

A Rare Variation of the Axillary Nerve Formed as Direct Branch of the Upper Trunk

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ABSTRACT

The brachial plexus has a complex anatomical structure from its origin in the neck and through its course in the axillary region. Knowledge of variations of the brachial plexus has important clinical applications especially in relation to trauma and surgical procedures of upper limb. The present study has reported a rare variation of the brachial plexus where the “axillary nerve” arising as a direct branch from the upper trunk instead from the posterior cord. Once the “axillary nerve” was given off, the remaining superior trunk had joined with the anterior division of middle trunk in the formation of the lateral cord. The posterior cord was formed by the union of posterior divisions of the middle and inferior trunks. The “axillary nerve” has given off branches to subscapularis, latissimus dorsi, deltoid and teres minor muscles while having given a “communicating branch” for the posterior cord. The current report indicates an anatomical variation not documented so far which may help in planning safe surgical procedures in this region and to explain unusual resulting complications.

Keywords: Brachial plexus, Posterior cord, Posterior divisions, Variations

CASE REPORT

During routine dissection of the axillary region of embalmed adult cadaver (64 years, Sinhalese, Sri Lankan), a variation in the posterior cord and the axillary nerve were noted on the right side. Dissections of the brachial plexus were performed on both sides of the cadaver and were compared.

The formation of roots and trunks were normal according to the standard textbook. However, obvious variations were observed in the formation of the posterior cord and in formation of the axillary nerve [Table/Fig-1]. The upper/superior trunk was formed by the C5 and C6 spinal nerves between the anterior and middle scalene muscles and was sited within the lower part of the posterior triangle. Initially the nerve to subclavius and suprascapular nerve branches were given off from upper trunk and then a large “axillary nerve” was given as a direct branch of the upper trunk. Thereafter, the remaining upper trunk joined with the anterior division of the middle trunk to form the lateral cord. Clear divisions of the upper

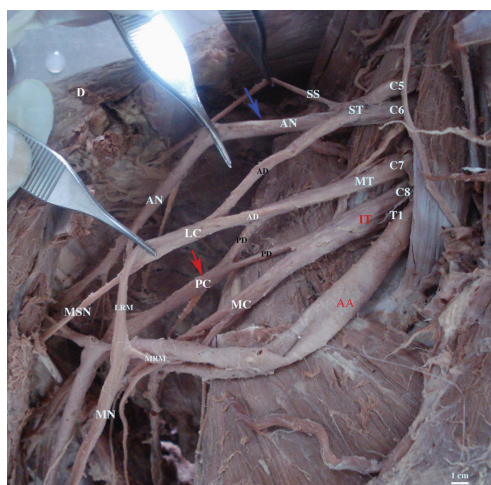
trunk into anterior and posterior divisions were not evident. No variations were noted in formation and distribution of the lateral cord [Table/Fig-1]. The posterior divisions of the middle and inferior/lower trunks formed the posterior cord. The posterior cord was formed without any contribution from the upper trunk.

The “axillary nerve” was sited lateral to the axillary artery throughout its entire course. It initially gave off branches to the subscapularis and latissimus dorsi muscles respectively and followed by a “communication branch” to the posterior cord before it run backwards through the quadrangular space, just below the capsule of the shoulder joint with posterior circumflex humeral vessels below it. Finally it divides into anterior and posterior branches and supply deltoid and teres minor muscles.

In addition to the nerve given off from the “axillary nerve”, the latissimus dorsi muscle was also supplied from the posterior cord. However, this branch from the posterior cord was given off before the “axillary nerve” was connected to the posterior cord through a “communication branch” [Table/Fig-2]. Following the connection with the “axillary nerve” the posterior cord continued as the radial nerve. Lateral cord had a normal distribution with its terminal divisions into musculocutaneous nerve and lateral root of the median nerve to form the median nerve.

DISCUSSION

The brachial plexus has a complex yet planned anatomical pattern from its origin to its innervation of the muscles and skin of the upper limb. This knowledge forms the basis of understanding in the normal muscle function and the nerves supply both at spinal level (segments/myotomes) and at a peripheral level (peripheral nerves). It also helps the clinician in his analysis of the signs and symptoms resulting from a partial or complete damage to the plexus at different levels.



[Table/Fig-1]: General arrangement of the brachial plexus with the formation of the posterior cord and the axillary nerve. D – Deltoid muscle, C5 – C8 – Cervical spinal nerves 5-8, T1 – Thoracic spinal nerve 1, ST – Superior trunk, MT – Middle trunk, IT – Inferior trunk, SS – Suprascapular nerve, AN – Axillary nerve, AD – Anterior division, PD – posterior division, LC – Lateral cord, PC – Posterior cord, MC – Medial cord, LRM – Lateral root of the median nerve, MRM – Median root of the median nerve, MSN – Musculocutaneous nerve, MN – Median nerve, RN – Radial nerve, CB – Communication branch, S – Subscapular nerves, BL_1 and BL_2 – Branches to the latissimus dorsi muscle

[Table/Fig-2]: Axillary nerve and its branches with its communication to the radial nerve. D – Deltoid muscle, C5 – C8 – Cervical spinal nerves 5-8, T1 – Thoracic spinal nerve 1, ST – Superior trunk, MT – Middle trunk, IT – Inferior trunk, SS – Suprascapular nerve, AN – Axillary nerve, AD – Anterior division, PD – posterior division, LC – Lateral cord, PC – Posterior cord, MC – Medial cord, LRM – Lateral root of the median nerve, MRM – Median root of the median nerve, MSN – Musculocutaneous nerve, MN – Median nerve, RN – Radial nerve, CB – Communication branch, S – Subscapular nerves, BL_1 and BL_2 – Branches to the latissimus dorsi muscle

All nerves to the upper limbs have specific root values, which cannot be traced during routine dissections [1]. Usually the axillary nerve is situated in the axilla as a terminal branch of the posterior cord where the posterior cord being formed by the posterior divisions of all three trunks [2]. However, variations in the origin of the axillary nerve have been described. Singhal et al., observed a branch of the upper trunk joining with the anterior division of the middle trunk to supply the deltoid muscle [3]. Chaware et al., found the axillary nerve arising from the posterior division of the upper trunk [4], while Jamuna observed the axillary nerve as a branch arising from the posterior division of the posterior cord [5]. A study conducted on human fetus documented the axillary nerve being separated from the posterior division of the superior trunk in 2.5% of cases [6] and Singhal et al., noted 10.8% of cases where the axillary nerve originating from the posterior division of the upper trunk [3]. In the present study the axillary nerve was originating as a direct branch of the superior trunk (C5 and C6) without any distinctive division of the superior trunk into anterior, posterior divisions.

The spinal segments contained in the axillary nerve are C5 and C6 [1]. The embryological concept of myotomes (nerve segments) supplying segmental muscles associated with a particular function is also described [2]. For instance, the supraspinatus muscles and the deltoid muscles, which are both abductors of the shoulder joint are supplied by the 5 and 6 cervical spinal segments. The identification of the myotomes and their innervations of a particular functional group of muscles are based on clinical situations and not all of them are accurate. In the present study it was clearly evident that the "axillary nerve" arises directly from the upper trunk formed by the C5 and C6 and would therefore contain the C5 and C6 spinal segments confirming the above fact. In additionally, subscapular muscle receiving a direct branch of the axillary nerve without any contribution from the posterior cord had confirmed the fact that the medial rotation of the shoulder initiated by this muscle is from the myotomal origin from C5 and C6 spinal segments.

There were many noted variations in the formation of the posterior cord for instance, absence of the posterior cord [7], formation of the posterior cord from by upper and lower posterior cords, where upper and lower posterior cords formed by the posterior division of superior trunk and middle and inferior trunks respectively [8] and formation of the posterior cord by the posterior divisions of the superior and middle trunks, and axillary and the radial nerves not receiving fibers from C7 and C8 was described [9]. However, in the present study the posterior divisions of the middle and inferior trunks formed the posterior cord, with no direct contributions from the superior trunk. Once the superior trunk gave off the "axillary nerve", it continued to join with the anterior divisions of the middle trunk to the lateral cord and the "communication branch" from the "axillary nerve" to the posterior cord probably carried C6 (C5) fibers to the posterior cord.

Although superior and inferior subscapular nerves and thoraco-dorsal nerve normally arise from the posterior cord [1]. Chaudhary et al., observed these branches arising from the posterior division of the upper trunk [10]. In the current study, the branches to the subscapular muscle is purely innervated through a single branch from the 'axillary nerve' without any contribution from the posterior cord while the latissimus dorsi received two branches one from the axillary nerve which probably carried C6 fibers to the muscle and the other from the posterior cord proximal to the point of union of the branch from the axillary nerve and would therefore have carried the C7 and C8 nerve fibers.

CONCLUSION

The present study reports an anatomical variation in the formation of the axillary nerve where it was arising as a direct branch from the upper trunk instead from the posterior cord and the posterior cord formed by the union of posterior divisions of the middle and inferior trunks. The "axillary nerve" had given branches to subscapularis, latissimusdorsi, deltoid and teres minor muscles while having given a "communicating branch" for the posterior cord.

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REFERENCES

- [1] Sinnatamby CS. Last's anatomy : regional and applied. Sinnatamby CS, Last RJ, editors. Edinburgh: Elsevier/Churchill Livingstone; 2006.
- [2] Standring S. Gray's anatomy: The anatomical basis of clinical practice. 40th ed. London: Elsevier Health Sciences UK; 2008. Pp. 361-94.
- [3] Singhal S, Rao VV, Ravindranath R. Variations in brachial plexus and the relationship of median nerve with the axillary artery: a case report. *J Brachial Plex Peripher Nerve Inj.* 2007;2:2-21.
- [4] Chaware PN, UGhade JM, Pandit SV, Maske GL. Variant branches of brachial plexus-a case report. *Int J Anat Var.* 2012;5:5-7.
- [5] Jamuna M. A rare variation in the mode of termination of posterior cord of brachial plexus. *IJAV.* 2010;3:95-96.
- [6] Uysal II, Seker M, Karabulut AK, Büyükmumcu M, Ziyil T. Brachial plexus variations in human fetuses. *J Neurosurg.* 2003;53(3):676-84.
- [7] Pandey S, Shukla V. Anatomical variations of the cords of brachial plexus and the median nerve. *Clin Anat.* 2007;20(2):150-56.
- [8] Thwin SS, Zaini F, Than M, Lwin S, Myint M. Unusual variations of the lateral and posterior cords in a female cadaver. *Singapore Med J.* 2012;53(6):128-30.
- [9] Fazan VPS, Amadeu AdS, Caleffi AL, Rodrigues Filho OA. Brachial plexus variations in its formation and main branches. *Acta Cir Bras.* 2003;18:14-18.
- [10] Chaudhary P, Singla R, Kalsey G, Arora K. Branching pattern of the posterior cord of the brachial plexus: A cadaveric study. *J Clin Diagn Res.* 2011;5(4):787-90.

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