Case report

High riding innominate artery: An unusual pulsatile pretracheal mass

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\textbf{A R T I C L E  I N F O}

Article history:
Received 14 March 2021
Revised 7 April 2021
Accepted 9 April 2021

Keywords:  
High riding brachiocephalic trunk  
High riding innominate artery  
Pulsatile anterior neck mass

\textbf{A B S T R A C T}

Anterior neck masses are common and such patients commonly present to ultrasonography units for further evaluation of underlying pathology. We encountered an atypical case of pulsatile anterior neck swelling in a 45-year-old lady. Evaluation of the swelling using neck ultrasonography and color doppler study revealed that the mass was of vascular origin and contrast-enhanced computed tomography of neck confirmed the presence of an aberrant high riding innominate artery. Knowledge of such variants is of great importance and should be reported by the concerned radiologist. Lack of knowledge of such variants may lead to inadvertent surgical complications during procedures and can be life-threatening to the patient.

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\section*{Introduction}

Anterior neck masses are common. Although the majority of these masses are non-vascular in origin, certain vascular origin masses/variations can also present with an anterior neck mass. One of such vascular origin anterior neck mass is an aberrant or high riding brachiocephalic trunk, a rare aortic arch variation [1].

We describe a case presenting with a pulsatile anterior neck mass which turned out to be the brachiocephalic trunk ascending to an abnormally high level.

\section*{Case report}

A 45-year-old lady having a suspicion of thyroid swelling was sent to our ultrasonography unit for high-resolution ultrasonography (HRUSG) of the neck region. The patient had a complaint of a painless anterior neck mass for the past six months that showed a gradual increase in size. She also complained of subtle dysphagia. She had no signs or symptoms pointing towards thyroid gland abnormality. No history of neck trauma was present. There was no history of other associated symptoms (as odynophagia or hoarseness of voice). No significant past medical or surgical history...
was present. On neck examination a non-tender, pulsatile, well-circumscribed anterior neck mass (roughly measuring 3 × 3 cm in size) was seen, which does not move with tongue protrusion; however, showed movement on deglutition [Fig. 1].

High-resolution ultrasonography and color doppler study was performed that revealed that bilateral thyroid lobes and isthmus had normal size and location. However, the neck swelling was corresponding to a vascular structure inferior to thyroid gland isthmus and overlying trachea that was crossing midline and was giving rise to the right common carotid artery and another vessel (possibly right subclavian artery) [Fig. 2]. Taking into consideration the vascular origin of the mass and demonstration of origin of right common carotid artery and right subclavian artery from this vascular mass, the possibility of a high riding innominate artery/brachiocephalic trunk was kept. Contrast-enhanced computed tomography (CECT) of the neck was performed for further evaluation which confirmed the presence of a high-riding brachiocephalic trunk [Figs. 3-5]. The high riding innominate artery was seen ascending along the anterior aspect of the trachea beyond the right sternoclavicular joint. It reached the C7/D1 level and turned laterally giving off the right common carotid artery and the subclavian artery.

**Discussion**

Evaluation of neck swelling is a common indication of HRUSG and color doppler study of the neck region. The majority of neck swelling cases are due to the presence of anterior neck masses; the most common differentials being masses of thyroid origin (thyroid nodules and thyroglossal cyst) [1]. Other masses of anterior neck are lymph nodes, dermoid/epidermoid cysts [2], and vascular anomalies/pathologies (as aneurysm of the common carotid artery, arteriovenous malformation, or paragangliomas) [3]. Rare causes of anterior neck masses include aortic pathologies (as aneurysm or coarctation of aorta) [4].

In general, the approach to an anterior neck swelling include thorough clinical history and physical examination, followed by radiological (HRUSG neck region/ CECT/ angiography neck region) and pathological (cytology and histopathology) investigations [5]; however, in a suspected vascular lesion, fine needle aspiration for cytology or surgical biopsy should be avoided to prevent torrential bleeding [3].

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Fig. 1 – Anterior neck mass (black arrow).

Fig. 2 – B-mode high-resolution (A) and color doppler (B) ultrasonography images reveal vascular structure (high riding brachiocephalic artery) overlying trachea.
Fig. 3 – Axial, contrast-enhanced CT images (A and B) through the neck, above the level of the sternal notch, shows the innominate artery (white arrow) anterior to the trachea (star).

Fig. 4 – Coronal-oblique, multiplanar-reformatted, contrast-enhanced CT images show a high-riding innominate artery extending beyond sterno-clavicular joint (A), which is seen dividing into right common carotid artery (curved white arrow) and right subclavian artery (white arrow) (B).

Fig. 5 – Volume rendered, contrast-enhanced CT image shows a high-riding innominate artery extending beyond right sterno-clavicular joint.

Our patient is a middle-aged woman, thereby ruling out common anterior neck masses found predominantly in the pediatric/adolescent age group (thyroglossal duct cysts/lymphangioma). There was no evidence of any systemic signs and symptoms, thereby excluding inflammatory lymphadenitis. The presence of a large solitary thyroid nodule was considered as a differential as the neck mass moved with deglutition; however, thyroid masses are non-pulsatile.

The presence of the pulsation within mass led to the suspicion of a mass of vascular origin. The pulsatile anterior neck mass in our case is an unusual variant of right brachiocephalic trunk - a high riding brachiocephalic trunk.

The brachiocephalic trunk or innominate artery develops from two components - the aortic sac and the proximal right fourth aortic arch. It is the first and largest branch of the aortic arch. It passes upward and to the right of the thoracic trachea thereby dividing into the right subclavian and right common carotid arteries behind the sternoclavicular joint [6–7]. The incidence of this ‘normal’ pattern is reported to occur in approximately 70% (48% to 84%) of patients [8-9]. Persistence of a portion of the proximal segment of the right fourth aortic arch
causes the elongation of the brachiocephalic trunk superiorly leading to a high riding brachiocephalic trunk [8].

The exact incidence of aberrant/high riding innominate artery is scarce and yet to be discovered [10,11]. There have been cases of incidental intra-operative detection of high-riding brachiocephalic trunk as reported by Prashant et al., Racic et al., and Upadhyaya et al. [12–14]. Similar cases of incidental detection of high-riding brachiocephalic trunk picked up incidentally during the diagnostic work-up of neck region for suspected thyroid pathologies has been reported by Dua et al. and Gil-Carcedo et al. [15,16]. A handful of cases of aberrant innominate artery leading to inadvertent intra-procedural/intra-operative hemorrhage have also been reported [17–20].

Conclusion

High riding brachiocephalic trunk constitutes a rare but important variant of aortic arch anomalies. A thorough knowledge about such variants is of paramount importance as ignorance of such a variation may lead to inadvertent surgical complications during neck procedures/surgeries such as tracheostomy, thyroidectomy, and mediastinoscopy. Diagnosis of this variant can be confidently made on HRUSG of the neck region combined with a color doppler study; CECT of the neck can be performed as a supplementary imaging for confirmation of ultrasonographic findings and to rule out associated arch anomalies. This variant should be documented in the patient’s medical record for reference to avoid complications of neck surgery/neck procedures in the future.

Patient consent

We confirm that written, informed consent for publication of their case was obtained from the patient(s).

Supplementary materials

Supplementary material associated with this article can be found, in the online version, at doi: 10.1016/j.radcr.2021.04.018.

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