Endovascular Aortic Aneurysm Repair — Five Years Down the Road: Where to Now?

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In addressing the topic, “Endovascular Aortic Aneurysm Repair — Five Years Down the Road: Where to Now?”, it is necessary to consider what has been achieved to date.

Following the first report on the feasibility of endovascular repair of abdominal aortic aneurysms (AAA) by Parodi, et al. in 1991,1 we commenced a program using a modification of his method in May 1992. By the following year, White, et al.2 had developed a non-stented endograft and the first commercially produced endograft was available for clinical trials (Endovascular Technologies, Menlo Park, New Jersey).3, 4 The early prostheses required 24 Fr internal diameter introducing sheaths which were relatively inflexible. In general, they were anchored by metallic stents attached to the ends of the fabric grafts. Endografts were initially tubular in configuration and later aorto-uni-iliac and one-piece, bifurcated construction.

Increasing clinical experience and improvements in technology led to the development of second generation devices.5 These used smaller diameters and more flexible introducing sheaths and consisted of fabric grafts supported throughout their length by a self-expanding metal frame to minimize kinking and twisting. One-piece bifurcated endografts were replaced by modular ones.

We present here our experience over a five and one-half year period and make some observations, on this basis, for the future direction of endovascular AAA repair.

MATERIALS

Between May 1992 and December 1997 the endoluminal method was used for primary repair of AAA in 198 patients. There were 182 males and 16 females with a mean age of 72 years. Seventy patients had comorbidities sufficiently severe to lead to the patient being rejected for open aneurysm repair.

Operative technique. The procedures were performed in the operating room with the patient draped and prepared for open operation in the event of failed endoluminal repair. Access was gained through the common femoral artery or the iliac arteries via an extra-peritoneal approach. Fluoroscopy was used to deliver and deploy the endograft. Sizing of the endograft was based on pre-operative, contrast-enhanced, computed tomography (CT) and aortography. The configuration of the endografts is summarized in Table 1. An on-table, post-procedure angiogram was obtained in all patients.

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Follow-up. Follow-up consisted of physical examination and contrast-enhanced CT within one week of the operation, at 6, 12 and 18 months after the operation, and annually thereafter.

RESULTS

Successful endoluminal repair was achieved in 181 of 198 patients (91%). The remaining 17 patients required primary conversion to open repair at the original operation. Nine patients required secondary conversion on a subsequent occasion for: persistent endoleak (six patients); inadvertent covering of the renal arteries with the endograft (two patients); and increasing size of AAA in the absence of endoleak in one patient. Life table analysis of a smaller group of consecutive patients with AAA treated by the endoluminal method revealed a graft success probability of 73% at 4 years (Figure 1).

Analysis of the outcome according to the configuration of the endografts revealed a significantly larger number of failures with tube compared with non-tube (bifurcated and tapered aorto-uni-iliac) configuration using Fisher’s Exact Test. Life table analysis by log rank test did not reveal a significant difference, despite widely divergent Kaplan-Meier curves, due to the disproportionately greater number of tube endografts early in the study and bifurcated grafts later in the study (Figure 2).

DISCUSSION

The generally accepted benchmark diameter of AAA at which repair is indicated is 5 cm. Historically, this figure was arrived at as the crossover point where the risk of rupture exceeded the risk of open surgical AAA repair. The risk of endoluminal repair of the AAA in a group of patients in whom high-risk patients have been excluded may be as low as 0.8%, as we report in this paper. It is tempting, therefore, to reduce the minimal diameter at which endoluminal AAA repair may be undertaken. This is particularly true since the chances of an AAA being suitable for endoluminal repair are inversely related to the diameter of the aneurysm. The problem with a policy that offers endoluminal repair to patients with a small AAA is that the long-term outcome for this method of repair is unknown.

It seems likely, however, that there will be increasing acceptance of the endoluminal method of repair as long-term (10 year) follow-up becomes available. If this prediction is correct, patients with small diameter...
AAA (≤ 4.0 cm) may become eligible for treatment. Many, but not all, may be suitable for endoluminal treatment. Of those who are suitable for endoluminal repair, 4 out of 5 may be suitable for a tube endograft.

We may well observe, therefore, a paradoxical situation with tube endografts. Every effort was expended to identify patients suitable for tubular endograft repair in the early days of using this method, because this was the only configuration of prosthesis available. Subsequently, vascular surgeons became aware that the outcome following repair with tubular endografts was inferior to aorto-uni-iliac or bifurcated endografts. This was largely due to poor patient selection wherein tube endografts were deployed in patients with distal necks of inadequate length. Provided the distal neck is in the 2–2.5 cm range, it is highly likely that tube endografts will prove to be as durable as non-tube configurations. In addition, tube endografts are largely free of the complications of kinking and twisting with resulting thrombosis that may occur in the limbs of non-tube configurations. Thus, properly selected small aneurysms with adequate proximal and distal necks may well be treated in the future with tube endografts on a day-only admission basis in much the same way that occlusive arterial disease is currently treated with stents. These changes and potential changes in the usage of tube and non-tube configurations are represented graphically in Figure 3.

Much interest and research effort is centered around the relationship of the genetic make-up of individuals and their susceptibility to aneurysm formation. If the likelihood of developing an abdominal aortic aneurysm was known, it is a logical extension of the treatment of small aneurysms to offer treatment with tube endografts to genetically susceptible patients in order to prevent aneurysm formation. This may seem a little radical by current standards, but for this meeting the IAGS presenters were instructed to look into the future even if it proves to be provocative.

Technological advances are inevitable in both the imaging and the prostheses used for endoluminal repair. Intravascular ultrasound incorporated into the delivery system and aortoscopy both hold hope of avoiding the risk of irradiation and contrast nephrotoxicity associated with fluoroscopy. Methods for obtaining a better seal between the native artery and the endograft and better case selection should greatly reduce the incidence of endoleak. Similarly, a better method of anchoring endografts should eliminate migration. The threat of natural dilatation of the proximal neck not being arrested by endoluminal repair has been largely laid to rest by the long-term follow-up of Parodi’s early patients, which now extends up to 7 years. 7

REFERENCES

7. Parodi JC. Personal communication.

PANEL DISCUSSION

GERALD DORROS: The biggest problem we face is in knowing the long-term outcome. Data showing that the occurrence of endovascular leaks will continue to enlarge through collateral flow is our biggest problem in knowing whether or not this procedure will endure. Perhaps the use of spiral CT and MR will enable us to follow them. Presently, although these conclusions are in concert with what we talk about at the table, the data is still not in and this is really the appropriate method for a patient who is a good surgical candidate. These patients have to be followed and the long-term data is really what is most important.
JAMES MAY: Yes, I agree with Dr. Dorros. I think that we certainly need to see what the information is over 10 years because our own figures are insufficient to enable us to make those decisions at the moment.

GERALD DORROS: It is interesting that our radiology colleagues often look at the spiral CT, take a slice and conclude that the aneurysm is bigger or smaller. That has no bearing upon it because the volume of the aneurysm is the important thing — we now use 3-D spiral CT to create models, which tell us if the aneurysm is growing or not. There was an elegant presentation by the people from Rotterdam at the December symposium in Sydney talking about collateral flow, which is not really detected unless you do the spiral CT correctly and have delayed filming. There is a lot we don’t know; however, the most important thing to realize is that patients who die from this procedure die from rupture. We don’t know why this happens, but we need to know more before we tell a 40 or 50 year old that this is the way to go.