



Radiologie bij leverziekten

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(Erasmus MC)



No disclosers

Content, leerdoelen

- LIRADS (Liver Reporting and Data System (LI-RADS))
- HCA, FNH (Liver-specific contrast agents)

LI-RADS® International Consortium

The LI-RADS international consortium currently includes > 250 members from > 100 institutions from > 30 countries



Updated November 2018



LI-RADS may be used for :

- Clinical care
- Education
- Research

- *Supported and endorsed by the American College of Radiology (ACR)*
- *AASLD clinical practice guidance*

CT/MRI LI-RADS® v2018

Technical Recommendations

CT

Recommended equipment	<ul style="list-style-type: none"> Multidetector CT with ≥ 8 detector rows
Required images	<ul style="list-style-type: none"> Arterial phase (late arterial phase strongly preferred) Portal venous phase Delayed phase
Suggested images	<ul style="list-style-type: none"> Precontrast, if patient has had locoregional treatment Multiplanar reformations

CT: multiphase

- *Arterial ,*
- *portal venous,*
- *delayed (3 min)*

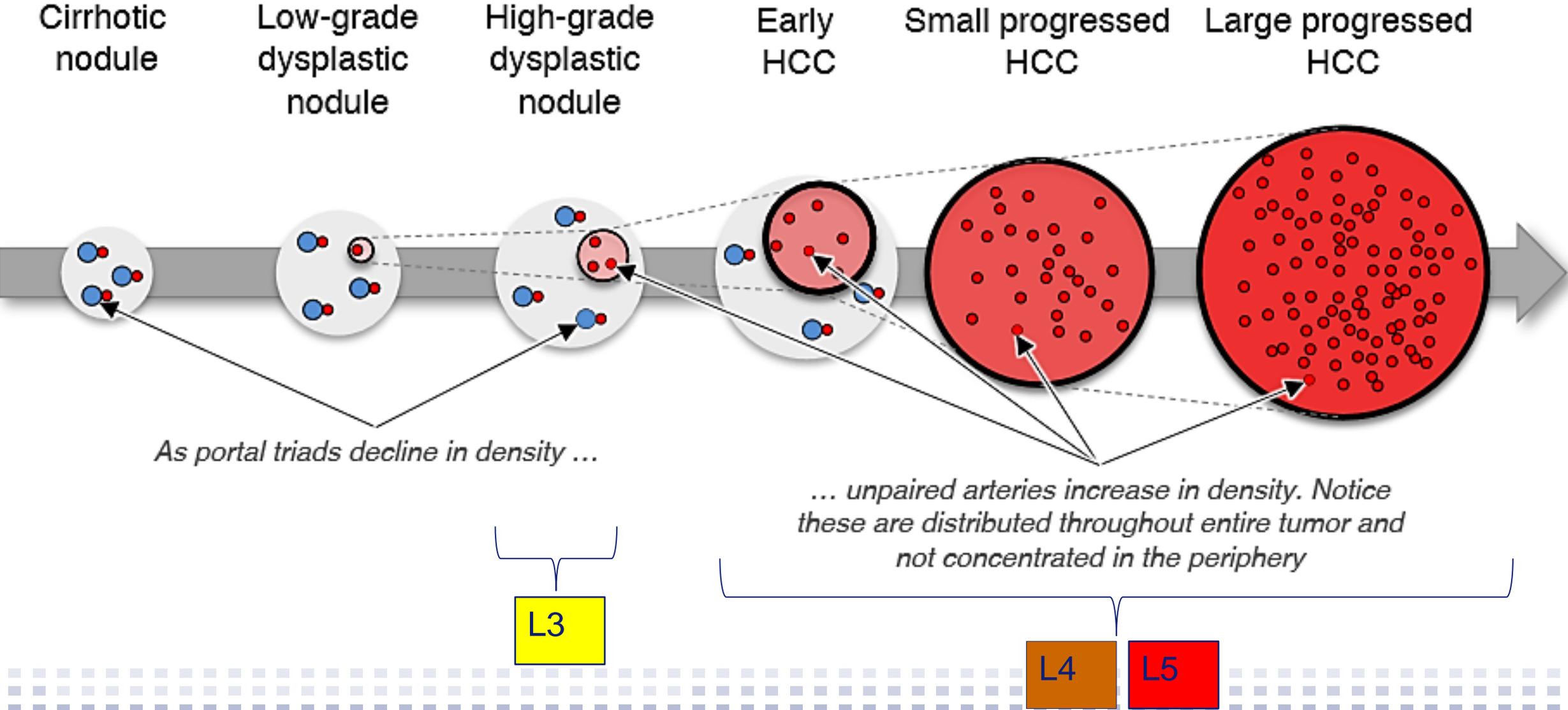
MRI with extracellular contrast agents or gadobenate dimeglumine

Recommended equipment	<ul style="list-style-type: none"> 1.5T or 3T Torso phased-array coil
Required images	<ul style="list-style-type: none"> Unenhanced T1-weighted OP and IP imaging T2-weighted imaging (fat suppression per institutional preference) Multiphase T1-weighted imaging <ul style="list-style-type: none"> Precontrast imaging Arterial phase (late arterial phase strongly preferred) Portal venous phase Delayed phase
Suggested or optional images	<ul style="list-style-type: none"> Diffusion-weighted imaging Subtraction imaging Multiplanar acquisition 1- to 3-hr hepatobiliary phase with gadobenate dimeglumine (same sequence type as for multiphase, may use higher flip angle to increase T1 contrast)

MRI

- *Multiphase*
- *T2W*
- *DWI*

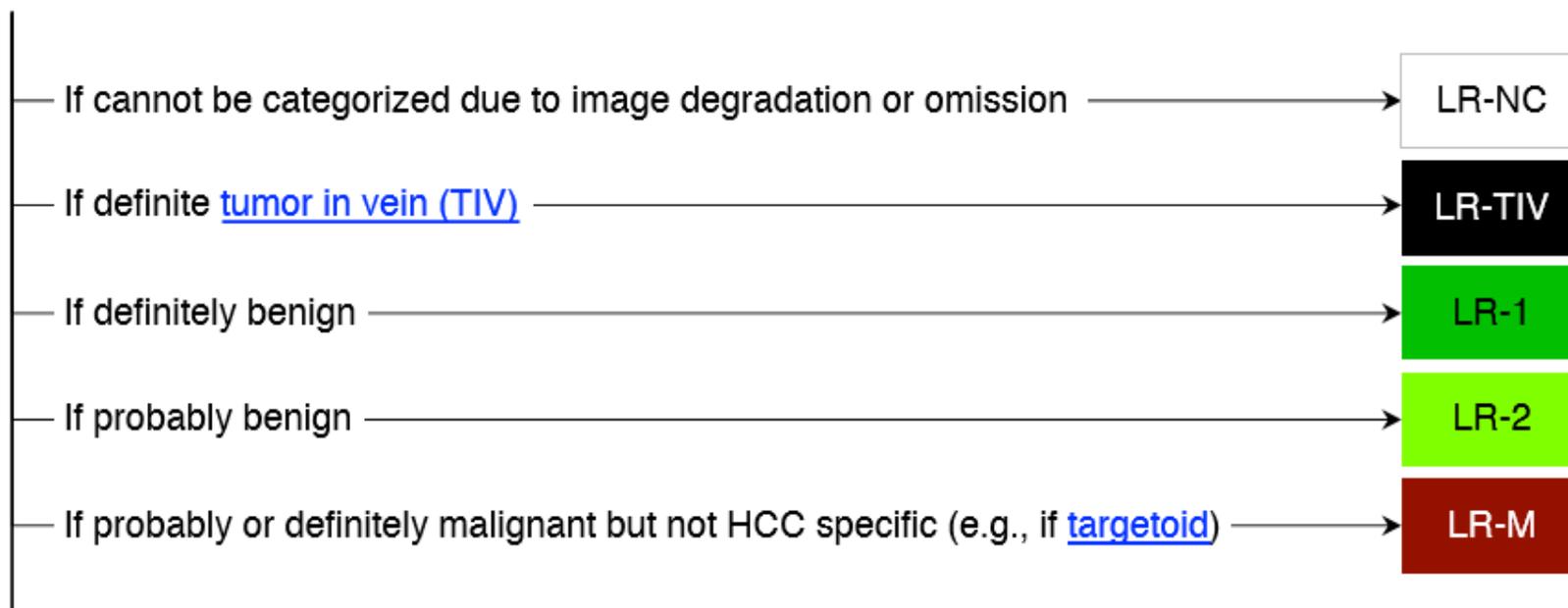
The unpaired arteries that form during hepatocarcinogenesis are distributed throughout and supply the whole tumor.



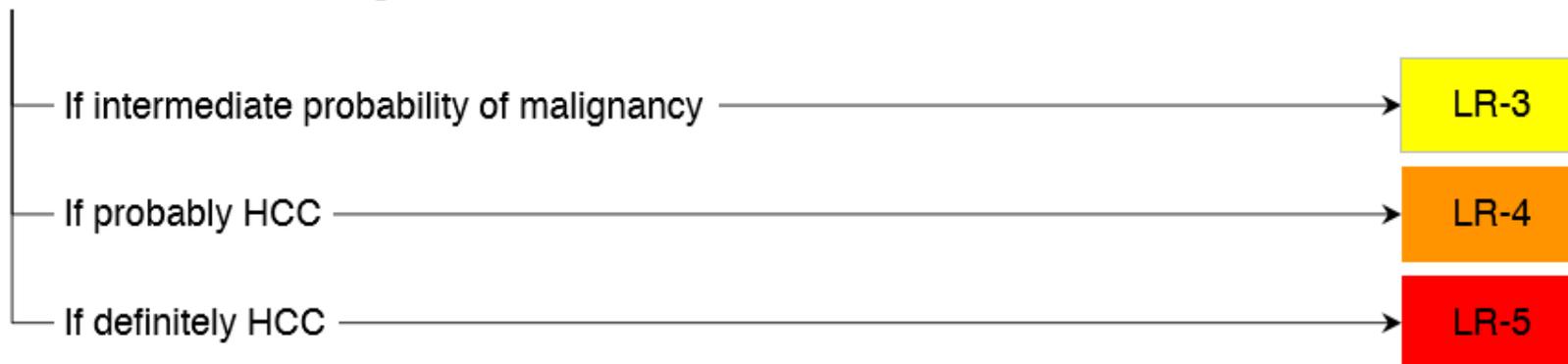


CT/MRI LI-RADS[®] v2018 CORE

Untreated observation without pathologic proof in [patient at high risk for HCC](#)



Otherwise, use CT/MRI diagnostic table below





CT/MRI LI-RADS® v2018

Apply in patients at high risk for HCC, namely those with:



- Cirrhosis **OR**
- Chronic hepatitis B viral infection **OR**
- Current or prior HCC

Including adult liver transplant candidates and recipients posttransplant

Do not apply in patients:



- Without the above risk factors
- < 18 years old
- With cirrhosis due to congenital hepatic fibrosis
- With cirrhosis due to a vascular disorder such as hereditary hemorrhagic telangiectasia, Budd-Chiari syndrome, chronic portal vein occlusion, cardiac congestion, or diffuse nodular regenerative hyperplasia



CT/MRI LI-RADS[®] v2018 CORE

Major criteria:

- (Non rim) Arterial phase hyperenhancement (APHE)



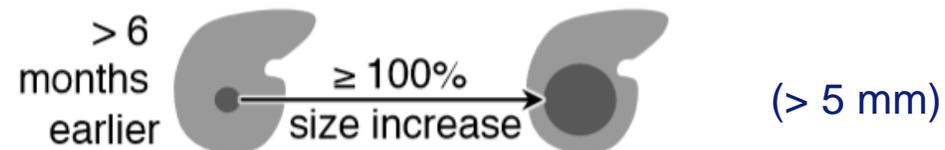
- (nonperipheral) wash out



- Enhancing capsule



- Treshold growth

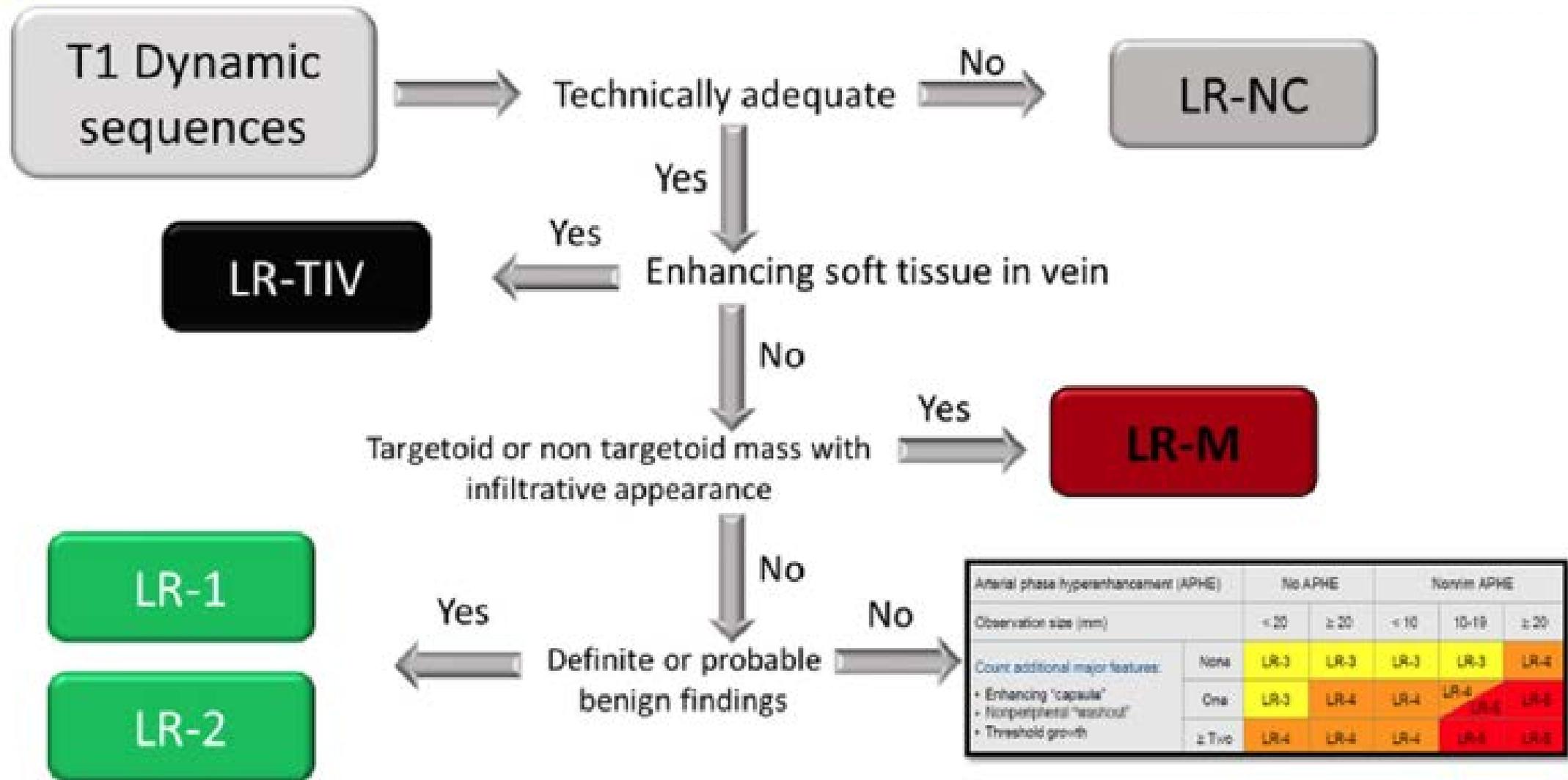


(Optional) apply ancillary features

- Nodule in nodule
 - Mosaic architecture
 - Fat in mass
 - Blood products in mass
-
- Improved detection, increased confidence, category adjustyment
 - Category adjustment: upgrade or downgrade by 1 category (max L4)



LI-RADS® v2018
CT/MRI Core



Arterial phase hyperenhancement (APHE)		No APHE		Non/m APHE		
Observation size (mm)		< 20	≥ 20	< 10	10-19	≥ 20
Count additional major features:	None	LR-3	LR-3	LR-3	LR-3	LR-4
	One	LR-3	LR-4	LR-4	LR-4	LR-5
	≥ Two	LR-4	LR-4	LR-4	LR-5	LR-5

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: <ul style="list-style-type: none"> • 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

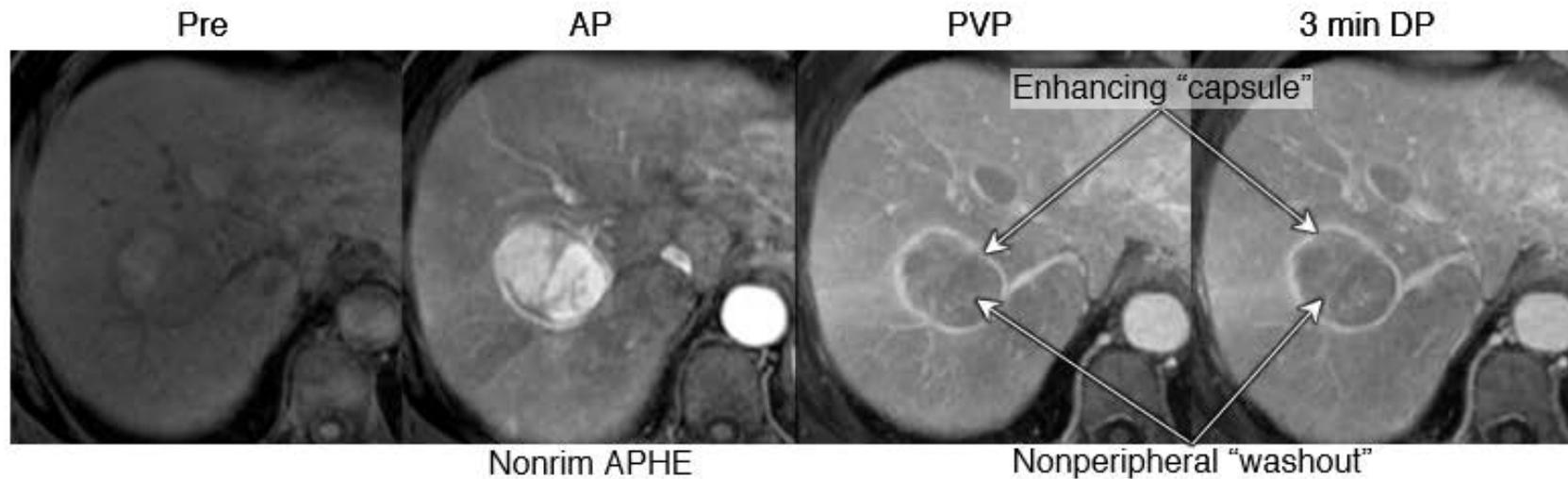
Observations in this cell are categorized based on one additional major feature:

- LR-4 – if enhancing “capsule”
- LR-5 – if nonperipheral “washout” **OR** threshold growth

If unsure about the presence of any major feature: characterize that feature as absent

LR-5: Definite HCC

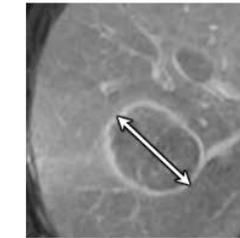
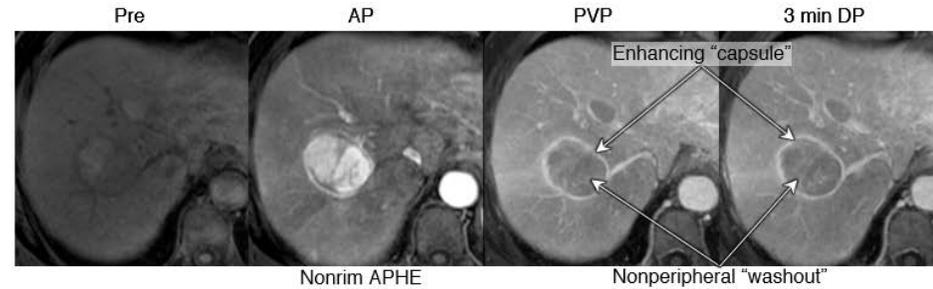
Example: Example: 47 mm observation in a 68 year-old man with cirrhosis



Note:
This case also illustrates mosaic architecture (AF-M)

LR-5: Definite HCC

Example: Example: 47 mm observation in a 68 year-old man with cirrhosis



Size = 47 mm

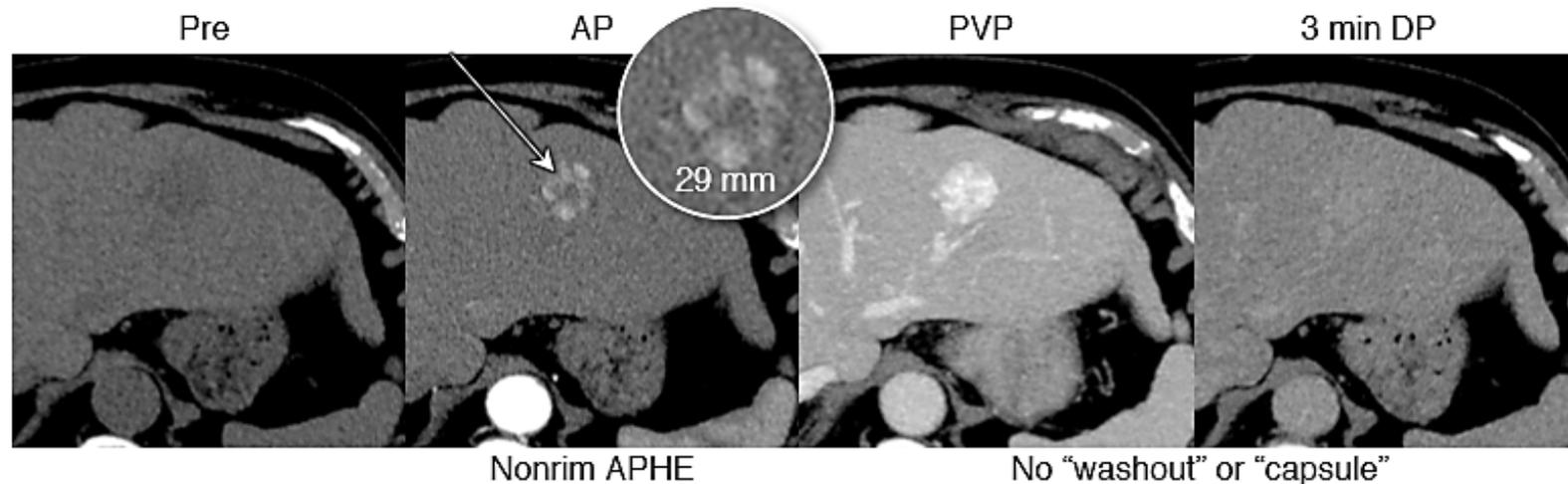
Note:
This case also illustrates mosaic architecture (AF-M)

MRI Diagnostic Table

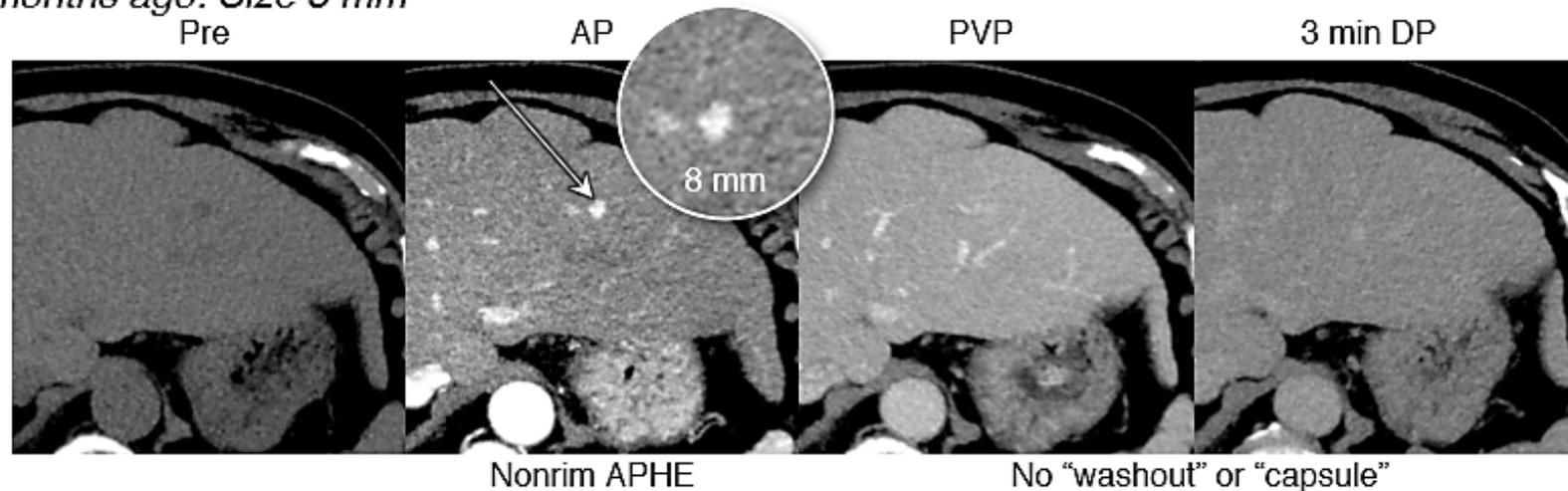
Arterial phase hyperenhancement (APHE)		No APHE		Nonrim APHE		
		< 20	≥ 20	< 10	10-19	≥ 20
Observation size (mm)						
Count additional major features: <ul style="list-style-type: none"> Enhancing "capsule" ✓ Nonperipheral "washout" ✓ Threshold growth ✗ 	None	LR-3	LR-3	LR-3	LR-3	LR-4
	One	LR-3	LR-4	LR-4	LR-4 LR-5	LR-5
	≥ Two	LR-4	LR-4	LR-4	LR-5	LR-5

LR-5: Definite HCC

Example: 29 mm observation in a 85 year-old man with cirrhosis



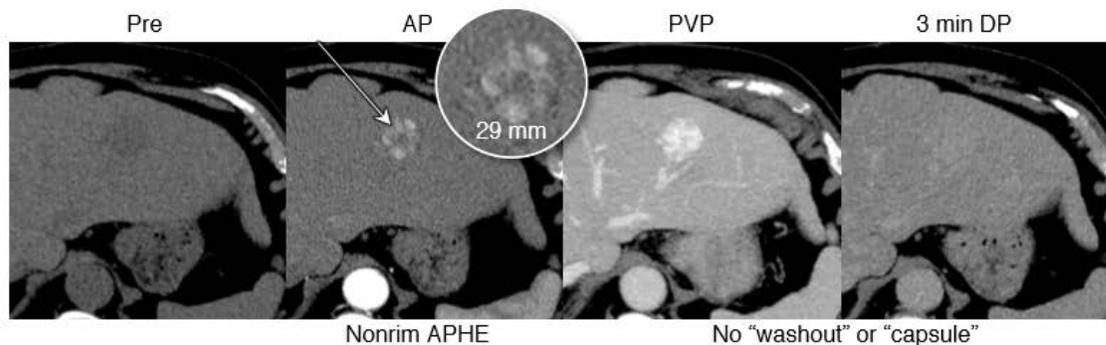
CT 3 months ago: Size 8 mm



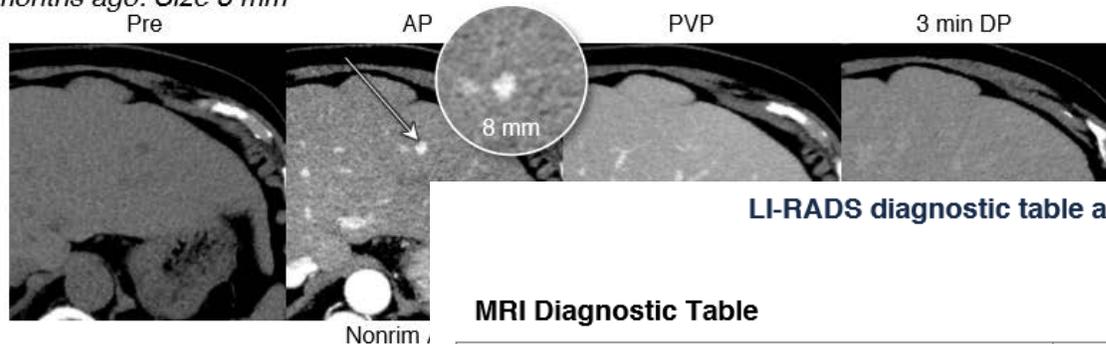
Note: In this case, size is measured in the AP as the observation is only visible in the AP.

LR-5: Definite HCC

Example: 29 mm observation in a 85 year-old man with cirrhosis



CT 3 months ago: Size 8 mm



LI-RADS diagnostic table assigns LR-3, LR-4, and LR-5

MRI Diagnostic Table

Arterial phase hyperenhancement (APHE)		No APHE		Nonrim APHE		
Observation size (mm)		< 20	≥ 20	< 10	10-19	≥ 20
Count additional major features:	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

Note: In this case, size is measured in the

LI-RADS diagnosis

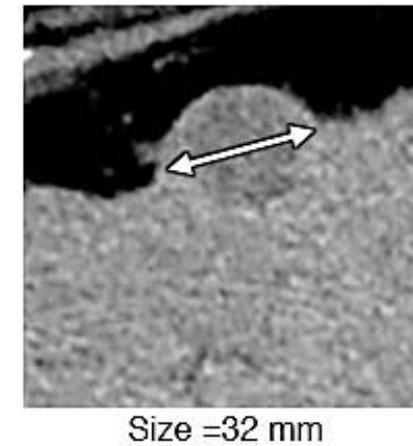
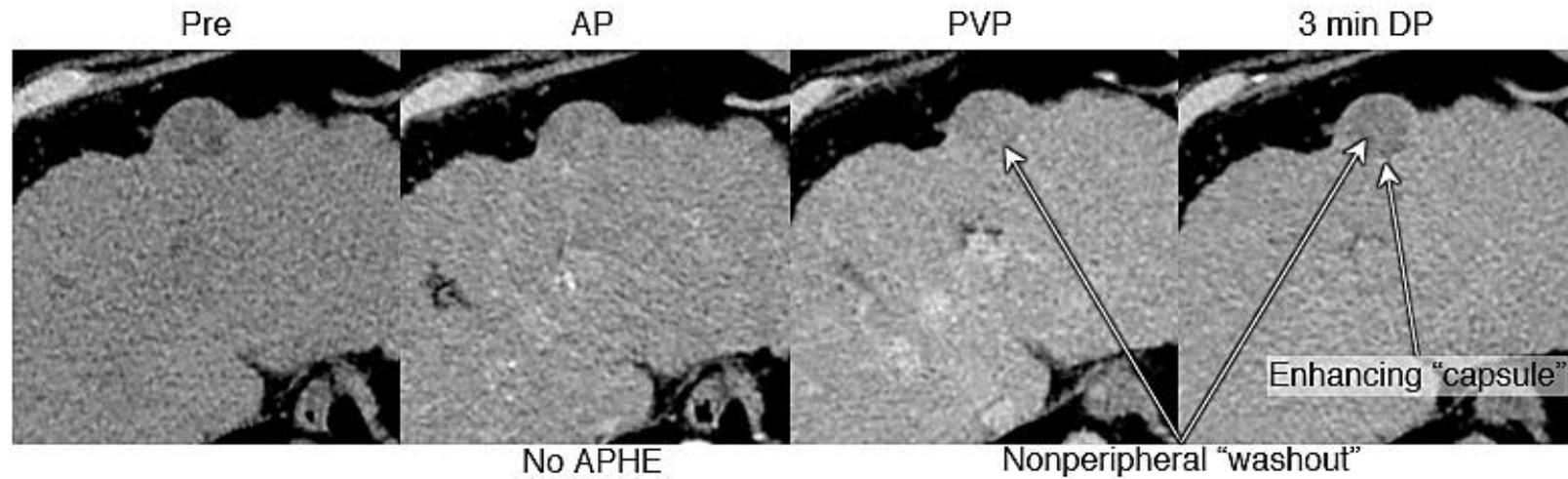
LR-4
LR-5

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

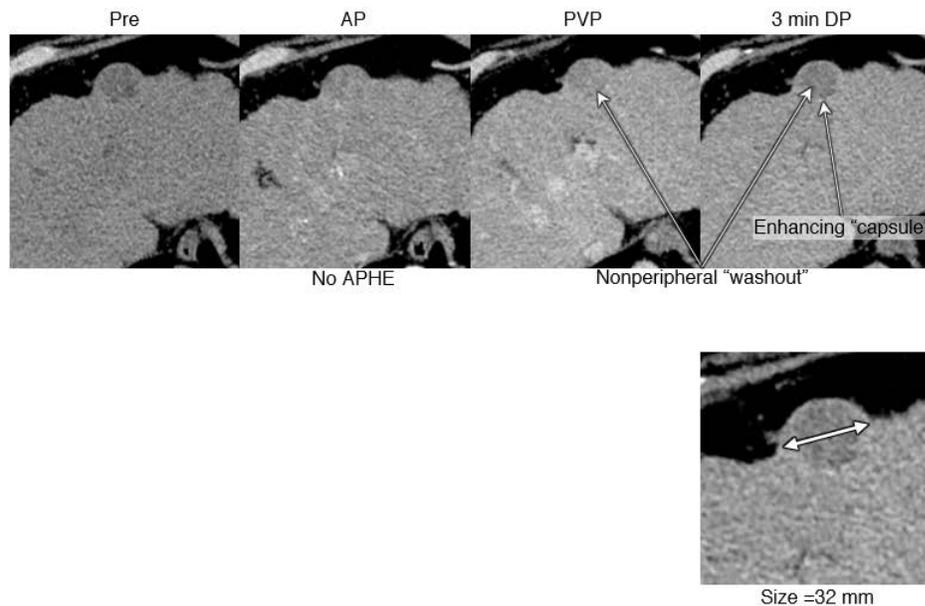
LR-4: Probable HCC

Example: 32 mm observation in a 67 year-old man with cirrhosis



LR-4: Probable HCC

Example: 32 mm observation in a 67 year-old man with cirrhosis

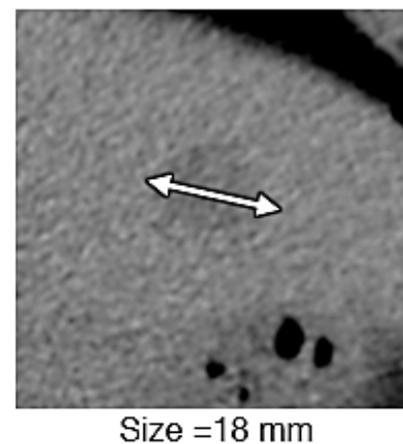
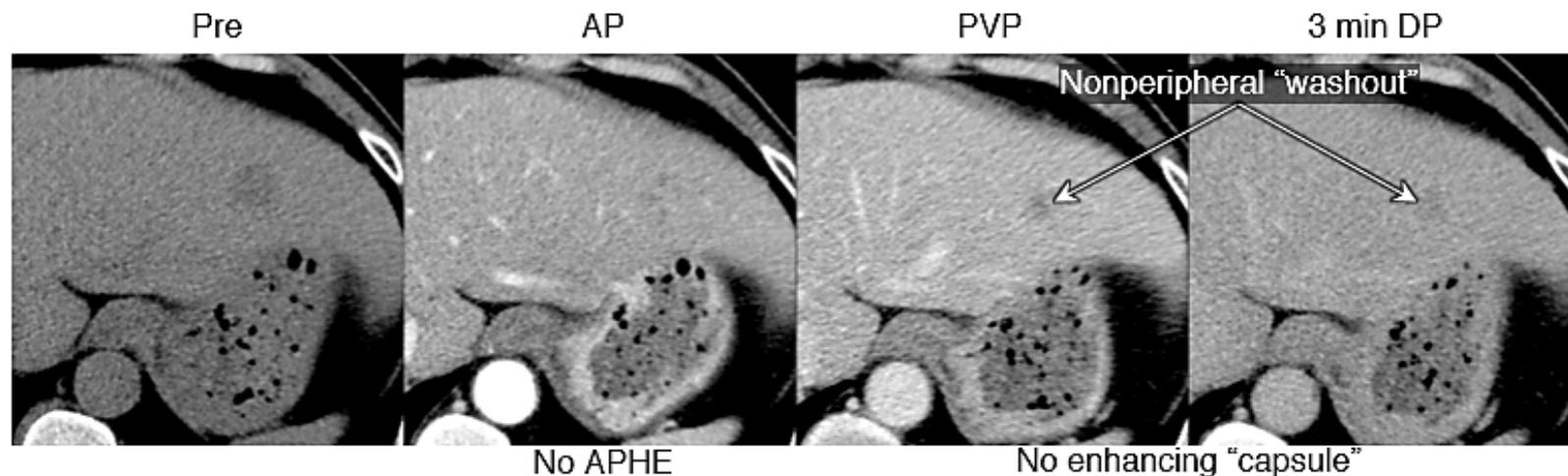


MRI Diagnostic Table

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

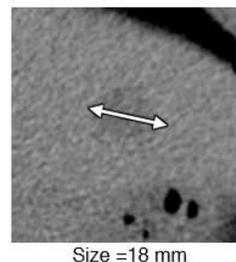
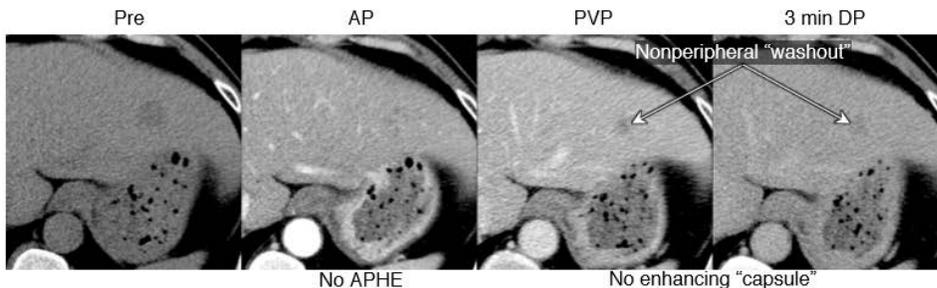
LR-3: Intermediate Probability of Malignancy

Example: 18 mm observation in a 46 year-old man with cirrhosis



LR-3: Intermediate Probability of Malignancy

Example: 18 mm observation in a 46 year-old man with cirrhosis



Size = 18 mm

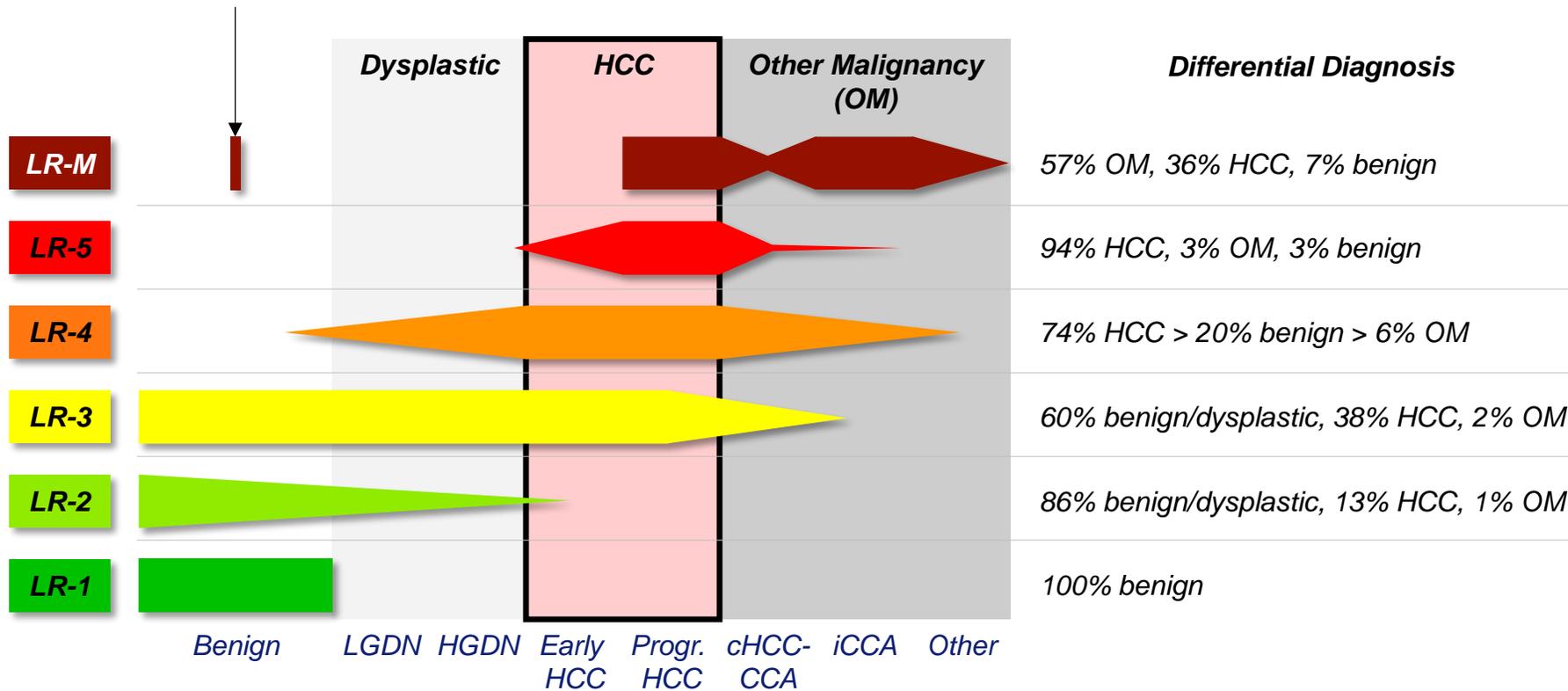
MRI Diagnostic Table

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



The probabilities associated with each category are becoming known

*sclerosing hemangiomas, infarcted regenerative nodules,
rare perfusion alterations with rim pattern, abscess*

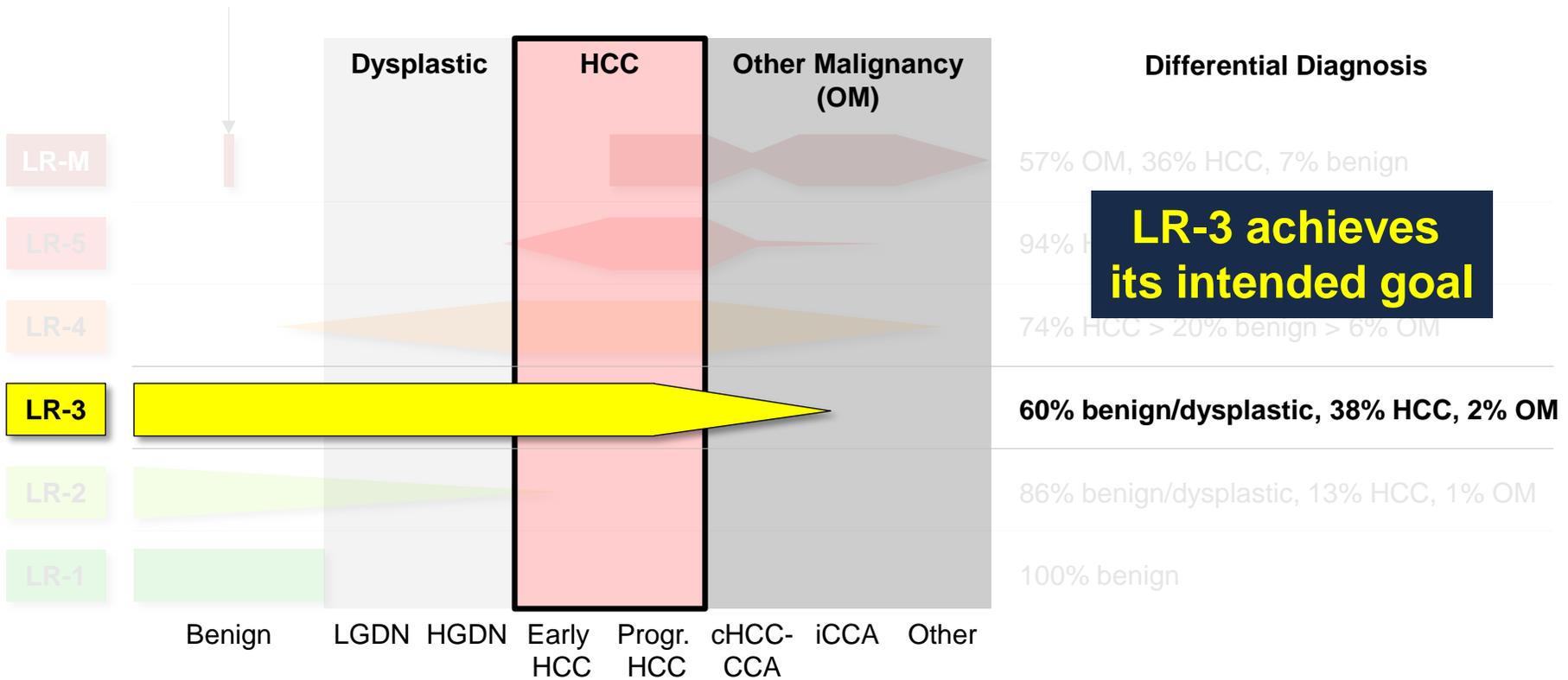




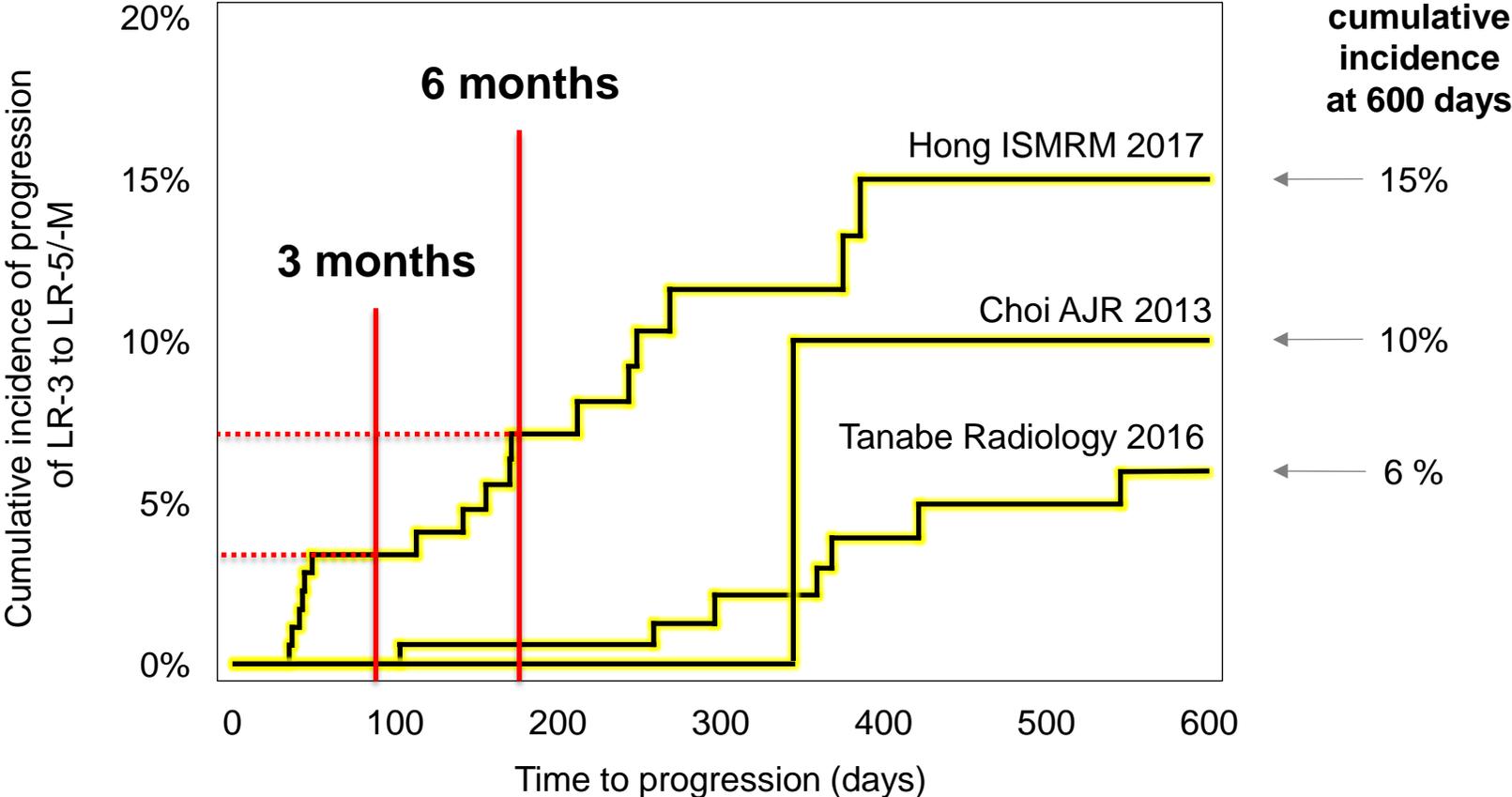
Let's focus on LI-RADS 3

LR-3: Intermediate probability of malignancy

sclerosing hemangiomas, infarcted regenerative nodules,
rare perfusion alterations with rim pattern, abscess

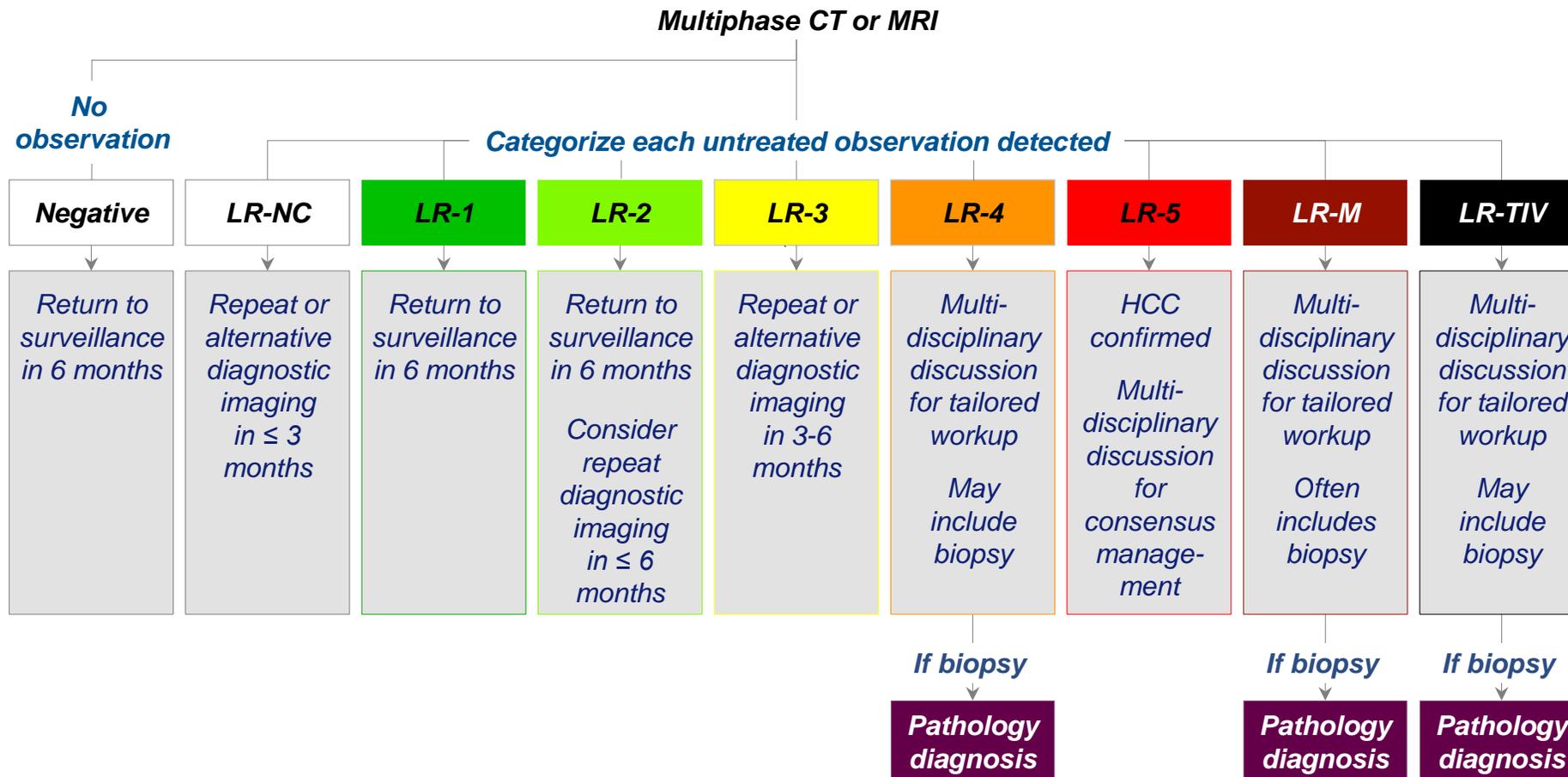


Progression at 3 months < 5%; progression at 6 months < 10%



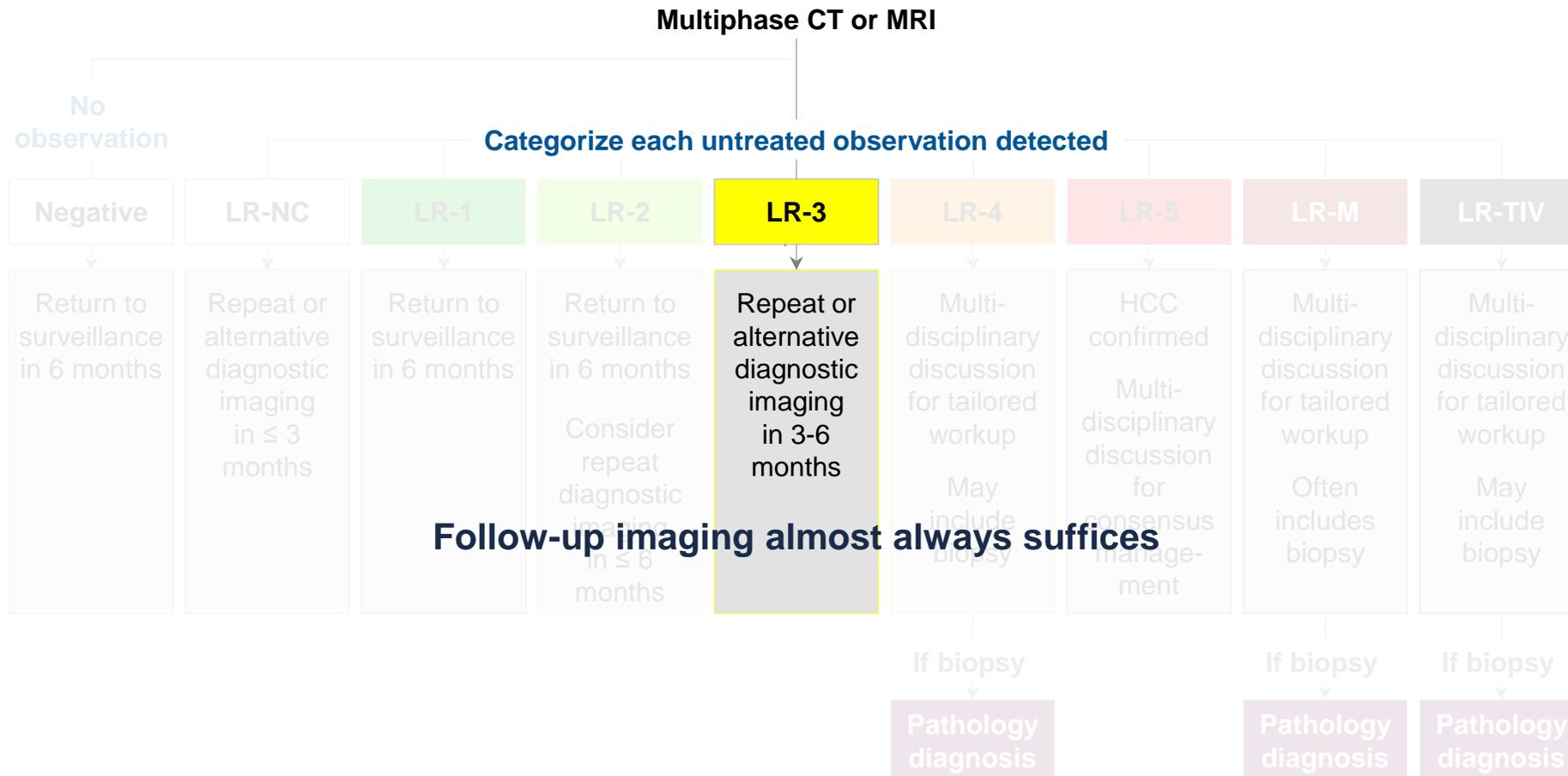


LI-RADS[®] permits individualized management



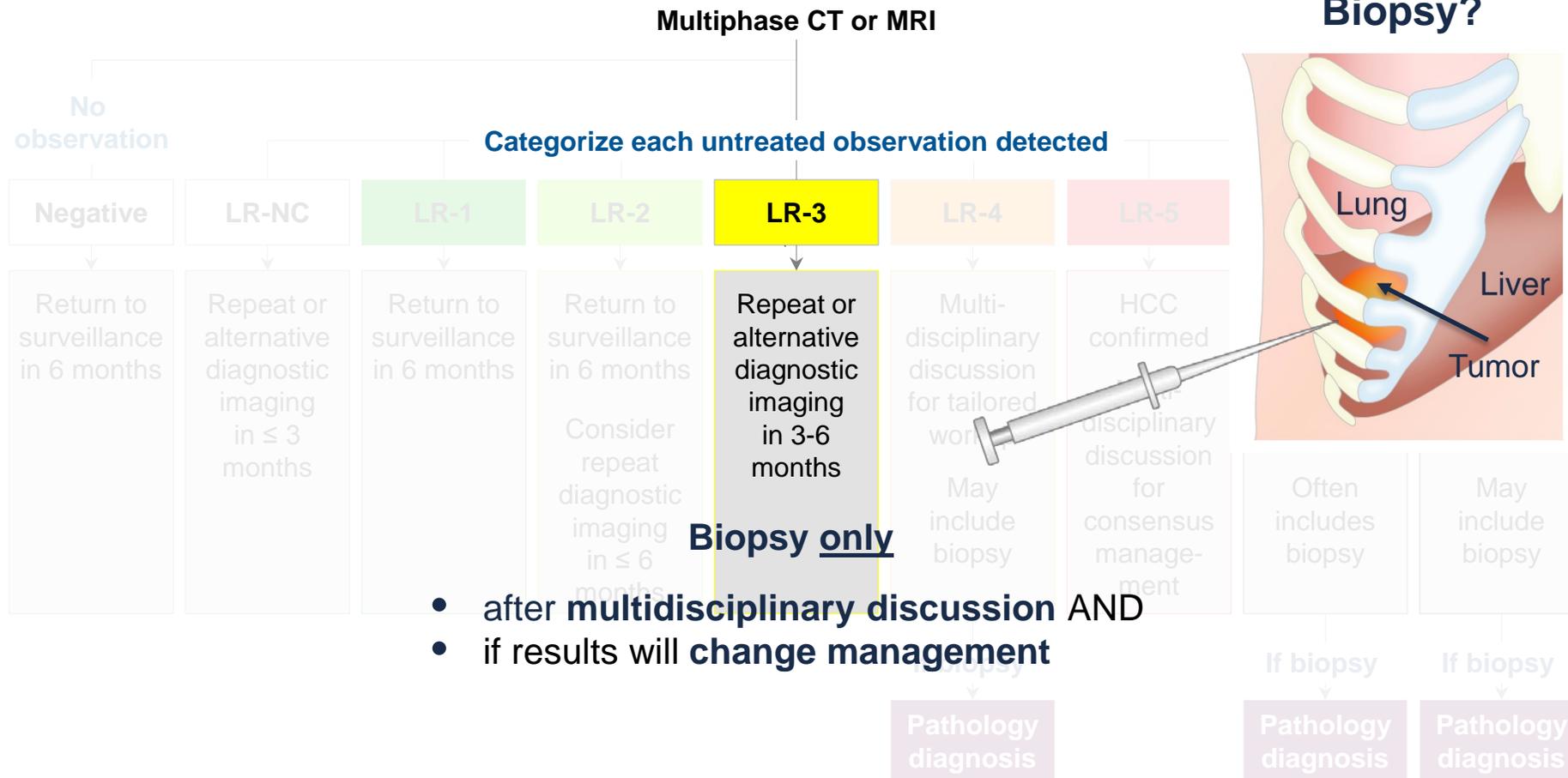


Let's focus on LI-RADS 3



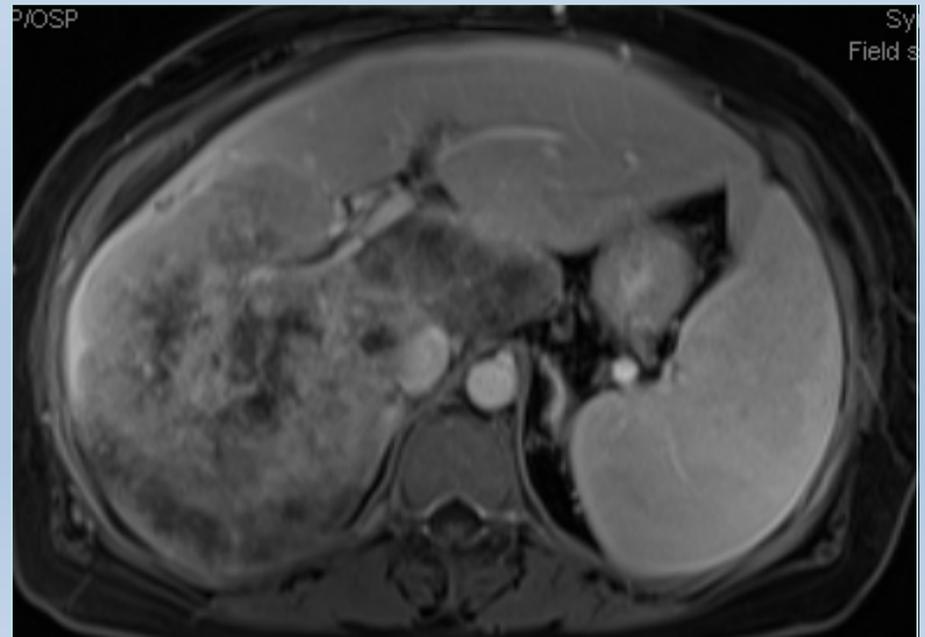
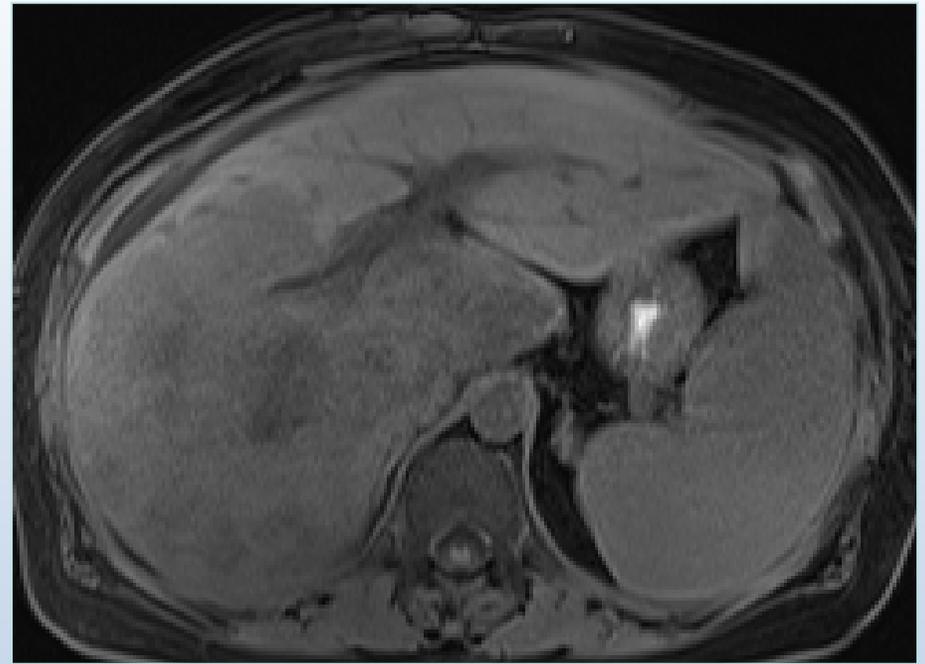
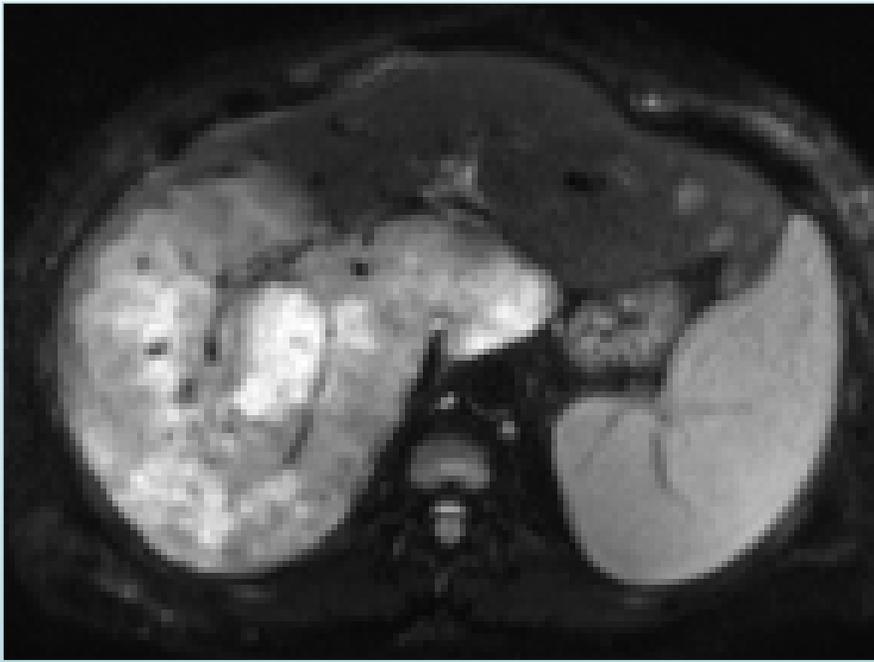


Let's focus on LI-RADS 3



Casus

- ❑ Jonge vrouw 51 jaar
- ❑ Herbeoordeling MRI lever 2014
- ❑ Nadere info → 2006 reeds leverlaesie

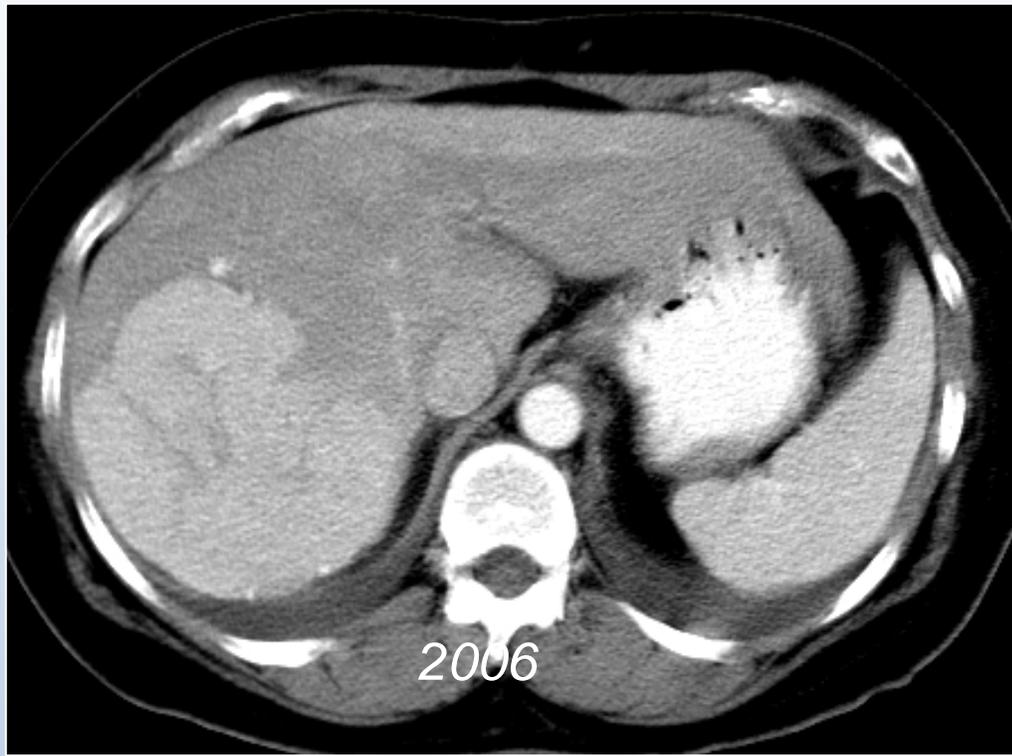


2014

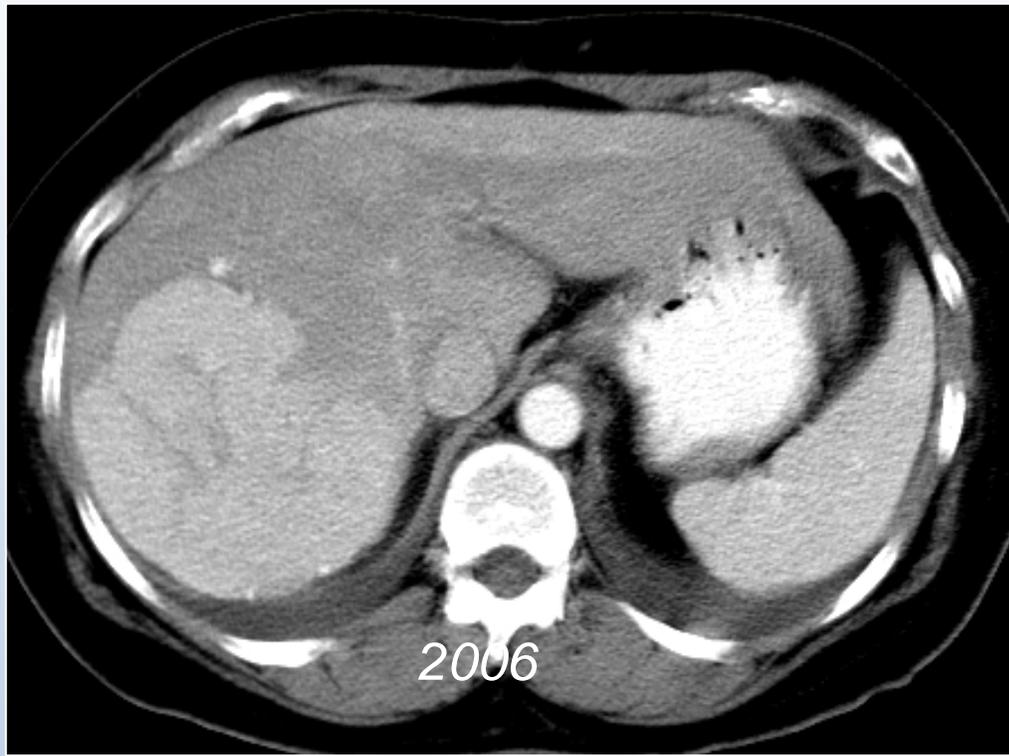
Casus



2006



What went wrong ?



What went wrong ?

- 1) No confident diagnosis in 2006
- 2) FNH / HCA cannot be diagnosed on monophasic CT !
- 3) No clear follow up advise (patient lost to follow up)

Lesion

T2/DWI

Contrast

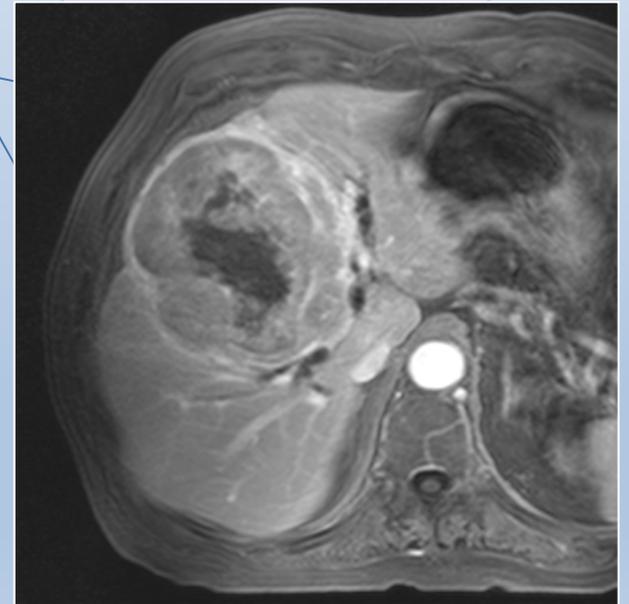
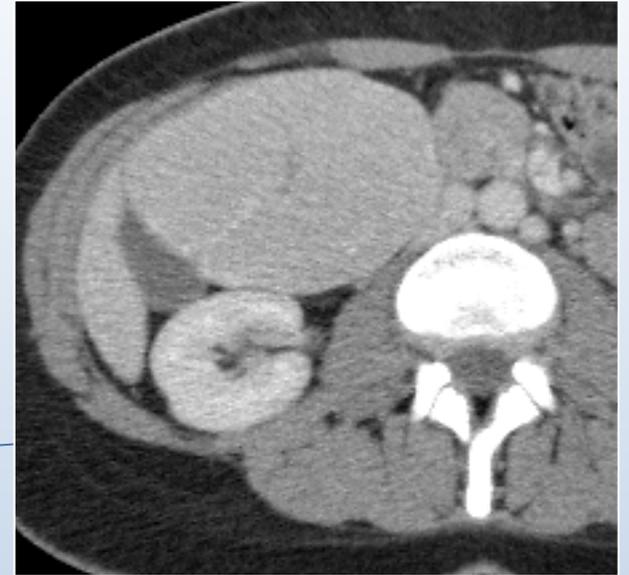
Focal liver lesion

Solid

Benign

Cystic

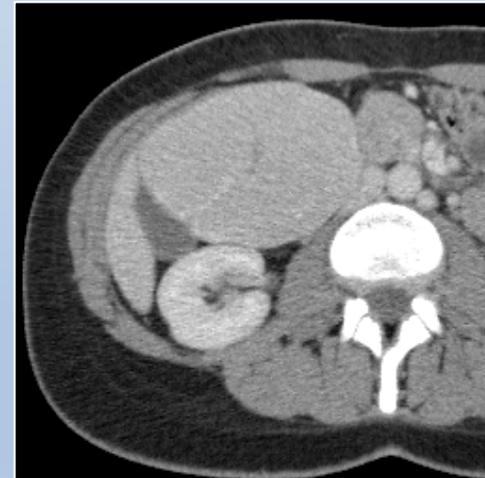
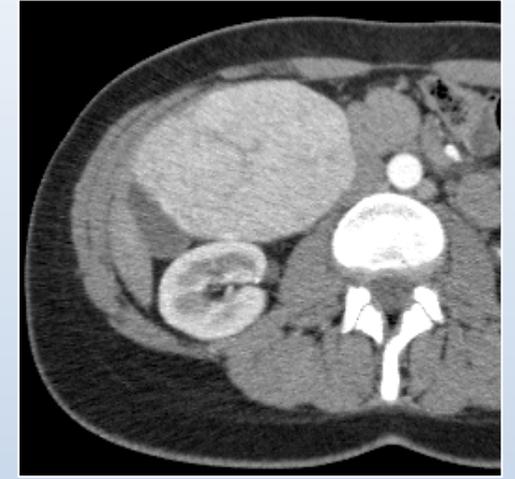
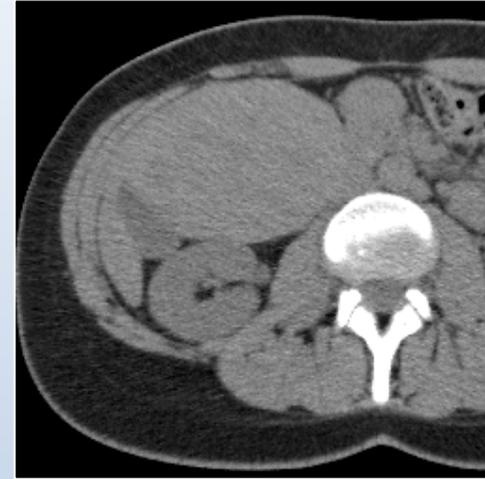
Malignant



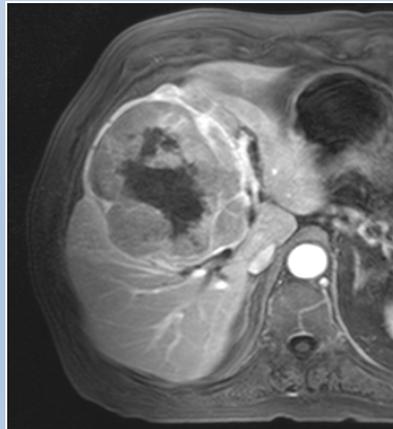
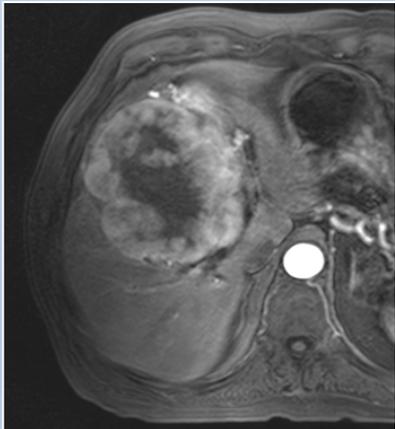
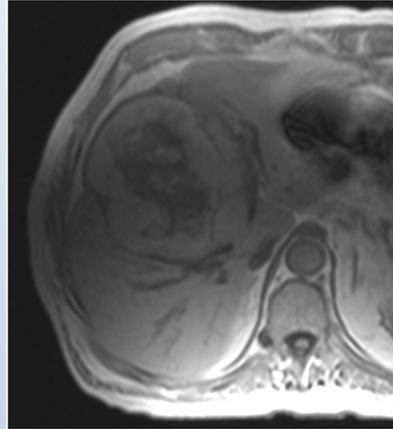
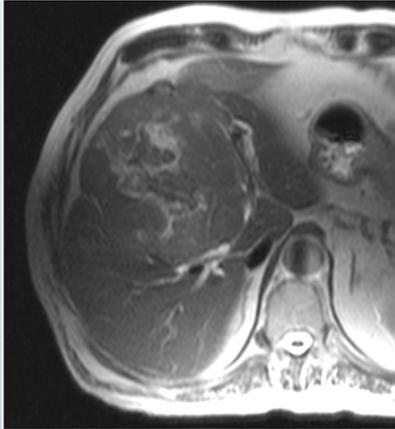
Differentiation benign - malignant

Benign

- Homogeneous
- Well demarcated
- No wash-out



Differentiation benign - malignant



Malignant

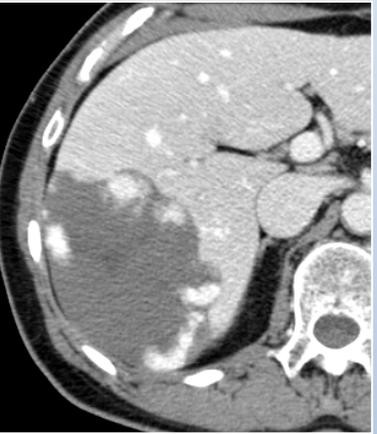
- Heterogeneous
 - Partial necrosis
- Irregular demarcated
- Wash-out

Differentiation benign - malignant

Benign

- Homogeneous
- Well demarcated
- No wash-out

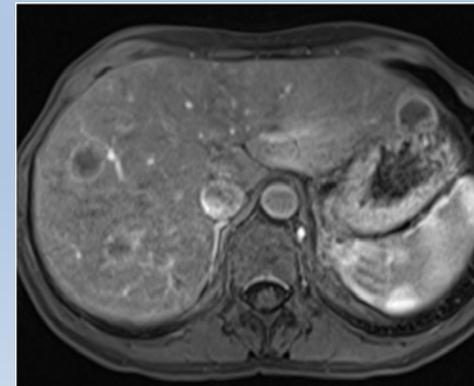
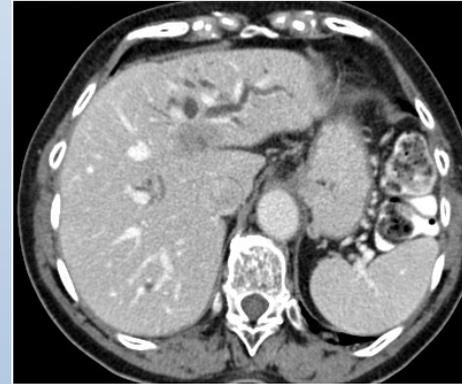
- Progressive nodular enhancement (haemangioma)

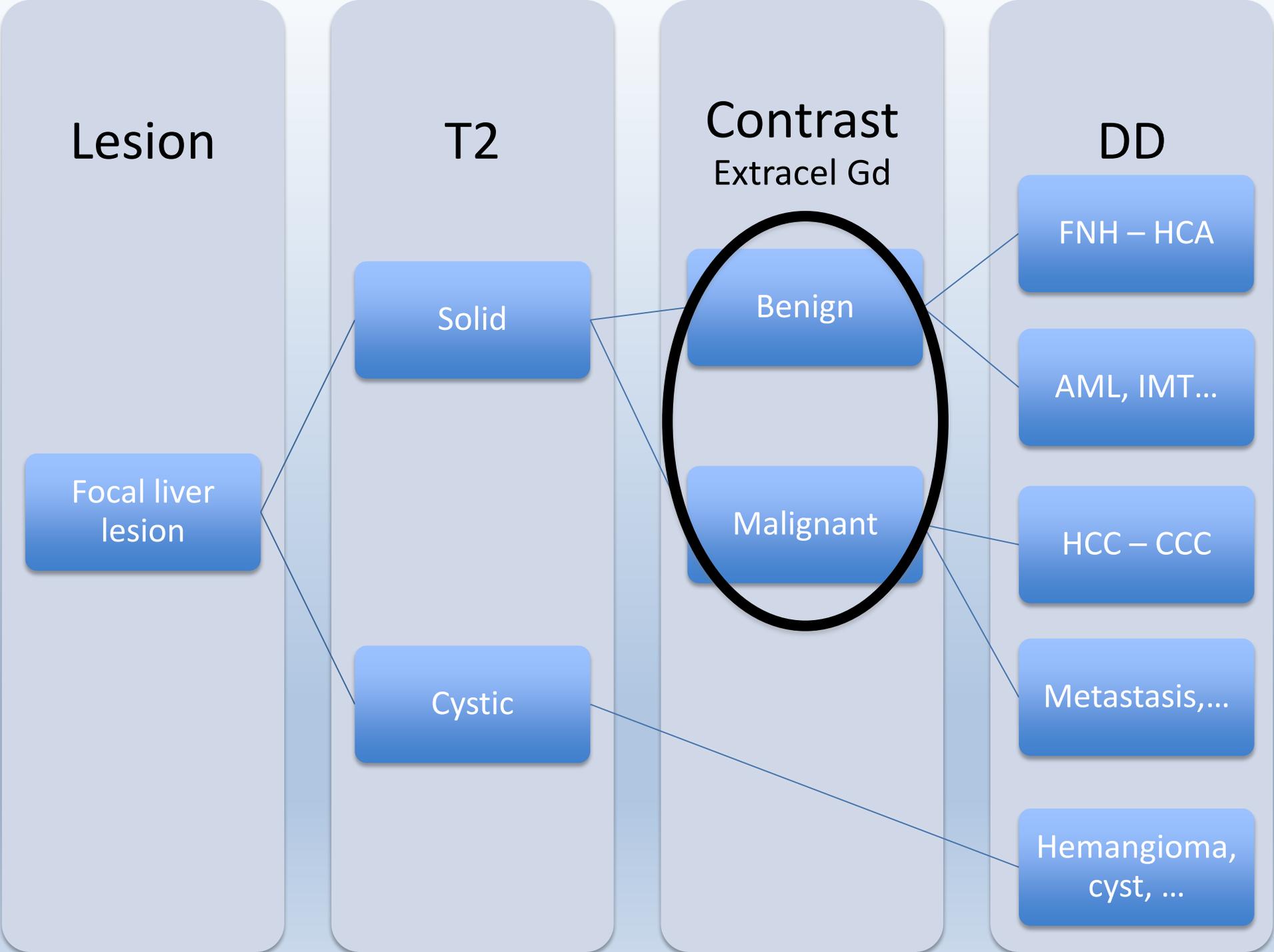


Malignant

- Heterogeneous
 - Partial necrosis
- Irregular demarcated
- Wash-out

- Capsular retraction
- Peripheral bile duct dilatation
- Continues rim enhancement (metastasis)





Lesion

T2

Contrast
Extracel Gd

DD

Focal liver
lesion

Solid

Cystic

Benign

Malignant

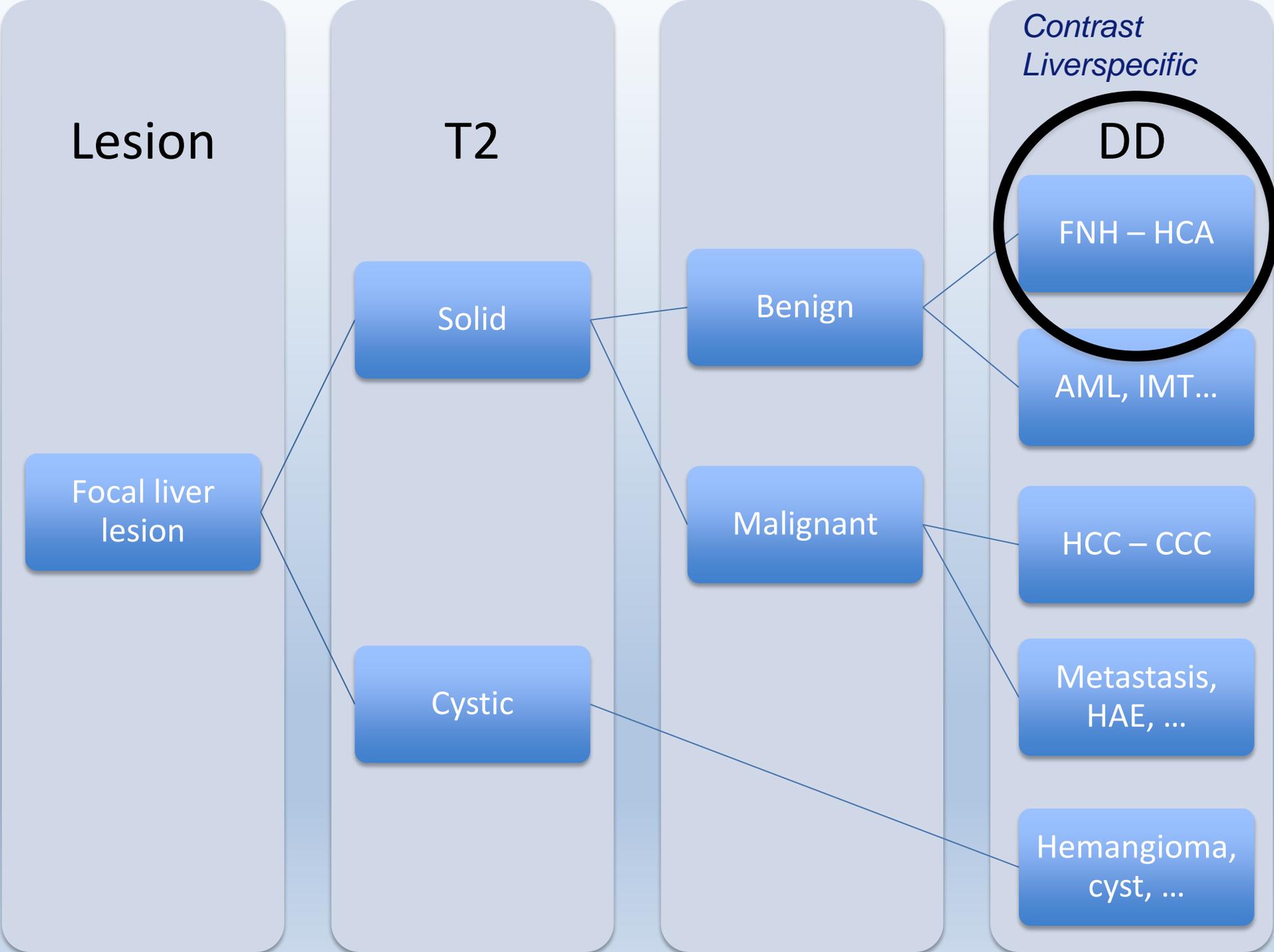
FNH – HCA

AML, IMT...

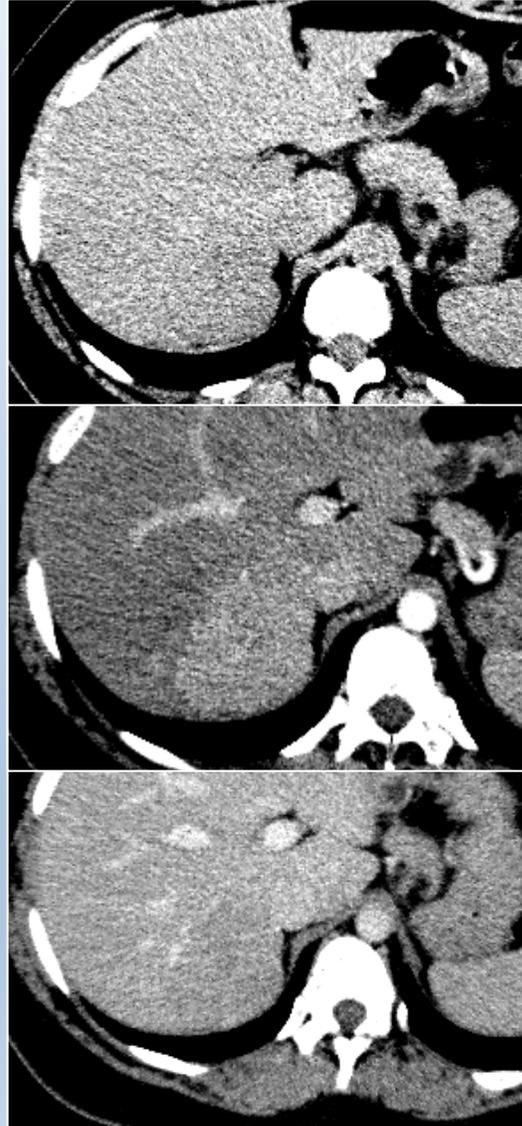
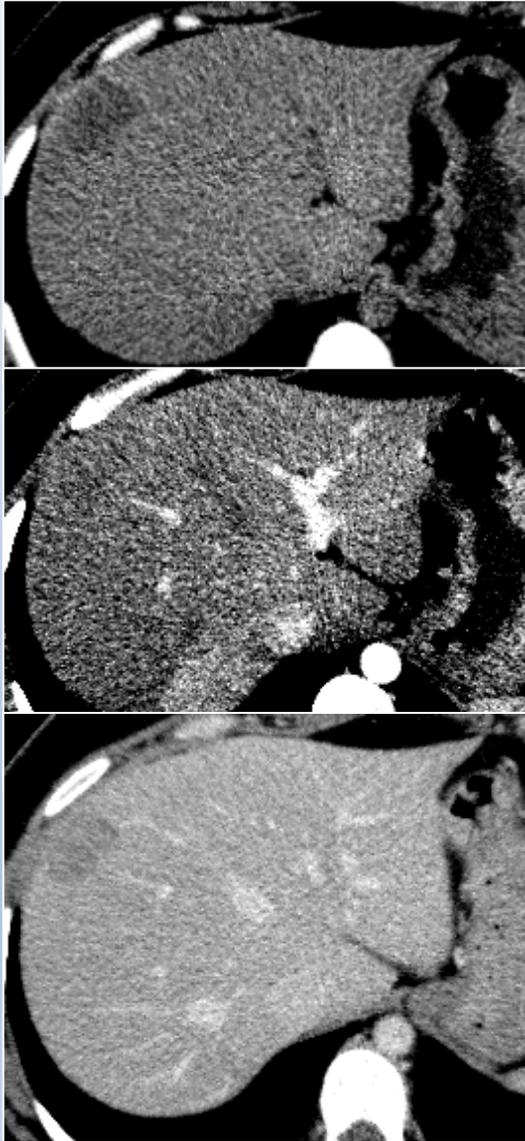
HCC – CCC

Metastasis,...

Hemangioma,
cyst, ...



Differentiation benign - malignant



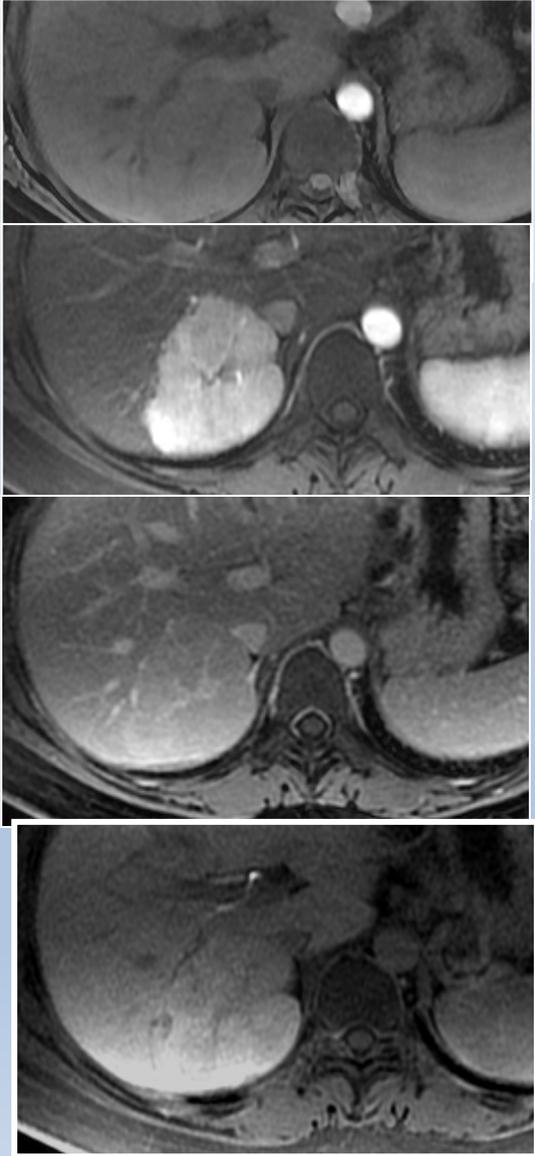
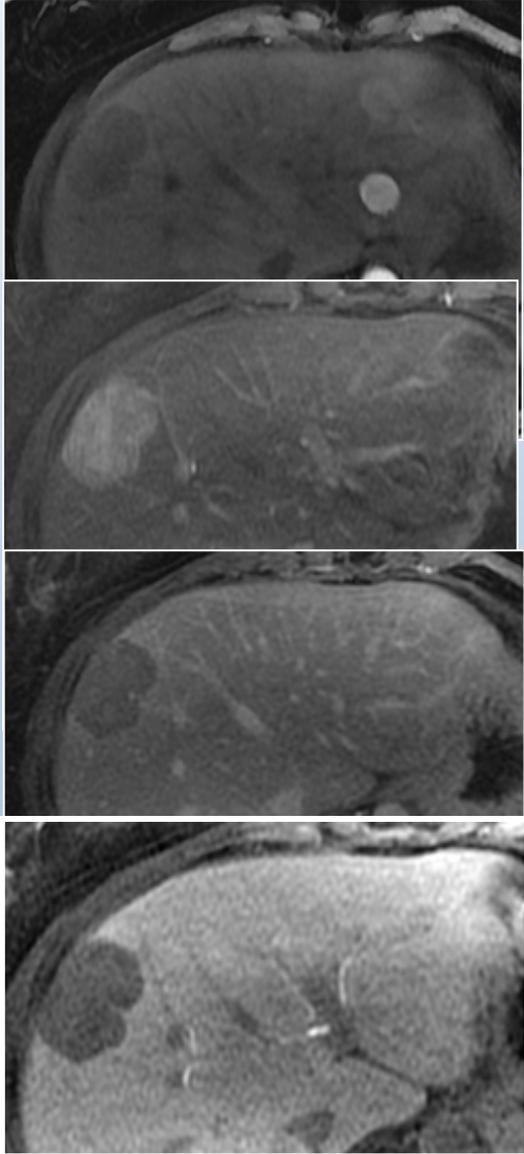
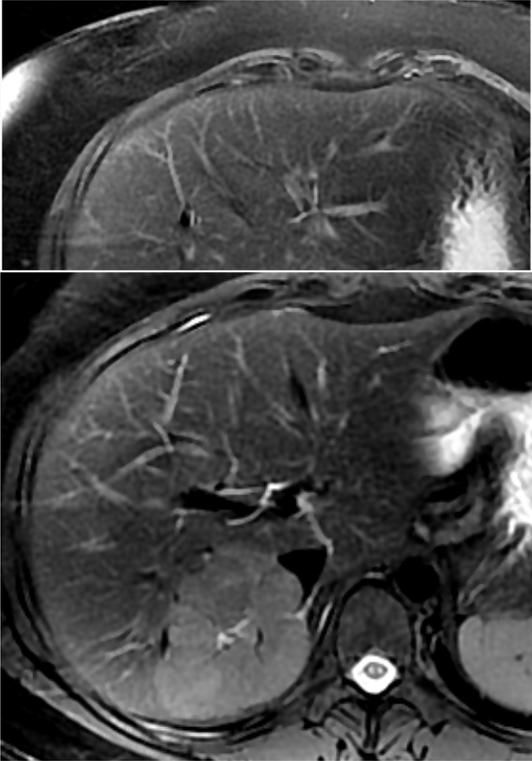
*Jonge vrouw,
30 jaar: 2x
laesies per
toeval ontdekt.
Gebruikt OAC*

Typical HCA & FNH

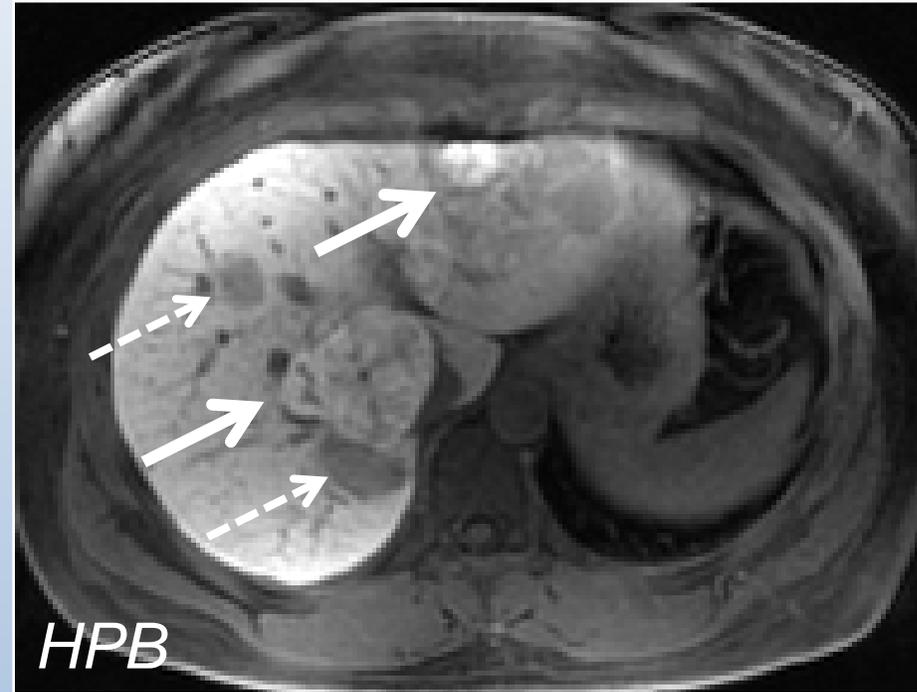
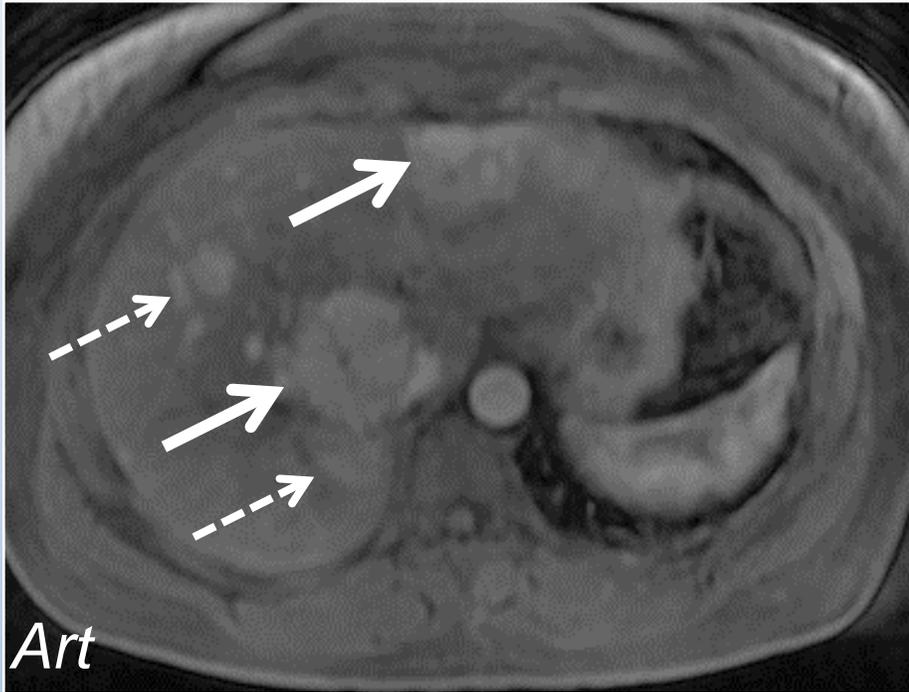
Differentiation benign - malignant

HCA

FNH

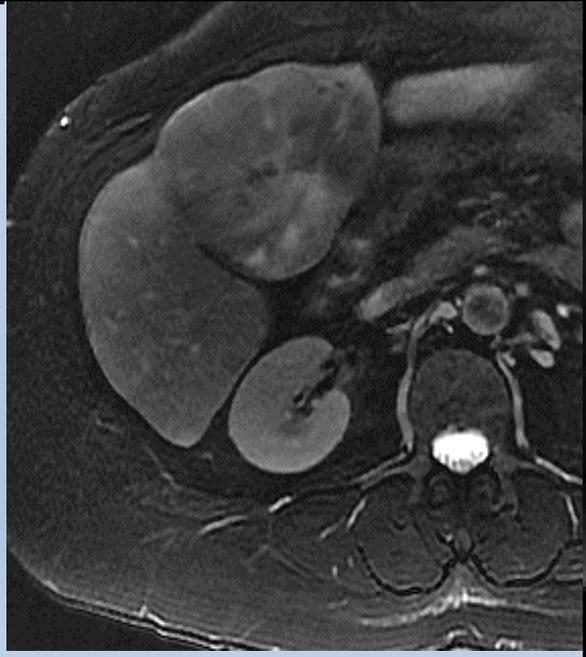
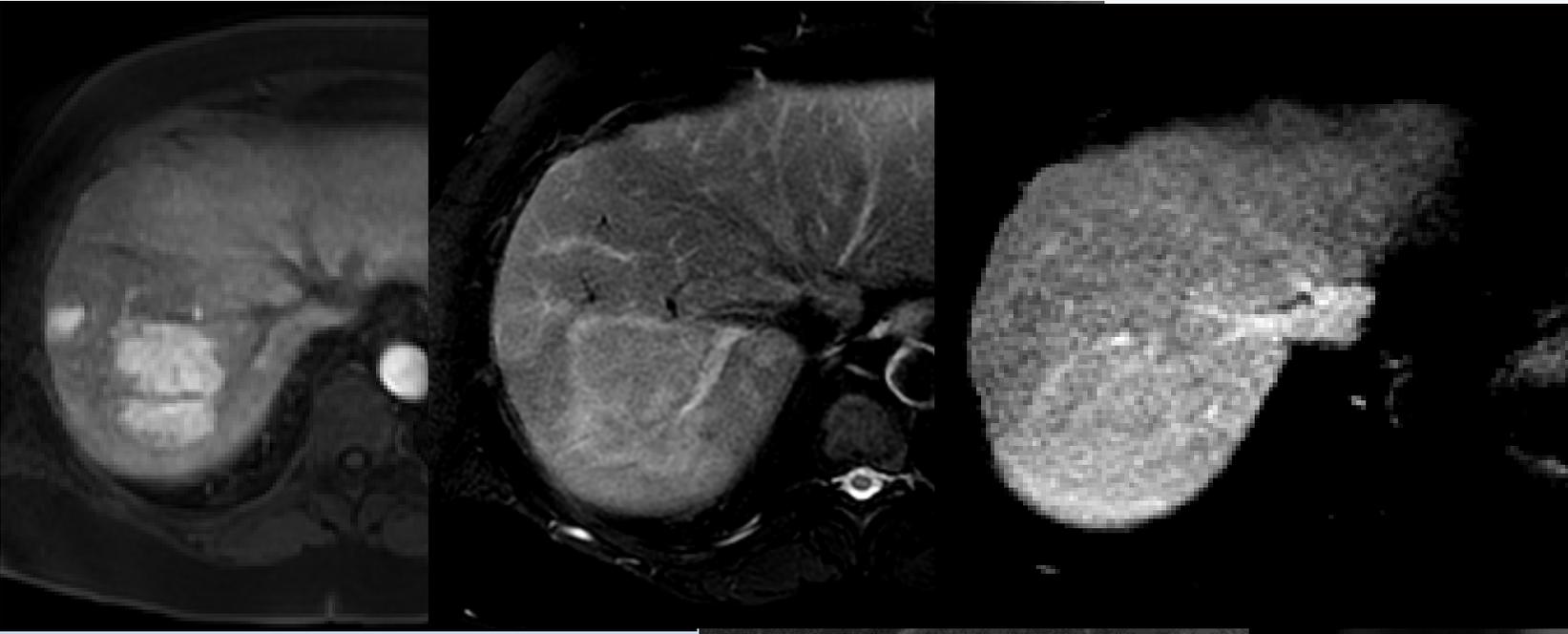


MRI contrast agent: liver specific

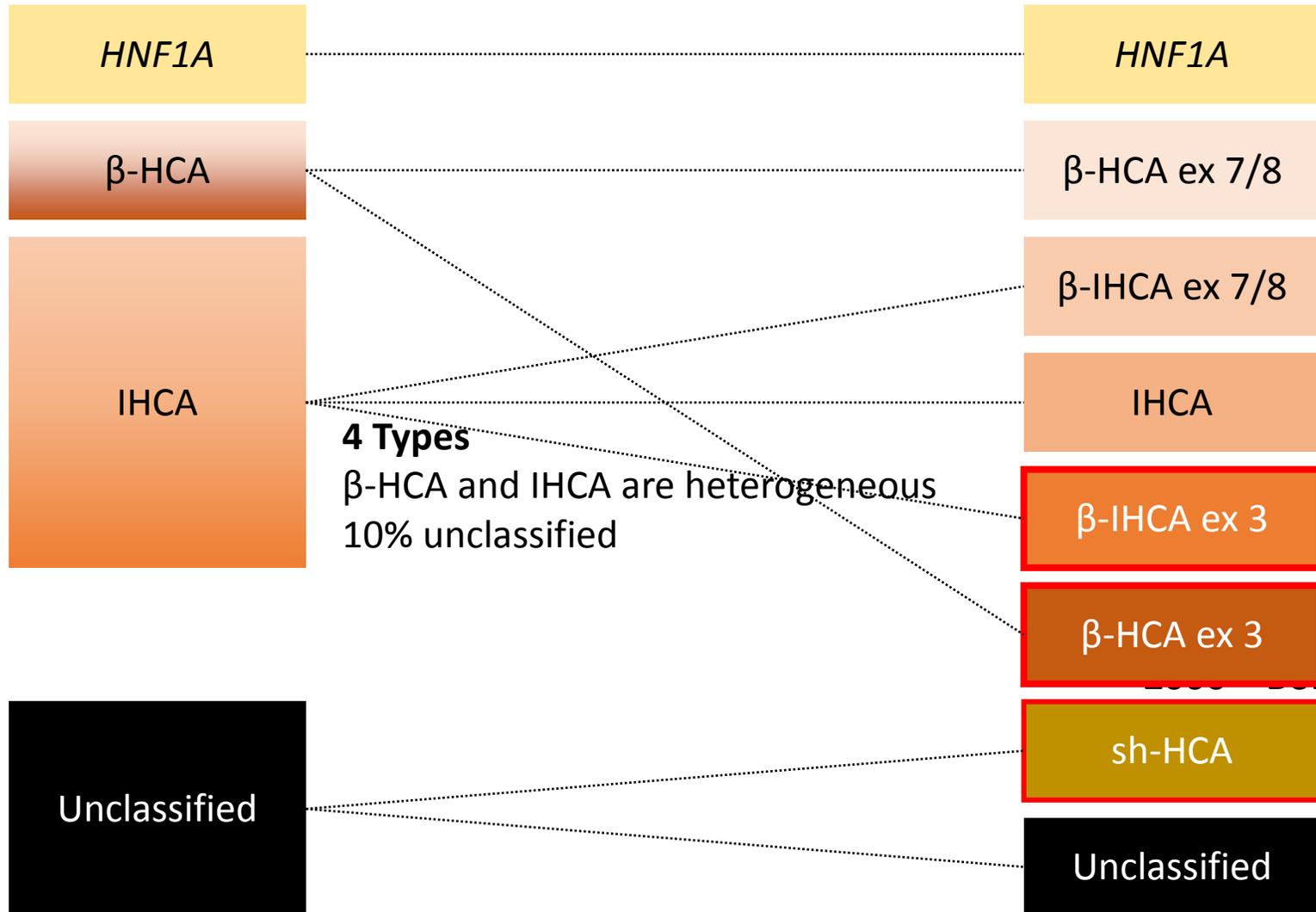


→ = FNH

- - - → = HCA



Adenomatosis with 1x HCC (typical features HCC)



4 Types
 beta-HCA and IHCA are heterogeneous
 10% unclassified

BASIC AND TRANSLATIONAL—LIVER

Molecular Classification of Hepatocellular Adenoma Associates With Risk Factors, Bleeding, and Malignant Transformation

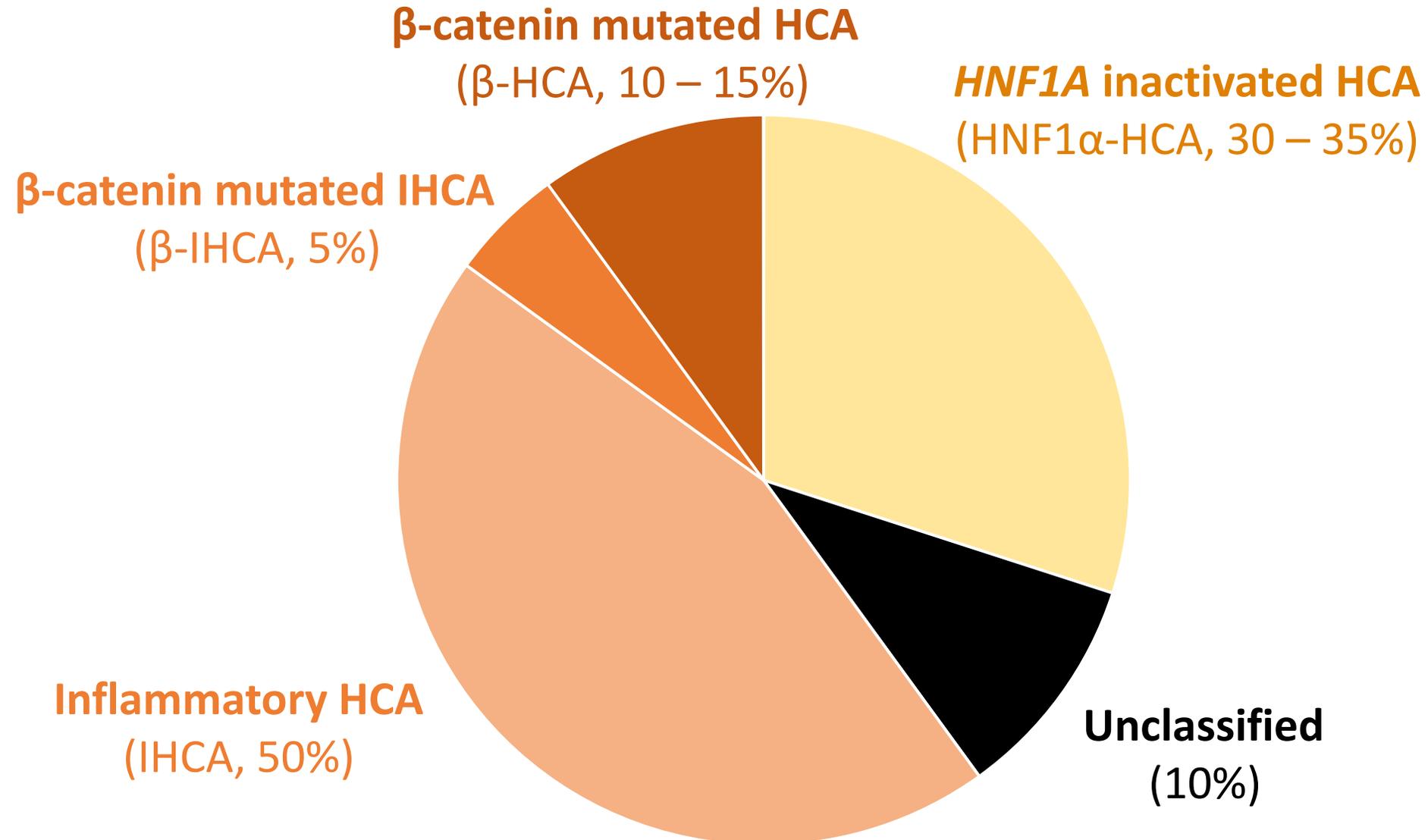
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Types
 beta-HCA and IHCA are refined
 sh-HCA is new
 7% unclassified

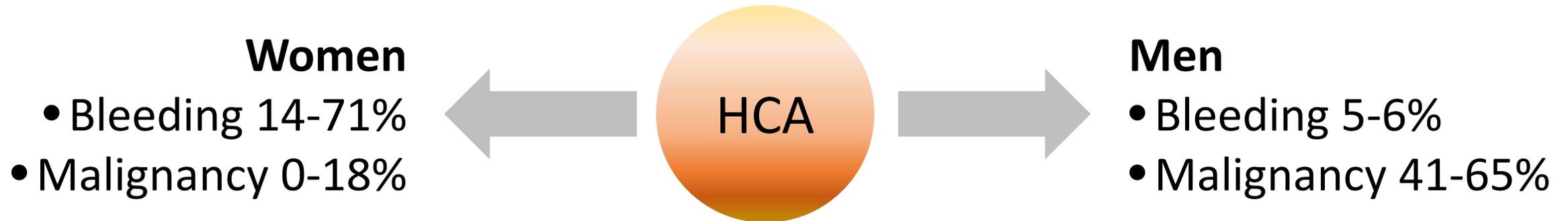
2008 vs 2017 deaux HCA Classification

2017 – Updated HCA Classification

Molecular Classification 2006



Clinical manifestations **depend on patient sex**



Clinical Manifestations: Women

High-risk HCA

β -IHCA ex 3

β -HCA ex 3

sh-HCA

- bleeding 21-36%
- malignancy 7-14%

Non-high-risk HCA

H-HCA

β -HCA ex 7/8

β -IHCA ex 7/8

IHCA

Unclassified

< 5 cm

- bleeding 14%
- malignancy 1%

> 5 cm

- bleeding 19%
- malignancy 3%

Clinical Manifestations: Men

High-risk HCA

β -IHCA ex 3

β -HCA ex 3

sh-HCA

- bleeding 5%
- malignancy 65%

Non-high-risk HCA

H-HCA

β -HCA ex 7/8

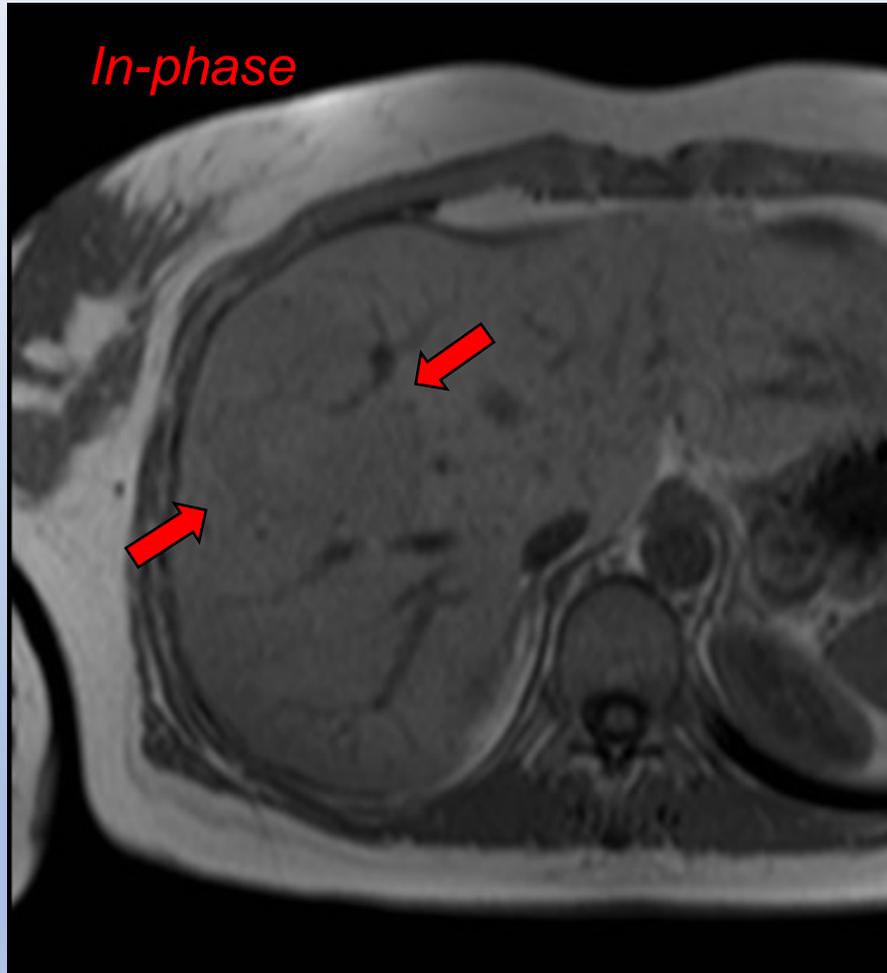
β -IHCA ex 7/8

IHCA

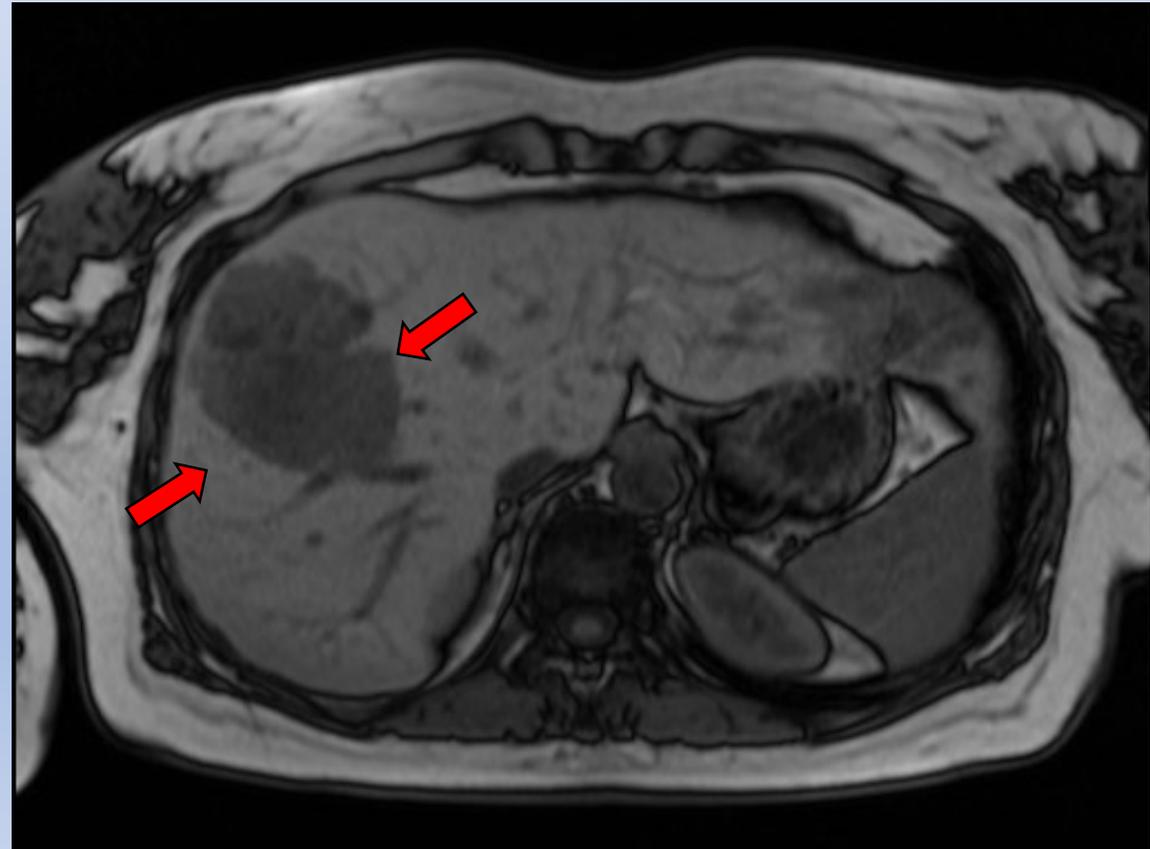
Unclassified

- bleeding 6%
- malignancy 41%

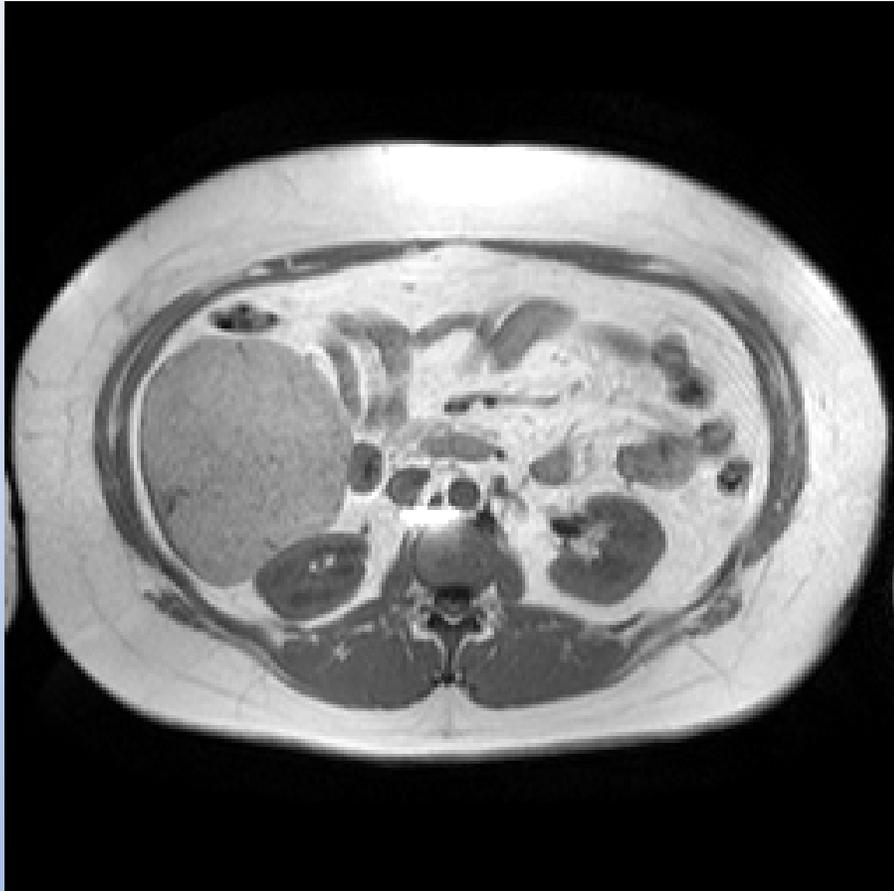
1. Steatotisch/ HNF1A gemuteerd type



Out-phase



T1W in-phase

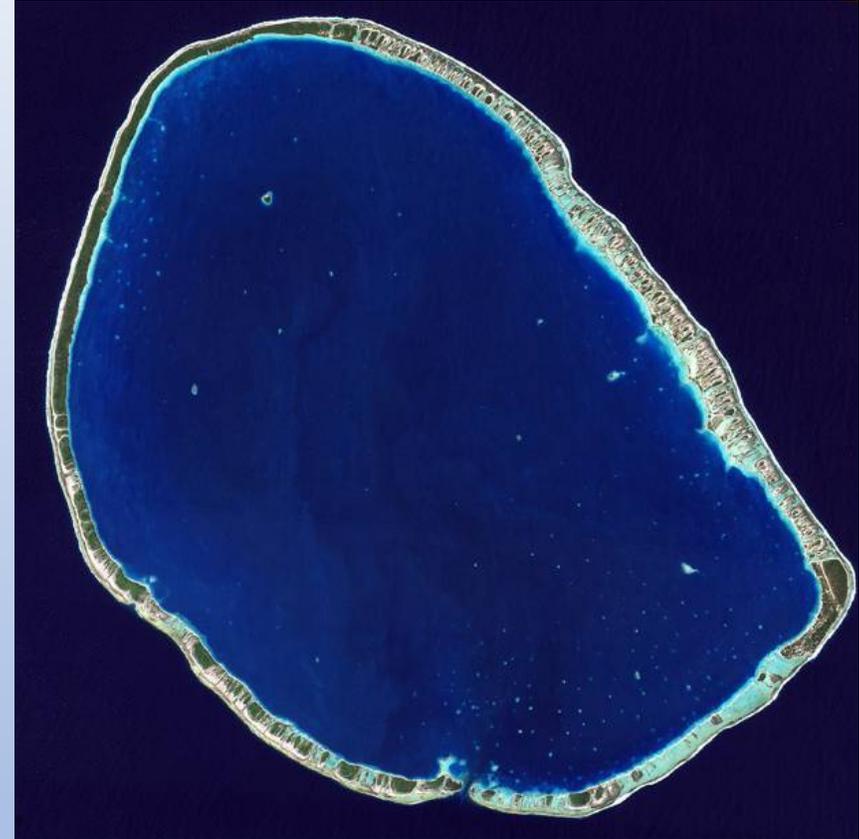
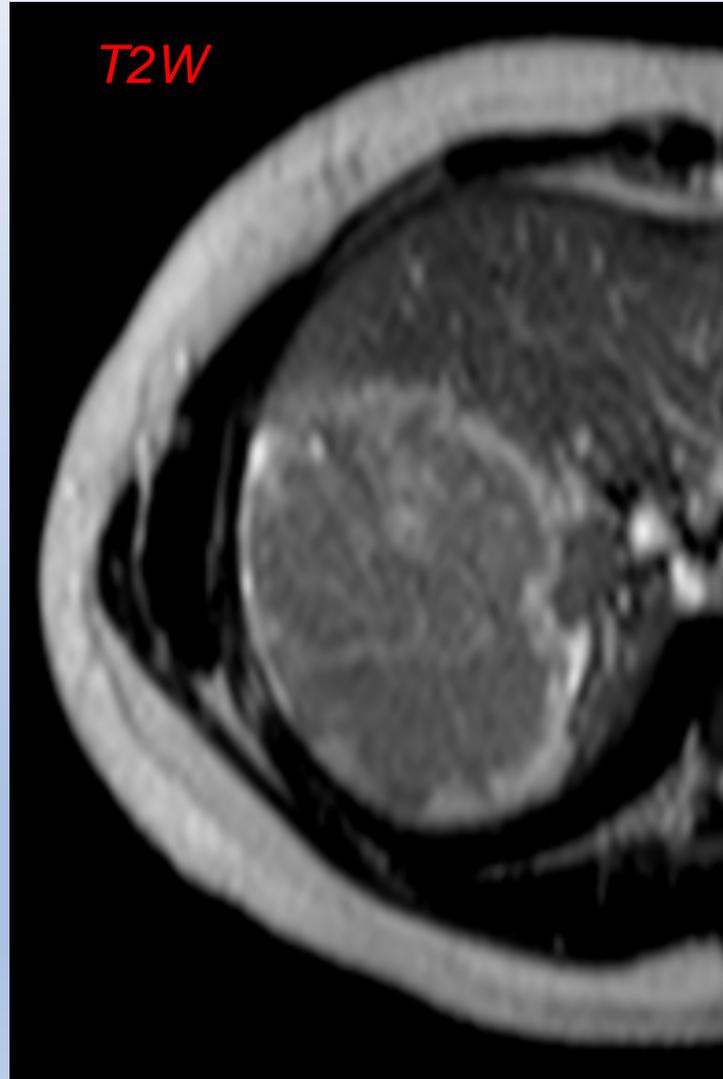


out-phase

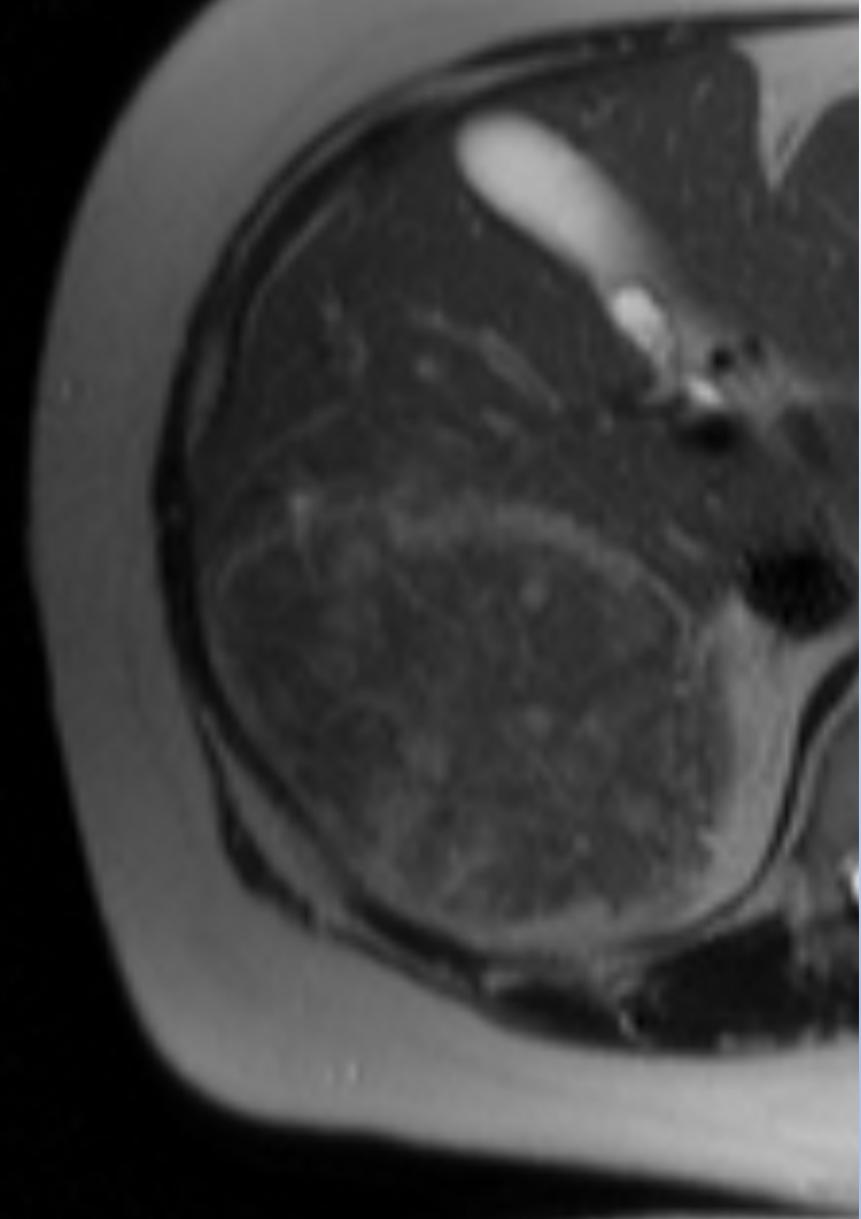
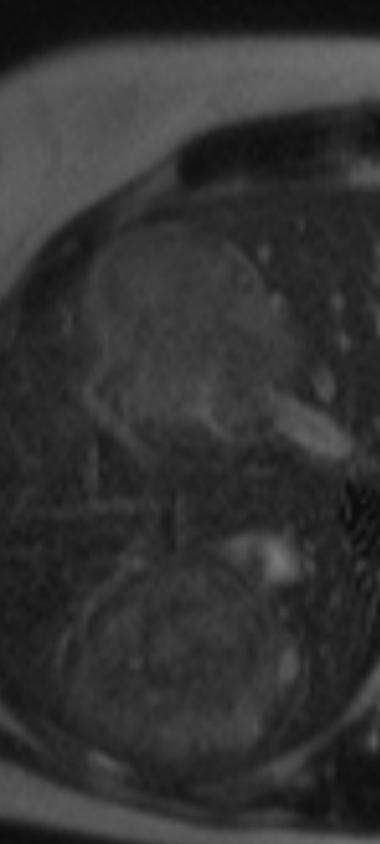
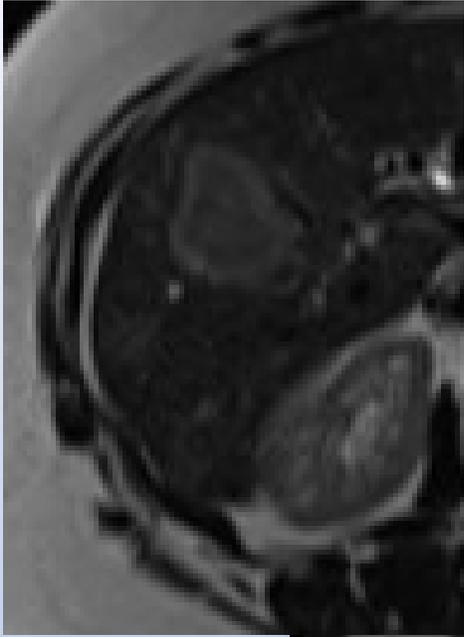


*(Steatotisch HCA) HNF1A inactivated HCA
(HNF1 α -HCA, 30 – 35%)*

2. Atoll-sign inflammatoir adenoom



Southern part of the Tikehau Atoll (google)

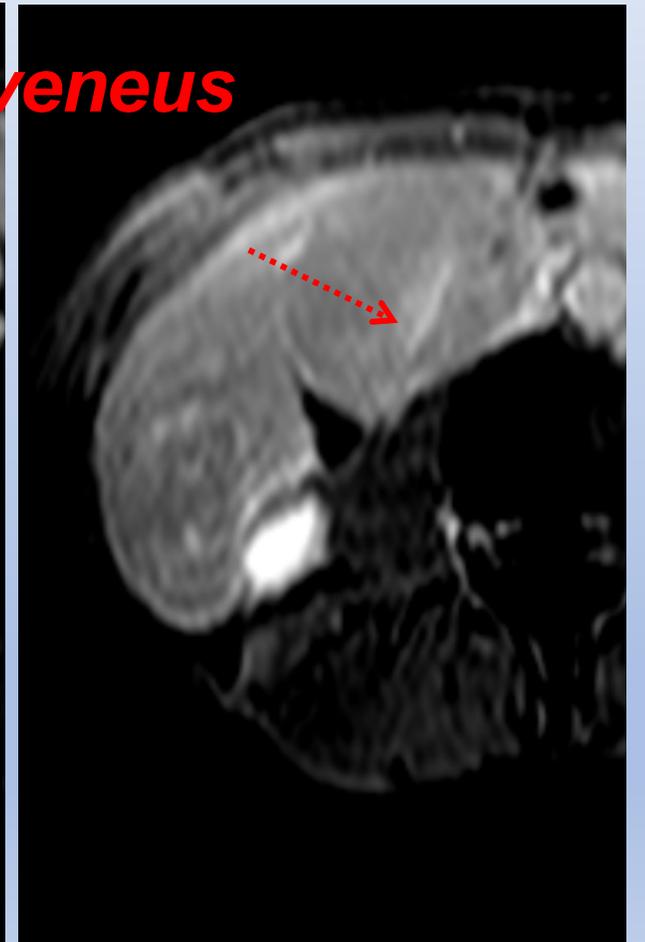
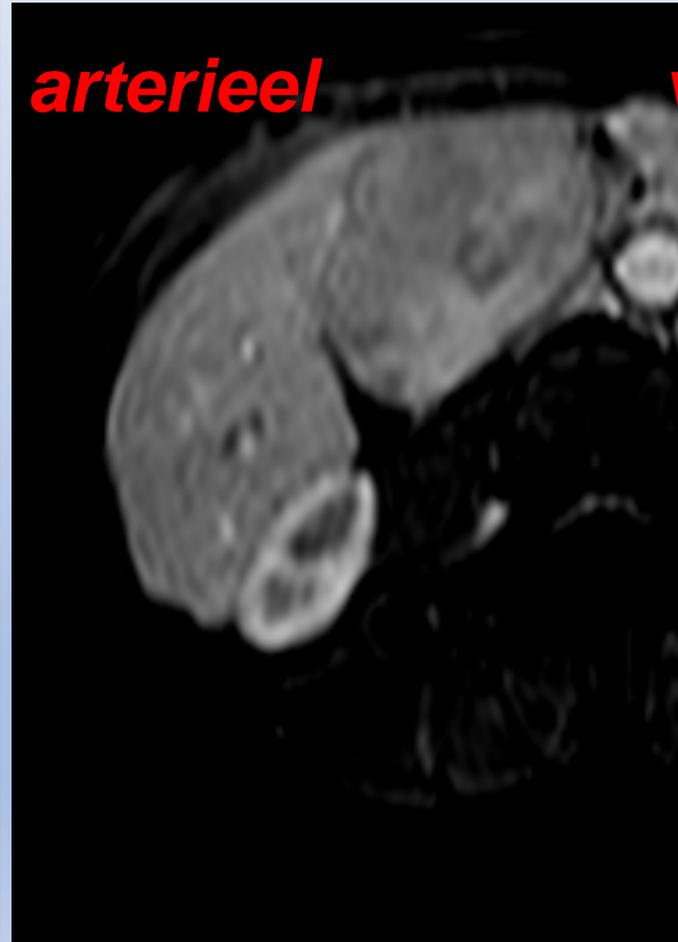


Inflammatoire type

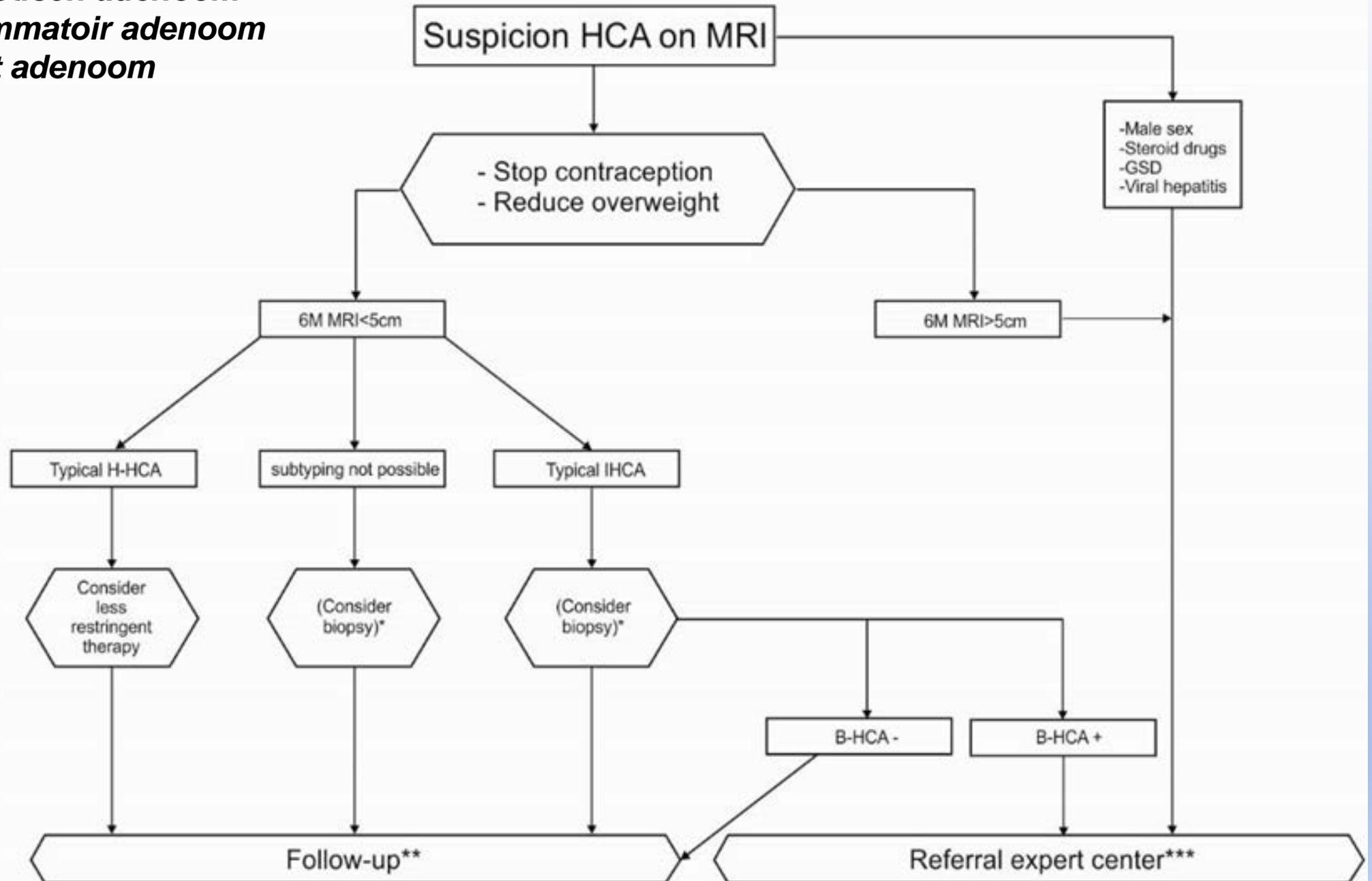
- 50%
- Atoll sign T2W
- biliaire ductuli +/-

3. β -catenine positief type, 10%-15%

Hoger risico maligne transformatie HCA > 4-5 cm, soms vage scar



H-HCA: steatotisch adenoom
IHCA: inflammatoir adenoom
B-HCA: b-cat adenoom



Take Home Messages

- MRI with liver spec. contrast is key for FNH, HCA
- FNH, conservative, no follow up
- HCA, treatment based on gender, size and pattern of progression

HCA molecular classification system

- New classification: 8 classes: 3 high risk, 5 not high risk.
- Imaging 3 (4) subtypes

Clinical manifestations

- Men: high risk of malignancy, regardless of class or size.
- Women: low-risk HCAs < 5 cm are slightly more indolent.

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Thank you !