Repair of Torn Aortic Root with the Left Atrial Appendage

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SUMMARY

A narrow aortic root and a small aortic annulus made aortic valve replacement in a 35-year-old female patient with calcified aortic stenosis rather difficult. At the end of the procedure, it was noticed that the aortic root was badly torn. The tear started at the end of the aortotomy incision, near the commissure between the non-coronary and left coronary cusps, ran flush with the prosthetic ring and extended beneath and a few millimeters beyond the ostium of the left coronary artery. Only a thin rim of the aortic wall was left proximally, which was not strong enough to support the sutures. The aorta was repaired using a pericardium covered Goretex patch, bolstered by the left atrial appendage.

Key Words:

Aortic valve replacement Aortic root Left atrial appendage

O PEN heart surgery exposes the ascending aorta to the possibility of serious injuries.¹⁾⁻³⁾ Aortic dissection related to cannulation site and aortic disruption at the bypass graft anastomosis site are dreaded complications that present formidable problems of management. The small aortic root or annulus presents challenging technical problems, as access is limited and it may also not accommodate an adequate size prosthesis.⁴⁾ In order to circumvent these problems, various aortic root/annulus enlargement techniques have been described.⁵⁾⁻⁷⁾ In our patient, the tissue annulus admitted a 19 mm St. Jude Medical (SJM) prosthesis, but the necessary traction required to provide exposure led to a tear of the aorta. The nature of this tear precluded conventional methods of repair.

CASE REPORT

A 35-year-old female patient presented with shortness of breath and

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chest pain of 10 years duration. Physical examination revealed a fit patient. She was in sinus rhythm, with a blood pressure of 100/60 mmHg. An ejection systolic murmur was audible in the aortic area. Two-dimensional (2-D) echocardiography showed left ventricular hypertrophy, good left ventricular function and a thickened aortic valve with an eccentric opening with a Doppler gradient of 90 mmHg across the valve. The mitral valve was normal. Cardiac catheterization showed normal oximetry, pulmonary capillary wedge pressure of 14 mmHg, pulmonary artery pressure of 34/15/22 mmHg, right ventricular pressure of 40/2/11 mmHg, right atrial pressure of 7 mmHg and aortic pressure of 115/80/95 mmHg. There was no aortic regurgitation. The aortic arch was on the right side.

The patient was submitted to open heart surgery, using hypothermic cardiopulmonary bypass with hemodilution. Cold asanguinous cardioplegia supplemented with topical cooling provided cardiac protection. The aortic root was small. The calcified valve was excised and a 19 mm SJM prosthesis was implanted using non-pledgeted sutures. The narrow aorta and small annulus provided limited access and the whole procedure was fraught with difficulty. Once the valve was in situ, it was noticed that the aortic root was badly torn. The tear started at the end of the aortotomy incision on the right side, running flush with the ring of the prosthesis and extended below and a few millimeters beyond the ostium of the left coronary artery (Fig. 1). Only a thin rim of the aortic wall was left proximally. It was too thin and friable to support sutures. The coronary artery with its thin rim of aortic wall was reattached to the proximal aorta with three simple inter-

Fig. 1. The torn aorta. (a) Left coronary ostium. (b) Tear. (c) St. Jude valve in situ.

rupted 6×0 prolene sutures. The rest of the aorta was repaired using a pericardial covered elliptical shaped Goretex graft, bolstered by the left atrial appendage. The left atrial appendage was large and could be pulled through the transverse sinus. The sutures went through the left atrial appendage, the pericardial and Goretex patches, through the thin rim of the aortic wall and through the prosthetic ring (Fig. 2). The appendage covered the postero-lateral part of the aorta over a length of approximately 2 cm

Fig. 2. Pledgeted suture going through L.A. appendage, Goretex patch, aortic wall and ring of valve prosthesis. (a) Pericardial patch. (b) Goretex patch. (c) L.A. appendage. (d) Ring of prosthesis.

Fig. 3. The repaired aorta. L.A. appendage covering postero-lateral aspect of aorta. (a) Ascending aorta. (b) Goretex patch. (c) L.A. appendage. (d) S.V.C.

(Fig. 3). The patient was weaned off bypass smoothly. The repaired area remained intact and there was no bleeding or hematoma formation. The postoperative course was uneventful. The aortic prosthesis was functioning well. There was no electro-physiological or biochemical evidence of infarction or ischemia. The patient was put on dipyridamole (Persantine) and aspirin in accordance with our anticoagulation protocol for SJM valves in the aortic position. During follow-up 1 year later, the patient was in good health. Two-dimensional echocardiography showed good function of the prosthesis, good LV function and a gradient of 9 mmHg across the valve.

DISCUSSION

Injury to the ascending aorta is a recognized complication of open heart surgery that can give rise to serious problems of management. Simple tear, disruptions at the anastomosis site of bypass grafts, or dissecting aneurysm related to cannulations are examples of trauma the ascending aorta can suffer during operation; management of these injuries has been described in the literature.¹⁾⁻³⁾

In our patient, exposure was limited on one hand, and on the other hand, the tear was such that it was not amenable to simple repair. While the aortic annulus admitted a 19 mm SJM valve, its placement was not straight forward. During the necessary retraction to implant the valve, the aorta gave way. The right-sided aortic arch could have predisposed to this complication, as the ascending aorta is less mobile in this position and the force of traction is not mitigated by the downward movement of the aortic arch. It could be argued that an aortic root enlarging procedure would have averted this mishap. However, the aortic annulus accepted a 19 mm valve which we felt was an adequate size.⁸⁾ Therefore, annular enlargement was not necessary and supra-annular aortic root enlargement would have come at the end of valve implantation anyway.

The problem of repair was twofold; (1) the extension of the tear beneath and beyond the orifice of the left main coronary artery, necessitating reattachment of the artery to the proximal aorta; and (2) the thin rim of the weak and friable aortic wall left proximally, especially on the postero-lateral aspect of the aorta which was too weak and friable to allow a strong repair. Because of its inaccessibility once off bypass, this area demands a sound repair.

The left atrial appendage has been used for repair of posterior ventricular wall rupture with success.⁹⁾ The length of the left atrial appendage in our case allowed it to be pulled through the transverse sinus and we used it to

bolster the postero-lateral aspect of the aorta with good effect. It served the dual purpose of supporting the suture-line and of providing hemostasis. The Goretex graft was used to repair the tear and this also resulted in enlargement of the supra-annular aorta. We covered the Goretex patch with autologous pericardium as this seals off the needle holes in the graft, thus preventing bleeding, as well as shielding it from infections in cases of mediastinitis. The patient was closely followed and at 1 year nothing sinister lurked in the repaired area. However, longterm follow-up is necessary, as complications can develop insidiously over the years.¹⁰⁾

The use of the left atrial appendage for the repair of the torn aortic root would appear not to have been previously published.

REFERENCES

1. Standerfer RJ, Livermore J, Khonsari S: Disruption of the ascending aorta. *Ann Thorac Surg* **41**: 95, 1986
2. Murphy DA, Craver JM, Jones EL, et al: Recognition and management of ascending aortic dissection complicating cardiac surgical operations. *J Thorac Cardiovasc Surg* **85**: 247, 1983
3. Boruchow IB, Iyengar R, Jude JR: Injury to ascending aorta by partial-occlusion clamp during aorto-coronary bypass. *J Thorac Cardiovasc Surg* **73**: 303, 1977
4. Pichler JM, Danielson GK, Pluth JR, et al: Enlargement of the aortic root or annulus with autologous pericardial patch during aortic valve replacement. *J Thorac Cardiovasc Surg* **86**: 350, 1983
5. Nicks R, Cartmill T, Bernstein L: Hypoplasia of the aortic root. The problem of aortic valve replacement. *Thorax* **25**: 339, 1970
6. Blank RH, Pupello DF, Bessone LN, et al: Method of managing the small aortic annulus during valve replacement. *Ann Thorac Surg* **22**: 356, 1976
7. Manouguian S, Seybold-Epting W: Patch enlargement of the aortic valve ring by extending the aortic incision into the anterior mitral leaflet. New operative technique. *J Thorac Cardiovasc Surg* **78**: 402, 1979
8. Wortham DC, Tri TB, Bowen TE: Hemodynamic evaluation of the St. Jude medical valve prosthesis in the small aortic annulus. *J Thorac Cardiovasc Surg* **81**: 615, 1981
9. Devineni R, McKenzie FN: Type I left ventricular rupture after mitral valve replacement. *J Thorac Cardiovasc Surg* **86**: 742, 1983
10. Barrat Boyes B and Blank RH: In discussion of Pichler JM, et al, *in*: Enlargement of the aortic root or annulus with autologous pericardial patch during aortic valve replacement. *J Thorac Cardiovasc Surg* **86**: 350, 1983