Case Report

Symptomatic aberrant right subclavian artery—A case report and anesthetic implications

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ABSTRACT

Vascular compression of the esophagus by an aberrant right subclavian artery (aRSA) leading to dysphagia is a rare occurrence. There has been a significant advancement in the diagnostic and surgical treatment modalities available for this disorder. Anesthetic management has evolved too and this case report highlights the anesthetic management of a 41-year-old woman presenting with symptoms of dysphagia because of compression of esophagus by an aRSA, who subsequently underwent re-implantation of aRSA into ascending aorta.

Keywords: Aberrant right subclavian artery, anesthetic management, dysphagia lusoria

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INTRODUCTION

Aberrant right subclavian artery (aRSA) is the most common congenital aortic arch anomaly with an incidence of 0.5–1.8% in general population.[1] This aberrant artery arises from descending thoracic aorta (DTA) after the origin of the left subclavian artery and can either course behind esophagus (80%) or between esophagus and trachea (15%) or can lie anterior to trachea (5%).[2] While an incidental finding in upto 90% of the patients, the typical clinical presentation is described as "dysphagia lusoria," (Greek translates to "freak of nature") the difficulty in swallowing caused due compression of esophagus by aRSA.[3] Surgery is indicated when patients become symptomatic and this case report highlights the unique aspects of anesthetic management in these patients.

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CASE REPORT

A 41-year-old woman presented with complaints of gradually progressive dysphagia to solids for past 5 years. There was no history of weight loss or breathing difficulty. Her clinical examination was uneventful and blood pressure was equal in both arms. She was evaluated with esophagogastroduodenoscopy, videofluoroscopic swallowing study [Videos 1 and 2], and CT thorax [Figures 1 and 2] which revealed an aRSA arising from DTA after the origin of left subclavian and coursing behind esophagus. The patient was planned for re-implantation of the aRSA into ascending aorta through right thoracotomy approach.

After standard anesthetic induction, patient was intubated with 35F left-sided double-lumen endobronchial tube. A 20Fr intercostal tube was placed in esophagus under

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direct vision. Anesthesia was maintained with sevoflurane in air-oxygen mixture and supplemental doses of muscle relaxants and analgesics. An additional 16G intravenous line was started and arterial lines were secured in both right and left radial arteries with a central venous catheter in right internal jugular vein. The patient was positioned in left lateral decubitus with right arm secured to a frame. Adequate cushioning of pressure points was ensured.

The ascending aorta was approached by a right posterolateral thoracotomy through the 4th intercostal space. One lung ventilation (OLV) was initiated after opening pleura. After 5 min into OLV, patient's peripheral oxygen saturation fell to 88%. Initially, the FiO_2 was increased to 1. This was followed by application of a PEEP of 5 cm of H_2O to the ventilated lung along with CPAP of 8 cm of H_2O to non-ventilated lung using a special circuit with an adjustable pressure limiting valve. The saturation improved to 100% and remained the same thereafter. The aberrant right subclavian artery was identified posterior to esophagus which was then looped and isolated. Tightening the loop and occlusion of aRSA caused a decrease in blood pressure by 20 mm of Hg and disappearance of pulse oximeter waveform on right hand [Figure 3]. The surgeon decided against a simple ligation and proceeded for division and bypass grafting of the aRSA. Unfractionated heparin, 1 mg/kg was administered. A 7 mm PTFE graft was sutured from the ascending aorta to distal right subclavian artery in end to side manner. The proximal stump of aRSA was suture closed as much close to DTA as possible. Reestablishment of flow resulted in equalization of blood pressure in both arms. A paravertebral catheter was introduced extrapleurally and tunneled through skin for continuous paravertebral block (PVB). After 100 min of OLV, double lung ventilation was resumed and thoracotomy wound was closed in layers. The chest tube in the esophagus was removed and thorough suction of the oral cavity and the DLT was done. After reversal of muscle relaxation, patient was extubated and an infusion of 0.125% bupivacaine at 5 ml/h was started through the paravertebral catheter. An OPD review after a month showed complete resolution of patient's symptoms.

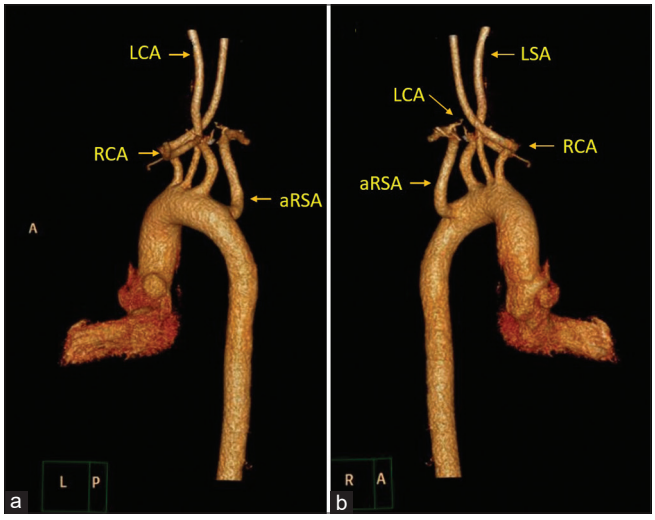

Figure 1: Digital Reconstruction of Axial CT Anterior (a) and Posterior (b) Views. Right Carotid Artery (RCA), Left Carotid Artery (LCA), and Left Subclavian Artery (LSA), Aberrant Right Subclavian Artery (aRSA)

DISCUSSION

aRSA was first reported in medical literature by Hanuld in 1735.[4] Embryologically, it is caused because of persistence of seventh intersegmental artery of right dorsal aorta. Although congenital, aRSA becomes symptomatic only in fourth to fifth decade of life. The reasons for this delayed presentation are the age-related increase in oesophageal rigidity and atherosclerotic changes that occur in aorta and the aberrant artery.[1] Onset of symptoms indicates the need for a proper investigation and treatment.

Physical examination of the patient is otherwise uneventful except for the rare asymmetry in radial pulses if associated with other vascular anomalies. An upper gastrointestinal endoscopy can reveal a pulsatile extrinsic compression on the esophagus, which usually raises doubt for this anomaly. The best method to diagnose an aRSA is by

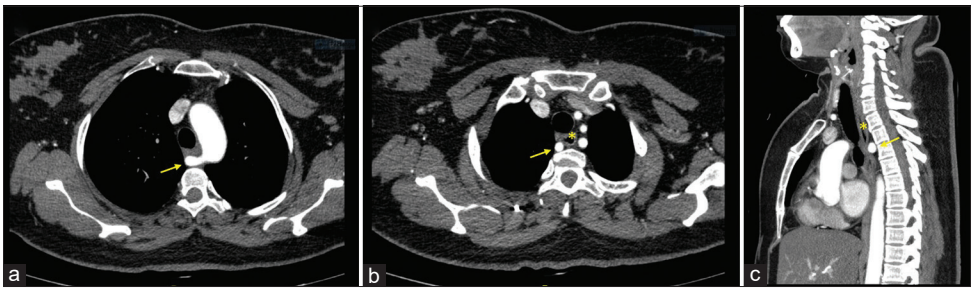

Figure 2: Preoperative Computed Tomography showing the aberrant Right Subclavian Artery behind the Oesophagus. (a and b) Axial sections depicting the relationship aRSA to Arch vessels, Trachea and Oesophagus of (c) Sagittal section showing the Oesophagus between the aRSA and Trachea. Asterisk - Oesophagus, Arrow – aRSA

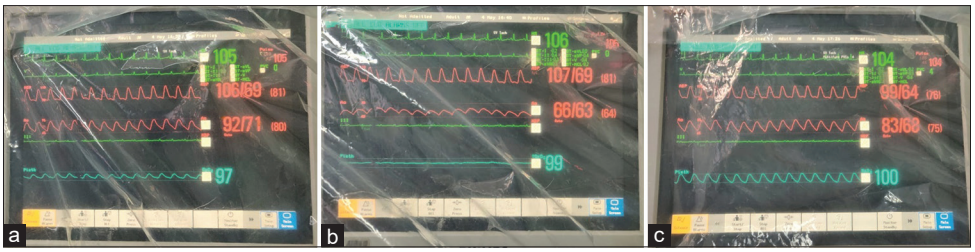

Figure 3: Intraoperative Haemodynamics. (a) Pre clamp Blood Pressures Equal in Right and Left Radial Arteries (b) After clamping the Right subclavian artery, the mean blood pressure decreased by 20 mmHg in Right Radial Artery and pulsatile plethysmographic tracing was lost (c) Post bypass grafting, the pressure equalized in both Right and Left Radial Arteries. ABP – Left Radial Artery Ao – Right Radial Artery

barium swallow.[5] Our patient underwent barium swallow under videofluoroscopy which showed an indentation at D4 level which is pathognomonic of aRSA compressing esophagus. Volume rendering and 3D reconstruction of the aorta help in further understanding of this pathology. A chest X-ray and CT chest would be of immense help to anaesthesiologist for ruling out airway compression and in planning OLV.

A simple surgical division of aRSA can relieve the symptoms of dysphagia but can cause subclavian steal and right arm ischemia. Reimplanting aRSA to right carotid artery by an end to side anastomosis is an option which avoids thoracotomy and its complications. But a patent stump, when left behind can cause residual dysphagia. Ligation and direct implantation of aRSA to the ascending aorta is the recommended surgical procedure. Hybrid procedures with endovascular occlusion devices followed by revascularization of the subclavian artery through an open right supraclavicular approach have been described.[6]

Adequate venous access with two large-bore intravenous cannulas ensured our preparation for massive blood loss. Central venous access was planned in the event of vasopressor or antiarrhythmic drug administration as the surgery involved manipulation of the heart. Lung isolation and OLV are essential in thoracotomy approach to the aRSA. A left-sided DLT ensured adequate surgical exposure and prevented trauma to right lung from surgical retraction by allowing its collapse. A 20Fr chest tube inserted in esophagus helped in its identification intraoperatively. It is essential to ensure that the chest tube is fixed to the angle of the mouth to prevent inadvertent dislodgement. While the left radial artery cannula was used for invasive hemodynamic monitoring the right radial artery cannula helped in intraoperative identification of the aRSA by loss of pressure waveform while looping aRSA. It also has other benefits like intraoperative decision making if the surgeon wants to only ligate without reimplantation of aRSA. A near-equal pressure after looping would have meant that the collateral circulation to the right arm is adequate and a mere ligation would have sufficed.[7] But in our patient, looping the aRSA led to fall in mean pressures by 20 mm of Hg, thereby prompting us to proceed with reimplantation. A right radial artery catheter also helped in determining proper flow after reimplantation.

An ascending aorta to aRSA anastomosis, as done in our patient, requires application of side biting aortic clamp for anastomosis at aortic end. This may be contraindicated in patients with ascending aortic atheroma or calcification. A right carotid to aRSA anastomosis would be preferred in those cases. These patients would require stump pressure monitoring to ensure ipsilateral brain perfusion.[7] EEG or NIRS monitoring would also help in detecting unilateral hypoperfusion.[8]

Thoracic paravertebral block provides post-thoracotomy pain relief comparable to thoracic epidural block. Continuous infusion of local anesthetics by a catheter placed under direct vision by the surgeon is a safe and effective method of providing analgesia. It provides multidermatomal ipsilateral somatic and sympathetic blockade. The sympatholytic effect may promote forward flow in subclavian artery and helps maintaining patency.[7] PVB avoids the bilateral sympathetic block that would occur with thoracic epidural and decreases the complications like hypotension occurring secondary to sympathetic blockade.[9] Intraoperative thoracic paravertebral block is safe analgesic technique especially in patients receiving anticoagulation.[10]

CONCLUSION

The perioperative anesthetic care in the setting of a patient posted for surgical division of aRSA extends beyond the traditional hemodynamic monitoring and selective one-lung ventilation for providing surgical access. Bilateral radial arterial pressure monitoring helps in perioperative decision making. Thoracic paravertebral blockade provides ipsilateral sympatholysis and analgesia that would increase the success of surgery and provide a pain-free postoperative period.

Declaration of patient consent

The authors certify that they have obtained all appropriate patient consent forms. In the form the patient(s) has/have given his/her/their consent for his/her/their images and other clinical information to be reported in the journal. The patients understand that their names and initials will not be published and due efforts will be made to conceal their identity, but anonymity cannot be guaranteed.

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Conflicts of interest

There are no conflicts of interest.

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