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Case Report

A high-riding brachiocephalic artery: a unique diagnostic dilemma

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ABSTRACT

We present a case of the A high-riding brachiocephalic artery, a rare variant of neck vessels. It is clinically and surgically important, as unknowingly may lead to severe life-threatening complications. A 67-year-old male, presented with throat pain, dysphagia, heartburn with belching for 4-5 months. He was diagnosed with High riding brachiocephalic on further evaluation with USG neck which was reported as, superiorly placed right brachiocephalic artery noted in the suprasternal notch with maximum diameter 1.6 cm. Asymptomatic nature conservative line of management was followed and on follow up, patient had improvement in the symptoms.

Keywords: High-riding, Innominate artery, Pulsatile

INTRODUCTION

A high-riding brachiocephalic artery is a rare variant of the neck vessels in which the brachiocephalic artery passes much more superiorly than normally. It is a clinically important variant, as mistaking it for a neck lump and sampling it or neck surgery in the region may cause a devastating hemorrhage.[1] Only a few handful cases have been published in medical literature.

The brachiocephalic artery, brachiocephalic trunk, or more commonly referred to clinically as the innominate artery, is one of the three great vessels of the aortic arch that supplies blood to the head, neck and upper extremities. Specifically, the artery goes on to form the right subclavian artery, which provides blood to the right upper extremity, and the right common carotid artery, which is one of the main arteries supplying blood to the head and neck. The innominate artery is of particular clinical significance not only due to its vital role in providing much of the blood to the superior aspect of the body but also due to anatomic variations that are numerous and not at all uncommon. These variations can often lead to malformations that may require surgical correction early on, primarily due to tracheal and/or esophageal compression. One of the more significant clinical circumstances involving the innominate artery is the formation of trachea-innominate artery fistulas in patients who have undergone tracheostomy and are a leading cause of mortality after such procedures.[2]

In normal anatomy, the innominate artery is the most proximal branch of the aortic arch. It arises to the right of and anteriorly to the left common carotid artery. The artery is short in length and courses superiorly and posteriorly from the aortic arch until it bifurcates into the right subclavian artery and the right common carotid artery at about the level of the sternoclavicular joint. Along its short course, it typically crosses from left to right anterior to the trachea around the ninth tracheal ring. However, due to anatomic variation, it is not uncommon for it to cross at any level from around the sixth ring to the thirteenth ring.[3] The innominate artery, in particular, lends itself to variations that make it of much clinical interest. By far, the most common aortic arch branching pattern variant is what is known as a bovine arch. This variant is when both the right and the left carotid artery (along with the right subclavian artery) share a common

trunk, essentially making the innominate artery have three branches instead of the typical two.[4] Common variations that involve the innominate artery are, common carotid artery, aberrant right subclavian, right-sided arch. Other less common variations involving the innominate artery are, left and right innominate arteries, four branches with no innominate artery, double aortic arch, left-sided arch with a left-sided innominate artery, aberrant right subclavian, common trunk of the innominate, left common carotid, and left subclavian.[4]

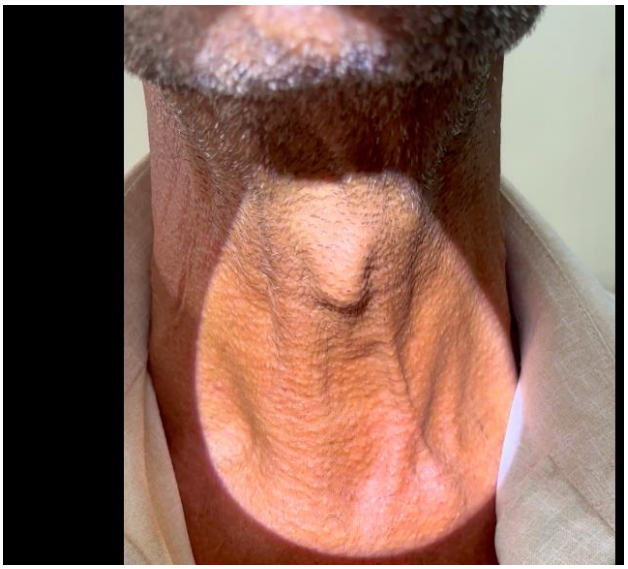

Figure 1: Pulsatile mass in anterior aspect of neck.

The innominate artery's position directly anterior to the trachea leaves it particularly vulnerable to injury when performing a tracheostomy. This potential danger can be from direct puncture of the artery during the procedure, as well as erosion of the vessel from prolonged direct contact with the tubing leading to the formation of a tracheoesophageal fistula. The risk of this happening is much greater the lower the tracheostomy site, which is why the typical suggestion is that it be performed no lower than the third or fourth tracheal ring.[5] Innominate artery compression syndrome is another cause of tracheal compression that is not considered a true vascular ring. It is caused by abnormal compression of the anterior aspect of the trachea as the artery crosses it; therefore, it is usually not involved with any abnormal variation of the artery.[6]

CASE REPORT

A 67-year-old male patient presented to the Otolaryngology OPD with h/o throat pain, dysphagia, heartburn with belching since, 4-5 months. The patient had been treated for GERD but was unresponsive to therapy. On further evaluation a 3x3cm, solitary, ovoid, midline swelling was noted on the left anterior aspect of the neck (The patient was unaware of the swelling). It was non tender, soft, fluctuant, compressible, and pulsatile in nature.

Indirect laryngoscopy revealed normal functioning vocal cords. USG neck was done, superiorly placed right brachiocephalic artery noted in the suprasternal notch with maximum diameter 1.6 cm. Considering the patients advanced age and asymptomatic nature conservative line of management was followed. The patient was reassured of his condition and discharged on rabeprazole, modified diet, lifestyle changes. On further follow-up, the patient stated that the symptoms of GERD had considerably reduced.

DISCUSSION

The innominate artery, also known as the brachiocephalic trunk, is a large caliber vessel with a diameter ranging from 10.5 to 13.5 mm. Most instances high riding brachiocephalic artery is asymptomatic and detected incidentally at neck surgeries such as tracheostomy, thyroidectomy or other laryngeal surgeries. Some may present as a pulsatile neck lump just below the level of the thyroid gland. Some cases may present as stridor due to tracheal compression.[1]

Ultrasound with Doppler interrogation is an efficient and accessible method to assess it and is usually the initial study. It will show the bifurcation of the brachiocephalic artery into the right common carotid artery and right subclavian artery located superior to the right sternoclavicular joint (normally located posterior to it). The bifurcation can be as high as the inferior part of the right lobe of the thyroid gland. CT, MRI, and angiography will show further details as the brachiocephalic artery ascends above the thoracic inlet before bifurcating.[2] The presence of a pulsatile anterior neck mass leads to suspicion of vascular anomalies like arteriovenous (AV) fistula, aneurysms, pseudoaneurysms, and carotid body tumors. A thorough history should be taken from patients presenting with a pulsatile neck mass, for example, AV fistula is commonly caused by trauma or medical procedures and pseudoaneurysms mostly appear following an arterial catheterization.[7]

Management of pulsatile anterior neck mass secondary to vascular anomalies, particularly carotid artery variant, depends on various factors including the patients' age and underlying medical condition, presenting complaint, possible outcomes, and complications of both the mass and surgery. For instance, in cases of atherosclerotic changes within the vessel, aneurysm, metastatic vascular tumor, pseudoaneurysm, AV fistula, and dissecting artery of the variant, surgical or endovascular intervention remains the main mode of management. Surgeons should be vigilant for cardiovascular accidents like transient ischemic attack following vascular surgery in these patients.[7]

Among the imaging modalities, Doppler ultrasound of the anterior neck is particularly preferred when diagnosing an HRIA as it is relatively inexpensive, non-invasive, painless, and without any known risk to patients.[8] There

was also no sign of an aneurysm or dissecting component on doing USG neck in the current patient. Invasive procedures such as fine-needle aspiration and cytology, which are generally indicated for the investigation of an anterior neck swelling, must not be performed. In our case, a pre-operative doppler ultrasonographic examination of the neck successfully identified the high position of the innominate artery above the suprasternal notch.[8] A high-lying innominate artery is defined as one with a position higher than the sixth tracheal cartilage level or when its upper edge reaches 2 cm above the suprasternal notch.

A high-lying innominate artery is undeniably at significant risk of injury when encountered during neck surgery. A brachiocephalic artery with an anomalous position may first be identified by visualizing or palpating a pulsatile mass at the anterior neck region, with diagnosis confirmed by radiological investigations including doppler ultrasonography, computer tomography, magnetic resonance imaging, as well as angiography of the neck and upper thorax.[8]

An HRIA can be asymptomatic or present as a painless pulsatile anterior neck mass. Rarely, the patient may complain of globus sensation in the throat with dysphagia when adjacent HRIA and the right subclavian artery compress the cervical esophagus. Most cases are only diagnosed after reviewing radiographical imaging of the neck, with several cases detected intraoperatively when an innominate artery was seen traversing anteriorly to the trachea within the surgical field.[8]

Dysphagia is a commonly encountered disorder with a reported incidence of 12%–13% in a short-term care hospital.[9] Dysphagia can be categorized as either oropharyngeal, pharyngeal, or esophageal depending on the location; moreover, it could be neuromuscular or structural depending on the cause. Identifying the dysphagia causes is important for proper management.[10] High-riding right brachiocephalic and subclavian arteries are often asymptomatic and rare vascular variations.

Moreover, dysphagia is rarely caused by large vascular variations in the neck area associated with pseudo-aneurysms or a tortuous common carotid artery. Oshinsky et al, performed dissections on ten fresh adult cadavers and discovered that the highest position of a brachiocephalic artery is mainly found at the ninth tracheal cartilage, and this point varies between the sixth to thirteenth tracheal cartilage.[11] Netzer et al determined that 7 cases of HRIA were detected in the operating theatre, 2 presented as prominent pulsations over anterior neck following hyperextension of neck, with the remaining 5 detected intraoperatively. Doppler ultrasonography of anterior neck was used to diagnose this condition.[12] To the best of the authors knowledge this is only the second ever documented case of high rising brachiocephalic artery to present with GERD mimicking symptoms.

CONCLUSION

High-riding right brachiocephalic and subclavian arteries are rare variations that are often asymptomatic or merely characterized by a pulsatile anterior neck mass. This vascular anomaly has been observed during anterior neck surgery, including tracheostomy, thyroid dissection, or mediastinoscopy, and could cause massive bleeding if it is not identified by the surgeon. There has been one reported case of dysphagia caused by a high riding brachiocephalic artery, which is more pronounced and elongated with aging and might eventually cause compressive dysphagia. Invasive examinations- FNAC must be avoided at all costs. High index of suspicion should be present to diagnose this condition. One of the important diagnoses in case under evaluation of dysphagia. Treatment mainly depends on patients' general condition, age, severity of symptoms and other underlying conditions. Particular attention should be given to this condition while operating in the neck surgeries.

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