Report of Regional Single Center Experience of Endovascular Abdominal Aortic Aneurysm Repair at King Hussein Medical Center

Mamoun Al-Basheer MD, Jan Shishani MD*, Hazem Habob MD***

ABSTRACT

Objective: To present our experience with elective Endovascular Aneurysm Repair (EVAR) cases done at King Hussein Medical Center, Amman, Jordan.

Methods: This is a retrospective chart review of elective Endovascular Aneurysm Repair procedures done during the period of January 2004 to November 2010. One hundred seventeen patients (91 males and 26 females) with a median age of 71 (range 52 to 79) successfully underwent the procedure. Devices used included Endurant (Medtronic AVE, Santa Rosa, Calif), Zenith (Cook Inc, Bloomington, Ind), Talent (Medtronic), and Excluder (W.L. Gore, Flagstaff, Ariz). Configurations included, 113 (96.6%) aorto-bi-iliac, three (2.6%) aorto-uni-iliac with femoro-femoral crossover graft, and one (0.8%) straight tube graft. Most patients (n=85, 72.6%) scored 3/4 in the American Society of Anesthesia (ASA) scale and had significant comorbidities. CT angiography was the main imaging modality used in both preplanning stage and follow up. Primary outcome measures included overall mortality and freedom from aneurysm rupture. Secondary outcome measures included access site complications, graft limb complications, and endoleaks.

Results: No conversions to open surgical repair or ruptures occurred post graft implantation. A total of 14 (12.0%) patients underwent re-intervention most of which were for access site problems. These included wound hematoma treated conservatively (n=5, 4.3%), wound infection treated with drainage and antibiotics (n=3, 2.6%), and vessel dissection or occlusion needing surgical repair (n=2, 1.7%). Graft limb complications included occlusions needing femoro-femoral bypass (n=2, 1.7%). A total of 27 (23.0%) endoleaks were diagnosed: three (2.6%) were type I and were managed with ballooning and proximal extension in one case, 1(0.9%) type 3 managed with an iliac limb extension, and 23 (19.7%) type 2 endoleaks managed conservatively. The mean in hospital length of stay (LOS) was 3.1 days (range 2-7) while the mean follow up was 16.2 months (range 6-58). Overall patient mortality during the study period was eight (6.8%) patients while in hospital mortality was four (3.4%). All late deaths were aneurysm unrelated.

Conclusion: Endovascular Aneurysm Repair is technically feasible and effective in aneurysm exclusion and preventing rupture. It offers major advantages over open aneurysm repair including reduced early mortality, hospital stay, and use of intensive care facilities. However, issues of cost effectiveness and late mortality in our setting are still to be resolved.

Key words: Aorta, Aneurysm, Endovascular, Repair.

JRMS December 2012; 19(4): 19-23

*Vascular Surgery Unit, King Hussein Medical Center, (KHMC), Amman-Jordan
** Interventional Radiology Unit, (KHMC)
Correspondence should be addressed to Dr. M. Al-Basheer, KHMC, E-mail:Drbasheer30@yahoo.com
Manuscript received June 30, 2011. Accepted March 8, 2012

Introduction

Repair of aortic abdominal aneurysm (AAA) is performed to prevent progressive expansion and rupture.[1] The surgical repair first reported in 1962 remains the treatment with the best long-term results. It is a major surgical procedure done under general anesthesia, usually consisting of a mid-line laparotomy and cross-clamping of the aorta and the iliac vessels. Open surgery has non-negligible mortality (3-7%) and postoperative complications associated with along hospital stay (10.8 days average).[2]

Since first reported nearly 20 years ago, Endovascular Aneurysm Repair (EVAR) has been established as a safe and effective alternative to open surgical repair in the treatment of infra-renal AAAs.[3] Equated to the gold standard of open repair, EVAR, as a 'one-time procedure', substantially reduces operative morbidity, hospital stay, costs, and utilization of intensive care facilities if performed in a high-volume center.[4] With improvements in devices, the main problems with EVAR are being tackled. These include the need for follow up imaging and re interventions, endoleak, and late ruptures.

EVAR is best performed in specialized centers. Our vascular surgery unit is one of the few specialized centers in the region. We report our experience in EVAR of 117 cases of abdominal aortic aneurysm with short and medium term outcomes.

Methods

Between January 2004 and November 2010, 117 patients (91 male, 26 female) with a mean age of 71 (range 52 to 79) underwent EVAR at King Hussein Medical center, Amman, Jordan.

This is a retrospective review of data collected from patient charts and scans.

Devices used included: Cook Zennith (n=11, 9.4%), Gore excluder (n=3, 2.6%), Medtronic Talent (n=52, 44.4%), and Medtronic Endurant (n=51, 43.6%). Graft configuration was mainly modular bifurcated aorto-bi-iliac (n=111, 94.9%)) while a straight tube graft was used in one (0.9%) case and aorto-uni-iliac with femero-femoral cross over bypass was used in five (4.3%) cases. In five patients (4.3%) there was hypogastric artery involvement requiring coil embolization.

All procedures were performed by members of the vascular team including our interventional radiologist in the setting of a multidisciplinary team. All procedures performed prior to January 2007 were done in the operating room with C-arm imaging system while procedure planning involved spiral CT and angiography. All procedures done since were performed in an interventional suite using a Siemens imaging system while multidetector CT angiography was the preoperative imaging modality.

Patient demographics, graft, and procedure details were collected. The American Society of Anesthesia (ASA) scale was used in grading patient perioperative risk. All procedures were preplanned and performed on elective basis.

Earlier procedures were done under general anesthesia with bilateral femoral cut down. Our current practice and most of our procedures were done with transverse groin incision and when possible percutaneous contralateral access under regional anesthesia.

Intravenous heparin (80-100 Units per kilogram) bolus and prophylactic antibiotic were routinely administered early in the procedure. Graft implantation involves preliminary angiography, marking of renal levels for proximal landing and deciding on distal landing which was usually in the common iliac.

Following implantation of the graft components and ballooning of the fixation sites, angiography was again performed to ensure that an adequate seal was obtained. A type II endoleak (sac filling from branch vessels) at the conclusion of procedure was considered acceptable. Once an adequate technical result was obtained with no type I endoleak (inadequate seal), the arteriotomies and groin incisions were closed.

Outcome measures included overall survival and freedom from aneurysm rupture (primary) in addition to early and late complications including endoleaks (secondary). CT angiography was the main radiological modality used in the follow up of all cases.

Results are summarized as means and range for continuous variables while categorical data are summarized as counts or percentages. Aneurysm

Table I. Patient characteristics

Characteristic	Number (%)
Male sex	91 (77.8)
Tobacco use	105 (89.7)
Hypertension	65 (55.6)
Diabetes Mellitus	23 (19.7)
Coronary artery disease	68 (58.1)
Peripheral vascular disease	29 (24.8)
ASA* 2	32 (27.4)
ASA 3/4	85 (72.6)

*American Society of Anesthesia

Table II. Aneurysm characteristics

Characteristic	Mean (range)/ centimeters
Aneurysm diameter	6.2 (5.3-9.1)
Infrarenal neck length	1.7(1.3-2.9)
Infrarenal neck diameter	2.8 (2.4-3.8)

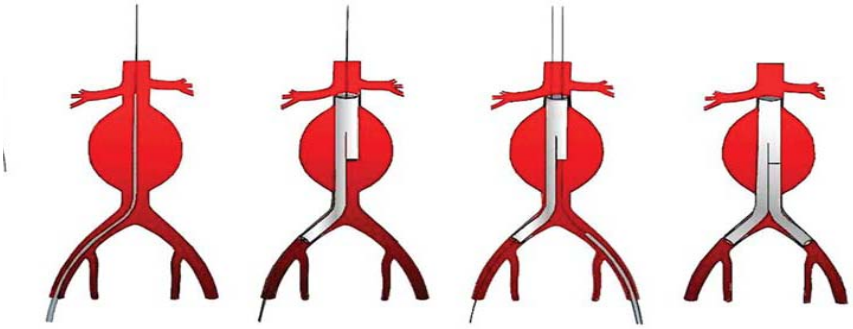

Fig. 1. Transfemoral exclusion of the aneurysm from the circulation

related outcomes were reported in accordance with the published standards. Follow-up involved a plain abdominal radiograph (antero-posterior and lateral views) prior to discharge; CT at 6 weeks, 6 months and then yearly; duplex ultrasound at 6 months intervals for sac expansion or substantial endoleak.

Results

Perioperative patient demographics, co morbidities, and ASA grade are presented in Table I, while aneurysm characteristics are presented in Table II.

The procedure was completed in all patients. Patient presentation was variable and included: asymptomatic aneurysm found incidentally on imaging for another reason in 84 (71.8%), vague abdominal and/ or back pain in 18 (15.4%), athero-embolization in 11 (9.4%), other in four (3.4%) patients.

Overall mortality was eight (6.8%) patients with four (3.4%) deaths within 30 days of the procedure and all prior to discharge from hospital (n=1 acute mesenteric ischemia, n=1 myocardial infarction, n=1 pulmonary embolus), and four (3.4%) late mortalities all of which were aneurysm unrelated.

No conversions to open aneurysm repair were undertaken and there were no late aneurysm ruptures. Graft limb occlusion needing fem-fem bypass graft was done in two (1.7%) patients.

Access site complications included: wound hematoma treated conservatively in five (4.3%), wound infection treated with drainage and antibiotics in three (2.6%), vessel dissection and or occlusion needing surgical repair in two (1.7%). A total of 27 (23.0%) endoleaks were diagnosed: three (2.6%) type I managed with ballooning in all cases in addition to proximal graft extension in one case, 1(0.9%) type III managed with an iliac limb extension, and 23 (19.7%) type II endoleaks managed conservatively (observed with early CT and later ultrasound). Of the type II endoleaks 15 (65.2%) had spontaneous resolution while eight (34.8%) are still being followed up. All patients with type two endoleaks are still alive and well despite non regression in aneurysm diameter in three (2.6%) patients.

A re-intervention was undertaken in 14 (12.0%) patients with most of these related to access site problems.

The mean LOS was 3.1 days (range 2-7). The mean follow up was 16.2 months (range 6-58) with all surviving patients having a minimum of six months postoperative follow up period.

Discussion

AAA accounts for 1.2% of male and 0.6% of female mortality, and the third most frequent cause of sudden death after coronary artery disease and stroke.[2,5,6] The incidence of the disease in the general population is 60/1000 inhabitants and between 1.8% and 6.6% in autopsy studies. In studies of natural history of AAA the rate of aneurysm rupture and death could exceed 60% within three years of the initial diagnosis.[7] The incidence of abdominal aortic aneurysms (AAA), treated both in elective and acute setting, has significantly increased over the past decade.[8]

As one of a few specialized vascular surgery units in the Middle East, we have noticed the marked increase in diagnosed aneurysms requiring treatment in our center. An aging population and smoking prevalence are mainly to blame, however the most important factor has been the prevalent use of diagnostic radiological modalities especially ultrasonography in health care institutions. This is reflected in our data by the fact that 72.9% of referrals for abdominal aortic aneurysm repair are from incidental findings of aneurysms during imaging for another reason.

Minimally invasive techniques (EVAR) have been developed in order to establish an artificial lumen for blood flow that excludes the aneurysm sac from systemic pressure and such protects from aneurysm rupture as shown in Fig. 1.[1,2,9]

The obvious advantages that reduce potential complications of aneurysm repair include absence of laparotomy and aortic cross clamping. The physiological stress of these two elements on patients is considerable.

Juan Parodi and colleagues performed the first endovascular aneurysm repair in Argentina in1990.[9] Two decades later, the technique has evolved immensely and new devices are being developed allowing a greater number of patients to be treated with EVAR.

EVAR is progressively replacing open surgery and now accounts for more than half AAA repairs in most vascular surgery units.[2,4,10] Since its introduction, EVAR multiple large clinical trials have confirmed the perioperative benefits of EVAR compared with open repair including lower surgical mortality rate.[11]

Although originally introduced for patients considered unfit for major surgery, EVAR has been used increasingly in patients judged fit for open repair (OR); results of randomized trials demonstrated that the 30-day mortality in such patients is around 3%.[9,12,13]

Although we had no open surgical repair controls for this group of patients, our early mortality rates at 3.4% for aneurysm repairs are comparable to published data. The late mortality was aneurysm unrelated and reflects the ASA stage of these patients.

Endoleaks occur when an aneurysmal sac continues to be pressurized despite endoluminal stent placement. There are a number of types of leaks: type I (leak at graft ends - inadequate seal), type II (sac filling via branch vessel e.g. lumbar), type II (leak through a defect in graft fabric), type IV (a generally porous graft), type V (endotension).[14-16]

Of note is our high rate of endoleaks, especially type II, comparative to recent published literature. This in part reflects our learning curve with the different graft types and configurations and in part due to our early agreed policy of accepting type II endoleaks unless there is aneurysm expansion on subsequent imaging. Recent literature show that percutaneous endovascular intervention for type II endoleak even with aneurysm sac growth does not appear to alter the rate of aneurysm sac growth, and the majority of patients display persistent/recurrent endoleak.[17] All other types of endoleak were dealt with ballooning and graft extensions as directed by the situation.

Patient criteria have been carefully selected regarding the anatomical suitability for endovascular repair and this is reflected in our low rate of re-intervention once access site problems were excluded.

The process of supply of grafts in our programme has not been optimal. It frequently involved a prolonged application process to an institutional committee which decides if grafts are bought or not. This also contributed to our relative long hospital stay where patients are frequently admitted during the initial application. Another factor contributing to hospital stay length include receiving patients from remote areas who lack the financial means for frequent

travel to our center and stay as inpatients until the care plan is finalized.

The required upfront payment of the price of the graft added to the difficulties of supply and is a relevant issue to most endovascular practices in developing countries. In comparison, surgical procedures pour into the local economy with payments distributed between the labor force and local material supply.

As reported previously, patients undergoing EVAR have been shown to have a higher quality of life in the short-term when compared with open repair.[18,19]

Quality of life analysis were beyond the scope of this publication however all of our patients were discharged home and most report reasonable early daily activity with no major limitations. Of note also is patient preference for the procedure once the benefits and risks of both EVAR and open repair explained.

Conclusions

EVAR is an integral part of aortic aneurysm management. Reduced early mortality and shorter hospital stay are great advantages especially in the setting of limited resources and expertise as is the case in our region. Issues of device supply, cost effectiveness and volume of practice are subject to further improvement.

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