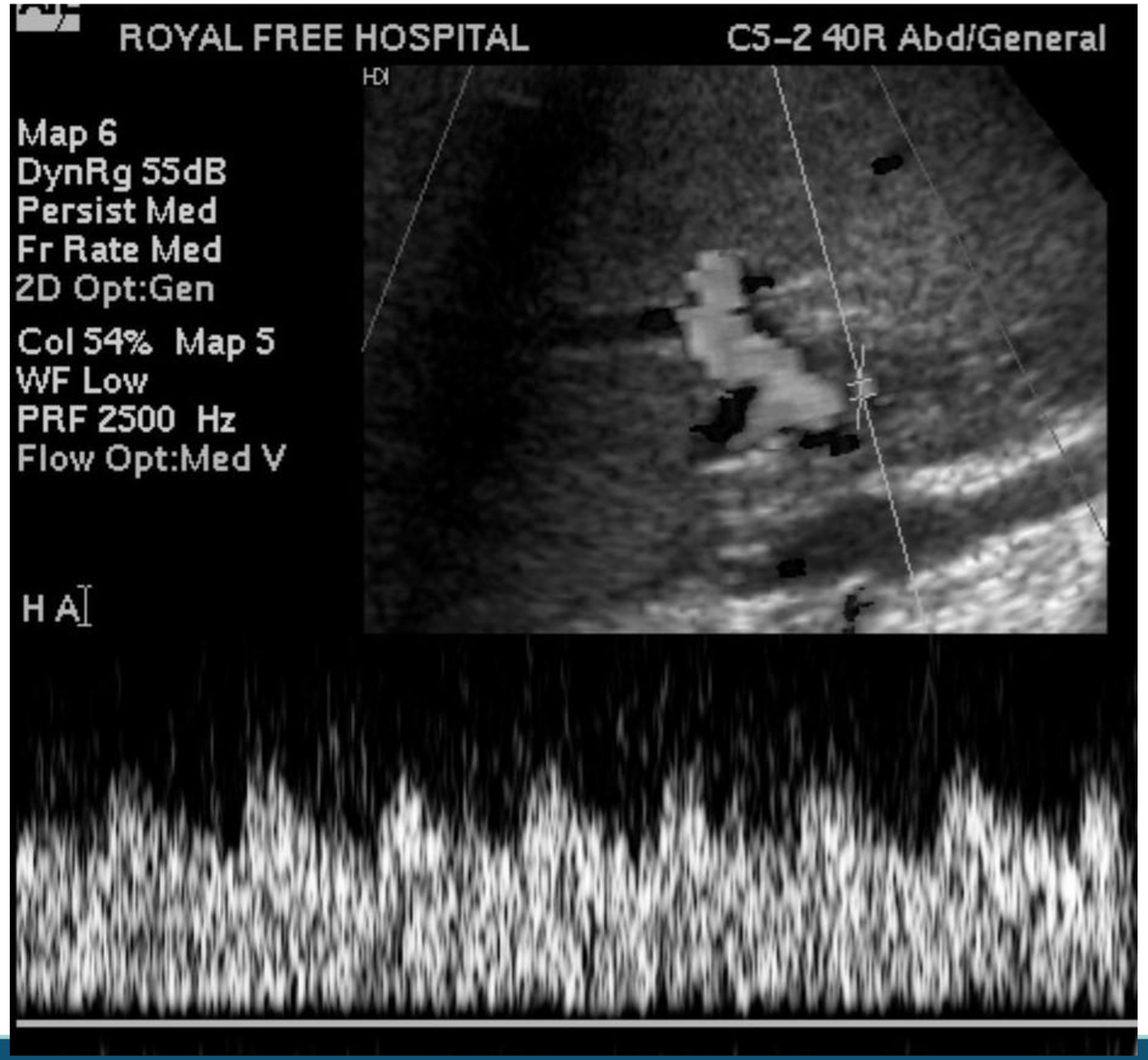
- 3-10 days
- Normal initial waveform
- No diastolic flow
- Dampening of systolic peak
- Total loss of hepatic arterial waveform

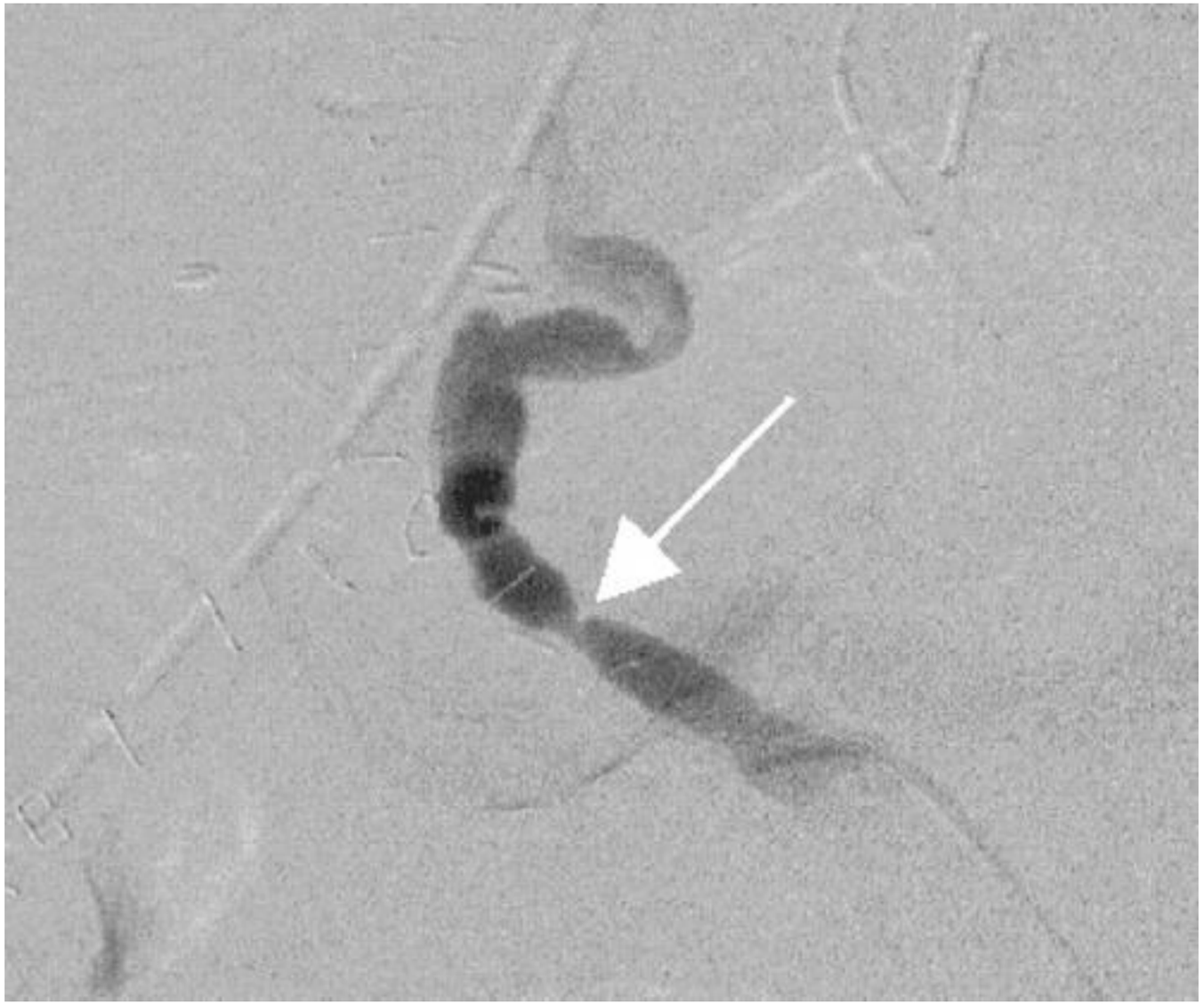
ABNORMAL HEPATIC ARTERY– TARDUS PARVUS

- Prolonged acceleration time and decreased resistive index



HEPATIC ARTERY STENOSIS – TARDUS PARVUS





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HEPATIC ARTERY PSEUDOANEURYSM

- Vascular anastomotic site
- Secondary to infections
- Fistula can form between aneurysm and biliary tree or portal vein
- Treated with surgery or stent placement

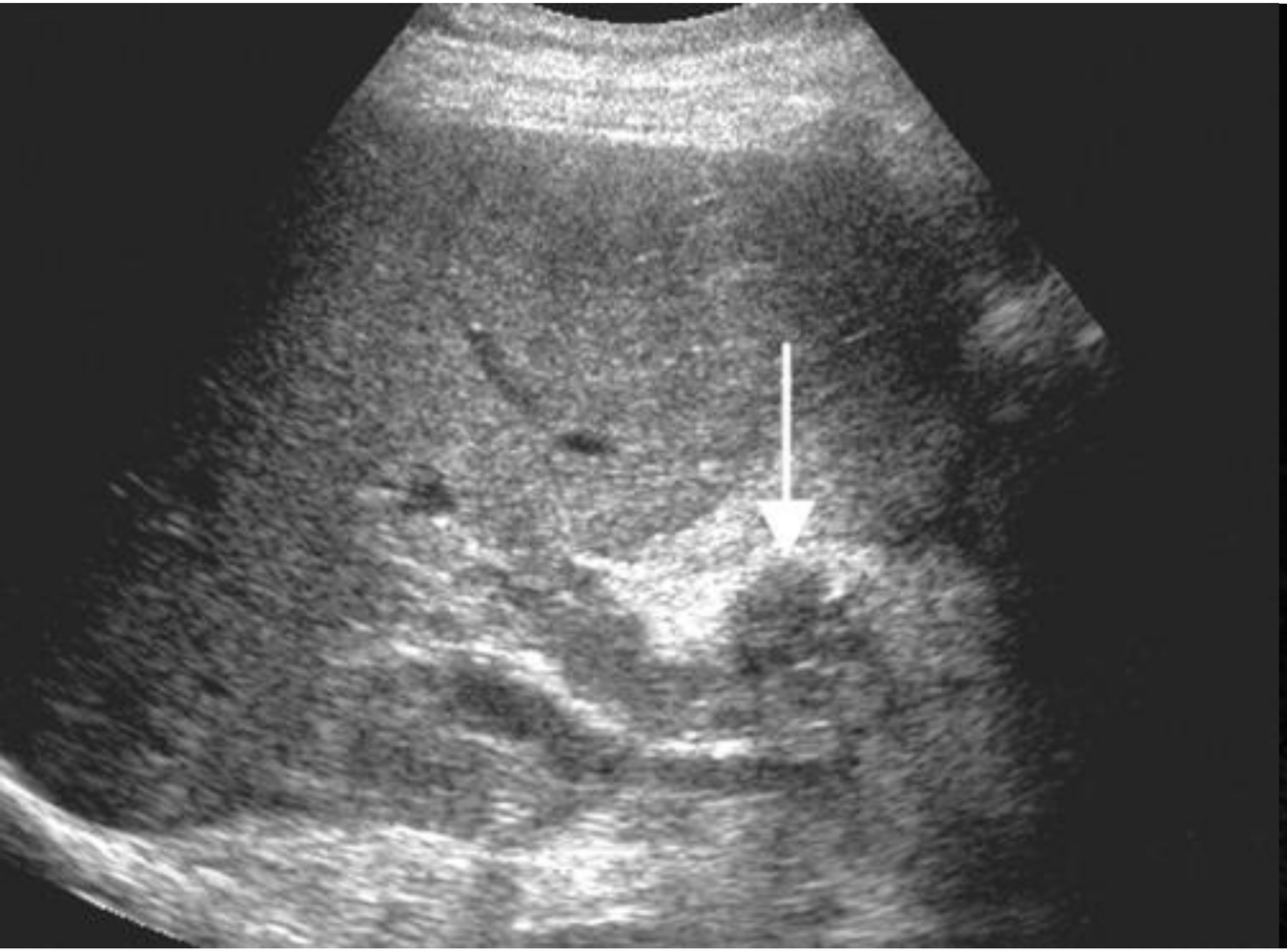
- US: periportal or intrahepatic cystic structure on B-mode US adjacent to/along course of hepatic artery

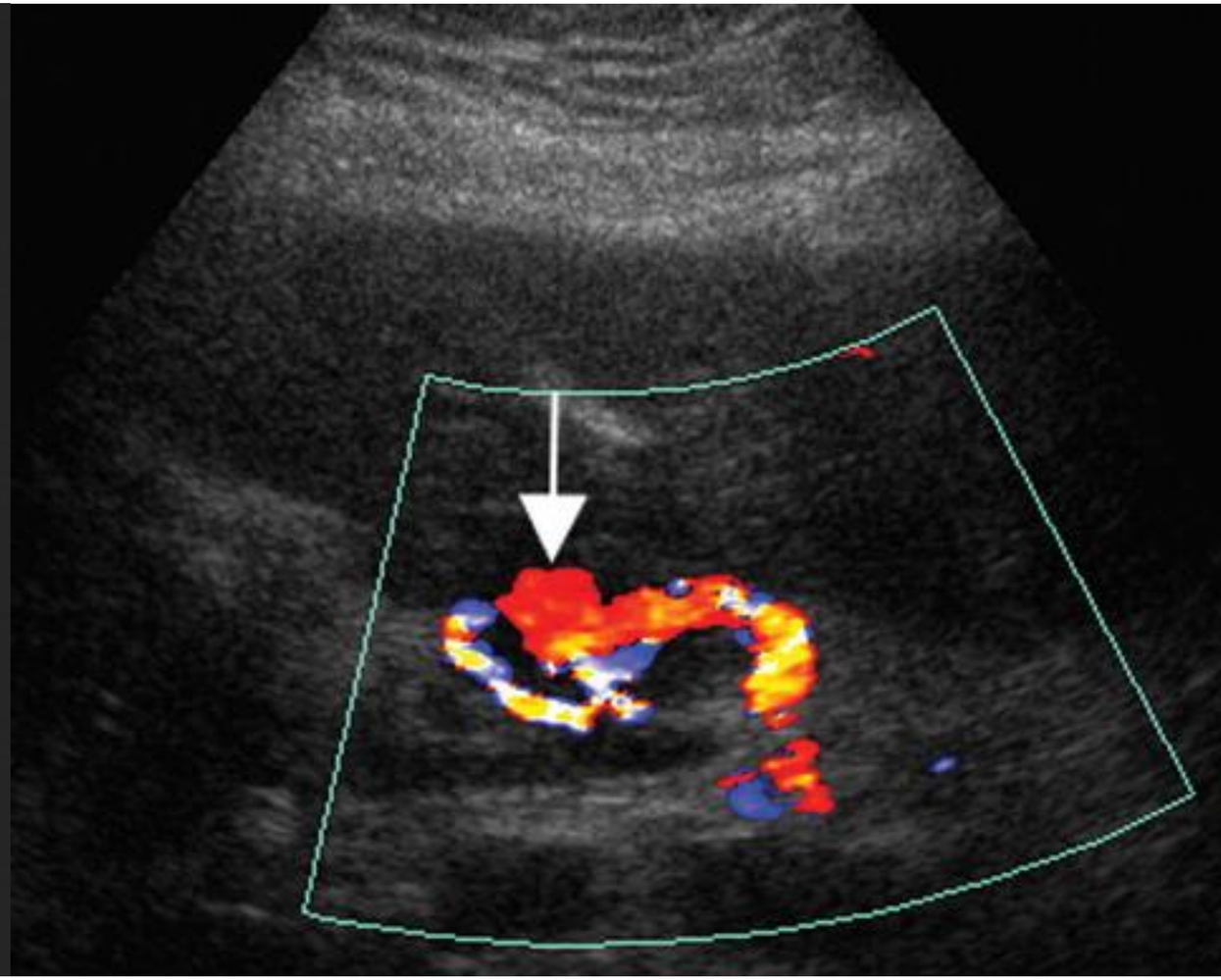
- Need colour and spectral Doppler to avoid misdiagnosis (e.g. collection)

HEPATIC ARTERY PSEUDOANEURYSM

- Doppler – abnormal arterial flow
- Intrahepatic tardus-parvus waveform
- Large pseudoaneurysm – monophasic flow

HEPATIC ARTERY PSEUDOANEURYSM





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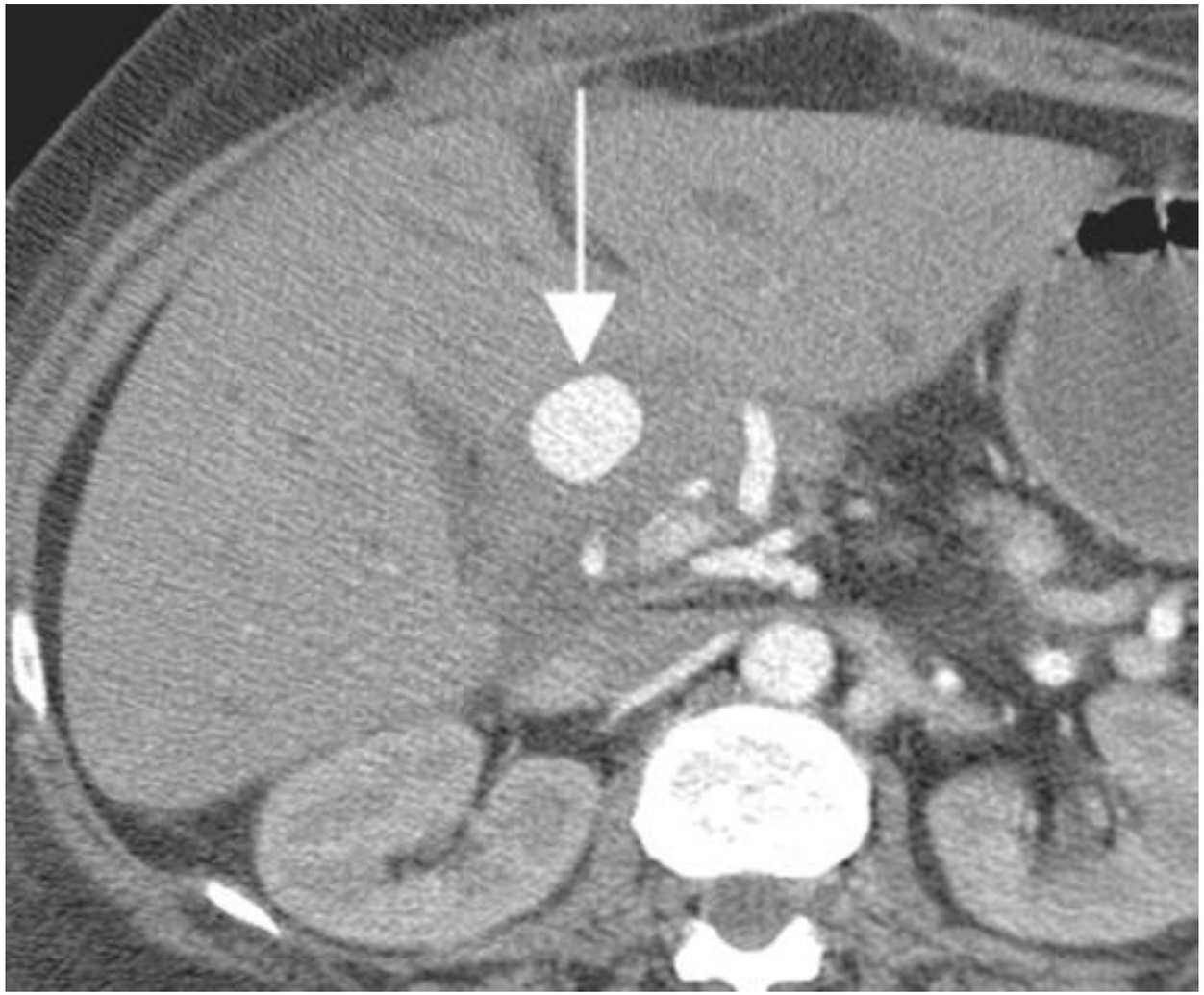
HEPATIC ARTERY PSEUDOANEURYSM



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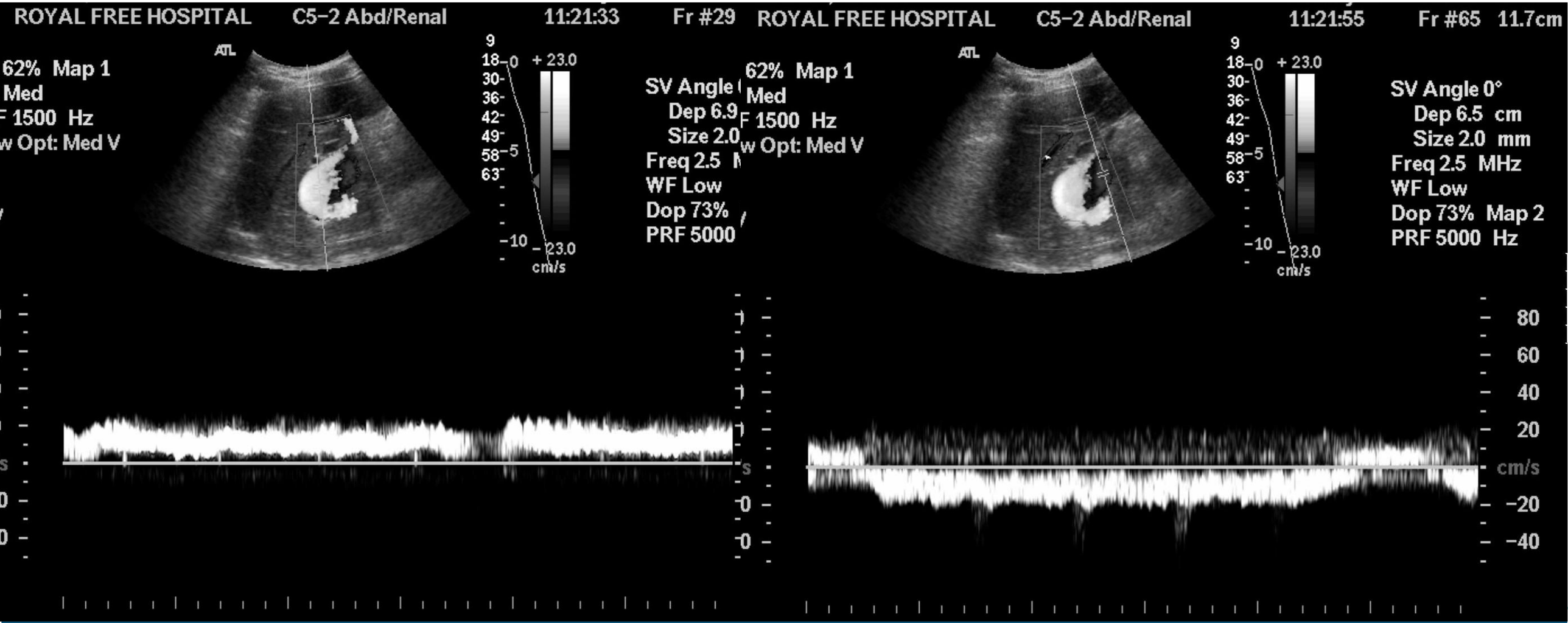
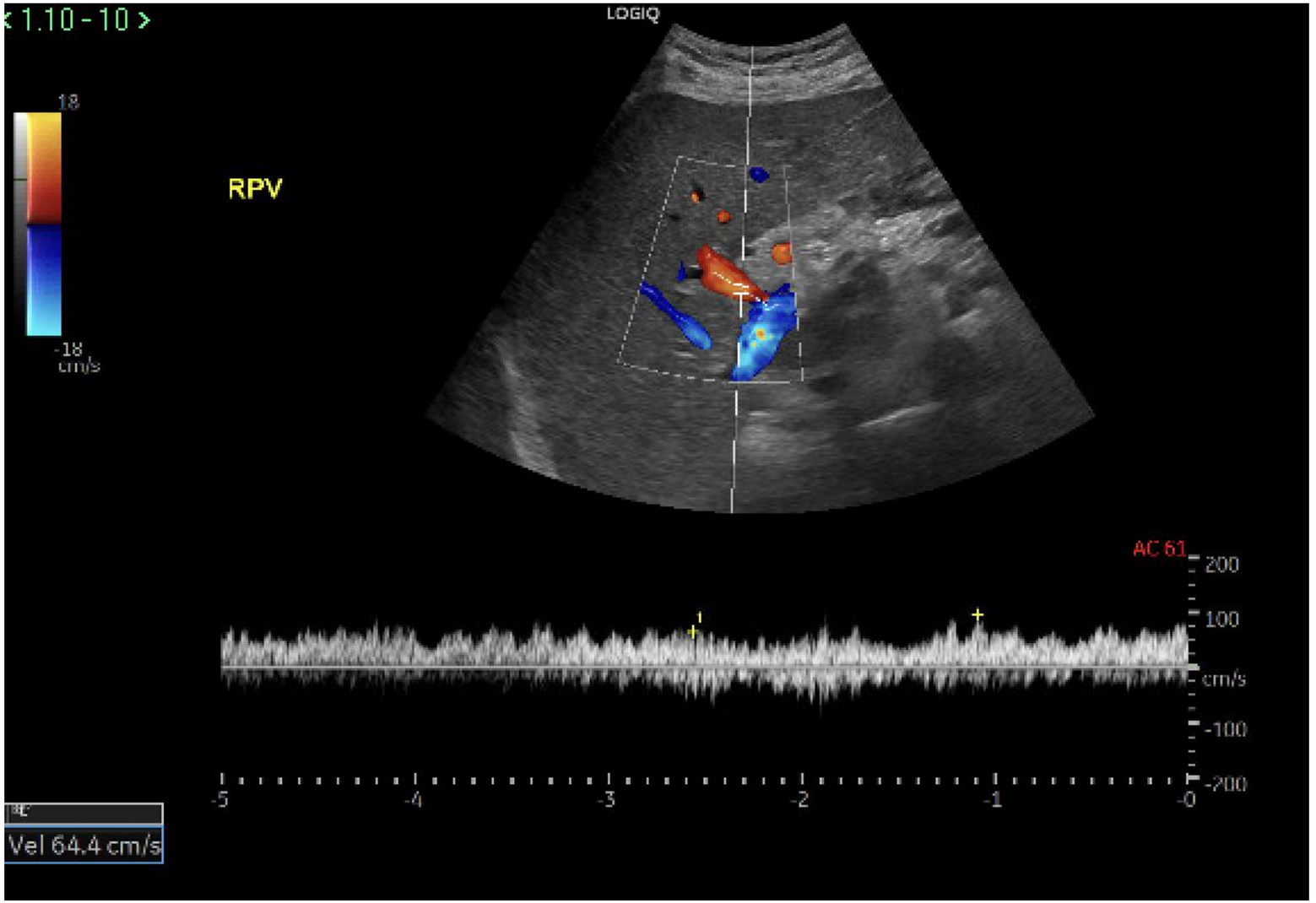


PORTAL VEIN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18
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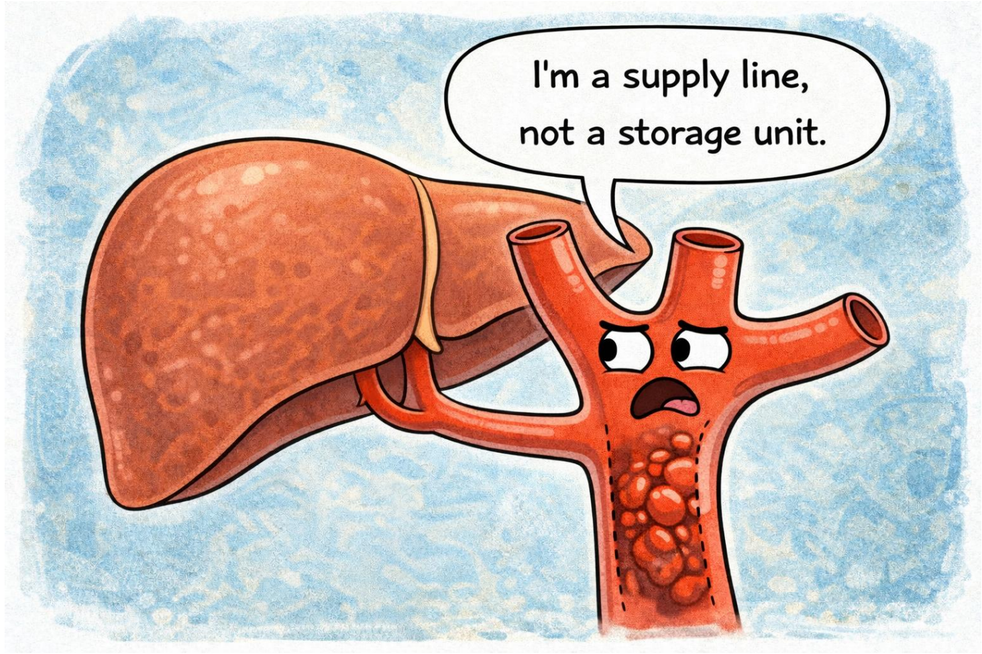
cm/s
RPV
AC 61
200
100
cm/s
-100
-200
-5
-4
-3
-2
-1
-0
Vel 64.4 cm/s

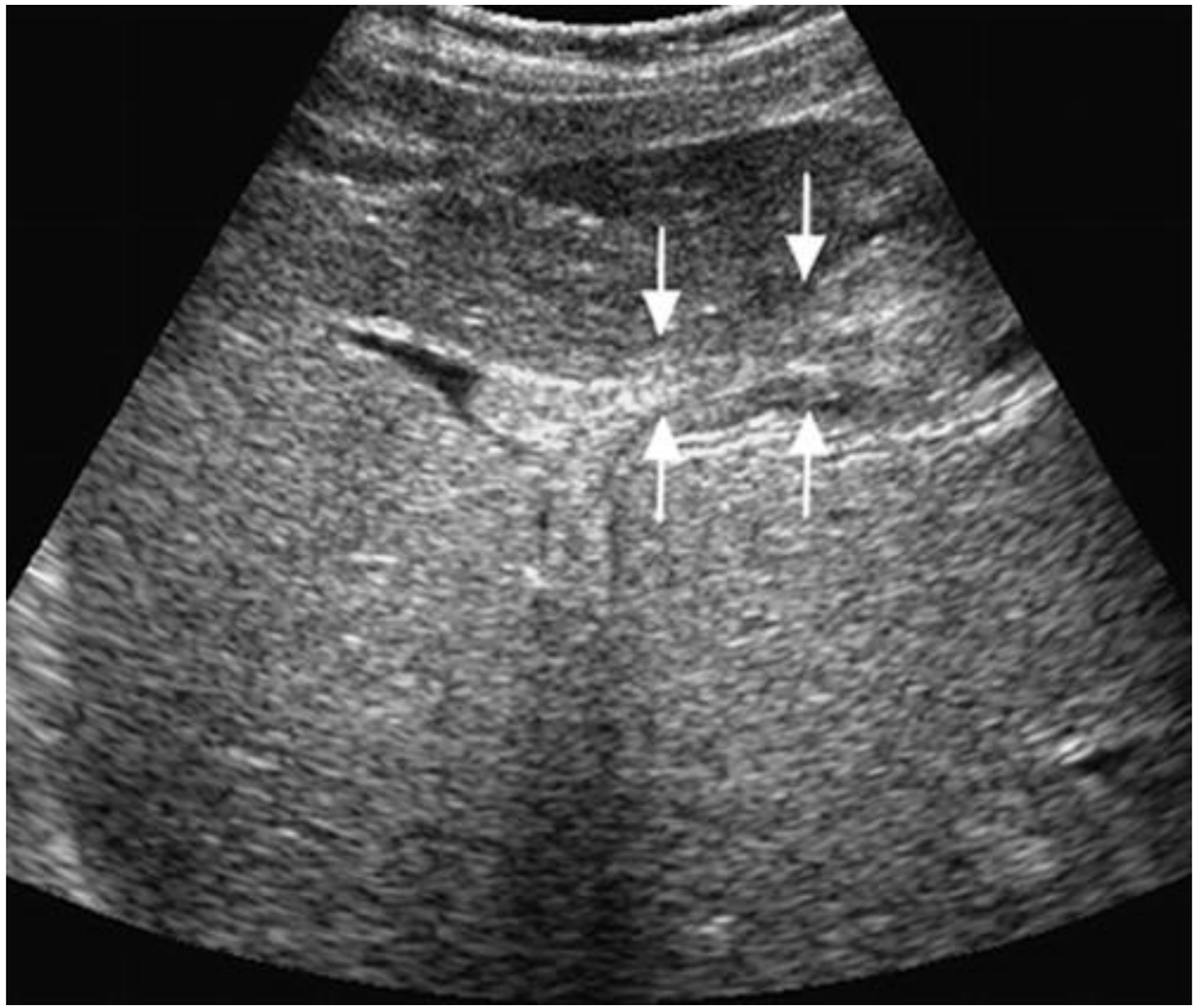
PORTAL VEIN THROMBUS

- B-Mode US: intraluminal echogenic filling defect

- Acute thrombus can be anechoic and only identified as a flow defect on colour Doppler



PORTAL VEIN THROMBUS



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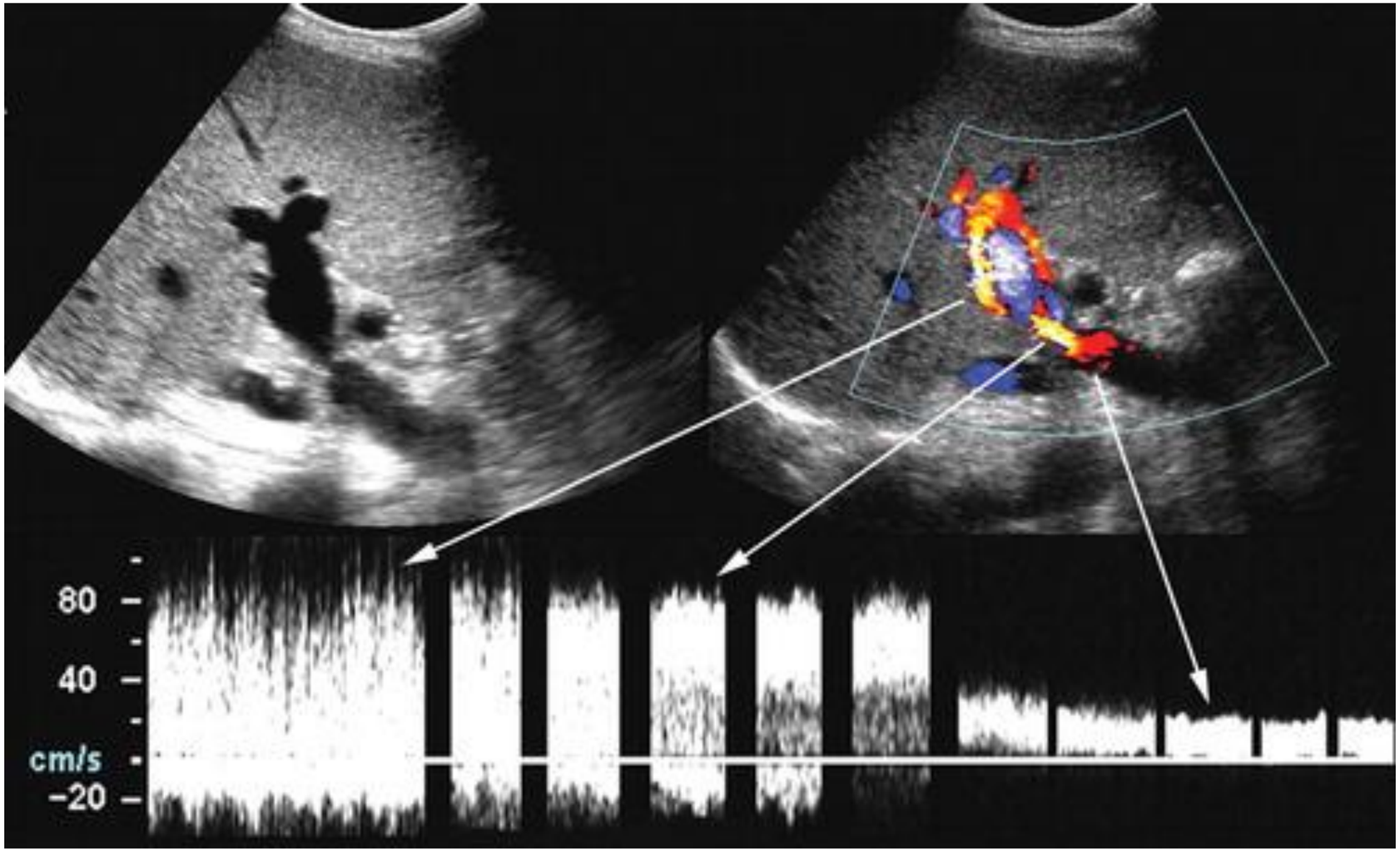
PORTAL VEIN THROMBUS



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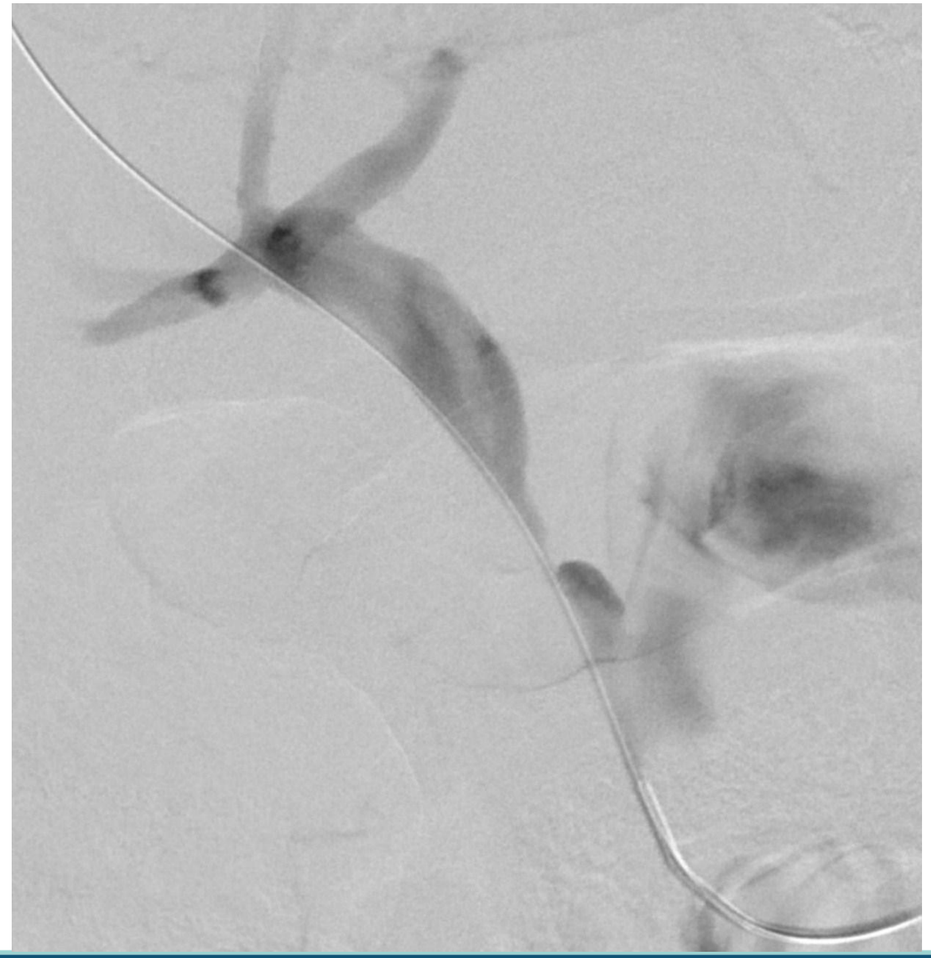
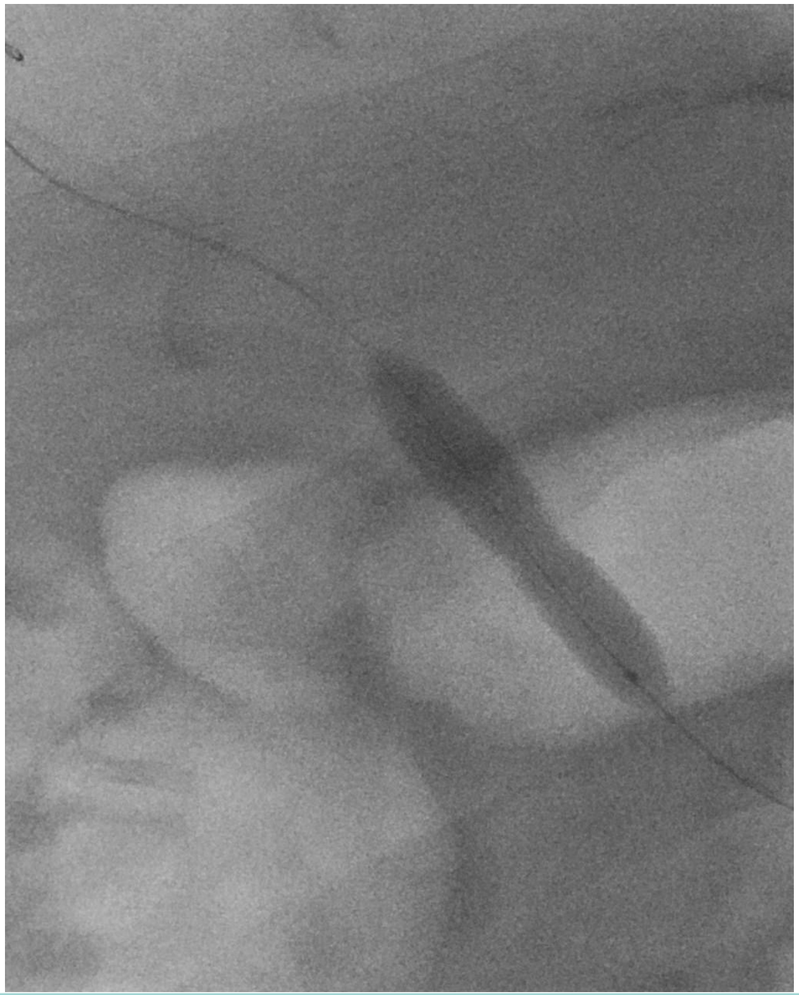
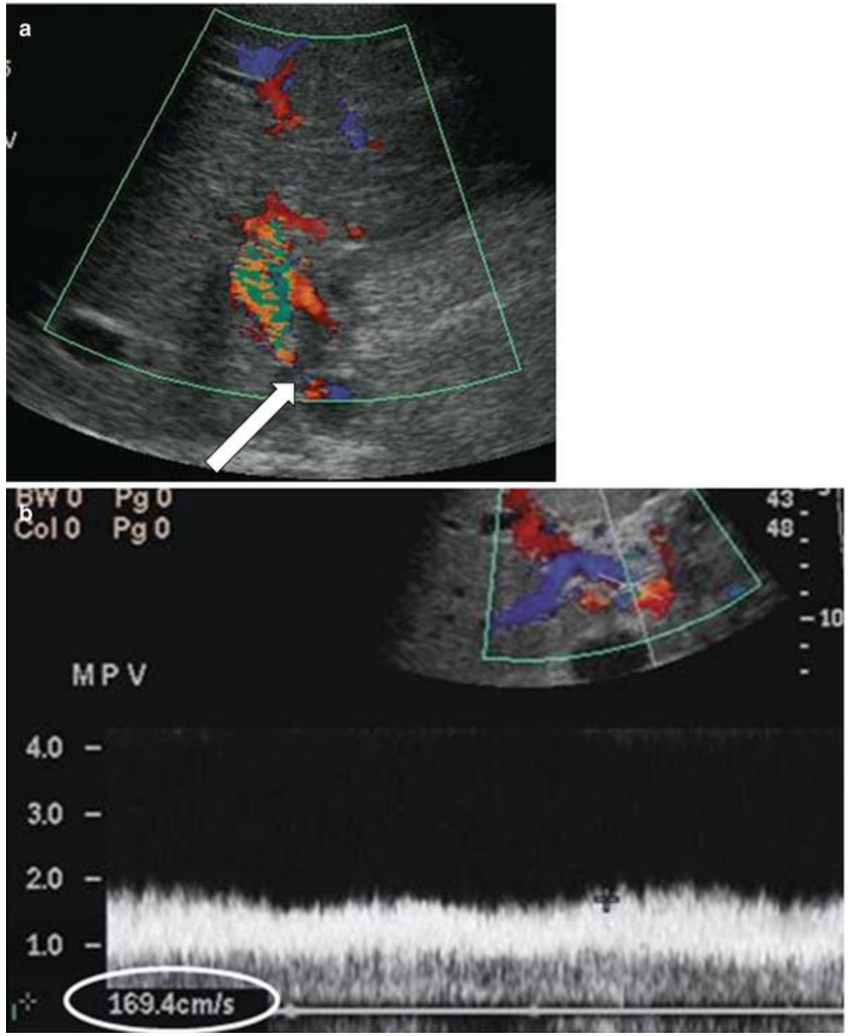
TRANSPLENIC PORTAL VEIN DILATATION





PORTAL VEIN STENOSIS



Source: US of Liver Transplants: Normal and Abnormal https://pubs.rsna.org/doi/10.1148/rg.235035031#F3A

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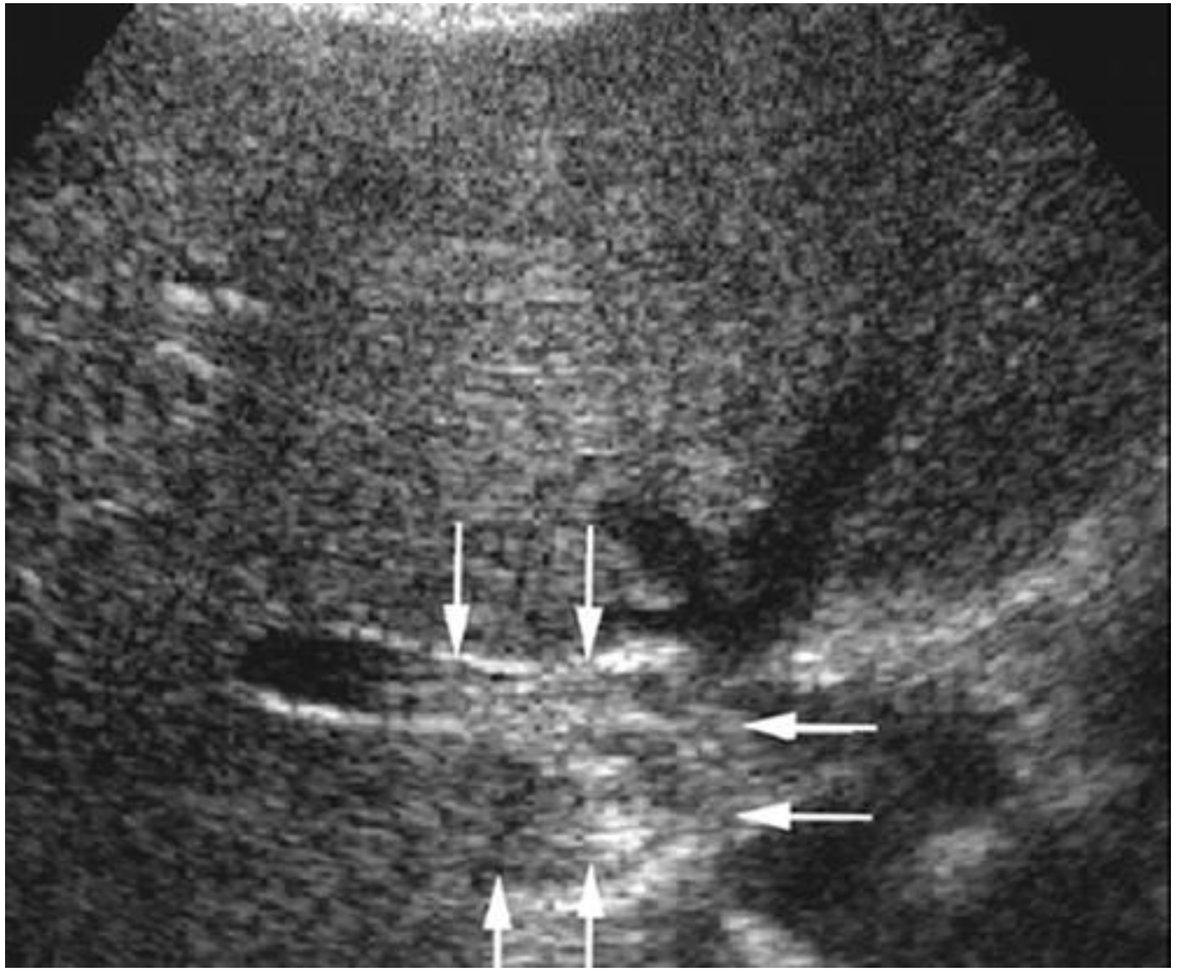
IVC/HV COMPLICATIONS

- Anastomotic IVC stenosis
- Kinking of the hepatic vein
- Budd Chiari

IVC THROMBOSIS



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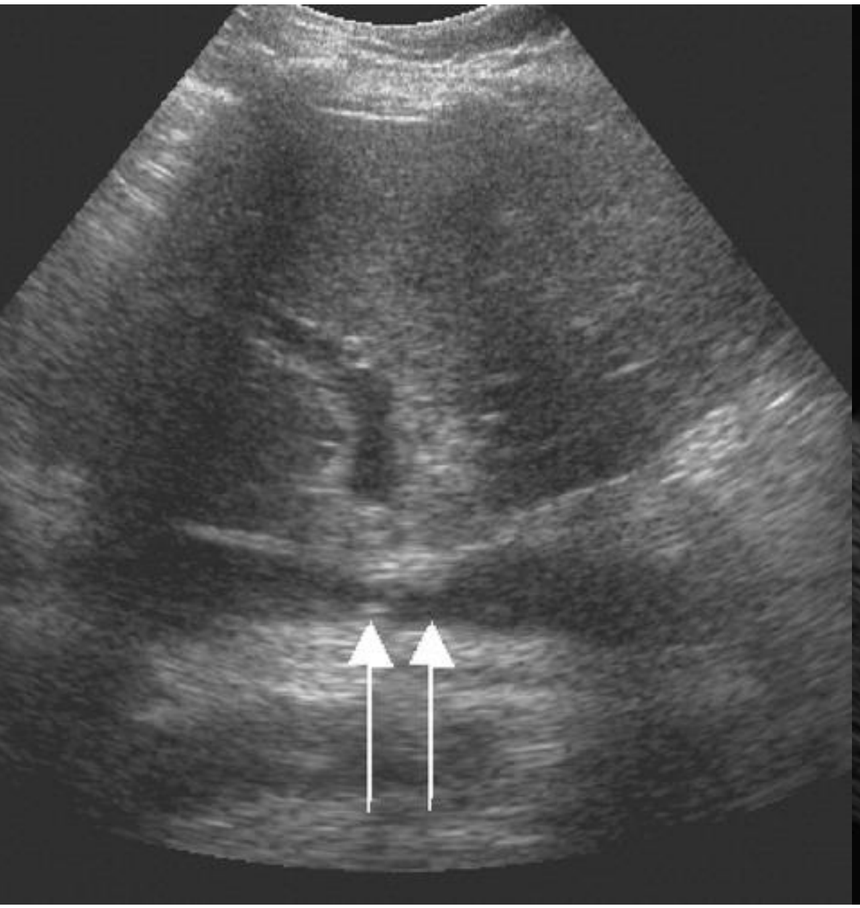

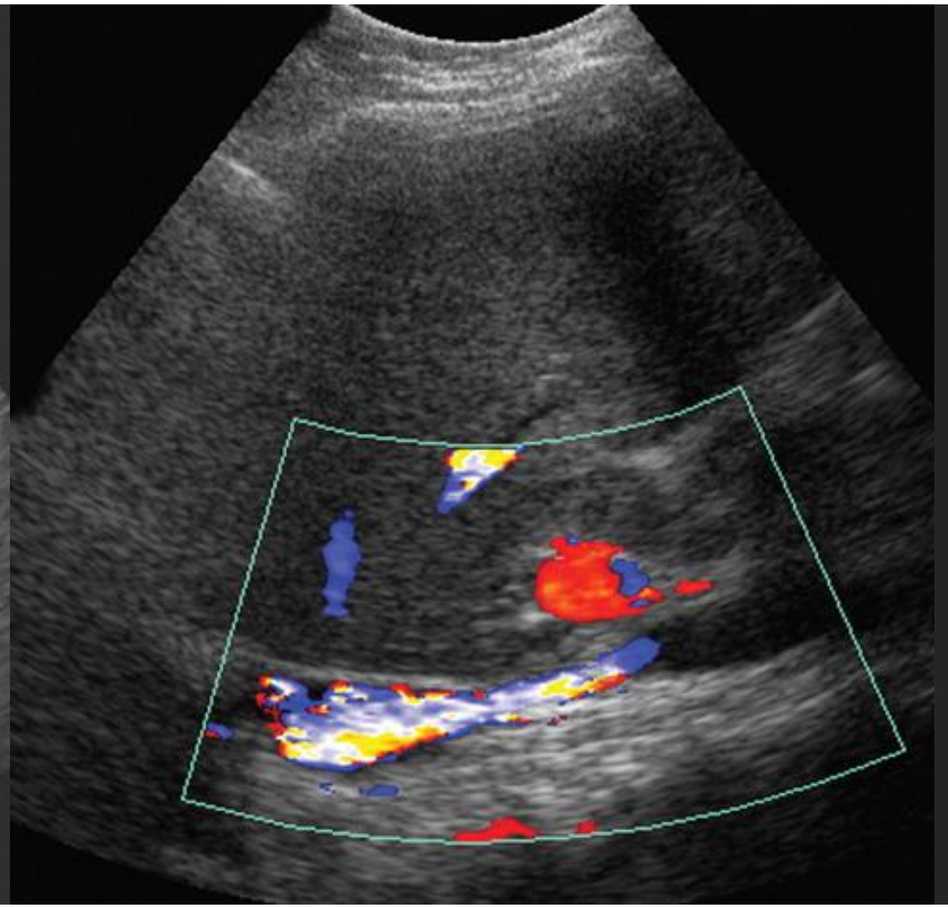

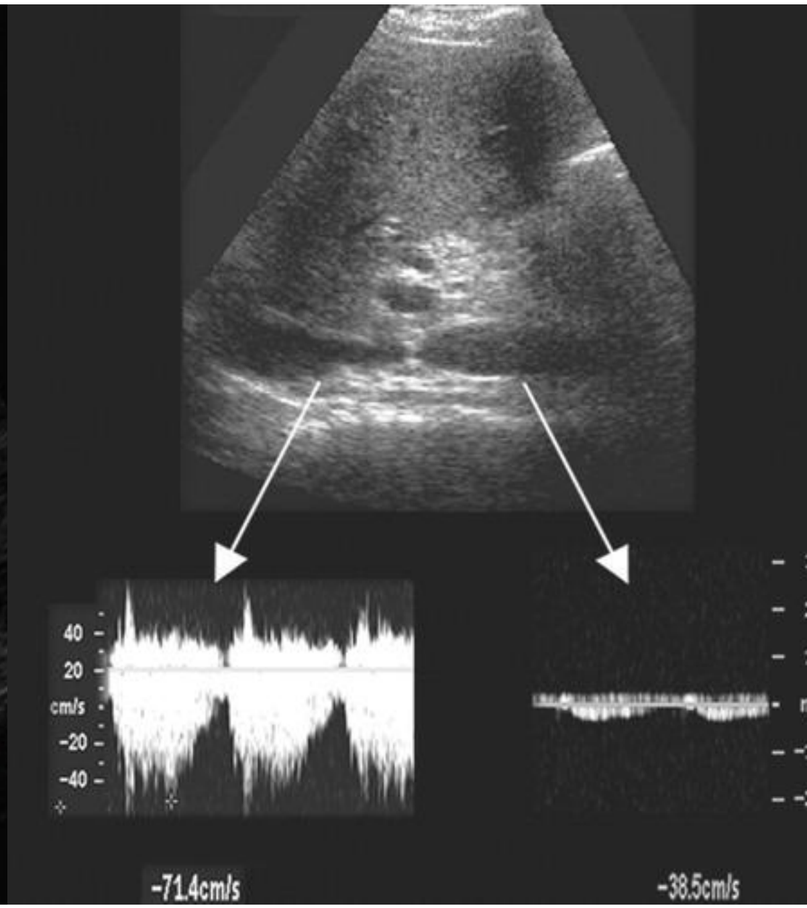

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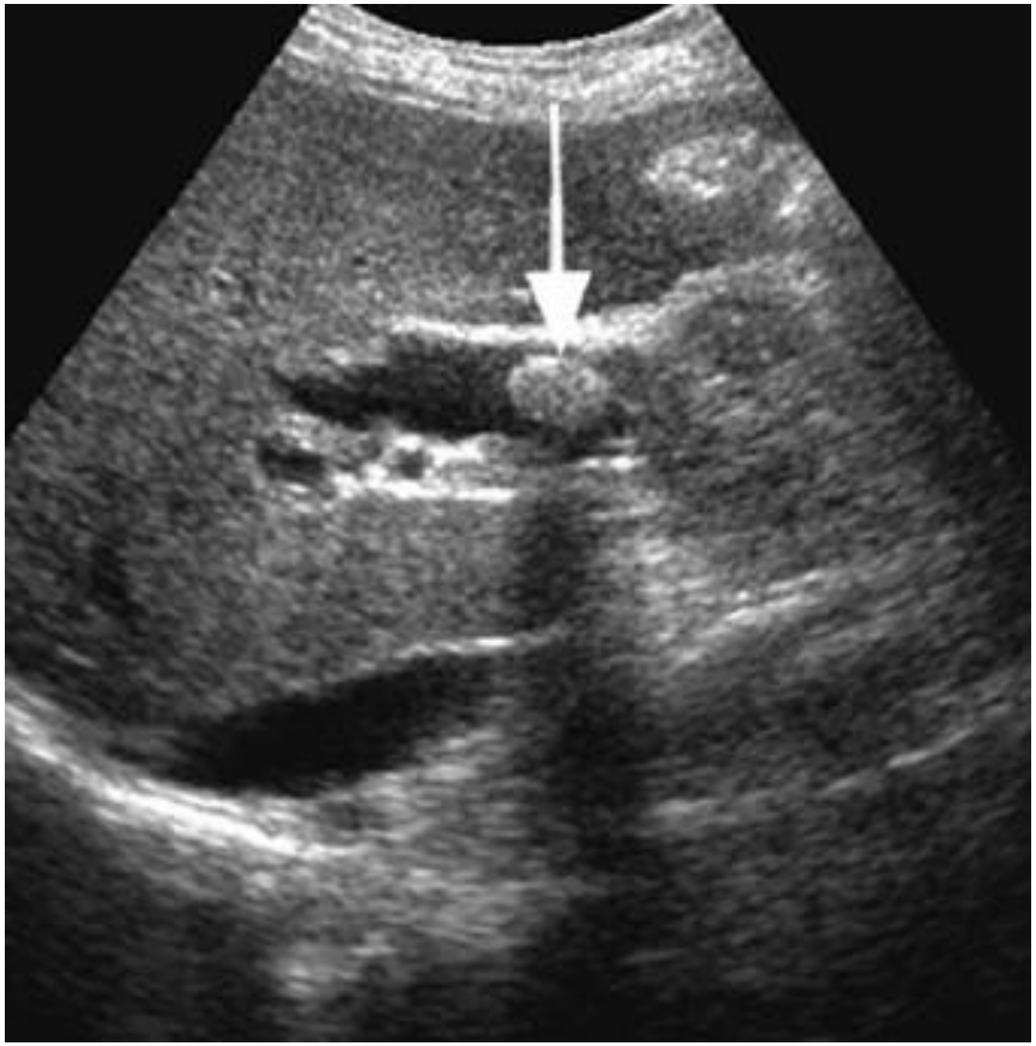
BILIARY COMPLICATIONS

- 25% patients
- Biliary tree – dependent on HA supply
- Bile leak
- Anastomotic stricture
- Non-anastomotic stricture
- PSC recurrence
- Calculus

BILIARY COMPLICATIONS

- Leak: perihepatic fluid collection
- Anastomotic stricture: dilated intrahepatic ducts and common duct dilatation to the level of the anastomosis. Distal to stricture, common duct will be normal in calibre
- Non-anastomotic stricture: secondary to ischaemia from HA compromise. Focal segmental intrahepatic or hilar duct dilatation with no obvious mass
- If IHD – evaluate hepatic artery closely, and if previous PSC – consider recurrence

INTRADUCTAL CALCULUS



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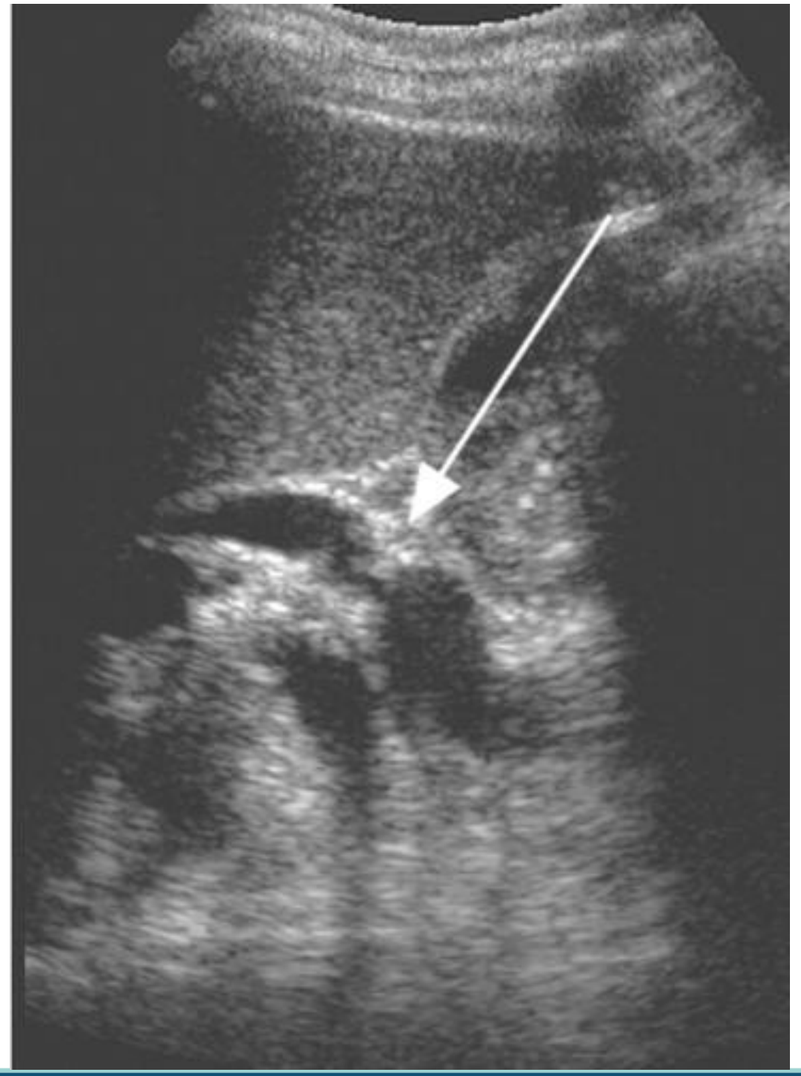
ANASTOMOTIC BILIARY STRICTURE



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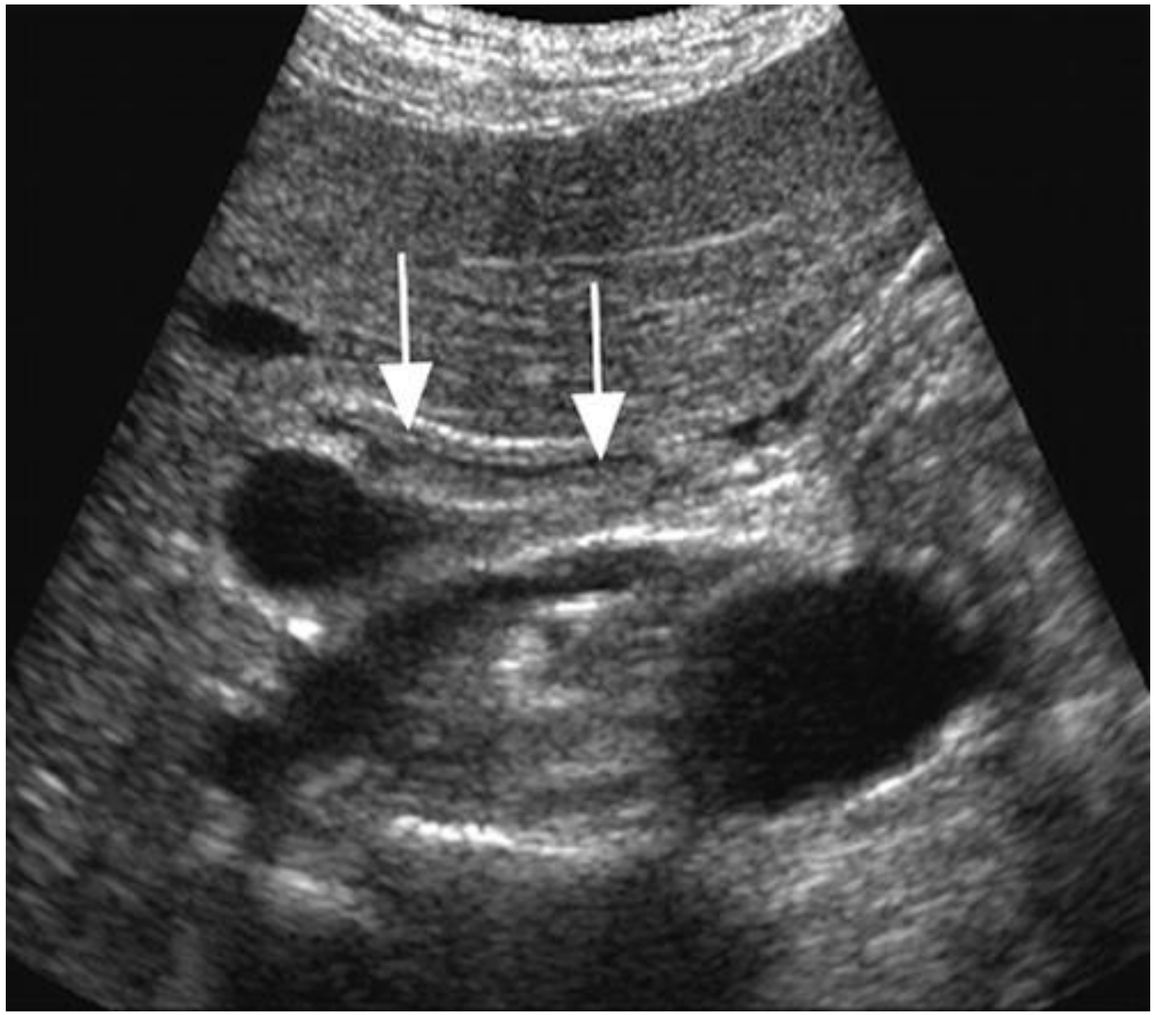
RECURRENT PSC



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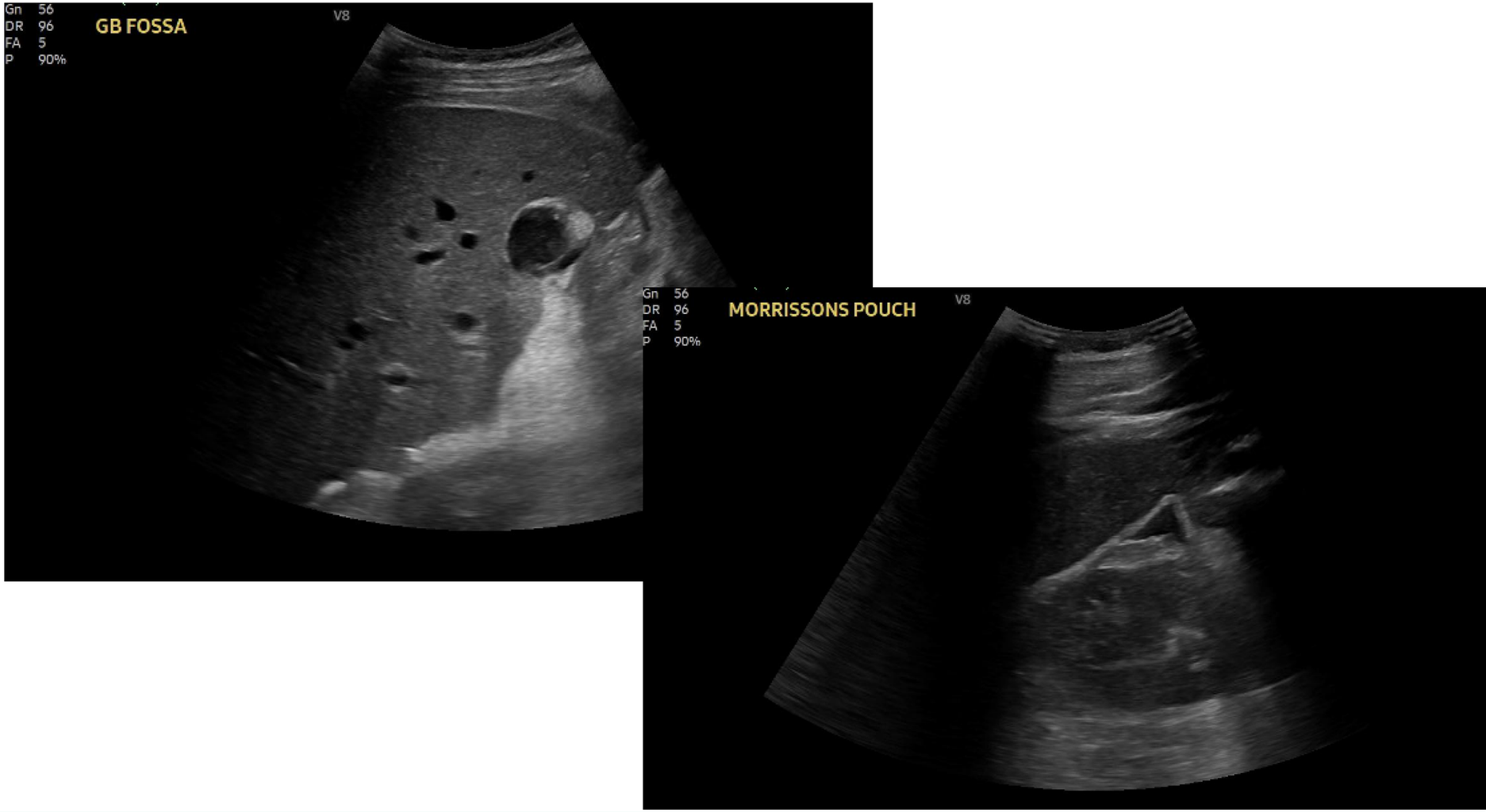
MALIGNANCY

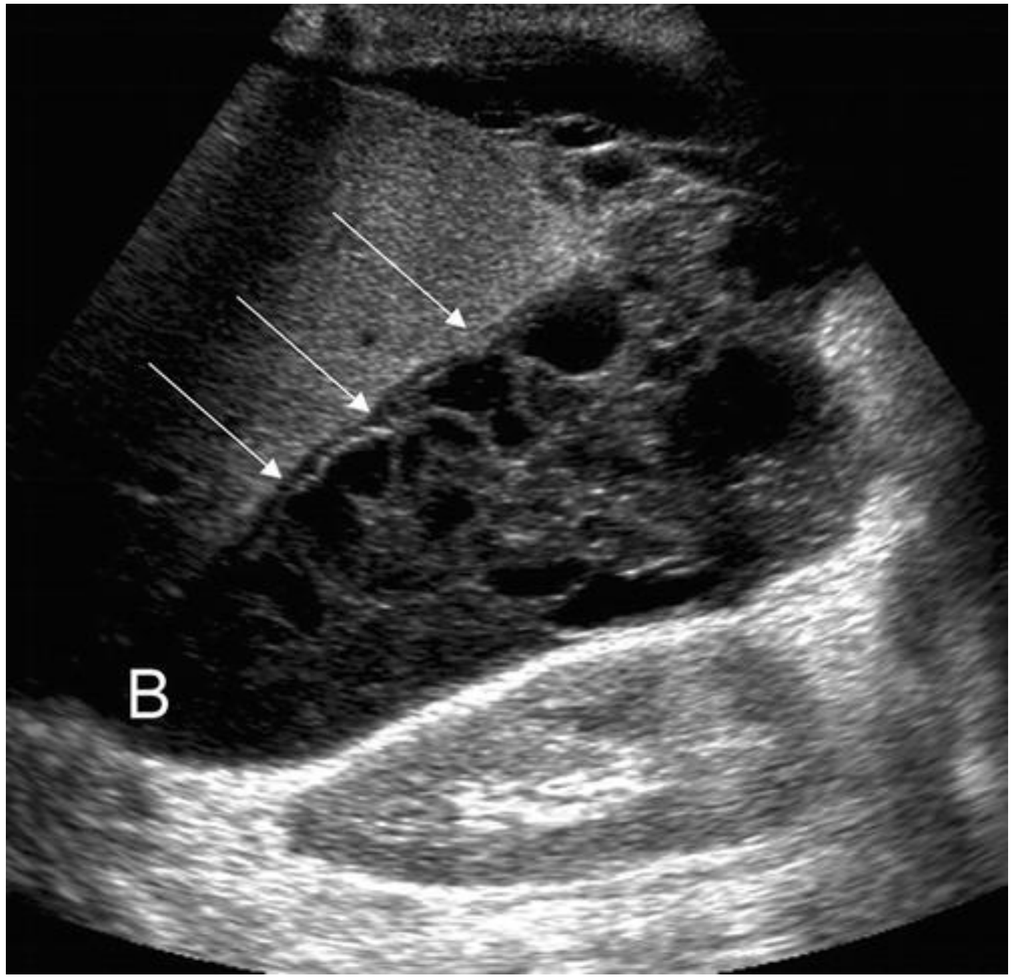
- HCC recurrence
- Disease in the transplant liver graft
- New malignancy
- Post transplant lymphoproliferative disorder (PTLD)

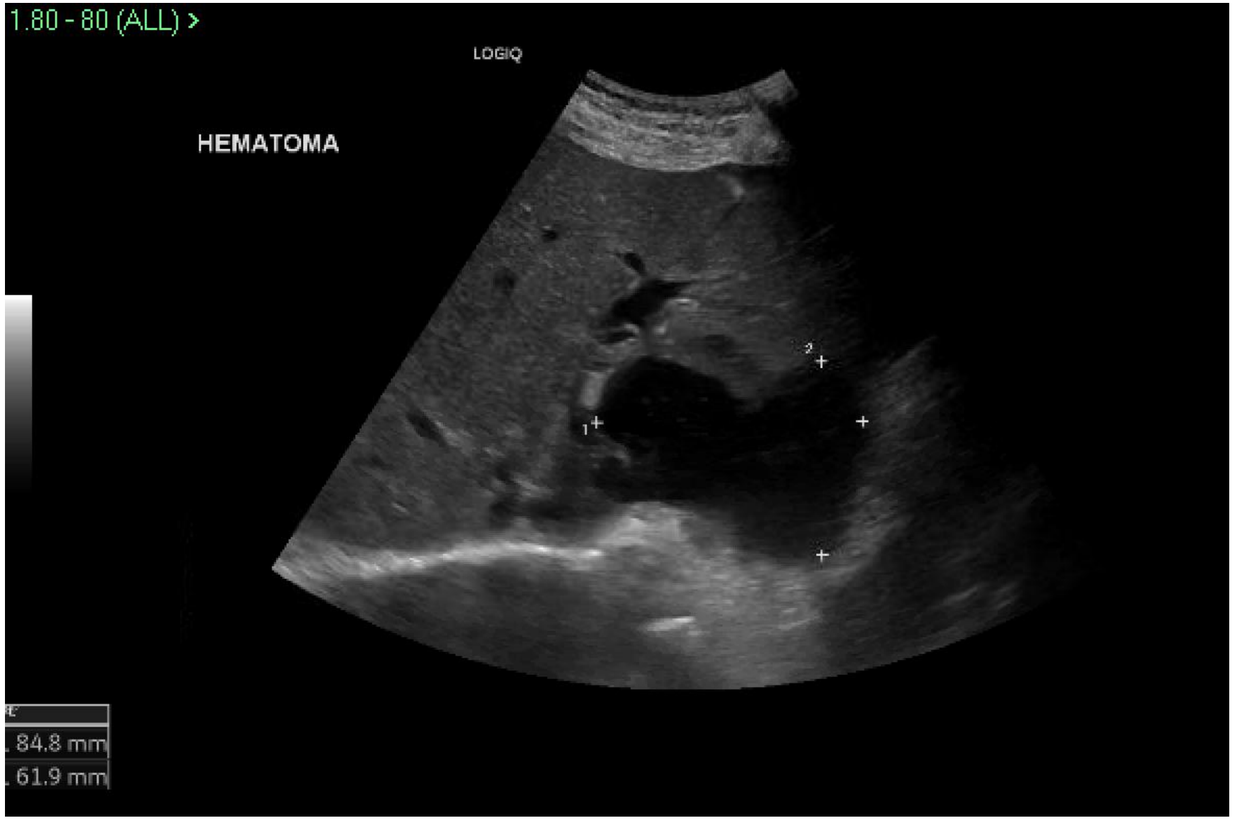
COLLECTIONS

- Bile leak
- Haematoma
- Seroma
- Abscess
- Ascites

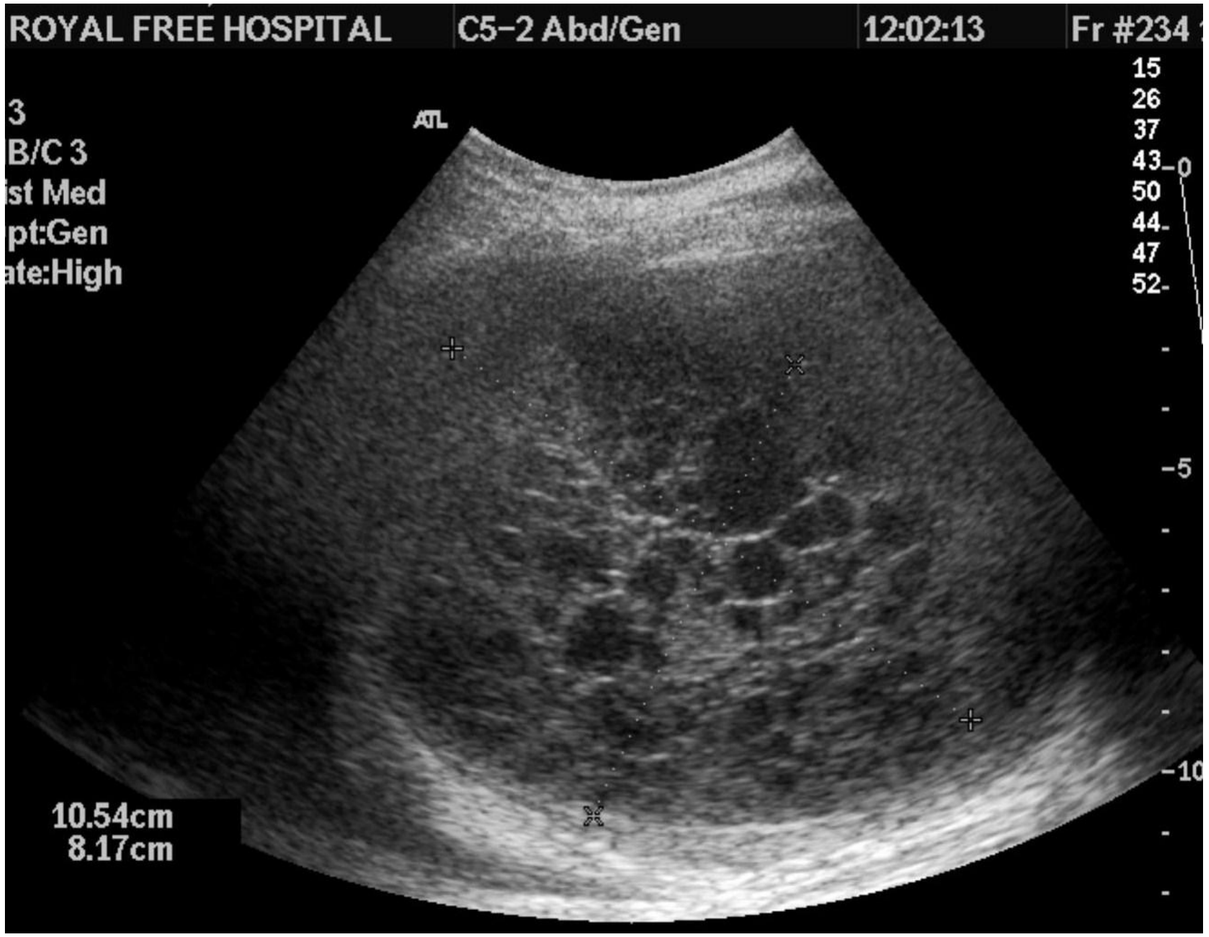


HAEMATOMA





BILE LEAK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pt:Gen
ate:High
ATL
15
26
37
43
50
44
47
52
10.54cm
8.17cm

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Thank you –

and may all your Dopplers demonstrate good flow…

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