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Case Report

Anatomy Section

Unilateral Variations of Brachial Plexus Involving the Lateral Cord, Musculocutaneous Nerve and Median Nerve: A Case Study with Clinical Implications

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ABSTRACT

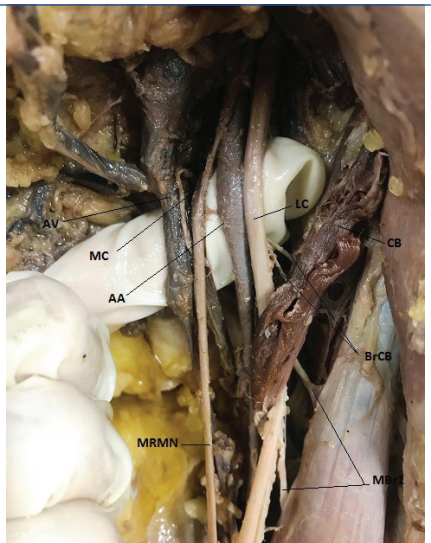
In the present case report, unilateral variations in the brachial plexus are reported. These variations were noted in a female cadaver, during routine undergraduate dissection in the Department of Anatomy, Lady Hardinge Medical College, New Delhi, India. In the left extremity, the lateral cord pierced the coracobrachialis muscle. Prior to passing through the coracobrachialis, the lateral cord gave off the lateral pectoral nerve and a small direct branch innervating the coracobrachialis muscle. Distally, the musculocutaneous nerve and multiple muscular twigs were given off by the lateral cord. The anterior compartment muscles of the left arm were innervated by the direct branches from the lateral cord of brachial plexus and branches from the musculocutaneous nerve. The lateral cord continued as the lateral root of the median nerve and joined the medial root from the medial cord to form the median nerve at the level of distal attachment of coracobrachialis. Documentation of brachial plexus variations portrays a remarkably significant role in clinical diagnosis as well as surgical practice.

Keywords: Coracobrachialis, Injuries, Peripheral nerves, Upper extremity

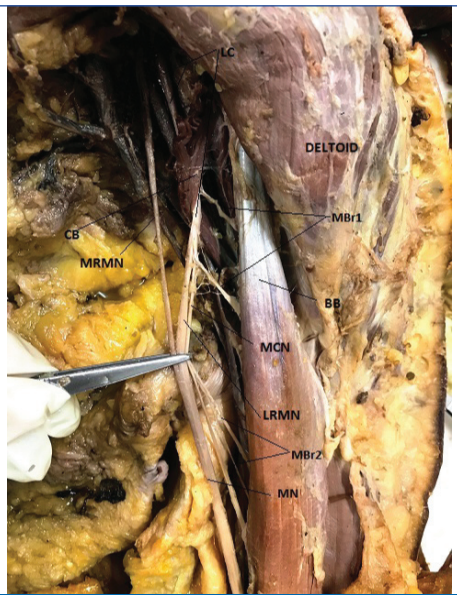
CASE REPORT

Unilateral variations in the brachial plexus were found in an embalmed female cadaver. Anomalies were discovered during a routine dissection for undergraduate teaching in the Department of Anatomy at the Lady Hardinge Medical College, New Delhi, India, in the academic year of 2019-2020. Cunninghams manual was followed for the entire dissection procedure. The incision was made, followed by removal of skin and fascia [1].

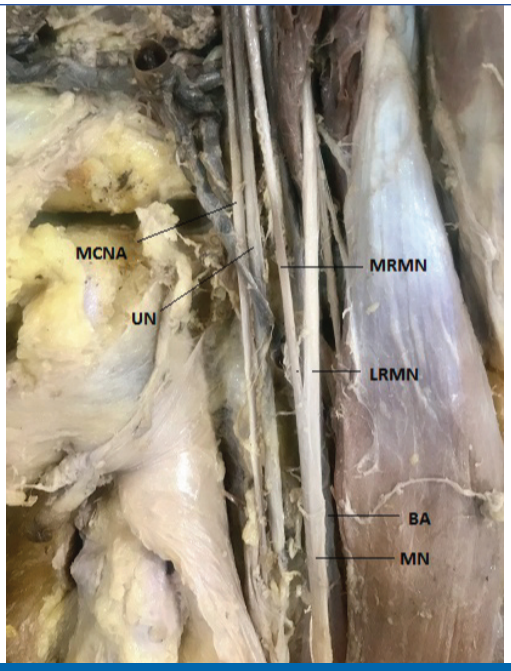
The axillary region was explored to note the brachial plexus and its formation. The lateral cord of brachial plexus passed through the coracobrachialis muscle prior to its bifurcation into the musculocutaneous nerve and the lateral root of the median nerve. Proximal to the entrance of the lateral cord into the coracobrachialis, it gave off the lateral pectoral nerve and a small direct branch innervating the coracobrachialis muscle [Table/Fig-1]. Distal to the penetration, the lateral cord divided to give the musculocutaneous nerve and multiple muscular branches. The anterior compartment muscles of the left arm were innervated by the direct branches from the lateral cord of brachial plexus and muscular branches from the musculocutaneous nerve. The musculocutaneous nerve continued as the lateral cutaneous nerve of the forearm. Distally the lateral cord, then continued as the lateral root and joined the medial root arising from the medial cord [Table/Fig-2]. The medial root was uncharacteristically long and joined the lateral root to form the median nerve at the level of the distal attachment of coracobrachialis muscle anterolateral to the brachial artery [Table/Fig-3].



[Table/Fig-1]: Shows the lateral cord piercing the Coracobrachialis (CB), after giving CB a direct branch.
AA: Axillary artery; AV: Axillary vein; MC: Medial Cord; LC- Lateral cord; BrCB: Direct branch to the Coracobrachialis; MBr1: Muscular branches from Lateral cord; MRMN: Medial root of the median nerve



[Table/Fig-2]: Shows post penetration into the CB the lateral cord divided to give the musculocutaneous nerve and multiple muscular branches and the main trunk joined the Medial Root of the Median nerve.
BB: Biceps brachii; MCN: Musculocutaneous nerve; LRMN: Lateral root of median nerve; MBr2: Muscular branches from musculocutaneous nerve; MN: Median nerve, CB: Coracobrachialis muscle; MRMN: Medial root of the median nerve; MBr1: Muscular branches from Lateral cord; LC: Lateral cord



[Table/Fig-3]: Shows the lateral root of the median nerve (continuation of the main trunk of lateral cord) joining the Medial root to form the Median nerve.
MCNA: Medial cutaneous nerve of the arm; UN: Ulnar nerve; BA: Brachial artery; MN: Median nerve; LRMN: Lateral root of median nerve; MRMN: Medial root of the median nerve

DISCUSSION

The brachial plexus is formed by ventral primary rami of the C5, C6, C7 and C8, and nearly all of the ventral primary ramus from T1. It innervates the muscles, joints and skin of the upper limb [2]. Brachial plexus variations are frequently encountered during dissection. According to a study, the lateral cord and its branches are more commonly involved in displaying variants [3]. In most of the cases, proximally, the musculocutaneous nerve pierces coracobrachialis muscle. It then lies deep to the biceps brachii and the brachialis. All the anterior arm muscles are supplied by musculocutaneous nerve. Distally, the musculocutaneous nerve continues as the lateral cutaneous nerve of forearm to supply the skin of lateral forearm [2]. According to literature, in a few cases the nerve does not pierce the muscle [3,4].

Variations of the median nerve formation and the musculocutaneous nerve have been extensively studied by many authors [1,5-7]. In a study, both the musculocutaneous and median nerves pierced the coracobrachialis muscle at different sites in the same case [3]. Another study reported the lateral cord piercing the coracobrachialis muscle [5]. According to Bergman RA et al., 90% of the musculocutaneous nerve arises from the lateral cord while in 2% of the cases it may arise from the median nerve or may be completely absent [6]. Usually, if the mucsculocutaneous is absent, the fibres of the musculocutaneous nerve travel through the lateral root of median nerve which takes the role of the musculocutaneous nerve in supplying all the muscles of the anterior compartment of the arm and lateral side of the skin of forearm [7]. In the present case, the lateral cord pierced the coracobrachialis muscle after giving the lateral pectoral nerve and a small twig to the coracobrachialis. Distal to the entrance of the coracobrachialis, the lateral cord gave multiple muscular branches and the musculocutaneous nerve. The musculocutaneous nerve bifurcated to give muscular branches and finally continued distally to the forearm as the lateral cutaneous nerve. The lateral cord then continued as the lateral root to fuse with medial root.

Variations in the formation of the median nerve has been widely documented. Usually, in the axilla the branches from the lateral and medial cords merge to form the median nerve (C5-T1). The formation of median nerve lower than normal has been reported by studies [8,9]. Generally, the median nerve formation occurs anterior or anterolateral to the axillary artery. In another case study the median nerve formation by the fusion of the two roots occurred behind the artery. Such a variation could be predisposed to nerve compression by the artery [10]. In the present case; the lateral root joined the unusually long median root to form the median nerve, at the level of the distal attachment of the coracobrachialis. The nerve was related anterolateral to the brachial artery.

Embryological Basis

According to literature, variations of the lateral cord of the brachial plexus are encountered more frequently than the medial cord. An insight of the development of different tissues may explain most of the queries with regard to variations in anatomical structure. The mesenchyme of paraxial mesoderm, forms the upper limb muscles. The axons of spinal nerve supplying it grow distally to reach the muscles and skin of upper limb bud [11,12]. The growing axons of the nerve in the path-finding stage, encounter intermediate guidance cues to be interpreted along the path to their destination. The guidance cues could be chemoattractants and the axon would choose to continue along the same path. In case of chemorepellents, the nerve would change the path or terminate. It appears that the number of variations in a nerve or cord depends upon the number of decision-making points along its path. Anomalies of the upper limb musculature and its innervations occurs due to variation in the coordination of muscle development and its neuronal signaling [3,13].

Clinical Correlation

Significance of brachial plexus anomalies in the present case relate to the possible clinical implications. Since the lateral cord penetrated the coracobrachialis muscle rather than the musculocutaneous nerve, innervation of the coracobrachialis was from the direct branches of the lateral cord. The lateral cord can be conjectured to being susceptible to injury when the coracobrachialis is approached during arthroscopic shoulder reconstructive surgery [5]. The coracobrachialis is often used in the flap surgeries of mastectomy and hence, the relevance of having the anatomical knowledge and its morphological variants is a must. The structures piercing the coracobrachialis muscle may inadvertently get injured during a surgical procedure.

To screen such variations, sonographic examinations can be done. This would help in effectively injecting nerve bocks and surgeons can also avoid iatrogenic nerve damages during surgical exploration of axilla and arm, reconstructive surgeries etc [14].

CONCLUSION(S)

Precise knowledge of these variations may impart supplementary anatomical information for the clinicians. Documentation of infrequent variations is noteworthy, particularly from the clinical point of view. Knowledge of such variations may help to describe an unusual symptom or a clinical sign.

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