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Endovascular aortic reconstruction surgery

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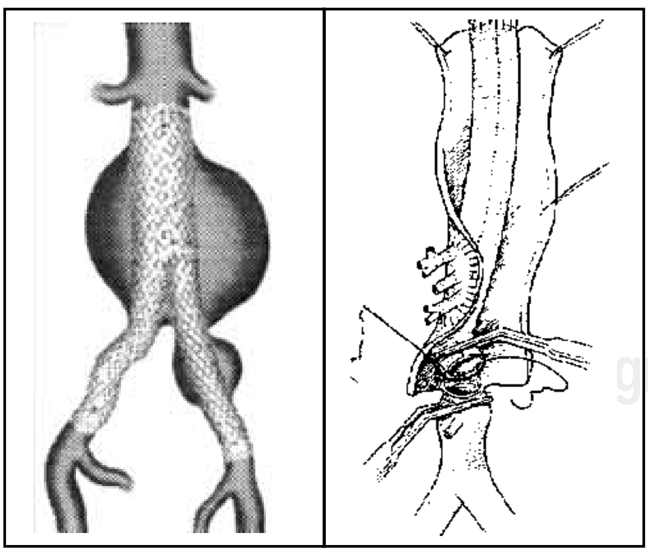
The conventional treatment of AAA is open repair, but a new minimally invasive method that was first suggested for higher risk patients, is gaining popularity. The graph on the right represents the yearly infrarenal AAA repair in our hospital between 1996 and the year 2000. The number of stent repair is growing exponentially at these years and it is has been moreso recently.

Today, the operation is not reserved exclusively for the high-risk patients but is suggested for all patients. Historically, the following are some of the landmarks that evolve in vascular surgery:

- 1951 - Dubost does first AAA resection
- 1955 - Crawford begins modern age AAA surgery
- 1969 - Endovascular grafting experiments
- 1988 - US patent for device approved
- 1991 - Parodi - first clinical experience[1]
- 1993 - First device implanted in US-trials

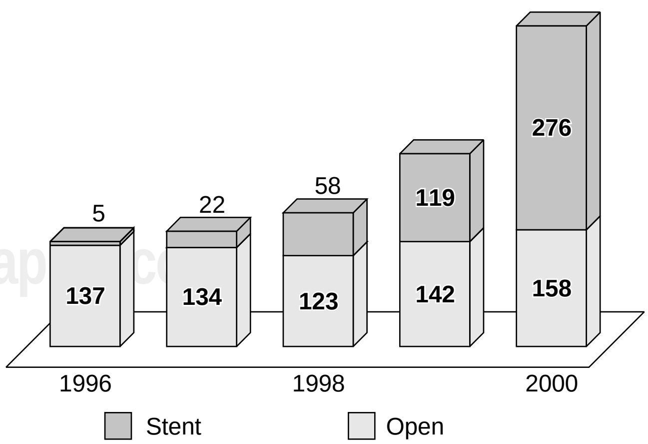


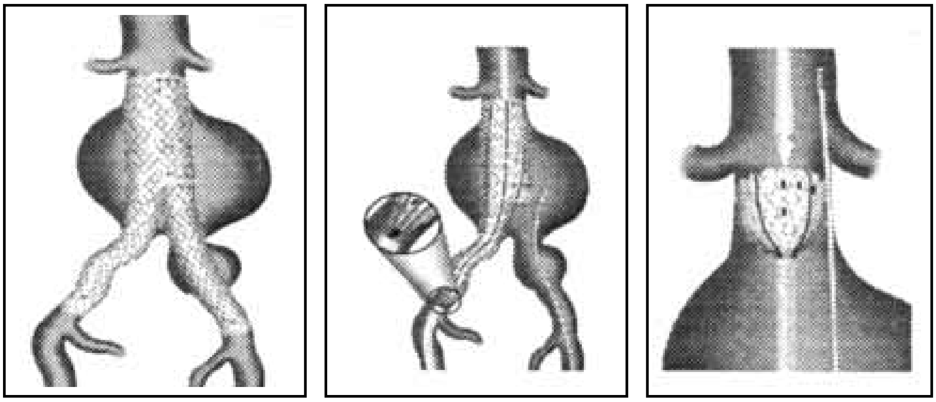
SURGICAL PROCEDURE

Involves an endovascular approach. The stent/graft is deployed from a remote arterial site, mostly the femoral artery at the groin. If a bifurcated graft is used, a second limb is deployed from the controlateral femoral artery. There are special surgical considerations in the choice of the graft, including aortic diameter and length of the 'neck' between the renal arteries and the aneurysm. The latest requirement is modified by newer experimental fenestrated stents.

ANESTHESIA CONSIDERATIONS

Patient's considerations are similar to the patients that are undergoing the open procedure. Detailed system evaluation and studies should be performed with an emphasis on the cardiovascular, renal and respiratory systems. Due to the risk of bleeding or the potential need for immediate conversion to open operation, the surgical and anesthetic preparations, are done as if it is going to be an open repair. Arterial line, central venous line and good intravenous access are used. As far as the anesthetic techniques of choice for endo-





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vascular AAA repair, early literature suggested general anesthesia due to high conversion to open technique and patients position. Local injection with sedation may not provide optimal conditions. Regional neuraxial anesthesia is our technique of choice either epidural or continuous spinal anesthesia. In our preliminary results in 136 patients, we reported less fluid, less blood loss and shorter procedure when neuraxial anesthesia was utilized[2] (Table I).

Table I. Endovascular repair under general *vs* regional anesthesia.

Variable Anesthesia	Endovascular General N = 30	Stent Epidural N = 106	p value (F)
EBL (L)	0.75 (0.3, 1.2)	0.4 (0.3, 0.7)	0.022
Blood (L)	0 (0, 375)	0.4 (0.3, 0.7)	0.48
Fluid (L)	3.4 (2.6, 4.0)	2.6 (2.0, 3.78)	0.039
Surgery (min)	226 ± 104	185 ± 64	0.046
Death	1 (3%)	0 (0%)	0.22
LOS (days)	2 (1, 3)	2 (1, 3)	0.32

EBL, estimated blood loss; RBC, red blood cell; LOS, length of stay; Values are as mean ± SD or median with interquartile range. F = Fishers exact

Table II. OAAA vs EAAA-outcome n = 138.

Variable	Open AAA N = 37	EAAA N =138	P- value W = Wilcoxon
EBL (L)	2.0 (1.0, 3.2)	0.4 (0.3, 0.9)	0.0001 (W)
Blood (L)	0.72 (0, 1.1)	0 (0, 0.33)	0.0001 (W)
Fluid (L)	8.45 (6.9, 11.0)	2.7 (2.0, 3.9)	0.0001 (W)
	8.71 ± 2.98	3.13 ± 1.46	
Surg (min)	443 ± 148.8	194 ± 76	0.0001 (W)
Mortality	2 (5%)	1 (1%)	0.12 (F)
Hosp (days)	8 (7, 9)	2 (1, 3)	0.0001 (W)

Values are reported as mean ± SD or median with interquartile range.

In general, endovascular stent-grafting offers a less invasive surgery that allows use of local, regional or 'minimal' general anesthesia. In most cases there is no aortic clamp involvement and therefore there are potentially less hemodynamic or metabolic complications[3-5].

OUTCOME

In our first series of 138 patients[6] that underwent endovascular aortic aneurysm repair, we described a faster ambulation, early discharge and less cost. There were also a significant improvement in morbidity and hospital length of stay, but no difference in mortality between these patients and 37 matched patients who had open aortic surgery (Table II).

Others[7-10] described similar findings. Becquemin[7] reported a decrease in cardiac-pulmonary morbidity (6.9% *vs* 19.6%) and an increase in 1st year survival (96% *vs* 82%). Chuter[8] describes a decrease in time to recovery: normal diet resumed in average of 0.58 days, ambulation in 1.22 days and mean discharge from the hospital was at 3.63 days.

Other complications were also less frequent with endovascular operation. Our met-analysis report of 313 endovascular patients was presented at the last meeting of the American Society of Anesthesiology[11]. We found lower cardiac and respiratory morbidity, less stroke and decrease incidence of renal complications (Table III). But, at this group, graft leaks and the need for additional surgeries were discouraging.

The need to convert to open surgery can happen in 2-20% of endovascular surgery. Pooled data suggest incidence of 9%, and more recent data describe < 2% incidence for conversion. Nevertheless, the mortality with conversion can reach

Table III.

(n = 313) Total	n	%		n	%
Cardiac morbidity	92	29	Groin hematoma	4	1.3
Dysrhythmias	9	2.9	Bleeding	1	0.3
Angina	2	0.6	Occlusion	1	0.3
ECG Changes	14	4.5	Graft thrombosis	5	1.6
Vasoactive drugs	67	21	Graft leaks	30	10.5
ARDS	2	0.6	Additional surgeries	99	41
ARF	11	3.5			
Stroke	1	0-3			

Table IV.

Complication of endovascular CCF, (n-703)	n	%
• Aneurysm death (< 30 D)	12	1.7
• Secondary surg	104	14.8
• Endoleaks	162	23
• Conversion	12	1.7
• Stent migration	25	3.6
• Graft limb occlusion	19	2.7

45%, making it a significant complication. The most frequent reason for conversion was persistent endoleak (> 50%).

Our endovascular surgical experience was just shared in publication this year by Ouriel colleagues[12] (Table IV).

Surgical mortality being the same, endovascular repair has been criticized on the basis of inferior long-term outcome. Secondary procedures may be necessary to address durability issues such as migration, high-pressure endoleaks, graft limb thrombosis and degeneration of the stent-fabric structure itself, issues that may compromise the primary goal of aneurysm repair, protection from rupture.

In conclusion, this is the way of the future. This procedure is evolving and anesthetic techniques must evolve with it. Keeping always a contingency plan for worst case scenario or acute conversion. Endovascular repair was found to protect from aneurysm rupture and death, and it satisfies many of the objectives for minimally invasive procedures. It is superior to open procedure but has questionable durability and high rate of secondary procedures that can impact on patient satisfaction. Newer devices and better experience might reduce the rate of secondary procedures and complications.

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