ter, complete arterial myocardial revascularization was accomplished with an end-to-side anastomosis of the radial artery and the right coronary artery, and a side-to-side anastomosis to the posterolateral branch was performed, as well as an anastomosis of the left internal thoracic artery to the left anterior descending coronary artery. A final end-to-side graft-to-graft anastomosis between the bypass graft to the descending aorta and the encircling aortic graft completed the repair. This bypass ran retrocardially near the right atrium through a pericardial window (behind the phrenic nerve) to the right side of the ascending aorta.^{1,2} With the given anatomy in this particular patient, it was easier to obtain control of the anastomotic site at the descending aorta through the opened pleura rather than a pericardial window. After rewarming, the patient was weaned from cardiopulmonary bypass with minimal inotropic support. The further course was uneventful, and the patient was discharged on postoperative day 14.

Discussion

The multiple abnormalities, including aortic coarctation, aortic ascending aneurysm, aortic valve stenosis, and ischemic heart disease, posed a tactical challenge. A 2-stage surgical repair with total arterial revascularization, mechanical valve replacement, and supracoronary ascending graft in a first-stage procedure and surgical treatment of the aortic coarctation in a second-stage procedure a few weeks later would have carried a considerable risk

because of the need for temporary exclusion of the left subclavian artery and, for this reason, the potential threat of myocardial perfusion through a left internal thoracic artery. The 1-stage surgical repair with 2 separate approaches would be a long and high-risk procedure because of the same reason. The treatment through a median sternotomy and repair of the aortic coarctation through the opened aortic arch would have been extremely demanding.^{1,2} Therefore, this patient underwent a single-stage procedure through a median sternotomy and total arterial revascularization, mechanical valve replacement, creation of a supracoronary ascending graft, and extra-anatomic ascending-descending bypass. The postoperative magnetic resonance angiography showed a patent ascending-descending bypass (Figure 1) after the approach that is described in this report. This procedure might therefore be a useful treatment alternative in selected patients with this rare combination of diagnoses.

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Aorta-coronary graft anastomosis marker: More than 30 years of experience

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Radiographic identification of the aorta-coronary graft anastomosis might be difficult and time consuming if the coronary graft is not widely patent. Previous reports indicate that the success rate of detecting coronary graft conduits is inferior to the rate of detecting native coronary arteries by catheterization.^{1,2} To facilitate the spatial

localization of the coronary artery bypass graft ostium at the ascending aorta, we have been using the described technique since 1970 in every patient who had an arterial or venous graft directly anastomosed to the ascending aorta. Early results with this method were first described in 1972 by Gopalrao and Ford.³ Despite the simplicity of this technique, there are no reports in the literature of long-term use of these homemade markers. We believe this technique is not used in most cardiac surgery centers in the world. This article describes our long-term experience with this marking method, which was used beginning in the early days of coronary surgery at our university and continues to this day.

Technique

After completion of each proximal aorta-coronary graft anastomosis, a portion (3 cm) of the radiopaque nontoxic barium sulfate-impregnated monofilament thread from a 4 × 4-inch gauze patch (Ray-Tec, Johnson & Johnson Medical) is removed and is placed around the anastomosis. The filament is secured by 2 knots from the ends of the suture used in the anastomosis, and a vascular stainless-steel clip (LIGACLIP, Ethicon Endo-Surgery) is used to secure the knots (Figure 1).

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Figure 1. Intraoperative picture: *AO*, Aorta; *G*, graft; *RA*, right atrium; *RV*, right ventricle.

Discussion

The described technique was used in an average of 250 patients per year who underwent coronary revascularization alone or in combination with other procedures since 1970. The radiopaque filament is easily visualized on conventional chest radiography and helps in localization of the anastomosis during follow-up angiography (Figure 2). Rapid identification of the anastomosis site allows easy catheter engagement and successful graft opacification. It also allows quick application of angioplasty and stents in the grafts. Peterson and colleagues¹ reported that the use of any type of markers decreased the total catheterization time, the fluoroscopy time, and the injected volume of contrast material. These improve the efficiency and lower the morbidity of the procedure. The markers also demonstrate the number of graft ostia that must be cannulated, increasing the chances of localizing the anastomoses. At times, it also identifies the surgeon or surgeons who use the method. The radiopaque filaments are nontoxic, they have not been

Figure 2. Coronary angiography: *A*, catheter localizing an aorta-coronary graft anastomosis; *B*, graft opacification. Arrows show graft ostium.

an independent source of infection, and they have been easily identified during reoperations. We have not encountered any fibrosis or narrowing of the anastomosis caused by this method. The material is already available in the operating room, and its use does not add to the surgical time or cost.

Conclusion

This method of tagging the aorta-coronary graft anastomosis is a simple and economical technique. It is not associated with complications and has helped in the identification of the coronary grafts. Although the technique has been described before, it is not used in most cardiac surgery centers. This report might encourage many surgeons to apply this simple and useful method.

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