Do type 2 endoleaks lead to sealing zone degeneration – and should we therefore treat them?

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THE 26TH INTERNATIONAL EXPERTS SYMPOSIUM
CRITICAL ISSUES
IN AORTIC ENDOGRAFTING
MARCH 21 & 22 2024
COPENHAGEN/MALMÖ
SCANDIC TRIANGELN, MALMÖ

Faculty disclosures

Barend M.E. Mees

- **Consulting, research grants, scientific advisory board**
  Philips, Cook Medical Inc., Bentley

- **Intellectual property**
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- **Vascular surgery training in Rotterdam**

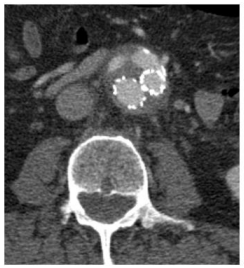
Type 2 EL after EVAR
FACTS

- Nobody knows
  2 endoleak in a
  - Shrinking
  - Stable ane
  - Growing a

Type 2 EL after EVAR
FACTS

It's low

2 days after EVAR



Summary on type 2 EL

- Is a type 2 EL dangerous? **NO**
- Which ones need treatment? **NONE**
- Is treatment effective? **NO**

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Houston calling

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Hence JM Verhagen, MD PhD
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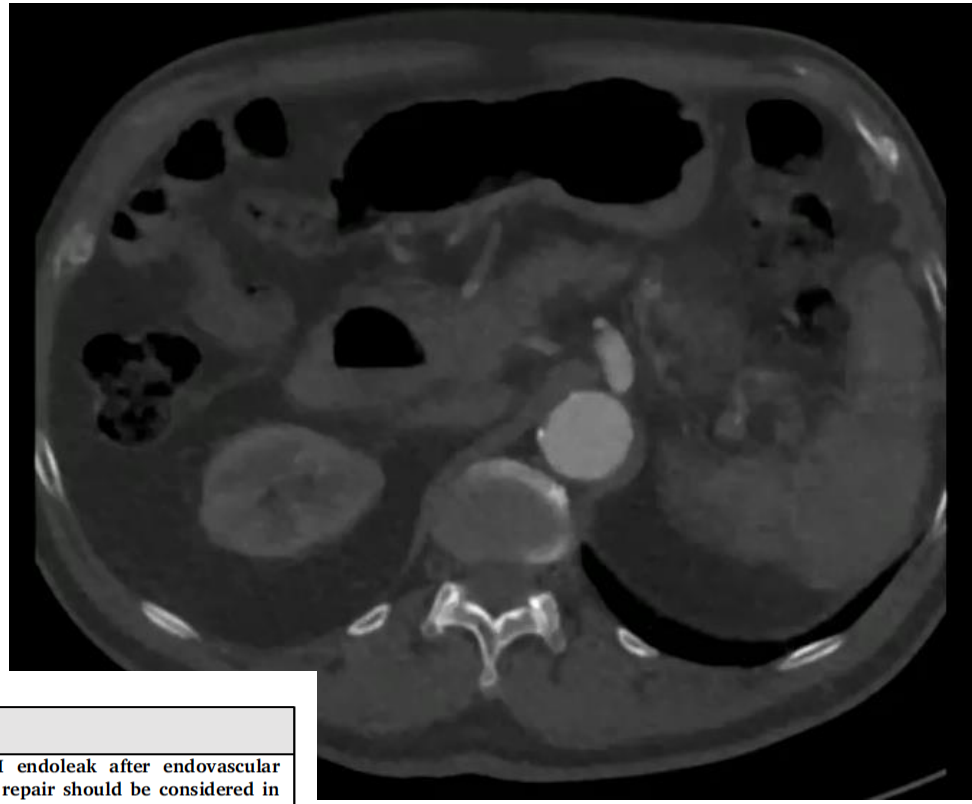
Type 2 endoleaks are NOT dangerous and should NOT be treated

Look harder for the true cause !

Patient

74-year-old male
2015 EVAR (AUI), IBD R & FFX

2020 CTA
Adequate proximal & distal seal
AAA growth 13 mm since 2015
Large L CIA aneurysm stable
IMA type II Endoleak
Visible Riolan Arcade



Recommendation 88		
Re-intervention for Type II endoleak after endovascular abdominal aortic aneurysm repair should be considered in the presence of significant aneurysm growth (see Recommendation 87), primarily by endovascular means		
Class	**Level**	**References**
IIa	C	[499]

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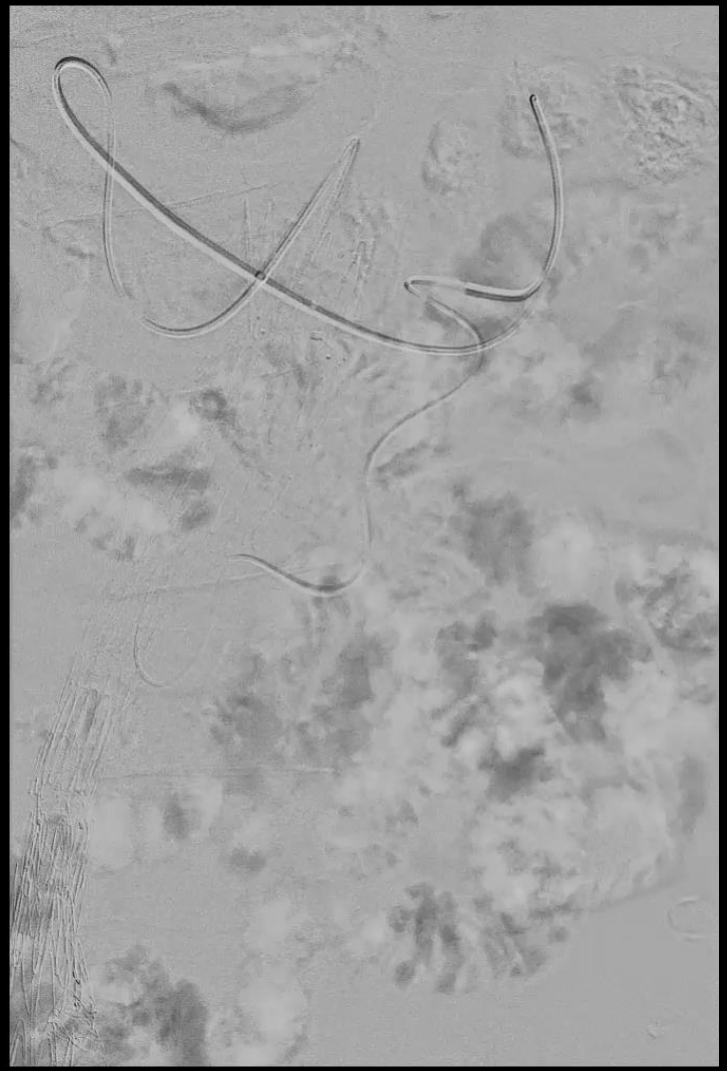
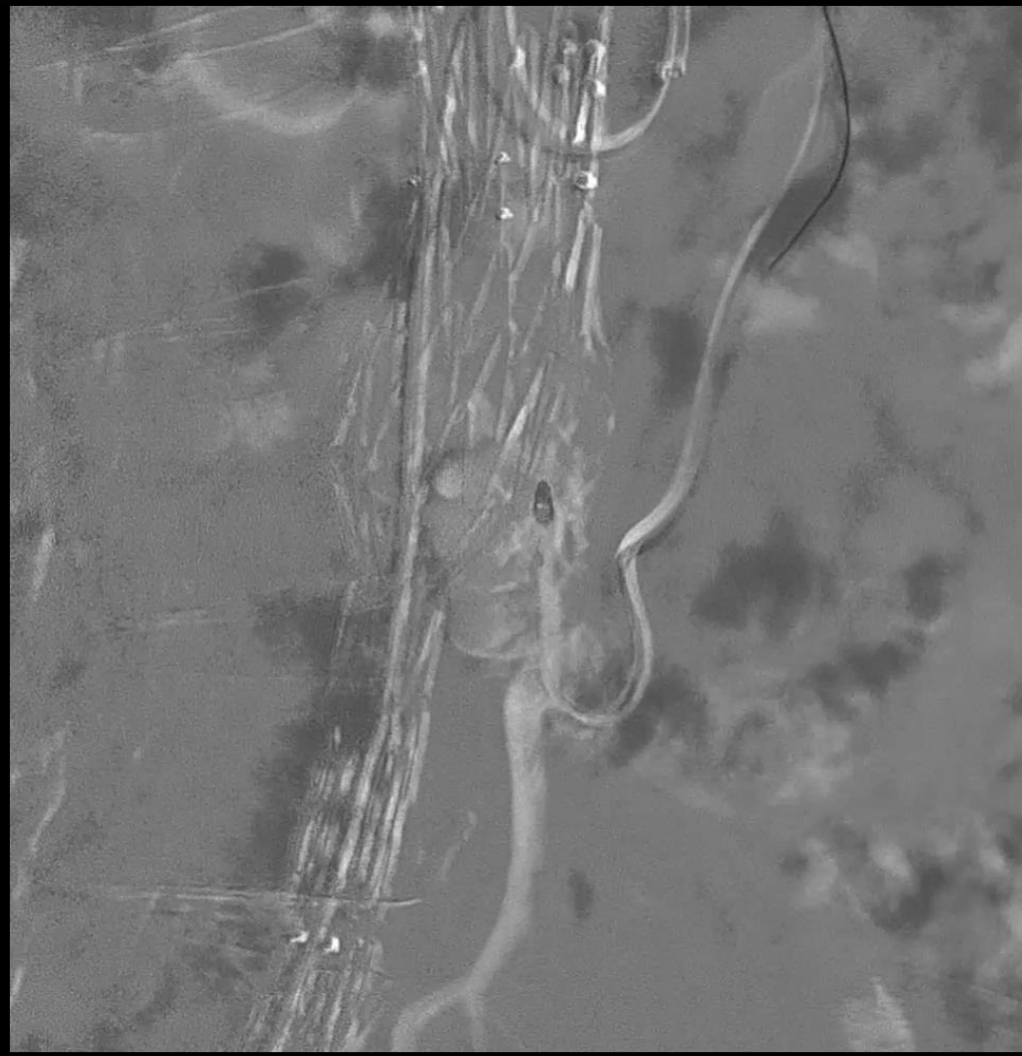
IMA coiling

Unilateral R CFA access (percutaneous)

1. 7 Fr sheath
2. 5 Fr sheath into SMA origin
3. Coaxial system for catheterization of Riolan



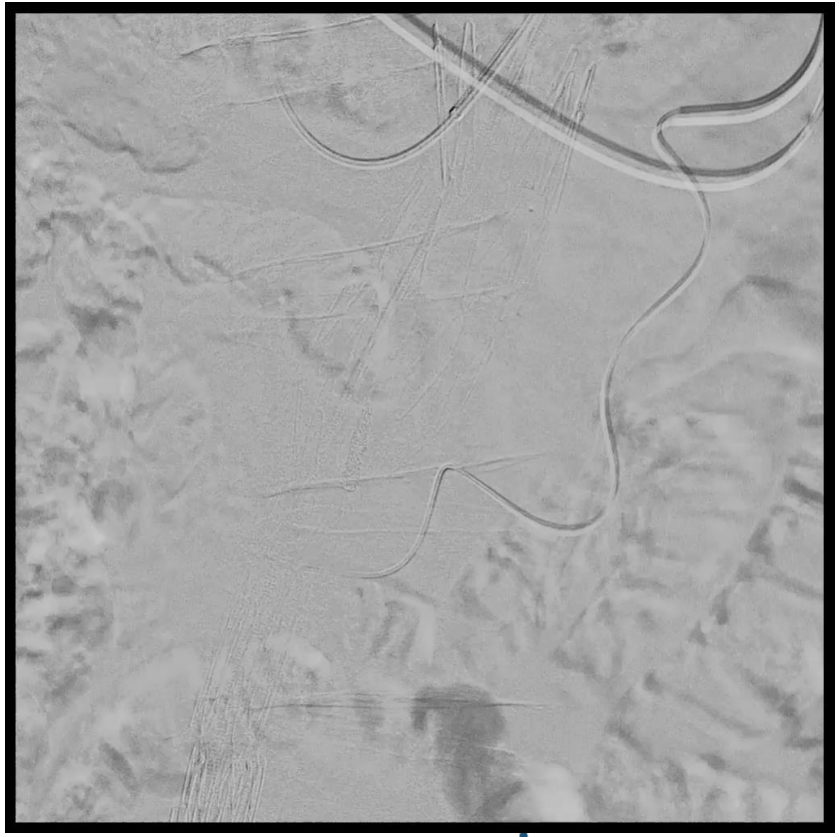


IMA coiling

Unilateral R CFA access (percutaneous)

1. 7 Fr sheath
2. 5 Fr sheath into SMA origin
3. Coaxial system for catheterization of Riolan
4. Coiling origin IMA (3x4mm & 3x2.5mm)

Uncomplicated



Follow-up

Persistent (small) type II EL ventral AAA sac (IMA?) on first CTA

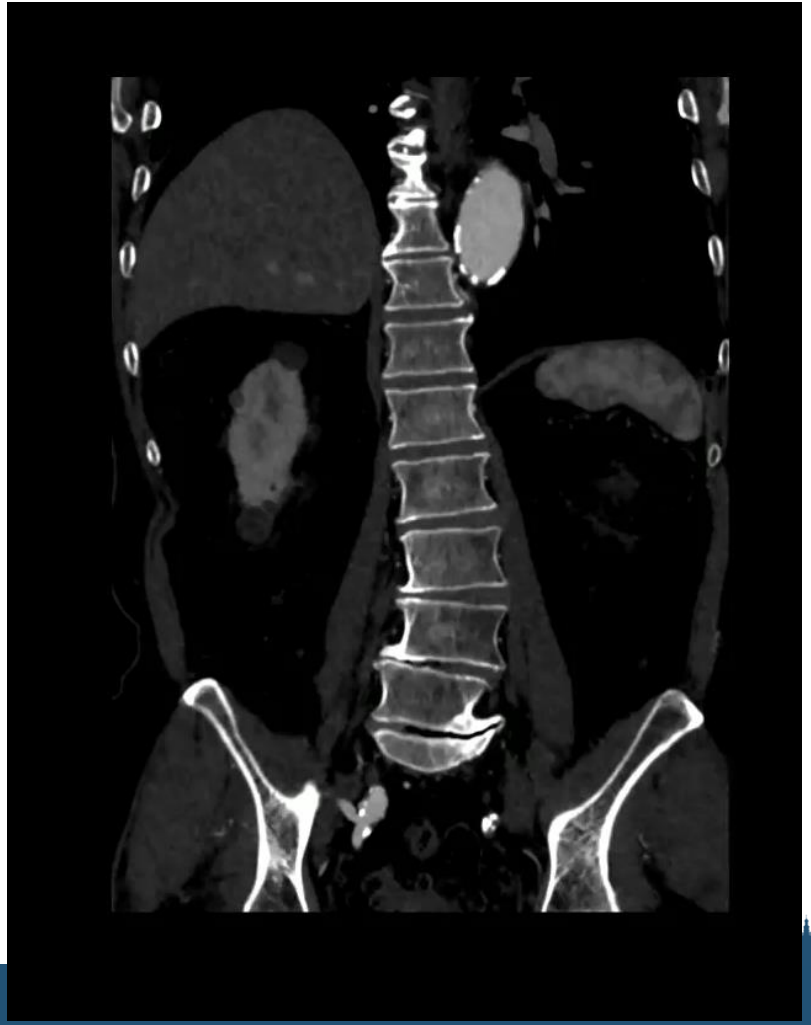
2022 CTA

Persistent A

Decreased s
mm)

Recommendation 105			New
For patients with a compromised proximal seal* after endovascular abdominal aortic aneurysm repair, proximal extension with fenestrated and branched devices should be considered in preference to other endovascular techniques.			
Class	Level	References	ToE
IIa	C	Doumenc *et al.* (2021),[798] Martin *et al.* (2014),[800] Wang *et al.* (2018),[802] Dias *et al.* (2018),[803] Falkensammer *et al.* (2017),[804] Budtz-Lilly *et al.* (2023),[806] Perini *et al.* (2019),[815] Juszczak *et al.* (2021)[807] Juszczak *et al.* (2020)[825]	

* Inadequate seal (< 10 mm) or progressive neck dilatation.



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Follow-up

2023

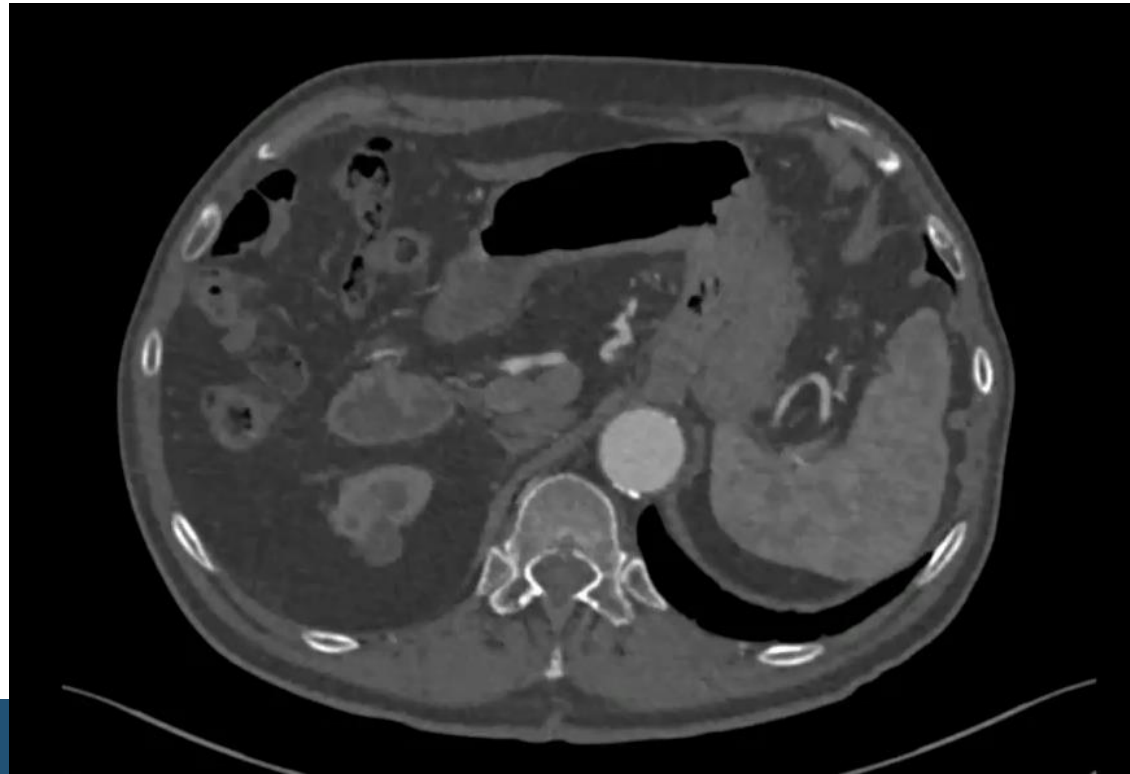
FEVAR in EVAR

(R unilateral femoral access,

R axillary access)

Uncomplicated

No more growth / complications on first post-FEVAR CTA



Our results from IMA embolization for type II endoleak

- 2015 -2023
  - 8 patients (75 (f)EVAR patients per year)

Year	Pre	Growth	Embolisation	Result EL	Result sac	Re-intervention
2015	EVAR	10 mm 6 year	IMA	recanalisation IMA	growth	x
2018	FEVAR in EVAR	6 mm 2 year	IMA	gone after 2 attemts; but type IB	growth	IBD 1 year after IMA coiling, still growth
2019	EVAR	15 mm 3 year	IMA	gone	growth	x, deceased 2022 (non AAA related)
2020	EVAR	13 mm 5 year	IMA	persist IMA EL	growth	FEVAR 1 year after IMA coiling, maybe stable
2020	EVAR for rAAA	4 mm 1 year	IMA	gone, EL LA	stable	x
2021	FEVAR	5 mm 1 year	IMA	gone, EL LA	growth	x
2023	EVAR	8 mm 3 year	IMA	gone	shrink	x
2023	EVAR IBD + LA coiling	8 mm 4 year	IMA and onyx LA	gone, EL LA	stable	x

Circulation

ACC/AHA CLINICAL PRACTICE GUIDELINE

2022 ACC/AHA Guideline for the Diagnosis and Management of Aortic Disease: A Report of the American Heart Association/American College of Cardiology Joint Committee on Clinical Practice Guidelines

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Developed in collaboration with and endorsed by the American Associatio
Radiology, Society of Cardiovascular Anesthesiologists, Society for Cardio
Thoracic Surgeons, and Society for Vascular Surgery

Endorsed by the Society of Interventional Radiology and Society for Vascu

have been developed. There is added
patients with aortic disease both before
institutional interventional volume and

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Circulation

ACC/AHA CLINICAL PRACTICE GUIDELINE

2022 ACC/AHA Guideline for the Diagnosis and Management of Aortic Disease: A Report of the American Heart Association/American College of Cardiology Joint Committee on Clinical Practic Guidelines

Table 21. Abnormal Findings on Duplex Imaging After EVAR That Should Prompt Additional Imaging

Aneurysm sac enlargement
Any endoleak
Stent graft fracture
Stent graft migration
Stent graft separation

EVAR indicates endovascular abdominal aortic aneurysm repair.

6.5.6.2. Surveillance After AAA Repair

Recommendations for Surveillance After AAA Repair
Referenced studies that support the recommendations are summarized in the Online Data Supplement.

COR	LOE	Recommendations
1	B-NR	1. In patients with AAA treated with EVAR, baseline surveillance imaging with CT is recommended at 1 month postoperatively[1,2]; if there is no evidence of endoleak or sac enlargement, continued surveillance with duplex ultrasound at 12 months and then annually thereafter is recommended.[1,3,4]

ACC/AHA CLINICAL PRACTICE GUIDELINE

2022 ACC/AHA Guideline for the Diagnosis and Management of Aortic Disease: A Report of the American Heart Association/American College of Cardiology Joint Committee on Clinical Practice Guidelines

No recommendations on indications for treatment and/or techniques

CLINICAL PRACTICE GUIDELINE DOCUMENT

European Society for Vascular Surgery (ESVS) 2024 Clinical Practice Guidelines on the Management of Abdominal Aorto-Iliac Artery Aneurysms☆

Anders Wanhainen [a,*], Isabelle Van Herzeele [a], Frederico Bastos Goncalves [a], Sergi Bellmunt Montoya [a], Xavier Berard [a], Jonathan R. Boyle [a], Mario D'Oria [a], Carlota F. Prendes [a], Christos D. Karkos [a], Arkadiusz Kazimierczak [a], Mark J.W. Koelemay [a], Tilo Kölbel [a], Kevin Mani [a], Germano Melissano [a], Janet T. Powell [a], Santi Trimarchi [a], Nikolaos Tsilimparis [a]

ESVS Guidelines Committee [b], George Antoniou, Martin Björck, Raphael Coscas, Nuno V. Dias, Philippe Kolh, Sandro Lepidi, Barend M.E. Mees, Timothy A. Resch, Jean Baptiste Ricco, Riikka Tulamo, Chris P. Twine

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Table 20. Long term complications after endovascular repair of abdominal aortic aneurysm.[465,468,469,711–720]

Complication	Meaning	Estimated incidence within five years	Rupture risk*
Type 1 endoleak	Sealing zone failure	5%	High
Type 1a	From proximal seal		
Type 1b	From distal seal		
Type 1c	From iliac occluder†		
Type 2 endoleak	Retrograde flow from aortic side branches	20–40% of which 10% persistent at two years	Low if no AAA sac expansion Intermediate if AAA sac expansion
Type 2a	One vessel visible		
Type 2b	More than one vessel visible		
Type 3 endoleak	Midgraft failure	1–3%	High
Type 3a	Separation or poor apposition of modular components		
Type 3b	Graft disruption		
Type 4 endoleak	Graft porosity		Low
Undetermined endoleak	Visible endoleak with no clear origin		Intermediate
Post-EVAR growth without endoleak		1%	Intermediate
Graft infection		0.5–1%	High
Post-EVAR rupture		1–6%	–
Graft obstruction	Partial or total obstruction of blood flow, including kinking	0.5–1%	Low
Migration	Proximal (descending) or distal (ascending) migration	0–9%	High if associated with Type 1 endoleak

* Rupture risk based on rough estimates indirectly derived from literature and expert panel opinion (low: < 1% year, intermediate 1 – 5%/year, high > 5%/year).

† In treatment with aorto-uni-iliac devices.

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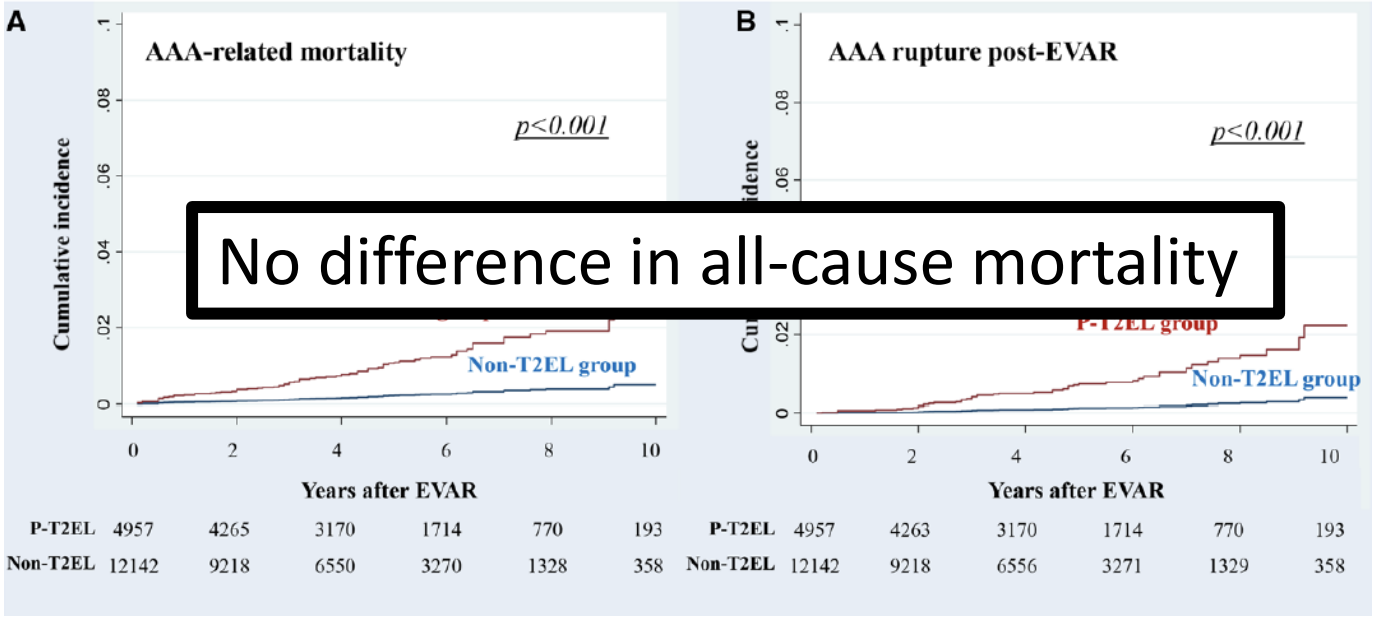
Type II Endoleaks in Japan

17 099 patients: 29.0% with persistent T2EL vs 71.0% w/o persistent T2EL



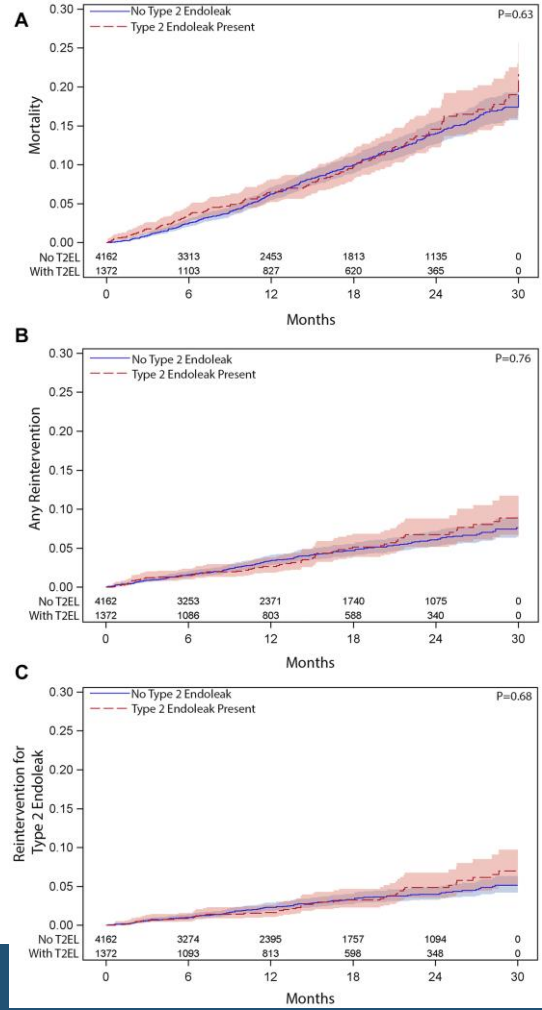
No difference in all-cause mortality

Seike et al, Circulation 2022

Type II Endoleaks in USA

5 534 patients, 1 372 (24.7%) had an identified T2EL and 4 162 (75.2%) did not

No difference in mortality, reinterventions or interventions for type II EL



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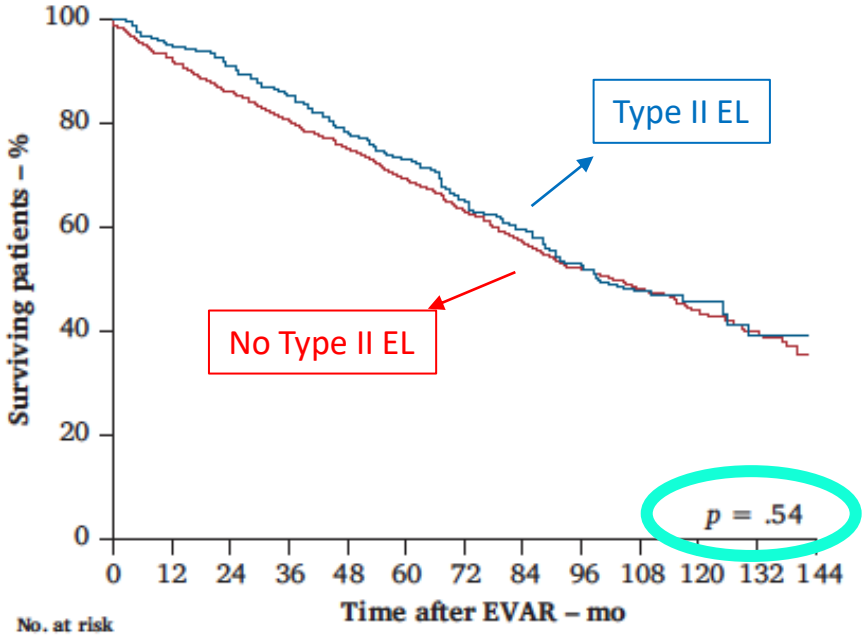
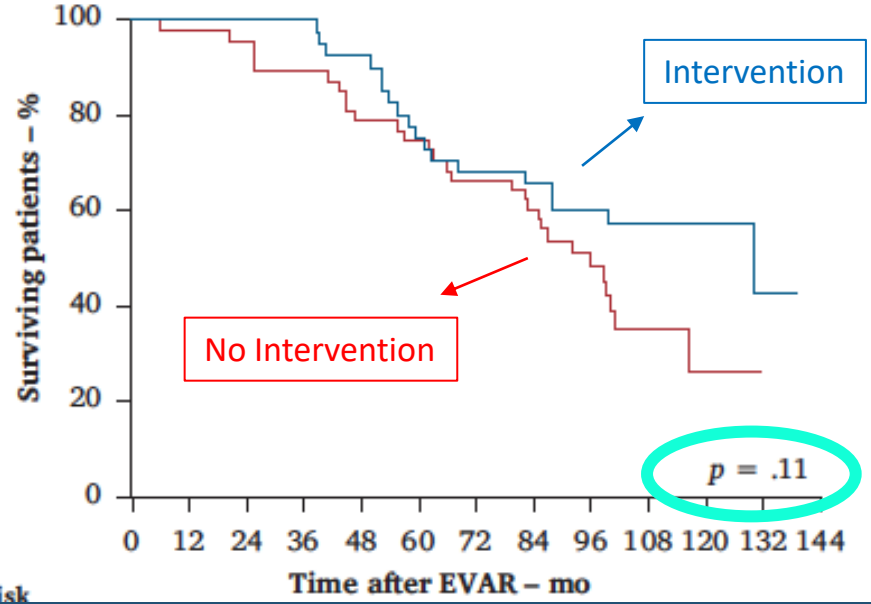
Type II Endoleaks in the Netherlands

2 018 patients with 62.1 months follow-up

Overall Survival



Survival in Pts with Type II EL and growth



Mulay et al, EJVES 2021

Eur J Vasc Endovasc Surg (2018) 56, 794—807

REVIEW

Editor's Choice — Systematic Review and Meta-Analysis of the Outcome of Treatment for Type II Endoleak Following Endovascular Aneurysm Repair

Klaas H.J. Ultee [a,f], Stefan Büttner [a,f], Roy Huurman [a], Frederico Bastos Gonçalves [a,b], Sanne E. Hoeks [c], Wichor M. Bramer [d], Marc L. Schermerhorn [e], Hence J.M. Verhagen [a,*]

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[e] Department of Surgery, Division of Vascular and Endovascular Surgery, Beth Israel Deaconess Medical Centre and Harvard Medical School, Boston, MA, USA

59 studies – 1073 pts

- Technical success 87.9%
- Clinical success 68.4%

- Peri-operative complications 3.8%
- AAA-related mortality 1.8%

Changes in sac diameter following type II endoleak treatment were documented in 157 patients to at least 24 months. Within this group an actual decrease in sac diameter was reported in only 27 of 40 patients.

Occult type I or III endoleaks are a common cause of failure of type II endoleak treatment after endovascular aortic repair

Michael C. Madigan, MD, Michael J. Singh, MD, Rabih A. Chaer, MD, Georges E. Al-Khoury, MD, *and* Michel S. Makaroun, MD, *Pittsburgh, Pa*

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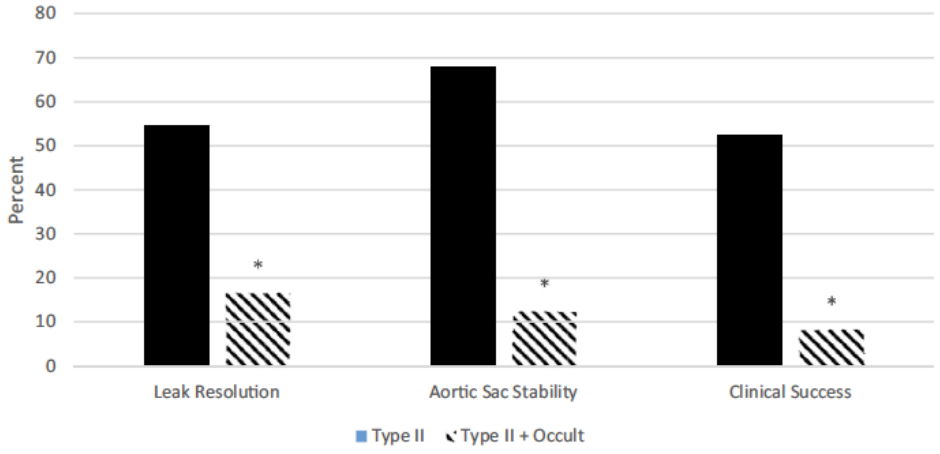
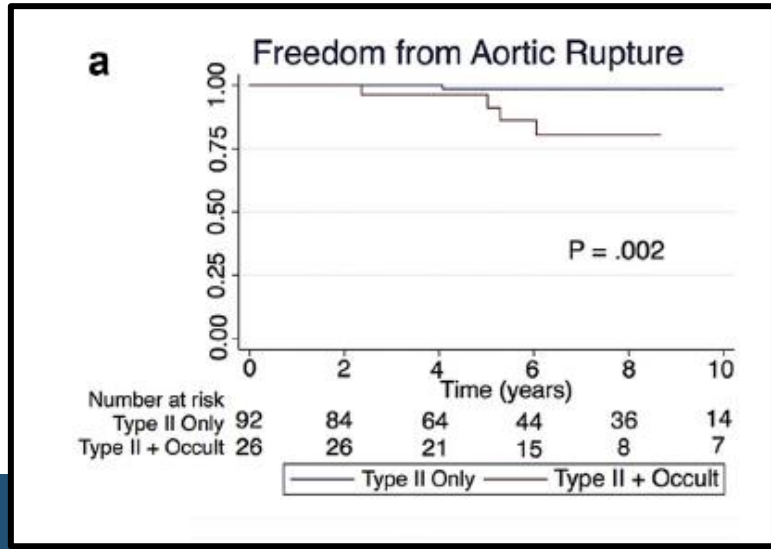
Outcome with or without occult endoleak





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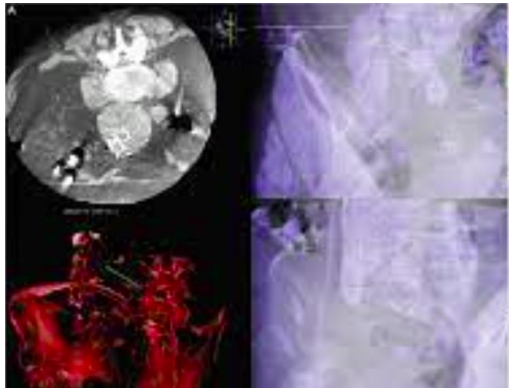
Based on the above, there is no strong evidence for when intervention is indicated for T2EL, but it is reasonable to proceed to invasive treatment when the aneurysm has expanded > 10 mm compared with baseline or the lowest diameter during follow up using the same imaging modality and measurement method.[719,846,849]

Recommendation 107			Changed
Secondary intervention for a Type 2 endoleak after endovascular abdominal aortic aneurysm repair should only be considered in the presence of significant aneurysm sac growth (≥ 10 mm compared with baseline or with the smallest diameter during follow up using the same imaging modality and measurement method), primarily by endovascular means, provided alternative causes including Type 1 or 3 endoleaks have been excluded.			
Class	**Level**	**References**	**ToE**
IIa	C	Sidloff *et al.* (2013),[719] Madigan *et al.* (2019),[844] Wu *et al.* (2021),[845] Mulay *et al.* (2021),[846] Ultee *et al.* (2018),[847] Dijkstra *et al.* (2020),[849] Mansukhani *et al.* (2023)[859]	

Techniques for treatment of type II endoleaks

- Embolization
  - Intra-luminal (trans-arterial)
  - Direct nidus puncture
    - Translumbar
    - Transcaval
    - Transabdominal
  - Perigraft
- Laparoscopic / Open ligation
- Conversion / Semiconversion



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- Translumbar and transcaval have higher technical success and lower complications than trans-arterial
- Translumbar with fusion guidance has higher technical success than conventional translumbar
- There is no comparative data on different embolic agent/coils/fluids
- Embolization has high technical success, but common recurrence
- A clear definition for successful intervention is lacking

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Recommendation 108			New
Patients with persistent aneurysm growth after endovascular attempt(s) to treat Type 2 endoleaks should be considered for elective open conversion with or without graft preservation.			
Class	**Level**	**References**	**ToE**
IIa	C	Dias *et al.* (2018),[803] Goudeketting *et al.* (2019),[819] Madigan *et al.* 92019),[844] Wu *et al.* (2021),[845] Ultee *et al.* (2018)[847]	

Conclusions

Type II Endoleaks

- are very common; and not *per se* a clinical problem;
- because they are generally innocent, leading to few events over time;
- have been associated with sac expansion and late rupture, which remains the most feared late complication of EVAR, but we cannot differentiate the dangerous from the harmless ones
- can be associated with occult type I and III endoleaks, which warrant treatment

- We have a variety of different technical tools but no clinically successful way to treat them when deemed necessary

My task for today

Do type 2 endoleaks lead to sealing zone degeneration – NO, but sac growth may

and should we therefore treat them?
Maybe, if all other causes for sac growth have been excluded

Discussion

- We usually follow the ESVS guidelines recommendations
- Survey these two days in Malmö:
- Clinical success of endovascular type II endoleak treatment is disappointing
- 1 (maybe 2) endovascular attempts, but when persisting growth go open

- Patients with growing sacs are pro-inflammatory, behave differently and need a systemic approach
- ”Focus on the patient, not the leak”