Resection of Kommerell Diverticulum and Reimplantation of Aberrant Left Subclavian Artery in Right Aortic Arch Vascular Ring

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Resection of Kommerell Diverticulum and Reimplantation of Aberrant Left Subclavian Artery in Right Aortic Arch Vascular Ring

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A right aortic arch vascular ring consists of an anomalous aortic arch course with a ligamentum arteriosum and an aberrant left subclavian artery arising from a Kommerell diverticulum. Division of the ligamentum arteriosum is required for the relief of symptoms in these patients. However, to prevent recurrent symptoms, resection of the Kommerell diverticulum and reimplantation of the subclavian artery to the left carotid artery is advocated. Here we describe our standardized surgical approach to this pathology.

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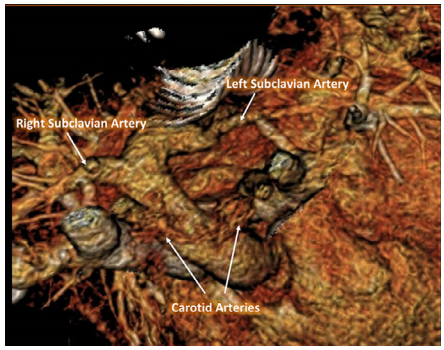
Keywords: Vascular ring, Kommerell diverticulum, Right aortic arch



Right aortic arch vascular ring with Kommerell diverticulum of the left subclavian artery.

Central Message

Resection of Kommerell diverticulum and reimplantation of the subclavian artery to the left carotid artery is achieved with relative safety although several pitfalls should be accounted for.

INTRODUCTION

Vascular rings are congenital abnormalities of the aortic arch in which the tracheobronchial tree is compressed by the combination of ligamentum arteriosum (LA) and the anomalous aortic arch course. A right-sided aortic arch is present in 0.05–0.1% of healthy population and in 50% of these, an aberrant course of the left subclavian artery (LSA)[1] arises from a Kommerell diverticulum.[2] Division of the LA alone does not suffice in relieving compression symptoms[3] and resection of the diverticulum with reimplantation of the LSA to the left carotid artery (LCA) is advocated.[3,4] Moreover, histologic analysis of the Kommerell diverticulum in young patients revealed important degenerative changes such as media necrosis, which enhances the chances of dissection and rupture emphasizing the importance of its surgical resection.[5] We aimed to describe our surgical technique in a 4-year-old pediatric patient.

SURGICAL TECHNIQUE

The procedure is performed with single-lumen endotracheal tube with invasive blood pressure monitoring of both radial arteries. In addition, throughout the procedure, we use transcranial Doppler monitoring. Several sequelae of subclavian occlusion in this population, such as cerebral ischemia and stroke, have been described[6,7]; hence, this region should be monitored appropriately. Furthermore, in case of low-flow cerebral perfusion during the cross-clamping of the carotid artery, the use of a vascular shunt is recommended.

The patient is positioned in the right lateral decubitus position and the chest is entered through a left posterolateral thoracotomy through the third intercostal space. After retraction of the lung, the mediastinal pleura is opened and the LSA is identified, dissected throughout its course and followed caudally to its base. The Kommerell diverticulum and the LA usually arise at the same level of the descending aorta (Fig. 1). The LA, which might be patent, is then ligated and divided. This facilitates dissection of the medial portion of the descending aorta and Kommerell diverticulum, in preparation for partial clamping of the aorta.

Next, the left common carotid artery is identified behind the left innominate vein, anterior to the trachea (Fig. 2). In this region, both the vagus nerve and the phrenic nerve enter the chest cavity and care should be taken to avoid their injury.

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Conflicts of Interest: The authors have no conflicts of interest to disclose.

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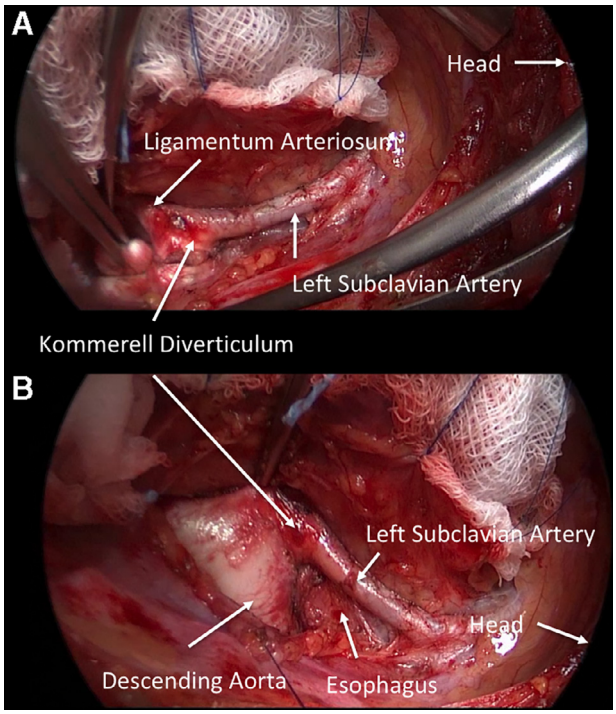


Figure 1. The ligamentum arteriosum (A) and the Kommerell diverticulum (B) are identified at the base of the LSA.

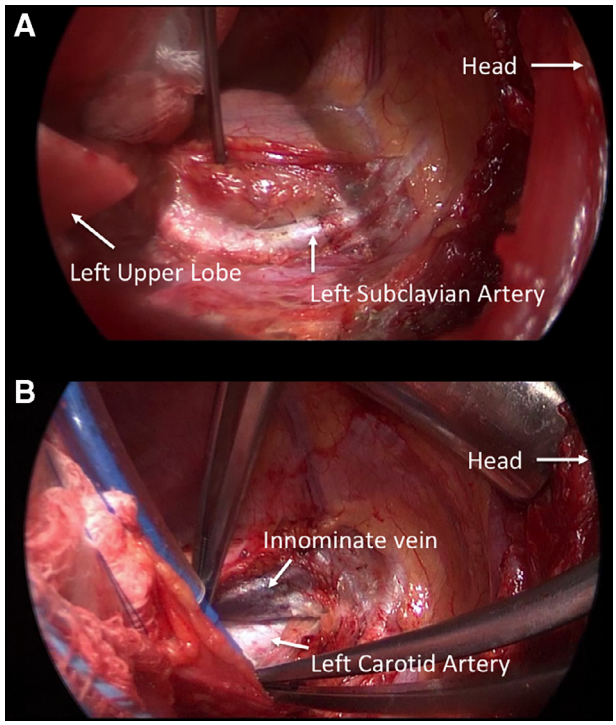


Figure 2. Dissection of the left subclavian artery (A) and the left common carotid artery (B).

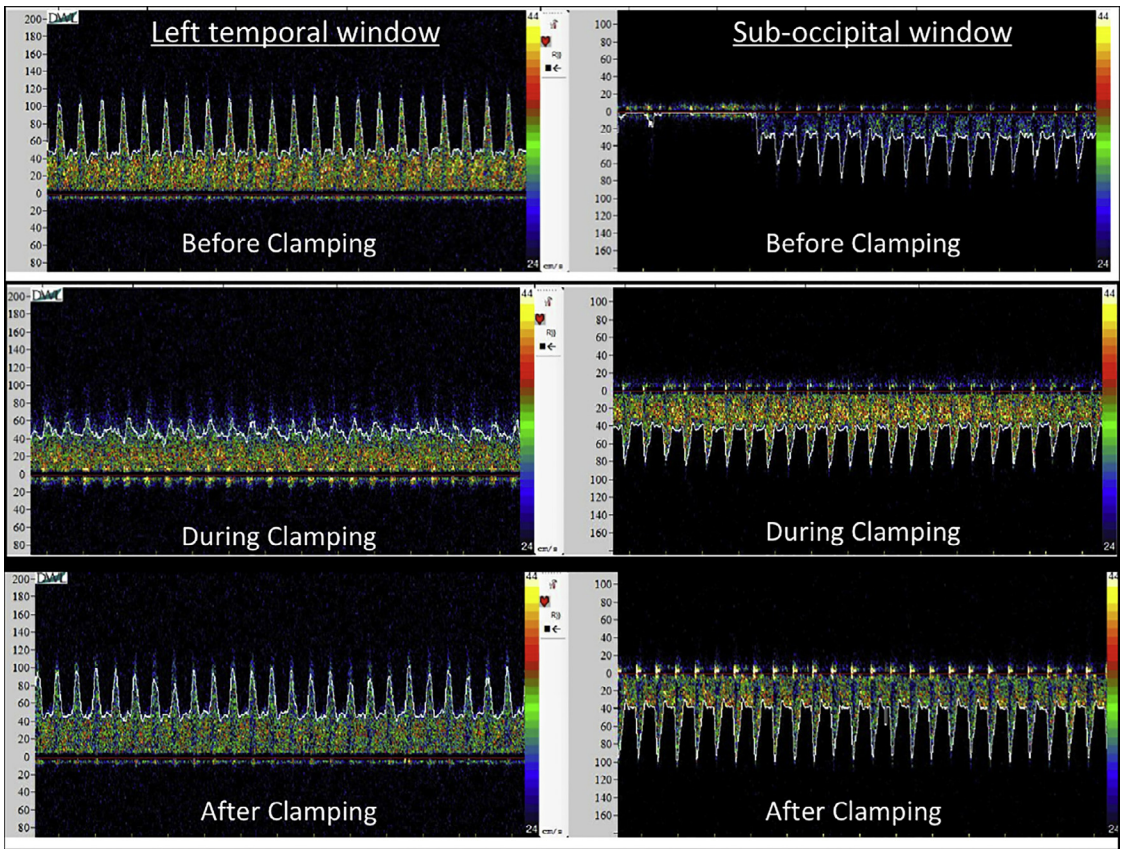


Figure 3. The left row (top to bottom) shows the left transtemporal window signals prior to, during, and after clamping, respectively. In the right, the same is seen for the suboccipital window.

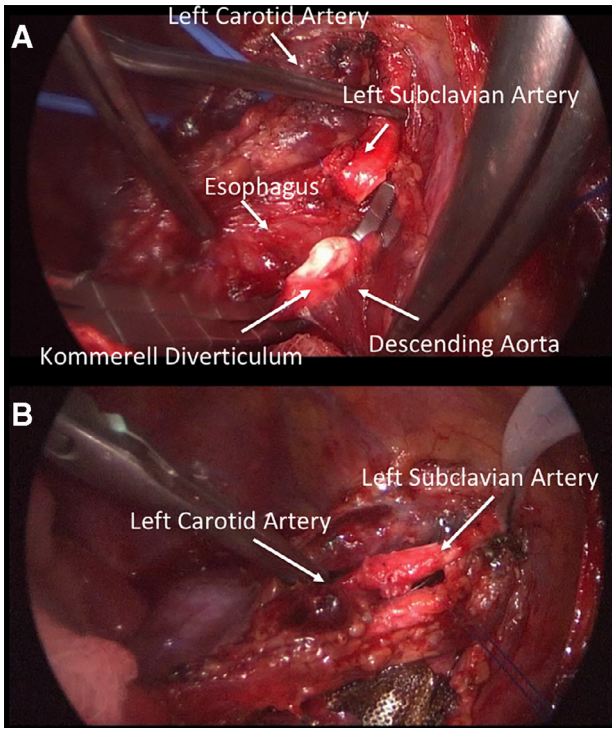


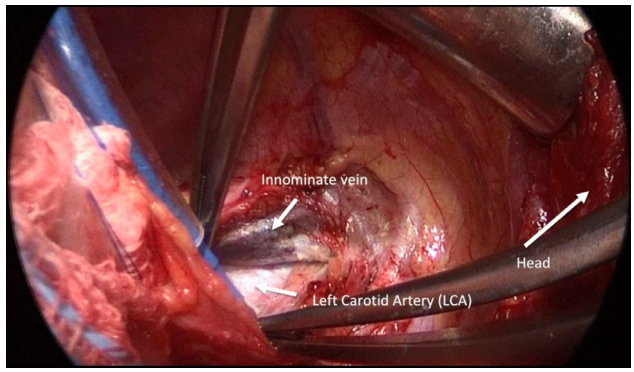
Figure 4. The Kommerell diverticulum is resected and divided using an aortic side clamp (A) and the LSA is anastomosed to the LCA (B).

Although the nerves may not be visible, they may react to electrocautery. In addition, the thoracic duct lies posterior to the LCA and enters the left subclavian vein.

Subsequently, we evaluate the transcranial Doppler signals by temporarily cross-clamping the LCA, accepting a decrease of up to 30%. We repeat this step for the subclavian artery and assess the suboccipital window manually, which is easily achieved as the patient is positioned in a right decubitus (Fig. 3). In this example, the basilar artery flow reduced by 33% after LSA clamping. However, by additional clamping of the LCA, the basilar artery flow increased again by 20% as an autoregulative reaction. When a stable cerebral circulation is assured, we declamp the carotid artery and proceed with resecting the Kommerell diverticulum at its base, using a side-biting clamp (Fig. 4). The aneurysmatic tissue of the subclavian artery is resected. The LCA is clamped, incised, and the LSA is anastomosed in an end-to-side fashion to the LCA. After deairing of the anastomosis by declamping of the LSA, the LCA is also declamped (Fig. 4). Care should be taken to prevent tension to the LSA, which may occur when the LSA is too short or progresses through a curve. Finally, the lung is released and the thoracotomy is closed in a standard fashion after infiltration with a long-acting local anesthetic. The patient is usually extubated in the operating room.

SUPPLEMENTARY MATERIAL

The following is the supplementary data to this article:



Video 1. Step-by-step illustration of the described procedure: resection of Kommerell diverticulum and LSA reimplantation in right aortic arch vascular ring.

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