AMSER Case of the Month August 2025

15-year-old male presents with right upper quadrant pain

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Patient Presentation

HPI: A 15-year-old male presents with 2 days of 7 out of 10 right upper quadrant pain. Reports that stool is hard but not painful to pass. Denies all other symptoms, recent travel, and sick contacts. Up-to-date on all vaccines.

PMH: Nephrolithiasis (x1 episode 6 months prior).

Surgical Hx: None.

Physical Exam: Right upper quadrant tenderness, obese habitus (BMI 32.1), otherwise unremarkable.

Pertinent Labs

- CBC w/ differential: WBC 9.04, Hgb12.8, absolute immature granulocytes 0.05, percent immature granulocytes 0.6, percent monocytes 11.2

- CMP: Total protein 8.6, Albumin 4.3, AST 45, ALT 68, Alkaline Phosphatase 102, Lactate Dehydrogenase 363

What Imaging Should We Order?

Select the applicable ACR Appropriateness Criteria[1]

Variant 2: **Right upper quadrant pain. Suspected biliary disease. Initial imaging.**

Procedure	Appropriateness Category	Relative Radiation Level
US abdomen	Usually Appropriate	O
CT abdomen with IV contrast	May Be Appropriate	☢☢☢
MRI abdomen without and with IV contrast with MRCP	May Be Appropriate	O
MRI abdomen without IV contrast with MRCP	May Be Appropriate	O
Nuclear medicine scan gallbladder	May Be Appropriate	☢☢
CT abdomen without IV contrast	May Be Appropriate	☢☢☢
CT abdomen without and with IV contrast	Usually Not Appropriate	☢☢☢☢

This imaging modality was ordered by the ER physician

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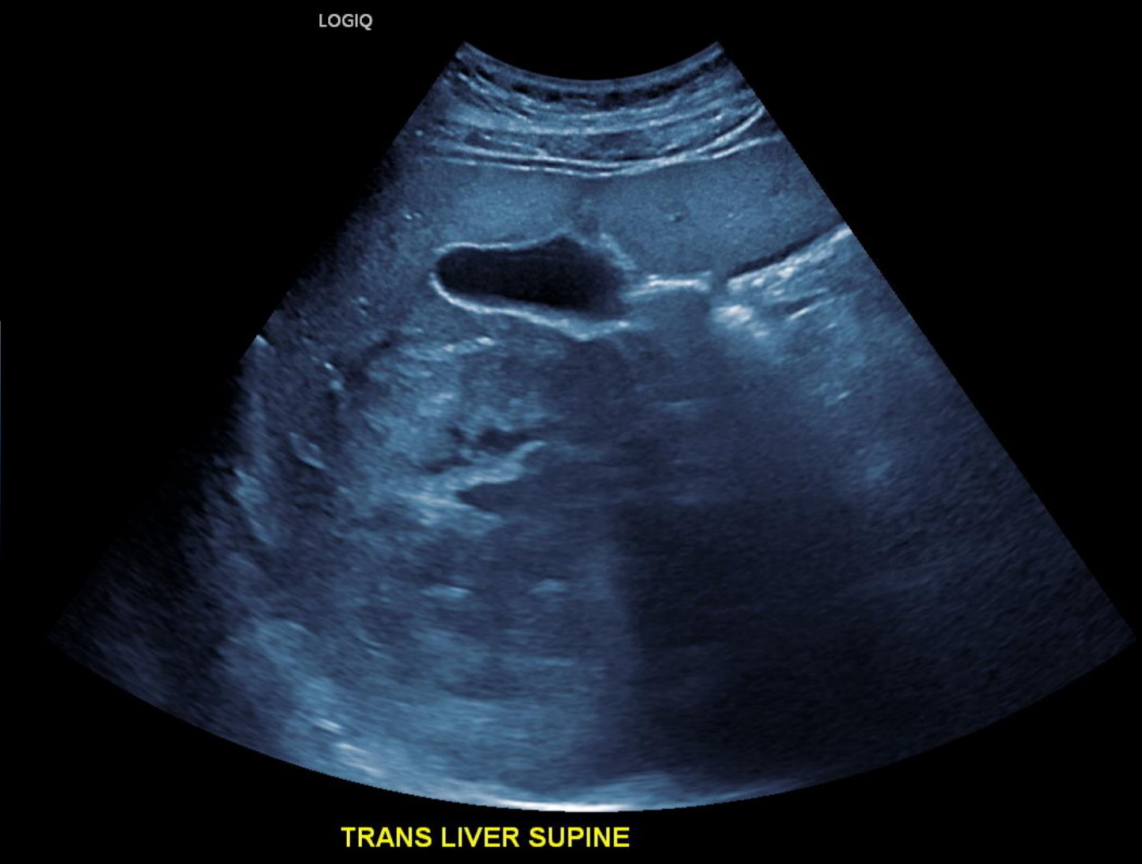
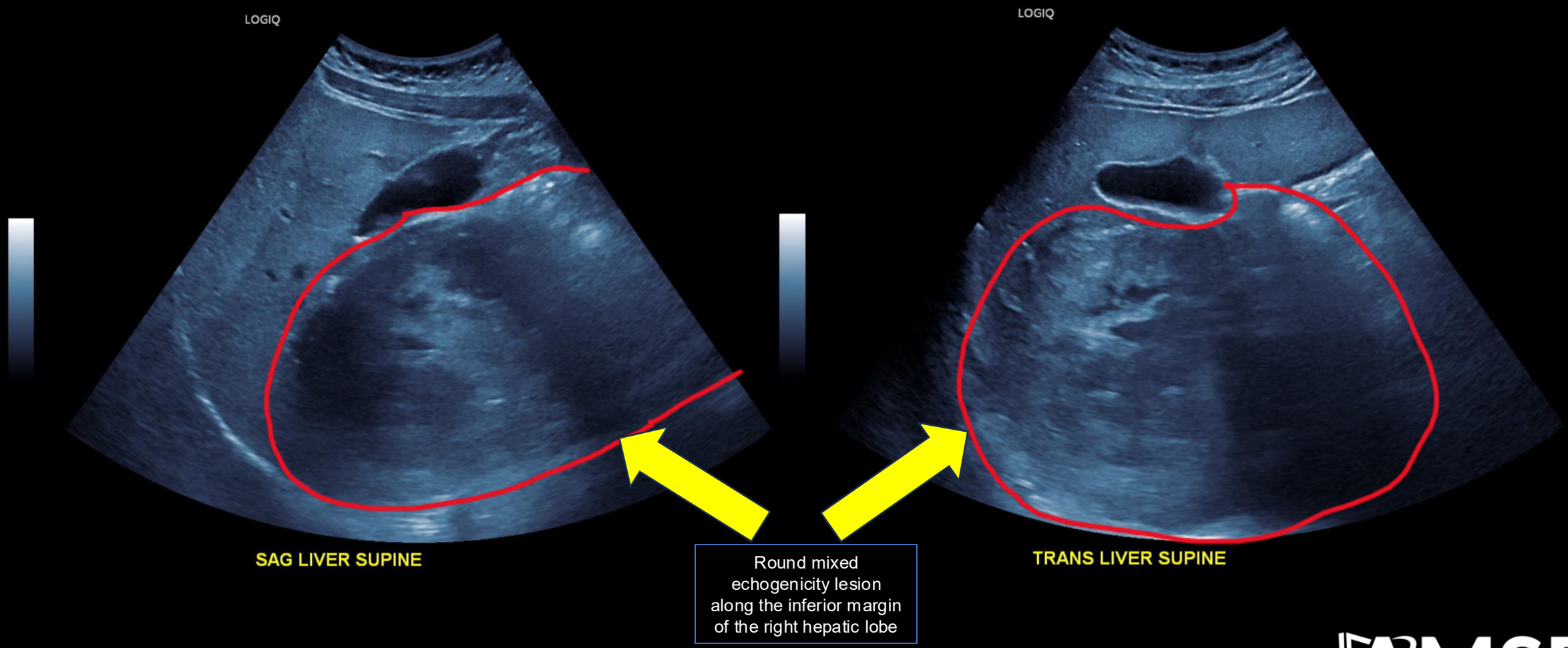
Ultrasound Findings (unlabeled)



Ultrasound Findings (labeled)



Select the applicable ACR Appropriateness Criteria[1]

Variant 1: **Indeterminate, greater than 1 cm liver lesion on initial imaging with US. Normal liver. No suspicion or evidence of extrahepatic malignancy or underlying liver disease.**

Procedure	Appropriateness Category	Relative Radiation Level
US abdomen with IV contrast	Usually Appropriate	O
MRI abdomen without and with IV contrast	Usually Appropriate	O
CT abdomen with IV contrast multiphase	Usually Appropriate	☢☢☢
MRI abdomen without IV contrast	May Be Appropriate	O
Image-guided biopsy liver	Usually Not Appropriate	Varies
CT abdomen without IV contrast	Usually Not Appropriate	☢☢☢
Liver spleen scan	Usually Not Appropriate	☢☢☢
RBC scan abdomen and pelvis	Usually Not Appropriate	☢☢☢
CT abdomen without and with IV contrast	Usually Not Appropriate	☢☢☢☢
DOTATATE PET/CT skull base to mid-thigh	Usually Not Appropriate	☢☢☢
FDG-PET/CT skull base to mid-thigh	Usually Not Appropriate	☢☢☢☢
Octreotide scan with SPECT or SPECT/CT chest and abdomen	Usually Not Appropriate	☢☢☢☢

This imaging modality was ordered by the ER physician. Of note – MRI is a good choice as sedation would not be needed and there is no ionizing radiation. CT chosen in part due to more immediate ER access.

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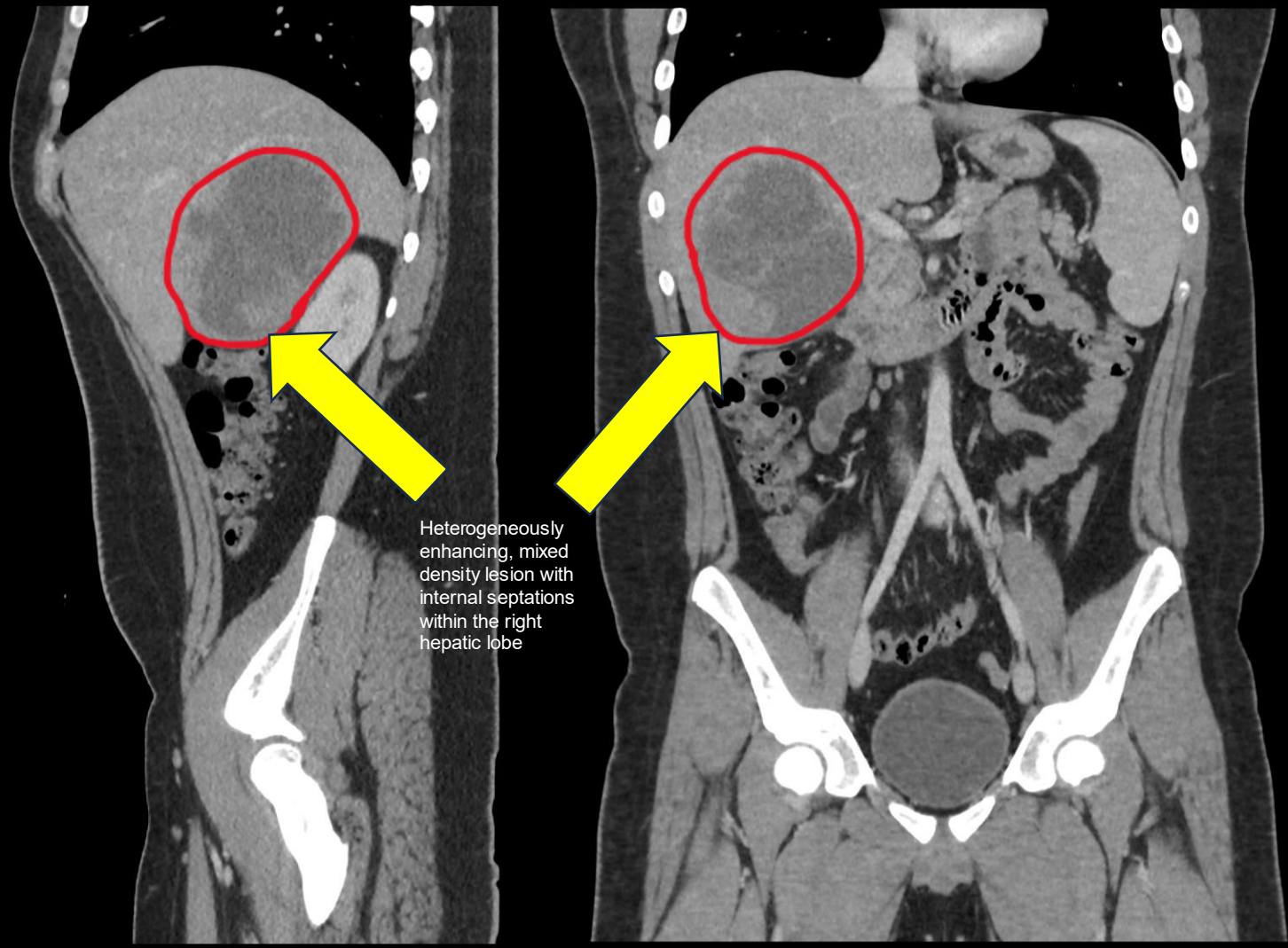
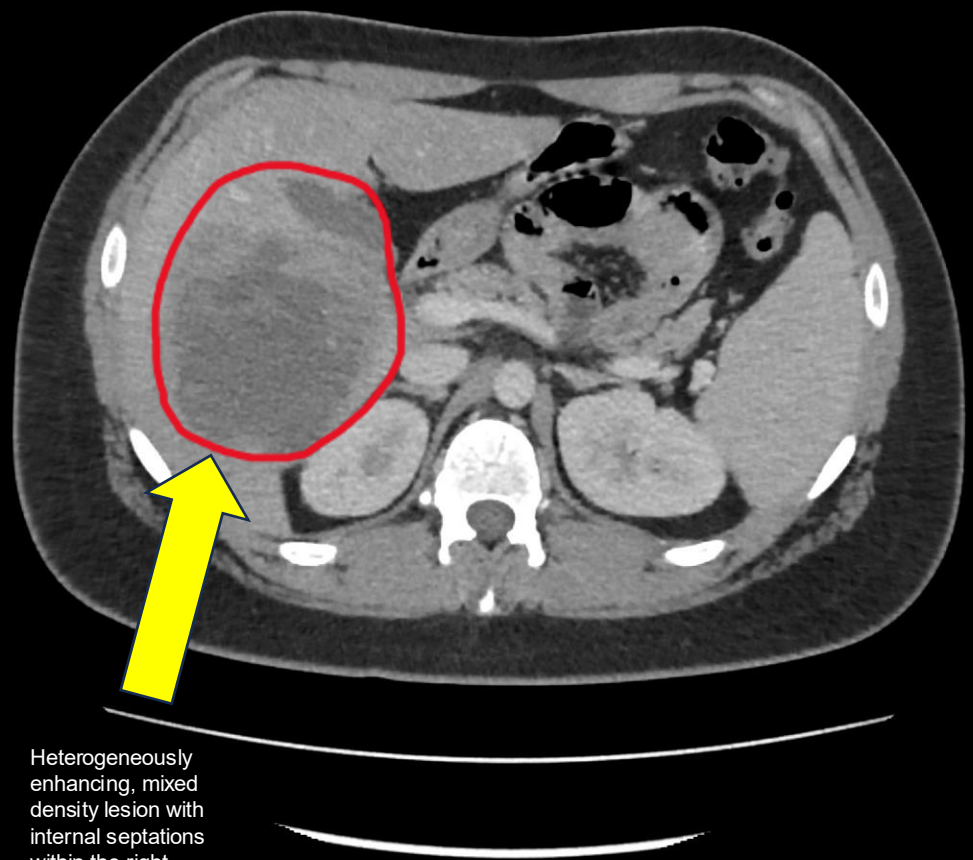
CT Findings (unlabeled)

CT Findings (labeled)



Heterogeneously enhancing, mixed density lesion with internal septations within the right hepatic lobe



Heterogeneously enhancing, mixed density lesion with internal septations within the right hepatic lobe

CT better delineates the intrahepatic location than US

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Select the applicable ACR Appropriateness Criteria[1]

Variant 2: **Indeterminate, greater than 1 cm liver lesion on initial imaging with CT (noncontrast or single-phase) or noncontrast MRI. Normal liver. No suspicion or evidence of extrahepatic malignancy or underlying liver disease.**

Procedure	Appropriateness Category	Relative Radiation Level
MRI abdomen without and with IV contrast	Usually Appropriate	O
CT abdomen with IV contrast multiphase	Usually Appropriate	☢☢☢
US abdomen	May Be Appropriate (Disagreement)	O
US abdomen with IV contrast	May Be Appropriate	O
Image-guided biopsy liver	Usually Not Appropriate	Varies
Liver spleen scan	Usually Not Appropriate	☢☢☢
RBC scan abdomen and pelvis	Usually Not Appropriate	☢☢☢
CT abdomen without and with IV contrast	Usually Not Appropriate	☢☢☢☢
DOTATATE PET/CT skull base to mid-thigh	Usually Not Appropriate	☢☢☢
FDG-PET/CT skull base to mid-thigh	Usually Not Appropriate	☢☢☢☢
Octreotide scan with SPECT or SPECT/CT chest and abdomen	Usually Not Appropriate	☢☢☢☢

This imaging modality was ordered by pediatric hematology-oncology

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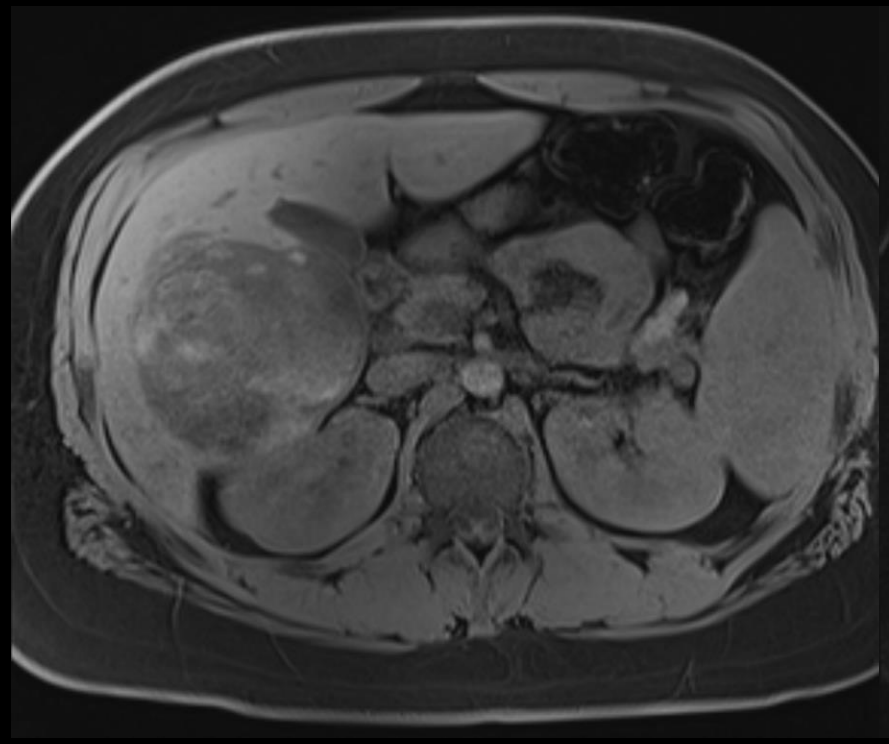
MRI Findings (unlabeled)

T1 with fat saturation
without contrast

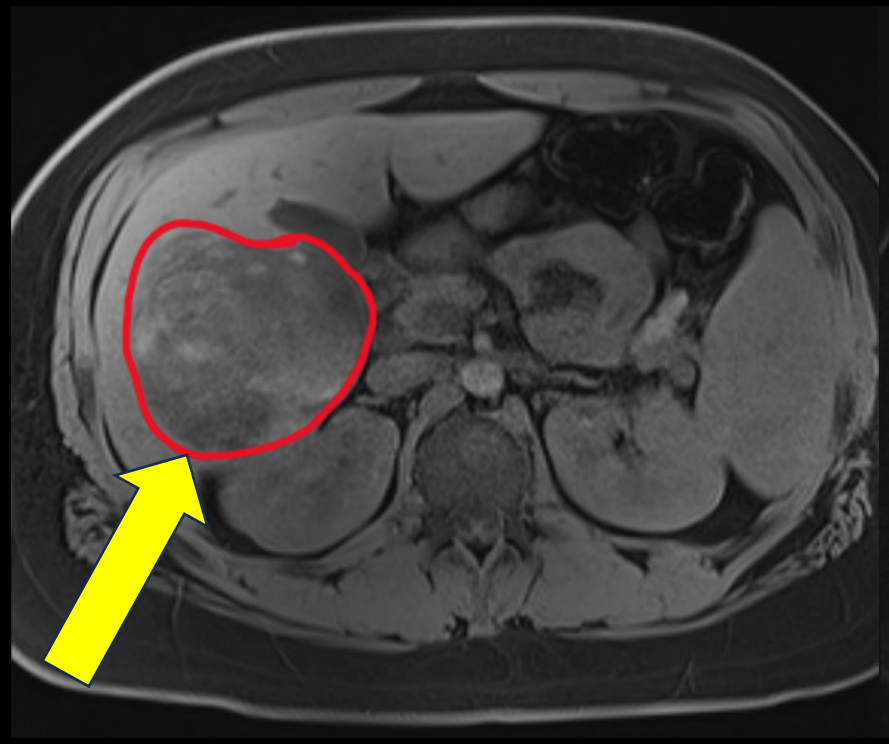


T2 Haste with
fat saturation

T2 Coronal

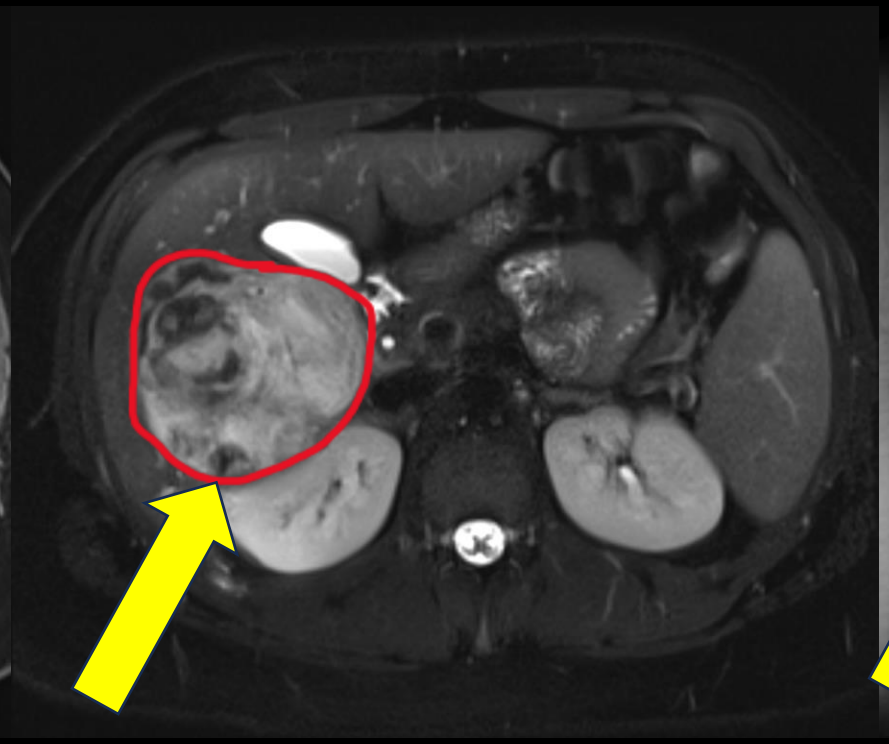
MRI Findings (labeled)

T1 with fat saturation without contrast



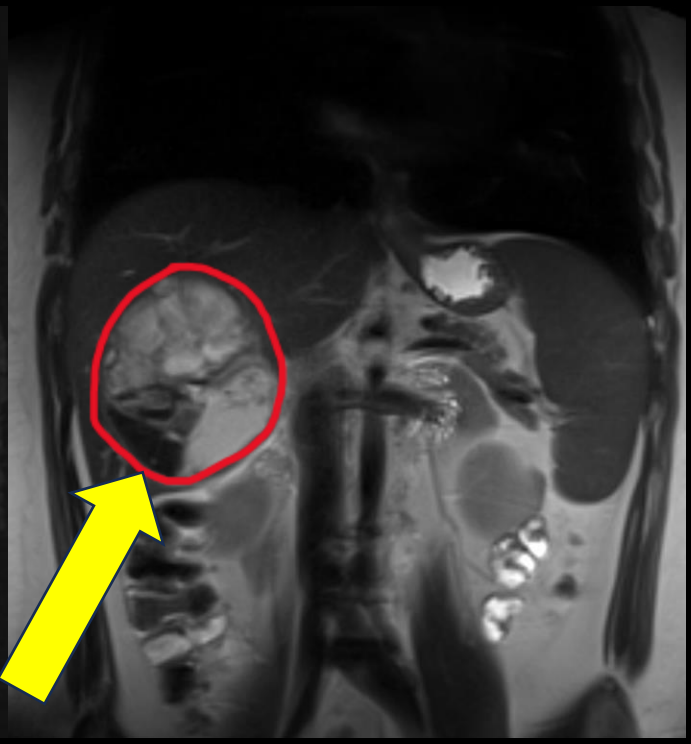
Large round mass of the right hepatic lobe with internal T1 hyperintensity, likely representing blood products

T2 Haste with fat saturation



T2 hyperintense mass with areas of T2 hypointensity suggestive of blood products and necrosis

T2 Coronal



Heterogeneous T2 hyperintense lesion

MRI Findings (unlabeled)

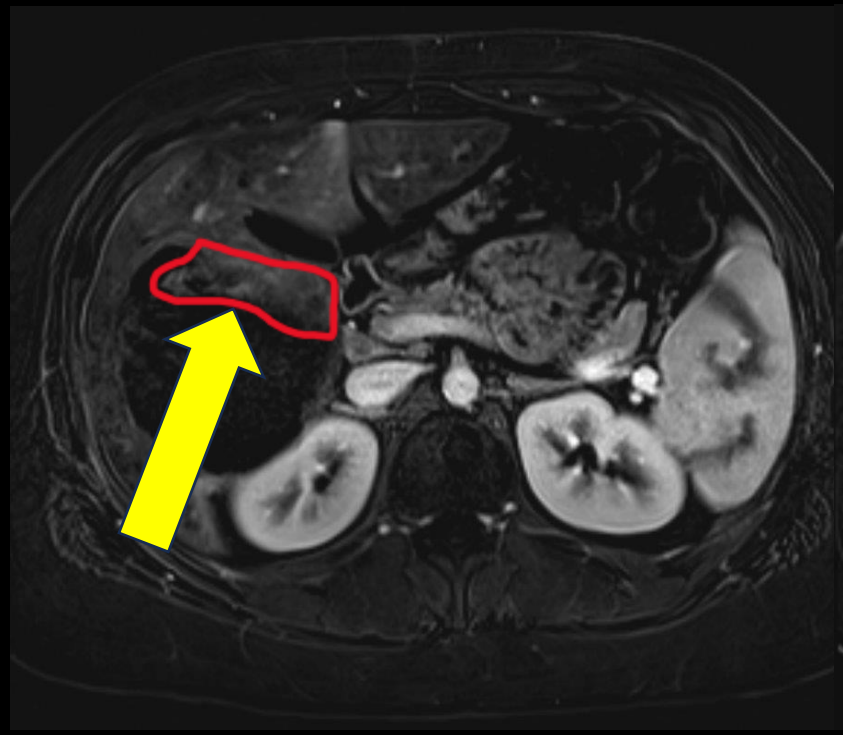
T1 arterial phase with subtraction

T1 post contrast venous phase with subtraction

T1 post contrast image with a 3-minute delay and subtraction

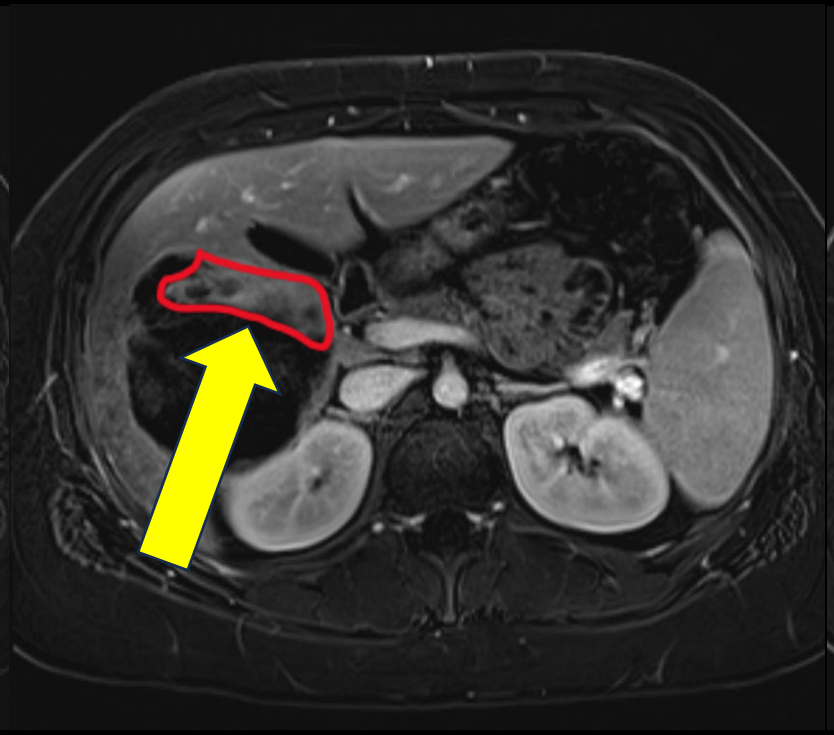
MRI Findings (labeled)

T1 arterial phase with subtraction



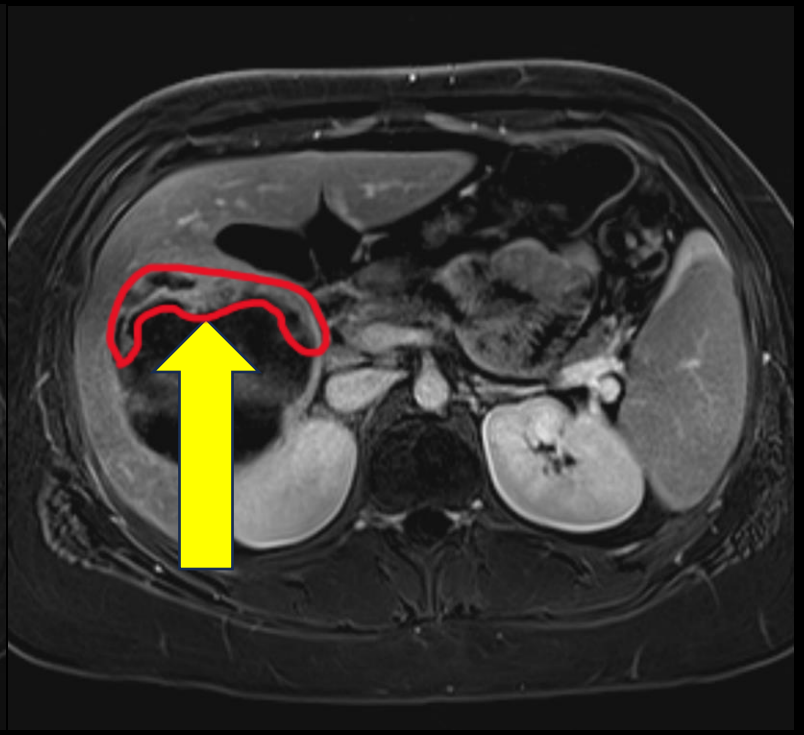
Enhancement in the anterior portion of the mass

T1 post contrast venous phase with subtraction



Continued enhancement in the anterior portion of the mass

T1 post contrast image with a 3-minute delay and subtraction



Persistent enhancement in the anterior portion of the mass and its remaining periphery

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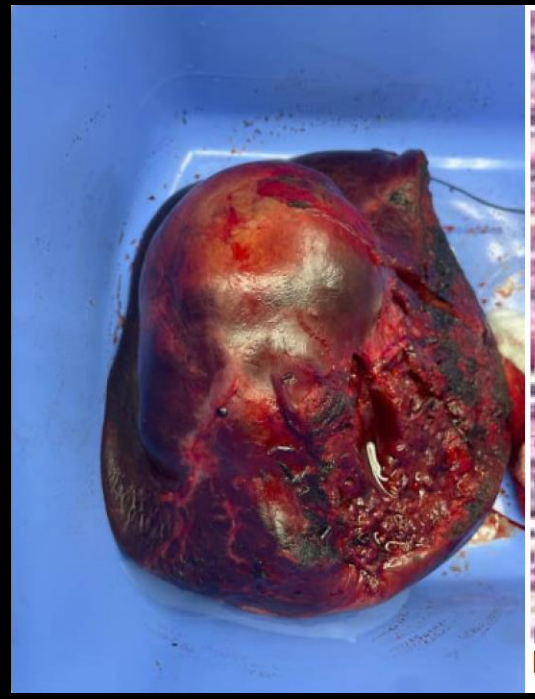
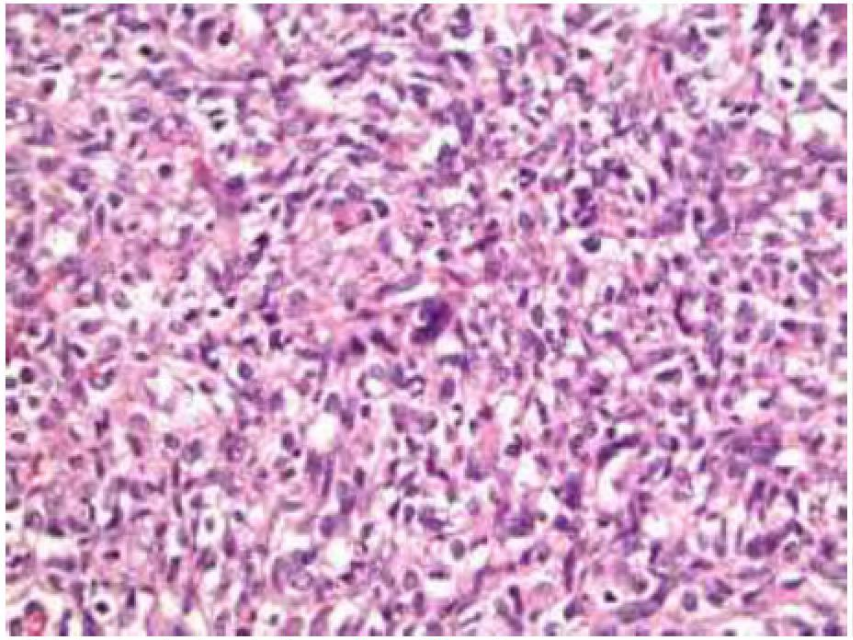
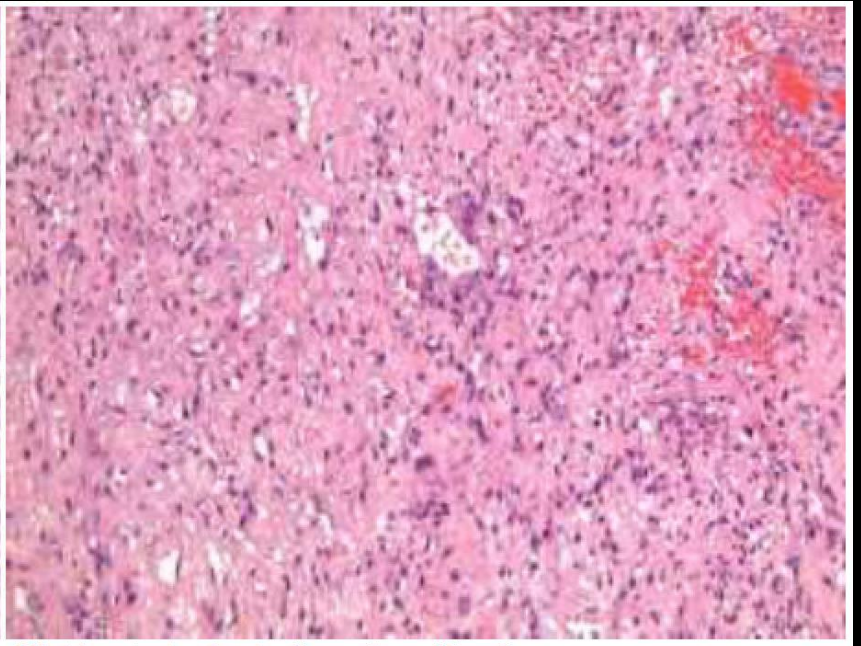
Final Dx:

Undifferentiated Embryonal Sarcoma of the Liver (biopsy confirmed)





Highly atypical spindle cell proliferation



Highly atypical spindle cell proliferation

Case Discussion

- Definition: Rare, aggressive mesenchymal malignancy that shows no evidence of differentiation on biopsy.[2,3]

- Epidemiology: Most common in children aged 6-10 years with slight male predominance but has been reported in patients as old as 86 years[2,3].

- Key Imaging Characteristics: Large mass more frequently involving the right lobe of the liver in a pediatric patient under 10 years, with a predominantly solid appearance on ultrasound but a heterogeneous cystic appearance on CT and MRI.

Case Discussion

- Clinical presentation: Abdominal mass +/- abdominal pain, possibly with associated fever, weight loss, anorexia, vomiting, diarrhea, lethargy, constipation, and/or respiratory distress.[2,3] If fever is present, usually associated with hemorrhage and necrosis of the tumor.[2]

- Diagnosis: Diagnosis is confirmed with biopsy. There is no associated specific laboratory finding; while liver function tests and neoplastic markers are typically normal, there may be slightly elevated transaminases, erythrocyte sedimentation rate, leukocytosis, or leukopenia.[2,3]

Case Discussion

- Pathophysiology: No confirmed pathogenic variants, but a recent case report suggests germline variants of TP53 and CHEK2.[4]
- Treatment: Multimodal including chemotherapy, radiotherapy, and surgical resection.[2,3]
- Differential Diagnosis:
  - Pediatric population: mesenchymal hamartoma, hepatoblastoma, and embryonal rhabdosarcoma of the biliary tree.[2,3]
  - Adult population: hepatocellular carcinoma, gastrointestinal stromal tumor, angiolipoma, and high-grade sarcomas.[2,3]

References:

1. American College of Radiology. Appropriateness Criteria. Acr.org. Published 2019. https://acsearch.acr.org/list
2. Putra J, Ornvold K. Undifferentiated Embryonal Sarcoma of the Liver: A Concise Review. *Archives of Pathology & Laboratory Medicine*. 2015;139(2):269-273. doi:https://doi.org/10.5858/arpa.2013-0463-rs
3. Osorio O, Campos A, Mammen S. Undifferentiated embryonal sarcoma of the liver. *Radiopaediaorg*. Published online December 30, 2017. doi:https://doi.org/10.53347/rid-57460
4. Kuhlen M, Schaller T, Dintner S, et al. Double Heterozygous Pathogenic Variants in *TP53* and *CHEK2* in Boy with Undifferentiated Embryonal Sarcoma of the Liver. *International journal of molecular sciences*. 2024;25(21):11489. doi:https://doi.org/10.3390/ijms252111489