# Outcomes of Anterolateral Thoracotomy With or Without Partial Sternotomy for Kommerell Diverticulum

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*Background.* **Kommerell diverticulum is a rare aortic arch anomaly. The indications for operative intervention and surgical strategy are still controversial. The standard surgical procedure at our institution is total aortic arch plus descending aortic replacement using anterolateral thoracotomy with partial sternotomy. The aberrant subclavian artery is reconstructed anatomically or extraanatomically.**

*Methods.* **From 2002 to 2014, 6 patients (1 woman), aged 55 to 78 years, underwent graft replacement through an anterolateral thoracotomy or anterolateral thoracotomy with a partial sternotomy approach for Kommerell diverticulum. All patients underwent graft replacement of the descending aorta or total aortic arch plus descending aorta in addition to aberrant subclavian artery reconstruction.**

*Results.* **No hospital deaths or major complications occurred. Recurrent nerve injury developed at discharge in 1 patient. All patients were well during the follow-up period (range, 11 to 116 months).**

*Conclusions.* **Kommerell diverticulum and its associated symptoms were surgically treated with acceptable outcomes.**

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The indications for surgical intervention and the proper management of Kommerell diverticulum (KD), a rare aortic anomaly, are controversial [1]. Although several case reports have been published, the indications for an operative repair varied [1–4]. Surgical repair is needed for symptomatic KD because of the vascular ring [5, 6]. Asymptomatic KD is difficult to manage, because it is reported to be at risk for rupture or dissection, although there is no well-established surgical indication [1]. The range of graft replacement, surgical approach to obtain good exposure of KD, and strategies for reconstructing the aberrant subclavian artery (ASA) are serious surgical issues for surgeons.

At our institution, we typically use the anterolateral thoracotomy with partial sternotomy (ALPS) approach for extended aortic arch aneurysms to obtain good exposure. We also use this approach for KD. This study reports a retrospective review of our surgical results for KD performed using the ALPS approach.

## Patients and Methods

The Hiroshima Shimin Hospital Institutional Review Board approved the present observational study, and additional patient consent was not deemed necessary.

From 2002 to 2014, 6 patients (1 man), aged 55 to 78 years, underwent graft replacement for KD using the anterolateral thoracotomy or ALPS approach. Operative repair was indicated if the following criteria were met: (1) the diameter of the KD (the cross-sectional diameter from the opposite aortic wall to the tip of the diverticulum) exceeded 50 mm, (2) rapid enlargement of the diameter (>5 mm/y), (3) any symptoms caused by the vascular ring, and (4) acute type A aortic dissection.

Preoperative characteristics are summarized in Table 1. The preoperative symptoms included 2 patients with dysphagia and 1 patient each with dizziness, chest pain, and acute type A dissection. The right aortic arch was affected in all 6 patients (Fig 1). The right descending aorta was affected in 5 patients and the left descending aorta in 1 patient. Five patients had an aberrant left subclavian artery (ALSA), and 1 patient had no ASA.

### *Surgical Procedure*

Our management strategy for KD was a two-stage operation consisting of ASA reconstruction (first stage) and KD resection and graft replacement (second stage; Fig 2). During the first operation, the ASA was reconstructed by ipsilateral carotid artery-to-subclavian artery bypass using a 6-mm graft, and the ASA was centrally ligated to the vertebral artery. Approximately 1 week after the first operation, the second procedure was performed.

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*Table 1. Patient Characteristics*

| Variables | No. (%) or Mean ± SD (N = 6) |
|---|---|
| Male gender | 5 (83.3) |
| Age, y | 68.17 ± 9.00 |
| Symptoms | |
| Dysphagia | 2 (33.3) |
| Dizziness | 1 (16.7) |
| Chest pain | 1 (16.7) |
| Acute dissection | 1 (16.7) |
| Side of aortic arch | |
| Right | 6 (100) |
| Side of descending aorta | |
| Right | 5 (83.3) |
| Left | 1 (16.7) |
| Side of ASA | |
| Left | 5 (83.3) |
| None | 1 (16.7) |
| Size of KD | |
| Diameter of opposite wall, mm | 61.5 ± 9.05 |
| Diameter of orifice, mm | 42 ± 13.39 |
| Comorbidity | |
| Marfan | 0 |
| Hypertension | 2 (33.3) |
| Hyperlipidemia | 1 (16.7) |
| Diabetes | 1 (16.7) |
| Stroke | 0 |
| Chronic kidney disease | 0 |

ASA = aberrant subclavian artery; KD = Kommerell diverticulum.

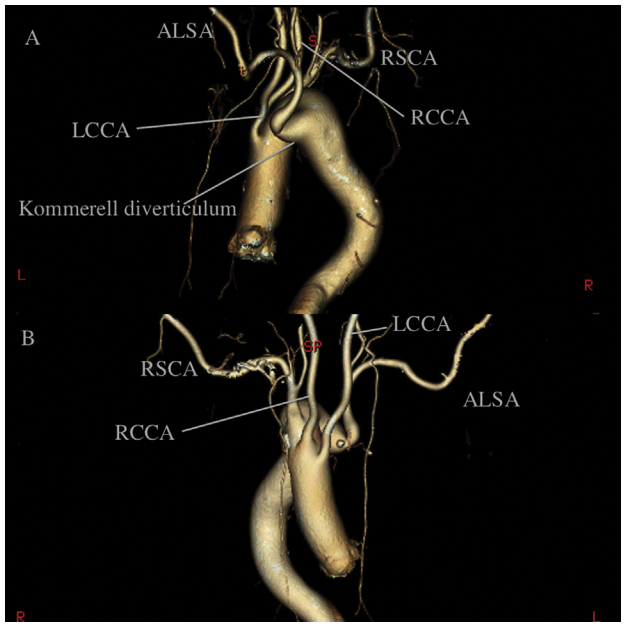


*Fig 1. Preoperative computed tomography findings. (A) Left anterior oblique view, (B) frontal view. (ALSA = aberrant left subclavian artery; LCCA = left common carotid artery; RCCA = right common carotid artery; RSCA = right subclavian artery.)*

In fact, during the beginning of the study period, we reconstructed the ASA in situ during the graft replacement. After we treated a patient in this series whose ASA was difficult to expose because of interference with esophagus and superior vena cava, we changed our surgical procedure. Thereafter, we started choosing the right ALPS approach when the patient's right aortic arch was affected.

The patient's upper body was placed in the left lateral position and the lower body in a 45-degree semilateral position. The right distal axillary artery and the femoral artery were separated. A skin incision was initially made from the lower angle of the scapula to the bottom of the xiphoid process at the fourth intercostal space. Anterolateral thoracotomy was subsequently performed at the fourth intercostal space, and the ipsilateral internal thoracic artery was ligated (Fig 3). Then, a lower partial midline sternotomy was performed. The Lobster retractor system (BOSS Instruments, Ltd, Gordonsville, VA) was used to expose the surgical field.

The ascending aorta and supra aortic vessels were separated. Cardiopulmonary bypass was established using the right femoral artery and right axillary artery or ascending aorta, or both, for arterial perfusion and the right atrium or superior vena cava and inferior vena cava for venous drainage. In addition to axillary perfusion, femoral perfusion was used to safely establish the total flow, to flush the debris and air, and to perfuse the lower body if distal clamping was applied. The left heart was vented through the right upper pulmonary vein. Systemic cooling to 28°C at rectal temperature was initiated, and cardiac arrest was achieved with ascending clamping and antegrade cardioplegia.

At first, a proximal anastomosis was performed. The right subclavian artery was clamped, and unilateral selective cerebral perfusion (SCP) was initiated. Then, the aorta was opened. SCP cannulas were directly inserted

*Fig 2. Postoperative computed tomography after aberrant subclavian artery reconstruction and Kommerell diverticulum resection and graft replacement.*