



# Bilateral anterior scalene muscles pierced by ventral rami of the C5 and C6 spinal nerves: case report

Published online June 7th, 2013 © <http://www.ijav.org>

Esat ADIGUZEL <sup>+</sup>  
Sahika Pinar AKYER  
Huseyin BAYLAN

Department of Anatomy, Faculty of Medicine, Pamukkale University, Denizli, TURKEY.



<sup>+</sup> Dr. Esat Adiguzel  
Professor  
Department of Anatomy  
Faculty of Medicine  
Pamukkale University  
Denizli, 20020 TURKEY.  
☎ +90 (258) 296 1675  
✉ [esatadiguzel@yahoo.com](mailto:esatadiguzel@yahoo.com)

Received May 11th, 2012; accepted February 28th, 2013

## Abstract

During routine dissection of a 58-year-old male cadaver for medical education in the Department of Anatomy, the anatomical variation between the scalene muscles and brachial plexus were observed bilaterally. Anterior scalene muscles were pierced bilaterally by ventral rami of the C5 and C6 spinal nerves. The right anterior scalene had three bellies separated individually by the ventral rami of C5 and C6 spinal nerves. The left anterior scalene had two bellies separated by ventral rami of the C5 and C6 spinal nerves either.

This variation between the scalene muscles and brachial plexus may be important during supraclavicular nerve block for regional anesthesia, and surgical procedures for thoracic outlet syndrome in this region.

© *Int J Anat Var (IJAV)*. 2013; 6: 90–92.

**Key words** [brachial plexus] [anatomy] [variation] [neck] [nerve] [upper extremity]

## Introduction

The posterior triangle of the neck is an important area for radiologists, physicians, surgeons, and anesthesiologists. It houses not only brachial plexus (BP), but also the cervical sympathetic ganglia, the major blood vessels, and many other structures. The thoracic outlet syndrome redounds to the clinical importance of this region. Nowadays, term of the 'thoracic outlet' has been used for identifying these structures in the manuscript about thoracic outlet syndrome [1].

Anesthetic administration to block cervical sympathetic ganglia or branches of BP, botulinum toxin injection into the scalene muscles, and surgical operations for thoracic outlet syndrome necessitate knowing anatomical variations about the structures in the neck [2]. Also, effective radiological evaluation requires a thorough understanding of the anatomy of this region and BP. Under this circumstance, the bilateral variation described here may be important for clinical evaluation of the neck anatomy.

## Case Report

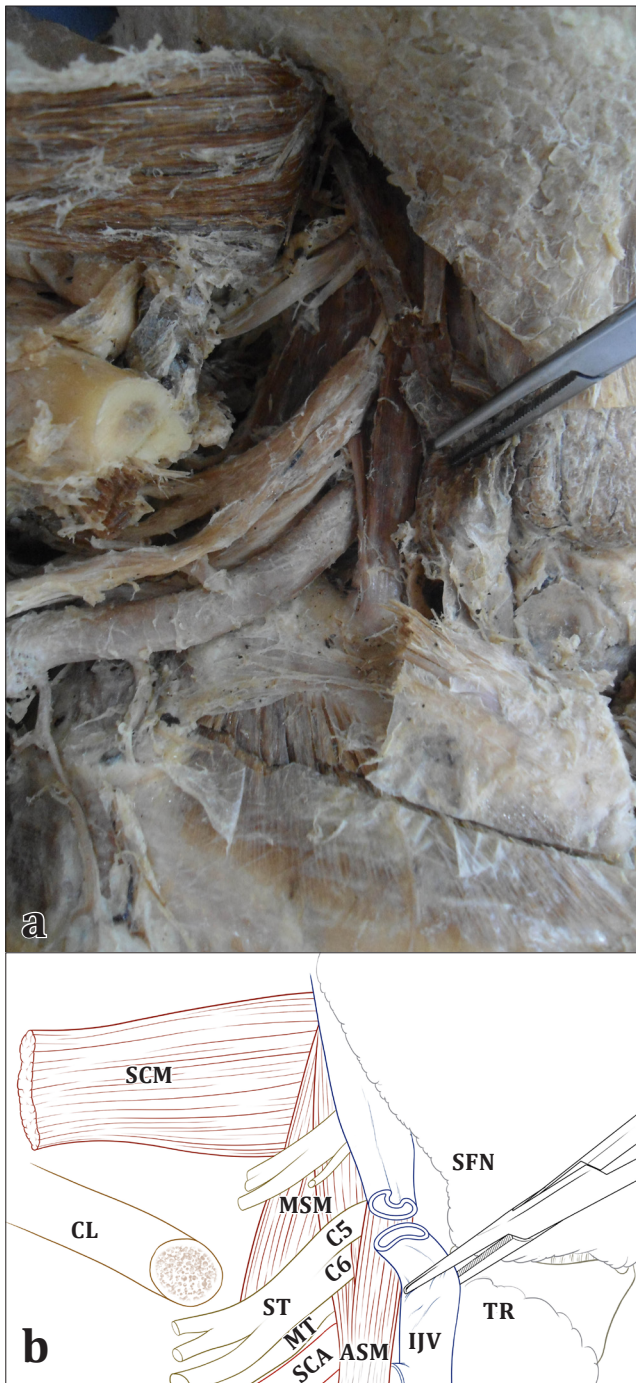
During dissection for medical education, bilateral variations were seen in relation between scalene muscles and the brachial plexus of a 58-year-old male cadaver. No visible

external anatomical variation or anomaly was noted. The anterior scalene muscles were deep to sternocleidomastoid bilaterally, concordant to classical anatomical description. After removing the sternocleidomastoids and fascial sheets, it was detected that the right scalenus anterior had three bellies separated individually by anterior rami of the C5 and C6 spinal nerves (Figure 1). These bellies converged and joined before attached by narrow, flat tendon to the 1st rib. The left anterior scalene muscle had two bellies separated by anterior rami of the C5 and C6 cervical spinal nerves either (Figure 2), and attached to the 1st rib similar to the right peer.

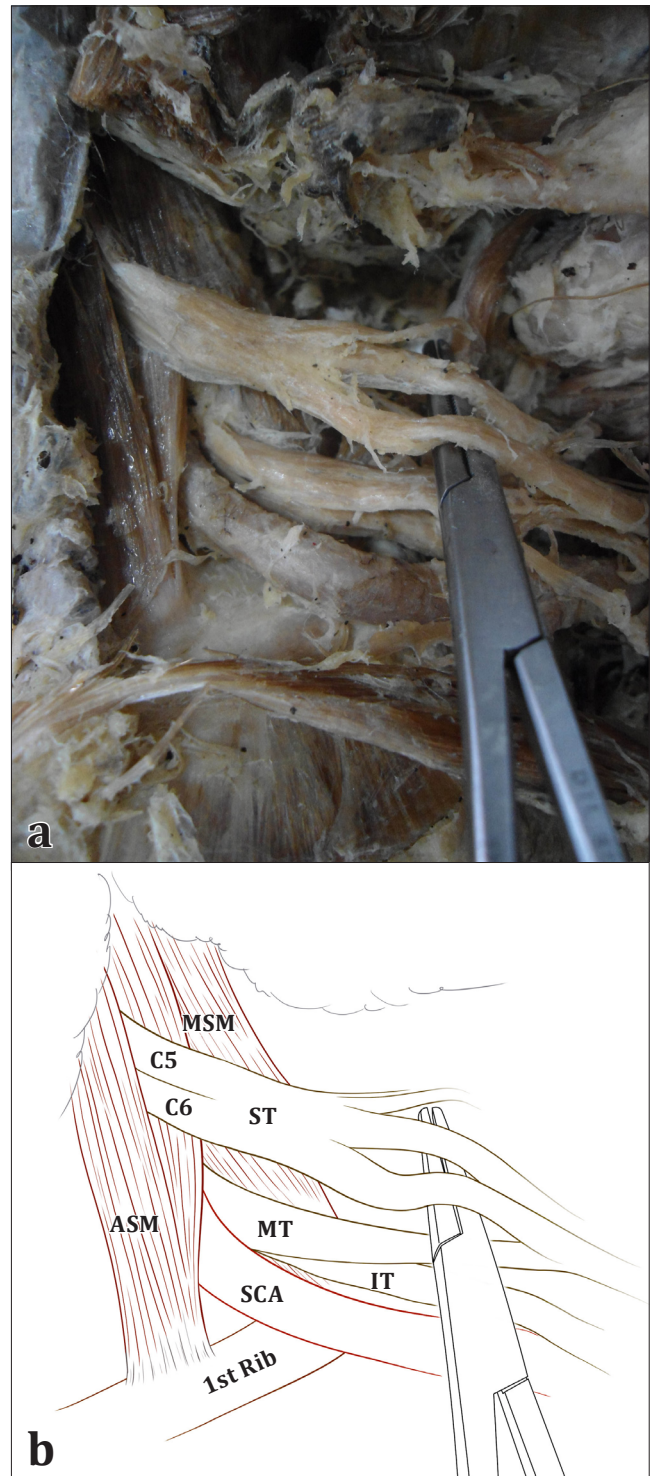
## Discussion

According to the classic description, BP composes of C5 to T1 spinal nerves' ventral rami combining to form three trunks in the posterior triangle of the neck. The ventral rami of C5 and C6 form the superior trunk, the ventral ramus of C7 spinal nerve continues as the middle trunk, the ventral rami of the C8 and T1 spinal nerves form the inferior trunk of the BP. BP passes between anterior and middle scalene muscles together with subclavian artery [3].

Upper limbs burgeon out opposite the 5th – 8th cervical and the first two thoracic segments in the seventh week of



**Figure 1. a)** Photo of dissected neck, right side. **b)** Explanatory illustration of the right neck dissection. Inferior trunk of brachial plexus is hidden behind of the subclavian artery. Anterior scalene has three belly pierced individually by ventral rami of C5 and C6 cervical spinal nerves. Middle and inferior trunk of brachial plexus and subclavian artery pass between anterior and middle scalene. (CL: clavicle; SCM: sternocleidomastoid muscle; MSM: middle scalene muscle; ASM: anterior scalene muscle; IJV: internal jugular vein; SFN: superficial cervical fascia; TR: thyroid gland; ST: superior trunk of the brachial plexus; MT: middle trunk of brachial plexus; SCA: subclavian artery; C5, C6: ventral rami of 5th and 6th cervical spinal nerves)



**Figure 2. a)** Photo of dissected neck, left side. **b)** Explanatory illustration of the left neck dissection. Middle and inferior trunk of brachial plexus and subclavian artery pass between anterior and middle scalene. (MSM: middle scalene muscle; ASM: anterior scalene muscle; SCA: subclavian artery; ST: superior trunk of the brachial plexus; MT: middle trunk of brachial plexus; IT: inferior trunk of the brachial plexus)

development. Shape of the muscles is controlled by connective tissue derived from somatic mesoderm. The mesenchyme is derived from dorsolateral cells of the somites that migrate into the upper limb bud's connective tissue to form upper limbs' muscles, while myoblasts from cervical hypomeres form the scalene, geniohyoid, and prevertebral muscles. At the same time, ventral rami from the 5th – 8th cervical and first two thoracic spinal nerves penetrate the connective tissue to reach appropriate upper limb muscles [4]. Postero-anterior oblique course of the anterior scalene from the transverse processes of the cervical vertebrae to the first rib, and discoordination between myoblast migration and nerve penetration lead relational variations between upper roots of BP and anterior scalene. There are lots of studies about the variations seen in relations between scalene muscles and the brachial plexus [1, 5, 6]. According to Harry et al., the incidence of this classically described localization of the BP is about 60% [5].

Localization of BP except classically described space has various features. In some cases, the root from C5 or upper

trunk of BP pass anteriorly to the anterior scalene. Rarely anterior scalene is perforated by the C5, C6 roots [6]. Bilateral variations in these structures are less frequent than those of the unilateral variations.

Treatment of patients suffered from neurogenic thoracic outlet syndrome includes various invasive methods from resection of the first rib to botulinum toxin injection into the anterior scalene [7, 8]. These methods are preferred for the purpose of to decompress the BP. In this respect, the variations described above may be a reason of unsuccessful operations.

In conclusion, awareness of neuromuscular variations in the posterior triangle of the neck allows physicians to overcome the complications and treatment failure during the surgery or injections such as scalene blocs, rib removal.

### Acknowledgement

We thank to Dr. Levent Efe (CMI, Melbourne) for explanatory medical illustrations.

### References

- [1] Atasoy E. Thoracic outlet syndrome: anatomy. *Hand Clin.* 2004; 20: 7–14.
- [2] Torriani M, Gupta R, Donahue DM. Sonographically guided anesthetic injection of anterior scalene muscle for investigation of neurogenic thoracic outlet syndrome. *Skeletal Radiol.* 2009; 38: 1083–1087.
- [3] Standring S, ed. *Gray's Anatomy*. 40th Ed., London, Churchill Livingstone. 2008; 435–466.
- [4] Sadler TW. *Langman's Medical Embryology*. 9th Ed., USA, Lippincott Williams & Wilkins. 2004; 199–207.
- [5] Harry WC, Bennett JD, Guha SC. Scalene muscles and the brachial plexus: anatomical variations and their clinical significance. *Clin Anat.* 1997; 10: 250–252.
- [6] Natsis K, Totlis T, Tsikaras P, Anastasopoulos N, Skandalakis P, Koebke J. Variations of the course of the upper trunk of the brachial plexus and their clinical significance for the thoracic outlet syndrome: a study on 93 cadavers. *Am Surg.* 2006; 72: 188–192.
- [7] Christo PJ, Christo DK, Carinci AJ, Freischlag JA. Single CT-guided chemodenervation of the anterior scalene muscle with botulinum toxin for neurogenic thoracic outlet syndrome. *Pain Med.* 2010; 11: 504–511.
- [8] Sanders RJ, Hammond SL, Rao NM. Thoracic outlet syndrome; a review. *The Neurologist.* 2008; 14: 365–373.