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Case Report

Thoracoscopic Division and Translocation of Symptomatic Aberrant Right Subclavian Artery

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Abstract

Thoracic vascular anomalies can impinge on the esophagus, trachea, and other mediastinal structures. When correction of intrathoracic vascular anomalies is indicated this typically necessitates a major operation performed through a sternotomy or thoracotomy. With advances in thoracoscopic techniques and stapler technology, new less invasive approaches are evolving. Here we present the first successfully performed (October 2006) translocation of a symptomatic aberrant right subclavian artery using a thoracoscopic approach to avoid major thoracotomy or sternotomy.

Keywords: *Thoracotomy; Sternotomy; Translocation; Aberrant Right Subclavian Artery*

Introduction and Case Report

We report a case of successful thoracoscopic translocation of an aberrant right subclavian artery for treatment of dysphagia lusorum that was performed in October 2006. To the author's knowledge, there is only one report of thoracoscopic division and translocation of an aberrant right subclavian artery [1] which was performed after this procedure. The patient was a 23 year old male who had Trisomy 21 with Down's Syndrome. He lived with his mother and was independent in his activities of daily living and had no other known medical conditions. The patient was able to give some history and additional information was obtained from his mother who accompanied him. He had a long history of dysphagia to solids, but not to liquids, but had achieved height (172 cm) and weight (66 kg) that were in the second quartile for age, with a BMI of 22.7 kg/m.

On a routine chest radiograph, the mediastinum was described as "widened" which led to a chest CT. Chest CT with contrast showed an aberrant right subclavian artery arising as the last branch of the aortic arch, without evidence of aneurysm. The right carotid had a single distinct origin from the aortic arch, as did the left carotid and left subclavian. The right subclavian traveled rightward between the vertebral body and the esophagus before giving off the right internal mammary and resuming a normal anatomic course. There was clear compression of the esophagus between the aberrant right subclavian and the trachea, and mild dilation of the esophagus above this point.

Given the patient's symptoms, a discussion was undertaken with the patient's mother about this finding and surgical correction with translocation of the right subclavian to the right carotid was offered. The mother expressed understanding and informed consent was obtained. We elected to attempt to mobilize and divide the aberrant right subclavian thoracoscopically to minimize postoperative pain and speed the patient's recovery.

Operative procedure in detail

The patient was brought to the operating room and placed under general anesthesia with invasive arterial monitoring and large bore central venous access. A double lumen endotracheal tube was utilized for lung isolation. The patient was placed in the right lateral decubitus position with the left arm well supported, then was prepped and draped in the usual manner.

Three 10mm thoracoscopic ports were placed in the left chest after deflating the left lung. Two ports were placed at the level of the nipple, one in the anterior axillary line and one below the tip of the scapula. A third port was placed in the posterior axillary line as inferior as possible. There were no pulmonary adhesion and visualization was good. The pleura overlying the aorta just below the aberrant right subclavian was incised and peel back to reveal the distal aortic arch, aberrant right subclavian, and proximal descending thoracic aorta. Blunt dissection with a Kitner was used to mobilize the right subclavian artery until a one half inch Penrose drain could be placed around the vessel. Once the penrose drain was around the aberrant right subclavian, the ends of the drain were secured with an endoloop, effectively creating a grasping point for retraction of the subclavian. Using this to retract the aberrant right subclavian, the vessel was mobilized into the mediastinum. Gentle traction was used to separate the esophagus from the aberrant right subclavian. The aberrant right subclavian was mobilized across the midline and into the thoracic outlet bluntly.

Once the dissection and mobilization of the aberrant right subclavian was complete, a no knife thoracoscopic vascular stapler was brought onto the field. The patient was given 10,000 units of intravenous heparin for anticoagulation and an Activated Clotting Time of over 250 seconds was maintained with additional doses. The no knife thoracoscopic stapler was placed at the base of the aberrant right subclavian and fired, occluding but no dividing the aberrant right subclavian. A second cutting stapler was then placed just above this staple line, and the aberrant right subclavian was again stapled and this time divided from the aorta. Both staple lines had good hemostasis.

Intercostal nerve blocks were done with local anesthetic for postoperative pain control, and a small bore silicone chest tube was placed for drainage. The lung was then re-expanded and the port sites closed.

The patient was then placed supine with the head turned to the left, and the neck and chest prepped and draped. A small incision was made in the supraclavicular fossa and carried down through the platysma muscle. The right carotid sheath was mobilized and opened, then the right carotid was mobilized. Medial to the anterior scalene, and taking care to identify and protect the phrenic nerve, the right subclavian was identified. The vessel was dissected free down into the thoracic inlet until the prior dissection plan was reached. At this point, the aberrant right subclavian stump was delivered into the neck incision. The internal mammary branch was preserved and care was taken to prevent any tension on it. A atraumatic vascular clamp was placed on the aberrant right subclavian and the staple line was removed. The vessel was back bled and flushed with heparinized saline before being trimmed for length. A non-occlusive side biting clamp was then placed on the right carotid, and a end to side anastomosis was created between the right subclavian and right carotid. The anastomosis was de-aired, then opened to antegrade flow. A pulse oximeter on the right hand immediately reflected pulsatile flow with good saturation. Anticoagulation was not reversed. The wound was closed in layers with absorbable suture.

Post-operative course was uneventful with removal of the chest tube on postoperative and resumption of a liquid diet on day one. On day two, the patient resumed a full solid diet without dysphagia and he was transitioned to oral analgesics. The patient was discharged to home on postoperative day four.

Discussion

An aberrant right subclavian artery is a common vascular variant, is often asymptomatic, and is usually discovered incidentally. The symptoms of esophageal compression can be vague and a long period of symptoms prior to definitive diagnosis is common. When

dysphagia is present, it is typically limited to solid foods and not liquids. If suspected, barium swallow and chest CT are the most commonly employed diagnostic tests.

When an aberrant right subclavian artery is diagnosed in conjunction with dysphagia symptoms, then surgical correction is indicated [2]. In pediatric patients, a right thoracotomy approach is most commonly employed [3]. In adults, a supraclavicular approach with either direct anastomosis of the right subclavian to the right carotid, or an extra anatomic bypass graft between the aberrant right subclavian and right carotid, with ligation of the aberrant right subclavian proximal to the bypass [4]. Advantages of this approach include avoiding entry into the chest cavity, but the approach leaves a long aberrant right subclavian stump that can cause distal embolization and can still undergo aneurysmal dilation since it is still pressurized. In adults, a combination left thoracotomy and right supraclavicular approach has been used to avoid the issue of a long stump, but the combined incisions increase morbidity and recovery [5].

We felt it was important to avoid a right subclavian long stump and potential future embolization and aneurysmal dilation in a young patient, so we decided that a supraclavicular approach alone was sufficient. We also wished to avoid the morbidity of thoracotomy, and therefore elected to use a thoracoscopic approach to mobilize and divide the aberrant right subclavian. Visualization with the thoracoscopic approach was excellent and the thoracoscope allows better visualization deep into the mediastinum versus open thoracotomy where direct visualization is often difficult. Mobilization of a large vessel such as the subclavian is not technically difficult and the left phrenic is easy to identify and avoid with thoracoscopic visualization. Control of the aortic side of the vessel upon division is certainly the most potentially dangerous part of the procedure. With modern stapling technology this risk is manageable. We elected to initially use a non-cutting staple load to occlude and depressurize the aberrant right subclavian prior to dividing the vessel with the second stapling.

Disadvantages of this approach are that it requires left sided thoracoscopy ports and a chest drain, in addition to the right neck incision. While this is more invasive than a supraclavicular approach alone, thoracoscopy is less morbid than thoracotomy. In addition, the need to reposition, and re-pre and drape the patient is inconvenient and adds time to the operation.

Conclusion

Given the widespread use of thoracoscopy in thoracic surgery and in surgical training, the level of skill has progressed significantly since this case was done in 2006. The explosion of thoracoscopic experience makes this technique available to many surgeons.

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