ABDOMINAL AORTIC INTERVENTIONS

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ACCESS SITES

- Bilateral percutaneous femoral artery access can be used in a great majority of cases. If femoral access is not possible due to severe stenosis of the femoral or iliac arteries, common iliac artery conduit via retroperitoneal approach should be considered.
- Upper extremity (brachial artery) is rarely used. It can be used for cannulating the contralateral gate in patients with extremely complex and tortuous iliac artery anatomy.

OVERVIEW

STENT GRAFT SYSTEMS

Endovascular stent grafts have been developed to avoid major abdominal surgery and to avoid the related morbidity and mortality. The less-invasive nature of endovascular placement of stent grafts is particularly important because of coexisting morbid conditions in the many of the patients presenting with AAA and provides a therapeutic alternative for those who are not surgical candidates. The early prostheses were relatively inflexible and required 24-F or larger sheaths. They are now more flexible and available in smaller diameters.

Currently, there are four devices approved in the US for endoluminal AAA repair: the AneuRx, Excluder, Zenith, and Powerlink devices. Each device is unique and offers different materials, stent designs, and delivery system diameters. They also have different modes of deployment. The Powerlink System is a self-expanding, unibody, bifurcated graft. The other three have a modular design. The modular design requires that the main body is delivered through a larger sheath, whereas an iliac limb endoprosthesis is delivered via a smaller sheath using the contralateral femoral artery. The device diameters range from 18 F to 21 F for the main body, whereas the iliac limb devices range from 12 F to 16 F. The AneuRx Expedient device can now be introduced into the common femoral artery without a sheath. A new version of this device has been available since September of 2002. The other devices should be introduced into the femoral artery via proprietary sheaths (Zenith, Powerlink, and Excluder).

IMAGING TECHNOLOGY TO DETERMINE PATIENT SELECTION

The simplest and most inexpensive noninvasive test available to confirm the presence of AAAs is the abdominal ultrasound, which has been shown to be a reliable method of evaluation before contemplating a surgical AAA repair. A spiral CT scan with three-dimensional reconstruction with intravenous contrast injection has been an essential method of preprocedural and postprocedural evaluation after endovascular AAA repair. This evaluation is of great benefit to determine if iliac arteries are of adequate size to accommodate the endoprosthesis. The successful implantation of endografts is predicated on preoperative evaluation, utilizing a combination of spiral CT scanning, three-dimensional reconstruction, and contrast arteriography with a calibrated marker catheter.

ACCESS SITE NOTES

To perform total percutaneous EVAR, the "preclose technique" can be used with an 8-F or 10-F Prostar XL device. The Prostar XL sutures must be deployed after initial access is achieved and before inserting the large-bore sheaths. The preliminary findings with this technique of percutaneous common femoral artery repair under local anesthesia and conscious sedation has further reduced the incidence of complications of this procedure. Each stent graft system uses different sheath sizes. Once 6-F sheaths are placed in both femoral arteries, the Prostar XL sutures are delivered through the vessel wall, the needles are removed from the device, and the sutures are secured with hemostats and laid to the side until the procedure is completed.

IMAGING EQUIPMENT

A fixed, flat-panel detector with digital unsubtracted and subtracted angiography is preferred. It uses less radiation

and provides approximately 40% more coverage with a larger field of view. The dynamic range of a flat-panel detector system is 5 to 10 times greater than the conventional image intensifier, which allows improved visualization of the vasculature and views the placement of endovascular stent grafts with greater precision. The entire field of endograft deployment can be seen on a single view. With improved visualization, contrast agent use can be reduced by approximately 30%, which is particularly important when imaging patients with existing renal dysfunction.

DIAGNOSTIC AND INTERVENTIONAL DEVICES USED

SHEATH SIZES

Two 6-F sheaths, one 8-F sheath, one 11-F sheath, one 12-F sheath, and one 18-F sheath. Note: 6-F sheaths are used for diagnostic angiography and delivery of Prostar XL sutures; the 8-F and 11-F sheaths are inserted into larger sheaths during wire exchanges, for balloon dilations, and gate cannulation to provide adequate valve hemostasis. The AneuRx system can be delivered without a sheath, 12-F and 16-F sheaths can be placed after the system has been successfully deployed. The use of dilators offers gradual dilatation of the access site, therefore reducing the risk of arterial laceration. It also offers an inexpensive way to determine if the delivery device of a selected stent graft system will accommodate the femoral and iliac arteries. The stent graft system should only be opened after the appropriate dilator has been easily advanced through the iliac artery.

DILATORS

After diagnostic angiography and delivery of Prostar XL sutures has been completed, progressive arterial dilation is performed first on the primary (bifurcated stent graft) femoral artery. When using the 18-F device, a 14-F, 16-F, and 18-F dilator are used before placing the 18-F sheath. When using the larger devices, a 20-F and possibly a 22-F dilator may be required. The contralateral artery is dilated with an 11-F dilator before placing the 12-F sheath, unless the sheathless stent graft system is used.

FLUSH DIAGNOSTIC CATHETERS

A 5-F calibrated (1-cm radiopaque markers) pigtail is used for the abdominal aortogram. This allows for precise measurements with regard to the length between the lowest renal artery and the aortic bifurcation, and the length between the aortic bifurcation and both internal iliac arteries.

A 5-F (65-cm) multipurpose catheter is used to facilitate guidewire exchanges (the more flexible J-wire for the stiffer guidewires used to deploy the stent graft system). Also, the 5-F multipurpose catheter is used to cannulate the contralateral gate once the bifurcated piece has been deployed.

SELECTIVE DIAGNOSTIC CATHETER

A 4-F or 5-F renal double curve is used to cannulate the lowest renal artery prior to stent graft deployment of the bifurcated piece. This step allows for precise deployment of the stent graft system. Note: the renal double curve is pulled back down into the aorta just before deployment. A 5-F pigtail catheter is also used during stent graft deployment to visualize the renal arteries. Occasionally, other diagnostic catheters are needed to cannulate the gate, including Bernstein, Head-hunter, Omniflush, and Amplatz catheters.

GUIDEWIRES

The .035-inch J-wire is used for initial femoral access. When "preclosing" with the Prostar XL in the femoral vessels, a .035-inch hydrophilic guidewire is best. Once "preclosing" is complete using the 5-F multipurpose catheter, a "super-stiff" exchange length guidewire is placed in the thoracic aorta to facilitate progressive arterial dilation, large-bore sheath placement, and stent graft deployment. Note: because both femoral access sites are

used, two "super-stiff" exchange length guidewires are needed. There are several companies that provide stiff guidewires that can facilitate vessel dilation and the passage and deployment of the stent graft systems. Diligent attention is imperative when passing and positioning these stiff guidewires, and these stiff wires should never be repositioned without fluoroscopic visualization.

PTA BALLOONS

Once the stent graft has been deployed, the attachment sites (proximal, distal, bilaterally, and the gate of the contralateral limb) should be dilated with an appropriately sized balloon to ensure fixation and approximation with the aortic and iliac vessel wall. An aortic occlusion balloon (20 mm to 32 mm in diameter and 2 cm in length) is inflated at low pressure (enough to dampen arterial pressure) at each attachment site. Note: meticulous attention should be placed on balloon positioning, keeping balloon's edges within the stent graft to avoid damage to the normal vessel wall. Note: because the occlusion balloons are so large, a 70% saline:30% contrast mixture should be used for the inflation medium. This will allow quicker inflate and deflate times.

ENDOVASCULAR SNARES

Endovascular snares are occasionally used to retrieve a wire from the contralateral side in complex anatomy and when the contralateral gate cannot be cannulated in an antegrade fashion.

OTHER EQUIPMENT USED

Dual three-port manifold systems are used for the femoral access sites. This allows flushing of heparinized saline during exchanges, which minimizes the bleed-back from the large-bore sheaths during exchanges, provides constant arterial pressure monitoring during balloon inflations, and controls the contrast usage throughout the procedure.

PHARMACEUTICALS

- Low-dose heparin anticoagulation is administered after bilateral access is achieved. Once the Prostar XL sutures have been delivered, additional heparin is administered to maintain an ACT between 200 and 225.
- All patients receive intravenous antibiotics before the endovascular procedure and for 24 hours after.
- Local anesthesia with lidocaine and conscious sedation can be used for the majority of patients that are candidates for percutaneous access and repair with the "preclose" technique.
- Acetylcysteine is usually given to patients with compromised renal function 24 hours before and for 24 hours after the procedure. Proper hydration is also necessary in patients with compromised renal function. The use of 25% normal saline with sodium bicarbonate has been used in these patients.

CONTRAST RECOMMENDATIONS

Nonionic contrast is generally recommended. In patients with impaired renal function, a less-nephrotoxic contrast (gadolinium) material can be used, however, it offers inferior imaging qualities. Nephrotoxic effects can result if more than 60 mL of gadolinium is used. Intravascular ultrasound can also be used in patients with impaired renal function.

POSTPROCEDURE MANAGEMENT OF VASCULAR ACCESS SITES

After successful femoral artery repair (either surgical or percutaneous), the patient remains at bed rest for 4 to 8 hours to avoid bleeding or hematoma. A 5-pound or 10-pound sandbag can be applied over the arterial access site for 4 to 6 hours in situations with minor bleeding or hematoma. A compression device can be used to achieve hemostasis, usually at 40 mm Hg pressure for 2 to 4 hours. ■