A case of chronic liver disease (hepatocellular carcinoma)

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Diagnostic Radiology, RAD 4001

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Clinical History

- 70 y.o. female with obesity and known NASH cirrhosis (diagnosed 7 years ago) presenting with confusion and disorientation
- Current symptoms:
  - Mild confusion, disorientation, forgetfulness (increasing over past few months)
  - Lower extremity and abdominal swelling
- Physical exam findings:
  - Stable vitals: 98.0 F, HR: 78, RR: 16, BP: 141/82, SpO2: 95%
  - LE pitting edema 2+ bilaterally
  - Abdominal distension, no mention of shifting dullness
- Work-up (notable labs):
  - CBC with differential: low platelets (122,000 mm^3)
  - Elevated alpha-fetoprotein (226 ng/mL) - *normal: 10-20 ng/mL*
    - >400 ng/mL is 95% specific for HCC[1]

ACR Appropriateness Criteria

- Chronic liver disease: NASH; w/ symptoms of hepatic encephalopathy & notable labs
- Imaging was appropriate according to ACR appropriateness criteria[2]

Variant 2: **Chronic liver disease. Screening and surveillance for hepatocellular carcinoma (HCC). No prior diagnosis of HCC.**

Procedure	Appropriateness Category	Relative Radiation Level
MRI abdomen without and with IV contrast	Usually Appropriate	O
MRI abdomen without and with hepatobiliary contrast	Usually Appropriate	O
US abdomen	Usually Appropriate	O
CT abdomen with IV contrast multiphase	Usually Appropriate	☢☢☢☢
MRI abdomen without IV contrast	May Be Appropriate	O
MR elastography abdomen	May Be Appropriate	O
US elastography ARFI abdomen	May Be Appropriate	O
CT abdomen without IV contrast	Usually Not Appropriate	☢☢☢
FDG-PET/CT skull base to mid-thigh	Usually Not Appropriate	☢☢☢☢
1D transient elastography abdomen	Usually Not Appropriate	O
CT abdomen without and with IV contrast	Usually Not Appropriate	☢☢☢☢

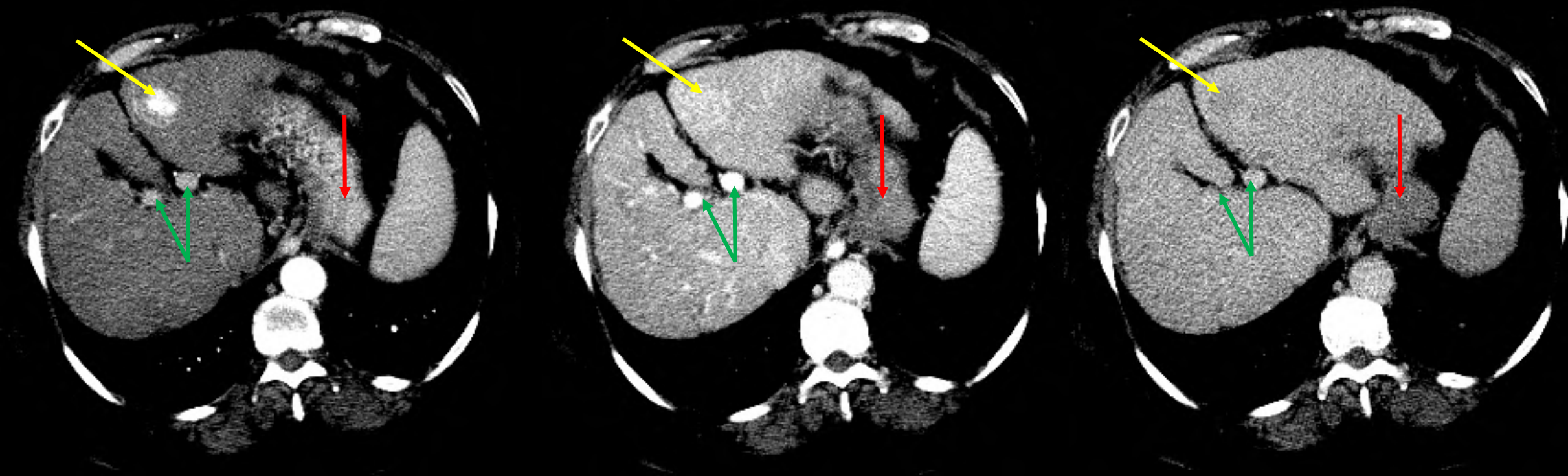
Liver lesion in segment 3

- 9/30/19: Triple phase CT abdomen w/ and w/out contrast (liver protocol), axial views

Arterial phase:
hyperdense

Portal venous phase:
hyper-/isodense

Delayed phase:
hypodense



Label Key

Yellow: 2.4x2.4x2.2cm mass in segment 6

Green: Portal vein (main branches)

Red: Stomach

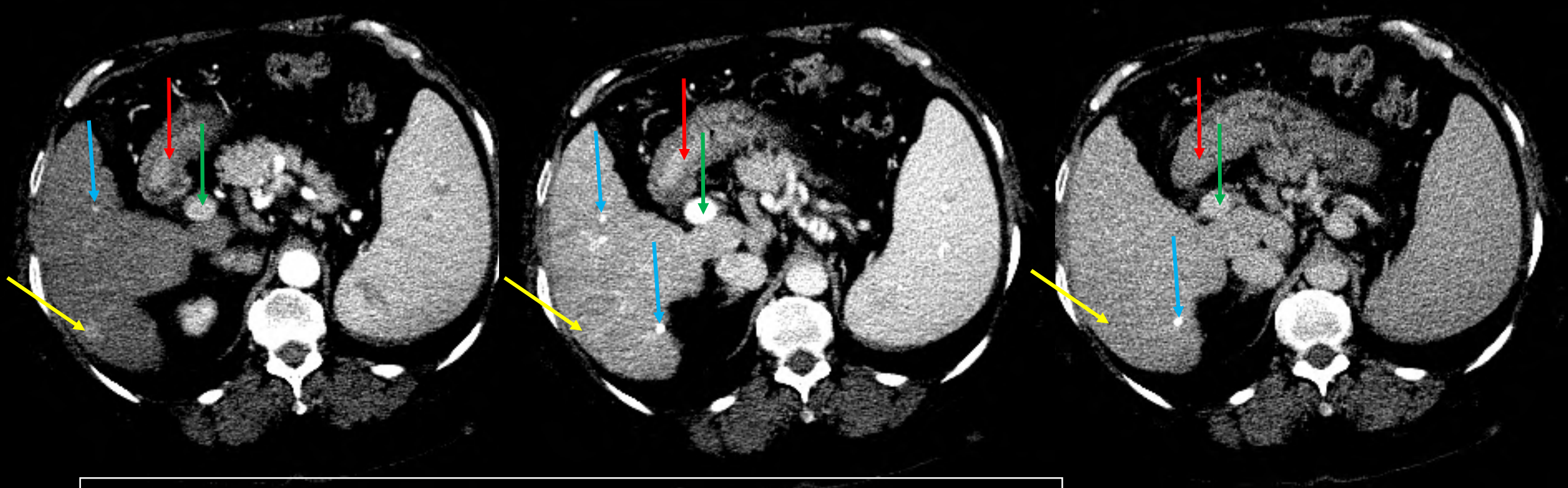
Liver lesion in segment 6

- 9/30/19: Triple phase CT abdomen w/ and w/out contrast (liver protocol), axial views

Arterial phase:
hyperdense

Portal venous phase:
isodense

Delayed phase:
isodense



Label Key

Yellow: 0.9x0.9x9.8cm mass in segment 6

Blue: calcified granulomas

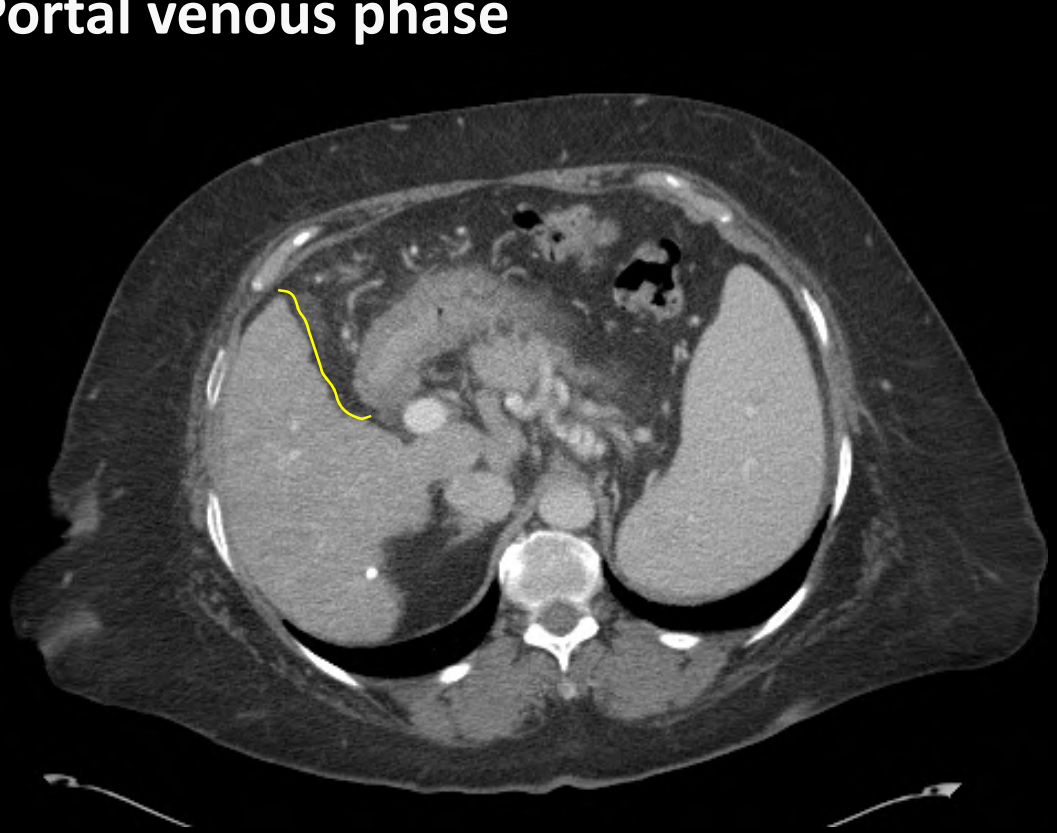
Green: Portal vein

Red: Gastroduodenal junction

Additional liver findings

- 9/30/19: Triple phase CT abdomen w/ and w/out contrast (liver protocol); axial & coronal views

Portal venous phase

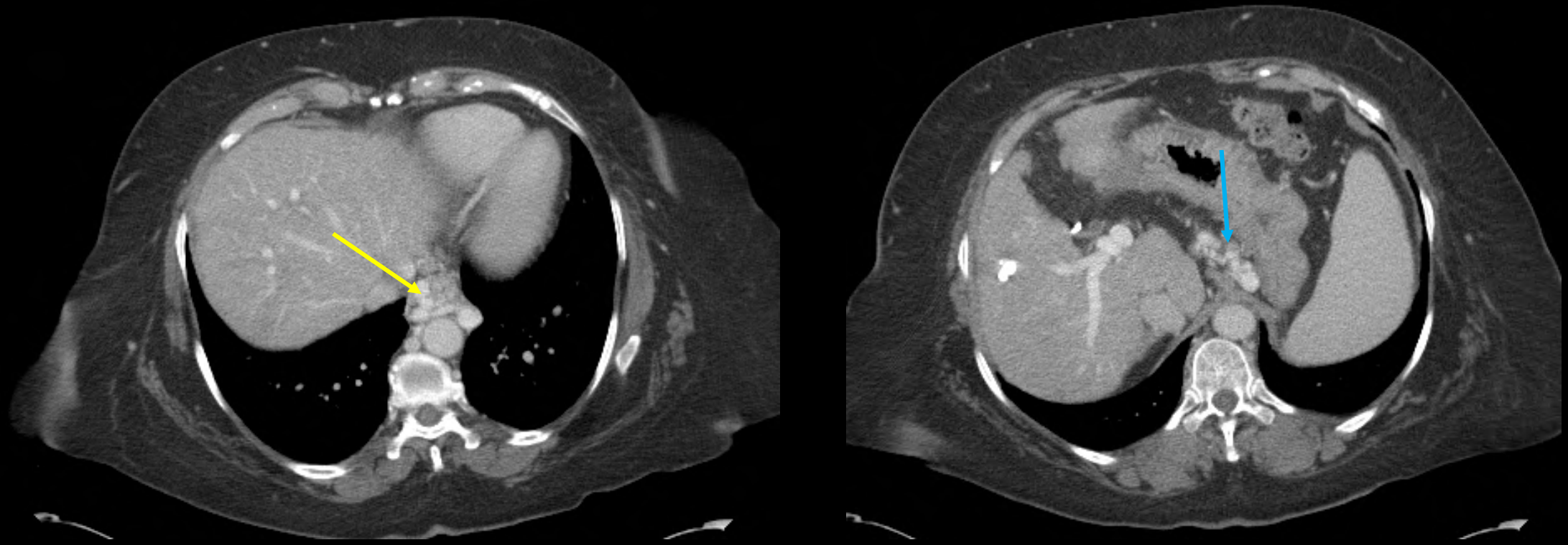


Label Key	
	Nodular liver
	Portal vein caliber = 1.6cm in this pt. (≥13mm in diameter suggests portal HTN[3])

Varices

- 9/30/19: Triple phase CT abdomen w/ and w/out contrast (liver protocol); axial views

Portal venous phase



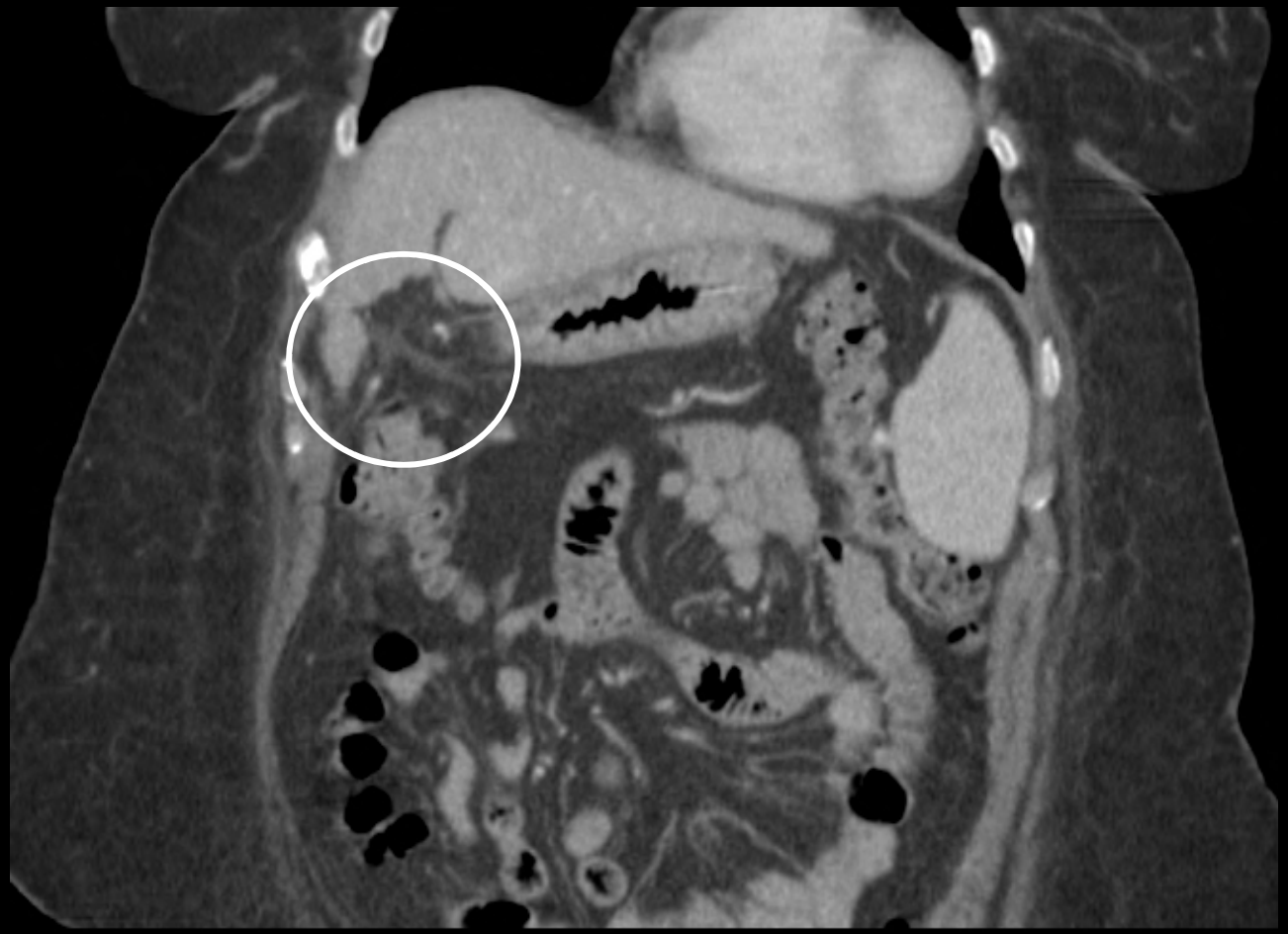
Label Key

Esophageal varices & gastric varices

Free fluid

- 9/30/19: Triple phase CT abdomen w/ and w/out contrast (liver protocol); axial view

Portal venous phase

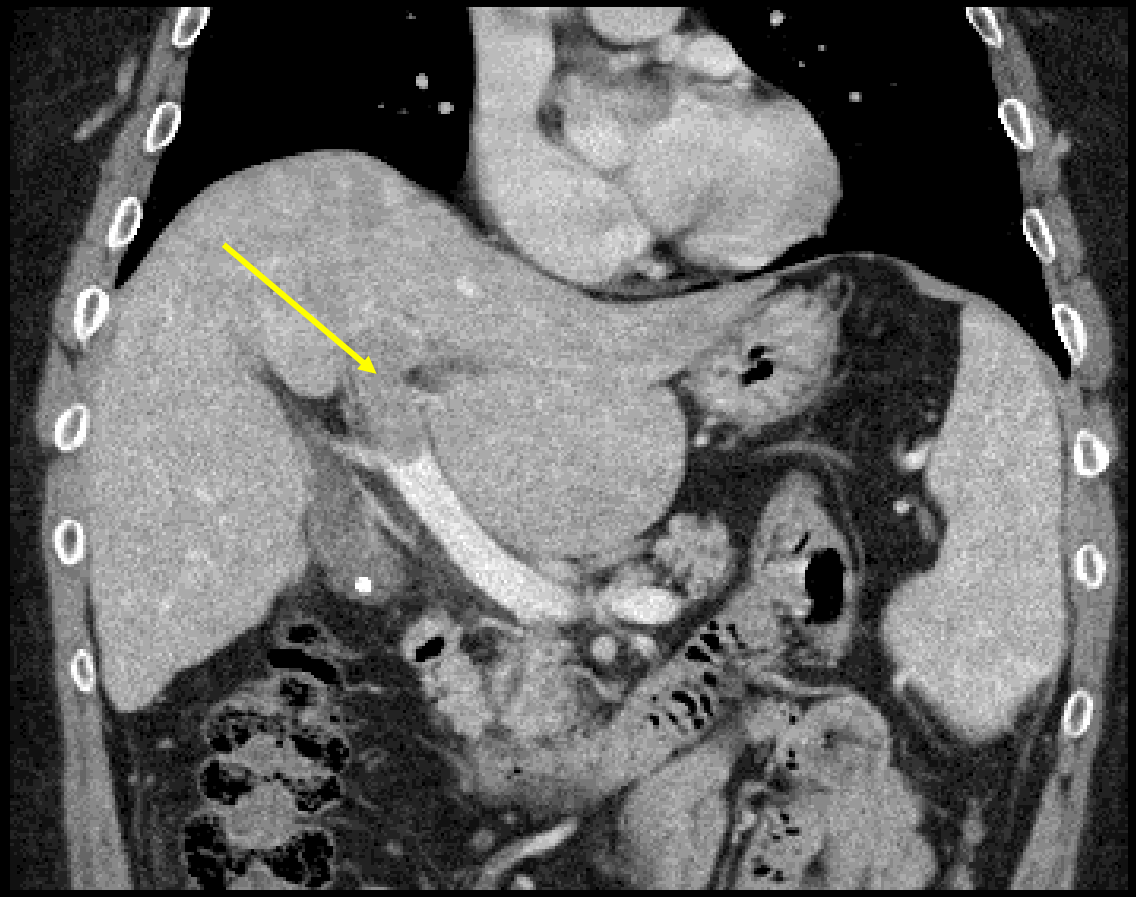


Label Key

Trace fluid fluid adjacent to liver (possibly developing ascites)

Portal vein tumor thrombosis (*different patient*)

Coronal CT C&A, arterial phase



Coronal CT C&A, portal venous phase

Yellow arrow: Portal venous tumor thrombosis

Image Source URL: https://radiopaedia.org/cases/infiltrative-hepatocellular-carcinoma-with-portal-vein-tumor-thrombosis?lang=us

Summary of Key Imaging Findings

- Patient PMH: obesity, NASH (chronic liver disease)
- Patient CC: confusion, disorientation, forgetfulness, LE edema
- Imaging findings:
  - Multiple liver masses: one in segment 3 and one in segment 6
  - Calcified granulomas in right liver
  - Portal vein caliber of 1.6cm
  - Large esophageal & perigastric varices
  - Trace free fluid adjacent to the liver with mild mesenteric stranding

Differential Diagnosis: Hypervascular liver lesions

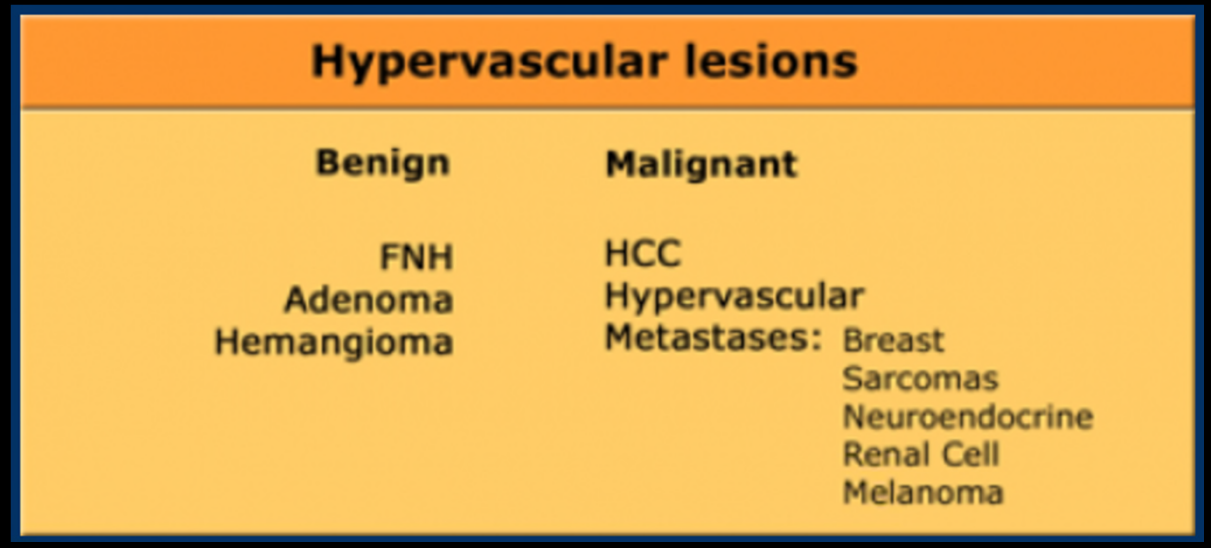


Figure 1[5]

- Liver has a dual blood supply: portal vein (80%) & hepatic artery (20%)
- Hemangiomas are the most common liver tumor[6]
- Cysts, abscesses, and certain types of metastasis (eg, from colon) are *hypovascular*, thus would *not* show this pattern of enhancement[6]

Discussion: LI-RADS Criteria (v2018)

Step 1: check if patient meets requirements to apply LI-RADS criteria for classification of liver masses

Use LI-RADS	Do not use LI-RADS
- Cirrhosis - Hep B +/- cirrhosis - Current or prior HCC	- < 18 years - Cirrhosis in: - congenital hepatic fibrosis - Budd-Chiari - portal vein occlusion - diffuse nodular regenerative hyperplasia - cardiac congestion

Figure 2a[7]

Step 2: apply diagnostic algorithm to classify each liver mass

CT/MRI Diagnostic Table

Arterial phase hyperenhancement (APHE)		No APHE		Nonrim APHE		
Observation size (mm)		< 20	≥ 20	< 10	10-19	≥ 20
Count additional major features: • Enhancing "capsule" • Nonperipheral "washout" • Threshold growth	None	LR-3	LR-3	LR-3	LR-3	LR-4
	One	LR-3	LR-4	LR-4	LR-4 / LR-5	LR-5
	≥ Two	LR-4	LR-4	LR-4	LR-5	LR-5

LR-4 / LR-5

Observations in this cell are categorized based on one additional major feature:
- LR-4 – if enhancing "capsule"
- LR-5 – if nonperipheral "washout" **OR** threshold growth

Figure 3a[8]

Discussion: LI-RADS Criteria (v2018) (cont.)

This patient:

- Segment 3 mass: 2.4x2.4x2.2cm, with non-peripheral washout
- Segment 6 mass: 0.9x0.9x9.8cm, with no additional major features

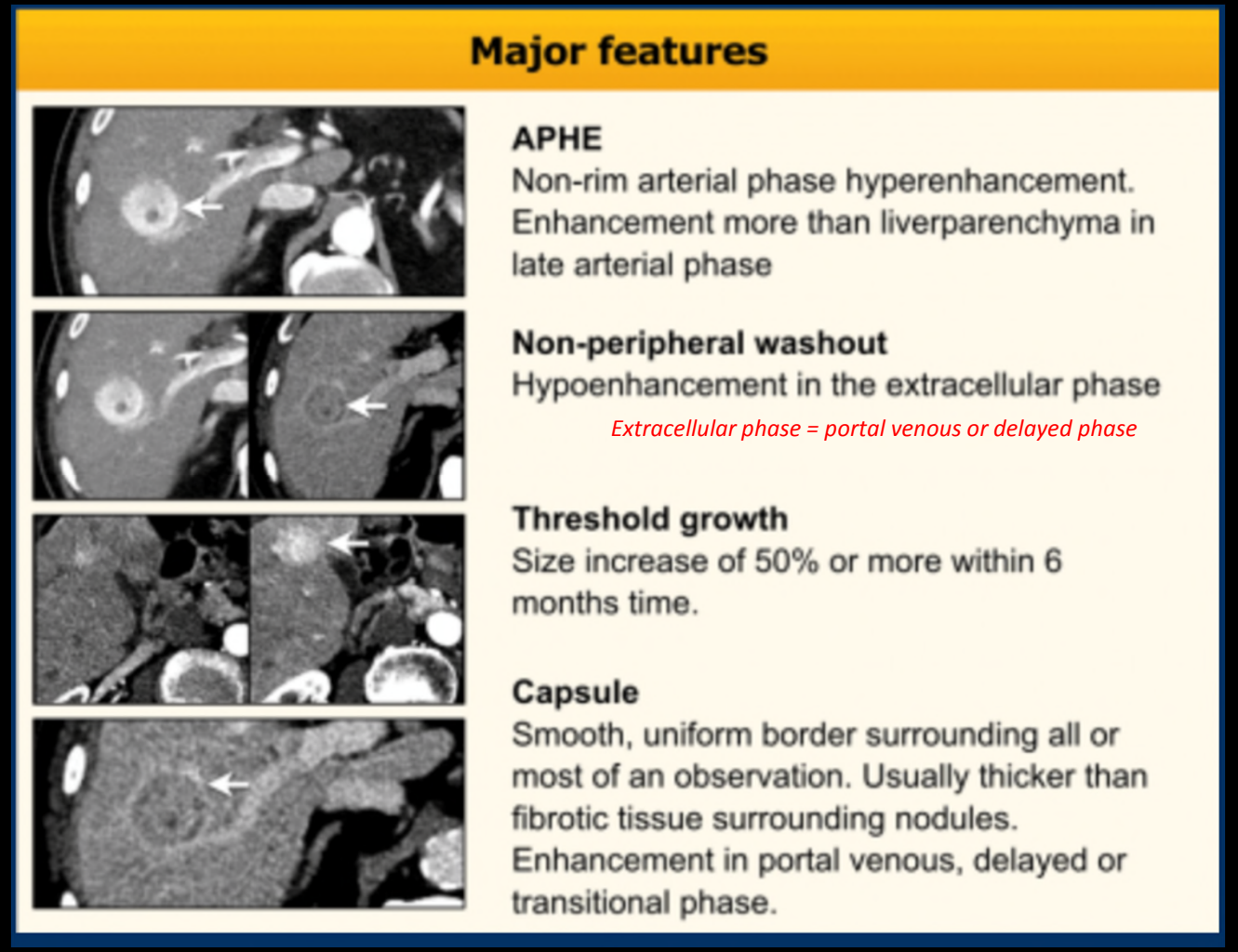


Figure 2b[7]

Discussion: LI-RADS Criteria (v2018) (cont.)

Step 3: determine next steps after classifying each liver mass

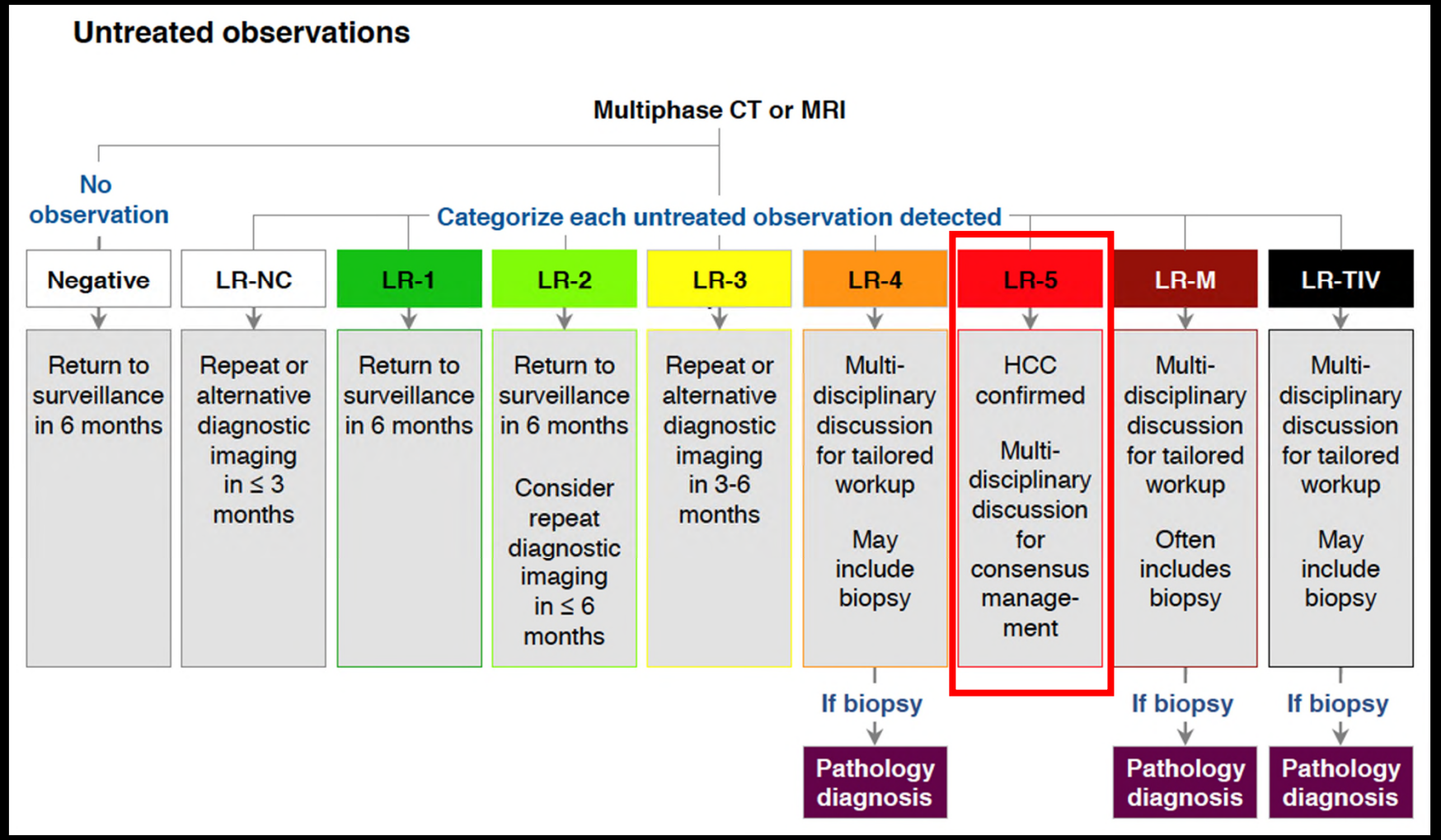


Figure 3b[8]

Final Diagnosis: Hepatocellular carcinoma

- Most likely secondary to NASH
- HCC can be solitary, multiple masses, or diffusely infiltrating[6]
- LI-RADS criteria for **hepatocellular carcinoma**:
  - Segment 3 mass meets LI-RADS grade 5 (diagnostic of HCC)
  - Segment 6 mass meets LI-RADS grade 3

Treatment Options: TACE

- Patient has been referred to IR for **TACE procedure**, and is also awaiting a liver transplant
- **Transcatheter Arterial Chemoembolization (TACE)**: administration of chemoembolic microspheres directly into main arterial branch supplying tumor

Other Treatment Options

- Minimally invasive treatments:
  - Thermal ablation (limitations[9]: size >5cm, near major vessels, # of nodules ≥3)
  - Transcatheter Arterial Chemoembolization (TACE)
  - Transarterial Y90 Radioembolization
- Other treatments:
  - Liver resection
  - Liver transplant (*this patient*: MELD score: 11; Karnofsky score: 60)
  - Systemic chemotherapeutic agents (sorafenib, regorafenib)

Cost of Imaging at Memorial Hermann

- CT Abdomen W/ & W/O Contrast[10]
  - Insured: charged $6,534, patient owes $284
  - Uninsured: patient owes $2,352

Take Home Points

- Hypervascular liver lesions *enhance* in arterial phase, whereas normal liver parenchyma will not enhance until portal venous phase
- LI-RADS grade 5 on CT or MRI is diagnostic of hepatocellular carcinoma
- Consider minimally invasive procedures (thermal ablation, TACE, Y90 radioembolization) to treat patients with HCC who meet criteria

References

- (1) Chan SL, Mo F, Johnson PJ, et al. Performance of serum α-fetoprotein levels in the diagnosis of hepatocellular carcinoma in patients with a hepatic mass. HPB (Oxford). 2014;16(4):366-72.
- (2) ACR Appropriateness Criteria, Chronic Liver Disease. Website URL: https://acsearch.acr.org/docs/3098416/Narrative/
- (3) Bogdan Procopet, Annalisa Berzigotti, Diagnosis of cirrhosis and portal hypertension: imaging, non-invasive markers of fibrosis and liver biopsy, Gastroenterology Report, Volume 5, Issue 2, May 2017, Pages 79–89, https://doi.org/10.1093/gastro/gox012
- (4) Portal Vein Tumor Thrombosis. Website URL: https://radiopaedia.org/cases/infiltrative-hepatocellular-carcinoma-with-portal-vein-tumor-thrombosis?lang=us
- (5) Hypervascular lesions. Website URL: https://radiologyassistant.nl/assets/liver-masses-i-characterisation/a509797744c753_TAB-hypervascular.png
- (6) Herring, W. (2007). Learning Radiology: Recognizing the Basics. 4th ed. Philadelphia: Elsevier, pp.181-183.
- (7) Liver – LI-RADS, Major Features. Website URL: https://radiologyassistant.nl/abdomen/liver-segmental-anatomy-1
- (8) American College of Radiology, LI-RADS Criteria v2018. CT/MRI Diagnostic Table. Website URL: https://www.acr.org/-/media/ACR/Files/RADS/LI-RADS/LI-RADS-2018-Core.pdf?la=en
- (9) Crocetti L, de Baere T, Lencioni R. Quality improvement guidelines for radiofrequency ablation of liver tumours. Cardiovasc Intervent Radiol. 2010;33(1):11–17. doi:10.1007/s00270-009-9736-y
- (10) Cost of Imaging at Memorial Hermann. Website URL: https://www.memorialhermann.org/patients-caregivers/pricing-estimates-and-information/


Questions?