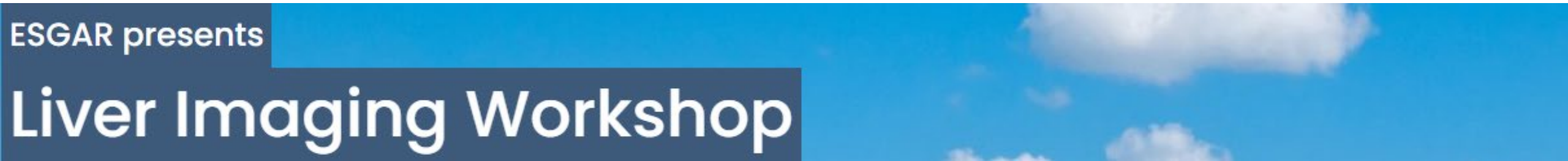
University of Palermo (Italy)
Department of Biomedicine, Neuroscience and Advanced Diagnostics

Liver MRI:

Extracellular agents

Dr. Roberto Cannella



Disclosures

- Co-funding by the European Union - FESR or FSE, PON Research and Innovation 2014-2020 - DM 1062/2021.
- Research collaboration with Siemens Healthineers.
- Support for attending meetings from Bracco and Bayer.

Learning objectives

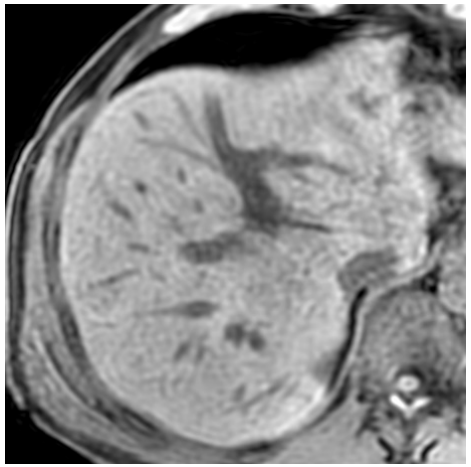
1. Basic concepts of extracellular contrast agent application for liver MRI.
2. Knowledge on the typical enhancement pattern for differential diagnosis of focal liver lesions.

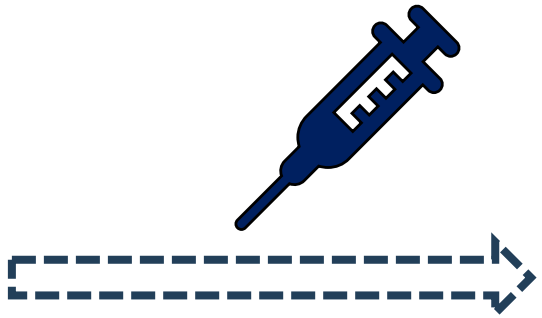
MRI

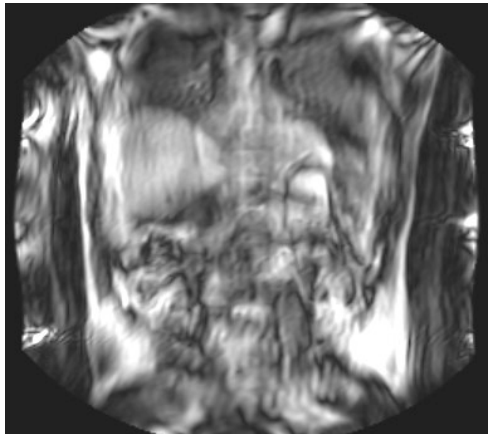
Which MRI contrast agent should I use to characterize a liver lesion?

MRI protocol

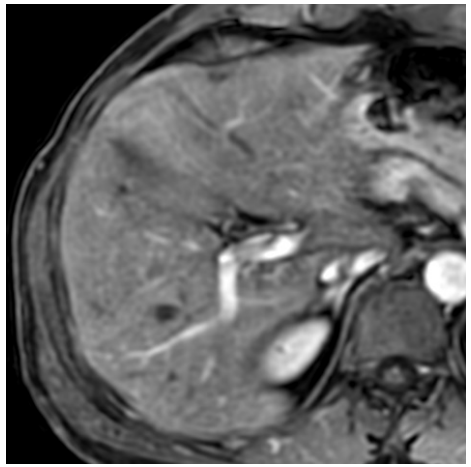
- MR scanners ≥1.5T



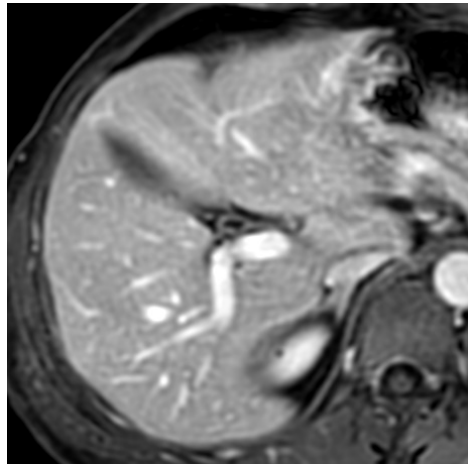




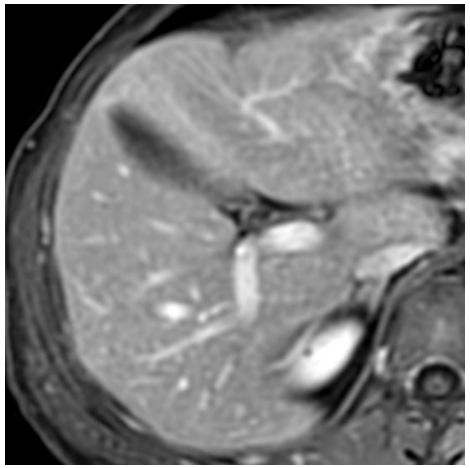
12-15 s



50-60 s

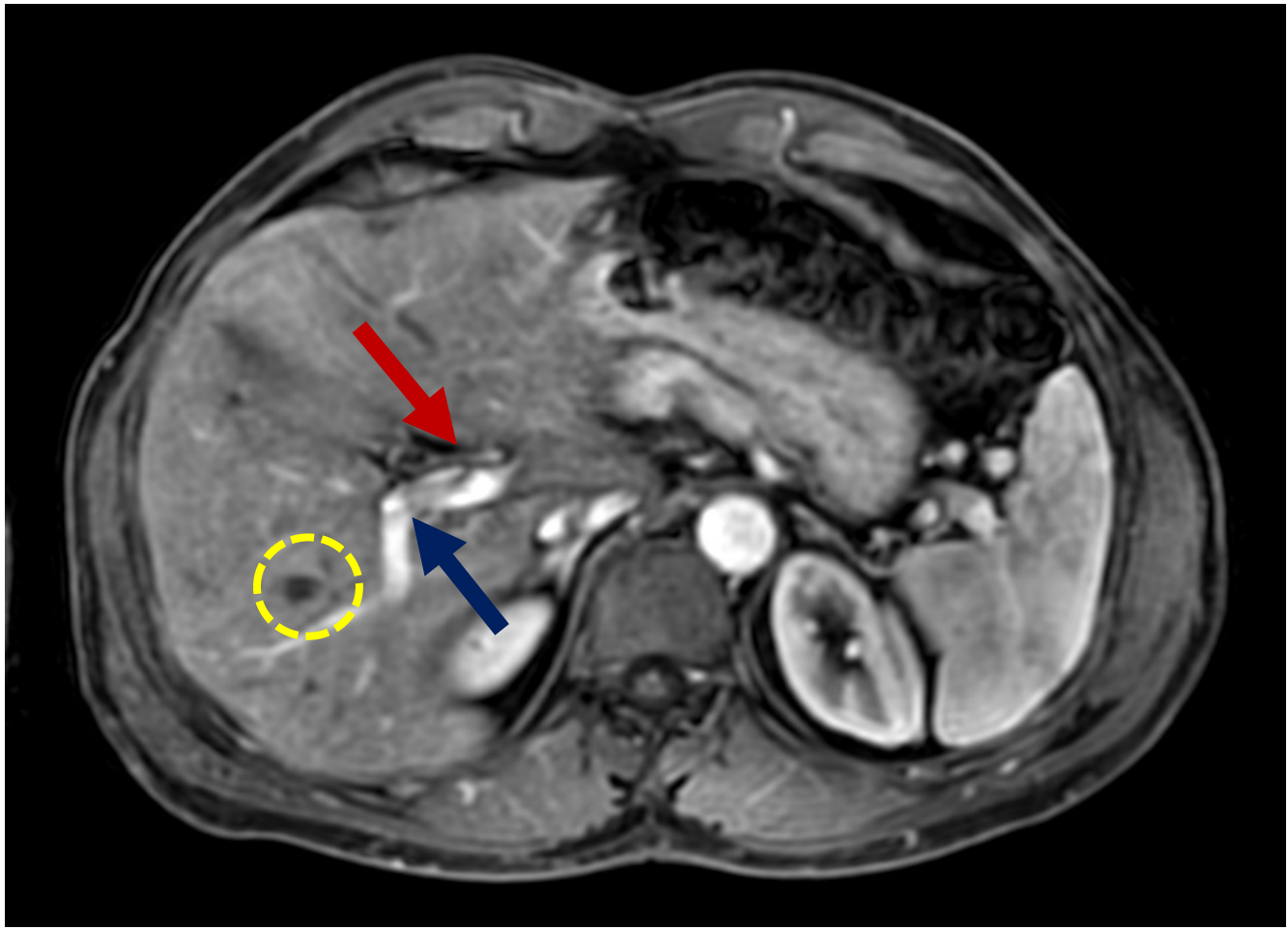


2-5 min



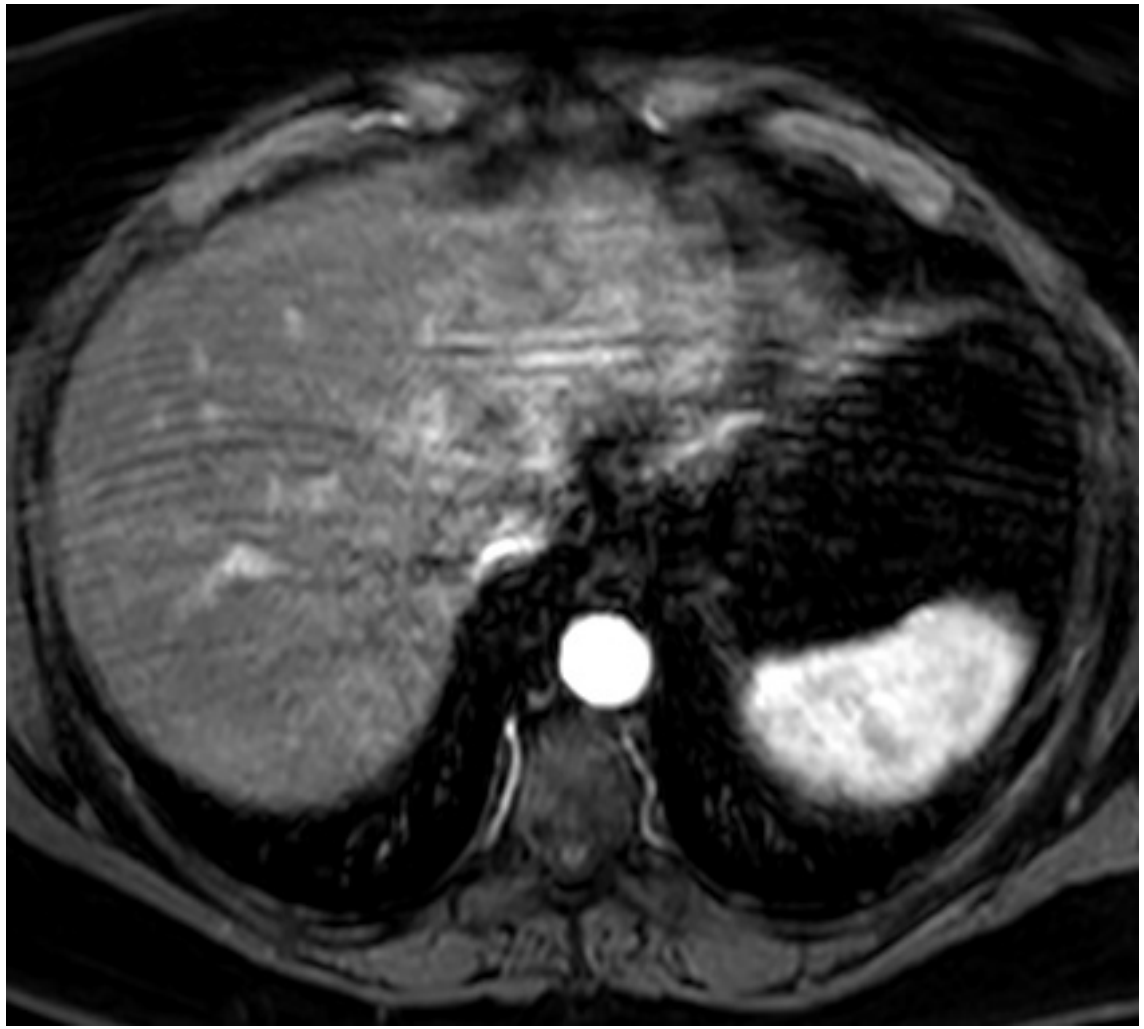
Hepatic arterial phase

- 3D sequence with a slice thickness <5 mm
- Fat saturation
- Late arterial phase should be preferred



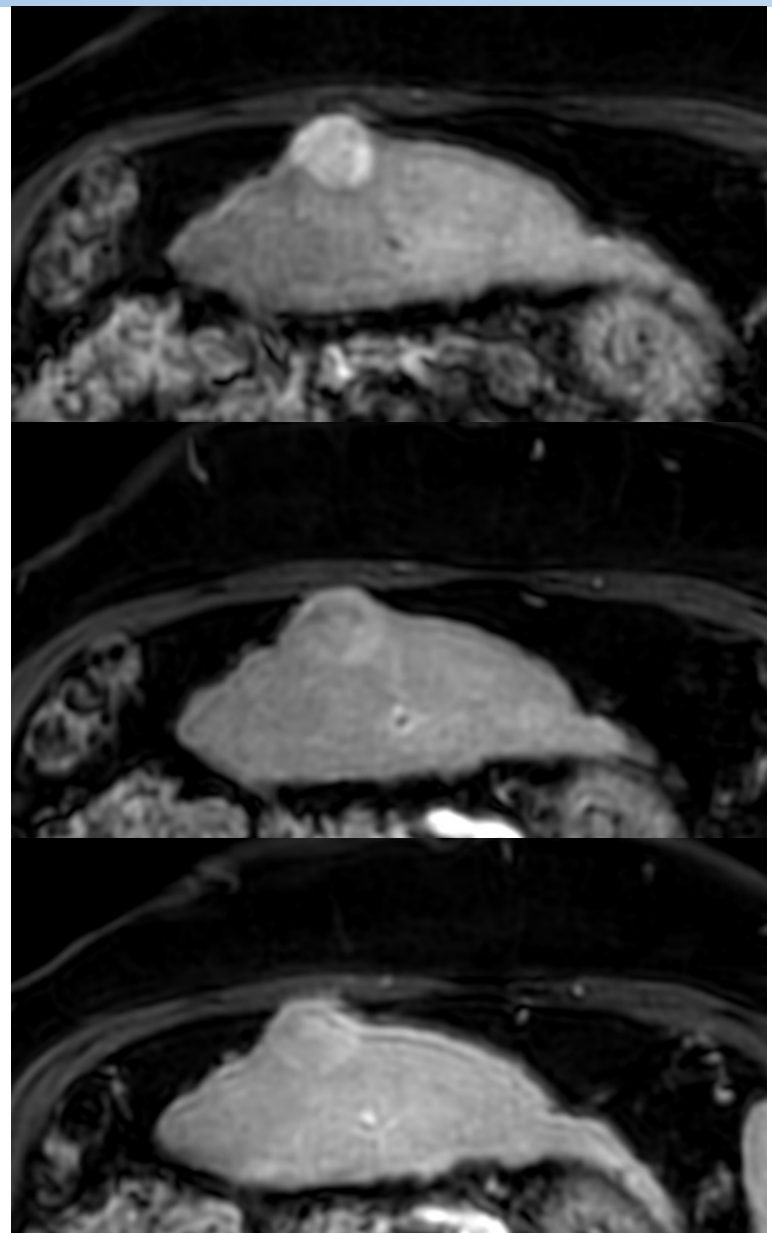
Hepatic arterial phase

- 3D sequence with a slice thickness <5 mm
- Fat saturation
- Late arterial phase should be preferred



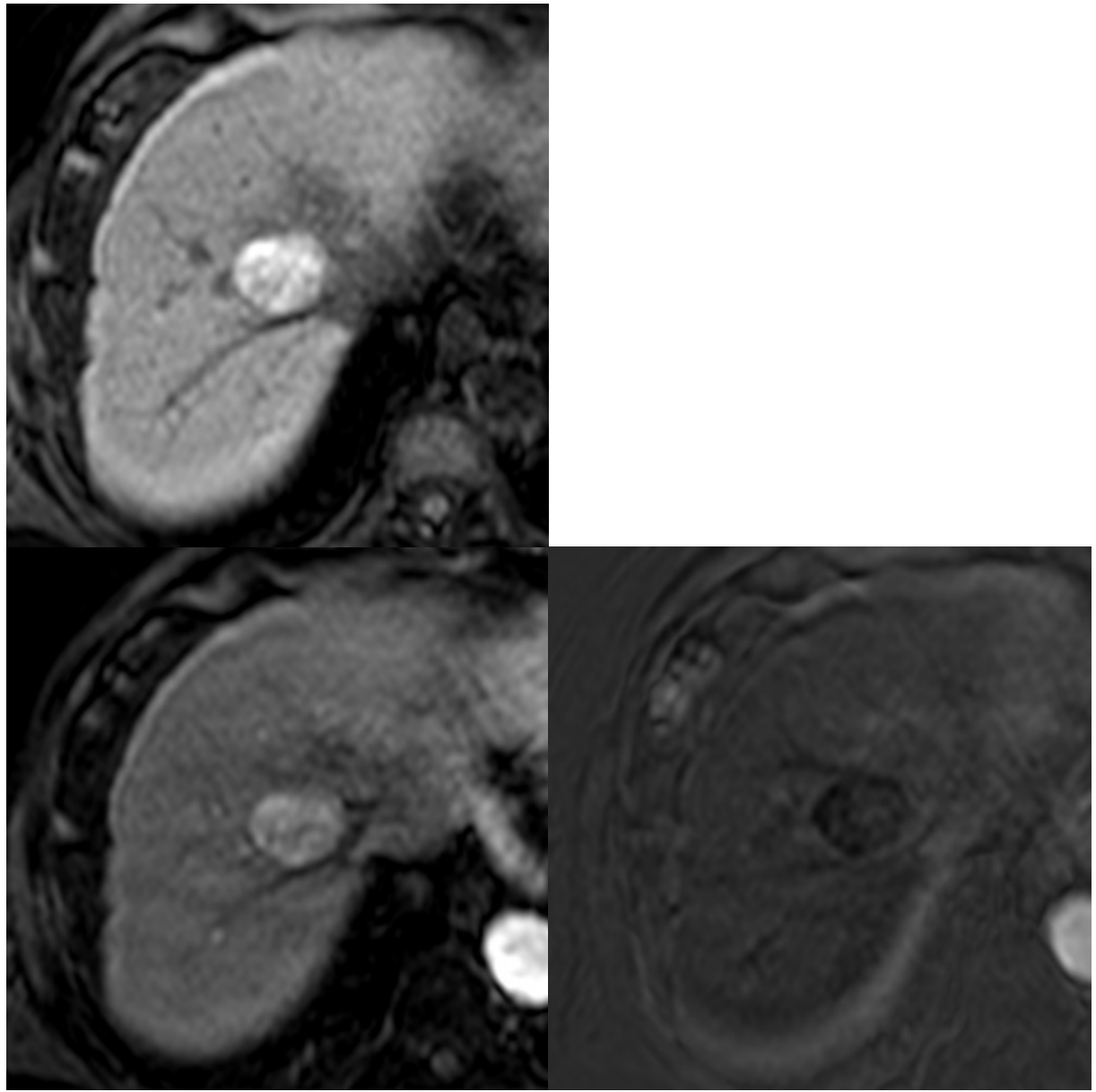
Hepatic arterial phase

- 3D sequence with a slice thickness <5 mm
- Fat saturation
- Late arterial phase should be preferred
- Multi-arterial should be preferred if available



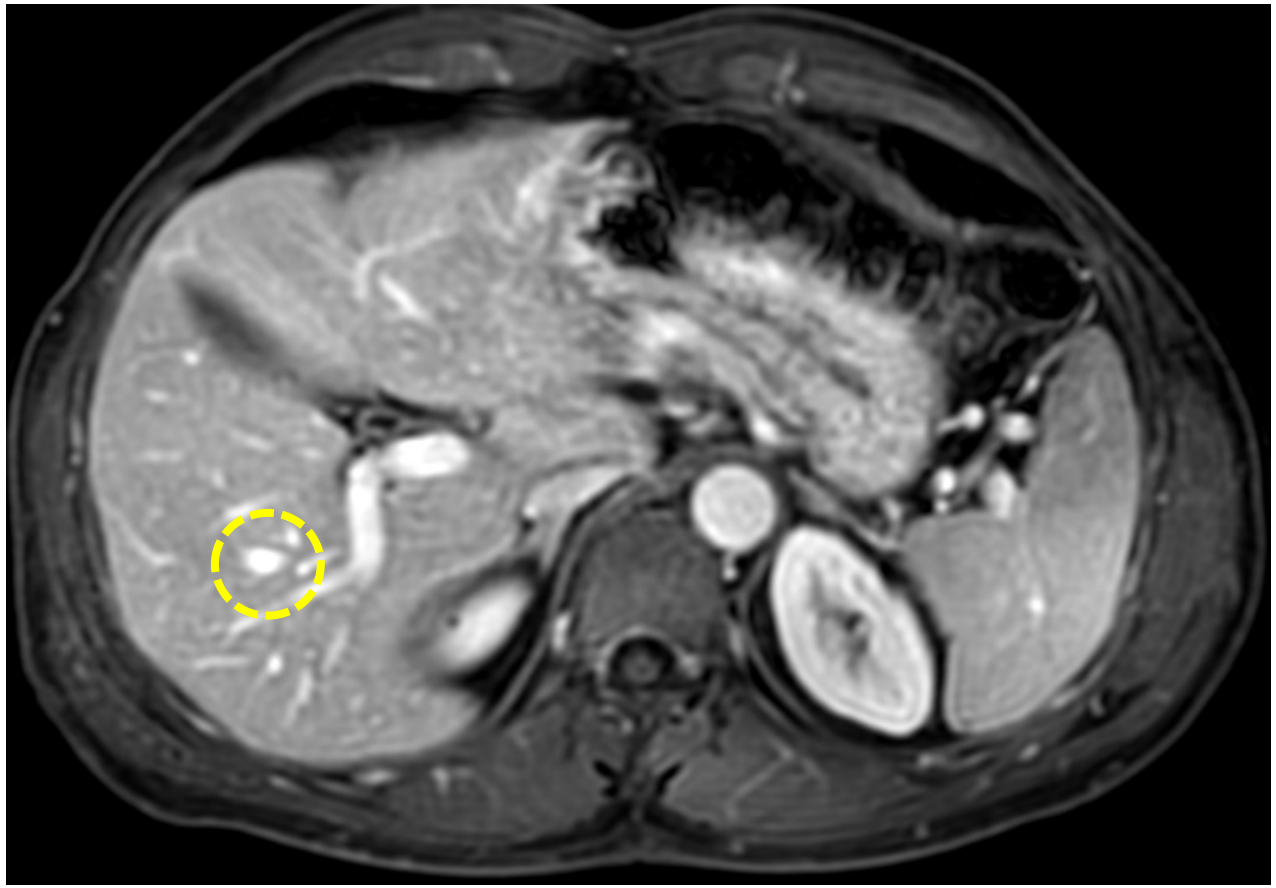
Hepatic arterial phase

- 3D sequence with a slice thickness <5 mm
- Fat saturation
- Late arterial phase should be preferred
- Multi-arterial should be preferred if available
- Subtraction images are suggested



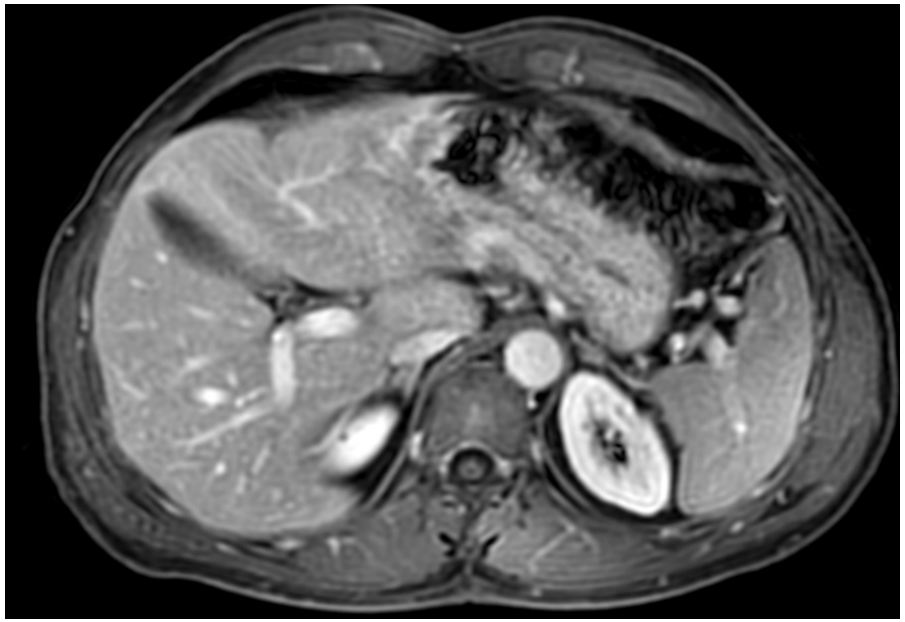
Portal venous and delayed phases

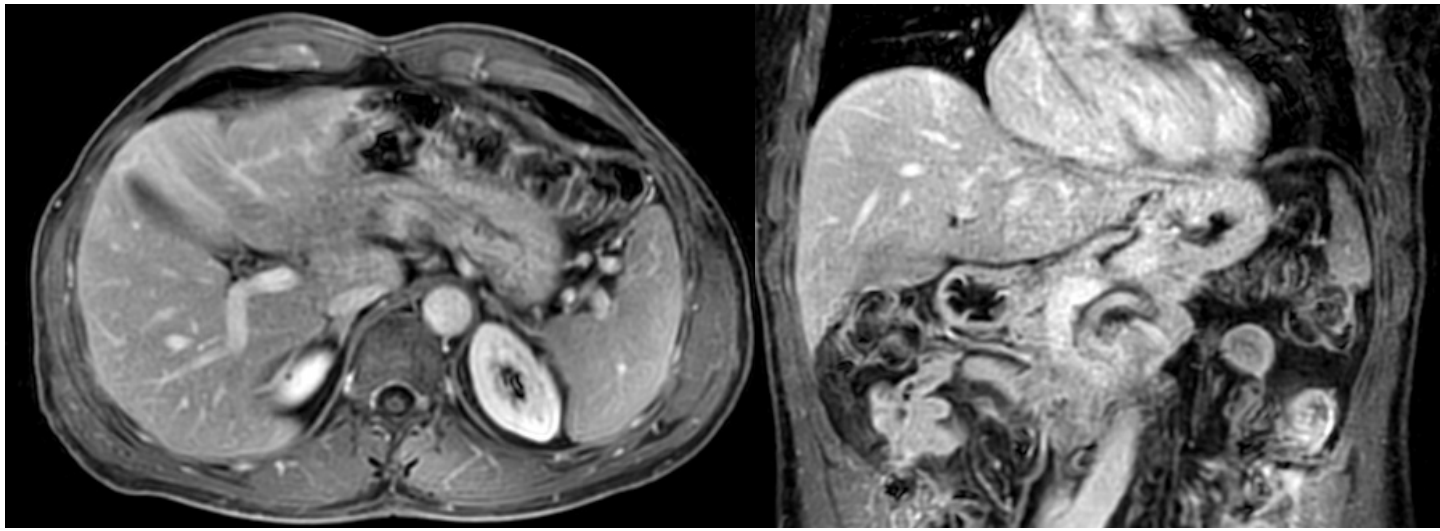
- 3D sequence with a slice thickness <5 mm
- Fat saturation
- 60-70 seconds



Portal venous and delayed phases

- 3D sequence with a slice thickness <5 mm
- Fat saturation
- 2-5 minutes delayed phases
- Multiplanar acquisitions are suggested





Technical recommendations

Abdominal Radiology

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LI-RADS technical requirements for CT, MRI, and contrast-enhanced ultrasound

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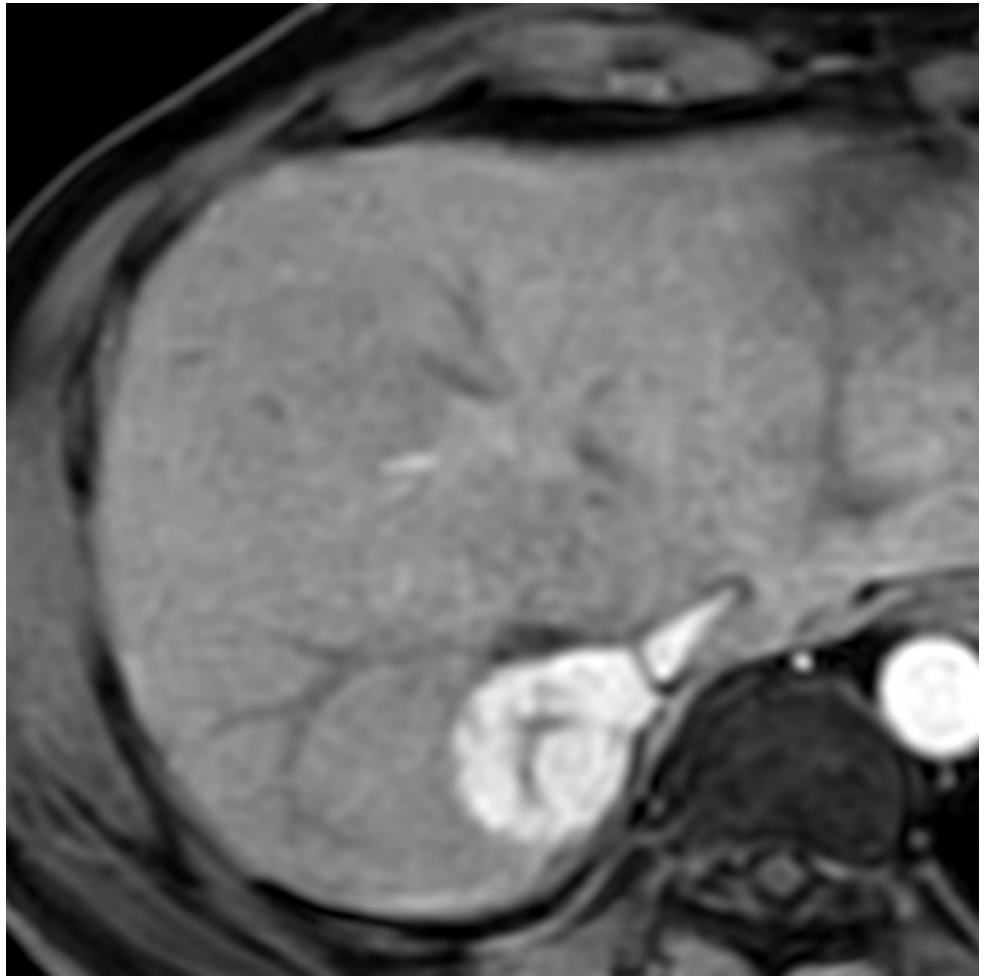
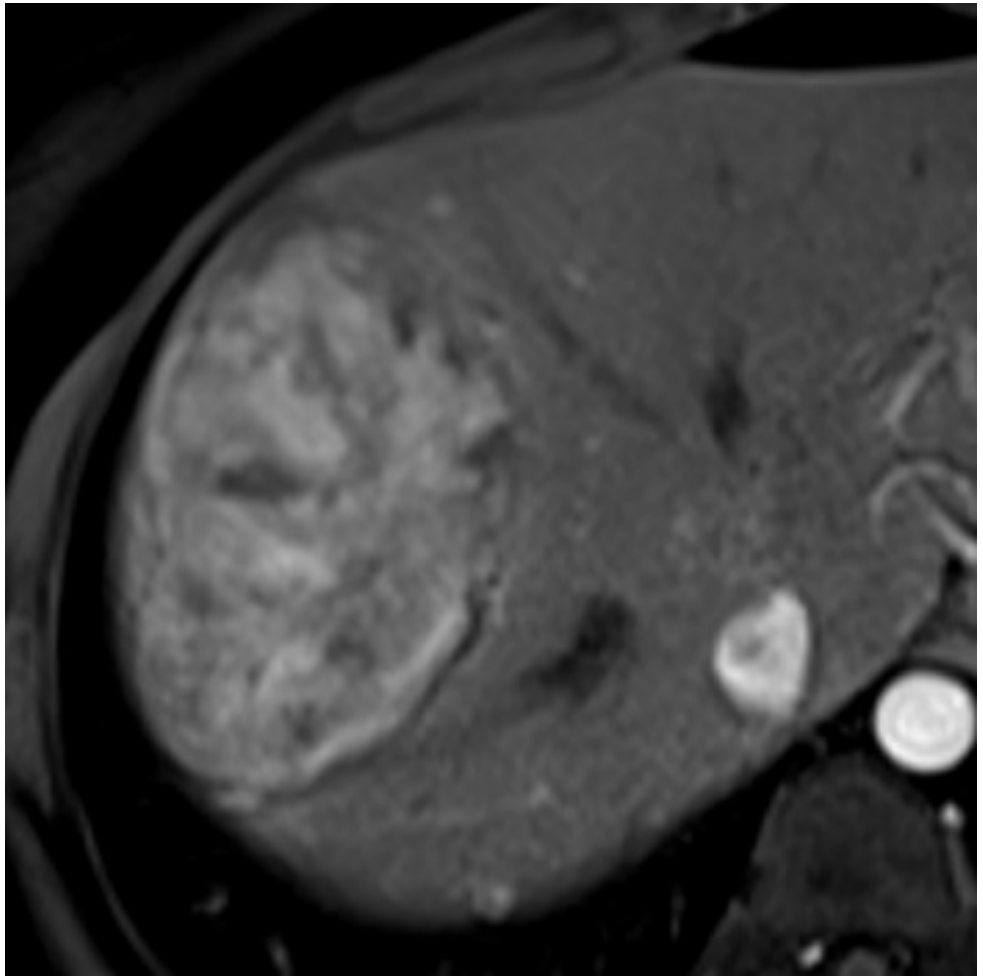
Enhancement patterns (HAP)

	Nonrim APHE
HH	
FNH	
HCA	
HCC	
iCCA	
MTS	

Enhancement patterns (HAP)

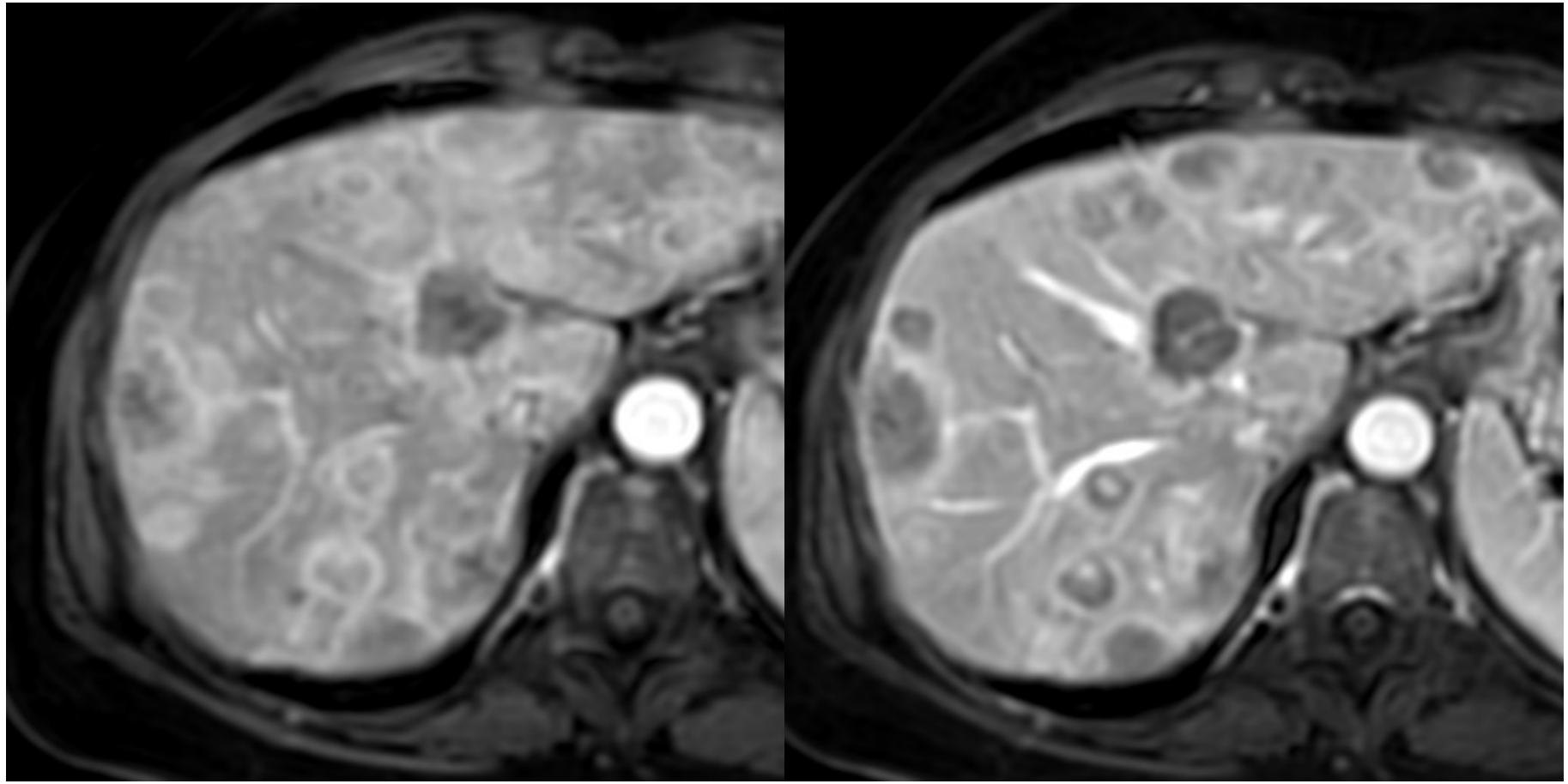
Nonrim arterial phase hyperenhancement (normal liver): FNH or HCA





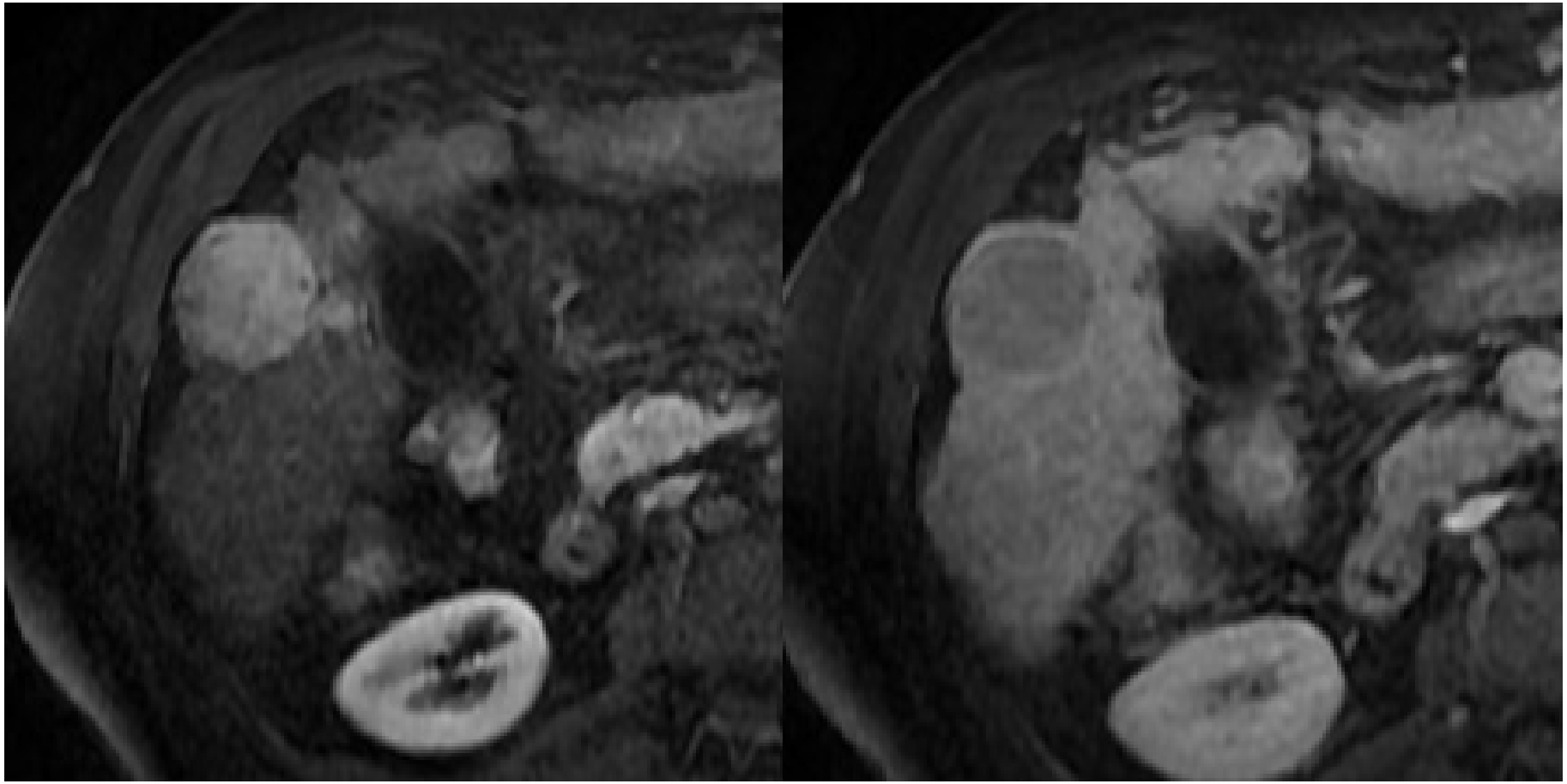
Enhancement patterns (HAP)

Nonrim arterial phase hyperenhancement (oncologic): hypervascular metastases



Enhancement patterns (HAP)

Nonrim arterial phase hyperenhancement (chronic liver disease): HCC

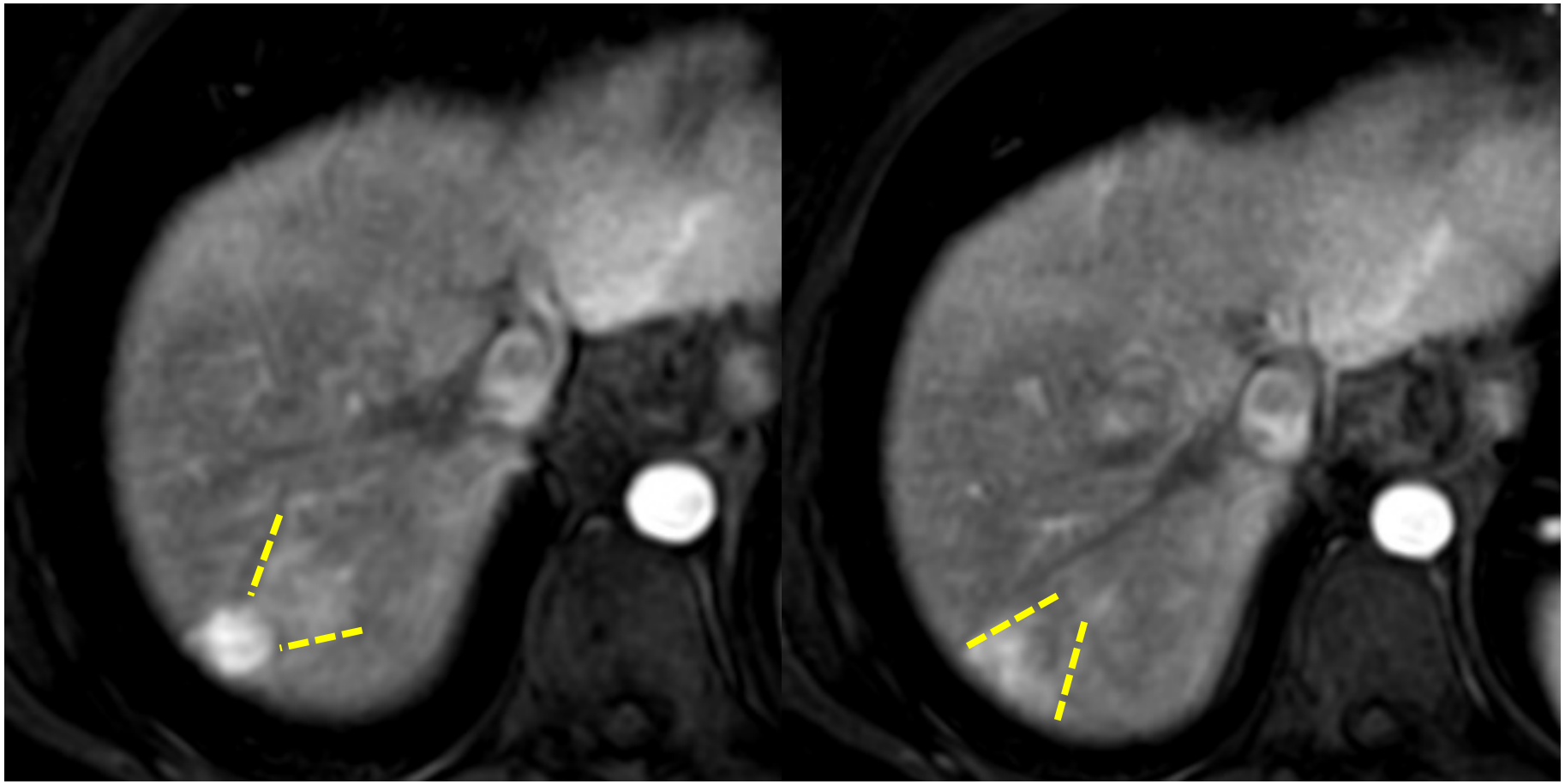


Enhancement patterns (HAP)

	Nonrim APHE	APHE + shunt
HH	✓	
FNH	✓	
HCA	✓	
HCC	✓	
iCCA		
MTS	✓	

Enhancement patterns (HAP)

APHE with peripheral shunt: capillary hemangioma

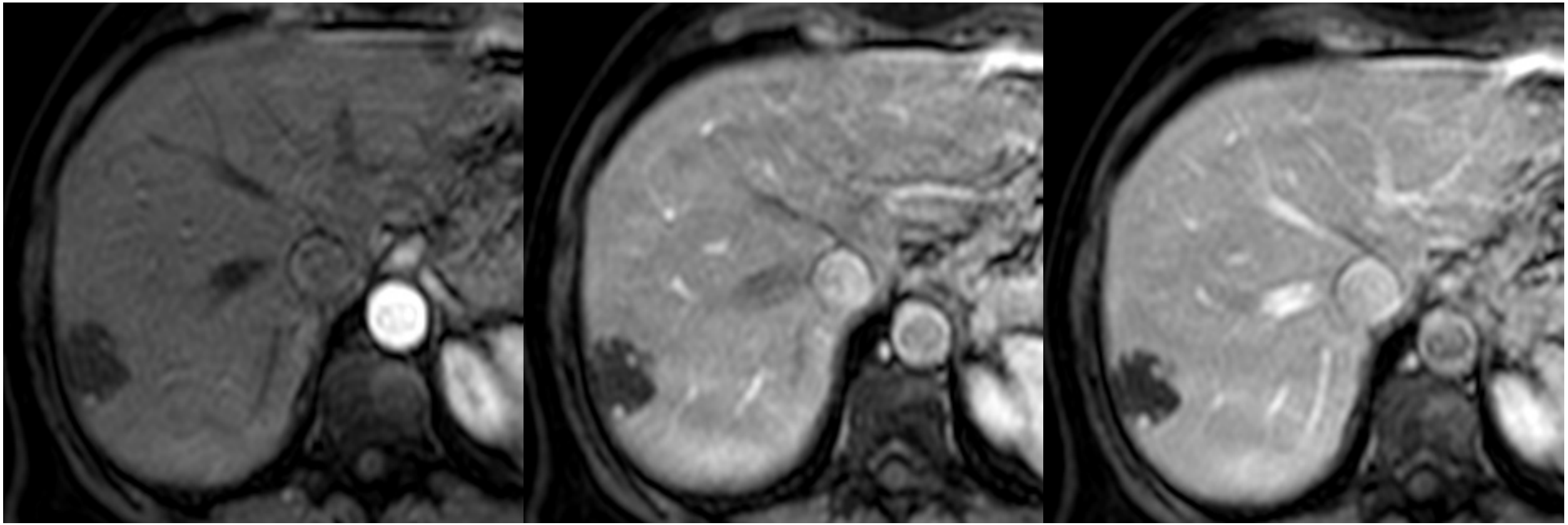


Enhancement patterns (HAP)

	Nonrim APHE	APHE + shunt	dot-like
HH	✓	✓	
FNH	✓		
HCA	✓		
HCC	✓		
iCCA			
MTS	✓		

Enhancement patterns (HAP)

Peripheral dot-like (discontinuous): cavernous hemangiomas

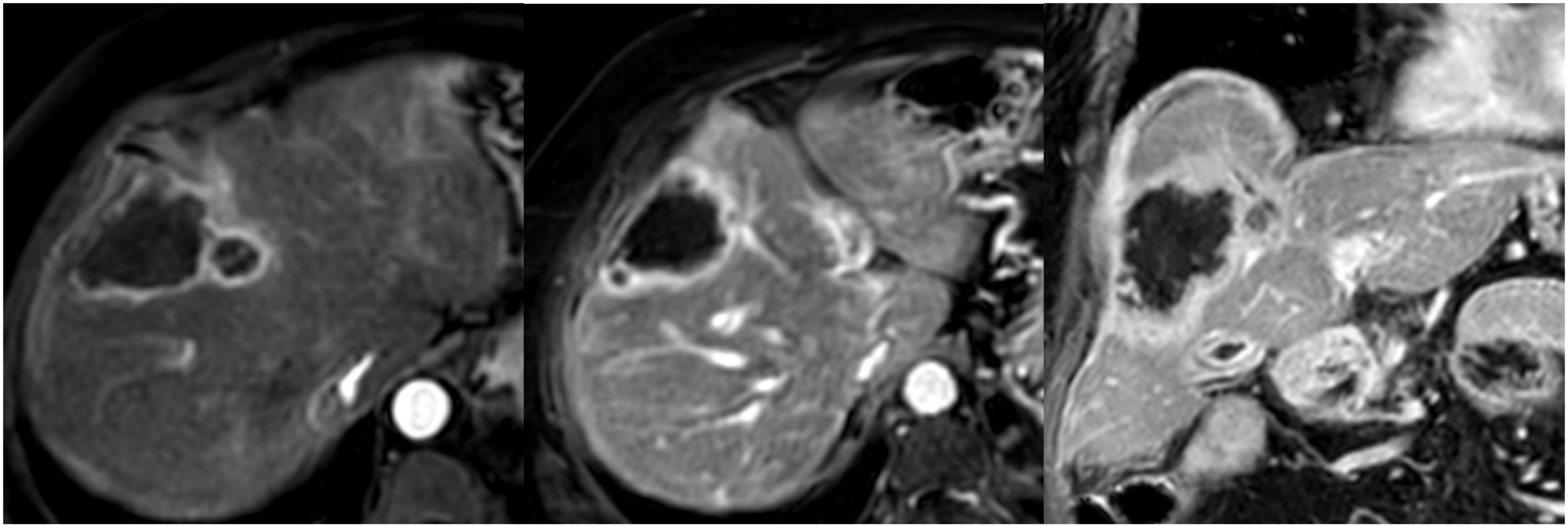


Enhancement patterns (HAP)

	Nonrim APHE	APHE + shunt	dot-like	rim APHE
HH	✓	✓	✓	
FNH	✓			
HCA	✓			
HCC	✓			
iCCA				
MTS	✓			

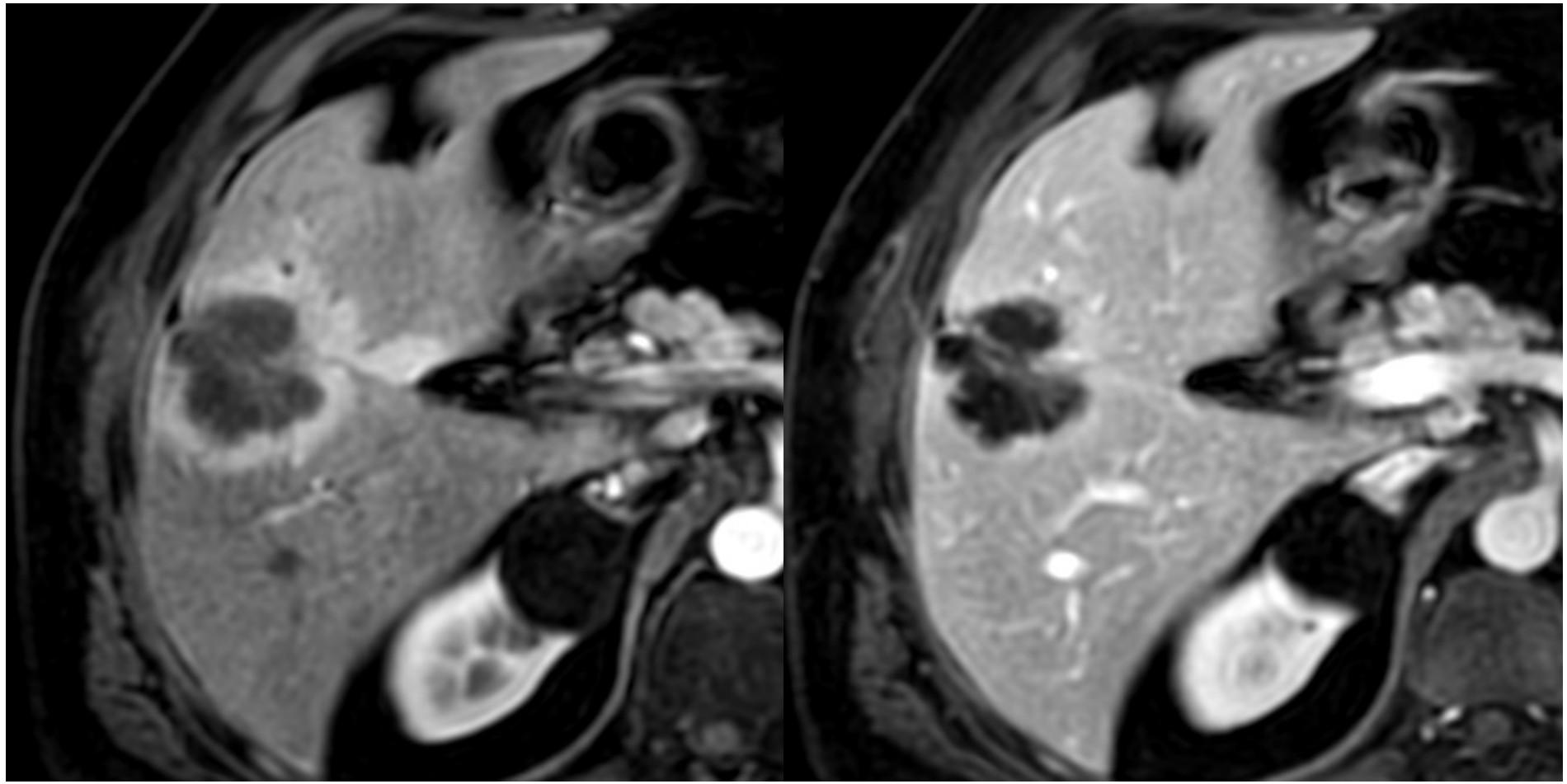
Enhancement patterns (HAP)

Rim arterial phase hyperenhancement (oncologic): metastasis



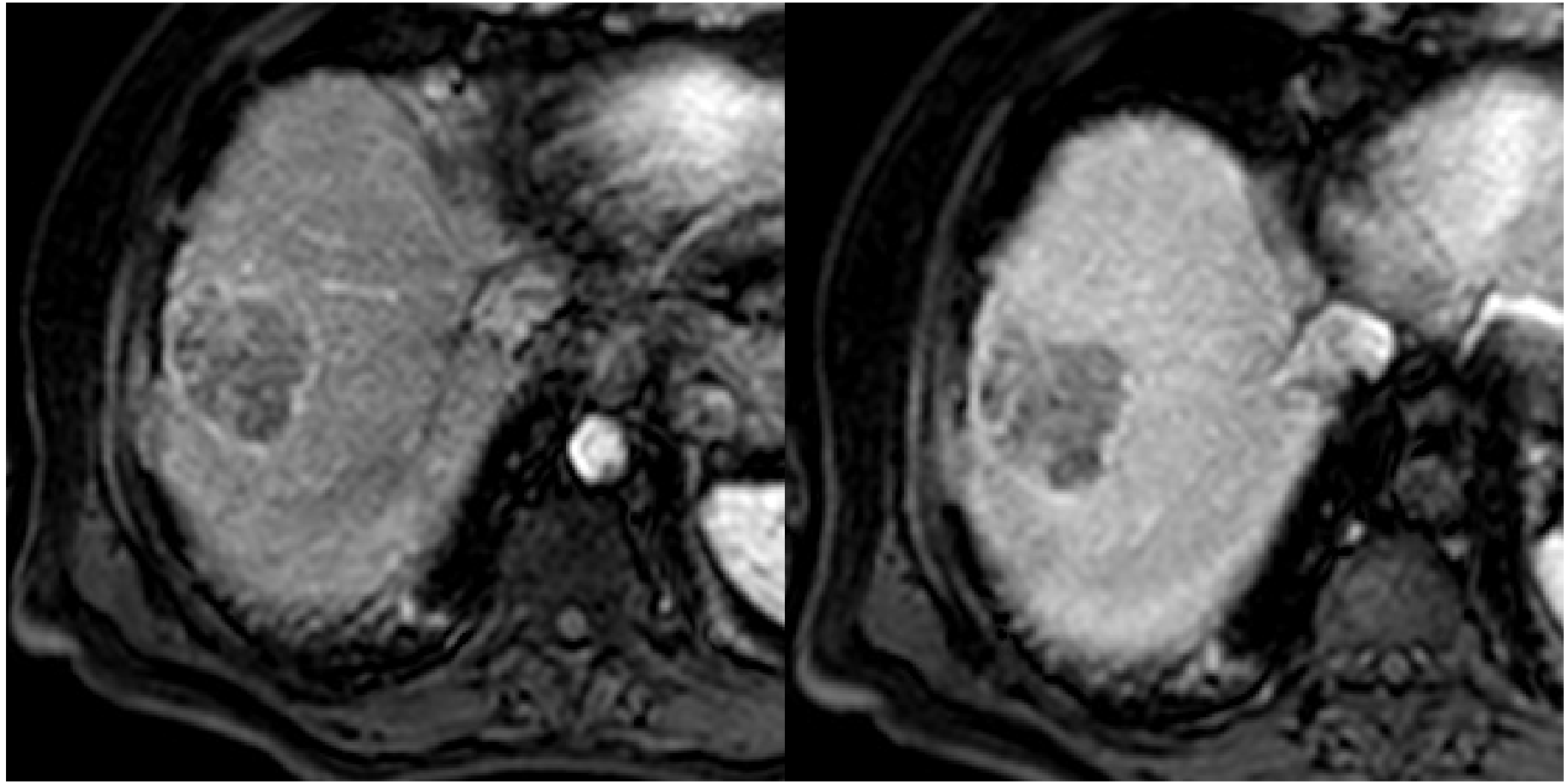
Enhancement patterns (HAP)

Rim arterial phase hyperenhancement (chronic liver disease): ICC



Enhancement patterns (HAP)

Rim arterial phase hyperenhancement (chronic liver disease): HCC (atypical)

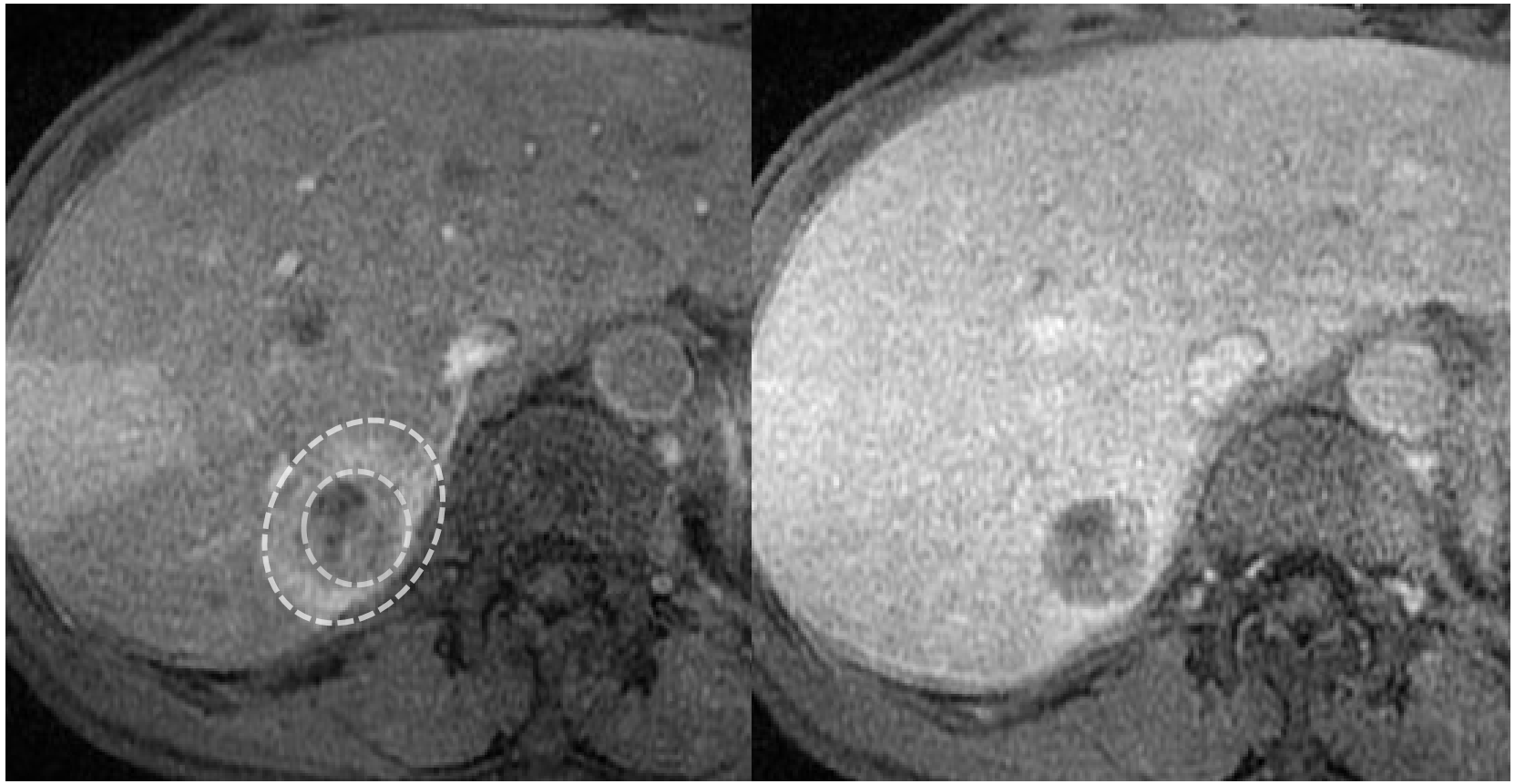


Enhancement patterns (HAP)

	Nonrim APHE	APHE + shunt	dot-like	rim APHE	corona
HH	✓	✓	✓		
FNH	✓				
HCA	✓				
HCC	✓			✓	
iCCA				✓	
MTS	✓			✓	

Enhancement patterns (HAP)

Corona enhancement

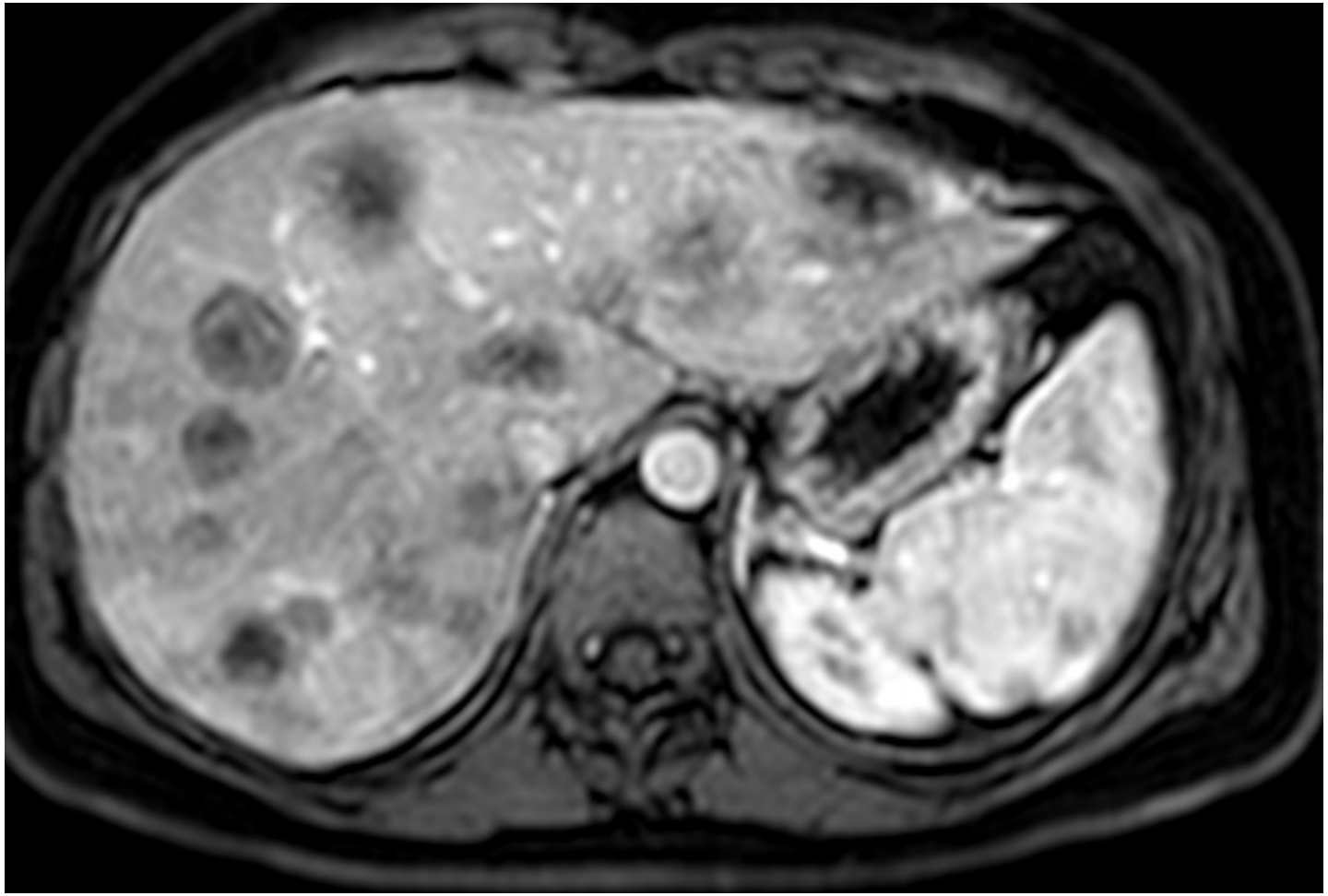


Enhancement patterns (HAP)

	Nonrim APHE	APHE + shunt	dot-like	rim APHE	corona	hypo
HH	✓	✓	✓			
FNH	✓					
HCA	✓					
HCC	✓			✓	✓	
iCCA				✓		
MTS	✓			✓		

Enhancement patterns (HAP)

Hypoenhancement (oncologic): hypovascular metastases



Enhancement patterns (HAP)

	Nonrim APHE	APHE + shunt	dot-like	rim APHE	corona	hypo
HH	✓	✓	✓			
FNH	✓					
HCA	✓					
HCC	✓			✓	✓	✓
iCCA				✓		
MTS	✓			✓		✓

Enhancement patterns (PVP - DP)

Persistent enhancement

HH

FNH

HCA

HCC

iCCA

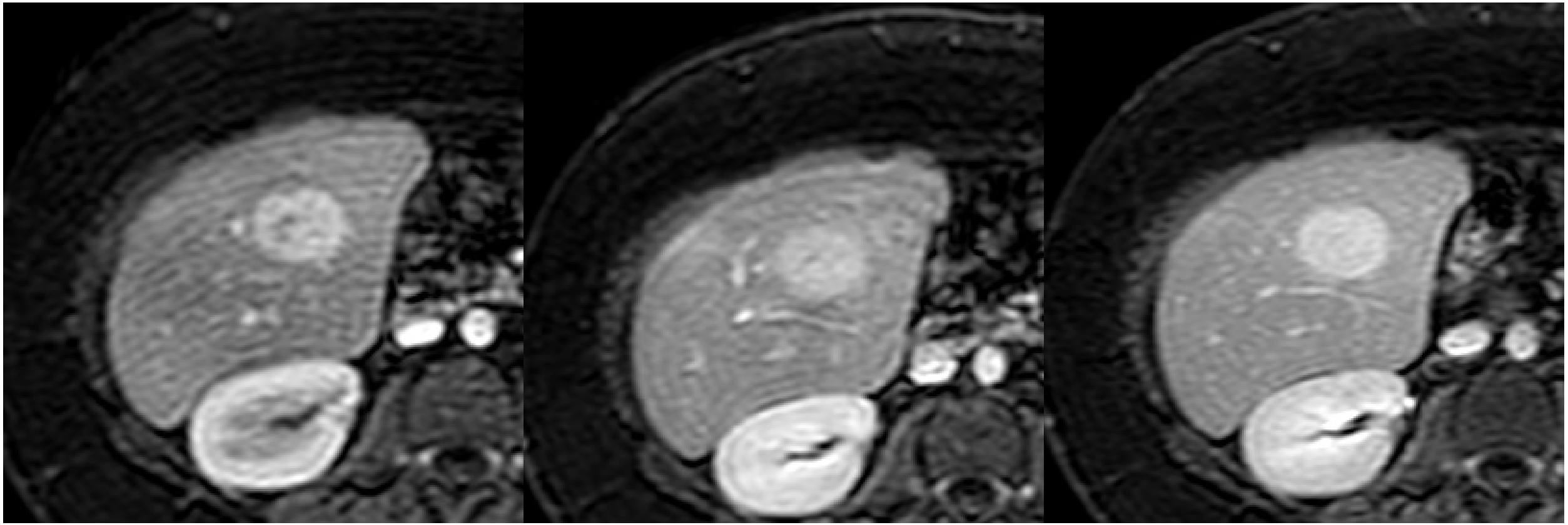
MTS

Enhancement patterns (PVP - DP)

Persistent enhancement: capillary hemangiomas

Enhancement patterns (PVP - DP)

Persistent enhancement: hepatocellular adenoma

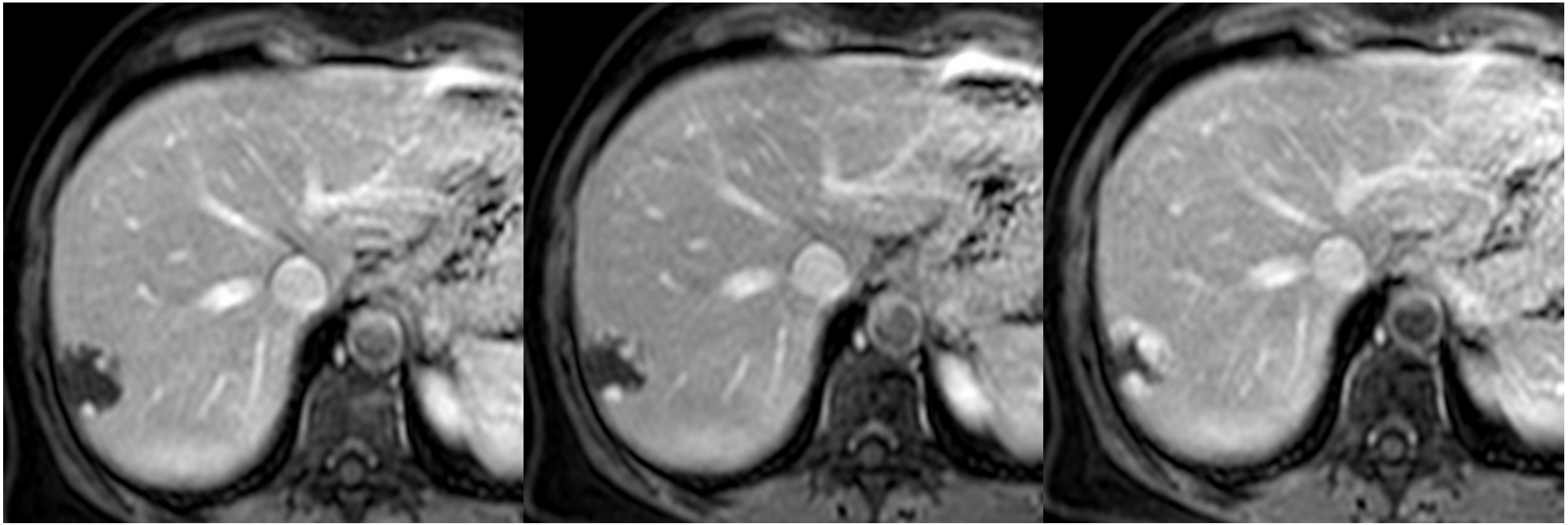


Enhancement patterns (PVP - DP)

	Persistent enhancement	Progressive/centripetal
HH	✓	
FNH		
HCA	✓	
HCC		
iCCA		
MTS		

Enhancement patterns (PVP - DP)

Progressive centripetal enhancement (normal liver): cavernous hemangioma



Enhancement patterns (PVP - DP)

Progressive centripetal enhancement (chronic liver disease): ICC

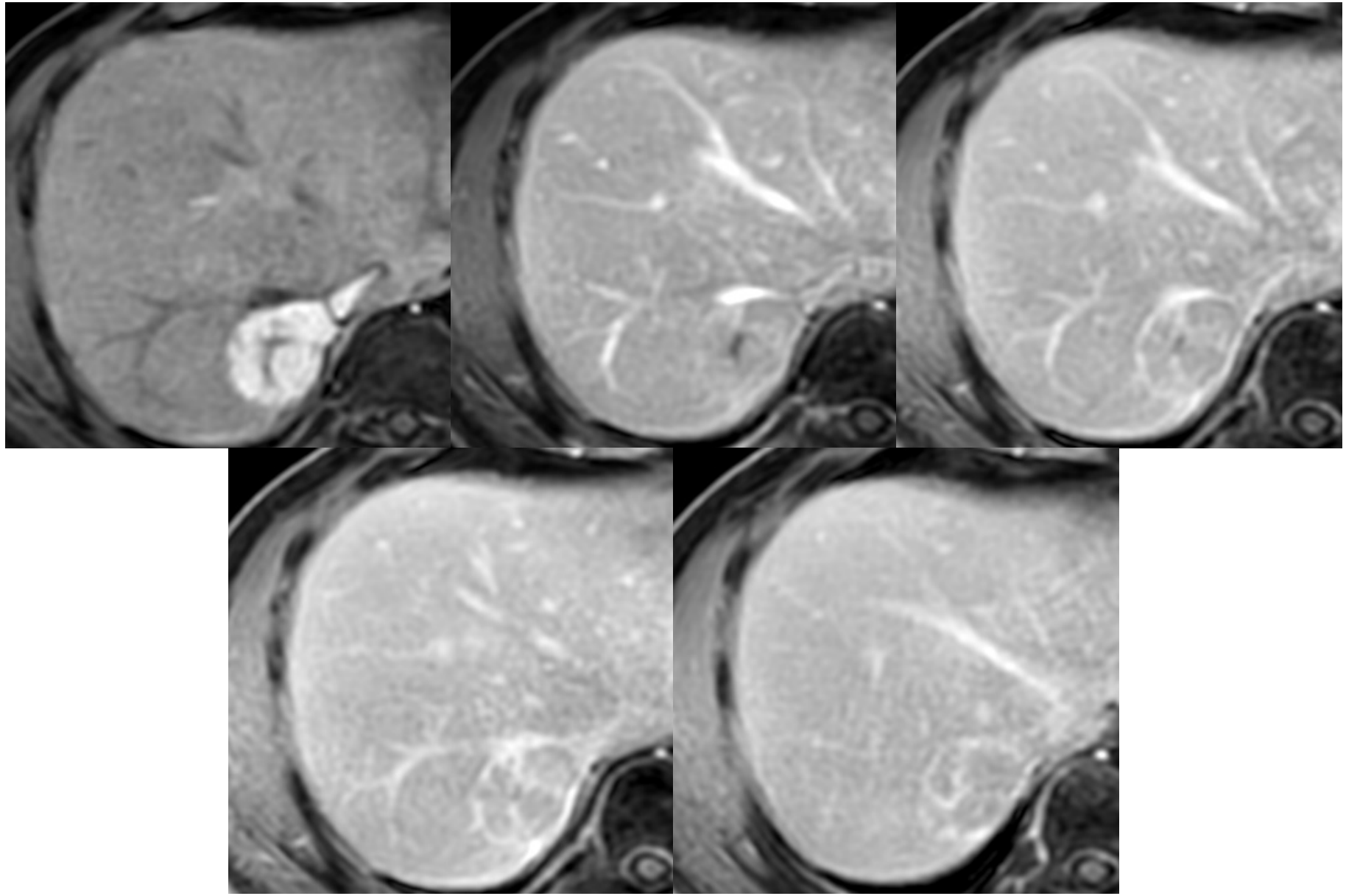
Enhancement patterns (PVP - DP)

	Persistent enhancement	Progressive/centripetal	Fading
HH	✓	✓	
FNH			
HCA	✓		
HCC			
iCCA		✓	
MTS		✓	

Enhancement patterns (PVP - DP)

Fading

FNH

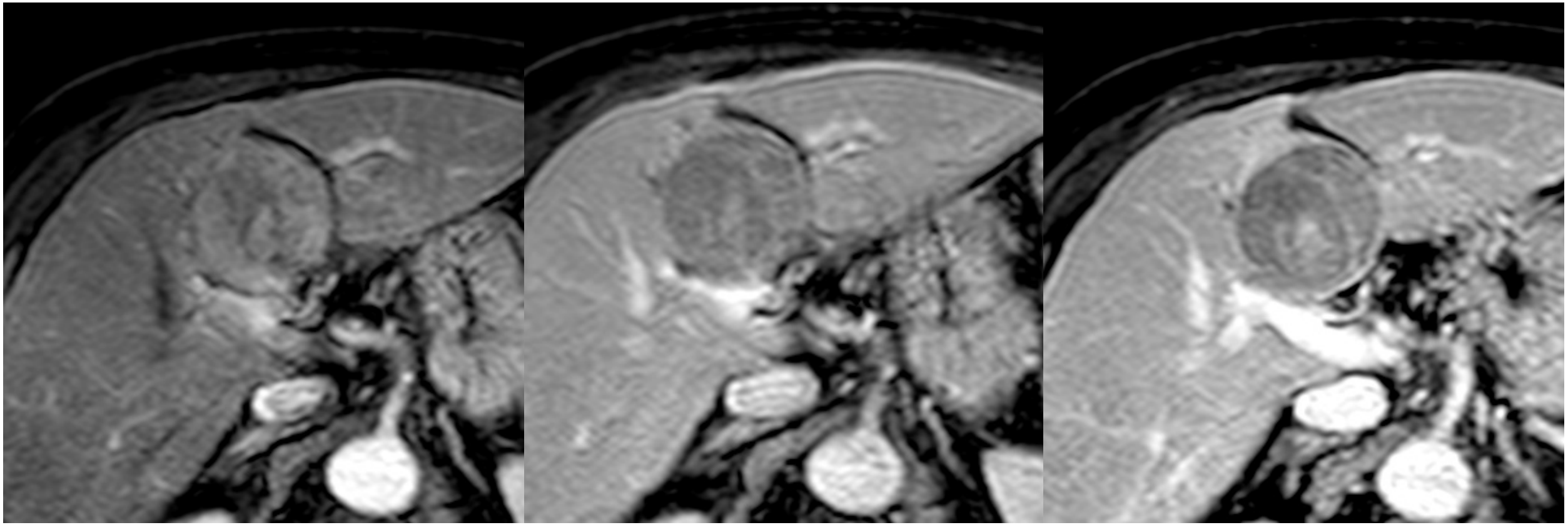


Enhancement patterns (PVP - DP)

	Persistent enhancement	Progressive/centripetal	Fading	Washout
HH	✓	✓		
FNH			✓	
HCA	✓			
HCC				
iCCA		✓		
MTS		✓		

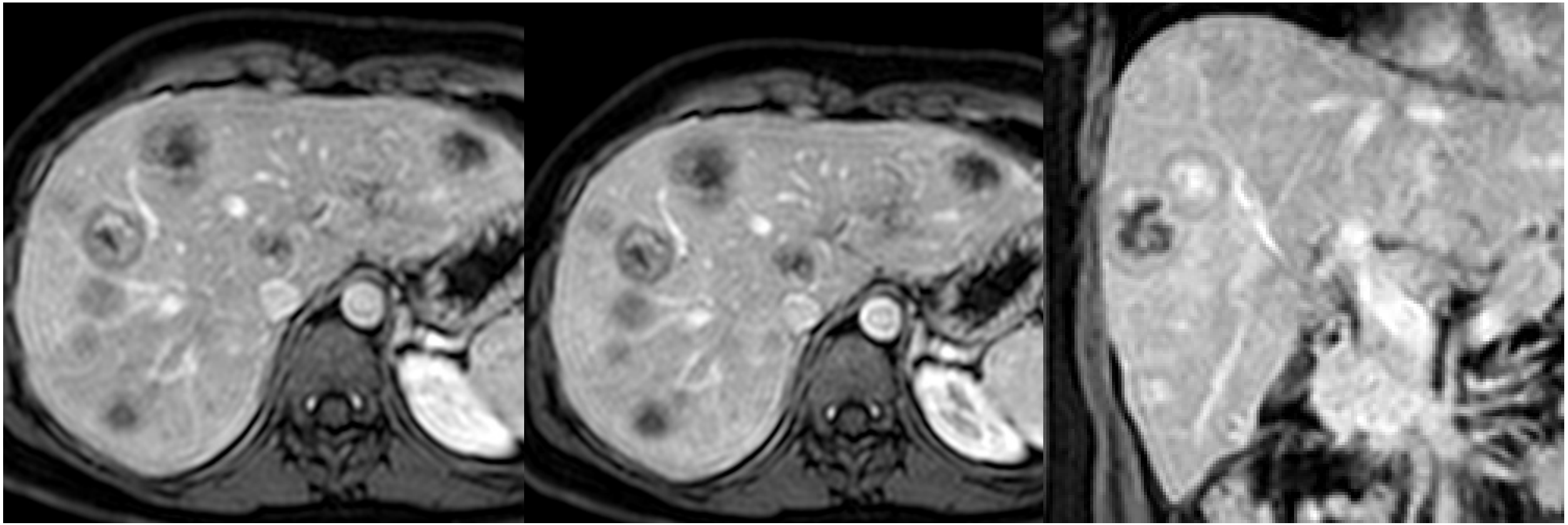
Enhancement patterns (PVP - DP)

Non peripheral washout: HCC



Enhancement patterns (PVP - DP)

Peripheral washout: metastases, ICC

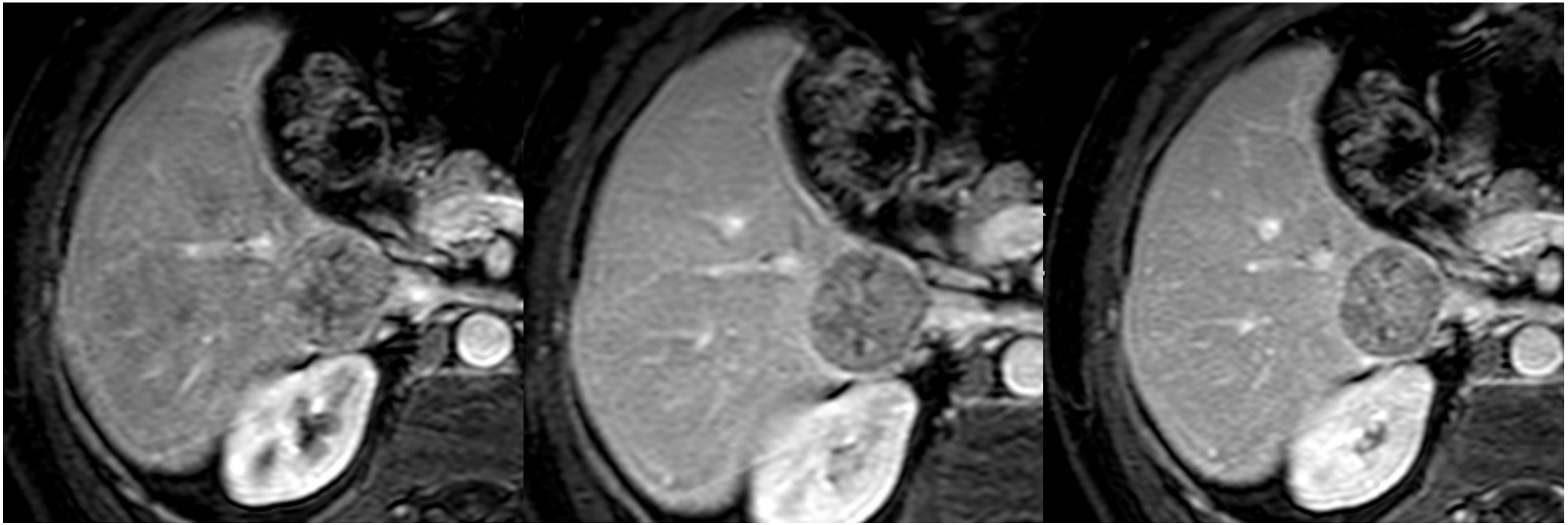


Enhancement patterns (PVP - DP)

	Persistent enhancement	Progressive/centripetal	Fading	Washout	Capsule
HH	✓	✓			
FNH			✓		
HCA	✓			✓	
HCC				✓	
iCCA		✓		✓	
MTS		✓		✓	

Enhancement patterns (PVP - DP)

Capsule appearance: HCC



Enhancement patterns (PVP - DP)

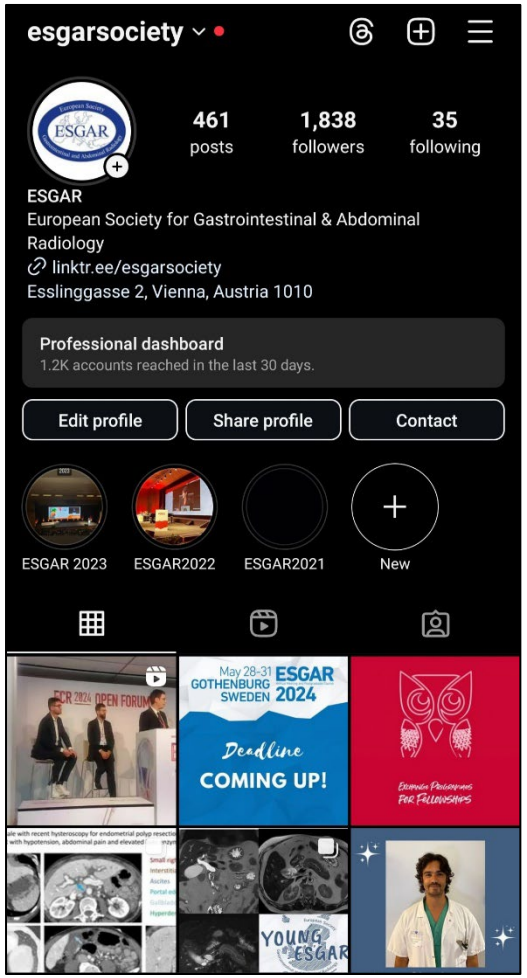
	Persistent enhancement	Progressive/centripetal	Fading	Washout	Capsule
HH	✓	✓			
FNH			✓		
HCA	✓			✓	
HCC				✓	✓
iCCA		✓		✓	
MTS		✓		✓	

MRI

Which MRI contrast agent should I use to characterize a liver lesion?

It depends!

Consider patient characteristics, availability, scanning time, background liver, suspected diagnosis



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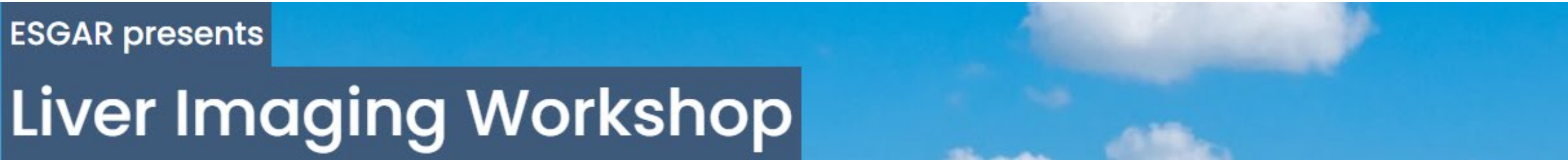

Thank you!

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