Healthy Heart

Volume-8 | Issue-87 | February 5, 2017

Price : ₹ 5/-

Honorary Editor :
Dr. Urmil Shah

From the Desk of Hon. Editor:

Dear Friends,

Endovascular repair of the aorta, also referred to as endovascular aortic repair (EVAR), refers to a minimally invasive approach that involves placing a stent-graft in the thoracic or thoracoabdominal aorta for the treatment of a variety of aortic pathologies.

EVAR was initially used to provide treatment to patients who were not considered to be surgical candidates, but it is now the preferred technique for treatment given the improved risk profile compared with open thoracic aortic surgery.

The emergence of endovascular stent grafting as an alternative therapy to open surgical repair of abdominal and thoracic aneurysms is an exciting advance. It is a less invasive alternative to open surgery for the treatment of thoracic as well as abdominal (Especially below renal artery) aortic aneurysms, dissections, or rupture, and thus has the potential to reduce the morbidity of open surgery. Long term outcome (upto 15 Years) of open surgery and EVAR are comparable.

- Dr. Urmil Shah

Case 1- 55 year old male presented with Hypertension , Asymmetrical pulse and Chest Pain. BP difference of upper limb and lower limb was 40 mm of Hg. ECG showed mild Left Ventricular Hypertrophy (LVH) ,chest X-ray showed possible dilated descending aorta(Fig.1). ECHO showed severe co-arctation with gradient of 60mm of Hg and dilated aorta.

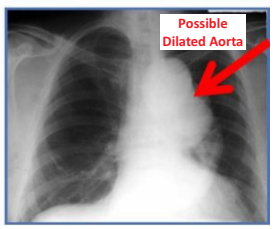


Fig 1 : Chest X-ray

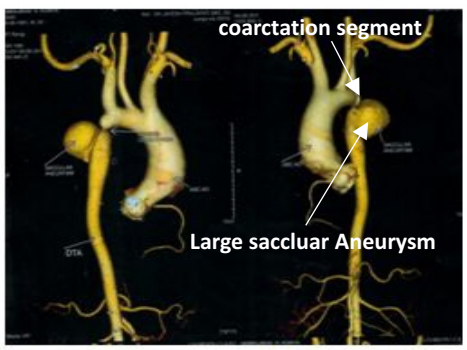


Fig 2: CT angio showing coarctationand large saccular aneurysm

CT angiography confirmed severe co-arctation with large secular aneurysm (Fig. 2)

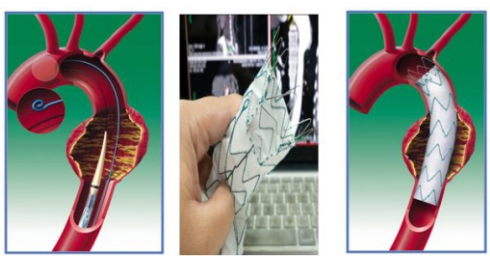


Fig 3: EVAR Procedure

So balloon dilatation of coarctation segment with endo placement of valiant stent - EVAR (Fig 3) was planned in this patient.

Successful balloon dilatation of coarctation segment and endo placement of Valiant Stent Graft done through right femoral arteriotomy. Procedure was completed in one and half hours. Precise

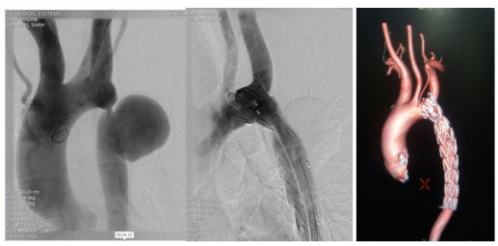


Fig 4

a) Pre-Prcedure b) Post-Prcedure c) Follow Up at 3 months CT Angio

placement of valiant endovascular stent graft procedure was done with help of aortic angiogram (4a) and Digital subtraction angiography (DSA) (Fig 4b) with no gradient across coarctation segment. Post procedure hospital course was uneventful.Patient was discharged on 2nd day. BP in both upper limb was 140 / 80 and in both lower limb was 146 / 86 mmHg. Echo showed 8 mm gradient across coarctation segment. Patient was discharged on amlodipine 5 mg bd, aspirin 75 mg, clopidogrel 75 mg.

At 3 month Follow-up BP in both upper limbs and in both lower limb were 130 / 80 mm Hg and 140/90 mm Hg respectively. He was continued with

amlodipine 5 mg bd and aspirin 75 mg daily. Follow-up CT Angio showed completely sealed aneurysm with no narrowing at co-arctation segment (Fig 4c).

Aortic Aneurysm

Aneurysm of aorta can be classified by their macroscopic shape and size and are described as either saccular or fusiform (Fig5).

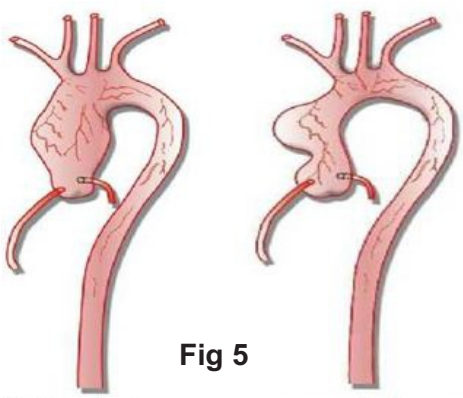


Fig 5

a) Fusiform Aneurysm b) Saccular Aneurysm

Saccular aneurysms are spherical in shape and involve only a portion of the vessel wall; they vary in size from 5 to 20 cm (8 inches) in diameter, and are often filled, either partially or fully, by thrombus. Fusiform ("spindle-shaped') aneurysms are variable in both their diameter and length; their diameter can extend up to 20 cm (8 in). They often involve large portions of the ascending and transverse aortic arch, the abdominal aorta, or less frequently the iliac arteries.

Etiologies

- Atherosclerosis
- Marfan's
- Type IV Ehlers-Danlos
- Infection (syphilis)
- Arteritis (giant cell, Takayasu, Behcet's)
- Trauma
- Congenital - Aberrant subclavian - Coarctation with aneurysm

Risk Factors

1. Age > 65 years
2. Peripheral vascular disease
3. Smoking
4. Chronic obstructive pulmonary disease (COPD)
5. Hypertension
6. High Body Mass Index (BMI)
7. Family history of aneurysms (up to 20% / more common with thoracic aneurysms)

In addition, less frequent genetic syndrome like Marfan and Ehlers-Danlos syndromes, collagen vascular diseases, and mycotic aneurysm are associated with aortic aneurysm.

Epidemiology

Although findings from autopsy series vary widely, the prevalence of aortic aneurysms probably exceeds 3-4% in individuals older than 65 years.

Genetic Syndromes Associated With Aortic Aneursym

Genetics Syndrome	Common Clinical Feactures	Genetic Defect
Marfan Syndrome	Skeletal features,Ectopia lentis Dural ectasia	FBN1 mutations*
Loeys-Dietz syndrome	Bifid uvula or cleft palate Arterial tortuosity, Hypertelorism Skeletal features similar to MFS Craniosynostosis Aneurysms and dissections of other arteries	TGFBR2 or TGFBR1 mutations
Ehlers-Danlos syndrome, vascular form	Thin, translucent skin Gastrointestinal rupture Rupture of the gravid uterus Rupture of medium-sized to large arteries	COL3A1 mutations
Turner syndrome	Short stature Primary amenorrhea Bicuspid aortic valve Aortic coarctation Webbed neck,low-set ears,low hairline,board chest	45,X karyotype

Death from aneurysmal rupture is one of the 15 leading causes of death in most series. The overall prevalence of aortic aneurysms (AA) has increased significantly in the past 30 years. This is partly due to an increase in diagnosis based on the widespread use of imaging techniques. However, the prevalence of fatal and nonfatal rupture has also increased, suggesting a true increase in prevalence. Population-based studies suggest an incidence of acute aortic rupture of 3.5 per 100,000 persons.

Presentation

- Most asymptomatic
- Superior vena cava syndrome
- Hoarseness
- Bronchial obstruction
- Dysphagia
- Hemoptysis
- Paralysis/paraplegia
- Lower extremity embolism
- Dull abdominal pain / dyspepsia

Average growth of aneurysm is 0.2 cm per year - faster when size of aneurysm is big. Annual surveillance is recommend when size of aneurysm is < 4 cm whereas bi annual when size of aneurysm > 4 cm. Aortic size is a very strong predictor of rupture, dissection, and mortality. At aortic sizes of 6.0 cm or greater, there is a marked step up in the average yearly rate of complications (rupture or acute dissection) to 6.9% per year (Fig 6).

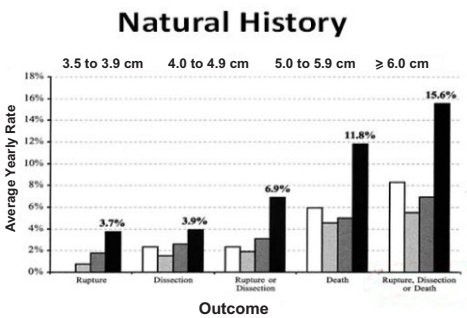


Fig 6: Average yearly rates of negative outcomes (rupture, dissection, and death).

At size greater than 6.0 cm, the odds ratio for rupture increases 27-fold (p = 0.0023).

Medical Treatment :

1. Stringent control of hypertension, lipid profile optimization (target LDL cholesterol of less than 70 mg/dL), smoking cessation, and other atherosclerosis risk-reduction measures should be instituted for all patient with aneurysm.

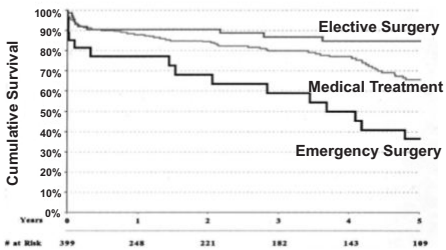
2. Antihypertensive therapy should be administered to hypertensive patients with aortic diseases to achieve a goal of less than 130/80 mm Hg to reduce the risk of stroke, myocardial infarction, heart failure, and cardiovascular death. Beta blockers and angiotensin-converting enzyme inhibitors or angiotensin receptor blockers should be given to the highest point patients can tolerate without adverse effects.

3. Beta adrenergic–blocking drugs should be administered to all patients with Marfan syndrome and aortic aneurysm to reduce the rate of aortic dilatation unless contraindicated. An angiotensin receptor blocker (losartan) is reasonable for patients with Marfan syndrome, to reduce the rate of aortic dilatation unless contraindicated.

As might be expected, a larger aneurysm carries a higher risk of rupture and ensuing morbidity and mortality even when treated promptly. A smaller aneurysm still carries a risk of rupture, but the risk is so small that elective repair is not indicated, despite the low incidence of complications from such treatment. The UK Small Aneurysm Trial showed that aneurysms smaller than 5.5 cm do not benefit from early intervention as compared with those larger than 5.5 cm.

Elective intervention carries less risk and better outcome compared to emergency intervention so elective inervention is always preferred (Fig 7).

Fig. 7 Natural History



kaplan-meier cumulative survival

Indications for Intervention

- Aortic size
  - Ascending diameter >5.5 cm
  - Descending diameter >6.5 cm
  - Growth rate >1 cm/yr (avg ascending 0.07 cm/yr; descending 0.19 cm/yr)
- Symptomatic aneurysm
- Traumatic rupture
- Pseudo-aneurysm
- Large saccular aneurysm
- Mycotic aneurysm
- Aortic co-arctation
- Bronchial compression
- Aorto-bronchial or aorto esophageal fistula

Intervention option

- **Endovascular stent grafting (EVAR)**

For patients with degenerative or traumatic aneurysms of the aorta exceeding 5.5 cm, saccular aneurysms, or postoperative pseudoaneurysms, endovascular stent grafting should be strongly considered when feasible.

- **Open repair**

For patients with chronic dissection, particularly if associated with a connective tissue disorder, but without significant comorbid disease and aortic diameter exceeding 5.5 cm, open repair is recommended.There are several complications that can be associated with open repair. Certainly, there's an increased risk of death associated with the surgical procedure. There's a risk of paraplegia. There's certainly a risk for bleeding and risk for neurologic complications and a risk of intraabdominal complications.

With endovascular repair there is often a quicker recovery because all you have is a small groin incision. There is certainly less risk of bleeding and less risk of wound complications and there has been some data to suggest that there is a lower paraplegia risk compared to open surgical repair.

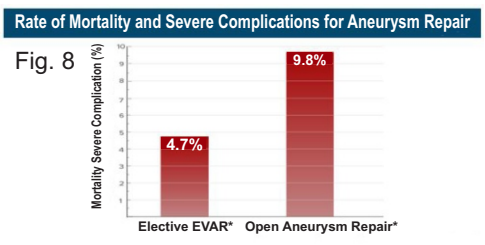


Fig. 8

The combined rate of operative mortality and severe complications was 4.7% for EVAR and 9.8% for open repair (Fig. 8).

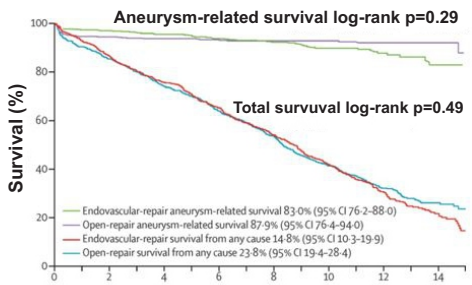


Fig. 9 **Time since randomization (years)**

Kaplan-Meier estimates for total survival and aneurysm-related survival up to 15 years of follow-up. The hazard ratio is 1•05 (95% CI 0•92–1•19) (Fig 9) for total mortality, and is 1•24 (0•84–1•83) for aneurysm-related mortality. Long-term outcomes of EVAR have been studied through large registries such as

EUROSTAR; the annual rate of reintervention for stent-graft–related problems is approximately 5%, and the annual risk of rupture after implantation is approximately 1%.

Case 2- Here is a case of 45 years old patient who had abdominal pain 2 to 3 months Patient had history of CNS (central nervous system) bleed which was fully recovered.

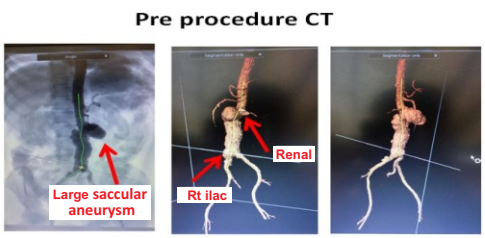
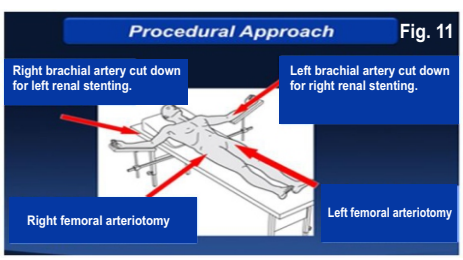
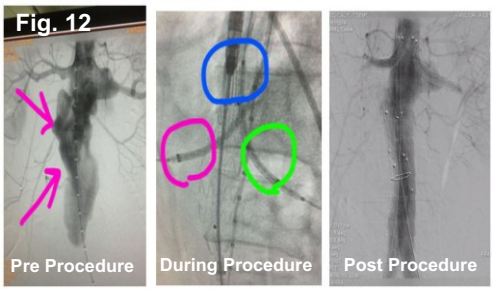


Fig. 10

Multi slice CT Angiography of aorta showed anomaly in aortic arch, fusiform abdominal aortic aneurysmal of renal and infra renal abdominal aorta, saccular abdominal aortic aneurysm from fusiform dilated abdominal aorta at level of renal arteries, saccular aneurysm from inferior aspect of right renal artery, fusiform aneurysm of left renal artery (Fig 10). Endovascular Aneurysm (EVAR) repair was planned. CAG showed coronary artery disease, aneurysmal coronaries, occluded OM, aneurysmal of abdominal aorta involving renal artery. Successful EVAR of Abdominal Aortic aneurysm with bilateral renal chimney graft done through both femoral arterotomy and both brachial access.(Fig 11 and 12)



Patient was discharged on 3rd day in hemodynamically stable condition.



Up to 30% to 40% of patients are unsuitable anatomic candidates for conventional endovascular aneurysm repair (EVAR), most commonly due to challenging proximal aortic neck anatomy and renal artery involment.

Techniques Option for aneurysm repair when renal artery is involved

Techniques for aneurysm repair include Open repair, Hybrid repair, Chimmney/Snorkel technique, In-suit fenestration, Custom fenestration.

SNORKEL/CHIMNEY EVAR Technique

The chimney technique in endovascular aortic aneurysm repair (Ch-EVAR) involves placement of a stent or stent-graft parallel to the main aortic stent-graft to extend the proximal or distal sealing zone while maintaining side branch patency. This technic was used in case 2.

Fenestration/Scallop (FEVAR)

Endograft with circular (fenestration) and semicircular (scallop) holes corresponding to aortic branch to maintain renal artery patency.

Annual screening with the help of ultrasography (very reliable) is recommended in patients with abdominal aortic aneurysm when size of aneurysm > 4cm. especially in elderly individual.

Out of all abdominal aortic aneurysm 80% are below renal. EVAR in below renal artery aneurysm is relatively easy.

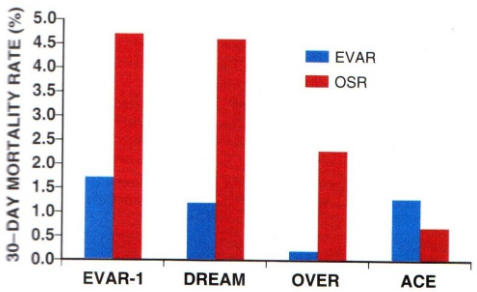
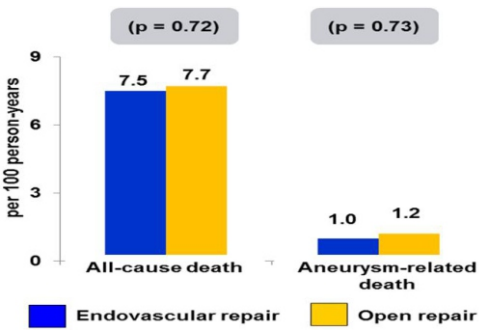


Fig 13 - Comparison of EVAR with open repair of abdominal aneurysm

EVAR is associated with less 30 day mortality compared to open repair (Fig 13). Long term outcome (15 years) with EVAR is equal to open repair (Fig 14).



Conclusion

Endovascular Aortic Repair (EVAR) is considered to be first line treatment for descending aortic aneurysm, infra renal abdominal aneurysm, selected cases of supra renal aneurysm with suitable anatomy as EVAR is associated with less 30 day mortality and equal long term outcome compared to open repair.

As there is high mortality associated with aneurysm rupture annual screening is highly recommended in all the patient with aneurysm when size of aneurysm is big. Planned intervention/surgery is better then emergency surgery.

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Healthy Heart

Volume-8 | Issue-87 | February 5, 2017

Healthy Heart Registered under RNI No. GUJENG/2008/28043
Published on 5th of every month
Permitted to post at PSO, Ahmedabad-380002 on the 12th to 17th of every month under
Postal Registration No. GAMC-1725/2015-2017 issued by SSP Ahmedabad valid upto 31st December, 2017
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Printed, Published and Edited by Dr. Keyur Parikh on behalf of the CIMS Hospital
Printed at Hari Om Printery, 15/1, Nagori Estate, Opp. E.S.I. Dispensary, Dudheshwar Road, Ahmedabad-380004.
Published from CIMS Hospital, Nr. Shukan Mall, Off Science City Road, Sola, Ahmedabad-380060.