Hôpital Beaujon AP-HP

International Congress on Coagulopathy in Liver Disease

Imaging Challenges in PVT Diagnosis

09 – 04 - 2026

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EUROPEAN JOINT PROGRAMME RARE DISEASES

VALDIG VASCULAR LIVER DISEASE GROUP

Menu

1. Tumoral vs bland PVT – a diagnostic challenge…
2. If bland, cause ? – the role of imaging

New EASL guidelines

3. Occlusion degree – quite easy…
4. Thrombosis evolution – easy ?
5. Recent vs chronic – not so easy…

PVT

What imaging to detect PVT

N 1499

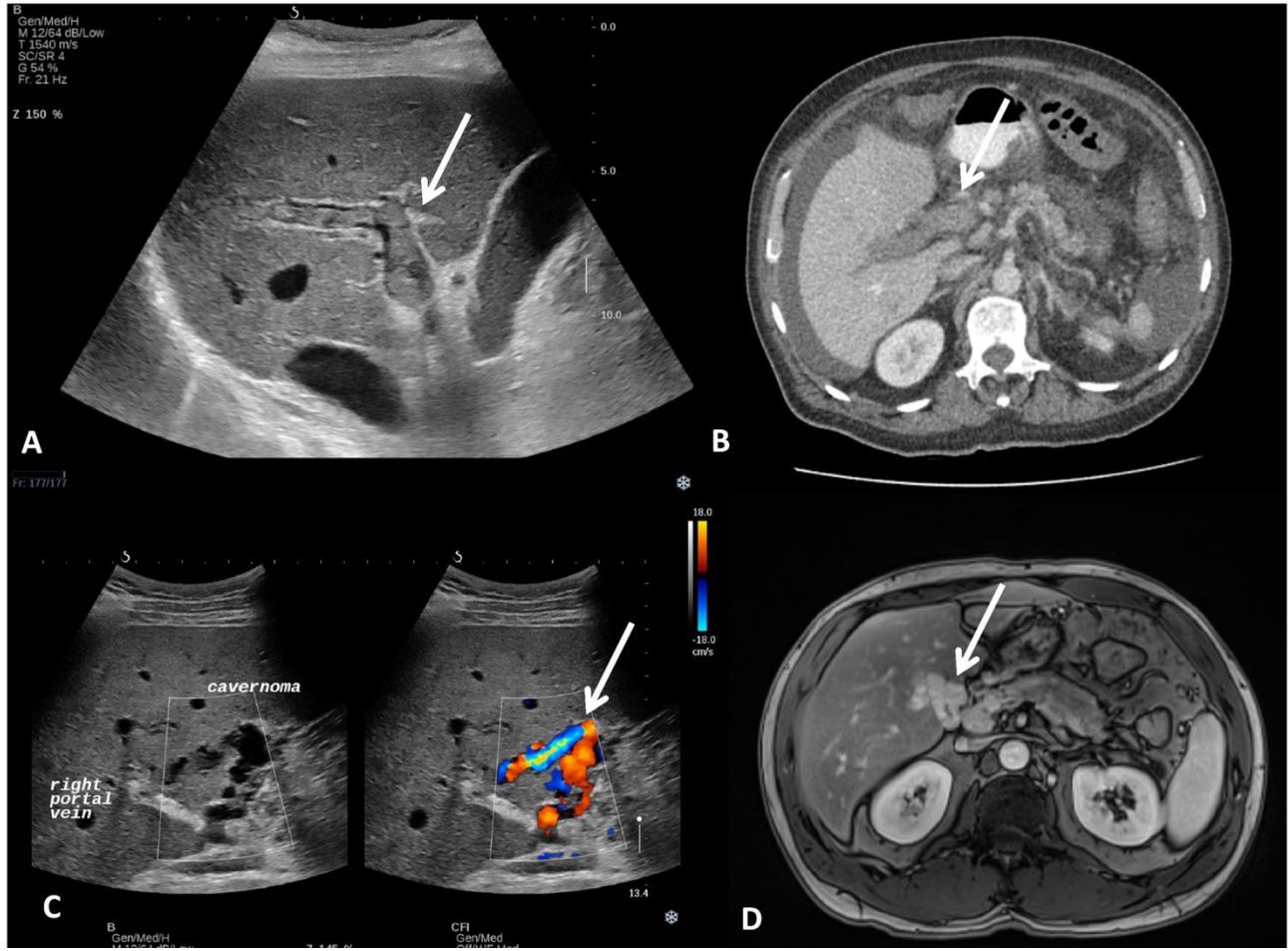
N 26

Pooled sensitivities and specificities :

0.84 (95 %CI 0.69-0.92) | 0.96 (95 %CI 0.92-0.98) for **US**
0.81 (95 %CI 0.66-0.90) | 0.96 (95 %CI 0.88-0.99) for **CT**
0.81 (95 %CI 0.65-0.90) | 0.98 (95 %CI 0.96-0.99) for **MRI**

US is the first line of assessment for PVT, with a specificity between **80** – **100** % and a sensitivity between **88** – **98**%, which is highest in cases of complete occlusion

CT examination should be performed to assess the extent of PVT, map collateral flow, and rule out complications
But also, to identify underlying causes



Girardi L. Diagnostic performance of US, CT and MRI in portal vein thrombosis: A systematic review with meta-analysis. *Thromb Res*. 2026
Margini C. Portal vein thrombosis: The role of imaging in the clinical setting. *Digestive and Liver Disease*. 2016

EASL 2026

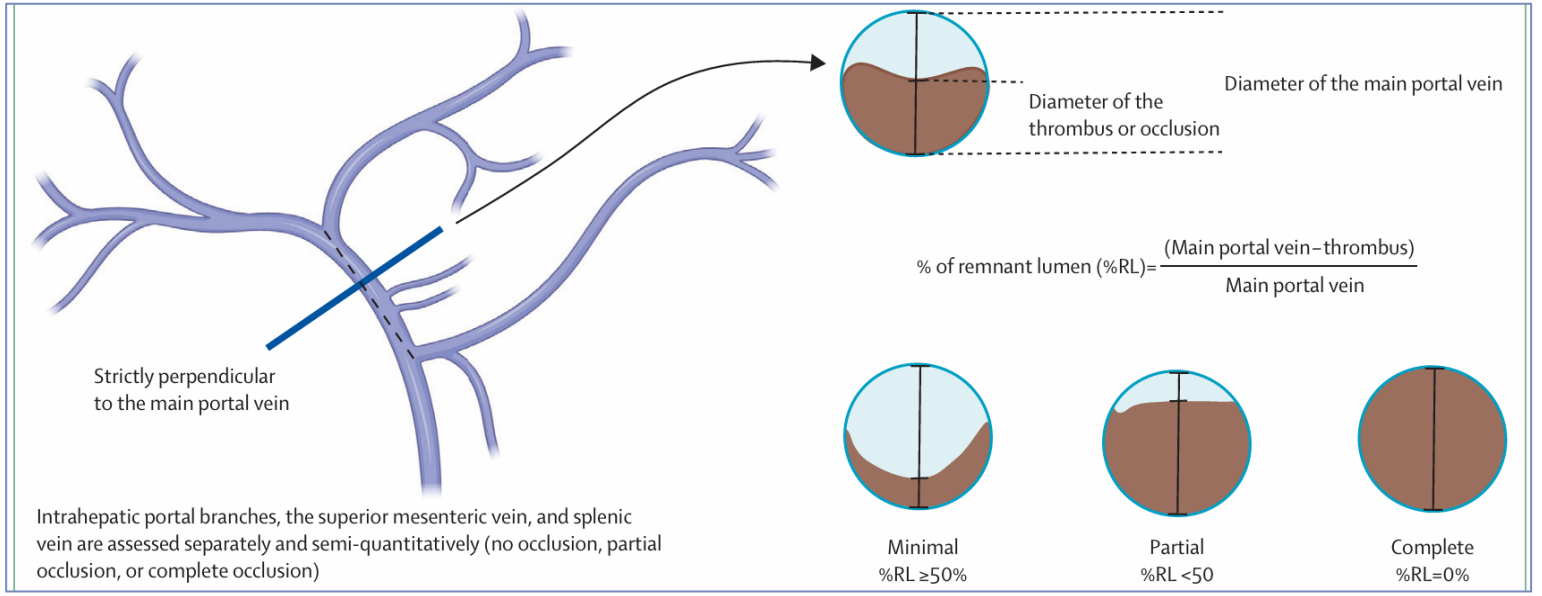
classification of portal thrombosis

"In patients <u>with</u> or <u>without</u> <u>cirrhosis</u> with PVT, a standardized description of initial site, extent, percent occlusion of main portal vein lumen, and time course is required. (LoE 5)"

The significant advance is the establishment of a uniform and detailed classification system for PVT

distinguishing between recent and chronic PVT based on a precise time interval and defining various degrees of occlusion

Feature	Definition
Time course	
Recent	PVT presumed to be present for <6 months
Chronic	PVT present or persistent for >6 months
Percent occlusion of main portal vein	
Minimally occlusive	Clot obstructing <50% of original vessel lumen
Partially occlusive	Clot obstructing >50% of original vessel lumen
Completely occlusive	No persistent lumen
Cavernous transformation	Gross porto-portal collaterals without original PV seen



EASL Clinical Practice Guidelines on vascular diseases of the liver. *J Hepatol*. 2026

Elkrief L. Portal vein thrombosis: diagnosis, management, and endpoints for future clinical studies. *Lancet Gastroenterol Hepatol*. 2024

First question

Bland or tumoral ?

LR-TIV: Malignancy with tumor in vein (TIV)

Conceptual definition: 100% certainty there is malignancy with tumor in vein

CT/MRI criterion:

Presence of definite enhancing soft tissue in vein, regardless of visualization of parenchymal mass

Suggestive but not definitive features of tumor in vein :

- Occluded vein with ill-defined walls
- Occluded vein with restricted diffusion
- Occluded or obscured vein contiguous with malignant parenchymal mass
- Heterogeneous vein enhancement not attributable to artifact

Hint: If any of these features are present, scrutinize vein for enhancing soft tissue.

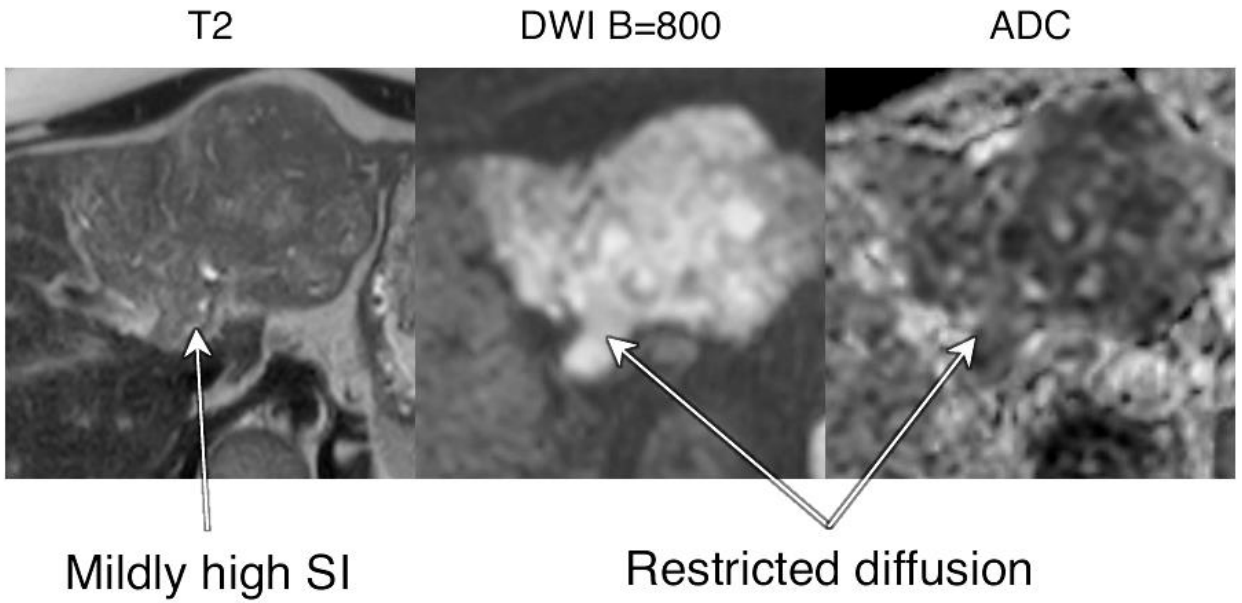
LR - TIV

Imaging criteria

Occluded vein with restricted diffusion

An occluded vein with intensity on DWI, not attributable solely to T2 shine-through, unequivocally higher than liver and/or ADC unequivocally lower than liver.

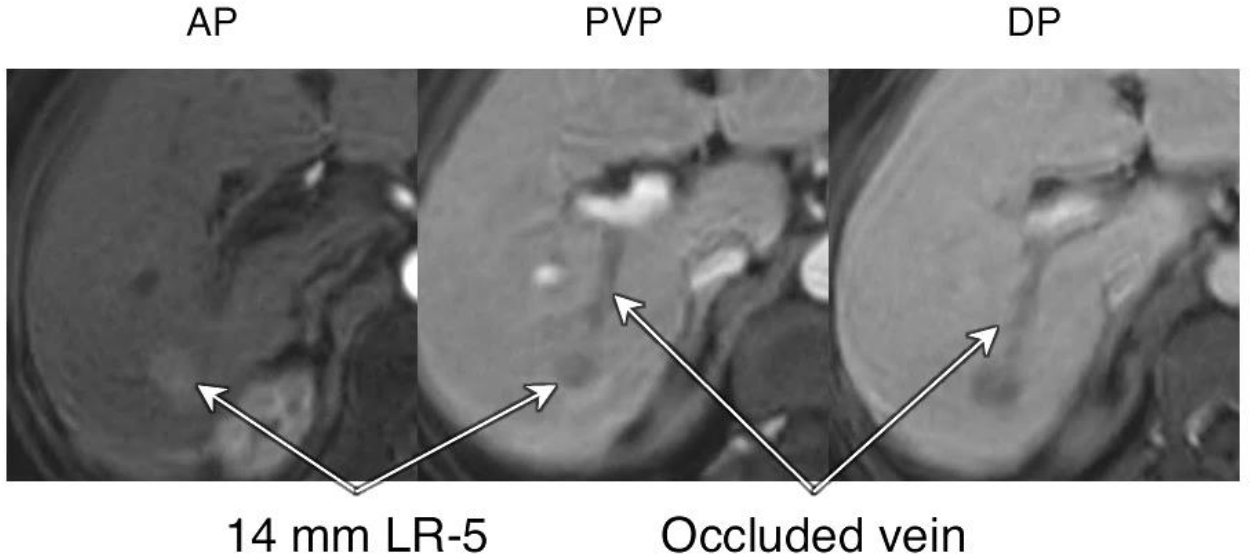
Pitfall: This is not specific for tumor in vein. It can occur in acute bland thrombus.



Occluded or obscured vein in contiguity with malignant parenchymal mass

An occluded vein that contacts a LR-5, LR-M, or path-proven malignant neoplasm in the liver parenchyma.

Pitfall: This is not specific for tumor in vein. It can occur in bland thrombus.



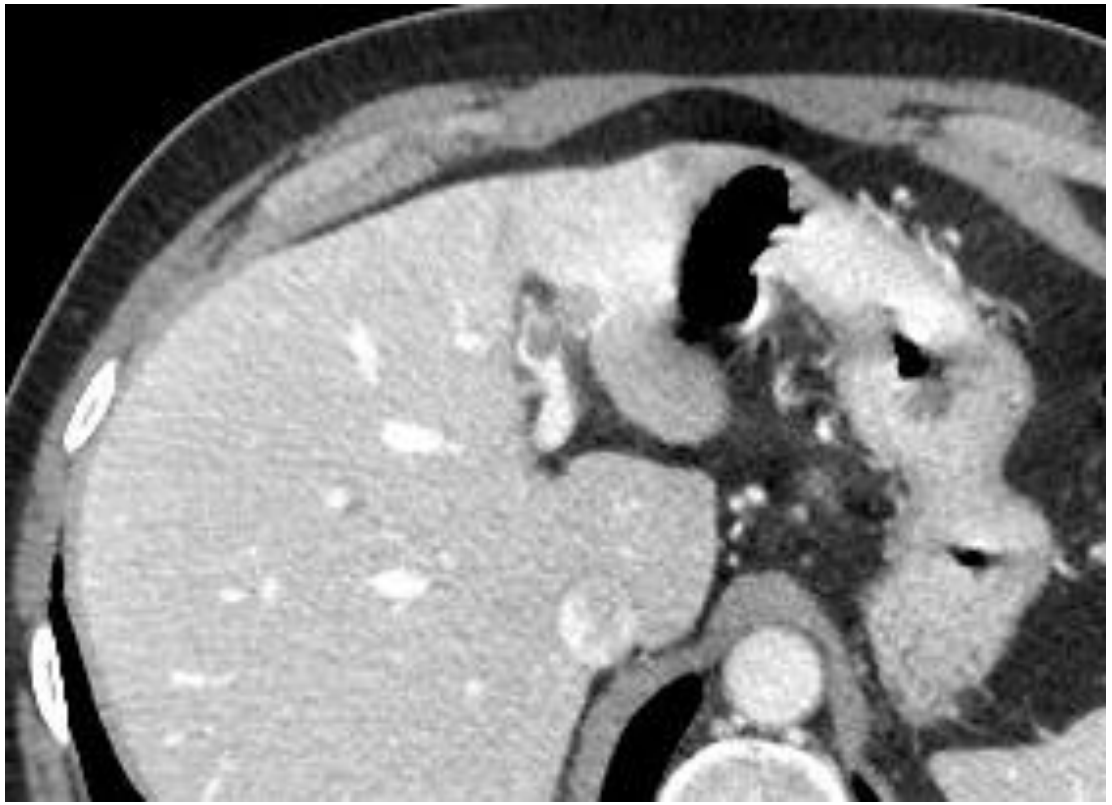
A - VENA

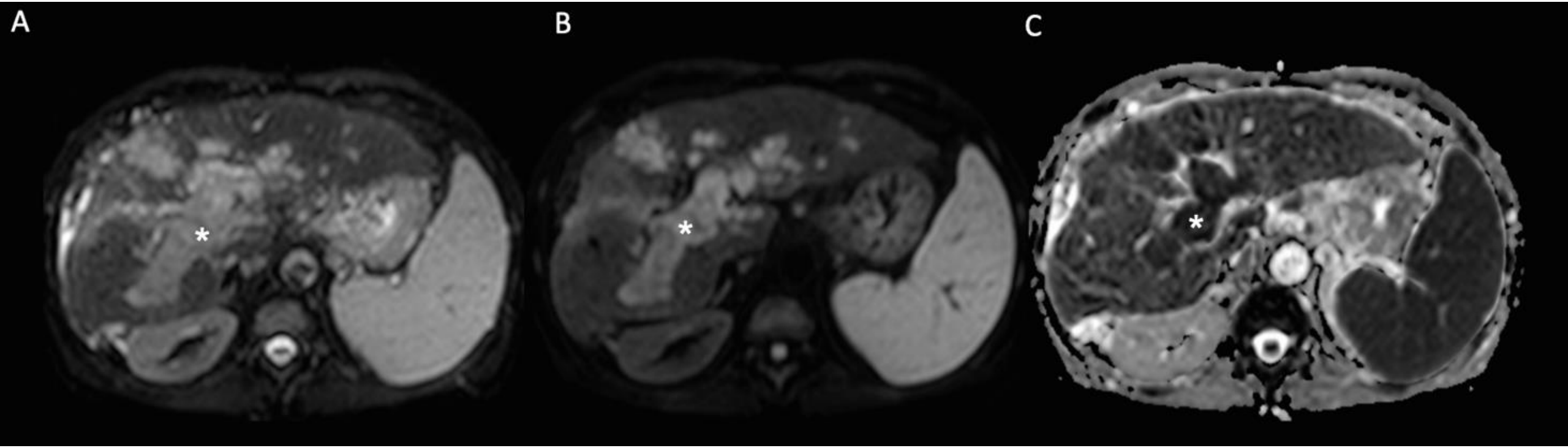
Imaging criteria + AFP

A	AFP > 1000 ng/mL
V	Venous expansion
E	Enhancement
N	Neovascularization
A	Adjacent tumour

Each criteria = 1 point

≥ 3 points = tumoral





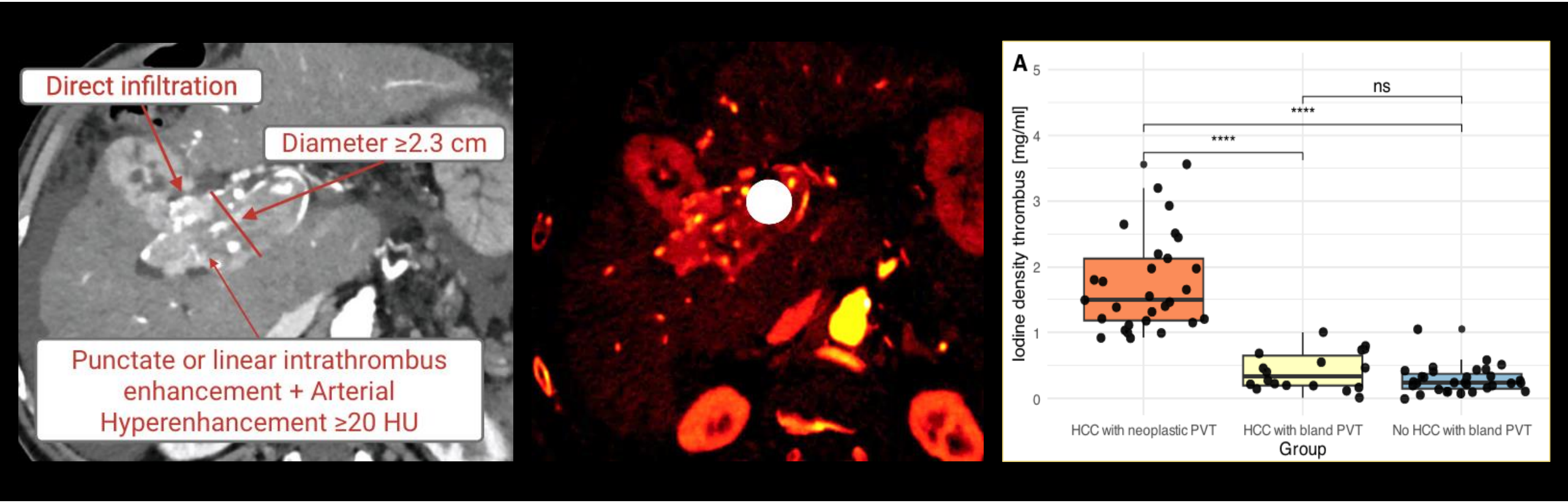
DWI and ADC map showed high sensitivity (100%) and good specificity (85%) for discrimination between bening and malignant thrombosis.

In case of malignant thrombosis, ADC values are similar to the primitive cancer

Catalano O. Differentiation of malignant vs bland thrombus of the portal vein in patients with HCC: application of DWI. *Radiology* 2010

CT

Quantitative Imaging



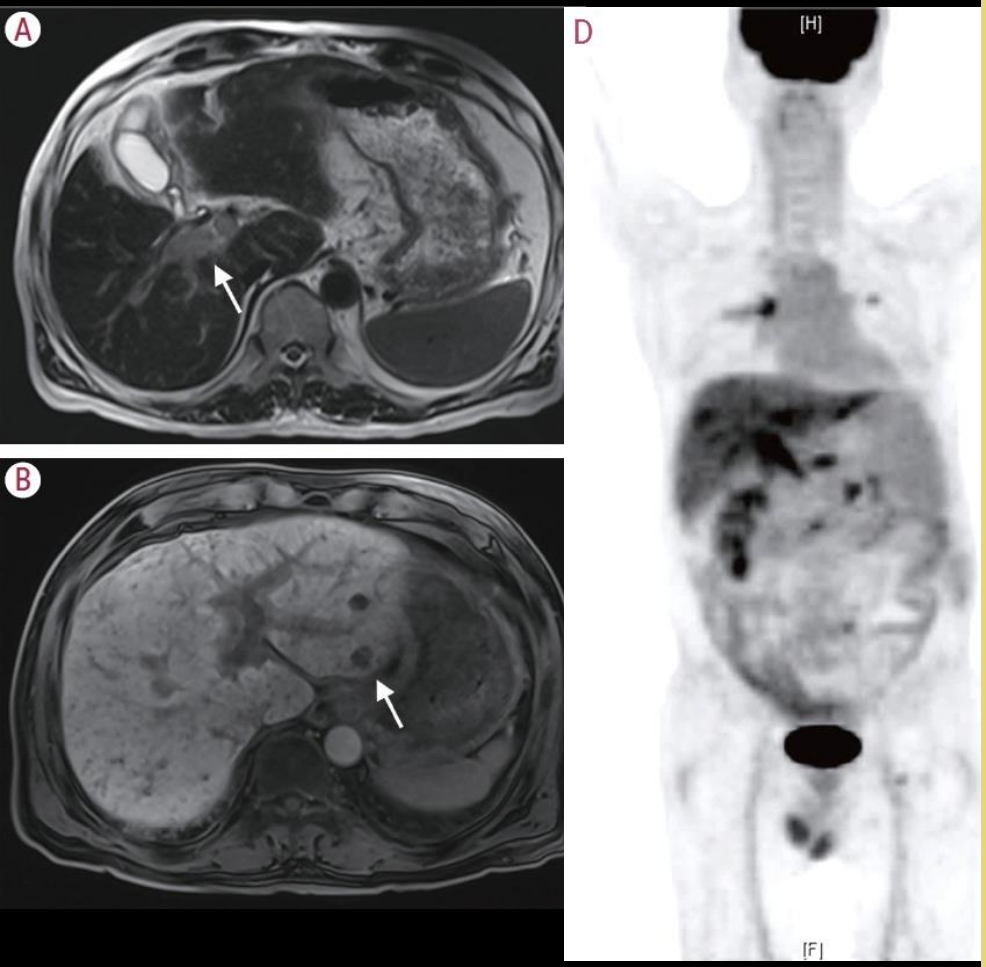
Iodine density measurements obtained with **photon-counting CT** accurately differentiated neoplastic from bland portal vein thrombosis and outperformed established morphologic CT features

Müller L. Photon-counting CT with iodine quantification: improved distinction between bland and neoplastic PVT. *Eur Radiol*. 2026

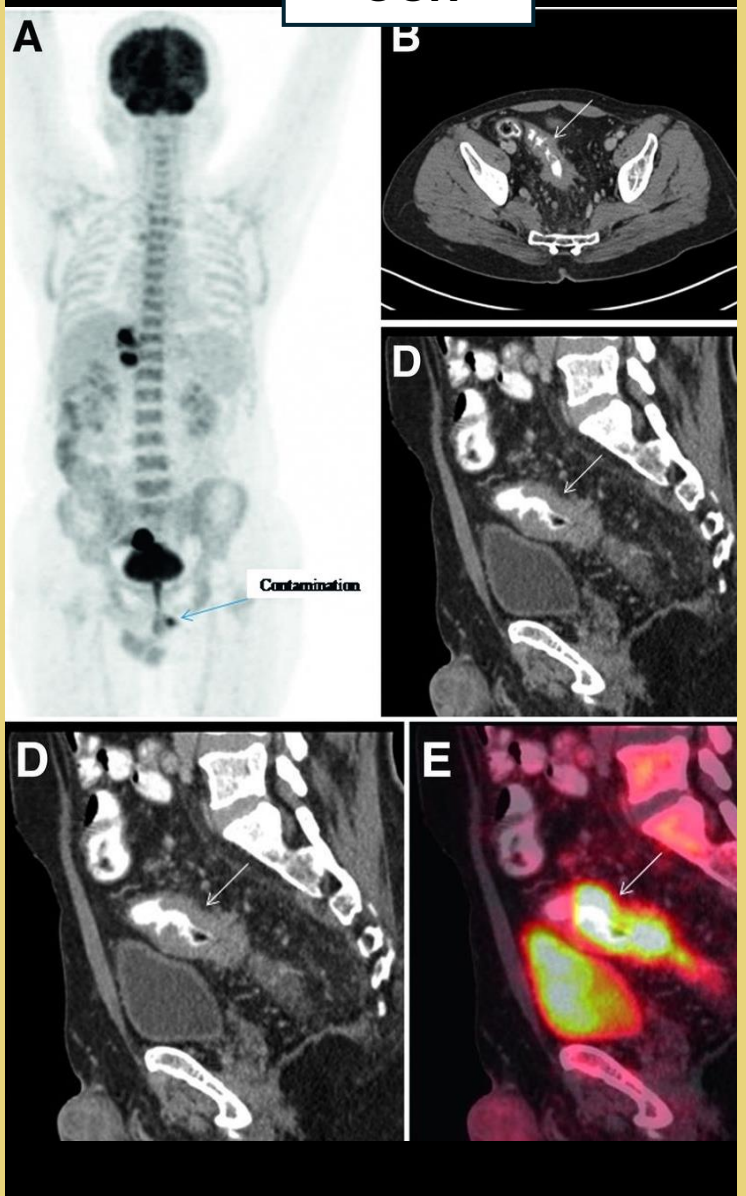
LR - TIV

Not only HCC

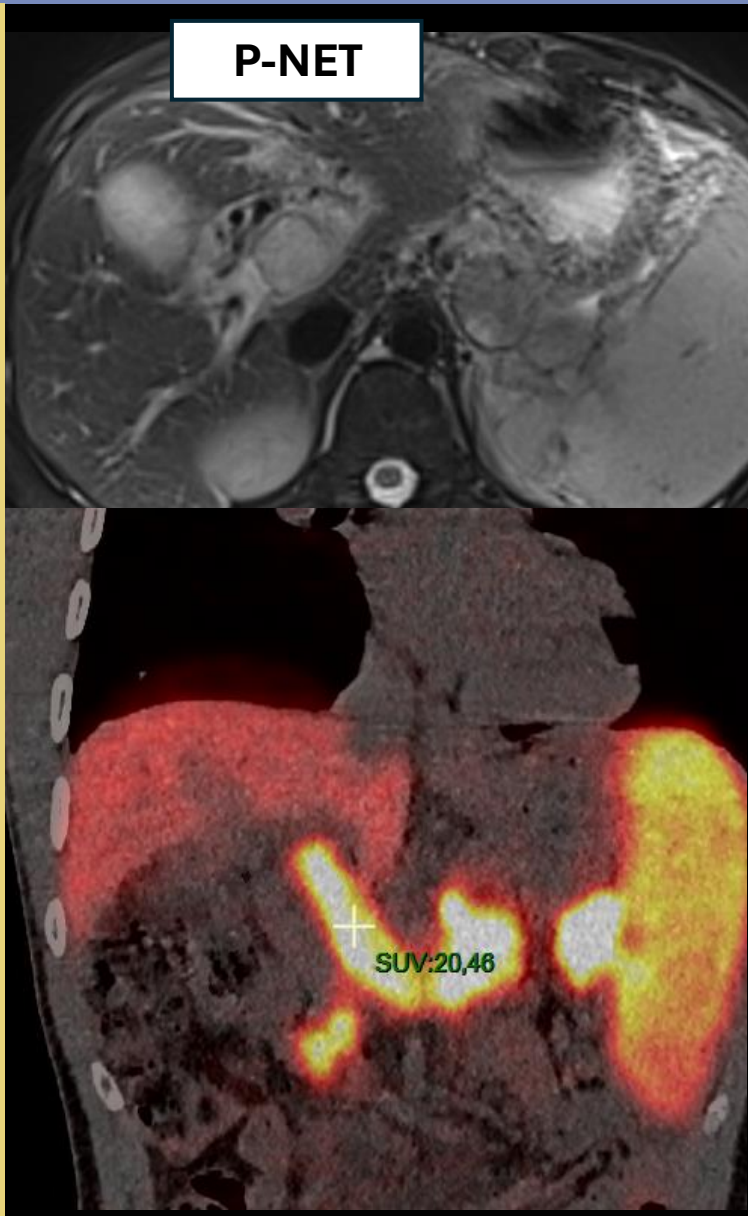
KIDNEY C



CCR



P-NET



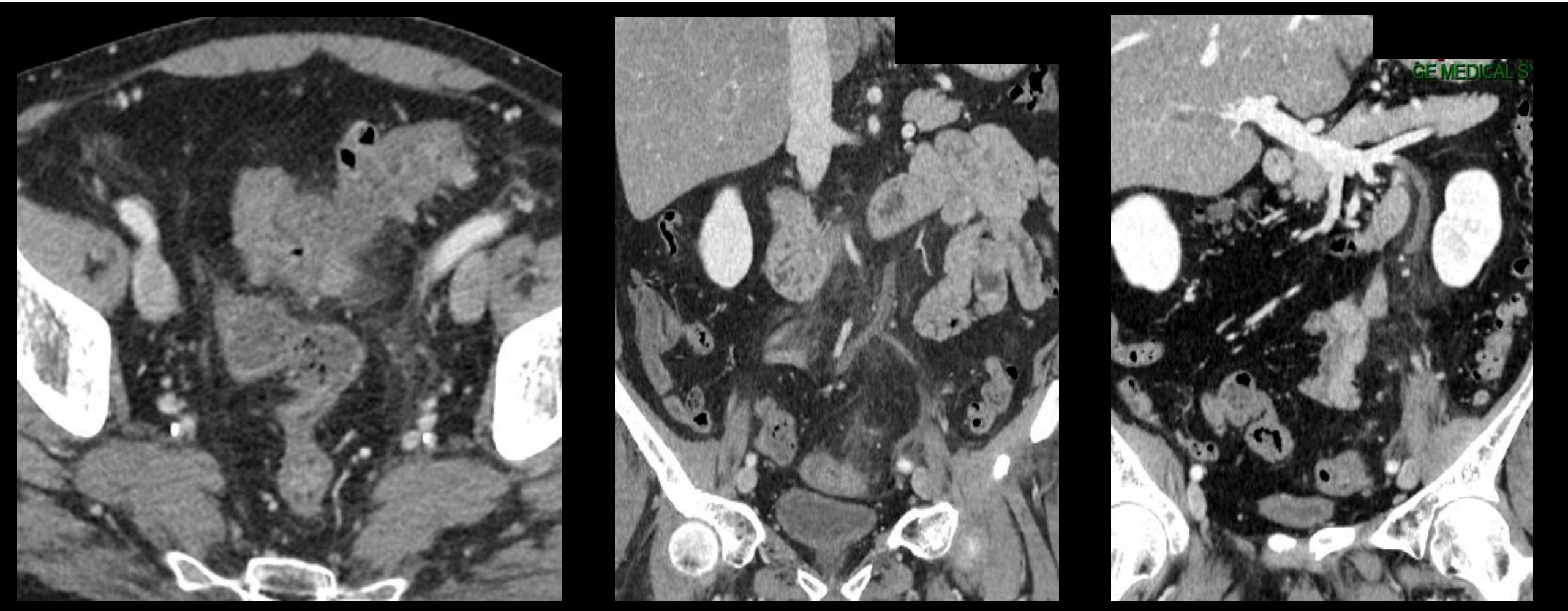
Second question

Causes - Local conditions

Local cause in approximately 30% of the cases

PVT induced by inflammation/infection can be seen close to the site

PVT may extend and/or embolize to portal trunk and branches



In practice

When I found a PVT

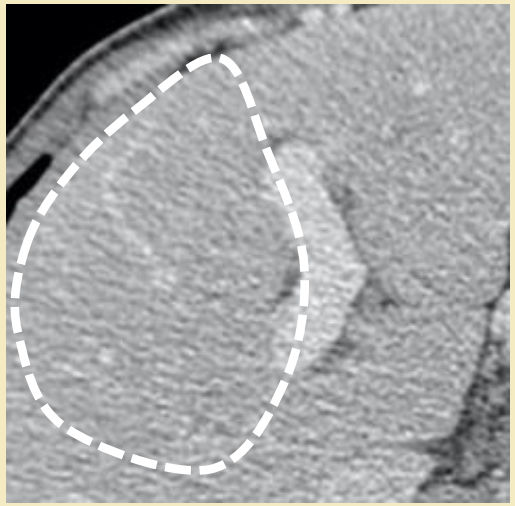
	cACLD	Normal liver	PSVD
PVT incidence	10% (5 years)	Rare +++	30% (5 years)
Disease Prevalence	Common	Very frequent	Rare ++

In patients with recent PVT, a complete clinical evaluation must be performed including searching for risk factors for cirrhosis and conditions associated with PSVD, determination of liver blood tests, liver stiffness measurement, **evaluation of liver morphology at imaging**

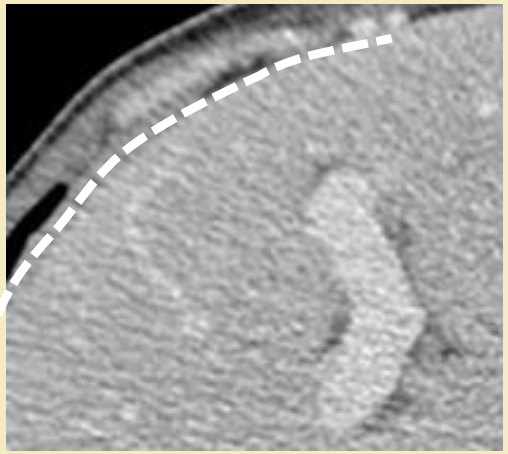
(LoE 5)

Morphology

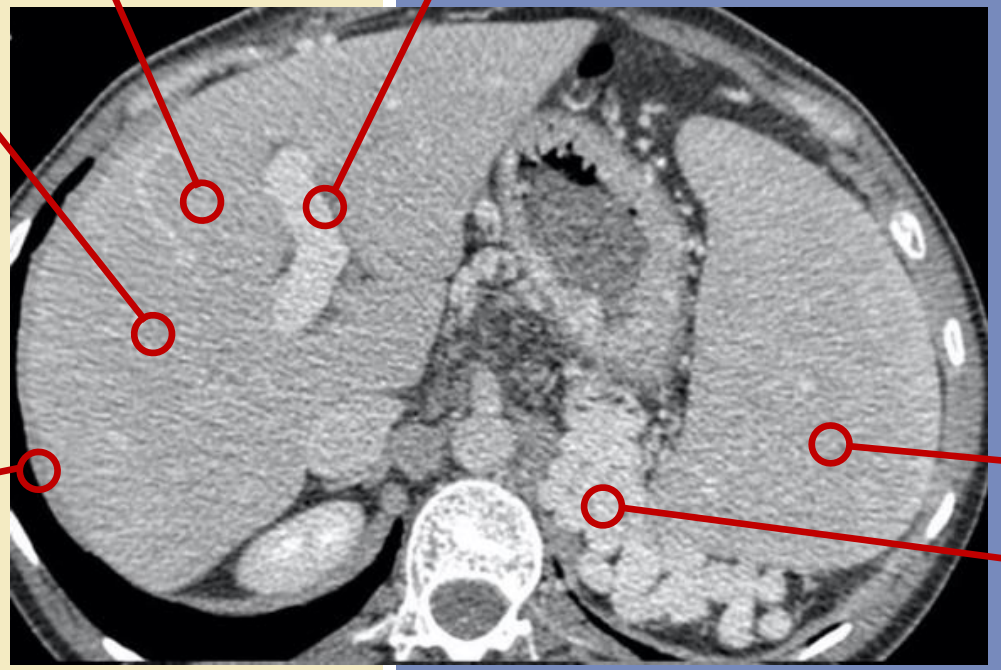
Pre-sinusoidal morphology



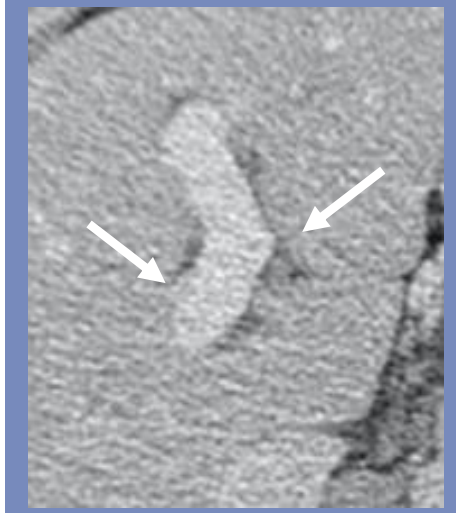
Segment IV normal ou large



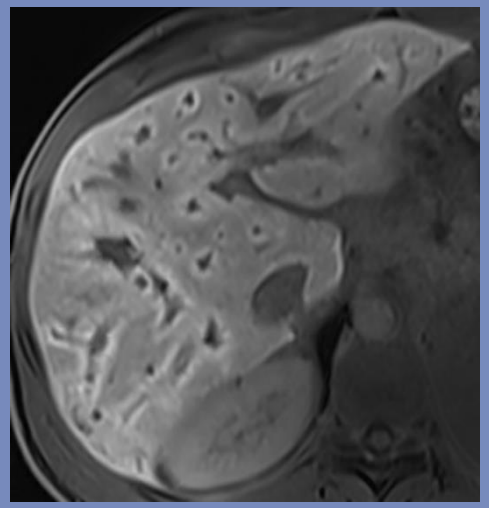
Smooth Margins



Vascular anomalies

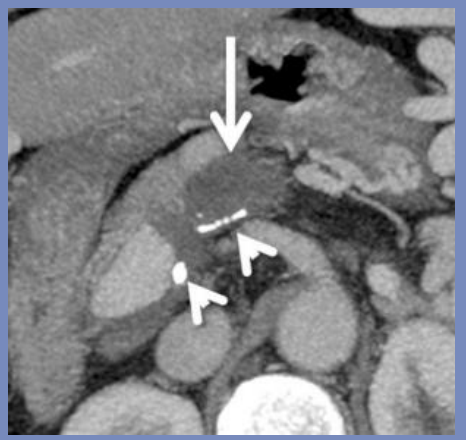


Small segmental portal veins



Periportal HBP hyperintensity

Hepatic Veins shunts



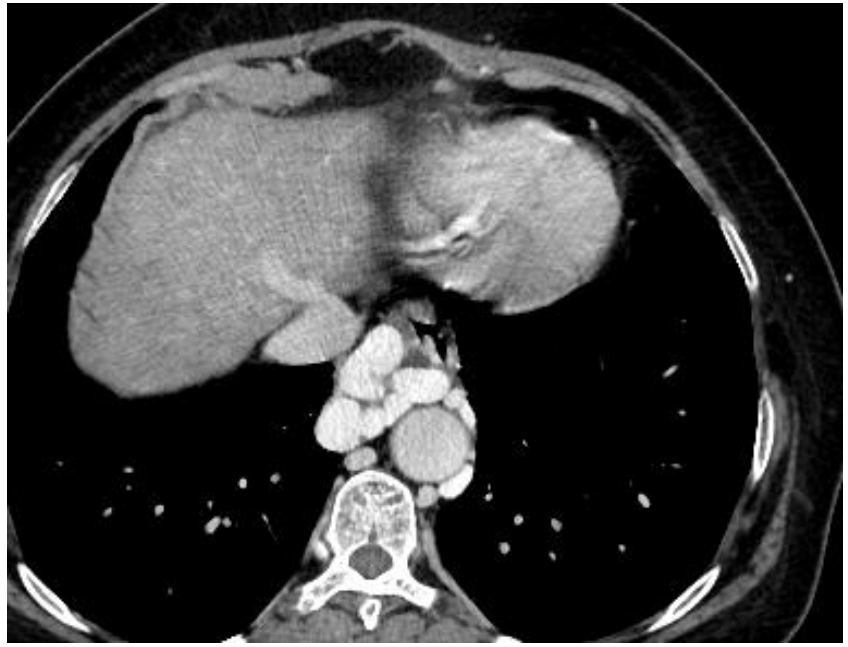
PVT and portal wall calcifications

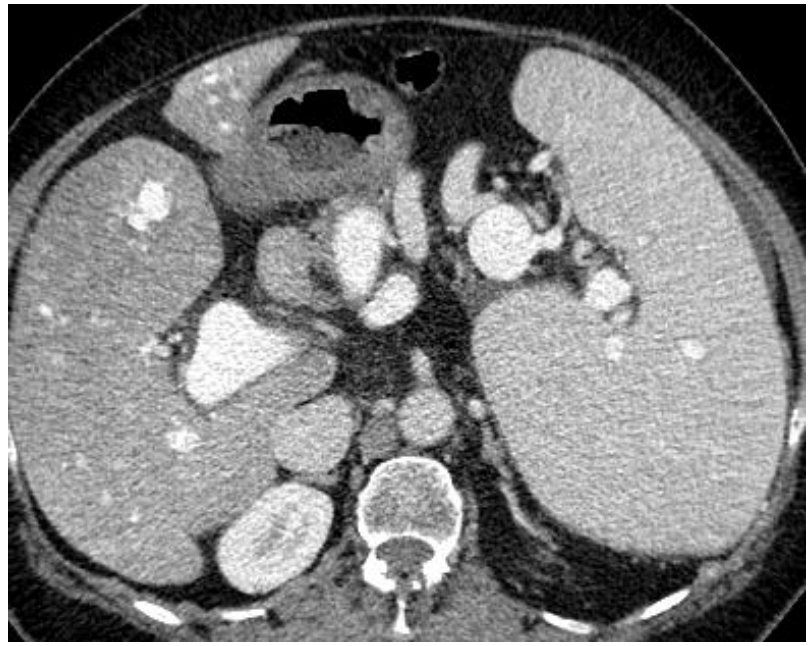
Portal Hypertension

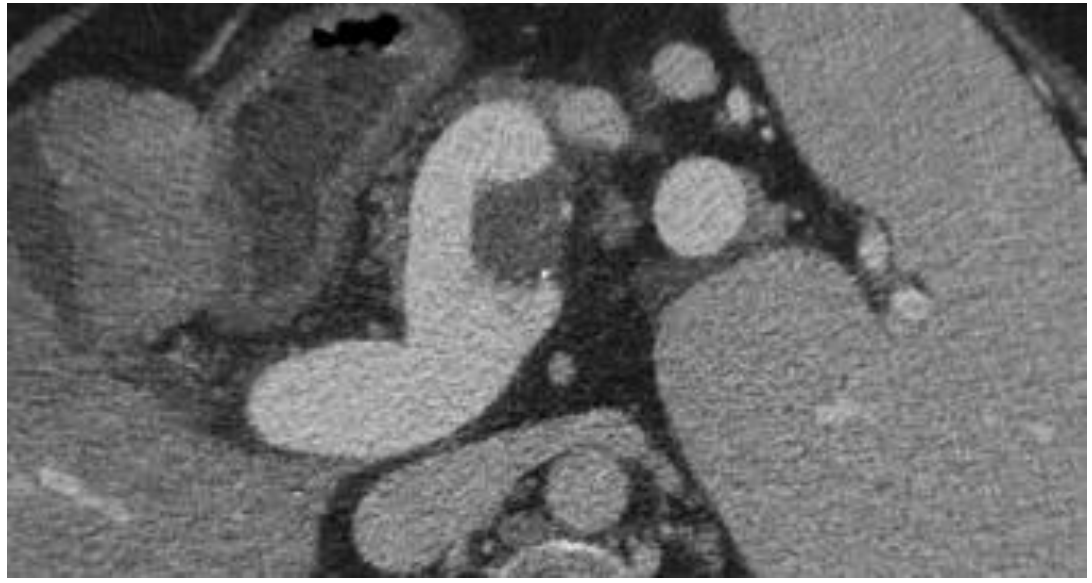
- Splénomégaly +++
- Porto-systémic shunts

PSVD

Imaging



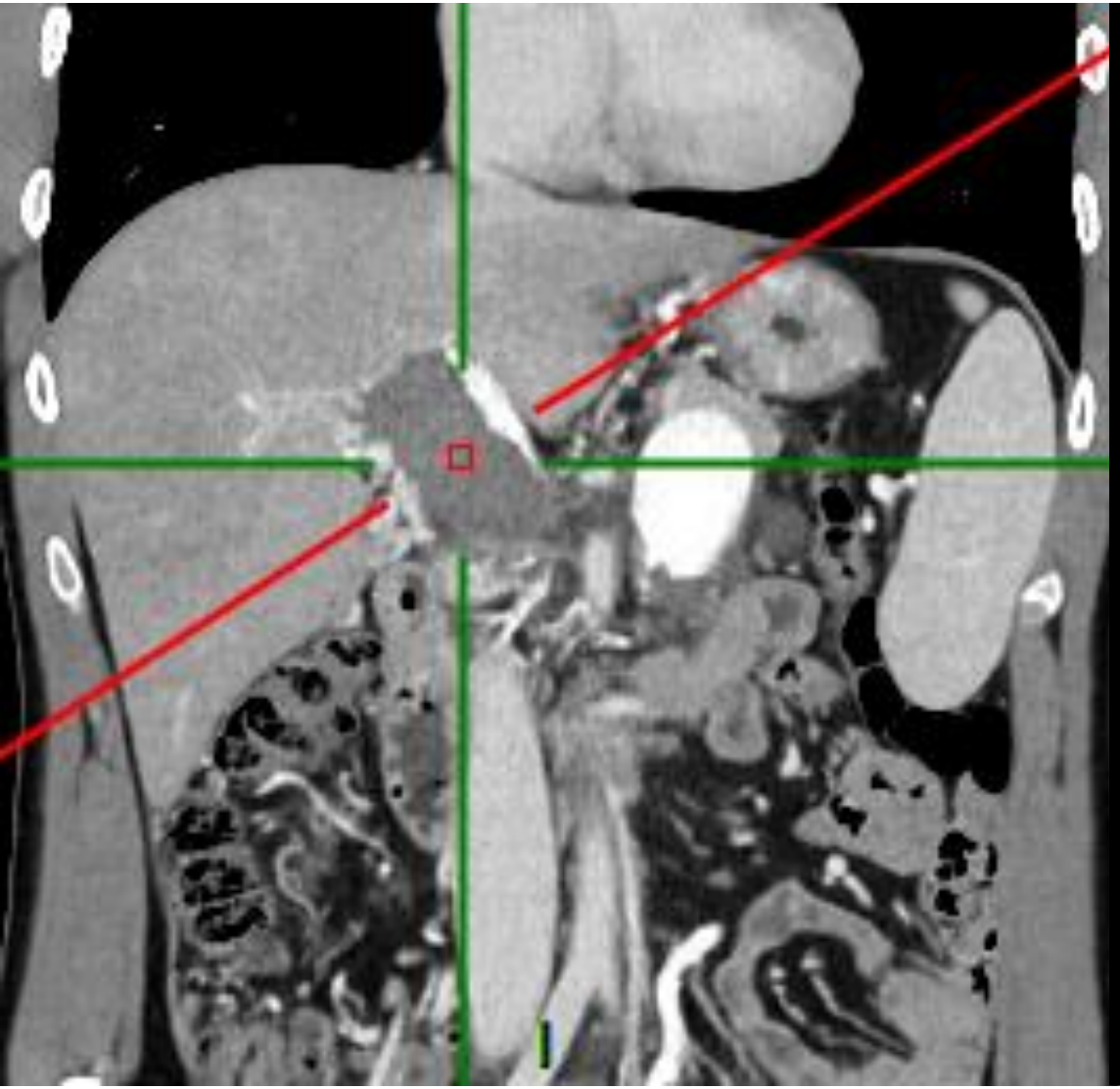


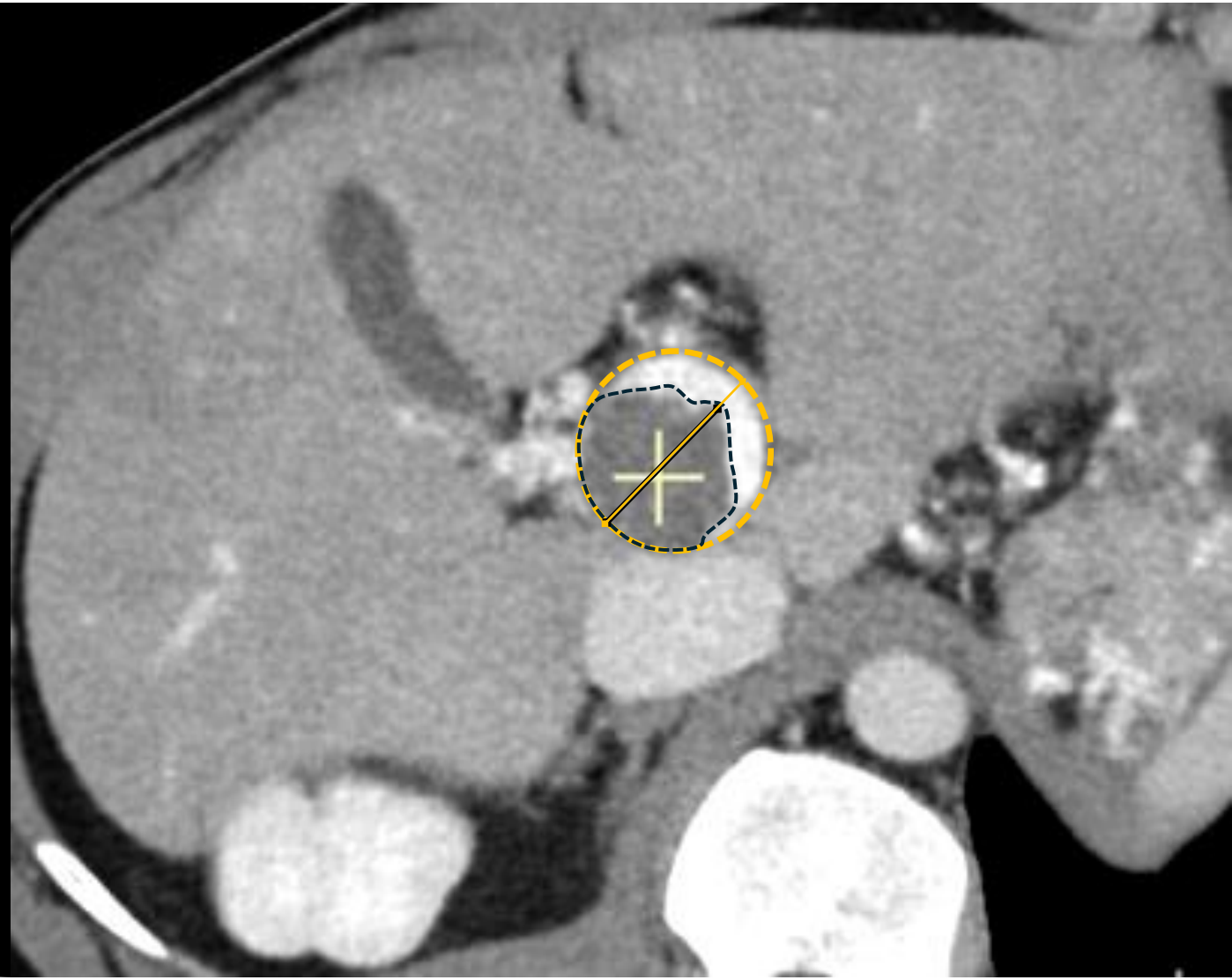


- PH signs
- Large PV branches and abrupt caliber reduction
- Smooth liver surface
- Normal- sized or enlarged segment IV
- Splenomegaly (often +++)
- **PVT and mural portal calcification**

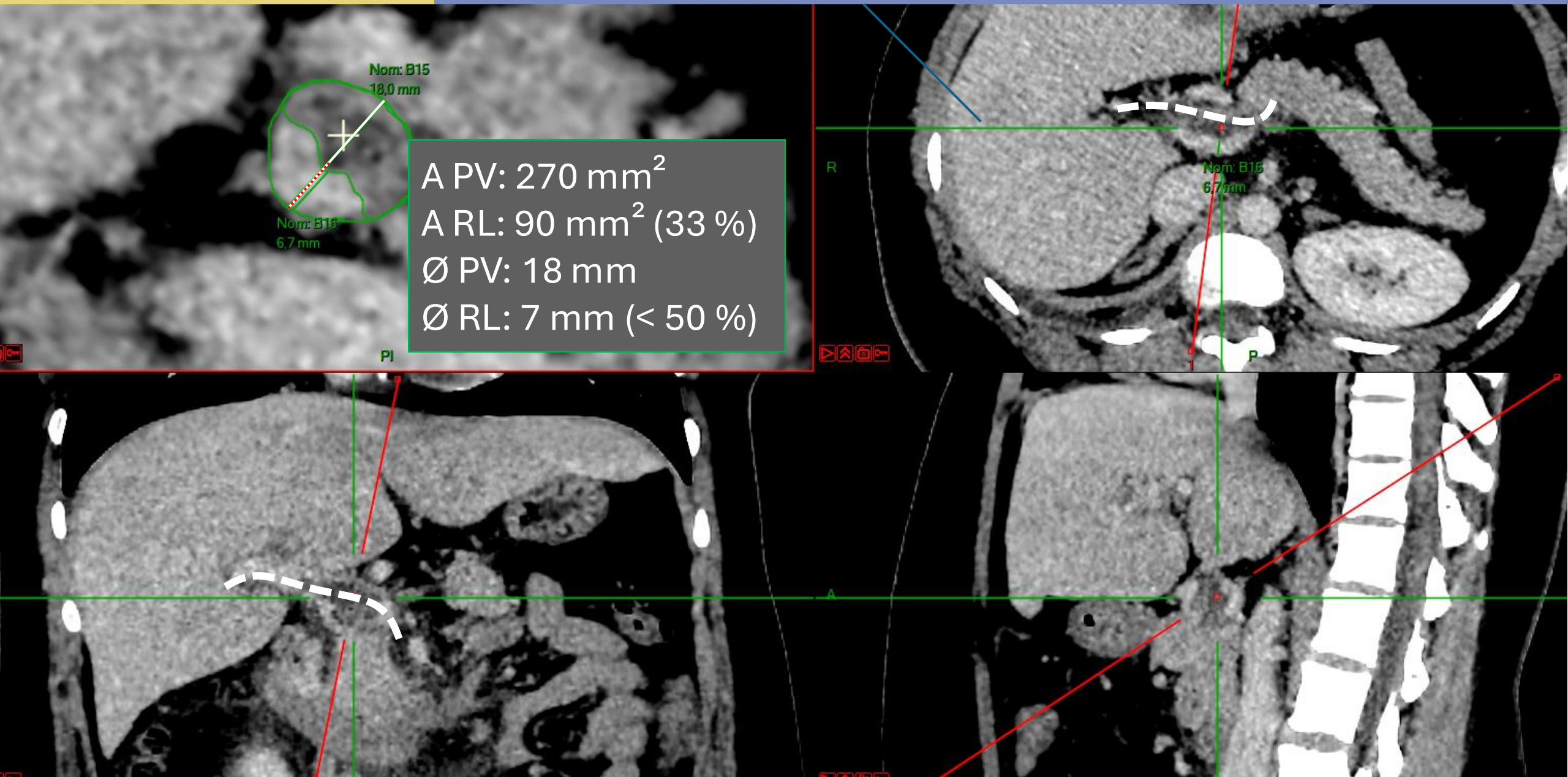
Third question

How to measure portal thrombosis ?





How to measure portal thrombosis ?



A PV: 270 mm^2
A RL: 90 mm^2 (33 %)
Ø PV: 18 mm
Ø RL: 7 mm (< 50 %)

Ø vs A

Inter-reader agreement for the assessment of PVT

N 44

2 centres

Ø ICC = 0.923 (0.860–0.958)
A ICC = 0.712 (0.529–0.832)

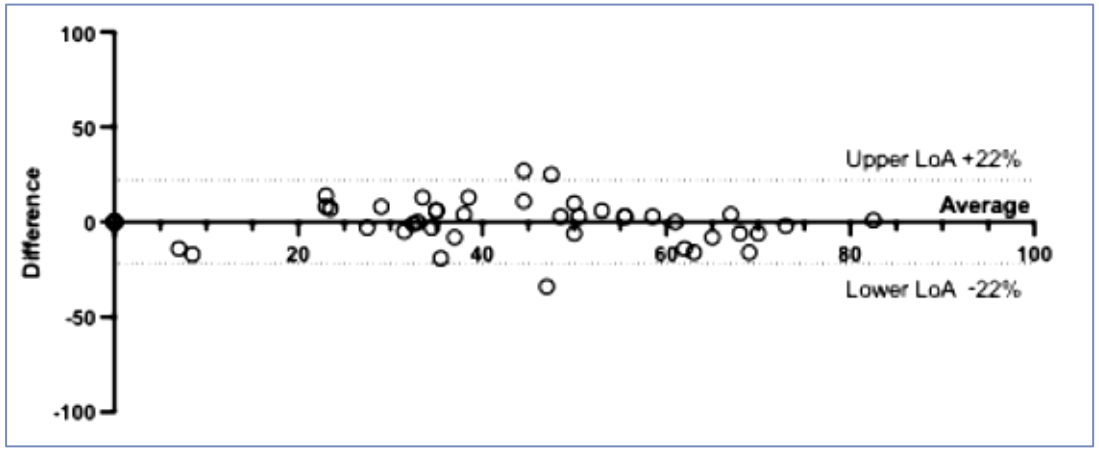
3-tier classification system:
- <50% occlusion
- ≥50% occlusion
- Complete occlusion (100%)

Ø = 80% agreement | K = 0.65
A = 73% agreement | K = 0.58

4-tier classification system:
- 0-25% occlusion
- 26-50% occlusion
- 51-75% occlusion
- 76-100% occlusion

Ø = 76% agreement | K = 0.58
A = 68% agreement | K = 0.38

Ø



Substantial inter-reader variability depending on the measurement method

Ø residual lumen has excellent reprod, better than Area

3-tier classification of PVT has higher inter-reader agreement than 4-tier

These findings support the use of simplified, Ø criteria as reliable endpoints for clinic and research

Plaforet V. Inter-reader agreement for the assessment of portal vein thrombosis. *Abdom Radiol, In Press*

Fourth question

Evolution of portal thrombosis

Definition of a standardized system for describing and assessing the evolution of PVT over time or in response to treatment

Standardized Framework like RECIST 1.1

The core concepts are:

- to assess thrombus of the main portal vein
- to assess the thrombus of the upstream and downstream veins
- to assess the occurrence of new thrombus in veins initially free from thrombus
- to combine the above assessments to categorize patients into 4 categories:

1) complete resolution
2) improvement
3) stability
4) progression of the thrombus

EASL 2026

Evolution of portal thrombosis

Response to treatment or interval change			
Main portal vein thrombus	**Thrombus of the upstream and downstream veins ***	**New thrombus site**	**Overall assessment**
Complete resolution ∫	Complete resolution ∫	No	Complete resolution
Complete resolution ∫	No complete resolution or no unequivocal progression ‡	No	Improvement
Complete occlusion that becomes partial; increase by more than 25% of the %RL	Complete resolution; no unequivocal progression	No	Improvement
Increase or decrease of 25% or less of the %RL	No complete resolution or no unequivocal progression ‡	No	Stability
Partial occlusion becoming complete; decrease by more than 25% of the %RL	Any	Any	Progression
Any	Unequivocal progression of one or more thrombosis site	Any	Progression
Any	Any	Yes	Progression

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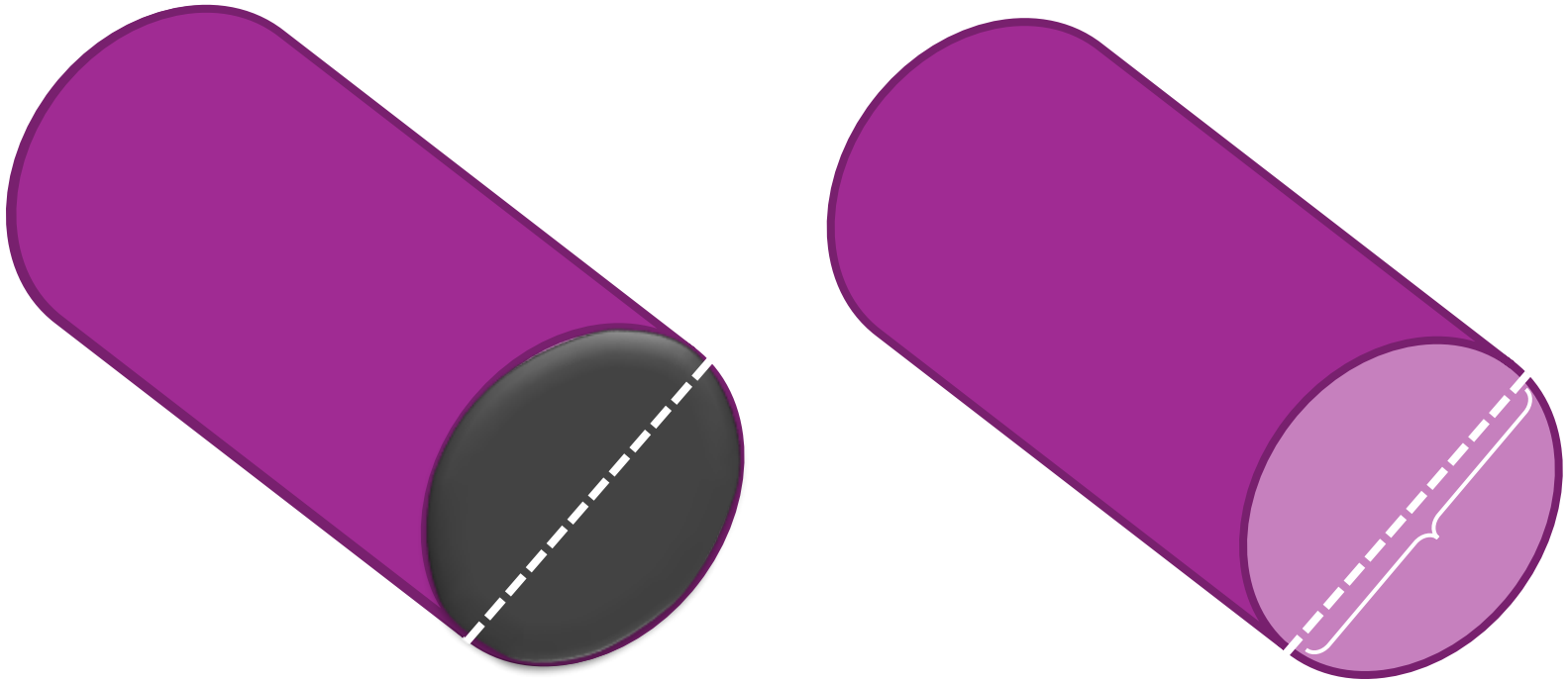
Evolution of portal thrombosis

Response to treatment or interval change			
Main portal vein thrombus	**Thrombus of the upstream and downstream veins ***	**New thrombus site**	**Overall assessment**
Complete resolution ∫	Complete resolution ∫	No	Complete resolution



COMPLETE RESOLUTION

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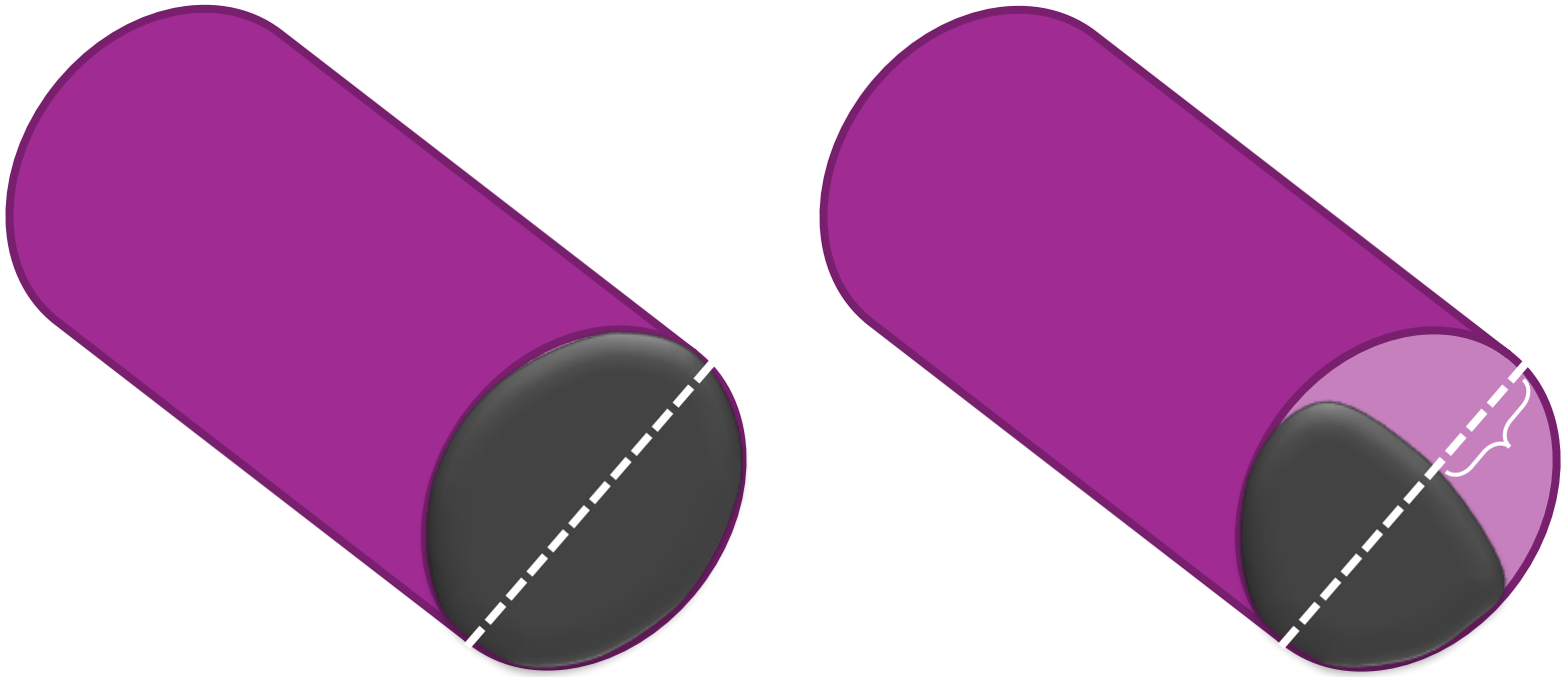
Evolution of portal thrombosis

Response to treatment or interval change			
Main portal vein thrombus	**Thrombus of the upstream and downstream veins ***	**New thrombus site**	**Overall assessment**
Complete occlusion that becomes partial; increase by more than 25% of the %RL	Complete resolution; no unequivocal progression	No	Improvement



IMPROVEMENT

RL% 40

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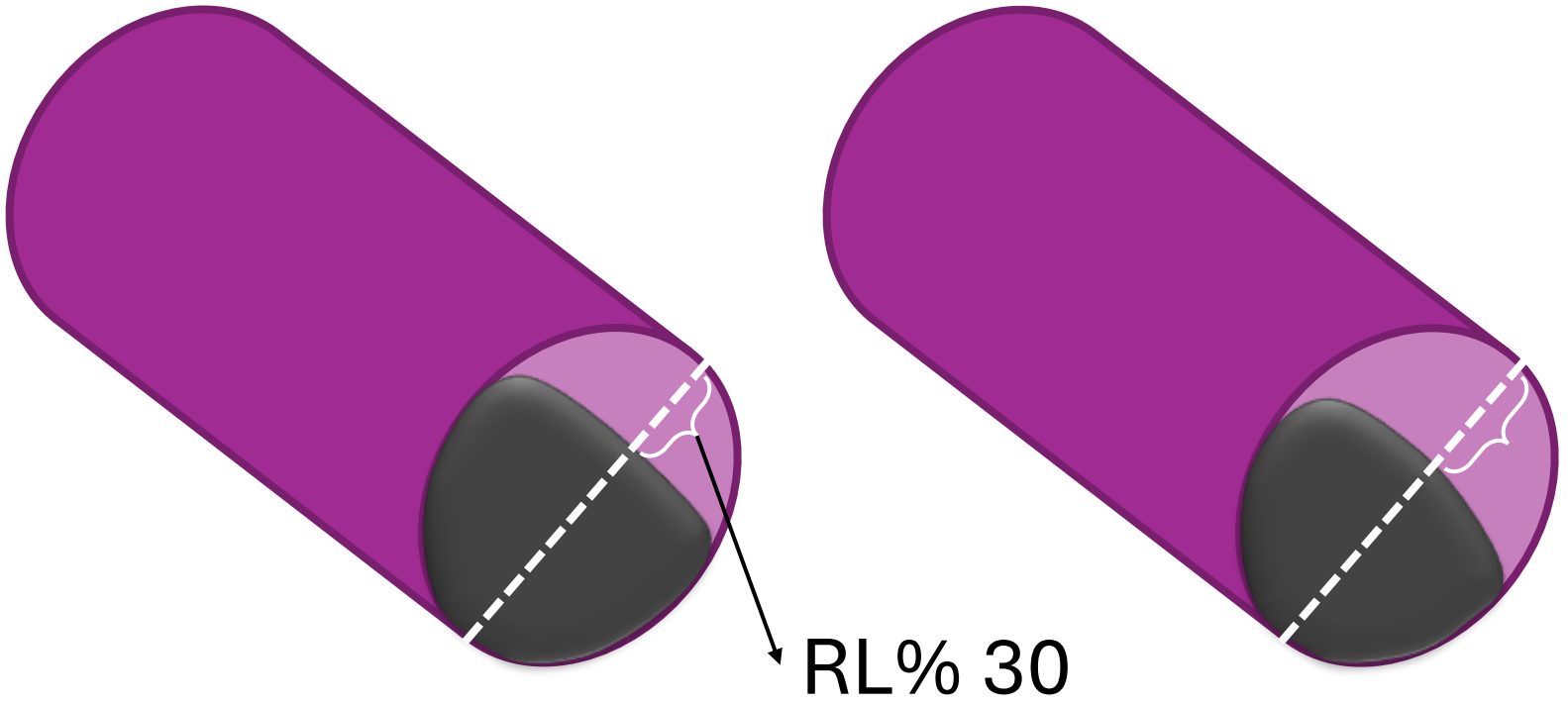
Evolution of portal thrombosis

Response to treatment or interval change			
Main portal vein thrombus	**Thrombus of the upstream and downstream veins ***	**New thrombus site**	**Overall assessment**
Increase or decrease of 25% or less of the %RL	No complete resolution or no unequivocal progression ‡	No	Stability



STABILITY

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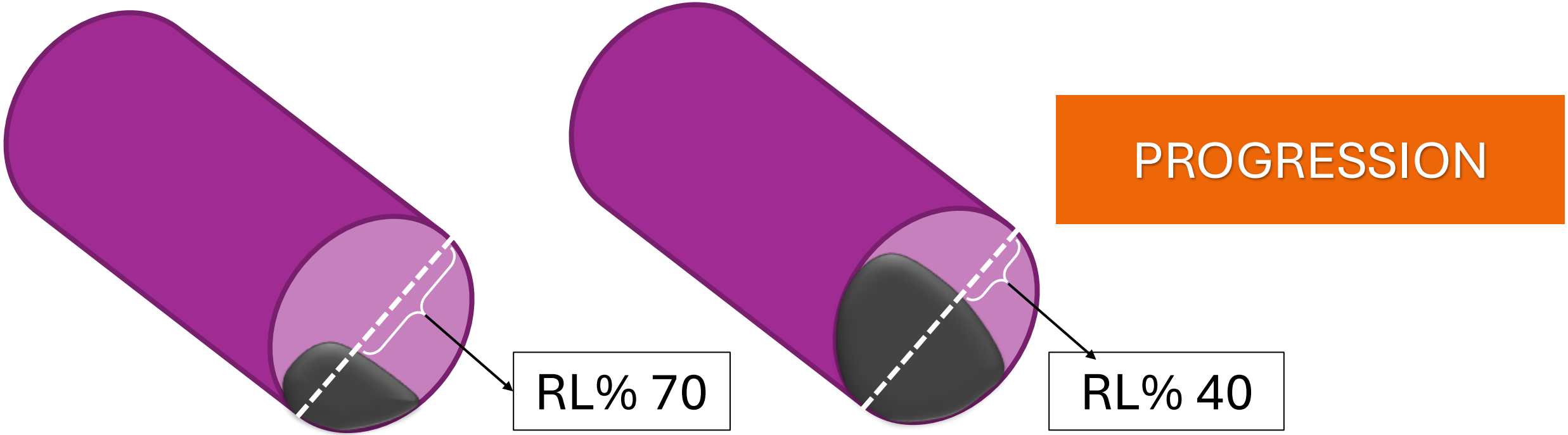
Evolution of portal thrombosis

Response to treatment or interval change			
Main portal vein thrombus	**Thrombus of the upstream and downstream veins ***	**New thrombus site**	**Overall assessment**
Partial occlusion becoming complete; decrease by more than 25% of the %RL	Any	Any	Progression



PROGRESSION

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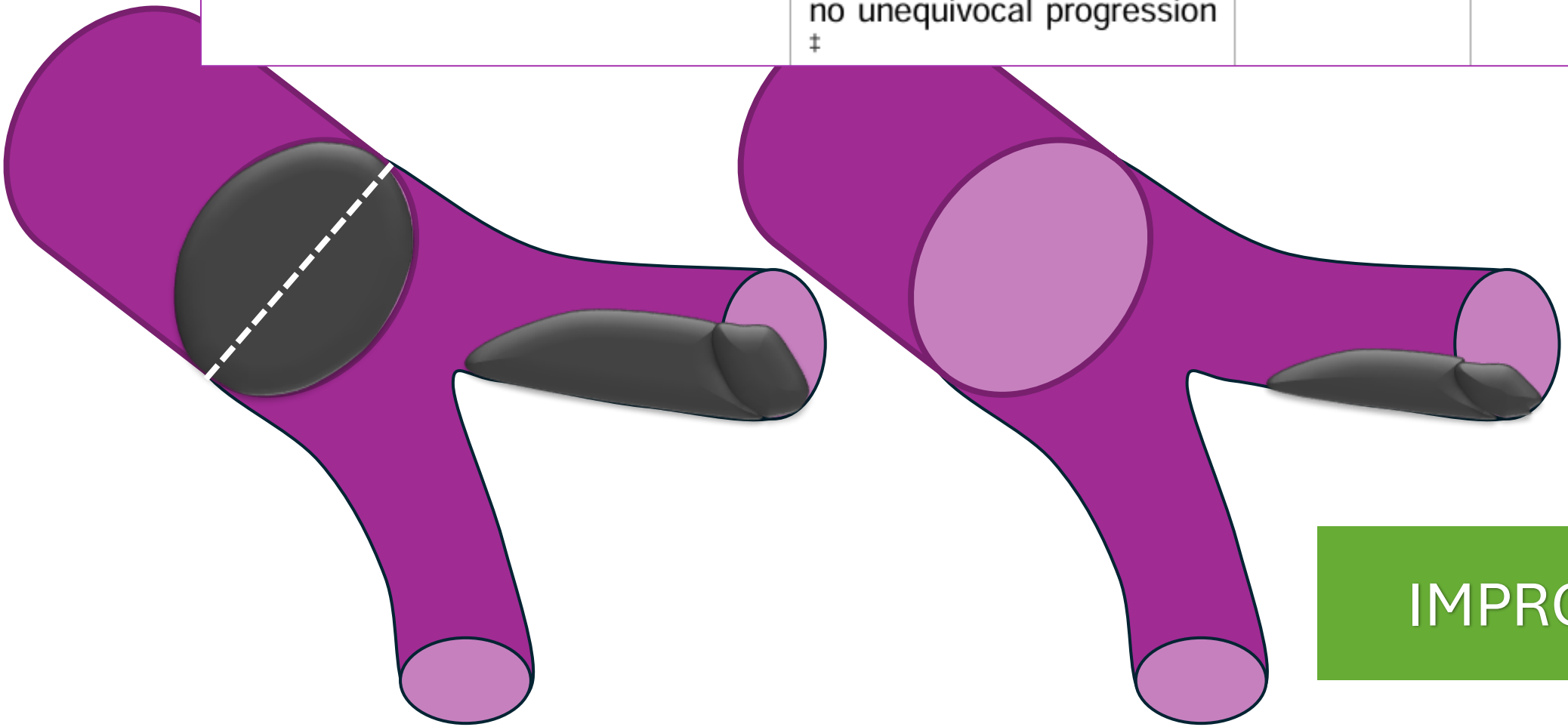
Evolution of portal thrombosis

Response to treatment or interval change			
Main portal vein thrombus	**Thrombus of the upstream and downstream veins ***	**New thrombus site**	**Overall assessment**
Complete resolution ∫	No complete resolution or no unequivocal progression ‡	No	Improvement



IMPROVEMENT

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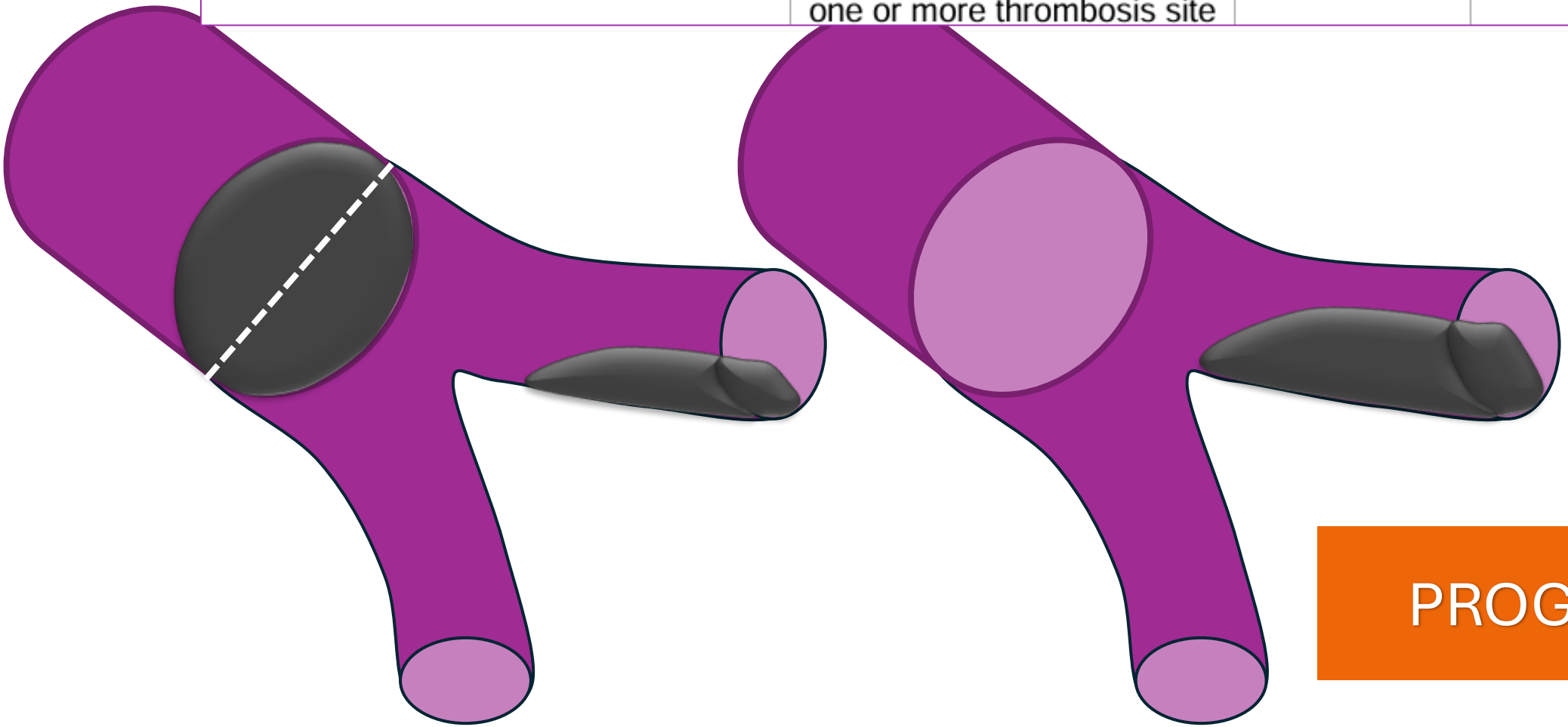
Evolution of portal thrombosis

Response to treatment or interval change			
Main portal vein thrombus	**Thrombus of the upstream and downstream veins ***	**New thrombus site**	**Overall assessment**
Any	Unequivocal progression of one or more thrombosis site	Any	Progression



PROGRESSION

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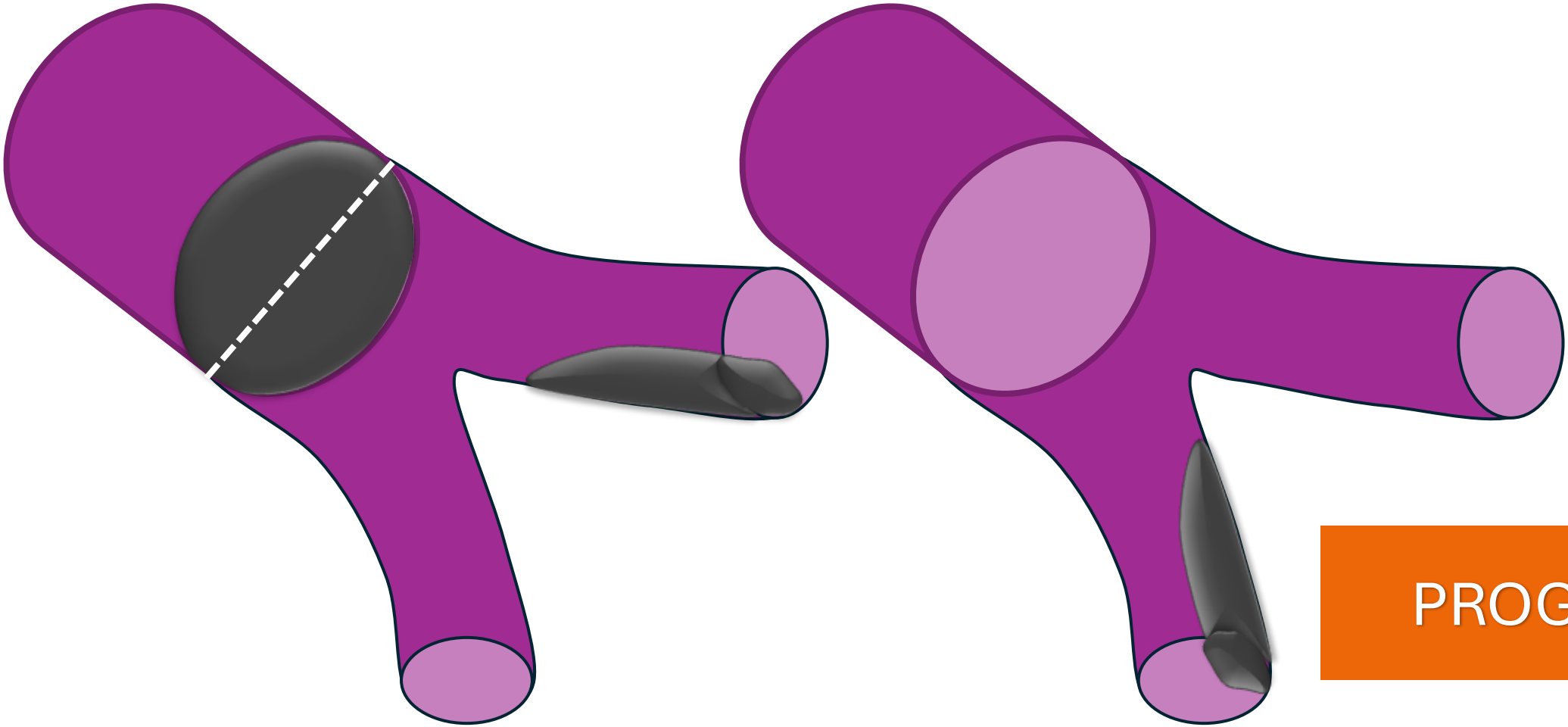
Evolution of portal thrombosis

Response to treatment or interval change			
Main portal vein thrombus	**Thrombus of the upstream and downstream veins ***	**New thrombus site**	**Overall assessment**
Any	Any	Yes	Progression



PROGRESSION

Evolution

Validation of RECIST criteria ?

N 1932 | 5 trials

Two blinded reader with BIRC

Meta-analysis | 12 studies

Relative measurement difference
95% (LOA)

Up to 40% disagreement in RECIST 1.1 response category

Main causes of discordance:

- new lesions 41%
- **target lesion diameters 33%**
- non-target lesions 12%

Interobserver variability:
−22.1% (95% CI: −30.3% to −14.0%) to
+25.4% (95% CI: 17.2% to 33.5%).

Intraobserver variability:
−17.8% (95% CI: −23.6% to −11.9%) to
+16.1% (95% CI: 10.1% to 21.8%).

Beaumont H. What are RECIST 1.1 progressions made of? Variability in double-read oncology trials. *Eur Radiol.* 2026
Yoon SH. Observer variability in RECIST-based tumour burden measurements: a meta-analysis. *Eur J Cancer*. 2016

tumoral

extension

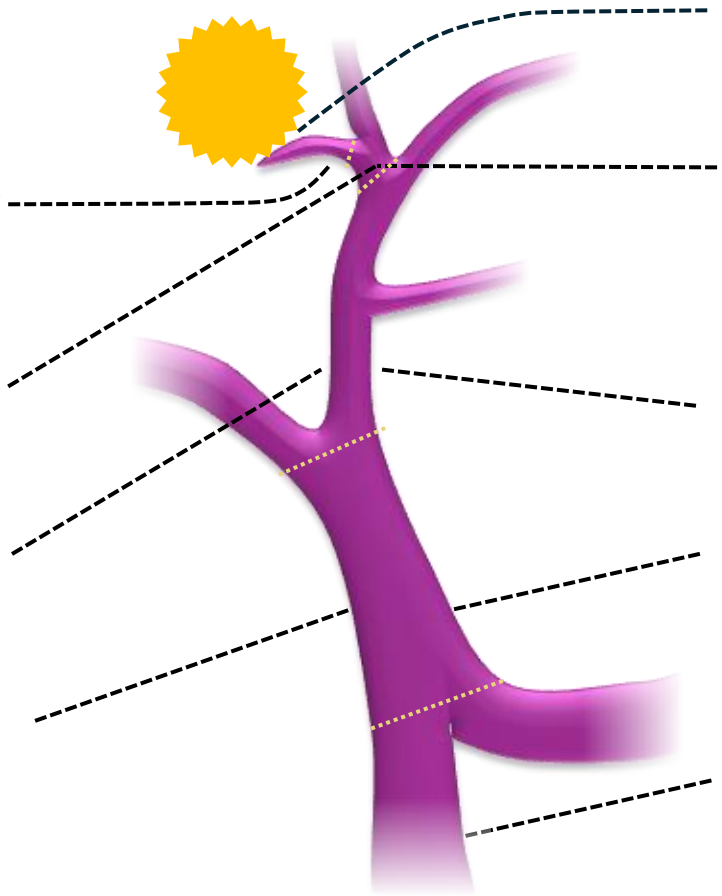
Vp0: No tumor thrombus

Vp1: Presence of a tumor thrombus distal to the second-order branches of the portal vein

Vp2: Invasion of the second-order branches of the portal vein

Vp3: Presence of the tumor thrombus in the first-order branches of the portal vein

Vp4: Tumor thrombus in the main trunk of the portal vein or a portal vein branch contralateral to the primarily involved lobe (or both)



Type I0: Microscopic portal invasion

Type I: Tumour thrombus involving the segmental branches of the portal vein or above

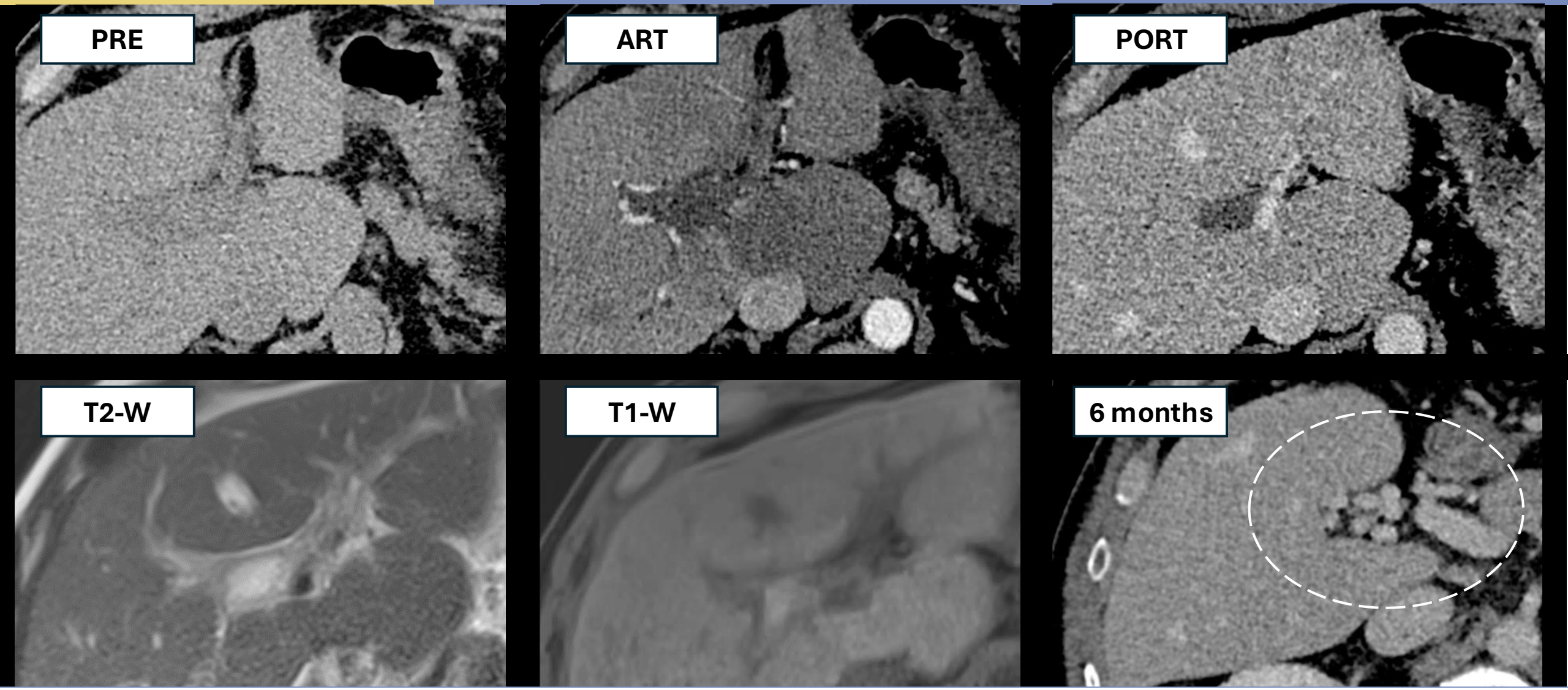
Type II: Tumour thrombus involving the right/left portal vein

Type III: Tumour thrombus involving the main portal vein

Type IV: Tumour thrombus involving the superior mesenteric vein

Fifth question

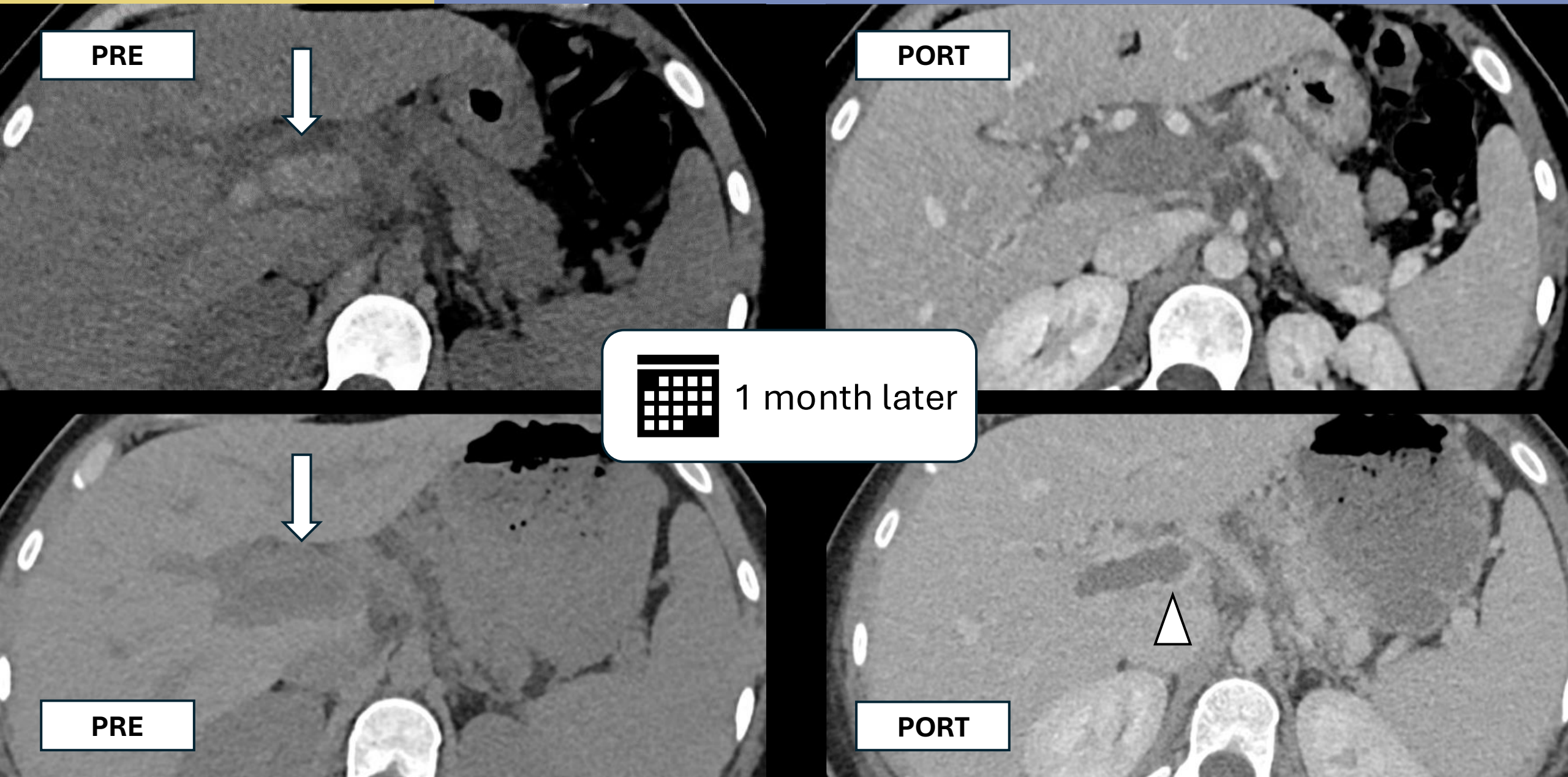
Recent vs Chronic



Recent thrombi are responsible for venous enlargement and frequently appear spontaneously hyperattenuating on CT images and hyperintense on T1-W images.

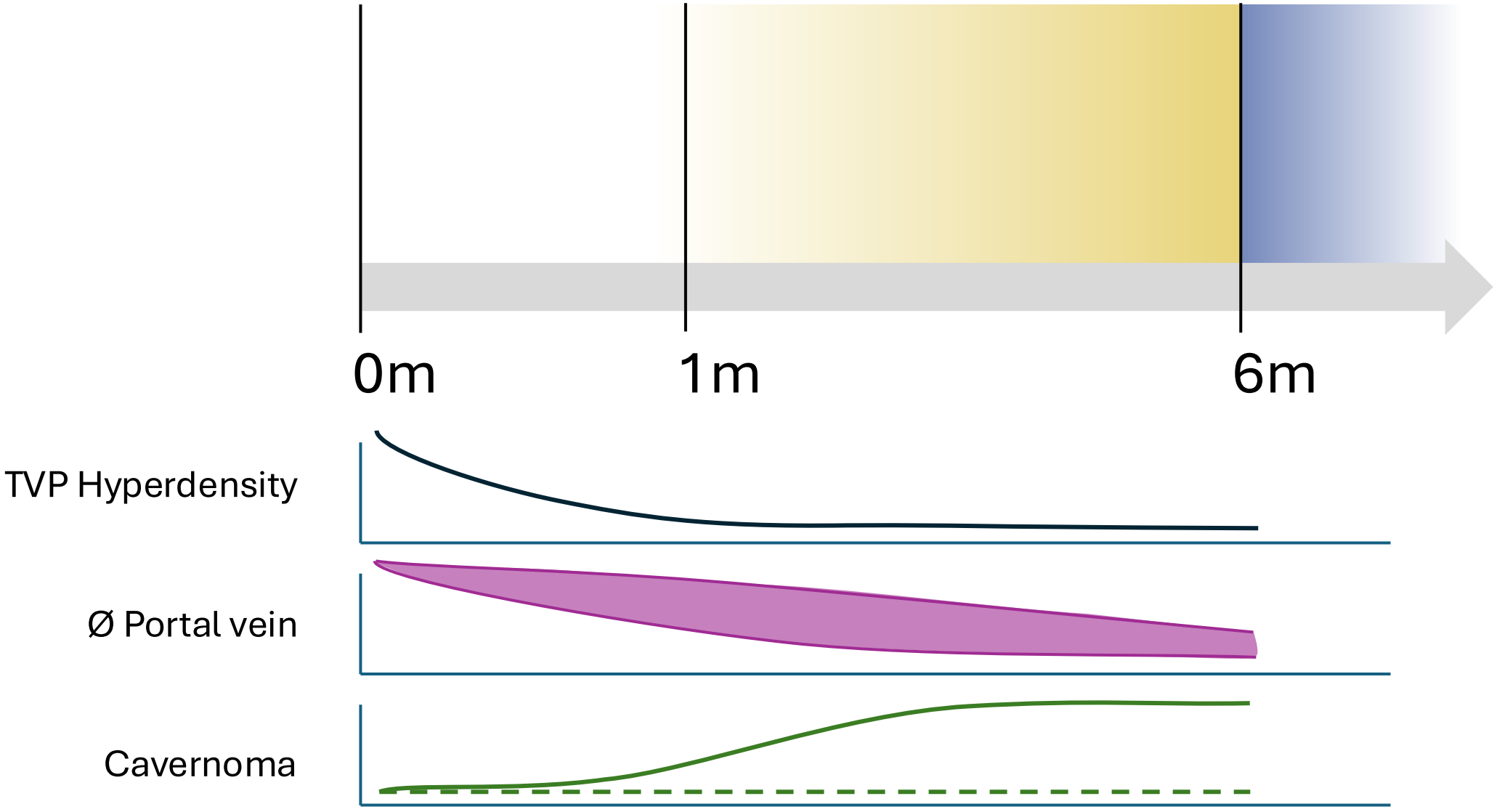
Fifth question

Recent vs Chronic

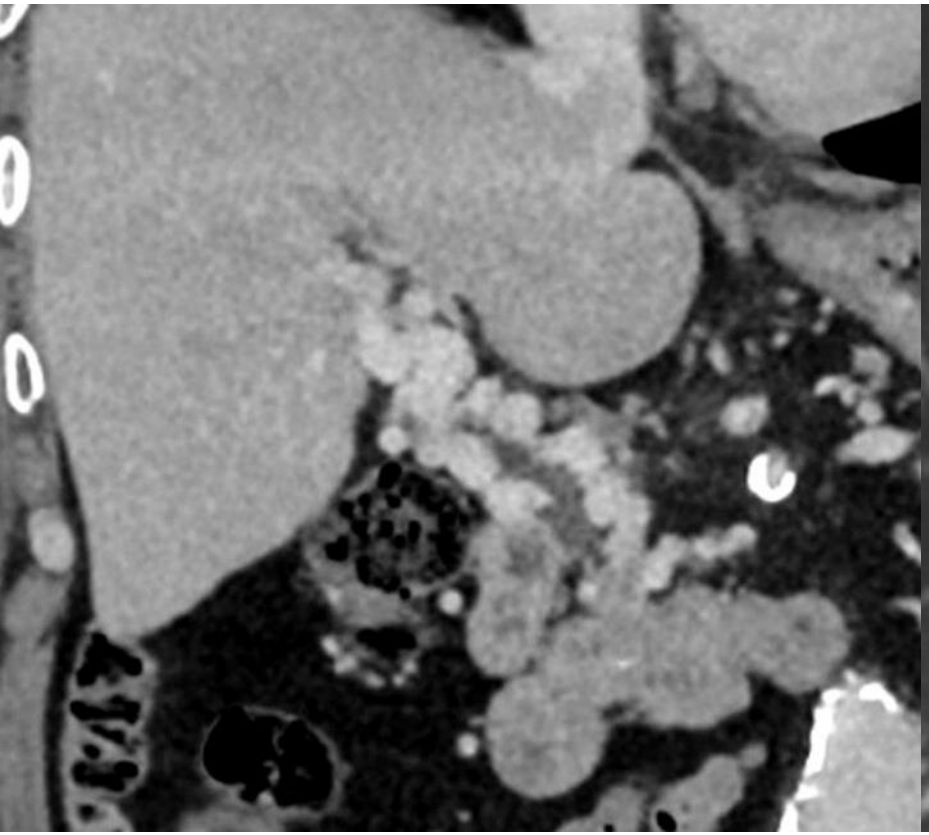


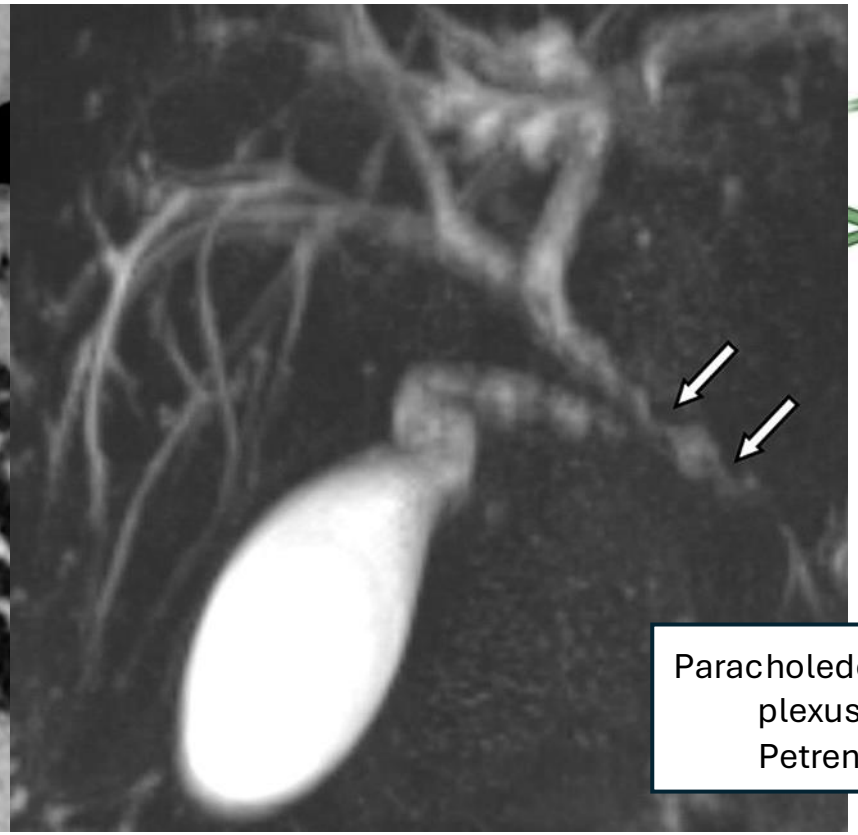
PVT

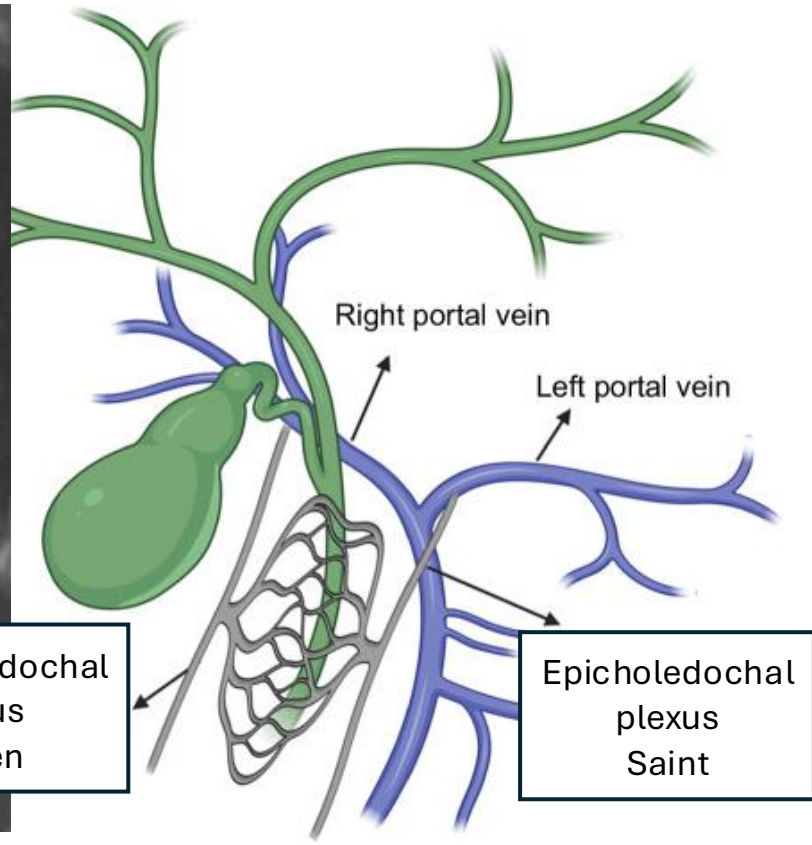
Recent vs Chronic



Cavernous transformation







80%–100% of patients with chronic PVT

Pinto E. Portal cavernoma cholangiopathy: Systematic review of current understanding, clinical significance, and management. *Hepatol Commun*. 2025

Conclusion

Tumoral vs bland PVT – *well defined criteria, validated*

PVT occlusion degree – *well defined criteria, validated*

PVT evolution – *“a priori” criteria, not validated*

PVT recent vs chronic – *imaging criteria ≠ clinical criteria*

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International Congress on Coagulopathy in Liver Disease

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