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Endoleak Type II prevention rather than endoleak treatment is the way to go

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Disclosures

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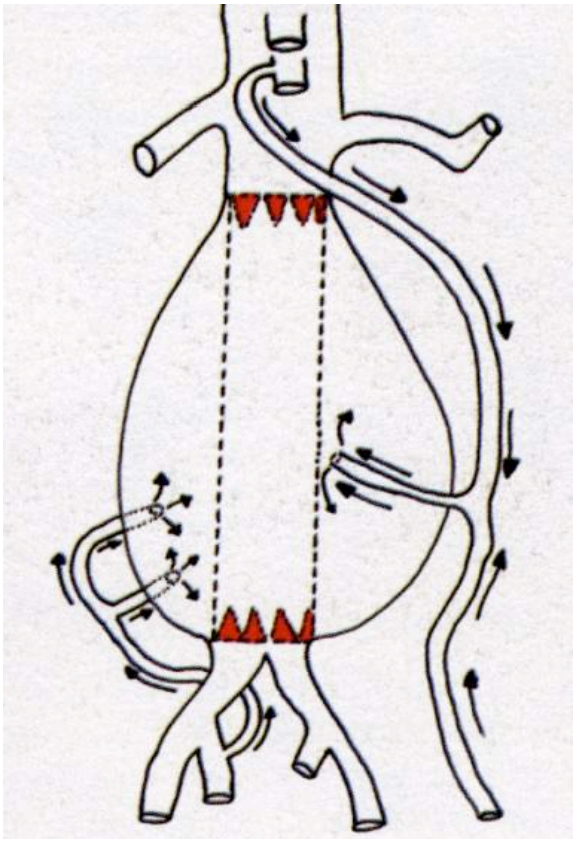
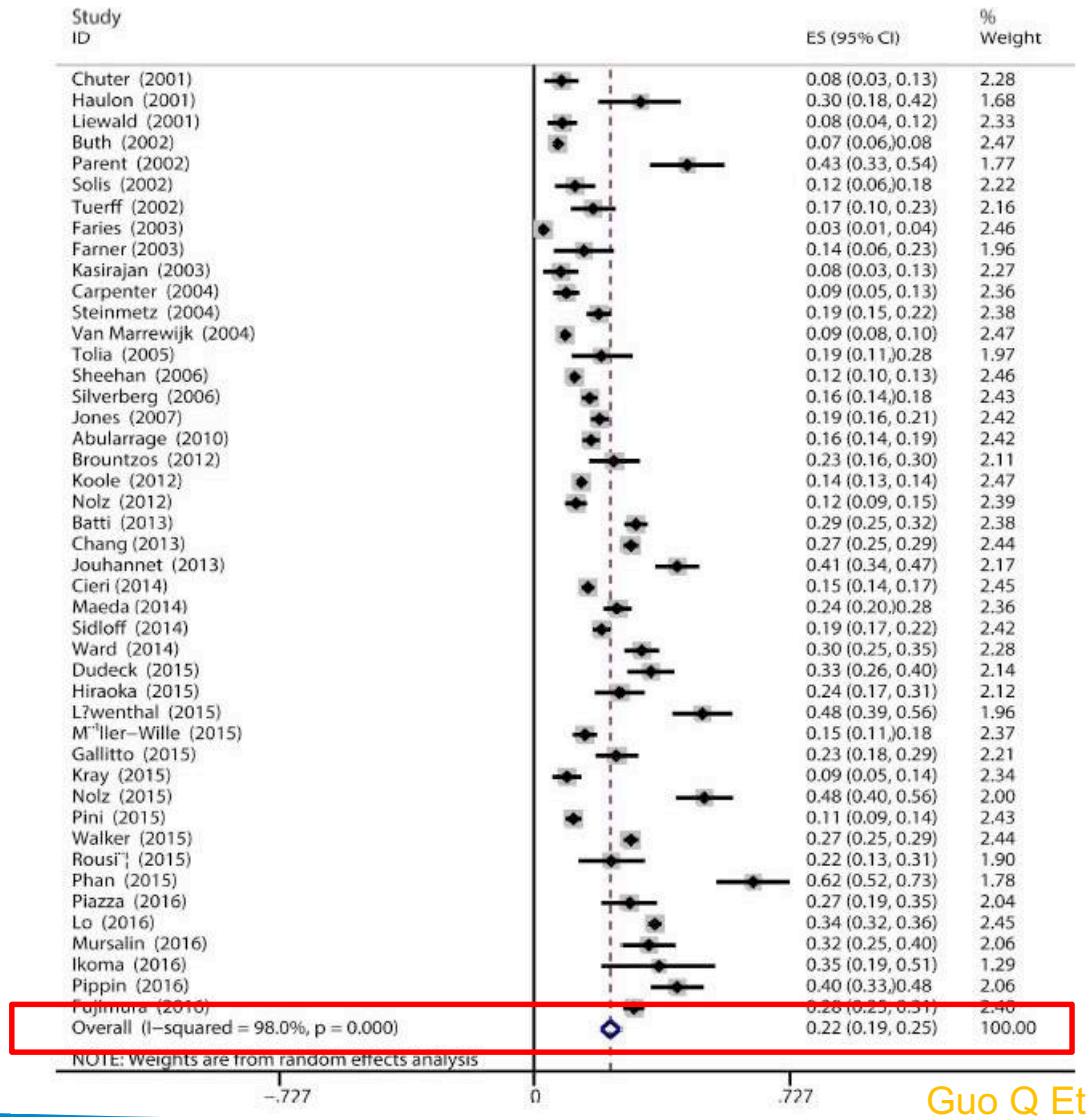
- I have the following potential conflicts of interest to report:
  - Consulting and speaking fees from:
    - Bentley Innomed GmbH
    - BD
    - Cook Medical
    - Cydar Medical
    - Endologix

Endoleak Typ II

- IIa: Simple or to-and-fro
  - from only 1 branch
- IIb: Complex or flow-through
  - 2 or more patent branches



Incidence of Endoleak Typ II



Guo Q Et al, PLoS ONE 2017

Risk Factors for Endoleak Typ II

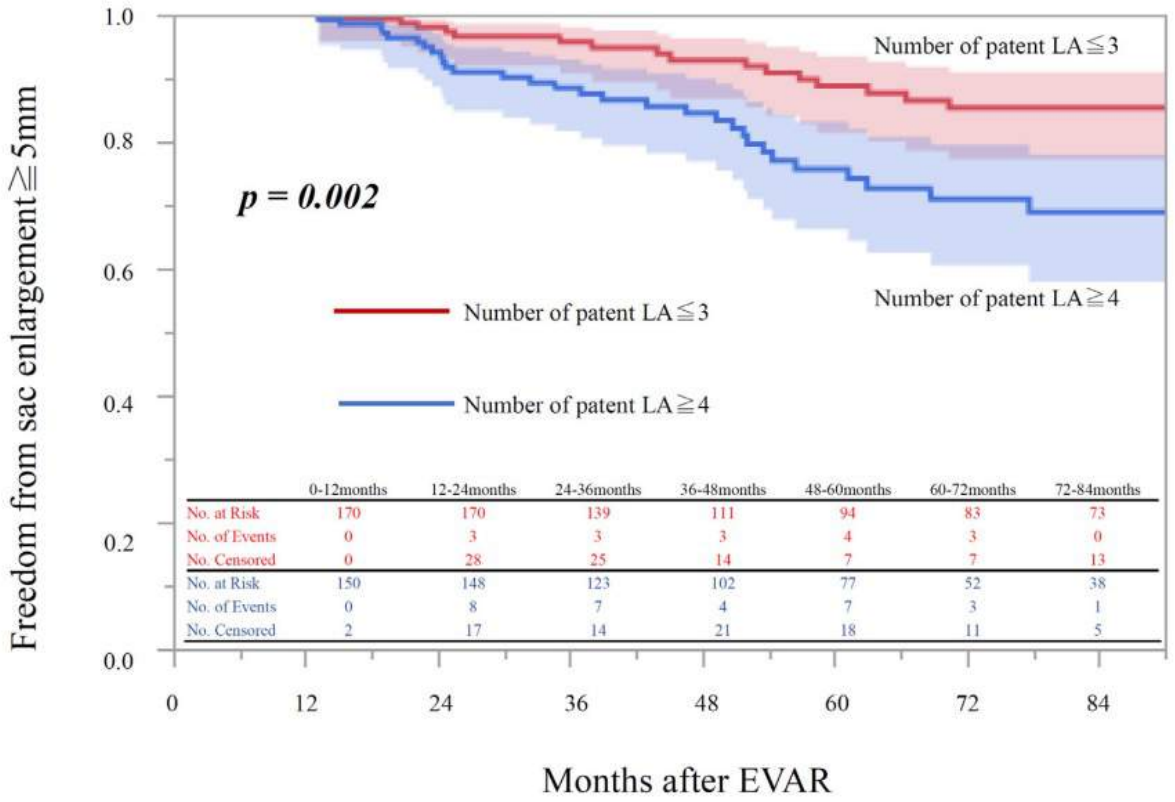
Table 3. Pooled ORs for association of commonly studied risk factors with Type II endoleak.

Potential risk factors	No. of studies	Total no. of participants	Pooled OR	95% CI	P value	I^2
Age	8	6278	0.37	0.31–0.43	<0.001	99.0
Male	12	11775	0.83	0.67–1.02	0.059	46.4
Smoking	14	20477	0.71	0.55–0.92	<0.001	86.4
Diabetes	10	7303	0.91	0.76–1.09	0.251	20.9
Hypertension	10	7281	0.98	0.85–1.12	0.484	0
Hyperlipidemia	7	5522	1.12	0.83–1.49	0.814	74.7
Chronic renal insufficiency	10	9201	0.85	0.53–1.36	0.600	85.3
COPD	10	5745	0.84	0.69–1.03	0.135	34.1
Polytrafluoroethylene-based endografts	7	8396	0.88	0.65–1.18	0.390	70.8
Anticoagulants	5	3758	1.27	0.97–1.67	0.537	0
Antiplatelet	5	3758	1.09	0.79–1.51	0.220	65.6
Patent IMA	3	4353	1.98	1.06–3.71	0.012	77.6
Number of patent lumbar arteries	2	758	3.07	2.81–3.33	<0.001	99.8
Maximum aneurysm diameter	7	4858	0.23	0.17–0.30	<0.001	98.0

Guo Q et al, PLOS ONE 2017

Risk Factors for Endoleak Typ II
- Patent LAs -

- The freedom from aneurysm sac enlargement (≥5 mm) at 5 years was 76% in patients with ≥4 LAs and 89% in patients with ≤3 LAs



Ide et al., Annals of Vascular Surgery 2021

Risk Factors for Endoleak Typ II
- Patent IMA -

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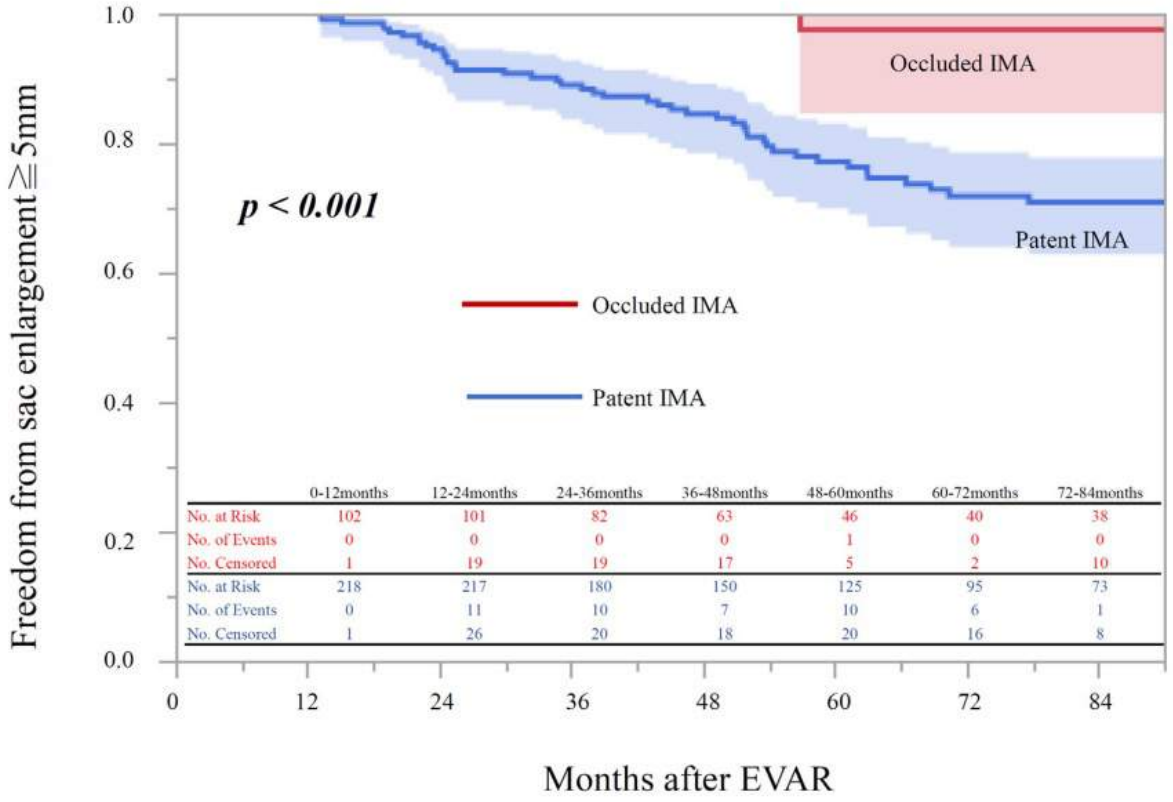
- The freedom from aneurysm sac enlargement at 5 years was 77% in patients with open IMA and 98% in patients with occluded IMA



	0-12months	12-24months	24-36months	36-48months	48-60months	60-72months	72-84months
No. at Risk	102	101	82	63	46	40	38
No. of Events	0	0	0	0	1	0	0
No. Censored	1	19	19	17	5	2	10
No. at Risk	218	217	180	150	125	95	73
No. of Events	0	11	10	7	10	6	1
No. Censored	1	26	20	18	20	16	8

Ide et al., Annals of Vascular Surgery 2021

Natural History of Endoleak Typ II

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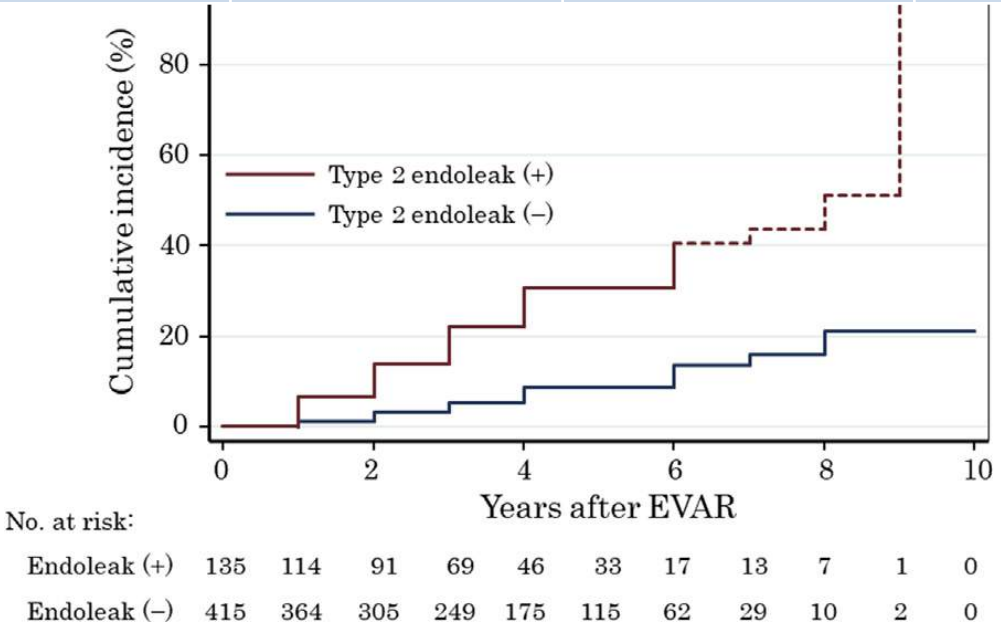
- The cumulative incidence of aneurysm sac enlargement (≥5 mm)

	Total (n=550)	EL2(+) (n=135)	EL2(-) (n=415)
Sac enlargement	14.2% ± 1.7%	30.7% ± 4.4%	8.7% ± 1.6%



Sakaki M, et al. Ann Vasc Surg. 2020

Typ 2 EL -significant predictor of sac enlargement (p = 0.002)!

Natural History of Endoleak Typ II

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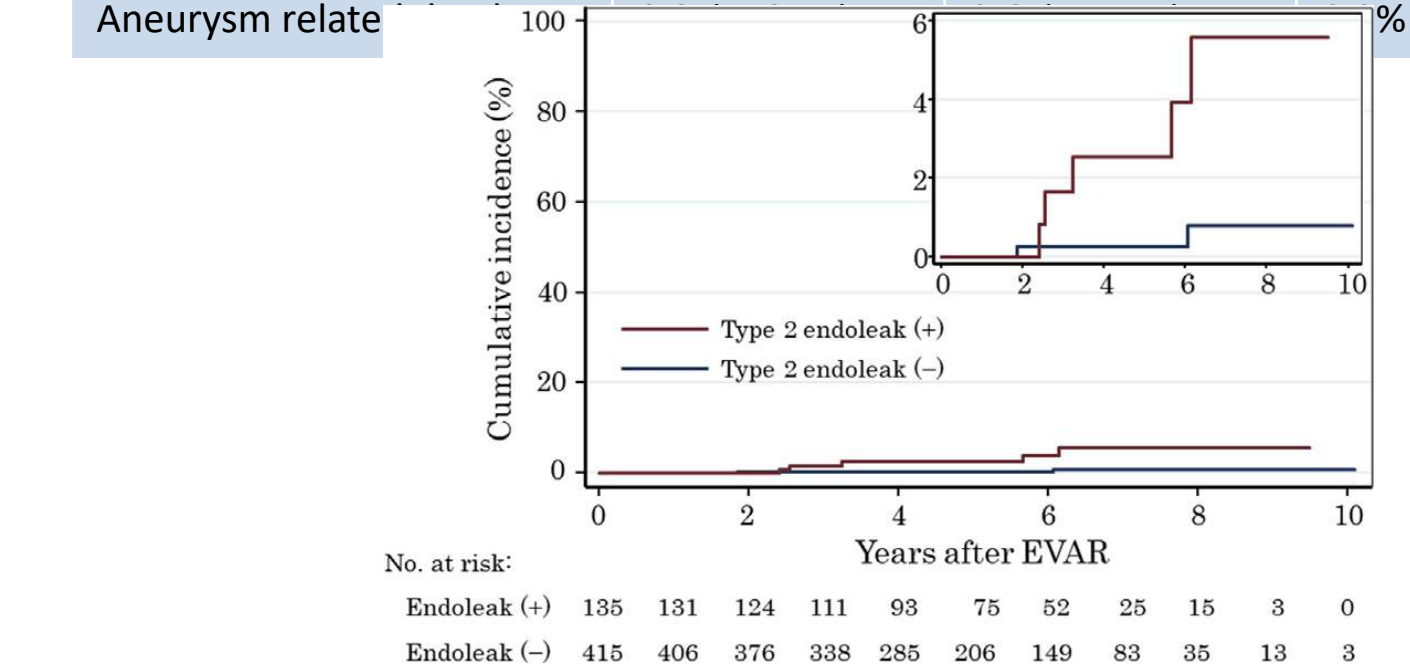
- The probability of freedom from aneurysm-related death after EVAR

	Total (n=550)	EL2(+) (n=135)	EL2(-) (n=415)
Aneurysm relate			% ± 0.3%



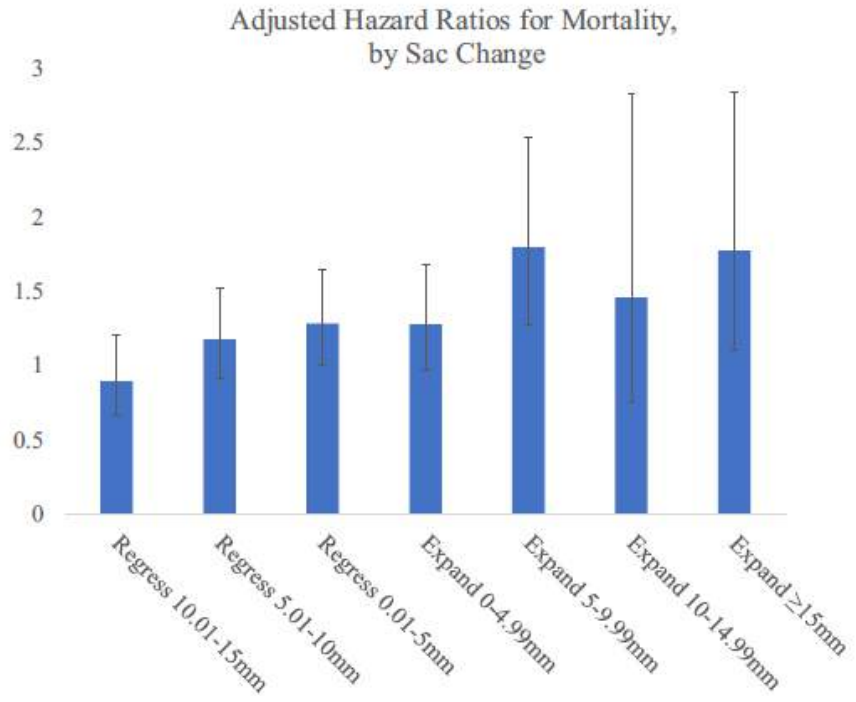
Sakaki M, et al. Ann Vasc Surg. 2020

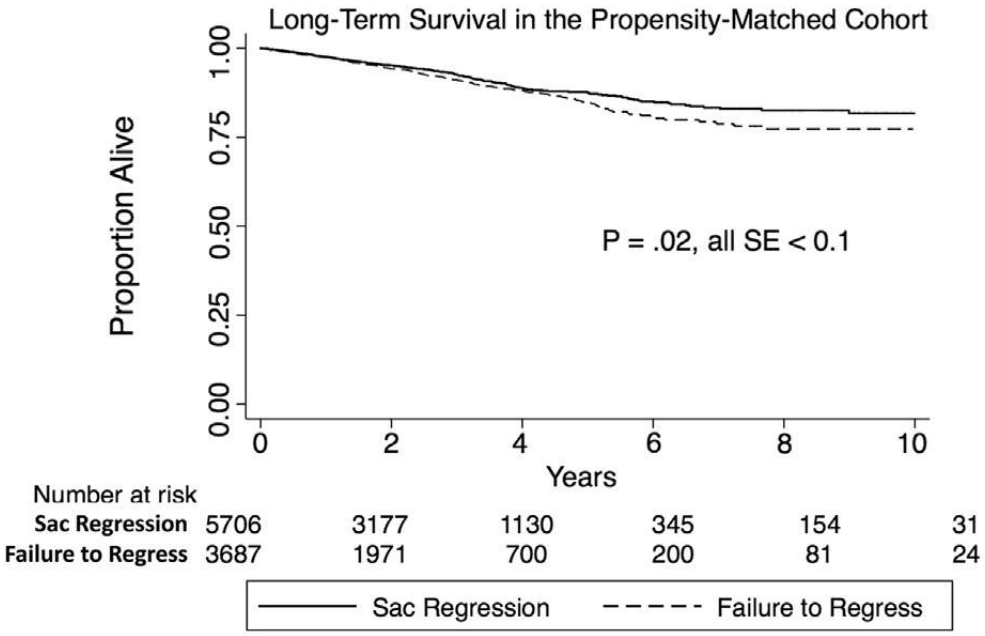
Typ 2 EL - significant predictor for aneurysm-related death after EVAR!

(hazard ratio, 7.80; 95% confidence interval, 1.50-40.58; P = 0.015).

Natural History of Endoleak Typ II

- Not only sac enlargement, but also the lack of sac regression is associated with lower long-term survival, independent of reinterventions





O'Donnell TFX, J Vasc Surg. 2019

Endoleak Typ II - Treatment

- Only indicated in case of sac enlargement.

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]

Recommendation 87		
Expansion of sac diameter ≥1 cm detected during follow up after endovascular abdominal aortic aneurysm repair using the same imaging modality and measurement method may be considered as a reasonable threshold for significant growth		
Class	Level	References
IIb	C	[499]

- Several treatments are available:
  - Embolization
  - conversion to open repair
  - laparoscopic clipping

-> Recurrence of T2EL after 3 years: 50.0%

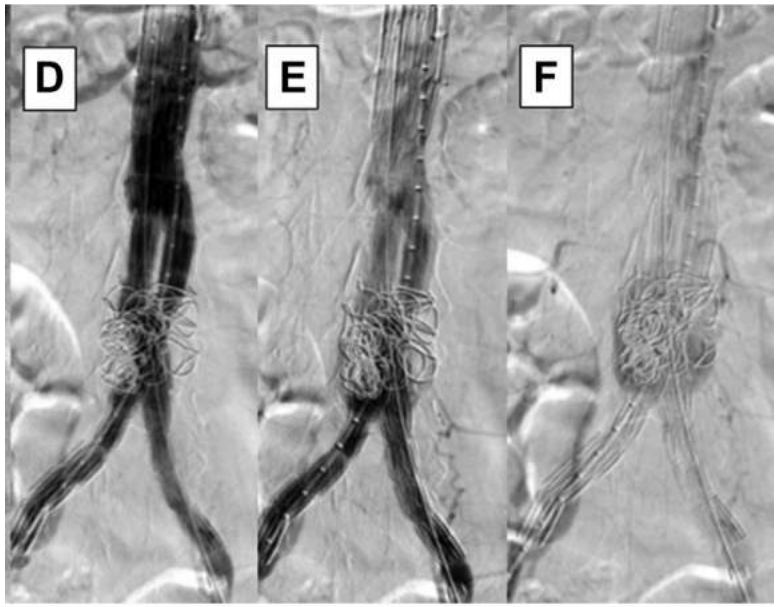
Uthofff, Katzen, et al. J Vasc Surg 2012

Patients need to be continuously monitored after EVAR to detect aneurysm growth and endoleaks, which increases the overall cost of AAA treatment

Prevention of Typ-2-Endoleaks

- several *preventive methods* have been introduced to reduce the occurrence of this complication:

Sac-Embolization

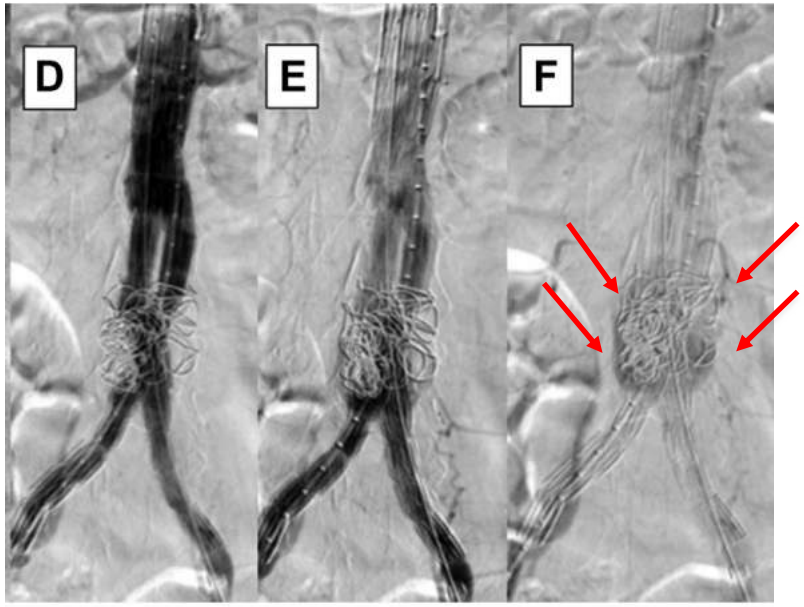


Dosluoglu HH, J Vasc Surg. 2019.

Pre-emptive embolization of Side branches of the aneurysm sac

Branzan D, et al. J Vasc Surg. 2021

Sac embolization - Disadvantages



No immediate T2EL exclusion

The artefacts produced by the coils on subsequent CT scans, potentially limiting the detection of endoleaks, especially smaller ones

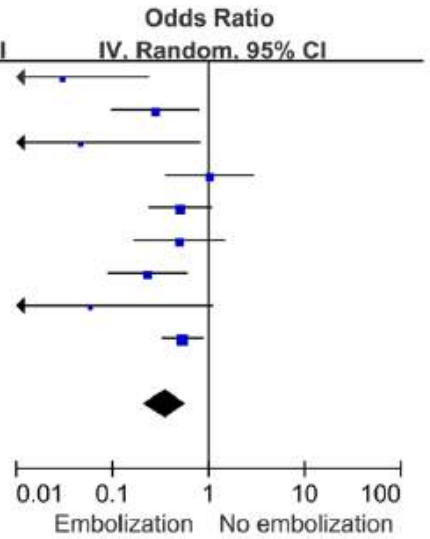
Dosluoglu HH, J Vasc Surg. 2019.

Preemptive embolization of Side branches of the aneurysm sac

A

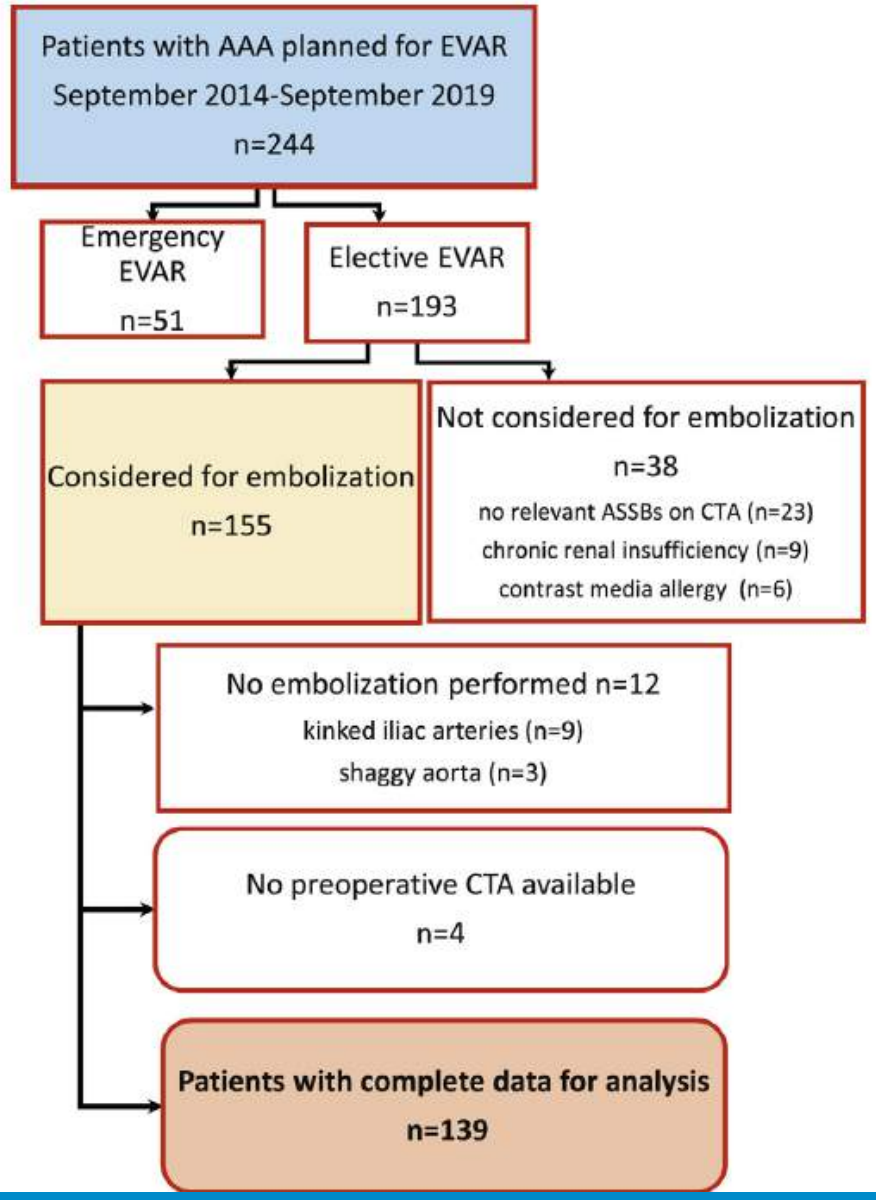
Study or Subgroup	Embolization Events	Total	No embolization Events	Total	Weight	Odds Ratio IV, Random, 95% CI
Aoki A 2017	1	24	33	56	5.2%	0.03 [0.00, 0.24]
Axelrod DJ 2004	5	30	30	72	12.6%	0.28 [0.10, 0.81]
Burbelko 2013	0	33	9	38	3.0%	0.05 [0.00, 0.83]
Chikazawa G 2013	5	21	35	150	12.5%	1.03 [0.35, 3.00]
Hiraoka A 2017	9	58	60	226	16.7%	0.51 [0.24, 1.10]
Müller-Wille R 2014	6	31	14	43	12.2%	0.50 [0.17, 1.49]
Nevala T 2010	10	40	23	39	14.0%	0.23 [0.09, 0.60]
Parry DJ 2002	0	14	8	22	2.9%	0.06 [0.00, 1.12]
Ward TJ 2013	37	108	78	158	21.0%	0.53 [0.32, 0.89]
Total (95% CI)		**359**		**804**	**100.0%**	**0.35 [0.21, 0.60]**
Total events	73		290			

Heterogeneity: $Tau^2 = 0.28$; $Chi^2 = 16.03$, df = 8 (P = 0.04); $I^2 = 50\%$
Test for overall effect: Z = 3.88 (P = 0.0001)



- In most of these studies, vessels were not routinely occluded as only larger diameter vessels were embolized
- It is unclear whether, to prevent T2EL, the interruption of direct blood flow to the aneurysm sac by occluding all ASSB should be performed according to the same principle as open aneurysm repair

Preemptive embolization of Side branches of the aneurysm sac



- Patients to be excluded from pre-EVAR coil-embolization:
  - Urgent repair required
  - Renal insufficiency
  - LA to be covered with the stent graft (LA2)

Branzan D, et al. J Vasc Surg. 2021

Preemptive embolization of Side branches of the aneurysm sac

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Table I. Baseline demographics and aneurysm characteristics (N = 139)

Variable	No. (%) or mean ± SD
Total	139 (100)
Male sex	122 (87.8)
Age, years	74.8 ± 7.9
Hypertension	132 (95)
Diabetes mellitus	46 (33.1)
Coronary heart disease	56 (40.3)
Smoking	94 (67.6)
COPD	26 (18.7)
Peripheral artery disease	41 (29.5)
Hyperlipoproteinemia	88 (63.3)
Renal insufficiency	
GFR <60 mL/min/1.73 m^2	33 (23.7)
GFR, mL/min/1.73 m^2	71.2 ± 17.7
Body mass index, kg/m^2	27.9 ± 4.1
Aneurysm diameter, mm	56.6 ± 8.6
Type of infrarenal pathology	
AAA	111 (79.9)
PAU	23 (16.5)
Dissection	2 (1.4)
CIA aneurysm	3 (2.2)
Previous abdominal surgery	27 (19.4)

Patent ASSBs identified by CTA	
Total	626
LA	481
0	5 (3.6)
1	8 (5.8)
2	22 (15.8)
3	24 (17.3)
4	55 (39.6)
5	13 (9.4)
6	12 (8.6)
IMA	108 (77.7)
Other	37 (36.6)
Midsacral artery	23 (16.5)
Accessory renal artery	14 (10.1)

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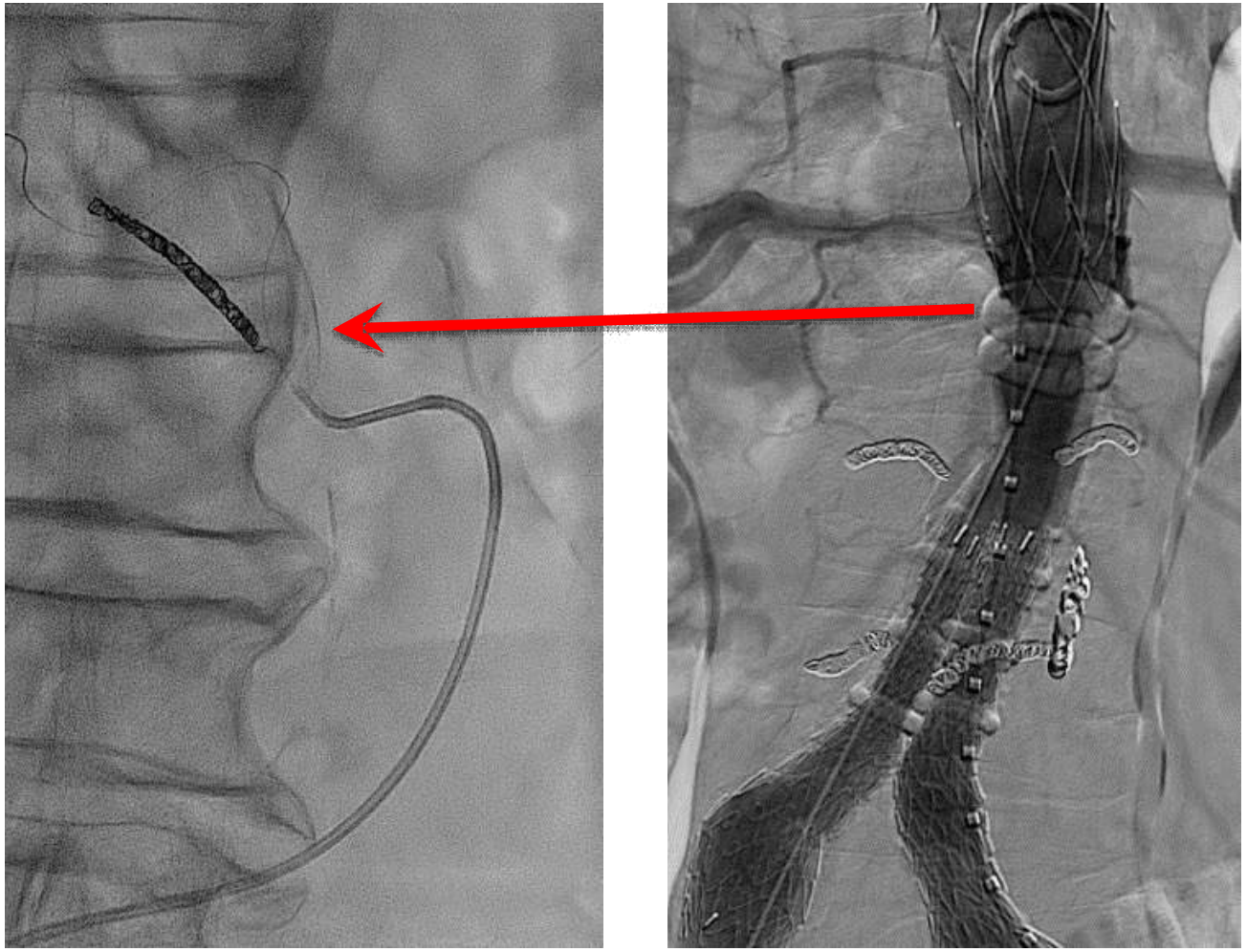

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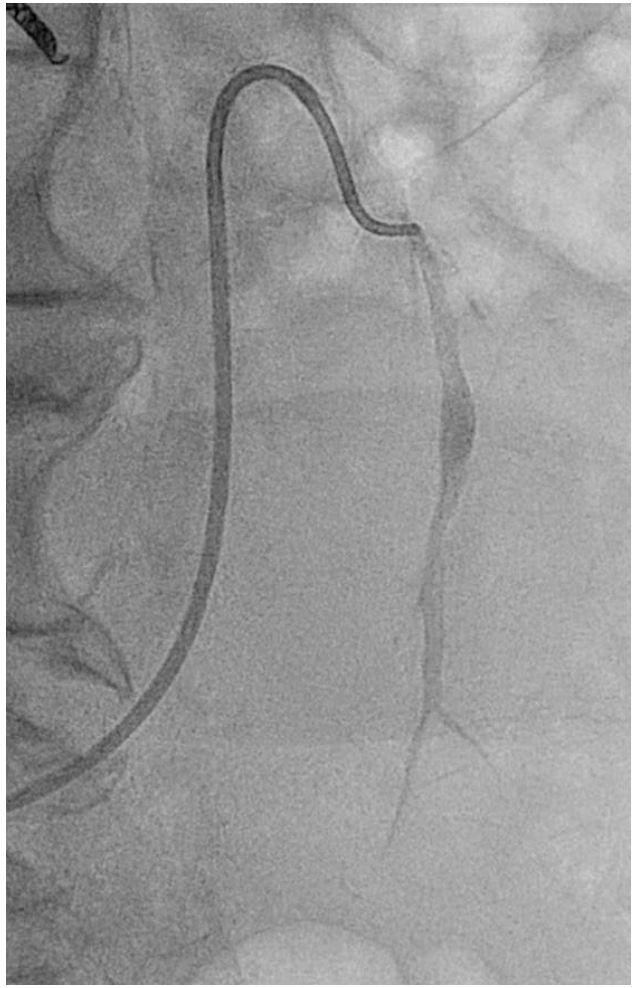
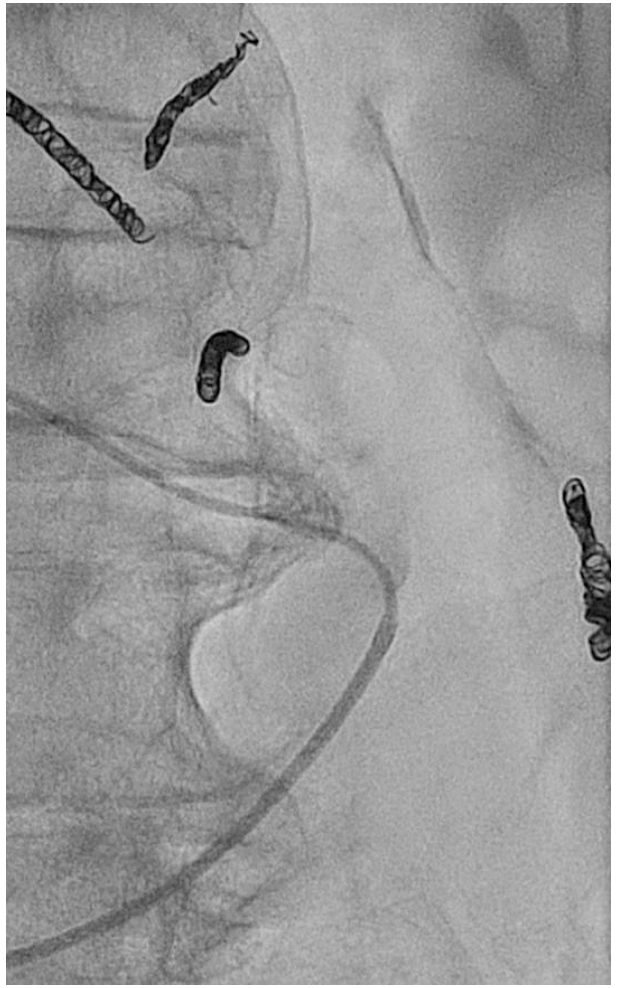


IMA-embolization



L3: 6Fr.-IMA + SIM I 5Fr.

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Preemptive embolization of Side branches of the aneurysm sac

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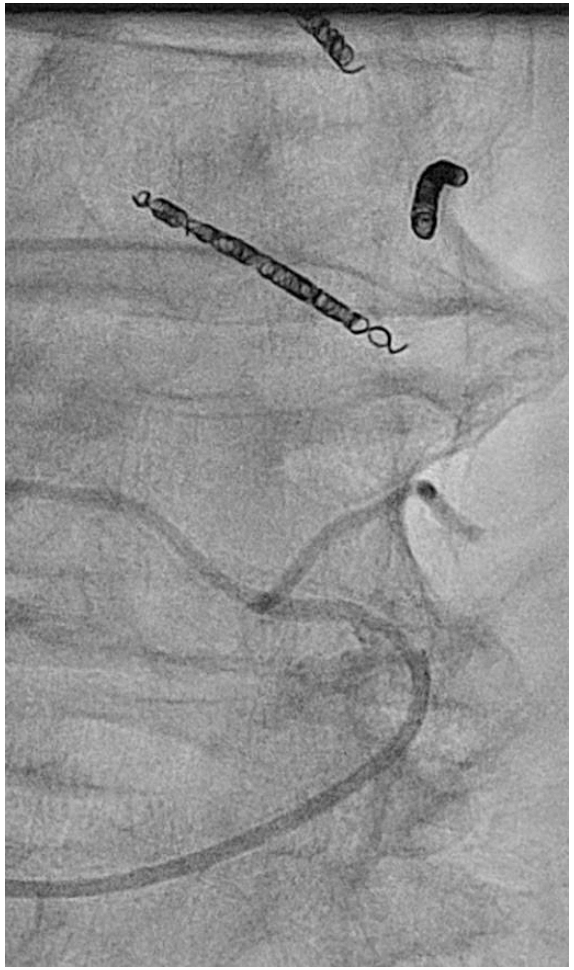
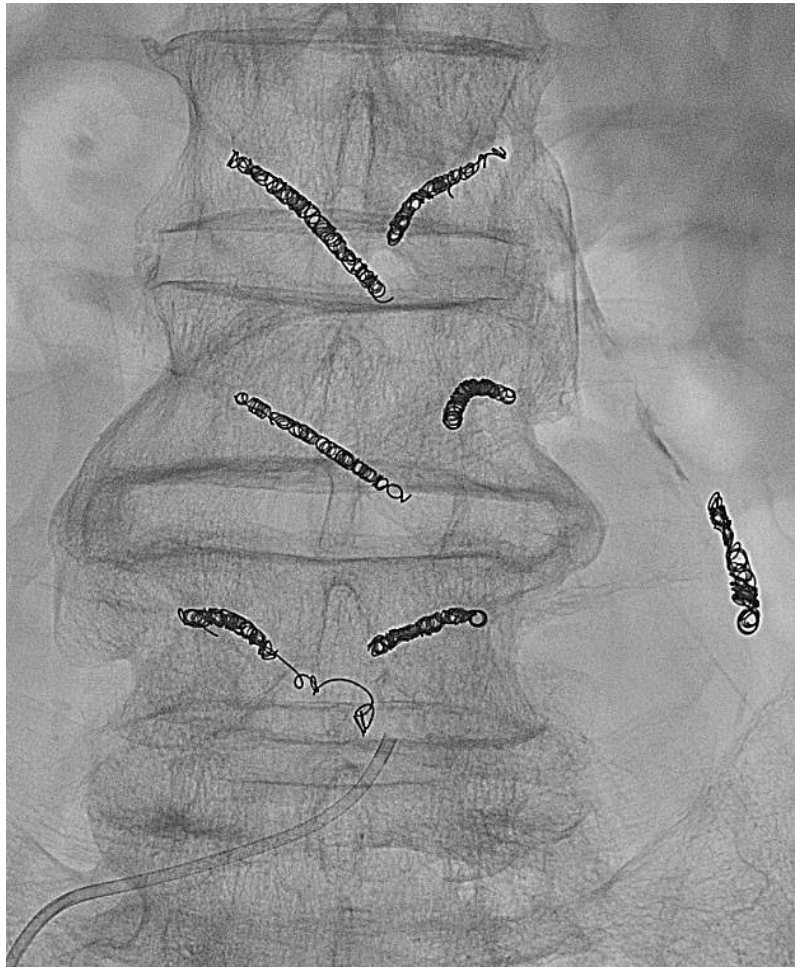
Preemptive embolization of Side branches of the aneurysm sac



L4



Final result

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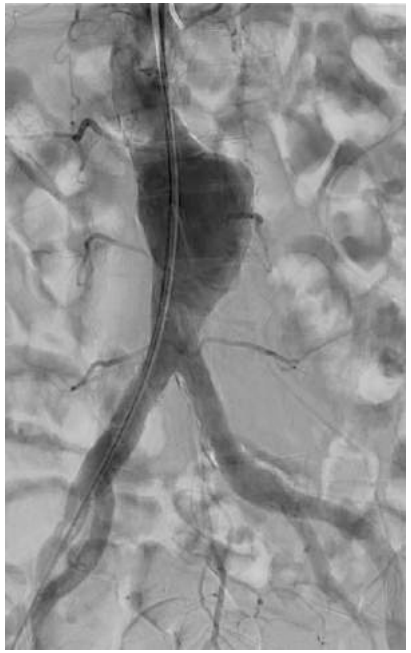
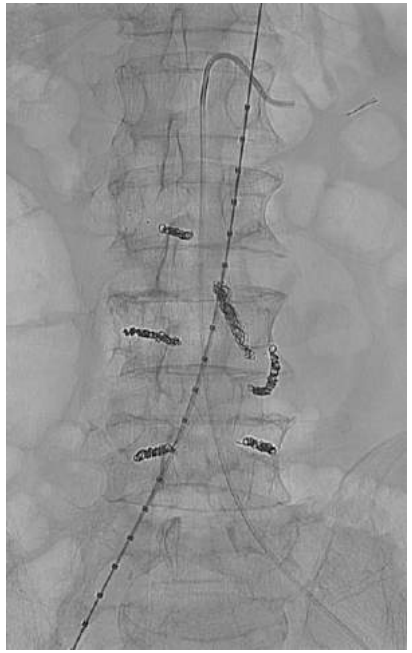
	Patent	Coiled		Open before EVAR	
		n	%	n	%
LA	481	370	77	111	23
IMA	108	86	80	22	20
Median	5 (1-8)	3 (1-8)		1 (0-5)	





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Preemptive embolization of Side branches of the aneurysm sac

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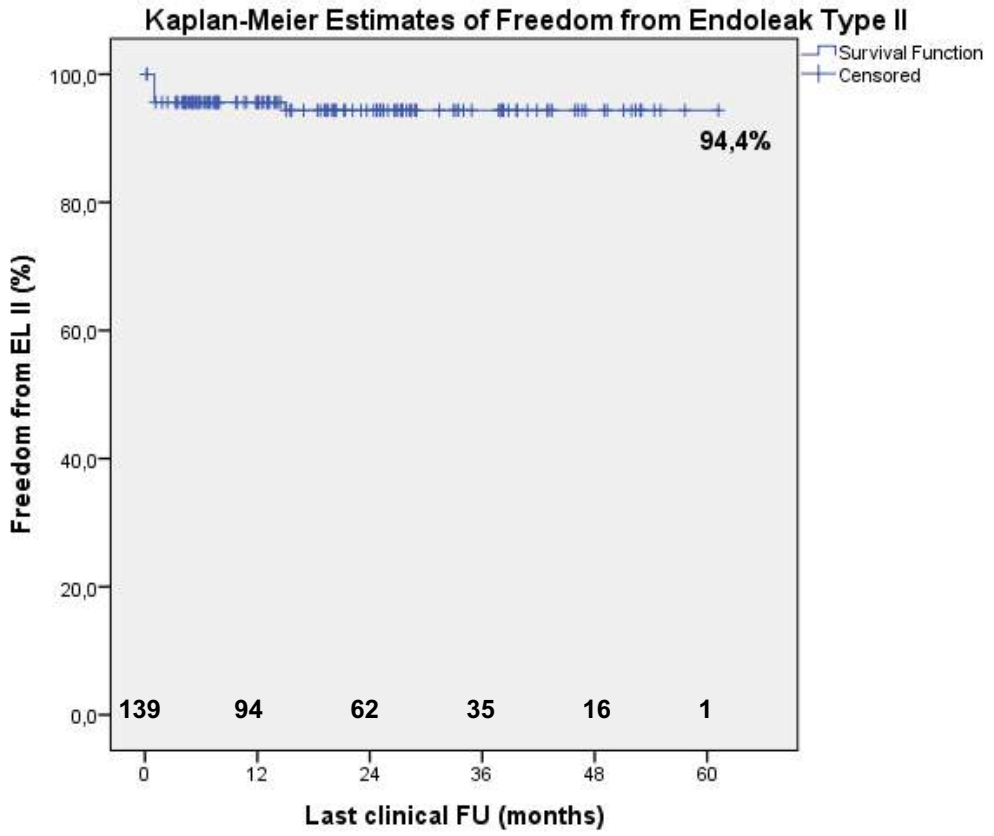
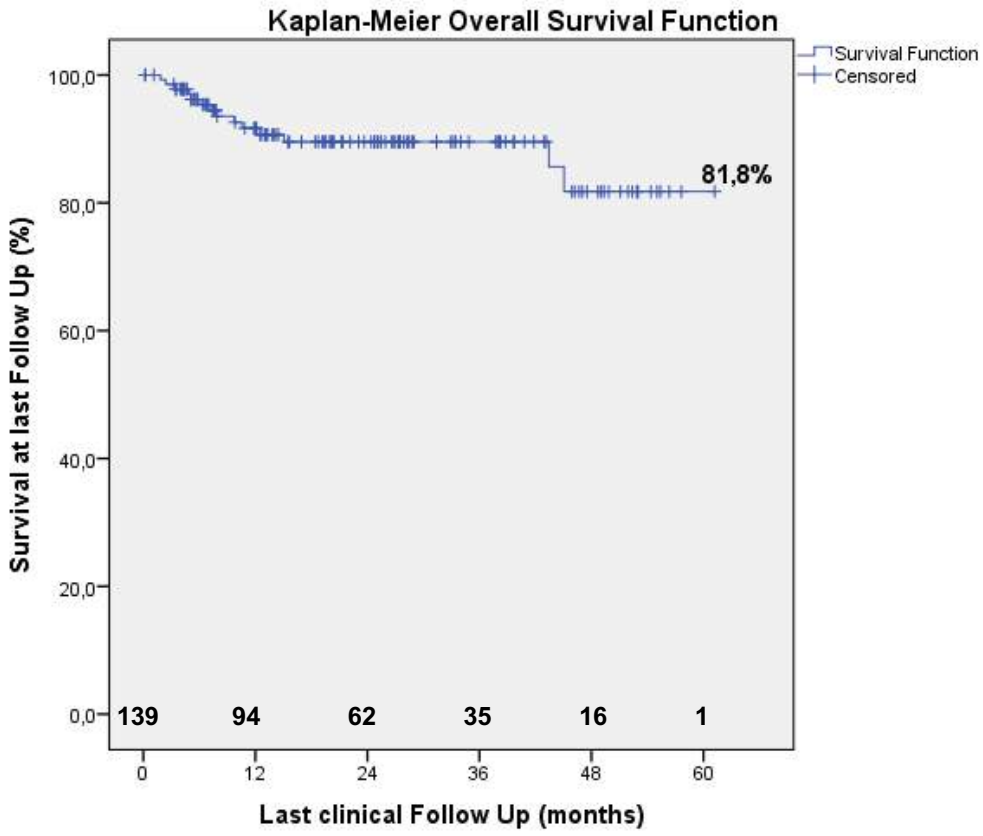
mean follow-up: 1.9 ± 1.3 years





7 (5%) patients presented with isolated T2EL

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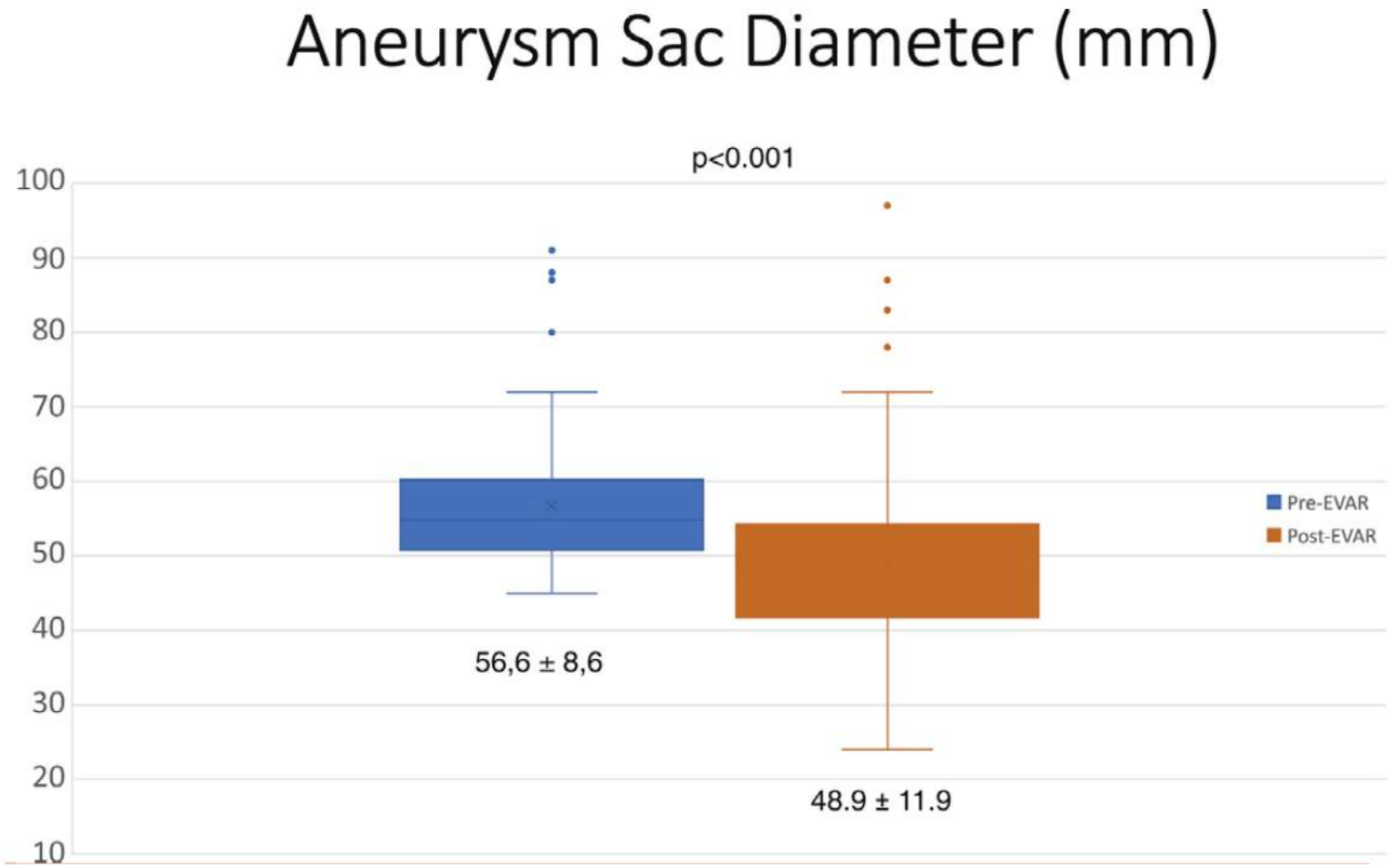
Preemptive embolization of Side branches of the aneurysm sac



mean follow-up 1.9 ± 1.3 years

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AAA shrinkage compared to literature

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	ENGAGE Registry	Leipziger Cohort
Follow-up (Y)	2	1.9 ± 1.3
N	939	139
AAA Decreased	38.1% Dijkstra et al. J Vasc Surg 2019	86.7% Branzan D, et al. J Vasc Surg. 2021
AAA Stable	48.7%	6.7%
AAA Increased	2.6%	6.7%

Conclusions

- Preventive embolization of ASSBs in patients with AAA is safe and effective in preventing T2EL after EVAR.
- Shrinkage of the aneurysm sac was observed in a high proportion of patients.
- Definitive evidence for routine embolization of ASSBs to prevent T2EL after EVAR and promote shrinkage of the AAA sac requires a randomized controlled trial.

Thank You!

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