

Airway Improvement with Medium-Term Compression Duration after Right Pulmonary Artery Anterior Translocation

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Left main bronchus compression occasionally occurs in patients with cardiac disease. A 19-month-old female patient weighing 6.7 kg was admitted for recurrent pneumonia and desaturation. She had an atrial septal defect (ASD) with a right aortic arch. Her left main bronchus had been compressed between the enlarged right pulmonary artery (RPA) and the descending thoracic aorta for 14 months. We conducted ASD closure and RPA anterior translocation via sternotomy. The left main bronchus compression was relieved despite the medium-term duration of compression.

Key words: 1. Congenital heart disease
2. Left main bronchus compression
3. Pulmonary artery anterior translocation
4. Atrial heart septal defects

Case report

A 19-month-old female patient weighing 6.7 kg was admitted for atrial septal defect (ASD) surgery. She had undergone omphalocele repair during the neonatal period. She had been admitted for pneumonia and desaturation at the age of 5 months. Left main bronchus focal narrowing developed at the age of 5 months, based on chest computed tomography (CT). However, the respiratory symptoms and pneumonic infiltration improved on follow-up chest X-rays, so we did not consider the left main bronchus to be a major issue. Subsequently, she was admitted 4 times for a recurring lung issue in the left lung field. We rechecked the chest CT and found an enlarged main pulmonary artery (PA) with a right aortic arch, accompanied by a 10-mm ASD com-

pressed in the left main bronchus between the right-sided descending thoracic aorta and enlarged right PA (RPA) (Fig. 1). The presence of a 10-mm ASD with a significant left-to-right shunt and a tricuspid valve regurgitation velocity of 2 m/sec was confirmed on echocardiography.

We considered several surgical options: (1) ASD closure only, (2) ASD closure and aortopexy via right thoracotomy as a staged operation, (3) ASD closure and aortopexy via sternotomy, (4) ASD closure and RPA anterior translocation, and (5) ASD closure and slide tracheoplasty. Among these surgical possibilities, we considered options 1, 3, and 4 to be the best procedures to undertake as the first surgical procedure.

Under general anesthesia, the patient underwent a median sternotomy. We pulled the ascending aorta upward with forceps, avoiding the dissection of other

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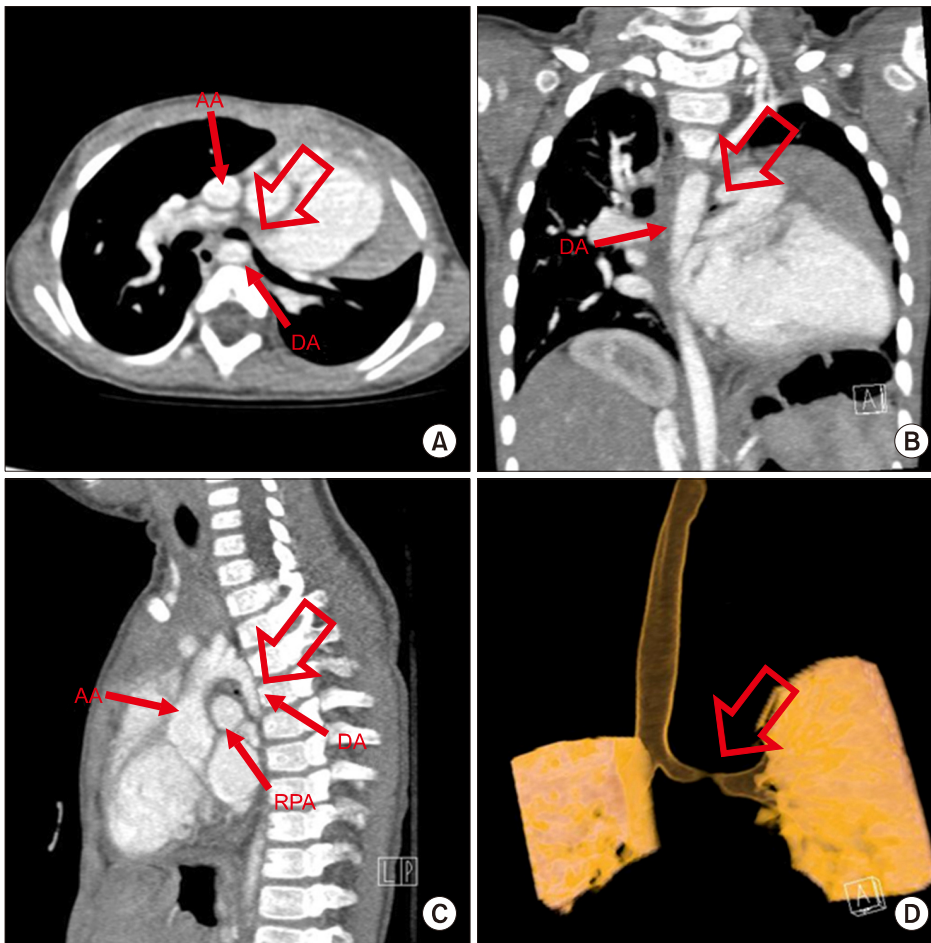


Fig. 1. Preoperative computed tomography revealed left main bronchus compression between the enlarged RPA and descending thoracic aorta. (A) Axial view. (B) Coronal view. (C) Sagittal view. (D) Three-dimensional reconstruction view. The arrow indicates the point of airway narrowing. AA, ascending aorta; DA, descending thoracic aorta; RPA, right pulmonary artery.

tissue, and we checked whether the left main bronchus showed improvement under bronchoscopic guidance. However, we did not observe bronchial improvement. Thus, we decided to perform ASD closure with RPA anterior translocation. We conducted a routine cannulation and extensive PA mobilization to the second PA branch under cardiopulmonary bypass support. Aortic cross-clamping (ACC) was performed. The ASD was closed with a glutaraldehyde-fixed autologous pericardium after a right atrial incision was made. The RPA was excised from the posterolateral wall of the main PA under spontaneous beating after ACC was removed.

The length of the RPA was adequate to make a direct anastomosis, so a direct anastomosis of the anteriorly translocated RPA to the main PA was performed (Fig. 2). The cardiopulmonary bypass weaning was smooth. The cardiopulmonary bypass time and ACC time were 132 and 25 minutes, respectively.

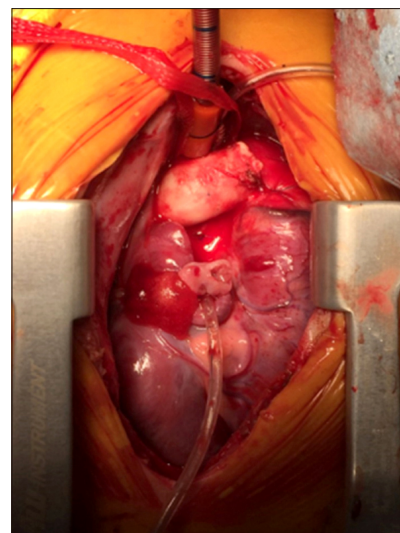


Fig. 2. Operative picture of right pulmonary artery anterior translocation.

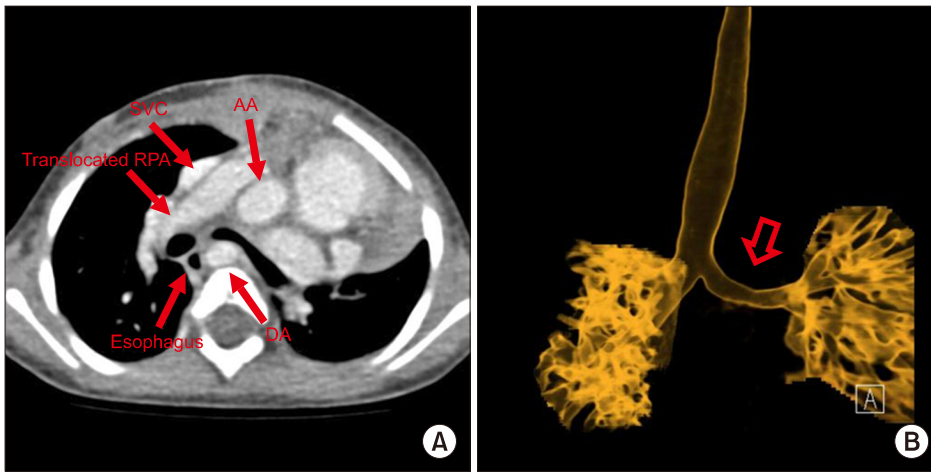


Fig. 3. Postoperative computed tomography revealed left main bronchus improvement at 2 months postoperatively. (A) Axial view. (B) Three-dimensional reconstruction view. The arrow indicates the airway improvement. AA, ascending aorta; DA, descending thoracic aorta; SVC, superior vena cava.

The intubation tube was removed on the first postoperative day (POD). However, reintubation was conducted on the third POD due to CO₂ retention. We conducted successful re-extubation on the patient's fifth POD after extensive lung care. She was discharged on the 14th POD. We conducted postoperative CT angiography 2 months later. We found improvement in the narrowing of the left main bronchus (5 mm) and no narrowing site in the RPA (Fig. 3). Improved left lung aeration was shown on a chest X-ray. The patient was doing well as of the latest follow-up.

Discussion

Airway compression from congenital heart disease is a major cause of respiratory issues. In such cases, airway relief by aortopexy, RPA anterior translocation, or sliding tracheoplasty concomitant with intracardiac repair has been successful for relieving airway compression [1-4]. Aortopexy is a surgical method that yields positive results in cases of severe, localized tracheobronchomalacia by pulling the aorta with minimal tissue dissection around the aorta [2,5]. We chose aortopexy as the first surgical option. We did not find airway improvement after pulling the ascending aorta upward via a median sternotomy approach under bronchoscopic guidance.

Sliding tracheobronchoplasty is also a viable option for airway relief, but it is a surgical option for the relief of congenital tracheobronchial stenosis, caused by features such as a vascular ring or sling, so we did not consider this as a surgical option [6]. In this

patient, the airway compression duration was medium-term (approximately 14 months), so we were concerned about the effects of a space-making procedure around the compressed tracheobronchus, such as RPA anterior translocation, as compared to aortopexy by compressed bronchus traction or sliding tracheobronchoplasty by direct tracheobronchial enlargement. Almost all reports of space-making procedures in patients with a PA sling or vascular ring have involved a relatively short-term airway compression duration [7,8]. We did not anticipate airway improvement by space-making during the early postoperative period because of the initial lengthy airway compression. Instead, we anticipated gradual airway improvement with growth. We identified positive airway improvement in this patient, despite the short-term follow-up.

Initially, we considered only ASD correction if the aortopexy via median sternotomy failed. However, we thought that ASD closure alone might be insufficient to relieve the airway compression from the narrow space between the right aortic arch and the enlarged RPA. We then considered aortopexy via right-side thoracotomy. However, this approach would have required an additional incision and we were concerned about possible esophageal complications resulting from aortopexy due to the right-sided course of the esophagus. Thus, we decided on anterior translocation of the RPA. We were concerned with RPA kinking or superior vena cava (SVC) compression at the SVC-RPA junction after translocation in this procedure. Therefore, we conducted an extensive mobilization of the RPA to the second branches. We ob-

served no RPA kinking or SVC compression on the final follow-up CT.

In conclusion, RPA anterior translocation may improve airway compression despite a medium-term compression duration.

Conflict of interest

No potential conflict of interest relevant to this article was reported.

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