● Case Report ●

Simultaneous Repair of the Aneurysm of the Descending Aorta with Off-pump Coronary Artery Bypass Grafting

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Abstract: Cardiac complications, particularly coronary artery disease, contribute substantially to patient mortality during repair of aneurysm of the descending thoracic aorta. Treatment options in such patients include percutaneous coronary intervention or coronary artery bypass grafting (CABG) before elective aortic surgery, CABG concomitant to aortic surgery. However, to the best of our knowledge, few studies have reported simultaneous repair of aneurysm of descending aorta with CABG. We report successful simultaneous repair of aneurysm of the descending aorta with off-pump CABG through left thoracotomy. (J Jpn Coll Angiol, 2004, **44**: 809–812)

Key words: aneurysm of descending aorta, off-pump coronary artery bypass graft, lateral thoracotomy

Introduction

The results of thoracic aortic aneurysm repair and coronary artery bypass grafting (CABG) have recently improved with the developments in mechanical intraoperative support and refined techniques. Simultaneous repair of aneurysm of the thoracic aorta with CABG has gained wide acceptance. However, few studies have reported simultaneous repair of aneurysm of the descending or thoracoabdominal aorta and CABG.[1, 2] The fact that mortality of patients undergoing repair of the descending thoracic aorta can be severely affected by concurrent coronary artery disease[3] suggests that management of coronary artery disease in patients undergoing thoracic aortic surgery is strongly needed. We report successful concomitant repair of aneurysm of the descending aorta with off-pump CABG through left thoracotomy.

Case

A 75-year-old man was brought to our hospital by ambulance for back and abdominal pain. A history of myocardial infarction with right coronary artery occlusion, cerebral infarction and thrombosis of the lower extremities was reported. The patient had undergone repair of aneurysm of the aortic arch four years previously, in addition to repair of aneurysm of abdominal aorta seven years previously. He was conscious with a blood pressure of 200/120 mmHg in the right arm. Computed tomography with contrast medium revealed the aneurysm of the descending aorta with a dilatation 6 cm in diameter, which had the intramural hematoma (**Fig. 1**). Magnetic resonance angiography (MRA) also indicated the aneurysm of the descending aorta just above the level of the diaphragm (**Fig. 2**). Electrocardiography revealed ST depression in I, V_5, and V_6, and Q waves in II, III, and aV_F. Coronary angiography revealed significant (75%) stenosis of the left anterior descending artery (LAD) and occlusion of the right coronary artery (RCA). The left internal thoracic artery (LITA) was not diseased entirely. Dipyridamole myocardial perfusion imaging test revealed ischemia in the region of the LAD and infarction in the area of the RCA. Myocardium only in the LAD region remained viable. Combined repair of the aneurysm of the descending aorta and CABG (LITA to LAD) was required because of the higher risk of rupture of the aortic aneurysm. Off-pump

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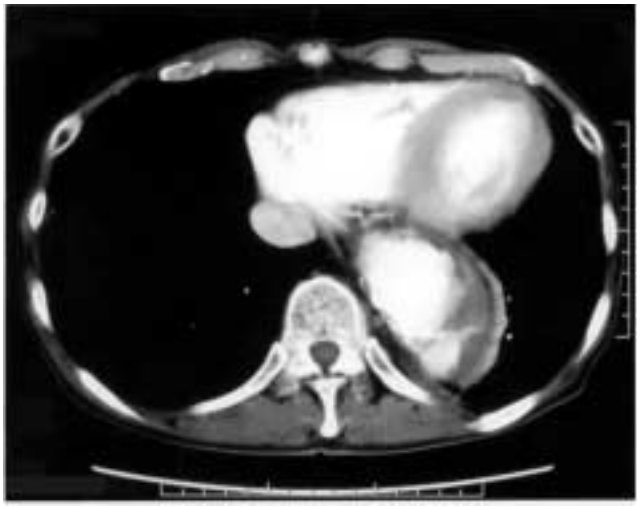

Figure 1 Computed tomography demonstrating an aneurysm of the descending aorta, with a dilatation 6 cm in diameter.

Figure 2 Magnetic resonance angiography demonstrating an aneurysm of the descending aorta at the level of the diaphragm.

CABG was selected to minimize the duration of the femoro-femoral bypass. A left thoracotomy approach was selected on the basis of the patient's history of total arch replacement due to aortic arch aneurysm.

For the operation, the patient was placed in the right lateral decubitus position. The operation was performed through a left thoracotomy in the bed of the resected 6th rib, with selective right lung ventilation. First, LITA was harvested in its entire length and the left femoral artery and vein exposed for distal perfusion. With full systemic heparinization, LITA was anastomosed to the LAD using 7-0 prolene continuous suture without cardiopulmonary bypass (CPB). CPB was ready to be initiated whenever hemodynamic instability was observed during anastomosis. However, anastomosis was completed without CPB, and distal perfusion using a partial femoro-femoral bypass was then performed. The patient was progressively cooled to 30°C. The thoracic aorta was cross-clamped proximal and distal to the aneurysm, which was then incised longitudinally. Intraluminal thrombus was evacuated and atheromatous debris was removed. A woven Dacron tube graft was anastomosed using 3-0 prolene continuous suture. Proximal anastomosis was achieved using graft-to-graft anastomosis. During anastomosis, as many of the intercostals arteries under the T8 level as possible were perfused by the catheters connected to the bypass circuit. Reimplantation of the segmental arteries around the T10 vertebrae was included in a beveled anastomosis of the distal aorta. After declamping, the patient was weaned off the femoro-femoral bypass. Femoro-femoral bypass was maintained for 112 minutes, and cross-clamping of the descending aorta was in place for 109 minutes. The patient required continuous hemodialysis and hemofiltration temporarily due to acute renal failure. No evidence of neurological deficit was observed. The patient was discharged from hospital 21 days postoperatively. Postoperative MRA revealed successful repair of the descending thoracic aorta and a patent LITA graft (**Fig. 3**).

Discussion

Although cardiac complications and coronary artery disease in particular, are a common cause of mortality in patients undergoing repair of aneurysm of the descending thoracic aorta,[3] treatment for aneurysm of the descending thoracic aorta and concurrent coronary artery disease has yet to be established. Treatment options in such patients

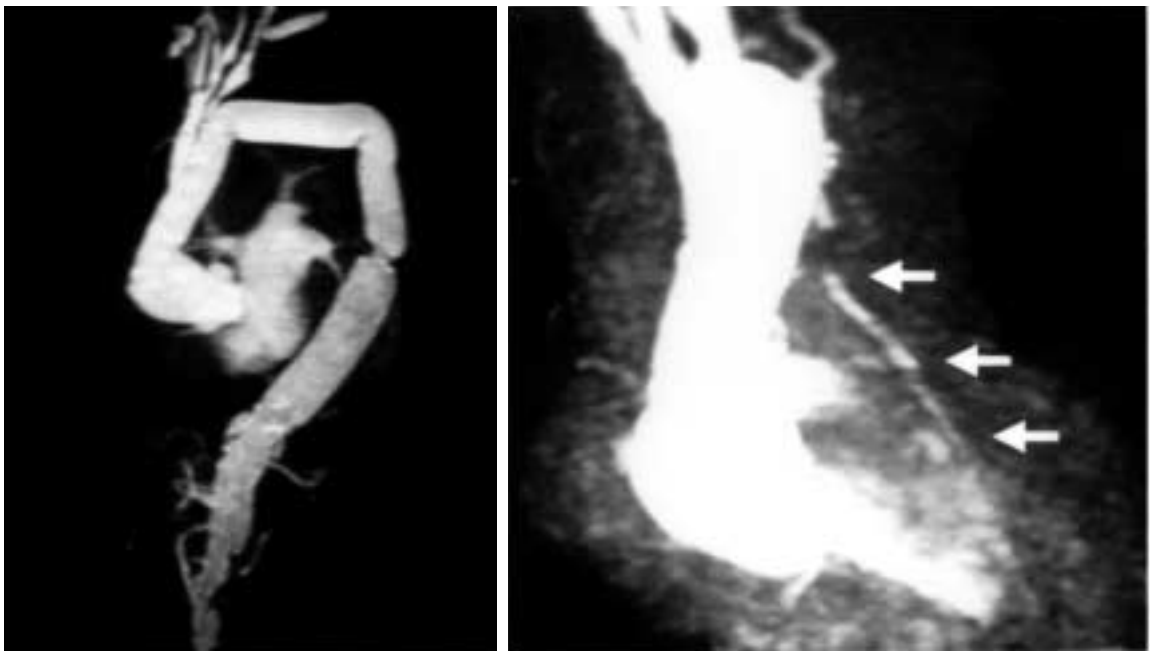

Figure 3 Postoperative MRA showing successful repair of the descending thoracic aorta (A) and patent LITA graft with several defects due to metal clips (arrows)(B).

A | B

include percutaneous coronary intervention or CABG prior to elective aortic surgery, CABG concomitant to aortic surgery. Our institute opts to conduct CABG concomitant to aortic surgery for patients undergoing repair of the ascending aorta and/or aortic arch with cardiac arrest, while patients undergoing repair of the descending aorta without cardiac arrest undergo coronary revascularization prior to elective surgery.[4] However, single-staged operation was selected for this patients owing to the tendency for rupture. We believe that double-stage procedure entails an increased risk of rupture of the aortic aneurysm, and had one patient who died from rupture of an aneurysm of the thoracic aorta on postoperative day 5 following CABG.

Left thoracotomy, which is the standard approach for repair of an aneurysm of the descending thoracic aorta, can be effectively utilized for CABG.[5] The approach allows excellent exposure of the left side of the heart and allows easy harvesting and use of LITA grafts. Off-pump CABG to the LAD or circumflex artery through left thoracotomy might be safe, because the excellent surgical view spares patients from vertical displacement of the heart. CABG to the posterior descending artery on beating heart is also feasible because the pericardium was opened through the inferior incision, which allowed exposure of the inferior surface of the heart.[1] Therefore, we believe that a left thoracotomy has become a useful approach even for revascularization of the triple vessel coronary artery disease except for proximal potion of the right coronary artery, especially for patients who are at high risk for conventional approach due to the prior cardiac surgery with sternotomy. Therefore simultaneous repair of the aneurysm of the descending aorta with off-pump CABG through a left thoracotomy would be practical, even if the patients has multiple coronary disease.

As reported by Mihaljevic and co-workers,[1] CABG on a beating heart with partial femoro-femoral bypass may be safer than off-pump CABG. However, the duration of the femoro-femoral bypass, which might remove atheromatous debris from the lumen of the descending aorta, had to be minimized in the present case because the patient had a history of thrombosis of the lower extremity and cerebral infarction. Off-pump CABG, which allows the minimum duration of the retrograde perfusion from the femoral artery, may be an

optimal option for those who are at the risk of thrombosis.

As regards the protection of spinal cord, Ueda and co-workers reported previously[6] that as many segmental arteries as possible were perfused selectively by the catheters connected to the bypass circuit during the anstomosis of the graft. Somatosensory evoked potential monitoring was perfomed simultaneously. The larger segmental arteries which had been perfused were reimplanted. In some cases, the segmental arteries with the aortic wall were anastomosed to the side of the Dacron graft. In others, the reimplantation of them was included in a beveled anastomosis of the distal aorta.

Despite selective perfusion of segmental arteries, spinal ischemia associated with aortic cross-clamping may occur when clamping extends over 120 minutes.[6] Insertion of catheters is often time-consuming, causing the aortic closs-clamping procedure to extend. Therefore, it is vital to conduct the aortic cross-clamping time under 120 minutes.

Conclusion

We have reported a case of simultaneous repair of aneurysm of the descending aorta and off-pump CABG through a single incision. The result of this operation seems to indicate that off-pump CABG via a left thoracotomy is a viable technique, especially for patients undergoing concomitant repair of the descending aorta or for patients who show high risk for the procedure through the midline sternotomy.

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