Repair of Vascular Ring with Resection of Kommerell Diverticulum and Transposition of Aberrant Left Subclavian Artery

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Abstract

A 32-year-old female presented with dysphagia. Radiographic studies revealed external compression of esophagus by a vascular ring. The anatomy was a right-sided aortic arch with aberrant retroesophageal left subclavian artery, emanating from a large Kommerell diverticulum (KD). Traditional repair with ligamentum division and adhesiolysis leaves a large KD still adjacent to the esophagus with the potential for persistent or recurrent symptoms. The objective of this study was the modification of operative technique to minimize the potential for persistent or recurrent symptoms. The operative repair included resection of KD with transposition of the left subclavian artery into the left carotid artery, in addition to the division of the ligamentum arteriosum and mobilization of the esophagus. The patient's dysphagia resolved and postoperative barium studies showed no residual compression. There were no significant perioperative complications. Resection of KD is a potential adjunct to traditional repair of vascular rings and might offer better long-term palliation by minimizing residual vascular compression of the esophagus.

Keywords

- ▶ aneurysm
- ▶ ligation
- ▶ repair
- ▶ resection
- ▶ subclavian
- ▶ transposition
- ▶ artery

Kommerell diverticulum (KD) is a bulb-like outpouching at the origin of the subclavian artery and ligamentum arteriosum. The aberrant subclavian artery can be traced to abnormal regression of the fourth primitive aortic arch during embryologic development.¹ Sixty percent of patients with an aberrant subclavian artery have KD.

KD occurs in association with right aortic arch (RAA) with aberrant left subclavian artery (ALSA) (0.05% of the population).² In a patient with a RAA and ALSA, the left common carotid artery arises first from the ascending aorta, followed by the right common carotid artery, the right subclavian artery, and finally the ALSA arises along with the ligamentum from KD, and usually passes posterior to the esophagus. This configuration creates a vascular ring.

Various surgical techniques have been applied to repair this anomaly, such as total arch replacement,³ replacement of the

descending aorta with aberrant subclavian artery–carotid artery transposition, open stent grafting with the extra-anatomic bypass, ligation of the aberrant subclavian artery, and reconstruction of the descending aorta. In the vast majority of cases, the operative approach, especially in children, has been the division of the ligamentum arteriosum and esophageal adhesiolysis. This approach divides the vascular ring but leaves behind the KD. This approach has been associated with a low, but finite, rate of recurrent symptoms of tracheal and esophageal compression by the retained KD.⁴ These recurrent symptoms have been treated with KD resection and reimplantation of the left subclavian artery in the left carotid artery.⁴ Use of this approach as a primary treatment has been suggested, but at this point it is not widely adopted. We report here the use of this technique as a primary treatment for a patient with RAA and ALSA with a particularly prominent KD.³

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Fig. 1 Preoperative MRA showing Kommerell Diverticulum and descending aorta.

Case Report

A 32-year-old female presented with a first time complaint of dysphagia. Radiographic studies revealed external compression of esophagus secondary to vascular ring (►**Fig. 1**). The anatomy included right-sided aortic arch with aberrant retroesophageal left subclavian artery and left-sided ligamentum arteriosum (►**Fig. 2**). In addition, there was a large KD at the origin of the left subclavian artery. We were concerned that the large size of the KD might predispose the patient to recurrent symptoms after the traditional treatment of ligamentum division and esophageal adhesiolysis.

The patient was intubated using a double lumen endotracheal tube and was approached via a posterolateral thoracotomy. Ligation and division of the ligamentum arteriosum and

Fig. 2 Preoperative oesophagus showing compression by esophagus Kommerell Diverticulum.

mobilization of the left subclavian artery led us to the KD, which was large. The recurrent laryngeal nerve was visualized and protected. The KD was mobilized as well, beyond its aortic origin under the esophagus. The esophagus was freed for some distance.

The left common carotid artery was then identified; this vessel is significantly deeper in the chest than might be expected. Unfractionated heparin 100 units/kg was administered. The left subclavian artery was clamped distally and a double-angle partially occluding clamp was placed under the base of the KD. The left subclavian artery was divided off of the KD.

The KD was resected, and the aortotomy oversewn very carefully with a double layer of 5-0 prolene, as the aorta disappears under the esophagus and is difficult to access after the clamp is removed. The left subclavian was anastomosed directly to the left carotid artery with a continuous suture, using 6.0 prolene.

The patient's postoperative course was uneventful, and postoperative studies showed no significant esophageal or tracheal compression.

Comment

A large KD occurring in the setting of RAA with an ALSA can cause symptoms of esophageal and tracheal compression even after division of the ligamentum arteriosum. The operation presented in this case has been described for patients undergoing reoperation for such recurrent symptoms. This case demonstrates the use of this procedure in the primary setting, in a patient whom we felt to be at high risk for recurrent symptoms after the more classical ring division approach. Although the outcome was favorable in this case and the risk low in the series presented previously by Backer et al utilizing this approach,⁴ it remains to be determined whether the increased complexity of the operation, which for most surgeons will be done with an open rather than VATS approach, is warranted in every patient with RAA and KD, or, if not, what criteria might be used to stratify the risk of recurrent symptoms to identify the patient group for whom this procedure is indicated in the primary setting.

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