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Case Report

Multiple anomalies of the brachial plexus: a case report

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ABSTRACT

During routine dissection of a 55-year old male cadaver, we observed multiple anomalies in the brachial plexus. The subclavian artery entered scalenus anterior muscle while the roots C8-T1 of the brachial plexus passed behind scalenus medius. The anterior divisions of upper and middle trunks united to form the lateral cord lateral to the axillary artery. The anterior division of the lower trunk ran as the medial cord medial to the axillary artery. Suprascapular nerve did not arise from the superior trunk; it arose from the root of C5. Superior subscapular, thoracodorsal and inferior subscapular nerves arose from the posterior division of the upper trunk. Afterwards, the posterior cord continued as axillary and radial nerves. The musculocutaneous and ulnar nerves had their normal courses. ***Neuroanatomy; 2007; 6: 21–23.***

Key words [anatomy] [brachial plexus] [cervical region] [scalene muscles] [variation]

Introduction

The brachial plexus is situated in the posterior triangle of the cervical region and in the axilla. This plexus is a union of the lower four cervical (C5, C6, C7, and C8) ventral rami and the first thoracic (T1) ventral ramus. At the lateral border of the anterior scalene muscle, the five roots unite to form the upper, middle, and lower trunks, each of which splits into anterior and posterior divisions in the floor of the posterior triangle of the neck. At the upper border of the first rib, the divisions join to form lateral, medial, and posterior cords. Just distal to the inferior border of the pectoralis minor muscle, near the third part of the axillary artery, the cords give off their terminal branches, including the axillary, musculocutaneous, radial, median, and ulnar nerves [1–4].

The scalene muscles are known as the paravertebral muscles and comprise anterior, middle, posterior, and minimus. Anterior scalene muscle arises from the anterior tubercles of the transverse processes of the third to sixth cervical vertebrae. It passes anterolaterally to be inserted by a narrow tendon on the upper surface of the first rib between the grooves for the subclavian vein and subclavian artery. The middle scalene muscle arises from the posterior tubercles and costotransverse bars of transverse processes of all or most of the cervical vertebrae. It inserts into the upper border of the first rib between the groove for the subclavian artery and the scalene tubercle. The brachial plexus and subclavian artery emerge between anterior and middle scalene muscles. The posterior scalene muscle arises from the posterior tubercles of the fourth to sixth cervical vertebrae and is inserted into the outer surface of the second rib [5].

The abnormalities of scalene muscles may result in compression to subclavian artery or brachial plexus in the root of the neck.

Case Report

During routine dissections for education, we dissected a 55-year-old-male cadaver in Department of Anatomy, Gulhane Military Medical Academy. The lateral aspect of the neck and the deltopectoral groove was dissected. The omohyoid muscle was retracted. The deep fascia and the fatty tissues were removed. Thus, the subclavian artery and brachial plexus were exposed.

In our case, the subclavian artery pierced the anterior scalene muscle. The roots C8-T1 of the brachial plexus passed behind the middle scalene muscle with the exception of normal course. Afterwards, upper trunk was formed by the roots C5-C6, middle trunk was formed by C7 and lower trunk was formed by C8-T1. The anterior divisions of the upper and middle trunks united to form the lateral cord in lateral to the axillary artery. Also, the anterior division of lower trunk ran on as the medial cord in medial to the axillary artery (Figure 1).

Furthermore, suprascapular nerve did not arise from the superior trunk. It arose from the root of C5; while the other branch of C5 joined C6. Superior subscapular,

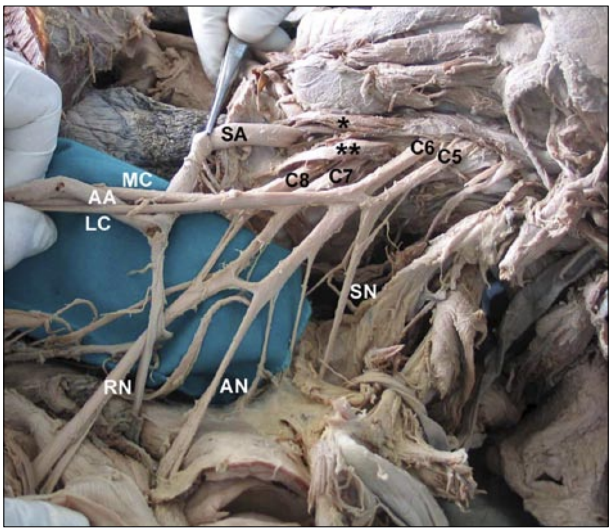

Figure 1. Brachial plexus and anterior scalene muscle in ventral view, left cervicoaxillary region. The subclavian artery entered the anterior scalene and the roots C8-T1 of the brachial plexus passed behind middle scalene muscle. Color version of figure is available online. *(**C5-8:** ventral rami of the fifth to eighth cervical spinal nerves; **SA:** subclavian artery; **AA:** axillary artery; **MC:** medial cord; **LC:** lateral cord; **SN:** suprascapular nerve; **AN:** axillary nerve; **RN:** radial nerve; ***:** anterior scalene muscle; ****:** middle scalene muscle)*

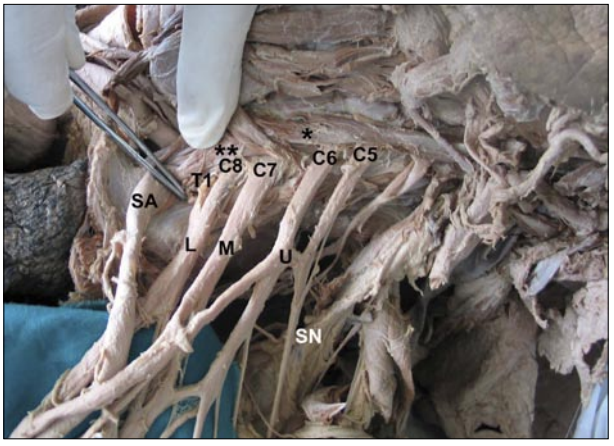

Figure 2. Ventral view of the left cervicoaxillary region. Middle scalene muscle is removed. Color version of figure is available online. *(**C5-8:** ventral rami of the fifth to eighth cervical spinal nerves; **T1:** ventral rami of the first thoracic spinal nerve; **SA:** subclavian artery; **SN:** suprascapular nerve; **L:** lower trunk; **M:** middle trunk; **U:** upper trunk)*

thoracodorsal and inferior subscapular nerves arose from the posterior division of the upper trunk, in stead of the posterior cord. Then, the posterior cord continued as axillary and radial nerves. The musculocutaneous and ulnar nerves had their normal course (Figure 2).

Discussion

Normally, the left subclavian artery springs from the aortic arch, behind the left common carotid, at the level with the disc between the third and fourth thoracic vertebrae. It ascends into the neck then arches laterally to the medial border of the anterior scalene muscle. After going behind this muscle, it descends laterally from the lateral margin of the scalenus anterior to the outer border of the first rib, then it becomes the axillary artery [6].

Anterior scalene muscle is separated from middle scalene muscle by the subclavian artery and the anterior rami of the C8 and T1 nerves. The second part of the subclavian artery lies behind anterior scalene muscle. The trunks of the brachial plexus and the third part of the subclavian artery emerge from the lateral border of the anterior scalene muscle. When present a cervical rib or fibrous band, it may result in pressure to the subclavian artery or T1 root when they cross over them. The subclavian artery and T1 nerve become displaced upwards over such a rib or band, and pressure upon the neurovascular structures from below may cause severe symptoms [7].

Until the 1920s, thoracic outlet syndrome (TOS) was believed to be a vascular condition caused by compression of the subclavian artery by a congenital anomaly, either a cervical rib or tight anterior scalene muscle. Today it is regarded primarily as a neurologic condition caused by neck trauma injuring and scarring the scalene muscles [6,8]. The subclavian artery may be affected either by a hypertrophic muscle, a strain, or accompanying soft tissue problems like fibrosis or congenital bands [6].

The proximity of the anterior scalene muscle to the brachial plexus, the subclavian artery and vein can give rise to compression syndrome [9]. Aberrant slips or bundles may also compress the brachial plexus or the ventral rami of the lower cervical nerves, causing similar compression syndrome [9,10].

Harry et al [5] reported the commonly described anatomical relationship of the brachial plexus as lying between the anterior and middle scalene muscles in 60% of 102 subjects. The most common variation was the penetration of the anterior scalene muscle by the C5 and/or C6 ventral rami. The C5 and C6 roots may fuse before piercing anterior scalene muscle (in 15% of cases) or the C5 root alone can pierce the belly of anterior scalene muscle (in 13% of cases) [5].

The C5 root was found to be completely in front of the anterior scalene muscle between 3% [5] and 3.2% [11]. In our case, the roots C8-T1 of the brachial plexus passed behind the middle scalene muscle. Harry et al [5] reported that the subclavian artery pierced the substance of anterior scalene muscle rather than passing posterior to it in one of their subjects. Similarly in our case, the subclavian artery entered the anterior scalene muscle.

These variations are predisposing factors for TOS; they may cause specific symptoms and require a different surgical approach in comparison to the other causes of the syndrome. Moreover, knowledge of these variations is important in performing anesthetic blockade to the brachial plexus [11], or in surgical procedures to the cervical and axillary regions.

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