One-stage repair for aortic regurgitation and Kommerell diverticulum with aneurysmal right aortic arch

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A patient who had aortic regurgitation (AR) and Kommerell diverticulum (KD) complicated with aneurysm of the ascending aorta in the right aortic arch (RAA) underwent aortic valve replacement and replacement of the ascending aorta, aortic arch, and proximal descending aorta. To our knowledge, simultaneous surgery for AR and KD has not been described.

Clinical Summary

A 69-year-old woman was referred to our hospital with a diagnosis of asymptomatic AR. The patient was advised that she had severe AR at another hospital 5 years earlier, and she had an infection in an artificial knee joint treated for a long time before she was finally referred for evaluation of the AR. Aortography revealed Sellers III AR in our hospital. Additionally, 3-dimensional computed tomography (3D-CT) revealed KD with a diameter of 78 mm in an aberrant left subclavian artery (LSCA), RAA, and aneurysm of the ascending aorta with a diameter of 60 mm (Figure 1). The left and right common carotid arteries (LCCA, RCCA) and the right subclavian artery (RSCA) arose from the aortic arch in that order, followed by the aberrant LSCA from the KD in the descending aorta.

Aortic valve replacement and replacement of the ascending aorta, the aortic arch, and the proximal descending aorta were performed. After median sternotomy with extension to the right supraclavicular region and right anterior third intercostal thoracotomy, cardiopulmonary bypass was established with cannulation to the superior and inferior venae cavae and the ascending aorta. The patient was cooled to 25°C. The aortic valve was tricuspid and thickened, and a 21-mm Capentier-Edwards Perimount bioprosthesis (Edwards Lifesciences, Irvine, Calif) was implanted. The aberrant LSCA was taped behind the LCCA. The proximal side of the aberrant LSCA was closed, and the distal side was anastomosed to a vascular graft to facilitate cannulation and reconstruction. An isolated right vertebral artery (RVA) was found behind the RCCA. Therefore, selective cerebral perfusion was initiated with cannulation to the LCCA, RCCA, the isolated RVA, and the grafted aberrant LSCA. The descending aorta below the KD could be easily watched, and distal anastomosis was performed to the descending aorta with a 4-branched aortic arch graft (Hemashield, Meadox Medical, Oakland, NJ) using the pull-through method. After proximal anastomosis to the ascending aorta, 5 branches of the aortic arch were reconstructed. The LSCA was reconstructed by the anastomosis to the first branch of the graft to the RSCA. The isolated RVA was anastomosed to the first branch of the graft, too. The patient was weaned from the respirator on the third postoperative day. Postoperative 3D-CT showed no abnormality of the graft (Figure 2). Pathologic findings revealed sclerosis of the aortic valve. As the patient's respiratory condition improved, she was transferred back to the referring hospital for rehabilitation and was without any cerebral problem at the 46th postoperative day.

Discussion

KD is aneurysmal dilatation at the beginning of an aberrant subclavian artery, and surgical treatment is recommended to avoid the possibility of rupture.^{1,2} Various approaches for the operation have been described, with 2-stage operations being the most common in the literature.¹⁻³ We chose a 1-stage operation because it seemed to be possible to do safely and

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Figure 1. Preoperative 3-dimensional computed tomographic scan. *RSCA*, Right subclavian artery; *RCCA*, right common carotid artery; *RVA*, right vertebral artery; *LCCA*, left common carotid artery; *LSCA*, left subclavian artery; *KD*, Kommerell diverticulum.

to be advantageous in manipulating continuous lesions like AR, ascending aortic aneurysm, and KD. Median sternotomy and right anterior thoracotomy were effective to perform aortic valve replacement and graft replacement to the proximal descending aorta in this case. Cannulation and reconstruction of the aberrant LSCA were not difficult after the anastomosis of the vascular graft. The extension of the incision to the supraclavicular region was also useful to expose the *RCCA*, isolated *RVA*, and *RSCA*.

Isolated vertebral arteries may be annoying anomalies during operations to replace the aortic arch because they are often identified in the operating room.⁴ We perfused the isolated *RVA* and reconstructed it, and no cerebral damage occurred consequently. Although the isolated *RVA* has a small diameter, we usually use moderate systemic cooling (25°C) and perfuse all of the cerebral

Figure 2. Postoperative 3-dimensional computed tomographic scan. For abbreviations, see Figure 1.

branches as long as we can. Some isolated left vertebral arteries have been reported previously, but the right-sided one seems to be extremely uncommon. Retrospectively, the preoperative 3D-CT had represented the isolated *RVA* only in one view, indicating the importance of careful preoperative evaluation for the presence of isolated vertebral arteries from many angles in 3D-CT.

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