Left internal thoracic artery patch aortoplasty for repair of coarctation of the aorta

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Adult patients with long coarctation of the aorta (CoA) may require coarctectomy and prosthetic tube or patch implantation. Potential drawbacks of these techniques, such as risk of infection, thrombosis, neointimal ingrowth, and aneurysm formation, are closely related to the use of prosthetic materials.¹⁻³ To avoid these specific risks, we developed a technique that includes resection of coarctation and two elements of plastic procedure: end-to-end suturing of the aorta posterior wall and patch closure of the longitudinally incised aorta anterior wall. The material for the patch is autologous left internal thoracic artery (LITA).

Technique

The approach is by left posterolateral thoracotomy through the fourth intercostal space. The length of the CoA and diameter of LITA are measured (Figure 1, A). If the LITA diameter is big enough, then a segment of this vessel is harvested within the area between the second and third intercostal spaces. The arterial cylinder is opened longitudinally to prepare a patch (Figure 1, B). After harvesting, the patch is preserved in sterile normal saline solution. The prestenotic and poststenotic parts of the isthmus of the aorta, coarctation, ligamentum arteriosum, left subclavian artery, and descending thoracic aorta are dissected. The ligamentum arteriosum is ligated and divided. After reduced heparinization (100 IU/kg intravenously), vascular clamps are placed on the aorta; the coarctation, together with ductal tissue, is then excised between the clamps. To achieve as wide as possible a lumen of the aortic anastomosis, two additional longitudinal incisions (approximately 20 mm each) are made: proximally on the isthmus toward the origin of left subclavian artery and distally on the descending aorta. Then the posterior wall of the anastomosis is constructed with 5-0 monofilament polypropylene continuous suture (Figure 2, A). The anastomosis is completed by suturing the LITA patch to the aorta within its longitudinally incised wall (Figure 2, B). The thoracotomy is closed after insertion of a chest drain.

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Results

From October 1998 through March 2005, this technique was applied to 20 selected patients with long CoA and isthmus hypoplasia. The mean age and weight were 16.2 ± 4.9 years and 60.6 ± 15.4 kg, respectively. The mean length of hypoplastic segment of the aorta was 54 ± 27 mm, and the LITA diameter was 6.9 ± 1.6 mm (range 5-10 mm).

The postoperative course was uneventful, with no signs of spinal cord damage. There were no in-hospital deaths or late deaths among our patients during mean follow-up of 22 ± 10.3 months. All patients were normotensive. No patient had a significant systolic pressure gradient at the site of the anastomosis, and there were no signs of aneurysm formation.

Figure 1. A, Intraoperative view. Length of hypoplastic segment of aorta is 40 mm, and LITA is huge. Ao, Aorta; dAo, descending aorta; LSA, left subclavian artery. B, Preparation of patch (arrow).

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Figure 2. A, Posterior wall of anastomosis is performed in an end-to-end fashion, and anterior wall is constructed with LITA patch. B, Patch enlargement of anterior wall of anastomosis.

Discussion

Young adults with CoA are a high-risk group of patients, because their usual surgical options, such as graft interposition or patch aortoplasty, can lead to serious long-term complications.¹⁻³ Unsatisfactory outcomes are most often associated with aneurysm formation, especially after patch aortoplasty. The incidence of aneurysms is reported to be from 5% to 38% of cases.³ Many factors have been proposed as etiologic, including abnormal tension

caused by the rigidity of the synthetic material against the aortic wall and the presence of ductal tissue in the aortic wall at the repair site. Thus it is reasonable to suppose that ideal surgical technique on the one hand should not use any synthetic materials and on the other should not leave any ductal tissue.

Moor and colleagues⁴ in 1972 originally described the procedure whereby a piece of the wall of the LITA was sutured within the aortotomy incision. Campalani and associates⁵ in 1985 published a series of 23 patients undergoing coarctation repair. They also used a technique of patch aortoplasty that uses the LITA as a free autogenous graft. Both groups, however, did not resect ductal tissue, leaving a possible etiologic factor for aneurysm formation in place. To eliminate this factor, we focused on the use of an autologous material (LITA patch) in conjunction with end-to-end anastomosis after adequate removal of ductal tissue.

We have always avoided performing prosthetic patch aortoplasty because of a previous big study from our institution regarding aneurysm formation after such a technique.³ The decision to use a LITA graft instead of a prosthetic graft was based on higher biocompatibility and less risk of infection. A LITA diameter of 5 mm was considered minimally acceptable for such repair.

In conclusion, autologous LITA is suitable for a patch to repair CoA. With this simple method, CoA repair can be performed safely and efficiently in young adult patients with long CoA or in situations involving hypoplasia of the aortic isthmus. We believe that avoidance of artificial materials makes this technique the method of choice for selected patients.

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