AAA Repair Using Local Anesthesia and Conscious Sedation

This approach is associated with significantly shorter procedure times and fewer complications.

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Endovascular exclusion of abdominal aortic aneurysms (AAAs) was developed in an effort to treat patients who are at high risk for complications after standard surgical repair.[1] The endovascular technique has clearly shown to decrease operative morbidity, patient discomfort, hospital stay, intensive care unit stay, blood loss, and the time needed to return to normal activities.[2,3]

The standard technique of endovascular AAA repair involves bilateral groin incision to expose and repair the femoral arteries. This procedure is commonly performed with the use of general or epidural anesthesia, which increases the invasiveness of the procedure and the risks of the complications. The complications associated with surgical access and repair of the femoral arteries include blood loss, infection, hematoma, lymphocele, femoral neuropathy, prolonged pain, and restricted mobility. These complications have been reported to occur in up to 17% of patients.[3,4]

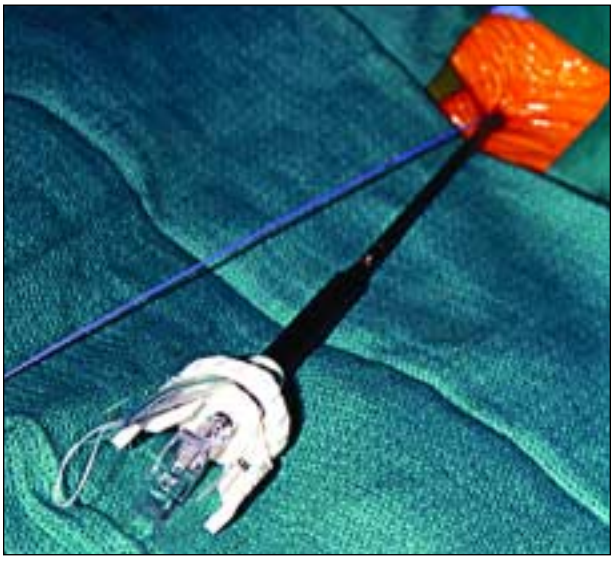

Figure 1. The 8-F Prostar XL percutaneous vascular suture device being deployed percutaneously over a wire.

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In 1996, we demonstrated that endoluminal repair of AAAs can be achieved safely and successfully in the cardiac catheterization laboratory with the use of local anesthesia and conscious sedation.[5] In 1999, in an effort to decrease the invasiveness of the procedure, we developed a technique to percutaneously repair femoral artery access sites after endoluminal AAA repair with use of the AneuRx (Medtronic, Inc., Santa Rosa, CA) stent graft.[6-9] This was achieved with the use of a Prostar XL percutaneous suture-mediated vessel closure device ([PVS] Abbott Vascular Devices, Redwood City, CA) for 16-F and 22-F sheaths (Figures 1).

TECHNIQUE OF PERCUTANEOUS FEMORAL ARTERY REPAIR

Intravenous heparin is administered to all patients after percutaneous arterial access is obtained to achieve and maintain the activated clotting time at >250 seconds. The patients receive a single intravenous dose of antibiotics 2 hours prior to the procedure. The patients also receive aspirin 325 mg/d and clopidogrel 75 mg/d for 1 month after the procedure.

Both common femoral arteries (CFAs) are accessed percutaneously using front-wall puncture (Modified Seldinger technique). Six-French sheaths are inserted in the left and right CFAs. The skin above the CFA access sites is widened to 1 cm using a scalpel, and the subcutaneous tissues are bluntly dissected using a hemostat. The 6-F sheath is then removed over a wire, and an 8-F Prostar XL device is advanced into the CFA (Figures 1). When pulsatile blood flow is seen through the marker lumen, indicating that the sutures and needles are within the vessel lumen, all four needles and sutures are deployed. The sutures are then removed from the Prostar device hub. The sutures are left untied and secured with hemostats. The PVS device is removed from the femoral artery over a wire and, after progressive dilation, a 12-F to 16-F, 35-cm-long, valved sheath (Cook Incorporated, Bloomington, IN) is placed in the CFA. This sheath is used for deployment of the iliac limb. The sheath size depends on the type and profile of the device used.

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The 6-F sheath is then removed over a wire from the contralateral CFA, and an 8-F Prostar XL device is advanced into the CFA over a wire. Once good blood flow is achieved through the marker lumen of the 8-F Prostar XL device, the needles and sutures are deployed. The sutures are then removed from the Prostar XL device hub. The sutures are left untied and secured on the table. The wire is inserted through the wire lumen of the 8-F Prostar XL device into the CFA. The 8-F Prostar XL device is removed and a 10-F Prostar XL device is then advanced into the CFA over the wire. Once good blood flow is achieved through the marker lumen the 10-F Prostar device is rotated 90º in reference to the previously deployed 8-F Prostar XL device. After this rotation, the four needles are deployed from the 10-F Prostar XL device.

The delivery of the second set of needles is perpendicular to the delivery of the first set; this delivery is facilitated by the marker arrow on the Prostar XL device. Such rotation prevents the sutures of each Prostar XL device from being placed in the same location in the arterial wall. The sutures are removed from the 10-F hub, taking care to identify the right and the left sets of sutures. These sutures are left untied, secured to the table, and marked with colored tape to keep them separated from the 8-F Prostar XL device sutures. The device is removed over a wire, which is reinserted through the guidewire port on the 10-F Prostar XL device, and a 12-F sheath is placed into the CFA. An exchange length, super-stiff Amplatz guidewire (Cook Incorporated) is placed through the arterial sheath in the CFA and advanced to the descending thoracic aorta. The CFA and iliac arteries designated for the 18-F to 22-F sheath are progressively dilated with 14-, 16-, 18-, and 20-F, 20-cm-long, percutaneous vessel dilators (Cook Incorporated). The dilators are removed from the femoral artery over a wire, and an 18-F to 22-F, 35-cm-long, valved sheath (Cook Incorporated) is placed in the CFA. This sheath is used for deployment of a bifurcated stent graft. The sheath size depends on the profile and the type of the device that is used.

The Excluder (W.L. Gore & Associates, Flagstaff, AZ) stent graft requires the use of an 18-F sheath for deployment of the bifurcated component and a 12-F sheath for the contralateral iliac limb deployment (Figure 2).

The AneuRx Xpedient device can now be introduced into the CFA without the sheath. A new version of this device has been available since September 2002 (Figure 3). It has a tapered and flexible tip, which allows for percutaneous introduction. The contralateral iliac limb is housed in a 16-F delivery catheter and currently also has a tapered and flexible tip. The Xpedient delivery system allows for sheathless deployment of a 21-F bifurcated component, followed by the insertion of a 16-F sheath, if necessary, to perform angiography or balloon angioplasty. This is possible because the outer diameter of the 16-F sheath is approximately the same as the 21-F delivery catheter. The contralateral iliac limb also can be deployed without the use of a sheath. If there is a need to use a

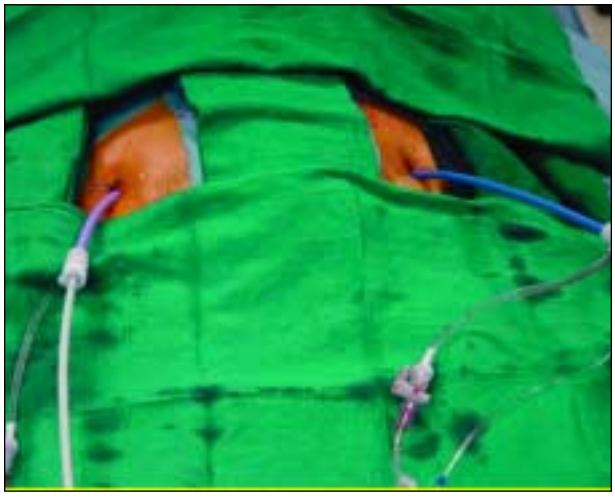

Figure 2. The Excluder, unlike the AneuRx Xpedient, requires an 18-F delivery sheath for deployment of the graft.

sheath after the deployment of the iliac component, a 12-F sheath can be used with adequate hemostasis (Figure 4).

Once the AAA is excluded from the circulation, 10-mL of 1% lidocaine with epinephrine (1:100,000) is then injected into the subcutaneous tissues surrounding both sheath entry sites. The 16-F sheath is removed and the two Prostar XL sutures are tied using the sliding knot technique. The 22-F sheath is then removed and the four Prostar XL sutures are tied with use of the sliding knot technique. Special care is taken to identify and separate the 8-F from the 10-F Prostar XL sutures so they could be knotted and tied separately. A knot pusher (Abbott Vascular Devices, Menlo Park, CA) is used to advance and secure the knots to the CFA entry site. After achieving hemostasis, the sutures are cut and the incision edges are approximated with adhesive Steri-Strips (3M Health Care, St. Paul, MN) (Figure 5). Both entry sites are cleaned with povidone-iodine and dressed with sterile nonadhesive dressing pads and clear Tegaderm (3M, Maplewood, MN). After the procedure, the patient is kept at bed rest for 4 to 6 hours, with their legs straight for 4 hours. After bed rest, the patients can ambulate under observation. Protamine is not used to reverse the effects of heparin.

TABLE 1. RISK FACTORS FOR CLOSURE DEVICE FAILURE
• Severe obesity
• Small vessel diameter (<6 mm)
• Artificial arterial conduits
• Coagulopathy
• Severe femoral artery calcifications and fibrosis
•Too low arterial access (SFA or profunda femoralis puncture)
• Too high arterial access (above the inguinal ligament)

Treatment of inadequate hemostasis after the procedure includes the use of 5- or 10-pound sand bags on the entry site for 4 hours. A Tamper device (Abbott Vascular Devices, Menlo Park, CA) can also be advanced over the

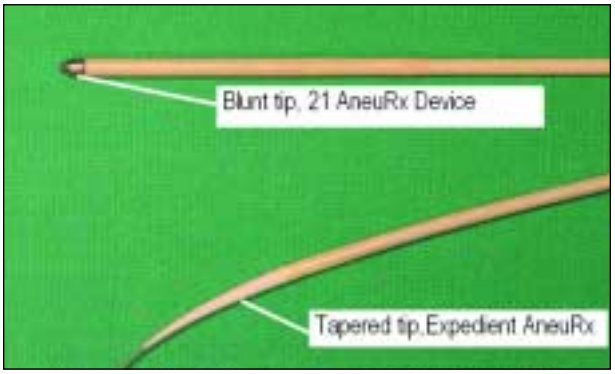

Figure 3. The AneuRx Xpedient (bottom) is tapered and more flexible than the original delivery system (top) and allows sheathless delivery.

sutures to the arterial entry site to stop the bleeding and kept in this position until adequate hemostasis is achieved (Figure 6). A FemoStop (Radi Medical Systems, Inc., Wilmington, MA) device can also be placed to stop the bleeding. Prior to removal of the guidewire from the femoral artery, a 6-mm to 10-mm angioplasty balloon catheter can be advanced over the wire into the femoral artery and gently inflated to stop the bleeding. A surgical femoral artery repair can then be performed with the use of local anesthesia and conscious sedation.

RESULTS

Through February 2004, a total of 671 endoluminal AAA repairs were performed at our institution. Percutaneous technique for endoluminal AAA repair was performed in 429 patients. Percutaneous closure of the CFA after placement of an AneuRx stent graft was performed in 297 patients. Percutaneous access and closure of the CFA after placement of a 16-F sheath to deliver a contralateral limb was successful in 97% of these patients (Table 1). Percutaneous closure of the CFA after placement of a 22-F sheath to deliver a bifurcated component of the AneuRx stent graft was successful in 91% of patients. Successful bilateral femoral artery repair was achieved in 88% of patients. Patients in whom femoral artery repair fails were treated by use of the Tamper device, FemoStop, sand bags, or surgical femoral artery repair. The incidence of femoral artery pseudoaneurysm was 1.3%, all of which required surgical repair.

Since May 2002, to further decrease the invasiveness of the procedure, we have performed endoluminal

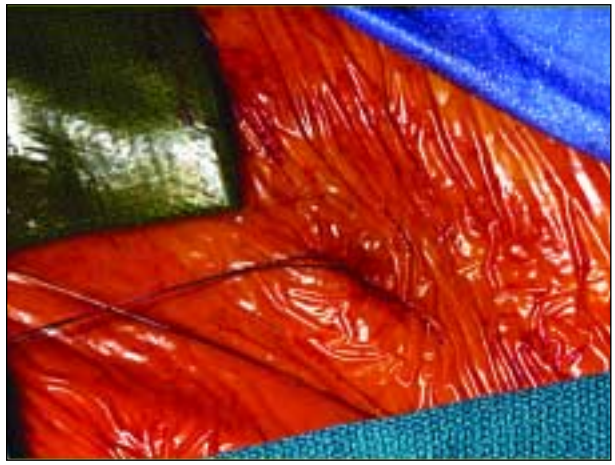

Figure 5. The femoral artery access site after the removal of the sheath and wire reveals good hemostasis.

Figure 4. After progressive dilatation, an AneuRx Xpedient 21-F bifurcated device and 16-F iliac limb device are introduced via sheathless entry into the right and left femoral artery.

Figure 6. A Tamper device is placed over the sutures to the arterial entry site to stop the bleeding after suboptimal hemostasis.

TABLE 2. BENEFITS OF PERCUTANEOUS REPAIR OF AAA WITH LOCAL ANESTHESIA
• Shorter procedural time
• Less patient discomfort
• Less blood loss and less need for transfusion
• Earlier return to a normal diet
• Earlier ambulation and discharge
•Lower incidence of femoral neuropathy
• Lower risk for infection

repair of AAA percutaneously, with the use of local anesthesia and conscious sedation. As of February 2004, we have performed percutaneous repair of 210 AAAs with this technique. The procedures were performed with use of the AneuRx, Excluder, and Zenith (Cook Incorporated, Bloomington, IN) stent grafts. The technical success was 99%. There was no procedural mortality and no procedural conversions to an open surgical repair. The average return to a normal diet was 1 hour. The average time to ambulation was 8 hours.

Our observations and the observations of others have revealed that the technique of bilateral percutaneous CFA access and closure has significantly shortened the anesthesia time, intubation time, and the procedure time. It also has reduced the amount of blood loss, the need for blood transfusion, and reduced the number of groin complications than open femoral artery access and repair (Table 2).[6-10]

CONCLUSIONS

Our findings revealed that percutaneous CFA repair, with local anesthesia and conscious sedation, offers a lower incidence of complications of this procedure than surgical CFA access and repair with general or epidural anesthesia. This technique has become a routine part of endoluminal AAA repair at our institution. The presence of a vascular surgeon during closure, however, is mandatory to achieve safe hemostasis in case the closure device fails. However, further refinements of percutaneous closure devices and a decrease in the profile of the stent graft delivery devices are needed to simplify this procedure and offer it to a broader number of interventionists. ■

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