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Clinical Anatomy of Nerve Variation

M Kavimani[1]*, and Christilda Felicia Jebakani[2].

[1]Department of Anatomy, Sree Balaji Medical Collegeand Hospital (Bharath University), Chrompet, Chennai, Tamil Nadu, India.
[2]Department of Anatomy, Madras Medical College, Chennai, Tamil Nadu, India.

ABSTRACT

Knowledge of variations in anatomy is important to clinicians, especially in radiological diagnoses and surgical procedures. Brachial Plexus innervates the upper limb. As it is the point of formation of many nerves, variations are common. Knowledge of these is important to anatomists, radiologists, anesthesiologists and surgeons. The presence of anatomical variations of the peripheral nervous system is often used to explain unexpected clinical signs and symptoms. On routine dissection of an embalmed 47 year old male cadaver, variations were found in the formation of divisions and cords of the Brachial Plexus of the left side. The median nerve was present lateral to axillary artery. The right side brachial plexus was also inspected and found to have normal anatomy. It is also concluded that although these variations may not have affected the functioning of upper limb in this individual, knowledge of such variations is essential in evaluation of unexplained sensory and motor loss after trauma and surgical interventions to the upper limb.

Keywords: Nerve variation, cadaver, motor loss.

Corresponding author

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INTRODUCTION

The topography of the brachial plexus plays an essential role in diagnoses, therapy and surgical procedures [1]. Knowledge of variations in this nerve plexus is imperative for clinicians in the fields of surgery, neurosurgery, orthopaedic surgery, vascular surgery, neurology and radiology. In this report, we describe an unusual variation of the median nerve was present lateral to axillary artery. The majority of nerves in the upper limb arise from the brachial plexus, a network of nerves which originate in the posterior triangle of the neck. The brachial plexus is formed by the union of ventral rami C5 through C8 nerves, the greater part of the ventral ramus of T1, and the union of roots C5 and C6 form the superior trunk. The middle trunk is a continuation of the C7 root and the inferior trunk is formed by the union of C8 and T1 roots. Typically, the trunks pass inferolaterally through a gap between the anterior and middle scalene muscles to the outer border of the first rib. The posterior triangle of the neck, including blood vessels, cervical lymph nodes, supraclavicular nerves, brachial plexus and fibrofatty tissue, is a key landmark during certain surgical procedures [2]. Variations in the plexus may occur in the formation of trunks, divisions and cords [1]. Origins and/or combinations of branches may differ from patient to patient [1]. VariatioSpecific signs and symptoms of injury or disease depend on which part of the brachial plexus is involved. The anterior divisions of the upper and middle trunk**s** form the lateral cord; the anterior division of the lower trunk continues as the medial cord and the posterior divisions of all three forms 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 unknown variations of the brachial plexus. Axillary artery passes between the lateral and medial cords of the plexus. The medial root of median nerve crosses the axillary artery to unite with the lateral root to form the median nerve which is lateral and anterior to the axillary artery.

Clinical anatomy of nerve

The study was done in the Department of Anatomy, Madras Medical College, Chennai. On routine dissection of an embalmbed 47 year old male cadaver, variations in the formation of the Brachial plexus of the right side were found [figure-1]. The clavicle and the scalenus anterior were cut to expose the roots and trunks of the plexus. The divisions and their branches were followed to the muscle they supplied for confirmation. The right side brachial plexus was also inspected and was found to be normal.

Figure 1

DISCUSSION

The brachial plexus was formed from roots C5, C6, C7, C8 and T1. The upper trunk was formed by the union of C5 and C6. Before joining the C6, the C5 gave a direct branch to the Subclavius Muscle and the Dorsal scapular Nerve. Similarly the C6 gave two small direct branches to Pectoralis Minor and a large branch to the

Latissimus Dorsi Muscle (Thoracodorsal Neve). The upper trunk after its formation gave the Suprascapular nerve and then divided into an anterior division and a posterior division. The posterior division gave 2 branches to the Subscapularis, a branch to Pectoralis major and then fused with the posterior branches of middle and lower trunks. This fused portion was the posterior cord lying posterior to the axillary artery and it gave one branch to subscapularis and continued as the Axillary nerve. The anterior division of the upper trunk gave a branch that joined with the anterior division of the middle trunk to supply the deltoid muscle. It then joined the anterior division of middle trunk completely to form the lateral cord that lay lateral to the second part of axillary artery. The lateral cord gave rise to a direct branch to the coracobrachialis, the lateral root of the median nerve and thereafter continued as the musculocutaneous nerve. The musculocutaneous nerve gave two communicating branches to the median nerve and the lateral root gave a communicating branch to the first communicating branch of the median nerve. The middle trunk gave a thin branch that fused with a branch of the anterior division of upper trunk to supply the deltoid muscle. It then gave the Long Thoracic Nerve that supplied the Serratus Anterior muscle. It then gave rise to one anterior division and two posterior divisions. The anterior division fused with the anterior division of the upper trunk. One of the posterior divisions fused with the posterior divisions of the upper trunk and the lower trunk. The second posterior division was the largest and it formed the radial nerve which was joined by the smaller posterior division of lower trunk. The lower trunk divided into one anterior and two posterior divisions. The first fused with the posterior divisions of middle trunk and the upper trunk. The second joined the radial nerve. The anterior division, which was the medial cord, gave rise to the medial root of the median, medial cutaneous nerve of the arm, the medial cutaneous nerve of forearm and continued as the ulnar nerve. The medial cord was medial to the axillary artery .The axillary artery was seen to have an abnormal relationship with the median nerve. The lateral root of median crossed the artery anteriorly and met the medial root such that the median nerve lay medial to the axillary artery. Normally the long thoracic nerve is formed from the contribution of the C5,C6 and C7 [3] Horwartz and Tocantins have found that in 8% of the cases, C7 may fail to contribute and some times failure from contributions from C5 have been observed in dissecting laboratories [4,5]. The C5 may contribute separately to the serratus anterior muscle. In our case the long thoracic nerve is seen emerging solely from C7. There are small branches from C5 and C6 that we were unable to trace. The lateral pectoral nerve in our case is seen to emerge from the posterior division of the upper trunk. Many authors have described that the lateral pectoral nerve may arise by one root from the lateral cord or by two roots from the anterior divisions of upper and middle trunks [3,4]. No case previously has described the contribution of the posterior division of the upper trunk. The nerve to coracobrachialis is a direct branch form the lateral cord. High origin of nerve to coracobrachialis from Lateral cord is not an uncommon finding [5,6]. The median nerve and the musculocutaneous nerve show two communications with each other proximal to the entry of the median nerve into the coracobrachialis muscle. Communications between musculocutaneous nerves and median nerves are the most frequent of all the variations observed in the brachial plexus [7,8]. There are 4 kinds of communications observed between the musculocutaneous nerve and the median nerves. Out of these, Type III is the kind where communications are present distal to the entry of the musculocutaneous nerve in the coracobrachialis muscle. Our case is similar to Type III [7]. In the present study communications are also present between the lateral root of median nerve and communications of the musculocutaneous nerve. The medial pectoral nerve in our study is a direct branch of the sixth cervical root. It is seen to give numerous branches to the pectoralis minor as it is supplying it. We were unable to study communications between the medial and lateral pectoral nerves. A case has been described wherein the medial pectoral nerve was a direct branch of the anterior division of the middle trunk [8,9.] Upper subscapular nerve is a direct branch from the upper trunk. According to Kerr and Fazan et al the upper subscapular nerve can arise as a direct branch from the the posterior division of the upper trunk but in our case it is given off from the trunk itself [7] and [10].The thoracodorsal nerve is seen as a direct branch from the sixth cervical root. Cases of it being branch of the axillary or the radial nerves are documented . Our case has not been observed before. The radial nerve is formed from the fusion of the posterior divisions of the middle and lower trunks. Only one similar case is present where the radial nerve was formed from the middle and lower trunks, the upper trunk giving no contribution to its formation.The deltoid muscle is innervated directly from the brachial plexus, from the upper and middle trunks. Normally it is supplied by the axillary nerve. The relationship of the axillary artery is not normal. In our case, the lateral root of median nerve crosses the artery anteriorly and meets the medial root such that the median nerve lies medial to the third part of axillary artery. Das and Paul have observed a similar case where there were two lateral roots of the median nerve.

The subclavian and axillary system of arteries is derived from the seventh cervical intersegmental artery. Hence, the artery passes between the lateral and medial cords, representing the fifth, sixth and seventh

cervical nerve on one hand and the eighth cervical and first thoracic on the other. Sometimes, the artery may arise from the sixth, the eighth or the ninth intersegmental artery and then it has abnormal relations to the plexus and the plexus is in turn modified by the presence of the abnormally placed artery. This might explain the various abnormalities seen in this case.

CONCLUSION

Awareness of variations in neurovascular anatomy allows physicians to derive more specific differential diagnoses. In the fields of neurosurgery and orthopaedic surgery, the knowledge of potential abnormal courses of any component of the brachial plexus would be valuable before proceeding with certain surgical procedures. Variations assume significance during surgical exploration of the axilla and can even fail the nerve block of infraclavicular part of the brachial plexus. Though the variations that we have mentioned here may not alter the normal functioning of the limb of the individual, it is important to keep these in mind in surgical and anaesthesiological procedures.

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