

**Case Report**



## **Brachial Plexus With Two Trunks and Double Axillary Veins: Applied Importance and Clinical Implications**

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**ABSTRACT**

During routine dissection in the Department of Anatomy following important anatomical variations on right side of a 30 years old male cadaver were observed. Brachial plexus comprised of only two trunks, the upper one was formed by union of C5, C6, C7 roots while the lower trunk was formed by union of C8, T1 roots. C5 root of brachial plexus was receiving a communicating branch from phrenic nerve. Double axillary veins were observed in the axillary region. Lesion or injury to upper trunk of brachial plexus in aforesaid case will manifest as wider spectrum of clinical signs with diffuse loss of function entirely different from the classic Erb–Duchenne palsy. This background of anatomical variations can help to minimize damage to important structures in the axilla during axillary dissection. ©2006, Firat Üniversitesi, Tıp Fakültesi

**Key words:** Brachial plexus, trunk, anatomical variation, axillary vein, phrenic nerve.

**ÖZET**

**İki Trunkuslu Pleksus Brachialis ve Çift Aksiller Ven: Uygulamada Önemi ve Klinik Anlamı**

Anatomi anabilim dalında, 30 yaşındaki erkek bir kadavrada rutin diseksiyon sırasında sağ tarafta önemli anatomik varyasyonların varlığı gözlemlendi. Brachial plexus sadece iki trunkustan meydana gelmişti; üst trunkus C5, C6 ve C7 köklerinin birleşmesinden, alt trunkus ise C8 ve T1 köklerinin birleşmesinden oluşmuştu. Brachial plexus'un C5 kökü phrenic sinirden bir bağlantı dalı alıyordu. Aksiller bölgede çift aksiller ven olduğu gözlemlendi. Bu tip bir olguda, Brachial plexus'un yukarı kolunun lezyon veya yaralanması klasik Erb–Duchenne palsy'den tamamen farklı olarak tam fonksiyon kaybı ve daha yaygın klinik bulgularla karakterize bir tabloyla ortaya çıkacaktır. Bu gibi anatomik varyasyonların bilinmesi aksiller bölgede diseksiyon sırasında önemli yapıların hasarlanma riskinin en aza indirilmesine yardımcı olacaktır. ©2006, Firat Üniversitesi, Tıp Fakültesi

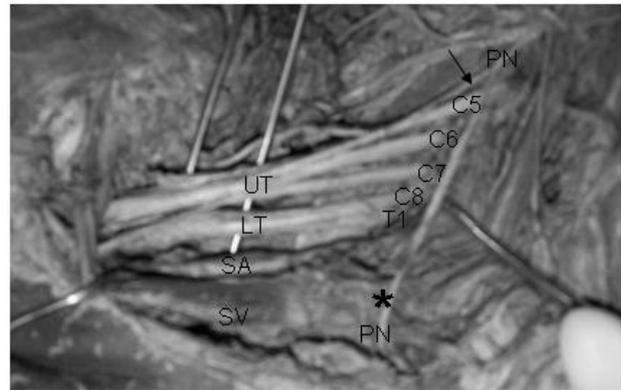
**Anahtar kelimeler:** Pleksus Brachialis, trunkus, anatomik varyasyonlar, aksiller ven, prenic sinir.

**K**nowledge of variations in anatomy is important to anatomists, radiologists, anesthesiologists and surgeons, and has gained more importance due to wide use and reliance on computer imaging in diagnostic medicine [1]. Anatomical variations of the brachial plexus and axillary region have been reported time and again by various authors [1, 2, and 3]. It must be remembered that the brachial plexus is merely a routing mechanism to get nerves with a common function in the proper terminal nerves and thus errors in distribution may occur that are corrected distally in the arms, forearm or hand, resulting in anatomical variations of the plexus [4]. The brachial plexus variations could result in failure in brachial plexus loco regional anesthesia [3]. Some variations are vulnerable to damage in radical neck dissection and other surgical operations of the axilla and upper arm [5]. Brachial plexus formed by only two trunks is very rare in literature [6].

**CASE REPORT**

The following variations were observed only on the right side during routine dissection in a 30 years old adult male cadaver. Middle trunk of brachial plexus was found missing (Fig.1 & 2). C5, C6, C7 roots of brachial plexus were uniting to form upper trunk and C8, T1 roots were forming its lower trunk (Fig 1 &

2.). After giving two branches, suprascapular nerve and nerve to subclavius, the upper trunk divided into two divisions.



**Figure 1.** Photograph of dissected right side of neck and axilla showing

PN: Phrenic nerve  
C5: C5 root of brachial plexus  
C6: C6 root of brachial plexus  
C7: C7 root of brachial plexus  
C8: C8 root of brachial plexus

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T1: T1 root of brachial plexus  
 UT: Upper trunk of brachial plexus  
 LT: Lower trunk of brachial plexus  
 SA: Subclavian artery  
 SV: Subclavian vein  
 Arrow denotes Phrenic nerve giving communicating branch to C5 root of brachial plexus

Denotes that Phrenic nerve is passing anterior to subclavian vein



**Figure 2.** Photograph of dissected right side of neck and axilla showing

C5: C5 root of brachial plexus  
 C6: C6 root of brachial plexus  
 C7: C7 root of brachial plexus  
 C8: C8 root of brachial plexus  
 T1: T1 root of brachial plexus  
 UT: Upper trunk of brachial plexus  
 SV: Subclavian vein  
 CV: Cephalic vein  
 AV1 : First axillary vein  
 AV2: Second axillary vein  
 PN: Phrenic nerve

\*Denotes Phrenic nerve passing anterior to subclavian vein

Anterior division of the upper trunk continued as lateral cord while the posterior division combined with posterior division of lower trunk to form posterior cord of brachial plexus. Anterior division of lower trunk continued as medial cord. The rest of the parts of brachial plexus were normal. Phrenic nerve after its formation was giving a communicating branch to C5 root of brachial plexus and it was passing anterior to subclavian vein (Fig. 1). Two separate axillary veins were uniting to form the subclavian vein (Fig 2.). Only one axillary vein was related directly with axillary artery and cords of brachial plexus.

## DISCUSSION

One case of bilateral fusion of upper and middle trunks of brachial plexus was reported by [6]. An extensive study by Uysal et al., [7] showed superior trunk not being formed in 1% of cases and inferior trunk not being formed in 9% of case. Our case of unilateral variation is associated with phrenic nerve

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variation (passing anterior to subclavian vein and communicating with C5 root) and double axillary veins.

This case report gains tremendous importance in context of upper trunk brachial plexus injury (Erbs paralysis). Above mentioned case will not manifest characteristic (waiter's tip position) or typical (porter's tip) deformity [8 and 9]. Lee Mc Gregor's book [8] described that abduction of shoulder is dependent on C5, while flexion of the elbow is dependent on C5, C6, on the contrary, adduction of at shoulder and extension of wrist and fingers are dependent C6, C7, while extension of the elbow is dependent on C7, C8. Hence the spectrum of clinical manifestations produced by upper trunk injury in the present case will be entirely different from the classic Erb's palsy and may mislead the clinicians. Phrenic nerve's communicating branch to C5 root may add pericardial and diaphragmatic manifestations along with brachial plexus injuries.

Kutiyawala [2] reported double axillary veins, but that case was not associated with trunk variation of brachial plexus. The axillary vein variations are important in breast carcinoma treatment, since venous drainage of the breast is mainly to axillary vein, whereas the first part of axillary vein may be used for venepuncture [8 and 9].

### Embryological hypothesis:

The formation of the brachial plexus begins in early development in the 4th week of gestation. In essence, as axonal growth is directed by sclerotome, nerve formation follows the dorsal rotation of the upper limb bud. The axons from the ventral column motor cells start to grow towards the sclerotome cell mass, thereby forming the ventral root. Similarly the dorsal root forms by axons growing in the opposite direction from the dorsal root ganglion cells. The primitive capillary plexus of the flattened limb buds gives rise to a peripheral border vein which serves as an early drainage channel to blood brought in by the axial arterial vessels. The border vein appears in the arm in the 6th week and the general venous plan becomes outlined within the next two weeks of intrauterine life. The radial extension of the border vein atrophies but the ulnar portion persists, forming at different levels the subclavian, axillary and basilic veins. The cephalic vein develops secondarily in connection with the radial vein but later it anastomoses with the external jugular vein, but finally opens into the axillary vein, as in the adult [10].

As suggested by Sannes et al [11] that the guidance of the developing axons is regulated by expression of chemoattractants and chemorepulsants in highly coordinated site specific fashion. Any alterations in signaling between mesenchymal cells and neuronal growth cones can lead to significant variations and probably in this case resulted in absence of middle trunk and phrenic nerve communication with C5 root along with double axillary veins. Once formed, any developmental differences would persist postnatally.

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*Kabul Tarihi: 07.07.2006*