Japanese Scandinavian Radiological Society

Contrast-enhanced MRI for focal liver disease

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JSRS Copenhagen June 2-4 2026

- → Contrast agents for liver MRI
- → Contrast enhancement, timing
- → Applied in focal liver disease
  - Detection
  - Characterization
  - Evaluation after treatment

Contrast agents in the liver – why?

- Soft-tissue contrast
- Contrast dynamics – vessels, tissue perfusion, excretion etc
- Tissue-specific uptake

Contrast media for liver MRI

Extracellular, ”standard”

- Gadolinium-based
- Macrocyclic

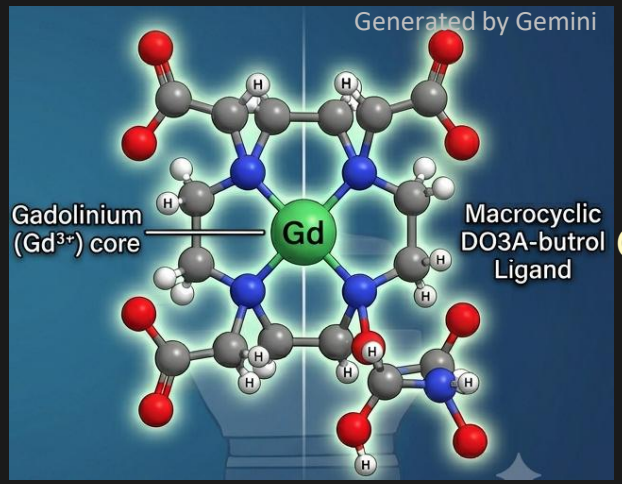
Liver-specific Gd-EOB-DTPA

- Gadolinium-based
- Hepatocyte-specific
  - Gd-EOB-DTPA/Gadoxetate
    - Primovist®/Eovist®
  - Gd-BOPTA
    - MultiHance®
- Others
  - (Manganese-based)
  - (Iron oxide-based - Reticulo-endothelial system-specific, SPIO and USPIO)

Contrast media for liver MRI

Extracellular, ”standard”

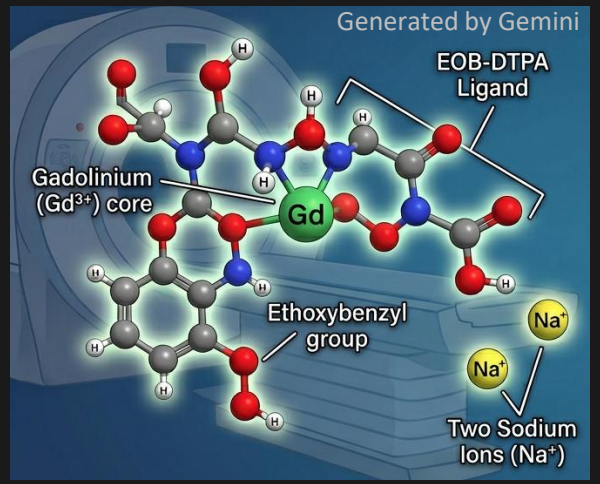
- Gadolinium-based
- Macrocyclic



Gadobutrol

Liver-specific Gd-EOB-DTPA

- Gadolinium-based
- Hepatocyte-specific
  - Gd-EOB-DTPA
    - Primovist®/Eovist®
  - Gd-BOPTA
    - MultiHance®



Gd-EOB-DTPA

Contrast media for liver MRI

Extracellular, ”standard”

- Only vascular+extracellular space
- Renal excretion

Liver-specific Gd-EOB-DTPA

- Initial vascular+extracellular space
- Hepatocyte uptake
- Biliary and renal excretion - 50/50

Liver MRI Protocol

Extracellular, ”standard”

Liver-specific Gd-EOB-DTPA

- T1W: In-phase and out-of-phase
- T2W or T2W with fat suppression
- Diffusion-weighted imaging (DWI)
- Contrast-enhanced 3D-T1W – Breath-hold, fat suppression:
  - Precontrast
  - Late arterial phase
  - Portal venous phase
  - Delayed phase/Transitional phase (2–5 minutes)

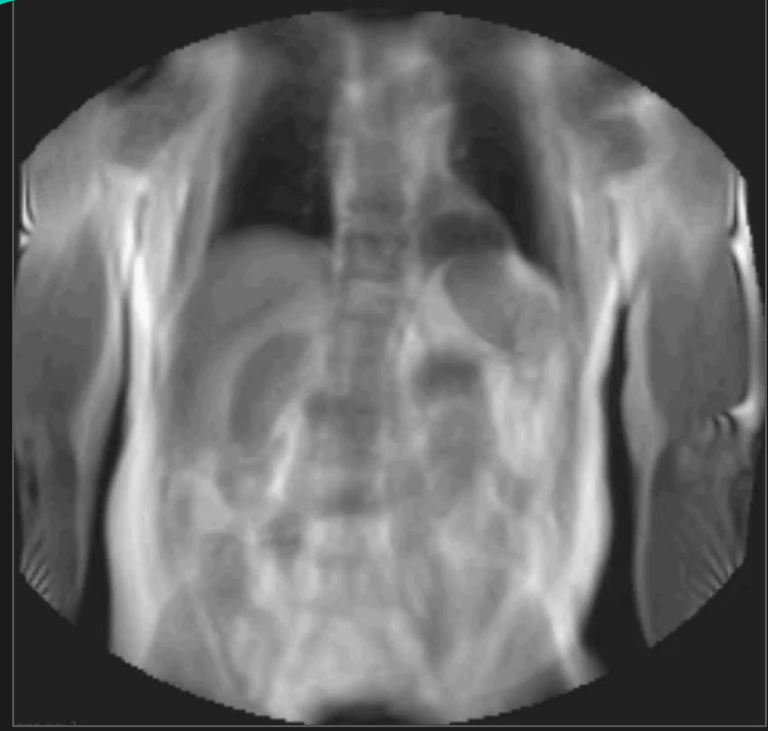
Optional: extra-delayed phase 10 min

Hepatobiliary phase 20 min

Dynamics of contrast enhancement

- Native
- Early Arterial
- Late Arterial
- Portal Venous
- Delayed
- Hepatobiliary (for liver-specific agents)

Bolus tracking



Extracellular CA from native to 3 min

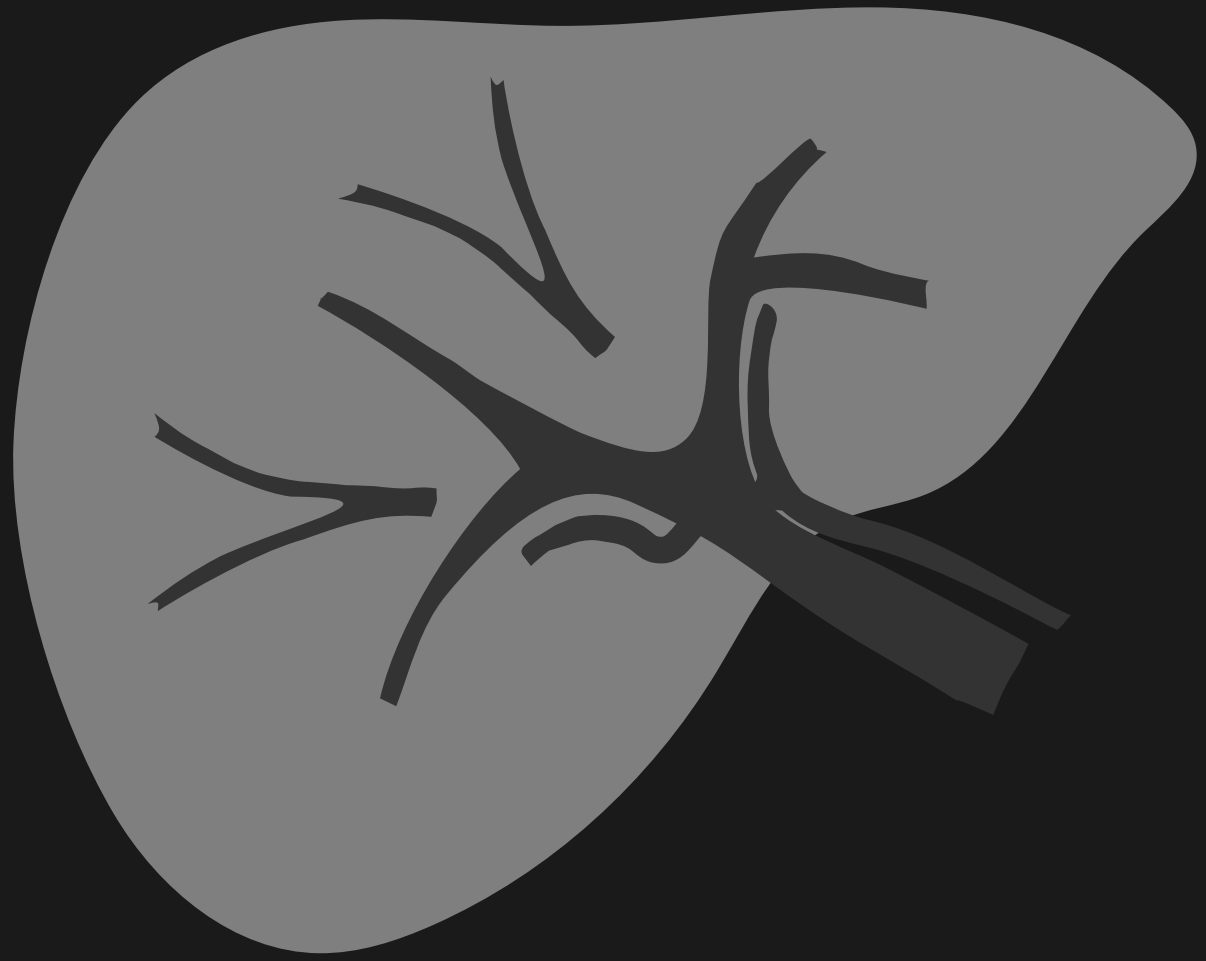
Native

Early Arterial

Late Arterial

Portal Venous

Delayed



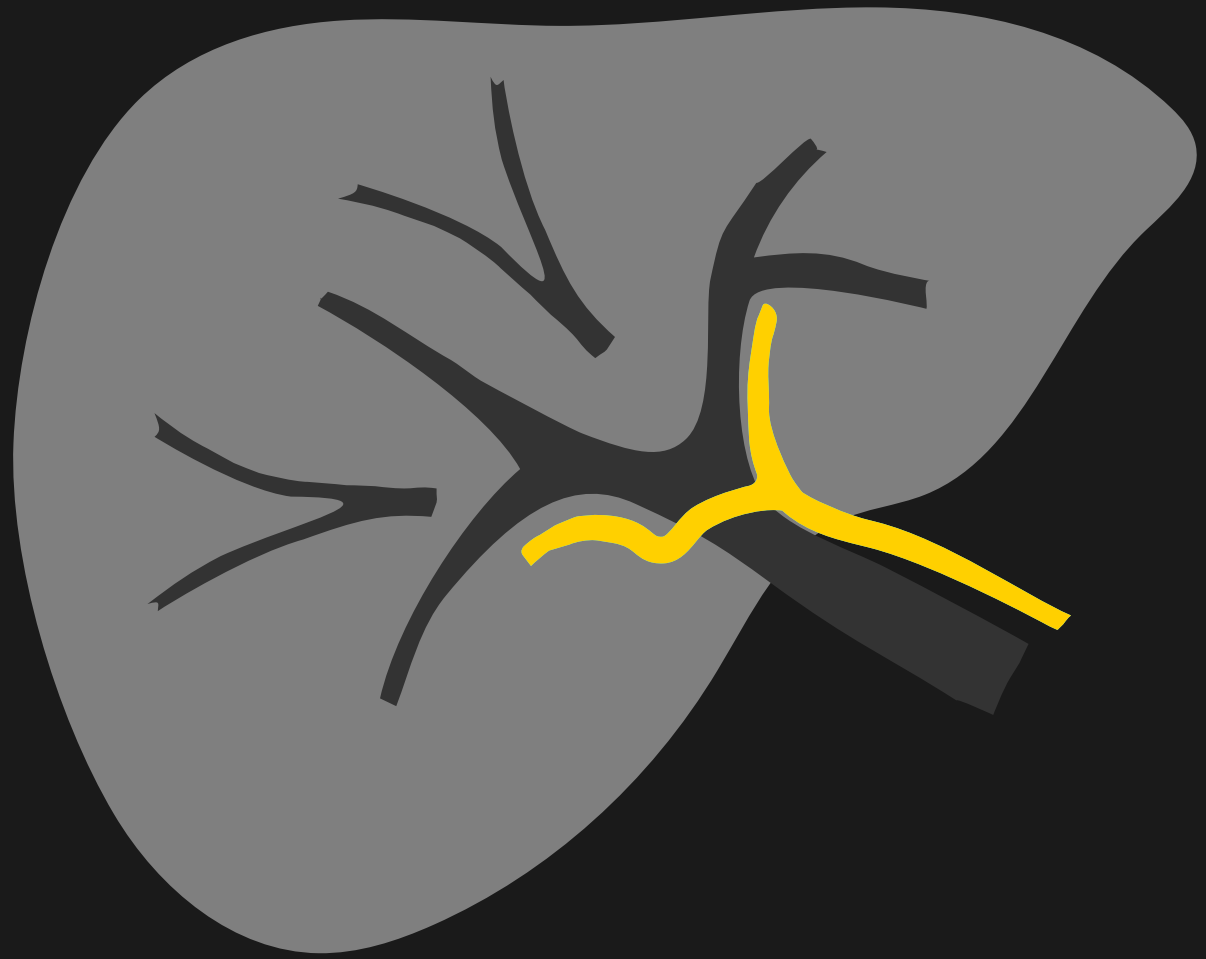
Native

Early Arterial

Late Arterial

Portal Venous

Delayed



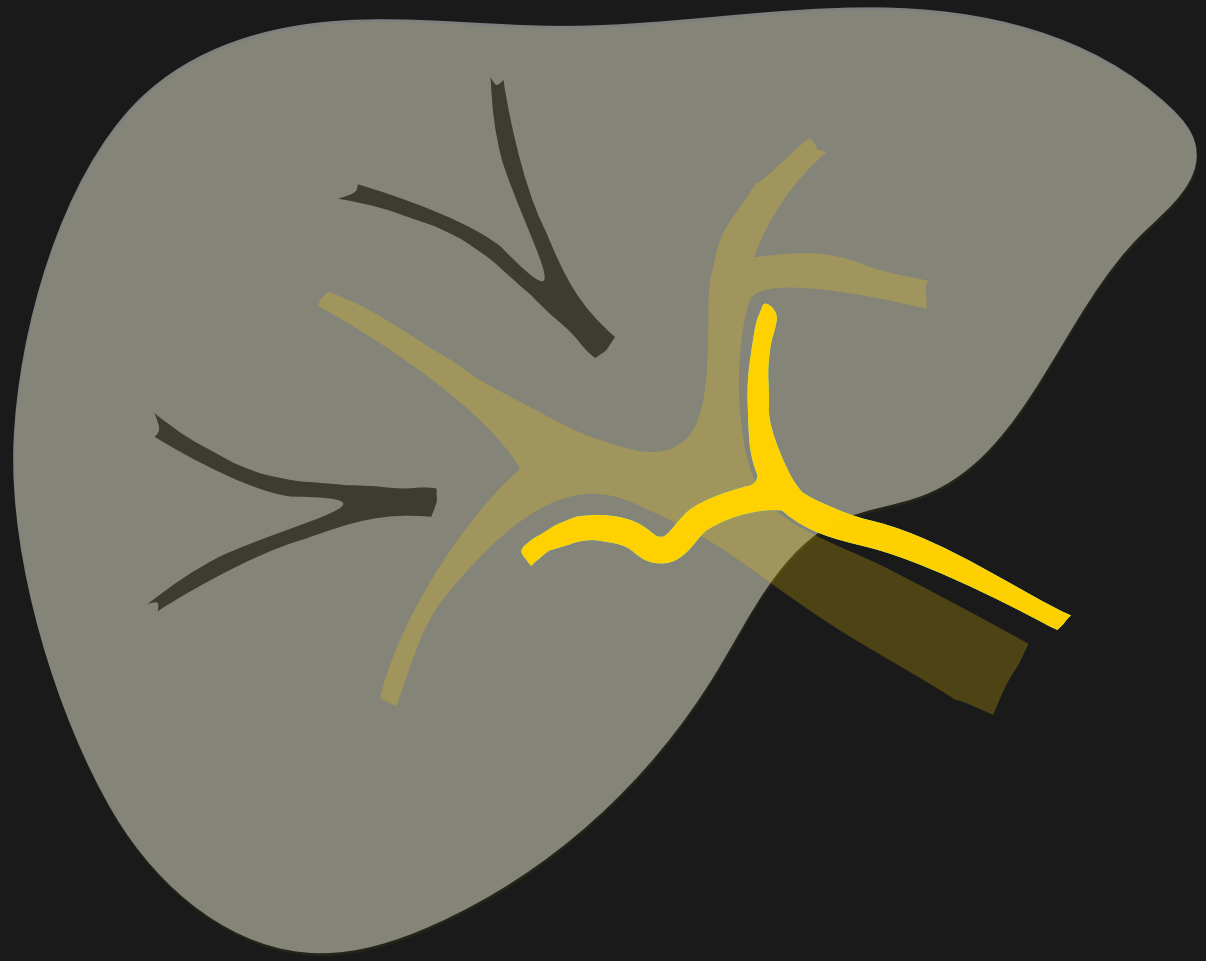
Native

Early Arterial

Late Arterial

Portal Venous

Delayed



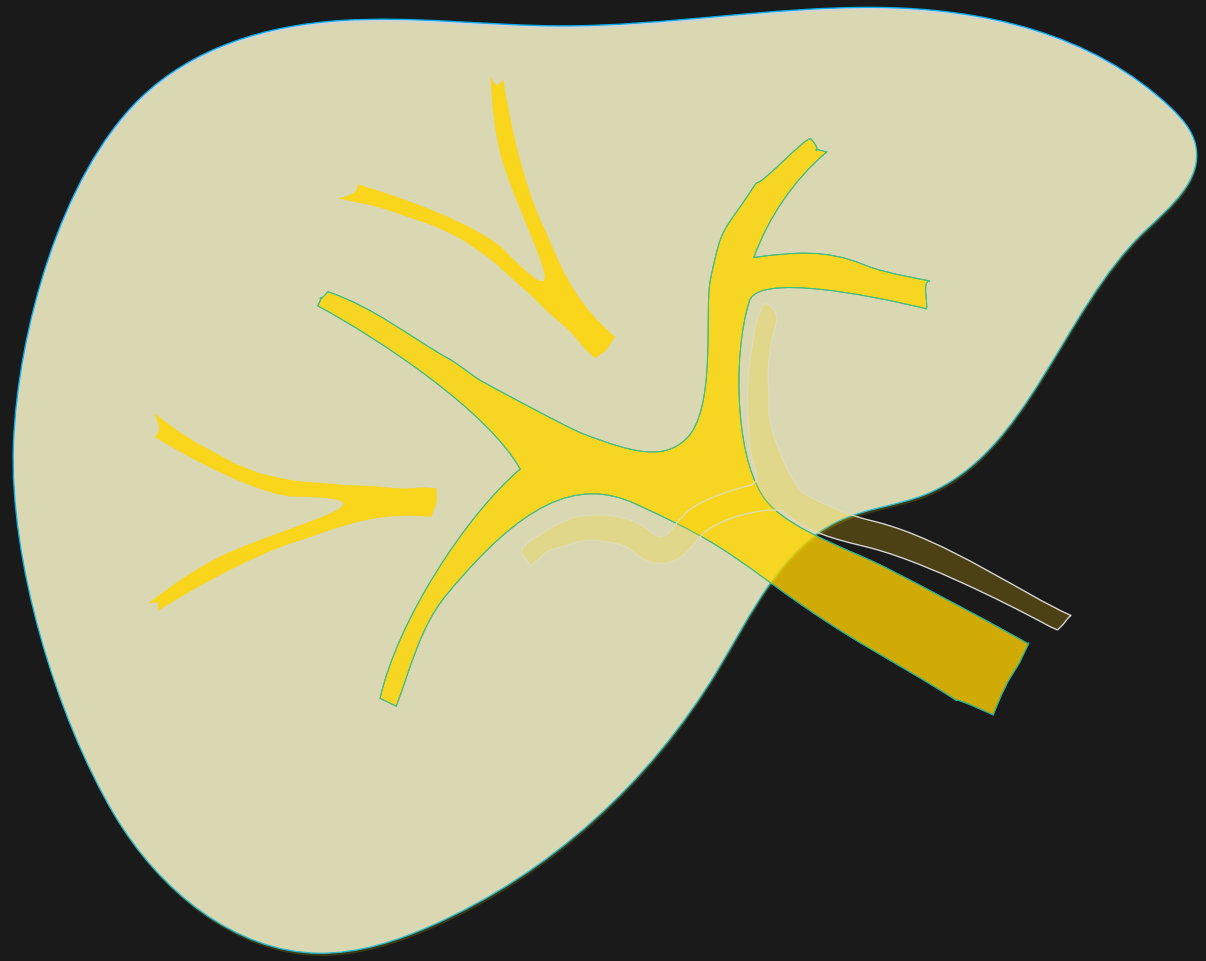
Native

Early Arterial

Late Arterial

Portal Venous

Delayed



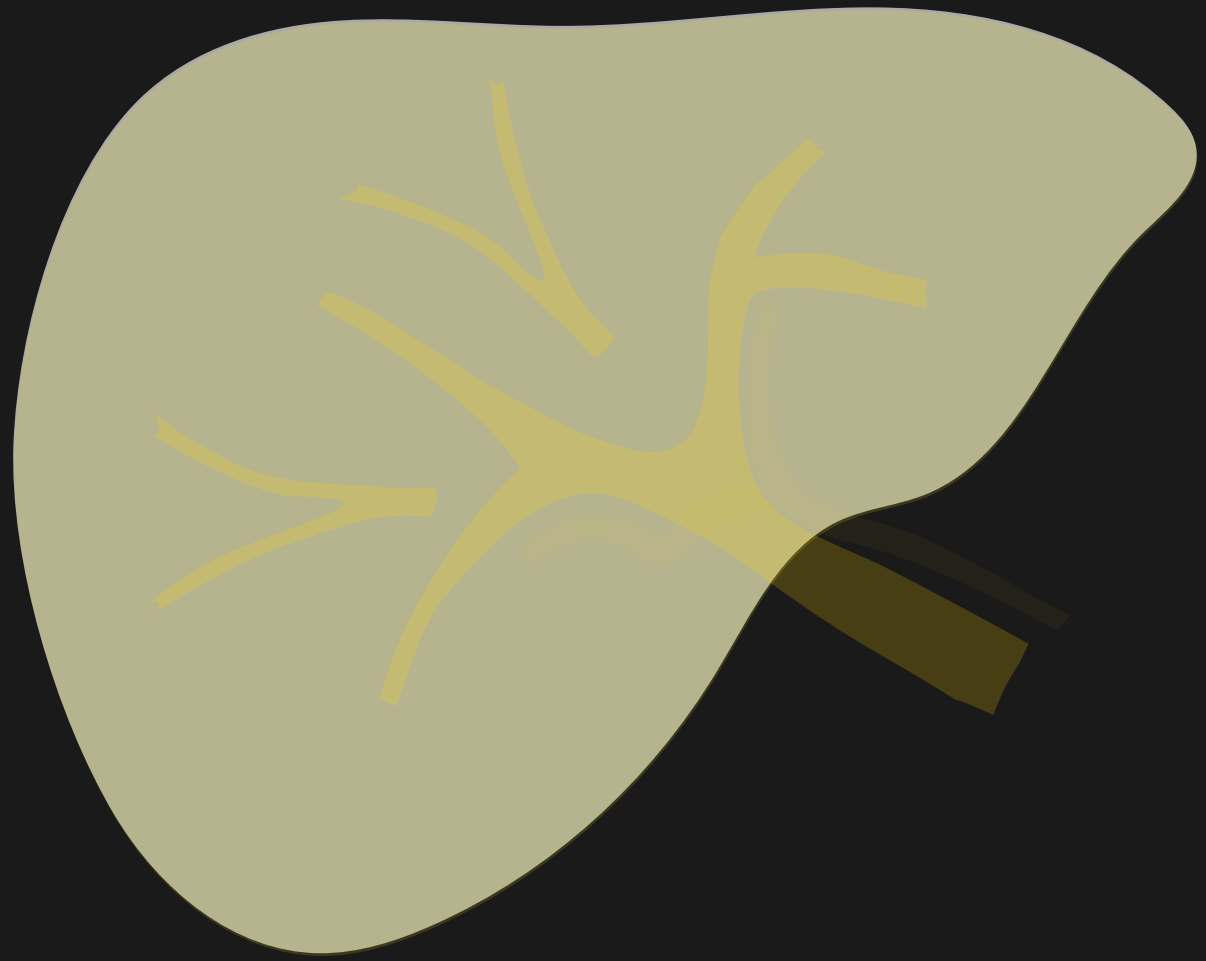
Native

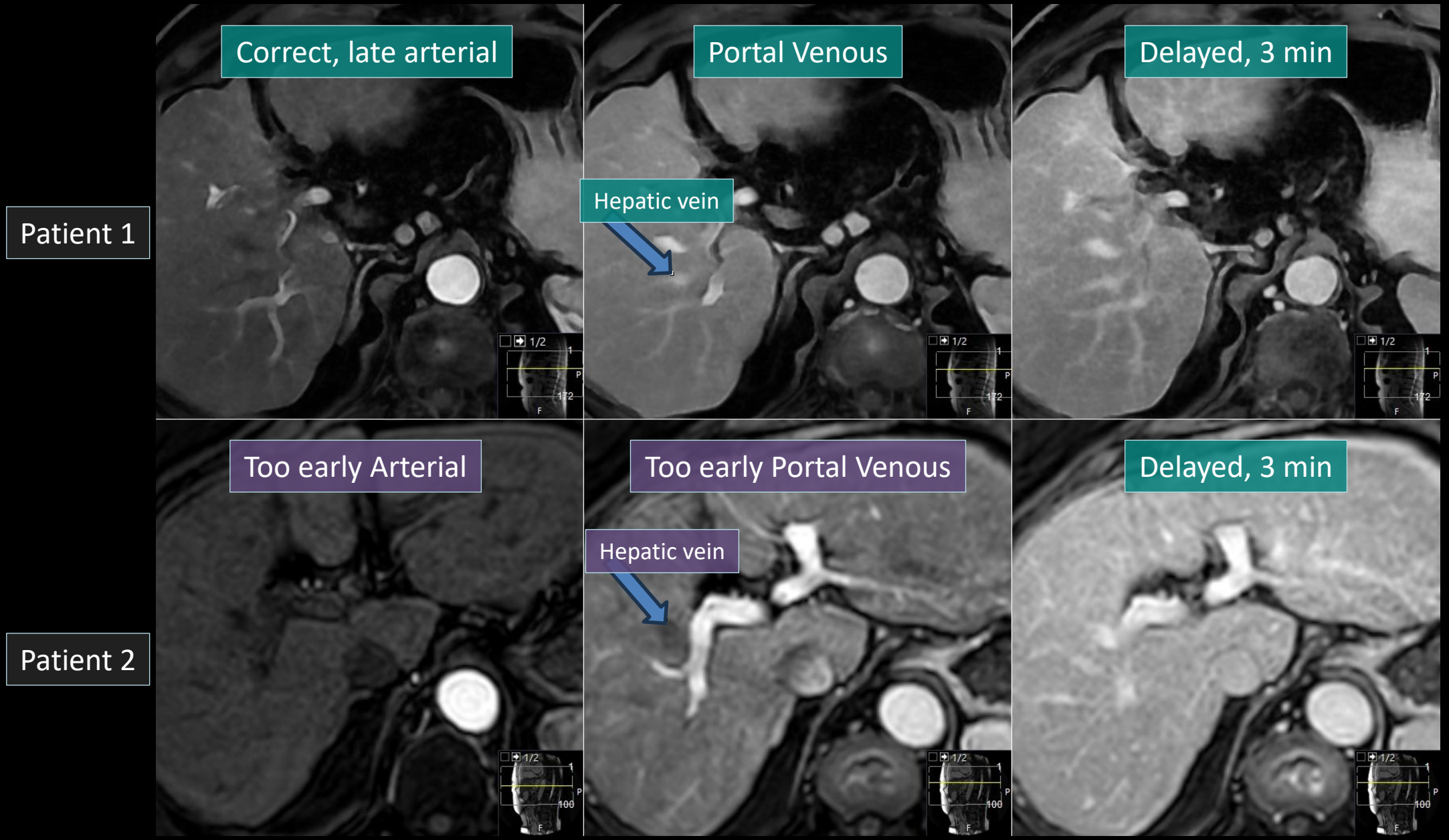
Early Arterial

Late Arterial

Portal Venous

Delayed




Patient 1
Correct, late arterial
Portal Venous
Hepatic vein
Delayed, 3 min
Patient 2
Too early Arterial
Too early Portal Venous
Hepatic vein
Delayed, 3 min

Gd-EOB-DTPA from native to 20+ min

Native

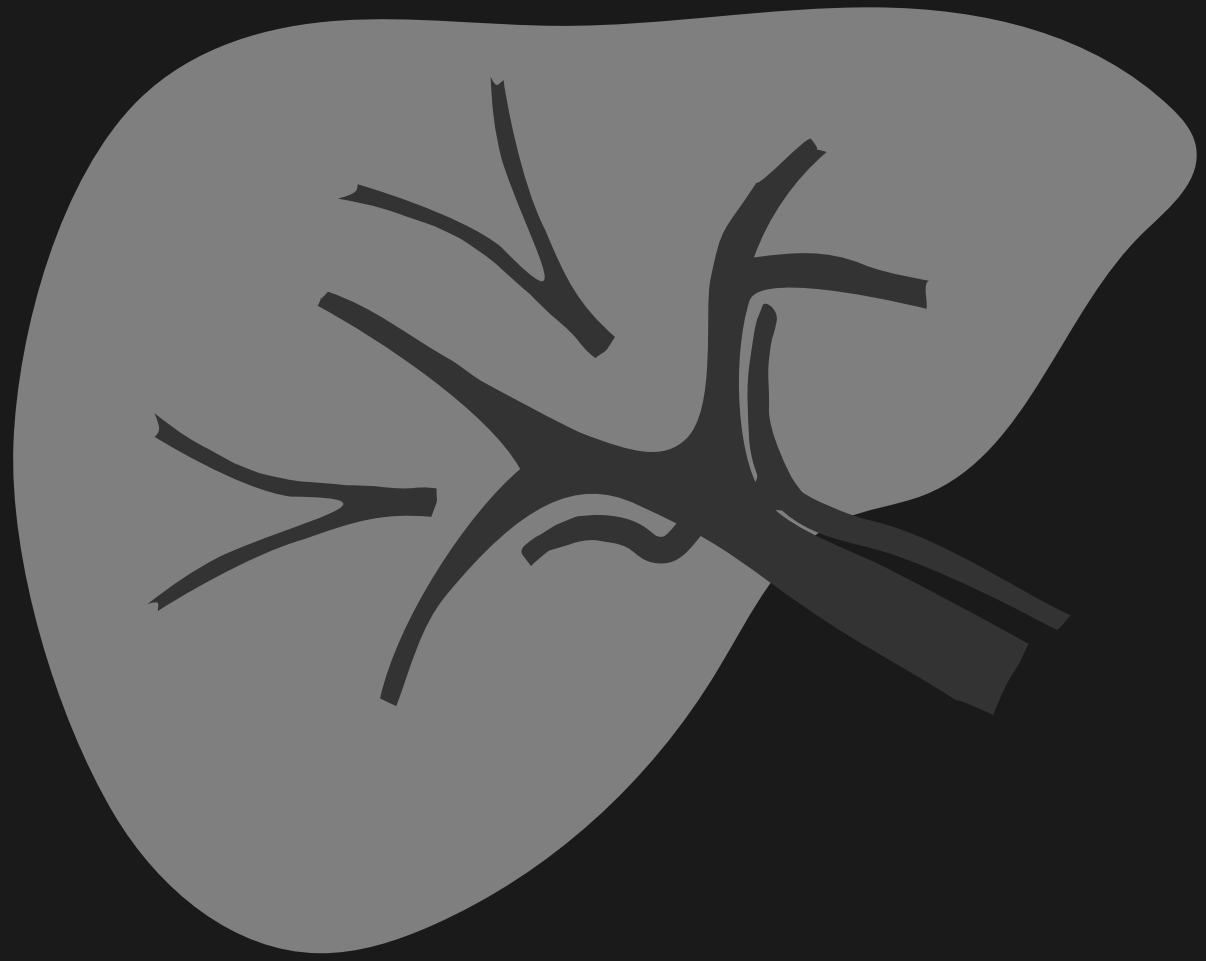
Late Arterial

Portal Venous

Delayed (3 min)

Hepatobiliary 10 min

Hepatobiliary 20 min



Native

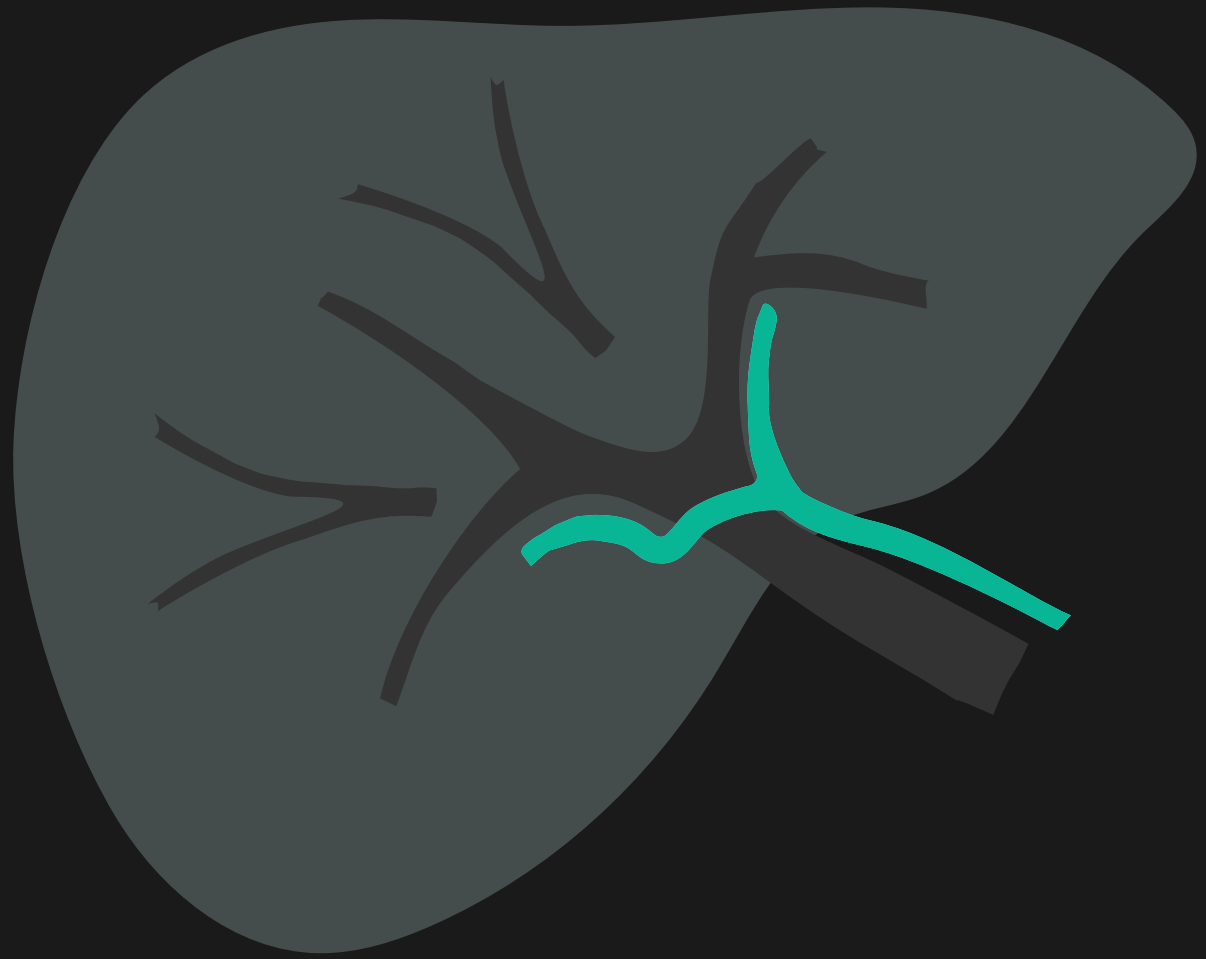
Late Arterial

Portal Venous

Delayed (3 min)

Hepatobiliary 10 min

Hepatobiliary 20 min



Native

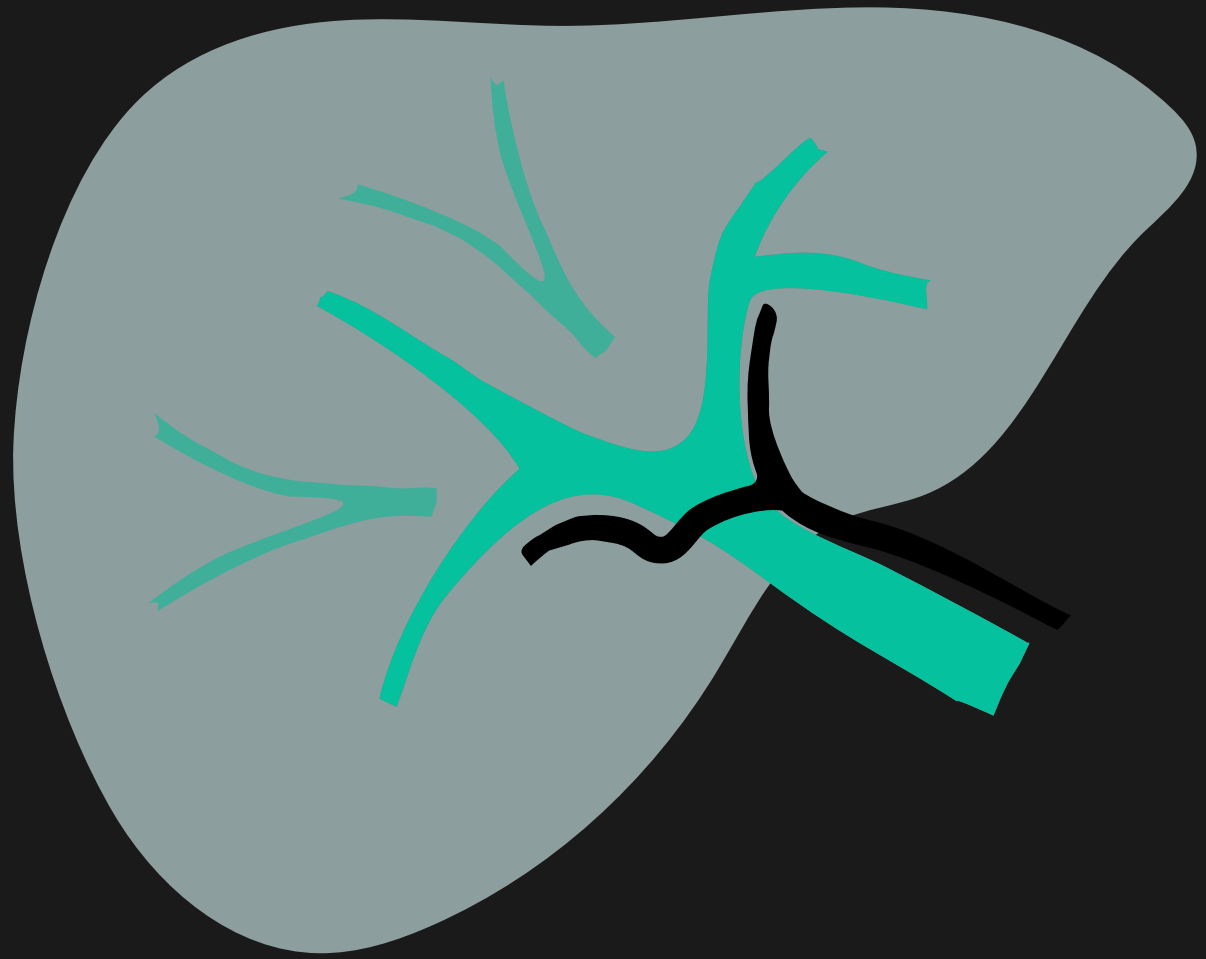
Late Arterial

Portal Venous

Delayed (3 min)

Hepatobiliary 10 min

Hepatobiliary 20 min



Native

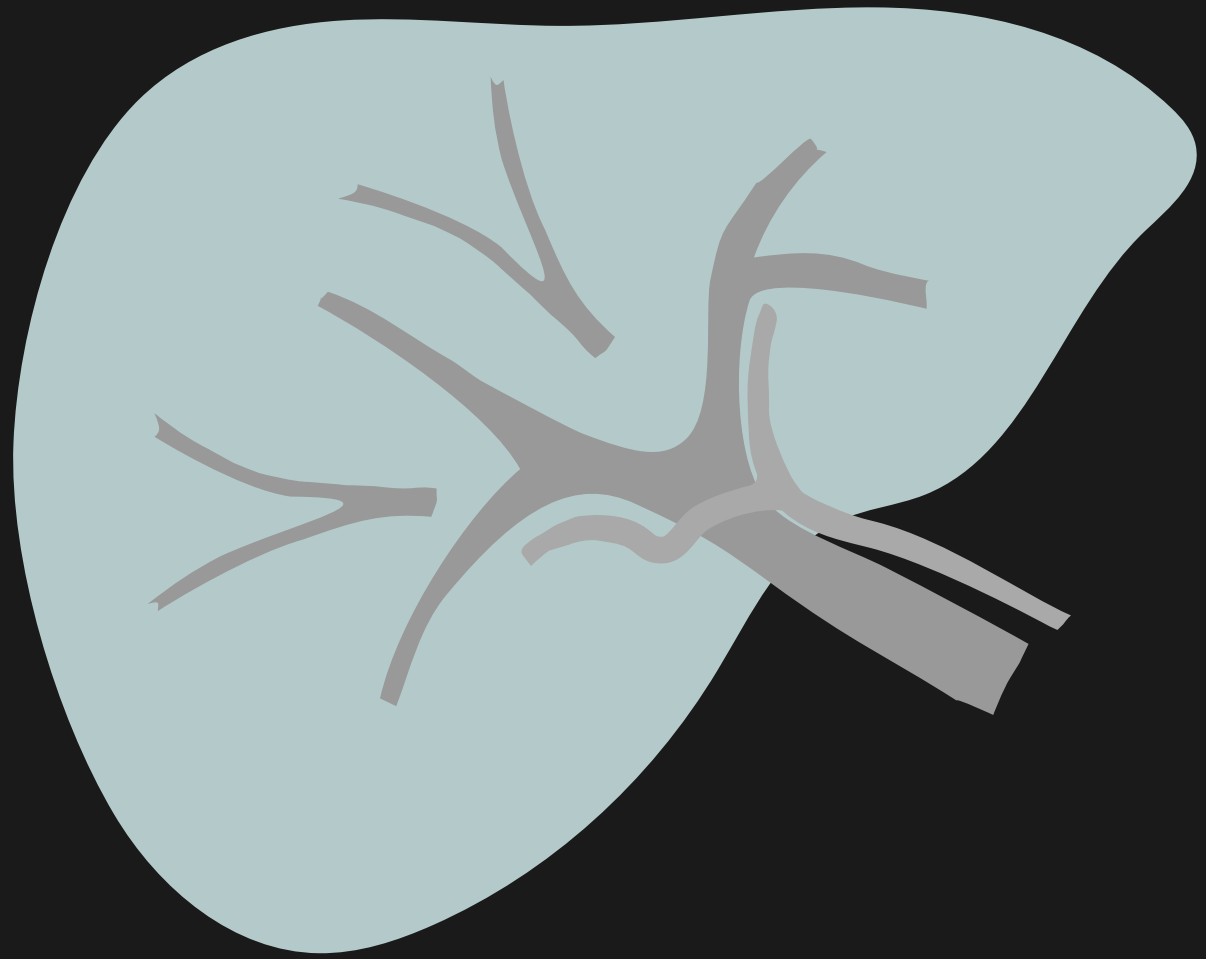
Late Arterial

Portal Venous

Delayed (3 min)

Hepatobiliary 10 min

Hepatobiliary 20 min



Native

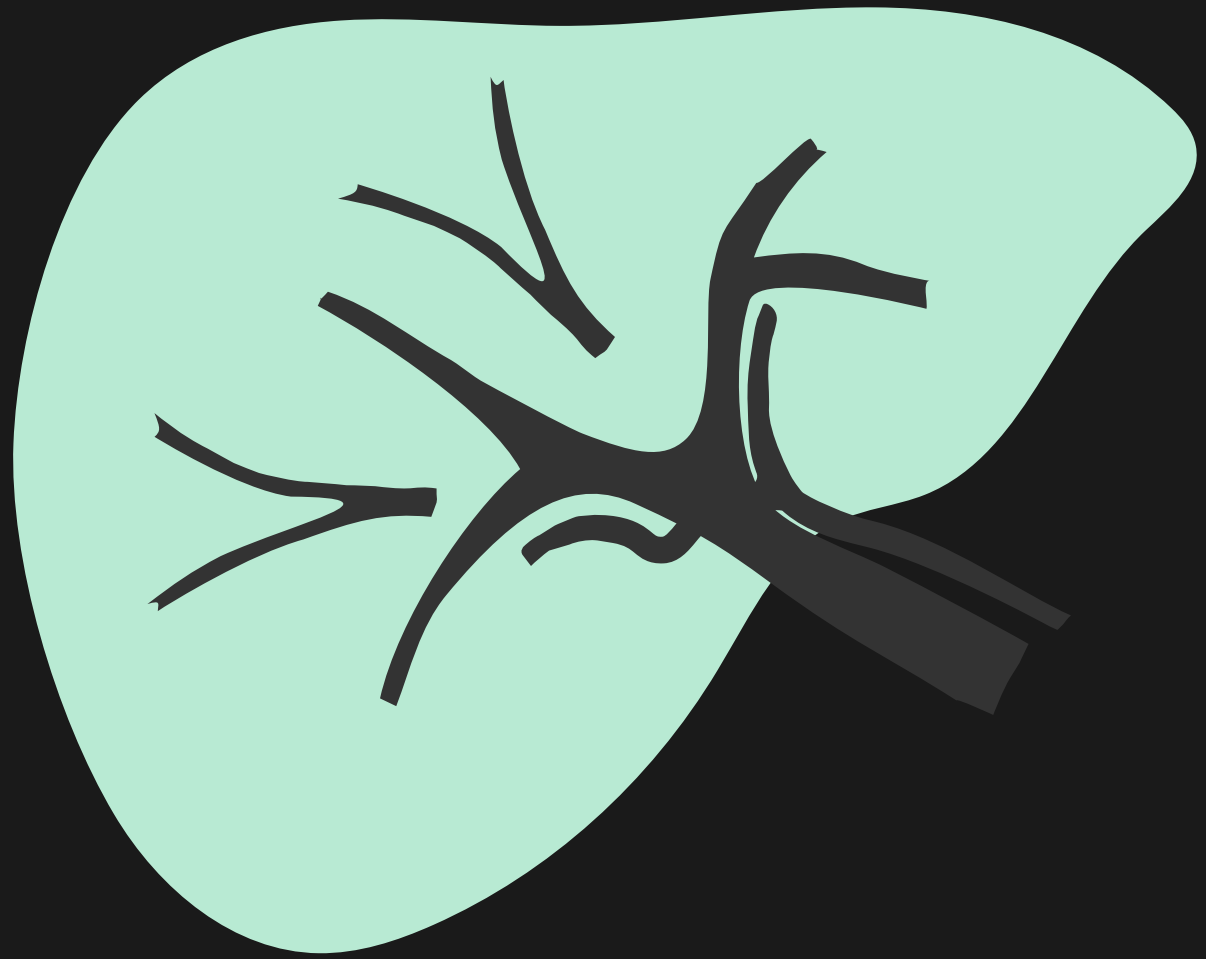
Late Arterial

Portal Venous

Delayed (3 min)

Hepatobiliary 10 min

Hepatobiliary 20 min



Native

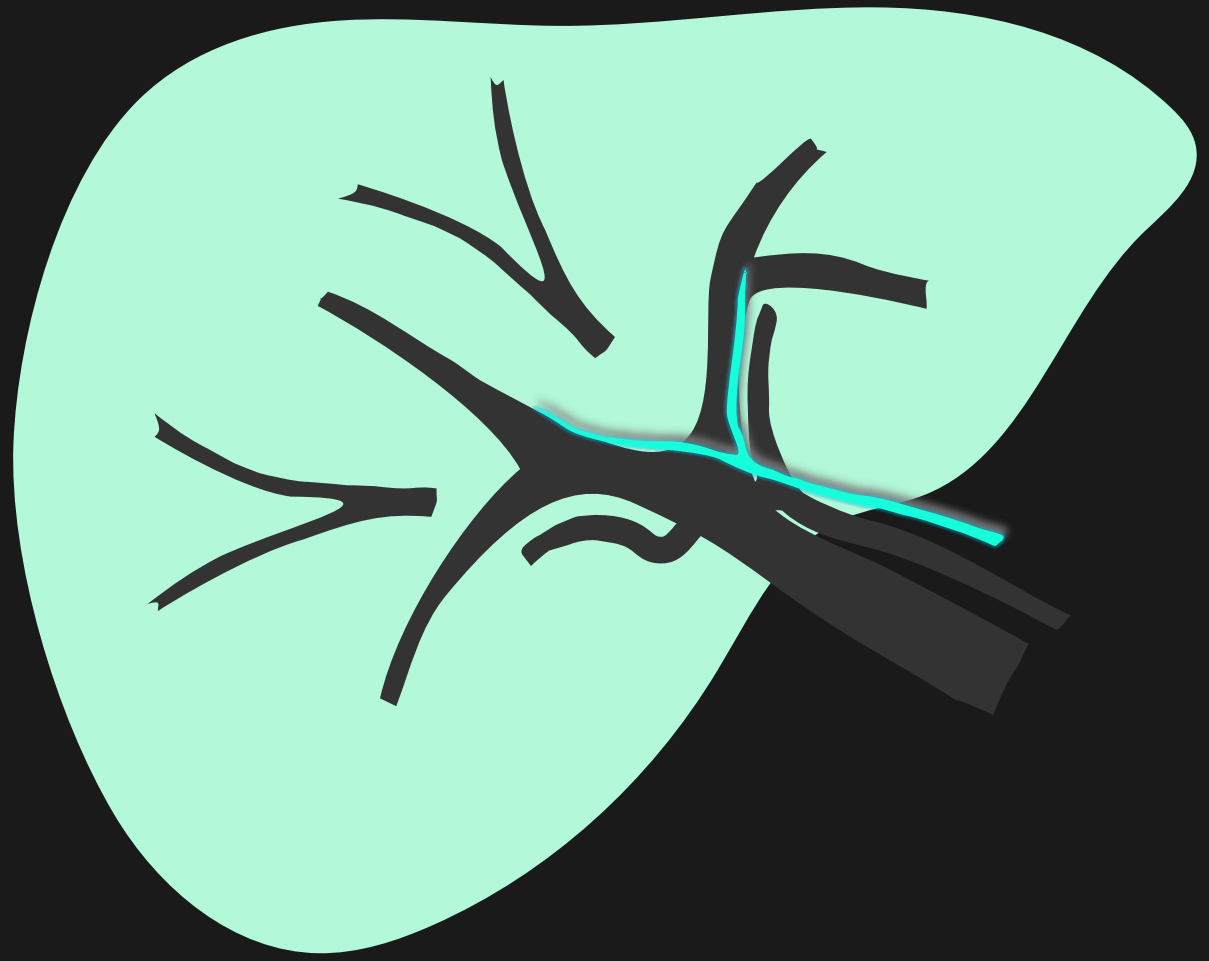
Late Arterial

Portal Venous

Delayed (3 min)

Hepatobiliary 10 min

Hepatobiliary 20 min



DCE-MRI Applied in Focal Liver Disease

- Detection
- Characterization
- Evaluation after treatment

➢HCC – LI-RADS concept

➢Colorectal metastases

Focal liver disease – MRI enhancement Patterns

- Hypervascular

vs

- Hypovascular

vs

- Transient perfusion anomalies

Hypervascular focal lesions

- ➢HCC (Hepatocellular cancer)
- CCC (Cholangiocarcinoma, intrahepatic)
- Also some metastases
  - NET (primarily small bowel and pancreas)
  - Thyroid cancer
  - Melanoma
  - Breast cancer
  - Renal cancer

Hypervascular – HCC

To detect:

1. Arterial hyperenhancement ”APHE”

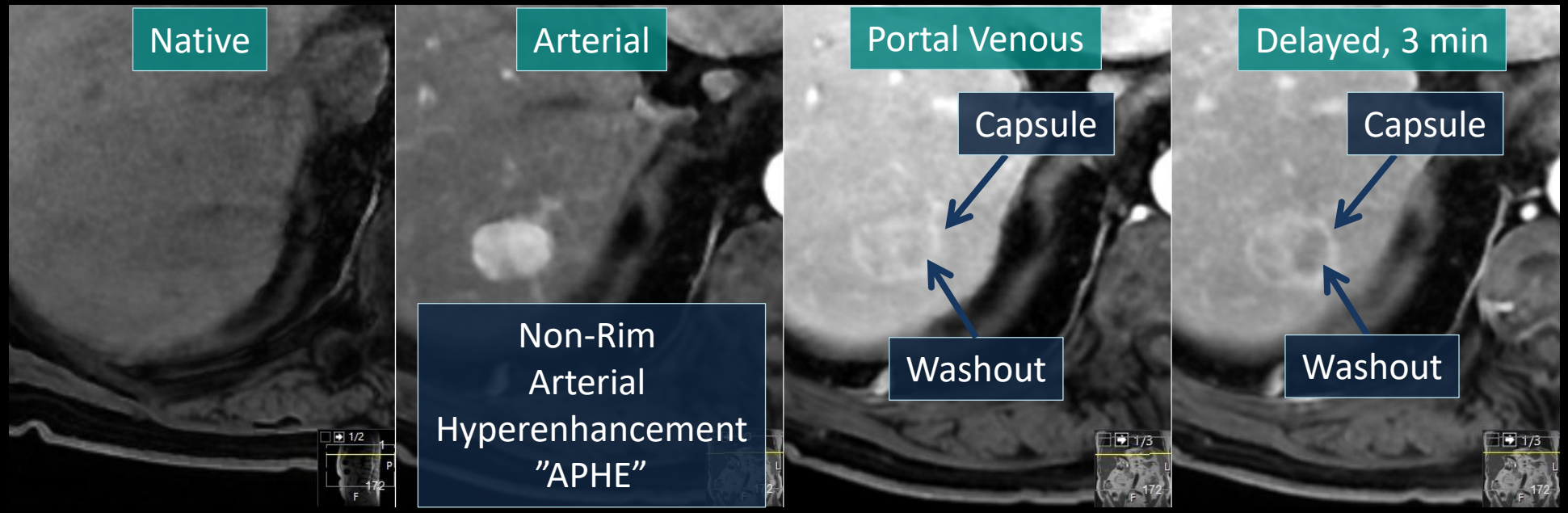
2. Washout
   - ➢ Portal venous phase
   - ➢ Delayed phase

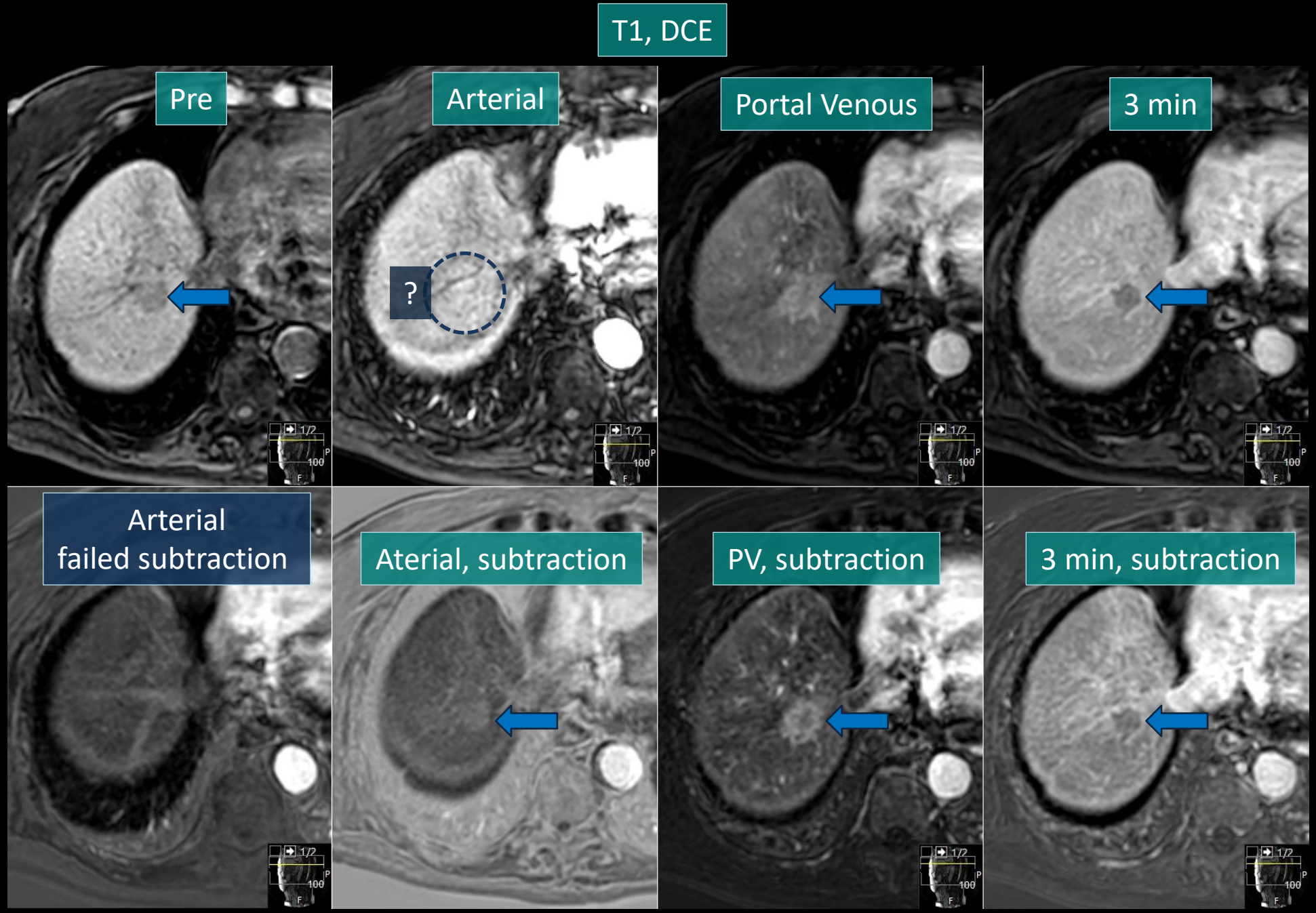
Use:

- Extracellular contrast
- Bolus injection and tracking
- 3D-sequence pre and post
  - high resolution
  - fat-suppressed
  - Breathhold under 20 s

HCC in Cirrhosis, LI-RADS 5

Using standard extracellular contrast


Native
Arterial
Non-Rim
Arterial
Hyperenhancement
”APHE”
Portal Venous
Capsule
Washout
Delayed, 3 min
Capsule
Washout


T1, DCE
Pre
Arterial
?
Portal Venous
3 min
Arterial
failed subtraction
Aterial, subtraction
PV, subtraction
3 min, subtraction

Hypovascular lesions

- ➢Metastases – most frequent malignant hypovascular lesion
- Abscesses, necrosis
- Cystic lesions
- CCC
- Focal fibrosis

Detection and treatment evaluation of colorectal liver metastases

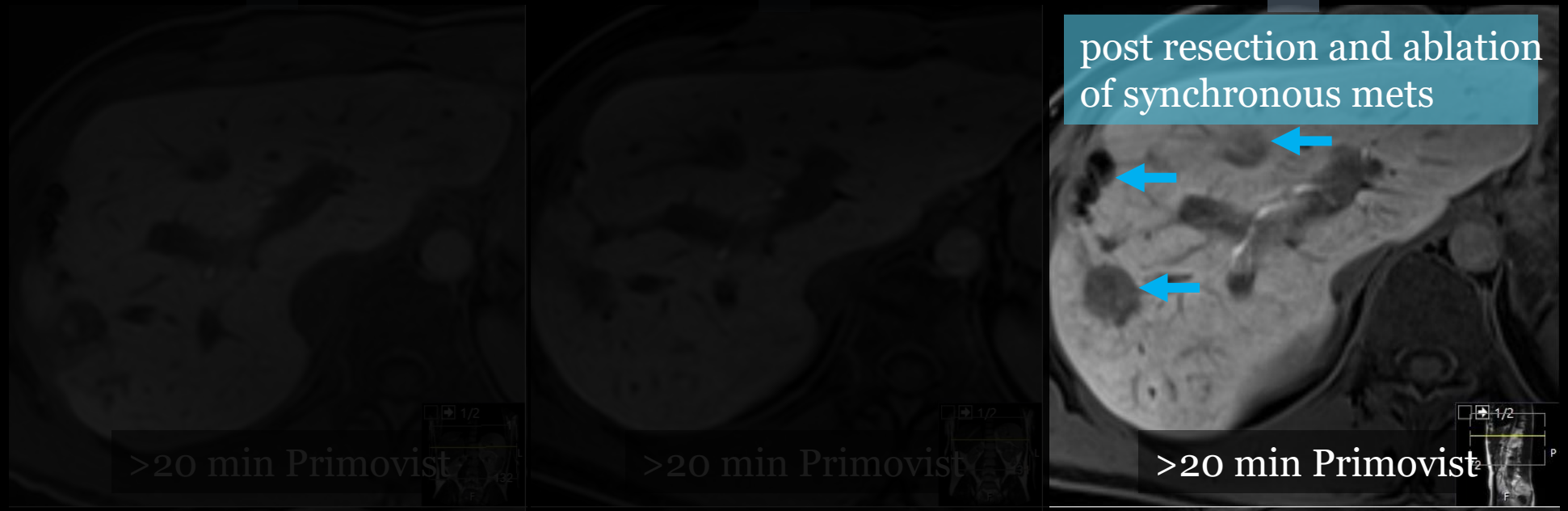
Using Gadoxetate in the hepatobiliary phase

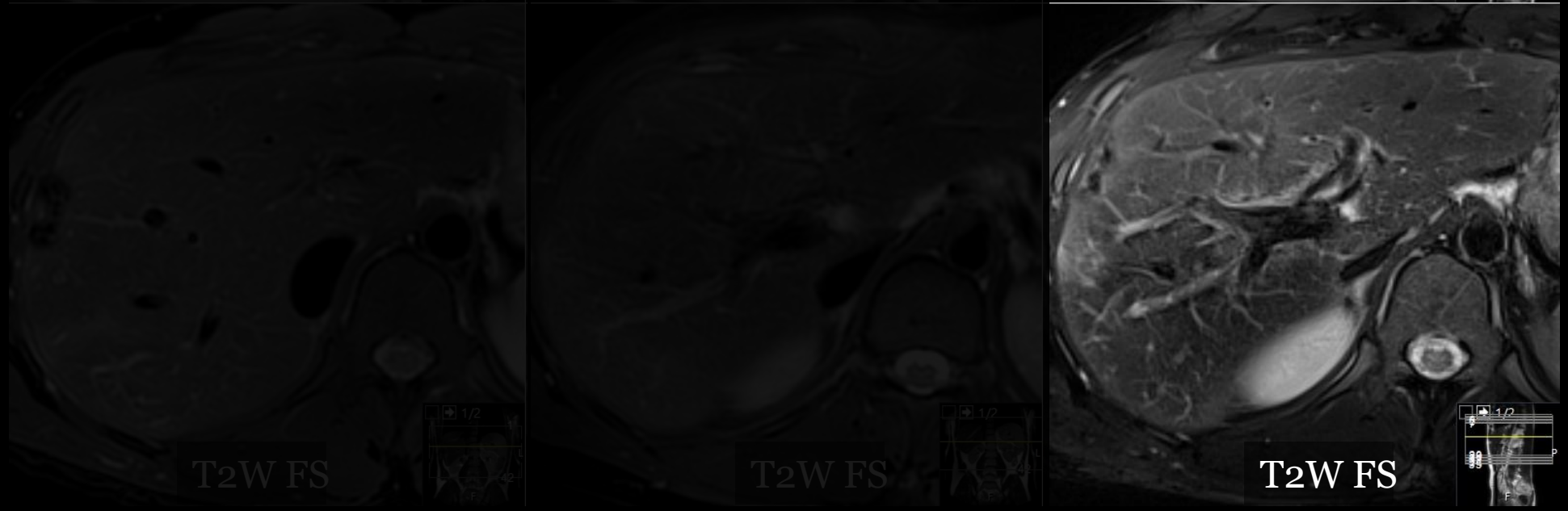
3

2

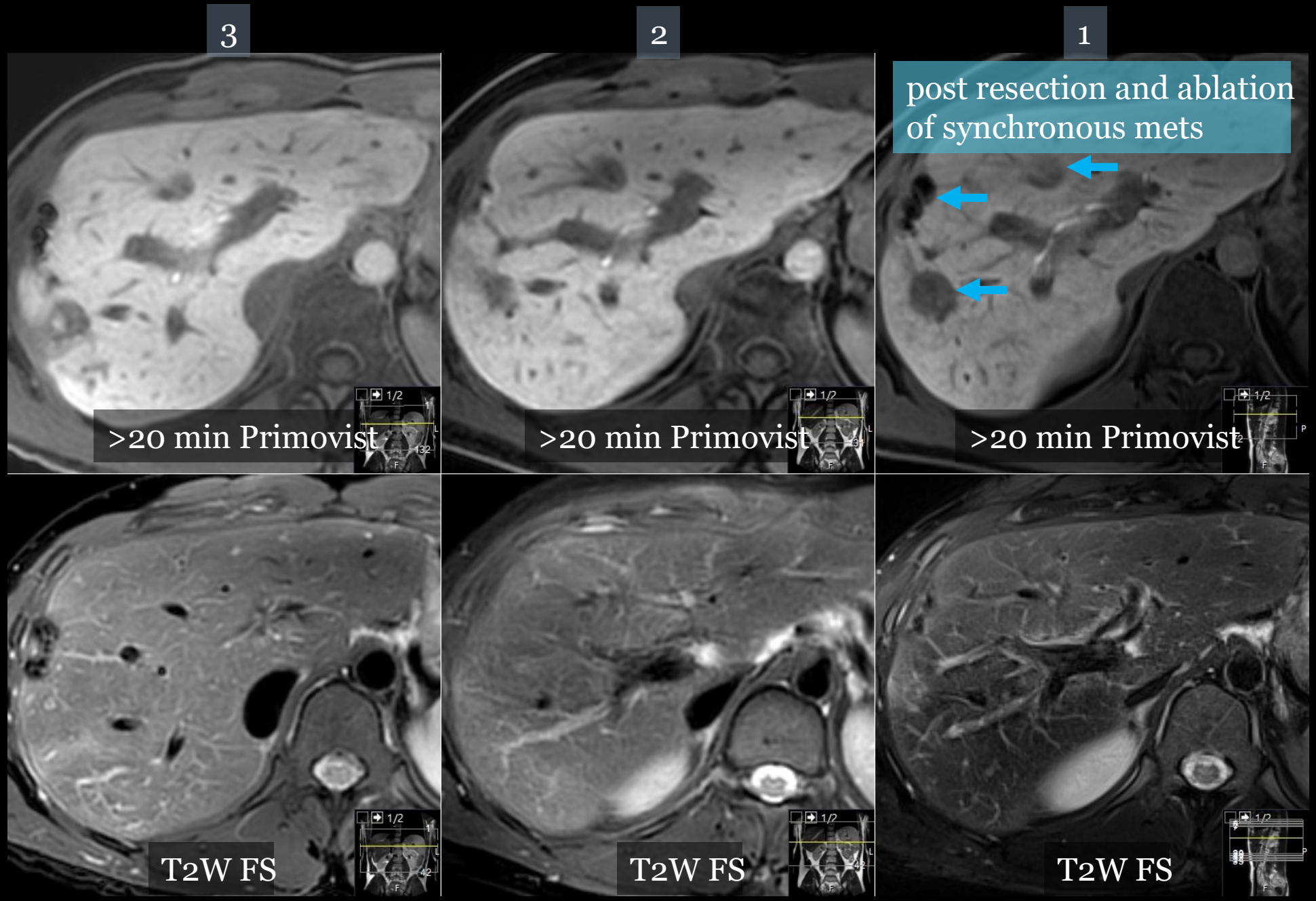
1

post resection and ablation of synchronous mets






3
2
1
post resection and ablation of synchronous mets
>20 min Primovist
>20 min Primovist
>20 min Primovist
T2W FS
T2W FS
T2W FS


3
2
1
post resection and ablation of synchronous mets
>20 min Primovist
>20 min Primovist
>20 min Primovist
T2W FS
T2W FS
T2W FS

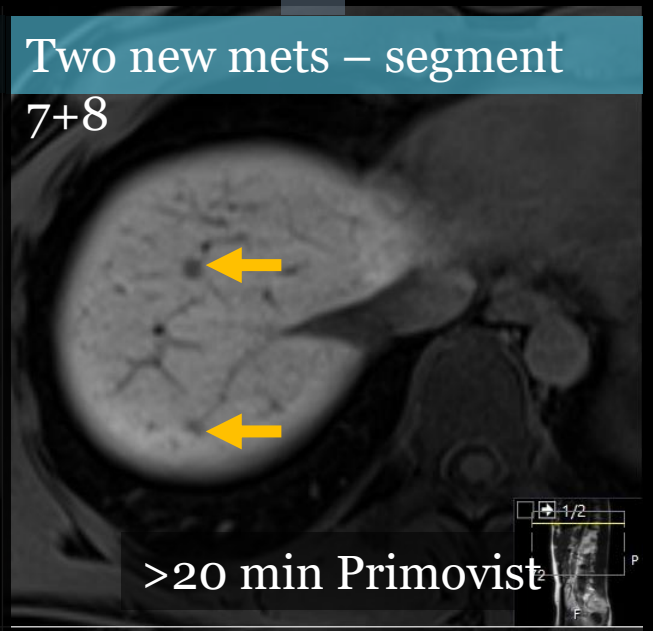
3

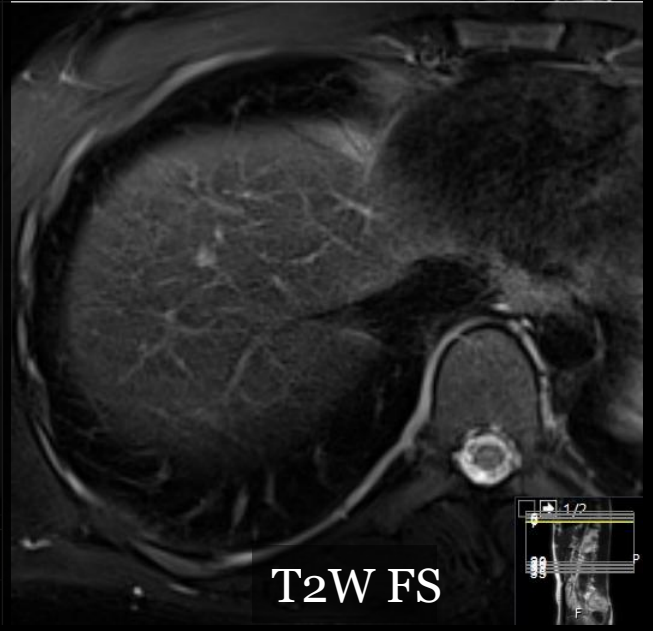
2

Post ablation

1

Two new mets – segment 7+8





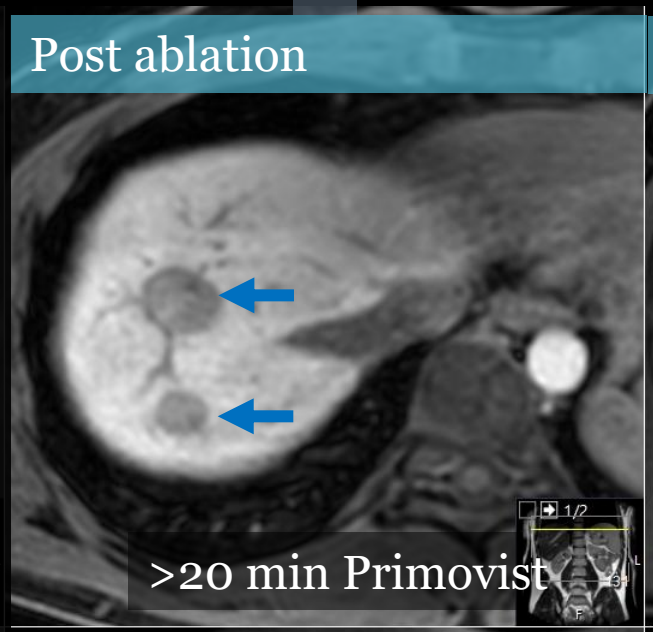
3

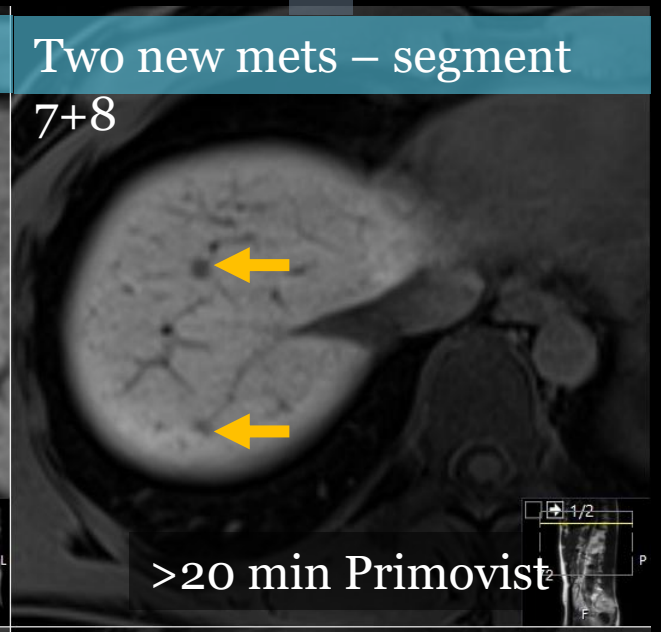
2

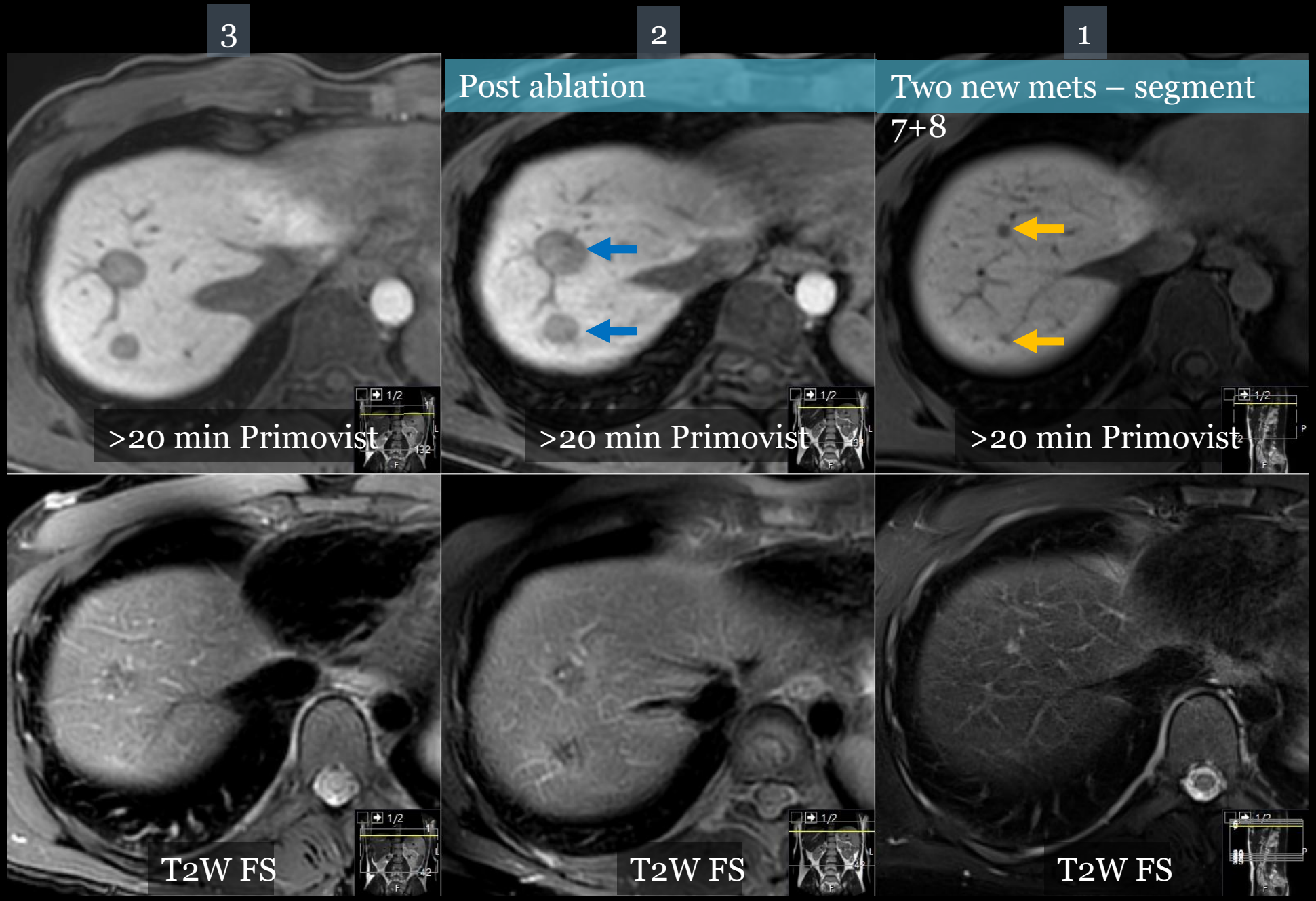
Post ablation

1

Two new mets – segment 7+8






3
2
1
Post ablation
Two new mets – segment 7+8
>20 min Primovist
>20 min Primovist
>20 min Primovist
T2W FS
T2W FS
T2W FS

3

>20 min Primovist

2

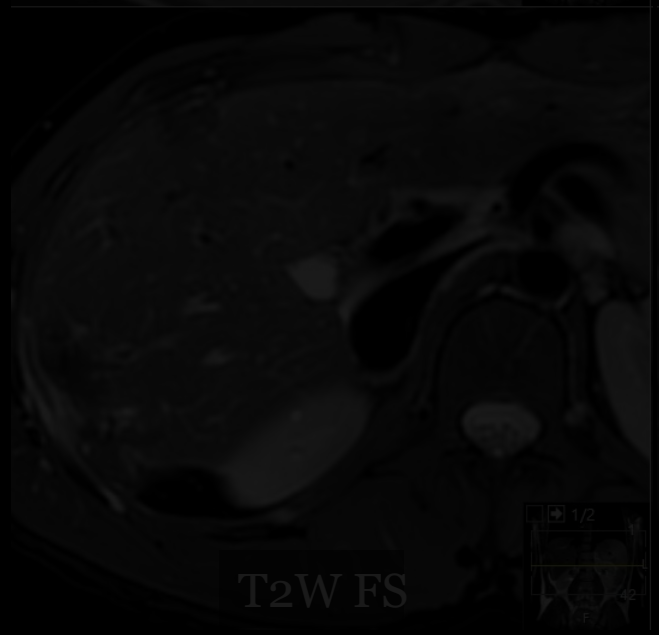
Post ablation

>20 min Primovist

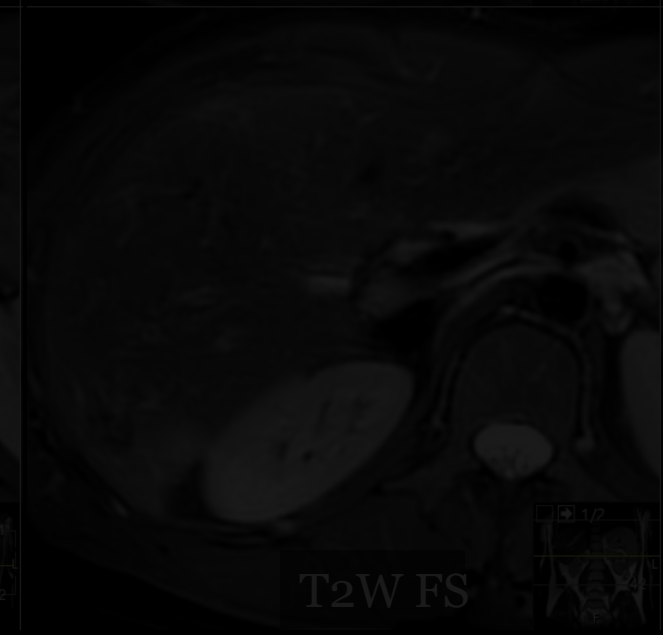
1

Suspected 3rd met, segment 6

>20 min Primovist

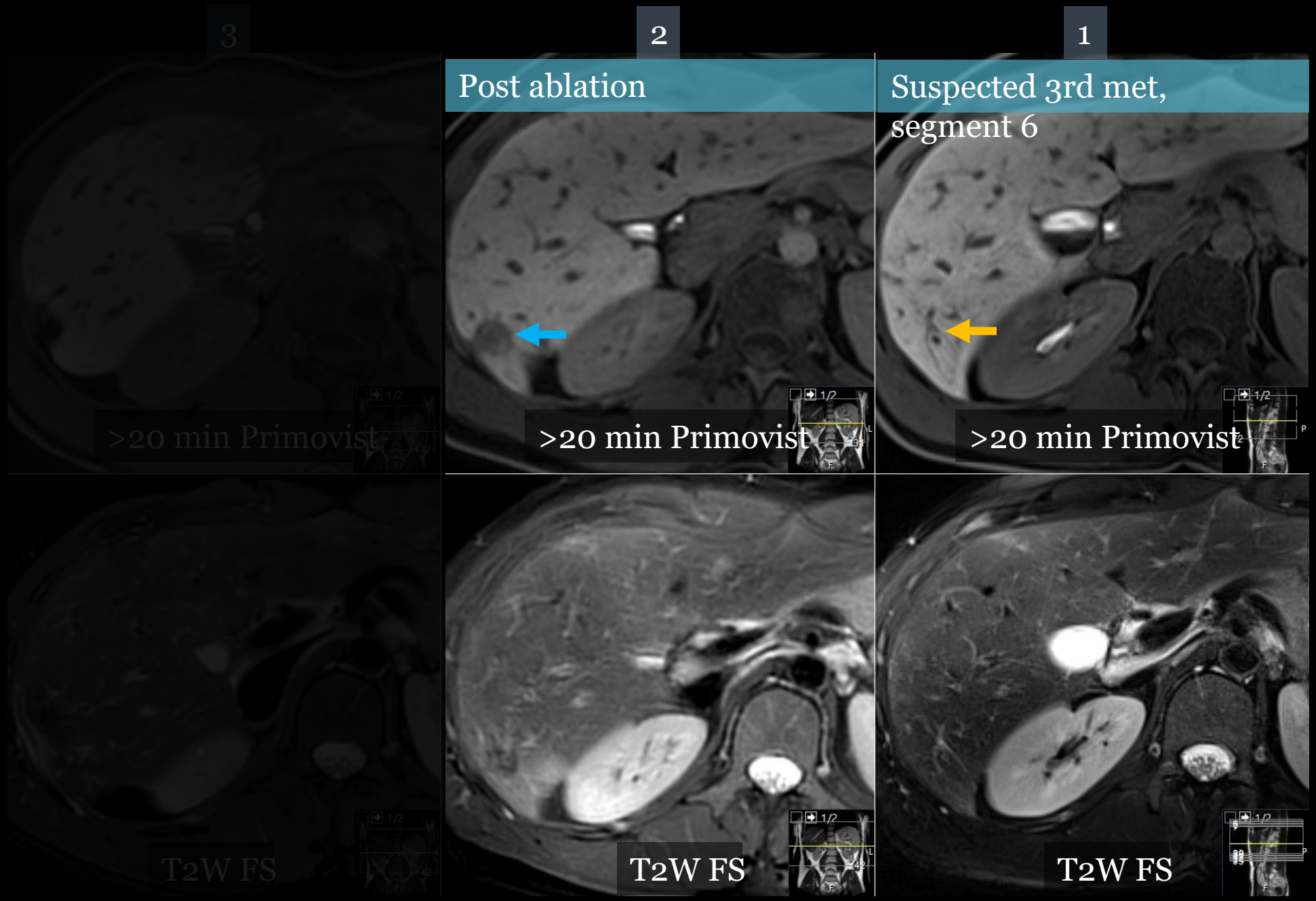


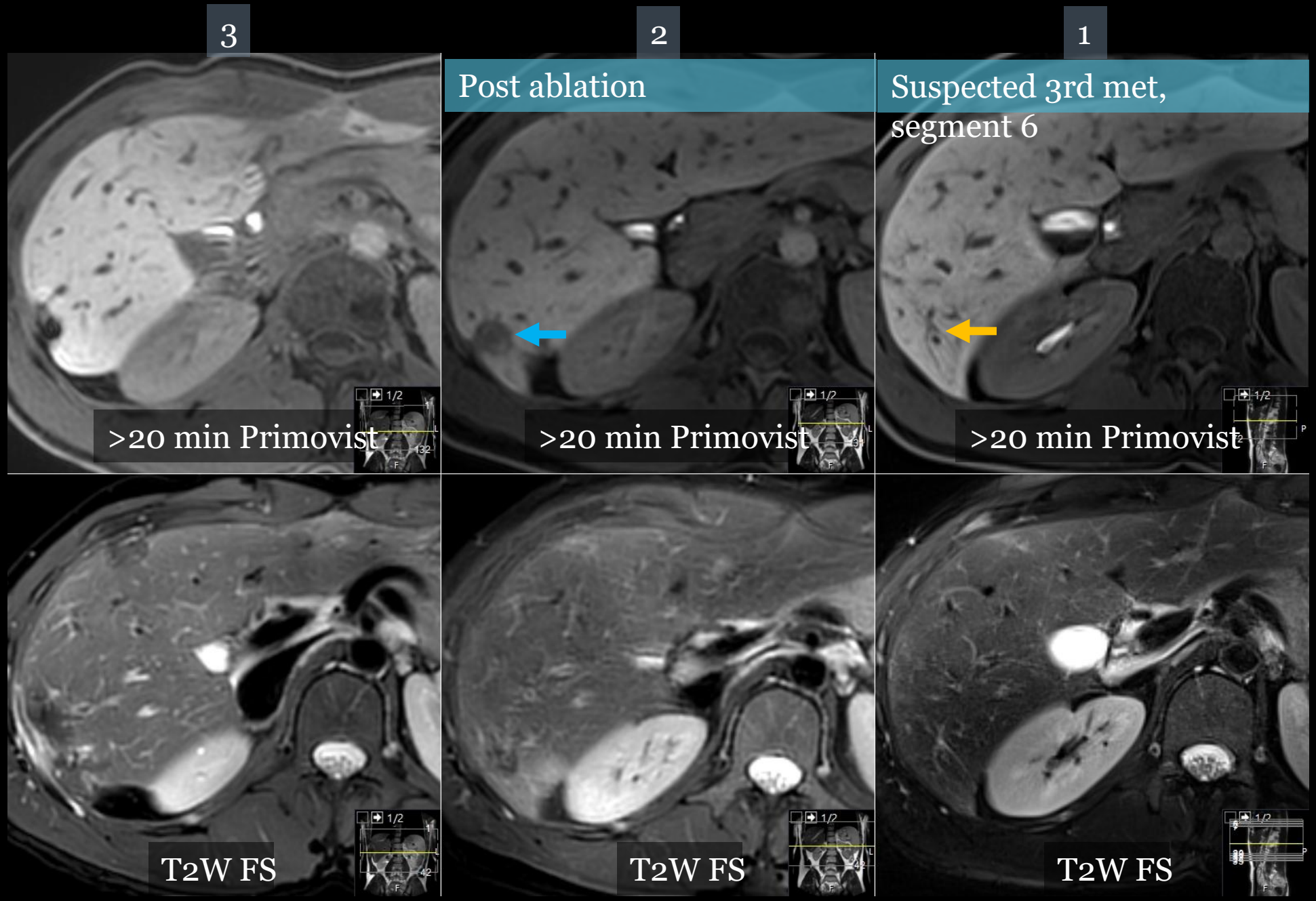
T2W FS

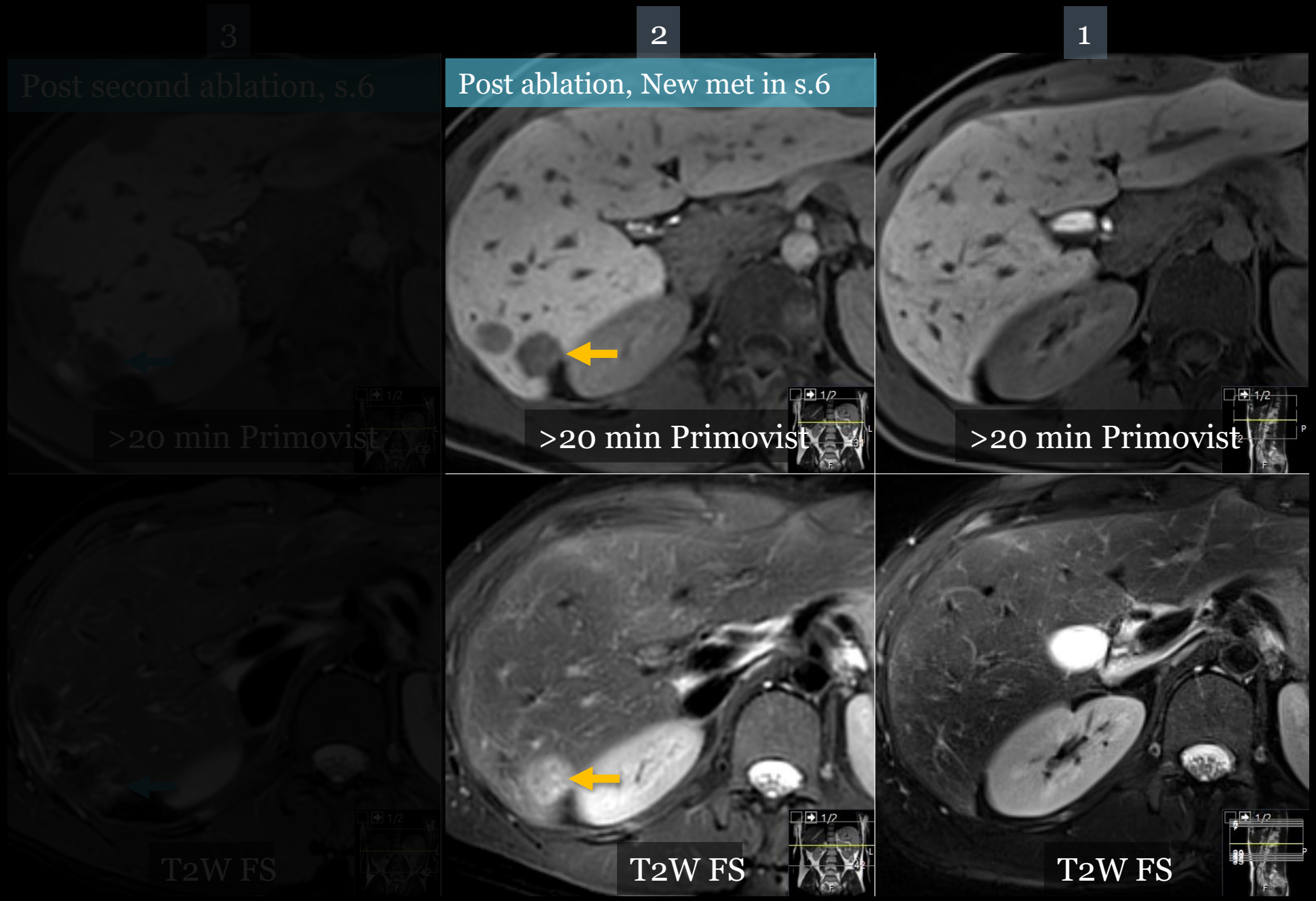


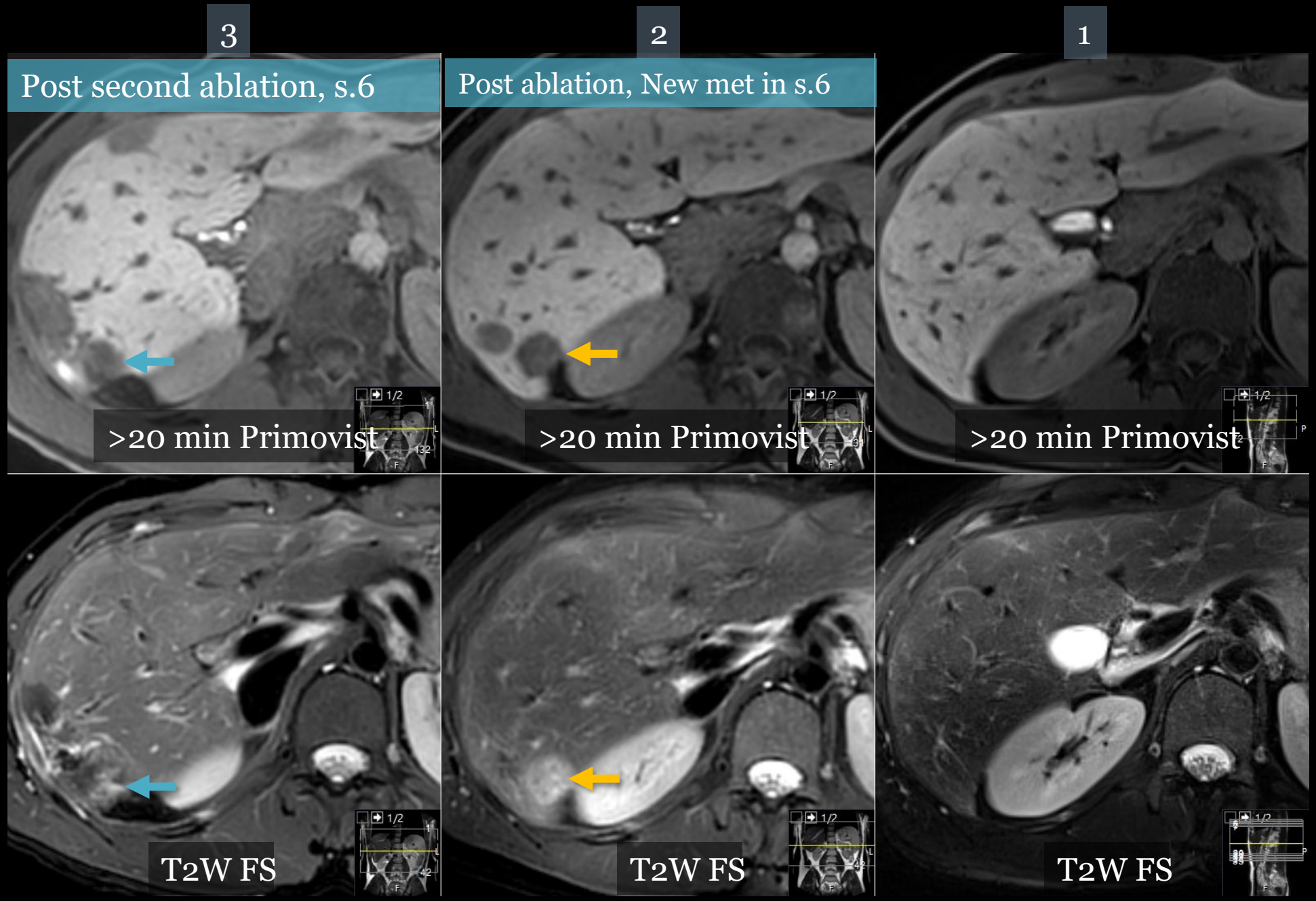
T2W FS

T2W FS


3
2
1
Post ablation
Suspected 3rd met, segment 6
>20 min Primovist
>20 min Primovist
>20 min Primovist
T2W FS
T2W FS
T2W FS


3
2
1
Post ablation
Suspected 3rd met, segment 6
>20 min Primovist
>20 min Primovist
>20 min Primovist
T2W FS
T2W FS
T2W FS


3
Post second ablation, s.6
>20 min Primovist
T2W FS
2
Post ablation, New met in s.6
>20 min Primovist
T2W FS
1
>20 min Primovist
T2W FS


3
Post second ablation, s.6
>20 min Primovist
T2W FS
2
Post ablation, New met in s.6
>20 min Primovist
T2W FS
1
>20 min Primovist
T2W FS

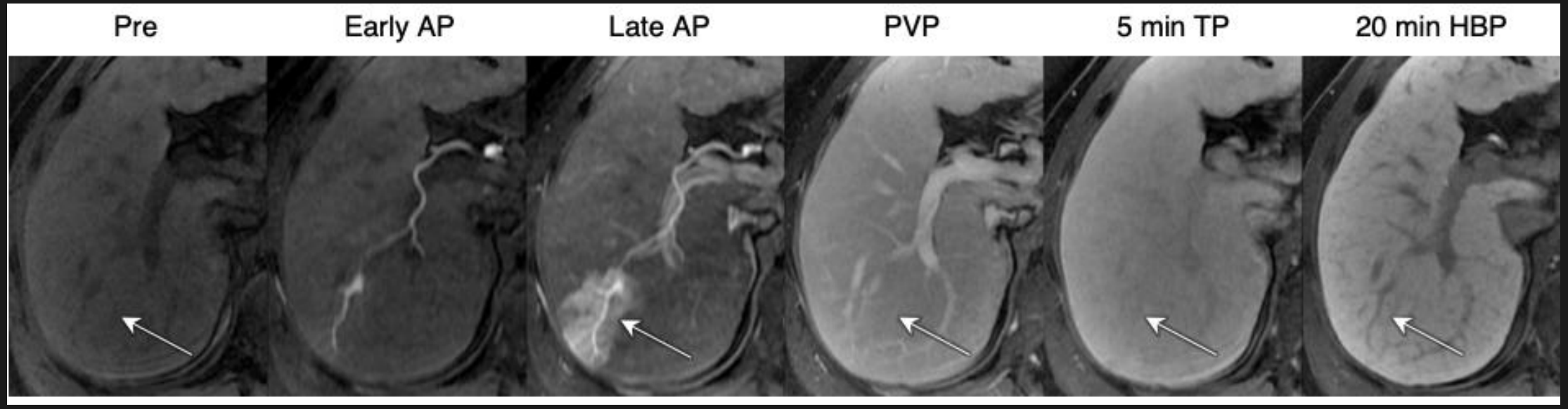
Transient perfusion anomalies

- Portal vein or hepatic vein obstruction
  - Hepatic arterial flow increases
    - Enhancement in the arterial phase is uneven, regional/geographic in pattern
    - But in later phases differences fades – these regions become isosignaling

- A key examination quality is to use a structured protocol in order to recognize perfusion anomalies.
- Focal masses can cause perfusion anomalies, which sometimes unveils a small focal mass that is difficult to detect.

Transient perfusion anomalies

Wedge-shaped



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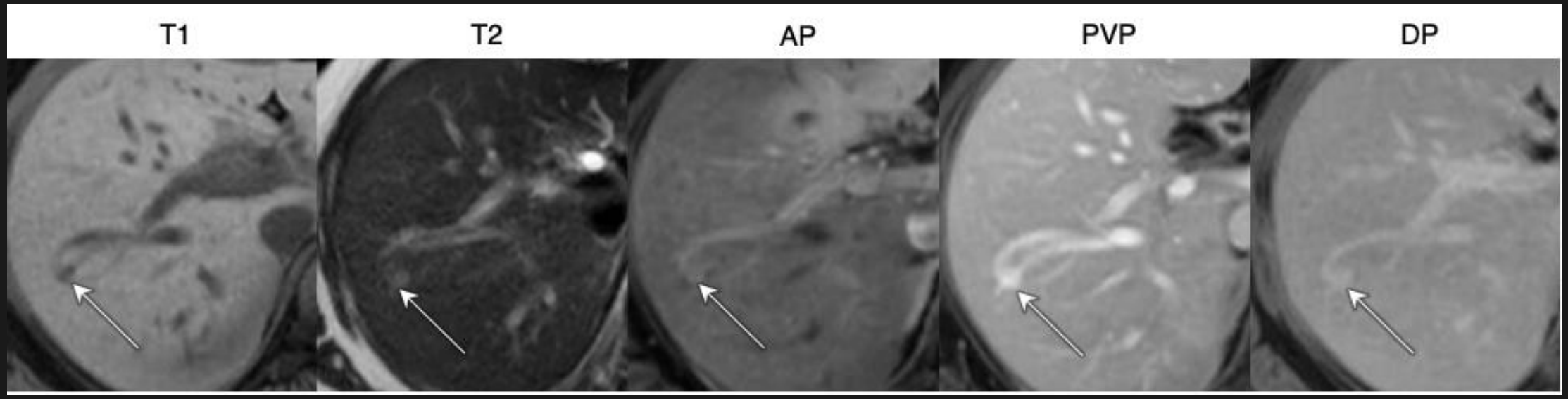
Transient perfusion anomalies

Focal



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Key takeaways

- DCE essential for characterizing both hyper- and hypovascular lesions
- LI-RADS provides standardized framework for HCC in cirrhotic livers but is also applicable in other focal malignancies
- Gd-EOB-DTPA improves detection/characterization but has varying performance in arterial phase
- Hepatobiliary phase is key for detecting hypovascular mets.
- Technique matters!

JSRS Copenhagen June 2-4 2026

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