Research Article

Comparison between conventional and interventional aortic aneurysm surgery: comparative study.

M. Hosny Eldosoky * MD, Essam A. El-kady ** FRCS, Ahmed G. Fouad * MD, Hosam Zaghlol, *MD, Mahmoud Abd El Aziz Eltony ***MSc
* Vascular Surgery Unit, Faculty of Medicine, Cairo University, ** Vascular Surgery, military medical academy, *** Vascular Surgery, Maady military hospital

Abstract
Background: Abdominal aortic aneurysm (AAA) is a condition in which the aorta becomes dilated in the segment below the diaphragm. Our study is Comparative observational study between EVAR and AAA surgical repair. **Purpose:** To assess the efficacy of endovascular aneurysm repair (EVAR) against open surgical repair of abdominal aortic aneurysm (AAA). **Patients and methods:** We plan to perform EVAR and open surgery on 30 patients with Abdominal Aortic Aneurysm. The study will be set up to test the safety, efficacy and cost-effectiveness of endovascular repair in patients with abdominal aortic aneurysm. **Results:** EVAR compared to conventional surgery has benefits such as lower hospital stay, ICU stay, blood loss, rates of hospital mortality, rates of complications and re-intervention, but EVAR requires training programs still unavailable in many vascular surgery centers. **Conclusion:** With proper patient selection, EVAR can effectively reach AAA repair goals. Training and improvement of the medical stuff influence outcomes following EVAR.
Key words: Endovascular Aneurysm Repair (EVAR), Abdominal Aortic Aneurysm (AAA).

Introduction
There is general agreement that a 50% increase in the size of the aorta compared to its diameter proximal to the dilatation should be considered as an aortic aneurysm. Repair of Abdominal Aortic Aneurysm is widely used for treating infra-renal aneurysms larger than 5.5cm. Abdominal Aortic Aneurysm (AAA) is the most common type of true aneurysm and has a high propensity to rupture, which make them a significant health care problem.

In Argentina EVAR was first introduced in 1991 by ***Juan Parodi*** and in the same year in the USA by ***Michael Dake.***

Patients and Method
This was a prospective study conducted over the period starting at September 2013 till June 2015 at military hospitals in Cairo, we assigned 30 patients with large abdominal aortic aneurysms (≥5.5 cm in diameter) to undergo either endovascular or open repair; 15 patients were assigned to each group. Patients were followed for type of anesthesia, operative time, blood loss, hospital stay, morbidity, mortality and complications.

Inclusion criteria:
AAA measured at least 5.5 cm, Fit for open surgery and Suitable anatomically.

Exclusion criteria:
AAA measured less than 5.5 cm, Unfit for open surgery, Rupture and Dissection.

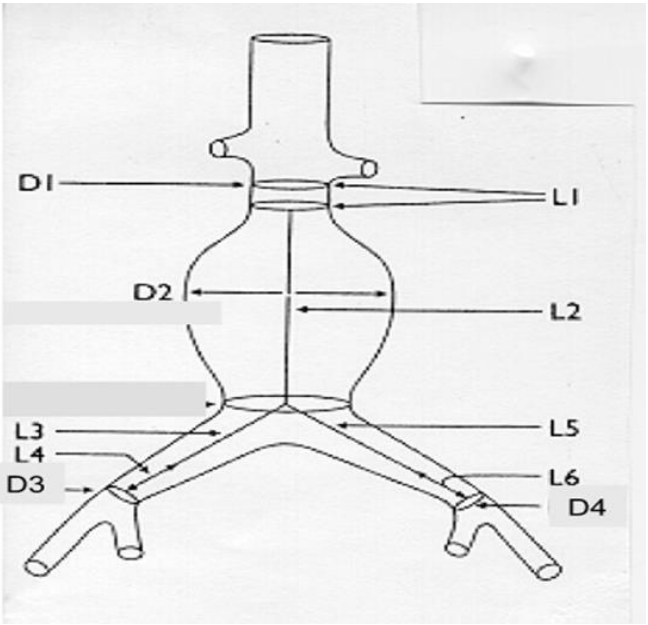
Patients who are included in this study were subjected to the following:
Consent and patient advice, proper history taking and clinical examination with emphasis on hemodynamic status, procedure time, blood loss & blood transfusion, ICU & hospital stay days, morbidity and mortality.

All operative data is documented regarding type of device, type of anaesthesia, site of arteriotomy, duration of procedure, pre or intraoperative embolisation of I.M.A, endoleak, blocking

of side branches and intraoperative complications.

Technique: All patients scheduled for open surgical repair had general anesthesia and through a trans-peritoneal incision, the abdomen is explored thoroughly to exclude other pathology and to assess the extent of the aneurysm, the proximal anastomosis is performed. After completing the graft is clamped, and the proximal aortic clamp is released briefly to check for and correct any suture line bleeding. If the distal anastomosis is to the aorta, a similar technique is used just above its bifurcation, if iliac artery aneurysms exist; the limbs of a bifurcated graft can be sutured to the normal iliac artery beyond these aneurysms. The aortic prosthesis and upper anastomosis must be isolated from the overlying duodenum during closure; if necessary, a pedicle of greater omentum can be interposed to achieve this purpose.

While patients undergoing EVAR were examined for suitability through an analysis of the vascular Morphology as represented by CT produces axial slice images, allowing accurate measurement of anatomic structures only in the axial plane. Length measurements of the aorta and iliac arteries made along the cranio-caudal axis tend to underestimate the distance to be followed by the endograft.



EVAR were performed inside an operating room prepared with C-arm or in an endovascular suite with facilities suitable for surgical cut-down approach under general, regional, or local anesthesia.

The common femoral arteries are exposed, a pre procedure aortogram with a calibrated pigtail introduced from the contralateral side of the device deployment, the positions of the renal arteries, aortic bifurcation, and iliac bifurcation are noted, The trunk and ipsilateral limb of the bifurcated prosthesis are deployed under radiographic control, after cannulation of the contralateral stump, the contralateral limb graft is deployed, post procedure digital subtraction aortogram is performed for the prescence of endoleak, to confirm graft position and that an adequate segment of iliac artery has been covered to provide secure distal fixation.

The outcome was clinically evaluated for all cases immediately post-operative. Follow up was done at 1, 6 and 12 months later by clinical examination plain X-ray and C.T scan.

Results

In our study we enrolled 15 patients underwent EVAR and 15 patients underwent open surgical repair. The patients of both groups have age above sixty except two patients in open repair group, the patients of both groups are males except two patients in EVAR group and most of both groups are smokers. (Table 1)

Table 1: General clinical data

Variables		EVAR N=15	Open N=15	P value
Age	**≥ 60** **< 60**	14 (93.2%) 1 (6.8%)	13 (86.6%) 2 (13.3%)	0.54
Gender	**Male** **Female**	13 (86.6%) 2 (13.3%)	14 (93.2%) 1 (6.8%)	0.54
Smoking	**No** **Yes**	4 (26.6%) 11(73.3%)	3 (20%) 12 (80%)	0.66

Anesthesia technique for open repair group was general anesthesia compared to 3 cases had regional anesthesia in EVAR group (table 2).

Table 2: Anesthesia

Anesthesia	EVAR N=15	Open N=15	P value
General	12 (80%)	15 (100%)	0.14
Regional	3 (20%)	0	

The mean duration of procedure for EVAR group was 93 minutes with range of 45 to 200 minutes compared to mean duration of procedure of 220 minutes with range of 180 to 320 minutes for open group.

The mean ICU stay for EVAR patient was 1 day with range of 1-2 days compared to mean ICU stay of 3.5 days with range of 3-6 days for open repair group. The mean hospital stay for EVAR patient was 1 day with range of 1-2 days compared to a mean hospital stay of 5 days with range of 4-11 days for open group.

Blood transfusion was required in 2 patients in EVAR group compared to all patients required blood transfusion in open repair group (table 3).

Table 3: Blood transfusion

Blood transfusion	EVAR N=15	Open N=15	P vaue
No Yes	13 (86.6%) 2 (13.3%)	0 (0%) 15 (100%)	0.00001

Four patients had acute ischemia due to graft thrombosis, two patients in each group, Fogarty thrombectomy was successful in three patients while fem-fem bypass was needed in one patient of the EVAR group due to excessive tortuosity.
Re-intervention was needed in one case among EVAR group due to thrombosis of a highly tortuous limb 12 hours latter which is treated by fem fem crossover compared to the open method, we had two cases explored due to retro-peritonial haematoma that caused hypotension and proved by ultrasound, So surgical evacuation was done & stitches was taken at the aortic anastomosis .

For EVAR group one patient had systemic complication compared to 5 patients had systemic complication in open repair group (table 4)

Table 4: Systemic complication

Systemic complication	EVAR N=15	Open N=15	P vaue
No	14 (93.3%)	10 (66.6%)	0.067
Yes	1 (6.6%)	5 (33.3%)	

The survival among EVAR group was better compared to open repair group. In open repair group 2 patients died, one of them one week after the operation due to myocardial infarction and the other patient died 1.5 week after the operation due to haemorhge, DIC and multi-system organ failure (table 5).

Table 5: mortality

Mortality	**EVAR N=15**	**Open N=15**	**P value**
No	15 (100%)	13(86.6%)	0.14
Yes	0	2 (13.3%)	

The results over a median follow-up period of 2 years confirm our previously published findings that operative mortality associated with endovascular repair of abdominal aortic aneurysm was only a third of that associated with the open-repair procedure and that aneurysm related mortality was reduced during the early years after endovascular-repair.

Discussion

In our study, we enrolled 30 patients to compare initial and short term results of Endovascular Aortic Aneurysm Repair (EVAR) and open surgical repair in patients with Abdominal Aortic Aneurysm. As our study was initial experience for EVAR we did our comparison with basic differentiation between new EVAR technique and the classical open surgical technique regarding anethesia technique, procedure time, blood loss, ICU stay, hospital stay, re-exploration, arterial complications mortality and morbidity.

Regarding the type of anethesia technique; 20% of the EVAR group was done under regional anethesia compared to 100% of the open repair which was done under general anethesia which is lower percentage in comparison to other studies which was 40% in Eurostar done under regional anesthesia.[11]

As regards the duration of procedure; EVAR was shorter in duration than open repair consuming 93min compared to 220min in open repair, which is in fact one of the major advantage which has to be considered in vascular patients as duration of the procedure has major role in the outcome of the patient.

Regarding blood loss and blood transfusion, only 13.3% of the EVAR group needed blood transfusion compared to 100% of the open surgical repair group, which shows that in the EVAR technique minimal amount of blood is lost during introduction and deployment of the device, which is Well-documented benefit of EVAR compared to conventional open surgical repair in all studies.[12]

Regarding the ICU stay; in this study it was found that EVAR group was shorter than the open surgical repair group in ICU stay, with ICU stay of 1-2 days versus 3-6 to open repair group which is also similar to other studies which showed that ICU stay is shorter than open repair as EVAR trial and Eurostar.[9,11]

Also EVAR group showed less hospital stay duration than open surgical repair group with stay of 1-2 days of the EVAR group versus 4-11 days to open repair which is also similar to other studies that shows EVAR needs less hospital stay than open repair.[13]

As regards re-intervention in the EVAR group there was thrombosis of one limb 12 hours later which was very tortuous treated by fem fem crossover, endoleak in one case, it was of type I endoleak and required aortic cuff in the same session and endoleak in 2 cases but it was of type II Endoleak and didn't require any intervention just for follow up. compared to 2 cases with retroperi-toneal haematoma manifested by marked hypotension and approved by ultrasound treated by surgical re-exploration so surgical evacuation was done and stitches were taken at the aortic anastomosis. Type II endoleaks occur frequently after EVAR, in up to 25-30% of patients. Type II endoleaks tend to be benign in nature carrying little potential for aneurysm enlargement and rupture. As such, most patients require follow up and observation only.[14]

Regarding arterial complications were equal, 2 cases in EVAR group and 2 cases in open repair group developed lower limb thrombosis on one side managed by fogarty thrombectomy.

Other studies show that the systemic complication is more with open surgical repair, a lower incidence of pulmonary complications with EVAR (2.9% versus 10.9%), hemorrhage (1.8% versus 3.4%), graft infection (0.6% versus 1.1%), and colonic ischemia (0.6% versus 1.1%).[15]

Regarding mortality; we had no mortality after EVAR, and we had 2 cases died after open surgical repair, one of them one week after the operation due to myocardial infarction and the other patient died 1.5 week after the operation due to haemorhge, DIC and multi-system organ failure. All other studies show that the mortality is much less in EVAR group than the open surgical repair group.[9]

Conclusion

EVAR compared to conventional surgery has some benefits, such as, lower hospital stay, ICU stay, blood loss, rates of hospital mortality, rates of complications &re-intervention, but EVAR requires training programs still unavailable in many vascular surgery centers. With proper patient selection, EVAR can effectively reach AAA repair goals. Training and improvement of the medical stuff influence outcomes following EVAR.

References

1. Teufelsbauer H,Prusa AM, Wolff K; et al.,, Endovascular stent grafting versus open surgical patients with infrarenal aortic aneurysms: apropensity score-adjusted analysis circulation, 2002; 106:782-7.
2. Thompson MM,Bell PR. ABC of arterial and venous disease: arterial aneurysms. BMJ, 2000; 320:1193-6.
3. Abu Rahma AF. Suggested standard for reporting on arterial aneurysm. J Vas Surg 2000; 31: 721.
4. Greenhalgh R. M., Brown L. C., Kwong G. P., Powell J. T. and Thompson S. Evar Trial Participants. Comparison of endovascular aneurysm repair with open repair in patients with abdominal aortic aneurysm (EVAR trial 1), 30-day operative mortality results:

randomised controlled trial. Lancet 2010,364 (9437) : 843-59.
5. Matsumura JS, Brewster DC, Makaroun MS, Naftel DC. A multicenter controlled clinical trails of open versus endovascular treatment of abdominal aortic aneurysm. J Vasc Surg, 2003; 37: 262-71.
6. Williamson WK, Nicoloff AD, Taylor LM Jr, et al., Functional outcome after open repair of abdominal aortic aneurysm. J Vasc Surg, 2001; 33:913.
7. Becquemin JP, Bourriez A, D'Audiffret A, et al., Mid-term results of endovascular versus open repair for alklominal aortic aneurysm in patients anatomically suitable for endovascular repair. Eur J Vasc Endovasc Surg, 2000; 19:656-61.
8. Buth J and Harris P. Endovascular treatment of aortic aneurysm, aortic aneurysm, Rutherford vascular surgery, Elsevier Saunders 2005; 101: 1454-62.
9. EVAR trial participants: Endo-vascular aneurysm repair versus open repair in patients with abdominal aortic aneurysm (EVAR trial 1): randomized control trial, Lancet, 2005; 365:2179-86.
10. Van Marrewijk CJ, Fransen G, Laheij RJF, et al., EUROSTAR Collabo-rators: Is type II endoleak after EVAR a harbinger of risk? Causes and outcome of open conversion and aneurysm rupture during follow-up. Eur J Vasc Endovasc Surg, 2005.
11. Buth J, Van Marrewijk CJ, et al., EUROSTAR Collaborators: Outcome of endovascular abdominal aortic aneurysm repair in patients with conditions considered unfit for an open procedure: A report on the EUROSTAR experience. J Vasc Surg, 2005; 35:211-221.
12. Jan-Peter van Kuijk, Willem-Jan Flu, and Don Poldermans: Comparing Endovascular and Open Repair of Abdominal Aortic Aneurysm JAMA. 2010; 303 (6):513-514.
13. Drury D, Michaelis J, Jones L et al., Systematic review of recent evidence for the safety and efficacy of elective endovascular repair in the management of infrarenal abdominal aortic aneurysm. Br J Surg, 2005; 92: 937-46.
14. Rosen RJ and Green RM: Endoleak management following endovascular aneurysm repair. J Vasc Surg 2008; 19:S37–S43.
15. Brewster DC, Jones JE, Chung TK, et al., Long-term outcomes after endovascular abdominal aortic aneurysm repair: the first decade. Ann Surg. 2008; 244: 426-38.