Descending Aortic Translocation for Relief of Distal Tracheal and Proximal Bronchial Compression

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Background. **A descending thoracic aorta that traverses the midline is an uncommon cause of airway compression affecting the distal trachea and proximal main bronchi. Posterior aortopexy has had inconsistent results.**

Methods. **A retrospective review determined that, since 2004, 5 children have undergone descending aortic translocation at Texas Children's Hospital. The average age at the time of surgical treatment was 4.2 years, and all patients presented with recurring respiratory illness requiring hospitalization. All patients had preoperative imaging (4 patients with computed tomography scans and 1 with magnetic resonance imaging) confirming a compromised airway caused by a midline aorta, and 4 of the 5 patients had perioperative bronchoscopy. Three patients had a right-dominant double aortic arch. Descending aortic translocation was performed through a midline sternotomy with cardiopulmonary bypass and deep hypothermia. The proximal descending aorta was transected distal to the subclavian artery, brought up through the transverse sinus caudad to the tracheal carina and pulmonary artery, and anastomosed in an end-to-side fashion to the ascending aorta.**

Results. **Mean cardiopulmonary bypass was 144.8 ± 32.6 minutes, with an aortic cross-clamp time of 59 ± 40.9. Absence of perfusion to the descending thoracic aorta averaged 44.4 ± 13.7 minutes. Concomitant procedures were performed in 4 of the 5 patients. At a median follow-up of 26 months (range, 3 to 101 months), all patients had resolution of symptoms.**

Conclusions. **A midline descending aorta can cause compression of the tracheal carina and proximal bronchi, with debilitating symptoms. Translocation of the descending aorta is a reliable procedure that relieves the compression and results in long-term resolution of symptoms.**

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Extrinsic compression of the airways by vascular structures may cause respiratory difficulties such as stridor, wheezing, recurrent lower respiratory infections or pneumonias, and apnea [1–3]. Unresolved, the compression can be a significant source of morbidity and mortality. Most commonly, the trachea and right main bronchus are affected as a result of compression by the innominate artery, vascular rings, or congenital heart defects that produce an enlarged ascending aorta or cardiomegaly. Less commonly, vascular airway compression can occur when the descending thoracic aorta traverses the midline and is located between the spine and tracheal carina or left main bronchus (Figs 1, 2A). Division of the ligamentum arteriosum divides the vascular ring, but it does not relieve the vascular compression caused by this abnormal anatomic configuration. Posterior aortopexy has been described as one option for the surgical treatment of this rare anatomic variation, but results are inconsistent [4, 5, 7]. The aortic uncrossing procedure, first reported by Drs Planche and LaCoeur-Gayet in 1984 [1], and repopularized more recently by Drs Russell and colleagues [8], has shown excellent results for cervical arch and circumflex aorta. We describe a novel surgical treatment for bronchial compression secondary to midline descending thoracic aorta that consists of division and translocation of the descending thoracic aorta to the proximal ascending aorta.

Patients and Methods

After obtaining Institutional Review Board approval, the departmental database at Texas Children's Hospital in

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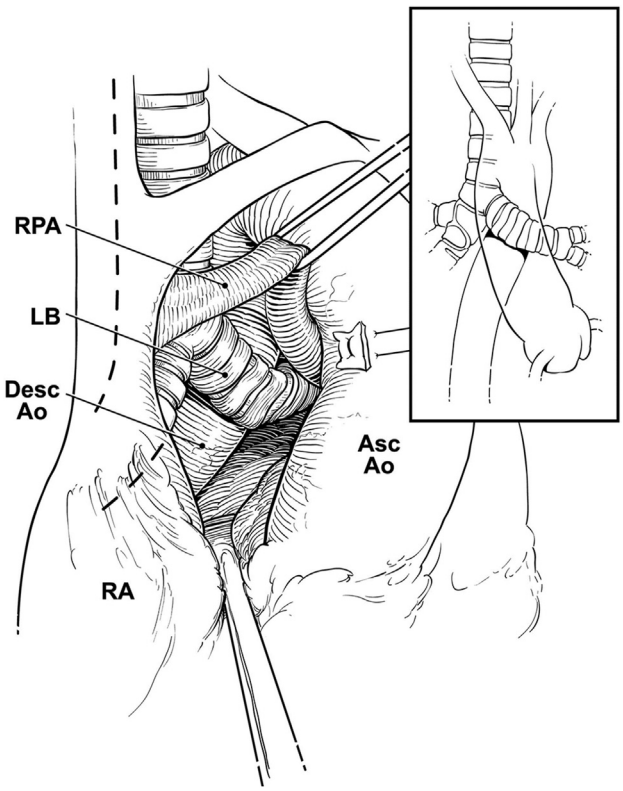

Fig 1. Anatomic relationship of the aorta to the airway causing proximal bronchial compression. The descending thoracic aorta traverses the midline and is located between the spine and left main bronchus (LB). (Asc Ao = ascending aorta; Desc Ao = descending aorta; RA = right atrium; RPA = right pulmonary artery.)

Houston identified 5 children since 2004 who had undergone translocation of the descending thoracic aorta for relief of tracheobronchial compression.

The mean age at the time of surgical treatment was 4.2 years old. Symptoms included recurring respiratory tract illness requiring hospitalization in all patients. In addition to that, 3 patients were hospitalized for respiratory distress at least once, and 1 patient had associated feeding difficulties and evidence of aspiration. All patients had preoperative imaging, 4 patients with computed tomography (CT) scans, and 1 patient with magnetic resonance imaging (MRI). Four of the 5 patients had perioperative bronchoscopy to confirm the diagnosis and evaluate the repair.

Three patients had a right-dominant double aortic arch. There was compression of the distal trachea and main bronchi in 1 patient, with compression of the left bronchus only in the other 2 patients that was caused by a midline descending aorta in this location. Two of these patients had previous vascular ring division as infants at outside institutions. One patient underwent primary repair at Texas Children's Hospital with reimplantation of an anomalous left subclavian artery to the left common carotid artery.

One patient had heterotaxy syndrome with a left aortic arch and a right-sided descending aorta that crossed the midline behind the left bronchus and caused compression. One patient had undergone previous aortic arch advancement and repair of an aortic-pulmonary window at Texas Children's Hospital. The arch advancement resulted in compression of the left main bronchus. Patient-related characteristics can be seen in Table 1.

All patients were approached surgically through a median sternotomy. After sternotomy, extensive dissection and mobilization of the ascending aorta, the aortic arch, and the proximal descending thoracic aorta were accomplished before the initiation of cardiopulmonary bypass. Division of several intercostal and mediastinal branches of the descending aorta was necessary. Great care was taken to identify and preserve the vagus nerve and its recurrent laryngeal branch. Deep hypothermia, defined as a rectal temperature of 18°C, was used during cardiopulmonary bypass for visceral organ protection. After reducing flows on bypass, the distal aortic arch was occluded with a vascular clamp, the left subclavian artery was controlled with a tourniquet, and the middle descending aorta was controlled with a tourniquet behind the left atrium. The proximal descending thoracic aorta was transected flush with the left subclavian artery to avoid the creation of a blind pouch and was oversewn. Clamps and tourniquets were removed from the arch and left subclavian artery. The descending aorta was then retracted from behind the carina and was brought up through the transverse sinus inferior to the tracheal carina and pulmonary artery. During myocardial arrest, a longitudinal aortotomy was created on its anterior surface, thereby giving exposure to the posterior wall of the aorta immediately above the valve and ostium of the left

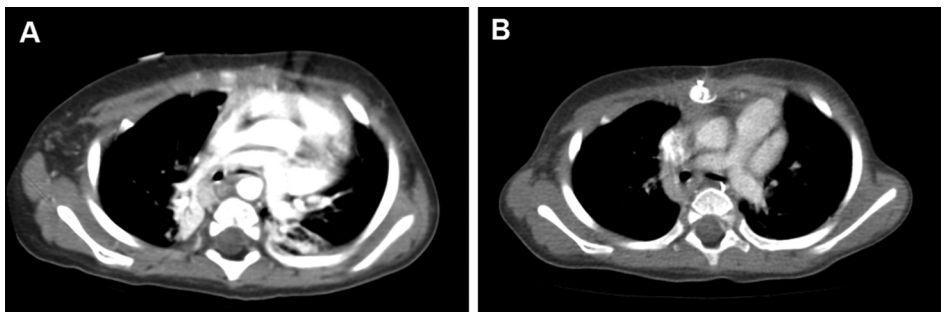

Fig 2. Preoperative and postoperative computed tomography scans of patient 1. (A) Preoperative scan showed a left aortic arch with significant compression of the left main bronchus and carina by an abnormal descending thoracic aorta crossing the midline, immediately posterior to the left bronchus. (B) In postoperative imaging, left main bronchus caliber is improved after aortic translocation inferior to the carina.