Hybrid repair of a Kommerell diverticulum associated with a right aortic arch and a left descending aorta

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This report describes the first successful case of a hybrid endovascular approach for management of aneurysmal Kommerell diverticulum arising from the left descending aorta in a right aortic arch. This patient also had dilatation of the ascending aorta and a small aortic arch aneurysm. This three-step procedure consisted of (1) ascending aorta replacement with total debranching using a handmade quarto-branched composite graft; (2) endovascular exclusion of Kommerell diverticulum and the aortic arch aneurysm by covering the whole aortic arch; and (3) coil embolization against the root of the left subclavian artery. The patient had no complications at 16 months after completion. (J Vasc Surg 2012;56:1727-30.)

A right aortic arch connected to a left descending aorta is a rare congenital defect, and Kommerell diverticulum is an aneurysm arising from an aberrant subclavian artery from the descending aorta. Although there are many reports that describe the treatment of Kommerell diverticulum arising from a right descending aorta in a right aortic arch, there are no reports that describe management of a Kommerell diverticulum arising from a left descending aorta in a right aortic arch.

Surgery via thoracotomy or a median sternotomy approach has usually been used to treat this aneurysm but can result in significant surgical mortality. In the case of a right aortic arch connected to a left descending aorta, a surgical approach is even more challenging because of the trachea overriding the aortic arch.

Recently, a hybrid endovascular treatment for Kommerell diverticulum has been described. The present report describes the first successful case of a hybrid endovascular treatment for aneurysmal Kommerell diverticulum arising from a left descending aorta in a right aortic arch.

CASE REPORT

A 67-year-old man was diagnosed with a 6.5-cm aneurysmal Kommerell diverticulum from a left descending aorta in a right aortic arch. This finding was in association with ascending aortic dilation (5.0 cm in diameter) and a small aortic arch aneurysm (Fig 1, A and B). The patient’s history was notable for multiple sternotomies. His first sternotomy was performed 25 years ago for back pain and a diagnosis of an aortic arch dissection. However, the surgery was not completed because the dissection was localized in the transverse arch aorta and because of complicated anatomy. The precise details of this operation were not available because the records were not fully preserved. A second sternotomy for false-lumen entry closure was performed for the dissected aortic aneurysm in the transverse arch aorta 17 years before the current presentation. In this operation, the right subclavian artery was ligated at its root because it had dissected and was too fragile to reconstruct. The blood flow of the right subclavian artery was preserved via collateral flow from the vertebral-basilar system.

The anatomy was complicated, and tight adhesion was expected. To avoid high-risk total arch replacement, the patient was offered a less invasive, three-staged hybrid endovascular procedure. First, ascending aorta replacement and aortic arch debranching were performed with cardiopulmonary bypass established from the femoral artery to the right atrium and via selective antegrade cerebral perfusion through the distal bilateral carotid arteries. Hypothermic systemic circulatory arrest with antegrade cerebral perfusion was applied for the open distal anastomosis of the ascending aorta replacement with insertion of an elephant trunk graft into the aortic arch to establish an appropriate proximal landing zone for the next endovascular step. The systemic circulatory arrest was performed for 39 minutes at 26°C. A handmade quarto-branched composite graft, composed of a 30-mm Intervascular graft (MAQUET GmbH & Co KG, Rastatt, Germany) attached to a 16-× 8-× 7-mm InterGard Quattro graft (MAQUET GmbH & Co KG) was used (Fig 2, A). The bilateral carotid arteries and subclavian arteries were reconstructed using a quatro-branch. Because there was tight adhesion around the aortic arch and it was difficult to dissect its trunks, they were reconstructed through a distal approach. Arteries were anastomosed to each graft in an end-to-end fashion. However, the left subclavian artery was anastomosed in an end-to-side fashion to serve as an access for subsequent coil embolization of the root of the left subclavian artery, which was necessary to stop the blood supply to the aneurysm from the left vertebral artery (Fig 3, A and B). Coil embolization was chosen instead of ligating the left subclavian artery prox-
imal to the left vertebral artery, because this approach was considered to be easier and safer with lower risk of coil migration in the context of insertion of an endovascular graft into the aortic arch. After this procedure, the patient developed pneumonia and had difficulty swallowing, but was discharged on postoperative day 56 with full recovery.

Three months after the operation, the patient was admitted to the hospital for planned endovascular aneurysm exclusion through a femoral access. A Talent endovascular graft (Talent TF3434; Medtronic, Minneapolis, Minn) was inserted into the elephant trunk 1 cm distal to the prior distal anastomosis, followed by a second Talent graft (Talent TF4040) that had been fitted to land on the distal aortic arch with an overlap of two stents between the endografts. Complete aortic arch covering was achieved with covering arch trunks (Fig 3, C). Ten days later, coil embolization was performed for the root of the left subclavian artery through left brachial access. The patient had no postoperative complications and was discharged 2 days after coil embolization. He remained asymptomatic without any complications over the 12-month follow-up period.

DISCUSSION

Kommerell first described an aberrant right subclavian artery originating from the descending thoracic aorta of a left aortic arch that was associated with persistence of a remnant of the right dorsal aorta. In a review of the literature regarding Kommerell aneurysms, Austin et al reported that 19% of patients presented with rupture and death. In a review of the literature of Kommerell diverticulum associated with the right aortic arch reported by Cinà et al, 53% of the 32 cases presented with rupture or dissection.

A right aortic arch connected to a left descending aorta with an aberrant left subclavian artery is extremely rare, but several cases have been reported. However, there are no case reports that describe treatment for Kommerell diverticulum from a left descending aorta in a right aortic arch.

A hybrid endovascular treatment for aneurysmal Kommerell diverticulum has recently been described. Frigatti et al conducted a hybrid two-step procedure, consisting of a total aortic debranching and endovascular aneurysm exclusion.

In the present case, two difficulties were considered with regard to the endovascular approach. First, a small
aortic arch aneurysm was located between the left carotid artery and the left subclavian artery. To cover this small aneurysm and to establish an extended landing zone proximal to the carotid arteries, total debranching was needed. Second, the aneurysmal portion of the ascending aorta was about 5.0 cm in diameter, making it unlikely that we could obtain a good fit using any commercially available endografts. Therefore, ascending aorta replacement was performed using a handmade quatro-branched composite graft to make an appropriate proximal landing zone before endovascular treatment was conducted.

CONCLUSIONS

This report describes a case in which the extended hybrid approach, consisting of ascending aorta replacement, total debranching, and endovascular treatment, was successfully used to treat an aneurysmal Kommerell diverticulum arising from a left descending aorta in a right aortic arch associated with ascending aorta dilatation and an

Fig 3. A, Front view of postoperative computed tomography scan. B, Back view shows a long insertion of an elephant trunk graft. C, Postendovascular treatment computed tomography scan shows complete covering of the aortic arch with the endovascular graft.
aortic arch aneurysm. Use of this hybrid endovascular approach may help reduce complications and mortality in complex and challenging aortic cases.

REFERENCES
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