Delayed surgery for traumatic rupture of aortic arch with dissection of the left anterior descending artery

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High-velocity accidents are now being reported with alarming regularity. A number of these patients unfortunately do not reach the hospital.

Clinical Summary

A 21-year-old man presented with multiple fractures in the face and extremities. The electrocardiogram showed features of acute anteroseptal myocardial infarction. Echocardiography showed moderate left ventricular (LV) dysfunction with an ejection fraction of 0.4. Chest radiography showed mediastinal widening and minimal left pleural effusion. A spiral computed tomography angiogram revealed a huge mediastinal hematoma and transection of the arch of aorta between the left common carotid artery (LCCA) and the left subclavian artery (LSCA) with no active bleeding.

After various options were considered, the decision was made to treat the aortic and suspected coronary injury conservatively until the patient was stabilized. Repeat imaging revealed no worsening in the pleural effusion or hematoma.

A computed tomographic angiogram at 12 weeks revealed a pseudoaneurysm in the arch of aorta between the LCCA and the LSCA involving approximately three fourths of the circumference (Figure 1, A). Coronary angiogram demonstrated dissection of the proximal left anterior descending (LAD) artery (Figure 2, A). Echocardiogram and methoxyisobutyl isonitrile scan showed moderate LV dysfunction (ejection fraction of 0.4) with a small apical LV aneurysm.

A single-stage procedure, including aortic arch repair, coronary artery bypass grafting of LAD, and LV aneurysm repair, was planned. With the patient under general anesthesia and in the supine position, the third part of the right subclavian artery was exposed through an infraclavicular incision, and an 8-mm polyester graft was sutured to it end to side. This was used as arterial inflow. The left radial artery (LRA) was harvested. A median sternotomy with extension into the neck on the anterior border of the left sternomastoid muscle gave adequate exposure of the arch of aorta and the neck vessels. The right atrium was cannulated for venous drainage, and the LV was vented through the right superior pulmonary vein. While cooling occurred, the distal end of the LRA was connected to the proximal LAD. At 18°C, deep hypothermic arrest was established. After snugging the innominate artery, antegrade cerebral perfusion was started at 900 mL/min, and retrograde flow through the LCCA and LSCA was noted. The aortic arch was opened between the LCCA and the LSCA into the pseudoaneurysm, and that segment of arch was replaced using an 18-mm polyester tube graft. The origins of the LCCA and LSCA were not affected and could be preserved by careful suturing (deep hypothermic arrest time: 50 minutes). On rewarming, the proximal of LRA was connected to the aorta. The small apical LV aneurysm was opened, parallel to the LAD, and a linear LV aneurysm repair was performed.

The patient was ventilated for 12 hours. The total drainage was 400 mL with transfusion of 1 unit of fresh whole blood. The intensive care unit stay was 2 days, and the hospital stay was 9 days.

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Received for publication Aug 24, 2007; accepted for publication Sept 24, 2007.

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J Thorac Cardiovasc Surg 2008;135:428-30
0022-5223/\$34.00

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doi:10.1016/j.jtcvs.2007.09.022

Figure 1. Sixty-four-slice computed tomographic angiogram reconstructions showing pseudoaneurysm of aortic arch (A) and postoperative picture of arch repair (B). *LRA*, Left radial artery; *LAD*, left anterior descending.

Postoperative imaging showed intact arch repair (Figure 1, B) with a patent LRA to LAD graft (Figure 2, B). One month after the procedure, the patient was asymptomatic and the echocardiogram showed a marginal increase in systolic function (ejection fraction of 0.45) with no apical aneurysm.

Discussion

Deceleration injury to the aorta has been reported; the most common site is the descending thoracic aorta just distal to the LSCA origin. Aortic arch injuries are rare,^{1,2} probably because most patients with these injuries do not reach the hospital alive. Few isolated coronary artery injuries have been reported.^{3,4} A combined aortic arch and coronary artery injury must be one of the rarest. This young man was fortunate to survive this accident and reach the hospital.

At presentation, the surgical treatment was deferred because the patient already had features of acute anteroseptal myocardial infarction. Thrombolysis was not considered for acute coronary syndrome

because of the fear of lysing the “life-saving” mediastinal hematoma. Also, the cause of acute coronary syndrome was thought to be dissection rather than thrombosis. Only unfragmented heparin was given under close supervision and monitoring. Antiplatelet drugs were commenced after 48 hours.

The patient’s young age, the position of pseudoaneurysm, the LAD lesion with viable muscle in that territory, and the need for general anesthesia in orthopedic procedures clearly demanded the need for surgical treatment.

The LRA was chosen as the conduit because the fate of the LSCA was not clear at the start of the operation. The right subclavian artery cannulation was of immense help in providing the antegrade cerebral circulation without any additional cannulae or tubings in the field. A linear LV aneurysm repair was performed because the septal scar was not clearly visible.

Delayed surgical treatment can provide optimal results in combined aortic and coronary injuries, provided a stable clinical condition

Figure 2. Angiogram showing dissection in the proximal LAD (A) and postoperative computed tomography reconstruction showing patent LRA-LAD graft (B). *LRA*, Left radial artery; *LAD*, left anterior descending.

can be achieved with conservative management consisting of rest, careful monitoring, periodic reassessment, and antiplatelet drugs.

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Simplified technique for surgical ligation of the left atrial appendage in high-risk patients

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The left atrial appendage (LAA) is the most frequent site of clot formation in patients with atrial fibrillation. The stroke rate in patient with atrial fibrillation is 12% per year at any age in clinical trial populations with a history of thromboembolism.¹⁻³

Ligation of the LAA is commonly performed during cardiac surgery procedures.¹ Complete obliteration of the communication between the LAA and the body of the left atrium (LA) is mandatory to eliminate the potential for stagnant blood flow² but challenges the cardiac surgeon. Many studies reported incomplete closure of the LAA after surgical procedures, which may even increase the risk of embolization.^{4,5}

This work describes our initial experience with a new simple surgical ligation of the LAA during cardiac surgery procedures. This technique enables “complete” obliteration of the LAA in high-risk patients undergoing cardiac surgery.

Surgical Technique

Operations were performed by five cardiothoracic surgeons in one institution. Ligation of the LAA was accomplished during open

chest cardiac surgery through complete or partial upper sternotomy. During cardiac arrest the heart was positioned as for lateral wall revascularization. As a first step, the epicardial base of the LAA was carefully mobilized, avoiding tissue bunching to increase the distance between the LAA and the circumflex artery. A Derra clamp was placed at the base of the LAA with attention to the circumflex artery. Two 90-cm 2–0 nonabsorbable Mersilene ligatures (Ethicon, Inc, Somerville, NJ) were knotted sequentially at the base of the LAA approximately 5 mm from each other. The clamp was moved stepwise during this procedure. The ligatures were controlled for bleeding or dehiscence (Figure 1).

Echocardiographic Assessment

Echocardiography was performed according to American Society of Echocardiography guidelines with a Vingmed Vivid 5 cardiac ultrasound scanner (GE Medicals, Fairfield, Conn). Multiplanar transthoracic echocardiography was performed in all patients intraoperatively, exploring the LAA in various planes from 0° to 120°. Maximal LAA areas were measured by tracing a line from the top of the upper pulmonary vein limbus along the entire endocardial LAA border. The LA and LAA were closely inspected for the presence of thrombi and spontaneous echo contrast. Surgical ligation of the LAA was clearly identified by the lack of any anatomic structure between the mitral valve base and the upper left pulmonary artery. Incomplete ligation was diagnosed by color Doppler flow, demonstrating a jet traversing the separation between the LAA and the LA body.

Results

From January 2006 until February 2007, 259 consecutive patients with atrial fibrillation and contraindication to long-term warfarin therapy or high risk for thromboembolism based on the presence of congestive heart failure, diabetes mellitus, hypertension, history of stroke, or transient ischemic attack undergoing cardiac surgery

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Received for publication Aug 3, 2007; accepted for publication Aug 14, 2007.

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J Thorac Cardiovasc Surg 2008;135:430-1

0022-5223/\$34.00

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doi:10.1016/j.jtcvs.2007.08.057