



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



Liver MRI:

Extracellular agents

Dr. Roberto Cannella

ESGAR presents

Liver Imaging Workshop

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?

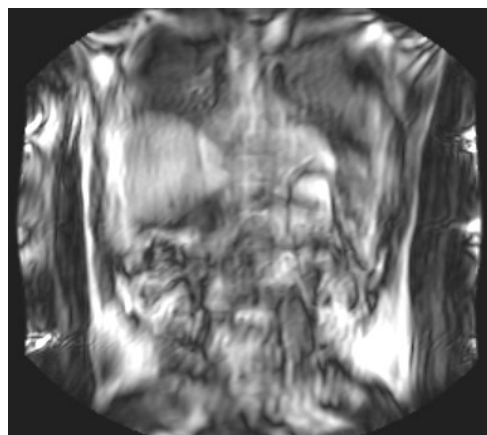
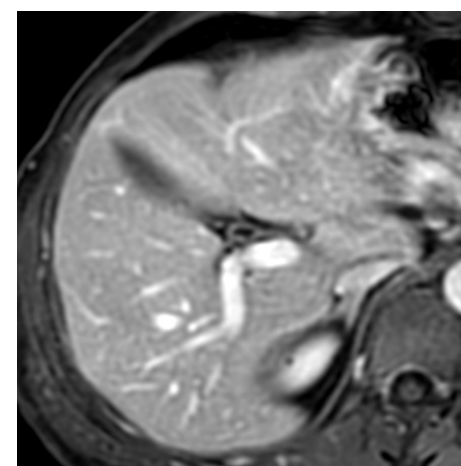
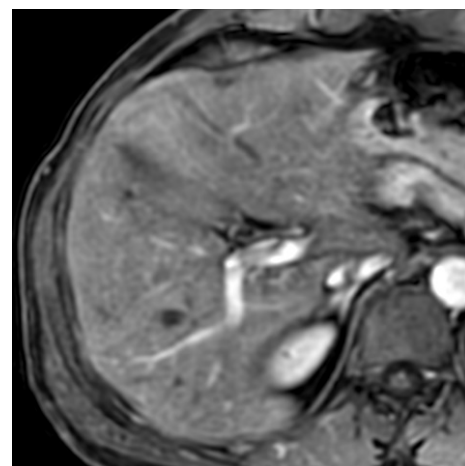
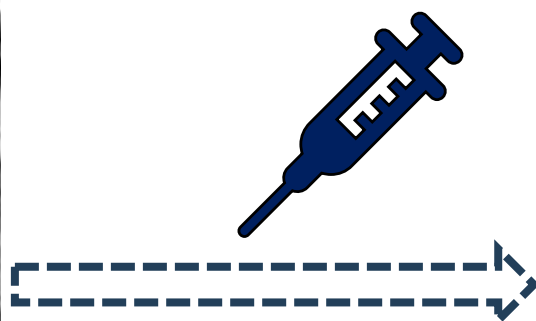
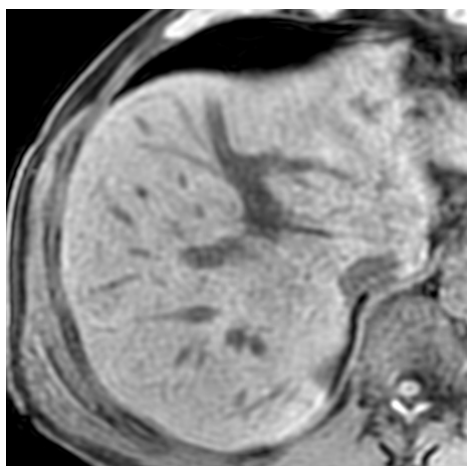
MRI protocol

- MR scanners $\geq 1.5T$

12-15 s

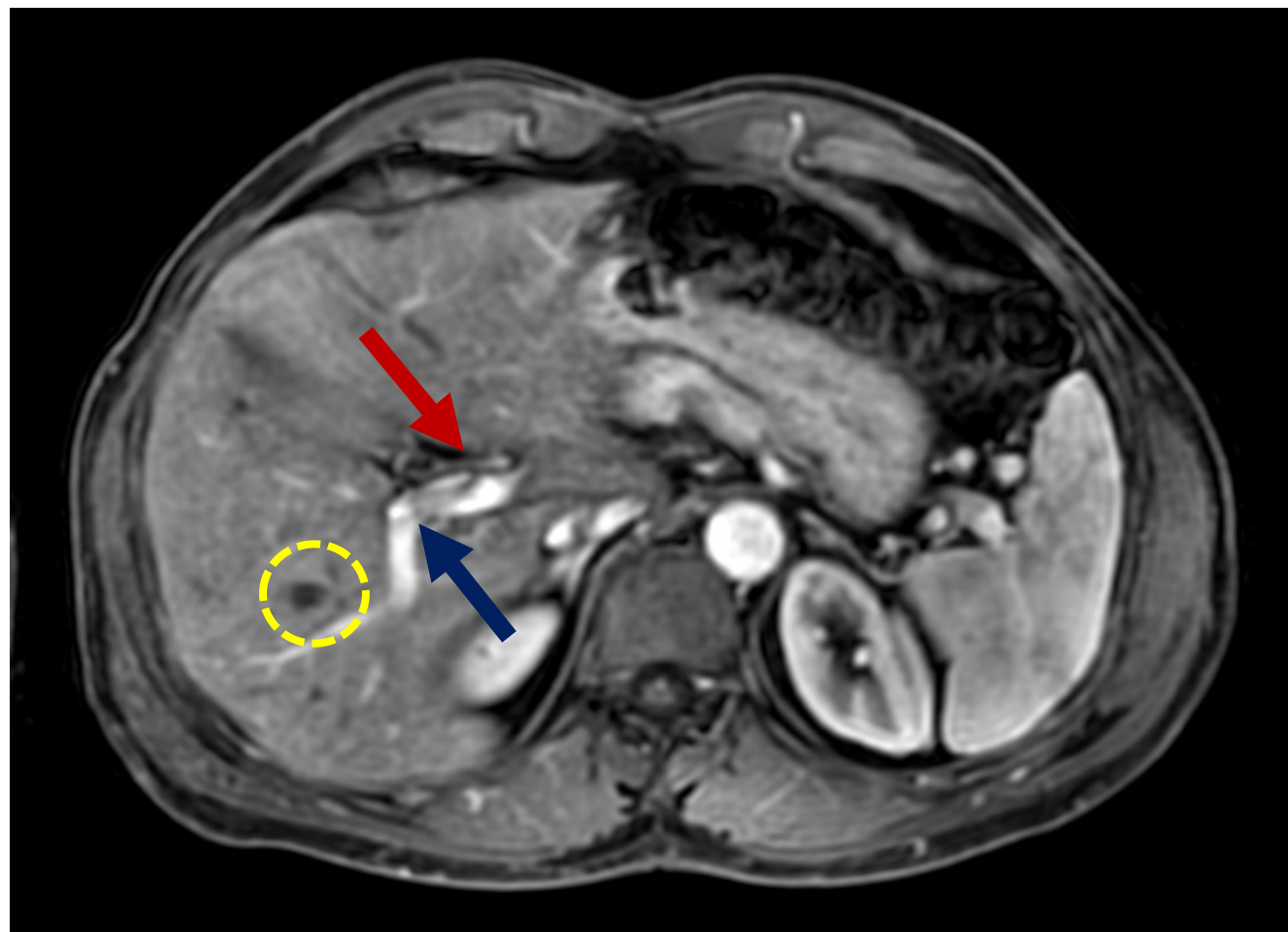
50-60 s

2-5 min



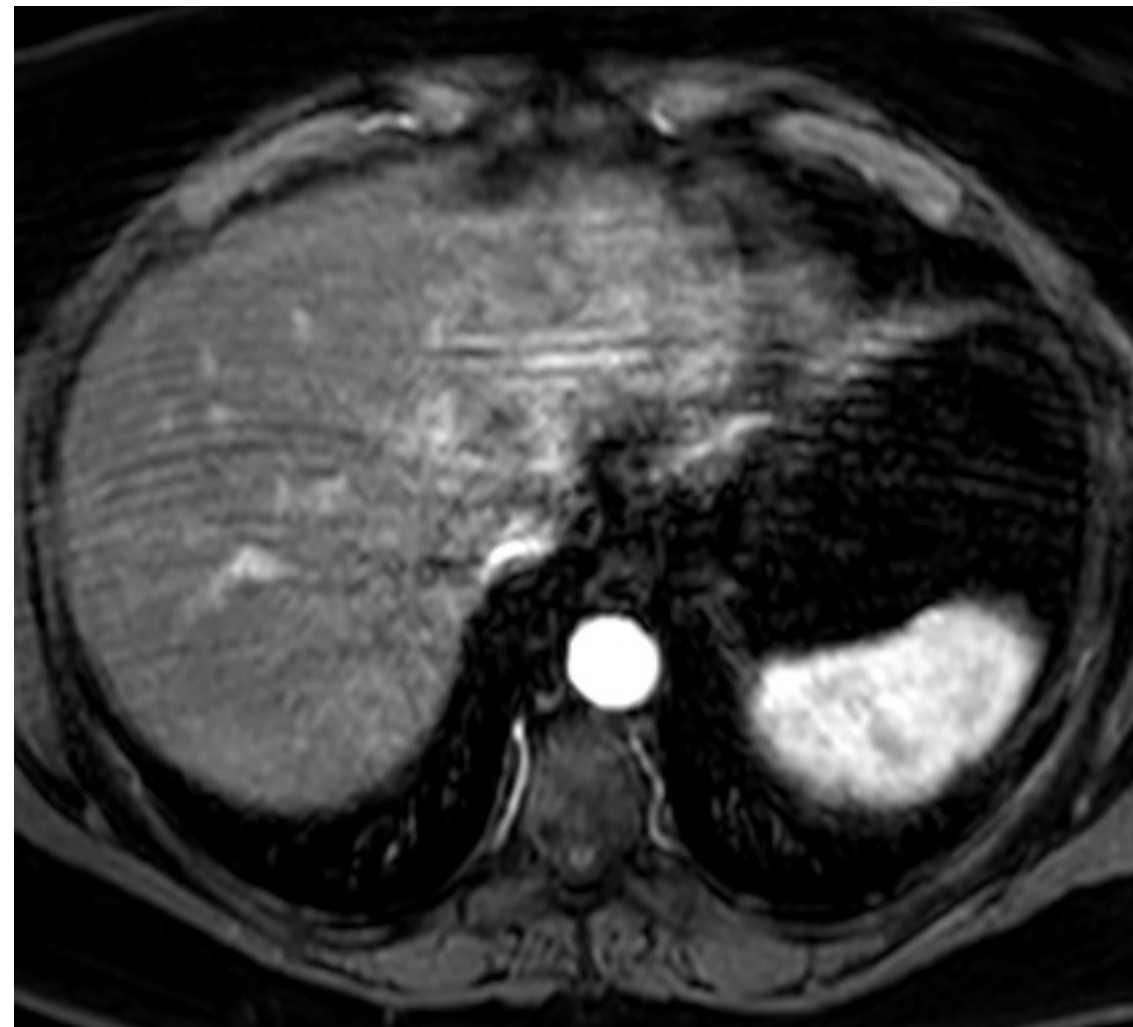
Hepatic arterial phase

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



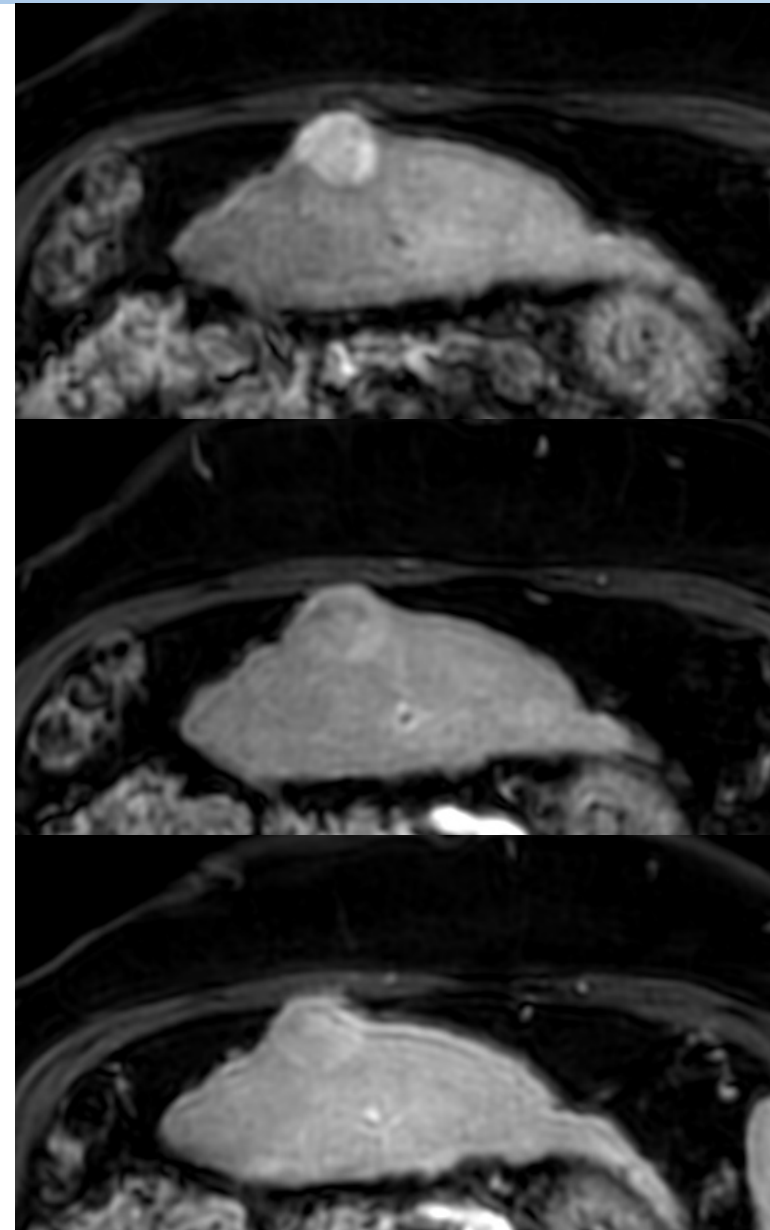
Hepatic arterial phase

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



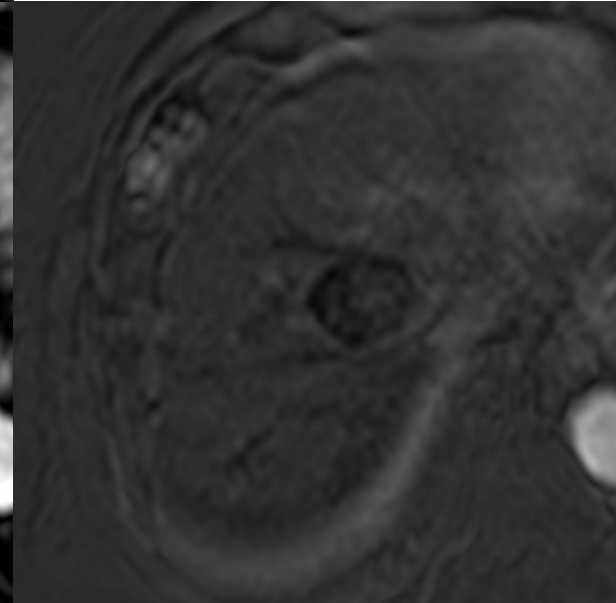
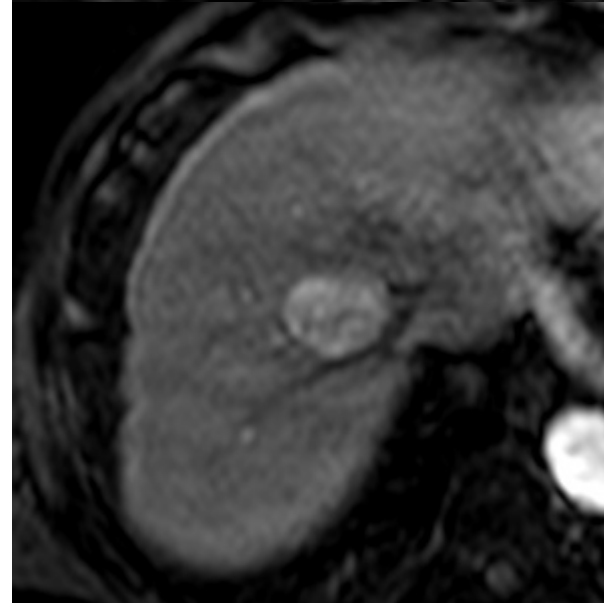
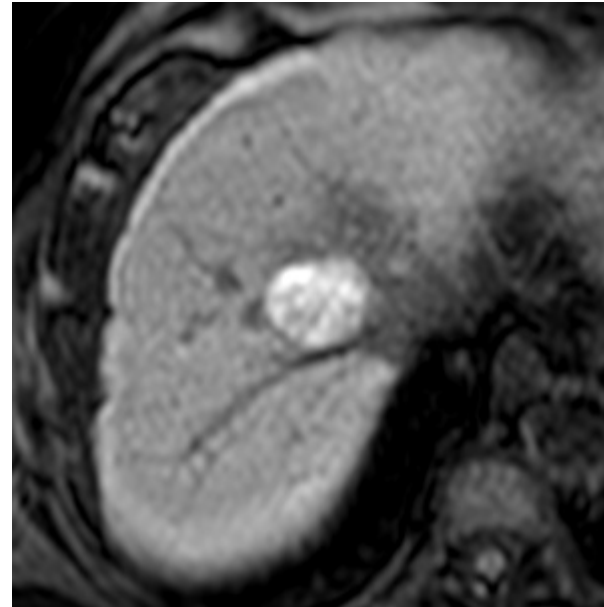
Hepatic arterial phase

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



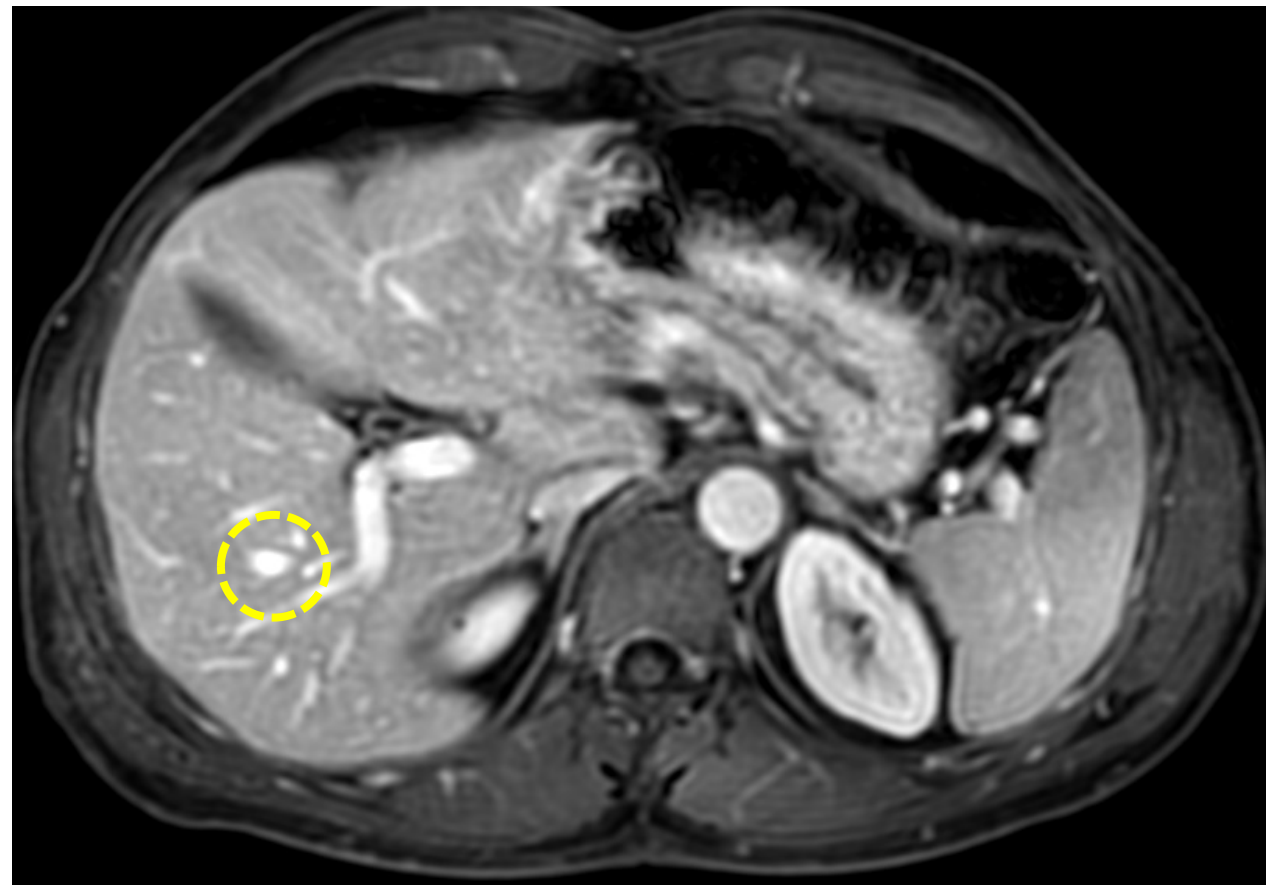
Hepatic arterial phase

- 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



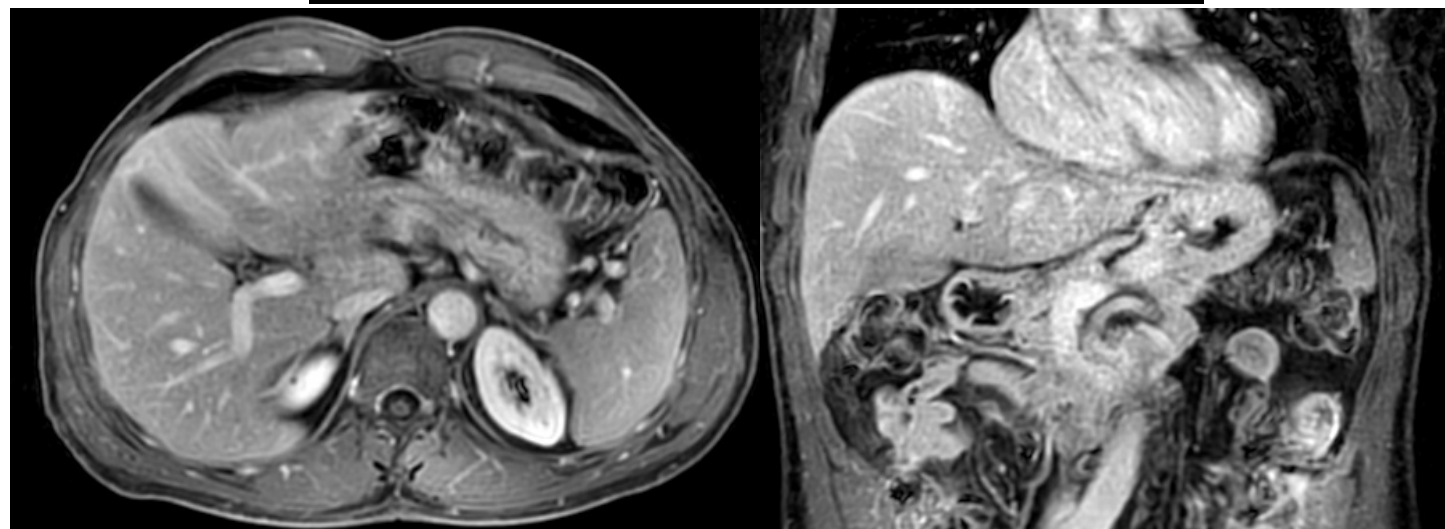
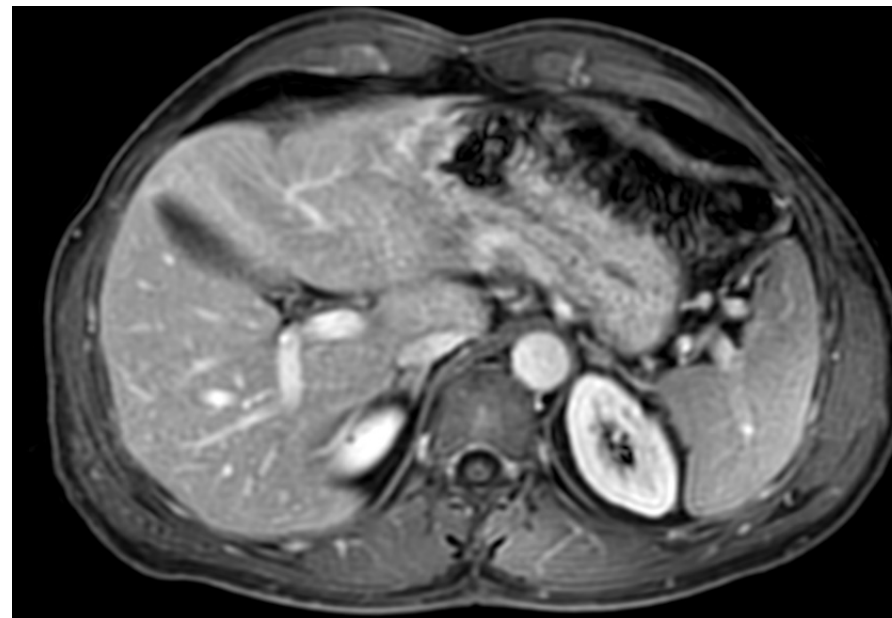
Portal venous and delayed phases

- 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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Alexander R. Guimaraes², Dushyant V. Sahani¹, Frank H. Miller⁸

Enhancement patterns (HAP)

Nonrim APHE

HH

FNH

HCA

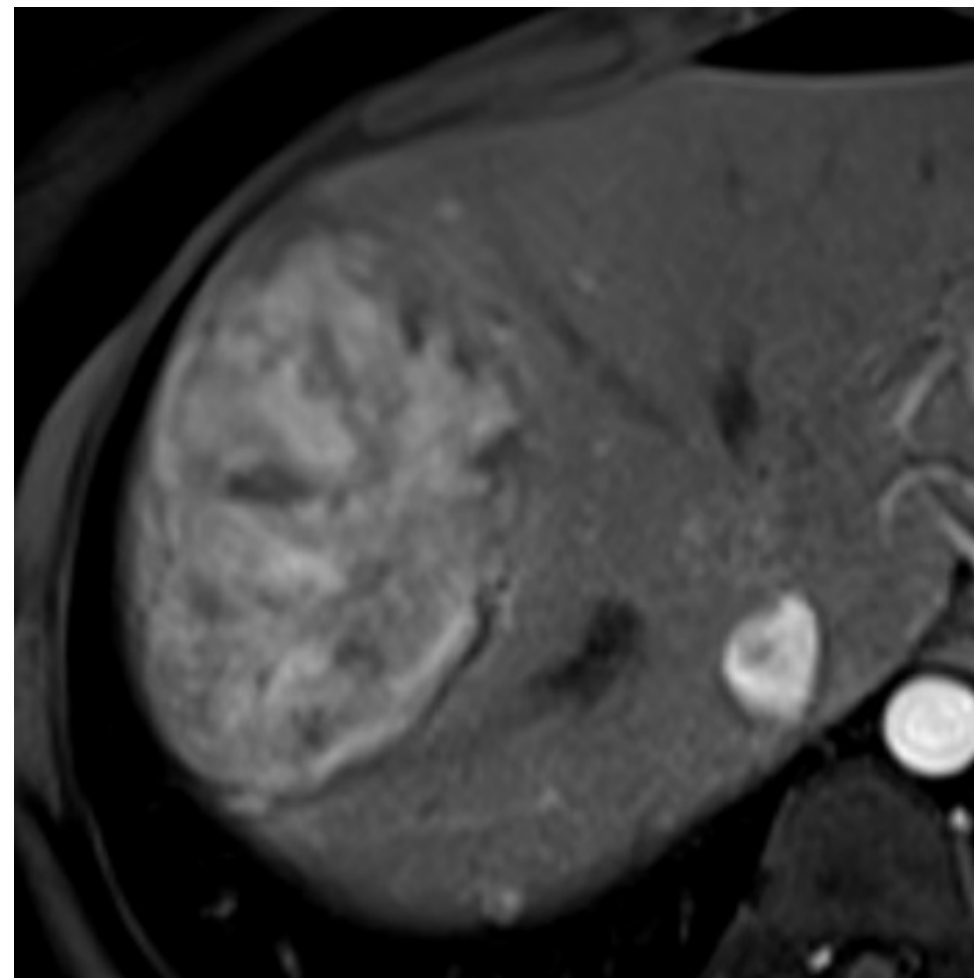
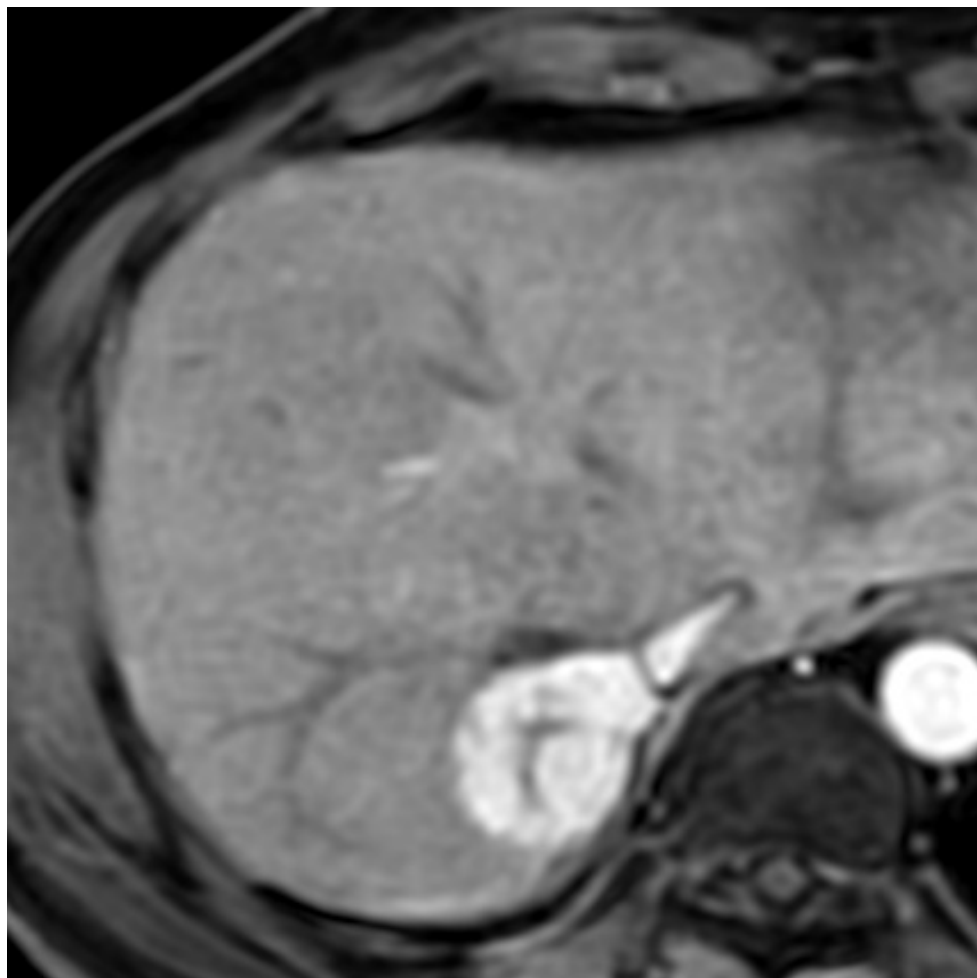
HCC

iCCA

MTS

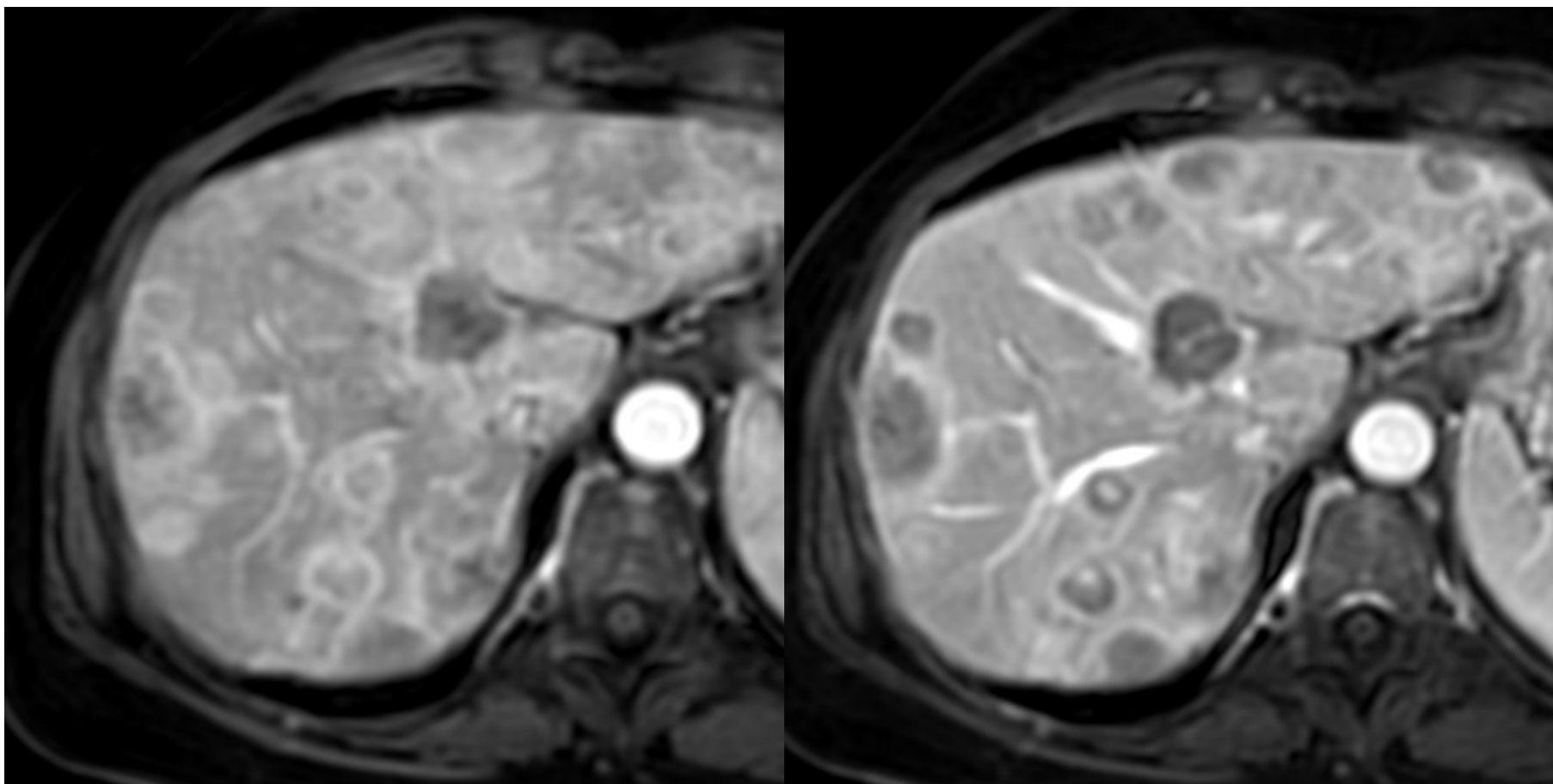
Enhancement patterns (HAP)

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



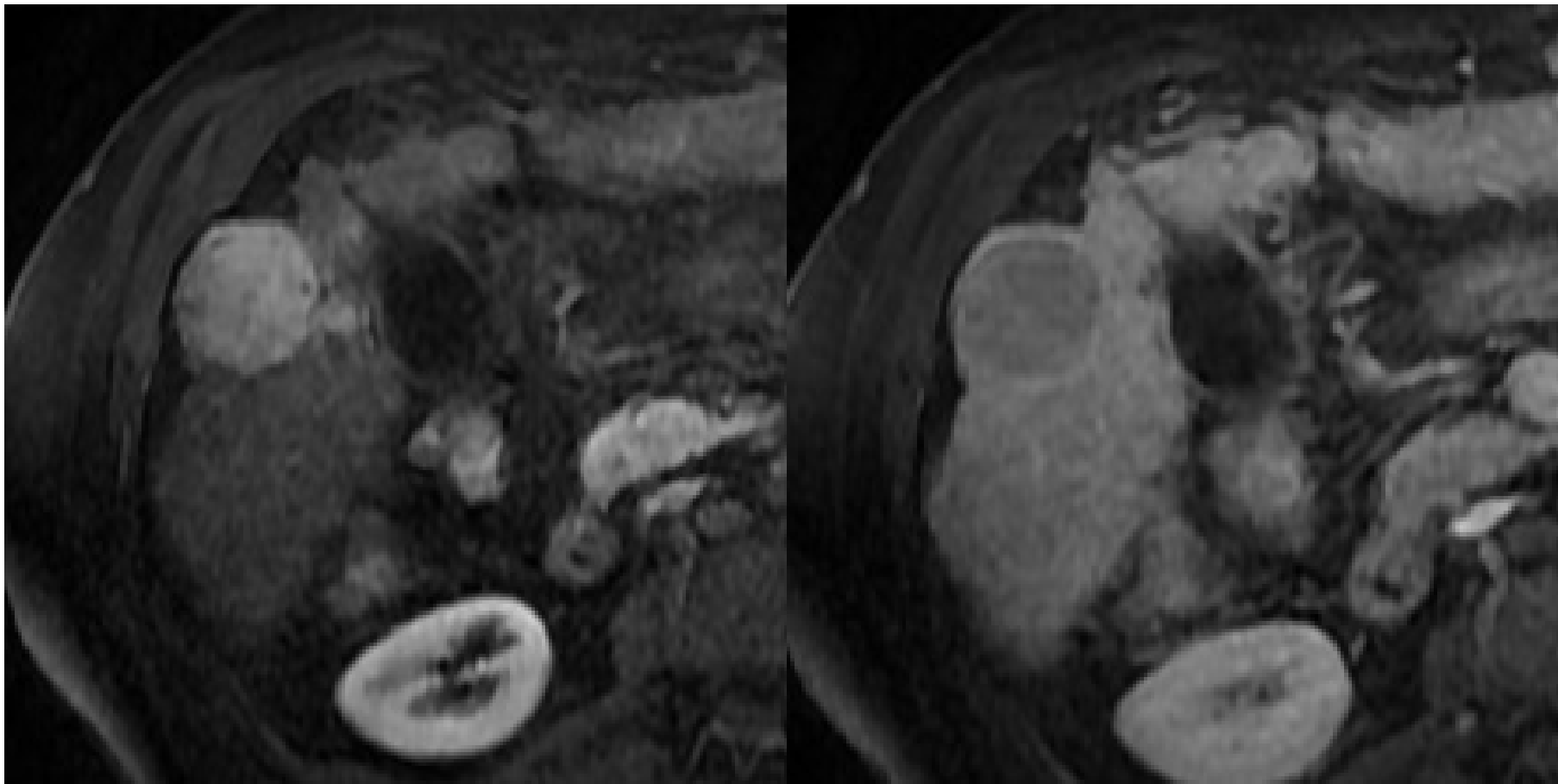
Enhancement patterns (HAP)

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



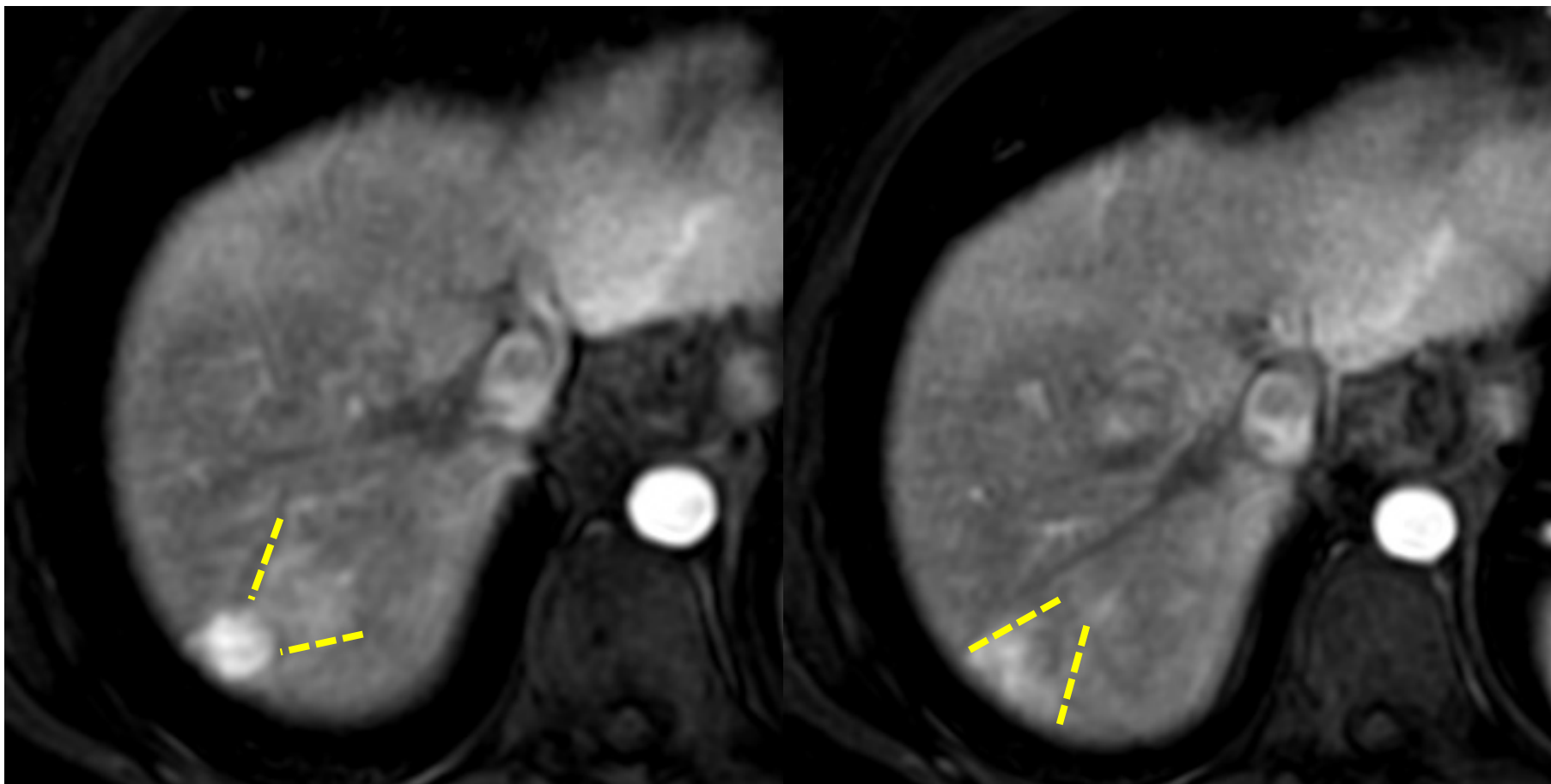
iCCA

MTS



Enhancement patterns (HAP)

APHE with peripheral shunt: capillary hemangioma

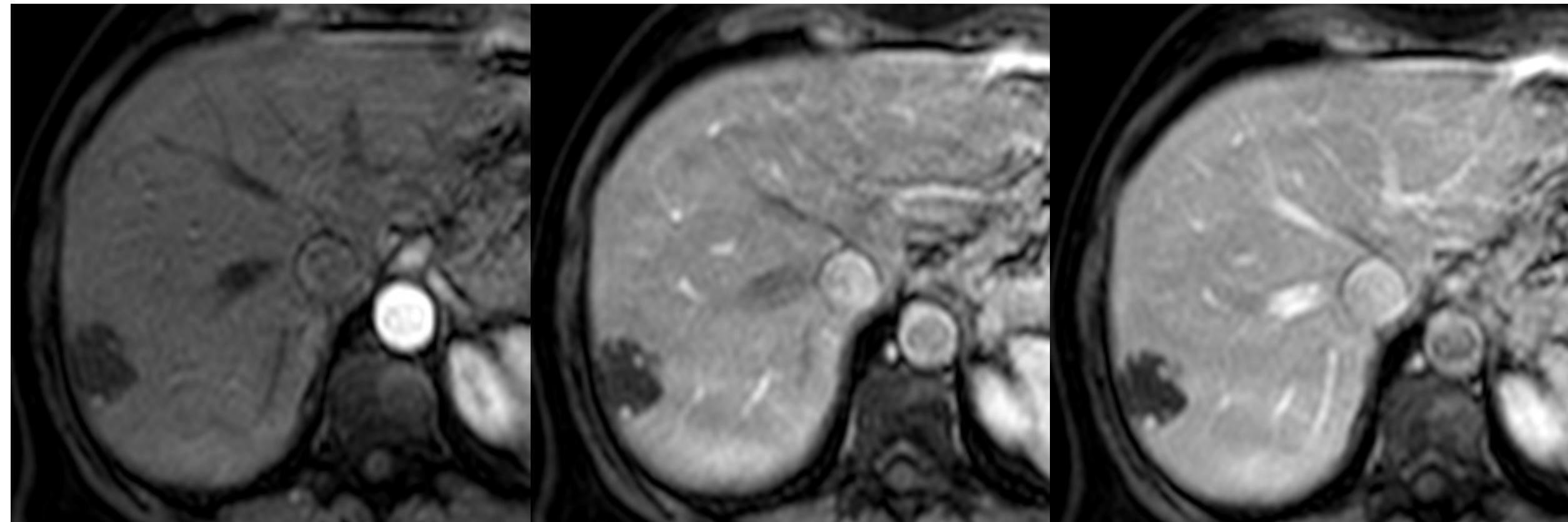


Enhancement patterns (HAP)

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

Enhancement patterns (HAP)

Peripheral dot-like (discontinuous): cavernous hemangiomas

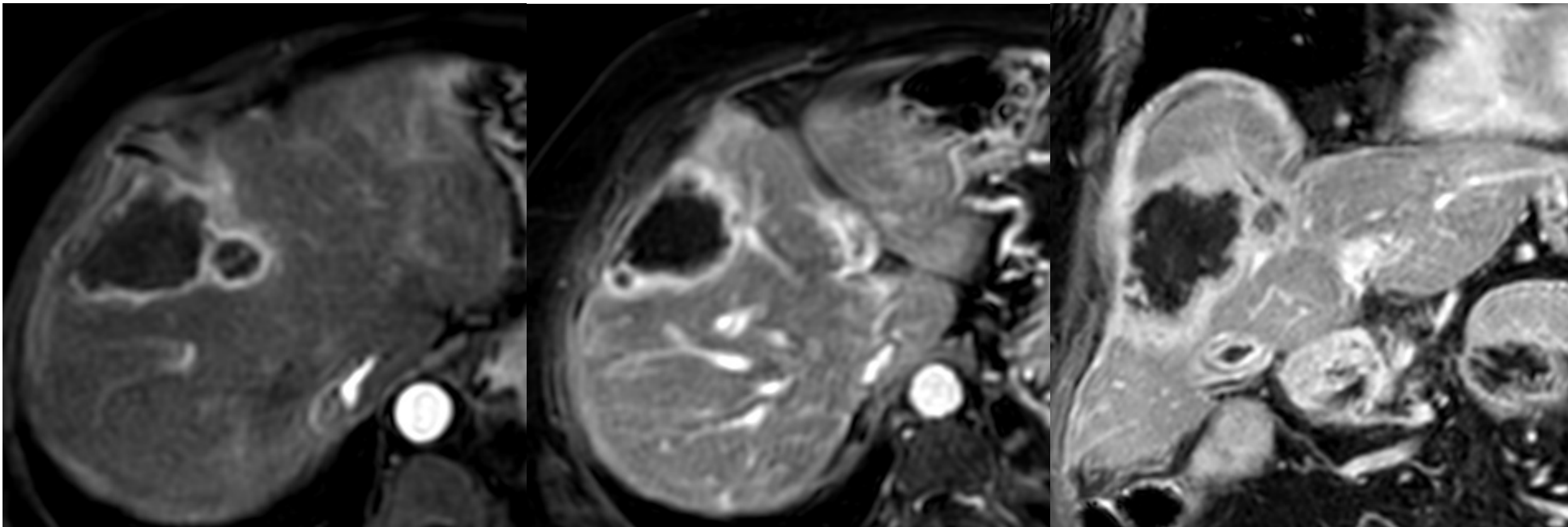


Enhancement patterns (HAP)

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

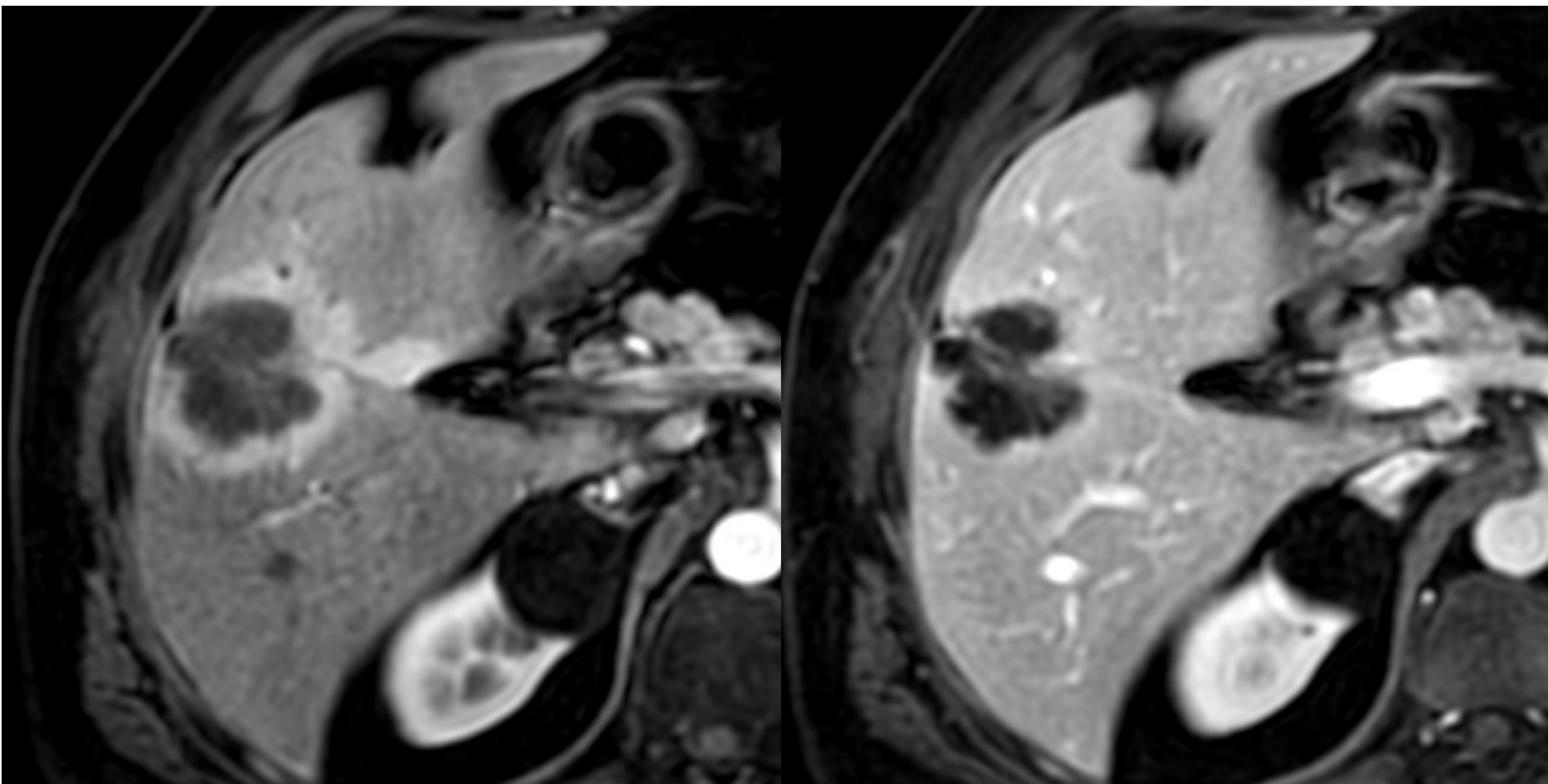
Enhancement patterns (HAP)

Rim arterial phase hyperenhancement (oncologic): metastasis



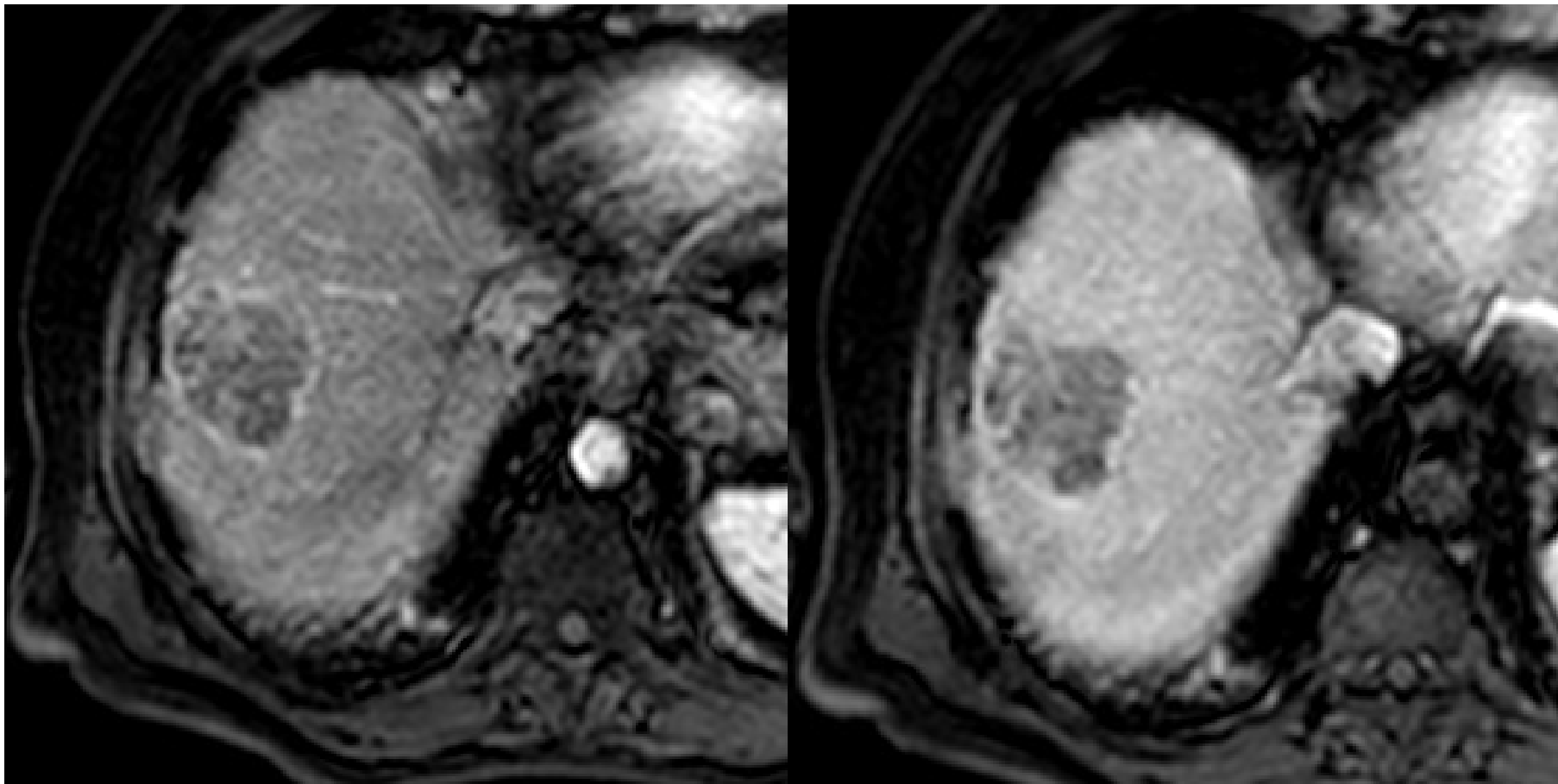
Enhancement patterns (HAP)

Rim arterial phase hyperenhancement (chronic liver disease): ICC



Enhancement patterns (HAP)

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

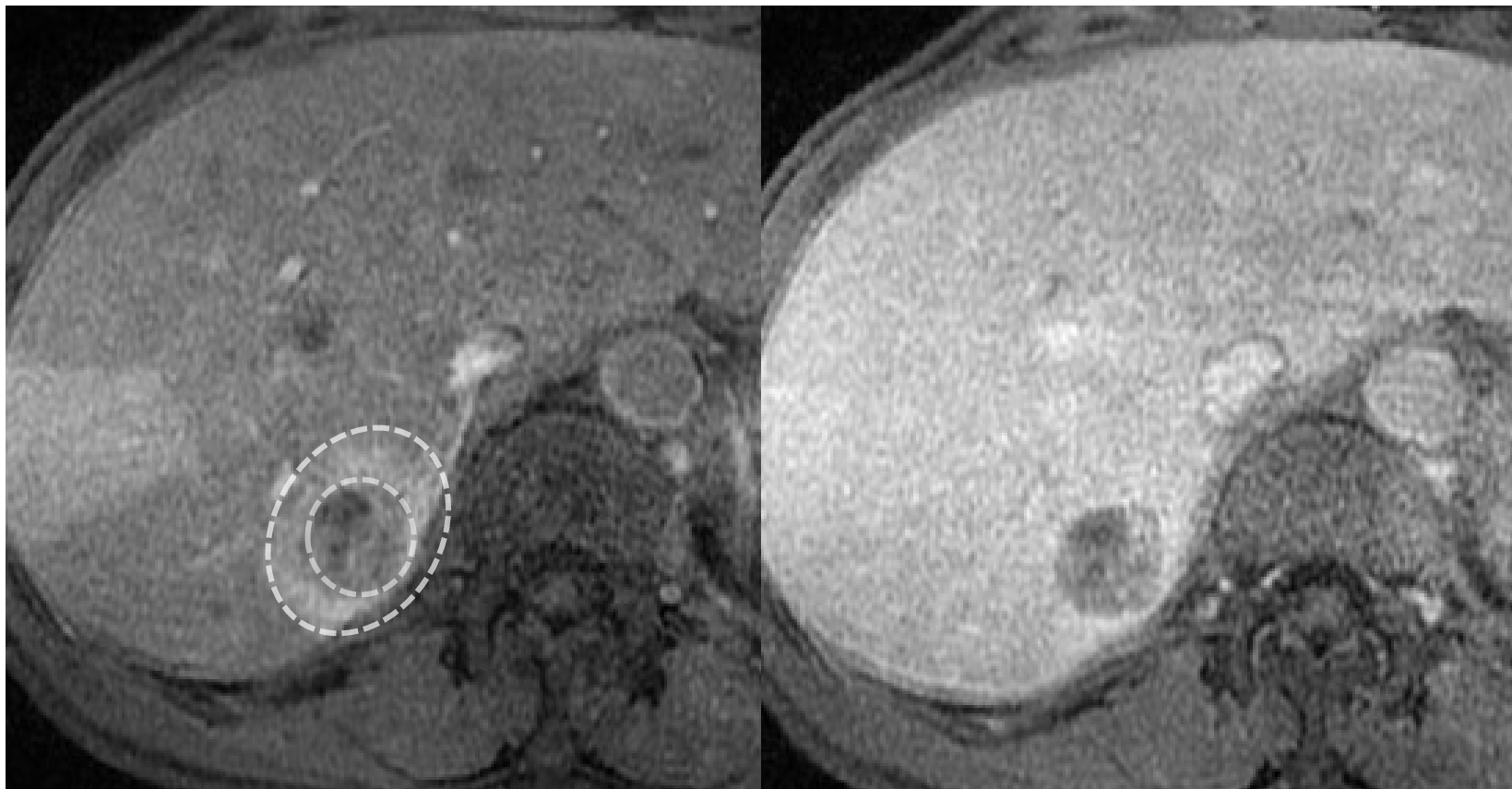


Enhancement patterns (HAP)

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

Enhancement patterns (HAP)

Corona enhancement

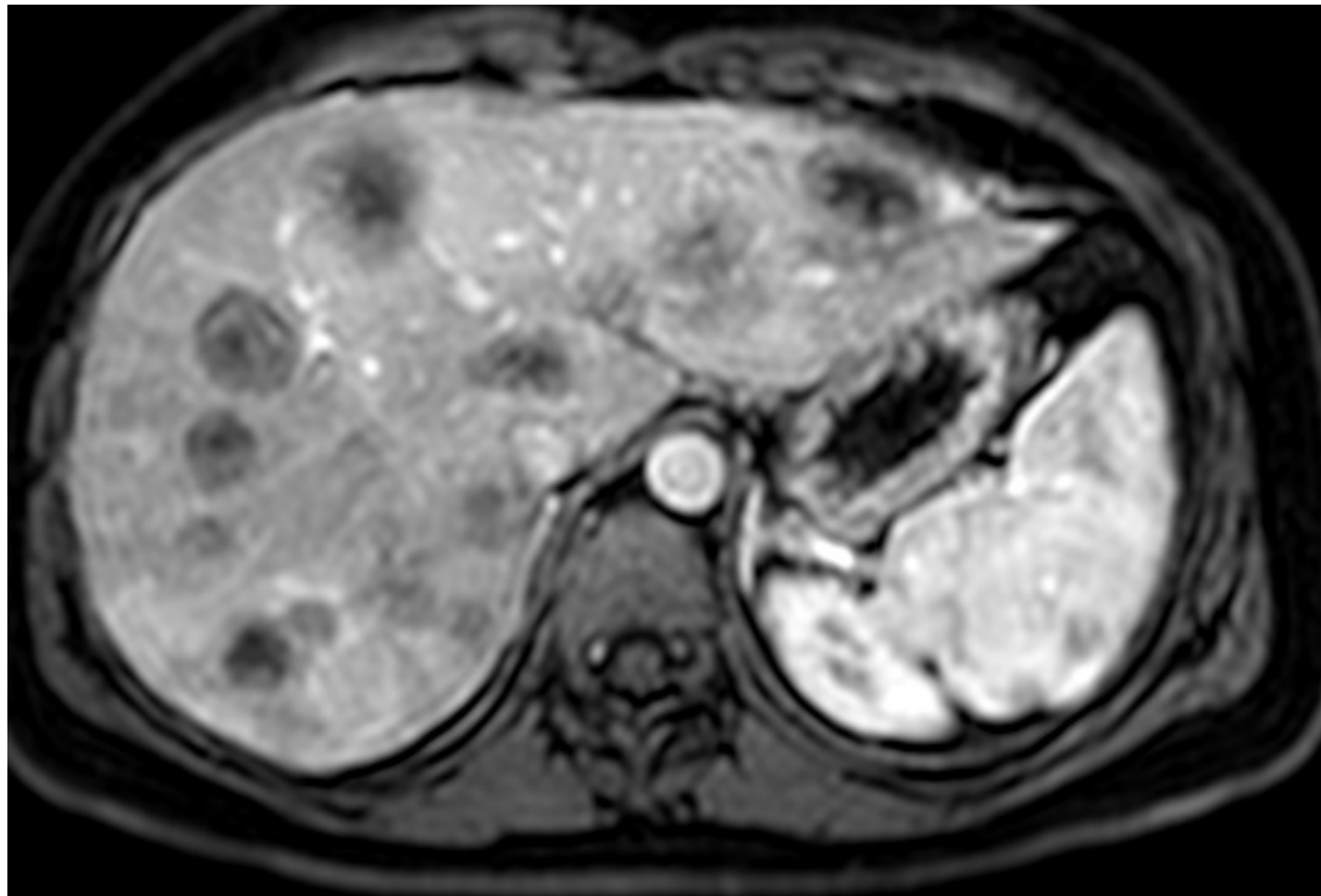


Enhancement patterns (HAP)

| | 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

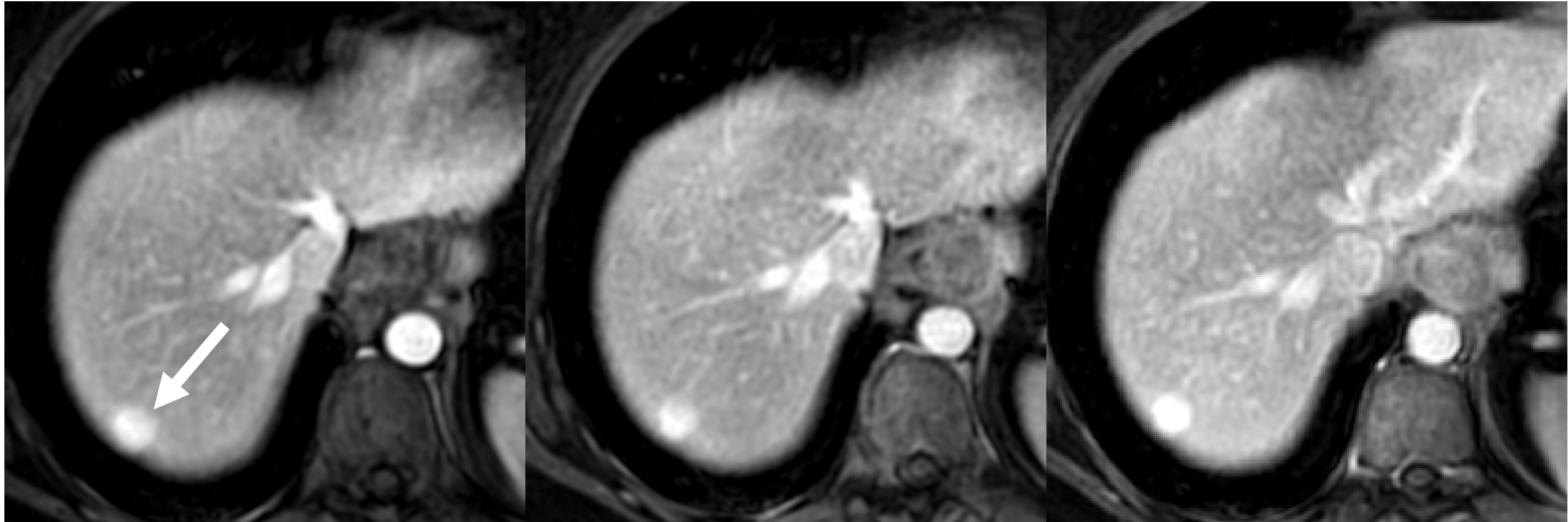
HCC

iCCA

MTS

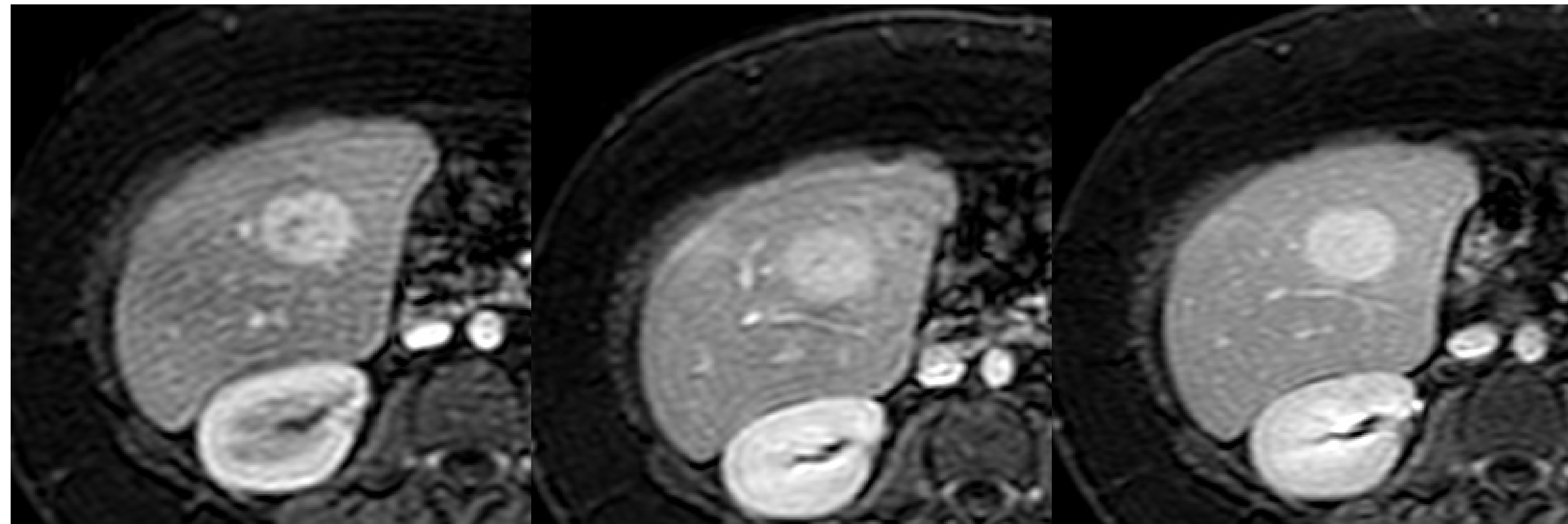
Enhancement patterns (PVP - DP)

Persistent enhancement: capillary hemangiomas



Enhancement patterns (PVP - DP)

Persistent enhancement: hepatocellular adenoma



Enhancement patterns (PVP - DP)

Persistent enhancement

Progressive/centripetal

HH



FNH

HCA



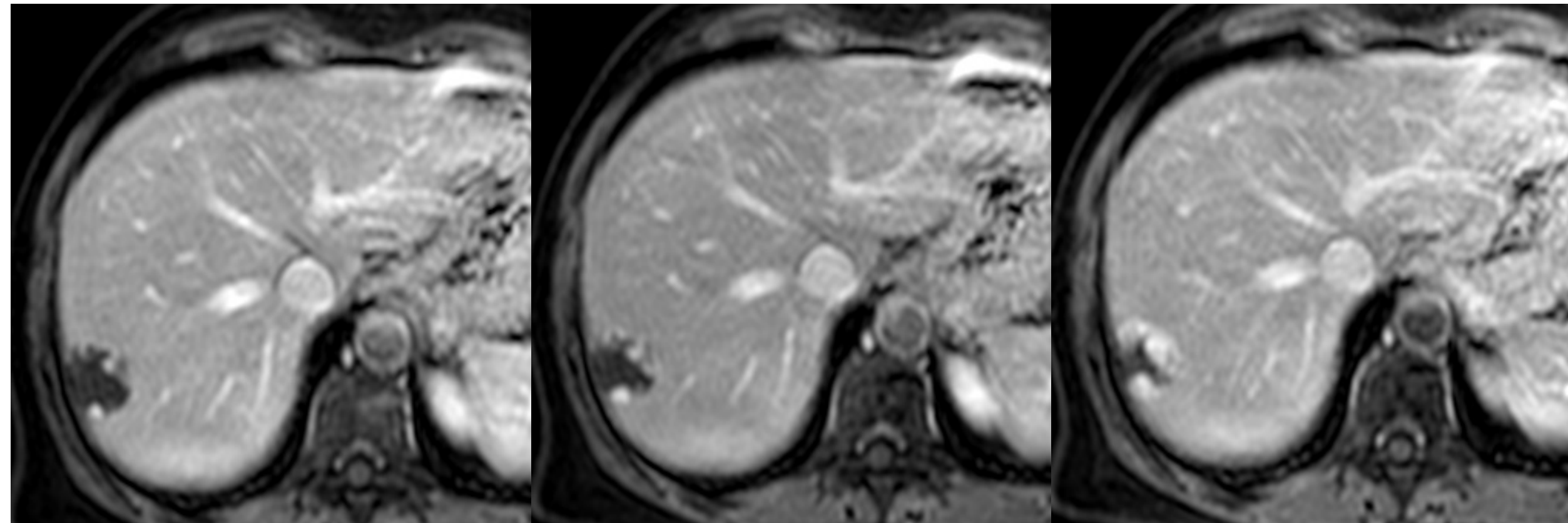
HCC

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



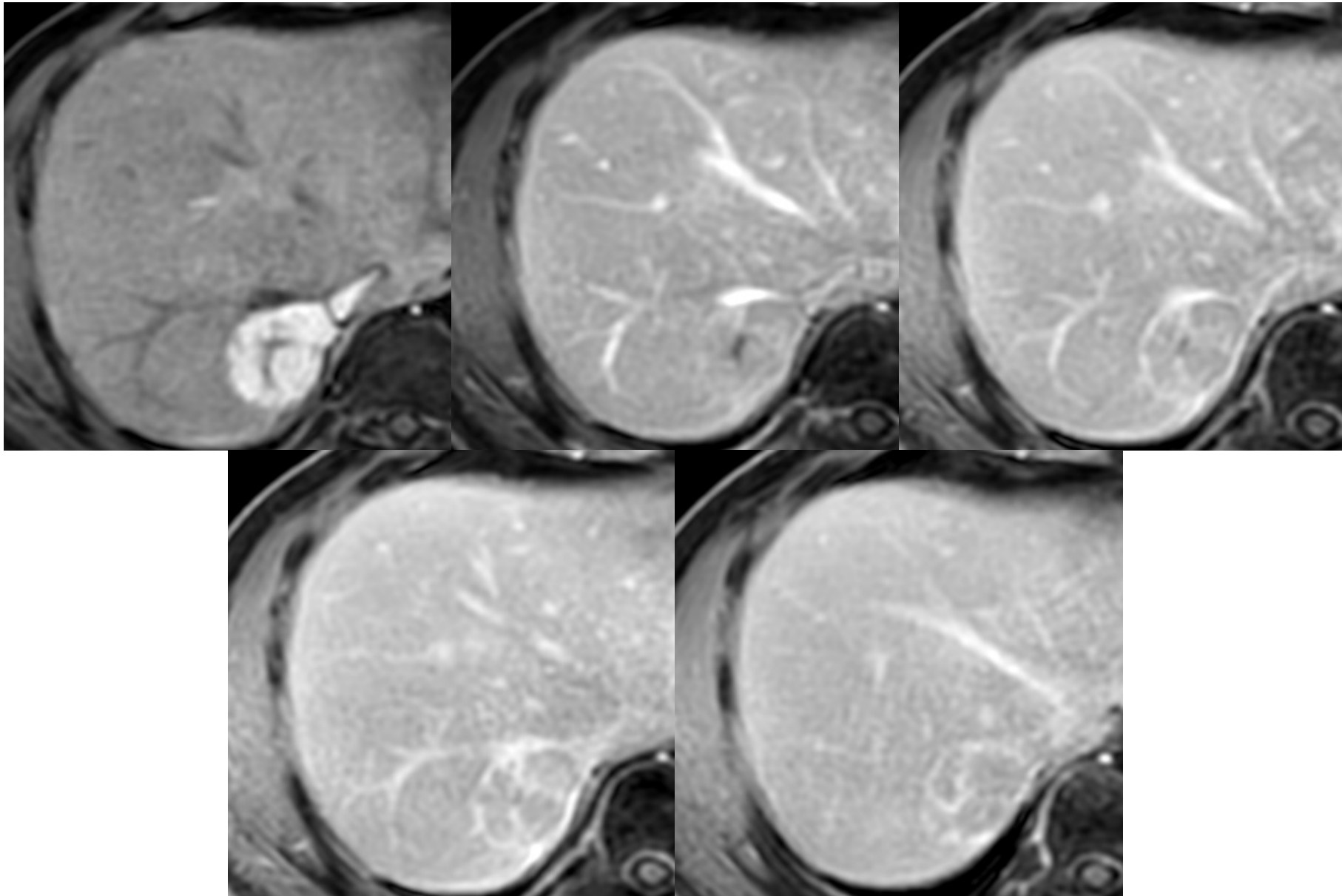
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Enhancement patterns (PVP - DP)

Fading

FNH

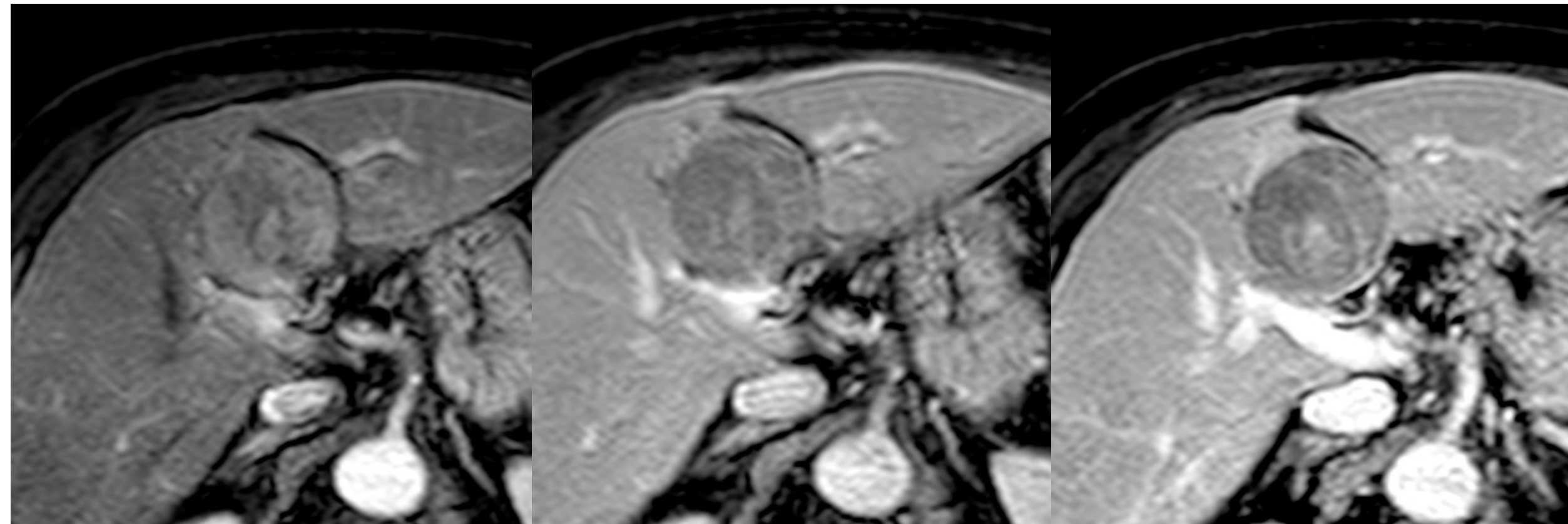


Enhancement patterns (PVP - DP)

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

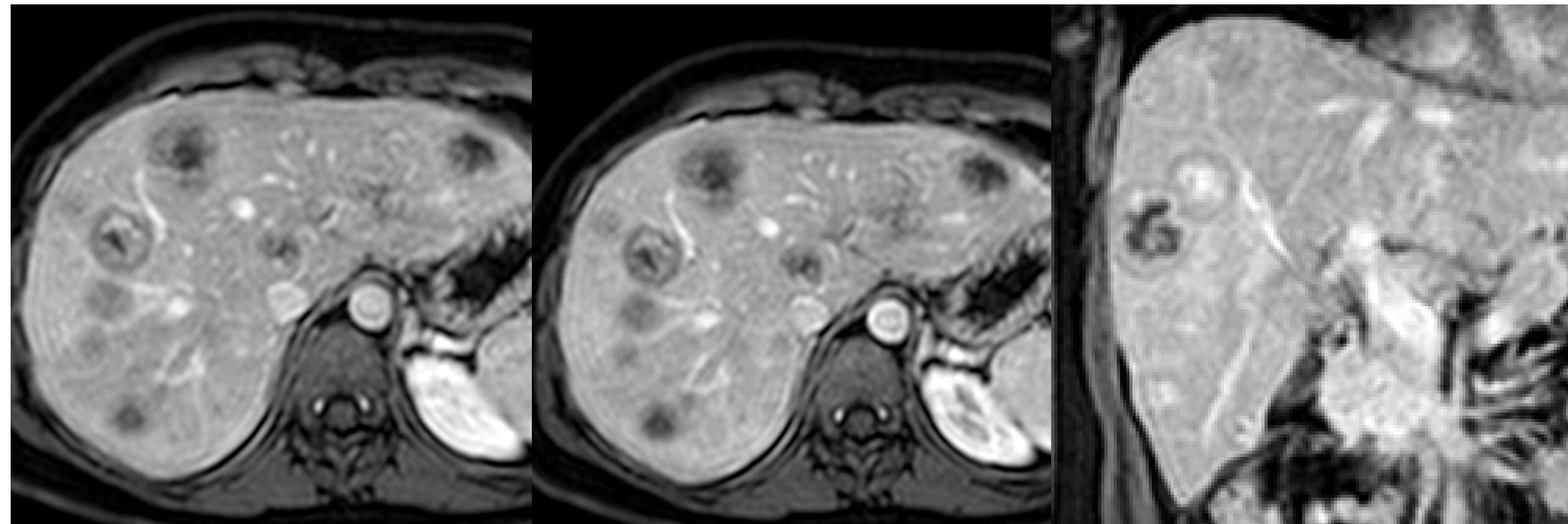
Enhancement patterns (PVP - DP)

Non peripheral washout: HCC



Enhancement patterns (PVP - DP)

Peripheral washout: metastases, ICC

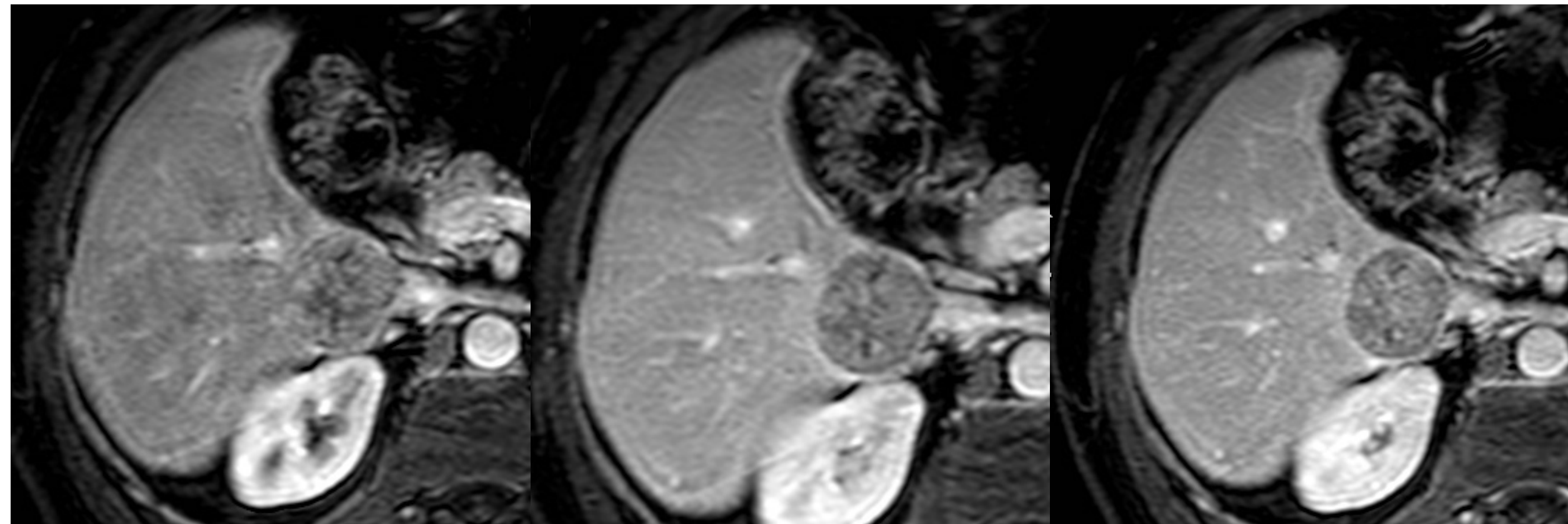


Enhancement patterns (PVP - DP)

| | 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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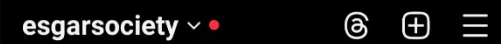
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Thank you!

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Roberto Cannella

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