

# 4D MRI and Endoleak treatment strategies

Pr Salma El Batti, MD, PhD

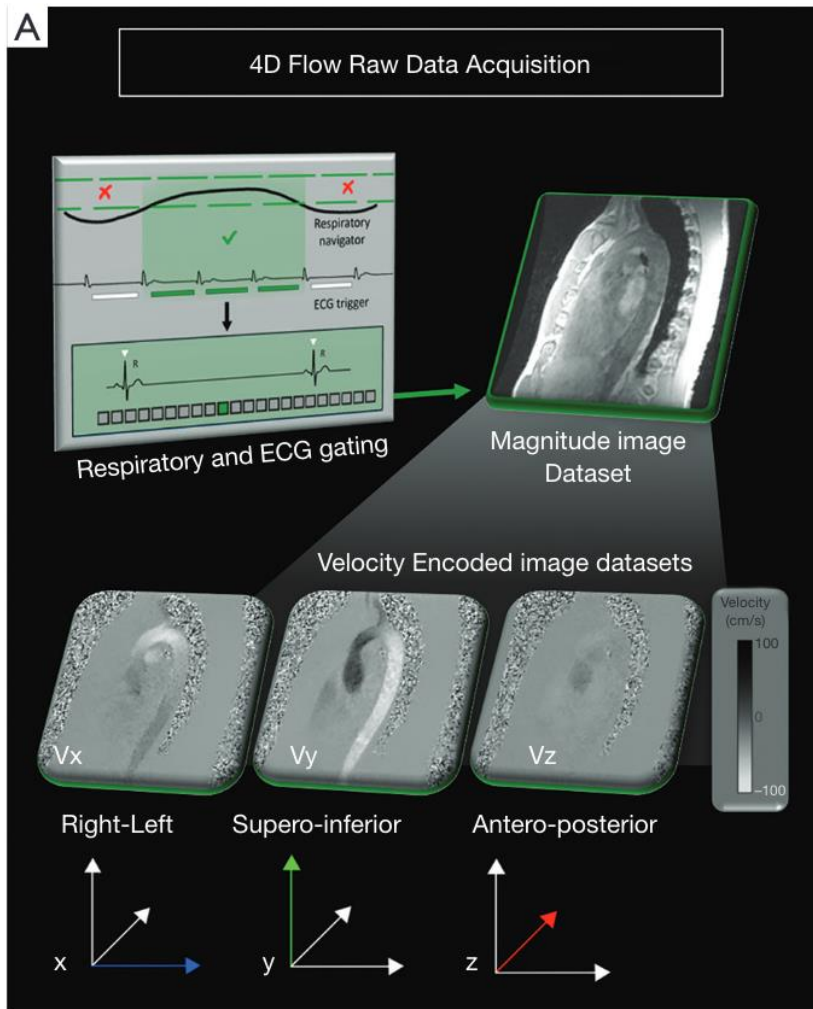
Hopital Européen Georges Pompidou, APHP, Paris

Université Paris Cité, Paris, France



# CRITICAL ISSUES

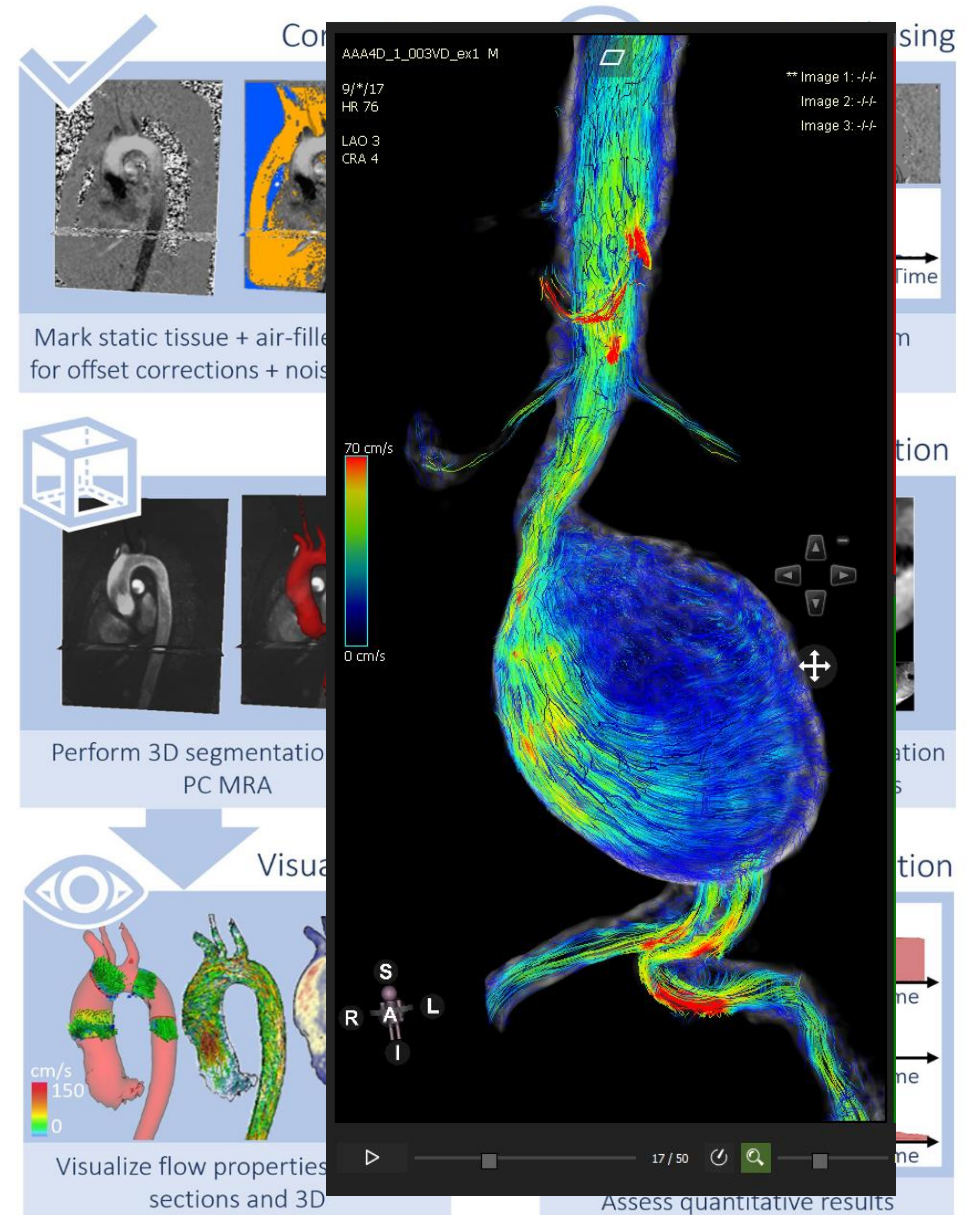
IN AORTIC ENDOGRAFTING



## 4D MRI?



## Postprocessing Workflow for 4D Flow CMR



# 4D MRI and EVAR

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# MARCH 21 & 22 2024

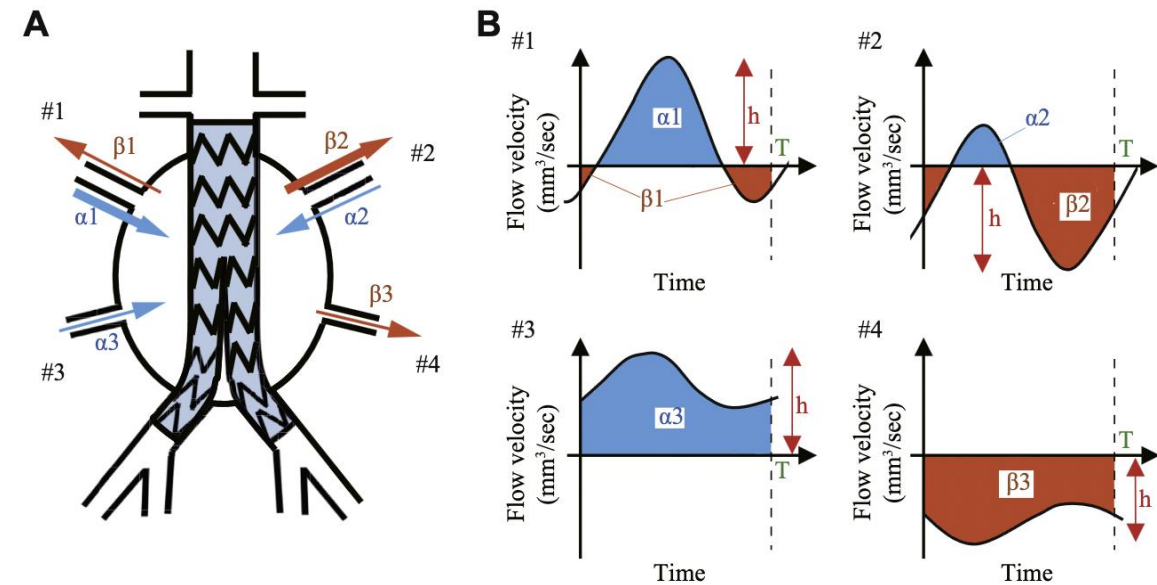
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## Hemodynamic Analysis of Endoleaks After Endovascular Abdominal Aortic Aneurysm Repair by Using 4-Dimensional Flow-Sensitive Magnetic Resonance Imaging

Mayu Sakata, MD; Yasuo Takehara, MD, PhD; Kazuto Katahashi, MD; Masaki Sano, MD, PhD;  
Kazunori Inuzuka, MD, PhD; Naoto Yamamoto, MD; Masataka Sugiyama, MD;  
Harumi Sakahara, MD, PhD; Tetsuya Wakayama, PhD; Marcus T. Alley, PhD;  
Hiroyuki Konno, MD, PhD; Naoki Unno, MD, PhD

## Pre-Operative Four Dimensional Flow Sensitive Magnetic Resonance Imaging Assessment of Aortic Side Branches as a Method to Predict Risk of Type II Endoleak Resulting in Sac Enlargement After EVAR

Yuta Yamanaka <sup>a,b</sup>, Masaki Sano <sup>a,b,\*</sup>, Kazuto Katahashi <sup>a,b</sup>, Kazunori Inuzuka <sup>a,b</sup>, Yasuo Takehara <sup>d</sup>, Toshiyuki Ojima <sup>e</sup>, Hiroya Takeuchi <sup>a</sup>, Naoki Unno <sup>a,b,c</sup>



# 4D MRI before and after EVAR

Oct. 2022 → Déc. 2023



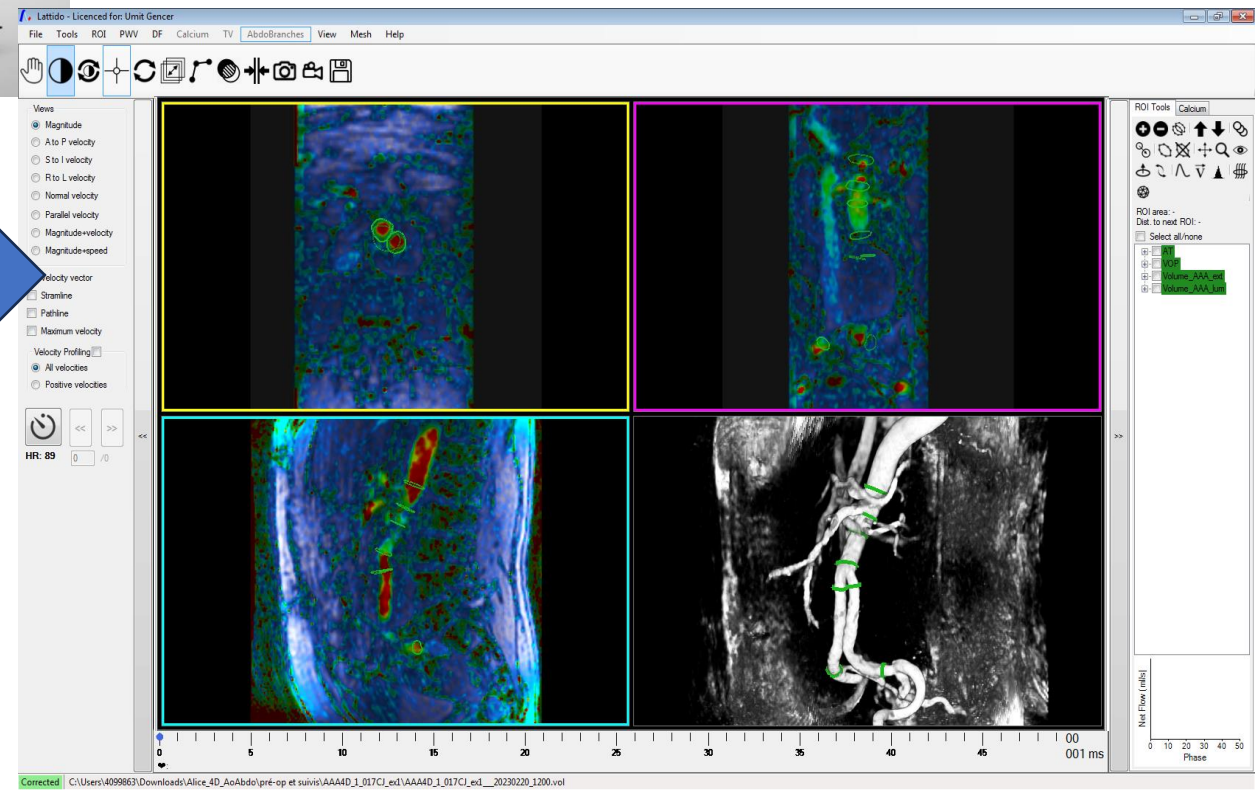
**Vascular Surgery Departement  
Radiology Departement**

AAA - EVAR



Pre op MRI

Post op MRI



LATTIDO<sup>©</sup>



Excluded  
FEVAR, BEVAR, IBD

25 patients and 52 MRI studies

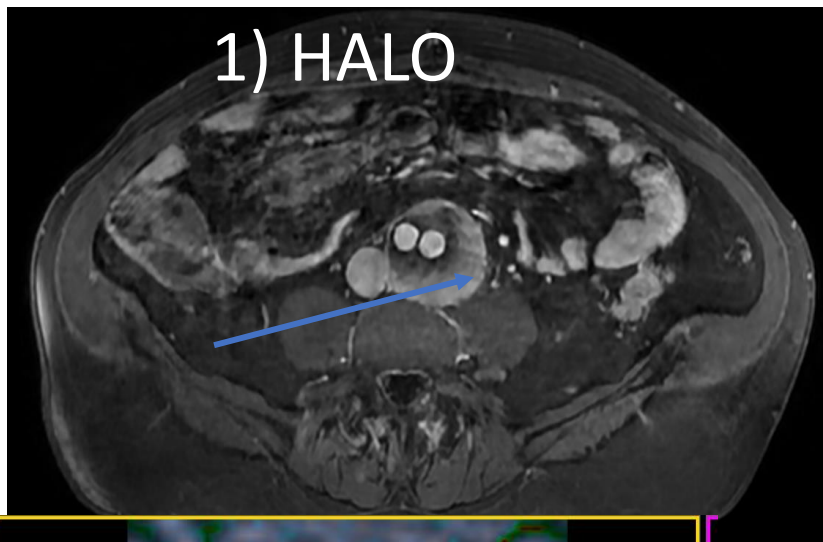
# Post op MRI

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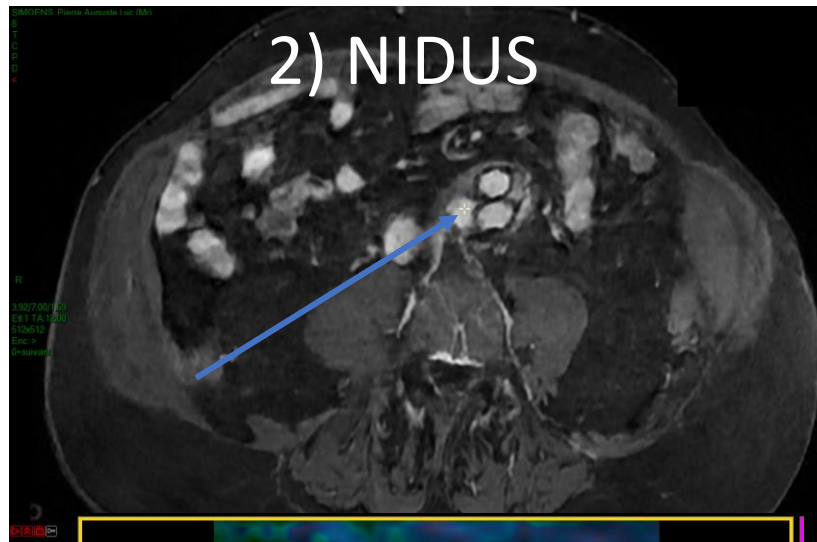
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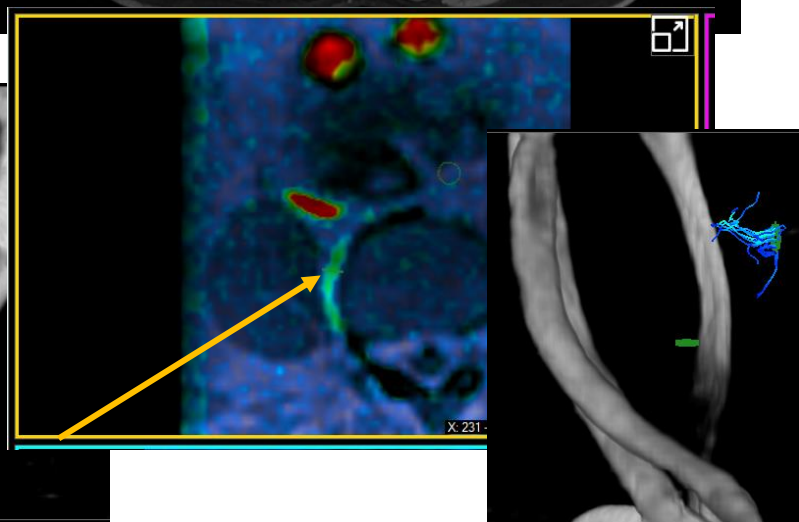
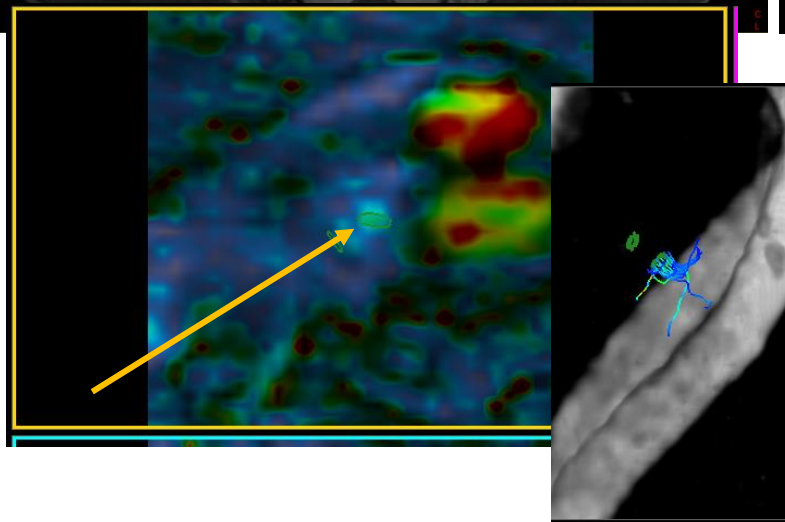
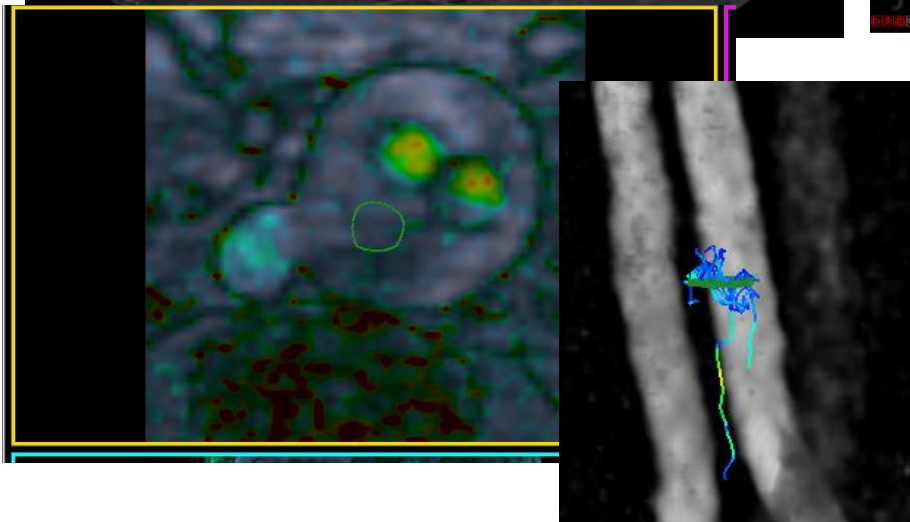
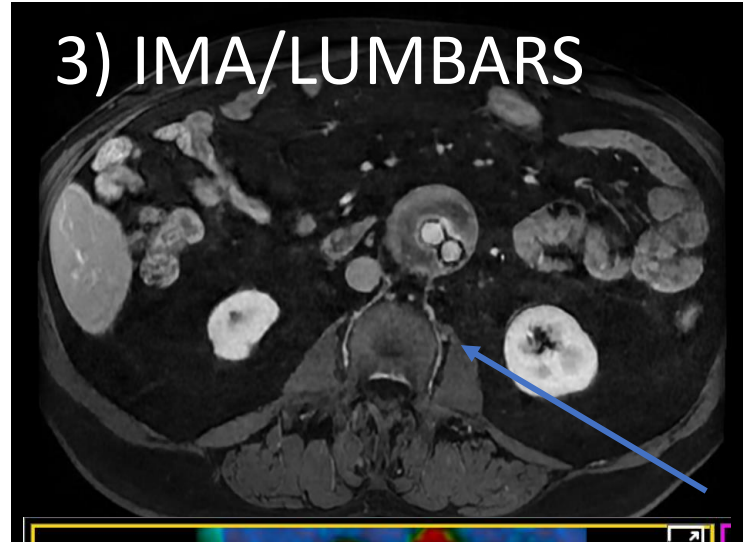
### 1) HALO



### 2) NIDUS



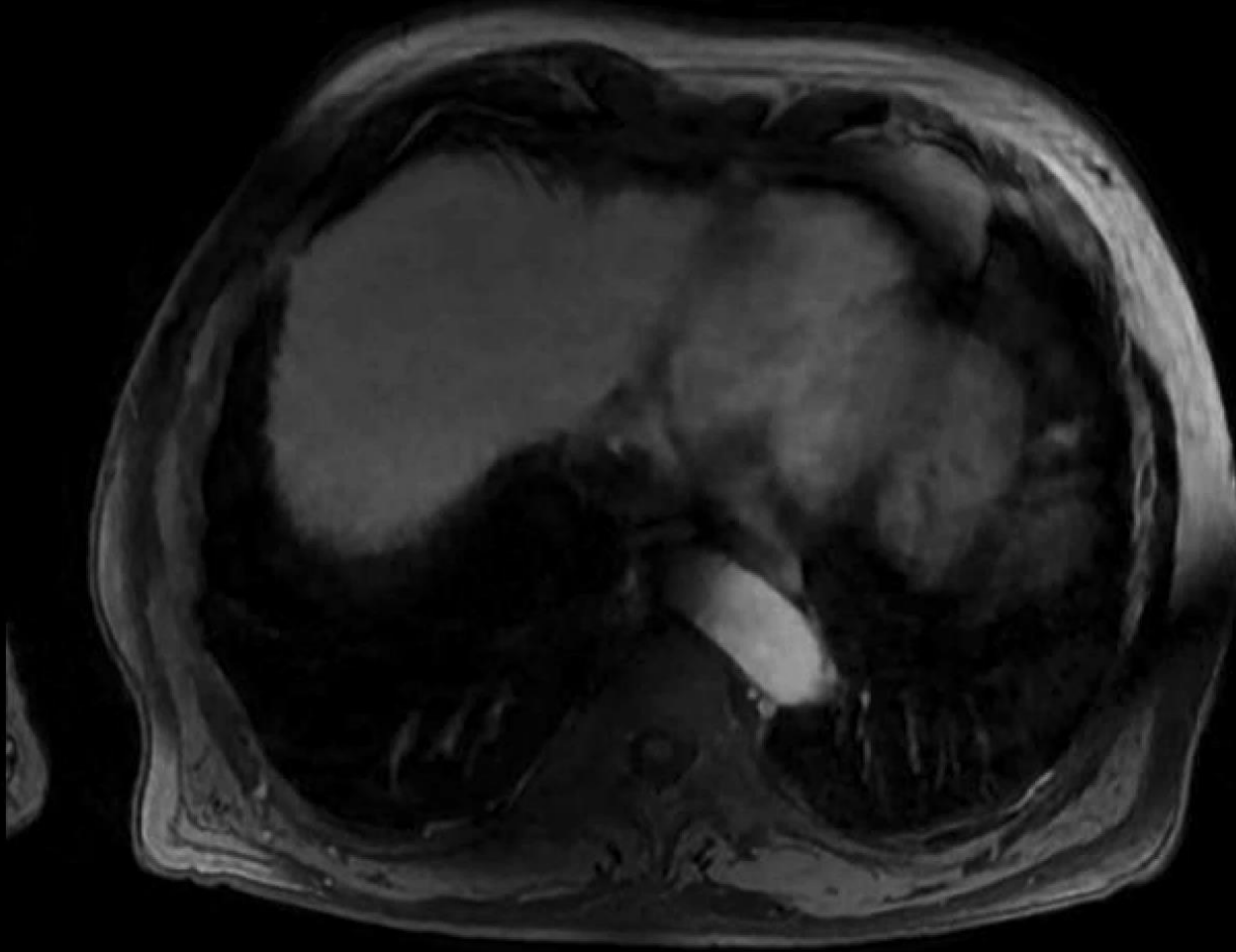
### 3) IMA/LUMBAR



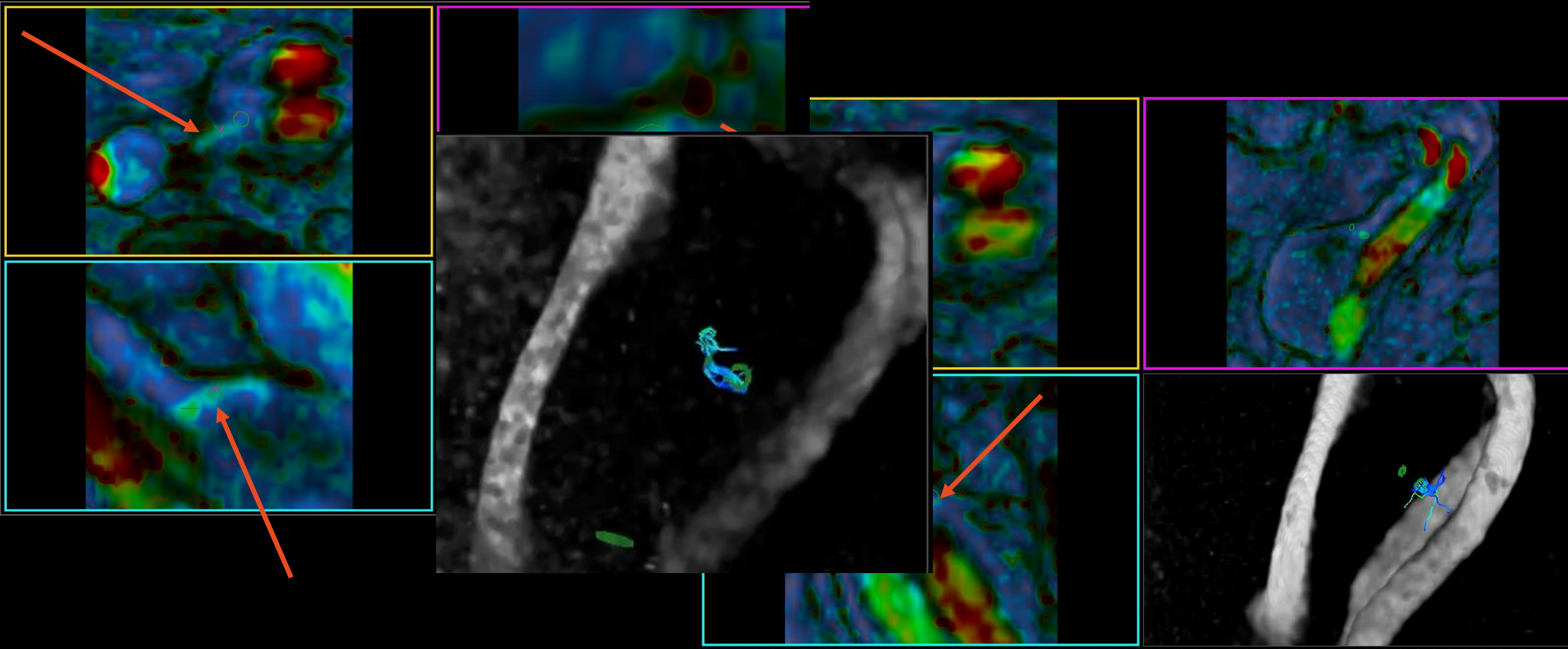
# Preliminary Results : 4D MRI and Endoleaks

Patients		Device	Time (Month)	LAVA					4D		
				EL / Type	Halo	Nidus	IMA	Lumbars	Nidus	Flow	Vmax (cm/s)
Post op	1	Excluder	1	II/III	1	1	1	4	0	No	-
	2	Endurant	1,5	II	1	1	Embolised	4	0	No	-
	3	Excluder	0,8	II/I ?	1	2	0	4	1	biphasique	9
	4	Excluder	1,5	II	1	1	1	7	0	No	-
	5	Endurant	1,5	II	1	0	2	6	0	No	-
During FU	6	Excluder	13	IB/II	1	2	1	6	1	biphasique	16
	7	Zenith $\alpha$	10	II	1	0	1	2	0	No	-
	8	Excluder	26	II	1	1	0	6	1	biphasique	6
	9	Zenith $\alpha$	23	II	1	2	1	6	0	No	-
	10	Endurant	27	II	1	2	1	6	2	biphasique	15

# 1. Flow inside the nidus

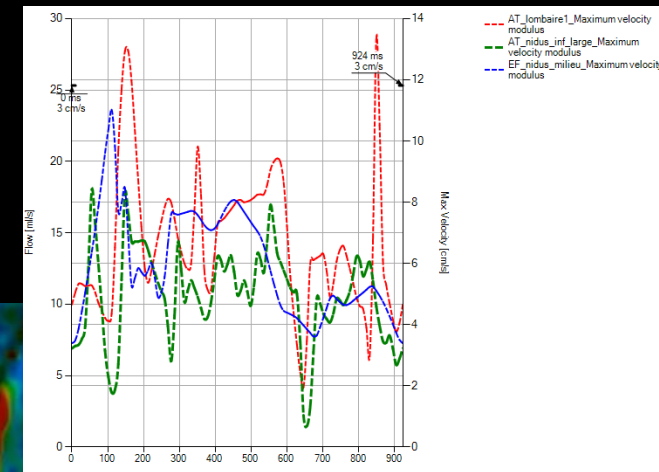
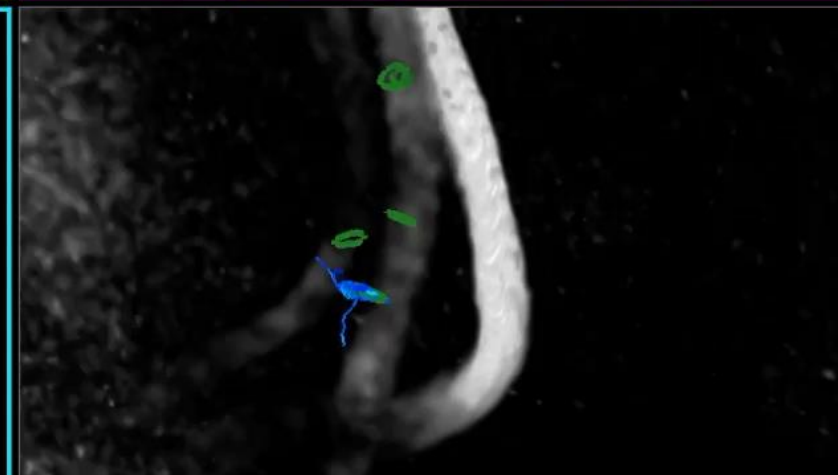
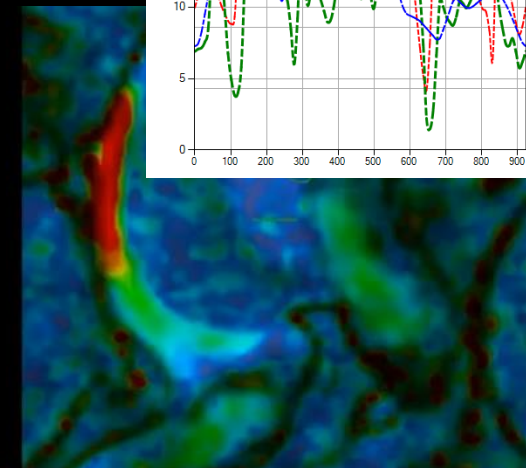
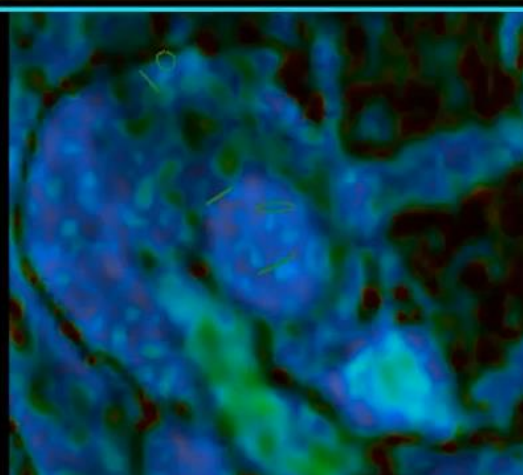
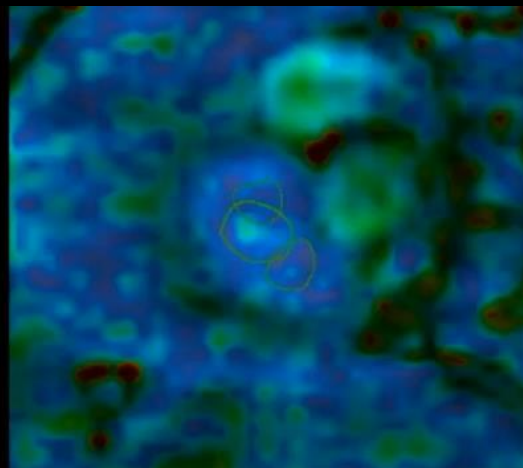
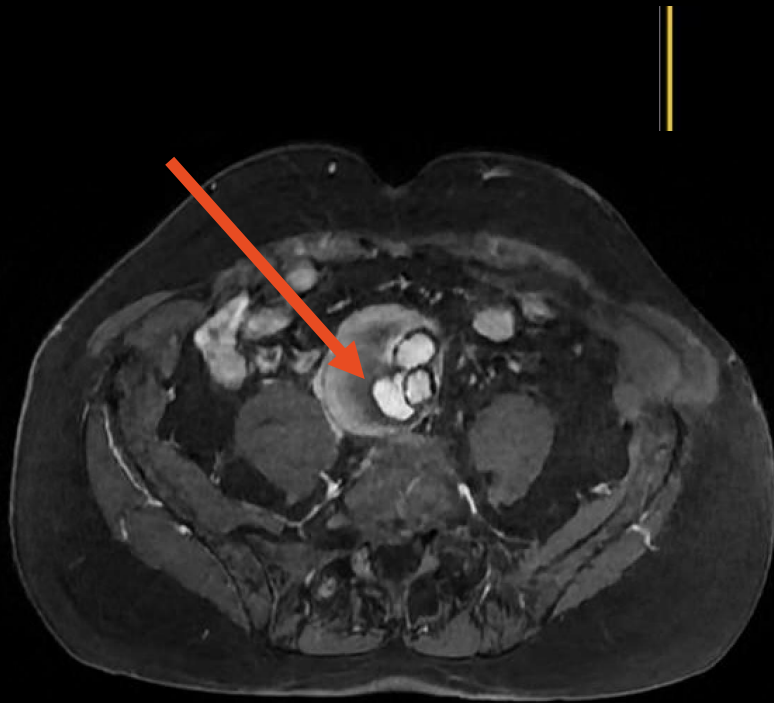


# Superior nidus: entering flow from a lumbar artery

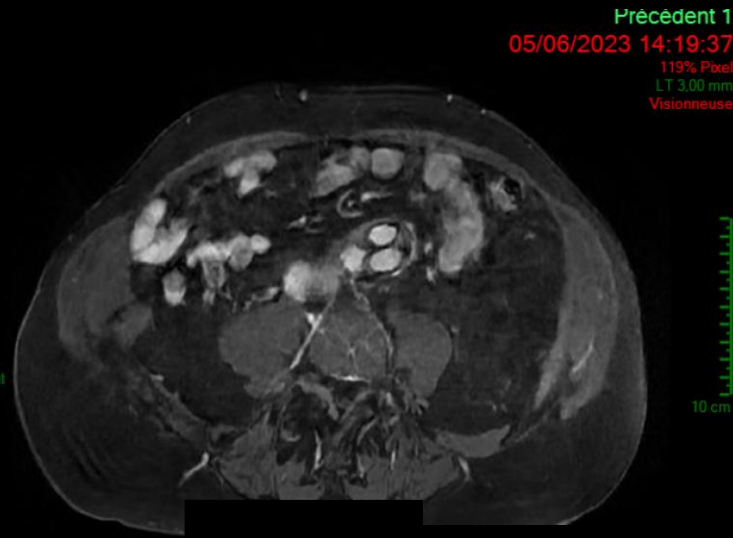
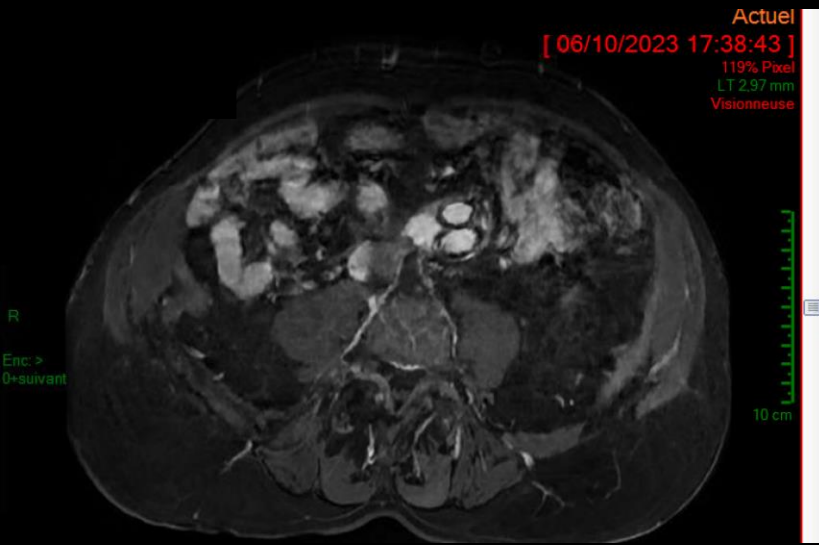





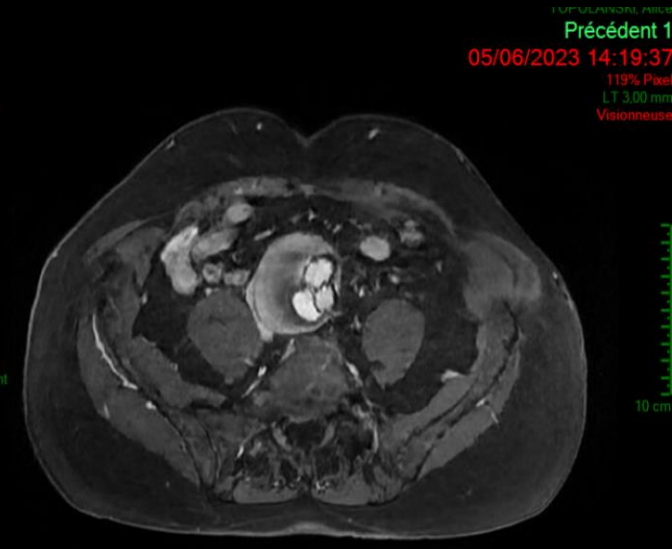
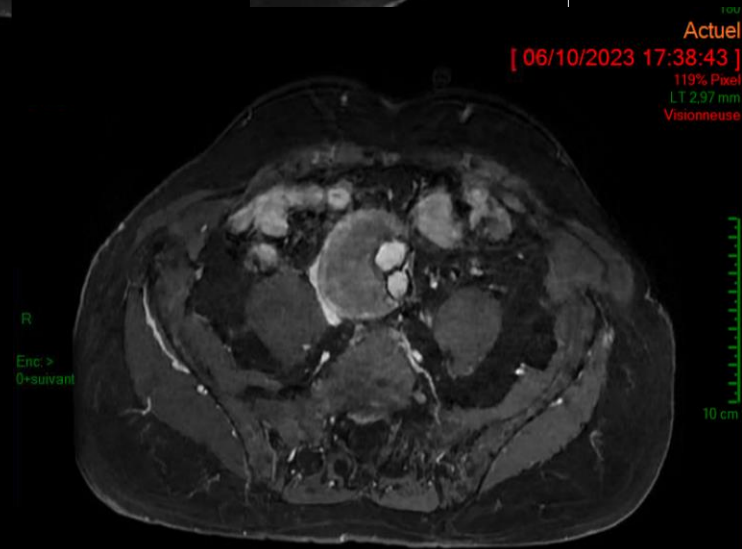
# Inferior nidus: no significant velocity



# 4D MRI at 3 months



 **Flow +  
Persistant EL?**

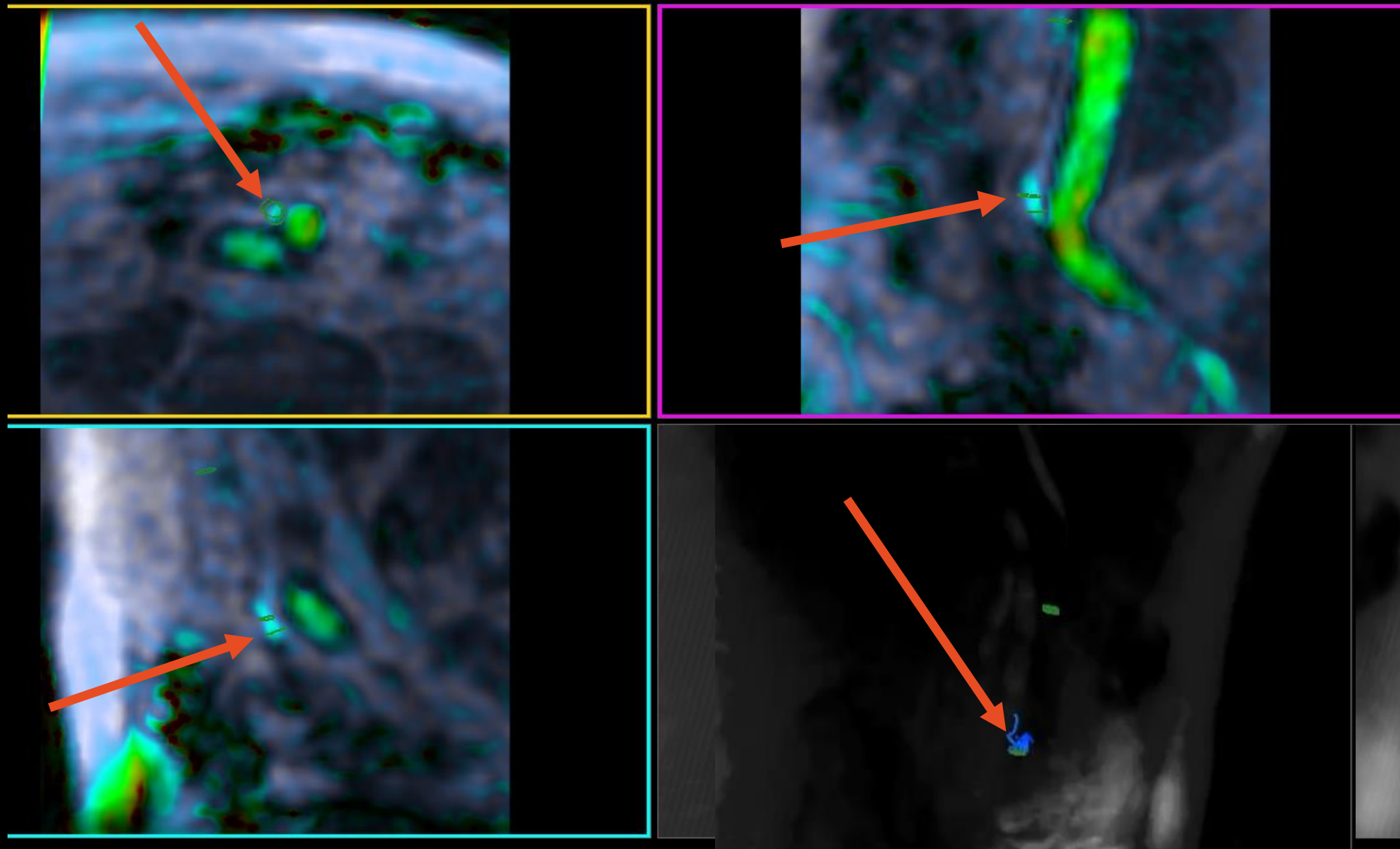


## 2. Complex Endoleak and growing AAA : flow direction



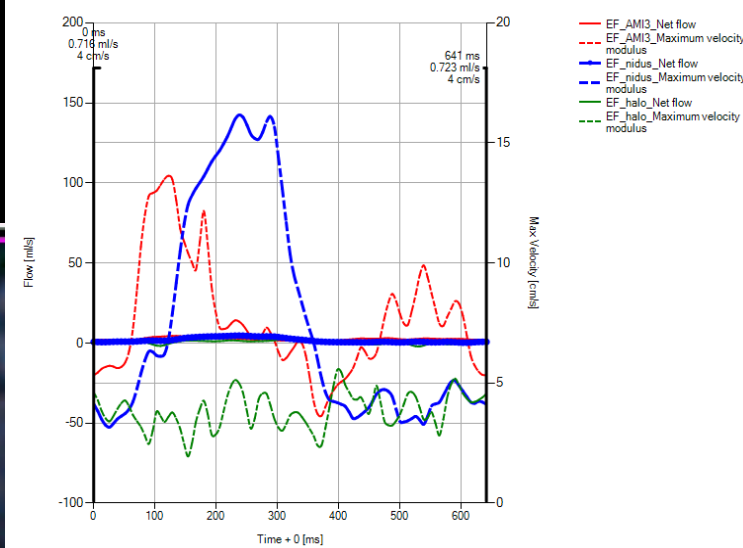
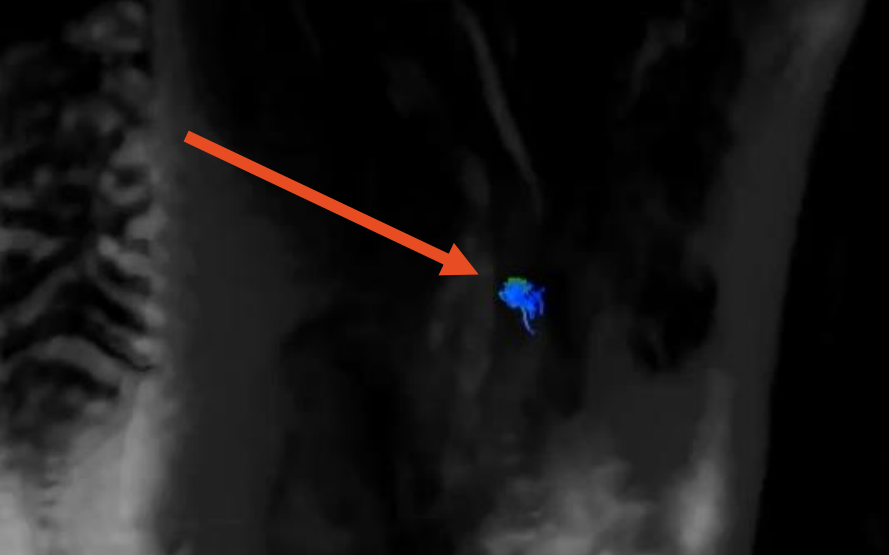
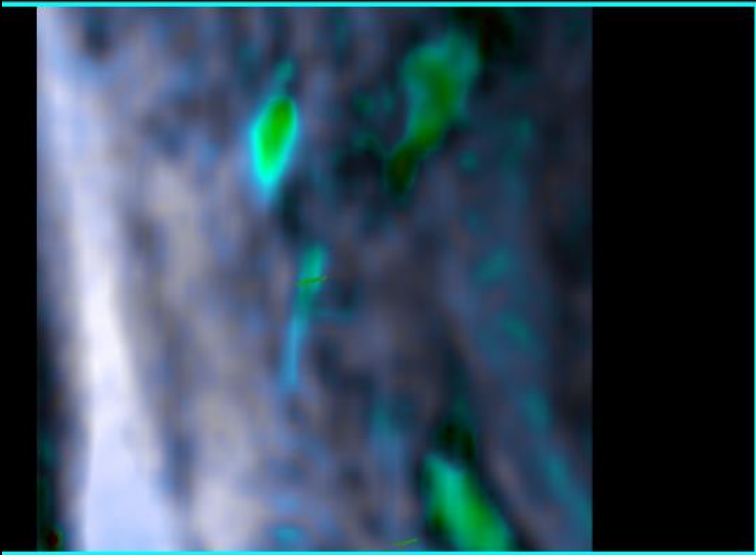
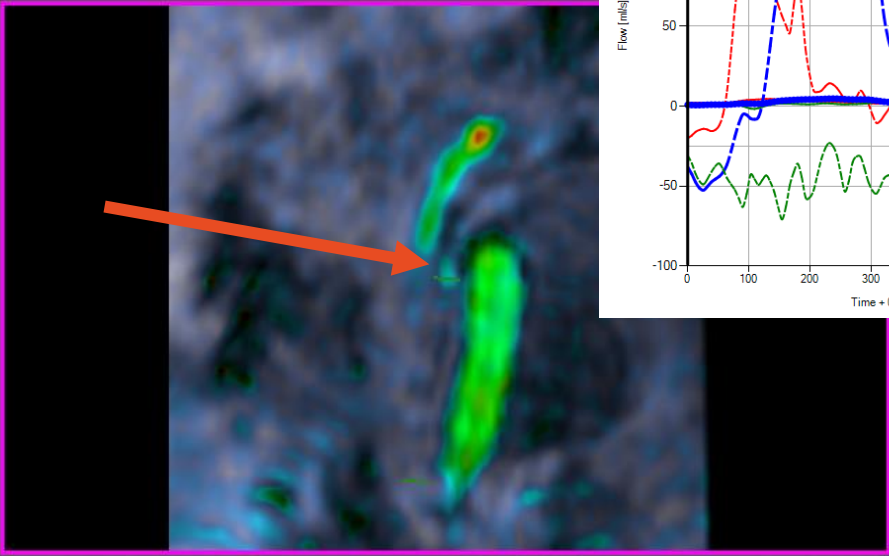
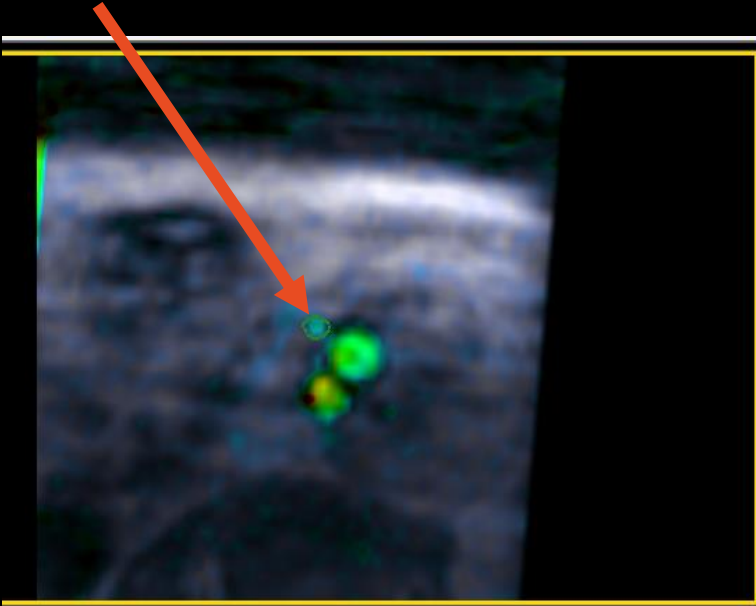
Suspicion of type IB on MRI but not on CT scan

# Flow direction: Ib endoleak

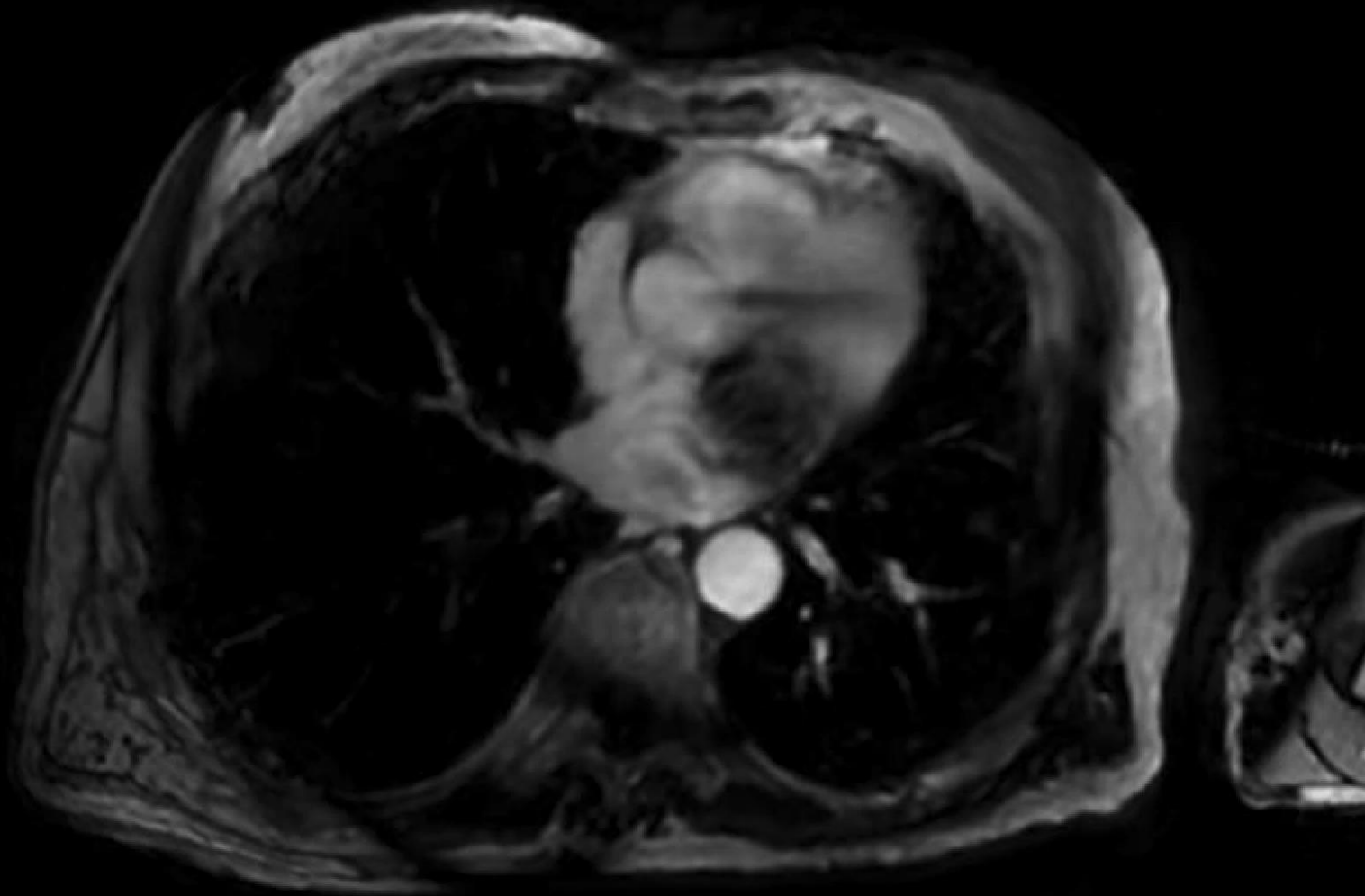


Ascending flow from the nidus to the top of the sac

# Outgoing flow into the IMA

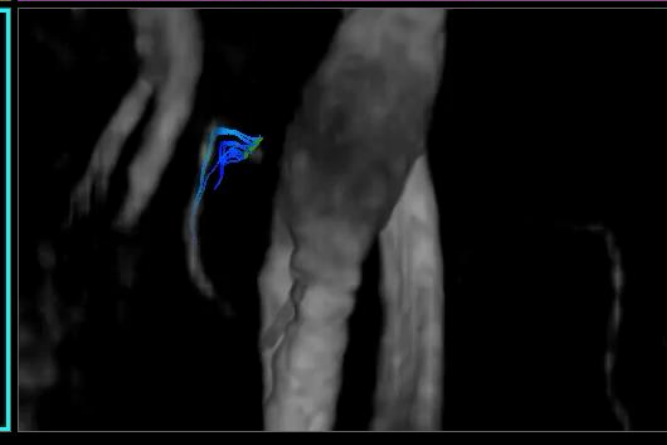
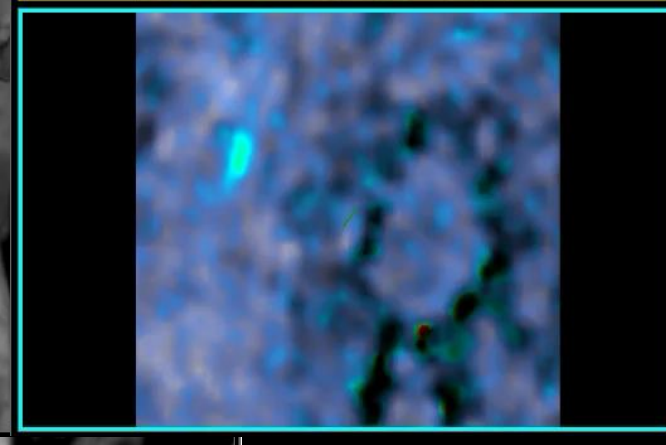
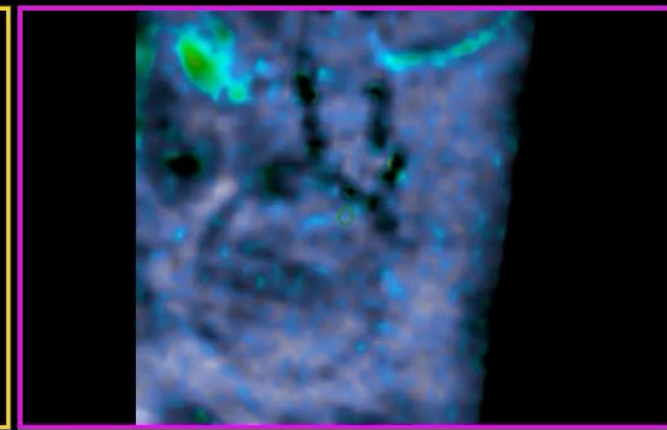
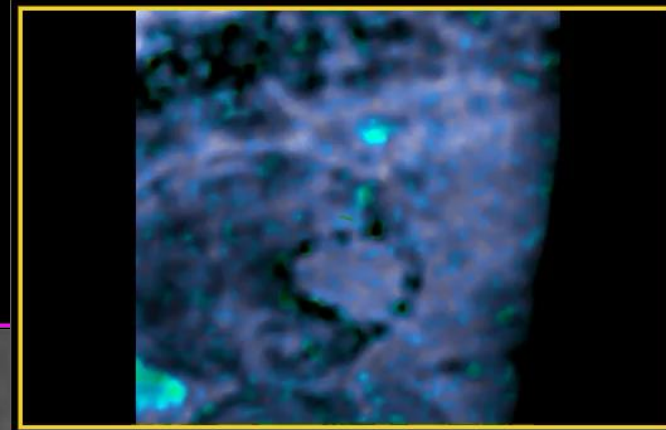
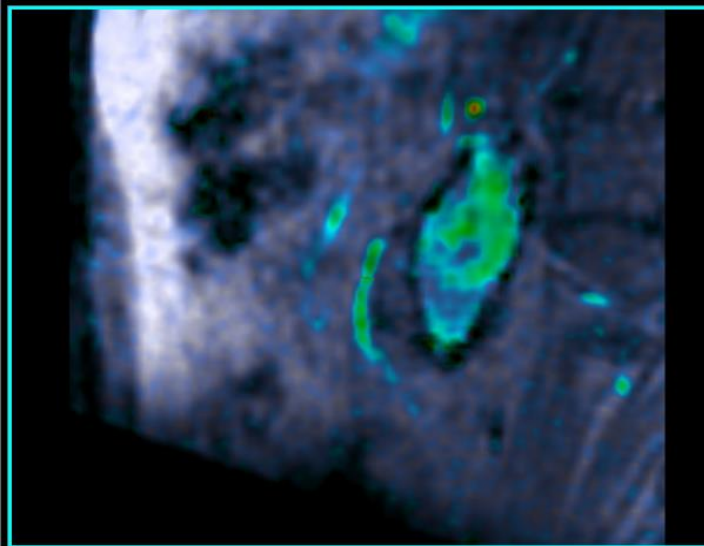
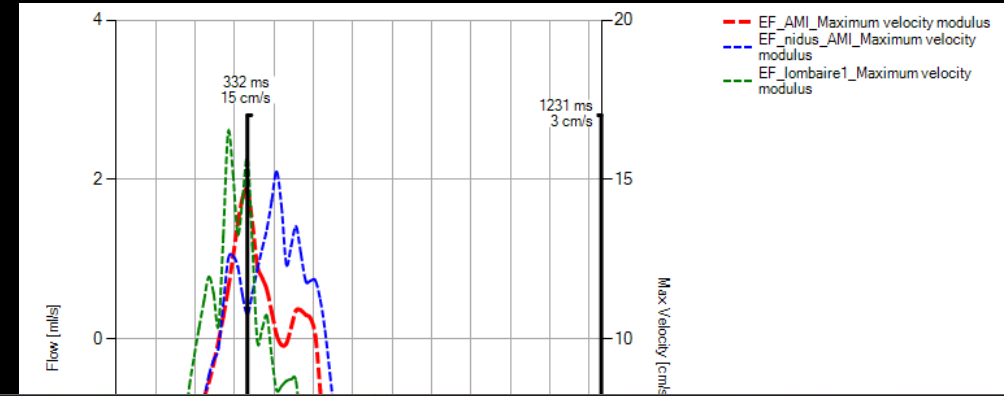
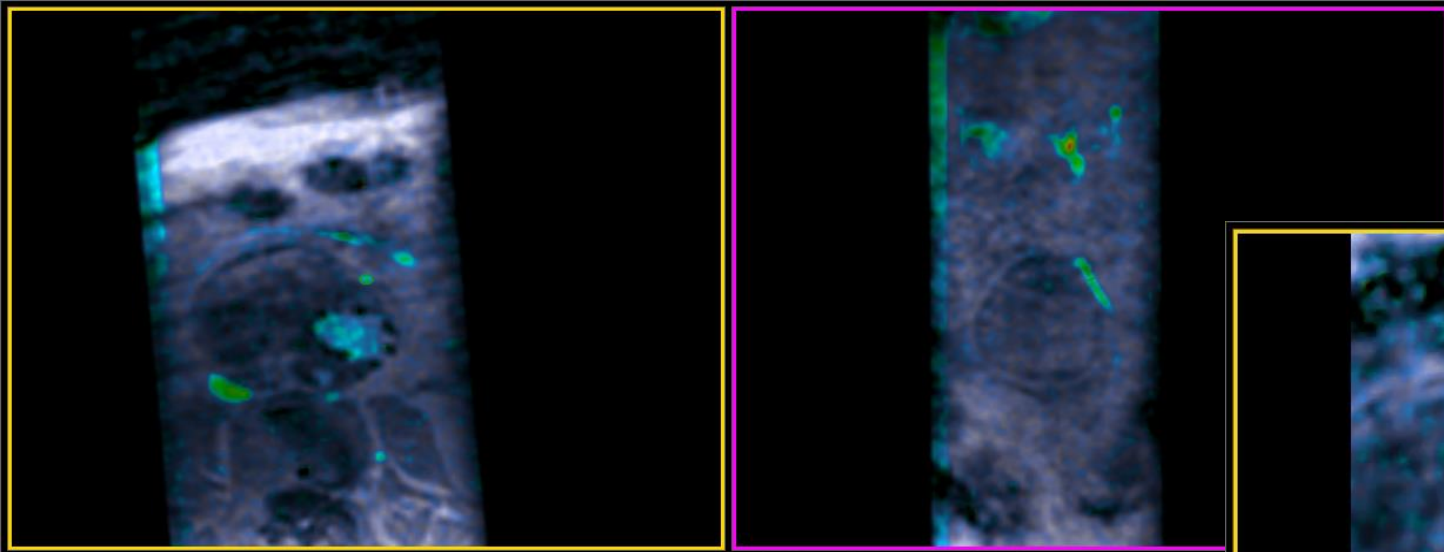


### 3. Growing AAA 2y after EVAR with multiple T2EL



2 nidus

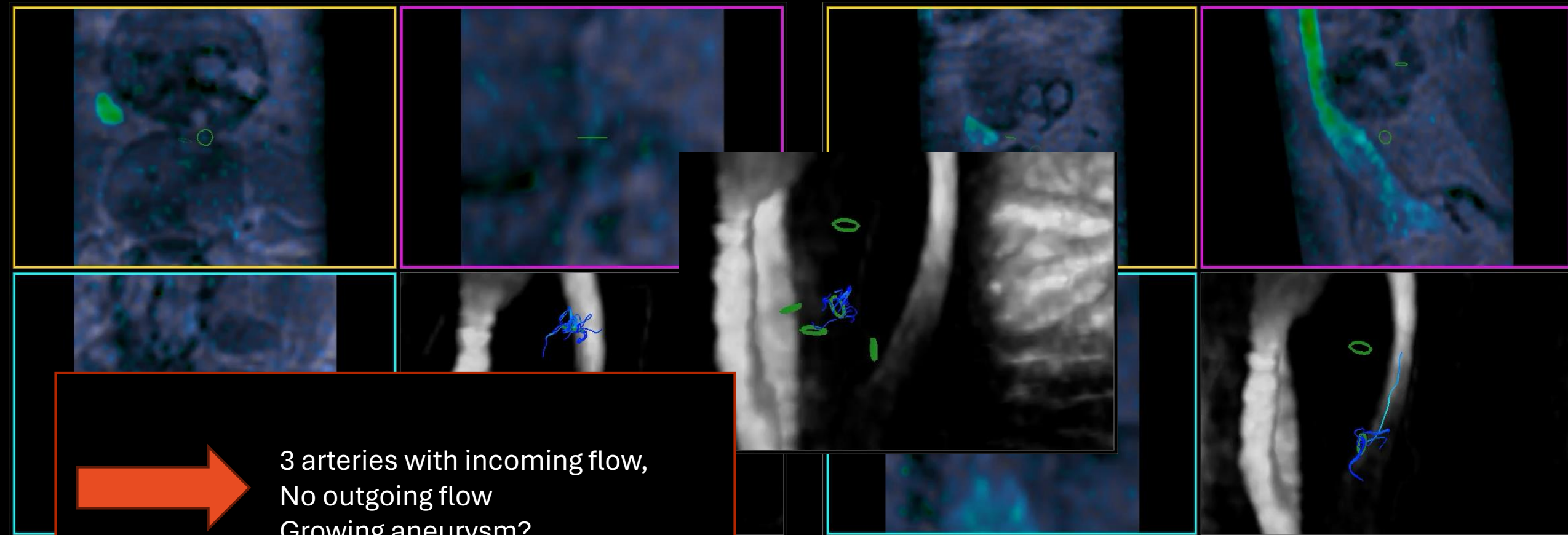
# Complex Type II endoleak



Superior nidus : Systolic inflow from the IMA and diastolic backflow

# Complex Type II endoleak

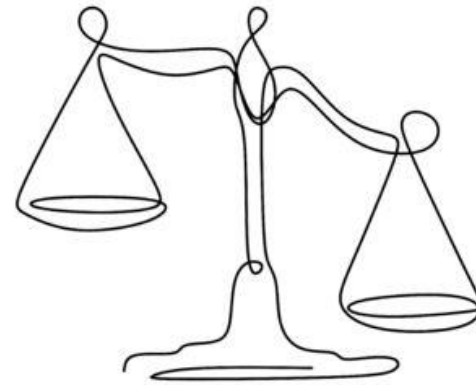
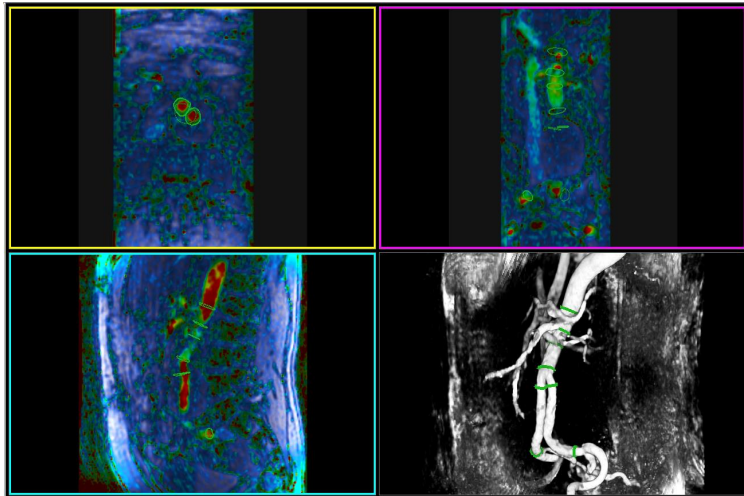
2 lumbar with incoming flow  
And a small vortex inside the nidus



3 arteries with incoming flow,  
No outgoing flow  
Growing aneurysm?



## 4D MRI and EL after EVAR : Preliminary Results



Availability  
Cost  
Reproducibility  
Acquisition time  
Post processing Time

Dynamic and morphologic  
Data to understand endoleaks  
Decision making



THE 26<sup>TH</sup> INTERNATIONAL EXPERTS SYMPOSIUM

# CRITICAL ISSUES

IN AORTIC ENDOGRAFTING

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**MARCH 21 & 22 2024**

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