Endovascular “repair” of abdominal aortic aneurysm and iliac artery aneurysm

WILLIAM P. SHUTZE, MD,1 GREGORY J. PEARL, MD,1 BERTRAM L. SMITH, MD,1 WILSON V. GARRETT, MD,1 CLEMENT M. TALKINGTON, MD,1 EDIC STEPHANIAN, MD,1 DENNIS R. GABLE, MD,1 CHET R. REES, MD,2 FRANK J. RIVERA, MD,2 STEPHEN P. LEE, MD,2 AND NORMAN G. DIAMOND, MD2

1Division of Vascular Surgery and 2Department of Radiology, Baylor University Medical Center, Dallas

Endovascular aneurysm repair is currently being developed as an alternative to traditional surgical repair for patients with abdominal aneurysms. The divisions of vascular surgery and interventional radiology are involved in a cooperative effort to develop, test, and implant the devices used for endovascular aneurysm repair. In the past 2 years, 15 patients have received endovascular aneurysm repair at Baylor University Medical Center. This report reviews the evaluation protocols, surgical devices, and methods used, as well as the results and complications, in our early experience with endovascular aneurysm repair.

In the USA, there are approximately 15,000 deaths annually due to ruptured abdominal aortic aneurysms (AAA). For this reason, >45,000 elective AAA repairs are performed each year (1). The standard operation for AAA is relatively safe, with a mortality rate <3% (2). However, in 1991 Parodi changed the landscape of traditional AAA repair by performing the first successful endovascular procedure (3). He sutured a Dacron graft over a balloon-expandable stent and inserted this device into an AAA via a femoral arteriotomy, successfully excluding a large AAA in a high-risk patient. The potential advantages of endovascular AAA repair include reductions in mortality, morbidity, hospital stay, intensive care unit utilization, discomfort, recovery time, and cost.

METHODS

Patients

Between October 25, 1996, and September 15, 1998, 15 patients underwent endovascular aneurysm repair. Thirteen patients had AAAs repaired, and 2 patients had iliac artery aneurysms treated. These patients ranged in age from 57 to 87 years (mean, 75 years). The sizes of the aneurysms ranged from 4 cm to 7.2 cm (mean, 5 cm). The preoperative evaluation consisted of a baseline physical examination and ankle brachial index measurements; a spiral contrast–enhanced, thin-cut (3-mm) computed tomographic scan (Figure 1); and a diagnostic aortogram performed with a specially marked catheter. Patients were excluded from endovascular repair if they had any of the following characteristics: ruptured aneurysm, serum creatinine >1.7 mg/dL, pregnancy, coagulopathy, infection,
contrast allergy, heparin antibody, or horseshoe kidney. Several morphological criteria were used to exclude patients as well. These criteria were a proximal aneurysm neck <15 mm in length or a proximal aneurysm neck with severe angulation, extreme iliac artery tortuosity or size (small or large), or the need to obstruct all of the internal iliac artery flow for AAA exclusion. Patients with a patent inferior mesenteric artery that was necessary for bowel viability also were omitted. Almost 100 patients were evaluated for endovascular repair during this 2-year period.

Device implantation

All implantations were performed in the operating room with adjunctive radiological imaging after the patient had been prepared for a standard AAA repair. A surgical cutdown in the groin provided access to the femoral artery through which the endovascular devices were inserted. If contralateral femoral access was needed, a percutaneous sheath was placed. Eleven of the implants used commercial devices as part of a phase I Food and Drug Administration–approved trial (Figure 2). Four other devices were made using available materials already approved for human implantation as per Dake et al (4) (Figure 3).

Endografts were successfully deployed in all 15 patients, and primary aneurysm exclusion was achieved in 14 patients. There were no perioperative deaths; only one patient went to the intensive care unit. The mean hospital stay was 2.5 days. Operative complications encountered were a single wound infection and one failure of aneurysm exclusion due to an early perigraft leak into the AAA (a so-called “endoleak”).

Follow-up

Patients were seen in follow-up intervals of 1, 3, 6, and 12 months. Plain-film abdominal x-rays (Figure 4), duplex sonograms, and computed tomographic scans were done as part of the follow-up process to evaluate the endoprosthesis and aneurysm sac for intactness, exclusion, endoleak, sac enlargement, and device migration. Except for one patient who was 2 years out from endografting, all patients were within 1 year of their implant dates. Late complications consisted of one patient who had recurrent graft-limb thrombosis and one who had a delayed endoleak due to a patent inferior mesenteric artery. The patient with the early endoleak underwent successful placement of another iliac stent graft that corrected the problem. The patient with the late endoleak underwent successful laparoscopic inferior mesenteric artery ligation to correct the leak. The patient with the occluded graft limb is doing well with minor claudication symptoms. No device migration, sac enlargement, or other complication has been detected.

DISCUSSION

Interest in and acceptance of endovascular AAA repair have been growing over the past 5 years with >2000 worldwide implantations. Nine main types of endografts are being studied at this time, all of which are fairly similar, with a few subtle and perhaps some important
differences (5). All but one of these require a femoral arteriotomy to introduce the endograft, and all share the same goal—aneurysm exclusion and secondary thrombosis of the aneurysm sac around a patent graft.

With each device, there is a learning curve during which the complication rate falls. The overall success of endovascular aneurysm repair is in the 90% to 95% range. The conversion rate to the standard open AAA repair is 5%. The mortality of conversion operations is twice as high as that of routine elective AAA repair. Whereas 5% to 10% of patients (40% in one study) will have early endoleaks, over one half of these will seal spontaneously in the first 6 months after implantation. Many of the remaining unsealed leaks can be repaired with a secondary, minor endovascular procedure. Despite this, a few additional patients may ultimately return to standard open AAA repair for continued endoleak.

The reported complication rate of endovascular AAA repair varies from 10% to 65%. The types of local complications include failure of device deployment, arterial injury, wound complications, groin lymph fistula, arterial emboli, and limb ischemia. Systemic complications include renal, cardiac, pulmonary, gastrointestinal, and neurologic system dysfunction. Patients having standard open repair tend to have more systemic complications compared with endovascularly repaired patients, whereas the latter tend to have more local complications. Overall complication rates appear to be similar between the 2 types of AAA repair. The reported mortality rates and costs for the 2 operations have been similar, but the average hospital stay is shorter for patients having endovascular repair.

Although endovascular AAA repair is still investigational, we have found it to be a relatively safe and effective treatment of aneurysms. The long-term success rate (>5 years) of these devices remains to be determined. Other considerations that need to be addressed are the reduction in the size and complexity of the delivery systems and the broadening of the applicability of these devices to more patients with aneurysms.

References


