

Do we always need to target the nidus in AV-malformations?

Gilles Soulez, Annouk Bisdorff

CHUM Université de Montréal, CHU Lariboisière, Paris

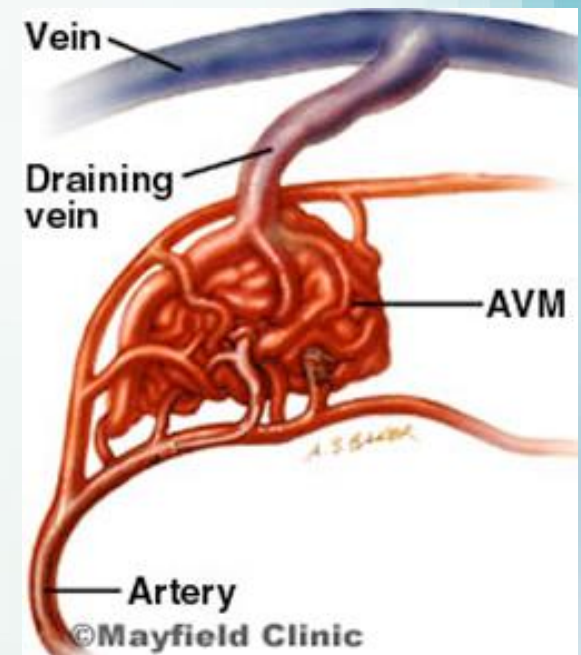


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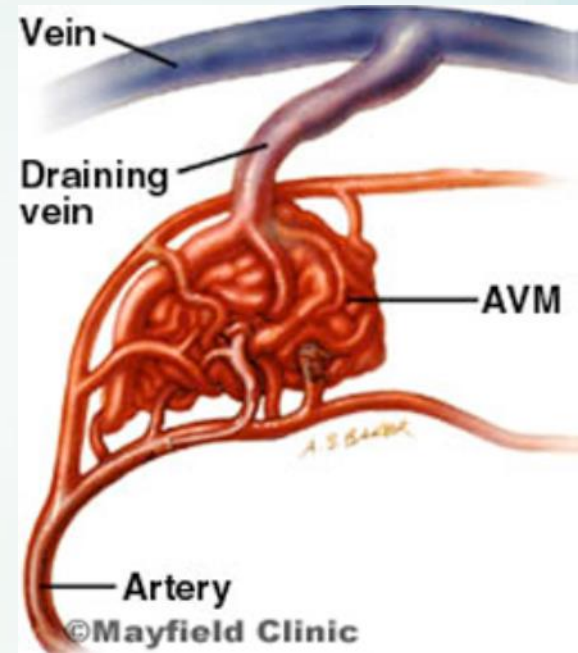
Arterio-venous malformation

- High-flow malformation
 - AV-shunting
- Nidus not seen in all AVM
 - Site of AV shunting
 - Abnormal network of small arterial vessels
 - Direct communication with the venous side
 - No capillary perfusion



Understand AVM rheology

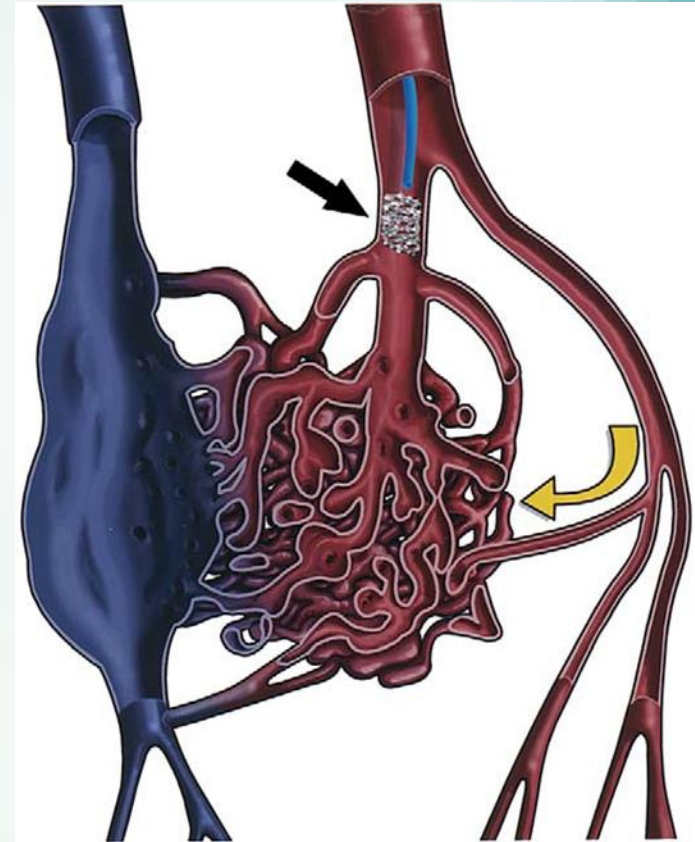
- AV fistula
 - Loss of peripheral resistance
 - Low pressure in fistula area (nidus)
 - High pressure in the draining vein



*Leghien G et al.
Orthop Clin North Am 2006*

Proximal occlusion

- Inefficient
 - Fistulas shunts in draining veins
- Proximal occlusion leads to recruitment of collateral vessels
- Stimulation of AVM
 - Angiogenesis ?

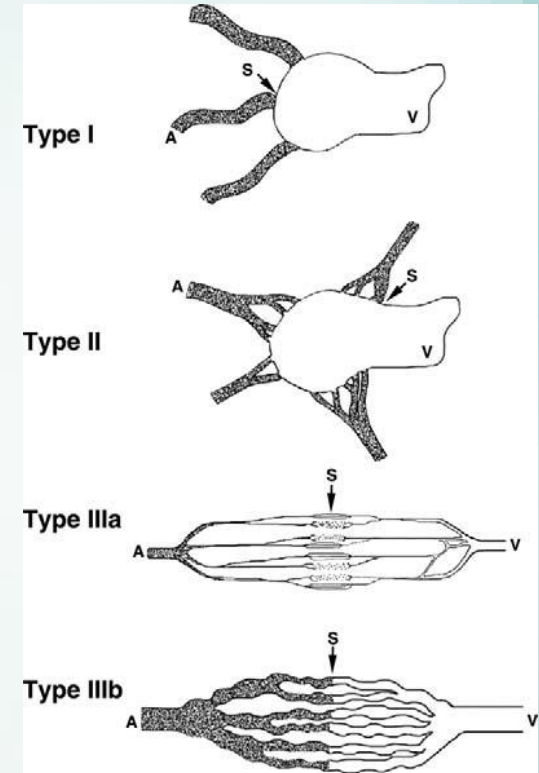


Need to close the fistulas

- Fistulas occur in the nidus!
 - Systematic targeting of fistulas
 - But different approaches are possible depending of
 - Angioarchitecture
 - Territory:terminal vs non terminal vascularization
 - Imbalance between inflow and outflow

AVMs – Different appearances

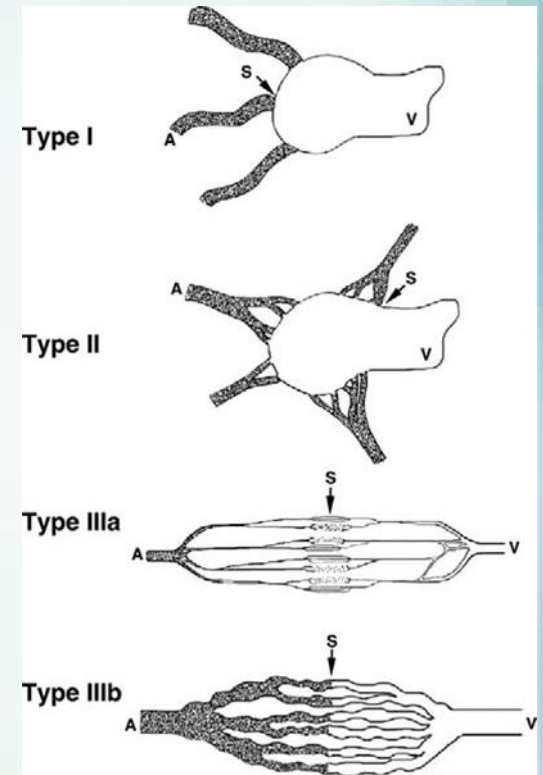
- Type I direct AVF ≤ 3 feeders
- Type 2 multiple arteriolo-venous fistulas, one draining vein
- Type 3a multiple arteriolo-venous fistulas and draining veins without dilatation
- Type 3b multiple arteriolo-venous feeders and draining veins with dilatation



Cho SK. J Endovasc Ther 2006;13:527–538

General concepts

- Start with an endovascular arterial approach to close the fistula from the arterial side
 - Use liquid agents (ROH, cyanoacrylates, onyx)
 - Sometime flow control needed
 - Balloon arterial or venous side
- If needed complete nidus occlusion
 - Direct puncture of nidus (type III)
 - Retrograde venous approach (type I and 2)



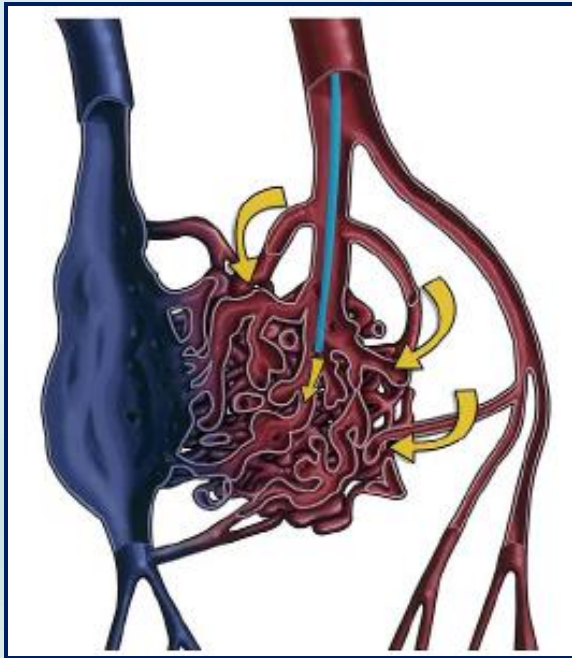
Adapt your strategy to patient symptoms

- Venous congestion or haemorrhage
 - Aggressive on the arterial side before occluding the vein
- Tissue necrosis due to capillary shunting
 - Aggressive on the venous side
- Rely on Doppler ultrasound

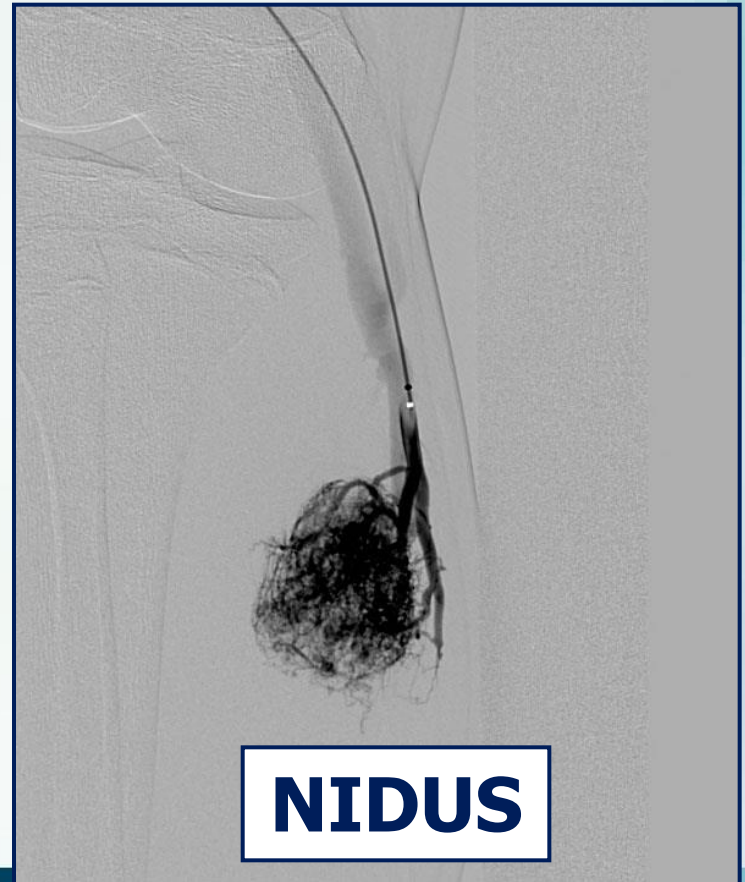


AVM and ethanol

- Nidus injection



*Leghien G et al.
Orthop Clin North Am 2006*

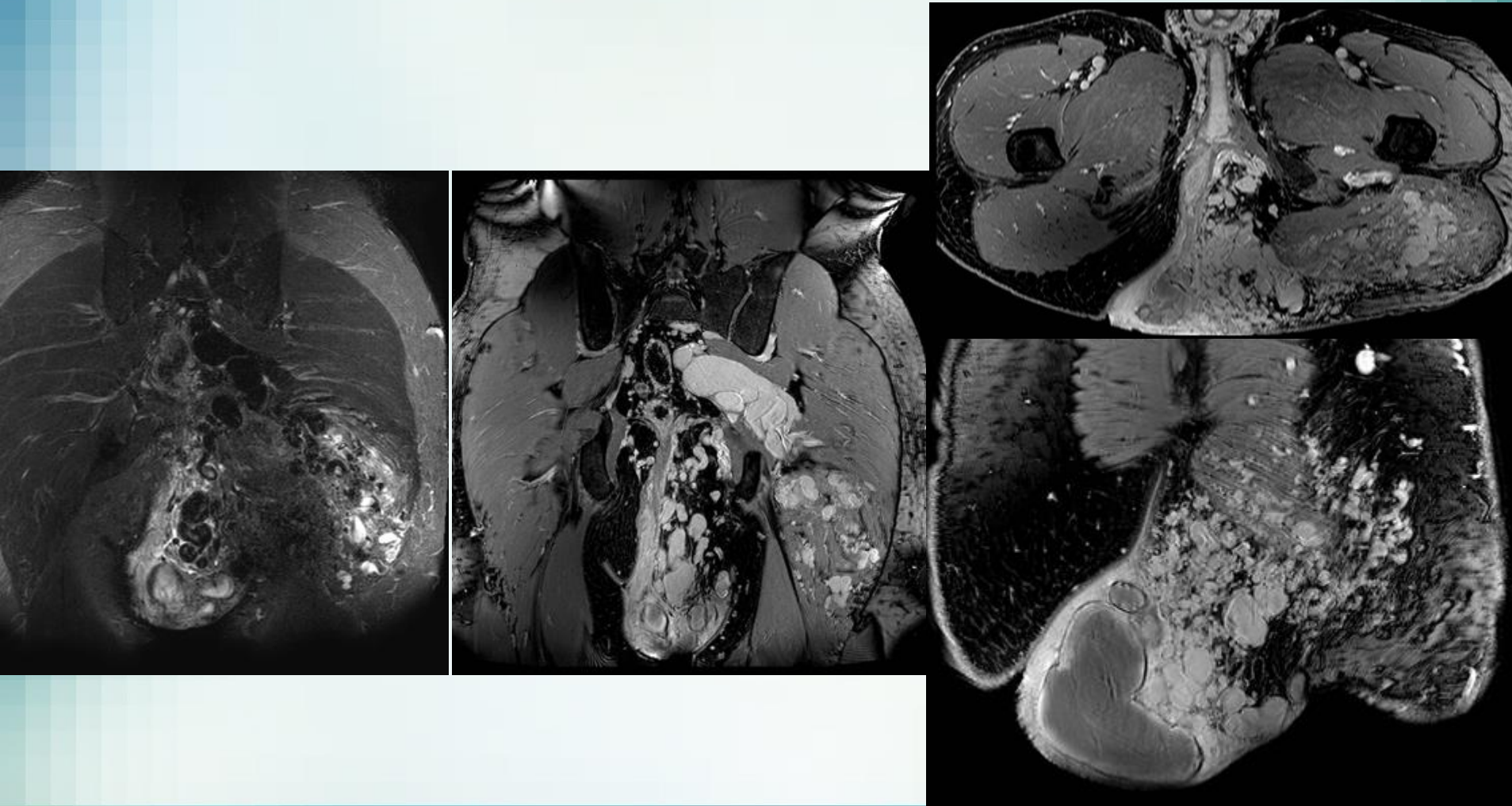


NIDUS

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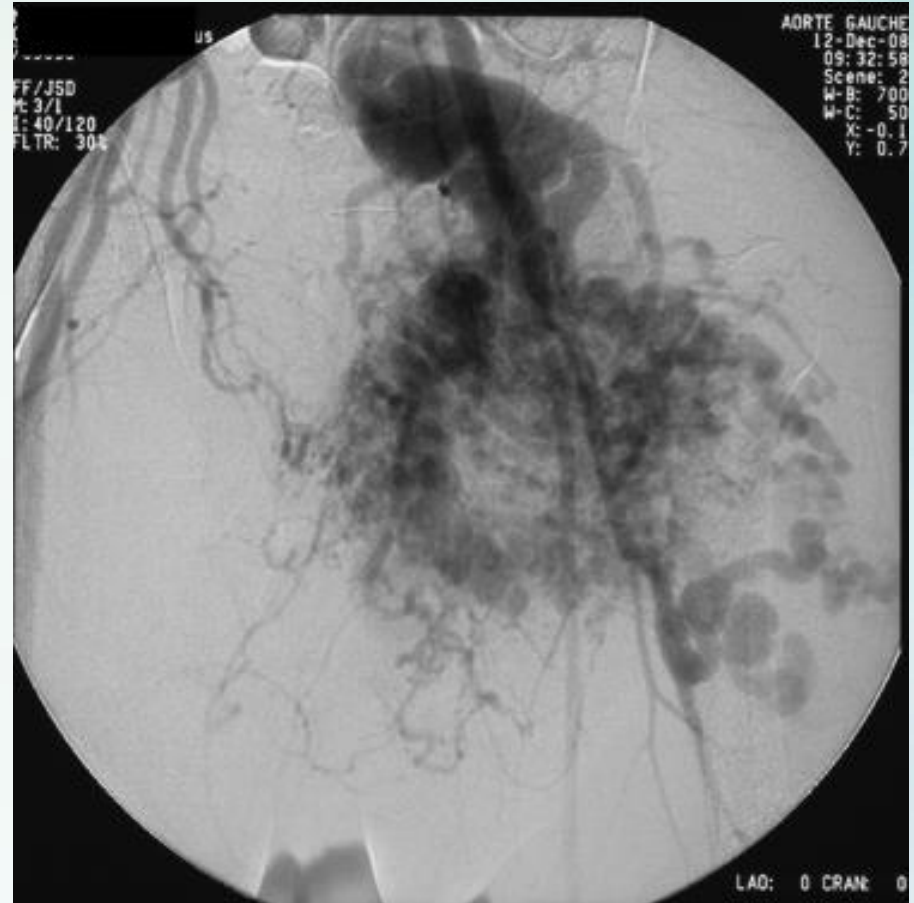
M 33: perineal AVM: pain+ulceration



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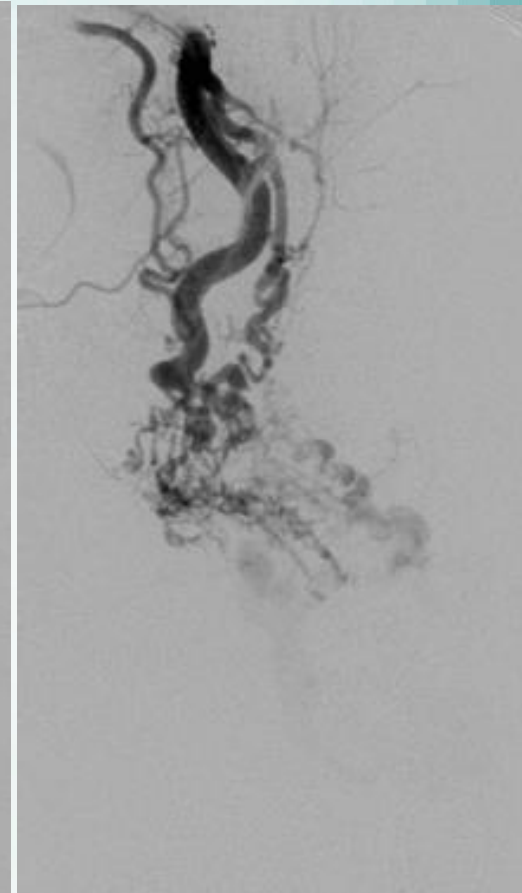
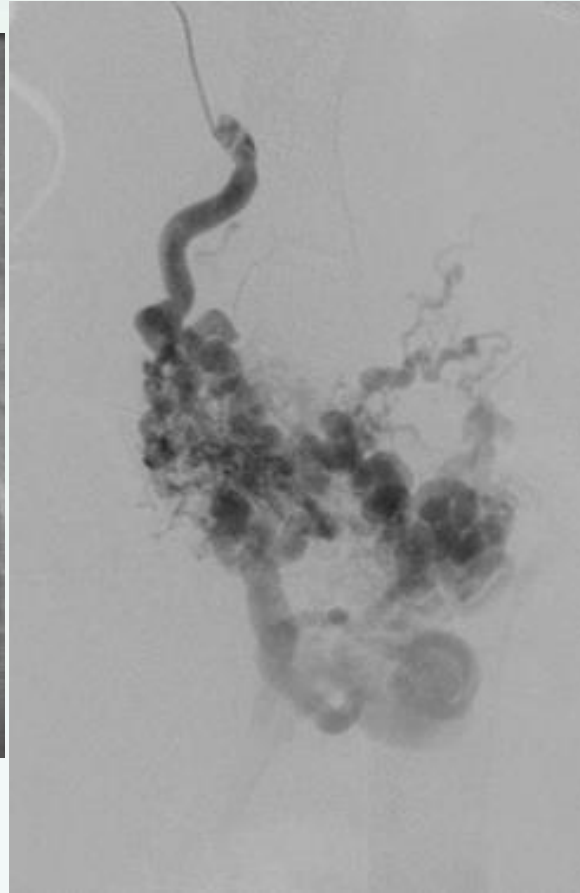
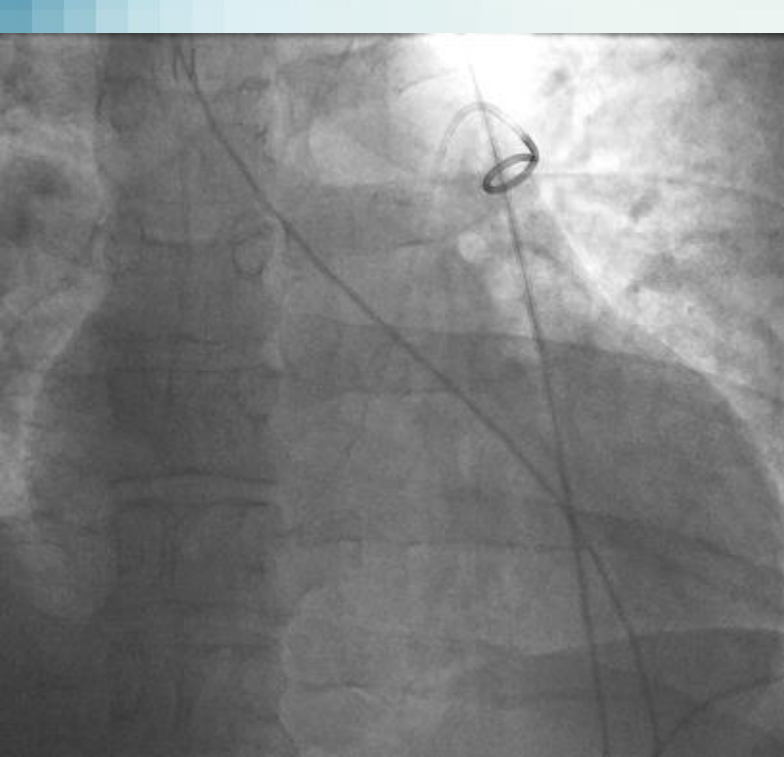
DSA



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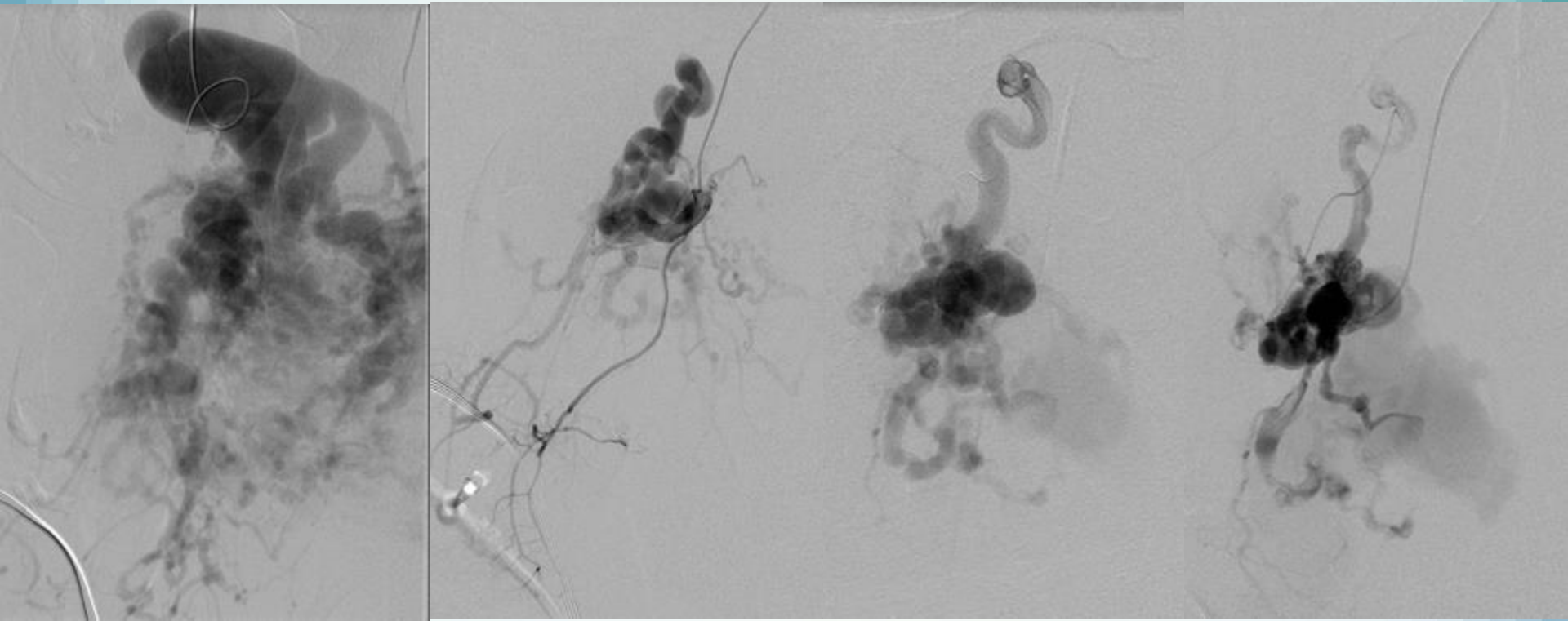
Ethanol embolization



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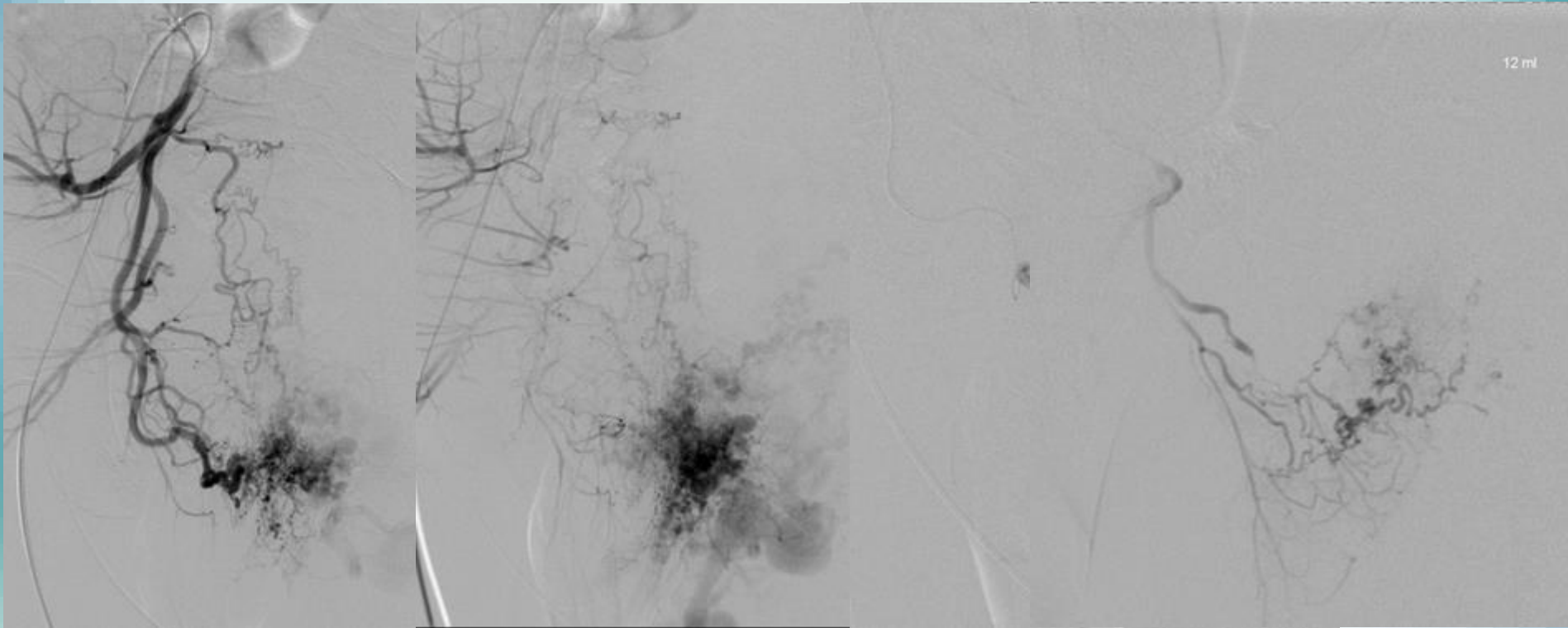
Ethanol embolization



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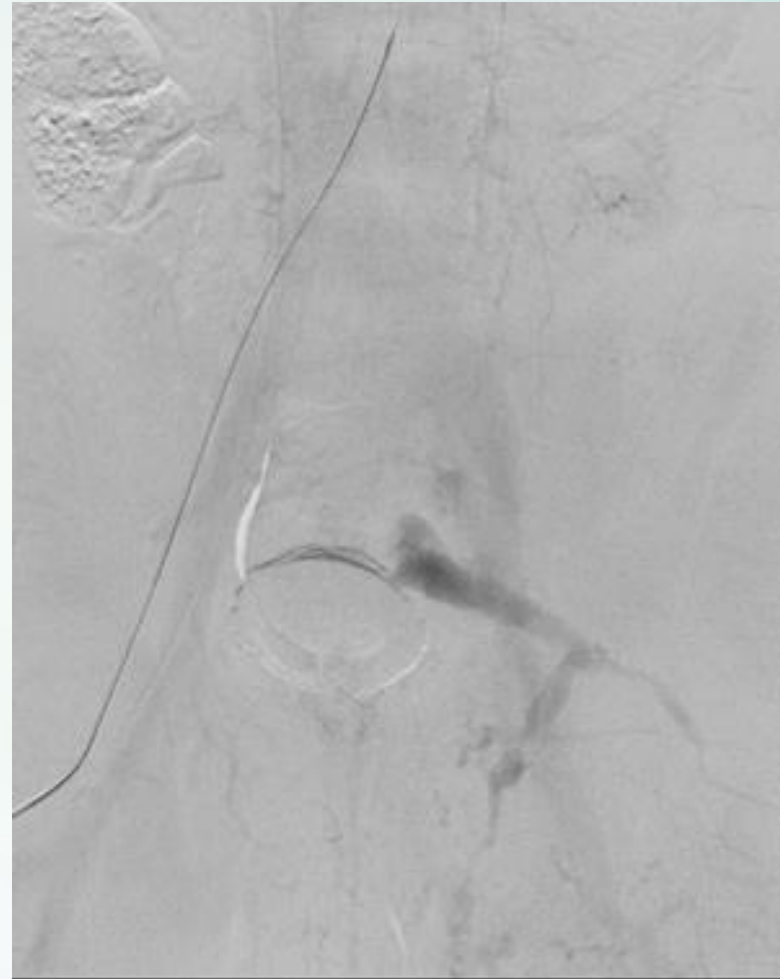
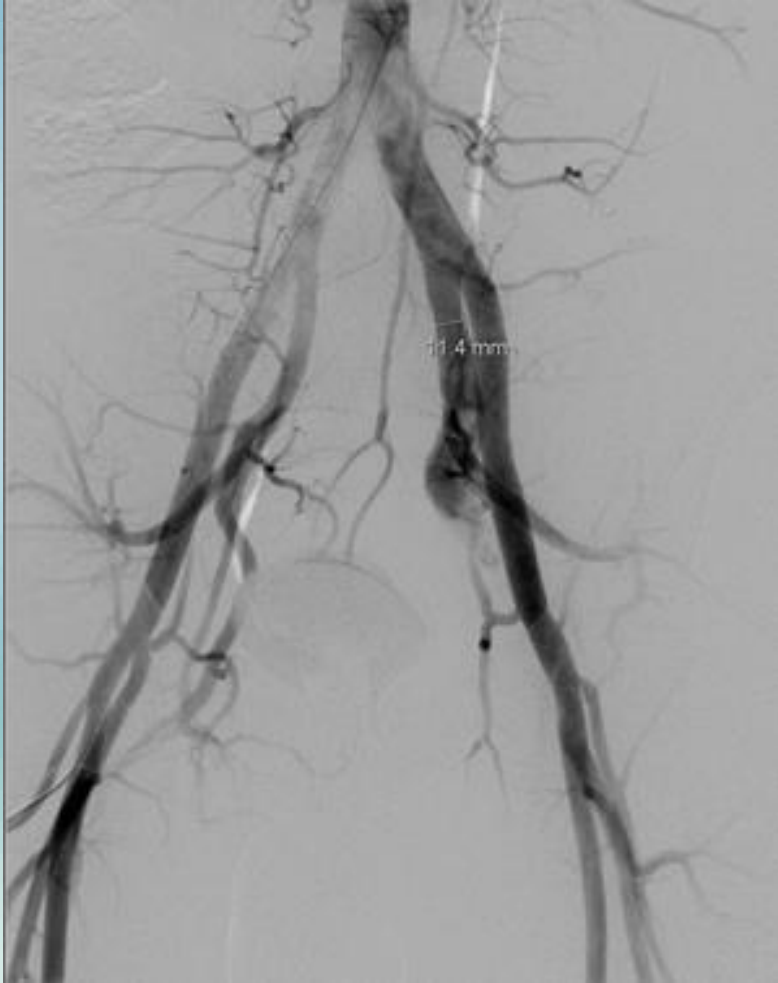
Ethanol embolization



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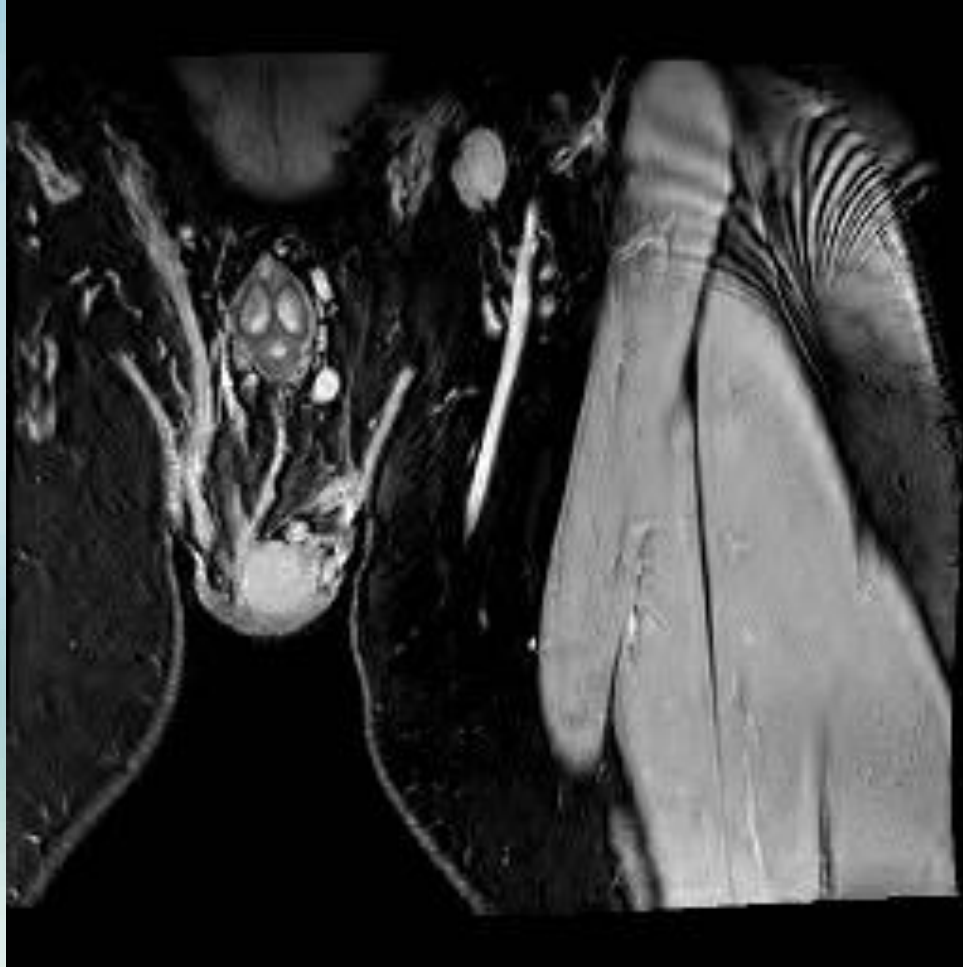
Final DSA



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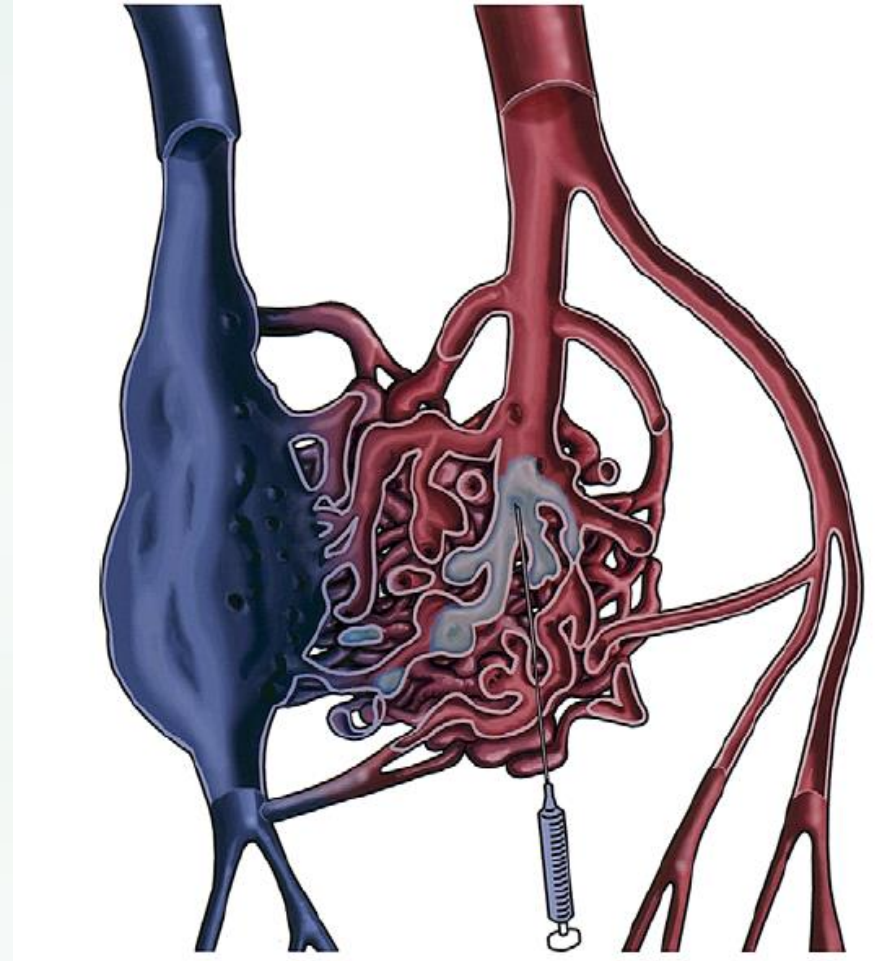
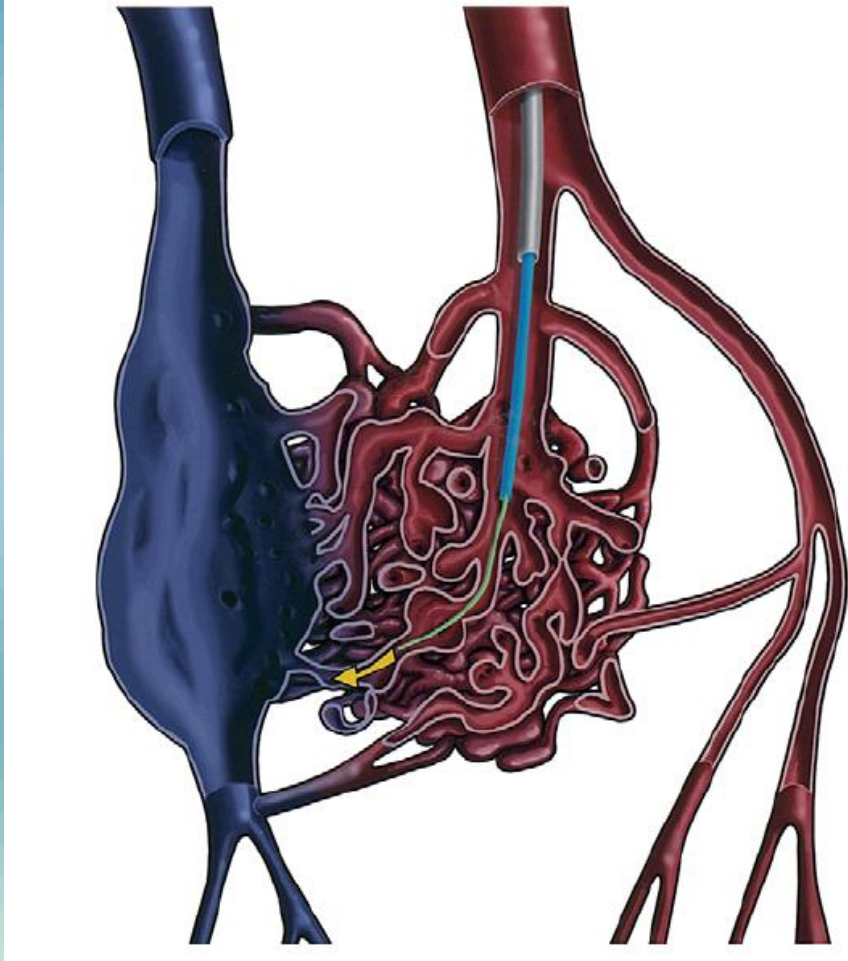
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Control MRI



- Surgical resection of the perineal mass
- Placement of balloon catheters in internal iliac arteries before surgery

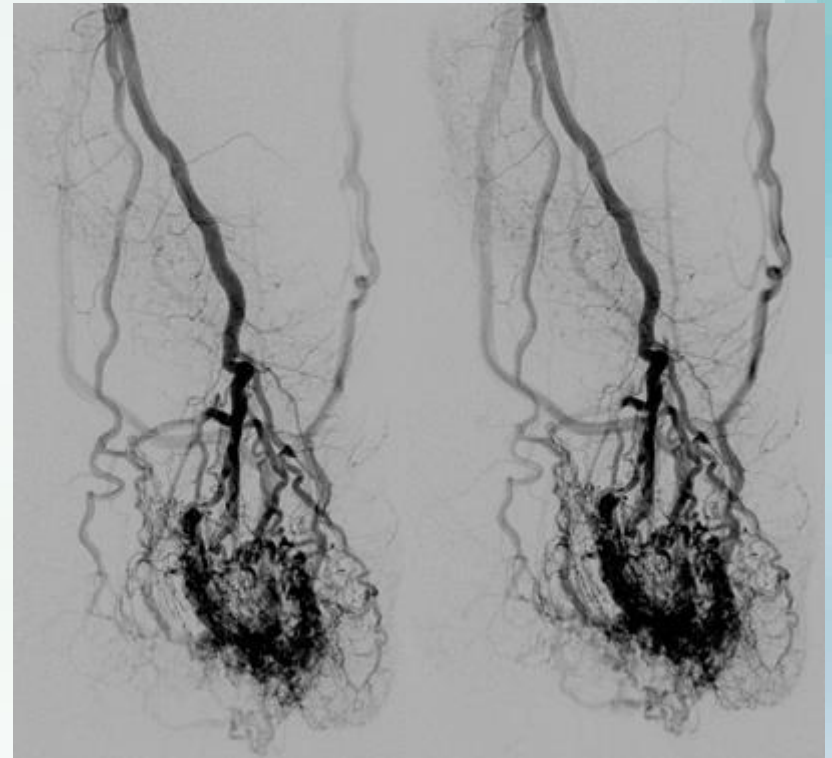
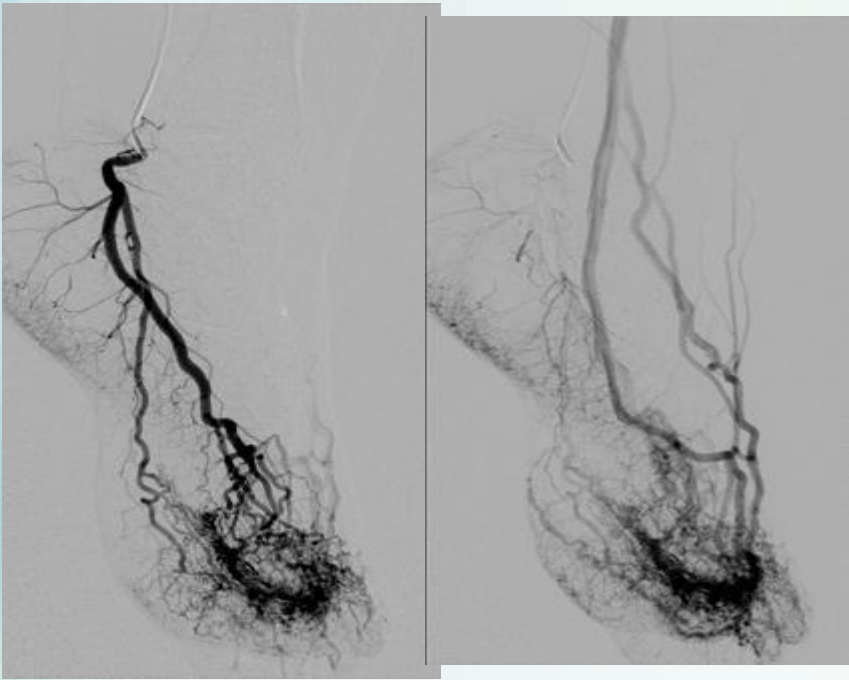
Endovascular & percutaneous



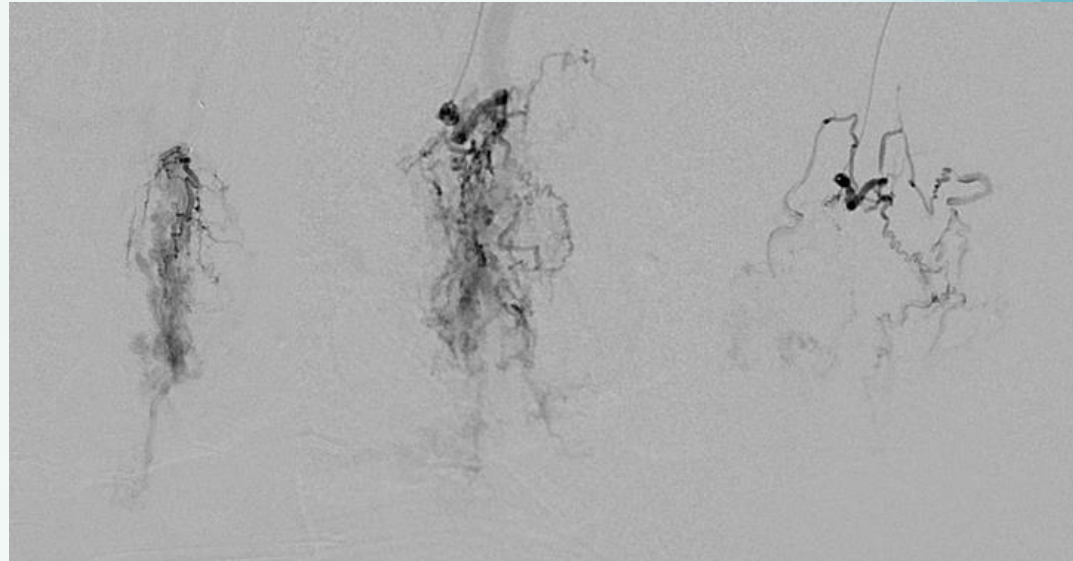
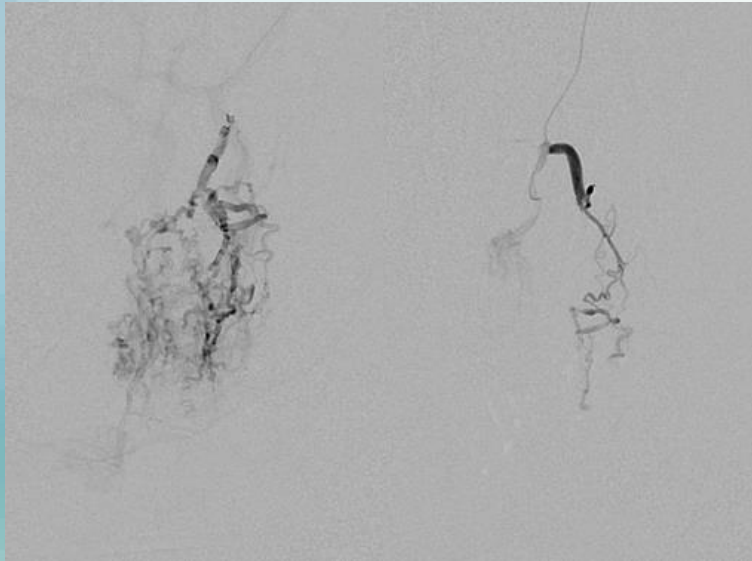
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58yo F, foot AVM ulceration 3rd and 4th toes



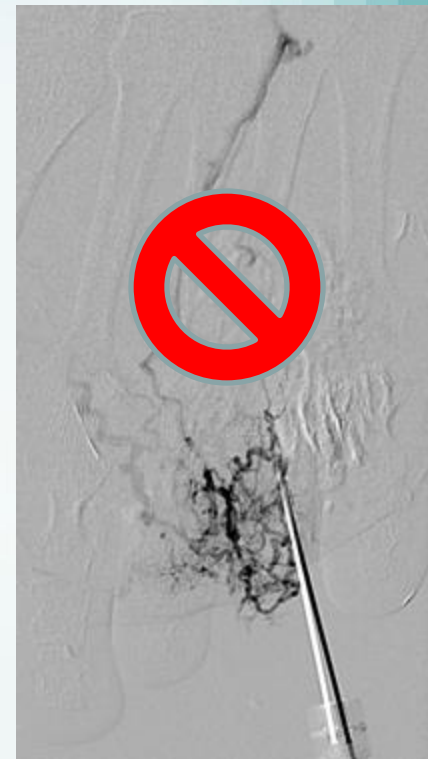
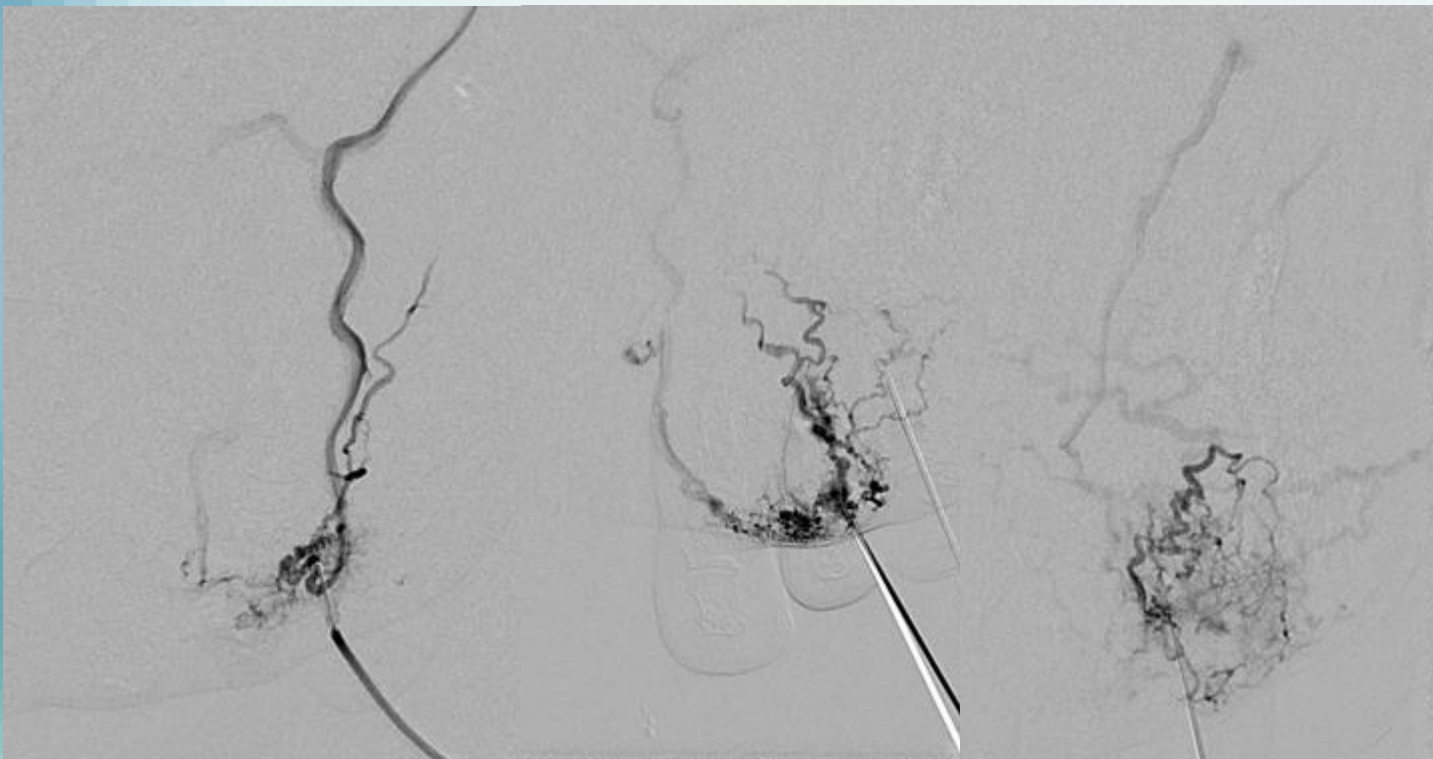
Supra selective embolization



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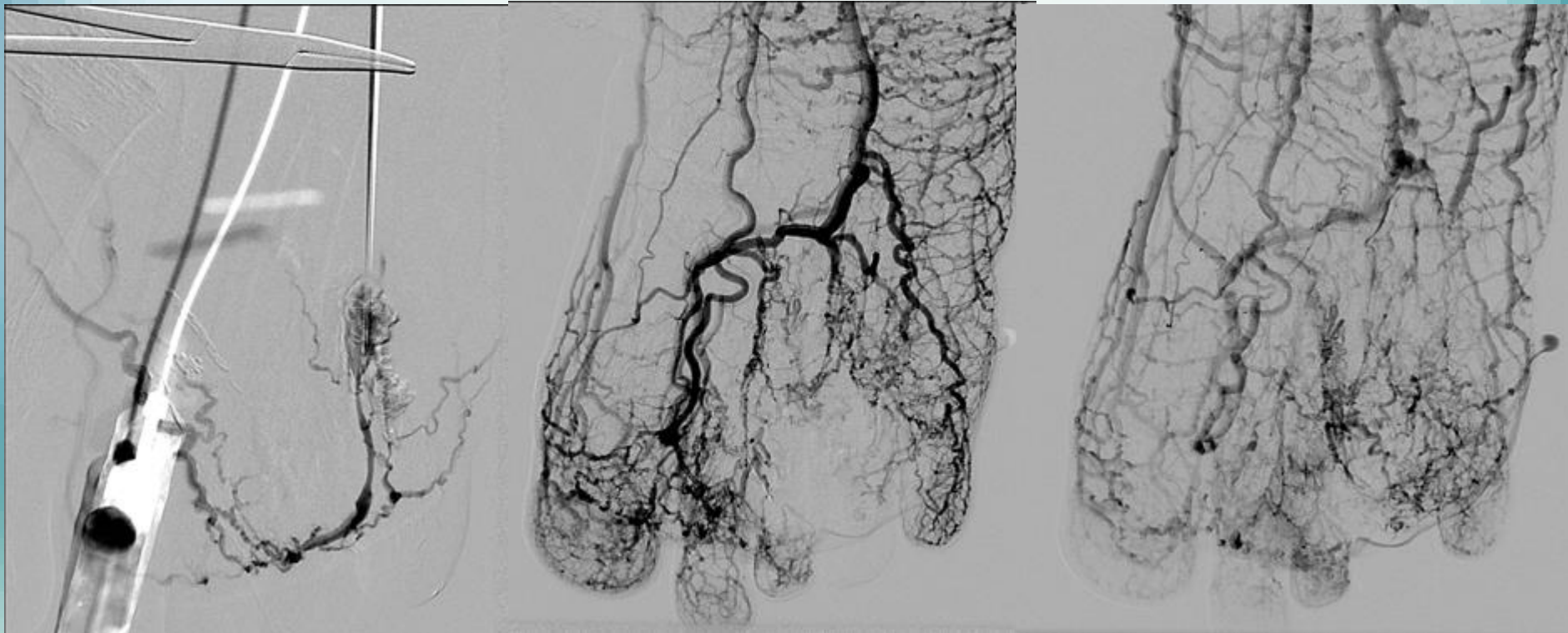
Direct puncture



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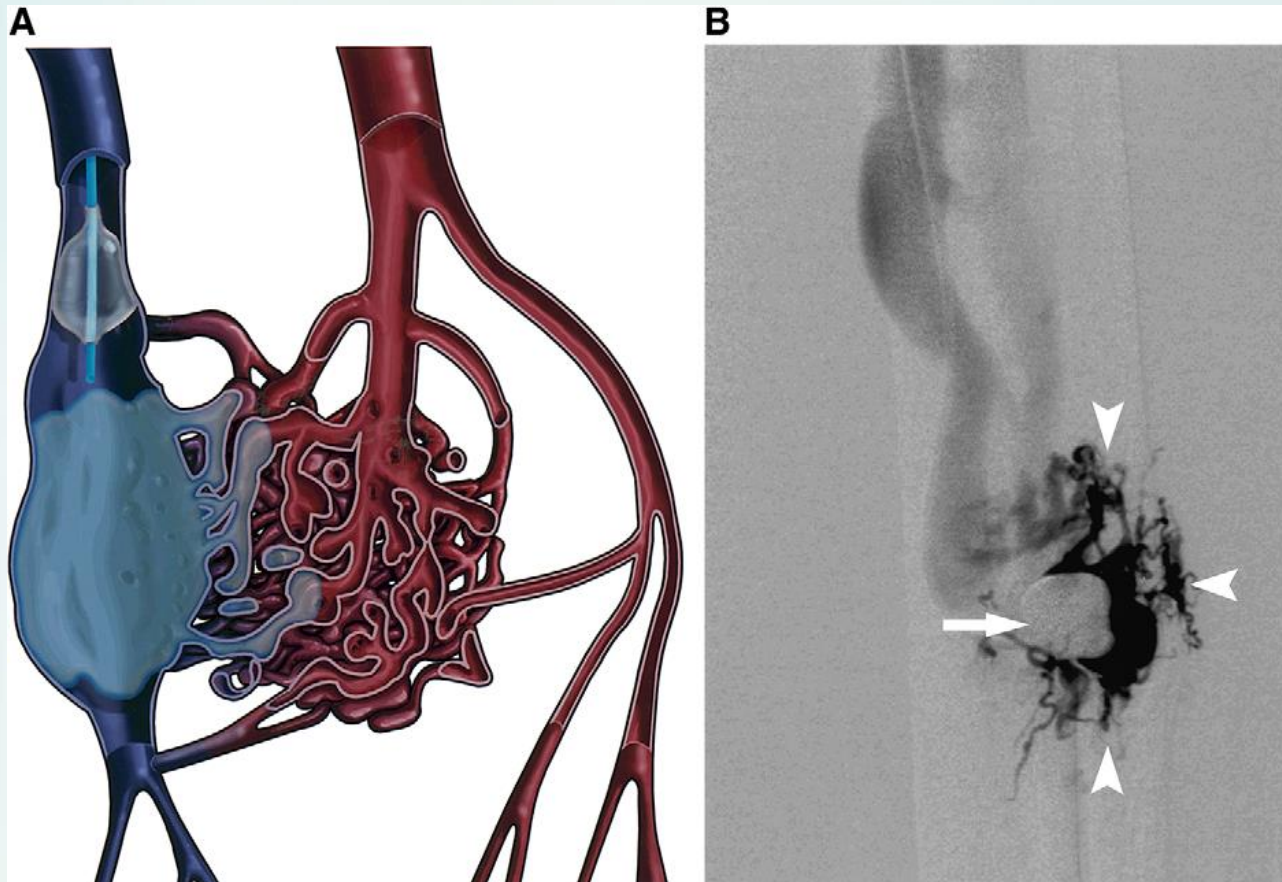
Final DSA



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Venous approach



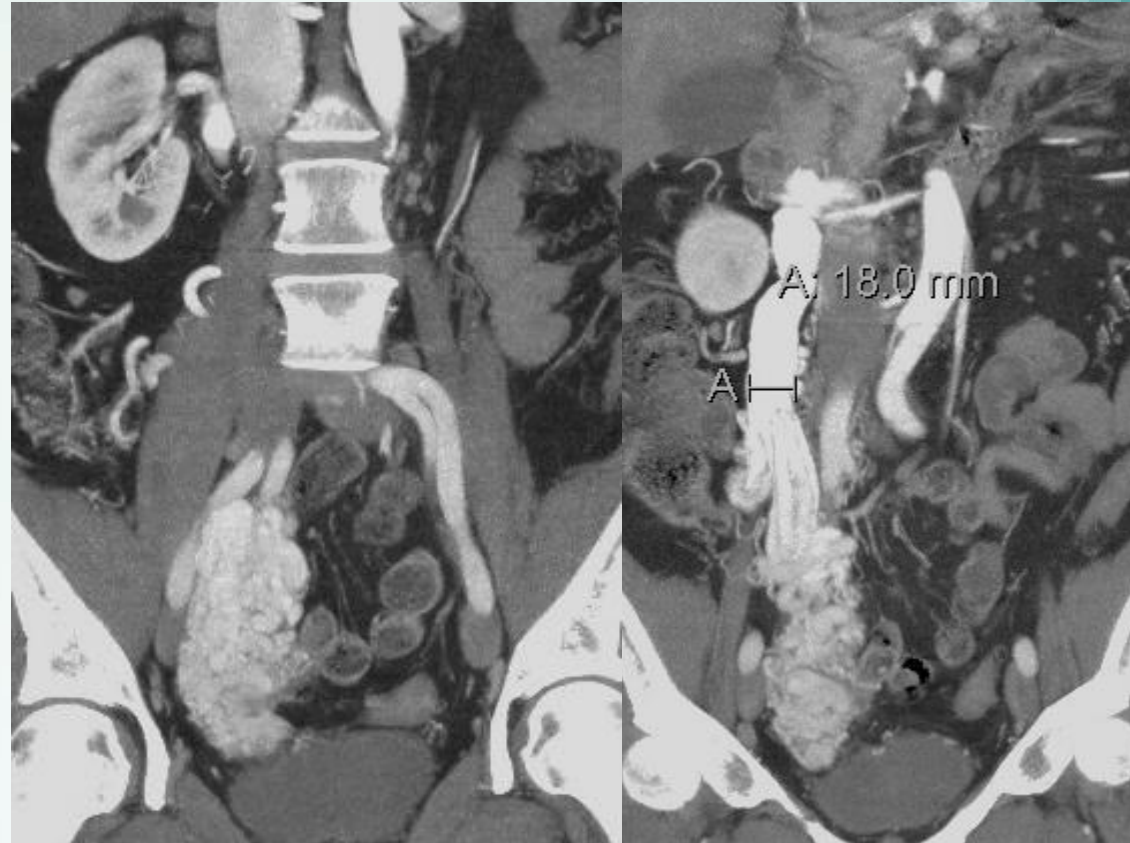
Leighen G. Ortho Clin North Am 2006

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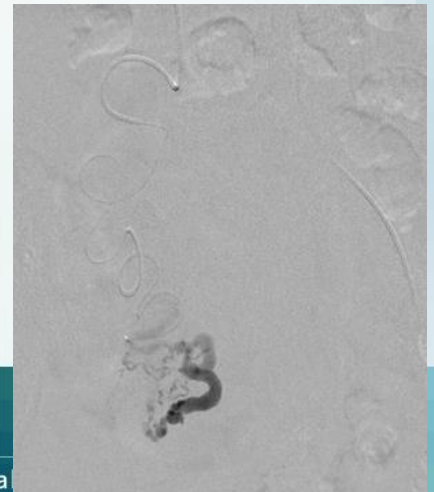
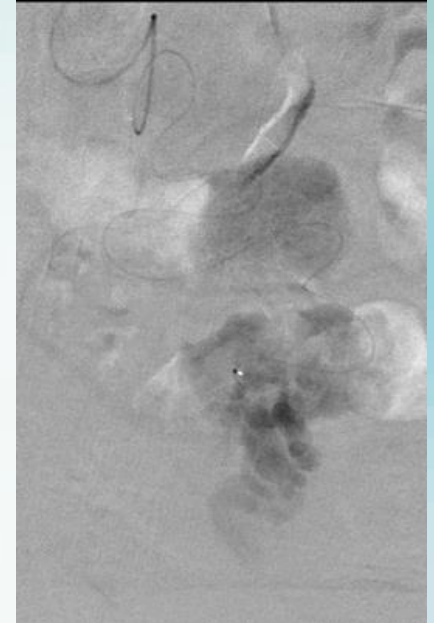
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45 Y-O Female

- Pelvic pain
- Massive bleeding during surgery (right ovariectomy)
- CTA
 - AVM



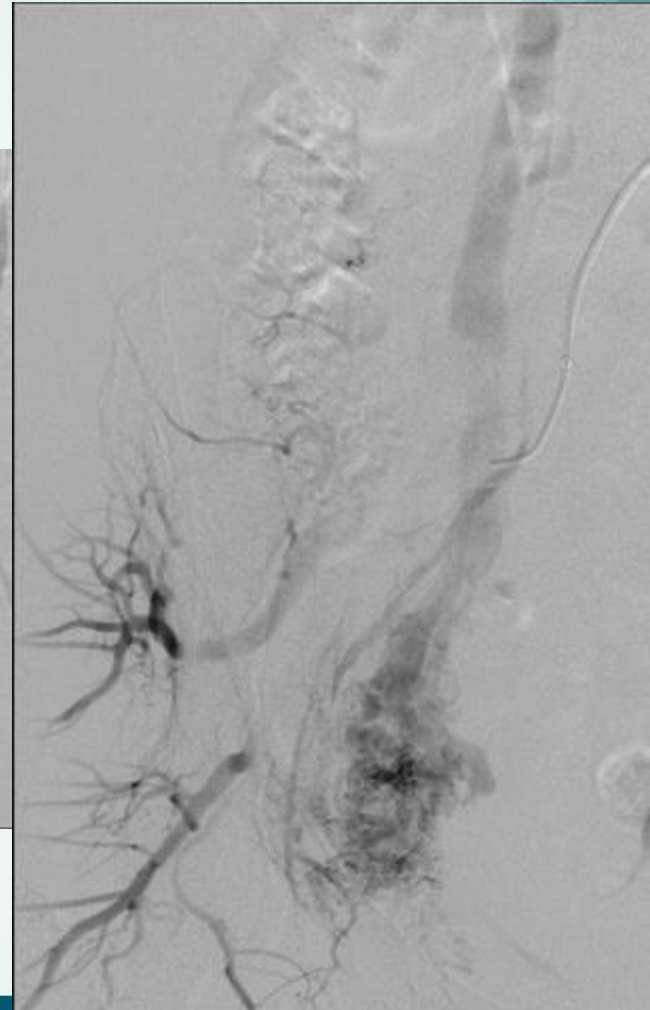
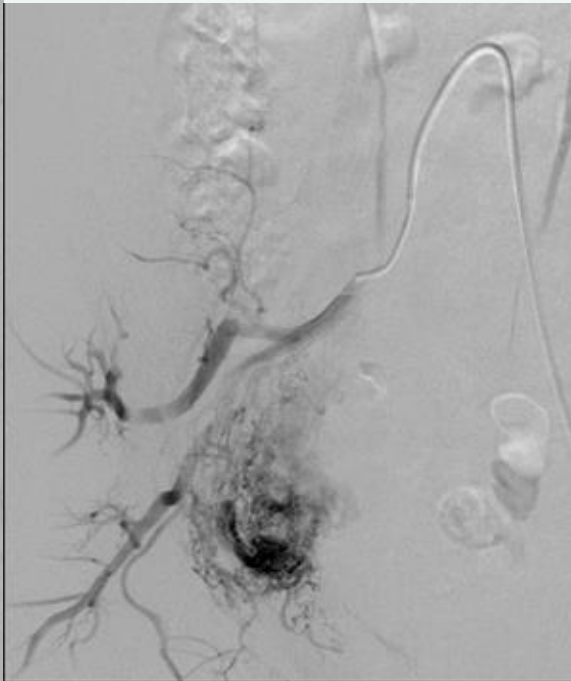
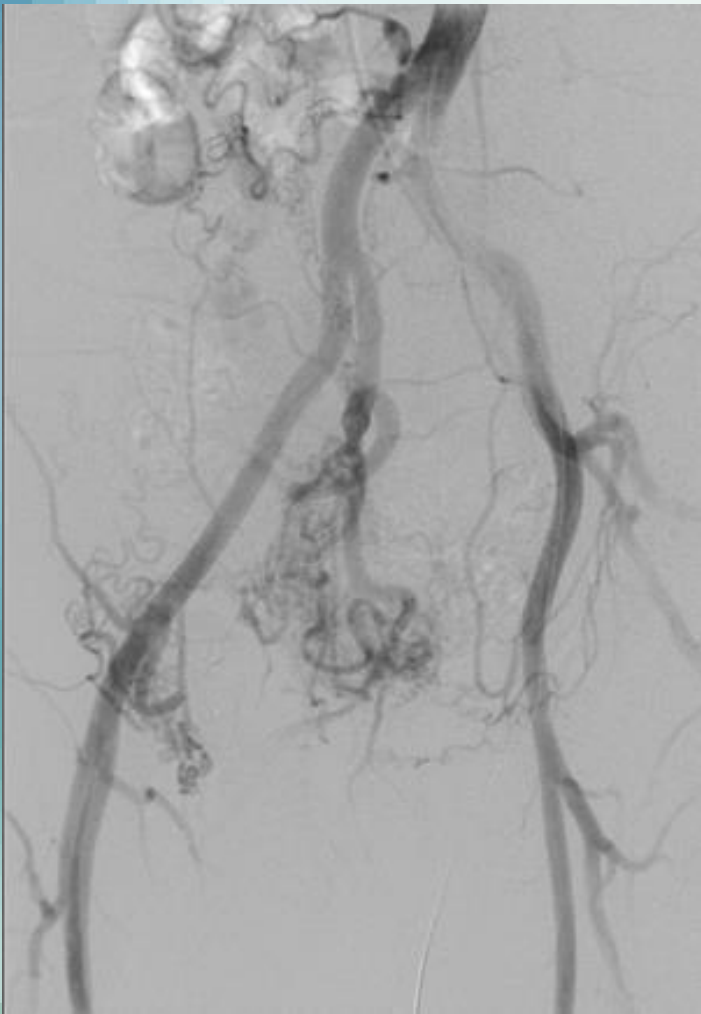
DSA-embolization 1



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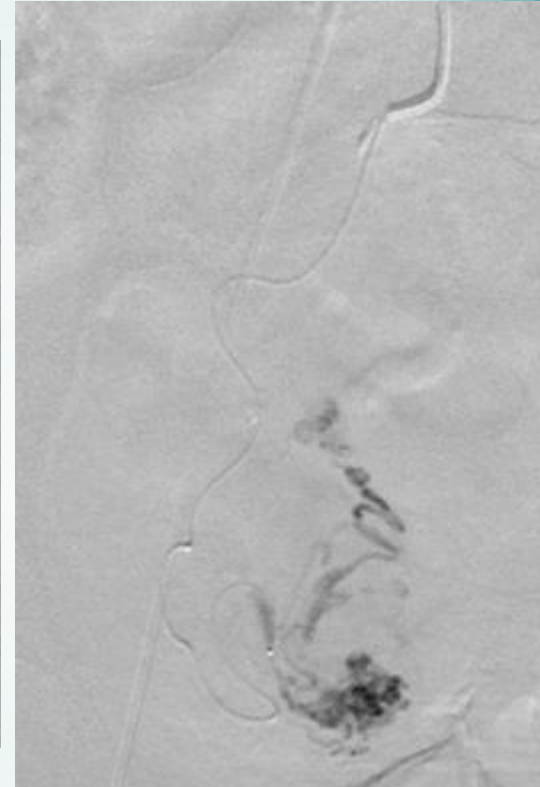
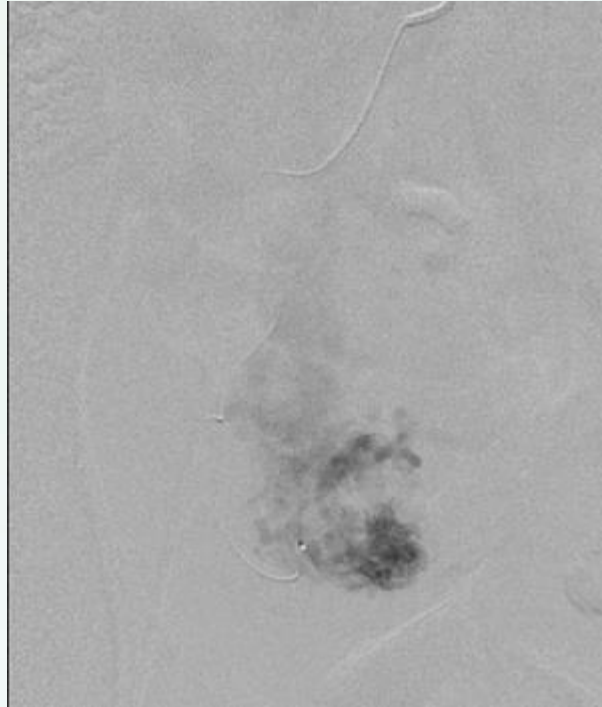
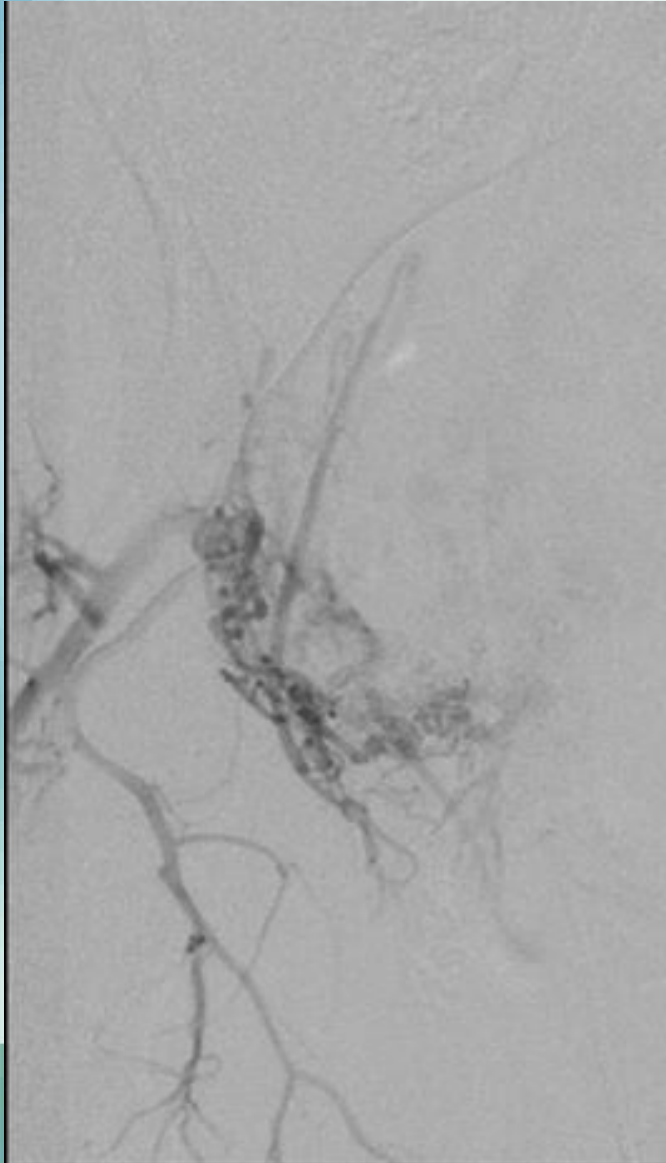
DSA-embolisation 2



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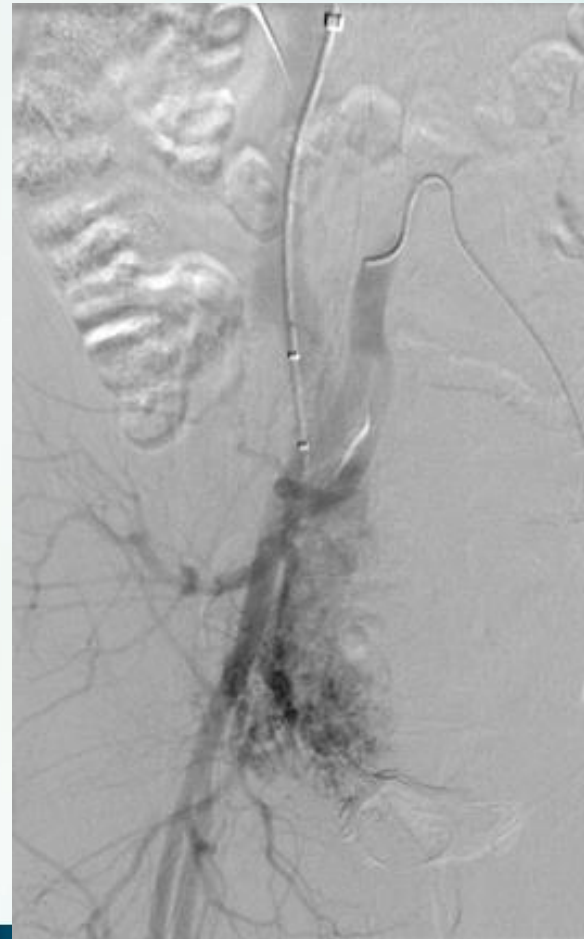
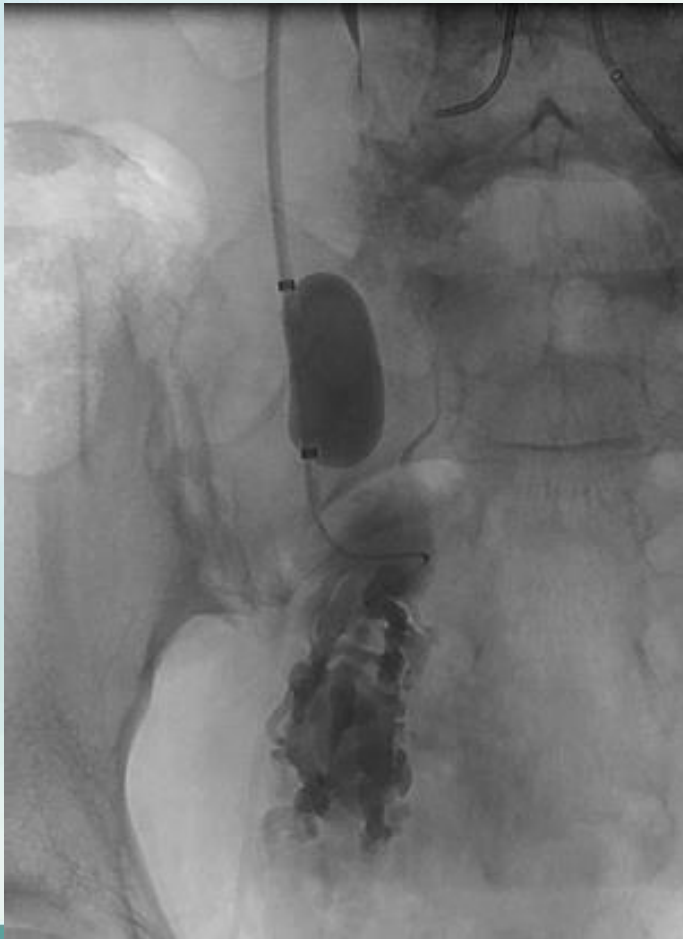
DSA embolization 2



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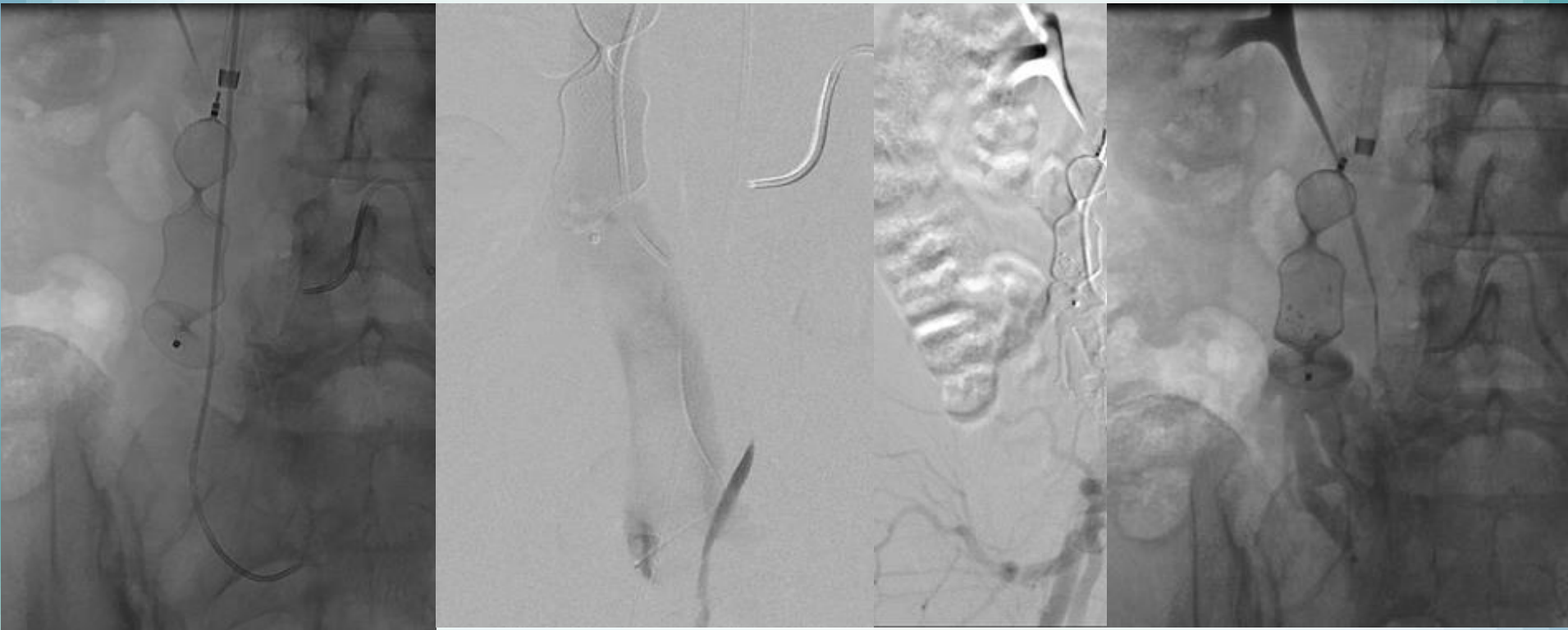
Venous approach (balloon + ethanol)



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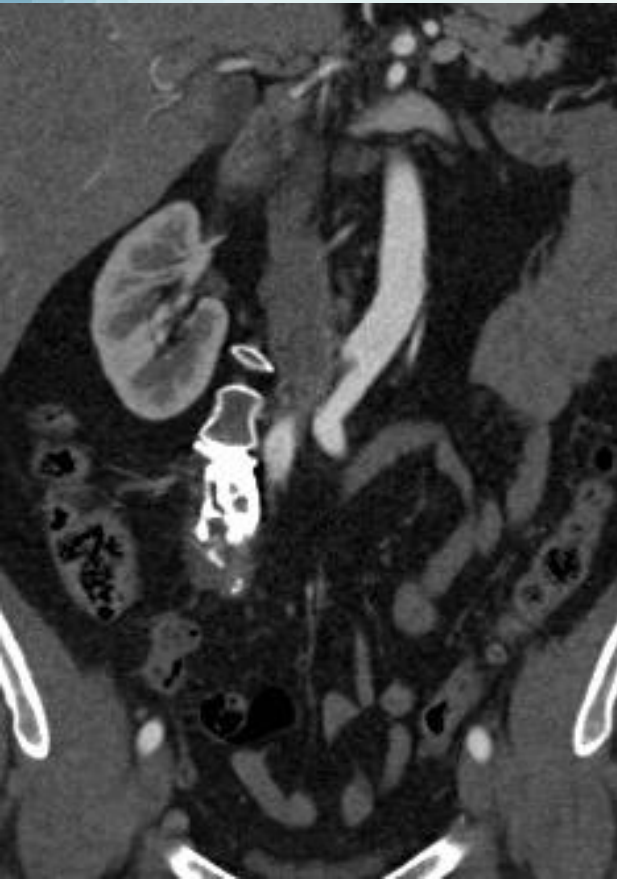
Venous approach (amplatzer+STS foam)



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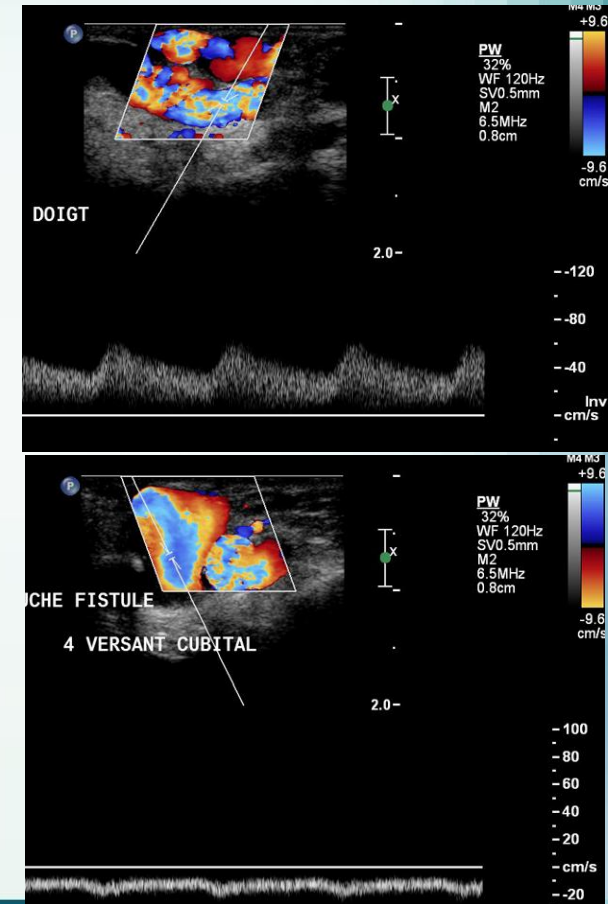
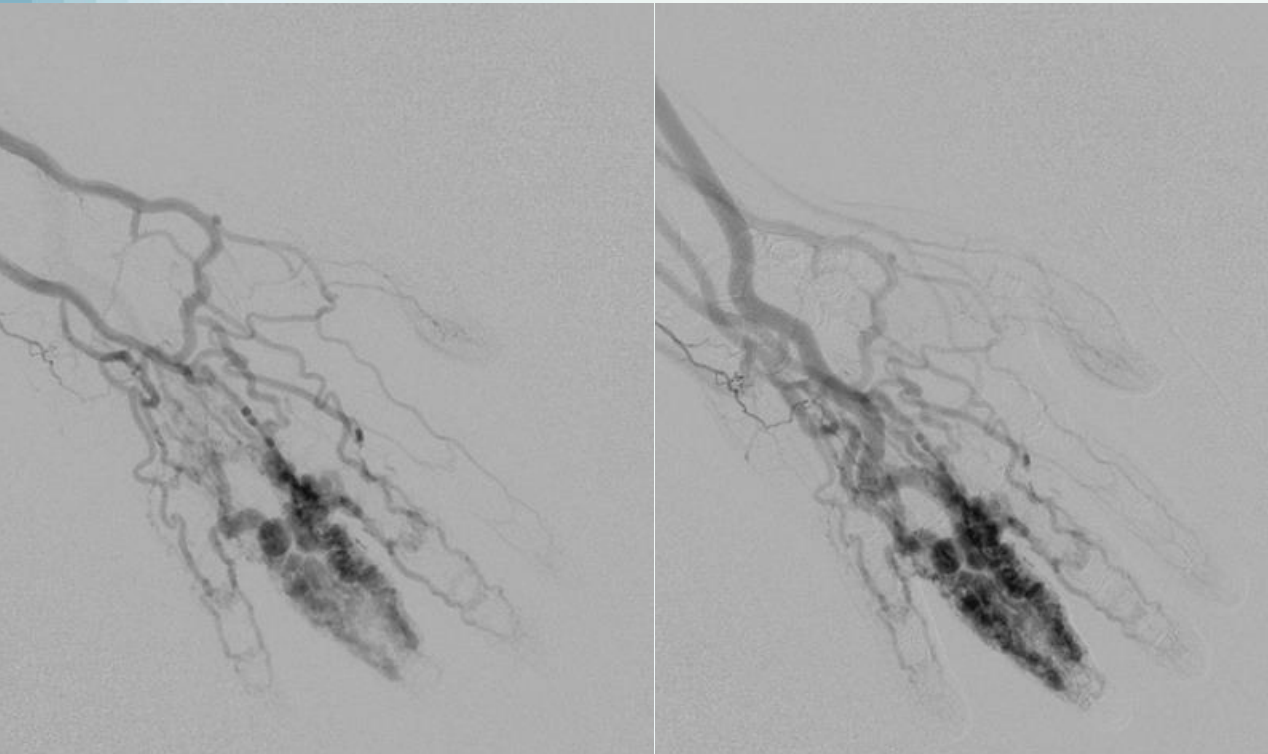
FU CTA



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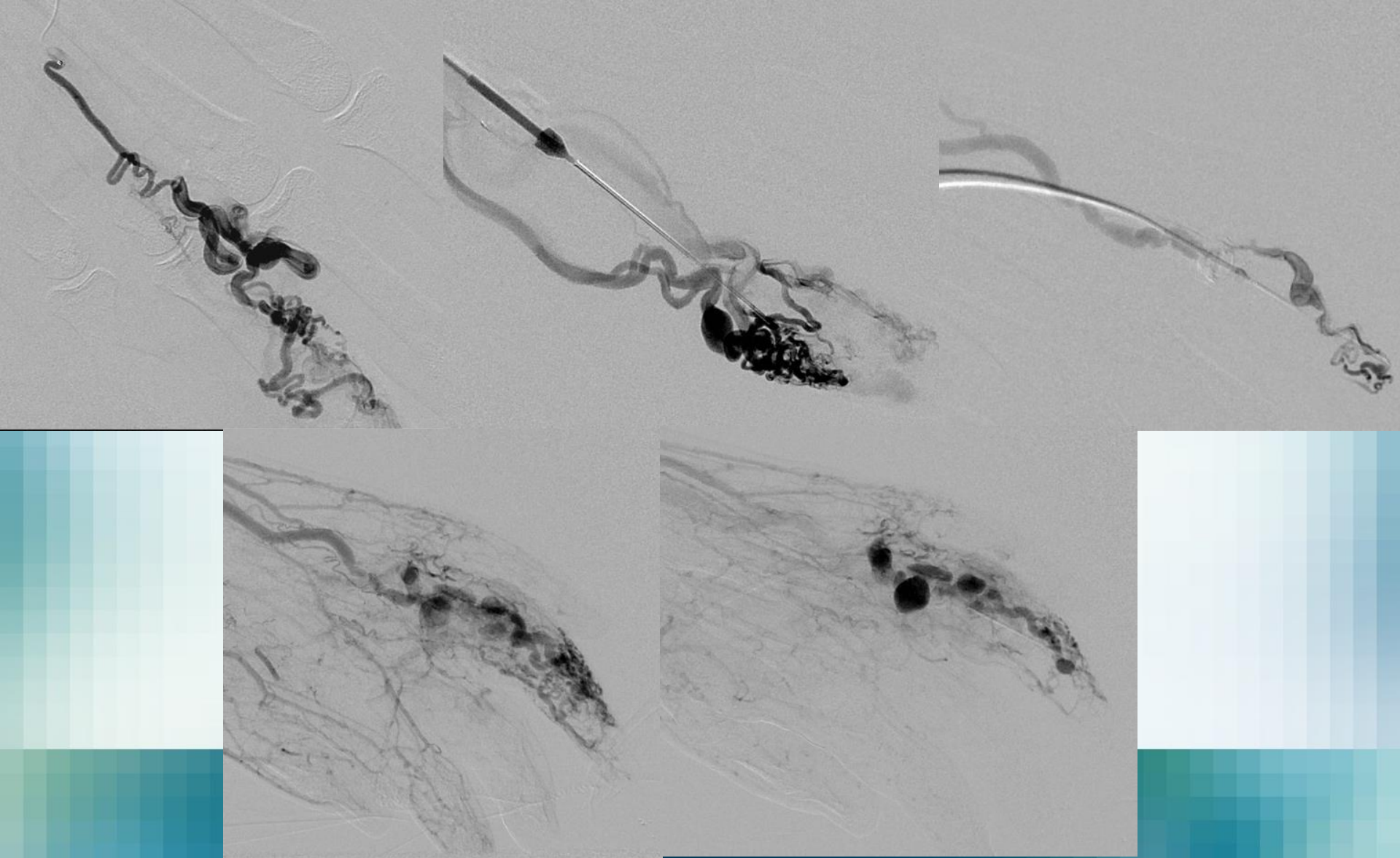
Correlation between Doppler and DSA



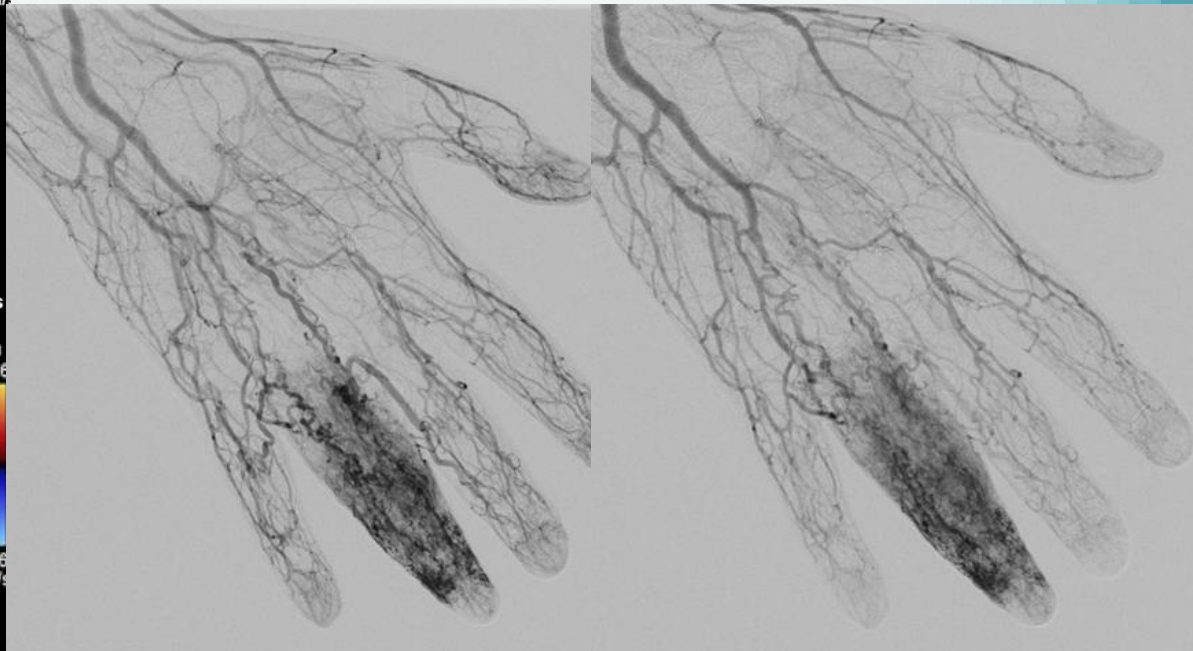
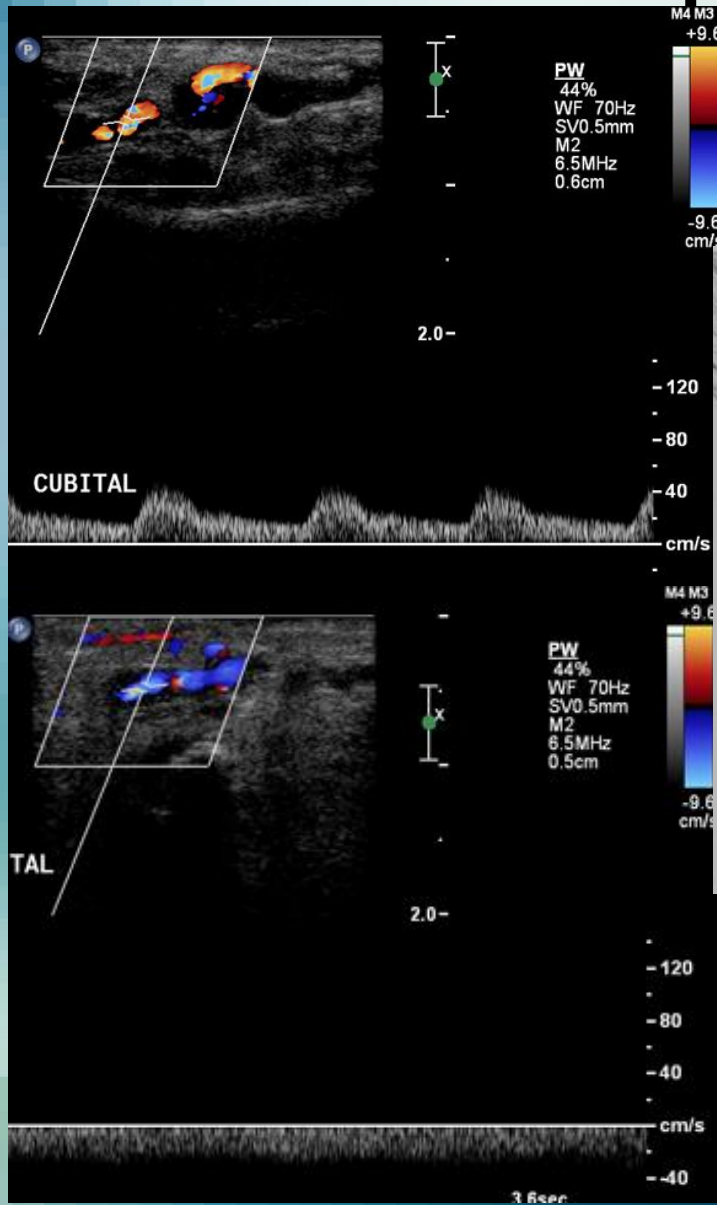
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Arterial (endo and percutaneous)



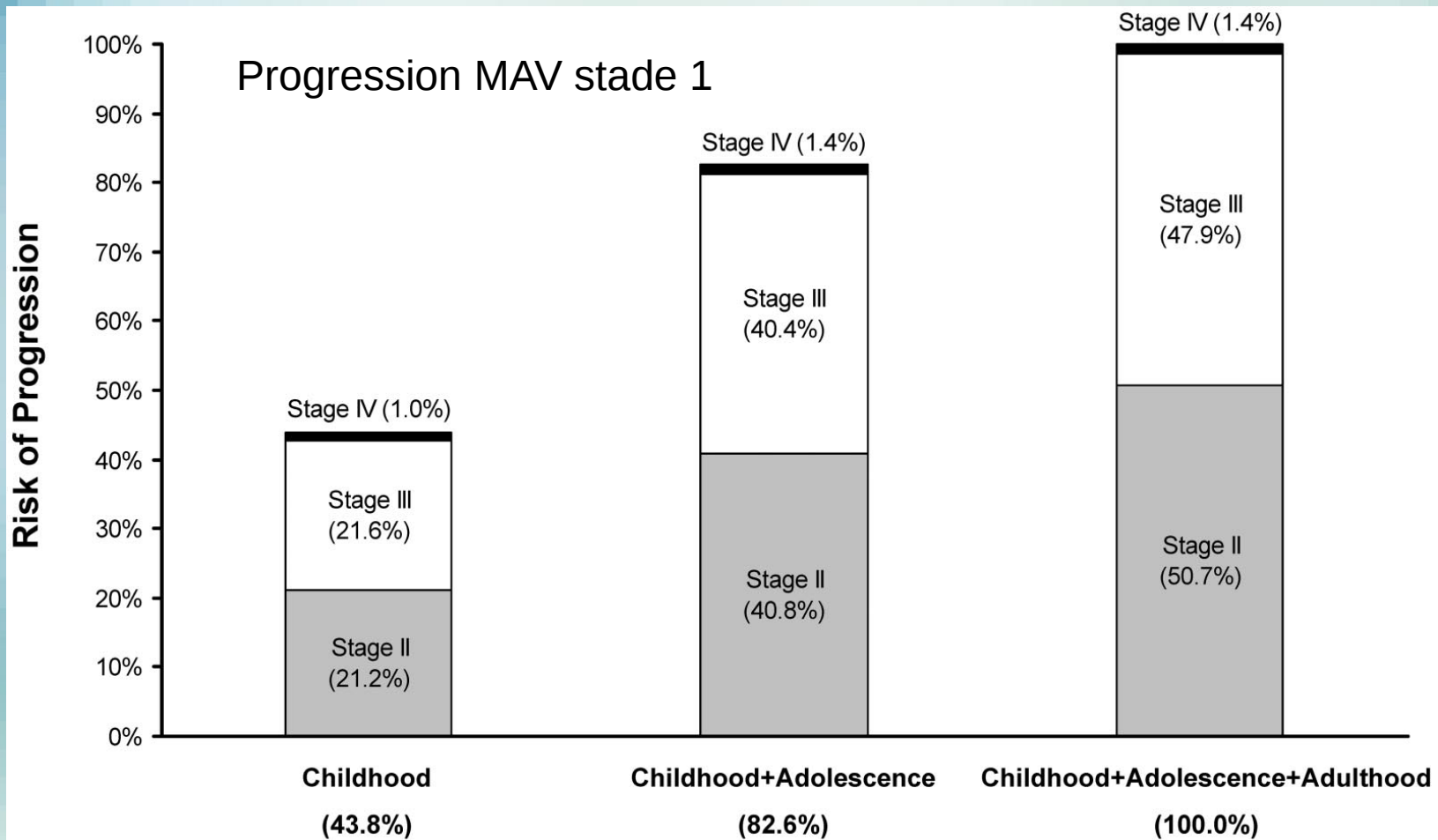
Follow-Up



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AVM evolution: Boston Study: n=272



Liu AS et al Extracranial arteriovenous malformations: natural progression and recurrence after treatment .Plastic and Reconstructive surgery 2010:1185

Recurrence embo versus surgery

(Boston study n=272)

- Mean FU: 8.9y $\pm$ 5.2y
 - Recurrence all patients 93%
- Predictor of recurrence:
 - Embo vs surgery (combined or not with embo)
 - Shobinger stage at treatment
- Resection
 - recurrence rate = 81%
 - Time to recurrence: 42.7% > 1y
- Embo alone
 - Recurrence rate = 98%
 - Time to recurrence: 14.4 % > 1y
- Selection bias +++

Liu et al Extracranial arteriovenous malformations: natural progression and recurrence after treatment .
Plastic and Reconstructive surgery 2010:1185

Conclusion

- Complete shunt occlusion and resection if possible is the ultimate goal
- Embolization
 - Arterial endovascular approach is the initial step in almost all cases
 - Depending on the angio-architecture and clinical symptoms
 - direct puncture
 - retrograde venous embolization
 - Liquid agent
 - Ethanol preferred (endothelial ablation)
 - Glue (dilution critical)
 - Onyx (good control)