

Evaluation of Emergency Composite Aortic Root Replacement with Direct Coronary Artery Implantation

Kamal Raissi, MD, Mohammad Sina, MD,
Mohammad Hassan Kalantar Motamedi, MD*

Abstract

Background- Composite aortic root replacement is the accepted treatment for acute dissections of the ascending aorta involving the root with aortic valve regurgitation, but controversy continues over the best technique of operation.

Methods- We reviewed all cases who underwent emergency operations in an over two-year period in our center for acute dissections of the ascending aorta in order to determine the surgeon's preference concerning the technique of the operation and the outcome of the patients. Twenty-five patients underwent emergency surgery for acute ascending aortic dissections from Jan. 1998 to Jan. 2000. There were 21 male (84%) and 4 female patients (16%), and the average age was 48 years (range 25 to 68 years).

Results- Hospital death occurred in 5 (20%) patients. Return to the operating room for bleeding was required in 9 patients, and hospital mortality due to bleeding was 3 patients. Neurological deficits developed in 3 patients in the immediate postoperative period, two of whom recovered completely. The third patient also had renal and multiple organ failure and died. One patient required tracheostomy and ventilatory support for 3 weeks. This patient finally died because of sternal infection and sepsis.

Echocardiogram was done on follow-up for all patients, and showed no evidence of coronary or other anastomotic disruption. No reoperations were needed for anastomotic aneurysms at any site.

Conclusion- Higher bleeding and mortality rates in our series compared to those reported in the literature can be reduced with the newly introduced gelatin-coated graft material. Our technique includes excision of the dissected aortic wall, implantation of a composite valve-graft conduit, direct coronary implantation to the graft and distal anastomosis to the divided aorta. (*Iranian Heart Journal*. 2002; 2(4)&3(1): 29-32)

Key words: acute aortic dissection < emergency < bentall procedure < aortic root replacement

Composite aortic root replacement involves replacing all aortic tissue from the left ventricular outflow tract to the distal ascending aorta or beyond with prosthetic materials for the treatment of

aneurysms of the root of the aorta with associated valvular involvement.

In 1968, Bentall first described the operation that excludes the entire aortic root from the circulation. They sutured the

From the Department of Cardiac Surgery, Shaheed Rajaie Cardiovascular Medical Center, Iran University of Medical Sciences, and

*Dept. of Cardiovascular Surgery, Baqiatallah University of Medical Sciences, Tehran, Iran.

Correspondence to: K. Raissi, MD, Dept. of Cardiac Surgery, Shaheed Rajaie Cardiovascular Medical Center, Tehran

Email: kaissi@rhc.ac.ir

Fax: +(9821) 2042026

sewing ring of an aortic valve prosthesis with an attached tube graft to the native aortic valve annulus, and then directly sutured the aortic tissue surrounding the coronary ostia to an opening in the aortic tube graft. These anastomoses and distal aortic anastomoses were all made within the interior of the aorta, and then the aneurysm wall was closed tightly over the repair; this has come to be known as the inclusion technique.¹

Pseudoaneurysm formation at the coronary artery and the aortic anastomoses has been a troublesome complication of this technique.² In an effort to decrease tension on the coronary anastomoses and to decrease bleeding, Cabrol and associates placed an aortic valve prosthesis inside a tube graft, which was then attached to the native aortic valve annulus. A separate 8-mm tube graft was then placed between the two coronary ostia and the middle portion anastomosed in a side-to-side fashion to the aortic graft. The distal anastomoses were made within the aorta, the aneurysm closed over the graft, and a fistula created between the peri-graft space and the right atrial appendage. Kinking or compression of the prosthetic coronary graft has been the source of both early and late myocardial ischemic problems with this procedure.^{3,4}

Kouchoukos and associates adopted an open technique in which the coronary orifices were detached from the aortic wall, the distal aorta was transected, a composite valve graft was attached to the native annulus, and both coronary arteries were sutured directly to openings in the tube graft. The distal anastomosis was made to the transected aorta, and the aneurysm wall loosely covered the prosthesis.⁵

We have also used the open technique of aortic root replacement, with resection of the aneurysm and direct implantation of the coronary arteries.

Material and Methods

We reviewed all cases of emergency valve-conduit replacement of the ascending aorta for acute dissections of the ascending aorta that were operated on over a two-year period from January 1998 to January, 2000 at our center. There were 25 patients, 21 (84%) males and 4 (16%) females. The average age was 48 years (range 25 to 68 years). The patients had acute ascending aortic aneurysm involving the aortic root with aortic valve insufficiency, and in 6 cases dissection extended beyond the aortic arch. Causes of the aortic process are detailed in Table I. All patients underwent an emergency operation once stabilized hemodynamically.

Operative Technique

All procedures were performed through a median sternotomy incision with femoral artery cannulation in 9 patients (36 %) and aortic arch cannulation in the rest. Systemic hypothermia of 25-28° C was used in twenty patients, but in two cases circulatory arrest was required with profound hypothermia to 18° C. Intermittent cold blood or crystalloid cardioplegia was administered directly into the coronary ostia in all patients. The aneurysm wall was excised and the main coronary arteries were then gently mobilized from surrounding tissue, preserving buttons of aorta surrounding the coronary ostia. The distal aorta was completely transected at the site of the anastomosis. Suture technique for proximal end of the valve graft to the native valve annulus was with continuous 3-0 polypropylene, interrupted at the three aortic valve commissures. The coronary buttons were attached directly to the aortic tube graft with 5-0 polypropylene running suture. The distal anastomosis of the conduit to the transected aorta was made with continuous 3-0 polypropylene suture, buttressed with a strip of felt on the outside of the aorta. We currently use the St. Jude

valve (22 cases) graft prosthesis, but when the suitable size was not available, Carbomedics (two cases) and in one case, a Bjork-Shiley valve was used. We created our own conduit by suturing the sewing ring of the aortic valve prosthesis to an appropriate-sized tube graft with a running stitch.

Results

Hospital death occurred in 5 (20%) patients. The causes of death are listed in table II. Return to the operating room and re-exploration for bleeding was required in 9 patients, and hospital mortality due to bleeding was 3 patients. Neurological deficits developed in 3 patients in the immediate postoperative period. Two of them recovered completely, but the third patient, who developed renal and multiple organ failure, died. One patient required tracheostomy and ventilatory support for 3 weeks; this patient finally died because of sternal infection and sepsis.

Echocardiogram was performed postoperatively and on follow-up in all patients and showed no evidence of coronary or other anastomotic site disruption. No reoperations were needed for anastomotic aneurysms at any site.

Comment

A review of our results with those reported from other centers of the world reveals a higher incidence of mortality in our center, and a higher re-exploration rate for bleeding. Bleeding remains a problem in our experience and also in other centers. The Availability of collagen and gelatin-impregnated grafts recently in our hospital and the use of finer anastomotic sutures have been helpful, however, in reducing postoperative bleeding.

Mechanical valves were used in all patients and there was no case of valvular dysfunction in this series. We conclude that

composite aortic root replacement is an effective treatment for acute ascending aortic dissection. Hospital mortality in our series has been higher, but with the use of impregnated grafts and fibrin glue, which can help control bleeding in most patients, a lower incidence of bleeding and also mortality rate can be anticipated. We are also evaluating the addition of a second suture line to help seal the annulus anastomosis as recommended by Copeland.⁷ This can be useful in the proximal part, but at the distal part in most cases, bleeding is due to the extension of the dissection to the aortic arch, where the aortic tissue is not suitable for additional sutures. In this situation, a strip of felt pledgets are placed both inside and outside the aorta and sutured with a continuous mattress stitch, and then the graft is subsequently anastomosed to the felt and aorta.

Regarding the technical aspects of the operation, we further believe that detached coronary artery buttons directly anastomosed to openings in the aortic tube graft offer the best opportunity for a trouble-free result. A follow-up of our patients has shown no reoperations were necessary for the management of coronary anastomotic complications, and echocardiograms have demonstrated no anastomotic aneurysms. This is consistent with the observations of Kouchoukos.⁶ He also reports that patients require reoperations for coronary pseudoaneurysm when the detached button technique is used. This is in contrast to our experience and that of other authors.⁸ The classic Bentall operation has been associated with pseudoaneurysms at all of the sites of anastomosis of tissue to prosthesis, including the aortic annulus, coronary ostia and distal aorta. Kouchoukos found pseudoaneurysms in 8% of their patients in whom the inclusion wrap technique was used. We have used root replacement for acute dissections when the intimal tear

arises in a pre-existing aneurysm or extends into the aortic root, in patients with Marfan's syndrome, and in those requiring aortic valve replacements that have extensive involvement of the aortic sinuses.

References

1. Bentall HH, DeBono A. A technique for complete replacement of the ascending aorta. *Thorax* 1968; 23: 338-9.
2. Marvasti MA, Parker FB, Randall PA. Composite graft replacement of the ascending aorta and aortic valve. Late follow up with intra-arterial digital subtraction angiography. *J Thorac Cardiovasc Surg* 1988; 95: 924-8.
3. Cabrol C, Pavie A, Gandjbakhch I, et al. Complete replacement of the ascending aorta with reimplantation of the coronary arteries. A new surgical approach. *J Thorac Cardiovasc Surg* 1981; 81: 309-15.
4. Svensson LG, Crawford ES, Hess KR. Composite valve graft replacement of the proximal aorta: comparison of technique in 380 patients. *Ann Thorac Surg* 1992; 54: 427-39.
5. Cabrol C, Pavie A, Mesnildrey P, et al. Long-term results with total replacement of the ascending aorta with reimplantation of the coronary arteries. *J Thorac Cardiovasc Surg* 1986; 91: 17-25.
6. Kouchoukos NT, Wareing TH. Sixteen-year experience with aortic root replacement. *Ann Surg* 1991; 214: 308-20.
7. Copeland JG, Rosado LJ, Snyder SL. New technique for improving hemostasis in aortic root replacement with composite graft. *Ann Thorac Surg* 1995; 55: 1027-9.
8. Bayfield MS, Korn IL. Reducing bleeding after replacement of the aortic root. *Ann Thorac Surg* 1995; 60: 1130-1.
9. Sundt TM, Kouchoukos NT, Saffitz JE, Murphy SF, Wareing TH, Stahl DJ. Renal dysfunction and intravascular coagulation with aprotinin hypothermic circulatory arrest. *Ann Thorac Surg* 1993; 55: 1418-24.