

Left Axillary Artery Perfusion in Surgery of Type A Aortic Dissection

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Purpose: A left axillary artery perfusion instead of a femoral perfusion has the benefit of avoiding false lumen perfusion and atheroembolization into the brain, which is caused by retrograde perfusion in type A aortic dissection surgery. We performed type A aortic dissection surgery using the left axillary artery perfusion technique and reviewed this method.

Patients and Methods: From April 2002 to January 2004, 8 patients with a mean age of 70 years (48 to 81), underwent axillary artery cannulation with a side graft technique in type A aortic dissection operations. Six patients had acute type A and 2 had chronic type A dissections. The surgical procedures were ascending aortic replacement in 5, hemiarch replacement in 2, and total arch replacement in 1.

Results: In all patients, a cardiopulmonary bypass was established through the left axillary perfusion. There were no operative deaths and no hospital deaths. All patients were able to avoid cerebral vascular accidents. One patient required a femoro-femoro bypass on the 10th postoperative day because of malperfusion of the left leg, which occurred suddenly. Postoperative hemorrhaging requiring re-sternotomy occurred in 2 patients.

Conclusion: A left axillary artery perfusion is safe and useful for arterial inflow for type A aortic dissection surgery. (*Ann Thorac Cardiovasc Surg* 2008; 14: 22–24)

Key words: type A aortic dissection, left axillary perfusion

Introduction

In surgery of type A aortic dissection, a femoral perfusion is commonly used. However, it has the risk of false lumen perfusion or atheroembolization into the brain, which is caused by retrograde perfusion. To avoid these complications, we used a left axillary artery perfusion instead of a femoral perfusion in 8 type A aortic dissection patients and reviewed this method.

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Patients and Methods

From April 2002 to January 2004, 8 patients, 3 men and 5 women, underwent axillary artery cannulation in type A aortic dissection operations. Their mean age was 70 years (range 48 to 81), and their mean body surface area was 1.39 m² (range 1.21 to 1.63 m²). Six patients had acute type A dissections and 2 had chronic type A dissections.

Surgical techniques

The patients were anesthetized in the supine position and had a single-lumen endotracheal tube inserted, and a Swan-Ganz catheter (Baxter International Inc.) was used. A short incision (8 cm) was made parallel to 1 cm below the left clavicle, corresponding to its middle portion. The pectoralis major and minor muscles were transected to expose the proximal segment of the axillary artery. After

heparinization (300 units/kg), the axillary artery was clamped proximally and distally. A longitudinal arteriotomy was made to suture an 8-mm Dacron graft (Intergard Collagen Impregnated Woven Dacron Graft, Intervascular Inc., Tampa, FL) with 6-0 polypropylene, which was used by the inflow of the cardiopulmonary bypass (CPB).

The chest was opened by means of a median sternotomy, and a single venous cannula was positioned via the right atrium to establish CPB. The left ventricle was vented through a right upper pulmonary vein, and during systemic cooling, the arch vessels were exposed for the cannulation of antegrade cerebral perfusion (ACP). When the bladder temperature had reached about 30°C, the ascending aorta was cross-clamped carefully and transected completely. Gelatin-Resorcin-Formalin (GRF) glue was applied into the false lumen in the proximal aortic root, and the aortic stump was reconstructed using 3-0 polypropylene continuous over-and-over suture with outer Teflon felt strip. When the bladder temperature had reached about 23°C, the systemic perfusion was stopped and the cross-clamp on the aorta was released to allow an inspection of the inside of the aorta. If a tear was found around the aortic arch, a total arch or hemiarch replacement was carried out, and if the aortic arch was not involved, the ascending replacement was performed with the open distal technique during ACP. An ACP was performed with left axillary perfusion, and with a balloon-tip cannula inserted directly into the innominate and left common carotid artery from inside the aortic arch. The distal stump was reconstructed in the same manner as that used for the proximal stump, which was an application of GRF and reinforcement with a Teflon felt strip. The distal anastomosis was carried out with a woven polyester graft (Gelweave™, Vascutek Ltd., Glasgow, Scotland), using a 3-0 polypropylene continuous over-and-over suture. When the distal anastomosis was completed, the CPB was resumed through a branch of the graft in total arch replacement or through the left axillary artery in an ascending or hemiarch replacement, and the patient was rewarmed. A proximal anastomosis was performed using 3-0 polypropylene, and a reconstruction of the arch vessels was carried out using 5-0 polypropylene sequentially.

After being weaned from the CPB, the cannula of the axillary perfusion was removed. The graft was cut and the short stump was oversewn with 5-0 polypropylene in two layers.

Results

Operative data

CPB was carried out at 2.4 L/m²/min. Peak flows through the axillary artery ranged from 2.9 to 3.9 L/min. A pressure measurement was performed with the right radial artery and the femoral artery to maintain it at about 60 mmHg (range 40 to 100 mmHg). The mean temperature at the circulatory arrest was 21.6±3.2°C, and cooling time to reach it from the CPB start was 81±16 min. The cerebral perfusion flow of the innominate artery and left carotid artery was maintained at 10 mL/min/kg (range 360 to 570 mL/min) with one pump, which was not changed by radial pressure, and the left axillary artery perfusion was decreased to 50–100 mL/min during ACP. The mean period of open distal was 47±15 min (range 25 to 78 min). Mean ACP time was 118±40 min (range 56 to 176 min). Mean cardiac arrest time was 97±20 min (range 69 to 124 min). Mean CPB time was 227±32 min (range 195 to 260 min).

The surgical procedures were ascending aortic replacement in 5 of the 8 patients, hemiarch replacement in 2, and total arch replacement in 1.

In all patients a cardiopulmonary bypass was established through a left axillary perfusion. There were no operative deaths and no hospital deaths. All patients were able to avoid cerebral vascular accidents. One patient required a femoro-femoro bypass on the 10th postoperative day because of malperfusion of the left leg, which occurred suddenly. Postoperative hemorrhaging requiring re-sternotomy occurred in 2 patients.

Comments

In the surgery of type A aortic dissection, femoral perfusion is commonly used; however, it has the risk of false lumen perfusion or atheroembolization into the brain, which is caused by retrograde perfusion. To avoid these complications, axillary artery perfusion techniques have been recently reported and many of them are right axillary perfusions.¹⁻⁵ However, Neri et al. described that the reason the left axillary route is preferred over the right is because the left subclavian artery has a separate and downstream origin from the carotid artery. It is an especially important clue with regard to brain protection to decrease the risk of embolization at the beginning of perfusion. Furthermore, in type A aortic dissection, the right subclavian artery is obstructed more frequently than the left; this is considered to be another reason to choose the left axillary route.⁶ We prefer left axillary cannulation for

the following reasons: (i) Involvement of an axillary artery by the dissection process is rare. (ii) In using the SCP method, we find the left subclavian artery cannulation most difficult because of the deep surgical view through the median sternotomy. (iii) In cases in which a reconstruction of the left subclavian artery was difficult because of a deep surgical view in total arch replacement, an axillary artery perfusion graft is useful as a reconstruction of the left subclavian artery to anastomose a branch of the arch graft through the thoracic cavity. Some authors have described a direct cannulation method for the right axillary artery or brachial artery.⁴⁻⁷⁾ However, there are many cases involving small women in which the axillary artery is small in diameter and very fragile, which reveals a possibility that sufficient CPB flow cannot be obtained with a smaller cannula, and injury may occur to the axillary artery at the cannulation. Therefore we prefer the graft interposed technique. A disadvantage is considered where edema of the left upper limb occurs in general, but it is not a fatal complication. In our patients there were no early or late neurological complications in the left upper limb, and edema was reduced after several days. Schachner et al. described that different complications occur with either direct cannulation or the side-graft technique for axillary artery cannulation. Cannulation problems or insufficient CPB flow due to a narrow vessel occurred in 0% of the sidegraft technique, whereas they were found in 4% with direct cannulation. Malperfusion in aortic dissections occurred in 20% of the sidegraft technique, whereas they were found in 0% with direct cannulation and at present the surgeons preferred technique for

axillary artery cannulation is used.⁵⁾

In type A aortic dissection surgery, left axillary perfusion is a very useful method to avoid false lumen perfusion and atheroembolization into the brain, and if necessary, an axillary artery graft cannulation is used for the reconstruction of the left subclavian artery.

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