Why EVAR Should Be Preferred Over Open Repair In Young Patients With Suitable Anatomy: From A Meta-Analysis Of >50,000 Patients

George Antoniou

Consultant Vascular Surgeon

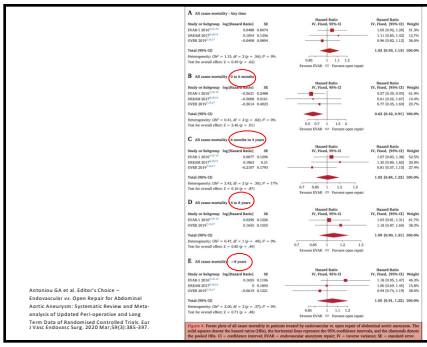
Manchester University NHS Foundation Trust

No relationships with commercial companies.

Information presented in this lecture is based on evidence.

Clinical practice guidelines specify two factors that should be considered when making decisions on treatment for AAA:

1. Anatomy
2. Life expectancy



Antoniou GA et al. Editor's Choice – Endovascular vs. Open Repair for Abdominal Aortic Aneurysm: Systematic Review and Meta-analysis of Updated Peri-operative and Long Term Data of Randomised Controlled Trials. Eur J Vasc Endovasc Surg. 2020 Mar;59(3):385-397.

Whilst an average survival of nine years has been reported following AAA repair[1], a longer survival is expected in younger patients.

Young patients might benefit from open surgery, that carries a lower risk of death and aneurysm-related complications in the long run.

Low perioperative mortality after open AAA repair in young and fit patients.

1. Mani K et al. Improved long-term survival after abdominal aortic aneurysm repair. Circulation. 2009;120:201-11.

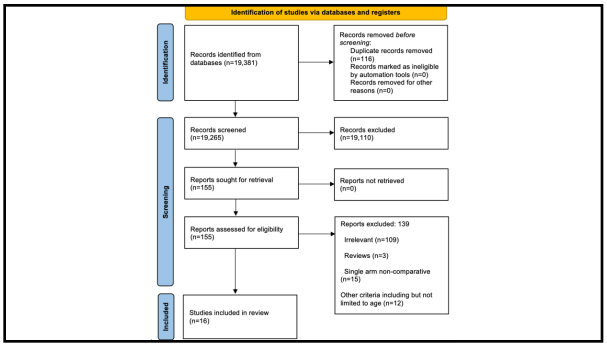
Hypothesis

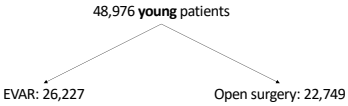
EVAR has worse long term outcomes than open repair in young patients:

- Higher reintervention
- Higher aneurysm-related mortality
- Higher overall mortality

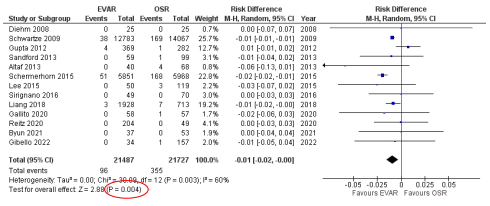
To test our hypothesis:

- Systematic review of the world literature.
- Eligible studies compared outcomes of standard EVAR versus open repair for intact AAA in young patients.
- We used the definition of "young" of the primary studies, but only definitions <70 years were accepted.
- Time to event data meta-analysis.

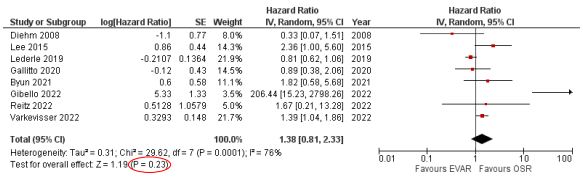




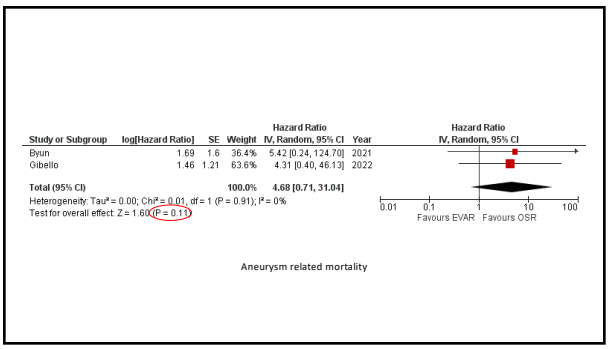
Study	Country	Study design	Definition of young	Recruitment period	No. of EVAR	No. of OSR	Duration of follow-up
Diehm et al[23]	USA, Switzerland	Retrospective, single center	<65 years	1994–2007	25	25	EVAR: 7.1 ± 3.2 years, OSR: 5.9 ± 1.8 years
Schwarze et al[24]	USA	Registry-National Inpatient Sample[a]	50–64 years	2001–2006	12783	14067	30 days
Giles et al[25]	USA	Registry-MEDICARE	67–69 years	2001–2004	3173	3173	Up to 6 years
Gupta et al[26]	USA	Registry-National Surgical Quality Improvement Program	<60 years	2007–2009	369	282	30 days
Altaf et al[27]	UK	Retrospective, single center	<65 years	1994–2011	97	68	Median 77 months (IQR: 36–140)
Sandford et al[17]	UK	Retrospective, single center	<65 years	2000–2010	59	99	75.5 ± 44.6 months
Schermerhorn et al[28]	USA	Registry-MEDICARE	67–69 years	2001–2008	5851	5968	NA
Lee et al[15]	Canada	Retrospective, single center	<60 years	2000–2013	50	119	EVAR: 62.5 months, OSR: 78.2 months
Stirpiano et al[29]	Italy	Retrospective, multicenter	<60 years	2005–2014	49	70	56.8 ± 42.7 months
Liang et al[21]	USA	Registry-Vascular Quality Initiative	<65 years	2003–2014	1928	713	Median 401 days (IQR: 357–459)
Lederle et al[22]	USA	RCT	<70 years	2002–2006	318	188	Median 9.4 years (IQR: 5.7–11.2)
Gallitto et al[30]	France, Italy	Retrospective, single center	<65 years	2005–2013	58	57	86 ± 38 months
Reitz et al[31]	USA	Retrospective, single center	<70 years	2003–2013	204	49	EVAR: median 4.45 years (IQR: 2.5–6.47); OSR: median 4.51 years (IQR: 2.6–6.8)
Byun et al[32]	Korea	Retrospective, single center	<70 years	2012–2016	37	53	Median 52 months (IQR: 42.8–70.5)
Gibello et al[34]	Italy	Retrospective, single center	<70 years	2010–2018	34	157	Median 71 months (IQR: 53)
Varkevisser et al[33]	USA	Registry-Vascular Quality Initiative	<65 years	2003–2021	6393	1547	Median 27 months (IQR: 12–72)



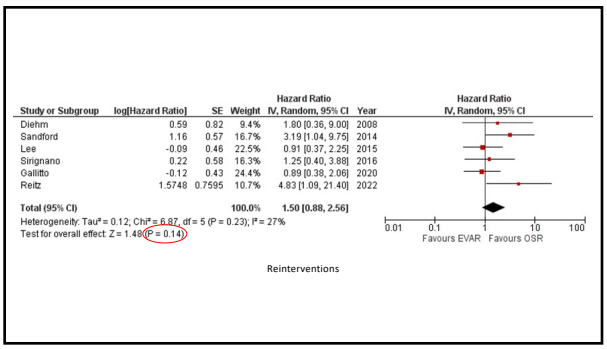
Perioperative mortality



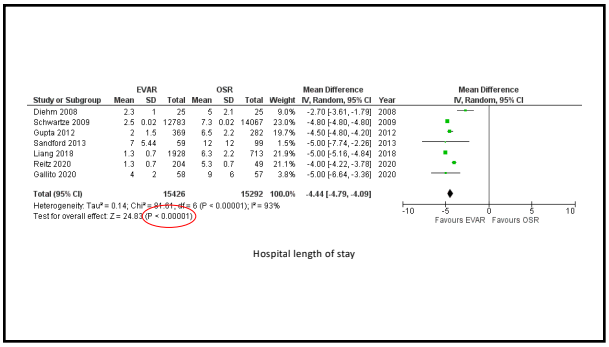
Overall mortality



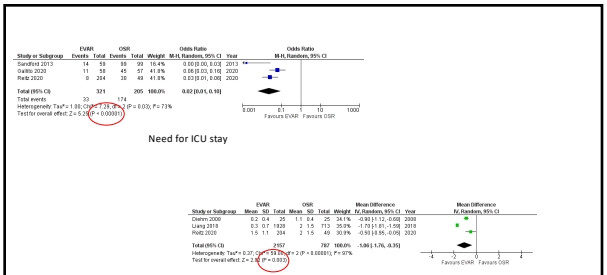
Aneurysm related mortality

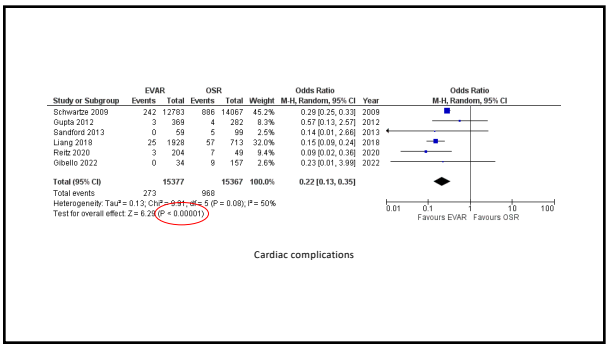


Reinterventions

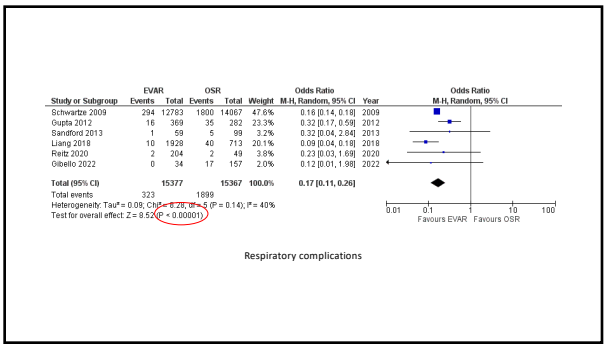


Hospital length of stay

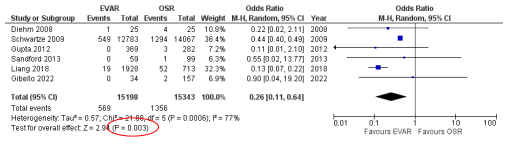




Cardiac complications



Respiratory complications

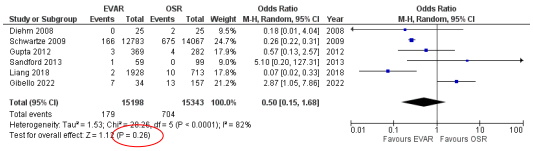


Study or Subgroup	EVAR Events	EVAR Total	OSR Events	OSR Total	Weight	Odds Ratio M-H, Random, 95% CI	Year	Odds Ratio M-H, Random, 95% CI
Diehm 2008	1	25	4	25	10.8%	0.22 [0.02, 2.11]	2008	
Schwartze 2009	549	12783	1294	14067	36.4%	0.44 [0.40, 0.49]	2009	
Gupta 2012	0	369	3	282	7.2%	0.11 [0.01, 2.10]	2012	
Sandford 2013	0	59	1	99	6.3%	0.55 [0.02, 13.77]	2013	
Liang 2018	19	1928	52	713	32.3%	0.13 [0.07, 0.22]	2018	
Gibello 2022	0	34	2	157	6.9%	0.90 [0.04, 19.20]	2022	
Total (95% CI)		**15198**		**15343**	**100.0%**	**0.26 [0.11, 0.64]**		
Total events	569		1356					

Heterogeneity: Tau² = 0.57; Chi² = 21.88, df = 5 (P = 0.0006); I² = 77%
Test for overall effect: Z = 2.94 (P = 0.003)

0.01 0.1 1 10 100
Favours EVAR Favours OSR

Bleeding complications



Study or Subgroup	EVAR Events	EVAR Total	OSR Events	OSR Total	Weight	Odds Ratio M-H, Random, 95% CI	Year	Odds Ratio M-H, Random, 95% CI
Diehm 2008	0	25	2	25	9.5%	0.18 [0.01, 4.04]	2008	
Schwartze 2009	166	12783	675	14067	24.7%	0.26 [0.22, 0.31]	2009	
Gupta 2012	3	369	4	282	17.9%	0.57 [0.13, 2.57]	2012	
Sandford 2013	1	59	0	99	9.0%	5.10 [0.20, 127.31]	2013	
Liang 2018	2	1928	10	713	17.8%	0.07 [0.02, 0.33]	2018	
Gibello 2022	7	34	13	157	21.2%	2.87 [1.05, 7.86]	2022	
Total (95% CI)		**15198**		**15343**	**100.0%**	**0.50 [0.15, 1.68]**		
Total events	179		704					

Heterogeneity: Tau² = 1.53; Chi² = 29.26, df = 5 (P < 0.0001); I² = 82%
Test for overall effect: Z = 1.12 (P = 0.26)

0.01 0.1 1 10 100
Favours EVAR Favours OSR

Renal complications

Quality assessment							No of patients		Effect		Quality	Importance
No of studies	Design	Risk of bias	Inconsistency	Indirectness	Imprecision	Other considerations	EVAR	OSR	Relative (95% CI)	Absolute		
30-day mortality												
13	observational studies	serious[1]	serious[2]	not serious	not serious	strong association[3]	96/21,487 (0.4%)	355/21,727 (1.6%)	RD -0.01 (-0.02 to -0.00)	12 fewer per 1000 (from 11 fewer to 13 fewer)	VERY LOW	CRITICAL
All-cause mortality												
8	observational studies	serious[1]	serious[2,3]	not serious	serious[4]	none	-	-	HR 1.38 (0.81 to 2.33)	-	VERY LOW	CRITICAL
Aneurysm-related mortality												
2	observational studies	not serious	not serious	not serious	serious[4,5]	none	-	-	HR 4.68 (0.71 to 31.04)	-	VERY LOW	CRITICAL

Take home messages

- EVAR has superior perioperative outcomes compared to open repair in young patients.
- The overall and aneurysm-related mortality are not significantly different between EVAR and open surgical repair in the short and medium term.
- Patient preferences and perspectives should be considered during shared decision-making process considering the available evidence.
- EVAR may be considered in young and fit patients with a suitable anatomy.