AMSER Case of the Month

22-year-old female presented with an incidental liver mass

Zaheer Irani, MS-IV, Lake Erie College of Osteopathic Medicine
Dr. Matthew Hartman, MD, Allegheny Health Network
Dr. Thomas Murickan, MD, Allegheny Health Network
Dr. Madeline Myers, DO, Allegheny Health Network

Patient Presentation

- HPI: Patient is a 22-year old female with past medical history of migraines who presented to the office with progressive abdominal discomfort, weight loss and nausea/vomiting.

- Patient reports early satiety that has been worsening as well as intermittent abdominal distension that has been refractory to conservative measures.

History/Objective Findings

- Medications: Atogepant, Diclofenac, Vitamin B12, Magnesium Oxide, Multivitamin, Rizatriptan, Topiramate
- Social Hx: No history of tobacco, alcohol, or illicit drug use
- Allergies: Ibuprofen
- Physical Exam: Abdominal tenderness to palpation over R-mid and RUQ, mild abdominal distension
- Given compressive/obstructive symptoms; Surgery was consulted

Pertinent Labs

- Hemoglobin: 11.0
- Hematocrit: 33
- AST: 12
- ALT: 18
- Bilirubin: 0.2

What Imaging Should We Order?

Select the applicable ACR Appropriateness Criteria

Variant 1: **Acute nonlocalized abdominal pain and fever. No recent surgery. Initial imaging.**

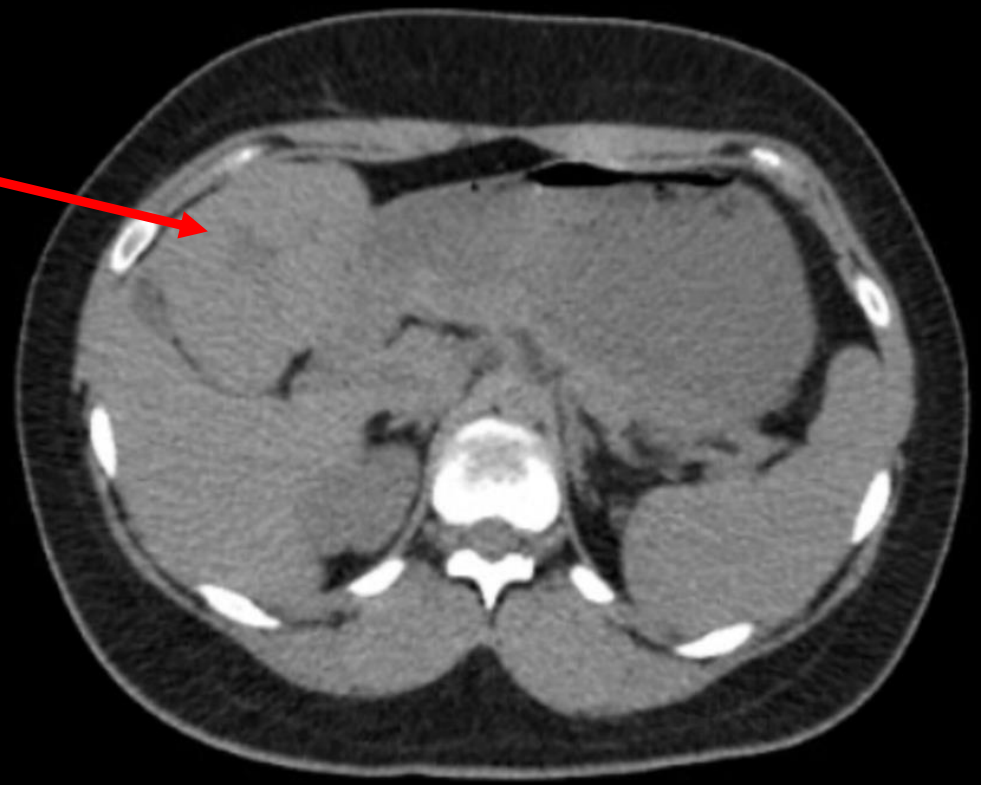
Procedure	Appropriateness Category	Relative Radiation Level
CT abdomen and pelvis with IV contrast	Usually Appropriate	☢☢☢
MRI abdomen and pelvis without and with IV contrast	May Be Appropriate	O
US abdomen	May Be Appropriate	O
CT abdomen and pelvis without IV contrast	May Be Appropriate	☢☢☢
MRI abdomen and pelvis without IV contrast	May Be Appropriate	O
CT abdomen and pelvis without and with IV contrast	May Be Appropriate	☢☢☢☢
Radiography abdomen	May Be Appropriate	☢☢
FDG-PET/CT skull base to mid-thigh	Usually Not Appropriate	☢☢☢☢
WBC scan abdomen and pelvis	Usually Not Appropriate	☢☢☢☢
Nuclear medicine scan gallbladder	Usually Not Appropriate	☢☢
Fluoroscopy contrast enema	Usually Not Appropriate	☢☢☢
Fluoroscopy upper GI series with small bowel follow-through	Usually Not Appropriate	☢☢☢

This imaging modality was ordered by the attending physician

Findings (unlabeled)

Findings: (labeled)

Solid appearing liver mass with central area of hypodensity in the left hepatic lobe



Select the applicable ACR Appropriateness Criteria

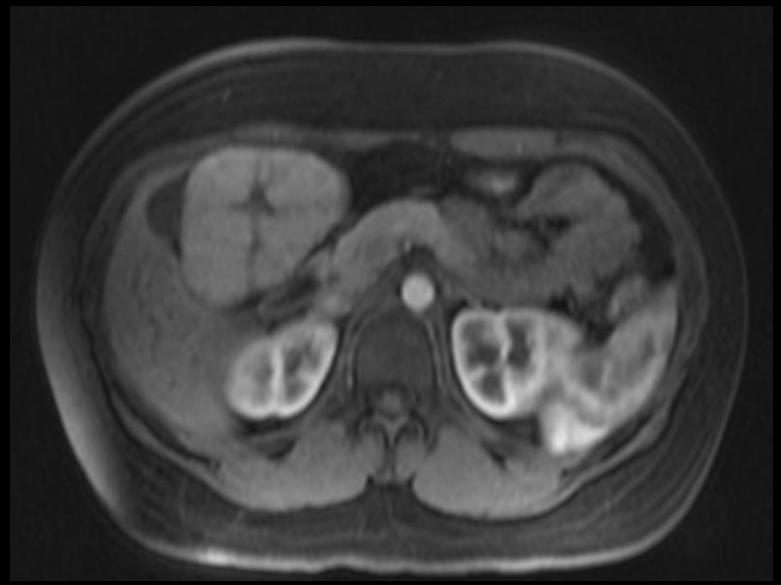
Variant 2: **Indeterminate, greater than 1 cm liver lesion on initial imaging with CT (noncontrast or single-phase) or noncontrast MRI. Normal liver. No suspicion or evidence of extrahepatic malignancy or underlying liver disease.**

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	☢☢☢☢

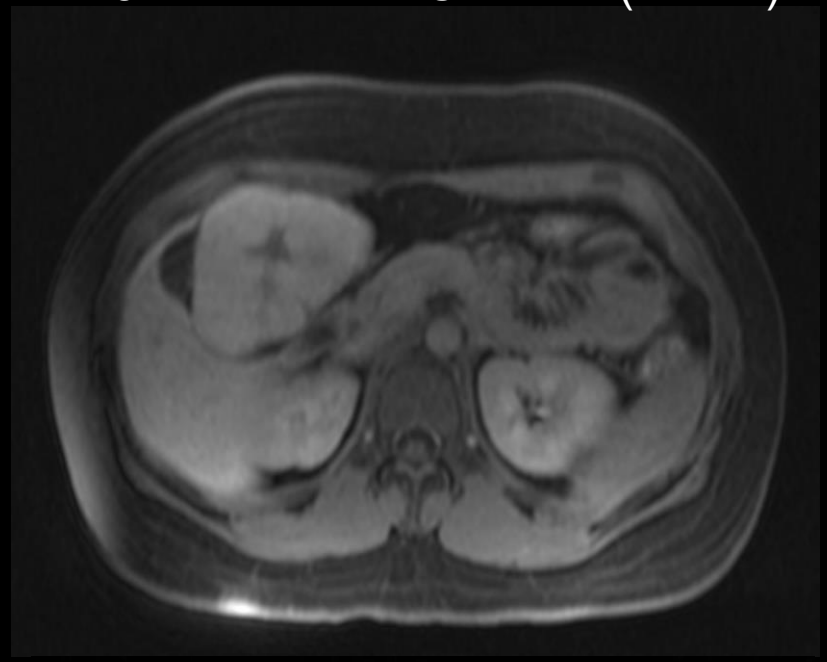
This imaging modality was ordered by the attending physician

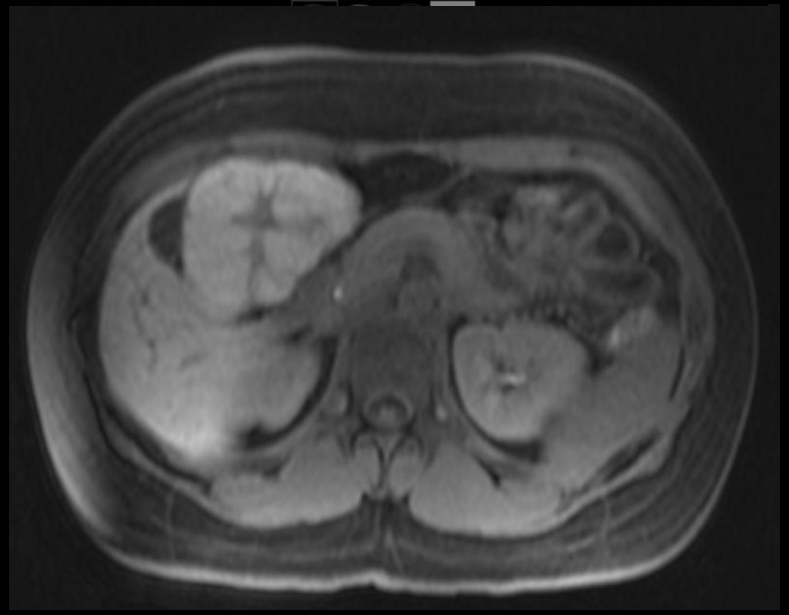
T1 Non-Contrast

T1 Immediate Post-Contrast (Eovist)

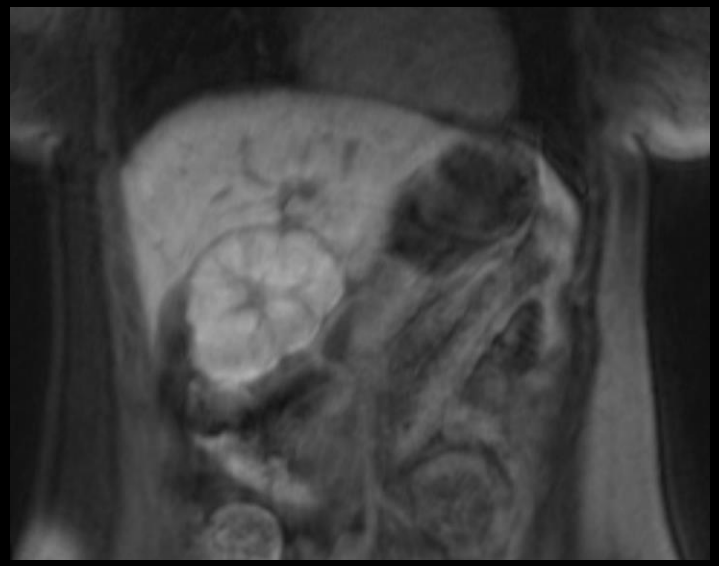


T1 5-Minute Post-Contrast (Eovist)

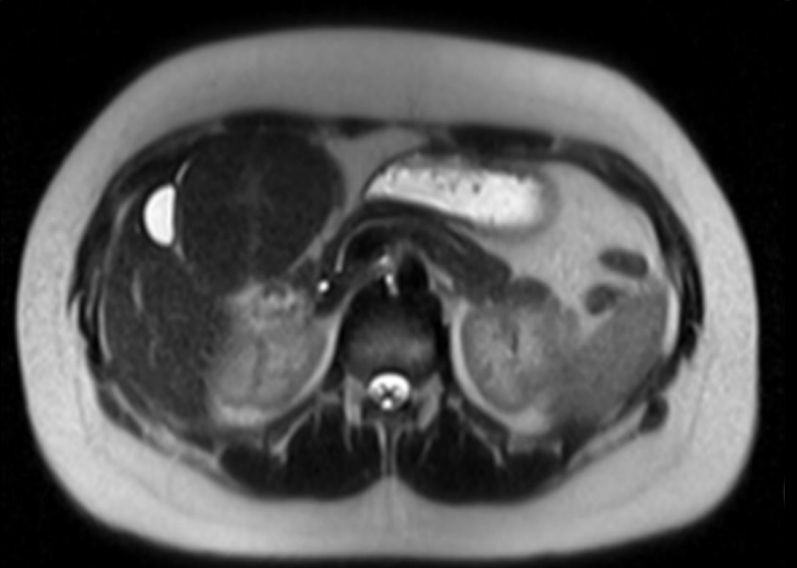




T1 20-minute Post-Contrast (Eovist)

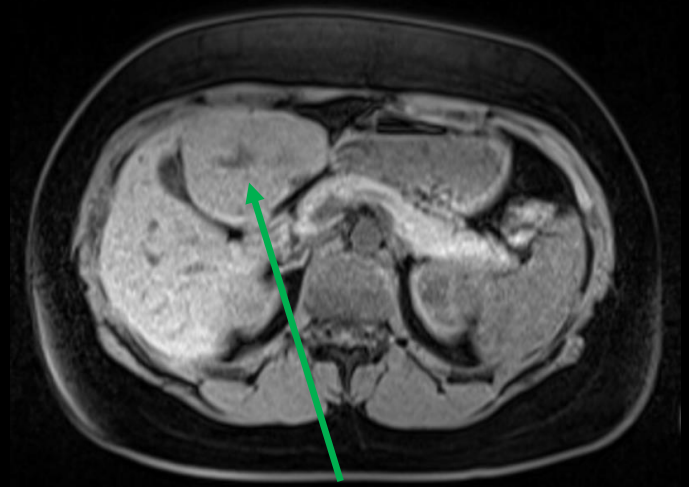


T1 20-minute Post-Contrast (Eovist) (Coronal)



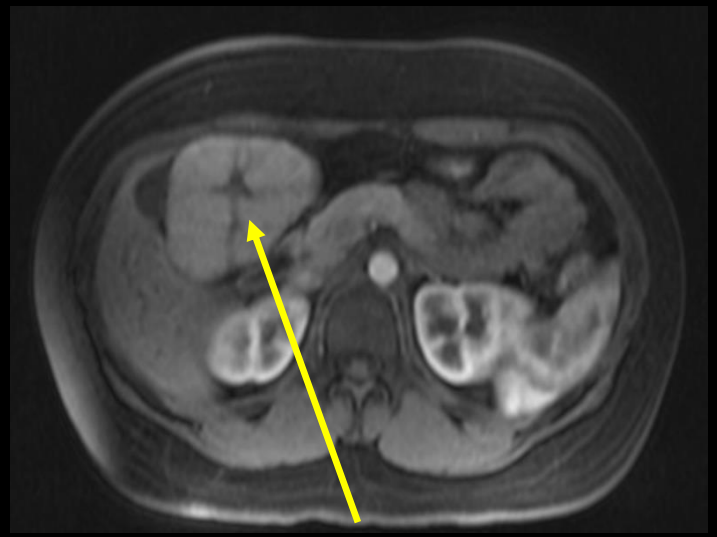
T2

T1 Non-Contrast



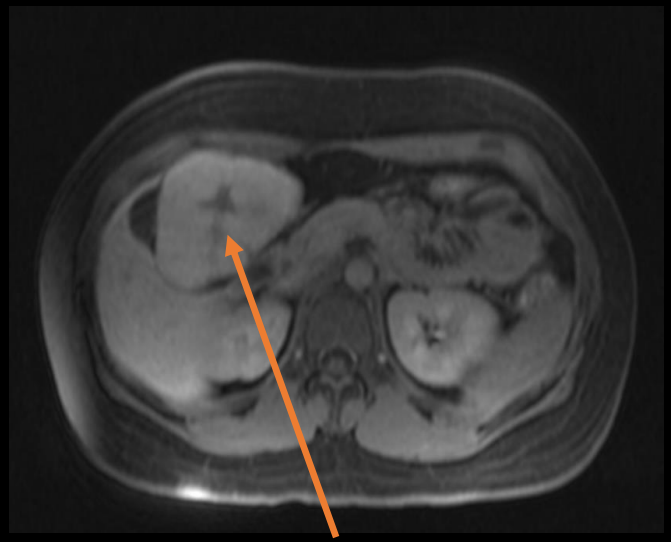
Hypo/isointense lesion with central scar

T1 Immediate Post-Contrast (Eovist)



Immediate lesion enhancement

T1 5-Minute Post-Contrast (Eovist)



Continued enhancement with hypointense central scar

Continued enhancement with hypointense central scar

T1 20-minute Post-Contrast (Eovist)

T1 20-minute Post-Contrast (Eovist) (Coronal)

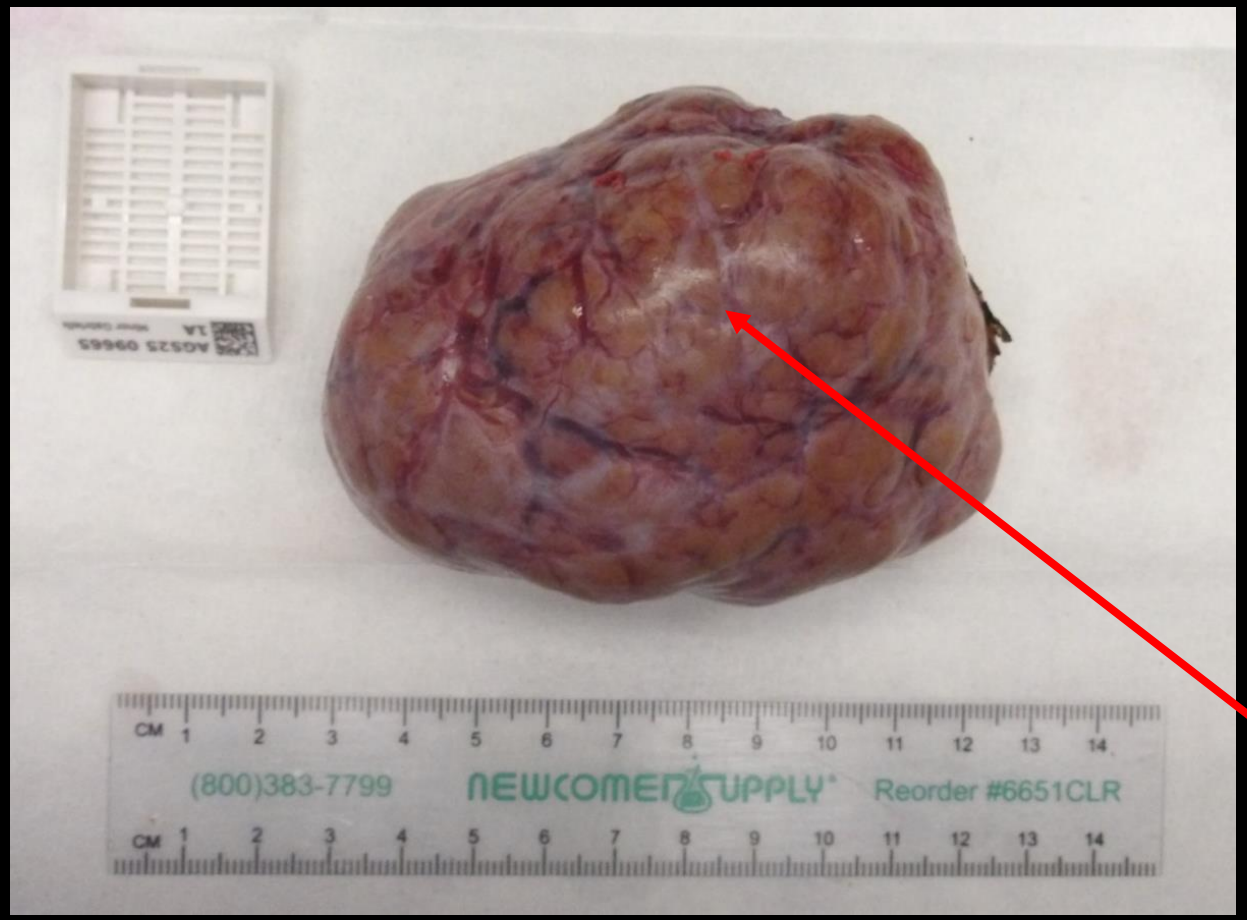
Isointense lesion with hyperintense scar

T2

Differential Diagnosis

- Focal Nodular Hyperplasia (FNH)
- Hepatic Adenoma
- Hepatic Hemangioma
- Hepatocellular Carcinoma (HCC)
- Hepatic Metastasis

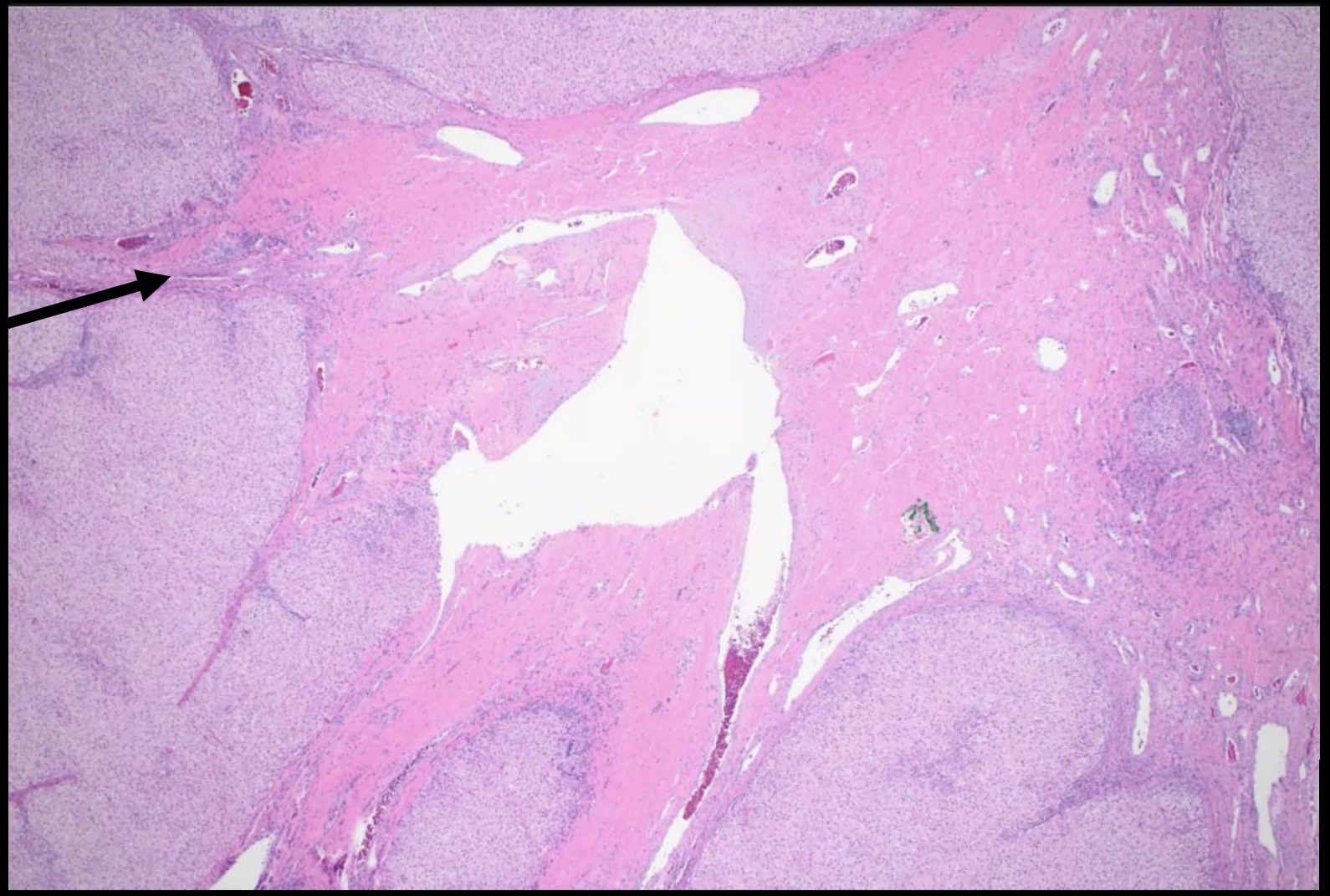
Gross Pathology



9.7cm x 8.2cm x 4.5cm Liver Mass with central tan white fibrotic area highly suggestive of FNH

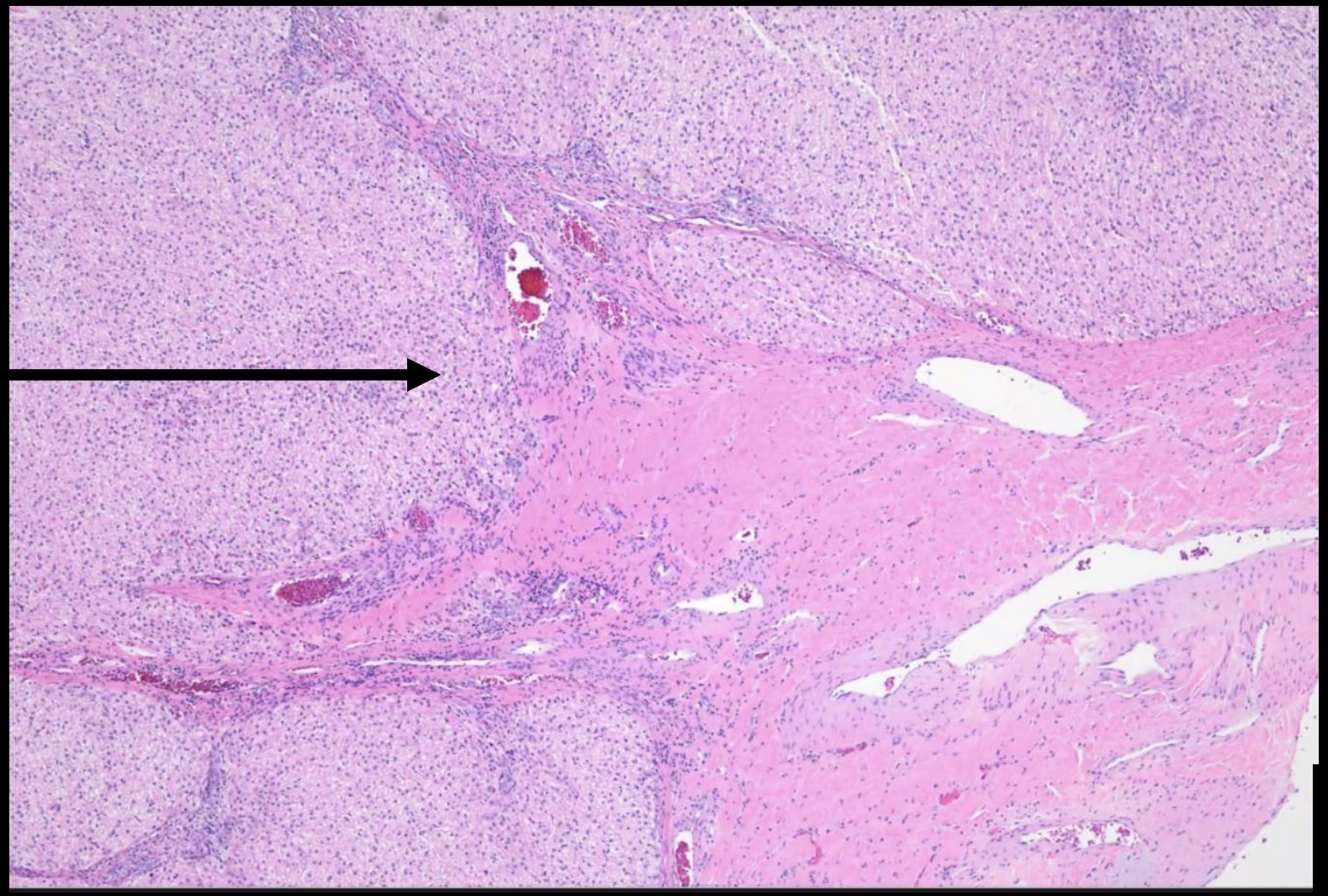
Micro Pathology

Liver Specimen at 2x: Liver Parenchyma with Central Scar



Micro Pathology

Liver Specimen at 4x: Liver Parenchyma with Central Scar



Final Dx:

Focal Nodular Hyperplasia (FNH)

Case Discussion

Definition:

- Focal Nodular Hyperplasia (FNH) is described as a benign regenerative hepatic mass and can be described as either typical or atypical depending on the gross and radiological findings

Epidemiology:

- Second most common benign liver lesion
  - Following hepatic hemangioma
- Most commonly occurs in young to middle aged adult women
  - Rarely affects men (15% of cases)
- In 25% of cases can occur with other liver lesions such as hepatic hemangiomas or AVMs

Case Discussion

Classic Clinical Presentation

- Usually asymptomatic and an incidental finding on abdominal imaging
- In about 20% of cases, patient presents with right-sided abdominal pain and signs/symptoms secondary to mass effect.

Pathophysiology

- The exact cause is still not fully understood; however, the leading explanation is that FNH arises secondary to arterial malformations in the liver. These vascular anomalies result in an increase in hepatocyte hyperplasia and regeneration. This response can occur secondary to both hypo- and hyperperfusion.

Case Discussion

- FNH on Multi-phase Liver CT
  - Non-contrast: Usually hypo- or isoattenuating
  - Arterial Phase: Bright homogenous enhancement except for central scar which stays hypo-attenuated
  - Portal Venous Phase: Lesion becomes less hyperattenuating and central scar remains hypodense
- FNH on MRI T1 C+ (Eovist)
  - Early arterial enhancement which continues through the delayed phase
  - Small amount of enhancement persists as the lesion slowly changes to match the surrounding liver intensity on the delayed hepatobiliary phase
    - FNH on T1 C+ (Gadolinium) does not have a hepatobiliary phase as Gadolinium is not readily taken up by hepatocytes
  - The characteristic central scar usually does not enhance in the delayed hepatobiliary phase
    - This is unlike FNH on T1 C+ (Gadolinium) in which the central scar retains its enhancement through its delayed phase

References:

1. “ACR Appropriateness Criteria®.” ® | American College of Radiology, www.acr.org/ClinicalResources/ACR-AppropriatenessCriteria. Accessed 12 Jul. 2025.

2. Gaillard F, Le L, Walizai T, et al. Focal nodular hyperplasia. Reference article, Radiopaedia.org (Accessed on 29 Jul 2025) https://doi.org/10.53347/rID-6749

3. Hamad S, Willyard CE, Mukherjee S. Focal Nodular Hyperplasia. [Updated 2022 Sep 26]. In: StatPearls [Internet]. Treasure Island (FL): StatPearls Publishing; 2025 Jan-. Available from: https://www.ncbi.nlm.nih.gov/books/NBK532244/

4. University of Pittsburgh Medical Center. (n.d.). *Focal nodular hyperplasia (FNH)*. UPMC. https://www.upmc.com/services/digestive-disorders-center/services/liver-diseases/conditions/liver-cancer/focal-nodular-hyperplasia

5. Venturi A, Piscaglia F, Vidili G, Flori S, Righini R, Golfieri R, Bolondi L. Diagnosis and management of hepatic focal nodular hyperplasia. J Ultrasound. 2007 Sep;10(3):116-27. doi: 10.1016/j.jus.2007.06.001. Epub 2007 Aug 1. PMID: 23396642; PMCID: PMC3478711.