Hirosaki Med. J. 75 : 39—43, 2024

CASE STUDY

Anesthetic management of brachiocephalic–axillary–femoral artery bypass in a patient with aortitis syndrome

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Abstract

Background: Aortitis syndrome causes obstructive and dilatory lesions of the aorta and its major branches, resulting in abnormal hypertension and impaired return to major organs. We present a case of brachio-axillary-femoral artery bypass in a patient with aortitis syndrome in whom anesthesia depth estimation was difficult.

Case presentation: A 66-year-old female patient with aortitis syndrome was scheduled for brachio-axillary-femoral artery bypass. She had brachiocephalic artery occlusion, left common carotid artery stenosis, left subclavian artery occlusion, and subrenal aortic to bilateral common iliac artery stenosis. Although general anesthesia was performed at a sufficient depth, she responded to intraoperative manipulation with multiple body movements. Additional muscle relaxants were administered at the time of anastomosis, and recovery of muscle relaxation on the muscle relaxation monitor was rapid. Central and peripheral systolic pressures diverged by approximately 200 mmHg, the systolic pressure in the brachiocephalic artery was controlled at around 150 mmHg to maintain regional cerebral oxygen saturation. The depth of anesthesia stabilized over time, and she was extubated the next day. She was transferred to the general ward on postoperative day 4.

Conclusion: Anesthetic depth and muscle relaxation monitor values may require unusual interpretations in patients with reduced peripheral perfusion.

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Key words: Aortitis syndrome; artery bypass; circulatory control; general anesthesia; muscle relaxation.

Background

Aortitis syndrome is a systemic inflammatory disease that causes obstruction and dilatation of the aorta and its major branches, resulting in abnormal hypertension and impaired return to major organs[1)]. It is known to require careful circulatory management during the perioperative period[2-4)].

In this report, we describe a case of a patient with aortitis syndrome in which we experienced difficulty managing circulation and maintaining anesthesia depth and muscle relaxation.

Case presentation

Written informed consent for publication of this manuscript and accompanying images was obtained from the patient.

A 67-year-old female patient (height, 146 cm; weight, 31 kg) with aortitis syndrome since age 32 years was scheduled for brachio-axillary-femoral artery bypass. She had artery occlusions of the brachiocephalic and left subclavian artery. She also had arterial stenosis of the left common carotid artery and from the subrenal aorta to the bilateral common iliac arteries, resulting in

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Correspondence: Y. Sato
Received for publication, February 16, 2024
Accepted for publication, March 15, 2024

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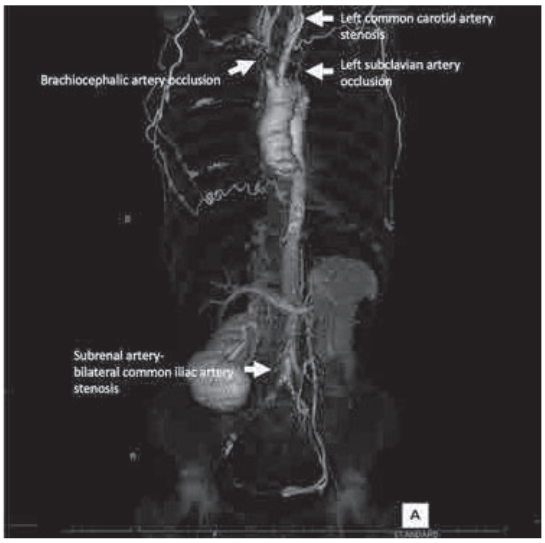

Figure 1 Preoperative three-dimensional computerized tomography showed brachiocephalic artery occlusion, left common carotid artery stenosis, left subclavian artery occlusion, and subrenal aortic to bilateral common iliac artery stenosis.

progressive claudication.

She was taking prednisolone 5 mg /day and tocilizumab for aortitis syndrome. She was also taking Ca antagonists for hypertension and was well controlled.

The ankle-brachial index (ABI) was 0.73 (right) and 0.35 (left), indicating a significant decrease bilaterally. Preoperative contrast-enhanced CT scan showed brachiocephalic artery occlusion, left common carotid artery stenosis, left subclavian artery occlusion, and subrenal aorta to bilateral common iliac artery stenosis (Figure 1). An MRI scan of the head showed ischemic changes in the bilateral lateral ventricles. There were no other abnormal preoperative and complications, like myocardial infarction, heart failure, bowel ischemia, renal failure other than cerebral ischemic changes.

Anesthetic management was performed by total intravenous anesthesia with propofol, ketamine, and fentanyl (Figure 2). After anaesthetic induction, Hydrocortisone Sodium Succinate 125 mg was administered intravenously as steroid cover. Propofol 4 mg/kg/h and ketamine 0.5 mg/kg/h were administered initially, but because of body movements during induction, additional propofol, ketamine, and fentanyl were administered. Rocuronium was used to maintain immobility during vascular anastomosis. Frequent administration was necessary because the train-of-four (TOF) increased about 20 minutes after rocuronium administration, and body movements were observed even with a TOF count of 1.

Intraoperative blood pressure was monitored by arterial lines placed in the left radial and right femoral arteries. Brachiocephalic artery pressure was measured before graft anastomosis. We observed blood pressure deviation of the systolic blood pressure between the brachiocephalic artery and left radial artery as high as approximately 200 mmHg. During brachiocephalic artery blockade, brachiocephalic artery pressure was maintained around 150 mmHg. Intraoperatively, the bispectral index (BIS) and regional oxygen saturation monitor (rSO_2) values were not significantly changed. The operative time was 464 minutes, and the anesthesia time was 573 minutes.

After surgery, the patient remained sedated and intubated and was admitted to the intensive

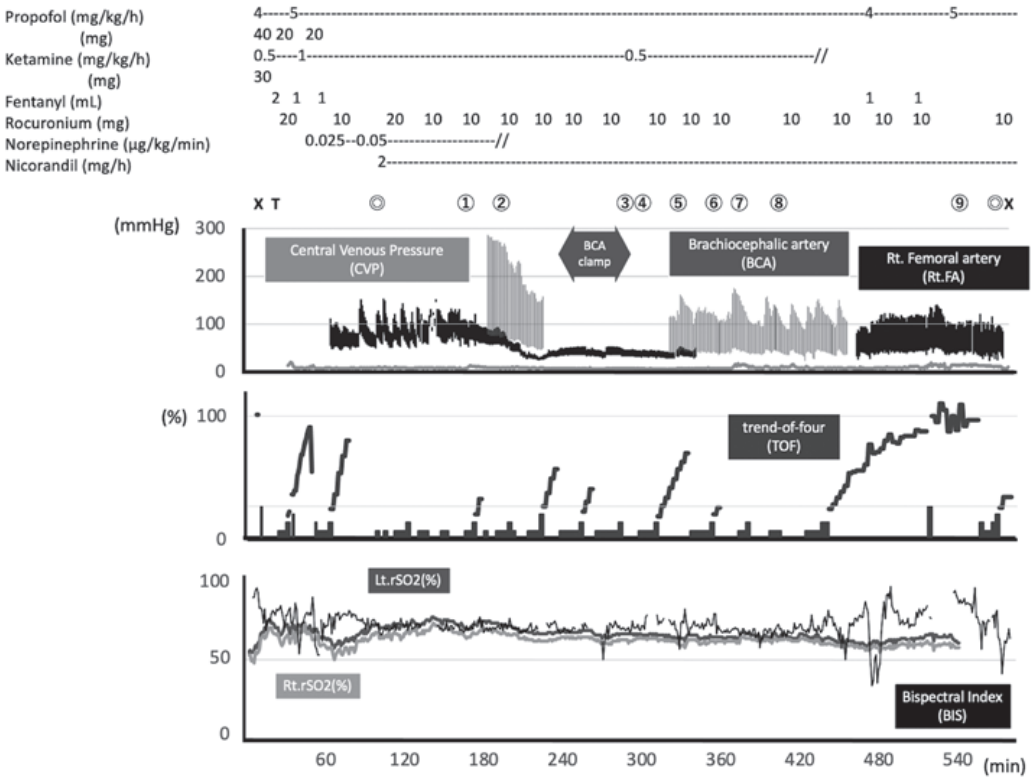

Figure 2 Time course of anesthesia

#1 Median sternotomy
#2 Brachiocephalic artery cannulation
#3 Brachiocephalic artery–artificial blood vessel anastomosis
#4 Brachiocephalic artery–right common carotid artery anastomosis
#5 Artificial blood vessel–right axillary artery anastomosis
#6 Artificial blood vessel–right femoral artery anastomosis
#7 Artificial blood vessel–left axillary artery anastomosis
#8 Artificial blood vessel–left femoral artery anastomosis
#9 Sternum closure

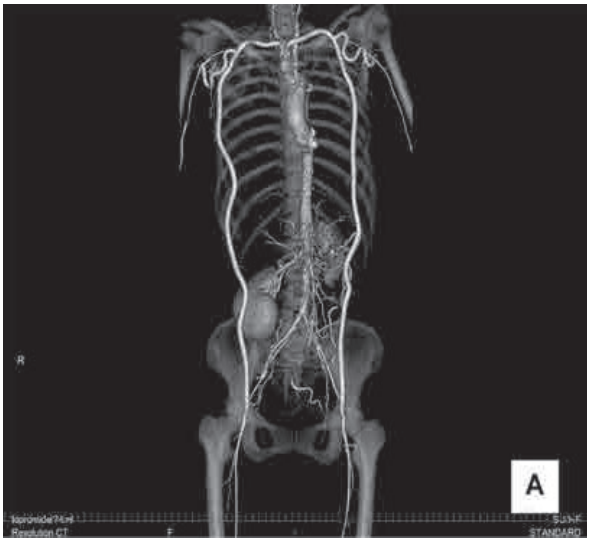

Figure 3 Postoperative three-dimensional computerized tomography

care unit. The patient was awake on the day of surgery and extubated the next day. After tracheal tube extubation, the patient's respiratory and circulatory status was stable, without any neurological abnormalities observed. Intraoperative radial artery pressure was about 30 mmHg lower than femoral artery pressure although gradually improved to the same pressure over time. Steroids were administered the day after surgery with hydrocortisone 200 mg/day and switched to oral on the second postoperative day. The patient was transferred to the general ward on the fourth postoperative day.

Discussion

Intraoperative circulatory management and estimation of anesthesia depth were difficult in this case.

Aortitis syndrome often presents with abnormal aortic hypertension due to stenosis or occlusion of branch vessels[3-6]. However, as in this case, such an extremely abnormal blood pressure difference between the aorta (270mmHg) and peripheral vessels (50mmHg) could not be expected. Whether the criterion for intraoperative blood pressure control should be aortic or peripheral vascular pressure is essential, although no settled opinion has been reached. In this case, the rSO_2 value was used as a reference, and peripheral hypotension was tolerated and managed to maintain cerebral perfusion. There is insufficient evidence for optimal anesthetic management for prevention of cerebral hypotension although some reports of regional anesthesia have shown that rSO_2 was useful in monitoring cerebral hypoxic events resulting from hemodynamic compromise in Takayasu's disease[7-9]. It was important to manage the patient with consideration of the risk of aortic injury associated with the blockade.

Although several previous reports have described difficulties in circulatory management in aortitis syndrome surgeries[2-4], we also had trouble maintaining anesthetic depth. Anesthetics such as propofol, ketamine, and fentanyl affect the brain and spinal cord. In this case, preoperative CT also showed stenosis of the partial cervical branch and spinal artery, which may have prevented anesthetics from reaching all spinal sites. The depth of anesthesia should be normal after the anesthetic drug reaches the patient, however, in this case, the anesthetic depth remained insufficient. The cause of insufficient anesthesia is unclear. Muscle relaxant delivery to the skeletal muscle could have been insufficient due to arterial stenosis. Insufficient muscle relaxation could affect the BIS because the degree of muscle relaxation affects BIS values. Indeed, cerebral and forehead blood flow was increased after recanalization, and BIS-based anesthesia depth was improved. These findings suggest that increased blood flow facilitated muscle relaxant delivery to the forehead where BIS was monitored by electromyography. However, the peripheral vascular stenosis was not improved by the muscle relaxant administration, due to poor delivery to the skeletal muscle of the extremities and body.

Although this case did not present with any significant intraoperative surgical complications, other options in such cases would be to consider the use of continuous rocuronium administration, infiltration anesthesia, and peripheral nerve blockade to maintain immobility and anesthesia depth.

Conclusion

We experienced a case of brachiocephalic–axillary–femoral artery bypass in a patient with aortitis syndrome in which it was difficult to estimate the effect of anesthesia. BIS and TOF may require unusual interpretation in patients with reduced peripheral perfusion.

Declarations

Ethics approval and consent to participate:
Not applicable.

Consent for publication:
Informed consent for scientific publication was obtained from the patients.

Availability of data and material:
Not applicable.

Competing interests:
The authors declare that they have no competing interests.

Funding:
None.

Authors' contributions:
YS, MH and TK experienced this case. YS wrote the first draft of the manuscript. TK and KH made the critical revisions. All authors approved the final manuscript.

Acknowledgements:
None.

Abbreviations:
Not applicable.

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