With Complex AAAs And Type IV TAAAs, The Incidence Of SCI Is 3 Times Greater With Endovascular Repairs Than Open Repairs: Why Is This A Controversial Finding And How Can It Be So

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No disclosures, no conflict of interests

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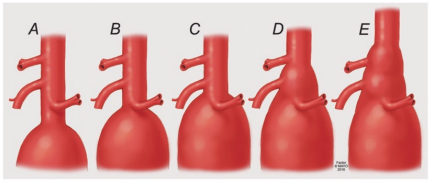
Definition of complex AAAs



Infrarenal

Juxta-renal

Pararenal

Paravisceral

Type IV TAA

Endovascular Aortic Repair: Current Techniques with Fenestrated, Branched and Parallel Stent-Grafts 1st ed. 2017, by Gustavo S. Oderich (Editor)

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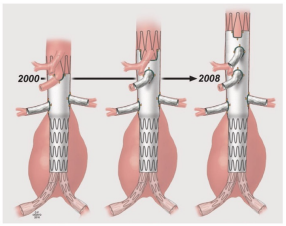
Increasing use of more complex endograft designs



Endovascular Aortic Repair: Current Techniques with Fenestrated, Branched and Parallel Stent-Grafts 1st ed. 2017, by Gustavo S. Oderich (Editor)

Fig. 16.14 Increasing complexity of endovascular repairs to improve durability. By permission of Mayo Foundation for Medical Education and Research. All rights reserved

Fenestrated and branched devices have been increasingly used to treat more complex AAAs

- This is attractive, especially in high risk individuals who might not tolerate supraceliac aortic clamping and visceral or renal ischemia

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EVAR vs. OSR for complex AAA; overlooked unacceptable outcomes

- Mortality is among the most commonly reported primary outcomes in studies comparing OSR with EVAR
- However, other unacceptable outcomes, such as the rate of *spinal cord ischemia (SCI)* are rarely highlighted and they are usually overlooked

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SCI after EVAR vs. OSR for complex AAA

- Paraparesis and paraplegia reduce the quality of life and have been associated with significantly shortened survival

Middleton J., Spinal Cord. 2012 Nov;50(11):803-11

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SCI after EVAR vs. OSR for complex AAA; scarce data is available

No Randomized Controlled Studies

NO well-standardized and homogeneous comparative studies

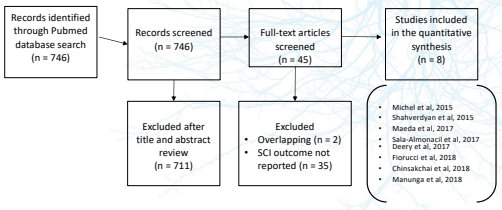
Lack of high quality evidence

Remarkable limitations for effectively comparing OS and EVAR

There is conflicting evidence concerning differences in SCI rate after EVAR vs. OSR for complex AAAs

- We performed a meta-analysis on all comparative studies which reported mortality and SCI rates after OSR and EVAR of cAAAs, also investigating at baseline patients' characteristics
- Pararenal, juxtarenal, suprarenal and type IV TAAAs were included
- PRISMA Guidelines for systematic reviews and meta-analyses were followed

Flowchart of study selection
Meta-analysis of comparative studies



Major differences in baseline characteristics

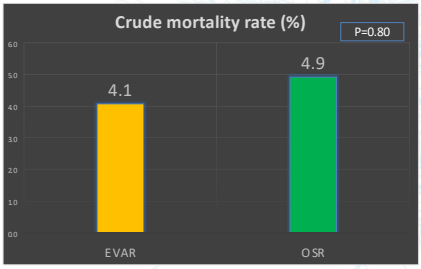
Baseline Characteristics	Endovascular treatment %	Open Surgical Repair %	OR	95% LCI	95% UCI	p value
Male gender	88.5	89.9	0.86	0.66	1.14	0.3
Hypertension	75.0	58.3	2.14	1.76	2.60	<0.001
Hyperlipidemia	48.0	37.2	1.56	1.30	1.88	<0.001
Diabetes Mellitus	13.6	12.7	1.08	0.84	1.40	0.54
Coronary Artery Disease	34.1	14.6	3.03	2.48	3.71	<0.001
Chronic Obstructive Pulmonary Disease	29.1	17.6	1.92	1.57	2.35	<0.001
Chronic Kidney Disease	17.9	10.2	1.93	1.52	2.47	<0.001
ASA Score						<0.001
1	4.2	24.1				
2	39.7	26.7				
3	46.3	40.8				
4	9.8	8.4				

- **hypertension**
- **hyperlipidemia**
- **coronary artery disease**
- **chronic obstructive pulmonary disease and**
- **chronic kidney disease**
- **ASA Score**

8 studies, 2.706 patients

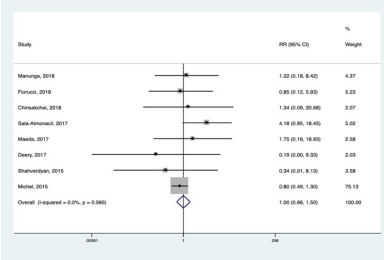
were 1.5 - 3 times higher in the ENDO Group

Mortality in OSR vs EVAR



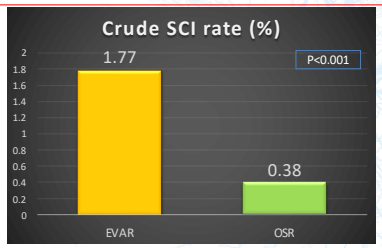
Crude Mortality was not significantly different between EVAR (27/663; 4.1%), compared to OSR (106/2,156; 4.9%)

Meta-analysis of Mortality in OSR vs EVAR



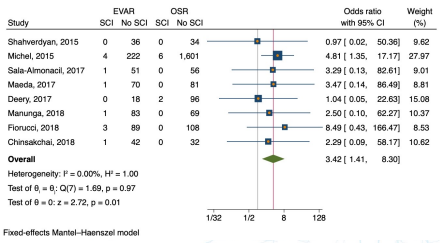
Mortality was not statistically different in the meta-analysis between OSR and EVAR
pooled OR = 1.00, 95%CI:0.66-1.50, p=0.99

SCI in OSR vs EVAR



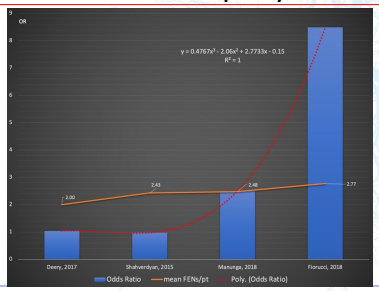
Crude SCI rate was >4 more frequent after EVAR (11/621; 1.77%), compared to OSR (8/2,085; 0.38%)

Meta-analysis of SCI in OSR vs EVAR



EVAR patients had 3.4 times higher risk for SCI, compared to OSR (pooled OR =3.42, 95%CI: 1.41-8.30, p=0.001)

Association of EVAR complexity with SCI risk

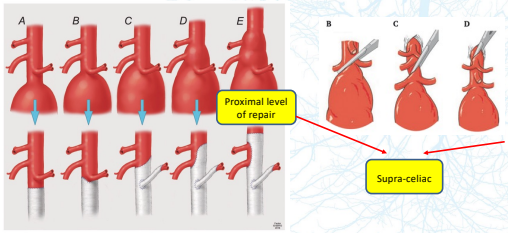


linear increase in the mean FENs/pt (which represents EVAR complexity / higher proximal aortic coverage) produced polynomial (more steep) increase in the odds for SCI after EVAR

Which factors may be responsible for the higher rates of SCI after EVAR vs. OSR for complex AAA?

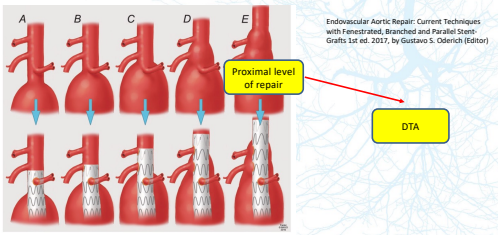
- Etiology of SCI is multifactorial
- However EVAR complexity and coverage of a larger proximal aortic segment with resulting intercostal artery obliteration in the lower thoracic aorta, could be responsible for the difference we have shown

Proximal level of open repair for complex AAA



- OSR in complex AAA may require inter-renal (B), suprarenal below the superior mesenteric artery (C), or supraceliac (D) clamping, which indicates the level of proximal repair
- Just above the celiac is the highest level of proximal repair which may be needed during OSR for cAAAs

Landing zone in f/b EVAR for complex AAA



- However, during f/b EVAR for complex AAA, the proximal landing zone is higher and may be well above the celiac
- As a result, a larger part of the proximal aorta should be covered to achieve proper sealing, compared to OSR

Proximal aortic coverage is much higher in bEVAR for complex AAA

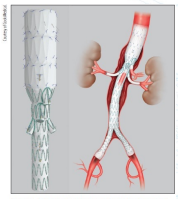
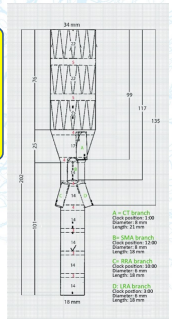


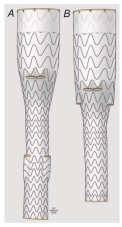
Figure 3. Zenith t-Branch thoracoabdominal endovascular graft.

99 mm



- 99 mm from the end of celiac branch to the proximal end of t-branch device
- + >20 mm from the origin of celiac artery to the end of celiac branch =
- >120 mm of aortic coverage above celiac artery

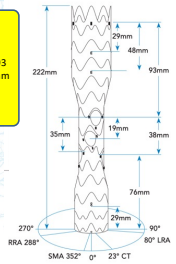
All the other available f/b EVAR devices also require extensive proximal aortic coverage



The Gore Excluder Thoracoabdominal Multibranch Endoprosthesis (TAMBE)

Terumo fenestrated Anaconda endograft

93 mm



JOTEC E-nside TAAA Multibranch Stent Graft System

Comparison of sacrificed healthy aorta during thoracoabdominal aortic aneurysm repair using off-the-shelf endovascular branched devices and open surgery

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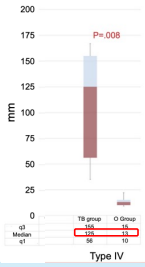
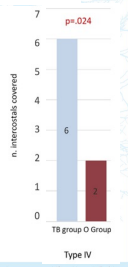


the amount of sacrificed healthy aorta was significantly higher in type IV TAAA after bEVAR (n=18) vs. OSR(n=18)

125 vs. 13mm

Resulted in an increased loss of intercostal arteries arising from healthy aortic proximal neck



› J Vasc Surg. 2018 Mar;67(3):695-702.

Conclusions

- Most series have primarily reported outcomes of only EVAR or OSR and data from comparative studies is limited
- No RCTs are currently available
- Our meta-analysis showed that SCI is >3-times higher after EVAR for complex AAAs, compared to OSR
- Higher complexity and higher level of proximal aortic coverage produced a very steep increase in the risk of SCI after EVAR

This is a controversial finding as it is based on a meta-analysis of small retrospective institutional series

Thank you very much

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