



A Rare Variation of the Brachial Plexus Involving The Trunks and Cords: A Case Report

Truncus ve Fasciculus'ları İçeren Nadir Bir Plexus Brachialis Varyasyonu:
Bir Olgu Sunumu

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Abstract

Anatomical variations of the brachial plexus are common. This study presents a case of brachial plexus detected during a cadaver dissection. During routine dissections at the Department of Anatomy, Faculty of Medicine, Istanbul Yeni Yüzyıl University, a variation in the formation and distribution of the left brachial plexus was found in a 74-year-old female cadaver. In this case, the roots of the C5 and C6 spinal nerves fuse to form the superior trunk. However C7, C8 and T1 spinal nerve roots formed a single common trunk instead of the middle and inferior trunk. The anterior branches of these two trunks formed a single lateral cord. The medial cord is located lateral to the axillary artery in the same extremity. The brachial plexus formation on the right is in the classical pattern. Knowing the variations in brachial plexus formation and distribution is guiding and important in clinical practice.

Keywords: Brachial plexus, trunks, cords, axillary artery, anatomic variations

Öz

Plexus brachialis'in anatomik varyasyonları yaygındır. Bu çalışmada kadavra diseksiyonu sırasında saptanan bir brakiyal plexus olgusu sunulmaktadır. İstanbul Yeni Yüzyıl Üniversitesi Tıp Fakültesi Anatomi Anabilim Dalı'ndaki rutin diseksiyonlar sırasında 74 yaşındaki kadın kadavrada sol plexus brachialis'in oluşum ve seyrinde bir varyasyon bulundu. Bu olguda C5 ve C6 spinal sinirler kökleri birleşerek truncus superior'u oluşturur. Ancak C7, C8 ve T1 spinal sinir köklerinin, truncus medius ve truncus inferior yerine tek bir ortak gövde oluşturduğu tespit edildi. Bu iki truncus'un ön dalları da birleşerek fasciculus lateralis'i oluşturdu. Aynı ekstremitedeki fasciculus medialis'in ise arteria axillaris'in lateralinde olduğu görüldü. Sağ taraftaki plexus brachialis oluşumunun klasik paternde olduğu tespit edildi. Plexus brachialis'in oluşumu ve dağılımındaki varyasyonların bilinmesi klinik uygulamada yol gösterici ve önemlidir.

Anahtar kelimeler: Plexus brachialis, truncus, fasciculus, arteria axillaris, anatomik varyasyonlar

Introduction

The brachial plexus (BP) is an important nerve network that is formed by the union of the anterior roots of the C5-T1 spinal nerves and provides the motor and sensory innervation of the upper extremity (1). According to the Carnegie stages, the human embryo completes its developmental chronology in 23 stages (2,3). Accordingly, at the 13th stage, the upper extremity nerves emerge from the spinal cord at C5-T1 levels. At stage 15, the spinal nerve begins to enter the upper extremity and fuses to form the BP. In the 21st stage, the BP clearly tends caudally and at this stage adult-like adjustment and regulation is completed (2,3). Variations of the BP generally show embryonal effects, and knowing these variations is

important and guides to clinicians.

It is important for neurologists to make a correct diagnosis and treatment plan, for radiologists to determine the structures encountered in radiological images, for anesthesiologists to determine the injection site in the region where catheterization and regional anesthesia will be performed, and for surgeons to make a correct surgical treatment plan. The aim of this study is to describe the variation in BP encountered and discuss the importance of these variations in clinical practice.

Case Presentation

During routine dissection of a 74-year-old female cadav-



er, which was fixed with formalin solution in Istanbul Yeni Yüzyıl University Faculty of Medicine, Department of Anatomy, differences were observed in the formation and localization of BP on the left side.

In this case, the anterior branches of the C5 and C6 spinal nerves fuse to form the superior trunk. However, unlike the normal anatomical pattern, anterior branches of the C7-C8 and T1 spinal nerves were seen to merge and form a single common trunk instead of middle and lower trunks. The anterior branches of these two trunks formed a single lateral cord to the axillary artery (AA) and the posterior branches formed a second cord behind the AA. These two trunks and two cords were named as upper and lower trunk, and the cords were named as upper and lower cords according to their anatomical positions according to AA (Fig. 1). According to the normal anatomical configuration, the peripheral nerves originating from the lateral and medial cords derived from the superior cord in this case. In addition, the peripheral nerves that should originate from the posterior cord, occurred from the inferior cord. On the right side of

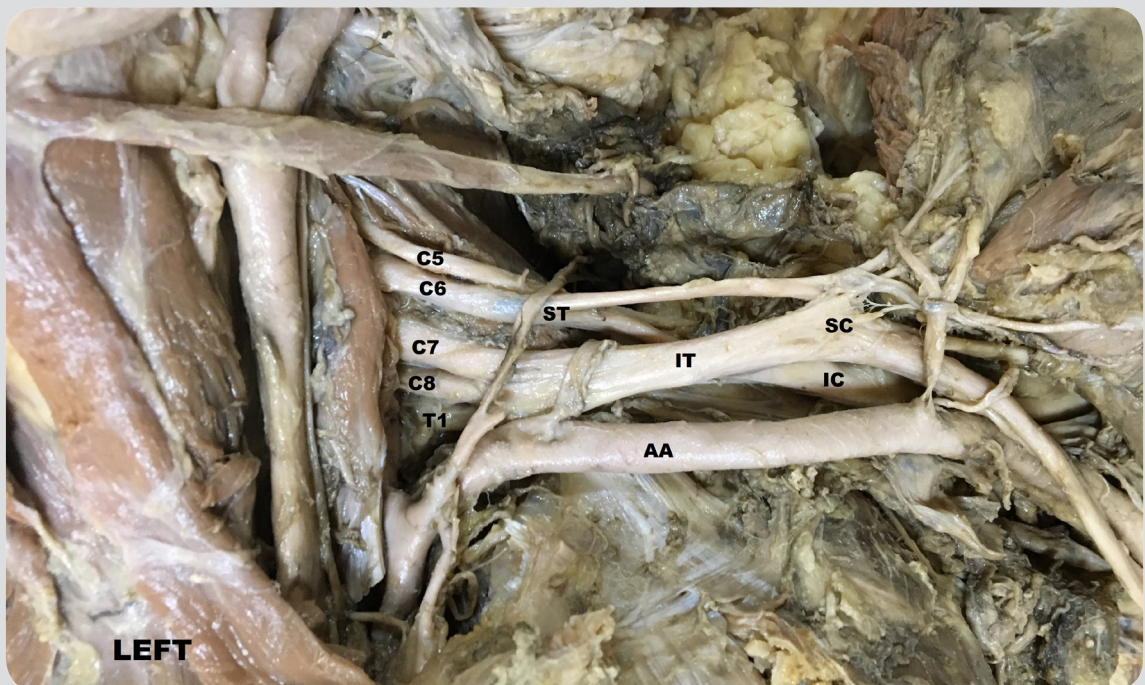
the cadaver, no variation was found in the formation and location of the trunks and cords (Fig. 2).

Discussion

According to the classical anatomical configuration, BP is formed by the union of the anterior branches of the C5, C6, C7, C8 and T1 spinal nerves. The anterior branches of the C5 and C6 spinal nerves unite to form the superior trunk, C7 alone to form the middle trunk, C8 and T1 unite to form the inferior trunk. Then the trunks are divided into anterior and posterior divisions. Anterior divisions of the superior and middle trunks' unite to form the lateral cord, and the anterior division of the inferior trunk form the medial cord and the posterior divisions of these three trunks' units and form the posterior cord (1). Cords are named according to their location to the AA (1).

Anatomical variations in the formation, localization and distribution of the BP are well described in the literature. Kerr et al. defined 29 different BP variations in 1918 and

Fig 1. Left-sided variation of brachial plexus



C5-T1: Anterior branches of spinal nerves; **ST:** Superior Trunk; **IT:** Inferior Trunk; **SC:** Superior Cord; **IC:** Inferior Cord; **AA:** Axillary Artery

Fig 2. Brachial plexus without variation on the right-side and with variation on the left-side



C5-T1: Anterior branches of spinal nerves; **ST:** Superior Trunk; **IT:** Inferior Trunk;
SC: Superior Cord; **IC:** Inferior Cord; **LC:** Lateral Cord; **MC:** Medial Cord; **AA:** Axillary Artery; **AV:** Axillary Vein

divided them into 2 main categories (4). For the first one, the proximal structure is different, but the spinal nerve fibers forming the terminal branches are like the normal branching pattern; in the second one, it was stated that the distribution of the fibers coming from the spinal nerves was different from the general formation. Then, Bergman defined 38 different BP variations in 1988 (5). Orebaugh et al. stated that, unlike the classical definition, there is a 53.5% variation of the BP (6). Similar to our study, Nayak et al. reported a variation of BP with two trunks in a 55-year-old male patient in unilateral (right-sided) (7). In this case, it has been stated that the C7 spinal nerve combines with the C5 and C6 spinal nerves and participates in the formation of the superior trunk. Uysal et al. categorized the trunks' variations they encountered in 200 BP that they examined bilaterally in 100 human fetuses (8). In one of the categories, it was found that the C7 spinal nerve did not form the middle trunk alone as in the normal anatomical configuration, and that it joined the C5 and C6 spinal nerves to form the superior trunk, similar to the work of Nayak et al. (7). They didn't encounter a variation similar to our study. However, they stated that the variations were more common in the female fetus

and right side. Similarly, the variation in our study was in the female cadaver, and contrary to the literature, it was detected on the left side. Aragão et al. found 3 different variations in their study in which they examined the trunk formation variations of a total of 40 BP in 20 human fetuses bilaterally (9). In the study performed by Singla et al. for trunk anomalies, the middle and inferior trunks emerged from a common trunk as in our study (10). In the study of Satyanarayana et al., medial and lateral cords are located separately in the lateral of the AA (11). Havaldar et al. described both trunks and cords formation in a male cadaver and right side similar to our study (12).

Knowing the anatomy of the region and its possible variations is one of the most important factors for the correct management of the operation process and prevention of possible complications in surgeries involving BP (5). In the literature, it has been reported that BP has injuries of obstetric or traumatic origin (13), in orthopedic treatment of the cervical spine (14), in capsulolabral repair of the shoulder joint (15), in breast surgeries such as mastectomy and axillary lymphadenectomy (16), in nerve/nerve sheath tumors such as schwannoma (17). Regional anesthesia is recommend-



ed for the surgical treatment of these conditions (18). Effective BP blockade requires a thorough understanding of the anatomy of the plexus, as well as an appreciation of anatomical variations that may occur (6). Today, the development of imaging methods has also enabled nerve blocks of BP and its terminal branches with various approaches. Of these, interscalene, cervical, supraclavicular, infraclavicular, axillary and humeral canal BP block approaches include trunks and cords. (19). Since the case described in this study includes the trunks and cords and its localization with respect to the AA is different from the normal anatomical configuration, it should be considered for the mentioned approaches.

Conclusion

As a result; the complex anatomical structure of the BP, its relationship with adjacent structures and its variations should be considered in order to increase success in both diagnosis and surgical treatment and prevent complications that may occur. This case represents a rare combination of variations in formation and localization of trunks and cords. Therefore, this study provides an important contribution to the literature on BP variations.

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