Technical Aspects of Endovascular Aortic Aneurysm Repair

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Endovascular aneurysm repair (EVAR) has become an acceptable treatment option since its first introduction by Juan Parodi in the early 1990s, this minimally invasive approach underwent an intense refinement in technique and device design. This resulted in impressively lower morbidity and mortality in comparison with the traditional open repair.

Indication:

There is no data to support different indications for EVAR other than the one already established for open repair. Two prospective randomized trials: the United Kingdom Small Aneurysm Trial and the USA Veterans Affairs Aneurysm Detection and Management trial (ADAM trial), both showing no survival benefit of treating aneurysms between 4-5.5 cm in diameter over medical management. It is safe to follow these patients with Ultrasound or CT scans at 6 month intervals until the aneurysm reaches 5- 5.5 cm in diameter. Exceptions to this rule are: rapidly expanding aneurysm (greater than 0.6 cm in one year), and symptomatic aneurysms (back or abdominal pain).

Independent risk factors include: female patients, COPD, HTN, and smoking. Non-independent risk factors include family history, the ratio of the AAA diameter to the native aortic diameter, and the shape of the aneurysm.

Preoperative Imaging:

Spiral CT scan should be obtained with and without intravenous contrast and without oral contrast and collimated at 2 mm cuts. The non-contrast images help evaluate vessel calcification. Avoiding oral contrast reduces artifacts. A three dimension reconstruction of the scan provides an excellent tool for graft sizing and detailed evaluation of the anatomy.

Contraindications:

1. High grade stenosis or occlusion of the superior mesenteric and celiac arteries with the inferior mesenteric artery (IMA) providing essential collateral circulation to the bowel.
2. Neck angulation greater than 60 degrees. 3) Iliac arteries with severe calcification and tortuousity or with smaller than 7 mm diameter are associated with significant intraoperative complications. 4) Renal insufficiency is an obvious contraindication to intravenous contrast.

Device prescription:

There are 4 devices approved by the FDA in the US market. These are the Zenith (Cook, Bloomington, Indiana), Excluder (W.L. Gore, Flagstaff, Arizona), AneuRx (Medtronic, Santa Rosa, California) and Powerlink system graft (Endologix, Irvine, California).

Follow up:

Plain films AP, lateral and oblique views as well as duplex scans are obtained before discharge. Fine cut CT scan with and without IV contrast is obtained at one, six, and twelve months, and yearly thereafter.

Endoleak:

Type I Endoleak is defined as leakage around the proximal neck or the distal iliac end. Type II endoleak is the most common type, and is associated with patent inferior mesenteric (IIa) or lumbar artery (IIb). Type III endoleak is leakage from overlap sites (IIIa) or through a defect in the endograft material (IIIb). Type IV endoleak (Endotension) is when the sac continues to expand without any of the above described endoleaks on fine cut CT scan and angiogram.

Results:

Operative mortality has decreased to 1.7%. Respiratory and cardiac morbidity is less than 1%. Wound complications including infection, seroma and pseudoaneurysm are 1-3%. Long term follow up (15 years) showed a remarkable decrease in Endoleak and reintervention rate to 10% (from 20%). The majority of reintervention procedures are done percutaneously or through a small groin incision. Long term aneurysm-related mortality is 0.3%. Migration incidence (below or above the renals) is 20% vs. 5% respectively. Aneurysm-related mortality and rupture post EVAR is associated with migration much more often than with Endoleak. Each one millimeter the device is deployed away from the lowest renal artery is associated with 5% increase in future migration.

EVAR vs. Open repair:

EVAR is associated with 30-70% reduction in morbidity. The average length of hospital stay is reduced by 80%. This is not surprising given the following facts:
Avoiding aortic clamping results in significant reduction in cardiac strain and MI.
Reducing the blood loss by 70% (average EBL during EVAR is 200-300cc).
Avoiding the peritoneal cavity eliminates postoperative ileus and allows same day feeding. Small groin incision with minimal postoperative pain. Patient is discharged within 24 hours. Because patients have less incisional pain and can breath and walk much earlier than with open repair, with less intubation time, the incidence of postoperative respiratory complication (atelectasis, pneumonia) is very small.

Sexual dysfunction following EVAR is about 1% compared to 30-50% in open repair. This striking difference is mainly related to avoiding dissection along pelvic nerves.

The operative mortality is reduced from 4.7% (open repair) to 1.7% (EVAR) in two European prospective randomized trials: Endo-Vascular Aneurysm Repair trial (EVAR I), and The Dutch Randomized Endovascular Aneurysm Management trial (DREAM). The US open versus endovascular repair trial (OVER) is ongoing. The operative mortality of open repair is significantly increased in patients with chronic renal insufficiency, CHF, recent MI, COPD and in patients older than 75 year old.

The decision of first whether to treat the AAA or not and second of the open versus EVAR has to be made by a non-biased surgeon who is well experienced with both approaches. Also, patient and family members should be well educated the morbidity and mortality of each approach in order to actively participate in the decision-making process. The long term follow up and 10% incidence of endoleak and possible reintervention should be clearly understood by the patient. Proper patient selection for EVAR, preoperative planning and surgeon training would minimize the perioperative and long term morbidity and mortality.