The Heart Surgery Forum #2003-15202
7 (1), 2004 [Epub December 2003]

Online address: www.hsforum.com/vol7/issue1/2003-15202.html

Radial Artery–to-Aorta Anastomoses Using Symmetry Aortic Connectors: Two Cases

(#2003-15202 . . . October 9, 2003)

F. Clark Sauls, MD

Department of Surgery, St. Mary's Regional Medical Center, Enid, Oklahoma, USA

Dr. Sauls

ABSTRACT

Symmetry aortic connectors (St. Jude Medical, Minneapolis, MN, USA) present a new alternative to hand-sewn proximal vein graft anastomoses. This report of 2 cases documents the feasibility of using these connectors for radial artery grafts as well.

INTRODUCTION

The recent availability of Symmetry aortic connectors (St. Jude Medical, Minneapolis, MN, USA) provides a simple, fast alternative for construction of proximal vein graft anastomoses [Eckstein 2002]. In the off-pump setting, use of these connectors allows the surgeon to avoid clamping the aorta [Eckstein 2001, Endo 2002]. In our practice, connector use has become routine for saphenous vein grafts. We were, however, unaware of any reports of connector use for radial artery grafts. Recently, the author encountered 2 patients for whom radial artery and saphenous vein grafts were planned as off-pump procedures. In both cases, all proximal anastomoses including those of the radial grafts were constructed with connectors as described below.

CASE REPORTS

Case 1

A 45-year-old male patient who was a smoker with hypertension and diabetes presented for repeat cardiac catheterization 4 months after acute myocardial infarction and stent placement in his circumflex artery. Catheterization results demonstrated an apparent 90% in-stent restenosis and dramatic disease progression in his right coronary artery. The patient's left anterior descending artery, although diffusely diseased, was free of significant obstruction.

Received September 8, 2003; received in revised form October 1, 2003; accepted October 9, 2003.

Address correspondence and reprint requests to: F. Clark Sauls, MD, Department of Surgery, St. Mary's Regional Medical Center, 330 S 5th Street, Suite 104, Enid, Oklahoma 73701, USA; 1-580-237-3608; fax: 1-580-237-3621 (e-mail: fcsauls@sbcglobal.net).

Preoperative screening results obtained by modified Allen test [Ruengsakulrach 2001] were satisfactory, and in the operating room the saphenous vein and the left radial artery were prepared for use. Our customary procedure is to harvest radial arteries without the use of electrocautery or harmonic scalpel. Branches are ligated with silk on the radial artery side, hemostatic clips on the other, and divided. Otherwise, the harvest technique is as described elsewhere [Reyes 1995]. A nitroglycerin infusion (35 μg/min) was begun prior to harvest and continued until after the second dose of extended-release isosorbide mononitrate (ER-ISMN, Imdur) postoperatively. ER-ISMN was continued for 6 months thereafter. The vessel was stored temporarily in 30 mL of heparinized blood to which 60 mg of papaverine was added. A median sternotomy was performed, and heparin was given intravenously to maintain the activated clotting time (ACT) above 300 seconds. After a brief inspection of distal targets, the vein was loaded onto a 4.5-5.0–mm (gray) aortic connector system. A site low and anterior on the aorta was chosen so the graft would lie in the atrioventricular groove on the right. A hole was cut in the aorta using the included circular knife, and the connector was deployed. Excellent inflow was immediately apparent. The proximal end of the radial artery was freed of connective tissue and cannulated. The vessel was filled with heparinized saline, avoiding further pressure or distention. Use of the plastic sizer indicated that the end of the vessel was appropriate in diameter for a gray connector system. The vessel was cut perpendicularly and gently loaded onto the system while heparinized saline was used for lubrication and to prevent dessication. We encountered no difficulty in loading the vessel or puncturing the end with the connector's hooks. The associated veins and connective tissue appeared too bulky to fit easily into the plastic sleeve, so they were gently removed. The remainder of the loading procedure was completed easily. A site for deployment was chosen on the left side of the aorta near the aorticopulmonary window. The connector was deployed per routine and excellent inflow was noted through the radial artery. Both anastomoses were hemostatic and normal in outward appearance. Using an Octopus III tissue stabilizer, we anastomosed the vein graft to a distal branch of the right coronary artery and then anastomosed the radial artery to the obtuse marginal artery without incident. Results of transit-time flow measurement (Transonic Systems, Ithaca, NY, USA) of the radial graft suggested peak, mean, and minimum flows of 42, 21.4, and 0.4

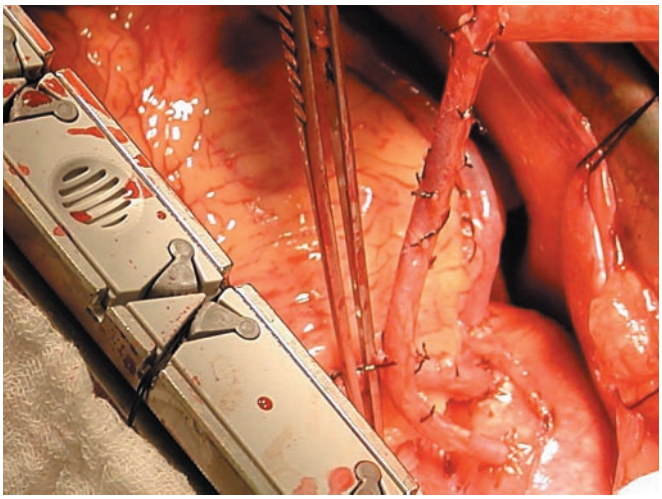
mL/min, respectively, and a pulsatility index (PI) of 1.9. Postoperatively, the patient did well in every respect and was dismissed from the hospital on postoperative day 3. He continued to do well after more than 8 months. During that time he experienced no further symptoms, cardiac events, or hospitalizations. Other than routine office follow-up he did not undergo additional invasive study.

Case 2

This 42-year-old male patient who was a smoker with diabetes suffered severe angina during heavy exertion in warm weather. Subsequent evaluation and cardiac catheterization results revealed severe multivessel disease that included a 75% left main lesion, tandem 80% and 95% obstructions of the proximal left anterior descending artery, a 60% obstruction in the circumflex artery, and a totally occluded right coronary artery.

In the operating room, the saphenous vein, left radial artery, and left internal mammary artery were all prepared. Following median sternotomy and heparin administration, all distal targets appeared amenable to off-pump techniques. Vein grafts for the diagonal and posterior descending arteries were loaded onto connector systems and deployed on the ascending aorta. Excellent inflow was seen in each graft. The radial artery was harvested and prepared as above and again appeared to be of appropriate size for a 4.5-5.0–mm connector. The artery was carefully loaded without any difficulty as described above. Deployment was accomplished as described above without incident to a site on the anterolateral aspect of the aorta (Figure). Excellent inflow was seen through the graft, and subsequently the distal anastomoses were constructed. The radial graft had peak, mean, and, minimum flows of 41.5, 14.9, and –21.8 mL/min, respectively, as measured by transit time flow meter. The PI was 4.2.

The patient was extubated prior to leaving the operating room and was ambulatory in the intensive care unit the afternoon of surgery. He was dismissed from the hospital the following day and was active and symptom free 8 months later. Other than routine office follow-up he underwent no additional invasive study.



Proximal anastomoses of the radial artery and 2 vein grafts.

DISCUSSION

Symmetry aortic connectors offer rapid, simple placement of vein grafts on the aorta, facilitating off-pump coronary artery bypass. Growing concerns about clamping or manipulation of the aorta and neurologic complications make these connectors an attractive alternative to hand-sewn anastomoses. This limited experience demonstrates the possibility of application for radial artery grafting as well.

It must be noted that connectors are not currently approved by the US Food and Drug Administration for use with radial artery grafts. The possibility of such use was discussed with both patients preoperatively, and both agreed to undergo the procedure. Intraoperatively, the apparent feasibility of this use of the connector allowed us to avoid the application of a side-biting clamp. Although this technique has served these 2 patients well to date, several issues remain to be resolved before this procedure could be recommended for general use. First, since these cases were done there have been reported instances of graft failure associated with connectors [Donsky 2002, Hornik 2003, Reuthebuch 2003]. Although these reports are limited in number, the technology is still new and its long-term performance is unknown. Also, second-generation connectors will be different in design and perhaps more applicable for radial artery use. Favorable design features would include elimination of a guide rod that must pass through the vessel and a smaller size connector option because it is not at all clear whether the 4.5-5.0–mm connector would be suitable for most radial arteries. Whether a connector entails more or less trauma to radial artery endothelium than conventional hand suturing remains uncertain. The author, from this experience, recognizes the possibility that connectors might be less traumatic and/or could be made even less so with future refinements. The need for cannulation and filling can probably be avoided, for example, by sizing the proximal end of the artery prior to removal from the arm. Finally, seeking to minimize graft trauma, the author has not routinely skeletonized radial arteries, but this concern has abated somewhat since a recent report suggesting that patency of such grafts may actually be superior [Amano 2002]. Whether this practice could facilitate development of a better connector for radials is unknown. These concerns limit further use of connectors for radials at the present time. A simple method of establishing uniform, reliable, less traumatic radial artery anastomoses to the aorta would be a welcome option in the future.

REFERENCES

Amano A, Takahashi A, Hirose H. 2002. Skeletonized radial artery grafting: improved angiographic results. Ann Thorac Surg 73:1880-7.

Donsky AS, Schussler JM, Donsky MS, et al. 2002. Thrombotic occlusion of the aortic ostia of saphenous venous grafts early after coronary artery bypass grafting by using the Symmetry aortic connector system. J Thorac Cardiovasc Surg 124:397-9.

Eckstein FS, Bonilla LF, Englberger L, et al. 2001. Minimizing aortic manipulation during OPCAB using the symmetry aortic connector sys-

tem for proximal vein graft anastomoses. Ann Thorac Surg 72:S995-8.

Eckstein FS, Bonilla LF, Englberger L, et al. 2002. The St. Jude Medical symmetry aortic connector system for proximal vein graft anastomoses in coronary artery bypass grafting. J Thorac Cardiovasc Surg 123:777-82.

Endo M, Benhameid O, Morin JF, Shennib H. 2002. Avoiding aortic clamping during coronary artery bypass using an automated anastomotic device. Ann Thorac Surg 73:1000-1.

Hornik L, Tenderich G, Minami K, et al. 2003. First experience with the St. Jude Medical, Inc, Symmetry bypass system (aortic connector system). J Thorac Cardiovasc Surg 125:414-7.

Reuthebuch O, Lachat M, Kadner A, et al. 2003. Early bypass occlusion in patients with the St Jude Medical Symmetry connector. J Thorac Cardiovasc Surg 125:443-4.

Reyes AT, Frame R, Brodman RF. 1995. Technique for harvesting the radial artery as a coronary artery bypass graft. Ann Thorac Surg 59:118-26.

Ruengsakulrach P, Brooks M, Hare DL, et al. 2001. Preoperative assessment of hand circulation by means of Doppler ultrasonography and the modified Allen test. J Thorac Cardiovasc Surg 121:526-31.

REVIEW AND COMMENTARY

1. Editorial Board Member GN24 writes:

The product application described here is clearly off-label use in the United States (and I assume Canada and Europe) and therefore has major medico-legal implications. Readers are encouraged to use caution when applying the technique in patients for whom other treatment alternatives are available.

I feel that it is premature to have used this device off-label in radial arteries in patients who appear to have had no contraindications to the conventional technique (side-biting clamp). It would have been more appropriate to have reserved this innovation for patients in high-risk situations (eg, diseased aorta) until appropriate laboratory and prospective clinical (with angiographic documentation) data is collected. Nonetheless, whether I agree with it or not, the cases were performed and should be reported.

a) Was the ascending aorta assessed (epiaortic or transesophageal echocardiography [TEE]) for atherosclerosis and if so what were the findings?

b) What antispasm regimen was used?

Author's response by F. Clark Sauls, MD:

a) We assess the ascending aorta visually and by digital palpation. We do not yet have a probe for epiaortic echo but I understand it is in the budget. We do use TEE routinely in the operating room but find limited value in assessment of the aorta.

b) We routinely use intravenous nitroglycerine and topical papaverine intraoperatively as well as isosorbide postoperatively for 6 months in cases involving a radial artery graft.

2. Editorial Board Member ST351 writes:

To my knowledge, St. Jude does not recommend using the device for radial arteries. The patients were placed at risk if the Symmetry device was used off-label without their knowledge.

a) Did the 2 patients provide their informed consent to have an approved device used off-label?

b) What is the opinion of the inventors and engineers of St. Jude regarding the use of their device in this unapproved setting?

Author's response by F. Clark Sauls, MD:

a) Both patients (and some family members) were aware from preoperative discussions that connectors were planned for their vein grafts and might be considered for the radial grafts. They knew that such use would be unconventional, in fact possibly the first ever use with radial arteries. They understood and agreed.

b) St. Jude is interested but not really free to express an opinion other than such use is presently off-label.

Since these cases, a few reports have been published documenting complications associated with connector use. We have not encountered any such problems and continue to use connectors routinely for vein grafts. Inevitably, these reports raise doubts that can be answered only with data from longer-term follow-up. Admittedly, use of connectors for radial grafts is off-label and cannot be recommended generally at this time. However, it is an idea that has potential benefits and merits further study.

3. Editorial Board Member PB44 writes:

a) They have stated that they use the device routinely. Has this impacted on costs?

Author's response by F. Clark Sauls, MD:

Our hospital is not presently equipped to give us cost information. There is no doubt whatsoever that these devices save time. At 10 minutes or so per proximal anastomosis, this is a significant time savings for a case of any size. I understand that the devices cost the hospital $450 each. Against that would be balanced the time in the operating room and the cost of sutures, labor, intravenous fluids, medications, etc that might be used during the additional time needed to hand sew.