

Nachuntersuchung nach EVAR

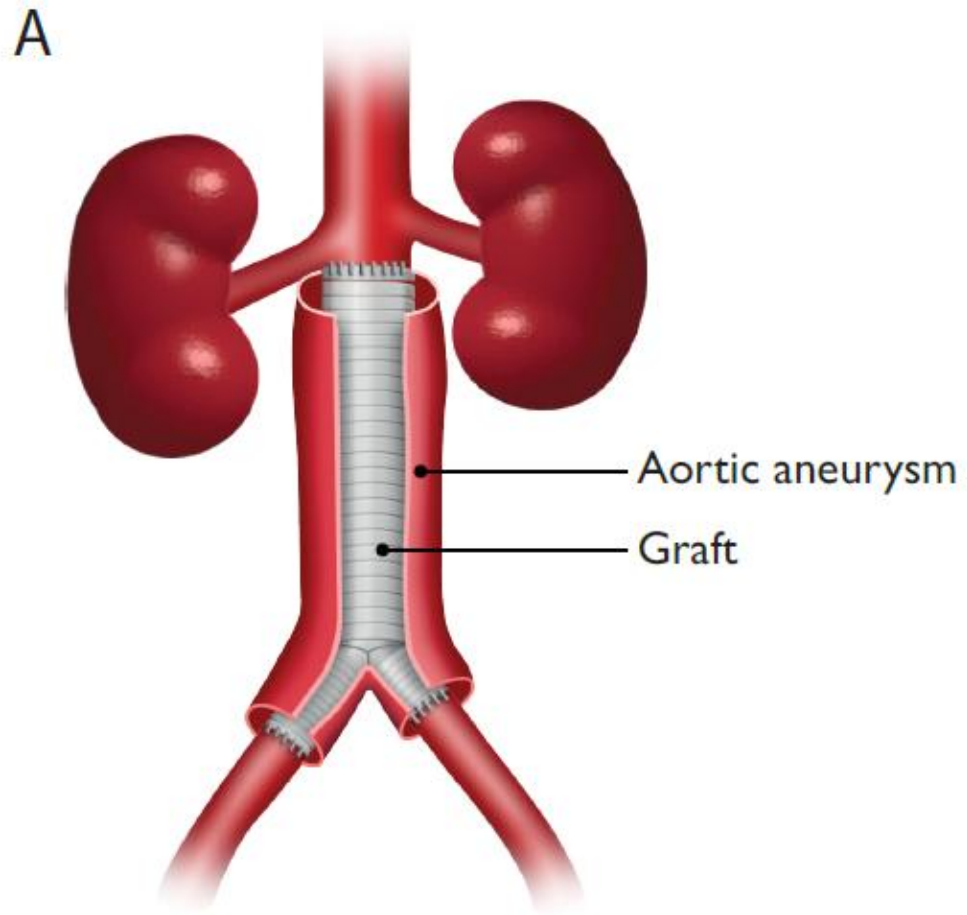
Daniel Staub

Angiologie

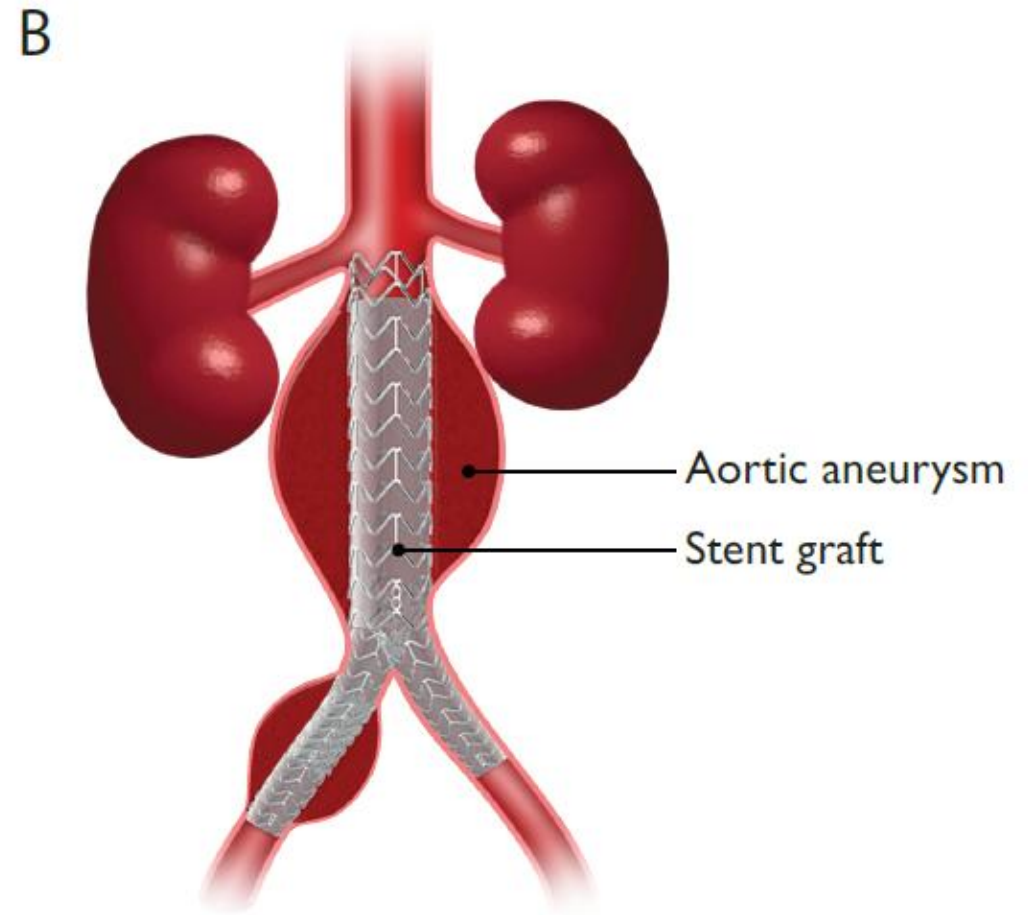
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Open aneurysm repair (OAR)



Endovascular aneurysm repair (EVAR)



Long-time follow-up after OAR

Table 6.1. Long-term complications after open abdominal aortic aneurysm repair, and their incidence within 5 and 10–15 years.

Complication	Estimated frequency during 5 year follow up	Estimated frequency during 10 year follow up
Para-anastomotic aneurysm formation	1%	12% (15 years)
Limb occlusion	1%	5% (15 years)
Incisional hernia	5–12%	5–21%
Graft infection	0.5–5%	
Secondary aorto-enteric fistula	<1%	

Recommendation 85

In all patients after open repair for abdominal aortic aneurysm, imaging follow up of the aorta and peripheral arteries may be considered every five years

Class	Level	References
I b	C	[549,548]

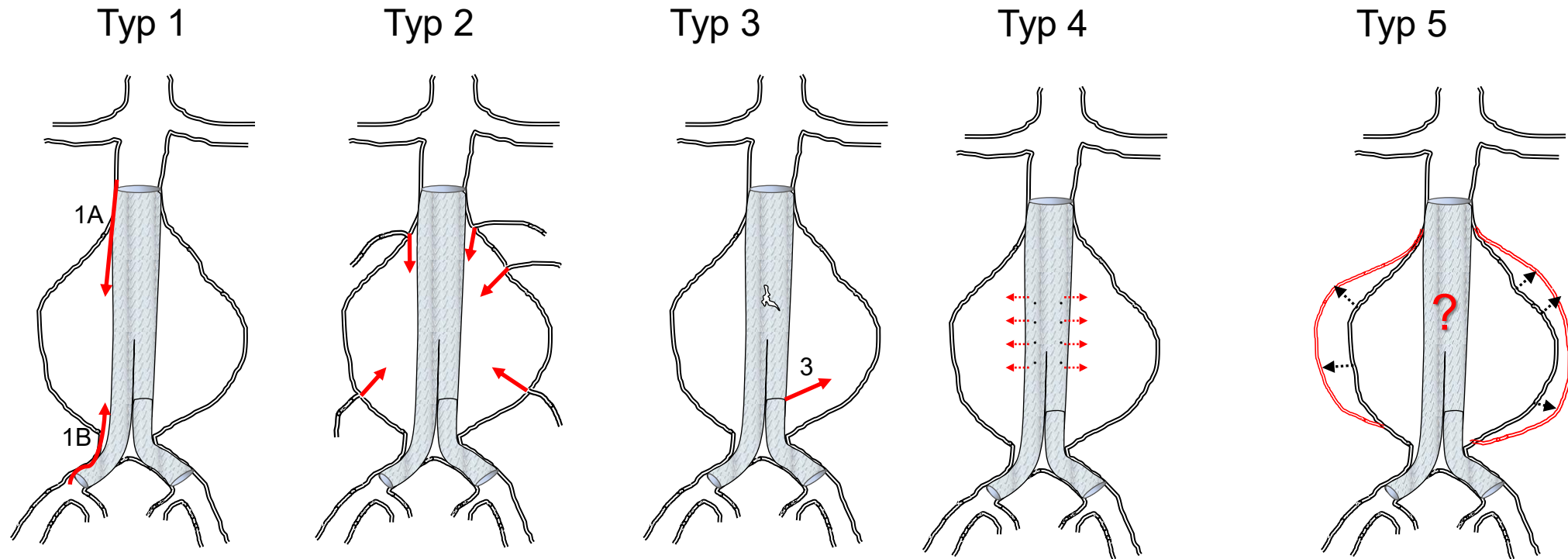
After open repair of AAA, first follow-up imaging is recommended within 1 post-operative year, and every 5 years thereafter if findings are stable. ^{1079,1096}



Long-term related complications after EVAR

Complications	Definition	Estimated frequency during 5 year follow up
Type I endoleak (high-flow)	Peri-graft flow occurring from attachment sites	5%
A	proximal end of stent graft	
B	distal end of stent graft	
C	iliac occluder	
Type II endoleak (generally low-flow)	Perigraft flow occurring from collateral branches to the aneurysm; inferior mesenteric artery (IIA) and lumbar arteries (IIB) Categorised as early or late/delayed (before or after 12 months) and as transient or persistent (resolved or not resolved ≤ 6 months)	20–40%, 10% persistent at 2 years
Type III endoleak (high-flow)	Peri-graft flow occurring from stent graft defect or junction sites	1–3%
A	leak from junctions or modular disconnection	
B	fabric holes	
Type IV endoleak	Peri-graft flow occurring from stent graft fabric porosity <30 days after placement	1%
Endotension	AAA sac enlargement without visualised endoleak	<1%
Migration	Movement of the stent graft in relation to proximal or distal landing zone	1%
Limb kinking and occlusion	Graft thrombosis or stenosis	4–8%
Infection	Stent graft infection	0.5–1%
Rupture	Aortic rupture	1–5%

Verlauf nach EVAR : Endoleaks



NEJM 2008

Rev Med Suisse 2016

Partovi S, Staub D et al. Br J Radiol 2018

b/f-EVAR assoziierte Endoleaks

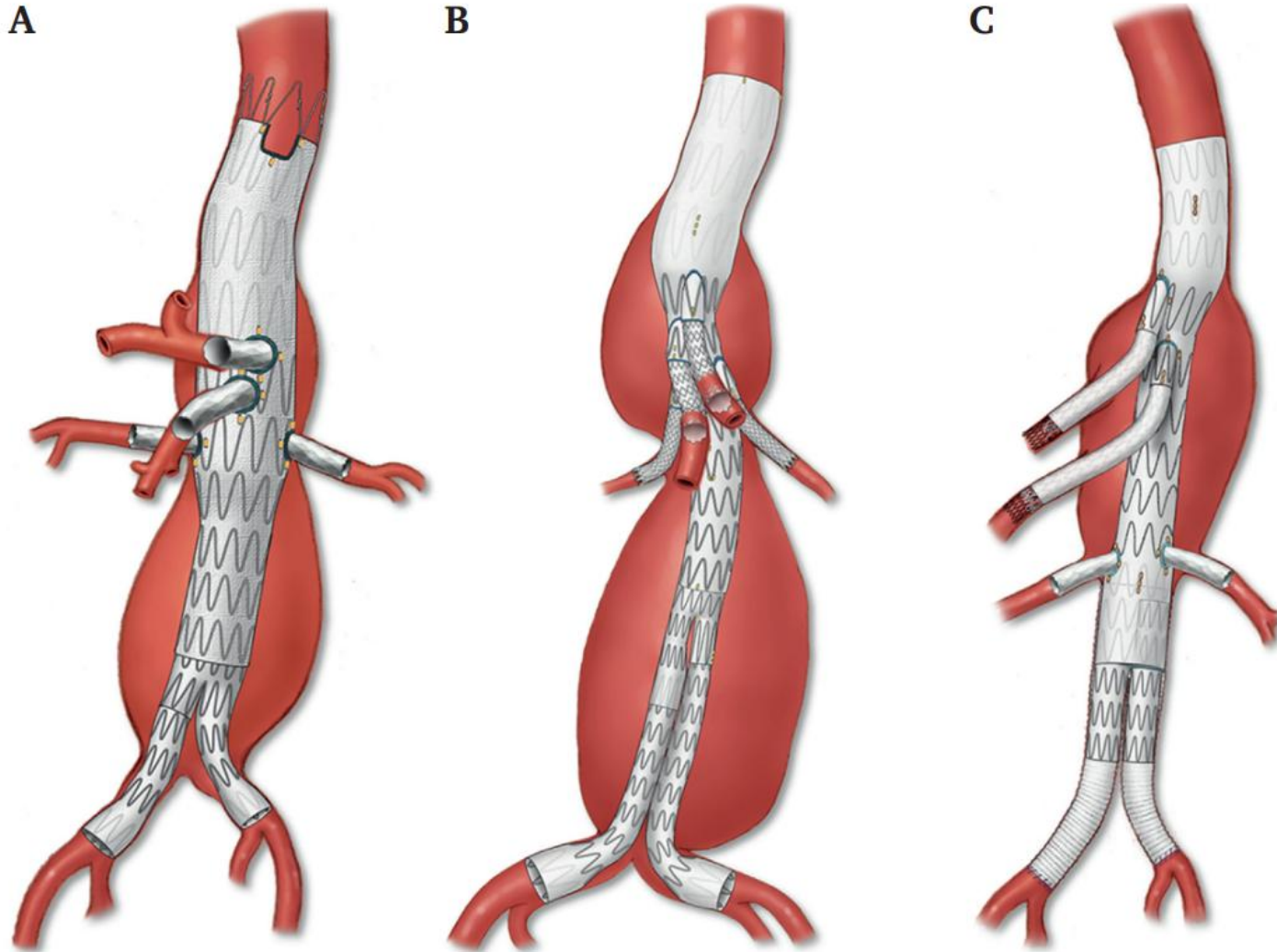


Figure 9. (A) Fenestrated endovascular aortic repair (fEVAR), (B) branched EVAR (bEVAR), and (C) f/bEVAR configurations. Permission to reproduce granted from Elsevier *J Vasc Surg.*⁹³⁵

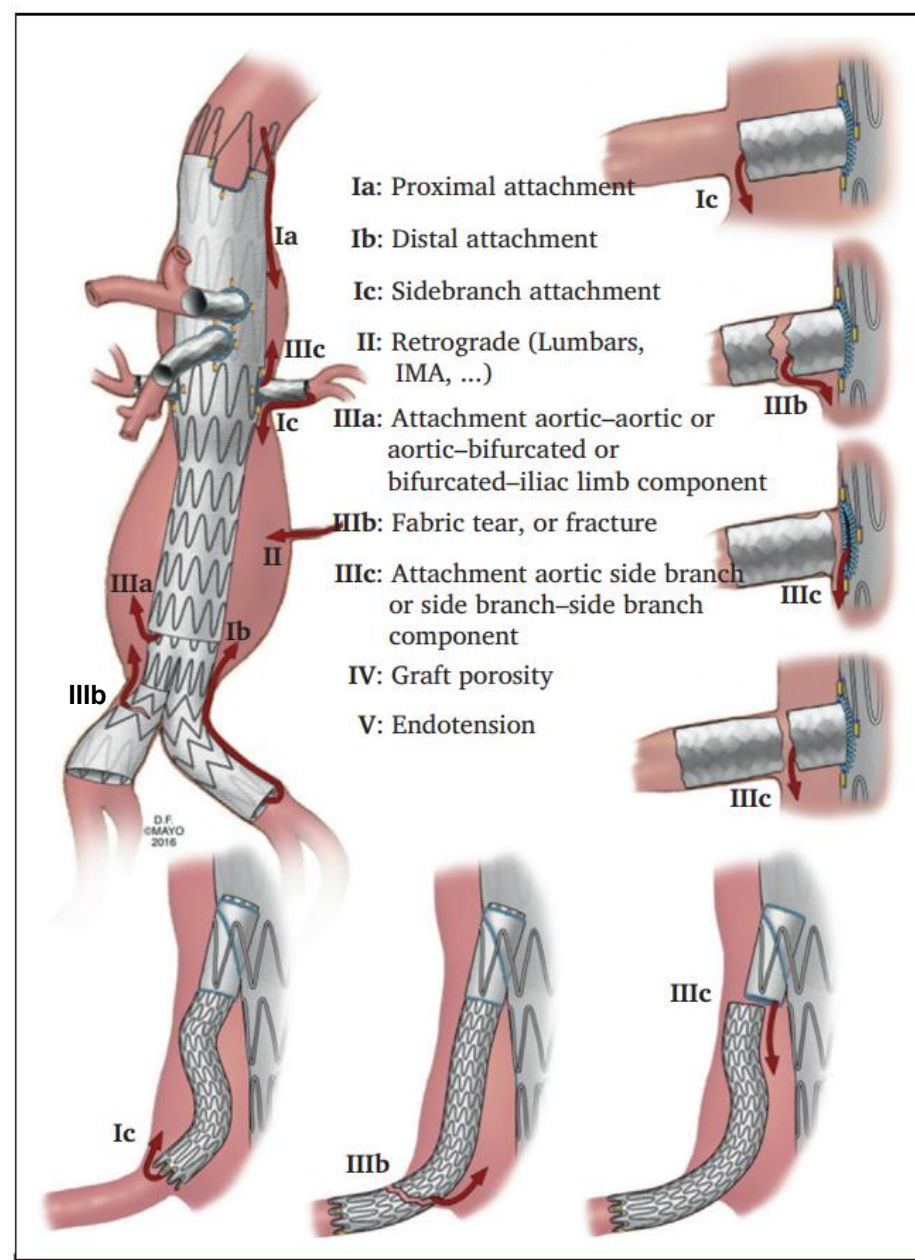


Figure 10. Endoleaks associated with failed bridging stents in the target vessels of fenestrated and branched endovascular aortic repair. IMA = inferior mesenteric artery. Permission to reproduce granted from Elsevier *J Vasc Surg.*⁹³⁵

Table 6.3. Imaging techniques applicable to detection of endovascular aneurysm repair complications and used during follow-up. (Modified from Dellagrammaticas et al.⁵⁸⁸).

	Imaging modality						
	AXR	DUS	CE-DUS	CT	CTA	MRA	PET-CT
Detection of possible EVAR complication							
Aneurysm sac enlargement	No	Yes	Yes	Yes	Yes	Yes	Yes
Endoleak	No	Yes	Yes	No	Yes	Yes	No
Sealing zone and component overlap	Yes	Limited	Limited	Yes	Yes	No	Yes
Migration	Yes	Limited	Limited	Yes	Yes	No	Yes
Limb kinking or occlusion	No	Yes	Yes	Kinking	Yes	Yes	Kinking
Stentgraft infection	No	Limited	Limited	Limited	Yes	Yes	Yes
Risks	Ionizing radiation	None known	None known	Ionizing radiation	Ionizing radiation. Contrast nephropathy.	Risk for nephrogenic systemic fibrosis if eGFR<30	Ionizing radiation
Technical aspects	Reproducibility difficult due to changes in patient position	Operator and patient dependent	As DUS	None	Timing of contrast administration important	Unsuitable for ferromagnetic stents & pacemaker bearers. Artefacts.	Non-specific markers for inflammation/cell proliferation, risk of false positive findings.
Suitable as sole modality for EVAR follow-up	No – combined with DUS/ CE- DUS	No – combined with CT or AXR ± CE-DUS	No – combined with CT or AXR	No – combined with DUS/ CE- DUS	Yes	No – as complement to CT/AXR + DUS/CE-DUS	No - only in case of suspected infection

EVAR = endovascular aneurysm repair; AXR = abdominal Xray; DUS = duplex ultrasound; CE-DUS = contrast enhanced duplex ultrasound; CT = computed tomography; CTA = CT angiography; MRA = magnetic resonance angiography; eGFR = estimated glomerular filtration rate.

Follow-up after EVAR with CTA

- Follow-up 4 year after EVAR (AAA initial max. diameter 5.8cm) with CTA:



- Endoleak type IA



- Custom made fenestrated EVAR with 4 branches

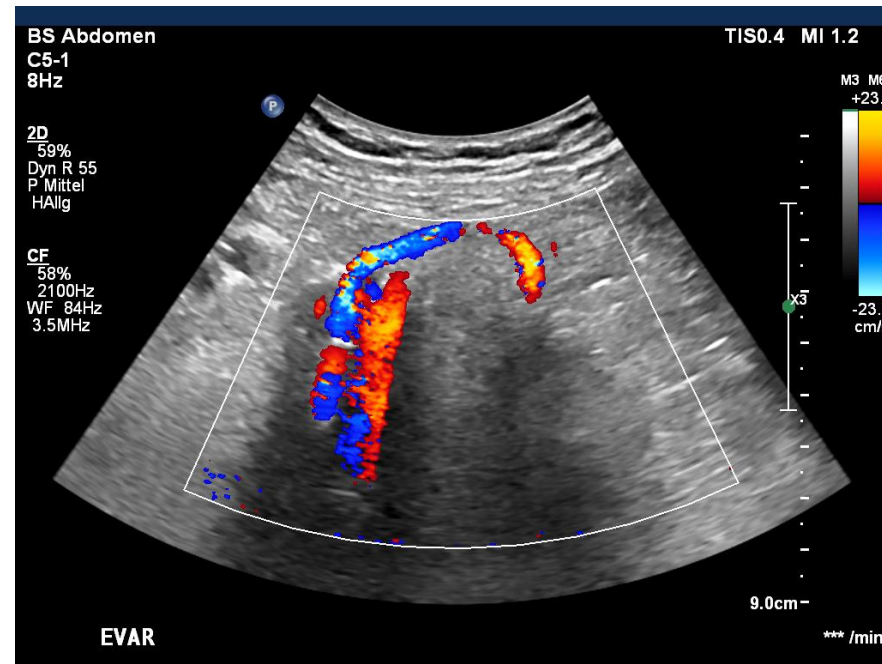
Follow-up after EVAR with ultrasound

Duplex ultrasound as alternative to CTA

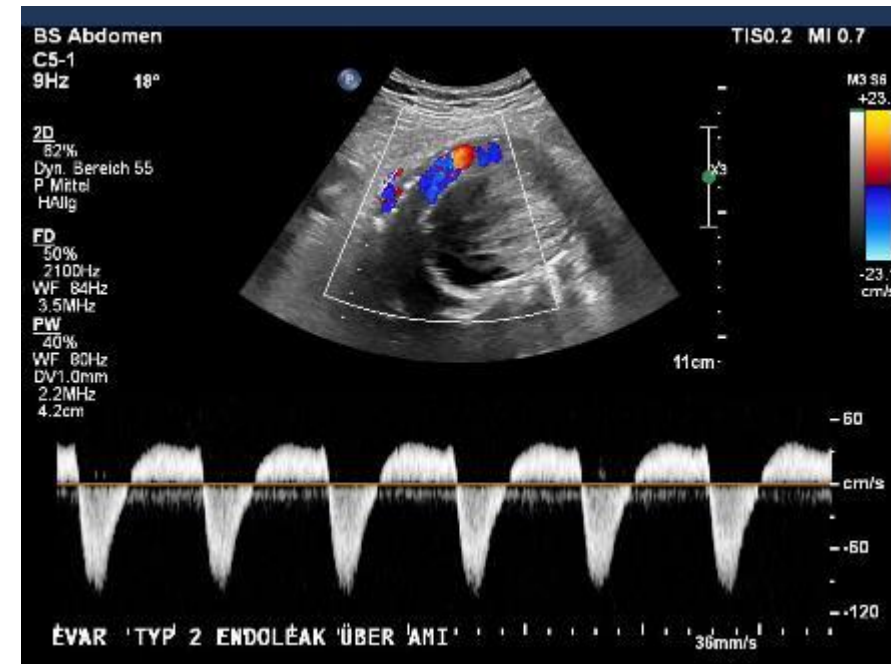
- Aneurysm-diameter, endoleak, stent occlusion/stenosis
- sensitivity of 0.77 and specificity 0.97 compared with CTA for the detection of endoleaks



- Aneurysma-diameter



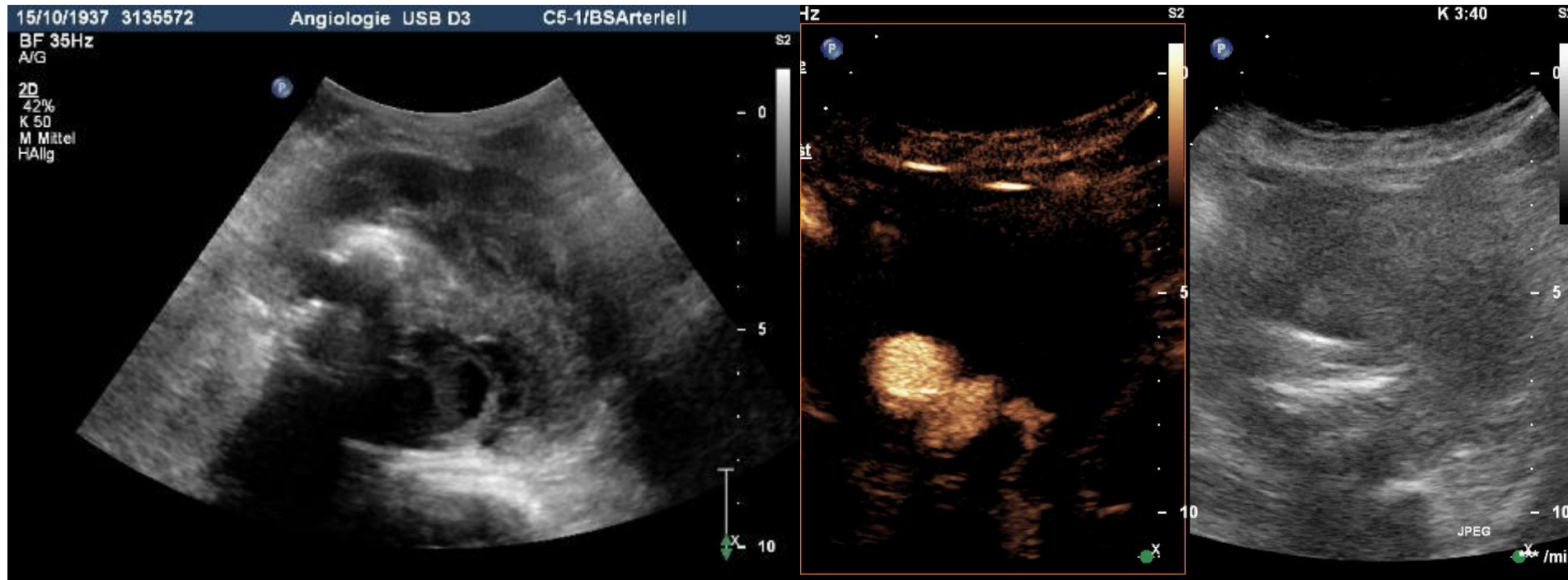
- Endoleak type II



- «To-and-fro»-signal

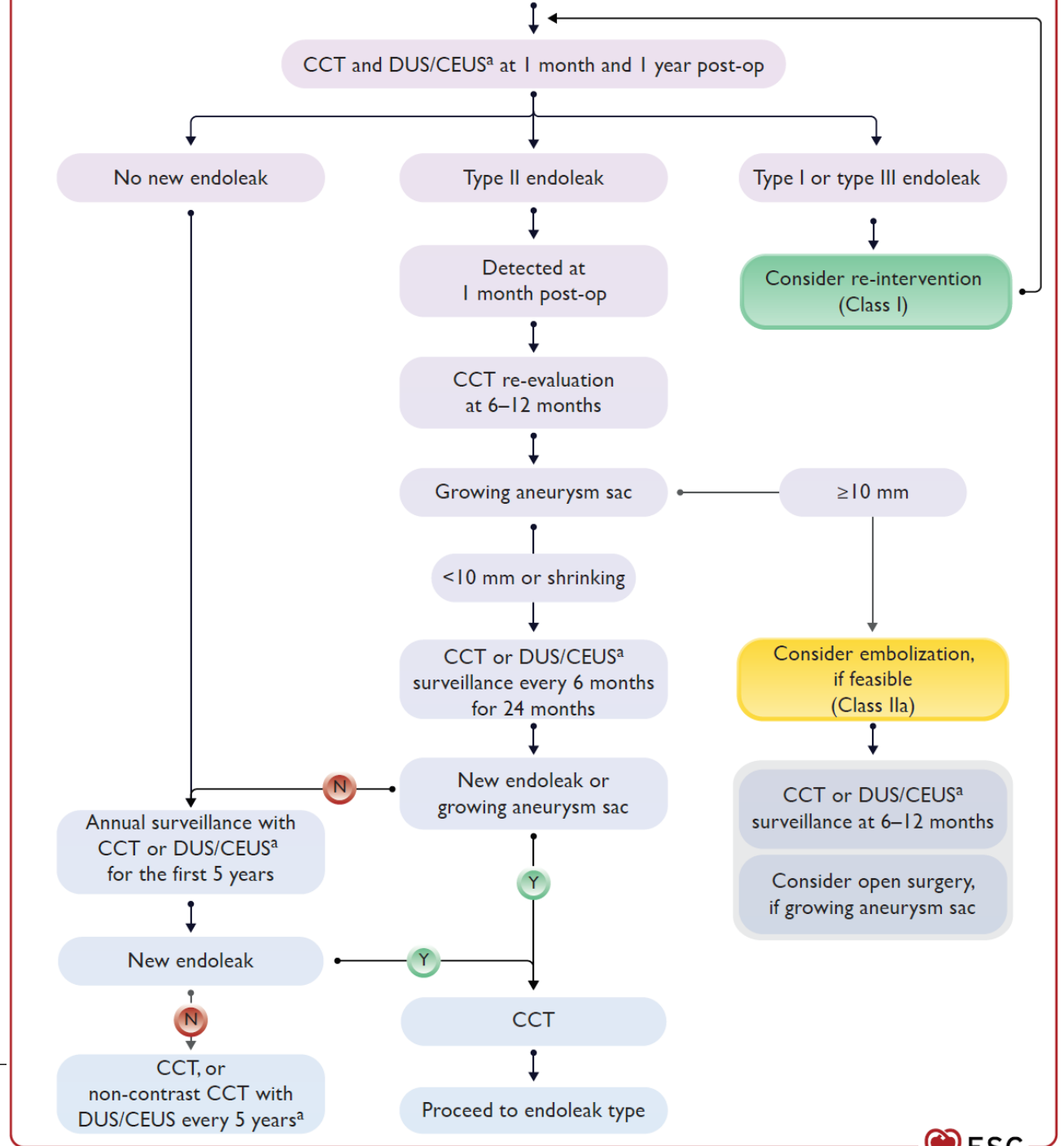
Follow-up after EVAR with contrast-enhanced ultrasound (CEUS)

- Follow-up 1 year after EVAR (AAA initial max. diameter 8.5cm) with ultrasound/CEUS:

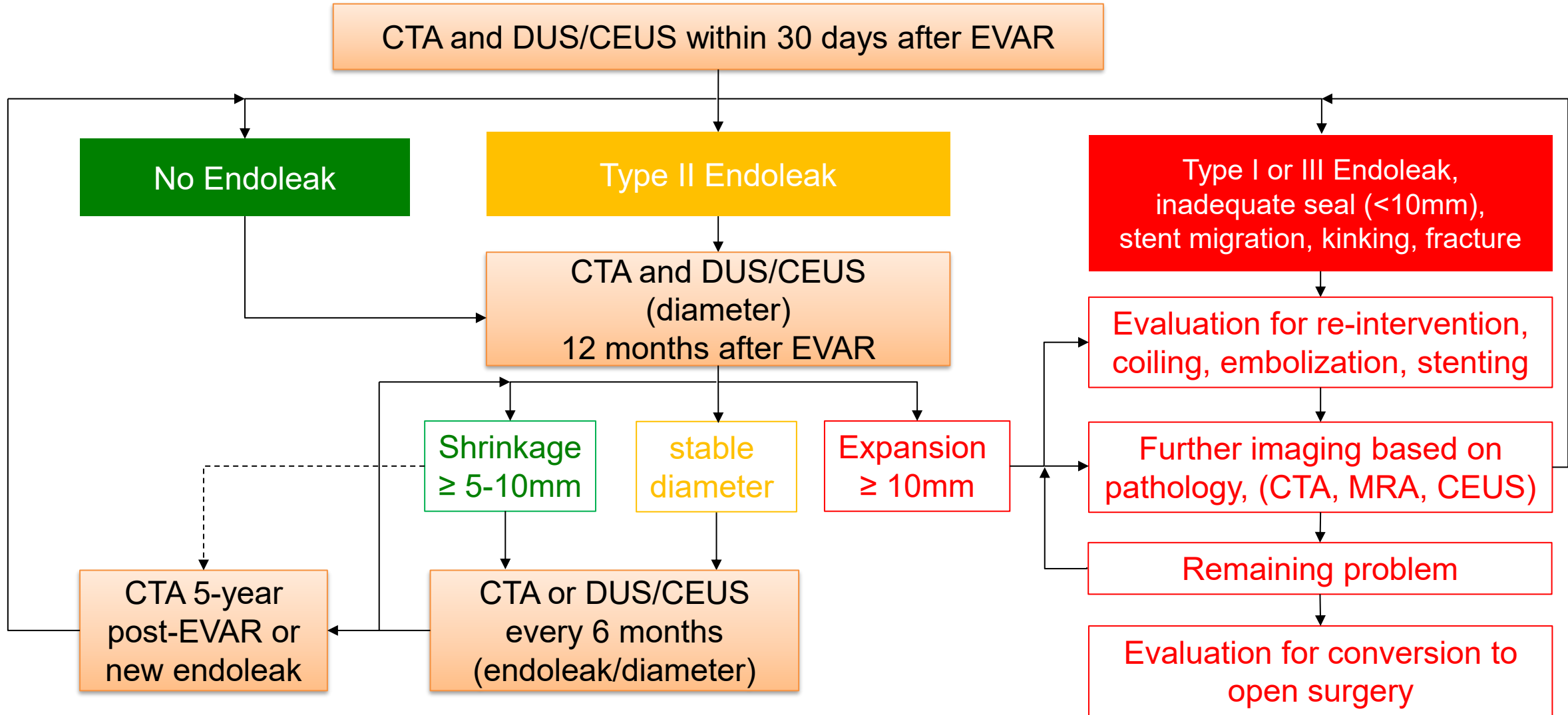


- B-mode-ultrasound: diameter 8.8cm
- CEUS: endoleak type II
- sensitivity of 96%-100% and specificity 82%-100% compared with CTA for the detection of endoleaks

Surveillance after EVAR and management of endoleaks



Long-time follow up after EVAR - Summary



Vielen Dank

Für ihre Aufmerksamkeit!

