

A rare variation in the formation of the lower trunk of the brachial plexus its embryological basis and clinical importance - a case report

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Abstract

Brachial plexus is the plexus of nerves, that supplies the upper limb. Variations in the branches of brachial plexus are common but variations in the roots and trunks are very rare. Here, we report one of the such rare variations in the formations of the lower trunk of the brachial plexus in the right upper limb of a male cadaver. In the present case the lower trunk was formed by the union of ventral rami of C7, C8 and T1 nerve roots. The middle trunk was absent. Upper trunk formation was normal.

Key words: Brachial plexus, lower trunk, upper trunk, middle trunk.

Introduction

The total amount of myelin fibres in the brachial plexus in adults range between 1, 20,000 to 1, 50, 000 and up to 25% of it innervates the upper limb. The brachial plexus is formed by the union of ventral rami of C5, C6, C7, C8 and T1 spinal nerves. The fifth cervical and the first thoracic nerves contain the least amount of myelin fibres, i.e between 15000 to 20000. The eighth is the biggest and contain about 30,000 myelin fibres. The greatest amount of motor fibres is in C5 and then in C8, the smallest amount in C7 and T1. The amount of sensory fibres is greatest in C7, then in C6 and finally in C8. ¹

The most common arrangement of the brachial plexus is as follows the fifth and the sixth rami unite at the lateral border of scalenus medius as upper trunk; the

eight cervical and the first thoracic rami join behind scalenus anterior as lower trunk; seventh cervical ramus becomes the middle trunk. The three trunks incline laterally either just above or behind the clavicle.² Variations are very common in the branches of brachial plexus but variations in the roots and trunks are very rare. The knowledge of rare variations in the roots and trunks of brachial plexus is very useful in the practice of orthopedics and anesthesia.

Case report

During routine dissection in the Department of Anatomy, College of Medical Sciences, Bharatpur, Nepal, a rare variation in the formation of lower trunk of the brachial plexus was found unilaterally, on the right side of a male cadaver aged about 60 years.

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The upper trunk was formed by the union of ventral rami of C5 and C6 spinal nerves. Middle trunk was absent and lower trunk was formed by the union of C7, C8 and T1 spinal nerve roots. The abnormal lower trunk was cleaned thoroughly to rule out the facial

connection between the middle and lower trunks. Abnormal lower trunk was medially related to the subclavian artery(Figure no:1). Rest part of the brachial plexus was normal.

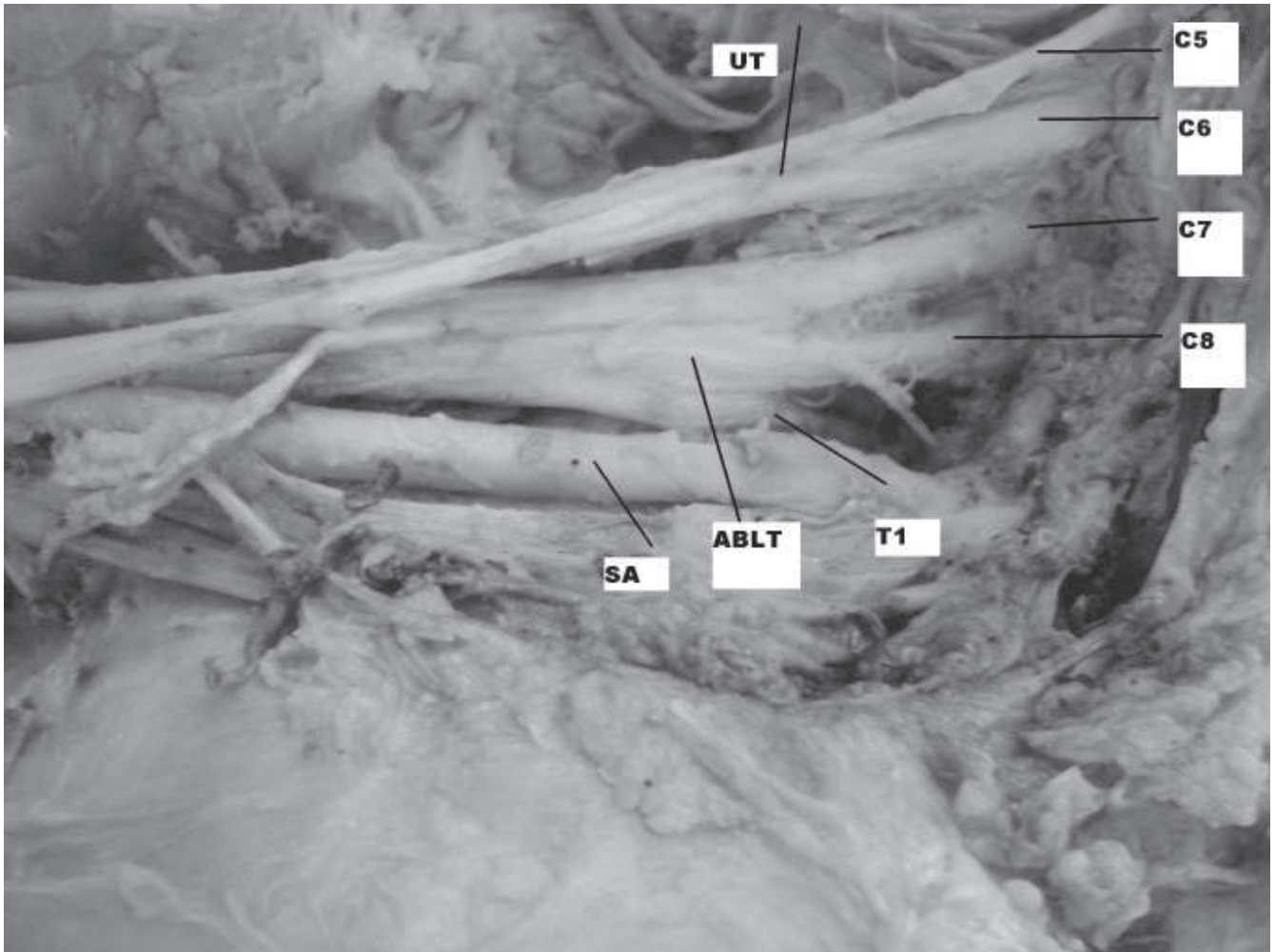


Fig1. Variation in the formation of the lower trunk of the brachial plexus.

UT=Upper trunk, ABLT=Abnormal Lower trunk, Roots of brachial plexus C5, C6, C7, C8 and T1, SA=Subclavian artery.

Discussion

Formation of lower trunk of brachial plexus by C7, C8 and T1 roots is very rare. This associated with the absence of the middle trunk is reported in the present case.

The variation seen in the current study is the result of developmental anomaly. The reason behind this variation may be the result of factors influencing the development of the limb muscles and the peripheral nerves during the embryonic life.

The development of forelimb muscles by regional expression of five Hox D genes occurs from the mesenchyme of paraxial mesoderm in the fifth week of the intrauterine life. The growth cones of the motor axons arrive at the base of the limb bud to form the brachial plexus and continue in the limb bud.^{3,4}

The guidance of the developing axons is regulated by the expression of chemo-attractants and chemo-repulsant in highly coordinated sight specific fission. Tropic substances such as brain-derived neurotropic growth factor, *neurtin-1*, *neurtin-2*, *c-kit ligand* etc. attract the correct growth cones that happen to take the right path.⁵ The significant variations in nerve pattern may be the result of altered signaling between the mesenchymal cells and the neuronal growth cones or circulatory factors at the time of fission of brachial plexus cords.

Satheesha nayak et al reported absence of middle trunk, variation in the formation of upper trunk by union of C5, C6 and C7 spinal nerves.⁶

An extensive study by Usyal et al showed superior trunk not be formed in 1% of cases, inferior trunk not be formed in 9% of cases and formation of superior

trunk by C4 and C5 roots, inferior trunk by T1 and T2 roots.⁷

The knowledge of variations in the formation of brachial plexus is very useful for the anatomist and radiologists, anesthesiologists and neurosurgeons and orthopedic surgeons.⁸

The knowledge of variations in the formation of brachial plexus is very useful for the neurosurgeons. It will help in the surgical treatment of tumors of nerve sheaths such as schwannomas and neurofibromas.⁶

This type of knowledge is mainly helpful for anesthesist, surgeons for improved guidance during infraclavicular block porcedures, surgical approaches for brachial plexus region tumors and orthopedic treatment of the cervical rib also need a through knowledge of normal and abnormal formation of brachial plexus.⁹

Finally in image process three dimensional volume rendered magnetic nuclear resonance scan allows visualisation of the entire brachial plexus within a single composite image important in computer imaging in diagnostic medicine.¹⁰

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