Imaging of Pediatric Transplant Patients

A multi-modality approach

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Children's Hospital
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No disclosures

Objectives:

- Describe the role of imaging and the pediatric radiologist in:
  - Pre-op work up
  - Immediate post-op complications
  - Surveillance / late complications

- Review findings using a variety of modalities
  - Vascular Doppler ultrasound
  - CT angiogram with multi-phase imaging
  - MRI/MRCP with hepatobiliary agents
  - Interventional procedures

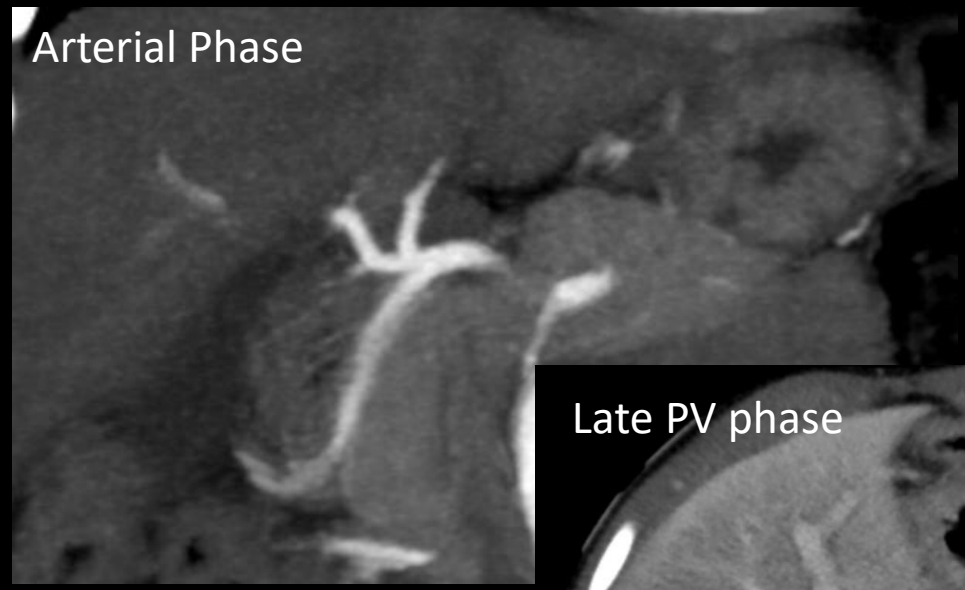
- Focus on liver and renal transplants

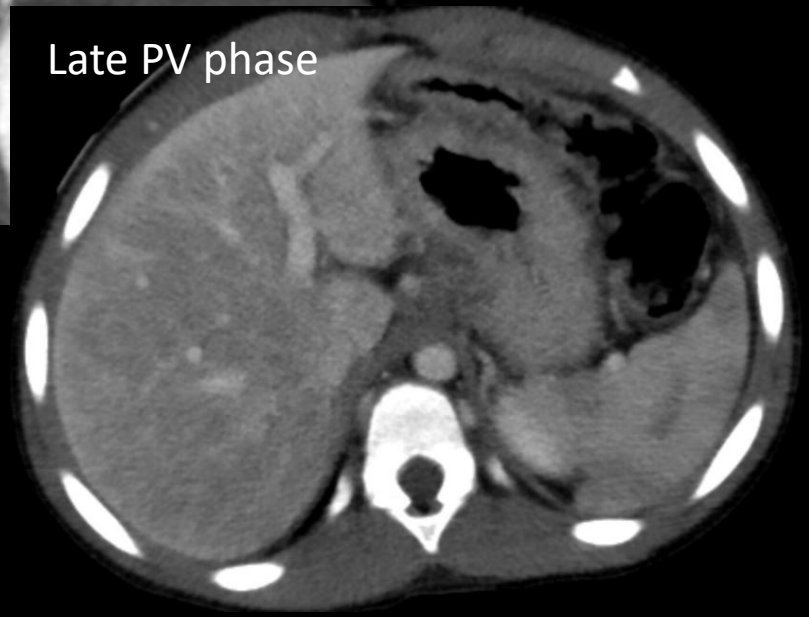
Liver Transplants

Liver: Case 1 - Pre-op evaluation

US normal

→ Multi-phase → CTA





7 yo male presents in acute fulminant liver failure with encephalopathy

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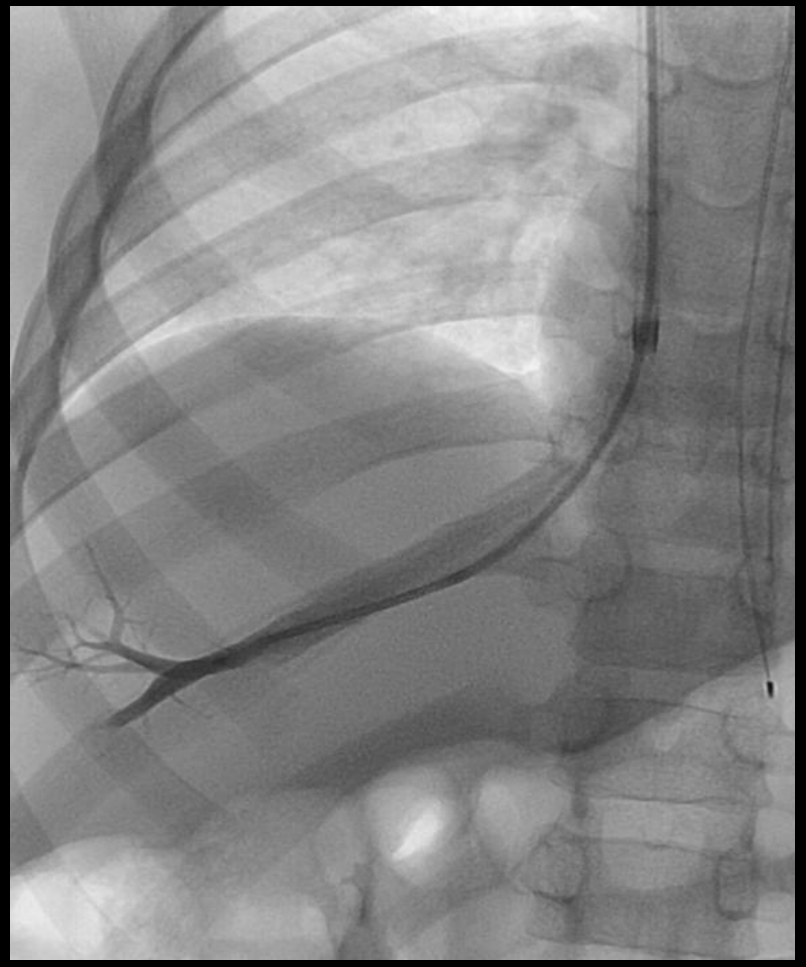
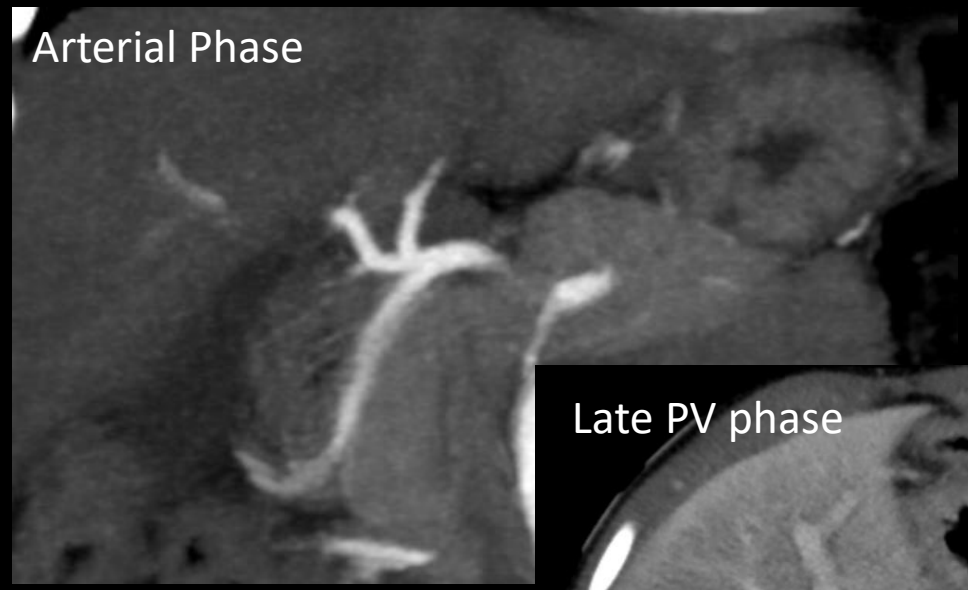
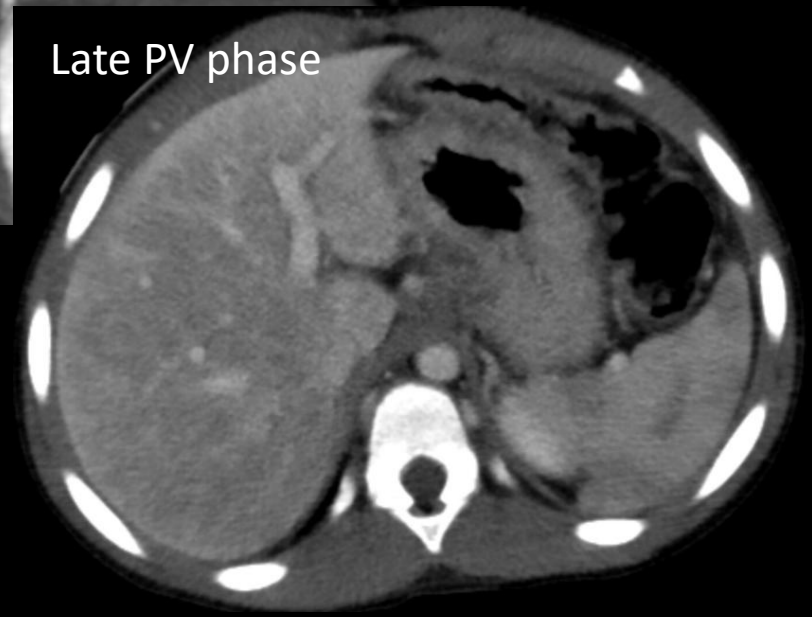
Liver: Case 1 - Pre-op evaluation



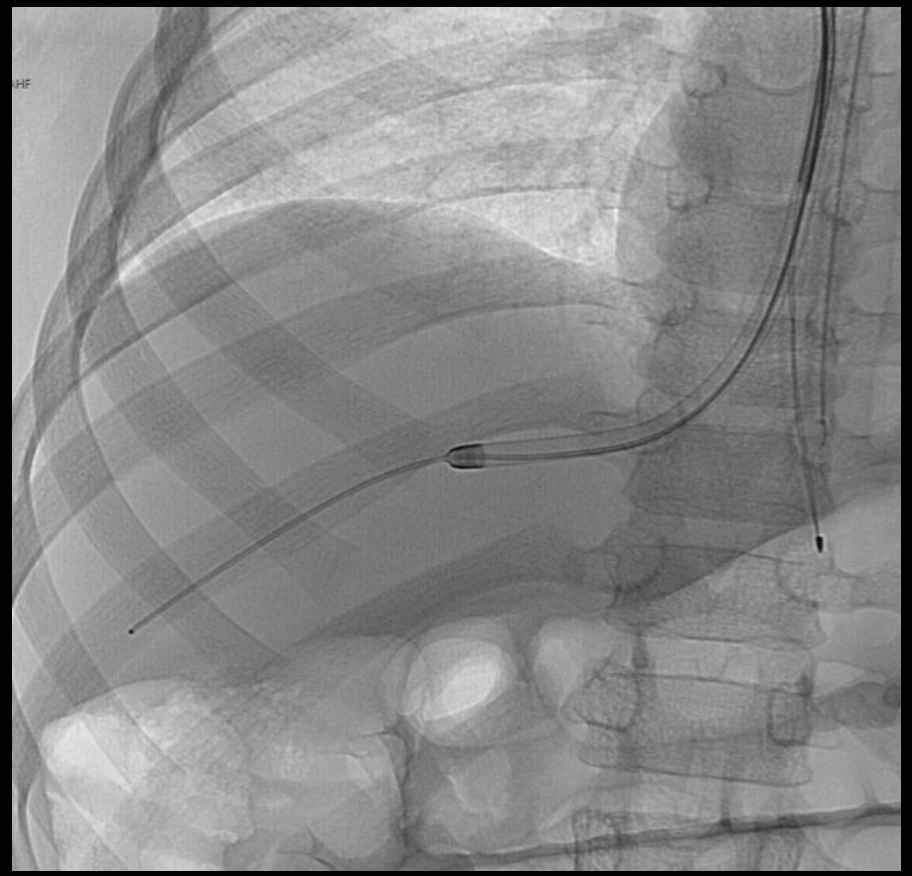




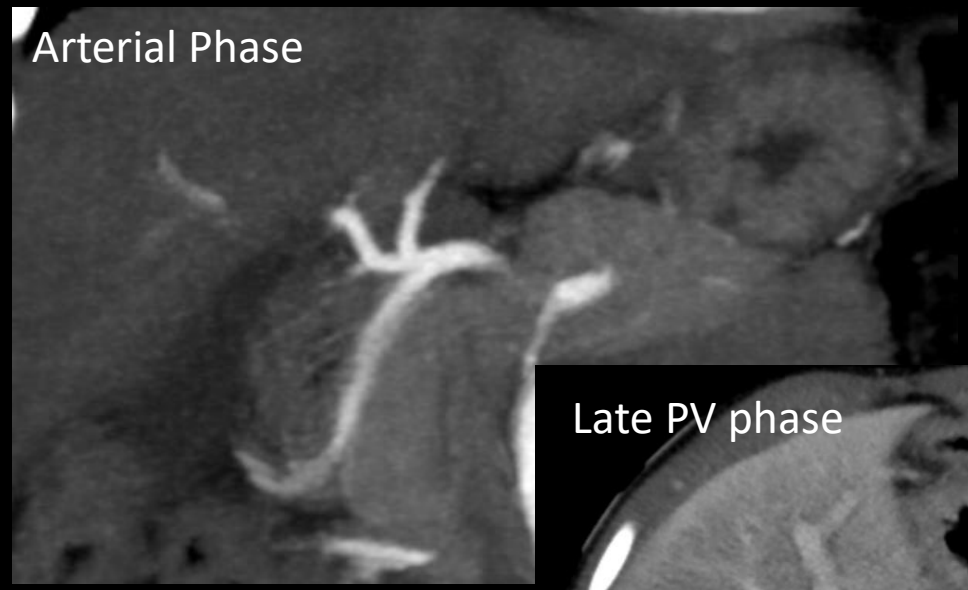
← IR ←

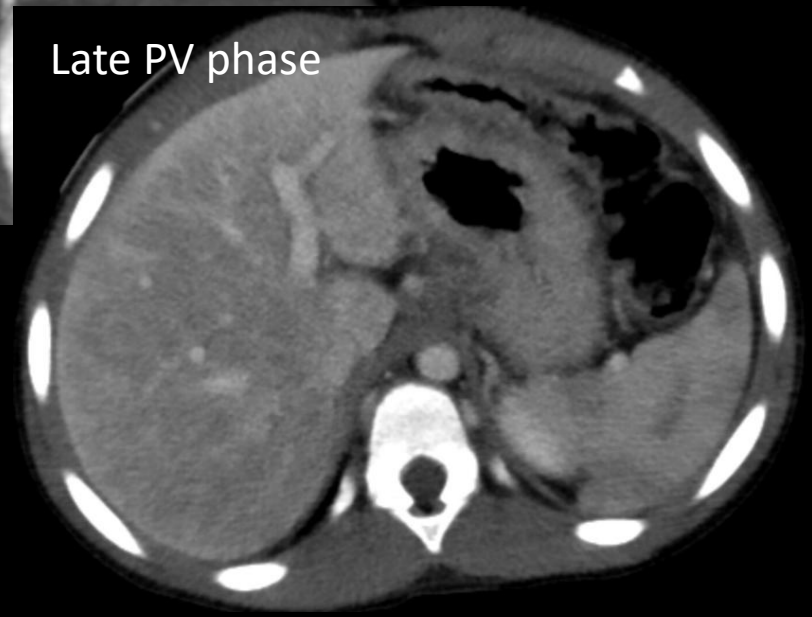
7 yo male presents in acute fulminant liver failure with encephalopathy

Liver: Case 1 - Pre-op evaluation



Dx: Autoimmune hepatitis





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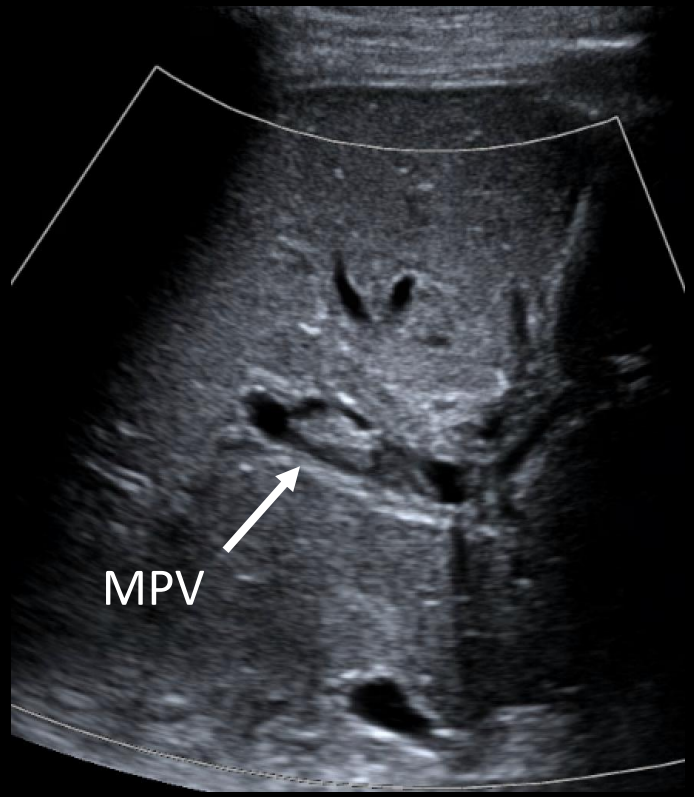
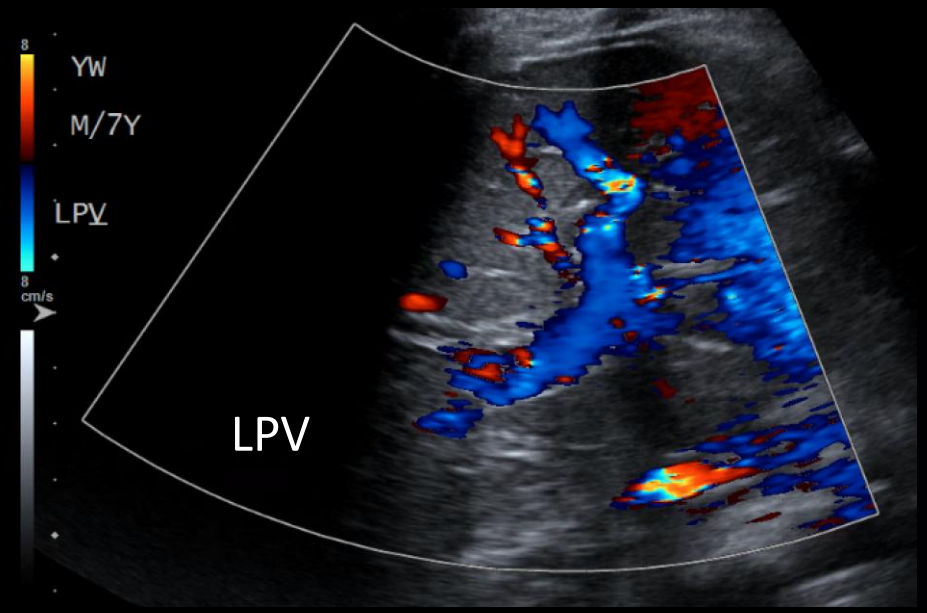
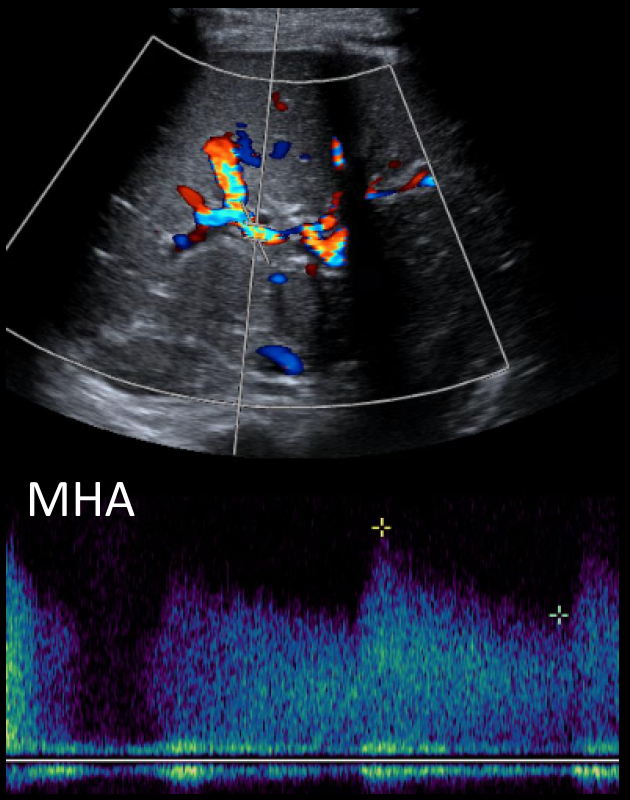
7 yo male presents in acute fulminant liver failure with encephalopathy

Liver: Case 1 - Post-op evaluation



POD 1 US





Patient underwent liver transplant 4 days later

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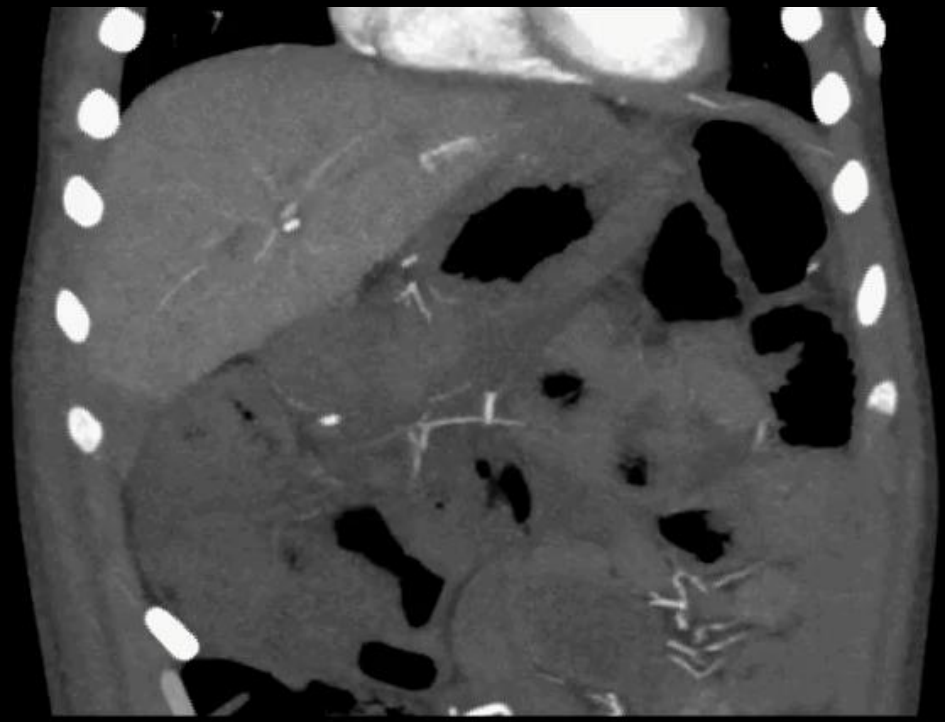
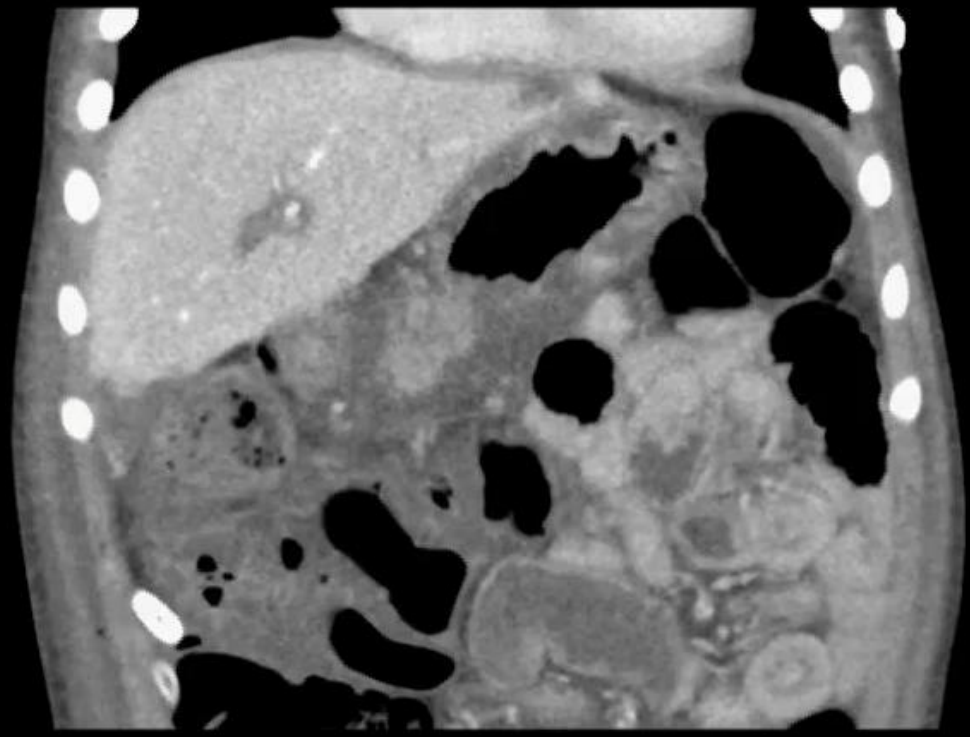
Liver: Case 1 - Post-op evaluation



Arterial phase



Portal venous phase

Post-op triple phase CTA

Patient underwent liver transplant 4 days later

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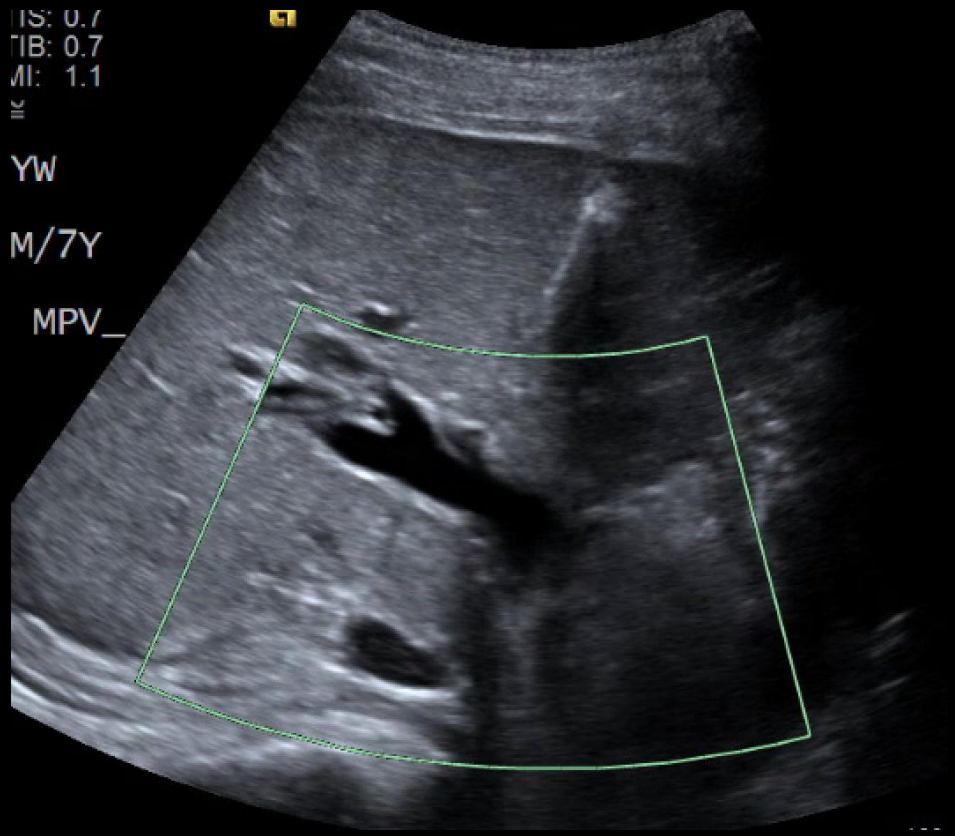
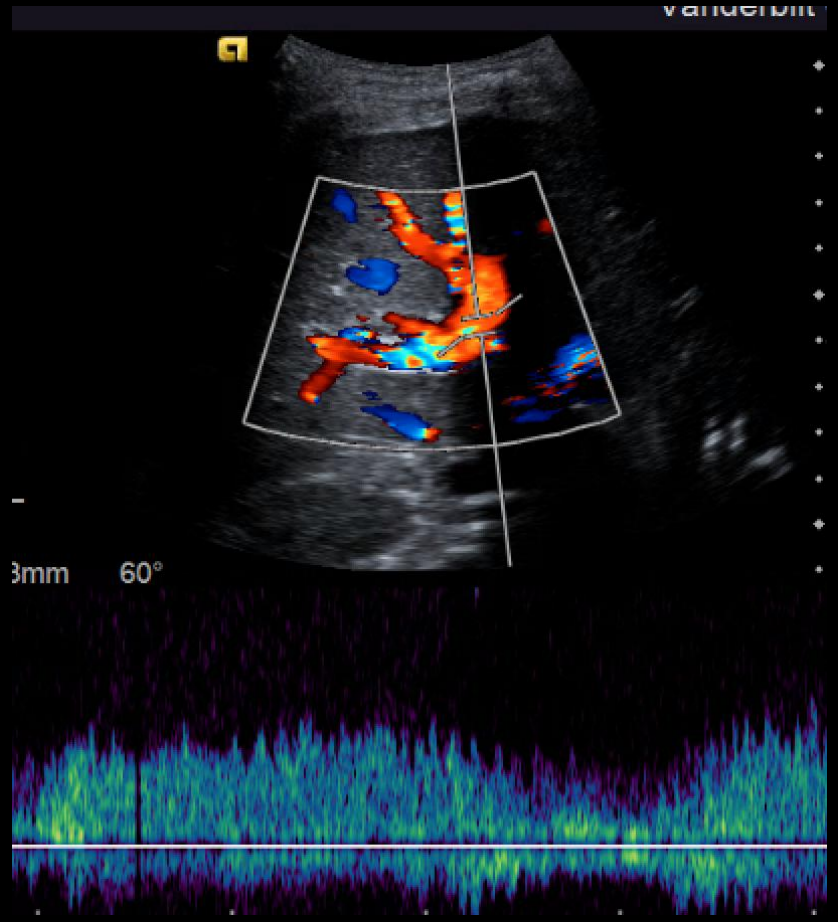
Liver: Case 1 - Post-op evaluation





Same day PV thrombectomy in the OR

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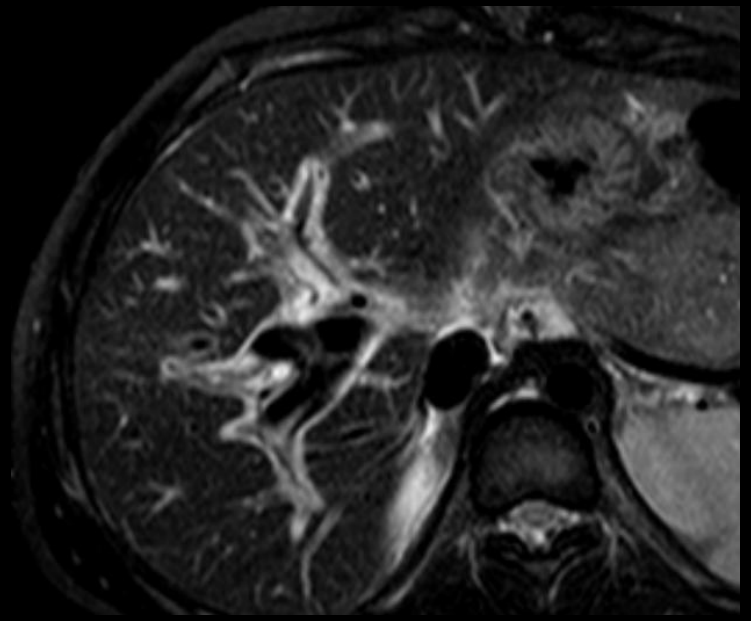
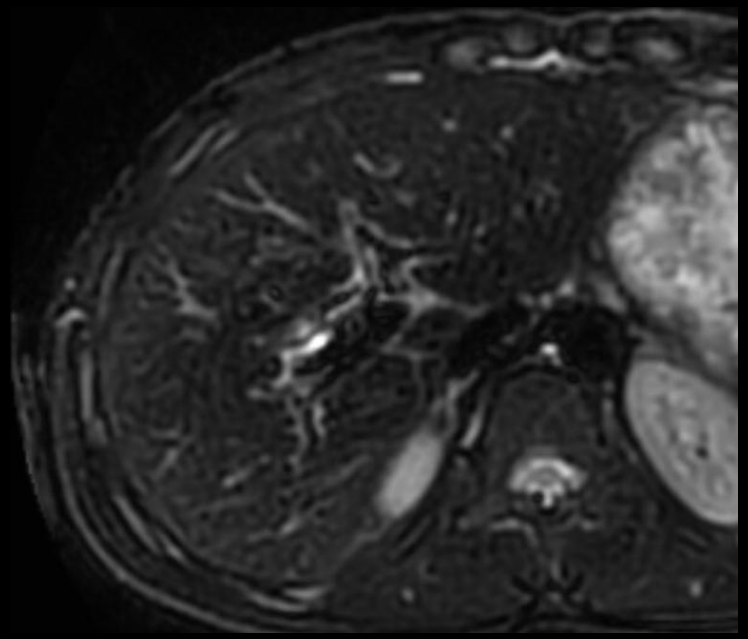
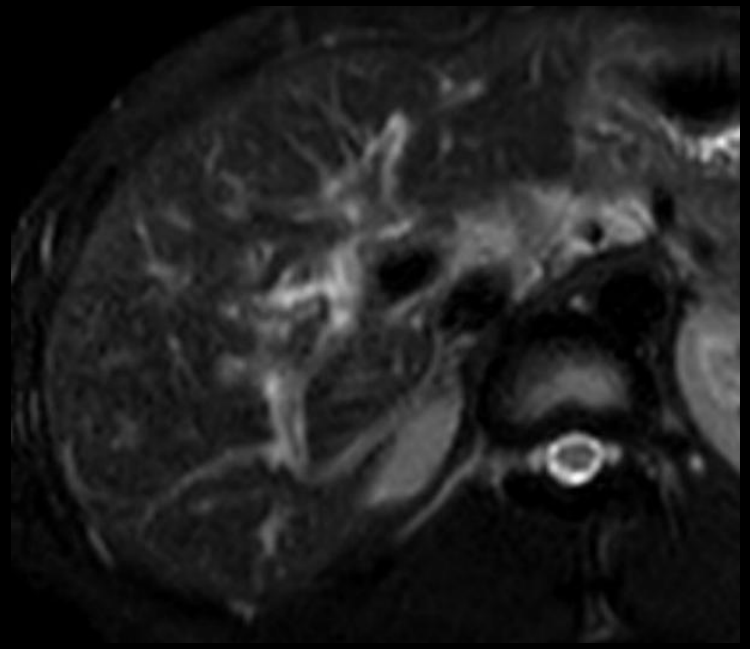
Liver: Case 1 – surveillance/late complications



2020
“moderate acute cellular rejection



2021
“Negative for acute cellular rejection



2025
“acute cholangitis. Neg for acute cellular rejection

Current status – 9 years post transplant

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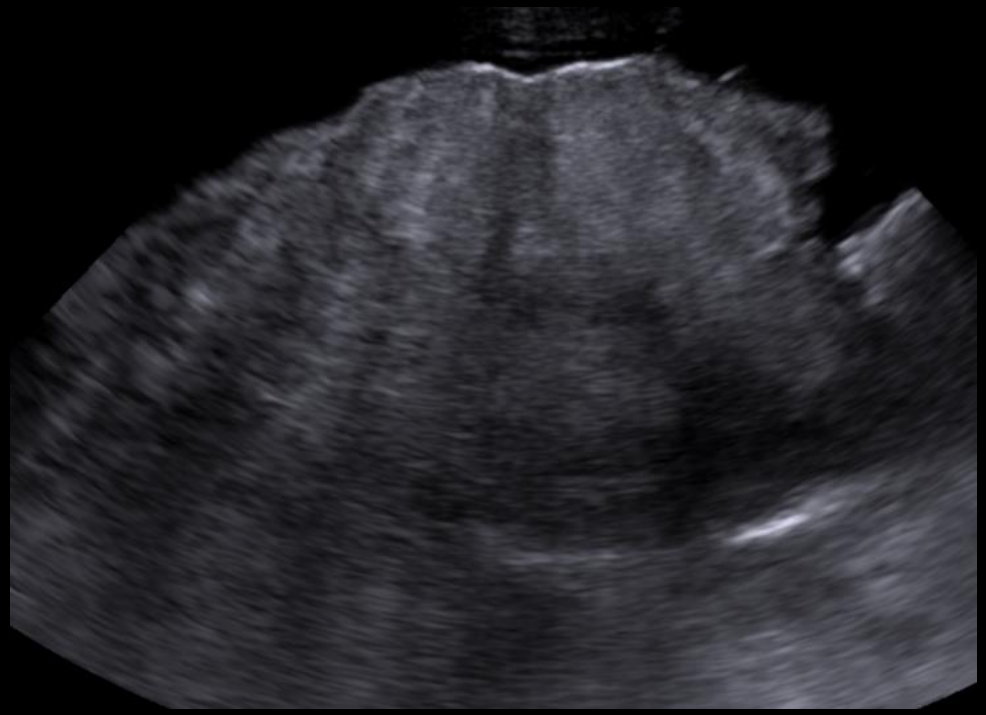
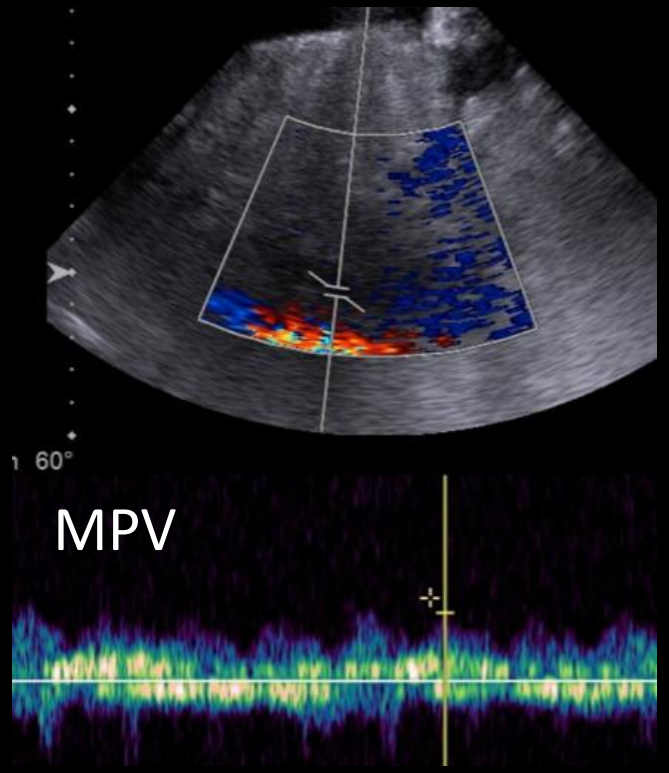
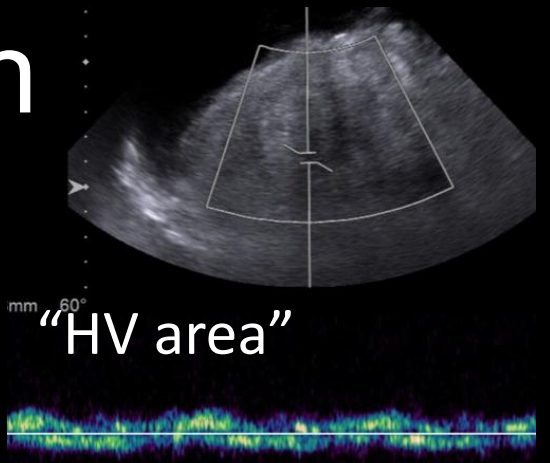
Liver: Case 2 - Pre-op evaluation

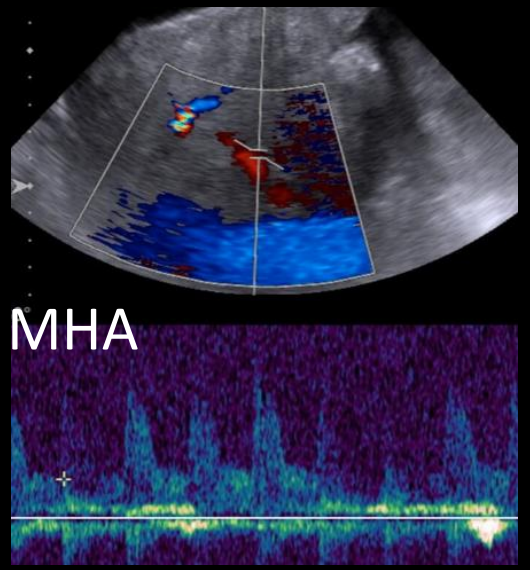


TRV liver





"HV area"



14 yo F with CF lost to care, presenting with synthetic liver dysfunction, ascites

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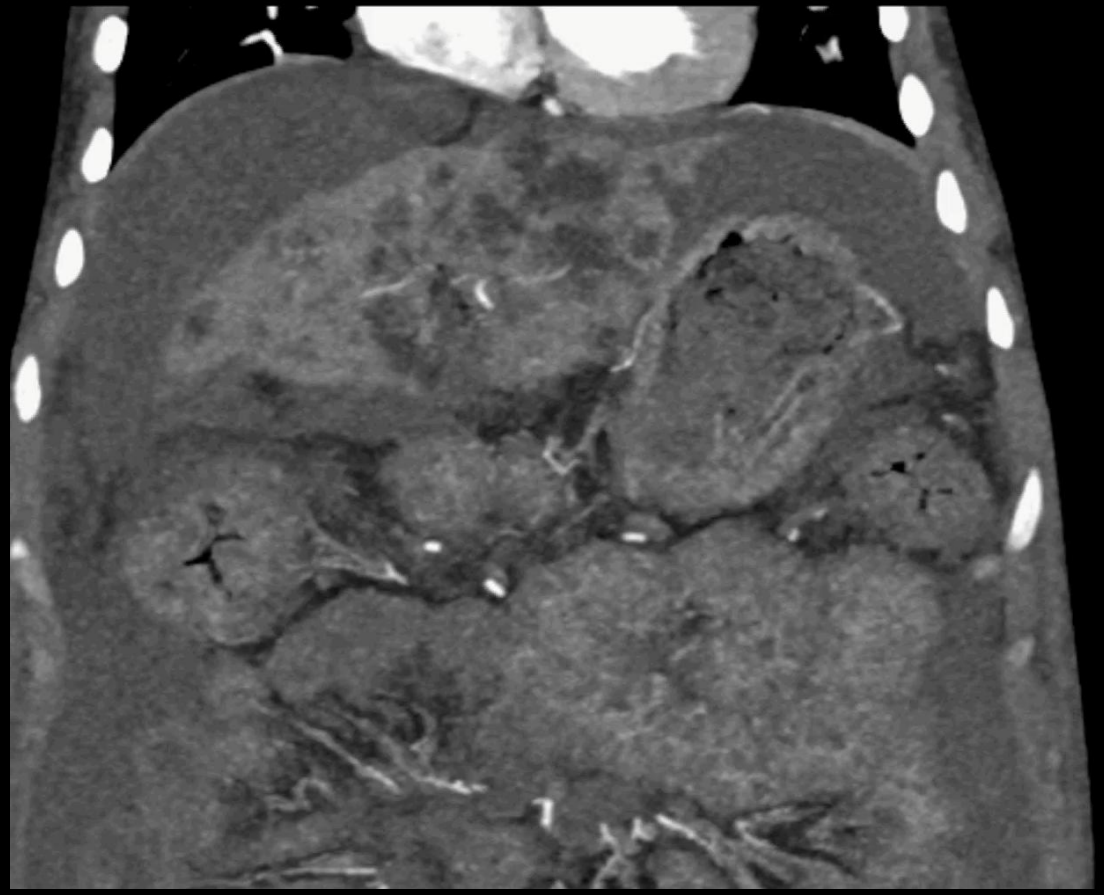
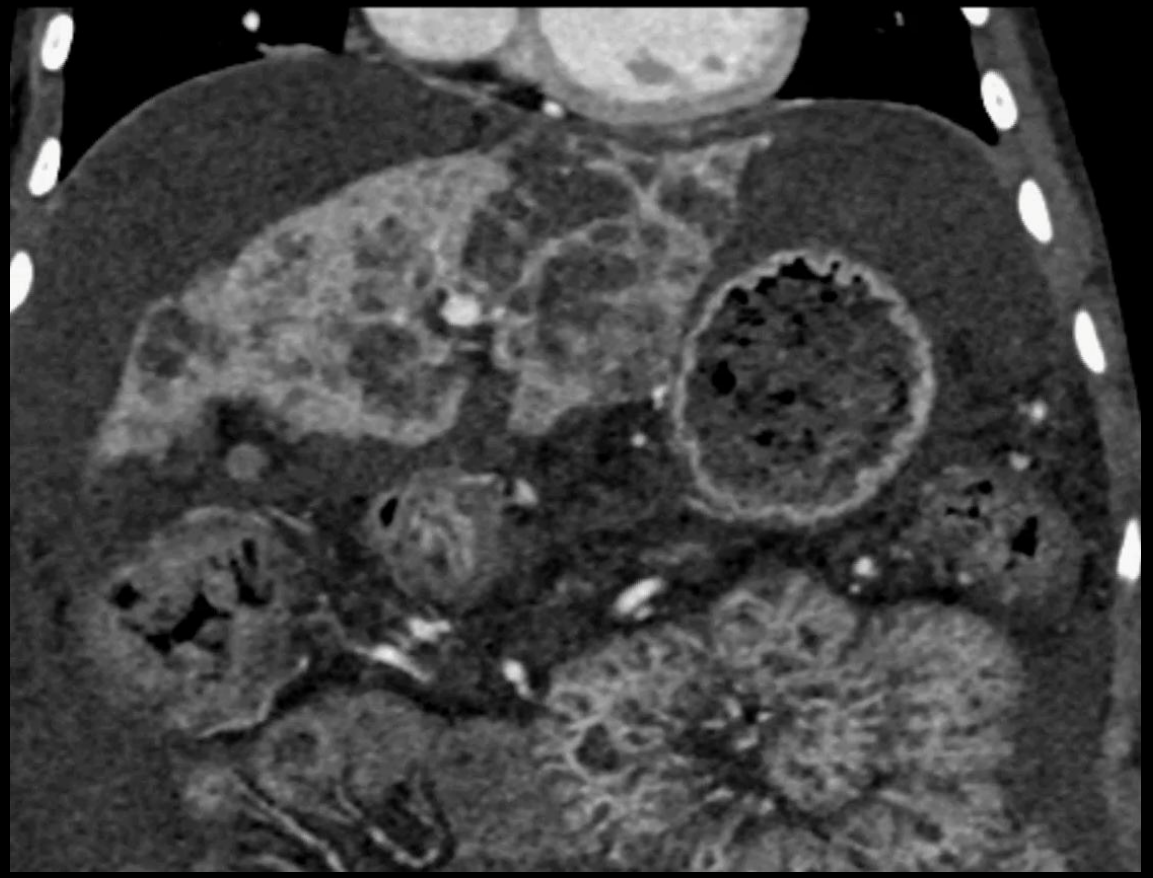
Liver: Case 2 - Pre-op evaluation



Arterial



Early PV

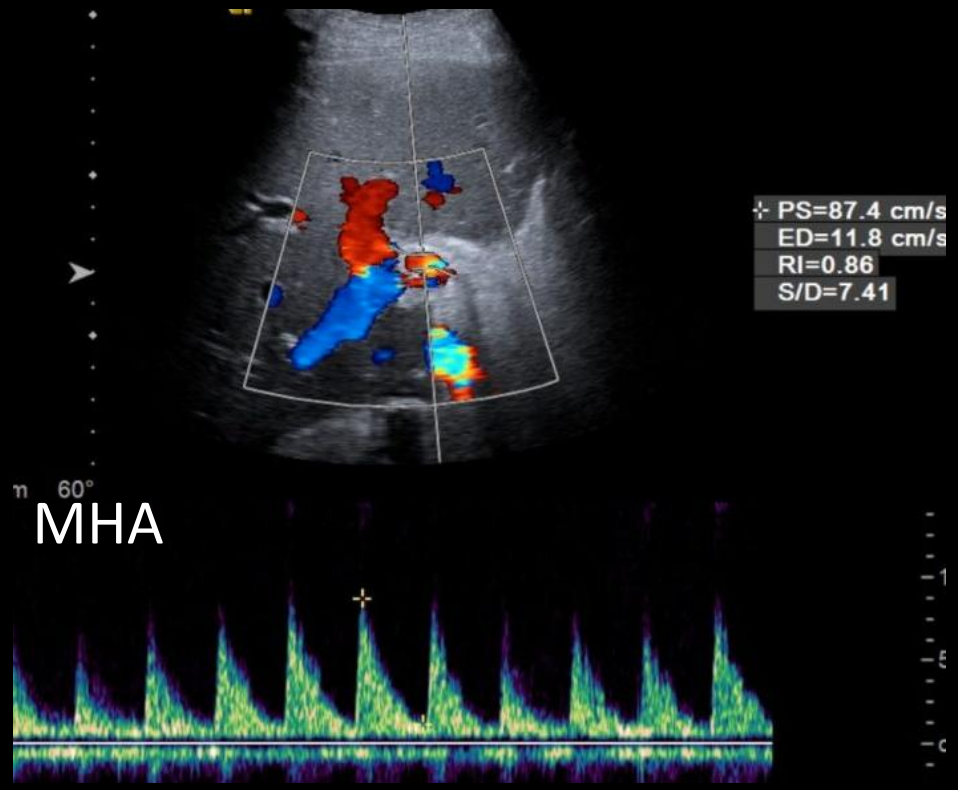
Pre-op eval for liver transplantation, triple phase CTA

Liver: Case 2 - Pre-op evaluation

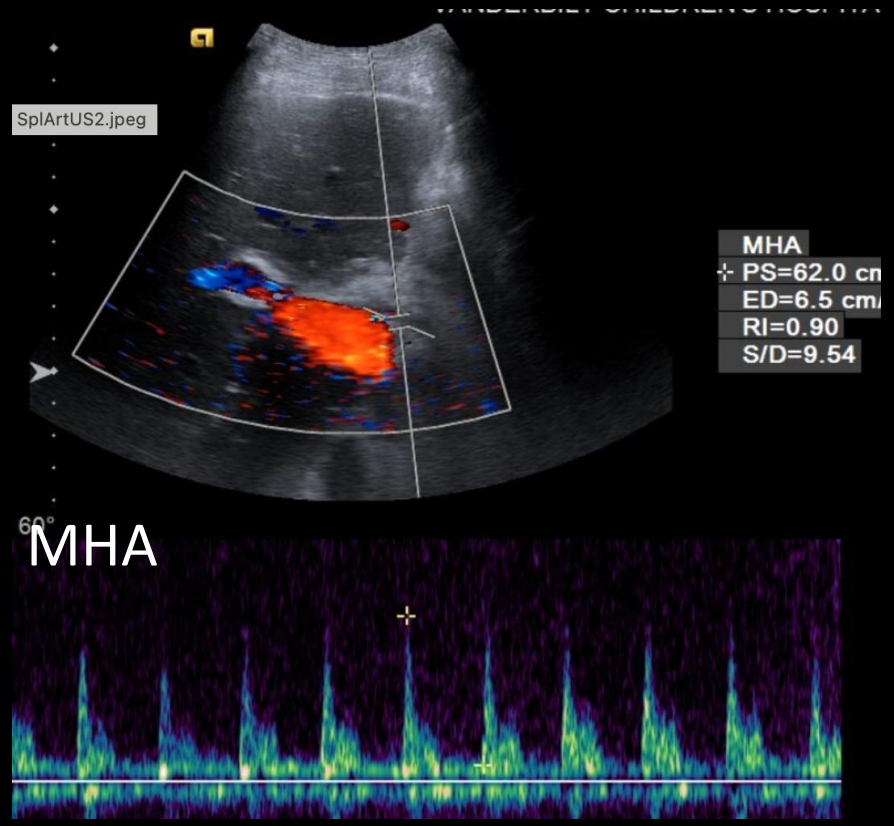
Late venous

Pre-op eval for liver transplantation, triple phase CTA

Liver: Case 2 - Post-op evaluation



POD 1



POD 2

6 weeks later, pt undergoes liver transplantation

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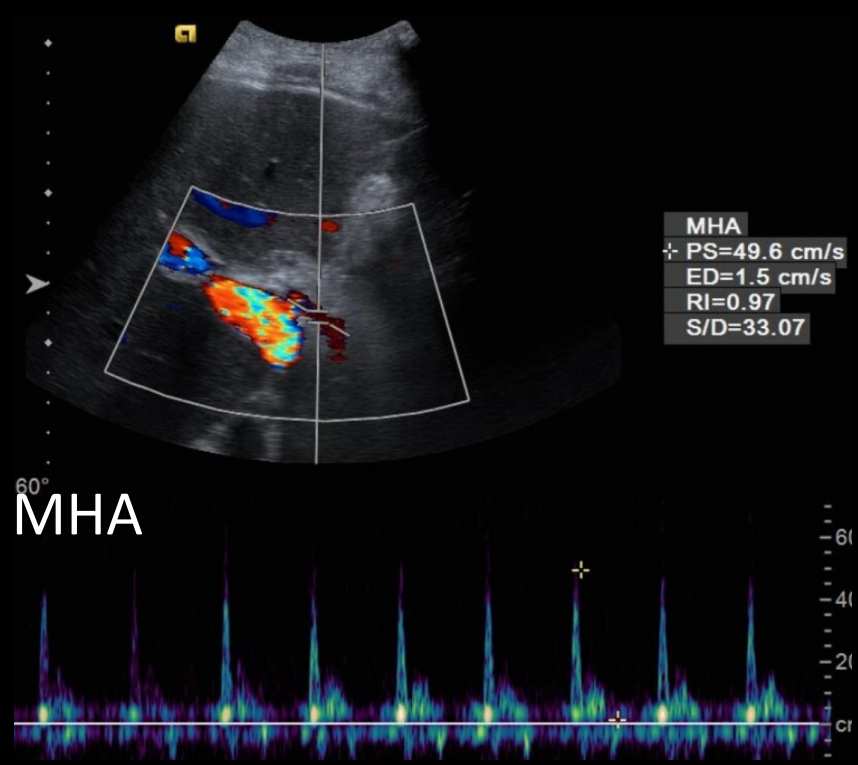
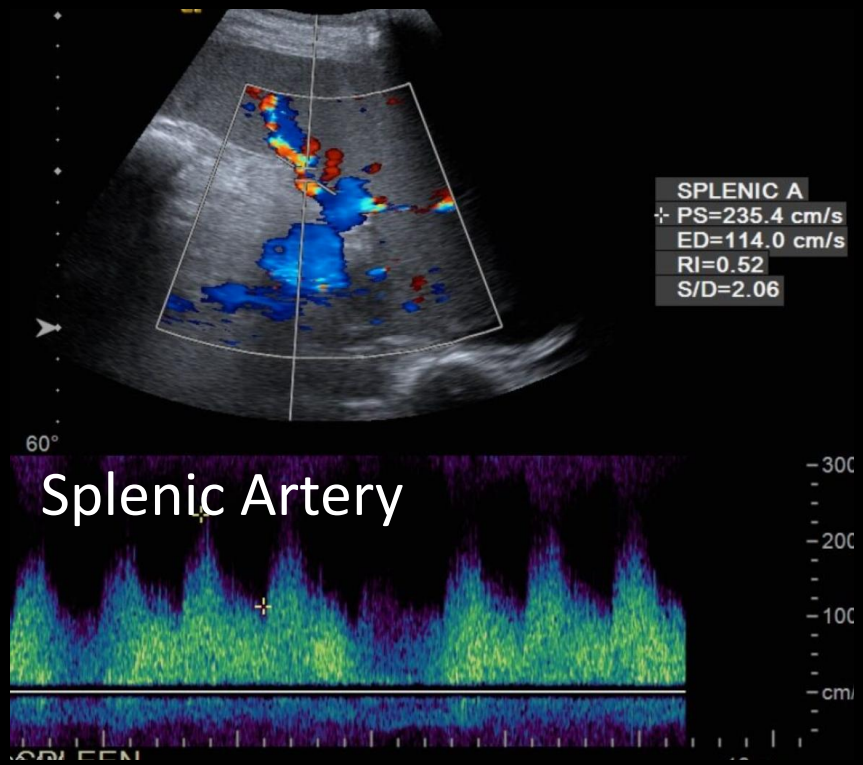
Liver: Case 2 - Post-op evaluation





POD 3

6 weeks later, pt undergoes liver transplantation

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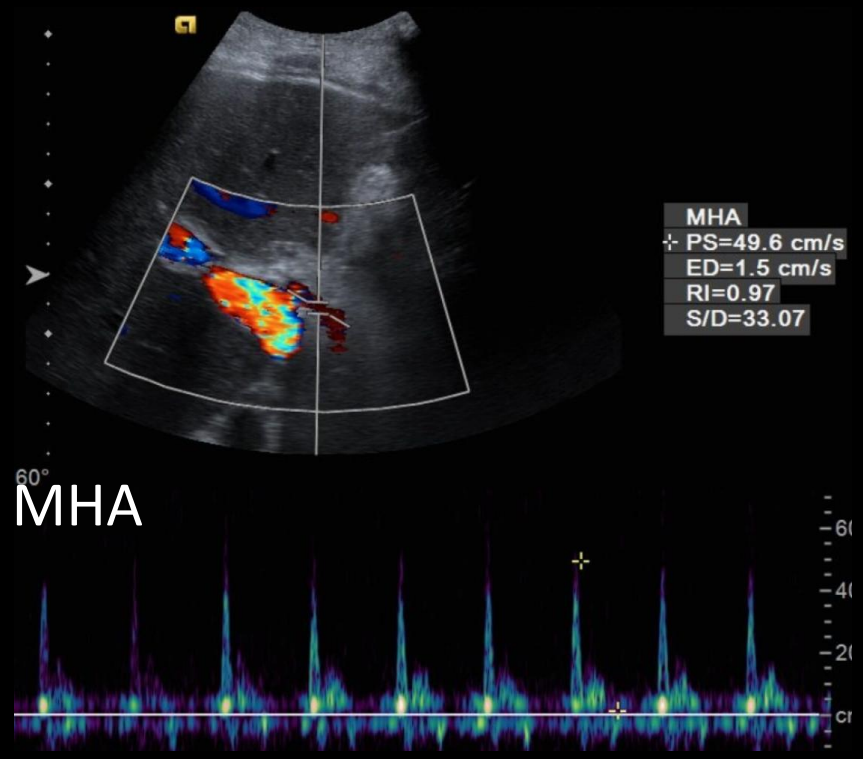
Liver: Case 2 - Post-op evaluation



POD 3

Findings concerning for Splenic Artery Steal Syndrome (SASS):

- Hypoperfusion of the liver transplant (reduced diastolic flow/elevated RI >0.8)
- No evidence of HA stenosis
- High velocities in the splenic artery (>115 cm/s)

6 weeks later, pt undergoes liver transplantation

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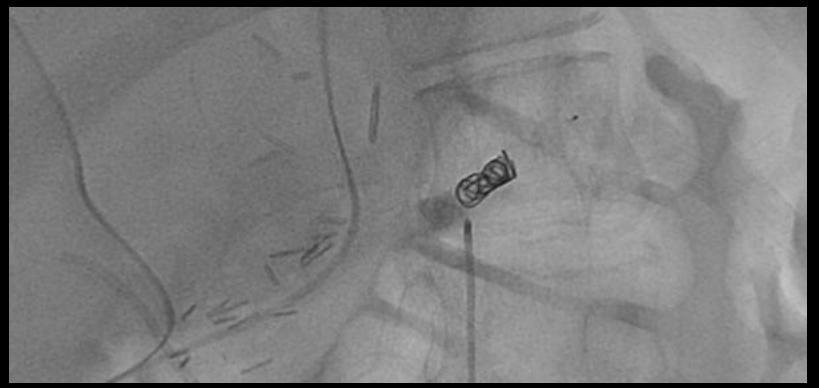
Liver: Case 2 - Post-op evaluation

Catheter-guided celiac artery angiography

with Amplatzer plug



With addition of microcoils

Next day - To the Interventional Suite

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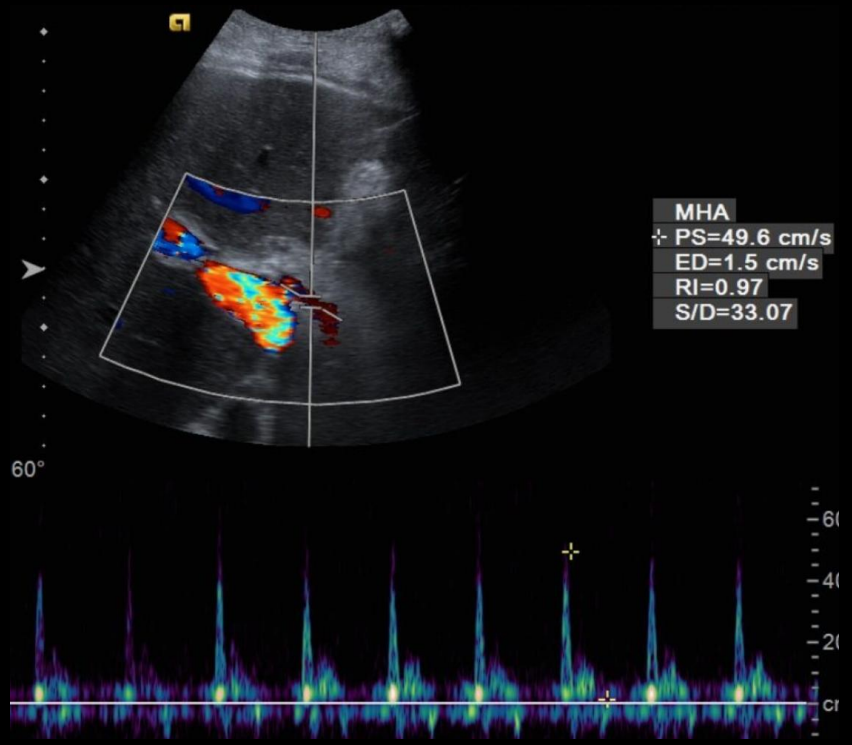
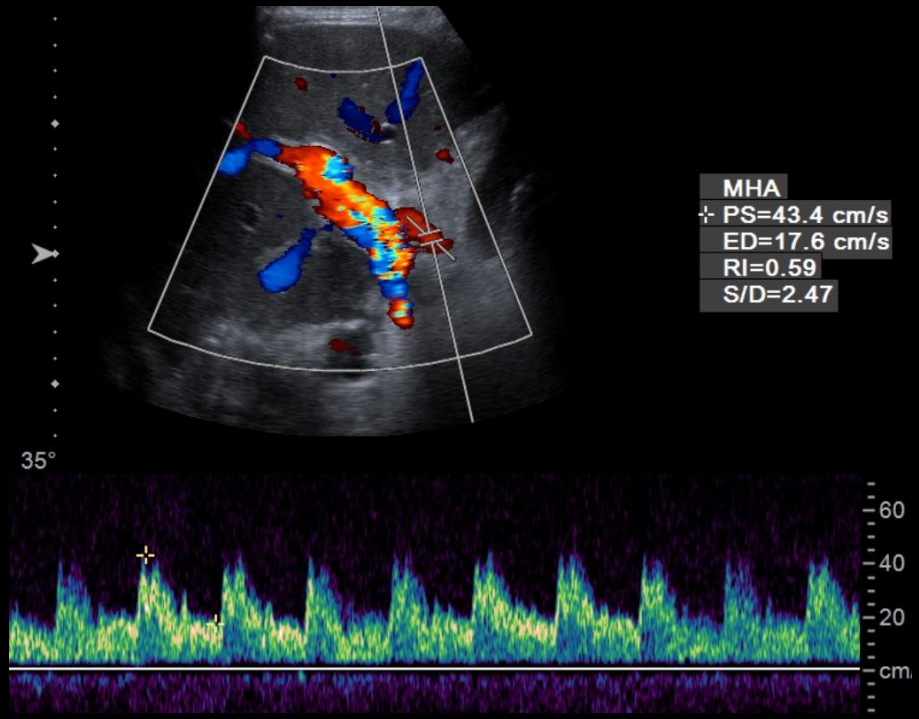
Liver: Case 2 - Post-op evaluation



MHA before

Splenic artery embolization →



MHA after

Pre and post SA embolization

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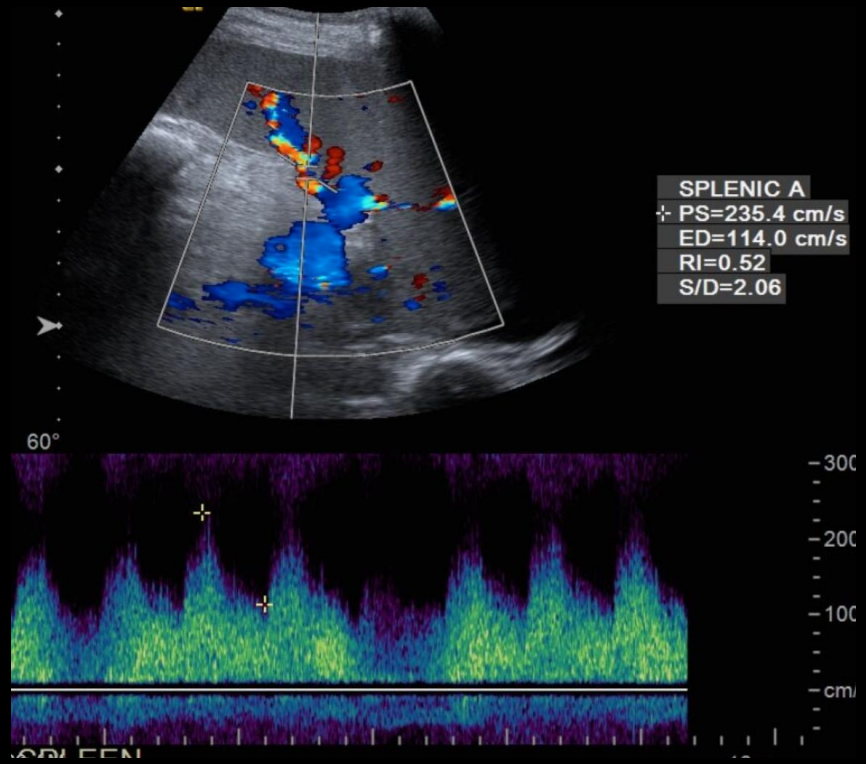
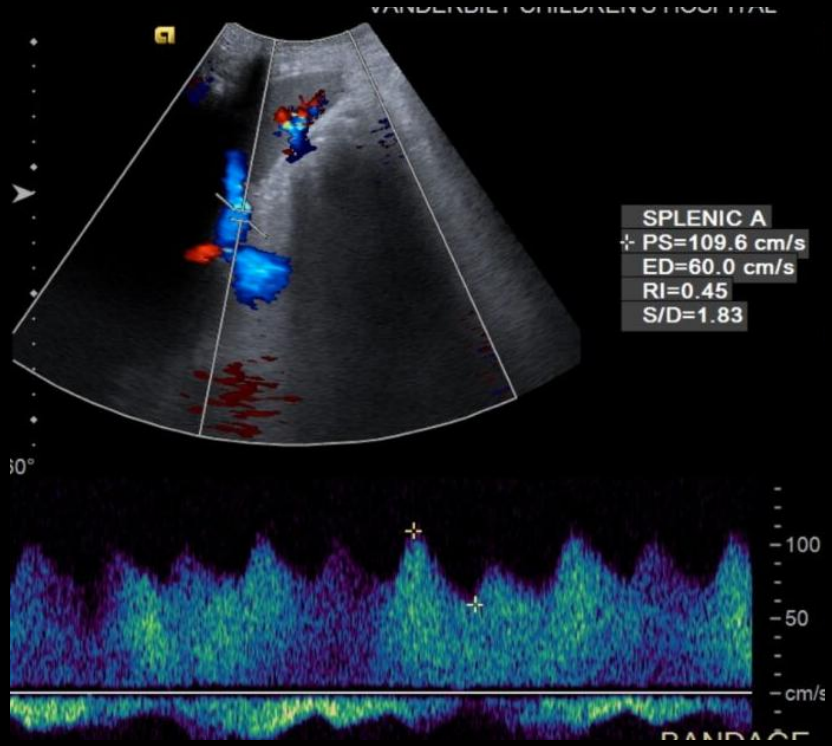
Liver: Case 2 - Post-op evaluation



Splenic A before

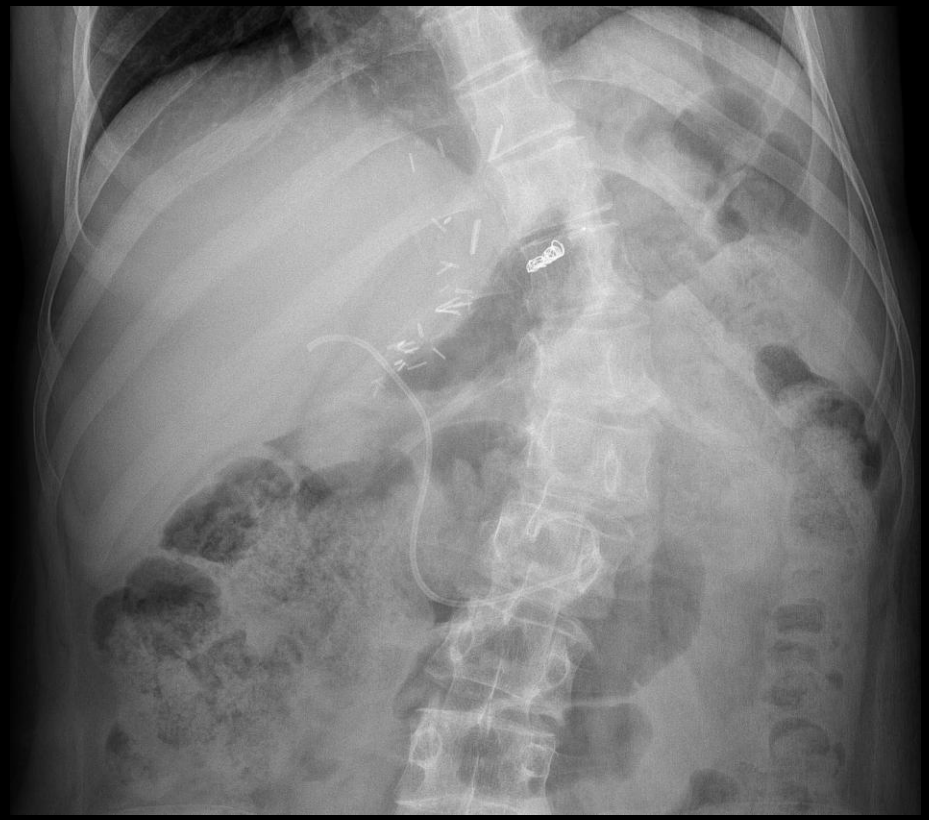
Splenic artery embolization →

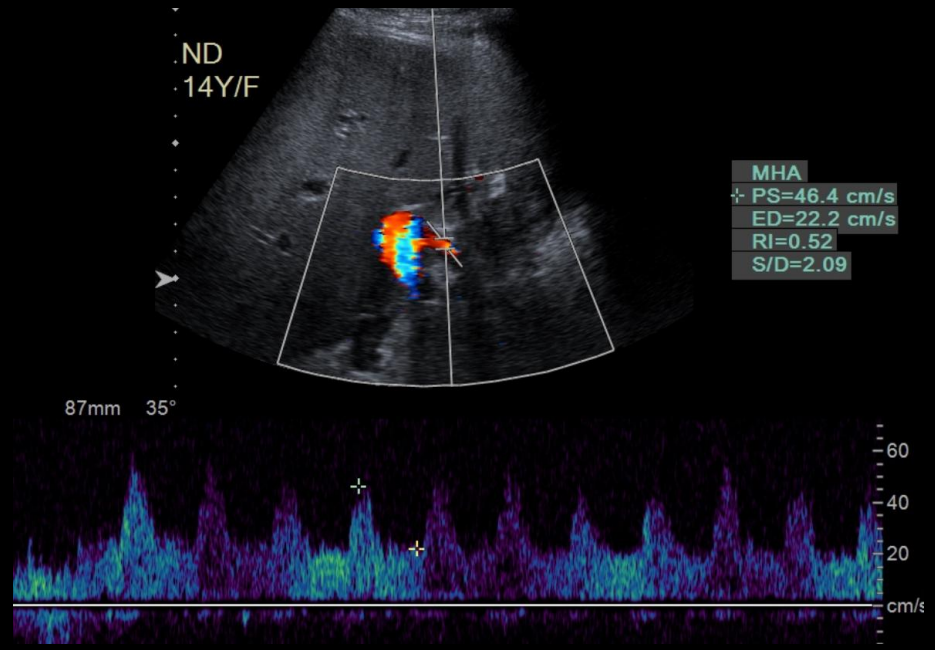


Splenic A after

Pre and post SA embolization

Liver: Case 2 - Post-op evaluation





MHA RI=0.52

Current status – 6 weeks post transplant

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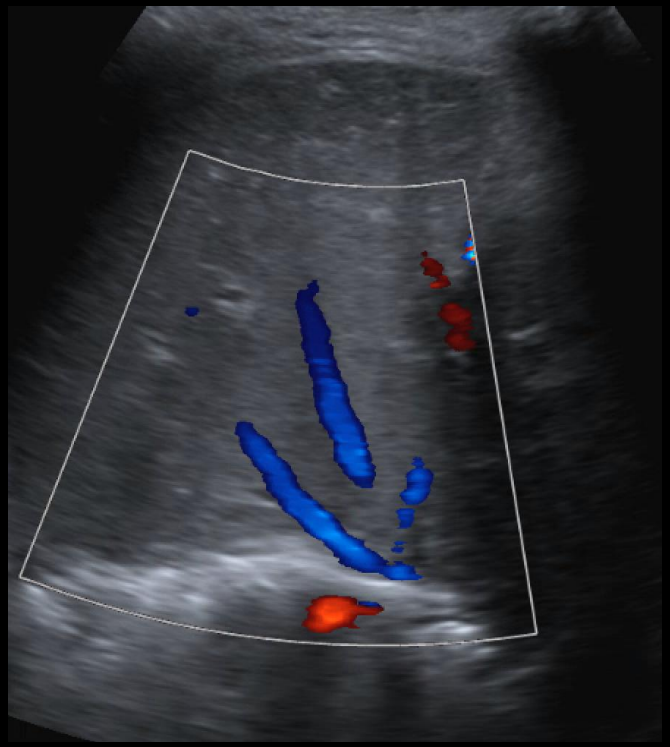
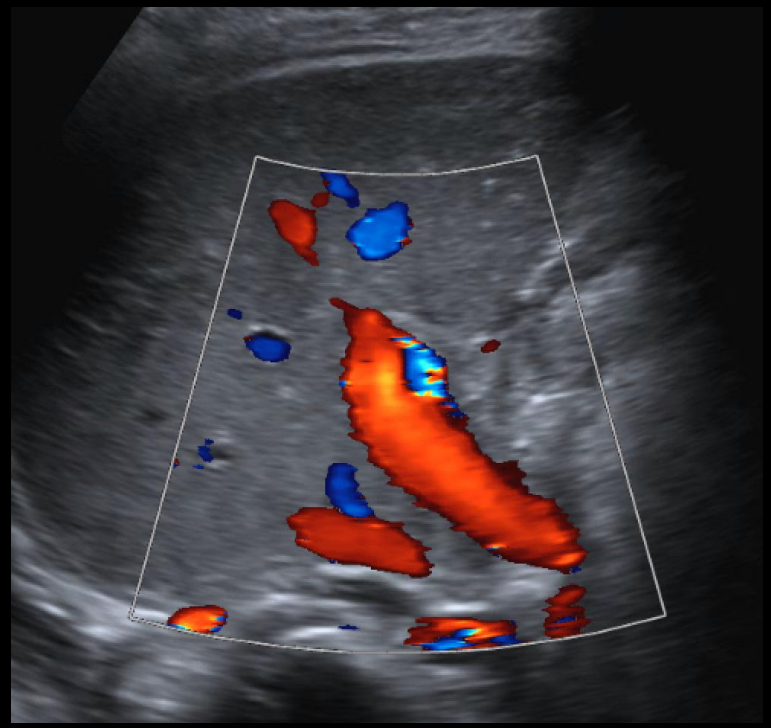
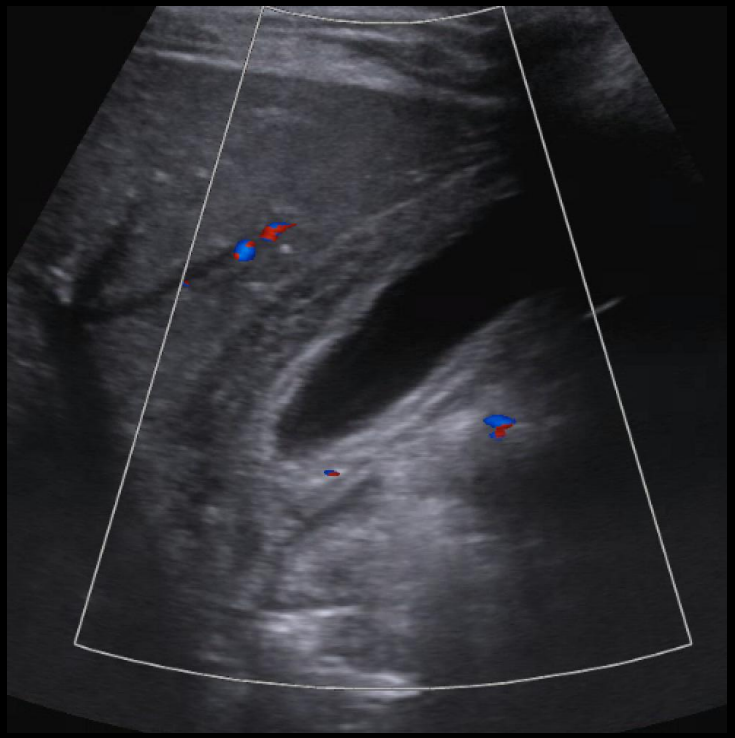
Liver: Case 3 – Pre-op evaluation



HVs patent



MPV patent



GB wall edema

16 mo male presents in acute liver failure, unknown cause, pre-op

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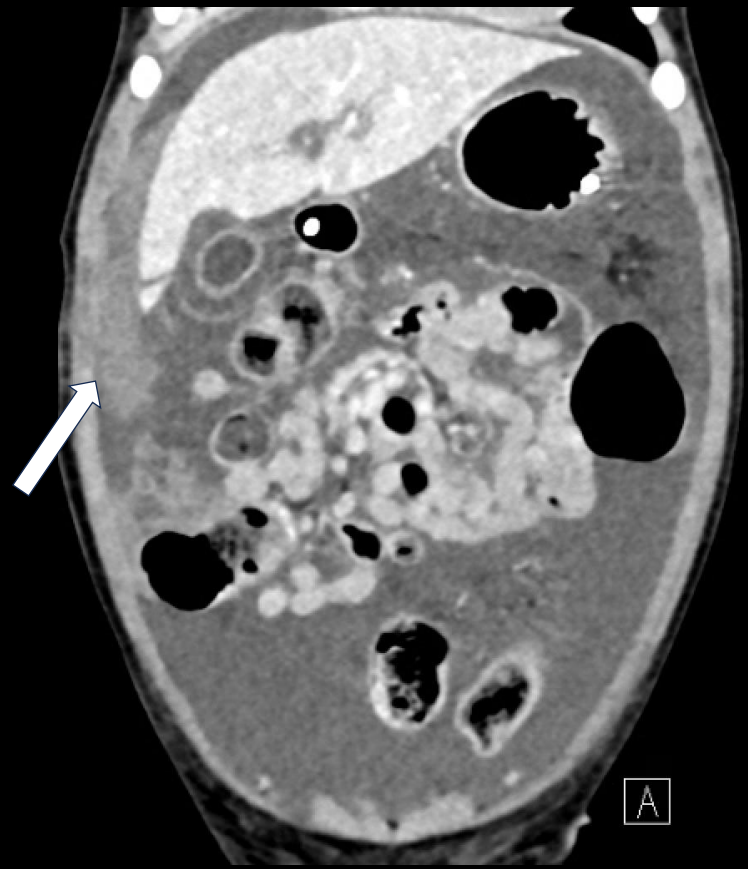
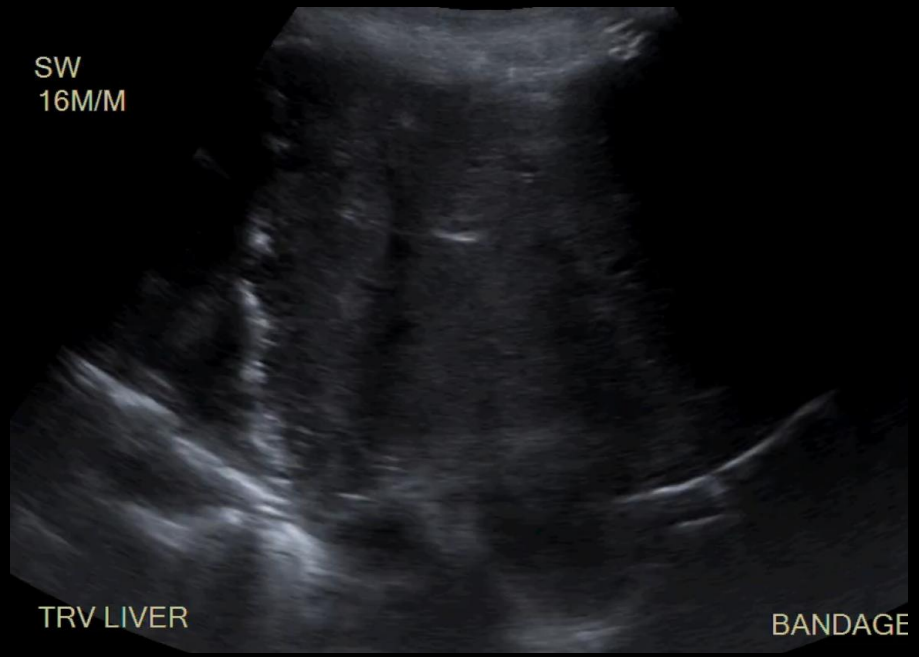
Liver: Case 3 – Pre-op evaluation

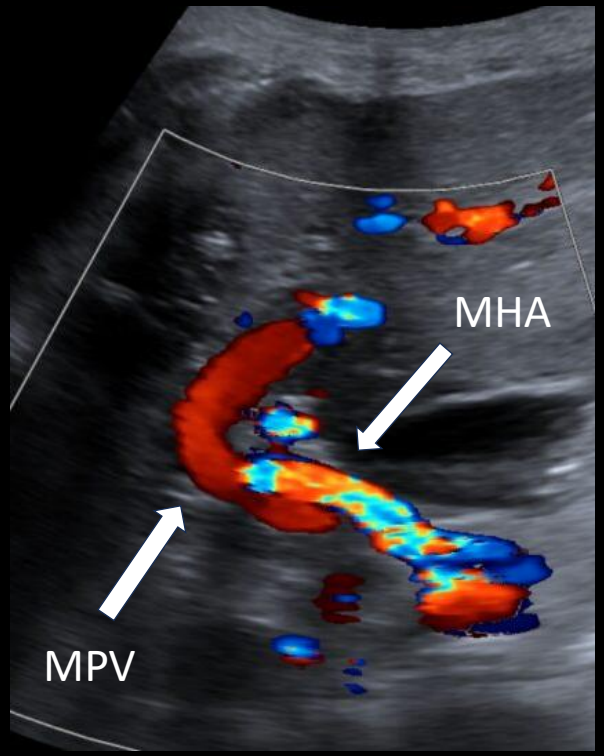


Next day biopsy followed by CT for concern for hemorrhage

Liver: Case 3 – Post-op evaluation



POD #1



POD #2

s/p left lateral segment transplant

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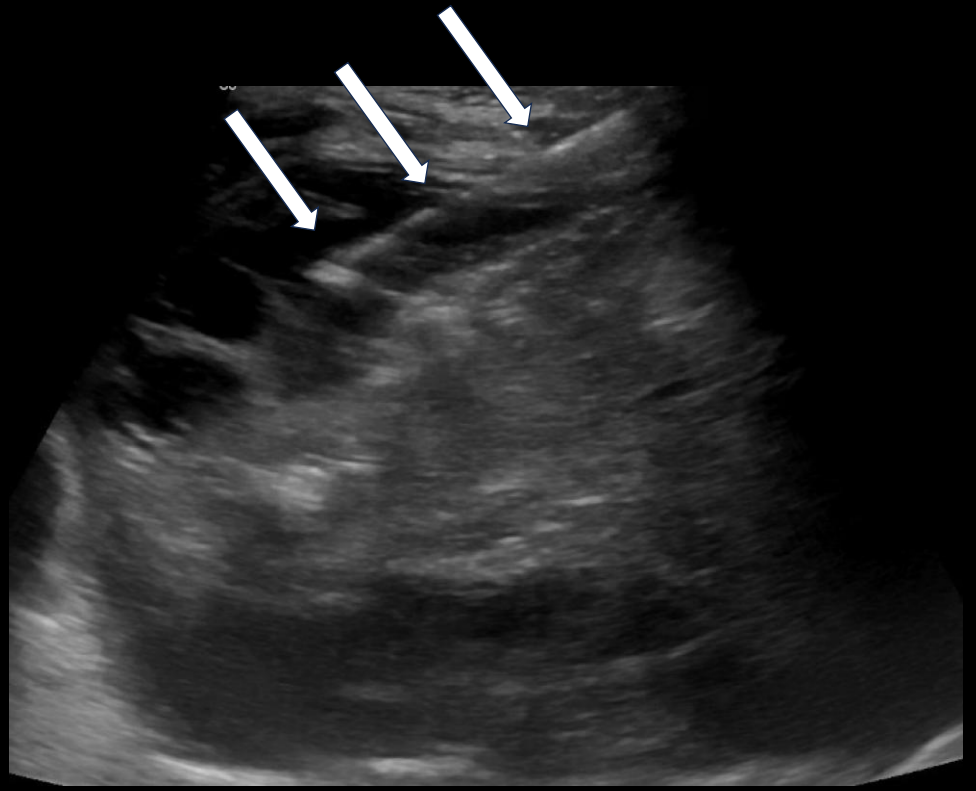
Liver: Case 3 – Post-op evaluation

POD #10 – rising WBC

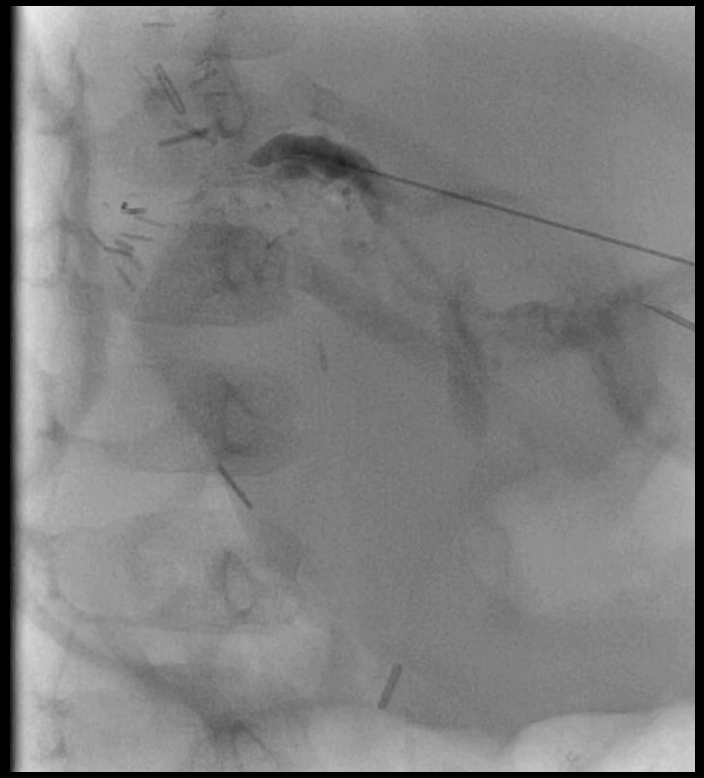
→ To IR →
For abscess drainage

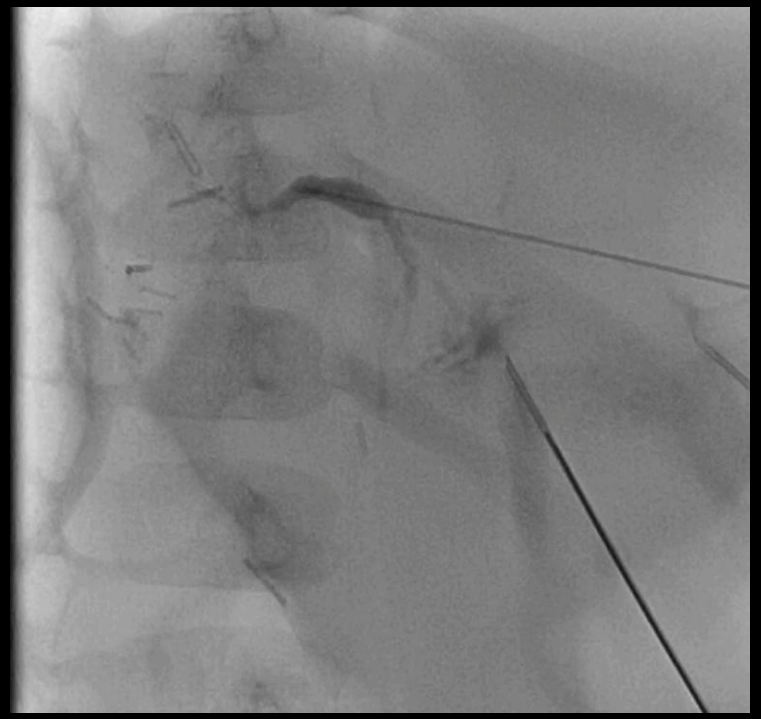


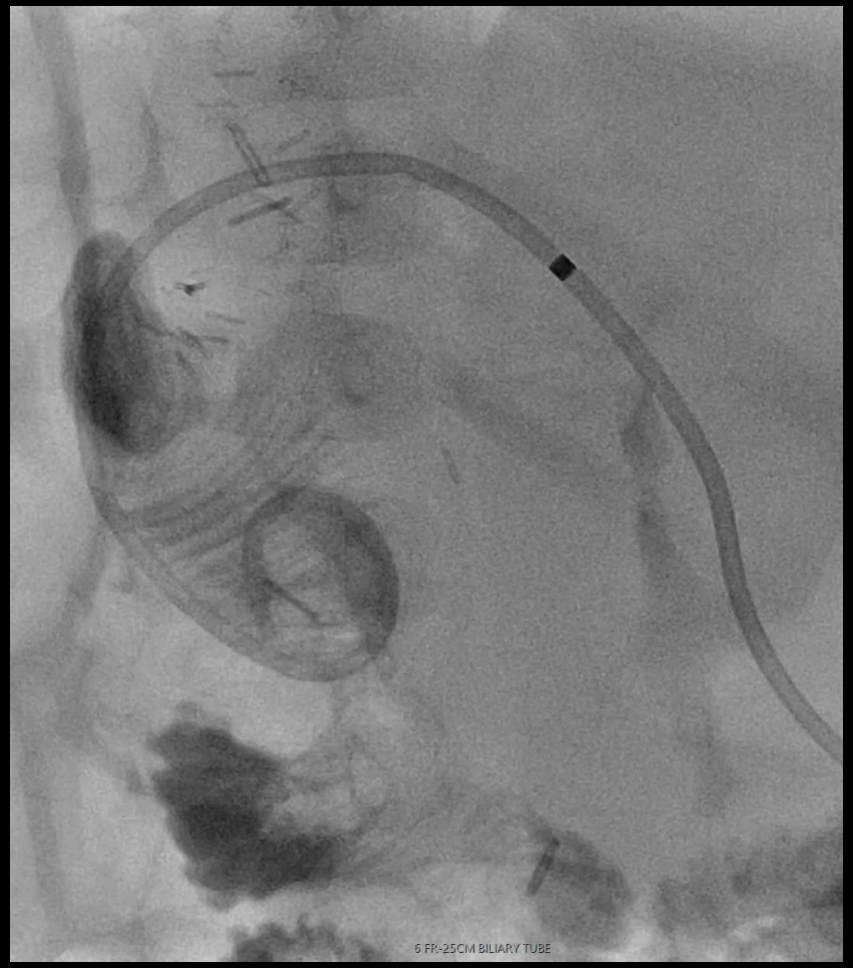
Dx: Biloma/bile leak

s/p left lateral segment transplant

Liver: Case 3 – Post-op evaluation



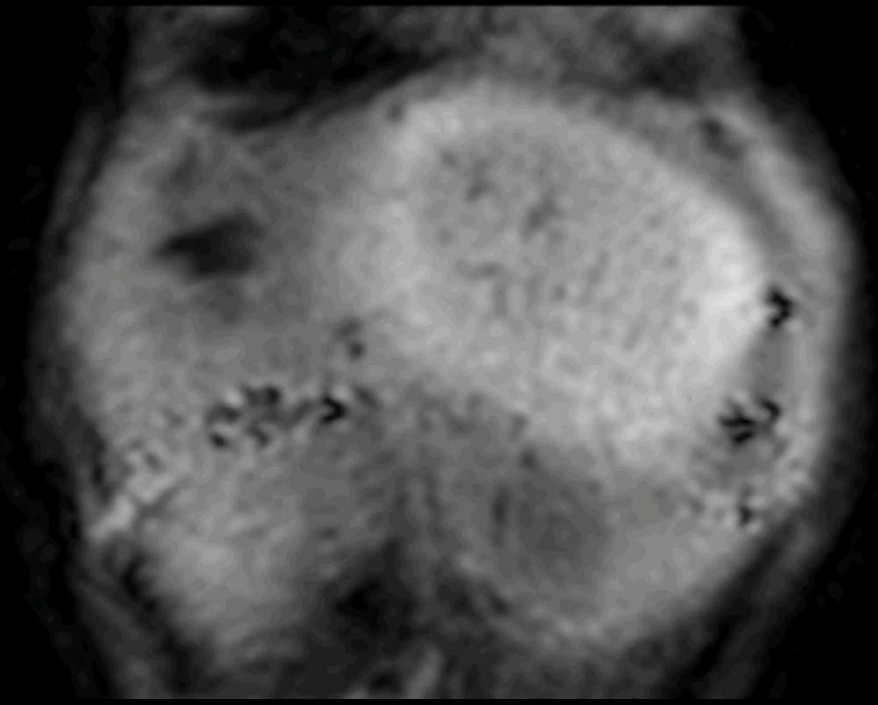




Back to IR due to concern for stricture on MRCP

Liver: Case 3 – Surveillance/late complications

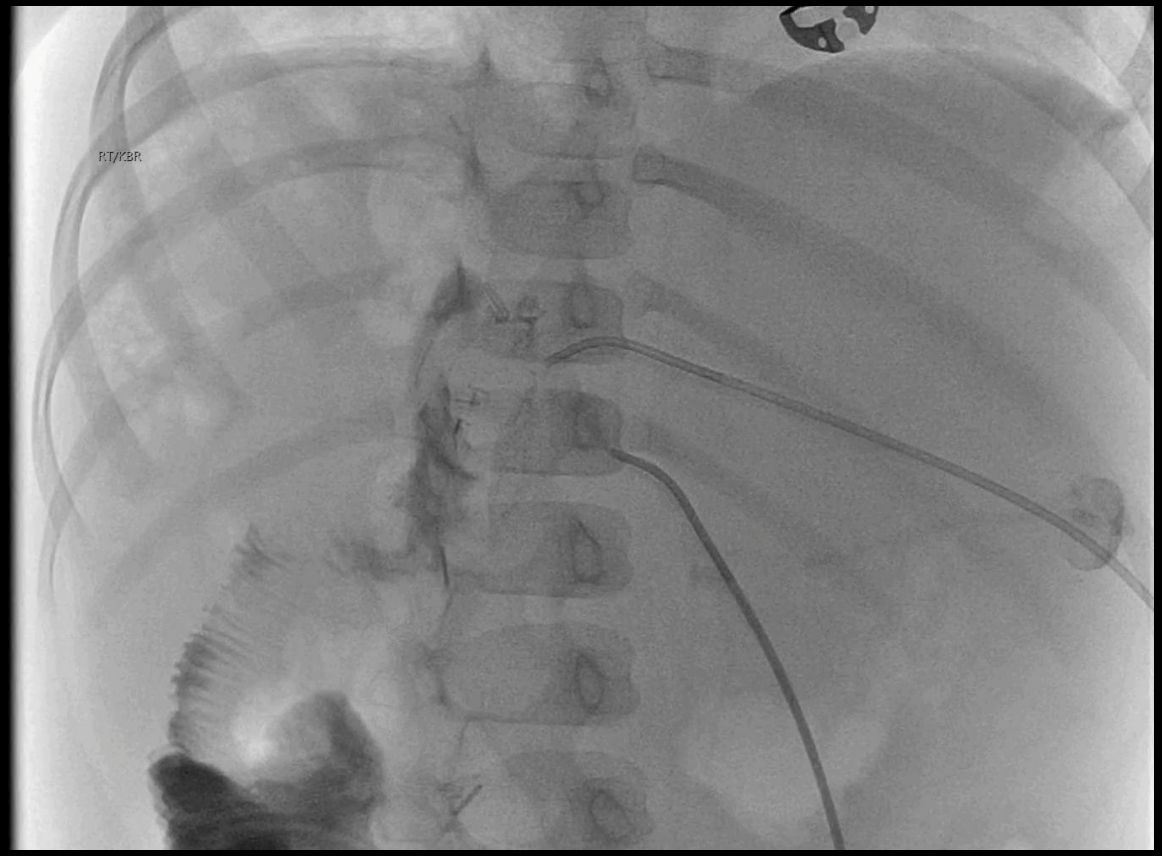
Mild periportal edema



Seg II stricture
Requiring a second drain

2 months later, presents with cholangitis. No improvement with exchange of biliary drain.

Liver: Case 3 – Surveillance/late complications



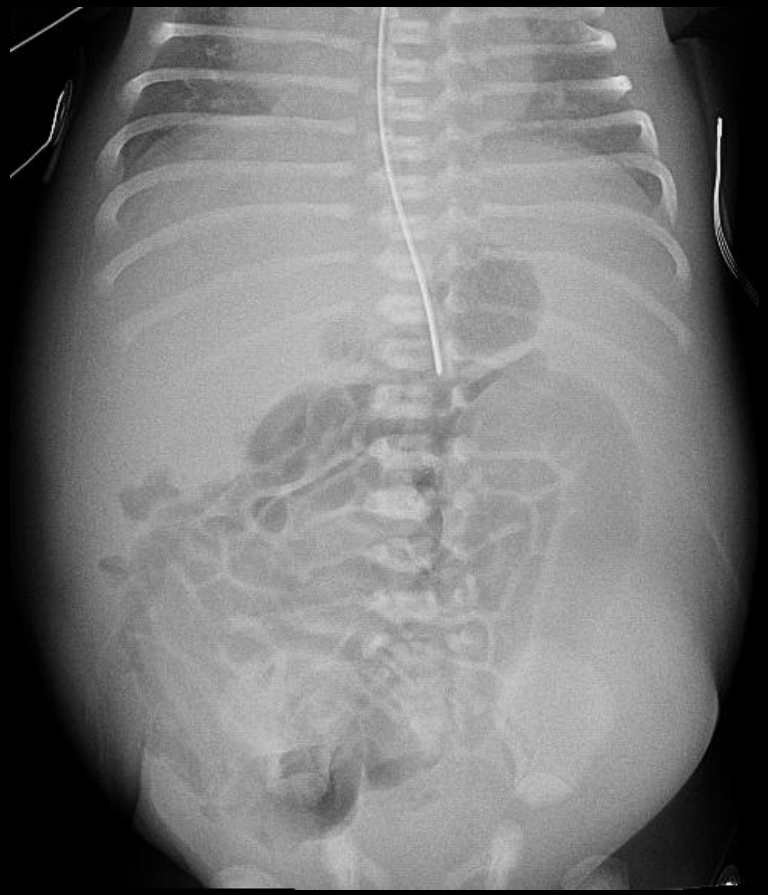
6 months later – labs stable, drain study performed

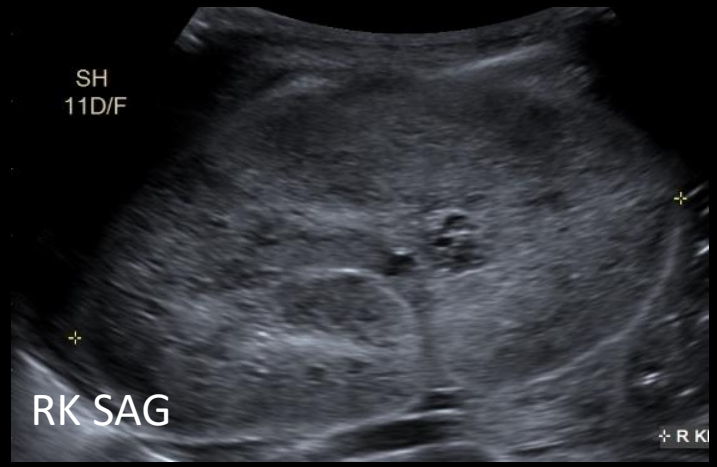
Points to remember for peds liver transplant:

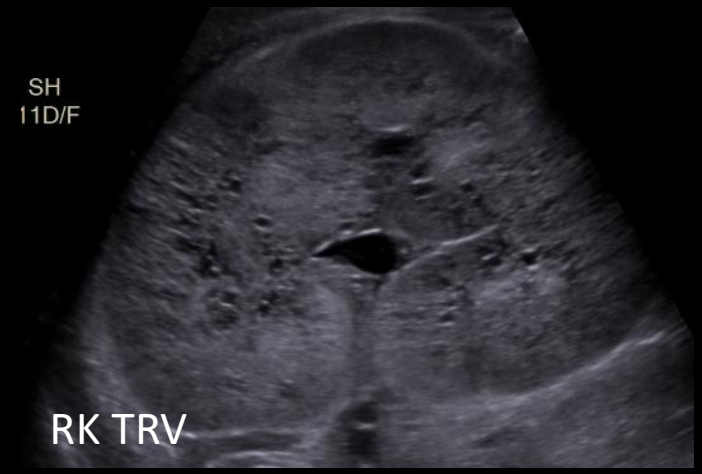
- Always start with ultrasound
  - Save on radiation exposure
  - Can inform next step imaging (i.e. are we dealing with a mass?)
  - Added vascular details (i.e. velocities, direction of flow, RIs)
- Consider dual phase CTA instead of triple phase, esp pre-op
  - Save on radiation exposure
  - Can still assess arteries, PVs, and HVs
- Post-op ultrasound for vascular and biliary complications
  - May need to proceed to CTA or MRCP for more info
  - If MRCP, consider adding hepatobiliary agent
- Close relationship with Peds IR

Kidney Transplants

Kidney: Case 1- Pre-op evaluation







Dx: ARPKD

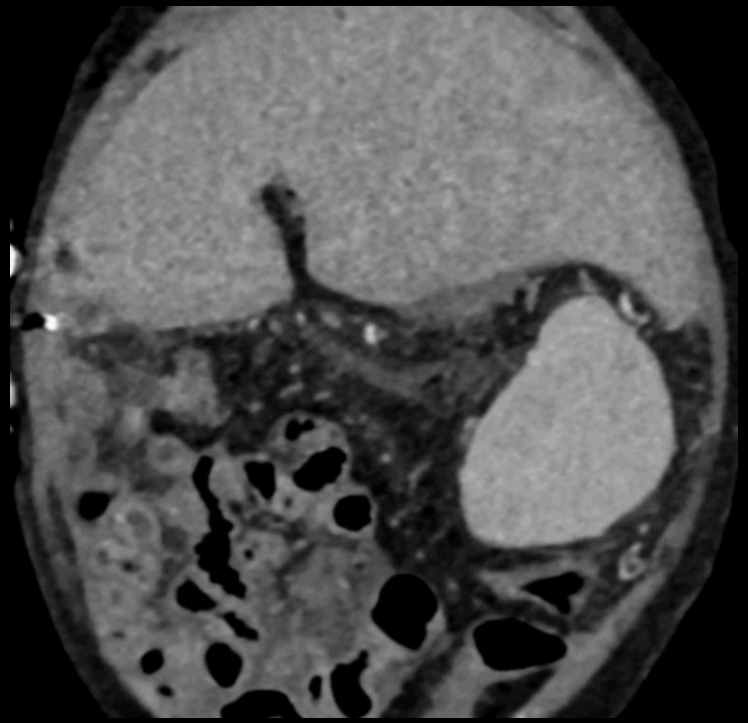
Most common reason for renal transplantation in children?
CAKUT

Newborn with abdominal distension

Kidney: Case 1- Pre-op evaluation

Arterial

Early PV

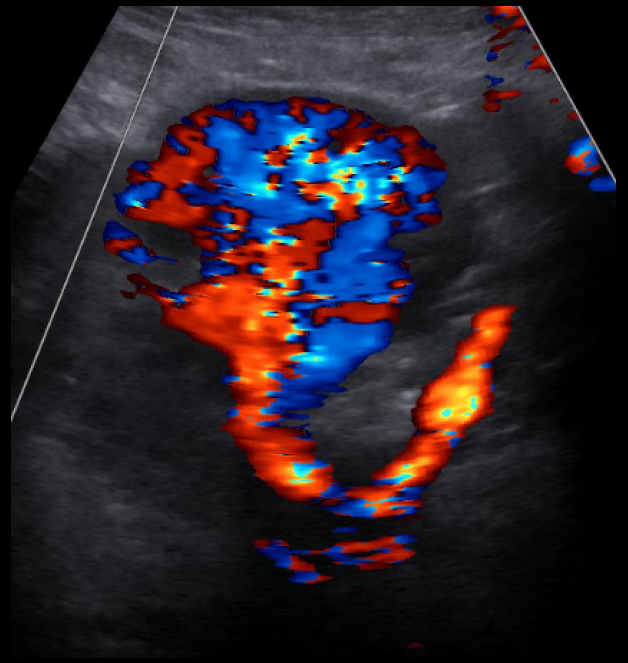


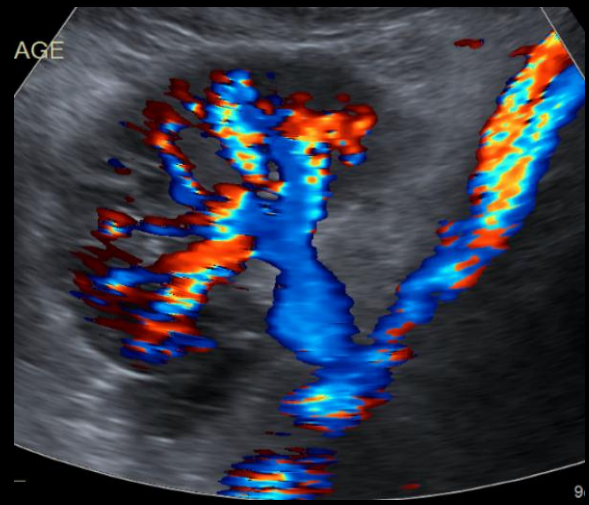
Delayed venous

Assoc dx: Congenital hepatic fibrosis w portal HTN
To OR for liver/renal transplant

4 years later – worsening liver disease

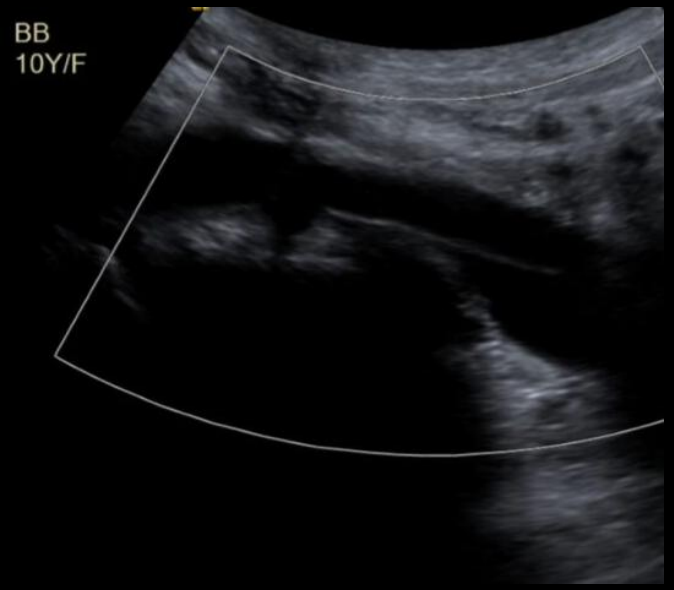
Kidney: Case 1- Post-op evaluation



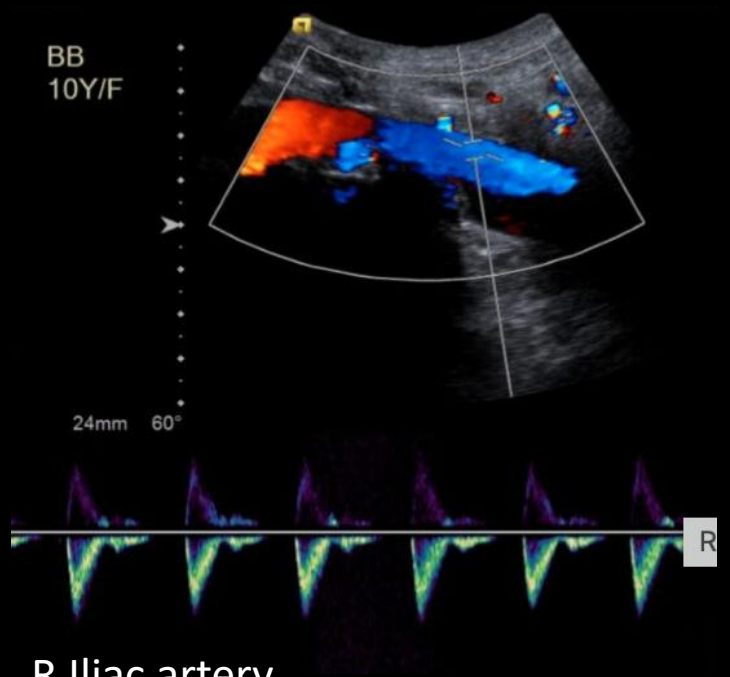


s/p liver-renal transplant

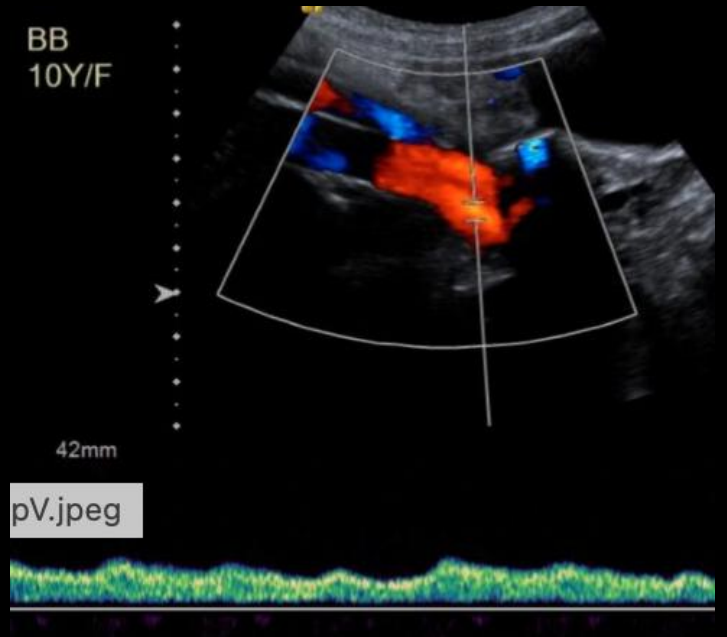
Kidney: Case 2- Pre-op evaluation



R Iliac artery



R Iliac artery



R Iliac vein

9 yo with ESRD (neurogenic bladder and recurrent UTIs)

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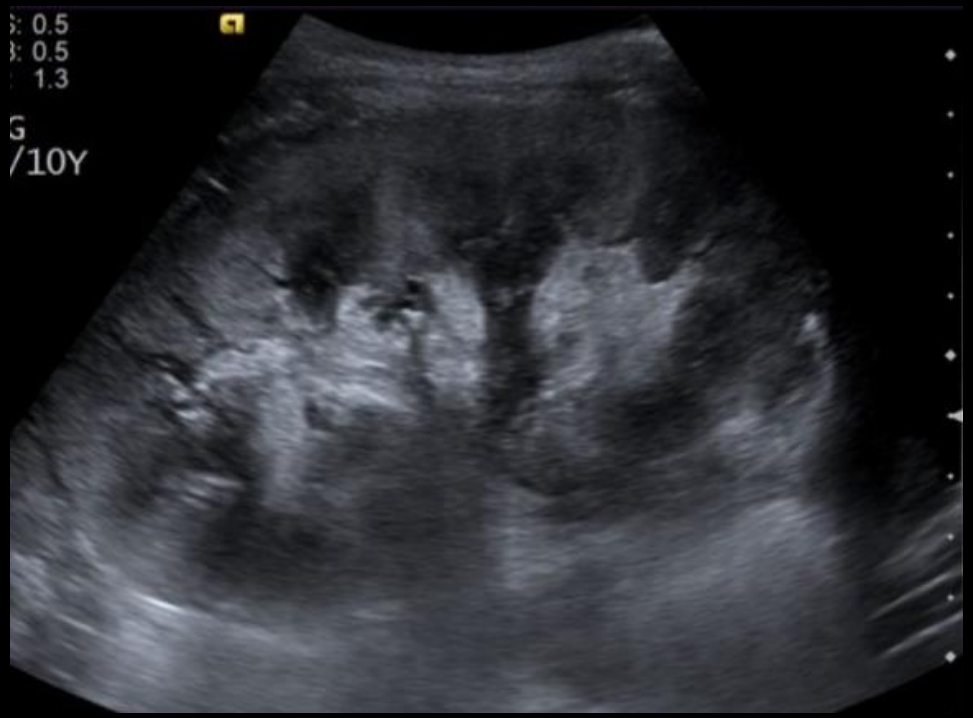
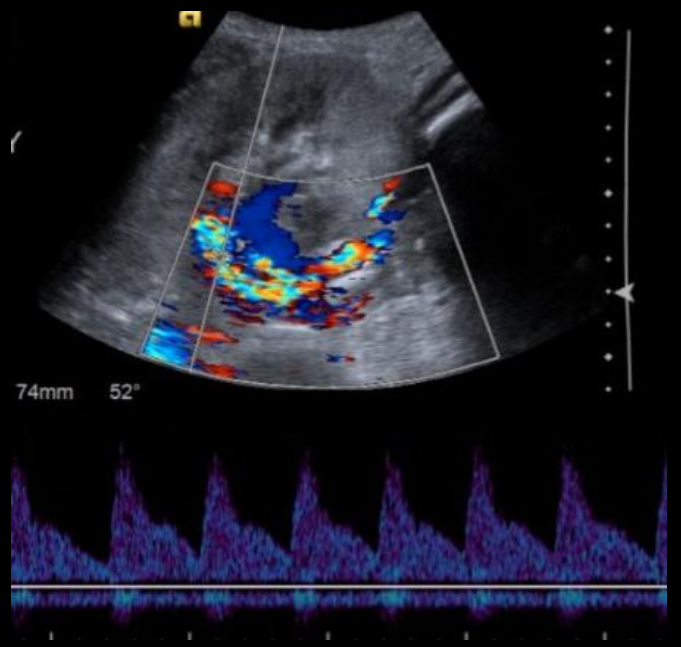
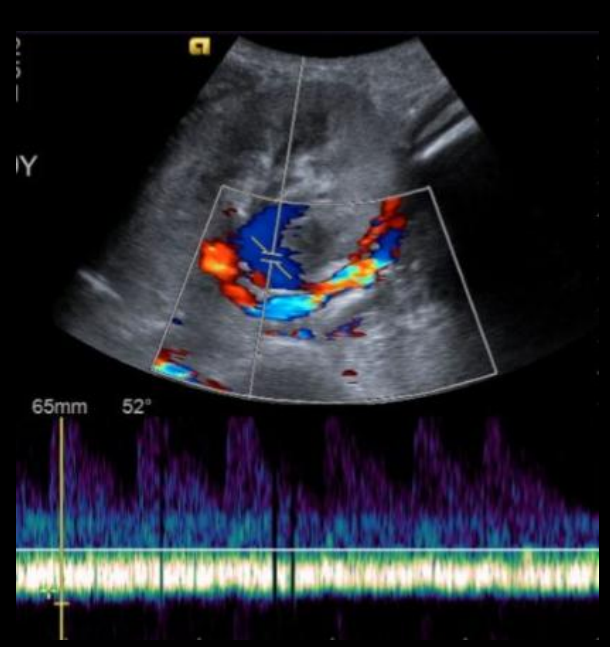
Kidney: Case 2- Post-op evaluation





Renal Artery



Renal Vein

2 weeks post-op, increasing creatinine

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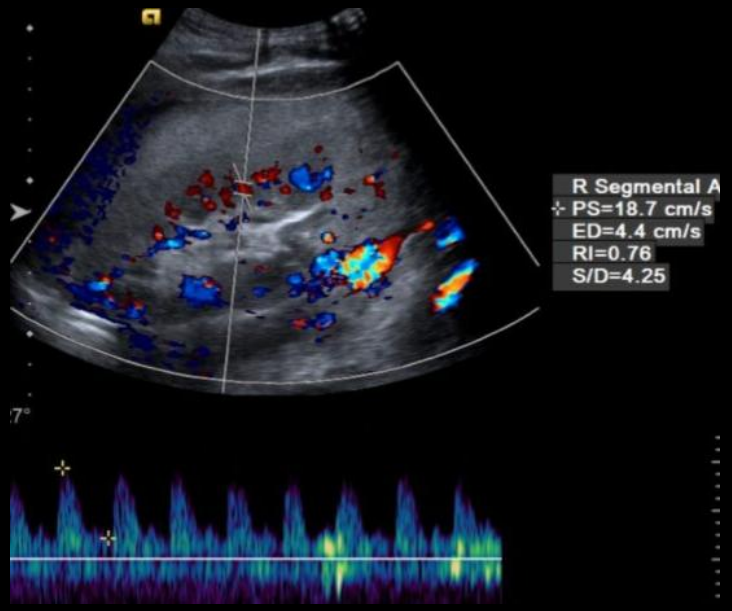
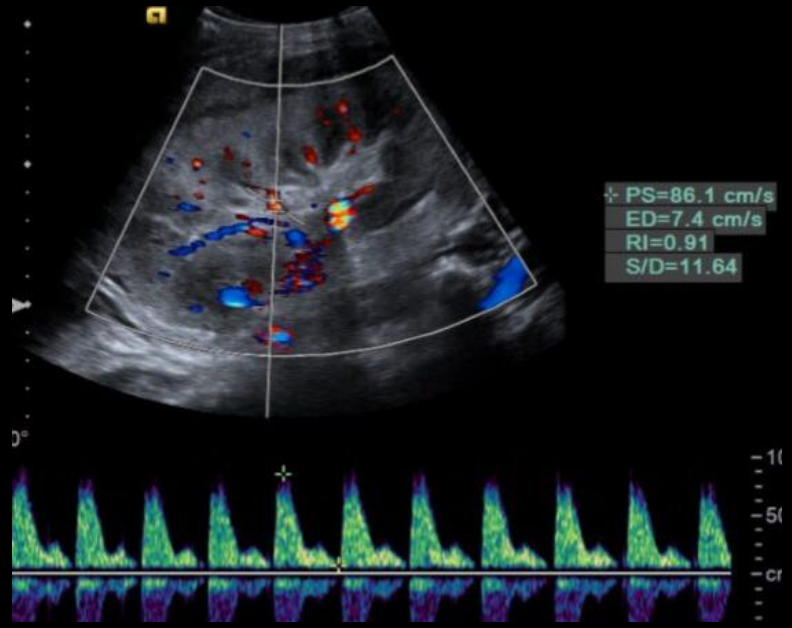
Kidney: Case 2- Post-op evaluation

4 days post renal biopsy



10am US



11pm US

Undergoes biopsy for possible rejection

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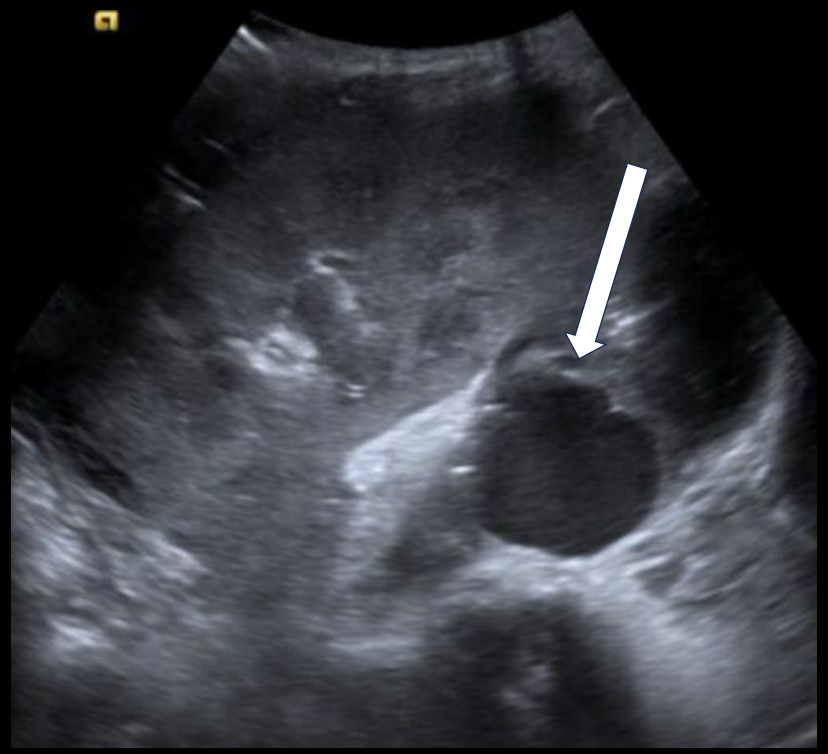
Kidney: Case 2- Post-op evaluation

5 days post renal biopsy

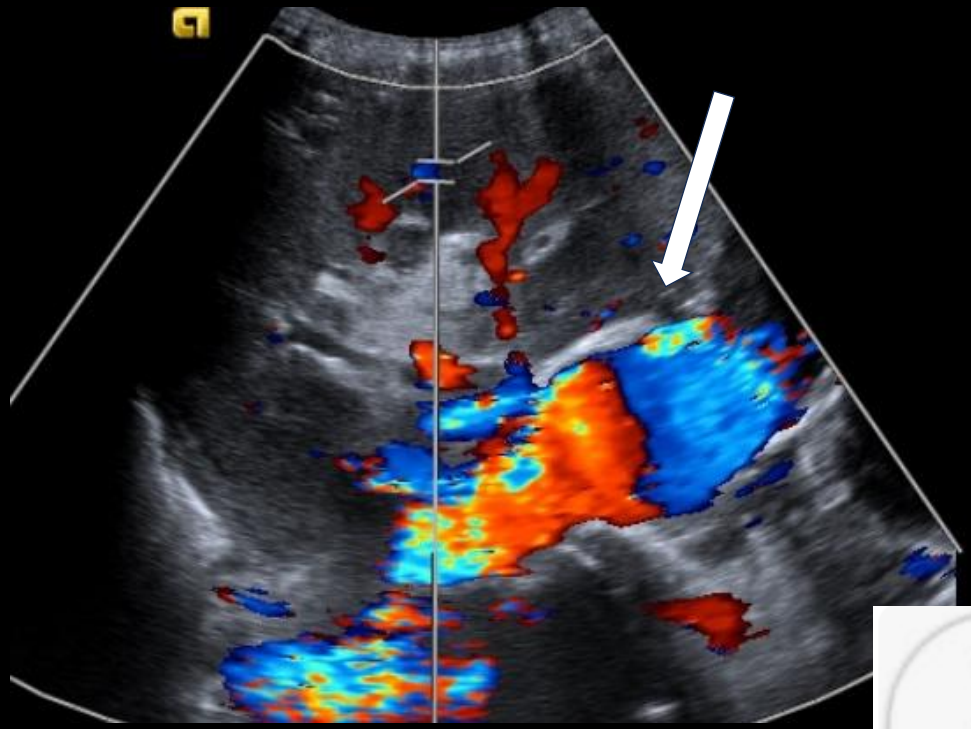
→ To OR for hematoma evacuation →

Undergoes biopsy for possible rejection

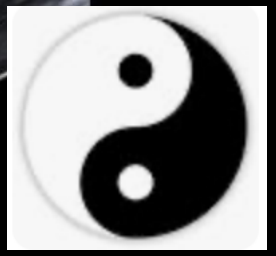
Kidney: Case 2- Post-op evaluation



US for “wound drainage and subcu collection”

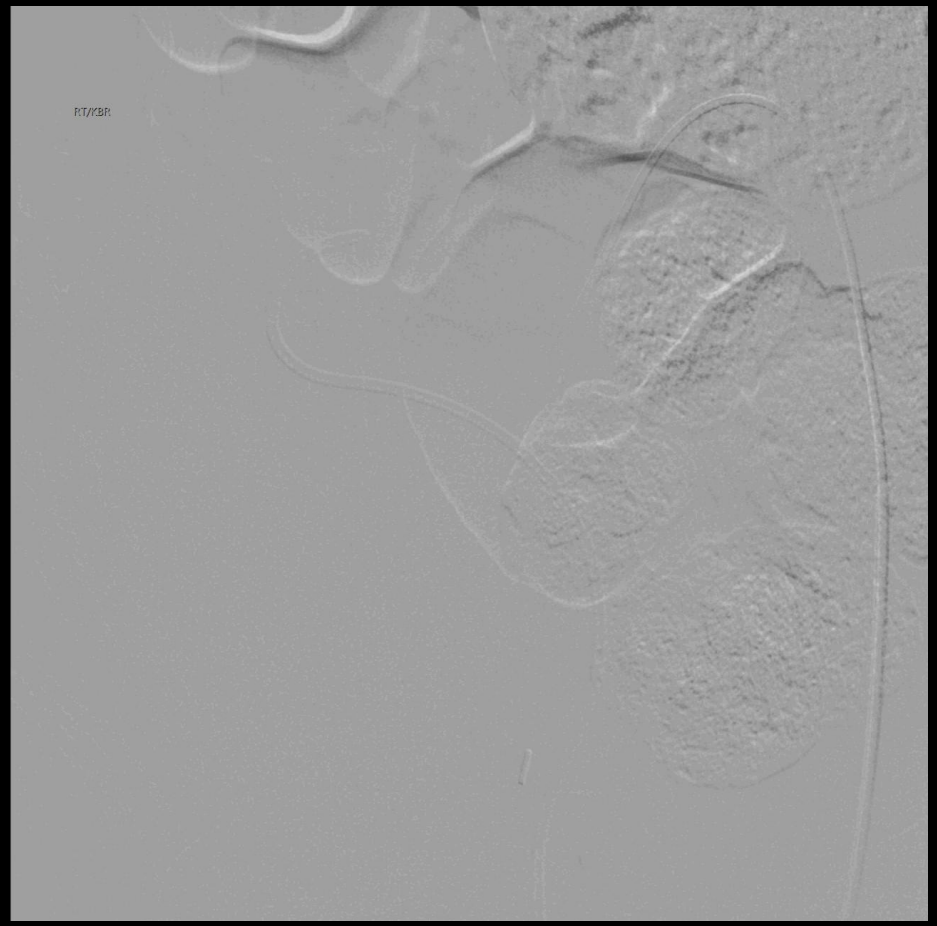


“Yin & yang sign” of a pseudoaneurysm



11 days later (POD 16/30)

Kidney: Case 2- Post-op evaluation



To IR for possible embo

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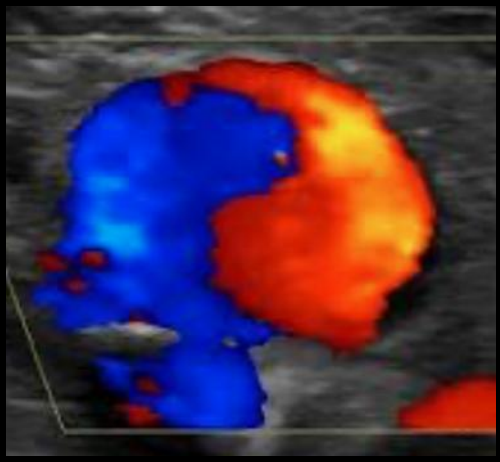
Points to remember for peds renal transplant:

- CAKUT - most common reason for renal transplantation in children
  - Acronym – Congenital Anomalies of the Kidney and Urinary Tract
  - Congenital cystic renal disease, obstructive uropathies, etc
- Doppler US usually suffices for pre-op work up
  - No radiation exposure
  - Iliac vessels easy to visualize and confirm size/patency
- Post-biopsy US w Doppler for perinephric hematoma
- Yin & yang sign of arterial pseudoaneurysm



Thank you!