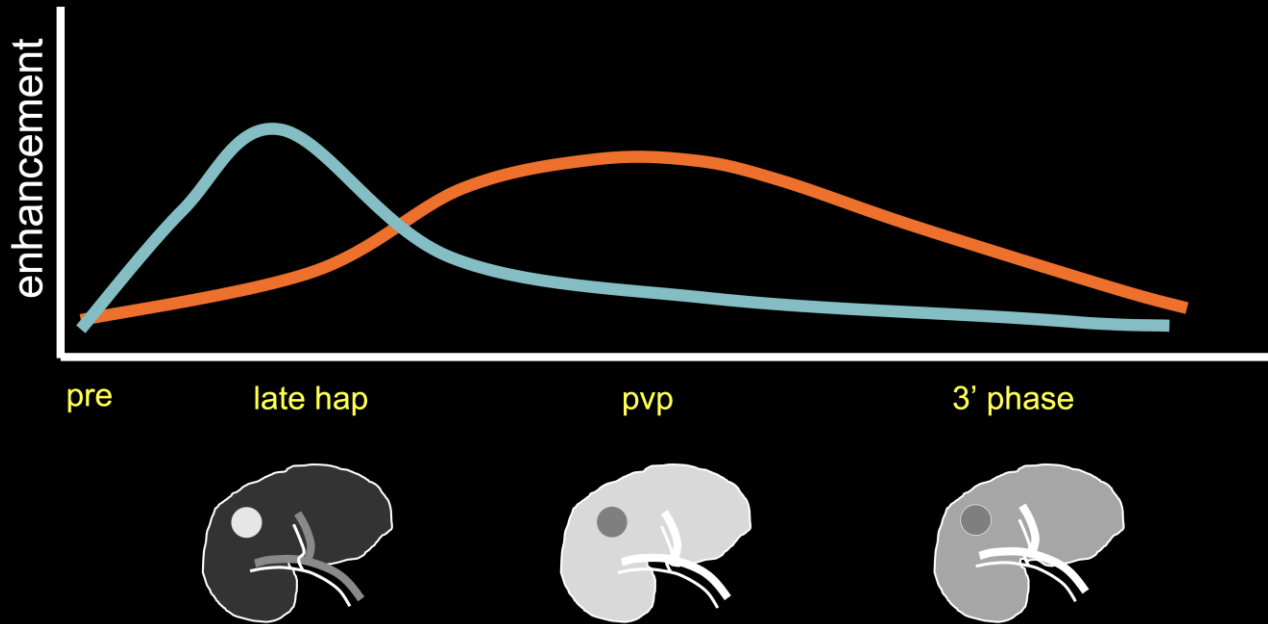


# Lesion characterization using extracellular contrast agents



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gbranca@yahoo.com

# Disclosures

Speaker for Bayer, Bracco, Guerbet, GE Healthcare

# Differential diagnosis of focal liver lesions

- #1. What is the prevalence of different liver lesions?
- #2. What is the cornerstone of any liver imaging protocol?
- #3. How can liver lesions be classified based on their behavior on hepatic arterial phase?
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# Differential diagnosis of focal liver lesions

## MESENCHYMAL CELLS

- Hemangioma

## CHOLANGIOCYTES

- Hepatic cysts
- Cholangiocarcinoma

## HEPATOCTES

- Focal nodular hyperplasia
- Hepatocellular adenoma
- Regenerative nodule
- Dysplastic nodule
- Hepatocellular carcinoma

## OTHER

## METASTASES

# NON-CIRRHOTIC LIVER

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- Hemangioma

## HEPATOCTES

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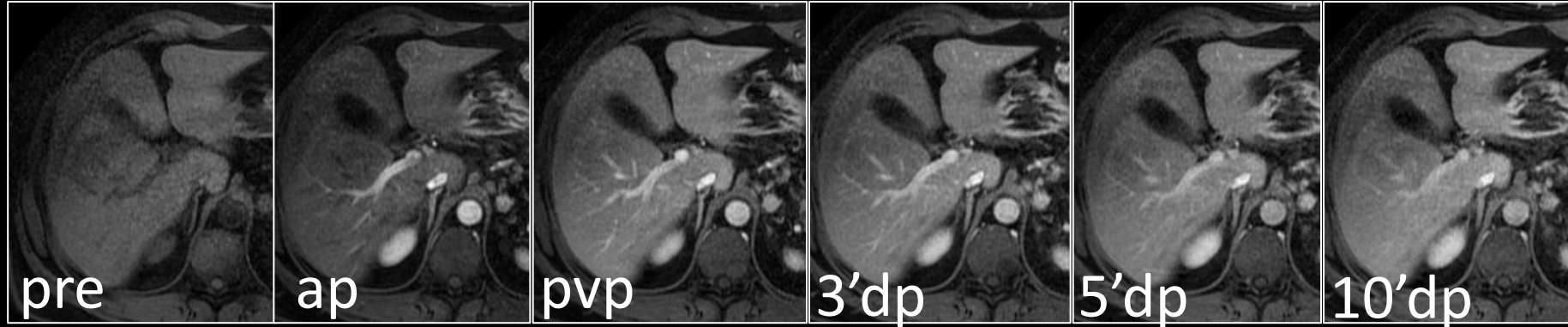
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# Extracellular agents



*Breath hold 3D GRE with fat suppression technique*

Multiphasic approach – information on vascularity

Extracellular agents distribute into intravascular + interstitial space

the multiphasic protocol is the  
cornerstone of liver imaging

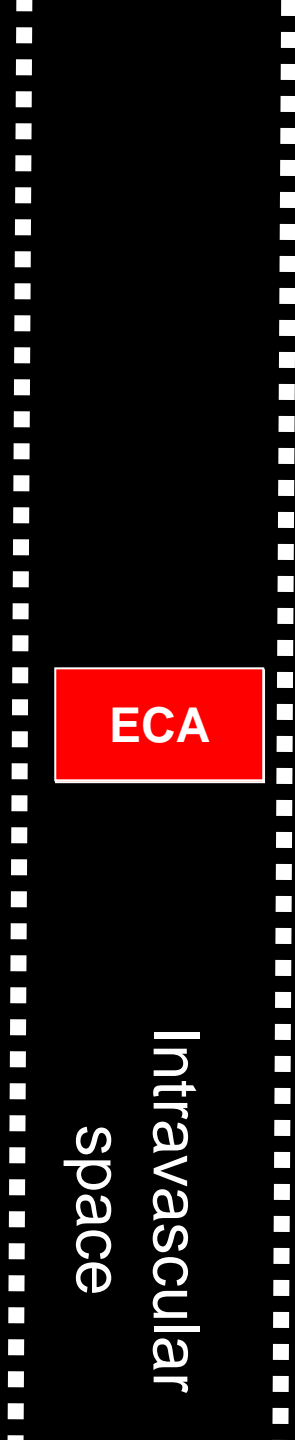
Intravascular  
space

Interstitial  
space



Hepa  
tocyte

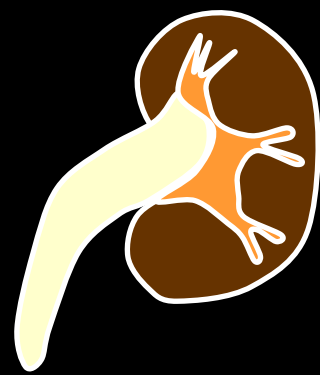
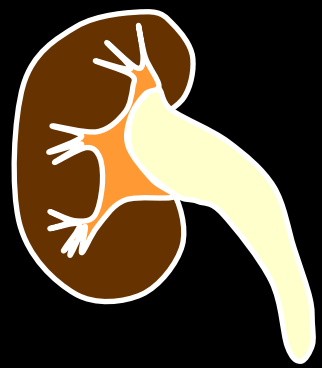
Bile  
duct



**ECA**

Intravascular  
space

Interstitial  
space

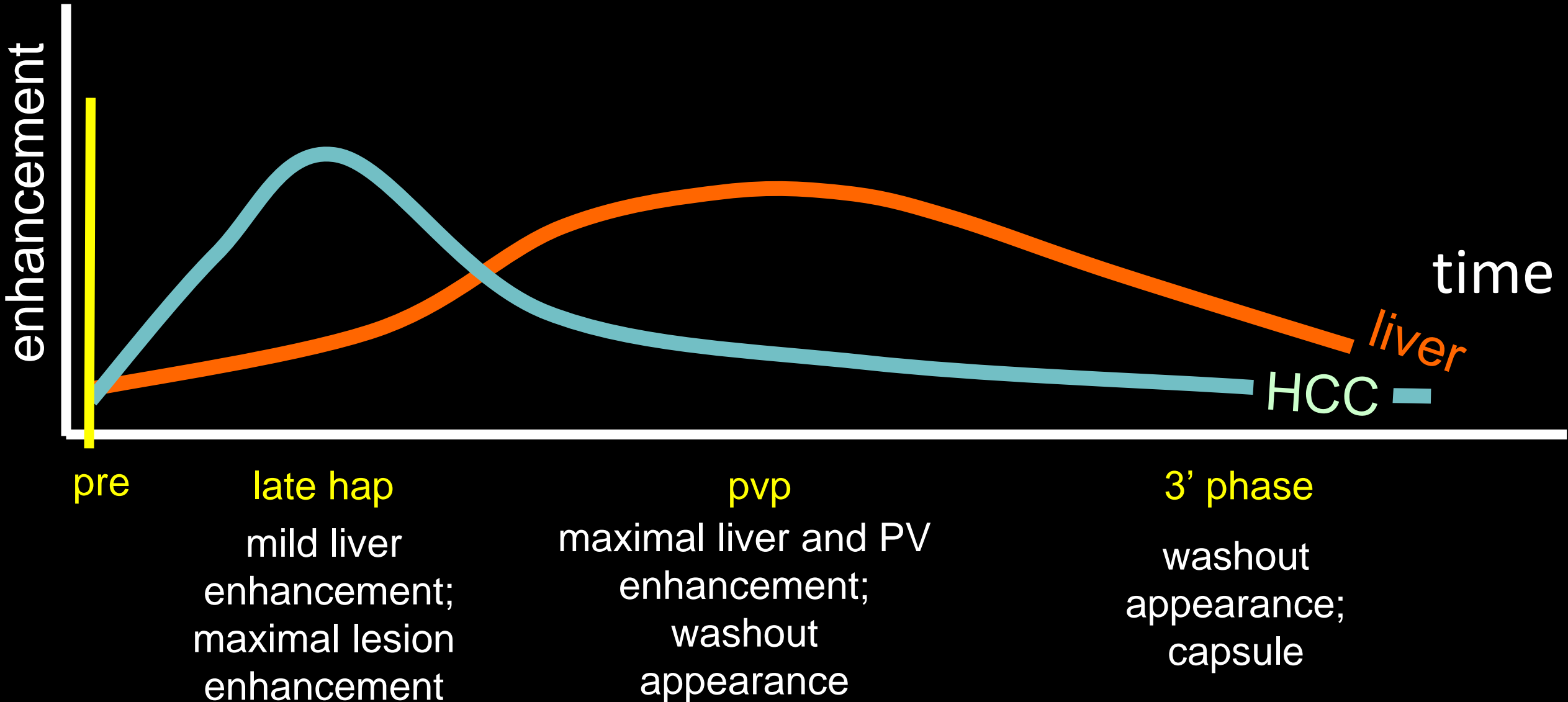


Hepa  
toocyte

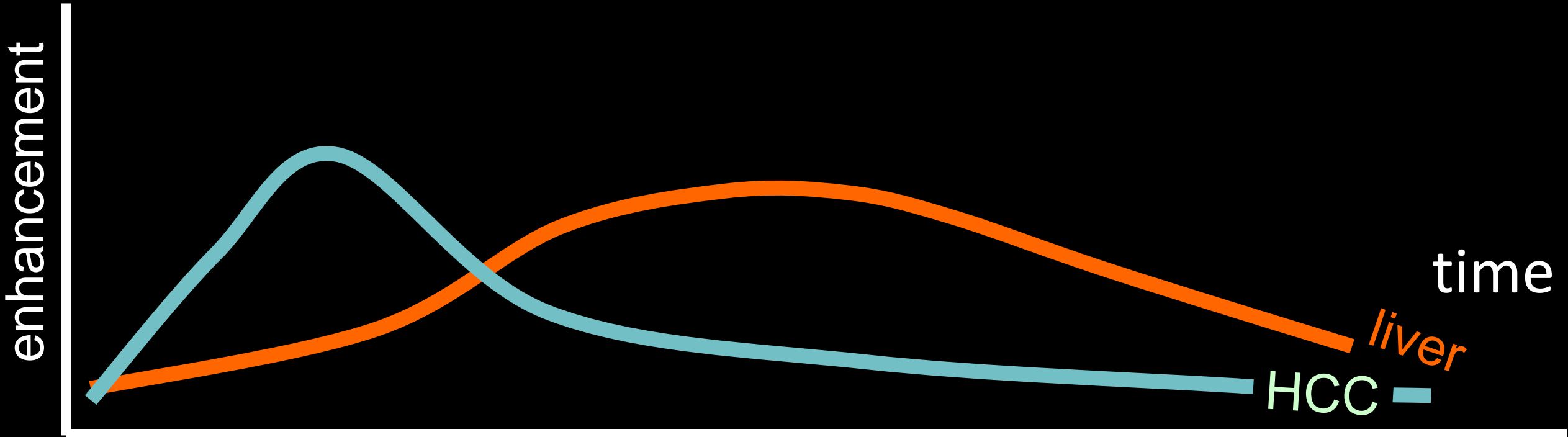


Bile  
duct

# Multiphasic liver imaging



# Multiphasic liver imaging



pre

late hap

pvp

3' phase

mild liver  
enhancement;  
maximal lesion  
enhancement

maximal liver and PV  
enhancement;  
washout  
appearance

washout  
appearance,  
capsule

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# Hypervascular tumor

# Multiphasic liver imaging

enhancement

liver  
lesion

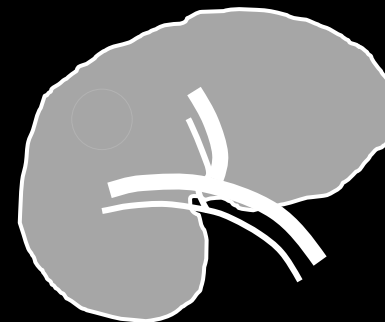
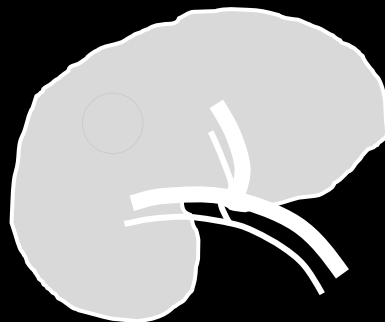
time

pre

late hap

pvp

3' phase





# Hypovascular tumor

# Multiphasic liver imaging

enhancement

liver  
lesion

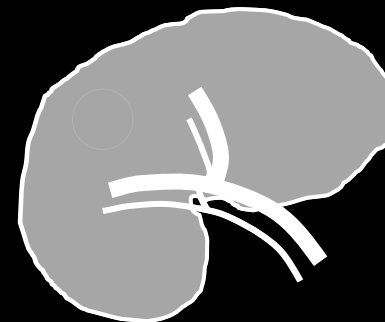
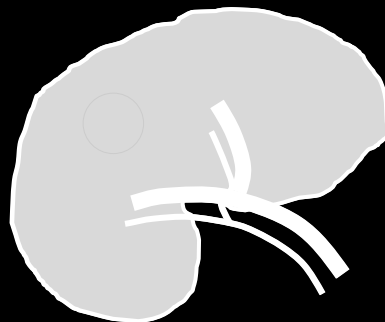
time

pre

late hap

pvp

3' phase



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# Hypervascular tumor

# Multiphasic liver imaging

enhancement

liver  
lesion

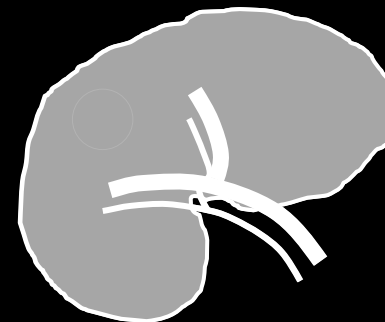
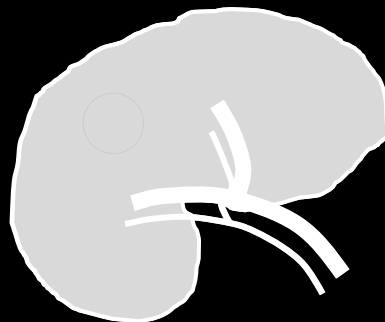
time

pre

late hap

pvp

3' phase



# Hypervascular tumor

# Multiphasic liver imaging

enhancement

liver  
lesion

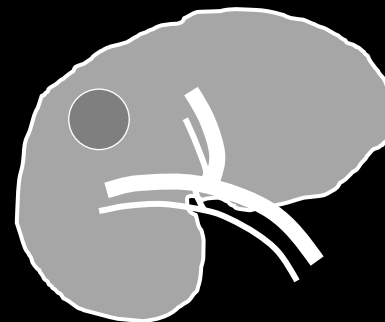
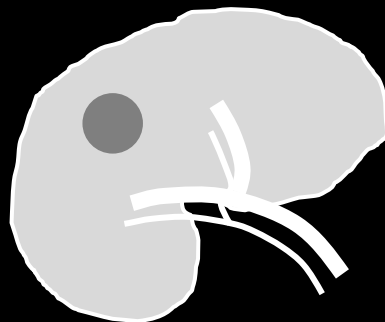
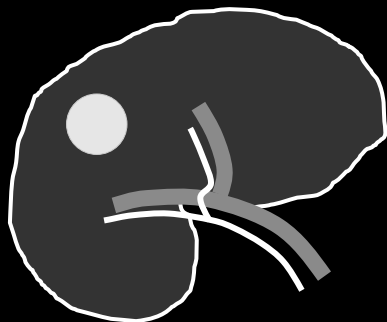
time

pre

late hap

pvp

3' phase



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arterial

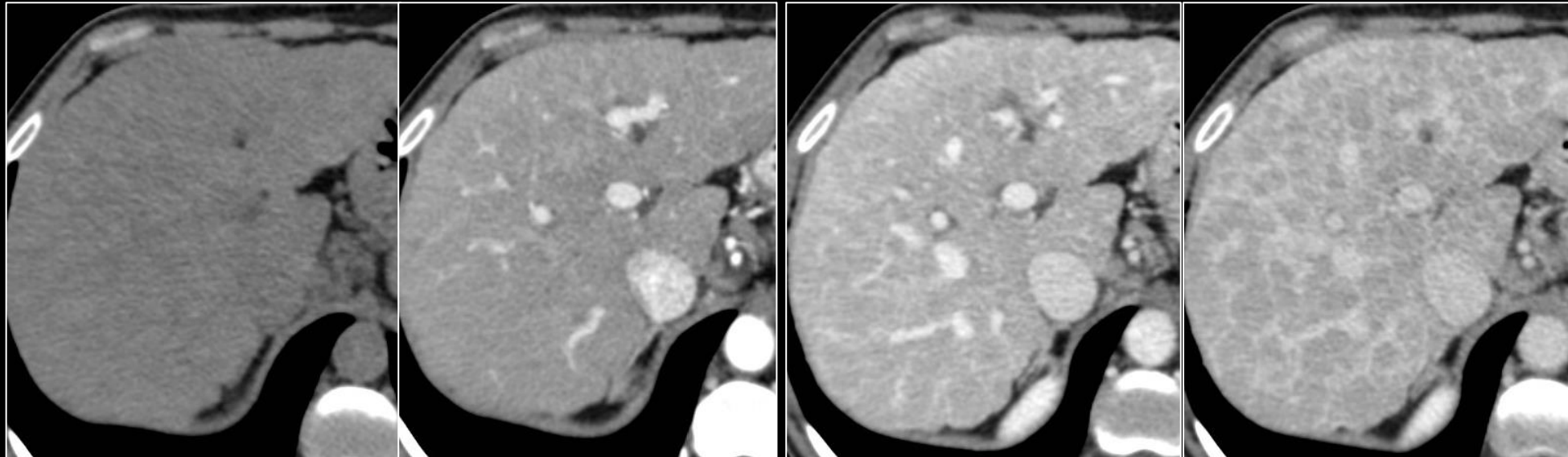
venous





49 year old female, HCV+ cirrhosis

Regenerative or dysplastic nodules

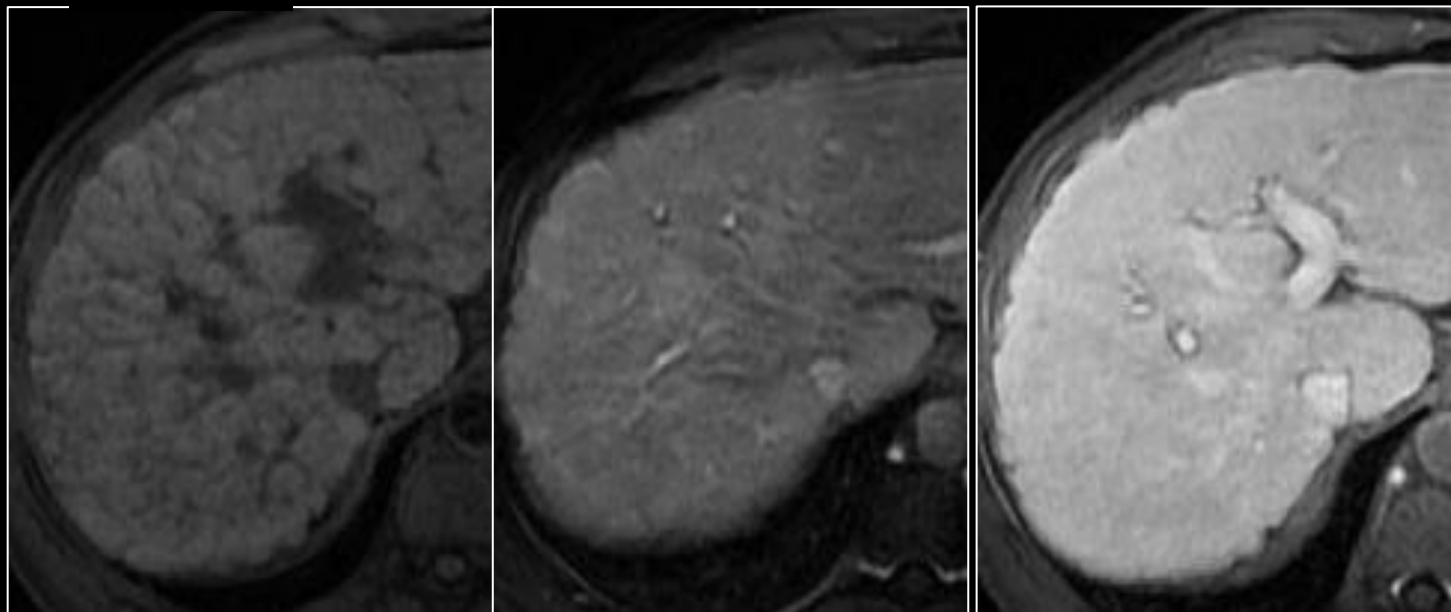




pre



HAP

PVP

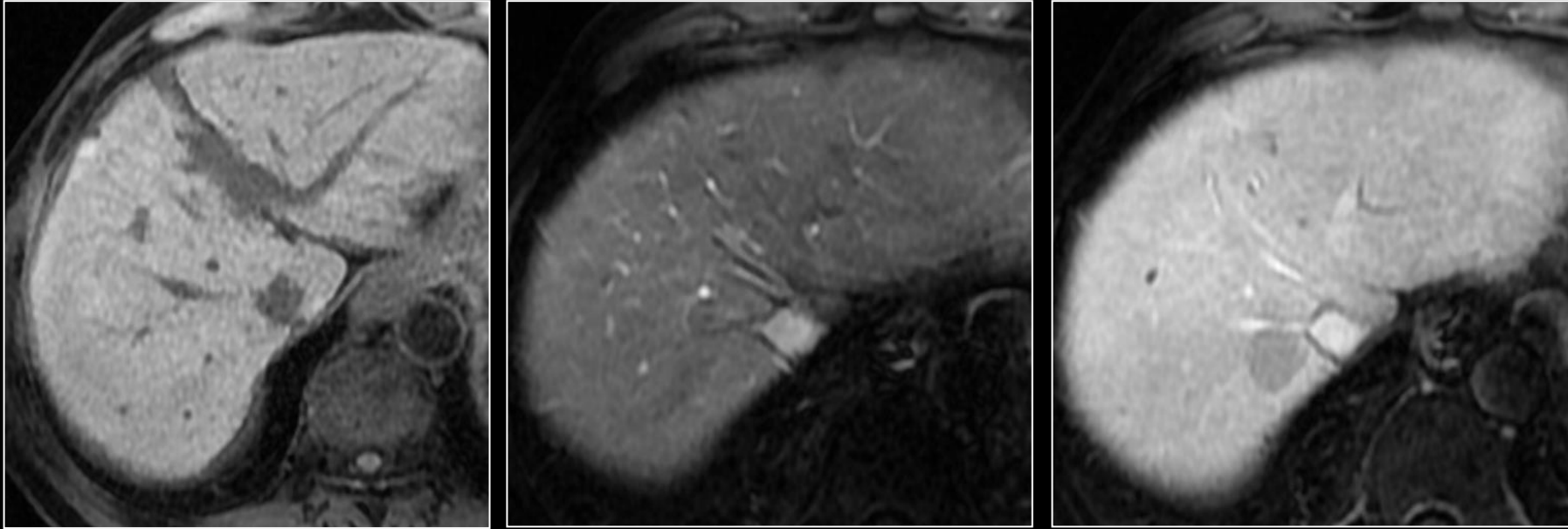
3'



arterial	venous	interpretation
↔	↔	regenerative or dysplastic nodules  

arterial	venous	interpretation
↔	↔	regenerative or dysplastic nodules  
↔	↓	

Man, 53 years-old, HCV+ cirrhosis






Hypovascular HCC




10-15% of HCC are hypovascular

60 year old man, colorectal carcinoma hypovascular metatasis

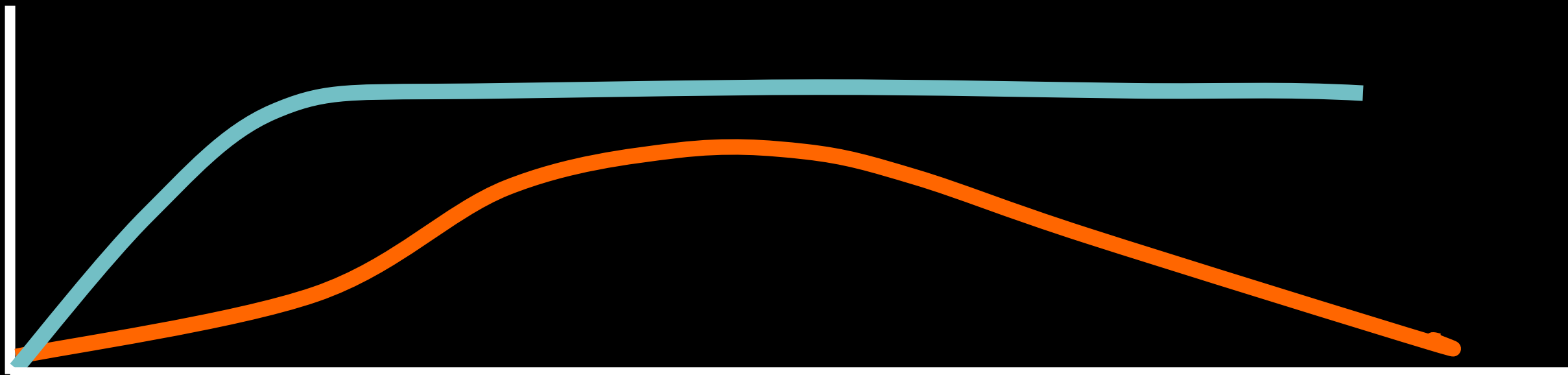
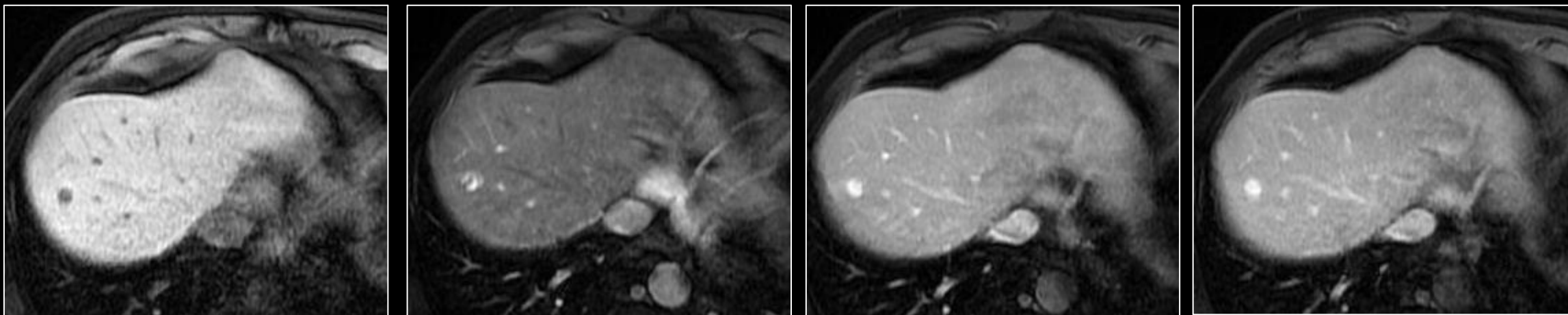


the majority of metastases are hypovascular

arterial	venous	interpretation	
h y	↔	regenerative or dysplastic nodules	 
p o	↓	HCC, mets	

arterial	venous	interpretation	
h y	↔	regenerative or dysplastic nodules	 
p o	↓	HCC, mets	
↑	↑		

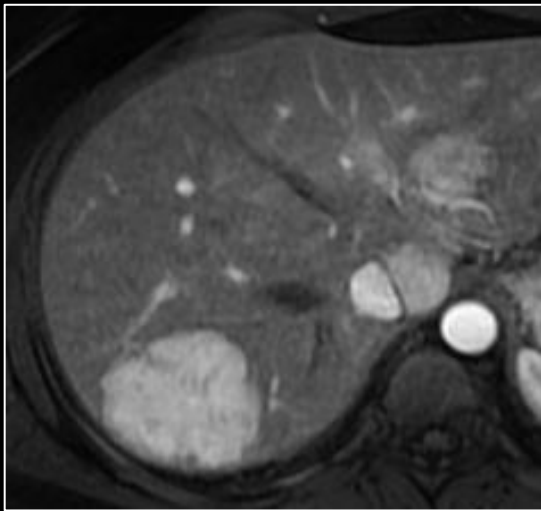
Flash fill hemangioma → Persist pattern  
49 year old man



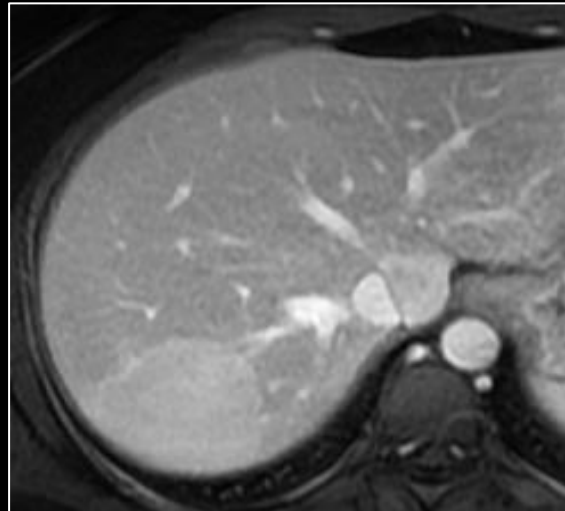


# Inflammatory adenoma → Persist pattern

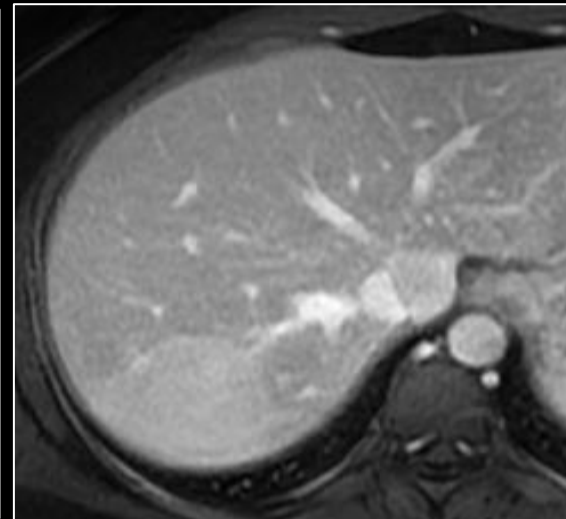
*Cannella et al, EJR 2018*



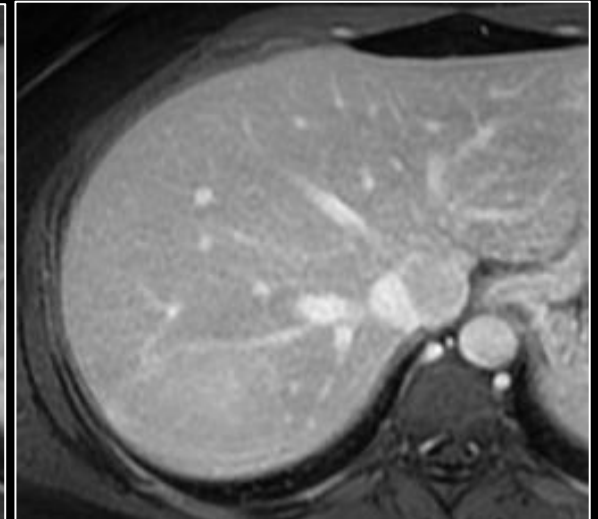
HAP



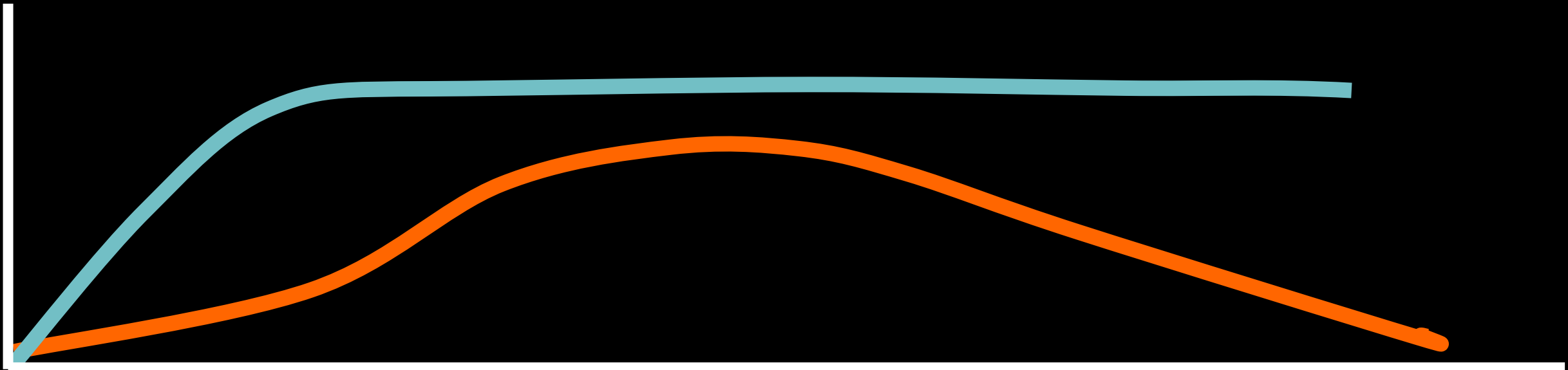
PVP



3'



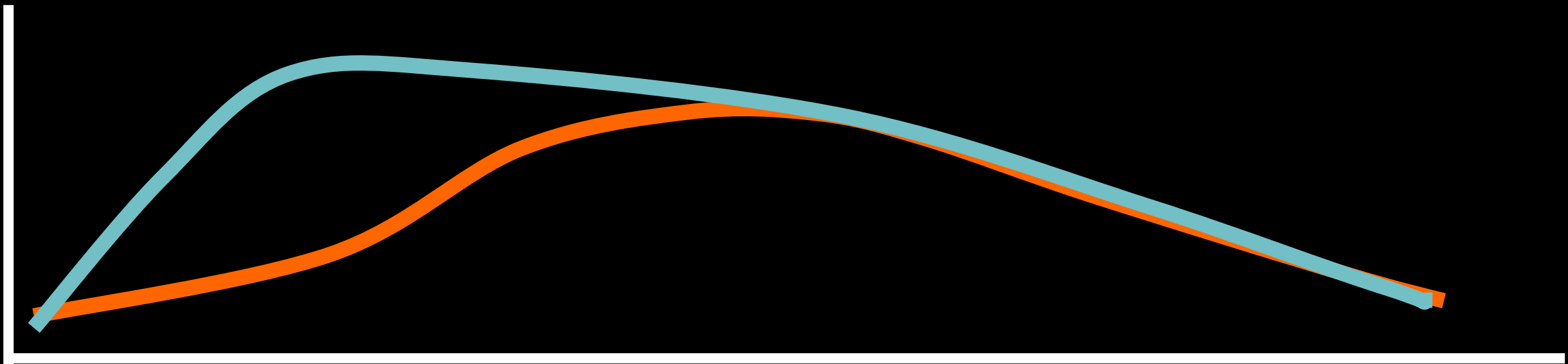
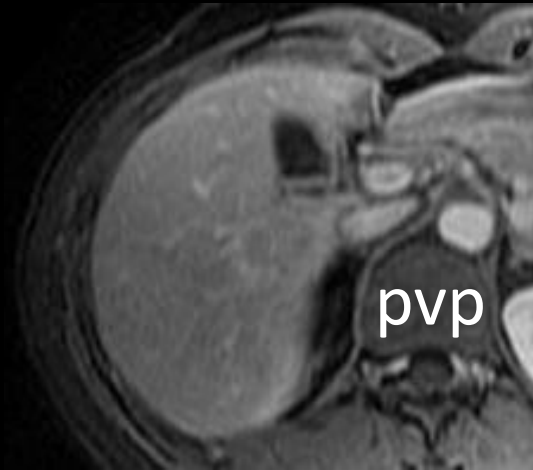
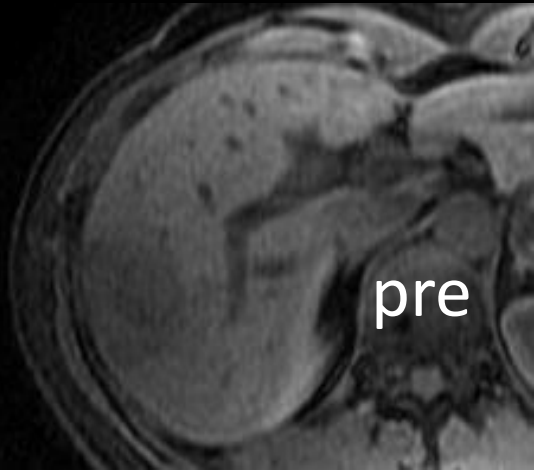
5'



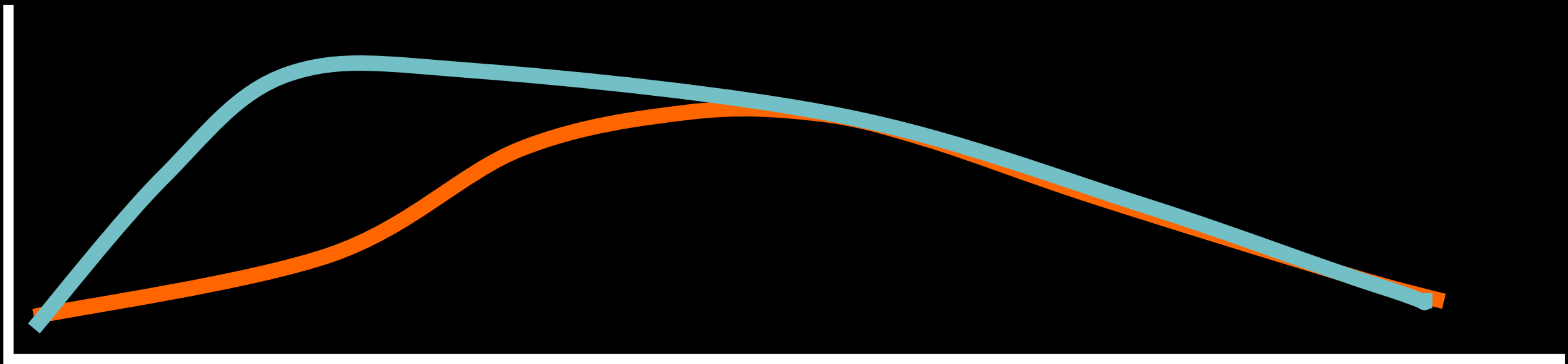
arterial	venous	interpretation	
h y p o	↔	regenerative or dysplastic nodules	😊 😐
↔	↓	HCC, mets	😞
↑	↑ persist	hemangioma, inflammatory adenoma	😊 😐

arterial	venous	interpretation	
h y p o ↔	↔	regenerative or dysplastic nodules	😊 😐
↔	↓	HCC, mets	😞
↑	↑ persist	hemangioma, inflammatory adenoma	😊 😐
↑	↔		

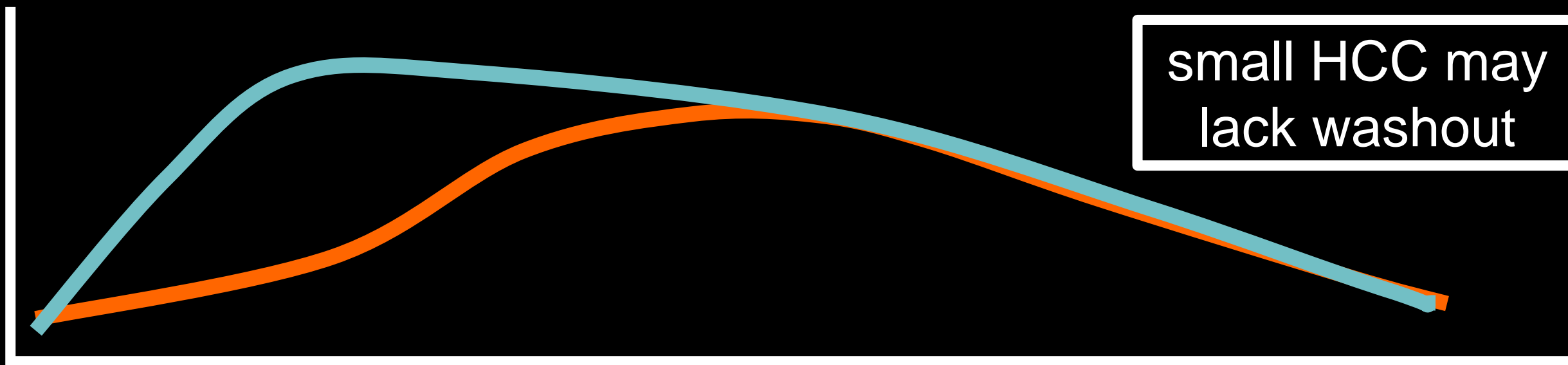
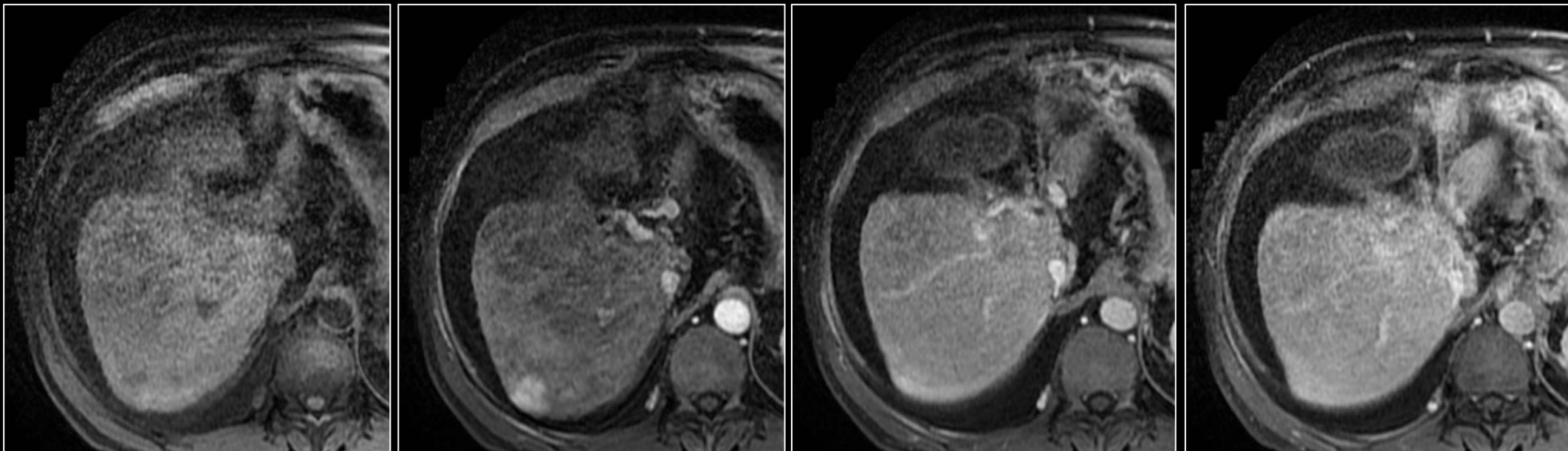
Focal nodular hyperplasia → fade pattern



Perfusion disorder → fade pattern



# Hepatocellular carcinoma → Fade pattern

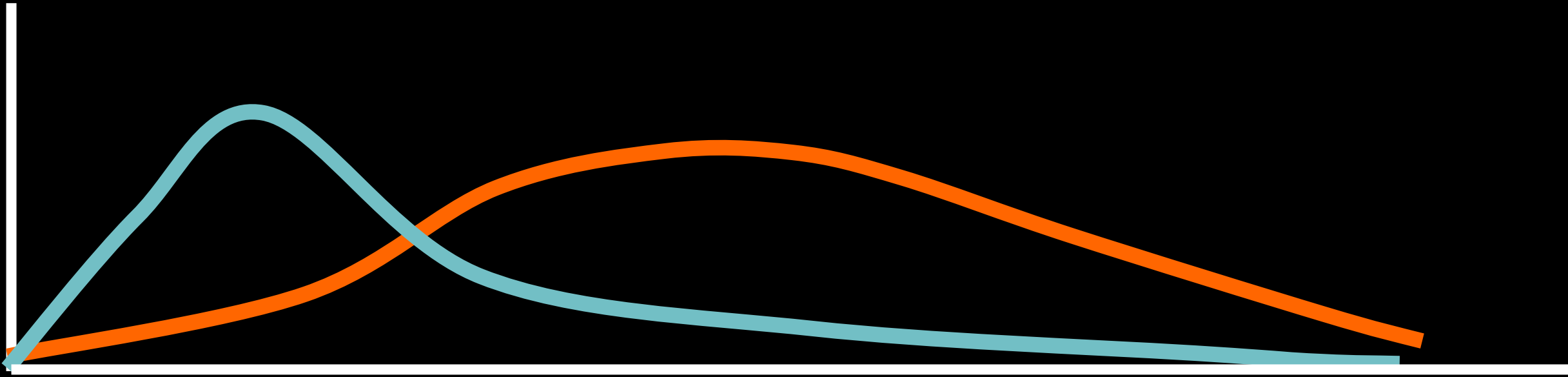
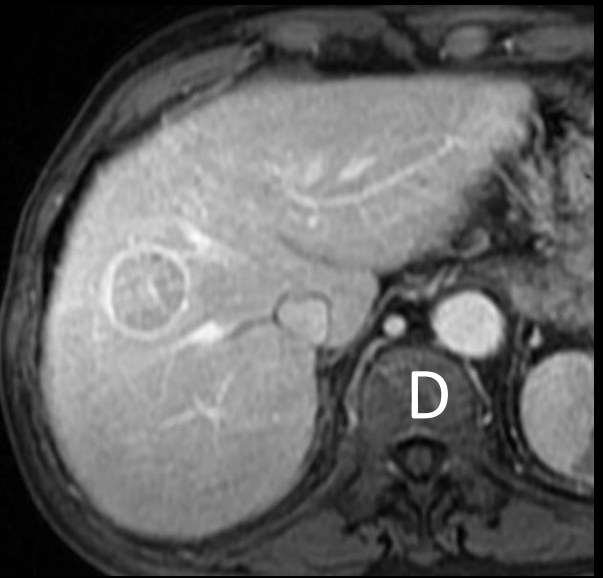
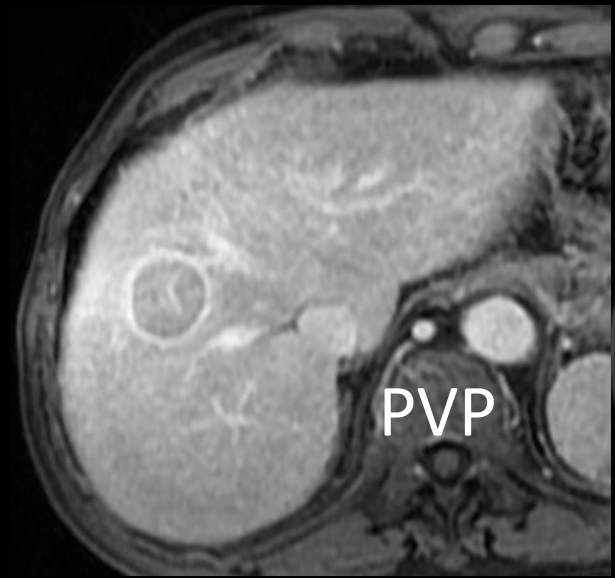
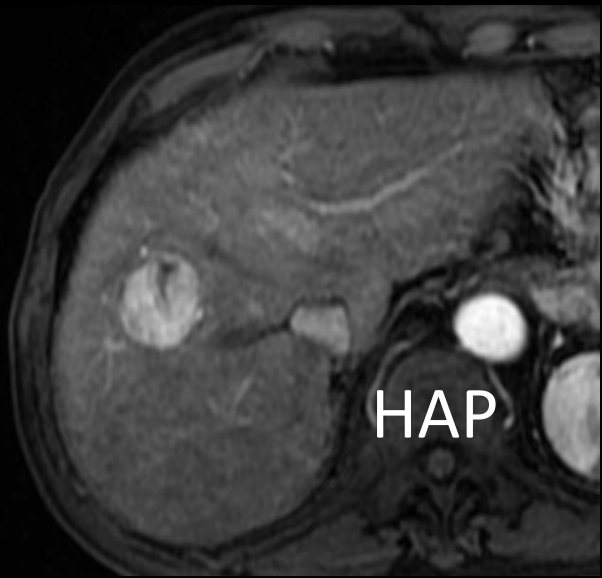
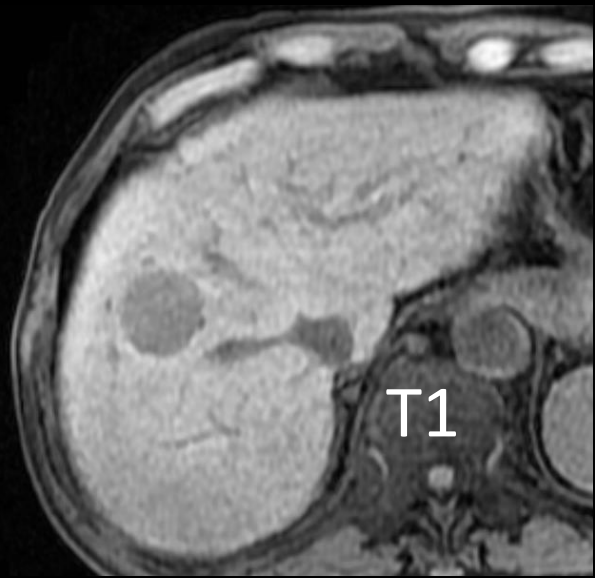










arterial	venous	interpretation	
h y p o	↔	regenerative or dysplastic nodules	😊 😐
↔	↓	HCC, mets	😞
↑	↑ persist	hemangioma, inflammatory adenoma	😊 😐
↑	↔ fade	FNH, perfusion disorder, HCC, mets	😊 😞

arterial	venous	interpretation	
h y p o	↔	regenerative or dysplastic nodules	😊 😐
↔	↓	HCC, mets	😞
↑	↑ persist	hemangioma, inflammatory adenoma	😊 😐
↑	↔ fade	FNH, perfusion disorder, HCC, mets	😊 😞
↑	↓		



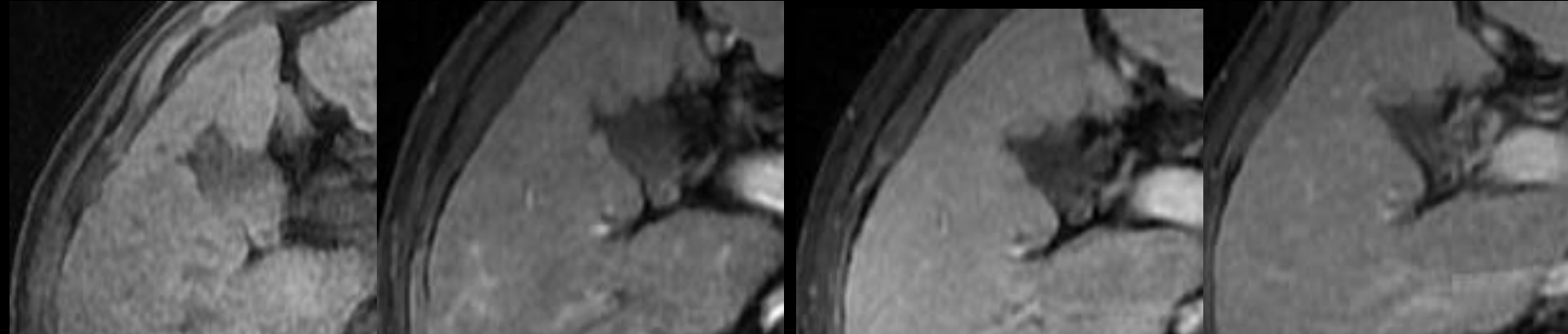
# Hepatocellular carcinoma → Washout pattern



	arterial	venous	interpretation	
hypo	↔	↔	regenerative or dysplastic nodules	 
	↔	↓	HCC, mets	
hyper	↑	↑ persist	hemangioma, inflammatory adenoma	 
	↑	↔ fade	FNH, perfusion disorder, HCC, mets	 
	↑	↓ washout	HCC, mets	

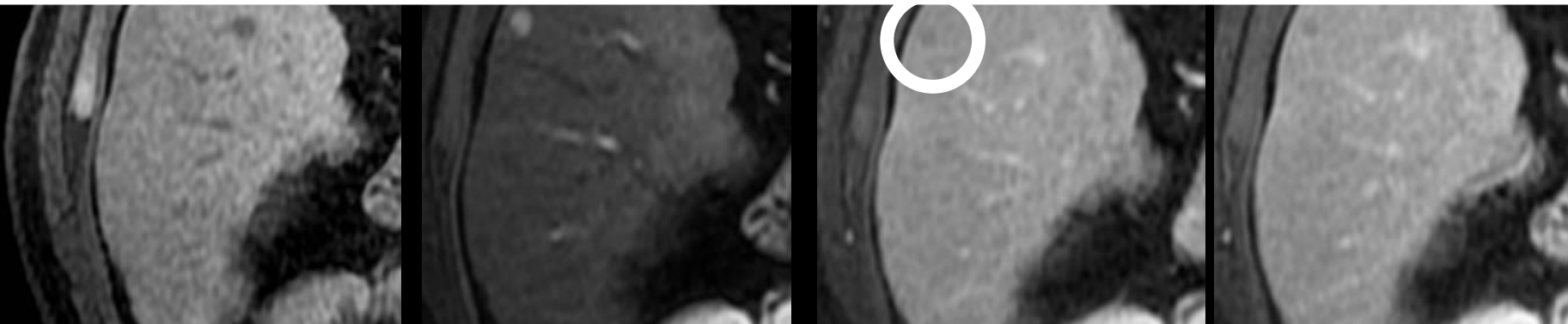
Is the portal venous phase important for characterization?

# Hypervascular tumor in cirrhosis











Persist =  
Hemangioma

Hypervascular liver lesions can have different pattern of enhancement on venous phase: persist; fade; washout.

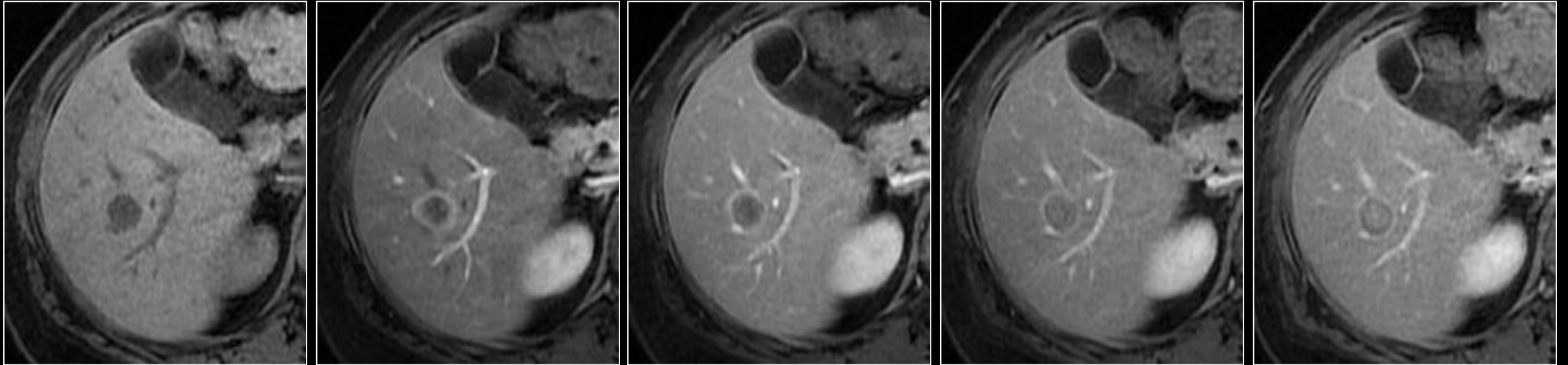


Washout =  
HCC

	arterial	venous	interpretation	
hypo	↔	↔	regenerative or dysplastic nodules	 
	↔	↓	HCC, mets	
hyper	↑	↑ persist	hemangioma, inflammatory adenoma	 
	↑	↔ fade	FNH, perfusion disorder, HCC, mets	 
	↑	↓ washout	HCC, mets	
	↑ rim	↑ rim		

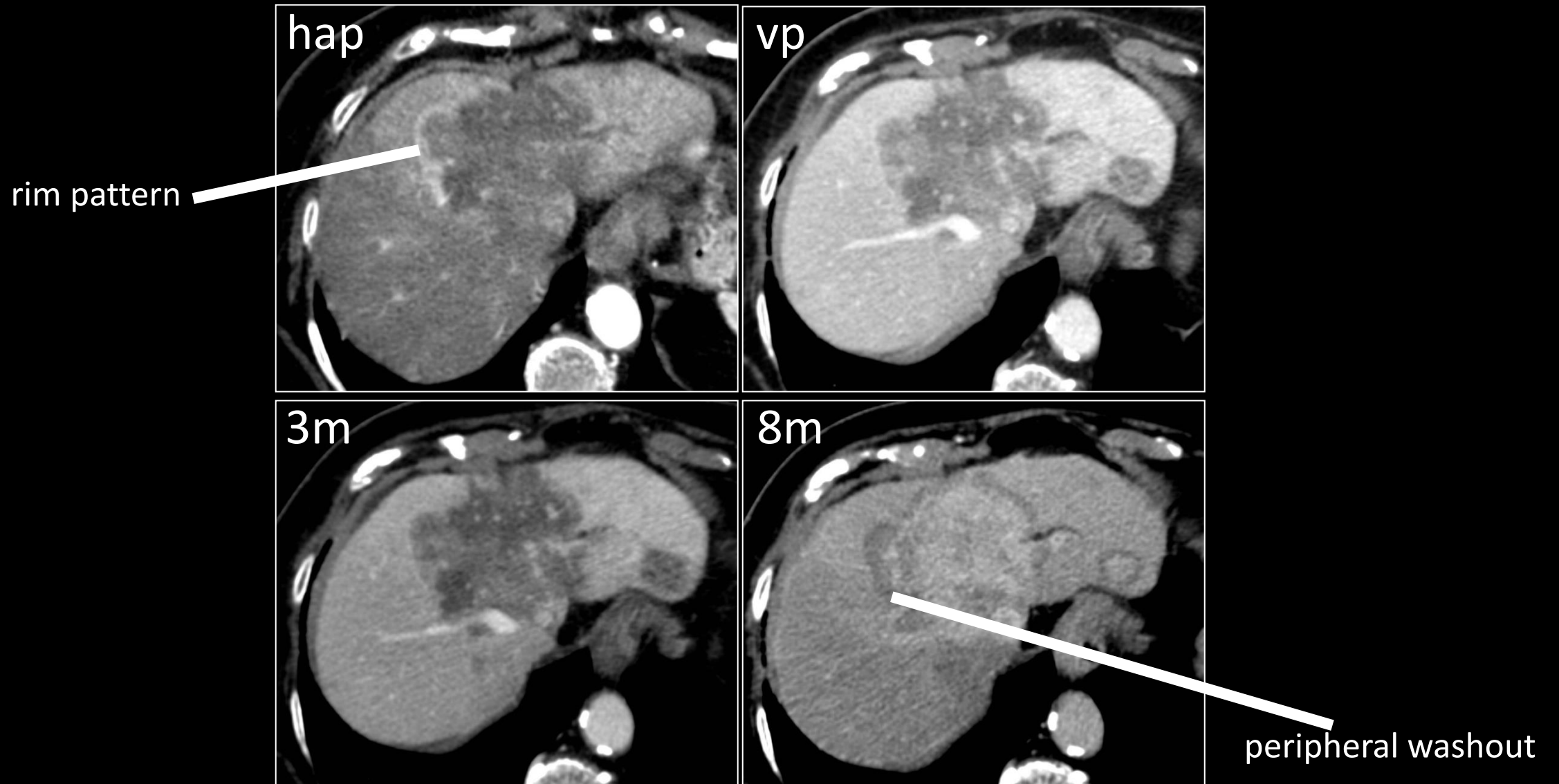
45 year old female

rim pattern + peripheral washout → rectal carcinoma



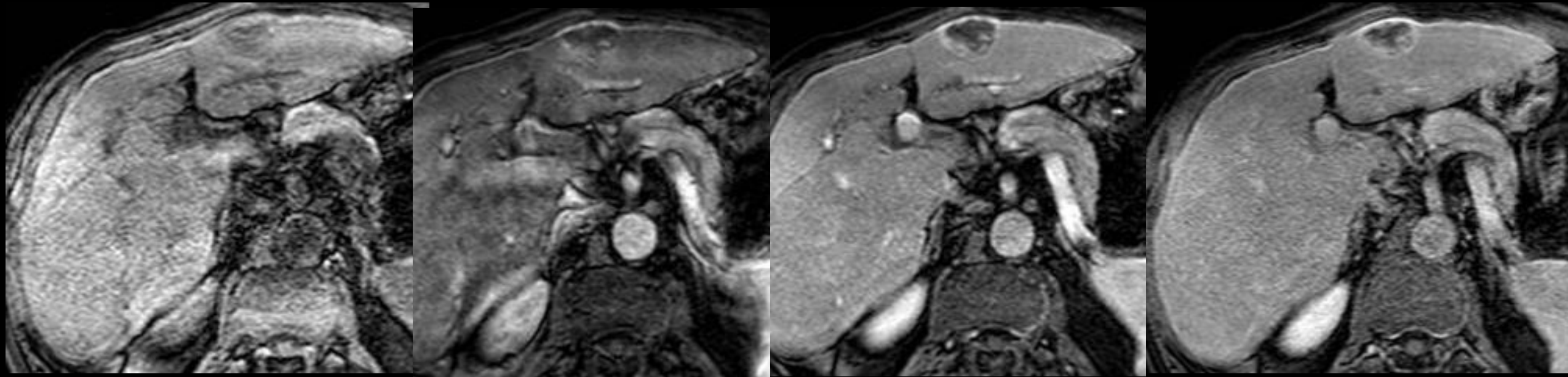
rim pattern & peripheral washout are observed  
in metastases and cholangiocarcinoma

rim pattern + peripheral washout → cholangiocarcinoma



78, man, HCV+ cirrhosis

Rim pattern → hepatocellular carcinoma



In the cirrhotic liver, 37% of lesions with rim enhancement are HCC



	arterial	venous	interpretation	
hypo	↔	↔	regenerative or dysplastic nodules	😊 😐
	↔	↓	HCC, mets	😞
hyper	↑	↑ persist	hemangioma, inflammatory adenoma	😊 😐
	↑	↔ fade	FNH, perfusion disorder, HCC, mets	😊 😞
	↑	↓ washout	HCC, mets	😞
	↑ rim	↑ rim	cholangiocarcinoma, mets, HCC	😞

Lesion characterization: extra-cellular contrast agents

#1. Prevalence differs among different lesions and is influenced by the setting (cirrhosis vs non cirrhotic liver)

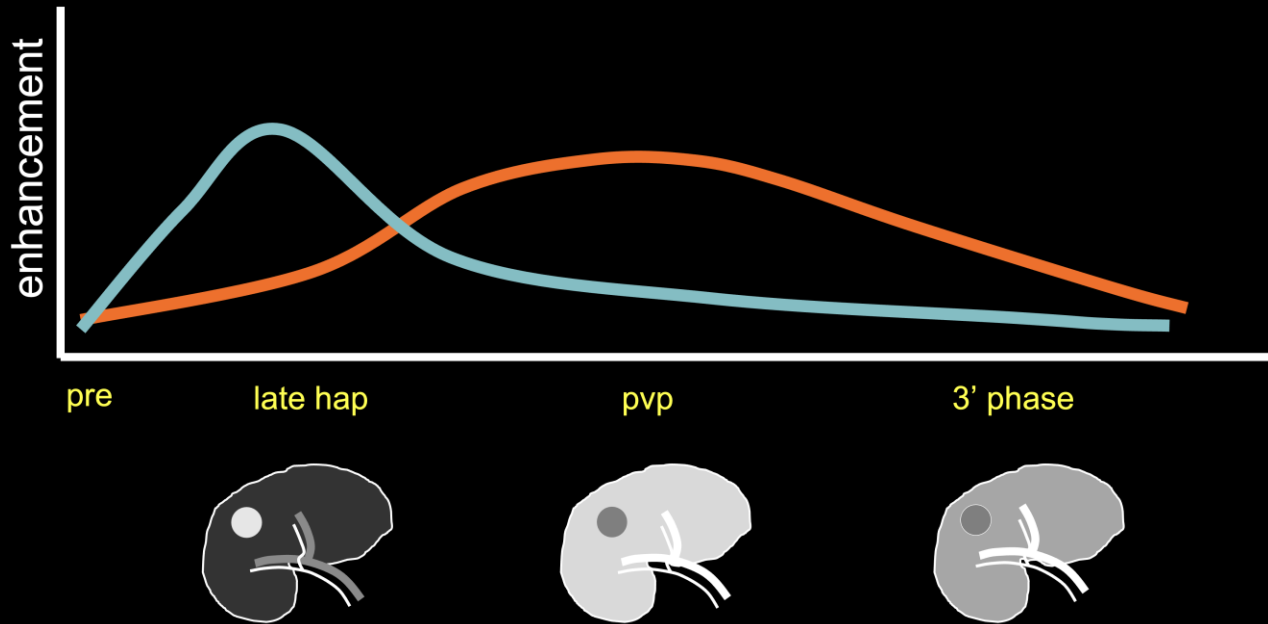
#2. The multiphasic protocol is the cornerstone of liver imaging

#3. Liver lesions can be divided into hypervascular and hypovascular based on their behavior on HAP

#4. Hypervascular liver lesions can have different pattern of enhancement on venous phase: persist; fade; washout.

#5. Lesion classification based on enhancement pattern

# Lesion characterization using extracellular contrast agents



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