2024 MID-ATLANTIC CONFERENCE

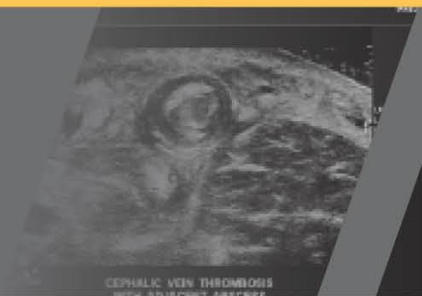
12th ANNUAL CURRENT CONCEPTS IN

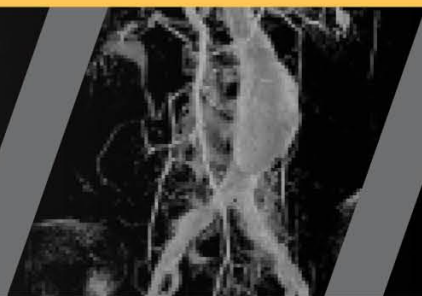
VASCULAR THERAPIES

2024

Hilton Virginia Beach Oceanfront
Virginia Beach, Virginia

APRIL 18-20





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Great debates:

One branch, two branch, fenestrations

Animesh Rathore, MBBS

Assistant Professor of Surgery

Eastern Virginia Medical School

Sentara Vascular Specialists

What's up with the title?

- "One branch, two branch, fenestrations" vs "Branches Smanches. Open Aortic Surgery Remains Durable and Right for Most Patients"

- My interpretation:
  - does open repair trump all complex endovascular aortic aneurysm repair?

Open aortic surgery rules, endovascular repair

BAD !!!

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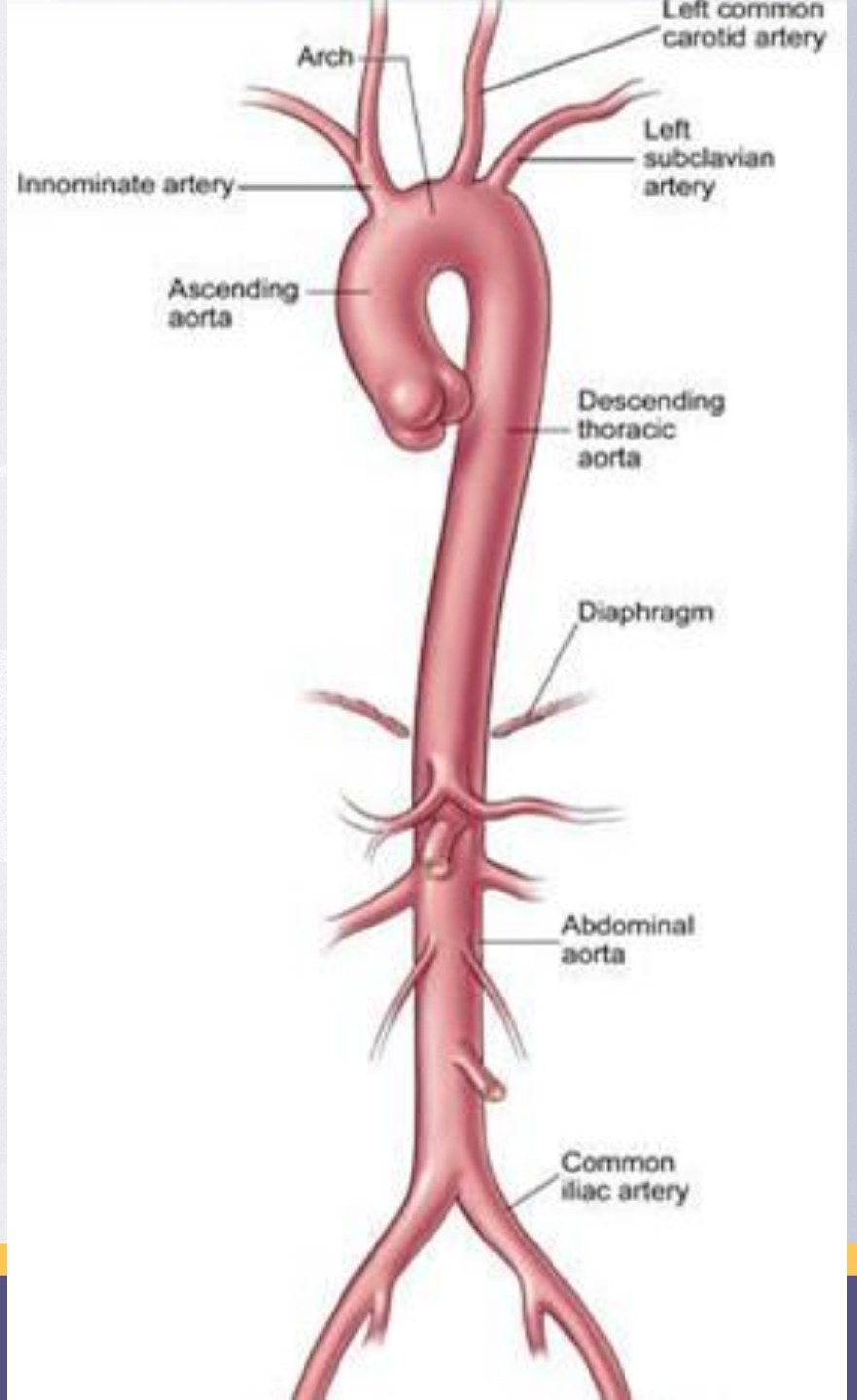
Complex aortas

Involvement of multiple branches (visceral or cerebrovascular) and/or involvement of thoracic + abdominal segment

Involvement of aorta above the renal arteries

Ascending, arch, thoracic, thoracoabdominal, visceral aneurysms

Involvement of internal iliac arteries



Complicated aortas

Ruptured aorta

End-organ malperfusion (cerebrovascular, limb, spinal cord, visceral, renal)

<u>Spectrum of complex pathologies:</u> aortic dissection, intramural hematoma, penetrating aortic ulcer, mural thrombus, mycotic aortas, inflammatory aortic pathology, connective tissue disorders

SENTARA®

So what are the options

- Open surgical repair
- Total endovascular repair
- Hybrid repair

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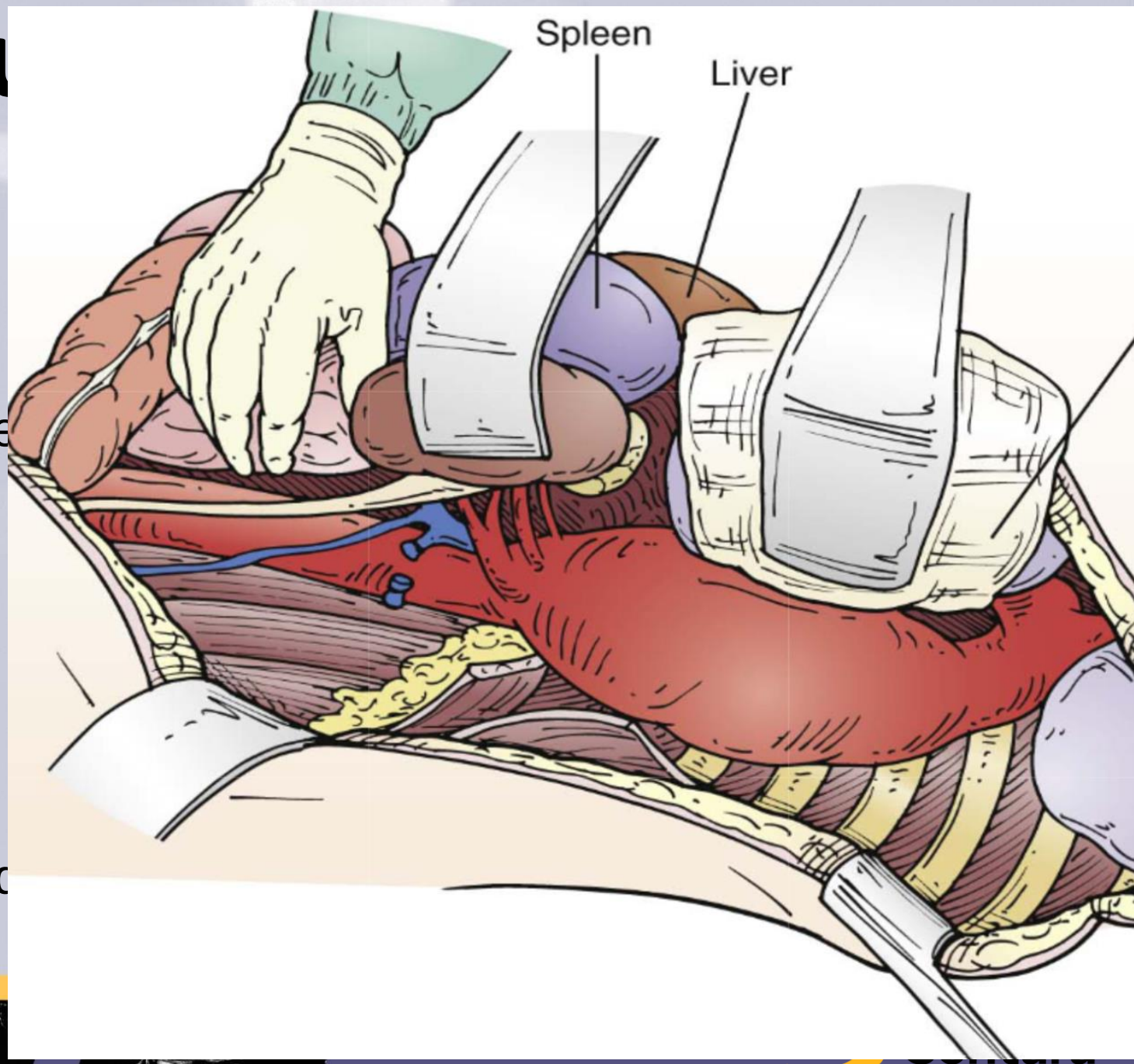
Open su

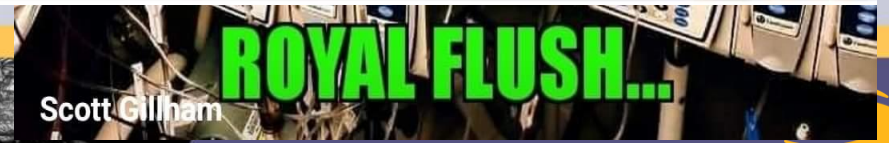
- General anesthesia
- Single lung ventilation
- Cardiopulmonary bypass (in sele
  patients)
- Hypothermic circulatory arrest
- Spinal drainage
- Visceral and renal ischemia
- Lower extremity perfusion consid



Open surgical repair

- Operati
- ~ 2 wee
- 2 - 4 day
- Up to 27
- Need fo
- Mortalit
- Paraple
- High vol
- Exhaust
  patient

Thoracoabdominal incision



Endovascular aortic repair

- General or local anesthesia
- Percutaneous or limited groin incision (+/- brachial puncture)
- Spinal drainage
- Operative times 45 min to 4 hours
- Hospital stay 1-5 days
- Side branch incorporation concepts for arch branches, visceral, renal and internal iliac branches

Endovascular options

	Patient specific design	**Off the shelf**
Currently approved	Zenith Fenestrated	Heli-FX Endoanchors Gore Iliac branch device Gore Thoracic branch endoprosthesis TAMBE (Gore)
Under trial	Cook Fenestrated/Branched Endografts	Cook P branch Cook T branch Thoracic Branch Devices (Cook, Bolton, Medtronic)
Physician modified	In situ fenestration Back-table modification (PMEG)	Parallel branch endografts (Chimney, Snorkel, Periscopes)

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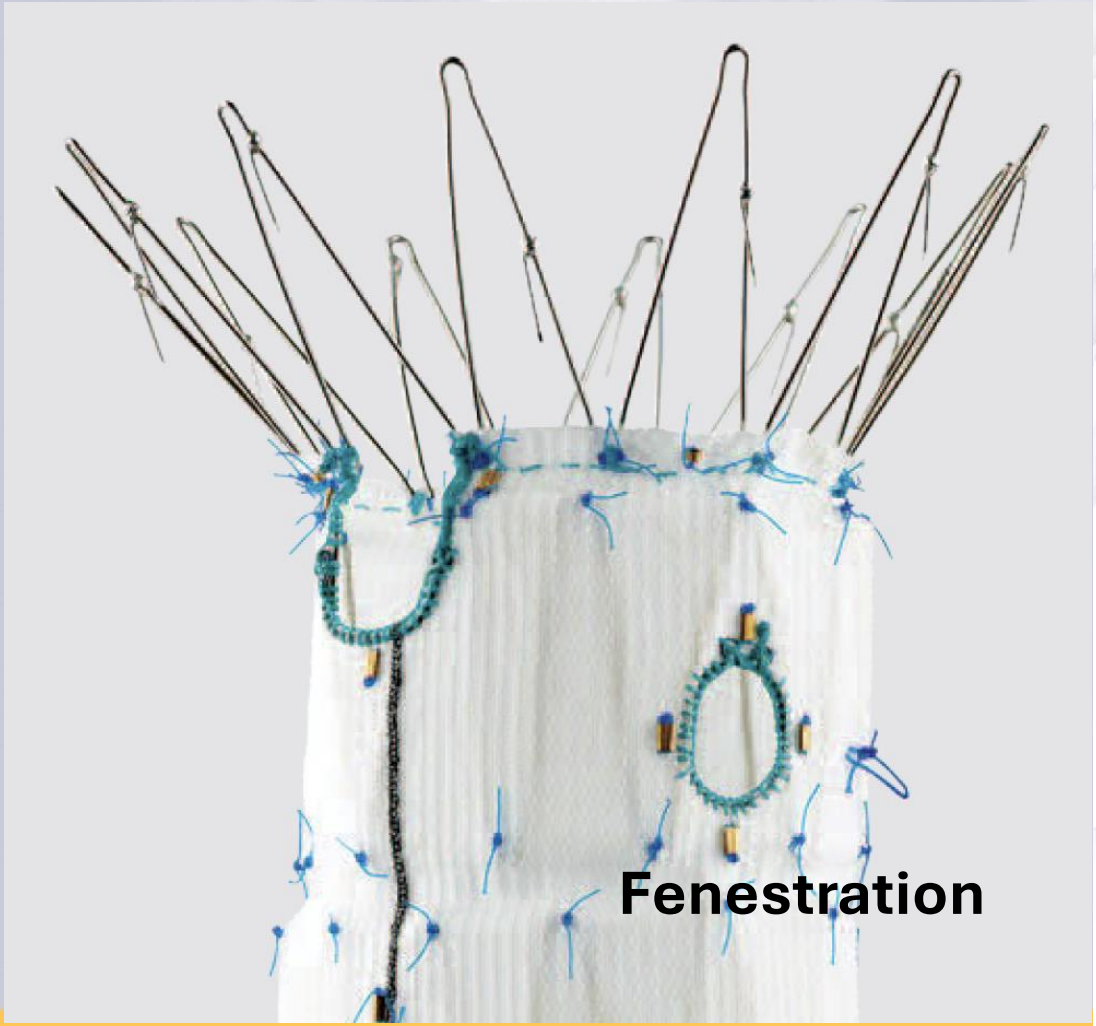
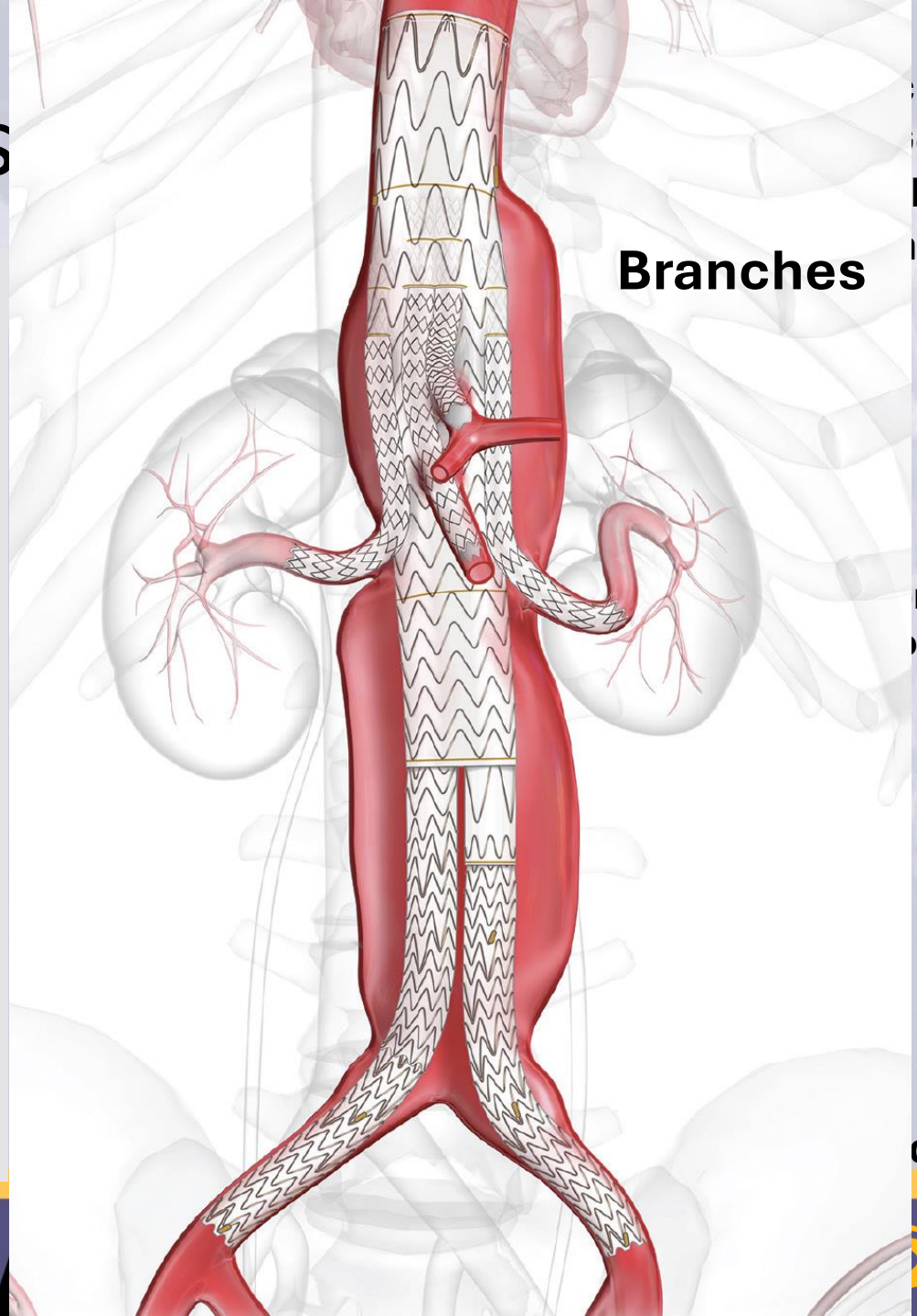
Endovascular options



Fenestration



Branches

branch devices
ore, Medtronic,
PMEGs, ASG,
n

TEVAR

Patient specific
ranched
tec, CHIMPS,

doprosthesis

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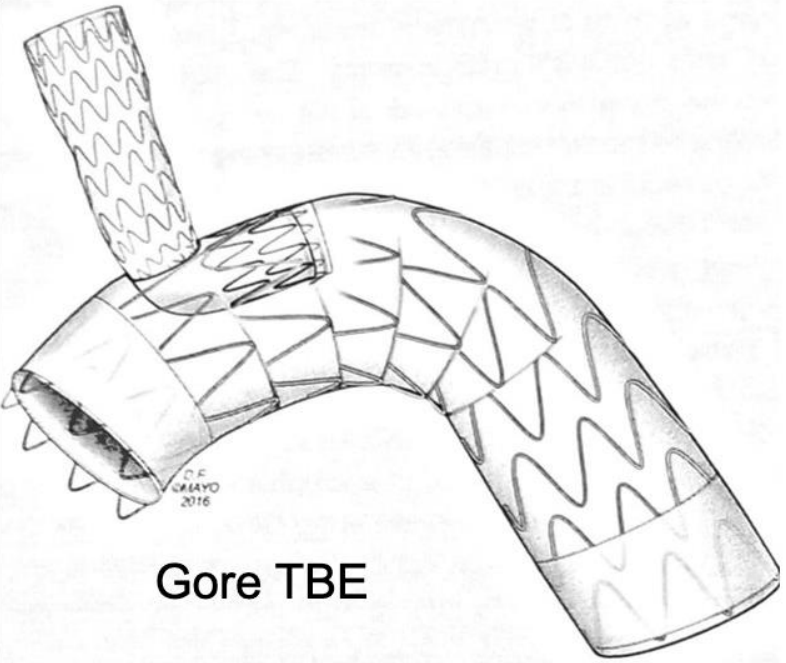
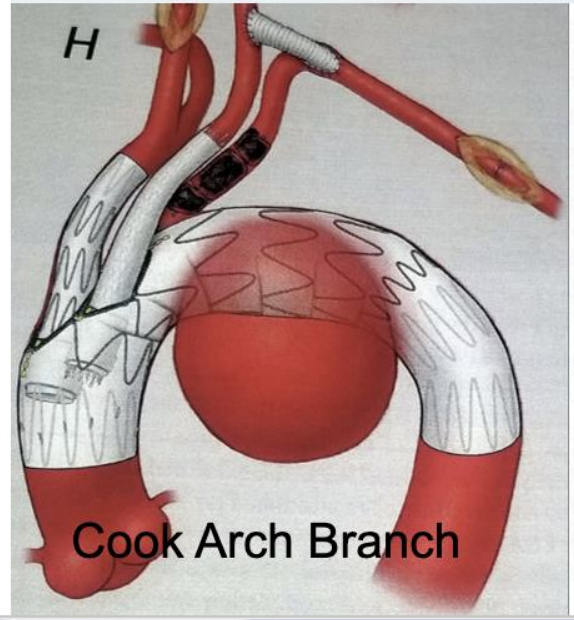
Endovascular options

Gore thoracic branch endoprosthesis is FDA approved for Zone 2, others are investigational





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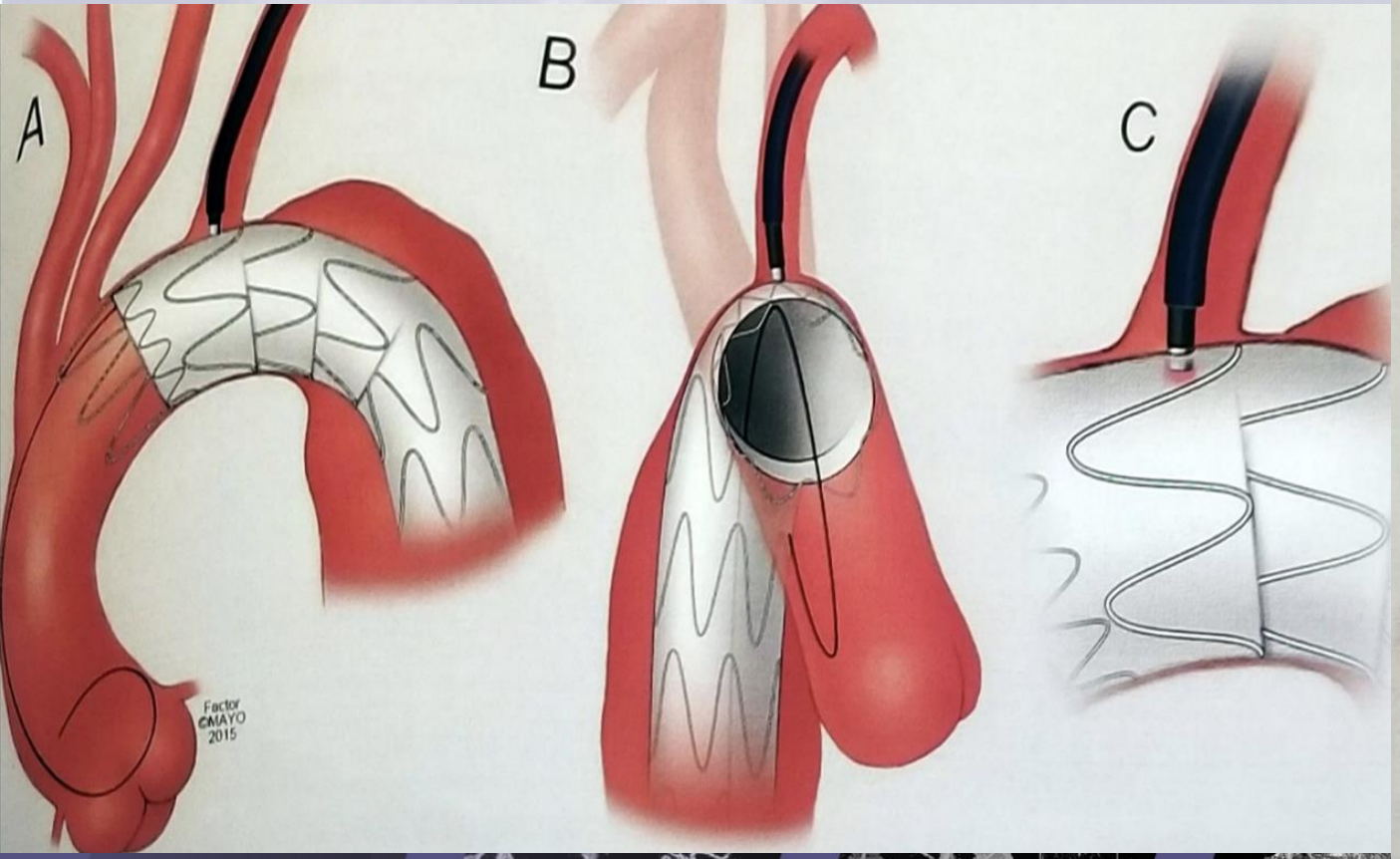
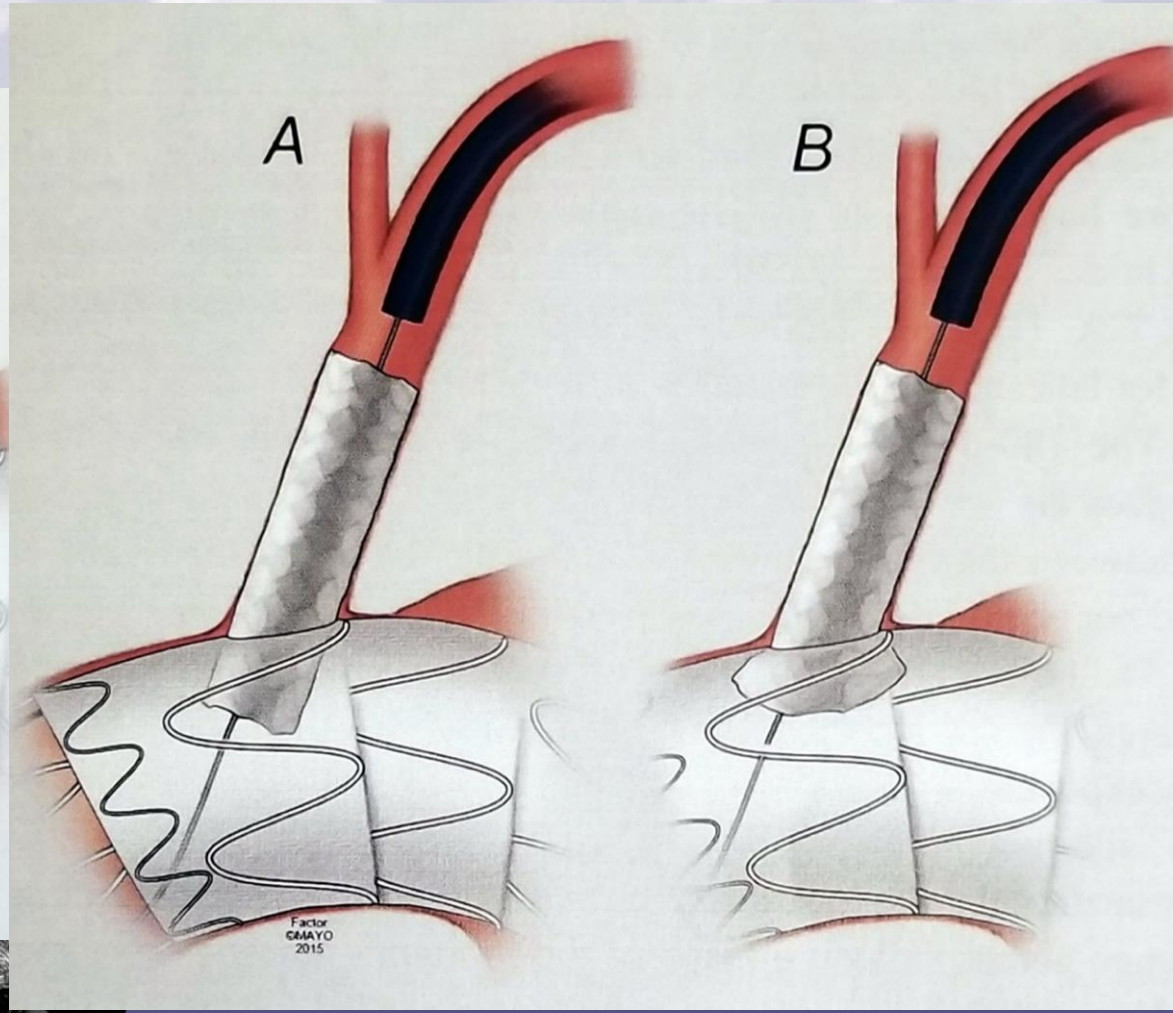
Endovascular options

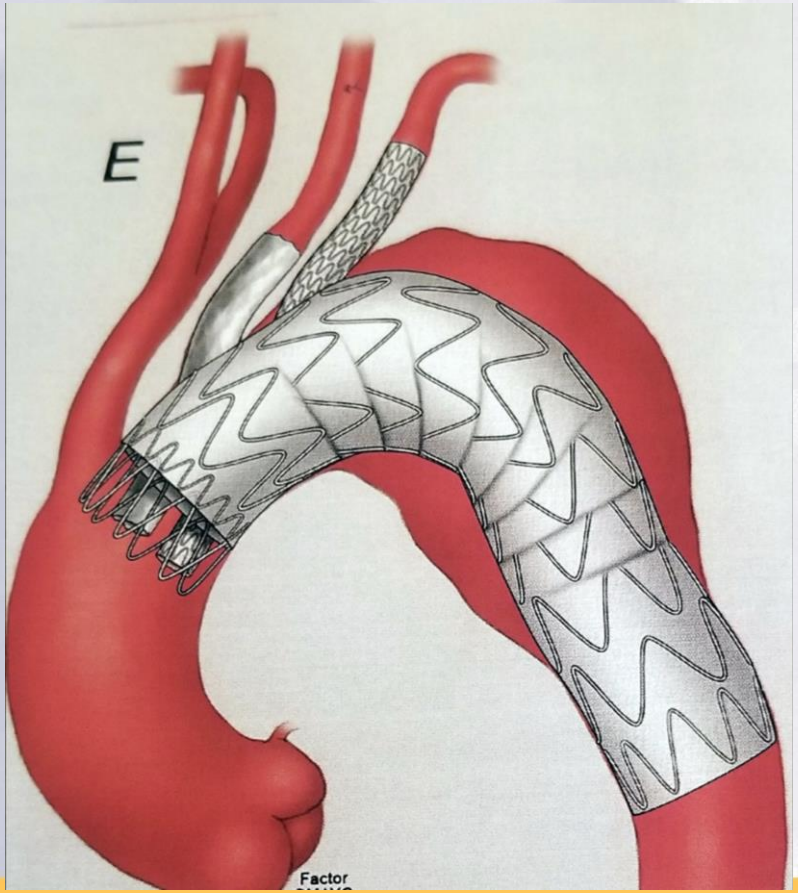
Laser in situ fenestration

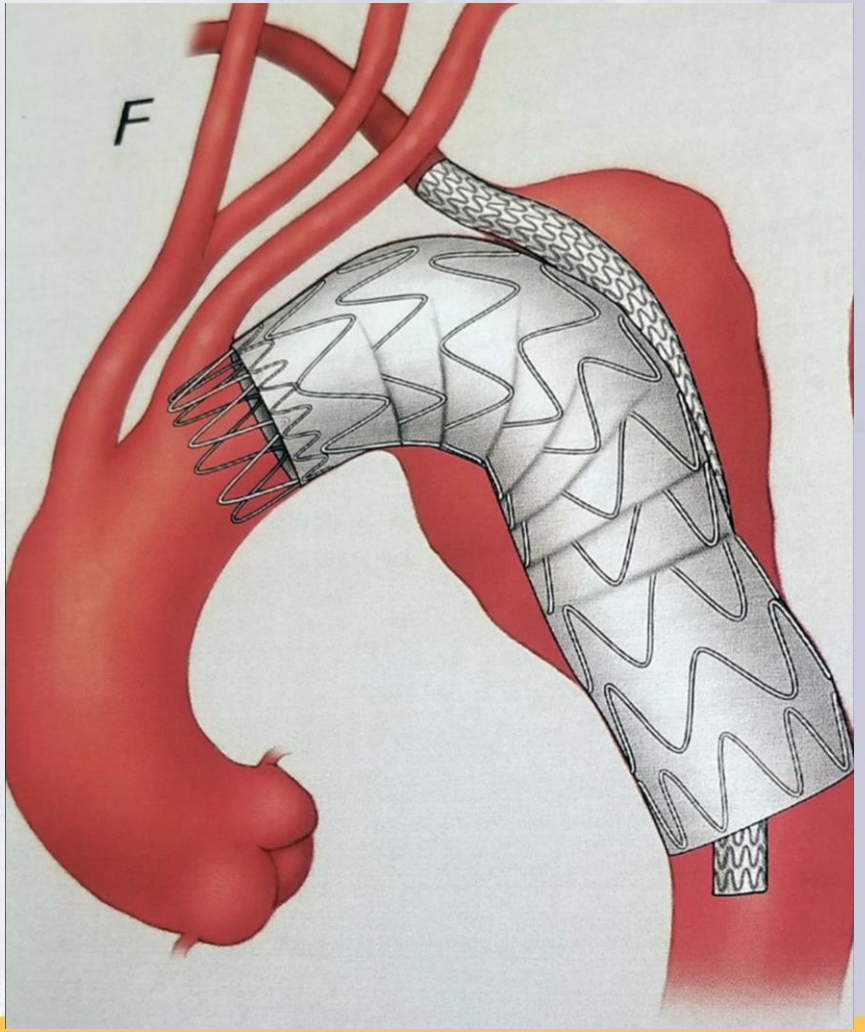




Parallel stent grafting

Chimney versus Periscope versus sandwich graft

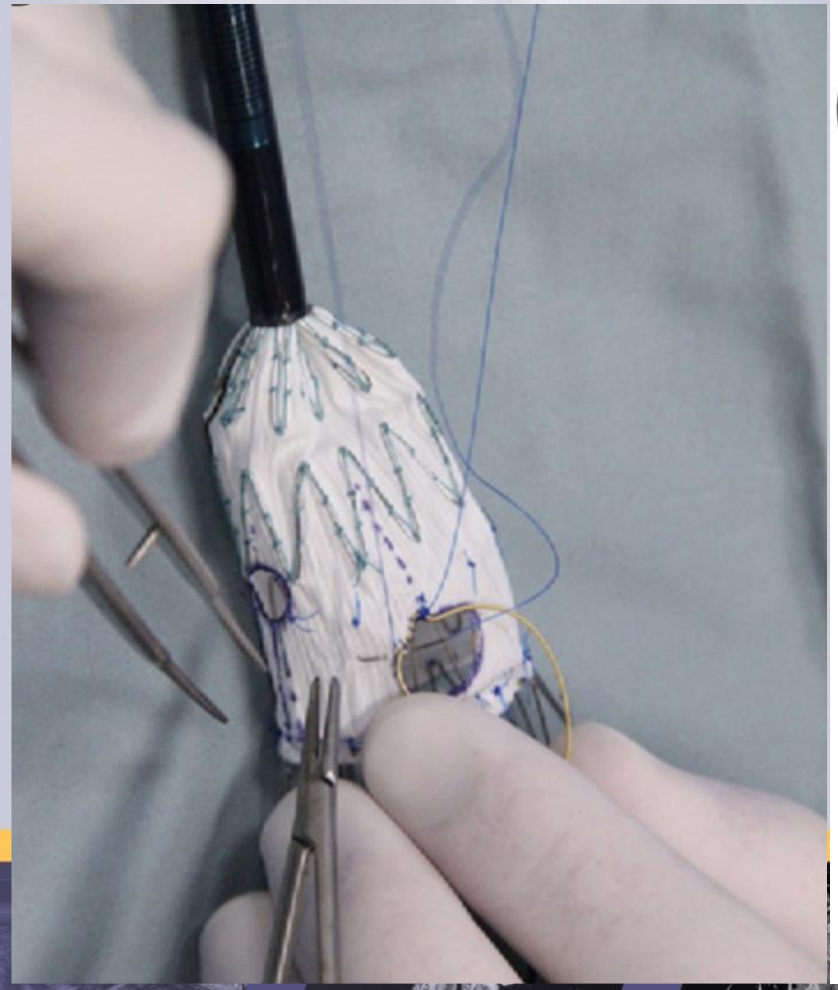


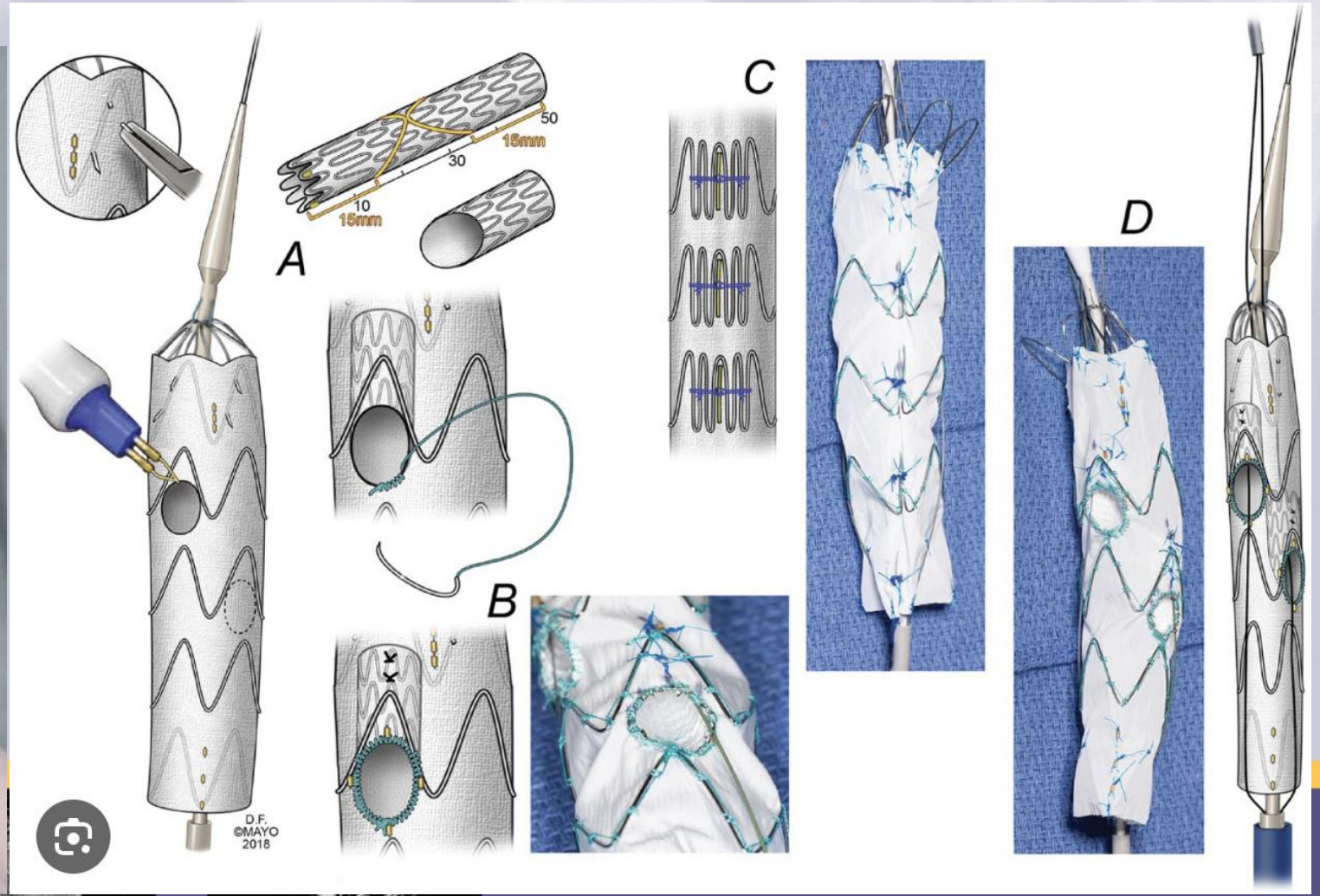


Physician modified endografting (PMEG) for ascending and arch reconstruction

Currently off-label

Can allow for various anatomy when a dedicated device is not available for implant





Take aways so far

- Endovascular aortic repair represents a less invasive approach to fix complex aortic pathology.
- Endovascular surgery leads to less physiologic stress and end organ ischemia compared to open surgical repair
- Recent years have seen several technical advances with incorporation of fenestration and branched base repair allowing for repair of the entire extent of aorta from ascending aorta to the iliacs
- A careful patient based individualized approach allows for treatment for nearly all anatomy. Both approaches have their pitfalls

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Lets look further…

- Open repair is more durable??
- More durable doesn't necessar
- But, lets open that door

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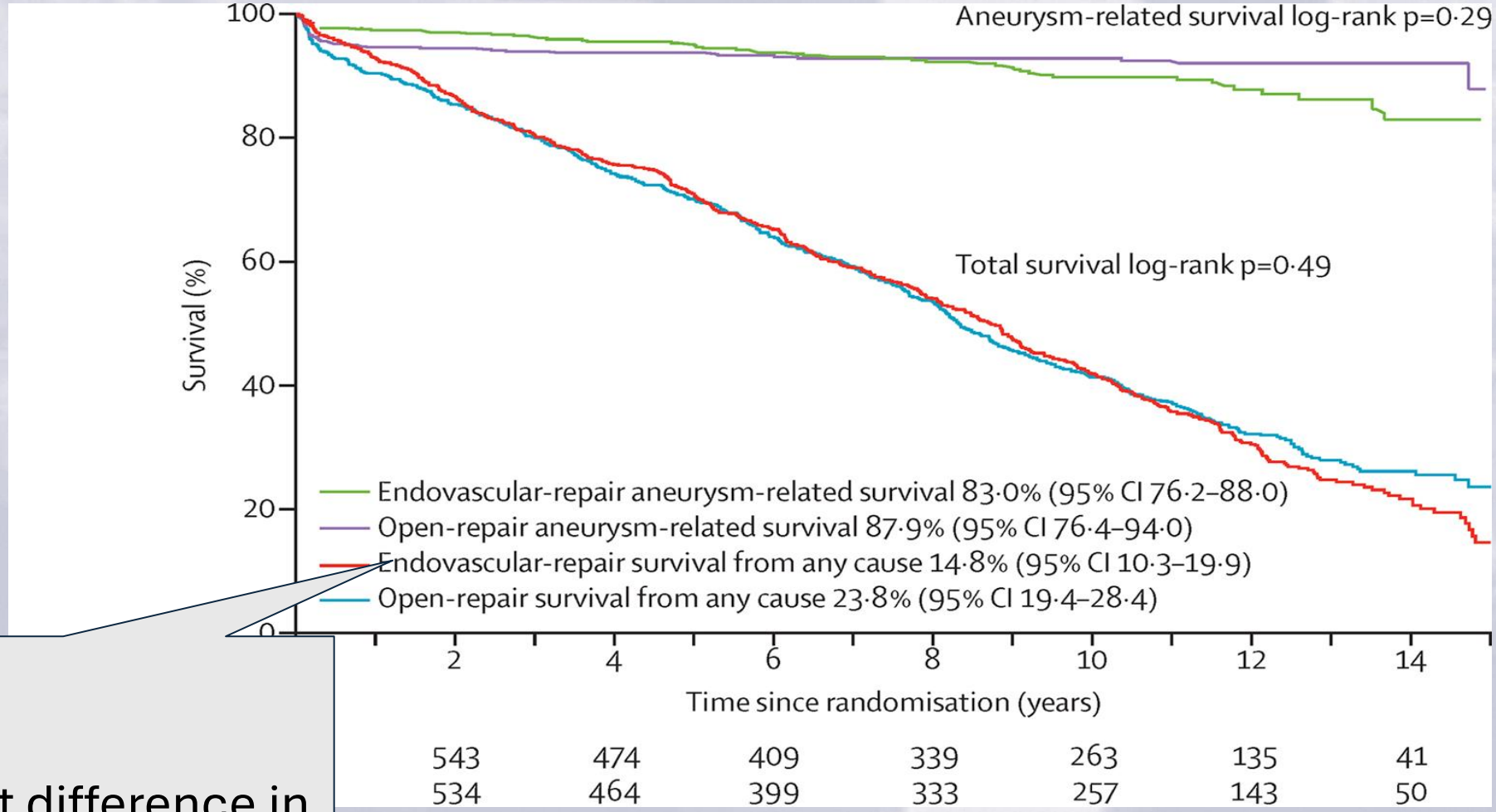
Long term clinical outcomes



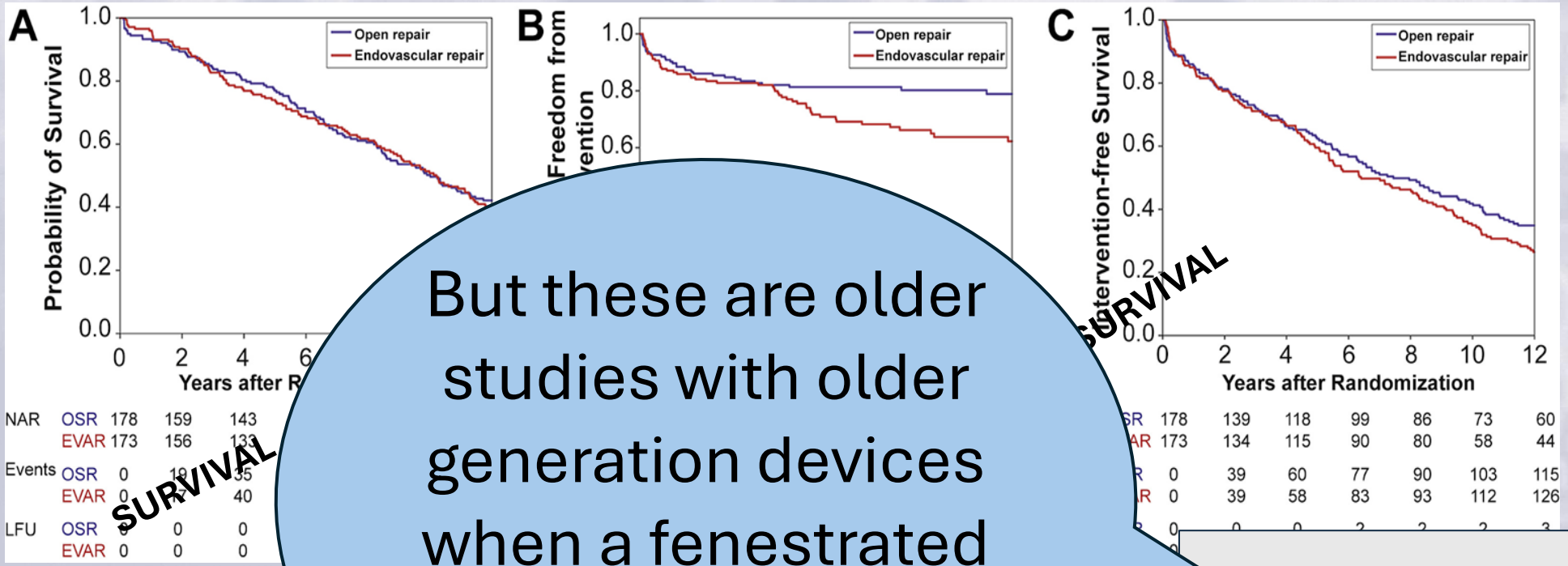
ir of abdominal aortic aneurysm in 15-years' follow-up of the UK endovascular aneurysm repair trial 1
ntrolled trial Patel, Rajesh et al.The Lancet , Volume 388 , Issue 10058 , 2366 - 2374

EVAR 1 Trial

No significant difference in mortality at 15 years

EVAR better in short term

Long term clinical outcomes

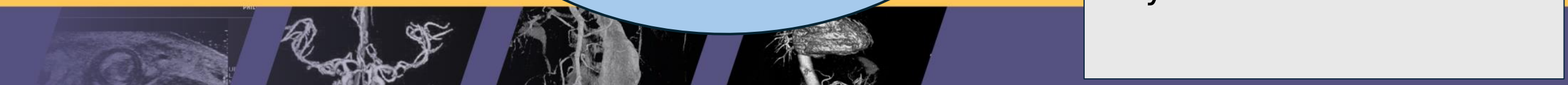


But these are older studies with older generation devices when a fenestrated repair was not an option.

DREAM trial

No significant difference at 12 years

Long-term survival and secondary p… …c aneurysms (D…
Surgery 2017 66, 1379-1389DOI: (10.10…



Open repair versus fenestrated endovascular aneurysm repair of juxtarenal aneurysms

Rohini Rao, BSc, Tristan R. A. Lane, MRCS, Ian J. Franklin, FRCS(Gen Surg), and
Alun H. Davies, DM, FRCS, *London, United Kingdom*

Background: **Open repair is the gold standard management for juxtarenal aneurysms. Fenestrated endovascular aneurysm repair (FEVAR) is indicated for high-risk patients. The long-term outcomes of FEVAR are largely unknown, and there is no Level I comparative evidence. This systematic review and meta-analysis of case series compares elective juxtarenal aneurysm surgery by open repair and FEVAR.**

Methods: **A systematic literature search was conducted for all published studies on elective repair of juxtarenal aneurysms by FEVAR and open repair. The MEDLINE, EMBASE, and Cochrane databases were searched from 1947 to April 2013. The exclusion criteria were case series of <10 patients or ruptured aneurysms. The primary outcomes were perioperative mortality and postoperative renal insufficiency. The secondary outcomes were secondary reinterventions and long-term survival.**

Results: **We identified 35 case series with data on 2326 patients. Perioperative mortality was 4.1% in open repair and FEVAR case series (odds ratio for open repair with FEVAR, 1.059; 95% confidence interval, 0.642-1.747; $P = .822$). Postoperative renal insufficiency was not significantly different (odds ratio for open repair with FEVAR, 1.136; 95% confidence interval, 0.754-1.713; $P = .542$). FEVAR patients had higher rates of secondary reintervention, renal impairment during follow-up, and a lower long-term survival compared with open repair patients.**

Conclusions: **FEVAR and open repair have similar short-term outcomes but have diverging long-term outcomes that may be secondary to the selection bias of FEVAR being offered to high-risk patients. FEVAR is a favorable option in high-risk patients, and open repair remains viable as the gold standard. (J Vasc Surg 2015;61:242-55.)**

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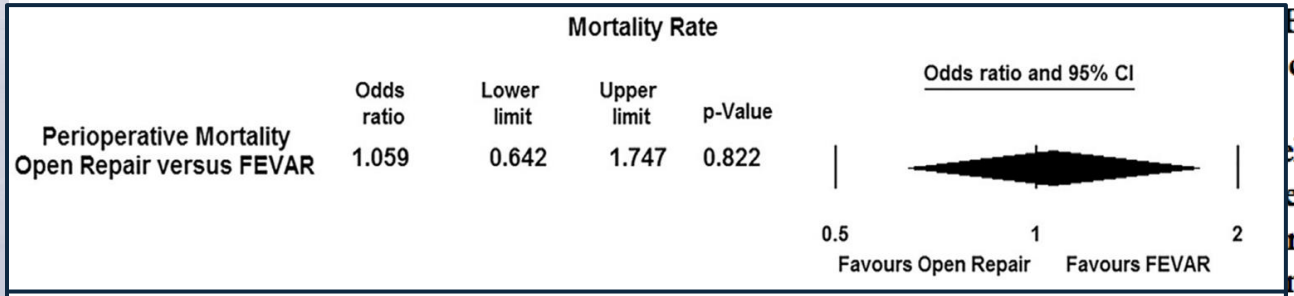

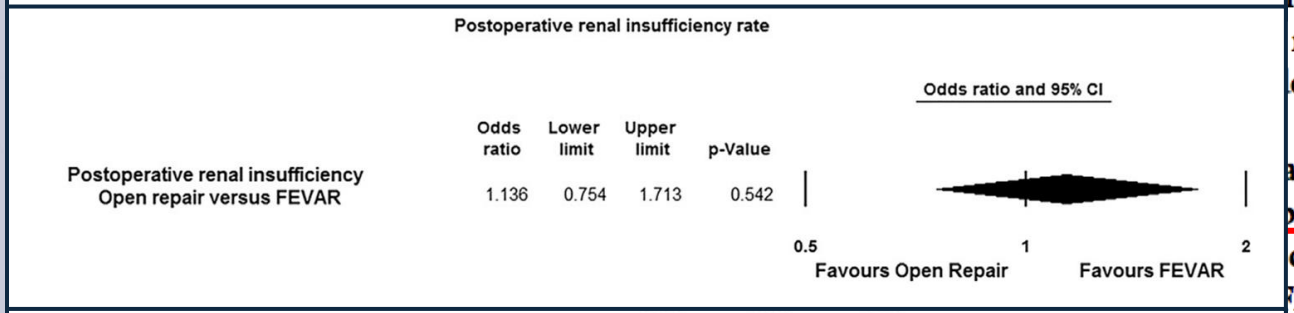

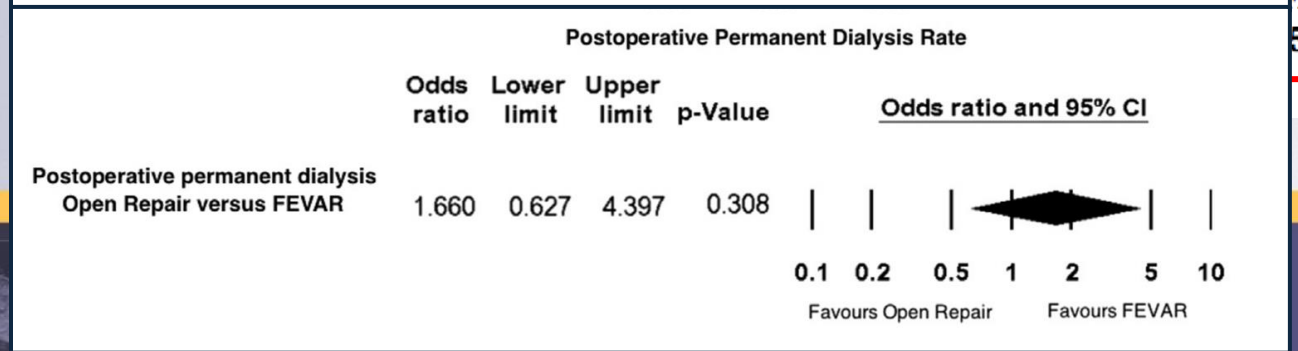

Metanalysis of 35 studies comparing FEVAR (750) and Open repair (1575)

- published upto 2013
- similar short term mortality, AKI, dialysis (favors FEVAR)

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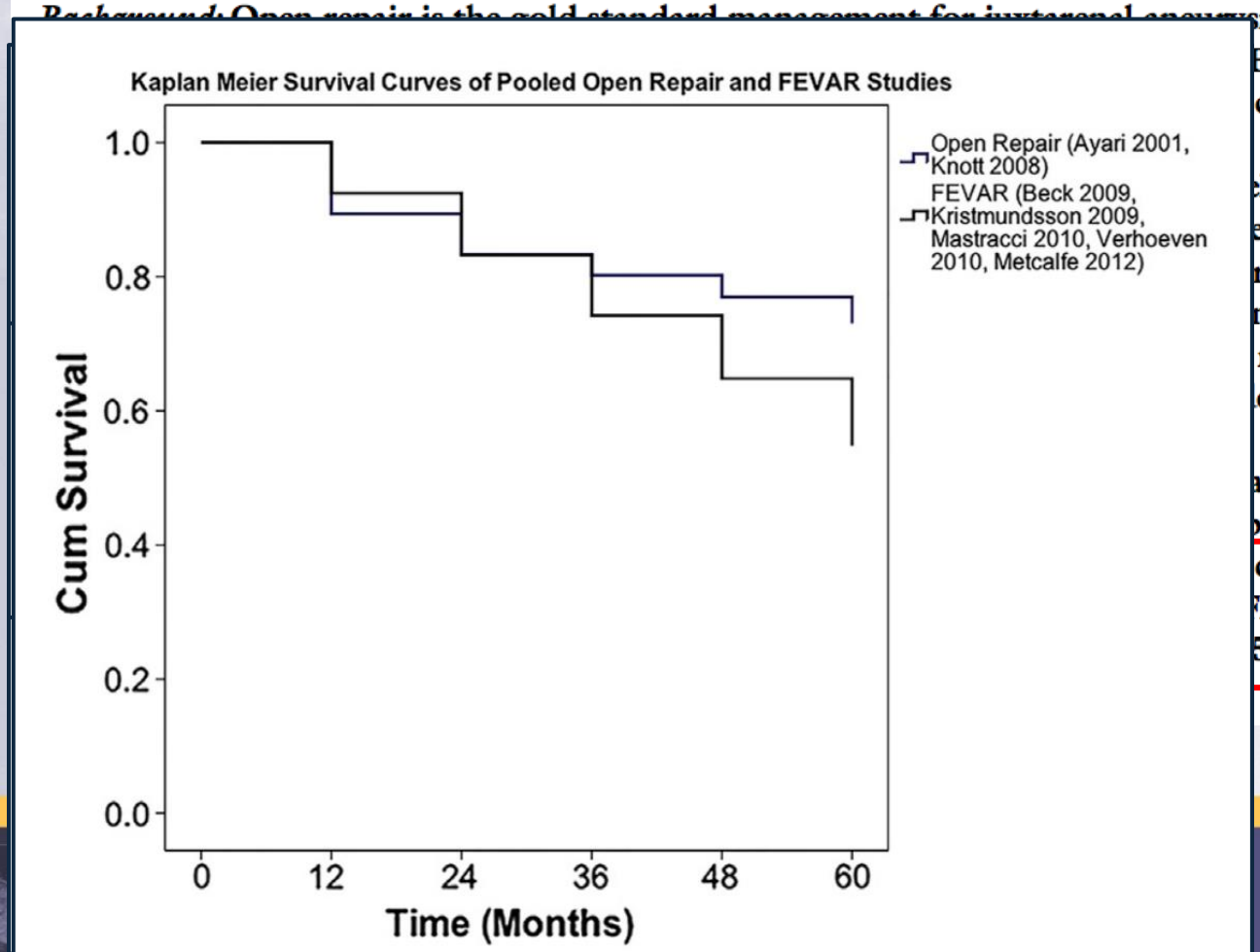
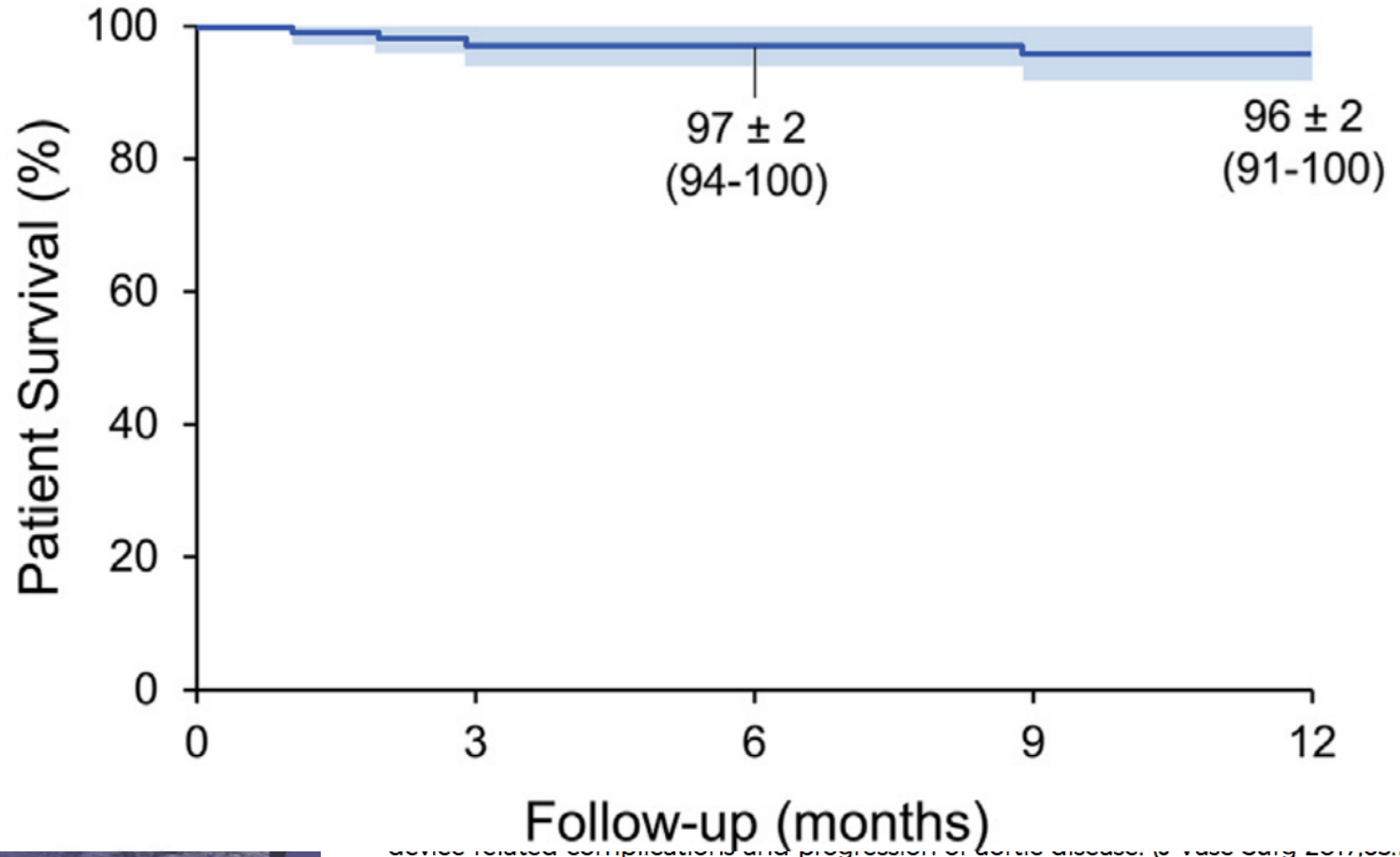


Metanalysis of 35 series comparing FEVAR (750) and Open repair (1575)

- Similar survival at 5 years
- Target vessel patency in FEVAR 95-98 % in long term
- Type I and III endoleak 5.8 % and 3.2 %Similar survival at 5 years
- Target vessel patency in FEVAR 95-98 % in long term
- Type I and III endoleak 5.8 % and 3.2 %

Prospective, nonrandomized study to evaluate endovascular repair of pararenal and thoracoabdominal aortic aneurysms using fenestrated-branched endografts based on supraceliac sealing zones

Gustavo S. Oderich, MD,[a] Mauricio Ribeiro MD, PhD,[a,b] Jan Hofer, RN,[a] Jean Wigham, RN,[a] Stephen Cha, MS,[c] Julia Chini,[a] Thanila A. Macedo, MD,[d] *and* Peter Gloviczki, MD,[a] *Rochester, Minn; and Ribeirão Preto, Brazil*



ovascular aortic repair (F-BEVAR) and thoracoabdominal aortic an-

in a prospective, nonrandomized design was based on supraceliac l examination, laboratory studies, nths, and yearly. End points adju- events (any mortality, myocardial , blood loss >1 L), f nection requiring r

ter of 59 ± 17 mm. hes, and 19 celiac s as 99.6% (n = 493/49 Major adverse even s). Follow-up was > After a mean follo ents were occluded condary target vesse eintervention was 9 e cohort.

nufactured F-BEVA e impact of four-ves

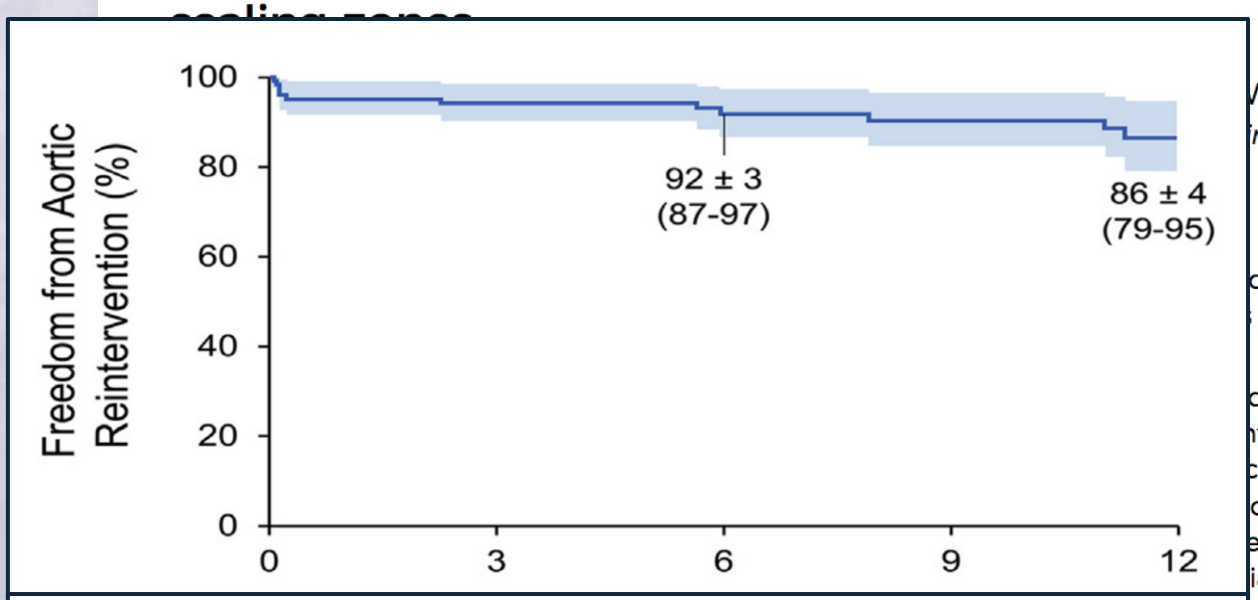
49-59.)

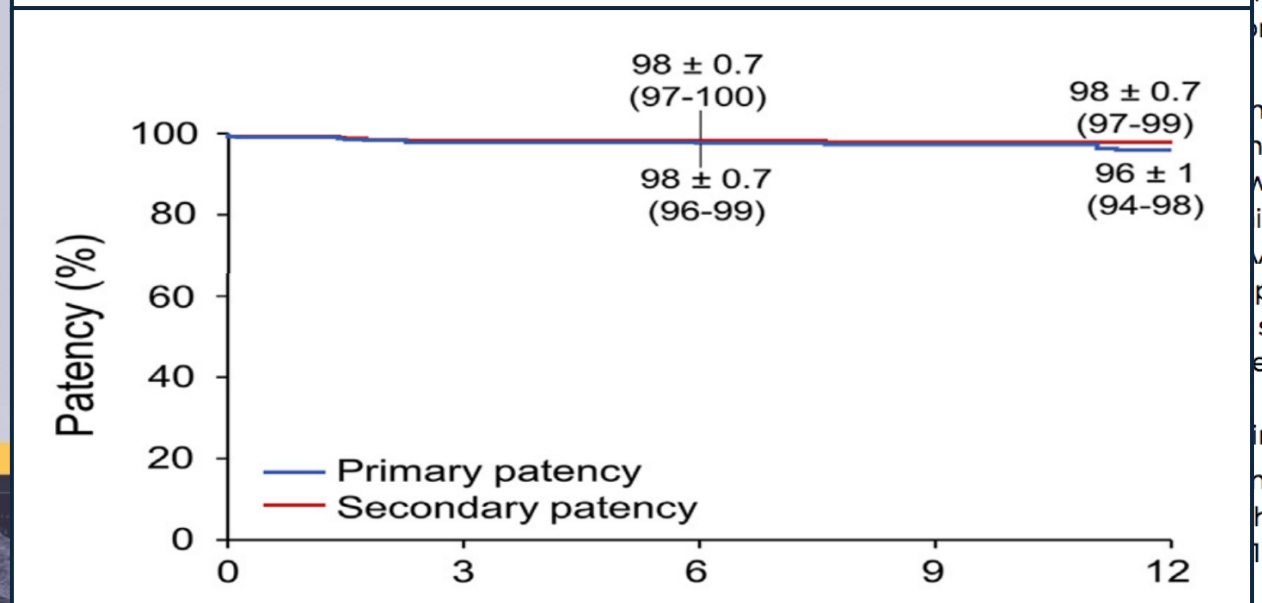
Mayo Clinic prospective study

127 patients (47 pararenal, 42 type IV, 38 type I-III) aneurysms repaired with patient specific endografts

- 1.5 % paraplegia
- 96 % survival at 1 year

Prospective, nonrandomized study to evaluate endovascular repair of pararenal and thoracoabdominal aortic aneurysms using fenestrated-branched endografts based on supraceliac





Vigham, RN,[a] Stephen Cha, MS,[c]
nn; and Ribeirão Preto, Brazil

dovascular aortic repair (F-BEVAR)
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Mayo Clinic prospective study

- Low reintervention
- Target vessel patency 98%
- 89% without renal dysfunction
- Low reintervention
- Target vessel patency 98%
- 89% without renal dysfunction

Cleveland Clinic experience

Outcomes/Complications	Open (n = 278) No.[a]	Open (n = 278) No. (%)	Endovascular (n = 278) No.[a]	Endovascular (n = 278) No. (%)	*P* Value
Hospital death	278	23 (8.3)	278	21 (7.6)	.8
Paralysis/paraplegia	278	11 (4)	274	14 (5.1)	.5
Permanent paralysis/paraplegia	278	10 (3.6)	274	6 (2.2)	.3
Permanent stroke	278	15 (5.4)	274	9 (3.3)	.2
Dialysis	278	24 (8.6)	275	9 (3.3)	.008
Respiratory failure	230	106 (46)	272	17 (6.3)	<.0001
Length of stay					
Intensive care unit, d	278	2.8 (5.0, 13)[b]	278	1.2 (3.0, 6.0) [b]	<.0001
Length of stay, d	278	7.0 (11, 22)[b]	278	4.0 (6.0, 14)[b]	<.0001
Sepsis	278	23 (8.3)	274	13 (4.7)	.09
Reoperation for bleeding	278	11 (4)	276	6 (2.2)	.2

[a]Patients with data available; [b]These data are shown as the median (15th, 85th percentiles). No., number.

<u>Single center retrospective propensity score analysis</u>

457 open vs 596 Endo

Comparable outcomes

Tong MZ, Eagleton MJ, Roselli EE, Blackstone EH, Xiang F, Ibrahim M, Johnston DR, Soltesz EG, Bakaeen FG, Lyden SP, Toth AJ, Liu H, Svensson LG. Outcomes of Open Versus Endovascular Repair of Descending Thoracic and Thoracoabdominal Aortic Aneurysms. Ann Thorac Surg. 2022 Apr;113(4):1144-1152. doi: 10.1016/j.athoracsur.2021.04.100. Epub 2021 May 25. PMID: 34048754.

Real world pooled open vs endo repair outcomes for TAAA

	Open TAAA repair (extent I, II, III, V)	Endovascular
Perioperative mortality	10-15%	3 – 9%
Spinal cord injury	4-6 %	3-10 % (majority reversible)
Renal complication rates (AKI, permanent dialysis)	7 – 20 %	3
Respiratory complication	~ 25 %	
Cardiac complications	3 - 5 %	
Side branch patency (long term)	97 – 100 %	8
5 year survival	~ 50 %	~

<u>Metanalysis of multiple studies</u>

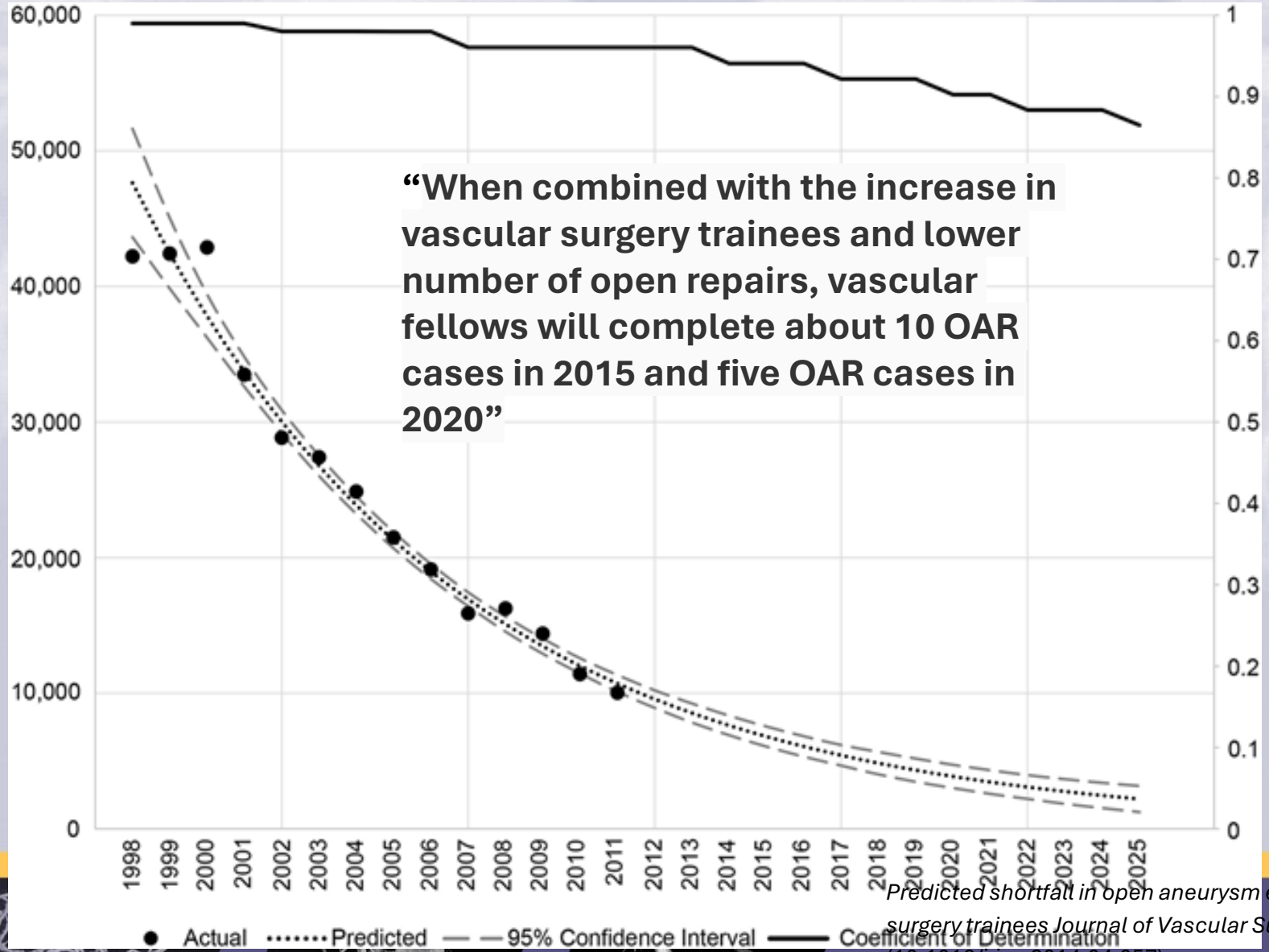
Included high volume centers

Endovascular approach offered to sicker patients

Comparable, if not superior outcomes with endovascular approach with F/BEVER

Cochennec F, Couture T, Chiche L. Comparison of Immediate, Medium, and Long-Term Postoperative Results of Open Surgery and Fenestrated/Branched Stent Grafts for Extended Thoracoabdominal Aortic Aneurysms. J Clin Med. 2023 Nov 21;12(23):7207. doi: 10.3390/jcm12237207. PMID: 38068258; PMCID: PMC10707369.

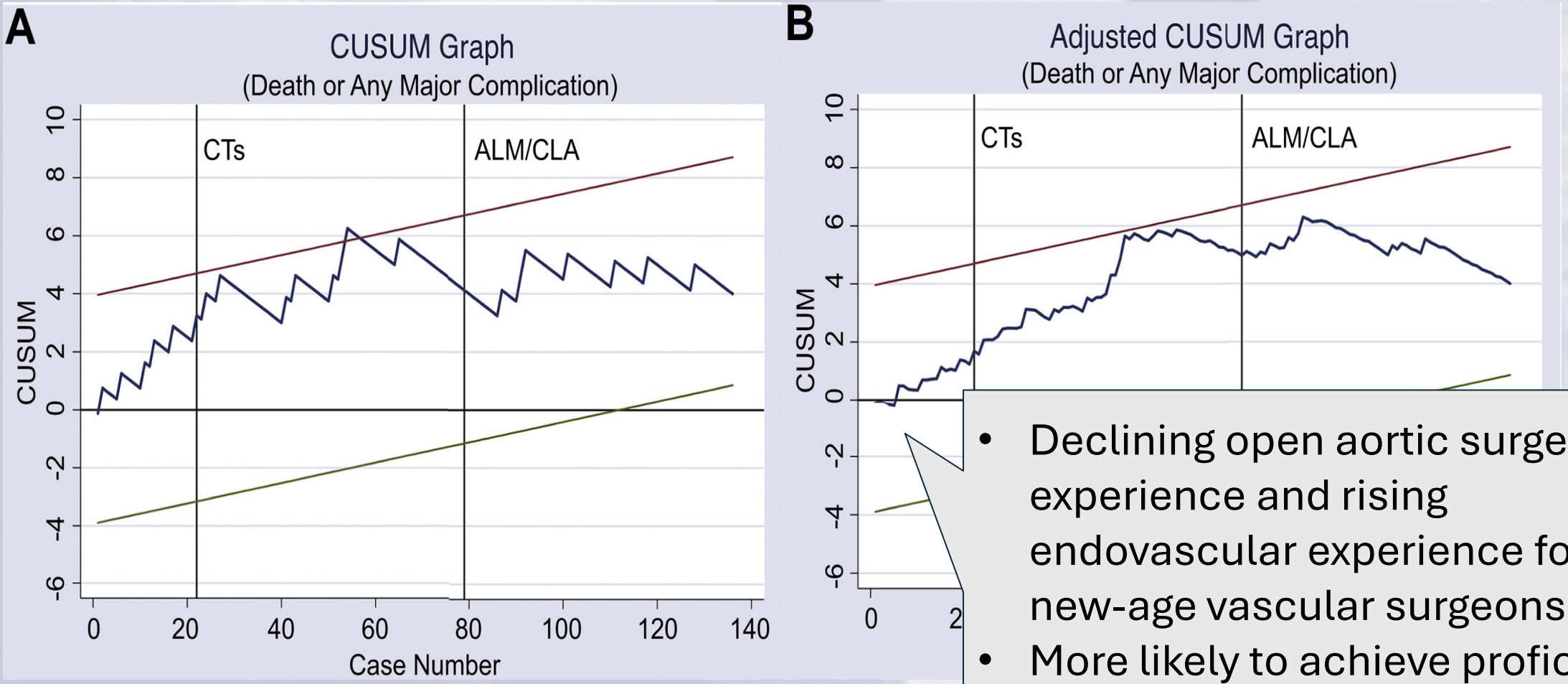
Real world: trends in open aortic repair



"When combined with the increase in vascular surgery trainees and lower number of open repairs, vascular fellows will complete about 10 OAR cases in 2015 and five OAR cases in 2020"

Predicted shortfall in open aneurysm experience for vascular surgery trainees Journal of Vascular Surgery 2014 60, 945-949DOI: (10.1016/j.jvs.2014.04.057)

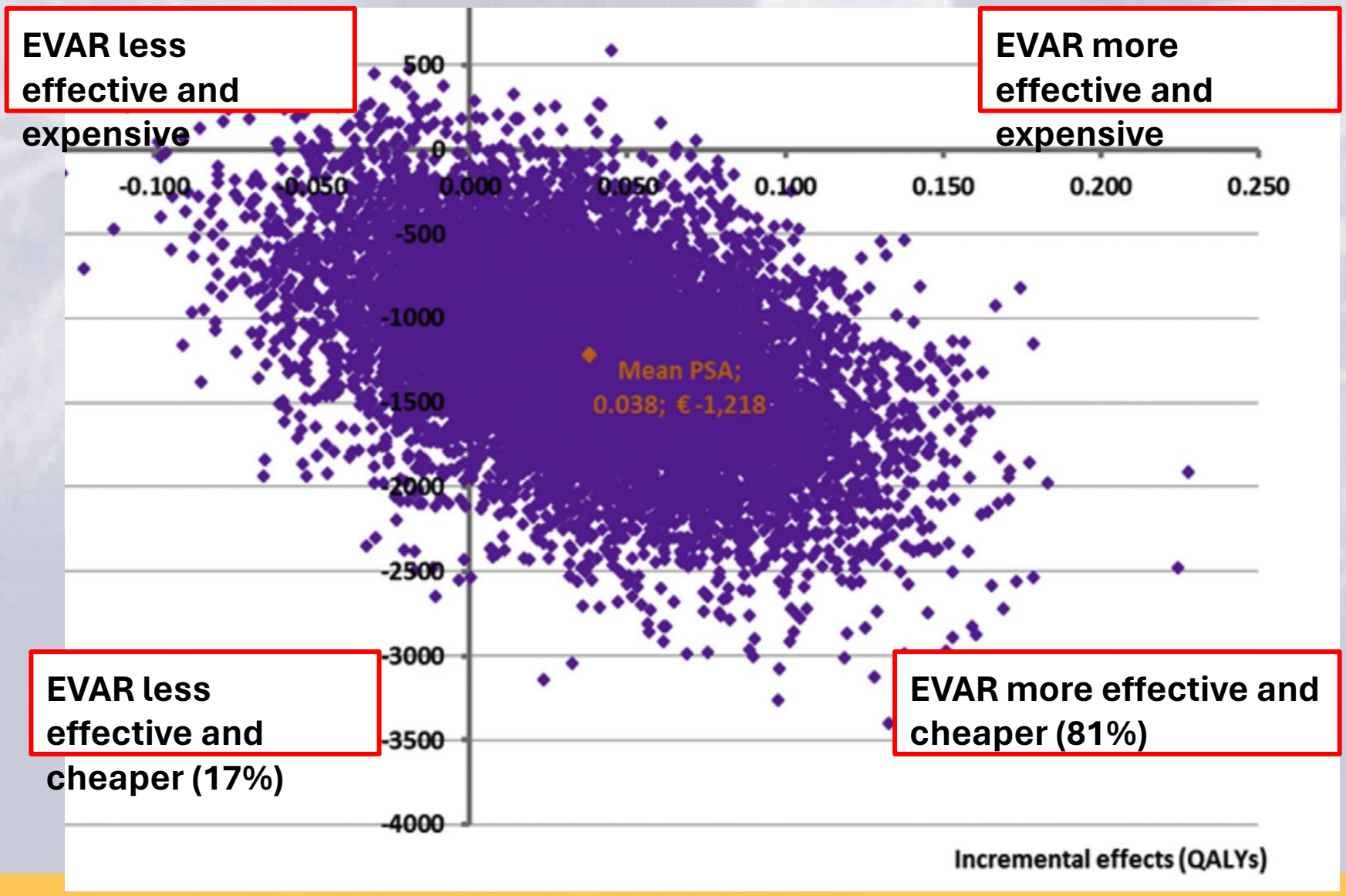
Learning curve for FEVAR



- Declining open aortic surgery experience and rising endovascular experience for the new-age vascular surgeons
- More likely to achieve proficiency with complex endovascular repair

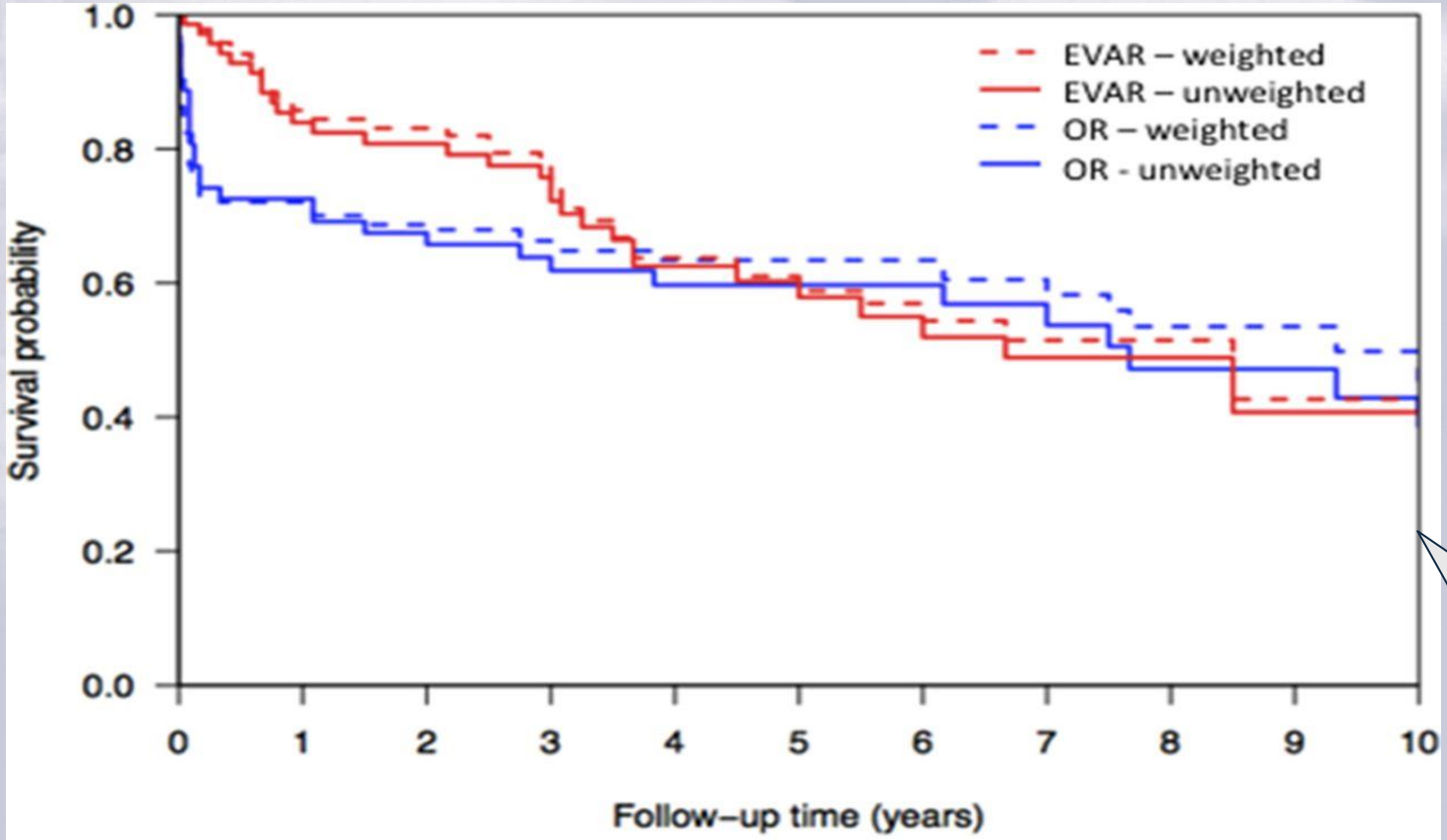
*Evaluation of the learning curve for fenestrated endovascular aneurysm repair*Journal of Vasc
(10.1016/j.jvs.2016.04.049

But, FB EVAR is expensive. NOT!!



Cost-effectiveness of Elective Endovascular Aneurysm Repair Versus Open Surgical Repair of Abdominal Aortic Aneurysms Burgers, L.T. et al. European Journal of Vascular and Endovascular Surgery , Volume 52 , Issue 1 , 29 - 40

More lies: you definitely cannot do FEVAR for infection



Propensity score weighted estimates of survival at respective time interval after surgery. Numbers within parenthesis indicate the 95% confidence interval.

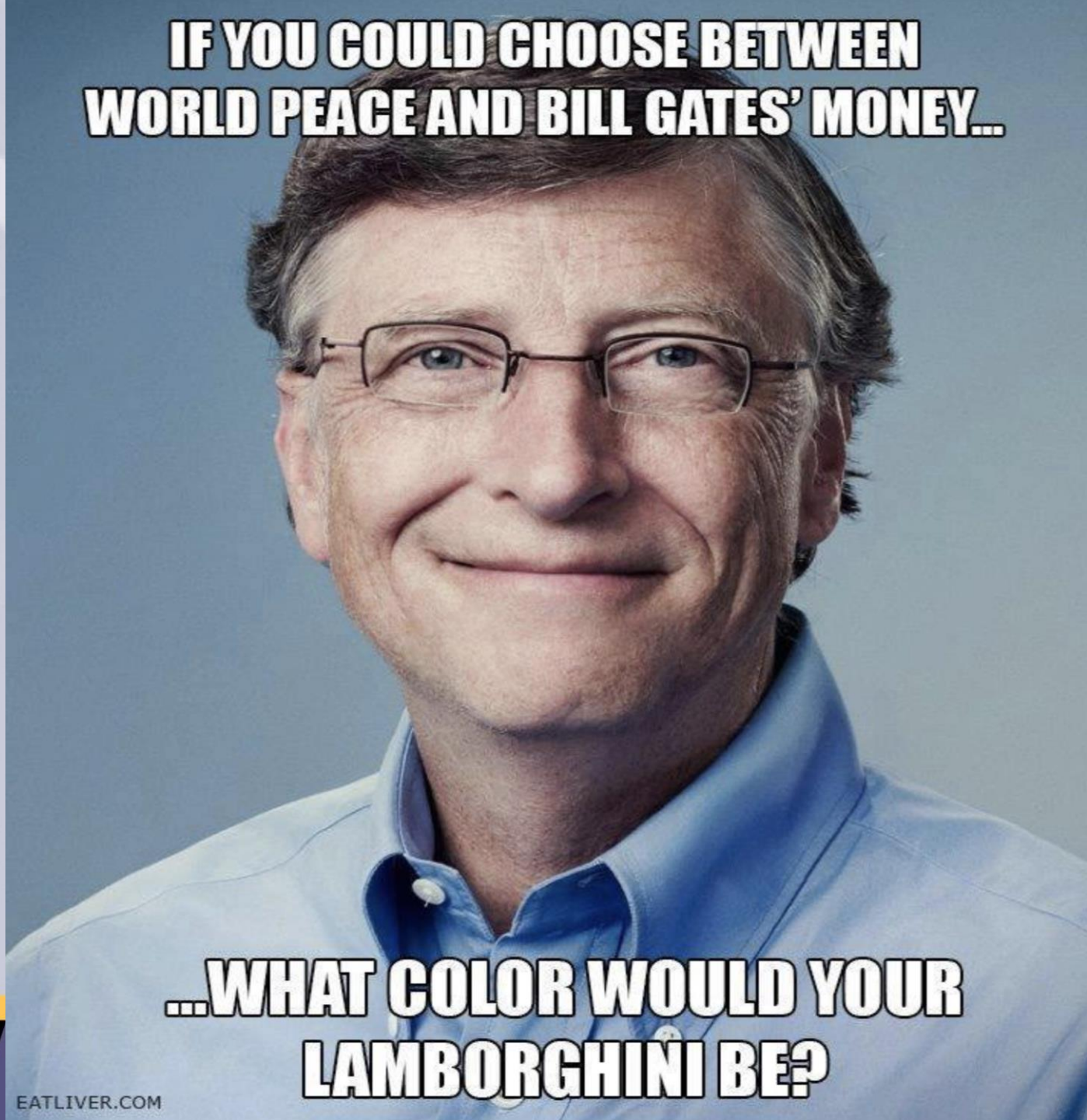
	3-months	1-year	5-years	10-years
OR	72.8 (65.9-80.5)	72.1 (65.1-79.8)	63.4 (55.5-72.5)	38.4 (26.7-55.1)
EVAR	96.9 (93.7-99.9)	85.8 (79.4-92.6)	58.8 (49.4-70.0)	42.7 (31.8-57.2)
p	<0.001	0.110	0.687	0.782
Numbers at risk	113	100	52	15

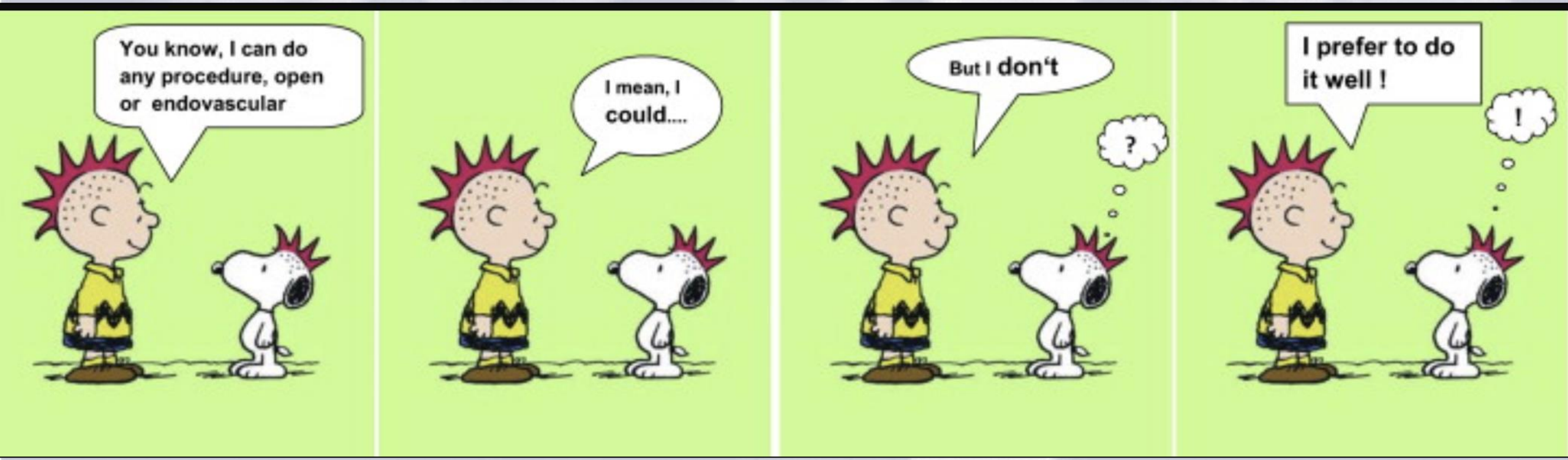
Paradigm shift in treatment of MAAA in Sweden

EVAR was associated with improved short-term survival in comparison with OR, without higher associated incidence of serious infection-related complications or reoperations.

Laparotomy/ thoracotomy versus percutaneous intervention?

- Prolonged procedure
- Postop pain
- Lengthy hospital stay ↑
- Higher in-hospital deaths and complications (dialysis, pneumonia, spinal ischemia)
- Recovery after procedure
- Declining surgeons' experience




You know, I can do any procedure, open or endovascular
I mean, I could....
But I don't
?
I prefer to do it well !
!

Back to the original question

- Does open repair trump all complex endovascular aortic aneurysm repair?

NO!!!

- Endovascular repair is also not without pitfalls
  - Higher reinterventions: mostly percutaneous and outpatient
  - Technology is still evolving
  - Takes a lot of planning and a thoughtful approach and should be offered at a center with institutional experience and expertise for this
  - Lifelong follow up needed
  - Connective tissue disorder, tortuous – calcified anatomy

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Back to the original question

- In fact, complex endovascular surgery is
  - applicable to most anatomy, and pathology (inflammatory, mycotic)
  - Durable
  - Safe as well as effective
  - Right for most patients
  - Teachable skill in modern practice
  - Cost effective
  - **Evolving science that is <u>READY FOR PRIME TIME!!!</u>**

- Appropriate surgery for the right patient with optimal clinical presentation should be the discussion, rather than the superiority of one over the other

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The best interest of the patient is the only interest to be considered

- William J. Mayo, MD

THANK YOU!!!

Animesh Rathore, MD FACS RPVI
Assistant Professor of Surgery
Sentara Vascular Specialists
Cellphone number: 646 894 6914

References slides

- Aortic Aneurysms (ascending, arch, descending, thoracoabdominal, abdominal, aortoiliac)
- Aortitis (mycotic vs large vessel vasculitis)
- Acute aortic syndromes
  - Aortic dissection
  - Penetrating aortic ulcer
  - Intramural hematoma
  - Aortic transection

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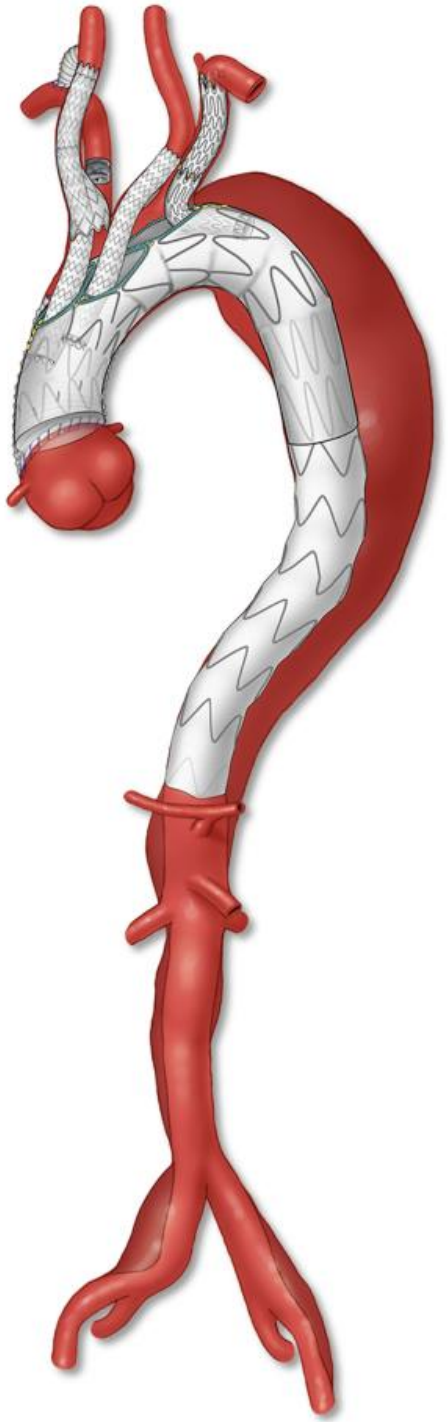
Thank you



athore, MD
ascular Specialists
number 646 894 6914

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Thank you

Animesh Rathore, MD
Sentara Vascular Specialists
Cellphone number 646 894 6914

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