Short- and Long-Term EVAR Complications:

How to Predict and Prevent ?

Jae-Hwan Lee, MD, PhD

Cardiovascular Center in
Chungnam National University Hospital

EVAR Today: Principle Limitations

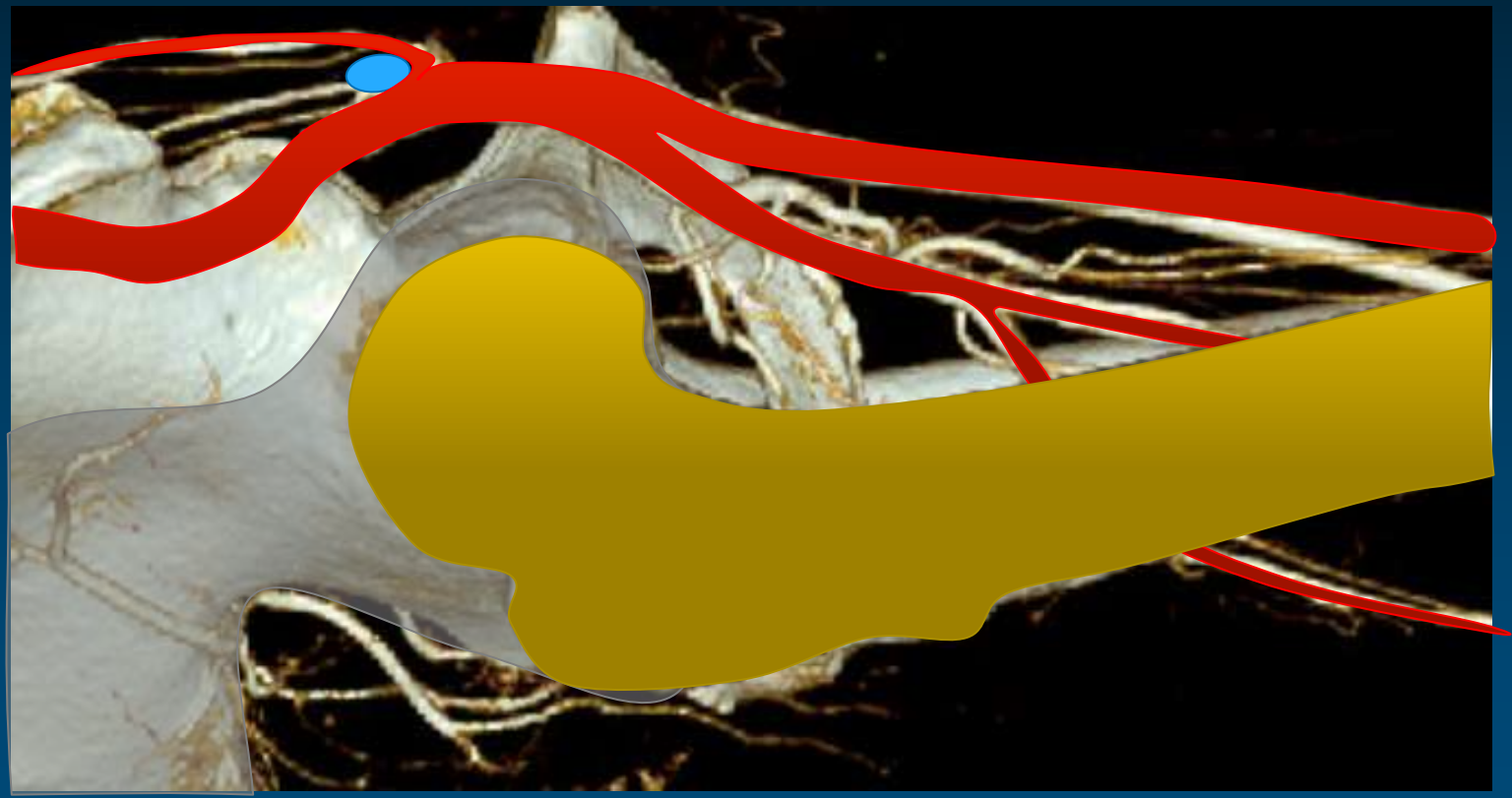
- Anatomic Exclusion Criteria
  - Hostile proximal neck
  - Access site anatomy
  - Branches
- Repeat intervention will be needed in 15-20%
- Surveillance requirements after EVAR
  : principally due to endoleak and the need to management
- Long-term results & durability: worse than surgery

Avoiding Access Complications

CT angiogram is mandatory to evaluate whole access route

- **Investigate puncture site with axial scan**
  - **stenosis or calcification**
  - **level of CFA bifurcation**
- **Internal iliac arterial status**
- **Calcification / Tortuosity of aortoiliac system**
- **Use dilators for the calcific stenosis**
  - **→ Balloon dilation for unsuccessful result**

Puncture site ?



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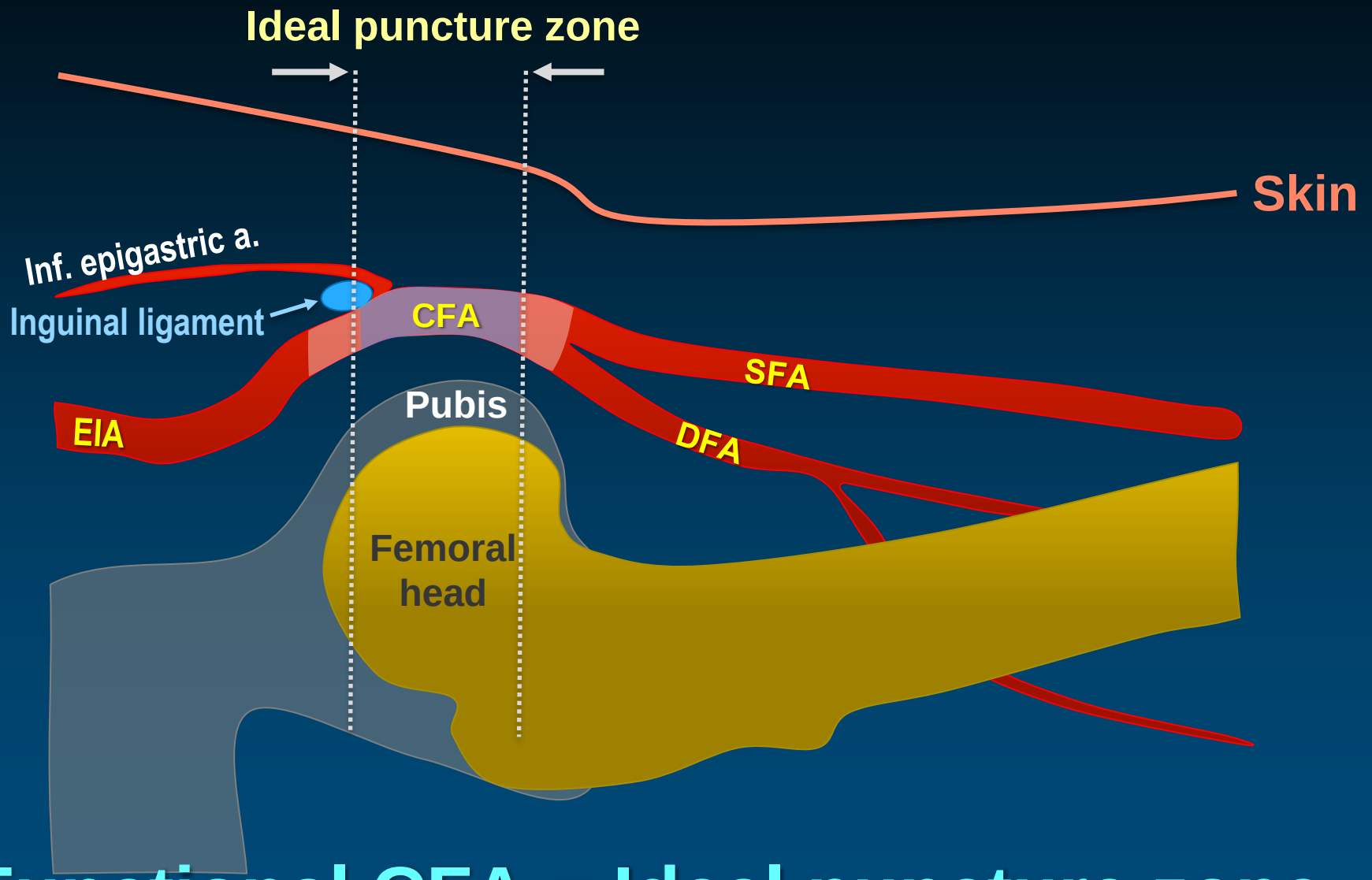
‘Conventional’ CFA vs. ‘Functional’ CFA



Functional CFA = Ideal puncture zone

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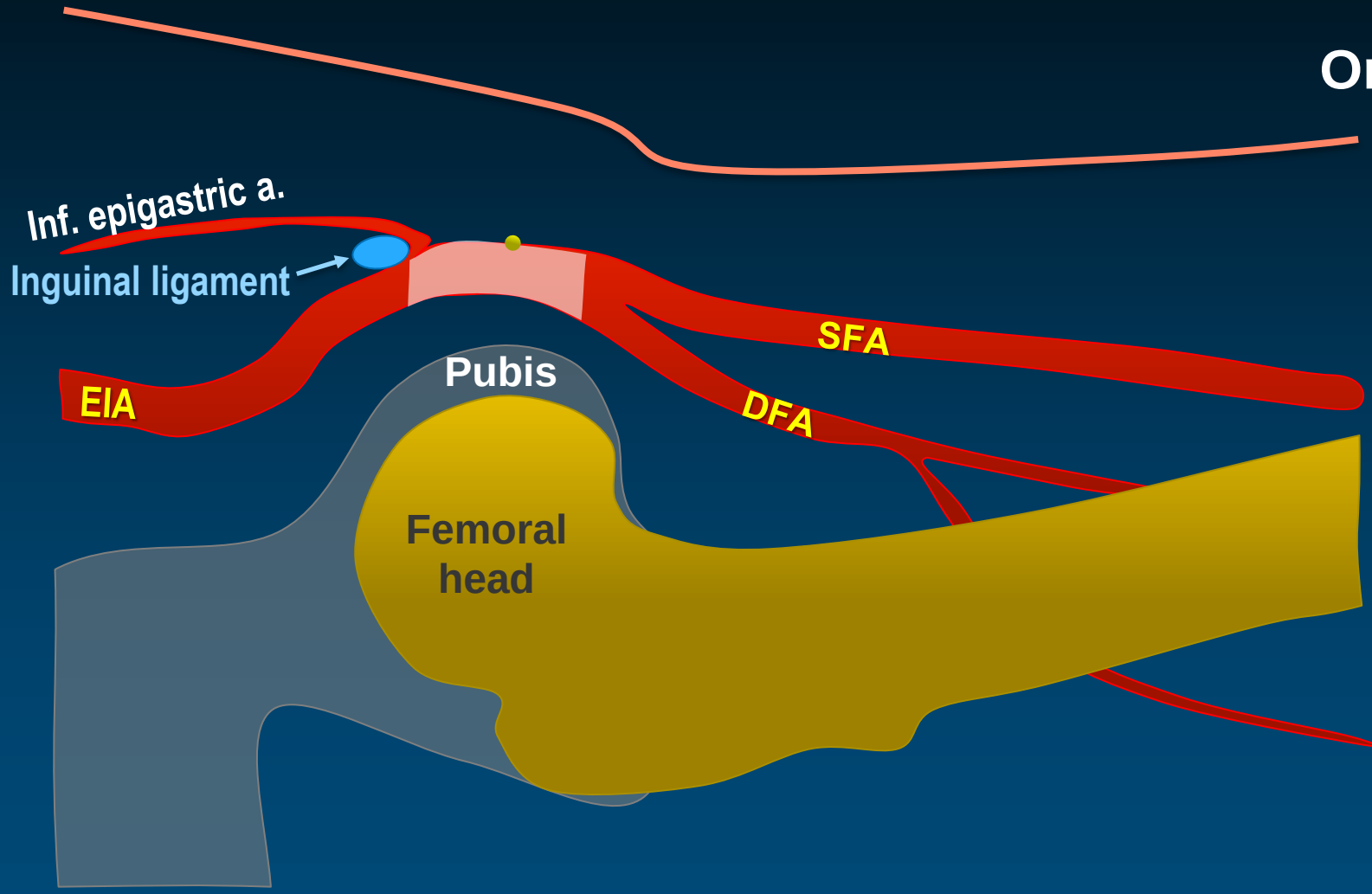
External Compression of Proper Access Site



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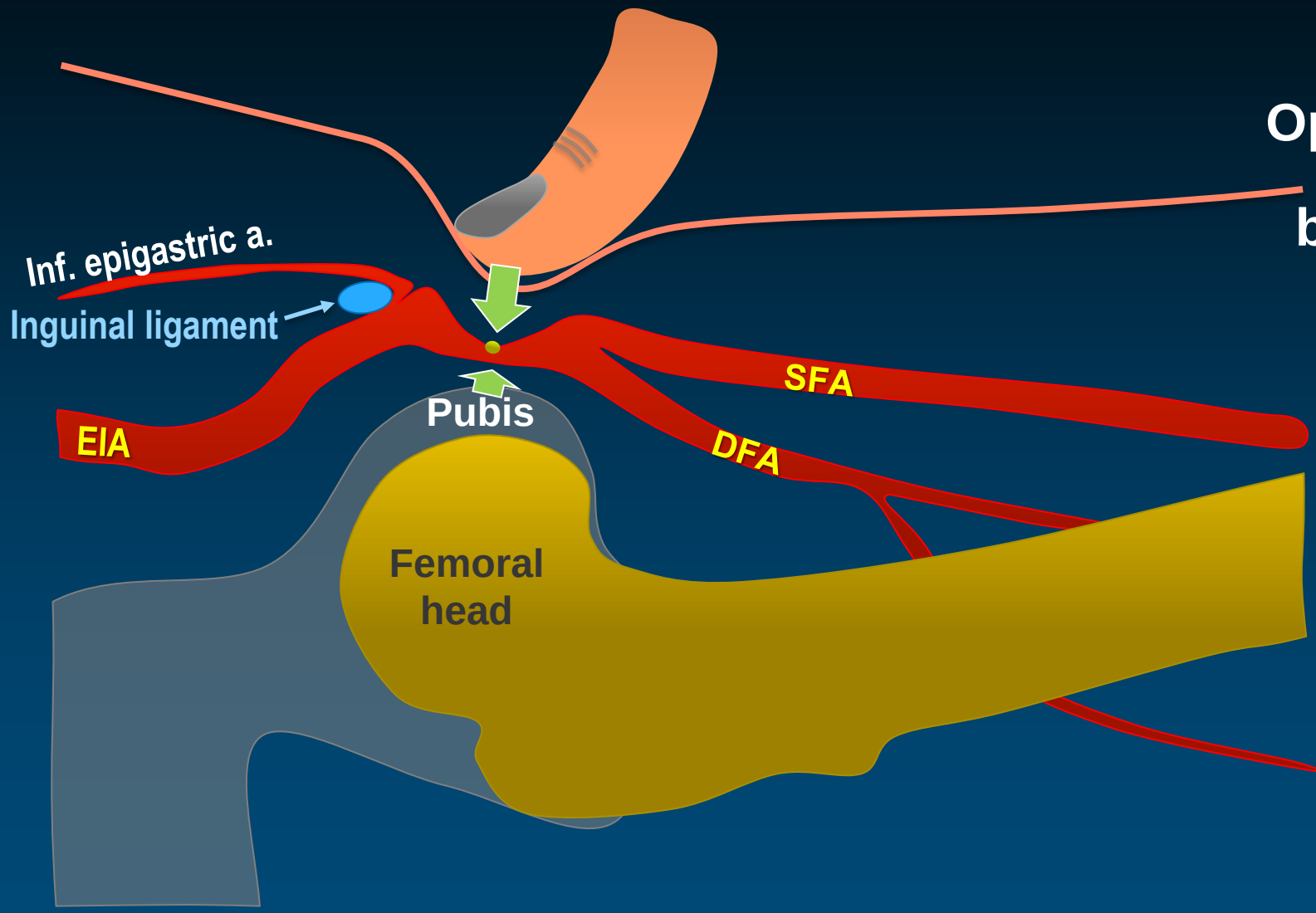

Optimal compression

between finger and pubis

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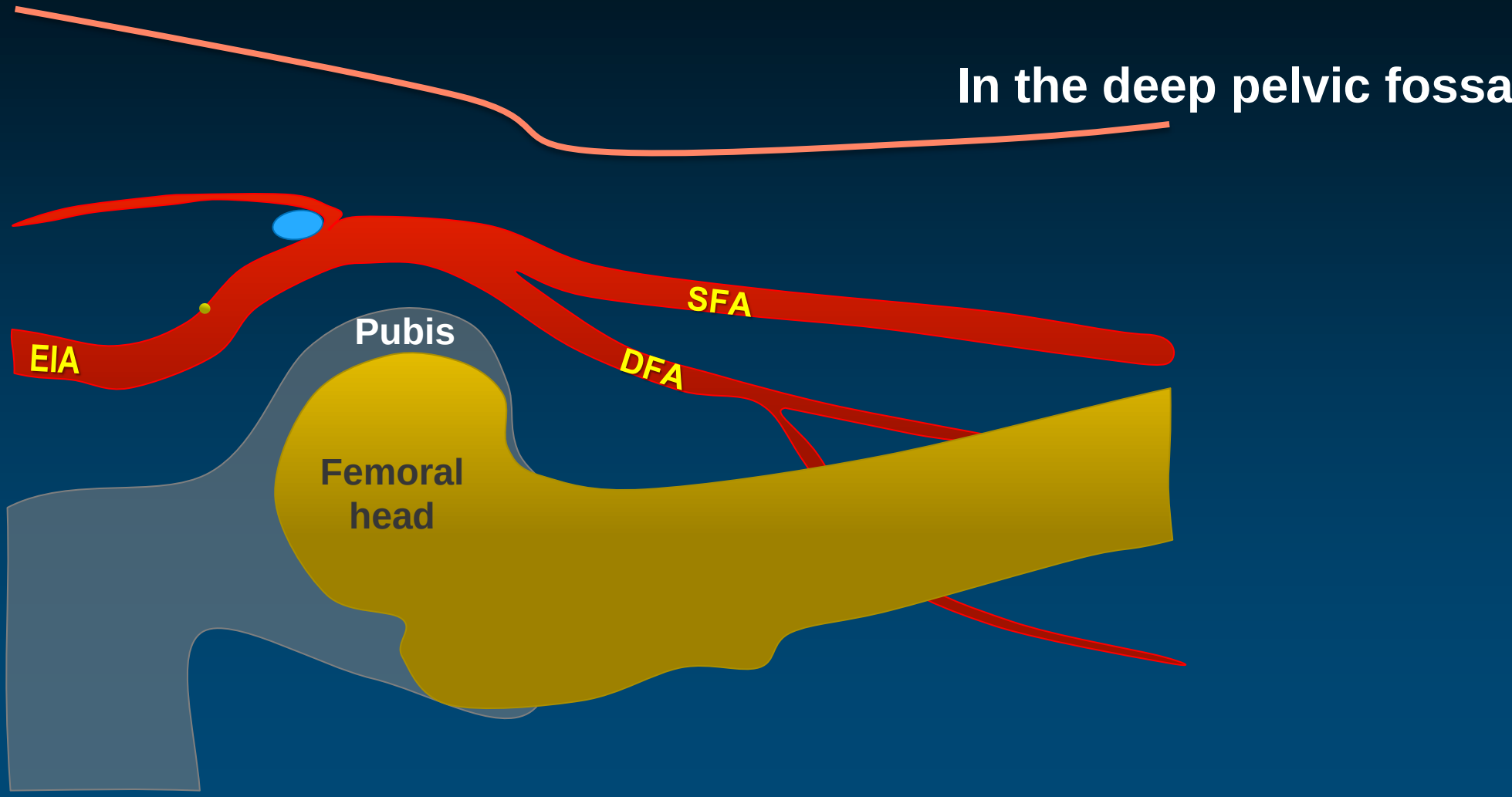

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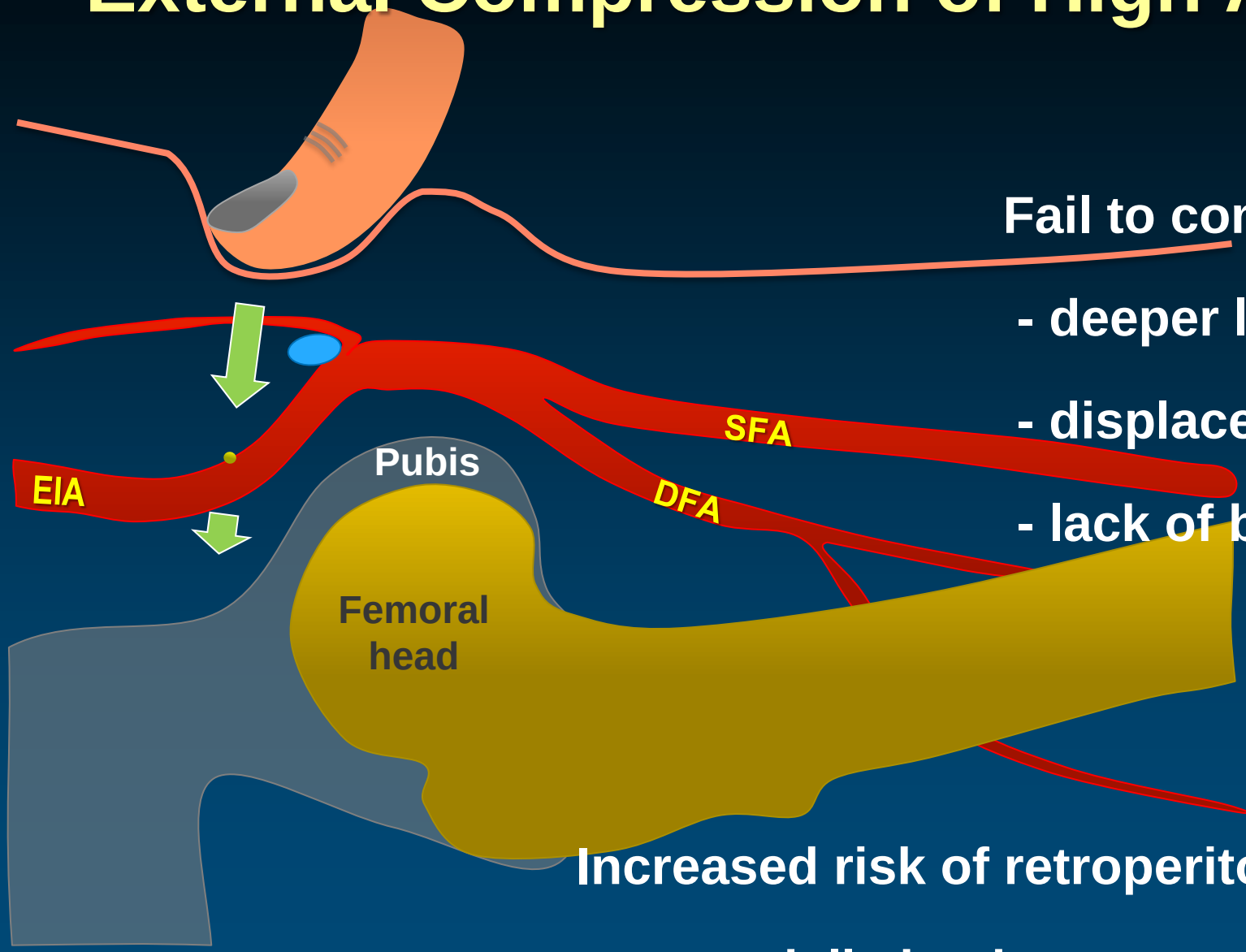

Fail to compress d/t

- deeper location of vessel
- displacement of vessel inferiorly
- lack of bony structure posteriorly

Increased risk of retroperitoneal bleeding

- especially in obese pt. and posterior wall puncture

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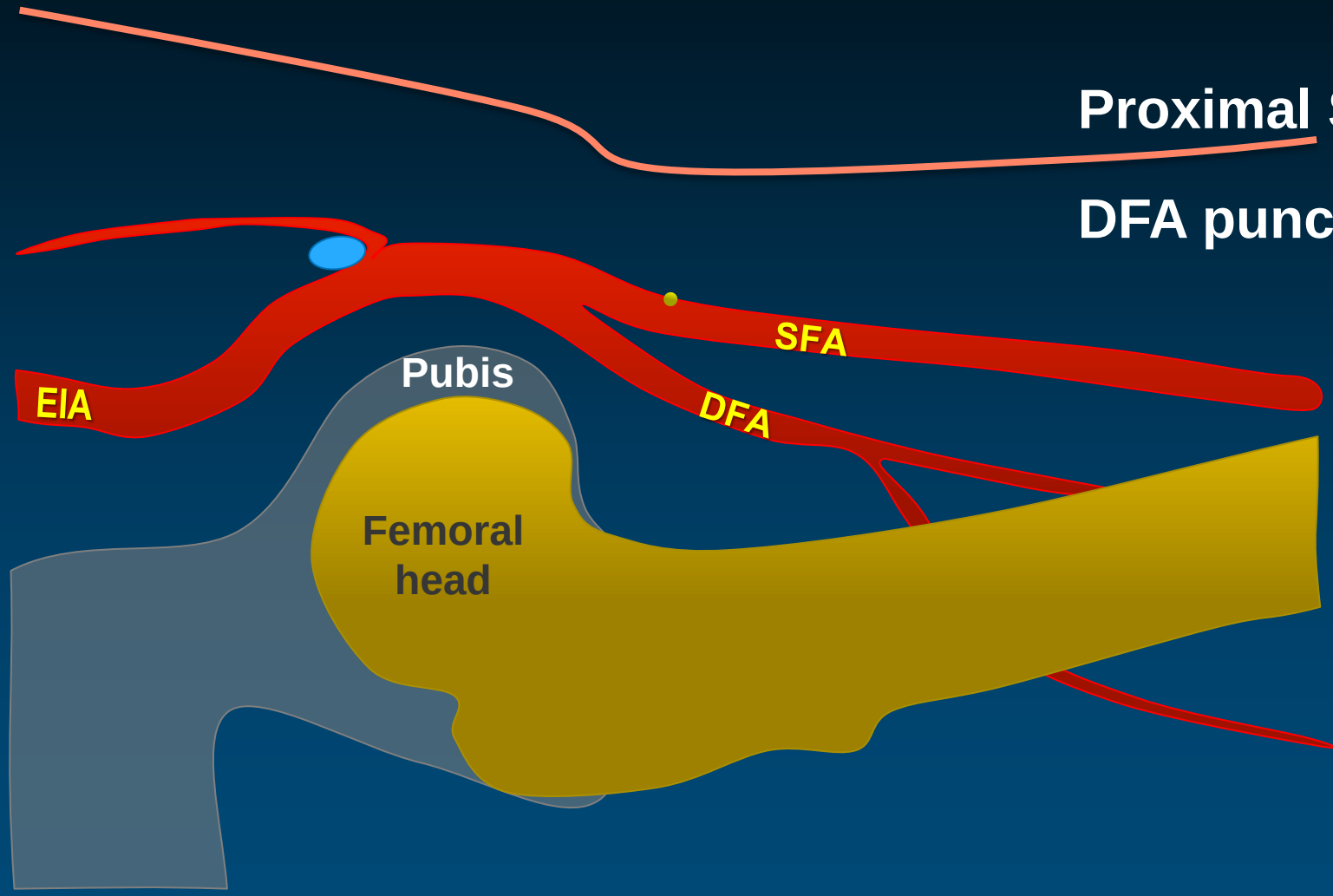
External Compression of Low Access Site



Proximal SFA puncture, usually

DFA puncture, sometimes

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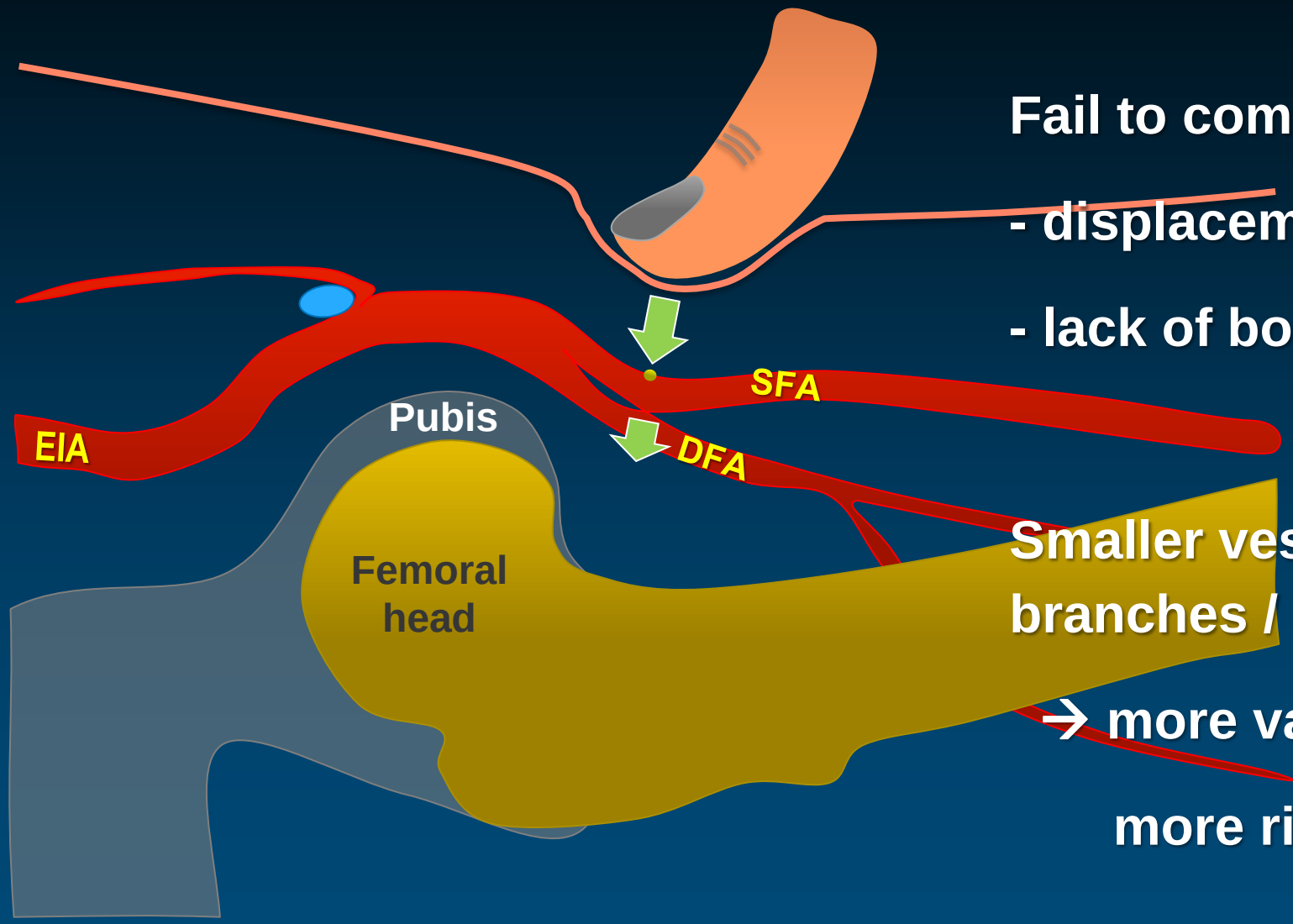

Fail to compress d/t

- displacement of vessel inferiorly

- lack of bony structure posteriorly

Smaller vessel size & plenty of branches / Frequent pSFA disease

→ more vascular complication

more risk of pseudoaneurysm

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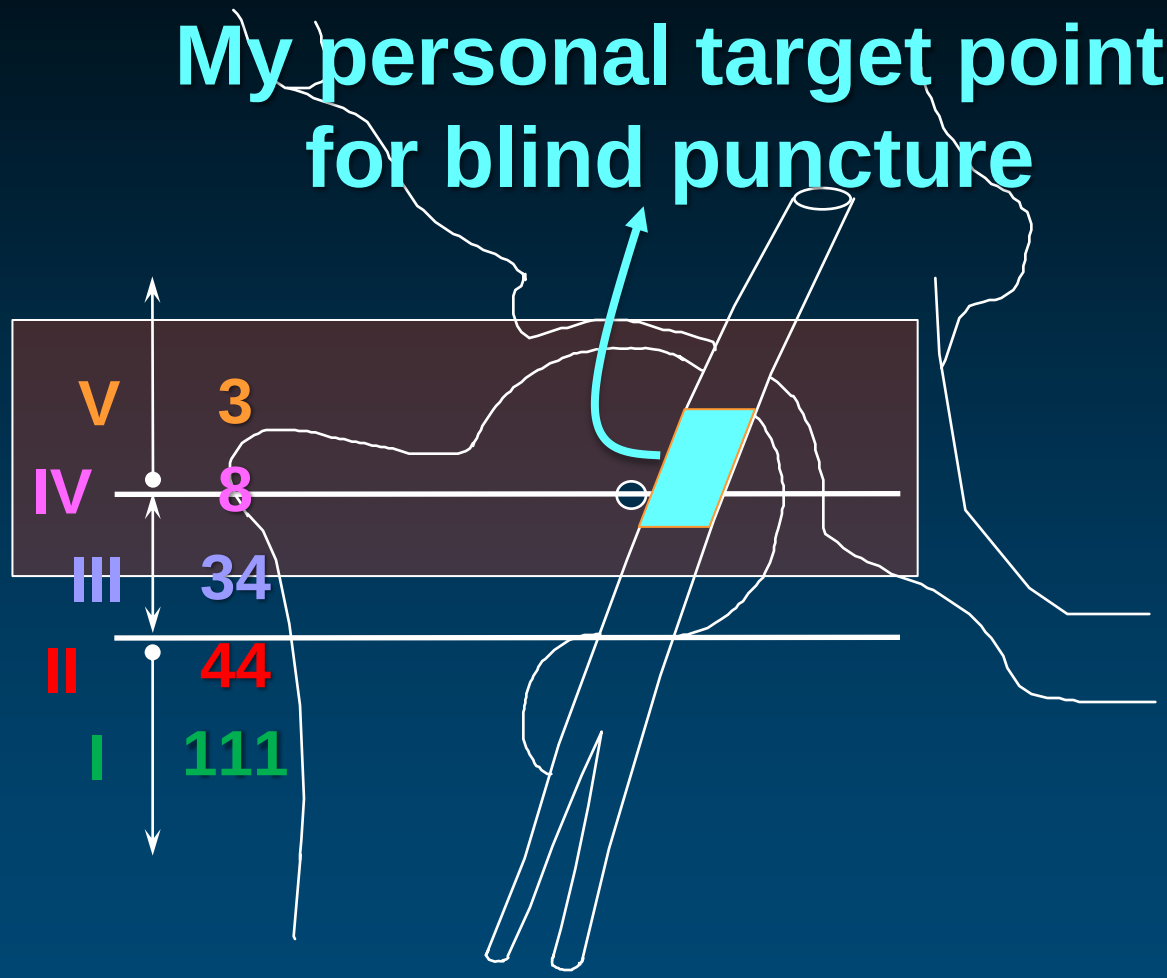
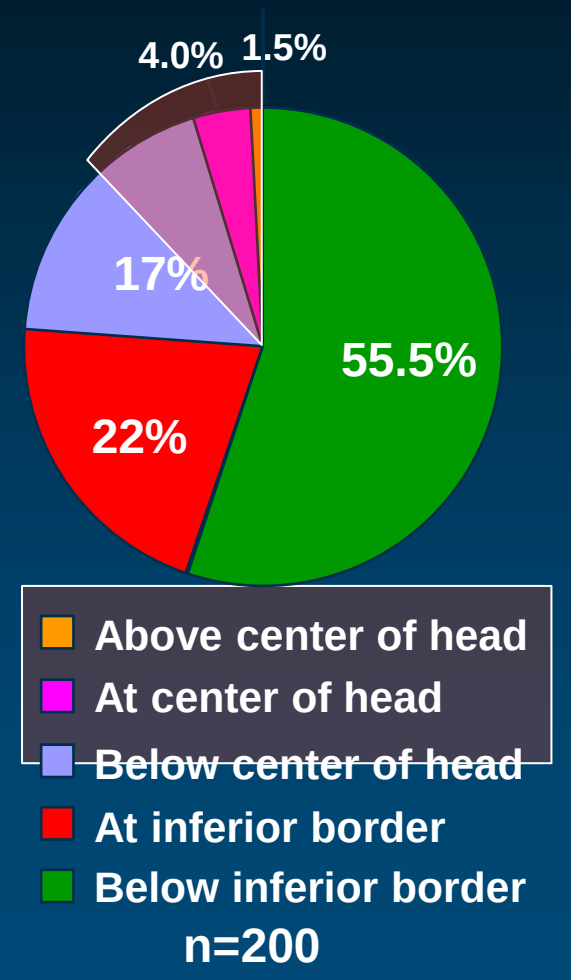
Femoral Head and the CFA Bifurcation

My personal target point for blind puncture

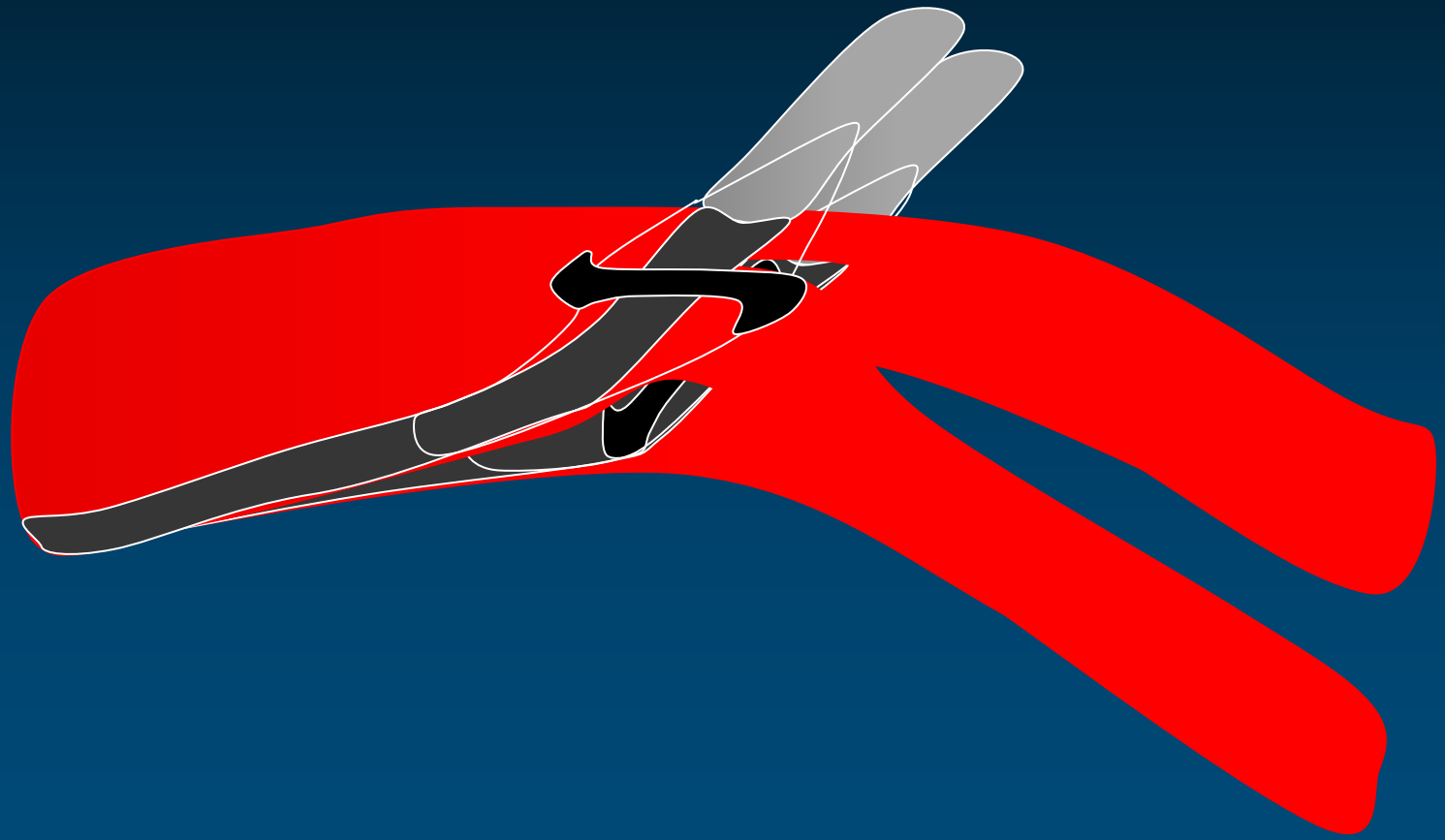




Intentional high puncture is needed in high CFA bifurcation anatomy

Potential Mechanism of Proglide Failure

Puncture of CFA Bifurcation



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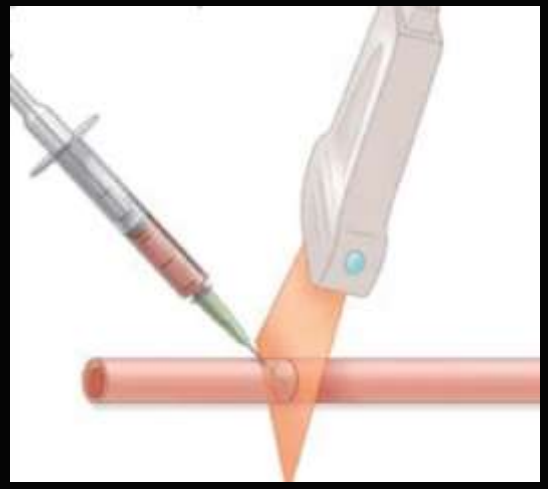
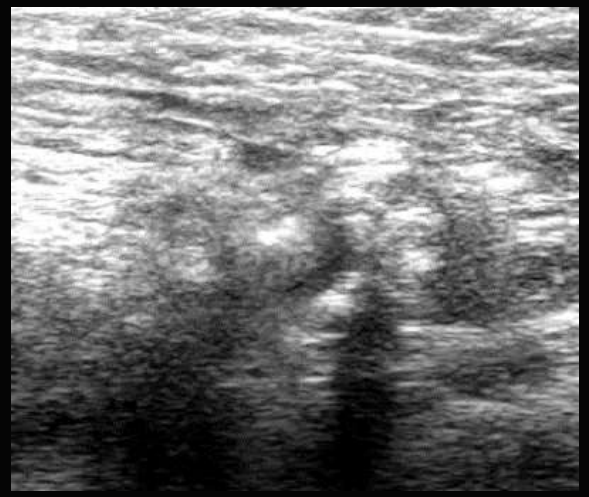
Do Not Use Skin Crease As A Landmark

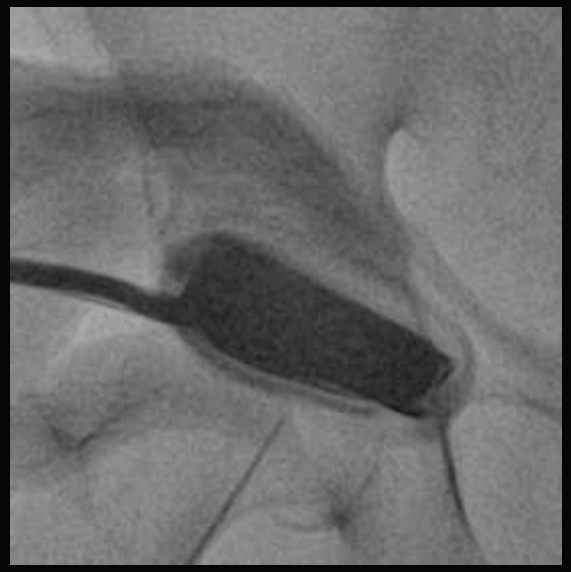
- Skin crease
- Maximum pulse
- Bony landmarks
- Previous puncture site

Landmark = Fluoroscopy-guided femoral head

Both Ultrasound & Fluoroscopy Guided Puncture







- Ultrasound
  - puncture the center of vessel

- Fluoroscopy
  - find the level of puncture
  - the relationship between the femoral head and the needle tip

Not All Necks Are The Same

Source: Ionel Droc, Dieter Raithel and Blanca Calinescu (2012). Abdominal Aortic Aneurysms - Actual Therapeutic Strategies, Aneurysm, Dr. Yasuo Murai (Ed.), ISBN: 978-953-51-0730-9, InTech, DOI: 10.5772/48596

Hostile Proximal Neck Anatomy

- Adverse outcomes during EVAR:
  - Neck angulation > 60-75°
  - Neck length <10-15mm
  - Conical shape (tapering or reverse tapering)
  - Presence of mural thrombus in the neck
  - Extensive Calcification

Hostile proximal necks challenge EVAR

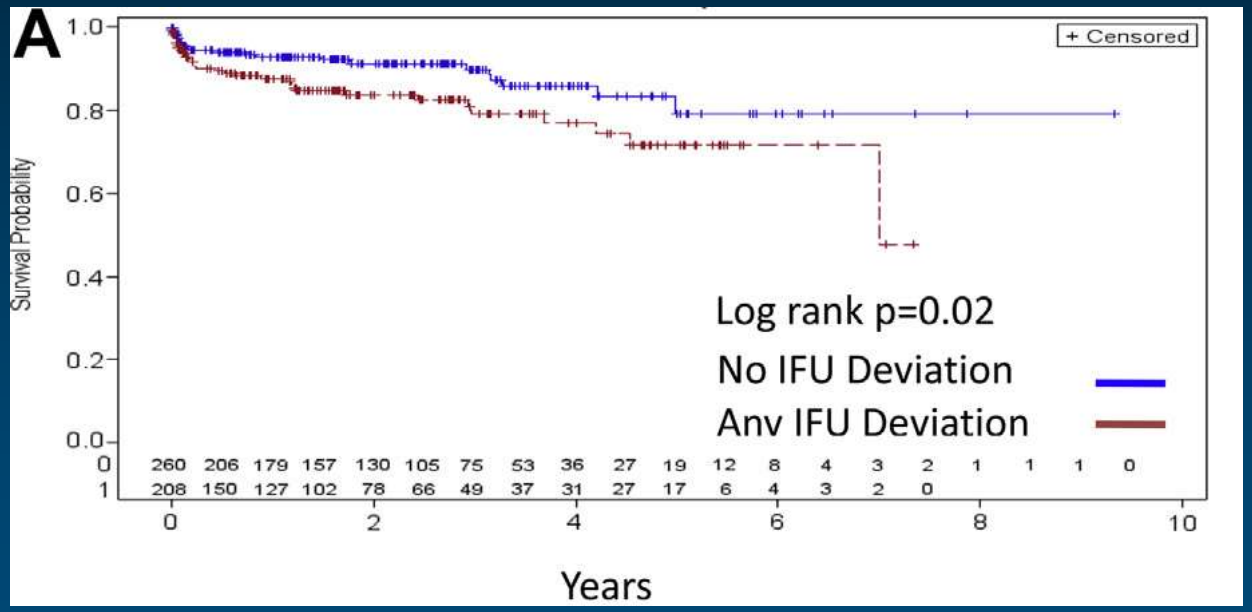
Meta-Analysis of 7 major studies in EVAR compared outcomes in hostile vs. friendly neck anatomies (total patients N = 1559)

- **Type I endoleaks 4.5x more likely at 1-year** after endograft implantation in hostile proximal aortic neck anatomy (P = 0.010)
- **Aneurysm-related mortality risk 9x greater** in hostile neck anatomy (P= 0.013)

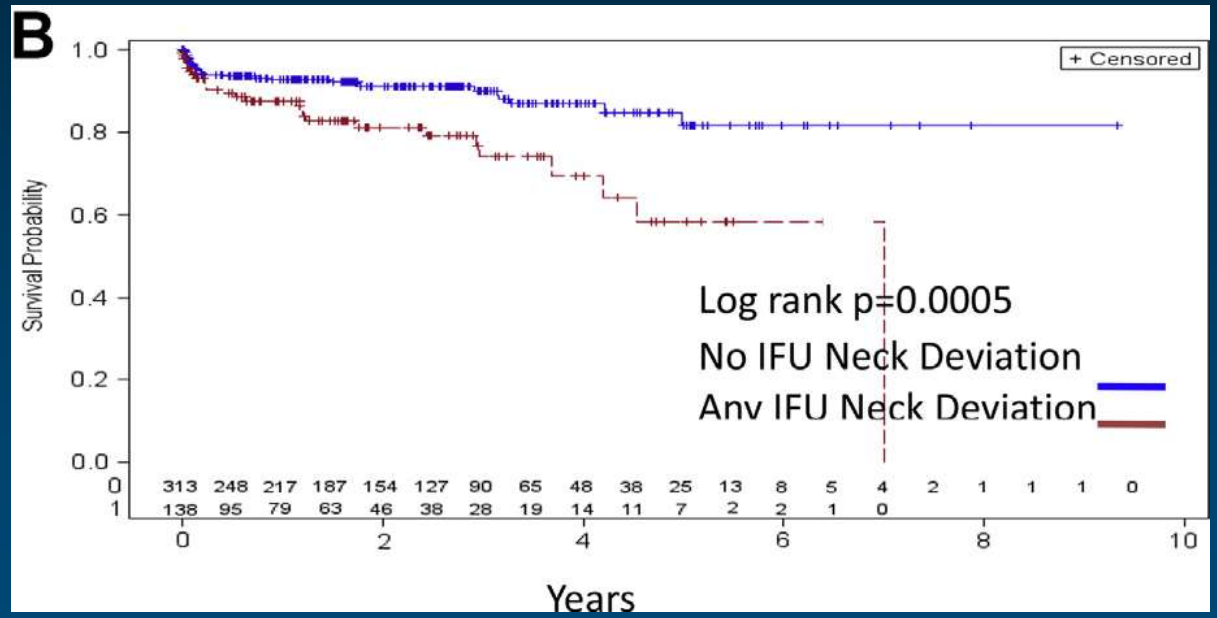
Antoniou G, et al. A meta-analysis of outcomes of endovascular abdominal aortic aneurysm repair in patients with hostile and friendly neck anatomy. *JVS* 2013; 57(2): 527-538

Any Deviation From IFU
Freedom from device failure

With or Without Any IFU Deviation



With or Without Proximal Neck IFU Deviation



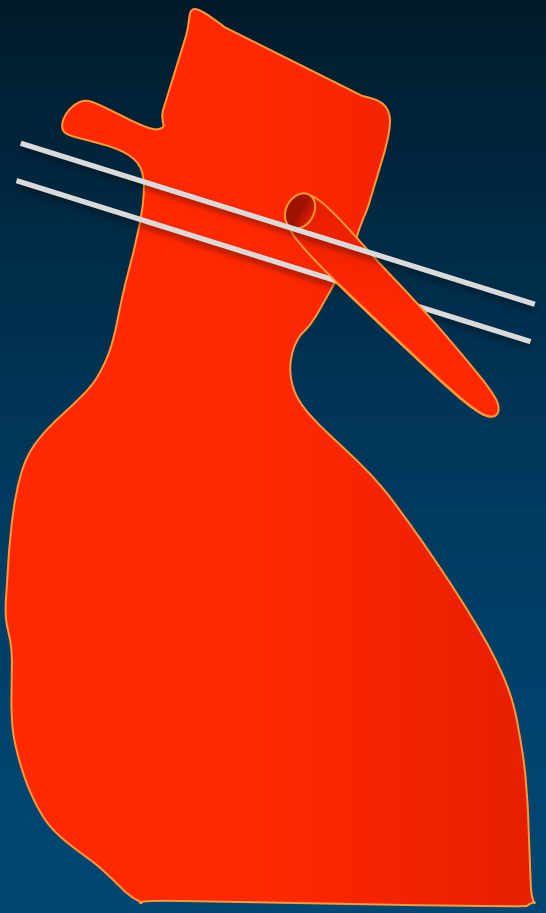
N=486 EVAR procedures
Multicenter; retrospective; 2005 to 2014 data collection
Charbonneau Ph et al, J Vasc Surgery 2016; 64(5); 1532-1533

Learning From Representative Cases

71 YO man, COPD, Cr 1.3 mg/dL
AAA 90 mm

Severe proximal neck angulation

Precise Determination of Renal Ostium



Graft migration with type Ia endoleak
AAA 90 → 96 mm in 4 yrs

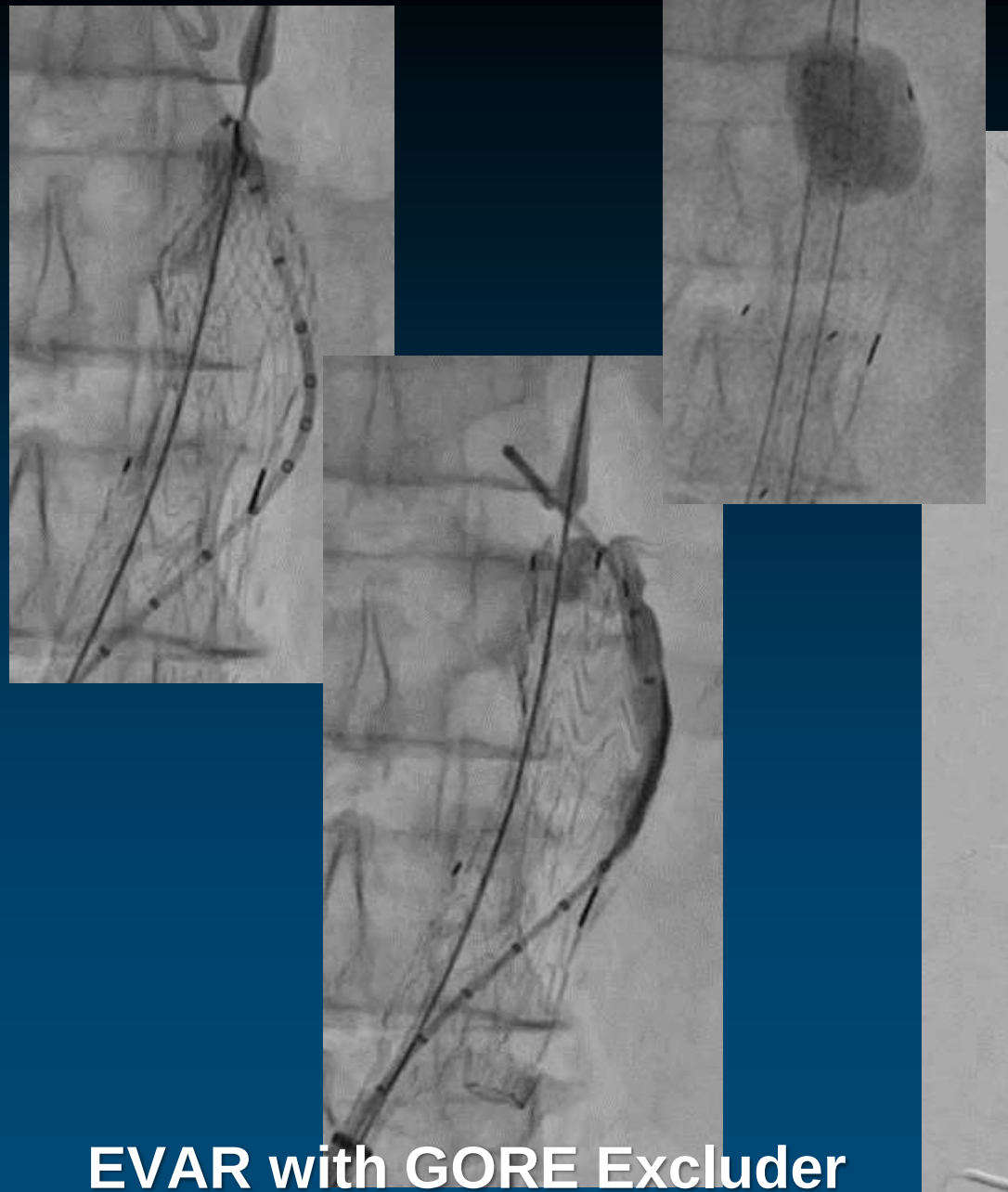
FU CT at 4 yrs

Type Ia endoleak
AAA 96 mm

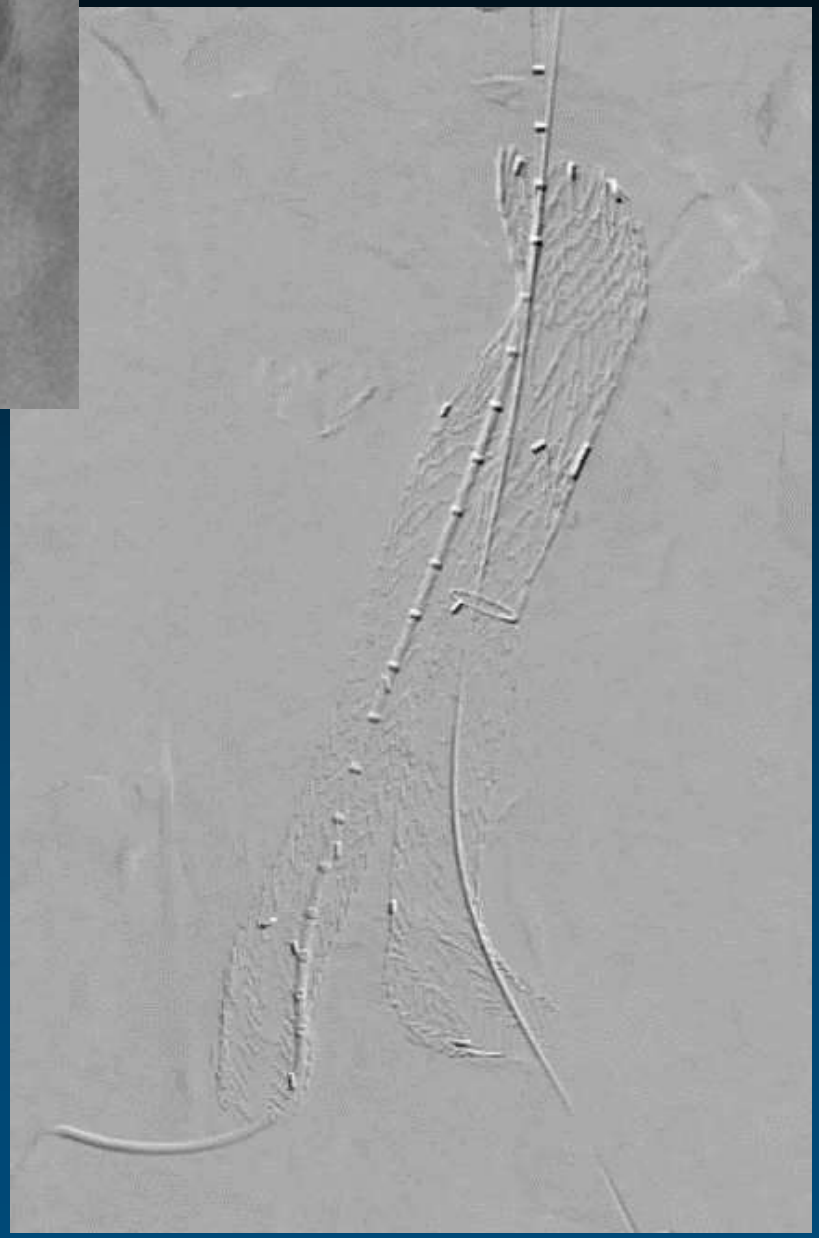
Proximal cuff extension

74 YO man
AAA 64 mm

Usual EVAR candidate

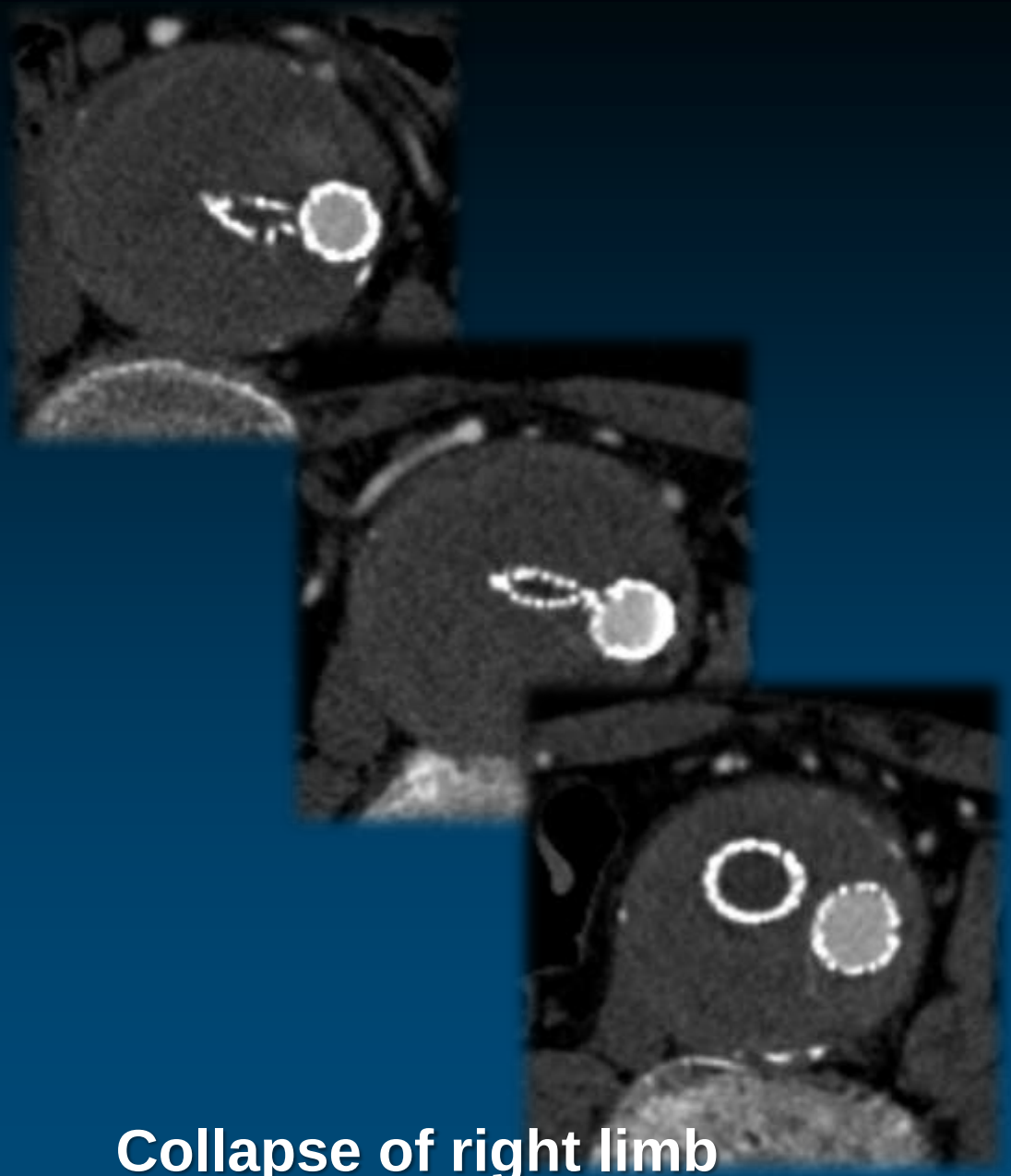


EVAR with GORE Excluder
(proximal neck folding)



FU CT in 6 months
Right L/E claudication, Rutherford 3

Proximal neck graft folding (Gore Excluder)



Collapse of right limb

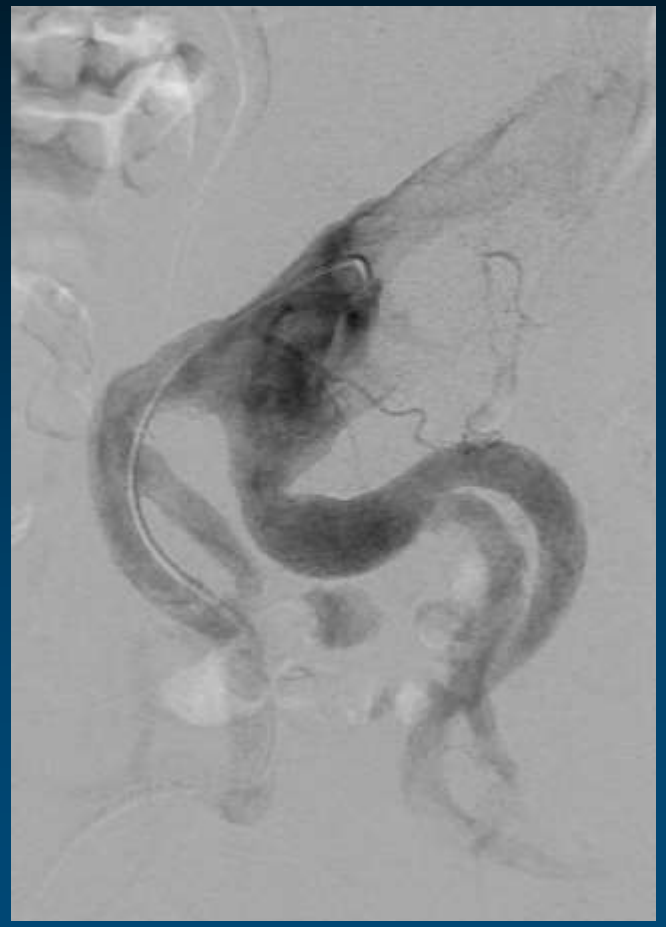
The 2nd procedure

Proximal edge folding
Right limb collapse and occlusion

Palmaz stent for proximal edge
Graft-in-graft for right limb

2 year CT FU; OK

66 YO man
AAA 85x105 mm



Left CIA angulation ≅ 180°

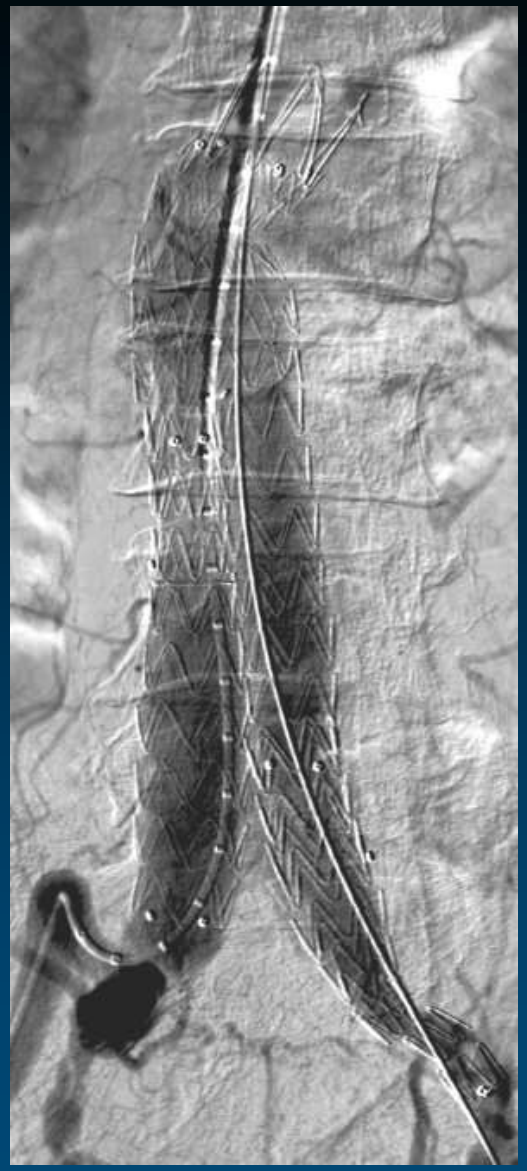
EVAR with
left IIA embolization

ALI in the evening

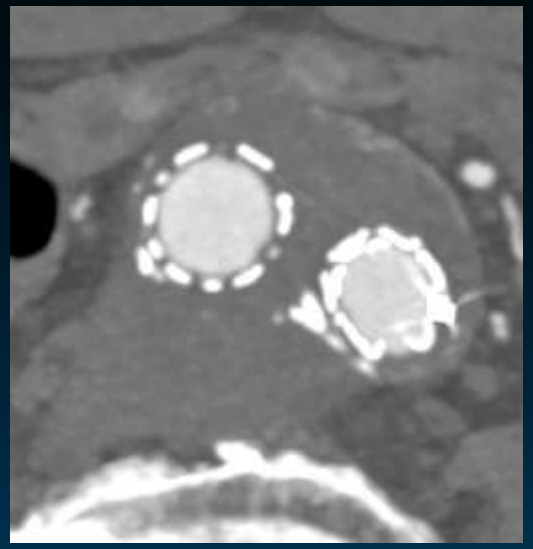
BE stent 10x29 mm

72 YO man
AAA 58 mm

Short right CIA



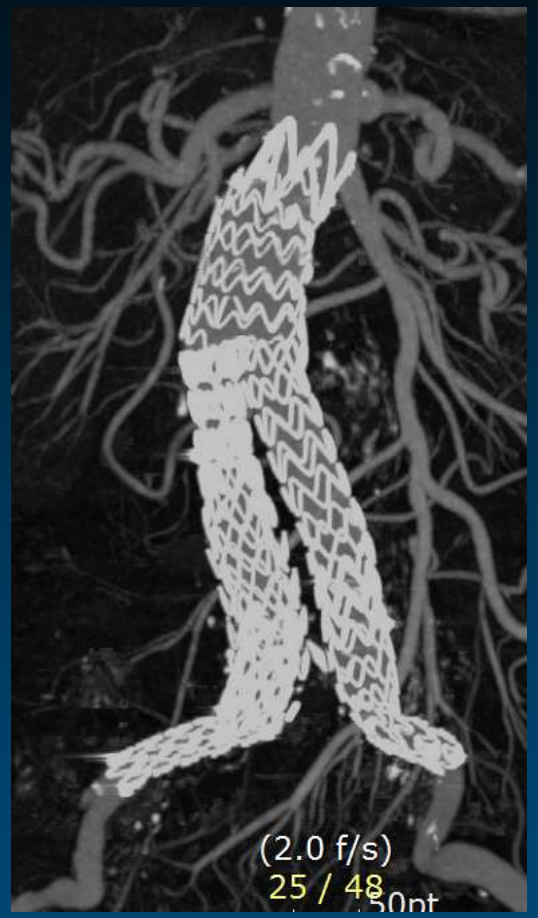
Shallow landing



1 yr FU OK

→ Pain and shock at 2 yr

72 YO man
AAA 58 mm



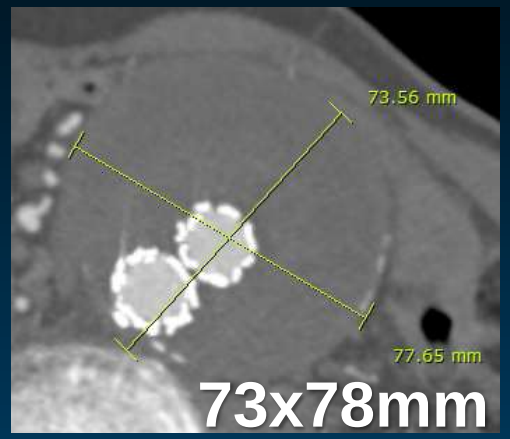
Survived
2 yrs after rupture

Type IIb endoleak → Graft extension to EIA

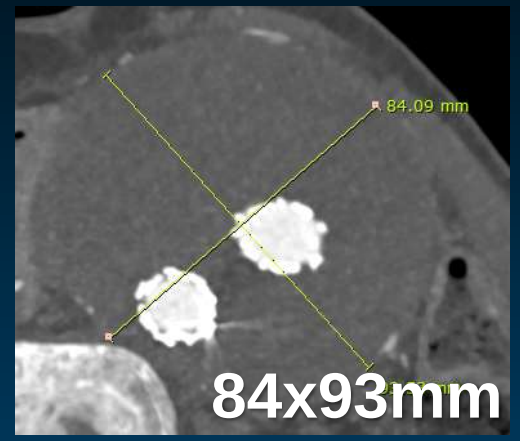
84 YO man, Severe LV dysfunction
AAA 77 mm

Angulated

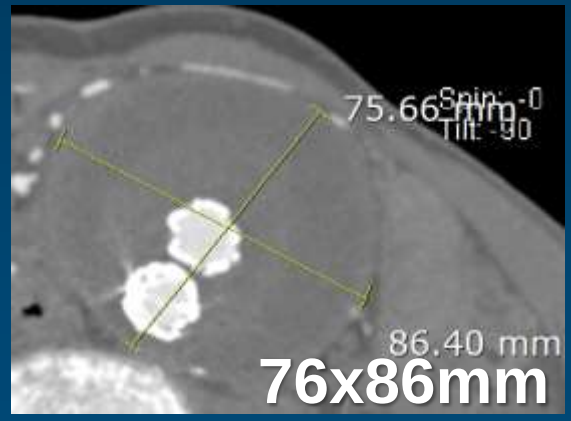
1 month FU



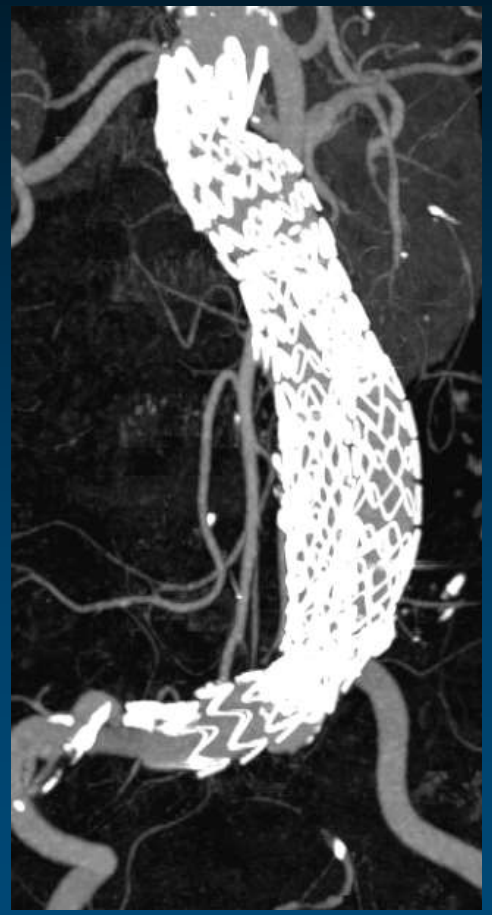
3.5 year FU



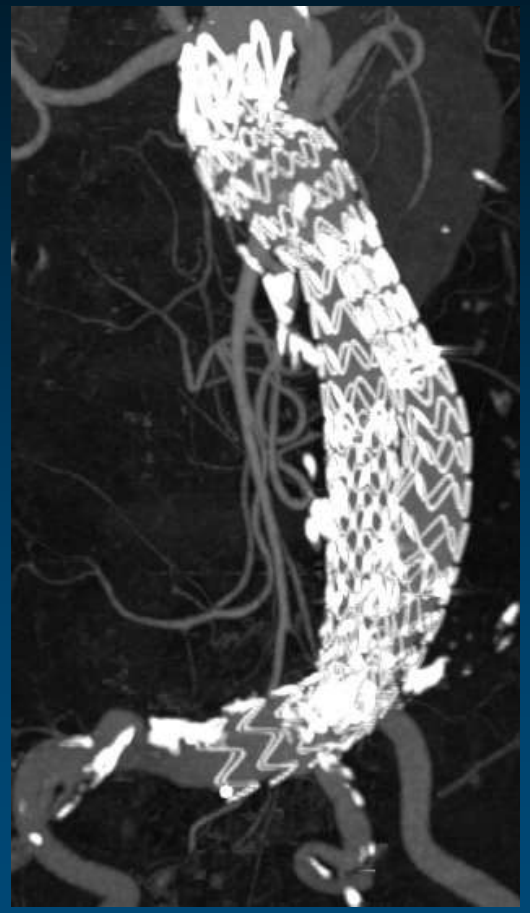
1.5 yr FU



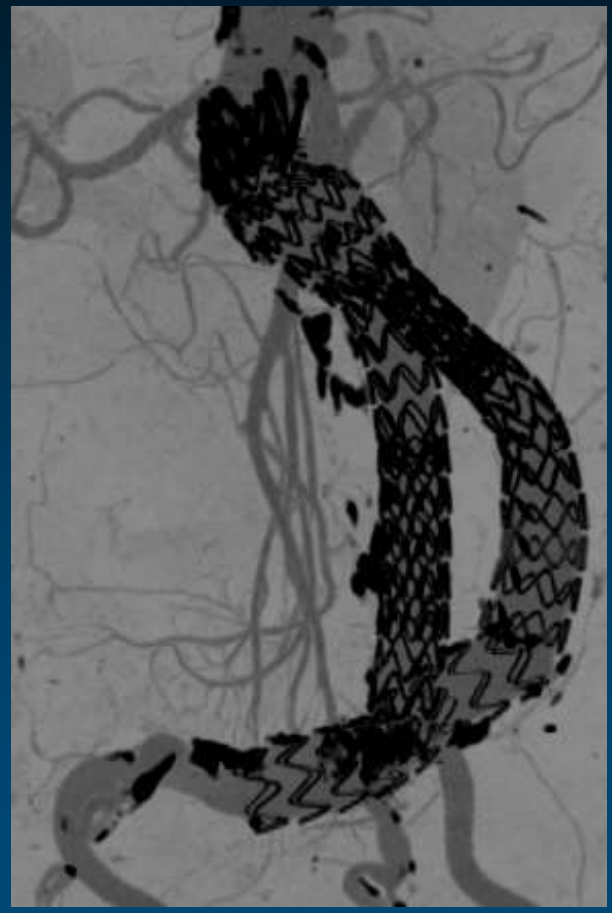
84 YO man, Severe LV dysfunction
AAA 77 mm



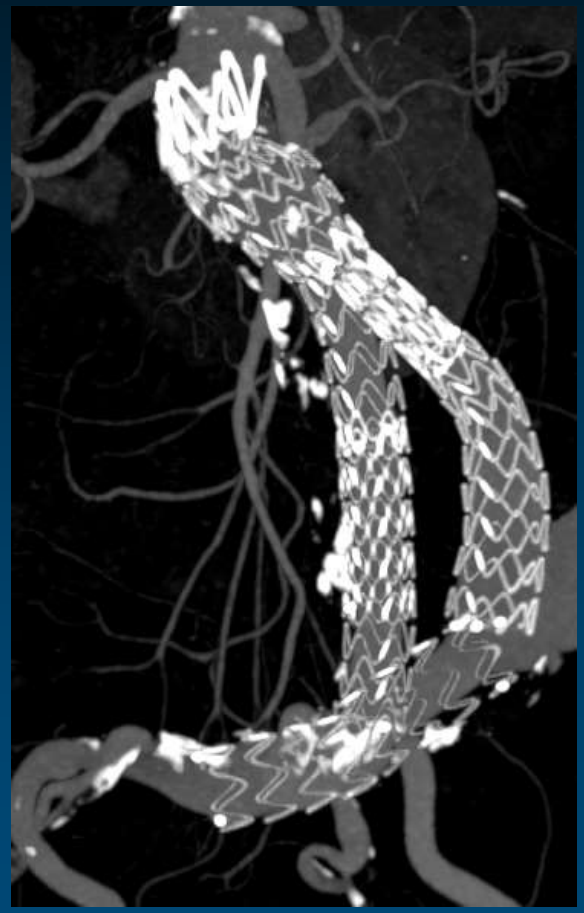
1 month



1.5 yrs



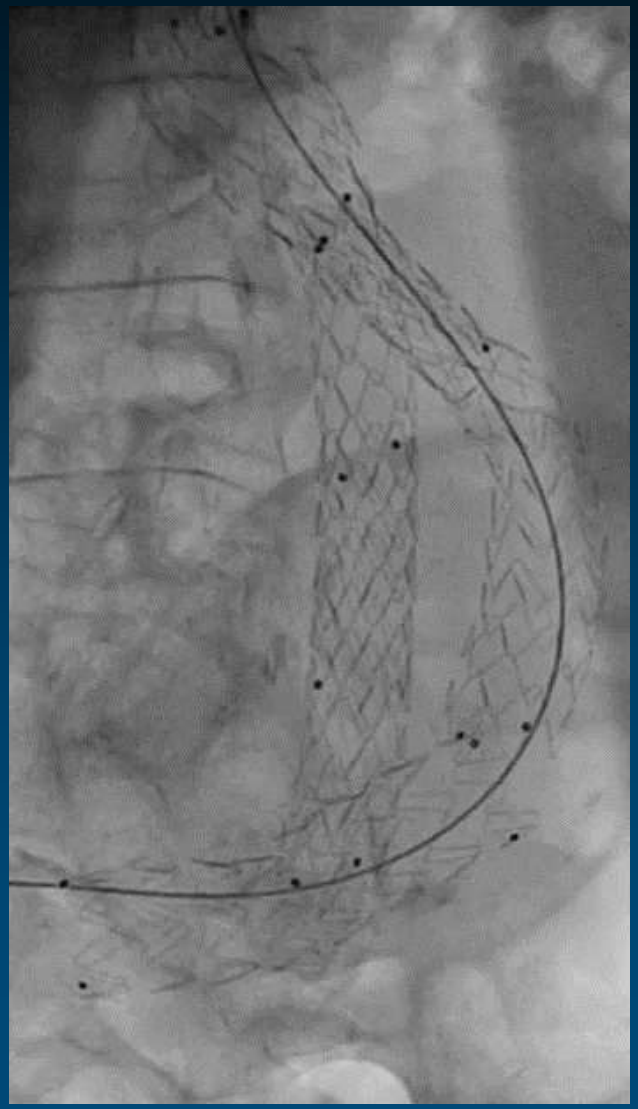
2.5 yrs

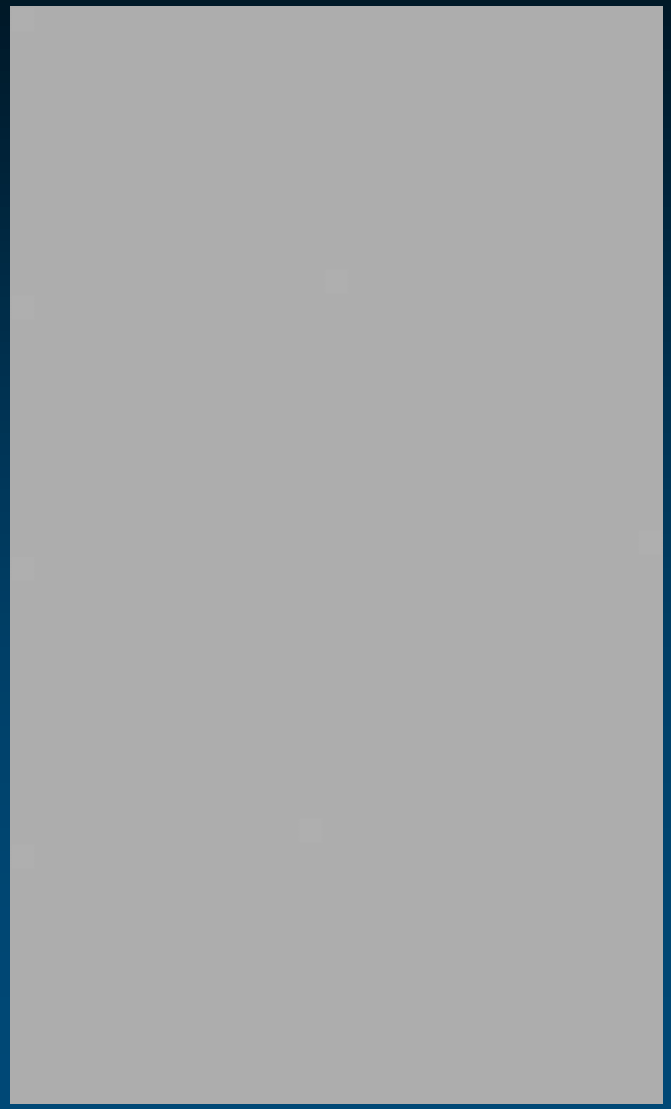


3.5 yrs

84 YO man, Severe LV dysfunction
AAA 77 mm

Graft for disarticulation





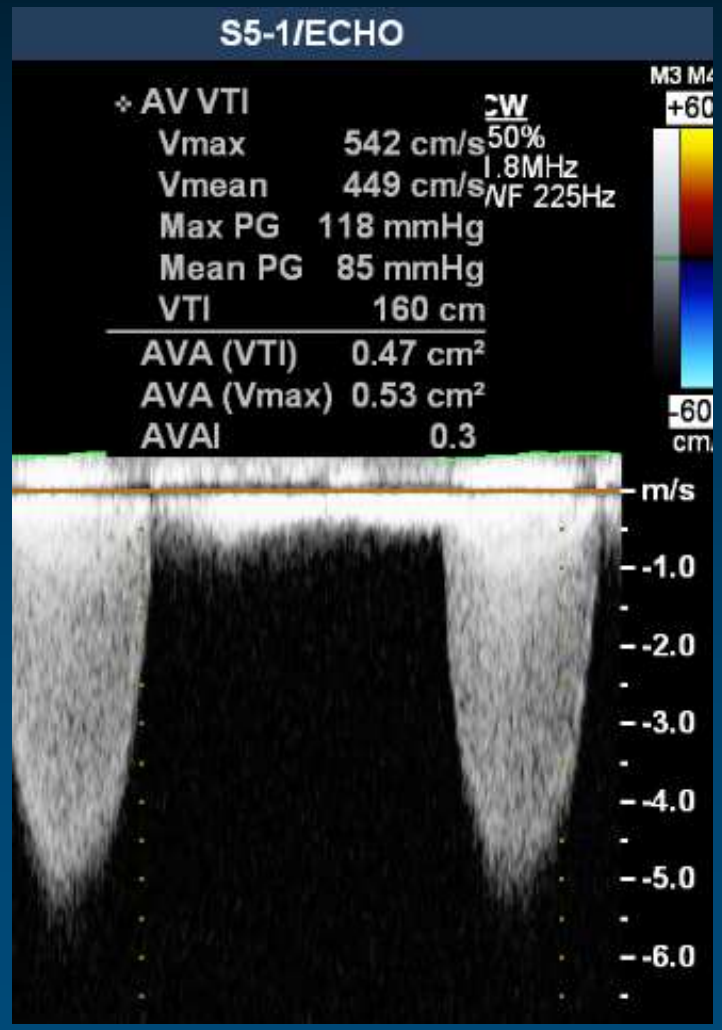
79/M, DM, HTN, Cr 2.0-2.2 g/dL

Old MI, severe 3VD, S/P multiple coronary stenting, 1995~

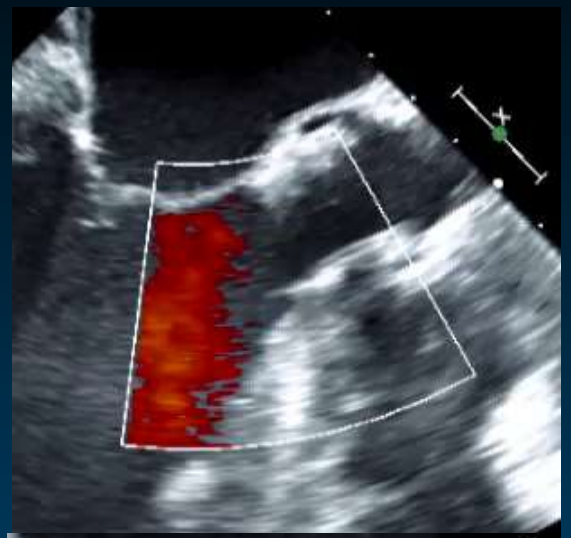
Severe AS and mod. AR, DOE and Chest pain on 50m walking

- PG 118/85 mmHg, AVA 0.5 cm², EF57%

AAA, 48x60mm 3 YA → 60x75 mm



TAVI with Sapien XT 23 mm THV



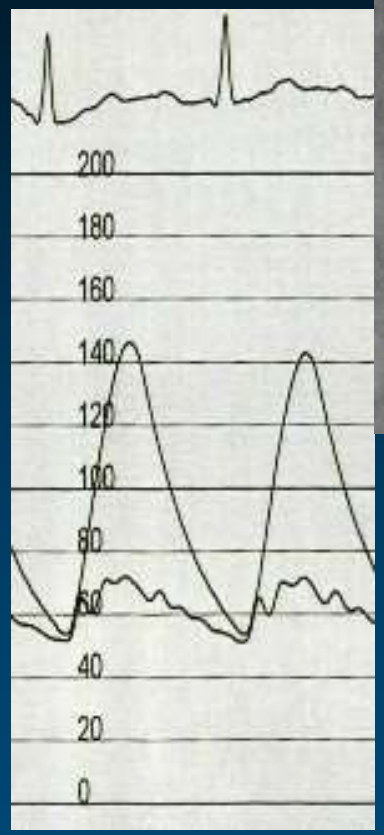
Mild to moderate PVL

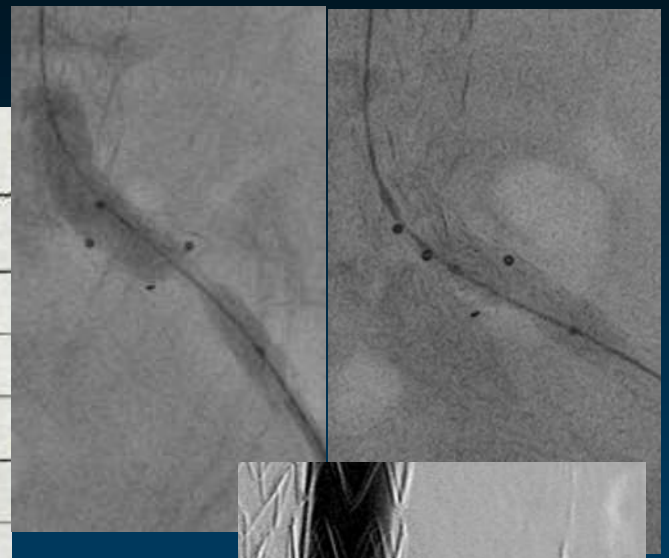
EVAR with right IIA embolization

10 mm
Amplatzer plug

Type Ib endoleak
→ Left Iliac limb extension

1 month later
Left L/E claudication, Rutherford 3 → ABI 0.69
Right buttock claudication

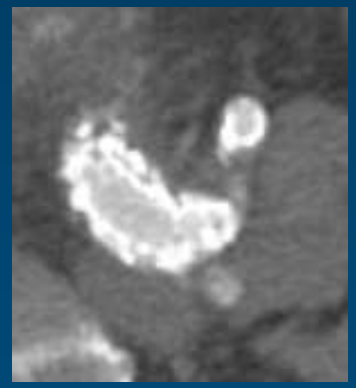




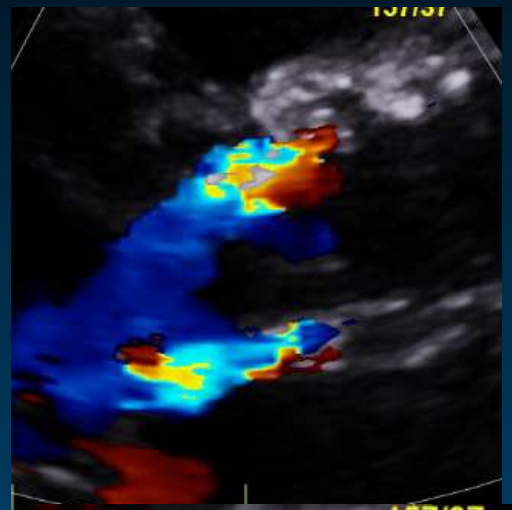
Balloon expandable
10x59mm stenting

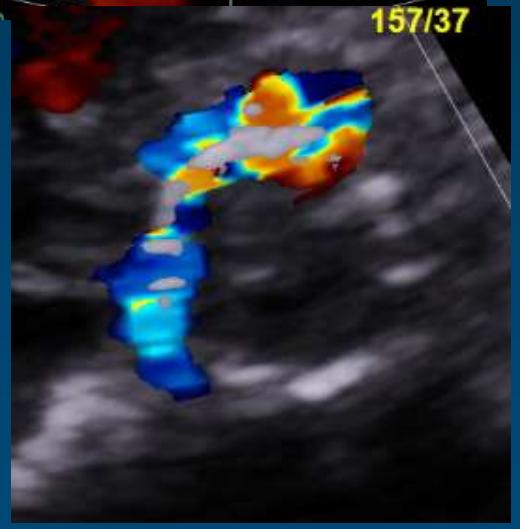
3 months later
Both L/E claudication, Rutherford 3
Exertional CP, CCS 3 and DOE Fc 2

Endoleak, type?

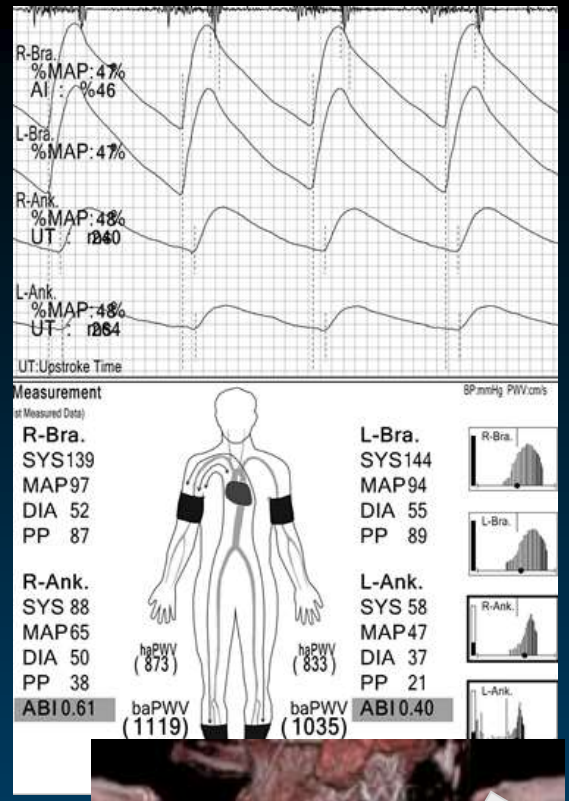


Left iliac; Stent-free zone





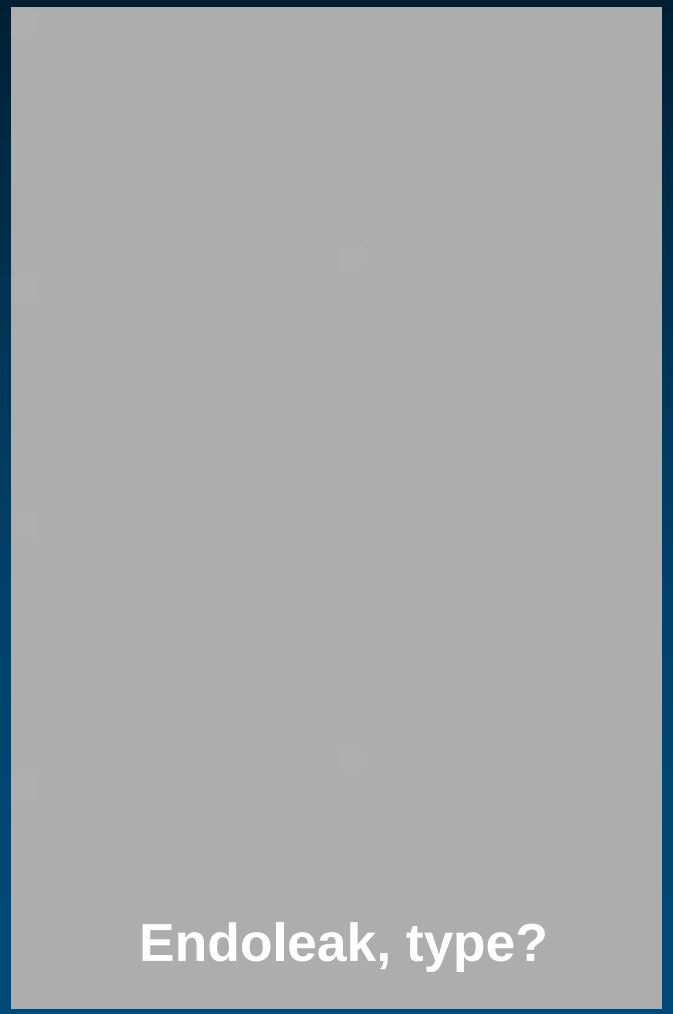
Severe PVL



Left brachial 6 Fr
Left femoral 14 Fr

dRCA stenosis

dRCA stenting

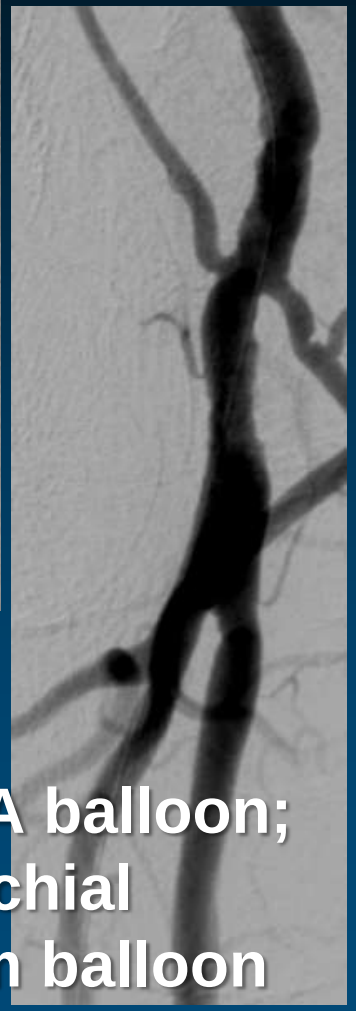


Endoleak, type?

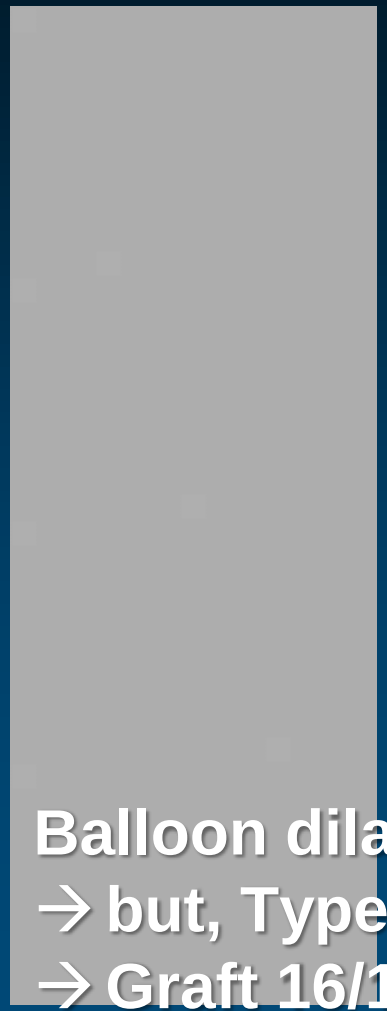
Iliac BMS Fracture

Right CFA puncture site stenosis

Left brachial 6 Fr
Left femoral 14 Fr + Right femoral 14 Fr

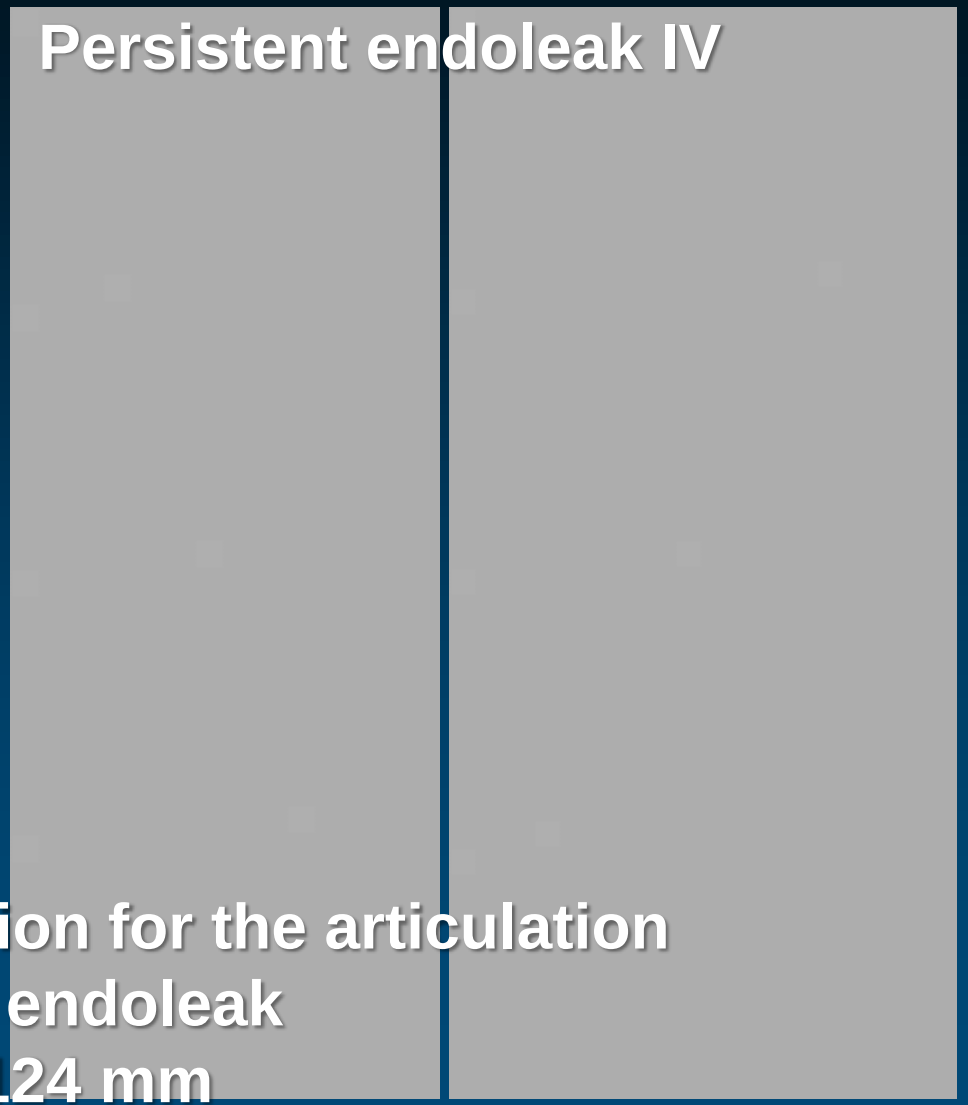


Right CFA balloon;
Transbrachial
7.0x20mm balloon

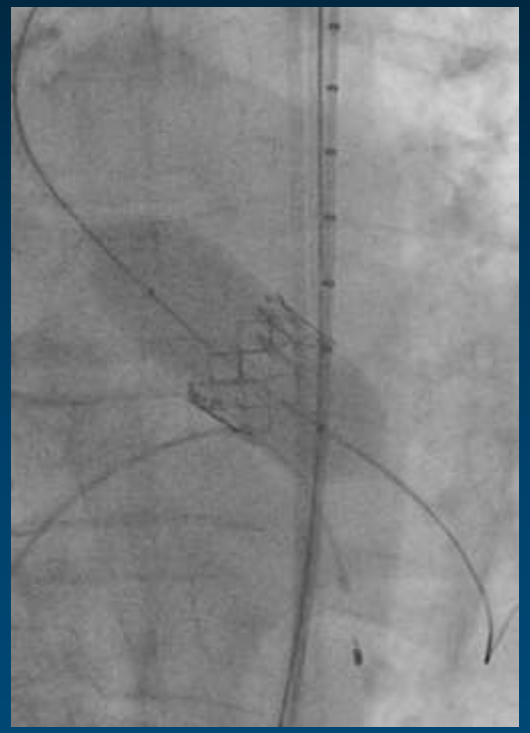


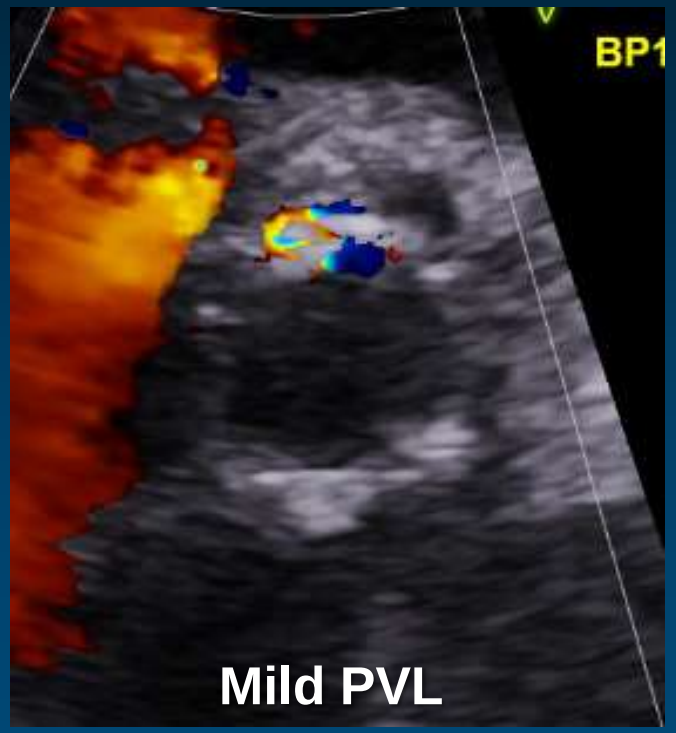
Balloon dilatation for the articulation
→ but, Type IV endoleak
→ Graft 16/10/124 mm

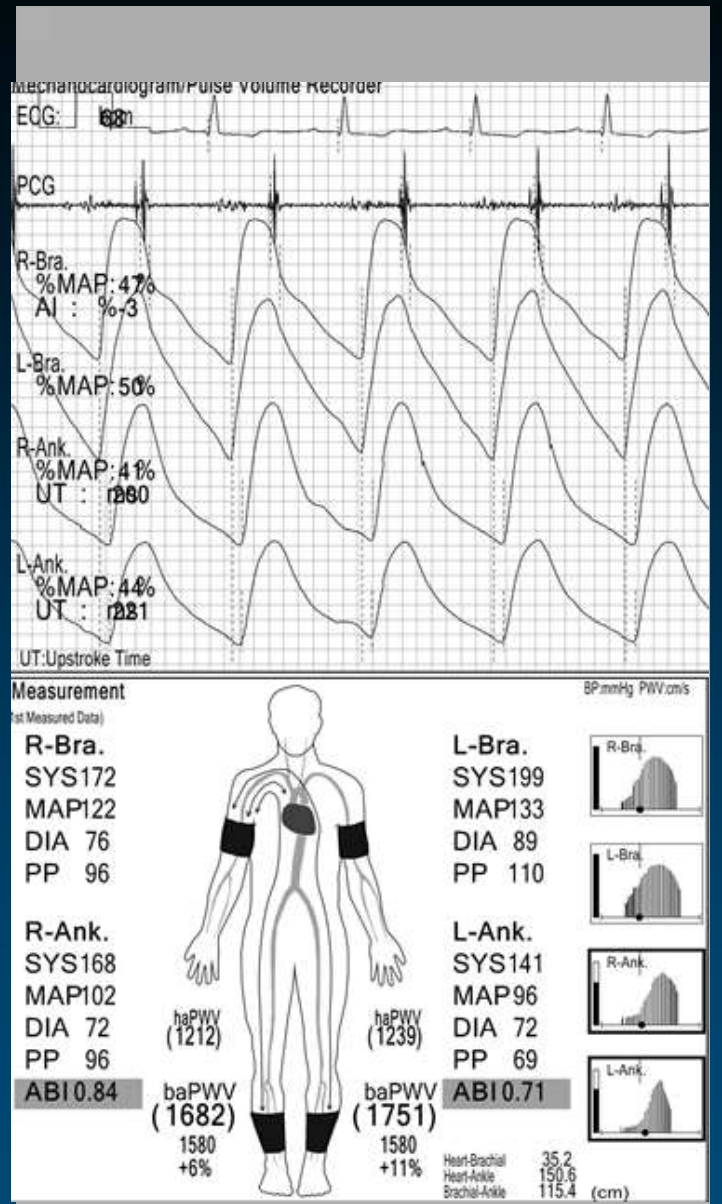
Persistent endoleak IV



dRCA stenting
Right CFA balloon angioplasty
Both limb graft reinsertion
Left iliac restenting with BMS
Balloon AV dilatation for PVL







Improved angina
Recurred left claudication, Rutherford II

No endoleak
after both limb graft-in-graft

EVAR-related Complications

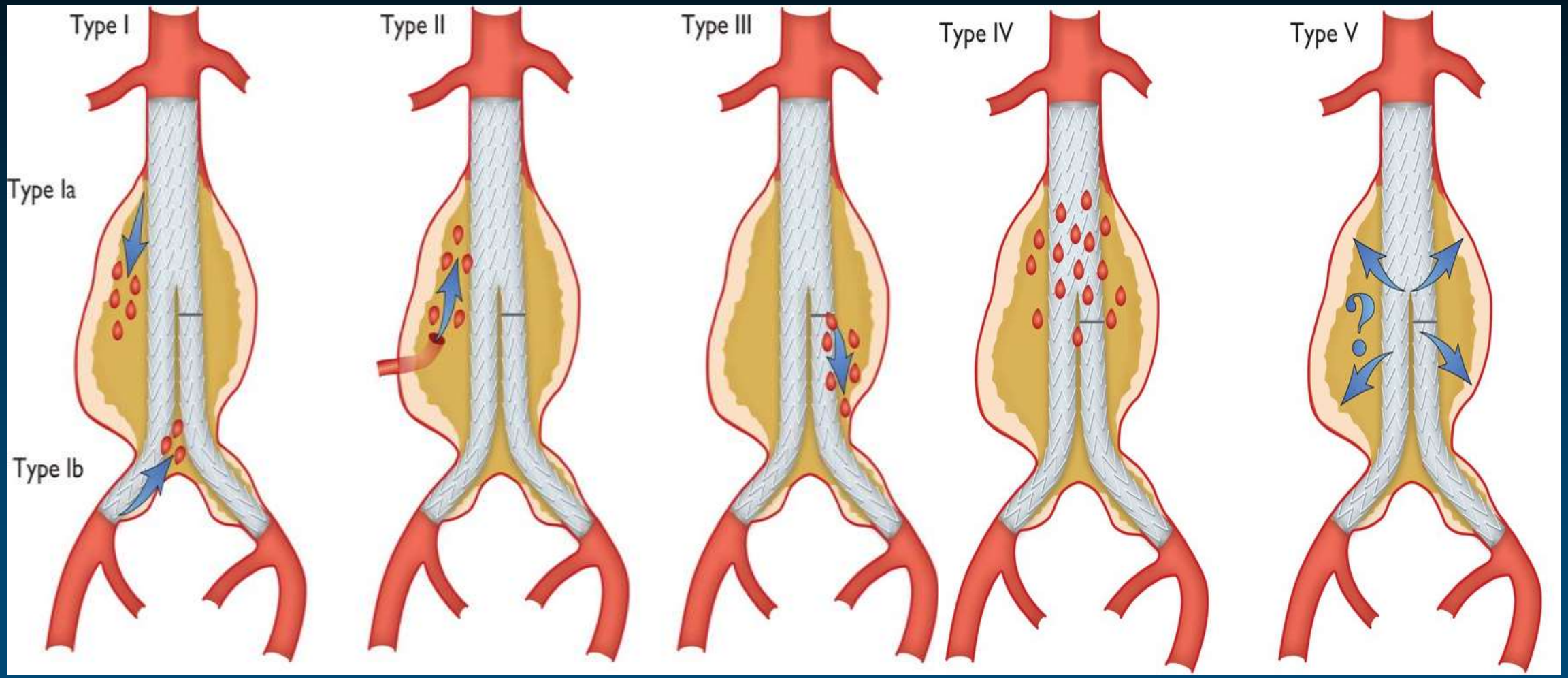
- ***How To Predict and Prevent ?***
  - Knowledge of AAA pathology
    - Proximal neck
    - Bifurcation
    - Access – Puncture site & Iliac tortuosity
    - Branches
  - Appropriate preprocedural planning
    - ; approach, sizing, device selection …
  - Proper selection of devices
  - Adjunctive procedure – Palmaz, Cuffs, Endoanchor …

Do not try to treat all AAA with EVAR …

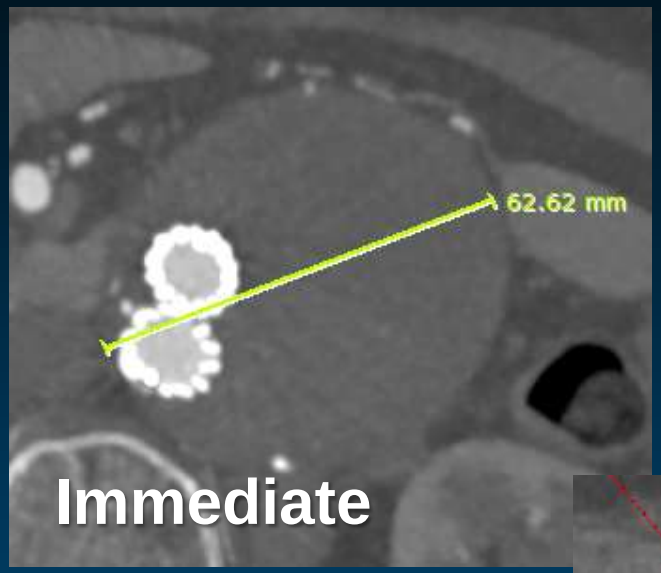
→ Send a difficult anatomy to a surgeon w/o hesitation

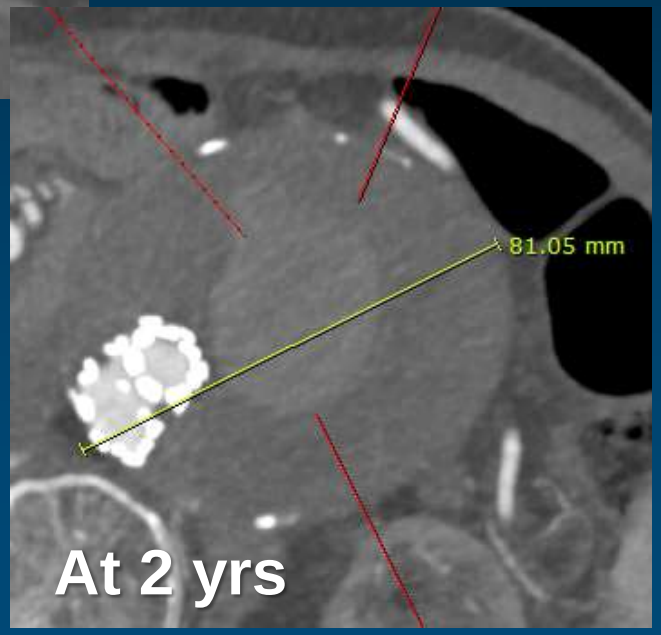
Thanks for the Time

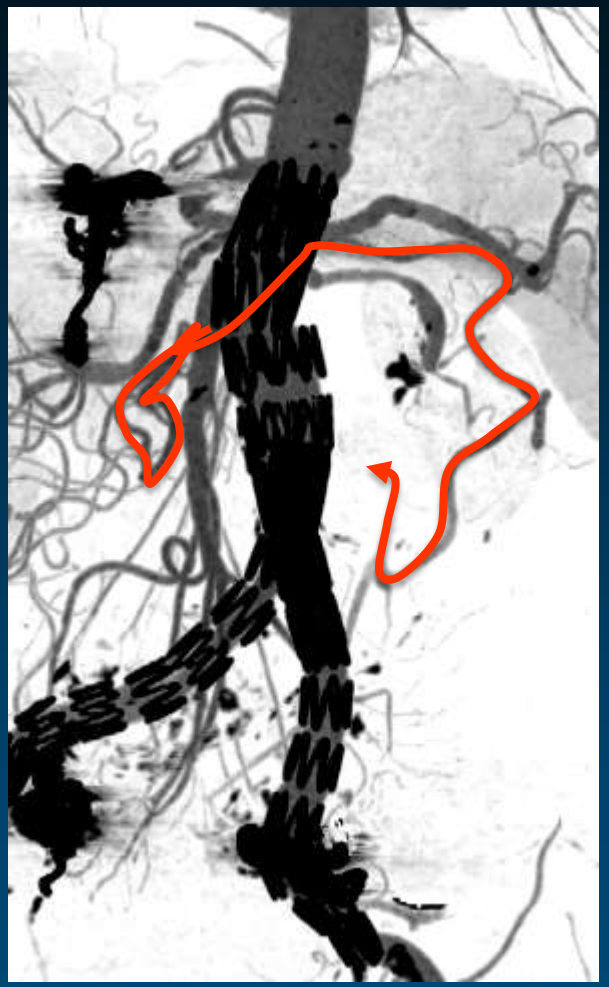
Endoleak after EVAR



77 YO woman
AAA 62 mm → EVAR → at 2 yrs, 80 mm

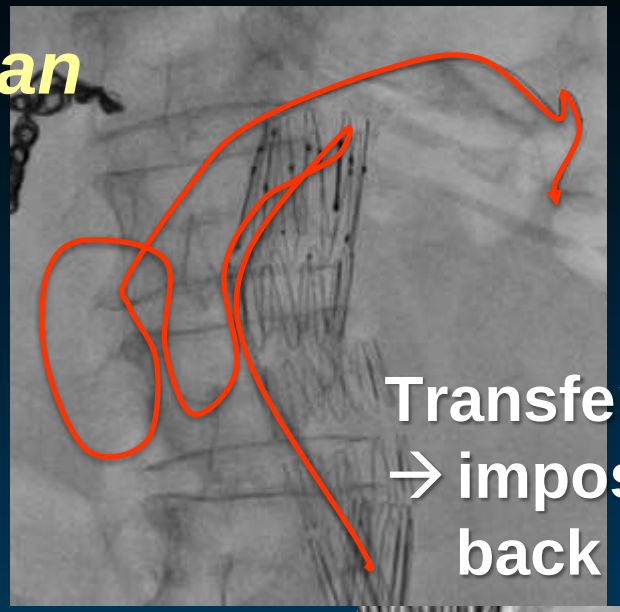




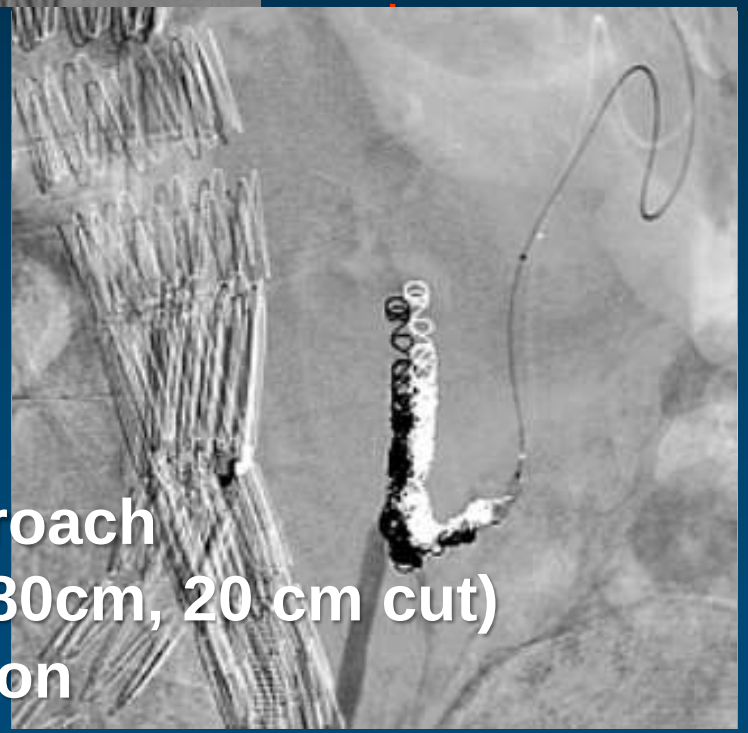


Type II endoleak via Arc of Riolan

77 YO woman
Type II endoleak, Arc of Riolan



Transfemoral approach
→ impossible d/t poor back up support

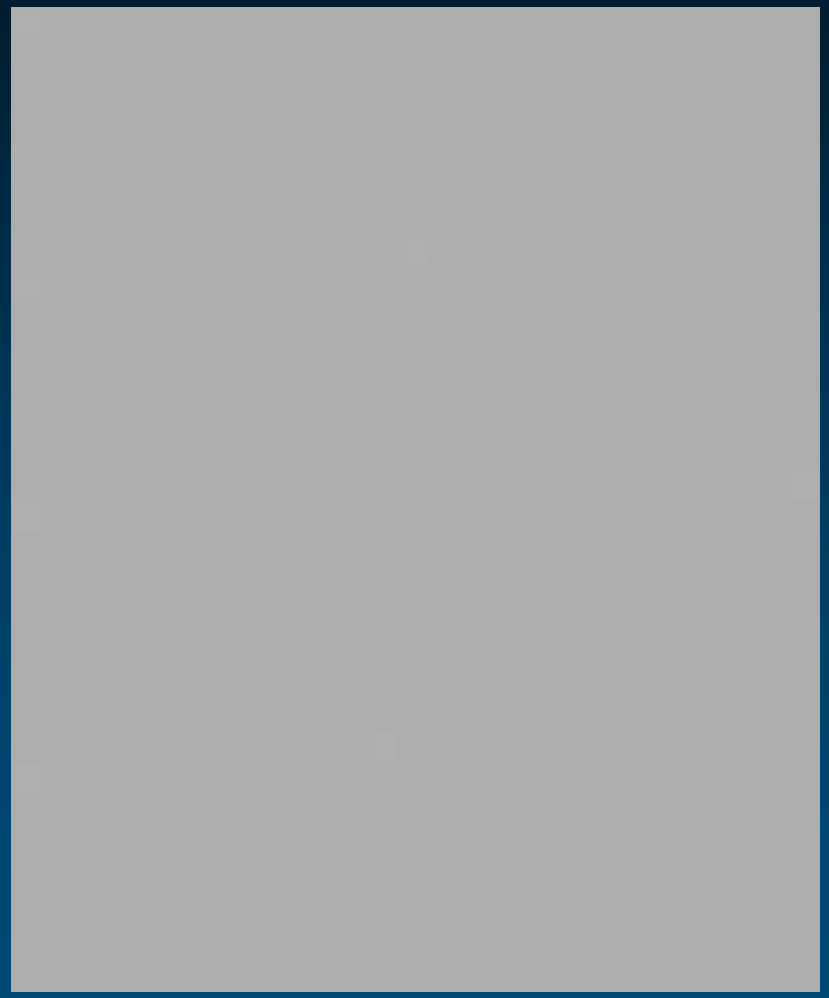


Left brachial approach
→ 5 Fr MP (100→80cm, 20 cm cut)
→ Coil embolization

77 YO woman

Type II endoleak, S/P Arc of Riolan occlusion at 2 yrs

→ FU lost, revisited 4 yrs after EVAR with abdominal protrusion

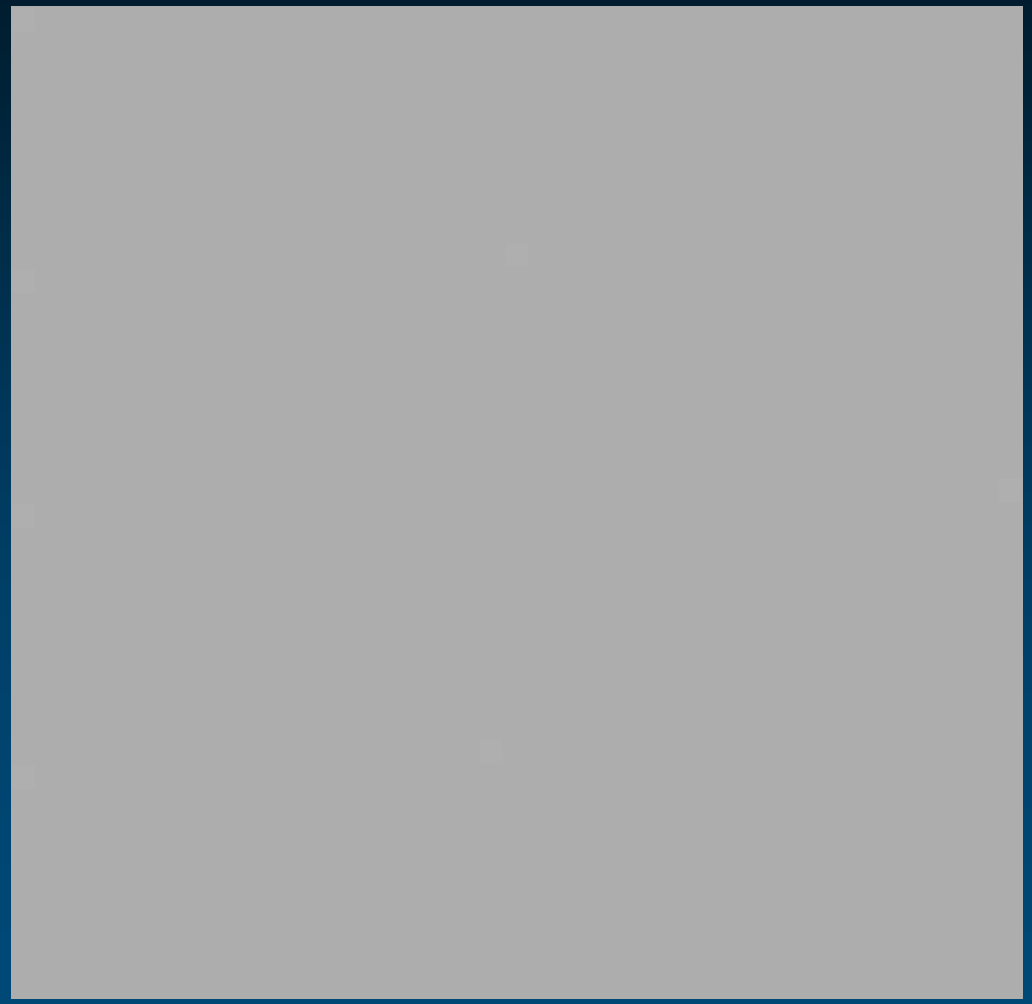


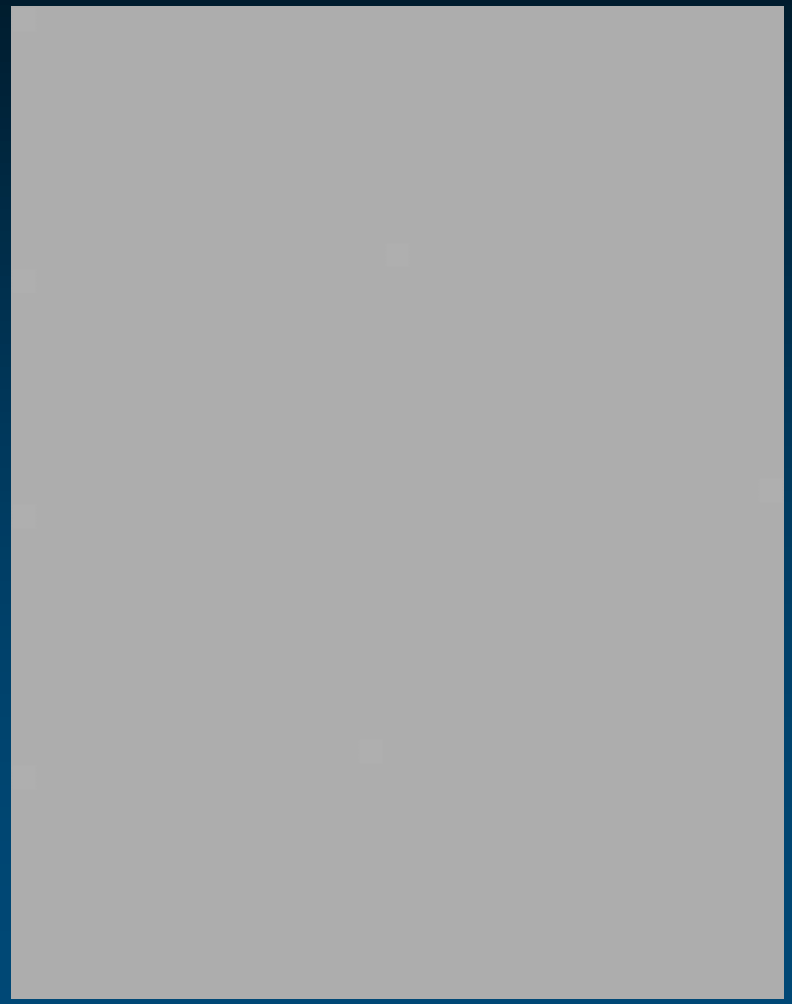
Superf. Circumflex IIA → Lumbar artery

77 YO woman

Type II endoleak, S/P Arc of Riolan occlusion at 2 yrs

→ FU lost, revisited 4 yrs after EVAR with abdominal protrusion





Superf. Circumflex IIA → Lumbar artery