

A STUDY OF 100 CASES OF BRACHIAL PLEXUS

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ABSTRACT

Brachial Plexus innervates the upper limb. As it is the point of formation of many nerves, variations are common. The presence of anatomical variations of the peripheral nervous system is often used to explain unexpected clinical signs and symptoms. Therefore it is of importance to anatomists, radiologists, anesthesiologists and surgeons. The current research work was aimed to study common and anomalous variations of brachial plexus and communication between its branches. The present study was done on 50 cadavers to study 100 brachial plexuses, 50 each of right and left upper limbs. 10 cases showed absence of musculocutaneous nerve and 8 cases of communication between musculocutaneous and median nerve. 18% of cases showed significant variations which can have bearing on surgical procedures.

Key-words: Brachial plexus, Anatomical variations, Peripheral nerves.

INTRODUCTION

All nerve plexuses are formed only by the ventral rami, and never by the dorsal rami.^{1,2,3} They supply the limbs. The plexus formation is physiological or functional adaptation, and is perhaps the result of the following special features in the limbs:

1. Overlapping of dermatomes
2. Overlapping of myotomes;
3. Composite nature of muscles;
4. Possible migration of muscles from the trunk to the limbs; and
5. Linkage of the opposite groups of muscles in the spinal cord for reciprocal innervation.

The brachial plexus supplies the upper limb, and is formed by the ventral rami of lower nerve (C5, C6, C7, C8, T1). It consists of roots, trunks, divisions and cords. (Figure-1)

Knowledge of variations in anatomy is important to anatomists, radiologists, anesthesiologists and surgeons, and has gained more importance due to the wide use and reliance on computer imaging in diagnostic medicine. Also, presence of anatomic variations of the peripheral nervous system is often used to

explain unexpected clinical signs and symptoms of nerve palsy syndrome and vascular problems.

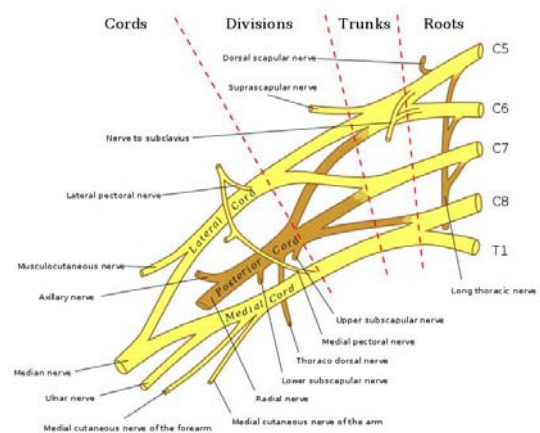


Fig 1: Brachial Plexus

The C5 and C6 fuse to form the upper trunk, the C7 continues as the middle trunk and the C8 and T1 join to form the lower trunk. Each trunk, soon after its formation, divides into anterior and posterior divisions. The anterior divisions of the upper and middle trunks form the lateral cord, the anterior division of the lower trunk

continues as the medial cord and the posterior divisions of all three form the posterior cord. The cords then give rise to various branches that form the peripheral nerves of the upper limb. The anterior divisions supply the flexor compartments of upper limb and the posterior divisions, the extensor compartments. Since the brachial plexus is a complex structure, variations in formation of roots, trunks, divisions and cords are common. The present study deals with some of the common variations and some hitherto unknown variations of the brachial plexus.^{4,5}

MATERIAL AND METHODS

This study was conducted on 50 cadavers (100 upper limb specimens) from the dissection laboratory with an age range of 50 - 80 years. The dissection was performed in dissection laboratories of Smt. N.H.L. Municipal Medical College, Ahmedabad, B.J. Medical College, Ahmedabad and Baroda Medical College, Vadodara from August 2006 to August 2008. Dissection was done according to Cunningham's Manual of practical Anatomy, Fifteenth edition.⁶ 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.

RESULTS

One case of fusion of lateral cord and medial cord, anterior to axillary artery found on left side. Branches of both the cords are normal. (Figure - 2)



Fig 2: Lateral and Medial cord fusion

Absence of musculocutaneous nerve in 10 cases.^{7,8,9} In those cases median nerve supplies coracobrachialis, biceps brachii and brachialis, and turns into lateral cutaneous nerve of forearm. (Figure - 3)



Fig 3: Absence of musculocutaneous nerve

Table 1: Cases with absence of MCN

Absence of MCN	Right	Left	Bilateral
Cases	7	3	2
%	14%	6%	4%

In present study, 8 cases of communication between MCN and MN.^{10,11} In those cases anastomotic branch was observed running from the MCN towards the MN, after piercing the coracobrachialis muscle. (Figure - 4).



Fig 4: Communication between MN and MCN

In two cases all the three cords were lying lateral to the axillary artery which has surgical importance in shoulder surgeries.

In present study MCN pierces coracobrachialis muscle at various levels from the point of coracoid process. (Figure-5).

Table 2: Cases with communication between MCN and MN

Communication between MCN and MN	Right	Left	Bilateral
Cases	1	7	2
Percentage	2%	14%	4%

Mean distance of MCN piercing coracobrachialis muscle from the coracoid process on right side is 56.2 ± 12.4 mm and on left side is 55.9 ± 13.3 mm. mean difference between right and left side is not statistically significant. ($Z = 0.11$, $P > 0.05$).



Fig :5 MCN Pierces CB at distance from Cor.Pr

Table 3: Distance of MCN piercing CB from Cor. Pr.

MCN pierces CB Distance from Cor. Pr. in (mm)	Right side	%	Left side	%
31 - 40	3	6	5	10
41 - 50	10	20	10	20
51 - 60	18	36	19	38
61 - 70	5	10	5	10
71 - 80	5	10	5	10
81 - 90	2	4	3	6
Total cases	43		47	

In present study formation of Median nerve by MRM and LRM at various level from the coracoid process. (Figure-6)



Fig:6 Formation of MN at distance from Cor.Pr

Table 4: Distance of formation of MN by LRM and MRM from Cor. Pr.

Formation of MN by LRM and MRM and distance from the Cor. Pr. in (mm)	Right side	%	Left side	%
31 - 40	5	10	5	10
41 - 50	10	20	10	20
51 - 60	10	20	10	20
61 - 70	20	40	20	40
71 - 80	5	10	5	10
Total cases	50		50	

On both side formation of MN by LRM and MRM and the mean distance from the coracoid process is 57 ± 11.8 mm. In present study no variation or communication between other branches of brachial plexus is seen.

DISCUSSION

In present study, 10 cases of absence of musculocutaneous nerve is found, here median nerve takes over supply of Biceps brachi, coracobrachialis and brachialis muscle. Aberrations were more on right side (7 cases) than left side (3 cases) while 2 cases had bilateral variation.

Le Minor (1990)¹² reported Types I - V regarding variant communications between the musculocutaneous and median nerve.

Type - I :There are no connecting fibers between the musculocutaneous and Median nerve.

- Type - II :Although, some fibres of medial root of median nerve unite with the lateral root of 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.
- 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 the median nerve.
- Type - IV :The fibres of the musculocutaneous nerve unite with the lateral root of the median nerve. After some distance, the musculocutaneous nerve arises from the median nerve.
- Type - V :The musculocutaneous nerve is absent. The fibers of musculocutaneous nerve run within the median nerve along its course.

In present study, 8 cases of communication between musculocutaneous and median nerve found. In those cases anastomotic branch was observed running from the musculocutaneous nerve towards the median nerve after piercing the coracobrachialis muscle. In all cases it presented the Le Minor type 2A pattern, which is also the most common.² Aberrations are more on the left side (7 cases). In 2 cases it presents bilaterally. Knowledge of various communications between MCN and MN may prove valuable in traumatology of the shoulder joint, as well as in relation to repair operations.¹³ Cases of communication between the median nerve and musculocutaneous nerve or median nerve and ulnar nerve have been reported (Srinivasan and Rhodes, 1981; Venieratos and Anangostopoulou, 1998; Gumusburun and Adiguzel, 2000; Choi et al 2002). These variation are not rare, and it is possible that the combined lesion of the musculocutaneous and part of median nerve would occur in injury of the lateral cord. Lesions of the communicating nerve may give rise to patterns of weakness that may impose difficulty in diagnosis. Clinical implication of this could be that injury of musculocutaneous and median nerve may lead to unexpected presentation of weakness of forearm flexors and thenar muscles. (Sunderland, 1978).

Communication between the musculocutaneous and median nerve may prove valuable in traumatology of shoulder.

In man, the forelimb muscles develop from the mesenchyme of the para-axial mesoderm during 5th week of embryonic life (Larsen, 1997). The axons of spinal nerves grows distally to reach the limb bud mesenchyme. The peripheral processes of the motor and sensory neurons grow in the mesenchyme, in different directions (Brown et al 1991; Williams et al 1995). Although it is unclear why neuronal processes assemble to form a mixed nerve, in this complex developmental event, there are multiple possibilities for the route taken by developing axons and thus for their arrival at the main trunk.¹⁴

Once formed, any developmental differences would obviously persists postnatally (Brown et al 1991). As the guidance of the developing axons is regulated by expression of chemoattractants and chemorepulsants in a highly co-ordinated site specific fashion any alterations in signaling between mesenchymal cells and neuronal growth cones can lead to significant variations (Sanes et al 2000). Alternatively the variation could arise from circulatory factors at the time of fusion of the brachial plexus cords (Kosugi et al 1986).

In present study, MCN pierces coracobrachialis muscle at various level from the point of coracoid process. The mean distance on right side is 56.2 ± 12.4 mm and on left side is 55.9 ± 13.3 mm.

In present study, formation of median nerve by LRM ant. MRM at various level from the coracoid process, in front of the axillary artery and mean measurement is 57 ± 11.8 mm from the coracoid process

CONCLUSION

1. The knowledge of variation in the formation of brachial plexus is very useful for neurosurgeons for treating tumours of nerve sheaths such as schwannomas, neurofibroma and non neuronal tumors like lipoma.
2. Orthopedic treatments of the cervical spine also need a thorough knowledge of the normal and abnormal formation of brachial plexus.
3. Keeping in mind the variations in anatomy and the level of penetration are important while performing neurolyzation of the brachial plexus lesions, shoulder arthroscopy by anterior glenohumoral

portal and shoulder reconstructive surgery.¹³

4. During surgical procedures of the axilla and the shoulder, a surgeon is exposed to the topographical anatomy of the neural structures and awareness of such variations may be of immense clinical help. Knowledge of such anomalies are also important during treatment of fractures.
5. Knowledge of variation is of immense importance during surgical exploration of axilla and arm region, during nerve block, during internal fixation of humeral fracture from common anterior approach to avoid injury to these nerves.

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