

# Percutaneous EVAR: How I Do It

From puncture to closure, one physician's technique for a fully percutaneous approach to endovascular aortic aneurysm repair.

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**A** bdominal aortic aneurysms (AAAs) are among the most common vascular disease presentations. In Europe, with its population of 340 million, AAAs exist in approximately 1.8 million people, are diagnosed in 180,000, and are treated in 60,000 patients. Endovascular aortic repair (EVAR) is performed in more than half of these patients and is the preferred treatment modality because the morbidity and mortality rates are significantly lower than with open surgery. In the DREAM trial, EVAR had a mortality rate of 1.2% versus 4.6% for open surgical repair.<sup>1</sup>

The risk of rupture grows with the diameter of the aneurysm. Rupture within 5 years is observed in aneurysms from 5 to 6 cm at a rate of 25%. The incidence increases up to 75% when the diameter of the aneurysm exceeds 7 cm. Therefore, EVAR is indicated in men with an aortic diameter of more than 5 cm and in women with a diameter of more than 4.5 cm. Patients with small aneurysms should have a life expectancy of more than 5 years to have the full benefit of the treatment (Figure 1).

In symptomatic patients with penetrating or ruptured aneurysms, the indication for EVAR is given independent of the diameter. Anatomic limitations for EVAR, such as insufficient neck length, severe neck angulation, and occluded or narrow iliac arteries, must be respected.

## PERCUTANEOUS EVAR VERSUS SURGICAL CUTDOWN

During the early period of EVAR, the common femoral artery (CFA) was exposed surgically on both sides. Larger wounds, wound complications, longer intervention times, and prolonged hospital stays were the reasons why we switched to the percutaneous technique. During the last 5 years, we have performed EVAR percutaneously in more than 80% of our AAA patients. Only patients with small-diameter CFAs are still treated surgically via a conduit connected at the iliac artery (Figure 2).

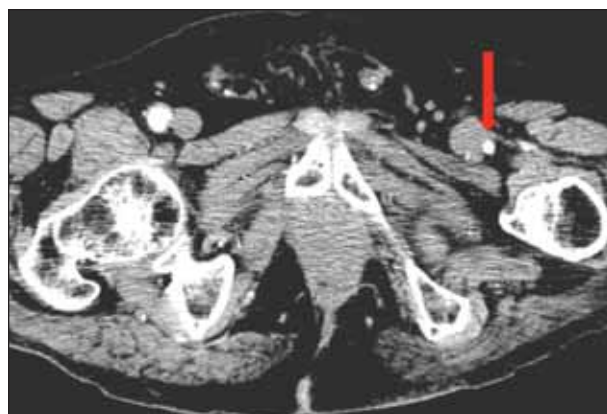


Figure 1. Left 5-mm CFA is too small for percutaneous EVAR (arrow); placement of a conduit was necessary.

## PROCEDURAL OVERVIEW

### Preprocedural Imaging

Imaging is essential in selecting patients suited for EVAR. Computed tomographic angiography (CTA) is the method of choice. The scans should cover the entire aorta, iliac, and CFAs down to the femoral bifurcation in a slice thickness of < 2 mm (Figure 3). For percutaneous EVAR, we need a CFA diameter that exceeds the diameter of the endograft catheter by at least 1 mm. In most cases, a diameter of more than 7 mm is required for endografts of 18 to 22 F. Additionally, we determine the amount and distribution of arterial calcifications at the access site. The examination also assists in choosing the type and size of the endograft and the extension limbs. During the intervention, ultrasound is used to define the best level of puncture and to puncture the artery from the front or in its middle from the front.

### Preparing the Access Site

Normally, it is easy to puncture the CFA, even in patients with moderate obesity (Figure 4). However, the puncture should fulfill two criteria: (1) it needs to hit the artery as precisely as possible from the front and (2) it should be done in an arterial segment that is free of calcified plaque.

### Puncture

Ultrasound-controlled puncture is helpful for this purpose. After successful puncture, we introduce a 10-F sheath and prepare the puncture channel for the Prostar XL system (Abbott Vascular, Santa Clara, CA). The two sutures of the Prostar XL should be handled

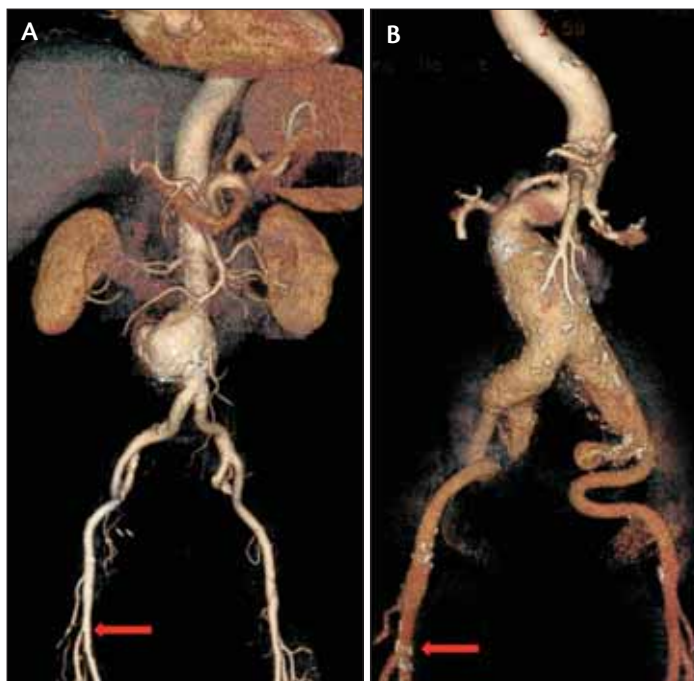


Figure 2. CTA must show the lower thoracic aorta, abdominal aorta, iliac arteries, and CFA down to the bifurcation (arrows). Small-diameter CFA (A). Calcification of the right CFA (B).

with care. Do not use excessive force when pulling on the suture ends to avoid cutting through the vessel wall. Closure will fail in that case.

### Placing the Endograft

Introduction of the endograft should be carried out slowly to avoid as much vessel damage as possible. We keep the shaft of the device wet to reduce friction

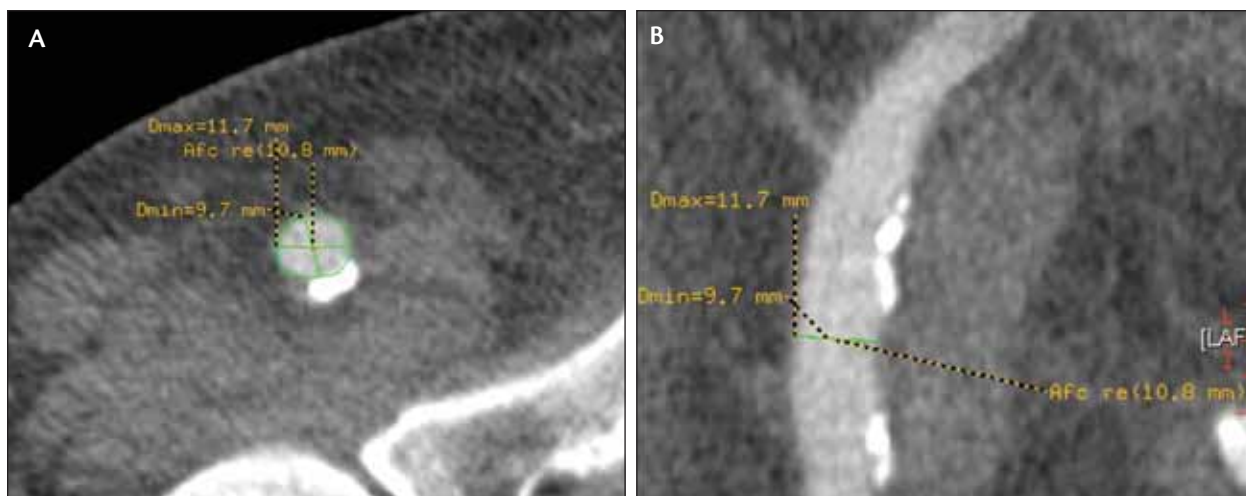


Figure 3. CTA showing diameter measurements of the CFA (A) and analysis of calcifications (B). The Prostar XL can be used because the anterior wall of the CFA is free of calcium.



**Figure 4.** In an obese AAA patient, the use of ultrasound-guided superficial femoral artery puncture is recommended.

between the artery and the catheter. Presently, many endografts have a hydrophilic coating that facilitates atraumatic introduction into the femoral artery.

After placing of the endograft, we prepare the knots of the Prostar XL sutures. We pull out the catheter and leave a guidewire in the artery for safety reasons. Should the closure fail, the guidewire serves as a valuable means for the introduction of a balloon catheter and for blocking the external iliac artery. Without compression of the puncture site, the femoral artery can be exposed surgically, and the puncture can be closed by a suture. The balloon catheter and guidewire are extracted during clamping of the artery.

## Closure

Normally, the knots of the Prostar XL system are pushed down to the surface of the arterial wall, and bleeding stops immediately. In some cases, manual compression is necessary for a couple of minutes.

After the procedure, the groin is controlled clinically. The next day, the puncture site is also examined by ultrasound to ascertain that closure is achieved without the development of a false aneurysm (Figure 5).

## RESULTS OF PERCUTANEOUS CLOSURE AFTER EVAR

In our series, closure was successfully accomplished in 304 of 308 patients (98%). Additional manual com-



**Figure 5.** False aneurysm with narrow neck after EVAR. Successful compression with ultrasound control.

pression was necessary in 18 (7%) for more than 10 minutes. Four patients needed surgical closure of the puncture hole. Follow-up examinations with ultrasound showed six pseudoaneurysms. Five of them were treated with ultrasound-guided compression. In one patient, compression failed to build a thrombus with occlusion of the false aneurysm. The patient was referred to vascular surgery, but a control examination on the planned day of surgery revealed a spontaneous occlusion of the false aneurysm. Surgical correction was no longer necessary.

With such a high success rate of arterial closure after EVAR, we routinely do not need any surgical backup. EVAR has become a percutaneous procedure for the majority of our patients. Future developments with downsizing of the endograft catheters to 16 F will make it even safer to perform EVAR percutaneously. ■

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1. Prinssen M, Verhoeven EL, Buth J, et al. A randomized trial comparing conventional and endovascular repair of abdominal aortic aneurysms. *N Engl J Med*. 2004;351:1607-1618.