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Vettath's Anastomotic Obturator: A Simple Proximal Anastomotic Device

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ABSTRACT

Background: Off-pump coronary artery bypass grafting has been shown to improve the postoperative course of patients undergoing coronary artery bypass grafting (CABG) surgery, but the need for side-clamping the aorta to perform the proximal anastomosis is still a risk factor for causing neurologic injury postoperatively. Hence, our endeavor to fabricate an obturator to perform the proximal anastomosis without side-clamping the aorta is described.

Methods: From July 2002 to February 2003, we performed more than 150 CABG surgeries in our new cardiac center, and 92 patients had proximal saphenous vein graft anastomoses performed with Vettath's anastomotic obturator (VAO).

Results: A total of 147 CABG surgeries (98%) were performed on the beating heart, of which 135 (90%) were done off-pump. Early in our experience, the top ends were performed with side-clamping until we introduced our new VAO after trials on a perfused animal heart model. Ninety-two patients had proximal anastomoses carried out with the VAO, and 97 proximal anastomoses were performed on the aorta, because 5 of the patients had 2 proximal anastomoses. We had only one patient in our series who came back with angina after 3 months. Results of repeat coronary angiography with this patient showed a patent proximal anastomosis and no graft problems.

Conclusion: Our initial results with the VAO have been excellent. We have been able to use it in all of our proximal anastomoses of late. With regular practice, this procedure can be performed with ease and can definitely avoid the neurologic deficits caused by side-clamping the aorta.

INTRODUCTION

With the advent of beating heart surgery, nearly 100% of coronary artery bypass graft surgeries are performed in most coronary centers without the use of the heart-lung machine, but the neurologic problems caused by side-clamping of the aorta in performing the proximal anastomosis still remain. Hence, there has been a great deal of research to avoid side clamping the aorta. A couple of anastomotic devices have already arrived on the market, but because the costs of these devices are prohibitive, we designed our own method for performing these proximal anastomoses.

MATERIALS AND METHODS

From July 2002 to February 2003, we performed 147 coronary artery bypass graft surgeries on the beating heart with 135 of these procedures performed off-pump and 12 of them carried out with pump assistance. Initially, the proximal anastomoses of these vein grafts were performed with a side clamp. Of late, all our top ends are being anastomosed with Vettath's anastomotic obturator (VAO). Ninety-two patients have had proximal saphenous vein graft anastomoses performed with our VAO.

Vettath's Anastomotic Obturator

This metallic instrument is made of solid steel (Figure 1). It is 18 cm in length and comes in small and medium sizes, 5 mm and 6 mm in diameter, respectively. The holding part is smooth. The inserting bit has a ridge 2.5 cm from the end of the VAO (Figure 2). This ridge projects perpendicularly like a shelf 2 mm from the steel rod. There are 3 grooves in the inserting end that are each 1 mm deep, and these grooves extend up to 1.5 cm from the inserting end of the obturator (Figure 3).

The shelf helps prevent blood from spurting directly into the eye. The grooves allow the needle to pass through the rod and thereby include the aortic intima in the suture.

Surgical Technique

The VAO allows us to anastomose the proximal end of the vein graft before or after the distal anastomosis. The aortic site proposed for anastomosis is marked with diathermy. Two 3.0 polypropylene purse-string sutures are applied 1 cm apart from the site. The aorta is stabbed with a no. 11 blade knife, followed by a 4-mm or 4.5-mm aortic punch for the 5-mm or 6-mm VAO, respectively. The punch hole is blocked with the left index finger. The size of the VAO introduced into the punch hole depends on the size of the hole (Figure 4). The

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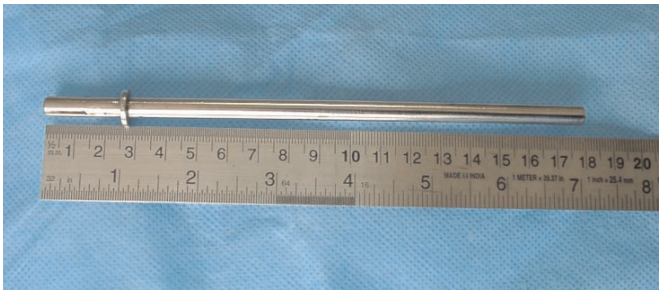

Figure 1. Vettath's anastomotic obturator.

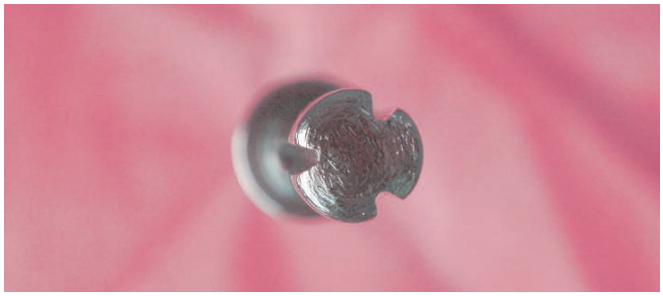

Figure 3. Close-up view of Vettath's anastomotic obturator.

purse strings are tightened with a snare to prevent excessive bleeding. Once the obturator is in and the snare is tightened, the proximal vein anastomosis is performed as usual with 5.0 or 6.0 polypropylene suture (Figure 5).

The sutures in the vein have to be inside out, and in the aorta, they have to be outside in. The aortic sutures are placed so that the needle passes through the aortic wall, goes into the groove of the obturator, and comes out between the aorta and the metal, thus taking the intima. The sutures are placed all around the aortic punch hole and are loosely held. Once the suturing is complete, the obturator is removed, and the left index finger is positioned on the aortic punch hole to prevent bleeding. The loose sutures are pulled and tightened with a nerve hook. The two ends of the sutures are held firmly with controlled traction by the assistant during this procedure. Once all of the sutures are in place, the two ends are tied snugly. The two snares on the purse string are removed, and they are tied in place with care, to avoid a purse string effect. The vein is then deaired, and hemostasis is attained.

RESULTS

Before the VAO devices were used on patients, they were used for anastomoses on the aortas and pulmonary arteries of various perfused animal heart models (Figure 6). The aortic and pulmonary artery pressures were maintained at 110 to 120 mm Hg systolic pressure while these anastomoses were being performed (Figure 7). These conduits were then explanted and examined for suture placement to see if all the aortic layers were included.

We have performed 97 proximal anastomoses in 92 patients. Initially, most of the anastomoses were performed with the proximal anastomosis first so that the flow in the vein graft could be fully assessed, but with our experience, we now perform most of our proximal anastomoses last. We have had no cases of postoperative ischemia, enzyme level changes, or perioperative infarction in any of our patients. We have had no perioperative mortality in our coronary patients. One patient presented with angina after 12 weeks, and repeat coronary angiography results showed a perfectly patent graft. We are planning to follow up these patients and to repeat coronary angiography after 6 months to see if the vein grafts remain patent.

DISCUSSION

With the present-day degree of myocardial protection and the refinement in surgical technique, the mortality and morbidity of coronary artery surgery is related more to the

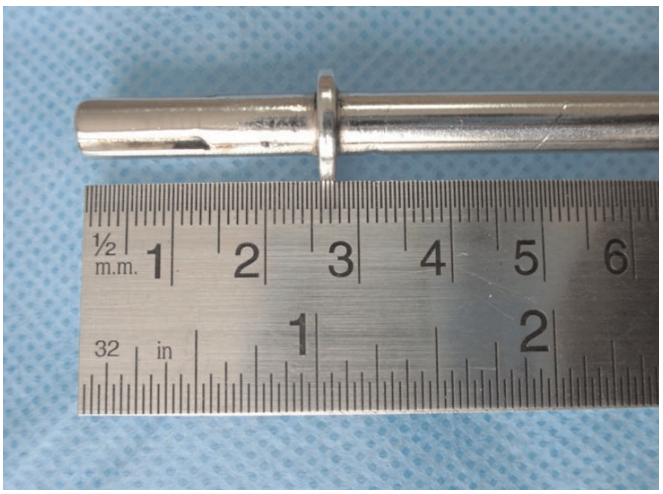

Figure 2. Inserting end of Vettath's anastomotic obturator.

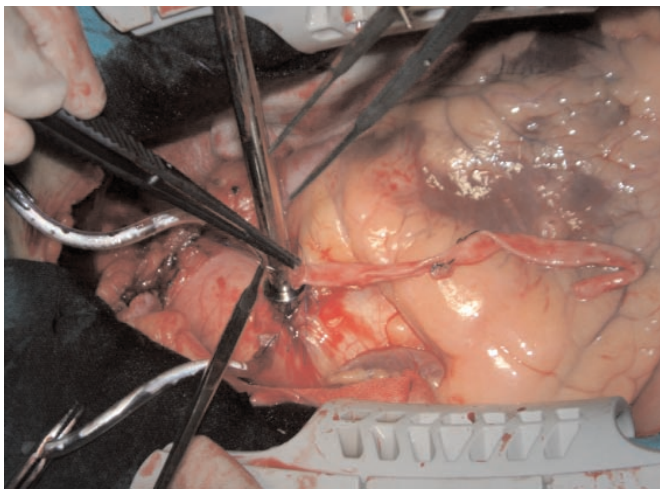

Figure 4. Proximal anastomosis in progress.

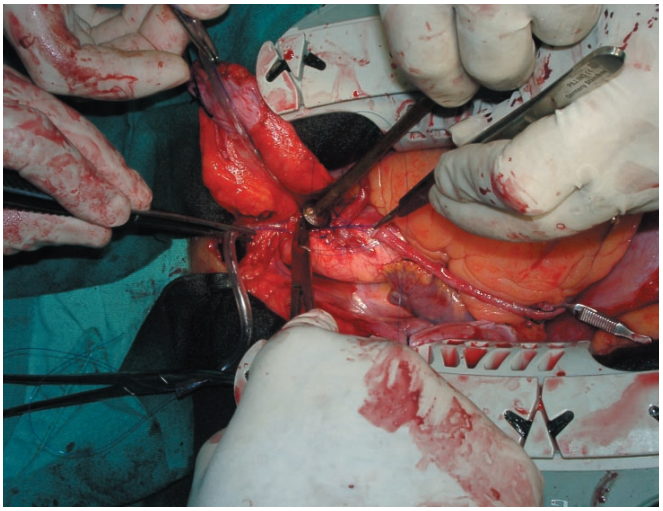

Figure 5. Two top ends being performed with Vettath's anastomotic obturator.

Figure 7. Conduits explanted from an animal heart for examination of suture placement.

copathologies of the patients than to the heart function and the complexity of the surgical procedure [Mohan 1992].

Avoiding the pathophysiology of cardiopulmonary bypass [Moshkovitz 1995] has further contributed to the reduction of mortality and morbidity in high-risk patients, such as those with postinfarction angina and a low ejection fraction.

With the VAO, the proximal end of the vein graft can be sutured as usual, taking the full thickness of the aortic wall. The vein graft is sutured with a continuous suturing technique.

Off-pump coronary artery bypass grafting avoids extracorporeal circulation and has been shown to reduce clinically relevant morbidity, especially with regard to neurologic sequelae. However, having to manipulate the ascending aorta by side-clamping it and performing the proximal anastomosis has definitely added to the neurologic risk during the performance of these anastomoses.

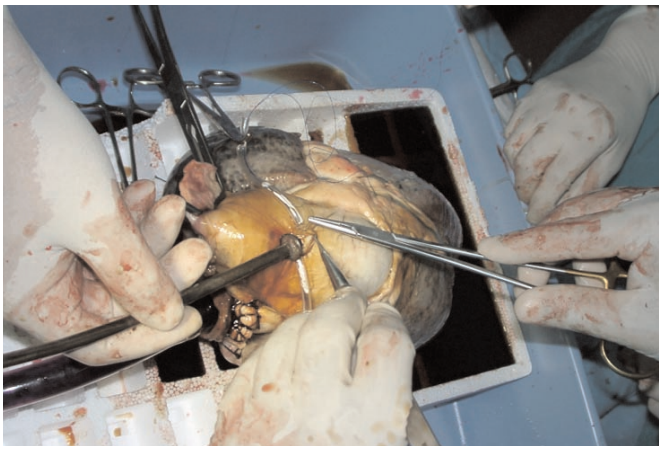

Figure 6. Perfused animal heart model.

This VAO we are using still needs the surgeon's skill to perform the suturing of the proximal vein graft to the aorta. The advantage is that we can perform either the proximal or the distal anastomosis first, an option that is not possible with the recently described sutureless anastomotic device [Calafiore 2001]. This obturator is made of steel, is reusable, and costs only approximately US $10 to fabricate it. Side-clamping of the aorta can be avoided, and hence there is no need to bring down the systolic pressure below 100 mm Hg. There is no injury to the vein intima, because nothing is introduced into the vein. The suturing procedure takes not more than 10 minutes, and the learning curve is very short or negligible. This VAO can also be used in calcified aortas if a small island of normal aorta is available anteriorly. As our clinical results are excellent, we are now awaiting the results of 6-month angiographic studies of the anastomoses we have performed, to confirm their long-term patency.

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