Dual aortic aneurysms with coronary artery and multiple cerebrovascular stenoses

Running title: Aneurysms with multiple stenosis

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Abstract

Simultaneous thoracic and abdominal aneurysms comprise approximately 10–20% of all cases of aortic aneurysms. Whether simultaneous or staged therapy can be used to treat multilevel aortic aneurysms remains controversial. Herein, we report the case of a 79-year-old woman with both huge abdominal and saccular thoracic aortic aneurysms who was referred to our hospital. Multiple stenotic lesions were observed in the major cerebral arteries; moreover, triple-vessel disease was observed on the coronary angiogram. Although this case required immediate primary surgery, cardiopulmonary bypass was difficult due to multiple stenoses in the cerebral arteries. We performed simultaneous surgery with total debranching thoracic endovascular aortic repair, endovascular aortic repair, and off-pump coronary artery grafting. Total debranching thoracic endovascular aortic repair is useful for avoiding neurological complications in cases where cardiopulmonary bypass is difficult. Furthermore, it helps devise an intraoperative cervical branch reconstruction method.

Key words: abdominal aortic aneurysm, cardiopulmonary bypass, thoracic aortic aneurysm

Introduction

The incidence of simultaneous thoracic and abdominal aneurysms is approximately 10–20% of all aortic aneurysms.[1] Whether simultaneous or staged therapy can be used to effectively treat multilevel aortic aneurysms is still debatable. We treated a patient with thoracic and abdominal aortic aneurysms (TAA and AAA), multiple stenoses of the cerebral arteries, and coronary artery stenosis. In this case, cardiopulmonary bypass (CPB) was difficult because of multiple stenosis of the cerebral arteries. We performed total debranching thoracic endovascular aortic repair (Td-TEVAR), endovascular aortic repair (EVAR), and off-pump coronary artery bypass grafting (OPCAB).

Case report

A 79-year-old woman who presented with pulsation in her abdomen was referred to our hospital for suspected AAA. Her medical history comprised hypertension and dyslipidemia. On computed tomography, AAA and saccular TAA were observed (Fig. 1 A-B). Immediate surgery was planned due to a high risk of rupture, but multiple stenotic lesions were observed in the major cerebral arteries (Fig. 2). Moreover, triple-vessel disease was observed on the coronary angiogram (Fig. 3). Brain magnetic resonance imaging findings suggested surgery using CPB, involving a high risk of cerebral infarction. Regarding coronary revascularization, we planned to perform OPCAB through the left anterior descending artery (LAD). Percutaneous coronary intervention (PCI) was to be performed afterward on other lesions. We planned simultaneous surgery with OPCAB from the aorta through the LAD using a great saphenous vein graft (SVG), Td-TEVAR, and EVAR. The patient provided informed consent for the publication of this report.

Surgical findings

In median sternotomy, both axillary arteries (AxiA) were exposed. The ascending aorta was partially clamped, and end-to-side anastomosis was performed with a 3-branched HEMASHIELD PLATINUM (⌀12 × 8 × 8 × 300 mm). The SVG was anastomosed to the LAD. Subsequently, an anastomosis was made to the right AxiA using another HEMASHIELD PLATINUM (⌀8 × 300 mm) to maintain cerebral blood flow under a beating heart. In this state, the brachiocephalic artery was blocked, and the first branch of the ⌀12 mm HEMASHILD was anastomosed to the brachiocephalic artery. After blood flow was reopened in the brachiocephalic artery, bypass to the right AxiA was blocked and cut off. In the left common carotid artery, a catheter was inserted into the third branch of the ⌀12 mm HEMASHILD. End-to-end anastomosis was performed with the second branch of the ⌀12 mm HEMASHIELD while ensuring blood flow to the left common carotid artery with the catheter. Finally, the left subclavian artery was reconstructed by anastomosing the third branch of the ⌀12 mm HEMASHIELD into the left AxiA. After reconstruction, the left subclavian artery was ligated at the root.

Following this, TEVAR was performed from zone 0 using a Conformable GORE TAG Thoracic Endoprosthesis (W.L. Gore & Associates, Flagstaff, Ariz; TGU373715J+TGU373720J), and EVAR was performed using a GORE EXCLUDER AAA Endoprosthesis (W. L. Gore & Associates; RLT281418J+PLC161400J). No endoleak was observed during intraoperative imaging.

Postoperative course

There were no neurological complications, and the patient was extubated on the day of surgery. The patient had a loss of appetite and was discharged on day 24 post-surgery. The absence of endoleak and SVG patency were confirmed using postoperative computed tomography (Fig. 1 C-D).

Discussion

In this case, TAA and AAA were observed simultaneously. The rupture of untreated infrarenal aneurysms accounts for 30% of deaths after thoracic pathology repair.[2] Furthermore, simultaneous EVAR in the thoracic and abdominal aorta did not show an increased incidence of spinal cord ischemia and was associated with fewer complications and deaths than simultaneous or staged open thoracic and abdominal repairs.[3] Thus, we performed simultaneous Td-TEVAR and EVAR.

The standard treatment for TAA is total arch replacement, which is always performed using CPB and selective cerebral perfusion. The risk of postoperative neurological complications increases in patients with bilateral internal carotid artery stenosis using CPB.[4] Therefore, to avoid neurological complications, TEVAR was chosen. Intraoperative cervical branch reconstruction was devised to maintain cerebral blood flow under a beating heart to avoid hypoperfusion.[5]

Complete revascularization of all three branches by bypass surgery was also considered. However, heart displacement is necessary during bypass to the right coronary artery and left circumflex artery (LCX), and blood pressure reduction was a concern. Intraoperative hypotension due to heart displacement is known to cause neurological complications. After team discussion, simultaneous LAD and LCX PCI was considered; however, the stenotic lesion in the LCX was close to the LCX ostium, so there was a distinct possibility that a stent would slip out in the left main coronary trunk, and it was deemed difficult to perform safe PCI. Therefore, we decided to use an SVG to perform bypass to the LAD and perform PCI in other areas at a later date.

The left internal thoracic artery was not used due to concern about ischemia of the coronary artery caused by coronary subclavian steal syndrome.[6] This could be caused if a stenosis or sudden occlusion occurred in the anastomotic part of the left AxiA.

Conclusions

In conclusion, Td-TEVAR is useful for avoiding neurological complications in cases where CPB is difficult and for devising an intraoperative cervical branch reconstruction method. Although this case had various difficulties, it was treatable without complications by working out a better method.

Author contributions:

Masafumi HASHIMOTO, Correspond Author.

Kenji MOGI, Approval of article.

Manabu SAKURAI, Approval of article.

Kengo TANI, Drafting article.

Shuntaro ITO, Data collection.

Yoshiharu TAKAHARA, Critical revision of article.

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TITLES OF FIGURES

Figure 1.— CT angiogram revealed a saccular TAA (70 mm) (A) and an infrarenal AAA (65 mm) (B). The postoperative CT angiogram showed total debranching thoracic endovascular aortic repair of the TAA (C) and endovascular aortic repair of the AAA (D), excluding the aortic aneurysm. Patency of the great SVG was also confirmed (C).

AAA: abdominal aortic aneurysm; CT: computed tomography; SVG: saphenous vein graft; TAA: thoracic aortic aneurysm.

Figure 2.— Brain magnetic resonance imaging revealed multiple stenoses of the cerebral arteries mainly in the bilateral internal carotid artery siphon site (arrow).

Figure 3.— Cardiac catheterization revealed coronary artery stenosis. LAD #7, #8, and #9: 75%, 75%, and 90%, respectively. LCX: 90%. RCA: 4PD: 75%.

LAD: left anterior descending artery; LCX: left circumflex artery; 4PD: posterior descending artery; RCA: right coronary artery.