Transapical aortic cannulation for acute aortic dissection with diffuse atherosclerosis

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In surgery for acute aortic dissection, the choice of appropriate arterial access for cardiopulmonary bypass is sometimes difficult because of dissection in large branches of the aorta. We report the efficacy of transapical aortic cannulation in acute type A aortic dissection in a patient with diffuse atherosclerotic disease.

Clinical Summary

The patient was a 76-year-old man with acute type A aortic dissection. Whole body computed tomographic scanning revealed acute aortic dissection extending from the aortic root to the origin of the brachiocephalic artery. Severe thickening and frail atheroma in the descending aorta and the abdominal aneurysm, 4 cm in diameter, were also noted. Arterial pulsation of the radial arteries and the femoral arteries was good. Emergency surgery was performed 20 hours after admission.

Initially the right axillary artery was exposed as the arterial access for systemic perfusion. Direct epiaortic echogram of the ascending aorta revealed an intimal tear in the middle portion of the ascending aorta, atheromatous ulcer, and stenosis at the origin of the left subclavian artery. The right axillary artery and caval veins were cannulated to institute extracorporeal circulation. However, right axillary artery perfusion was accompanied by a sudden rise in flow resistance when the flow rate exceeded 600 mL/min. Therefore, we conducted transapical aortic cannulation. The apex of the heart was elevated and a 3-0 polypropylene mattress suture with small felt pledgets was placed. Then the apex was lowered to the normal position to restore normal blood pressure. We elevated the apex again and inserted a 28F wire-reinforced venous cannula (RMI venous cannula; Edwards Lifesciences, Irvine, Calif) into the ascending aorta via the left ventricle (Figure 1). The duration of hypotension was approximately 10 seconds

Figure 1. Schematic drawing of transapical aortic cannulation in this patient.

each time. The position of the cannula was verified with epiaortic echography (Figure 2). Competence of the aortic valve was also confirmed by ultrasonography. The left atrium was vented immediately after the initiation of extracorporeal circulation. Replacement of the ascending aorta from the level of sinotubular junction to the proximal aortic arch was successfully performed with the aid of deep hypothermic circulatory arrest (20°C). Fragile atheromatous material at the origin of the left subclavian artery was removed simultaneously, and a short duration retrograde cerebral perfusion was performed before reperfusion. An arterial cannula was inserted into the graft and antegrade perfusion was resumed after completion of the distal anastomosis. Circulatory arrest lasted 38 minutes. The patient was weaned from cardiopulmonary bypass uneventfully. The endotracheal tube was removed on postoperative day 1 and the patient showed no neurologic deficit.

Discussion

Femoral artery cannulation has been widely used as arterial access for cardiopulmonary bypass in type A aortic dissection because of

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Figure 2. A, Epiaortic echogram of the ascending aorta (short-axis view). Note high echoic shadow of the cannula in the true lumen of the ascending aorta. B, Direct echogram of the left ventricular outflow (longitudinal view). The aortic valve was competent and the cannula was observed as a double track, high echoic shadow in the outflow tract.

easy exposure. However, retrograde perfusion from the femoral artery sometimes results in serious complications, including organ malperfusion and brain embolism.¹ Recently, the axillary artery has been used as alternative.² Use of this artery is advantageous to avoid atheroembolism from the diseased aorta to the brain, and the artery is available in patients with peripheral vascular disease.³ However, in this patient, perfusion resistance increased suddenly when the flow of extracorporeal circulation was increased. Since the right axillary artery was free from dissection, we thought this was due to a check valve phenomenon in the dissected brachiocephalic artery. Because of atherosclerotic change in the left subclavian artery, descending aorta, and abdominal aorta, the remaining option for arterial access was the ascending aorta via the left ventricle.

Transapical aortic cannulation was first used clinically by Wada and associates⁴ in 1971 for mitral valve surgery through a left thoracotomy. The efficacy of this method in congenital heart disease was also reported.⁵ However, this method was not widely used because of the inability to clamp the ascending aorta and to administer cardioplegic solution. Atherosclerotic disease sometimes accompanies peripheral vascular disease and severe ascending aortic disease. In such a situation, transapical aortic cannulation is a useful alternative.⁷ The drawback of using this method in median sternotomy is hemodynamic instability during elevation of the apex. However, in this patient, the duration of hypotension was short and cannulation was easy. The position of the cannula was easily verified by epiaortic echogram to avoid the escape of the

side hole into the left ventricle. In addition, since the cannula we selected was flexible and had multiple side holes, flow from the cannula was slow and consistent.

In conclusion, transapical aortic cannulation was a useful alternative in a patient with severe ascending aortic disease with inaccessible peripheral arteries.

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