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Research Article

Variations In Branching Pattern of Brachial Plexus : A Cadaveric study

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Abstract

Brachial plexus is formed by ventral primary rami of C_5 to T_1. The aim of the present study is to study the variations in branching pattern of the brachial plexus. In present study 100 brachial plexuses from 50 well embalmed Human cadavers were studied in anatomy department, B.J. Medical College, Ahmedabad. Out of 100 upper limbs, three upper limbs show multiple communications between Medial & Lateral root of median nerve. In one cadaver, we found that median nerve was formed by two lateral roots and one medial root on right side. Communication between musculocutaneous nerve and median nerve found were in 6 cases. In such cases, the communicating branch run from the musculocutaneus nerve to median nerve, after piercing the coracobrachialis muscle. In one cadaver, on right side, two variations were found. One variation was that upper and lower subscapular nerves were arising from axillary nerve. Second variation was that there was communication between radial nerve and axillary nerve. It is concluded that knowledge of such variations is essential in evaluation of unexplained sensory and motor loss after trauma and surgical interventions to upper limb. Knowledge of these is important to anatomists, radiologists, anesthesiologists and surgeons.
Keywords: Axillary Nerve, Brachial Plexus, Median Nerve, Musculocutaneus Nerve

1. Introduction

The brachial plexus is formed by the ventral primary rami of spinal nerves C_5-C_8 and T_1. The brachial plexus extends downward and laterally, and then passes over the first rib behind the clavicle and enters the axilla. The ventral rami of C_5 and C_6 unite to form the superior trunk, C_7 becomes the middle trunk, and C_8 and T_1 form the inferior trunk. These three trunks just above or behind the clavicle bifurcate into anterior and posterior divisions. All of the posterior divisions form the posterior cord. The lateral cord is formed by the union of the anterior divisions of the superior and middle trunk. The medial cord is formed as a continuation of the anterior division of the inferior trunk. The peripheral nerves arise from the cords. The brachial plexus supplies cutaneous and muscular innervation to the upper limb and any injury at this level can lead to significant disability.[1] The aim of the present study is to study the anatomical variations in the branching patterns of brachial plexus in the human cadavers.

2. Material and Method

In present study 100 upper limbs from 50 well embalmed Human cadavers of about 40 to 70 years aged were studied. The dissection was performed in the dissection hall of anatomy department, B. J. Medical College, Ahmedabad.

Dissection was done according to Cunningham's Manual of practical Anatomy, Fifteenth edition vol-1 (Upper & Lower Limb).[2] Dissection of front and back of arm, cubital fossa, flexor and extensor compartment of forearm and palm and dorsum of hand was done to trace all the branches of Brachial plexus upto their innervations in all cases.

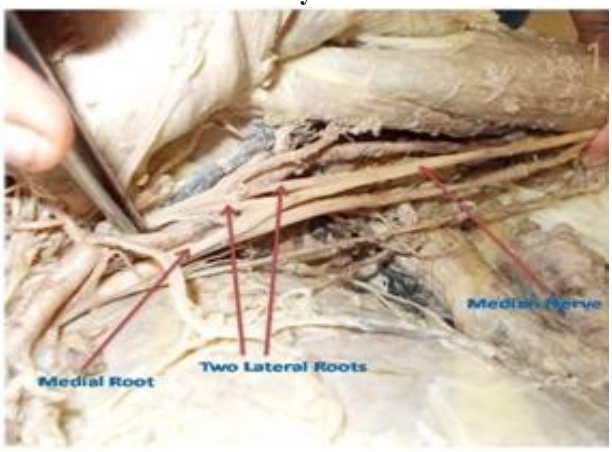
3. Result

In present study, out of 100, three upper limbs show multiple communications between Medial & Lateral root of median nerve [Table-1]. One limb shows that the median nerve was formed by two lateral roots and one medial root.[Image 1]

Table 1 Multiple communication between Medial & Lateral root of median nerve

Multiple communications between Medial & Lateral root of median nerve	Right side	Left side	Total
No. of cases	2	1	3

Image 1. Formation of Median Nerve by two lateral roots and one medial roots



In present study, there was communication between musculocutaneous nerve and median nerve found in 6 cases [Table-2]. In such cases, the communicating branch run from the musculocutaneus nerve to median nerve, after piercing the coracobrachialis muscle [Image 2].

Table-2 : Communication between Median and Musculocutaneous nerve

Communication between Musculocutaneus nerve and Median nerve	Present	Absent	Total
No. of cases	6	94	100

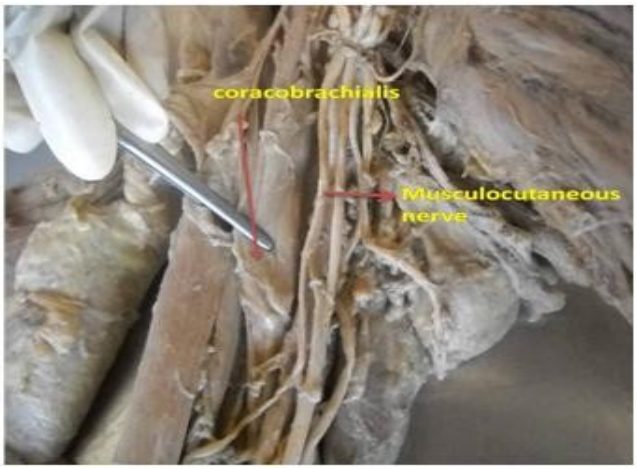
Image 2. Anastomotic branch from Musculocutaneous nerve to median nerve after piercing coracobrachialis

In present study, 4 cases were show presence of musculocutaneous nerve which was not piercing coracobrachialis muscle [Table 3]. In such cases, coracobrachialis, biceps and brachialis muscles were found to be supplied by median nerve [Image 3].

Table 3 : Musculocutaneous nerve not piercing coracobrachialis muscle

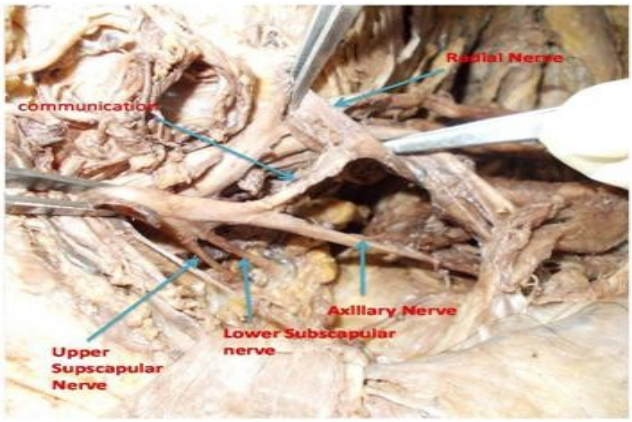
Musculocutaneous nerve not piercing coracobrachialis muscle	Present	Absent	Total
No. of cases	4	96	100

Image 3. Musculocutaneus nerve not piercing Coracobrachialis muscle



While in one cadaver, on right side, two variations were found. One variation was that upper and lower subscapular nerves were arising from axillary nerve, instead of arising directly from posterior cord. Second variation was that there was communication between axillary nerve and radial nerve which was of about 3.6 cm in length.

Image 4. Upper and Lower Subscapular nerves arising from Axillary nerve & Communication between Axillary and Radial nerve.



4. Discussion

In this study, we found formation of median nerve by two lateral and one medial root, which was earlier reported by Gupta M, Goyal N, Harjeet;[3] Chauhan and Roy;[4] and Saeed and Rufai.[5]

In this study, we found interconnections between the musculocutaneous nerve and median nerve. Eglseder and Goldman[6] noticed interconnections between the musculocutaneous nerve and median nerve in 36% of dissections. Venirratos *et al*[7] found 22 communications between the musculocutaneous and median nerves in 16 out of 79 cadavers. Z.

AslyAktan[8] found connections between the musculocutaneous nerve and median nerve were found in five arms out of 48 upper limbs. It is well documented by Choi *et al*(24.6%)[9], and Loukas and Aqueelah(63.5%).[10] Venirratos[7] found that musculocutaneous and median nerve is the most frequent of all the variations that could be observed in the brachial plexus. Anastomotic branch arising from the median nerve running distally to join with the branches of the musculocutaneous nerve was found by Saeed and Rufai. [5]

Some of these variations are Types I-V reported by Le Minor (1990). In **Type I,** there are no connecting fibers between the Musculocutaneous and median nerve as described in classic textbooks. In **Type II**, Although some fibers of the medial root of the median nerve unite with the lateral root of the median nerve and form the main trunk of median nerve, remaining medial root fibers run in the Musculocutaneous nerve leaving it after a distance to join the main trunk of median nerve. In **Type III**, The lateral root of the median nerve from the lateral cord runs in the Musculocutaneous nerve and leaves it after a distance to join the main trunk of median nerve. In **Type IV**, The fibers of the Musculocutaneous nerve unite with the lateral root of the median nerve. After some distance, the Musculocutaneous nerve arises from the median nerve. In **Type V**, The Musculocutaneous nerve is absent. The fibers of the Musculocutaneous nerve run within the median nerve along its course. In this type the Musculocutaneous nerve does not pierce the coracobrachialis muscle.[11]

Venieratos and Anagnostopoulou[7] also reported three types of communications between median and Musculocutaneous nerves considering the coracobrachialis muscle as the reference point. In *type 1*, the communication was proximal to the entrance of the Musculocutaneous nerve into coracobrachialis. In *type 2*; the communication was distal to the muscle and in *type 3*; the nerve and the communicating branch did not pierce the muscle (Venieratos et al). [7]

In this study, we found that in 4 cases musculocutaneous nerve was not piercing the coracobrachialis muscle, which was similar to the findings of Gomusburun, E. and Adiguzel, E.[12]

The upper and lower subscapular nerve usually arises from the posterior cord, but in the present study in one limb the upper subscapular nerve originated from the axillary nerve. Earlier, Kerr,[13] Fazan *et al*,[14] Ballesteros and Ramirez,[15] Chaudhary *et al*[16] and Tubbs *et al*[17] had found it originated from the axillary nerve in 25.4%; 59%; 50%; 3.33% and 3% of their dissections respectively. Suruchi Singhal[18] found 33.9% upper subscapular nerve originating from the PC and the rest from axillary, suprascapular and C8 spinal nerves.

In this study the lower subscapular nerve took its origin from the axillary nerve in one limb. Earlier, Kerr,[13] Fazan *et al*,[14] Ballesteros and Ramirez,[15] had reported such an origin of the lower subscapular nerve from the axillary nerve in 43.31%, 54% and 54.4% of their dissections respectively. Tubbs *et al*[17], Suruchi Sighal[18] and Priti Chaudhari *et al*[16] found same variation in 3%, 33.9% and 3.33% cases respectively.

Koizumi M *et al*[19] found in his study that communications between axillary and radial nerves present in 8 upper limbs out of 602 upper limbs from Japanese cadavers. In our study, in one cadaver there was communication between radial nerve and axillary nerve.

5. Conclusion

The brachial plexus supplies cutaneous and muscular innervation to the upper limb and so any injury at this level can lead to significant disability. So, knowledge of these variations is of clinical significance in anesthetic blocks, surgical approaches and nerve entrapment syndromes involving different branches of brachial plexus. Clinical implication of this could be that injury of musculocutaneous nerve proximal to the anastomotic branch between musculocutaneous and median nerve may lead to unexpected presentation of weakness of forearm flexors and thenar muscle.

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