原 著

Anesthetic Management in Two Patients Who Underwent Surgery for Stanford Type A Acute Aortic Dissection Using Transapical Aortic Cannulation

Masayuki Oshima*, Yoichi Shimada*, Atsuhiro Sakamoto*
Ryo Ogawa*, Takashi Watanabe**

Introduction

In the surgery for the Stanford type A acute aortic dissection, the femoral artery is commonly used for the cannulation site for cardiopulmonary bypass. However, in the case of the femoral cannulation, there is a risk of malperfusion and cerebral infarction caused by arterosclerotic atheroma in the aorta dislodged with retrograde perfusion. When an axillary artery is chosen as antegrade perfusion site, the surgery may be more difficult due to the small artery diameter and it may require a longer time. Aortic cannulation via the apex of the left ventricle and the aortic valve can prevent the complications that sometimes occur as a result of retrograde perfusion and is much simpler than axillar cannulation, since it is performed together with transesophageal echocardiography (TEE).

In this study, we report the cases of two patients who underwent surgery for the Stanford type A acute aortic dissection using the transapical aortic cannulation, and discuss anesthetic management with reference to reports in the literature.

Key words: Stanford type A acute aortic dissection, transapical aortic cannulation, anesthetic management

*Department of Anesthesiology, Nippon Medical School
**Department of Cardiovascular Surgery, Cardiovascular Center, Sekishinkai Kawasaki Saiwai Hospital

Surgical procedure

A median sternotomy was made on a patient under general anesthesia. The bicaval cannulation was performed for venous drainage, and a 1-cm incision was made on the left ventricular apex. Then a 24-Fr perfusion cannula (Kurary® thin wall catheter; Kurary Co., Osaka, Japan) was inserted through the cardiac apex and placed proximal to the ascending aorta via the aortic valve (Fig. 1). The position of the tip of the cannula was monitored by TEE and maintained at the level of Valsalva's sinus to avoid false lumen perfusion (Fig. 2). The cardiopulmonary bypass was established and a left ventricular vent cannula was inserted through the right upper pulmonary vein.

The blood circulation was arrested at a rectal temperature of 18℃, and the apical cannula was removed. The ascending aorta was incised to confirm the condition of the dissecting cavity, and retrograde cerebral perfusion was started. After forming a distal stump using the gelatin resorcinol formaldehyde (GRF) glue (Cardial SA, Saint-Etienne, France), distal anastomosis was carried out using a branched graft. After the anastomosis, cardiopulmonary bypass is then reestablished through the branched graft, and proximal anastomosis was performed during rewarming.

Case 1

A 64-year-old female patient was 150 cm tall and weighed 50 kg. Anamnesis and family history were

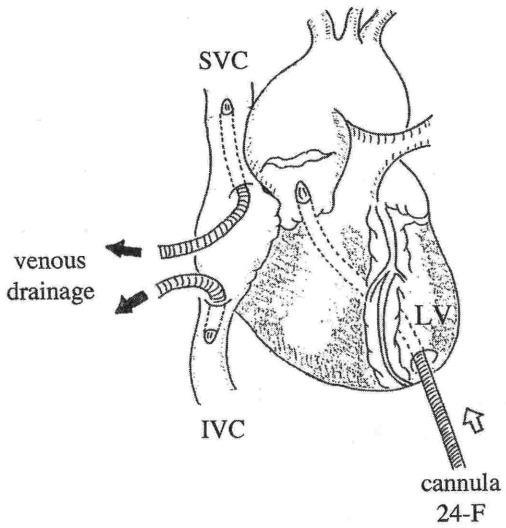

Fig 1. A 24-F cannula is passed from the apex of the left ventricle across the aortic valve to lie in the proximal ascending aorta.

This figure is made with author's permission (Tex Heart Inst J 28: 42-43, 2001). SVC: superior vena cava, IVC: inferior vana cava, LV: left ventricle

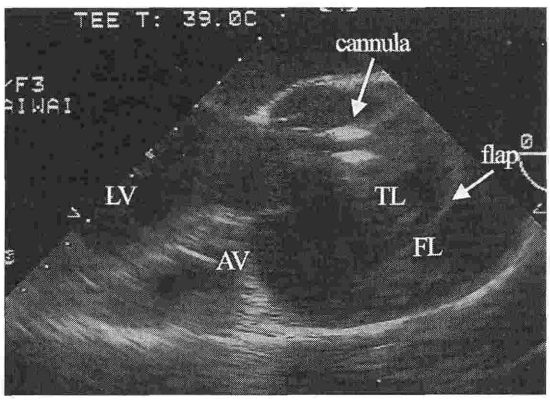

Fig 2. The tip of cannula was at the level of Valsalva's sinus monitored by transesophageal echocardiography.

AV: aortic valve, LV: left ventricle, TL: true lumen, FL:false lumen.

unremarkable. She had chest pain for five days and visited a neighborhood doctor for examination and treatment; however, the symptom did not improve. She visited another hospital and was diagnosed as having aortic dissection. She was transferred to our hospital for further examination and surgery. On auscultation, no cardiac murmur was audible, and flap in the ascending aorta was observed by thoracoabdominal CT. Cardiac tamponade was observed by transthoracic echocardiography; however, no aortic regurgitation was observed. The patient was diagnosed as having the Stanford type A acute aortic dissection, and an emergency surgery was performed. General anesthesia was induced with 0.3 mg of fentanyl, 10 mg of vecuronium and 2 mg of midazolam, and maintained with propofol and fentanyl. Following the induction of anesthesia, TEE was performed. After pericardium was incised, the cardiac tamponade was subsided gradually. After heparinization, hemiarch replacement was carried out employing transapical aortic cannulation. Antegrade cerebral circulation was arrested for 37 minutes, aortic clamping lasted for 88 minutes, and the cardiopulmonary bypass was used for 157 minutes.

No complications, such as cerebral infarction or false lumen perfusion, were observed perioperatively. The patient was discharged from the hospital 18 days after the operation.

Case 2

A 66-year-old female was 142 cm tall and weighed 49 kg. She had been taking medicine orally for hypertension since she was 60 years old. Her family history was unremarkable. She had sudden back pain and visited our hospital. The patient was diagnosed as having the Stanford type A acute aortic dissection based on the transthoracic echocardiography findings, and an emergency surgery was performed. Flap in the ascending aorta and cardiac tamponade was observed by transthoracic echocardiography. Dissection was observed only in the ascending aorta by thoracoabdominal CT. General anesthesia was induced with 0.5 mg of fentanyl, 10 mg of vecuronium and 4 mg of midazolam, and maintained with propofol and fentanyl. Following the induction of anesthesia, TEE was performed. After the cardiac tamponade was subsided gradually, heparinization was carried out, and then hemiarch replacement was performed employing transapical aortic cannulation. During cannulation, transient hypotension occurred for approximately 120

seconds when the cannnula passed the aortic valve via the left ventricle, however, no hypotension was observed after the start of blood perfusion. Antegrade cerebral circulation was arrested for 57 minutes, the cardiopulmonary bypass was used for 196 minutes and aortic clamp lasted for 127 minutes. No complications, such as cerebral infarction or false lumen perfusion, were observed perioperatively. The patient was discharged from the hospital 22 days after the operation.

Discussion

Since Morris et al.[1] reported the first successful surgery for proximal acute aortic dissection in 1963, the surgical technique has remarkably advanced. Cooly and Livesay[2] emphasized the importance of distal anastomosis "open" for type A dissections under deep hypothermia and circulatory arrest. In addition, the aortic cross clamp may damage the aorta, and as a result, anastomosis of distal ends becomes difficult[3]. Furthermore, circulatory arrest may lead to neurological disorders, whereas the risk of neurological sequelae may be minimized when retrograde cerebral perfusion is employed[4,5].

In the surgery for the Stanford type A acute aortic dissection, the femoral artery is commonly used as the perfusion site of the cardiopulmonary bypass. However, in this case, an intimal flap at the distal reentry may advance due to retrograde perfusion[6]. Based on analytical results of the autopsies of 50 patients who had the Stanford type A acute aortic dissection (29 patients did not undergo operation, while 21 did), the two major causes of death of patients who underwent operation were major brain disorder (33%) and cardiac failure (33%). Among them, 42% of the patients underwent femoral arterial perfusion and in whom an ascending aortic cross clamp was applied. Open arch inspection and repair caused minimal damage of the distal intimal disruption[7]. However, in the case of femoral arterial perfusion, there is a risk of cerebral infarction caused by arterosclerotic atheroma in the aorta dislodged with retrograde perfusion.

When an axillary arterial perfusion is used for antegrade perfusion, surgery may be more difficult due to the small artery diameter and it may require a longer time. The transapical aortic cannulation can prevent the complications such as cerebral infarction and false lumen perfusion that sometimes occur as a result of retrograde perfusion and is much simpler than axillar cannulation. Yamamoto et al.[8] and Flege et al.[9] reported the effectiveness of the perfusion method via the cardiac apex in 12 and 7 patients with aortic dissection, respectively. No complications, such as perioperative malperfusion or postoperative cerebral infarction, were observed in the two cases we have reported here, in addition to those reported by Yamamoto et al. and Flege et al.

With respect to perfusion via the cardiac apex, it is physically difficult to pass a cannula through an aortic valve in patients with aortic stenosis; this difficulty is similarly encountered after the aortic valve is replaced with a mechanical valve. Blood perfusion via the cardiac apex should not be applied to cases of left ventricular thrombosis. In cases of aortic regurgitation, blood perfusion may be applicable depending on the degree of regurgitation. When the amount of regurgitation is large, blood perfusion is possible by decreasing the left ventricular capacity using a left ventricular vent.

Regarding anesthetic management, evaluation of the dissection and the cardiac tamponade by TEE and measures for treating hypotension in cases when insertion of a cannula takes time are important issues.

References

1) Morris GC, Henly WS, DeBakey ME: Correction of acute dissecting aneurysm of aorta with valvular insufficiency. JAMA 184 : 63-64, 1963
2) Cooley DA, Livesay JJ : Technique of "open" distal anastomosis for ascending and transverse arch resection. Cardiovasc Dis (Bull Texas Heart Institute) 8 : 421-426, 1981
3) Svensson LG, Crawford ES, Hess KR, et al : Dissection of the aorta and dissecting aortic aneurysms. Circulation 82 (Suppl Ⅳ):Ⅳ24-Ⅳ38, 1990
4) Lin PJ, Chang C-H, Tan PPC, et al : Protection of the brain by retrograde cerebral perfusion during circulatory arrest. J Thorac Cardiovasc Surg 108 : 969-974, 1994
5) Kitamura M, Hashimoto A, Akimoto T, et al : Operation for type A aortic dissection: introduction of retrograde cerebral perfusion. Ann Thorac Surg 59 : 1195-1199, 1995
6) Robicsek F, Guarino RL : Compression of the true lumen

by retrograde perfusion during repair of aortic dissection. J Cardiovasc Surg 26：36-40, 1985
7) Arsdell GSV, David TE, Butany J : Autopsies in acute type Aaorticdissection-Surgicalimplications-.Circulation 98：Ⅱ 299-Ⅱ304, 1998
8) Yamamoto S, Hosoda Y, Yamasaki M, et al : Transapical aortic cannulation for acute aortic dissection. Tex Heart Inst J 28：42-43, 2001
9) Flege JB, Aberg T : Transventricular aortic cannulation for repair of aortic dissection. Ann Thorac Surg 72：955-956, 2001

(Circ Cont 23：289～292, 2002)