



COMPARISON OF ENDOVASCULAR TREATMENT AND OPEN SURGICAL REPAIR FOR ABDOMINAL AORTIC ANEURYSM: A META-ANALYSIS.

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ABSTRACT:

BACKGROUND AND OBJECTIVE: Endovascular aortic aneurysm repair (EVAR) is a relatively new technique as compared to open surgery (OS). The objective of this meta-analysis was to evaluate the safety and efficiency of this procedure for patients having abdominal aortic aneurysm (AAA).

METHODS: We systematically analyzed 55 articles in accordance with inclusion criteria. A total of 1888 patients with 1321 undergoing OS and 567 undergoing EVAR were reported in literature. Outcomes (endoleak, anastomotic leak, renal, pulmonary, cardiac, multi organ complication and stroke) of these two procedures for these patients were compared.

RESULT: No significant difference has been reported between two procedures with respect to success rates, operating time, intensive care unit (ICU) stay, and postoperative hospital stay. Blood loss and blood transfusion requirements were significantly lower in the EVAR group.

Differences were found in the rates of cardiac, renal, pulmonary, and visceral complications, which were all more frequent in OS group ($P = 0.01$). Lower limb ischemia was more common in EVAR group ($P < 0.05$). Mortality at 30-days, was higher in the OS group than EVAR group ($P < 0.05$).

CONCLUSION: EVAR is a feasible, safe and less invasive treatment for aortic aneurysm and patients have a quick recovery with fewer complications.

(*J Cardiovasc Dis* 2013;11(2):48 -52)

INTRODUCTION:

Abdominal aortic aneurysm (AAA) develops slowly over many years and often has no symptoms. It develops when the wall of the artery is weakened and distends like a balloon. Aneurysms are usually discovered incidentally during ultrasonographic examination of abdomen for some other reason or when they produce symptoms, such as back pain. If an aneurysm expands rapidly, tears or blood leaks along the wall of the vessel (aortic dissection) may occur and symptoms develop abruptly. Since a ruptured aneurysm is extremely dangerous and can cause life-threatening bleeding, aneurysms are best corrected by some intervention before this complication.

The first Endovascular aortic aneurysm repair (EVAR) for AAA was reported by Parodi et al.¹ In last two decades EVAR of AAA developed quickly and is practiced widely now a days. Patients who present with abdominal or back pain, even of an atypical nature, are at increased risk of rupture and intervention is recommended. Should aneurysm

rupture occur, more than half of patients die prior to hospitalization. Of those who reach the operating suite, the outcome is dependent on the presenting clinical condition, but typically carries a mortality of approximately 50%.² For those, who present with an asymptomatic AAA, management depends on size of the aneurysm.

EVAR of delayed rupture following prior open abdominal aortic aneurysm repair has been shown to achieve better survival rates.³ In some patients, EVAR treatment of patients has shown association with systemic inflammatory response (also called post implantation syndrome) and consequent prolongation of hospitalization⁴. Aneurysms shrinkage is also reported in some studies. Spontaneous fistulation of an AAA into the inferior vena cava (IVC) is an unusual⁵ and infrequently encountered complication in clinical practice but pre operative diagnosis reduces the chances of morbidity and mortality⁶. Low left ventricular ejection fraction (LVEF) is associated with reduced survival in AAA patients undergoing repair⁷.

In this meta-analysis, we analyzed available studies which were published with AAA patients treated by OS or EVAR, to compare the efficiency and safety of both treatments. It may provide a reference for selecting an optimal treatment strategy for AAA.

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METHODS:

We systematically analyzed 55 articles 1-55 (articles published in the year 1986,88, 1998-2013), last search made in February, 2014. Various keywords in English were used to collect widespread dataset. All case studies and original articles that reported outcomes of EVAR or OS or both for AAA were selected. The search was performed through MEDLINE, and PUBMED. The keywords used were (a) Open surgery (b) abdominal aortic aneurysm (c) endovascular repair. The options “a” and “c” were used to determine the cases of AAA. Article selection was performed on the basis of (1) AAA patients’ article which includes types of treatment, (2) article containing AAA patients receiving EVAR or OS, (3) latest articles with desired cases. Non clear classification articles as per title were excluded from study.

The standard protocol for data extraction was used. According to goals of our analysis, we modified the standardized protocol which includes predefined variables in regard to clinical features and ceremonial data. Data extraction was performed independently by all authors, Consensus with further discussion were achieved when any ambiguity occurred.

Statistical analysis was performed using SPSS version 16.0 and it followed a standardized protocol defined by Eggebrecht et al⁸, in their retrograde case reports. Events rate were calculated as event numbers over number of treated patients. The results were presented as frequencies and percentages. The two methods were compared through chi square test (two-tailed). P value < 0.05 was considered significant. The post-operative complications were compared in two groups.

RESULTS:

A total of 1888 patients with 1321 undergoing OS and 567 undergoing EVAR were reported in literature. Mean age the patients was 60.43±0.29 in OS group years and 65.80±0.19 years in EVAR

Table 1: Comparison of patient’s pre-operative characteristics

Pre-operative Variables	OS	EVAR	P-value
	Group-Available data ^{3,8,9,11,15-17,22,25}	Group-Available data ^{2-7,9-14,16-18,23-25}	
Smoking	68/150	96/172	0.0601
Coronary heart disease	300/1008	250/875	0.5708
Hypertension	520/900	502/901	0.3918
Diabetes Mellitus	202/1050	76/712	0.000*
Renal disease	40/410	24/370	0.1178
Pain	210/610	18/36	0.0725
Aneurysm rupture	111/714	one/79	0.000*

Table 2. Comparison of Complications with EVAR and OS.

Complications	EVAR	OS	p-value
	Group ^{2-7,9-14,16-18,23-25}	Group ^{3,8,9,11,15,17,22,25}	
Endoleak	26.3%	4.8%	P<0.05
Anastomotic leak	31.2%	8.7%	
Renal complications	5.0%	33.7%	
Pulmonary complications	14.2%	7.1%	
Cardiac complications	20-40%	7-15%	
Stroke	52.3%	55.1%	P>0.05
Multiple Organ Failure	35.9%	41.8%	
Procedure Related complication	7.5%	11.0%	

Table 3: Comparison of post-operative mortality after EVAR and OS.

Reference Study	Mortality	
	EVAR	Open Surgery ^{3,8,9,11,15,17,19-20,22,25}
	Group ^{2-7,9-14,16,17,19,20,23,25}	
(Steinmetz et al, 2010) ¹⁶	25%	54%
(Chahwan et al, 2007) ¹⁷	40.6%	29.6%
(Prusa et al, 2013) ³	6.9%	8.5%
(Wibmer et al, 2009) ²	2.2%	3.7%
(Coppi et al, 2010) ¹¹	30%	
(Beeman et al, 2010) ¹²	28.5%	38.7%
(May et al, 2004) ¹⁸	2.7%	3.5%
(Park et al, 2013) ¹⁹	16.6%	53.8%

group. The patients in OS group were younger than EVAR, and age difference was significant (P = 0.036). The two groups were similar with respect to pre-operative data except for Diabetes Mellitus and aneurysm rupture, Table 1.

No significant difference was found in success rates for both procedures. Among the patients treated with for EVAR, endoleak was the most common complication after EVAR treatment (P value < 0.05). Anastomotic leak, renal complications, pulmonary complications and cardiac complications were significantly different in both groups (P value < 0.05). Stroke, multiple organ failure and Procedure related complications were not statistically different among EVAR and OS groups (P value > 0.05). Comparison of complications from various studies is shown in Table 2.

In a multicenter study; it was observed that patients treated with EVAR had less blood loss (310 ± 19 mL versus 1590 ± 124 mL; P < .0001), fewer homologous transfusions (6% versus 32%; P < .0001), and shorter hospital stay (2.0 ± 0.1 days versus 9.8 ± 1.4 days; P < .0001). Complication rate was 14% as compared to 57% for open surgery (P < .0001); endoleak was observed in 20%.⁹ Post-operative mortality was compared in patients with EVAR and OS and results are shown in Table 3.

DISCUSSION:



The patient life is seriously threatened by the AAA. In patients with ruptured aneurysm, mortality remains high, hence this situation requires prompt diagnosis and treatment. Some of the elderly patients or those with organ dysfunction die without treatment, because the risk of therapy is unacceptably high for them.⁷ To choose between pre-operative mortality risk and post-operative complications (with EVAR or OS) is difficult for high risk AAA patients. But it is evident from available research that EVAR is associated with reduced mortality as well as reduced complications in all age groups, even in patients with ruptured AAA.¹⁹ The preoperative risks except diabetes were similar in both groups; preoperative pulmonary disease, however, is low in OS as compared to EVAR.²¹ Among other complications like aneurysm recurrence, bleeding etc, endoleak could lead to mortality in patients treated with EVAR. In obese patients EVAR is more effective than open surgery.⁹ This analysis showed that endoleak was more common after EVAR than after OS. It was observed that endoleak was due to anticoagulant drugs; Warfarin (the commonly used

anticoagulant drug) is an independent risk factor for the development of endoleak and persistent sac expansion.¹³ Post implantation syndrome (PIS), a clinical entity characterized by systemic inflammation manifesting as fever and leucocytosis after stenting of the abdominal aorta, is a common complication and it was observed in 35% of the patients in EVAR group.

Short term follow up studies reveal that complete exclusion of aneurysm was possible with EVAR and morbidity and mortality lower with this procedure particularly in emergency setting and in patients with high risk.²² The trends show that mortality is low in EVAR as compared to open surgery but without statistical significance.¹¹ It has also been observed that EVAR not only reduces aneurysm related death but in comparison to open surgery it reduces post operative morbidity, utilization of ICU, hospital stay and eventually cost.^{17, 23} Blood loss is less with EVAR as compared to open surgery.

In conclusion, EVAR is better than open surgery in many aspects like reduced blood loss, less hospital stay and less mortality.

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