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Case Report

UNILATERAL VARIANT BRANCHING PATTERN OF BRACHIAL PLEXUS AND AXILLARY ARTERY

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ABSTRACT

Anatomical knowledge of variations of brachial plexus and the axillary artery is very vital in surgeries of axilla and shoulder. In an adult male cadaver, during routine Anatomy dissection, we found a common cord instead of usual medial cord and lateral cord in the right brachial plexus. This common cord gave a branch to coracobrachialis, lateral and medial roots of the median nerve, ulnar nerve, medial cutaneous nerve of arm and forearm and single branch to pectoral muscles. Median nerve gave a branch in the arm to supply biceps brachii, brachialis muscle and continued as lateral cutaneous nerve of forearm. The right axillary artery was also found variant. Its first usual branch, i.e., superior thoracic artery aroused from second part instead of first part of the axillary artery. An additional branch from its second part supplied the pectoralis minor muscle. An additional trunk from second part divided into the lateral thoracic artery and also supplied the subscapularis muscle. Because of clinical significance, knowledge of such possible variations may be obliging for physicians and radiologists.

KEY WORDS: Brachial Plexus, Median Nerve, Musculocutaneous Nerve, Axillary Artery.

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INTRODUCTION

Infraclavicular part of the brachial plexus (BP) is formed by lateral, medial and posterior cords. The medial cord gives medial pectoral nerve, medial cutaneous nerve of arm and forearm, a medial root of the Median nerve (MN) and then continues as ulnar nerve. The lateral cord gives lateral pectoral nerve, a lateral root of the MN and musculocutaneous nerve (MCN). Usually, the MCN passes through the coracobrachialis muscle and then lies between the biceps brachii and brachialis muscle. After innervating these muscles, it continues as the lateral cutaneous nerve of forearm. The MN gives only the branch to the pronator teres above the elbow and then enters in the forearm [1].

The axillary artery (AA) is divided into three parts by pectoralis minor muscle. It gives the superior thoracic artery from first part, acromio thoracic trunk and lateral thoracic arteries from second part while subscapular artery, anterior and posterior circumflex humeral arteries from the third part [1].

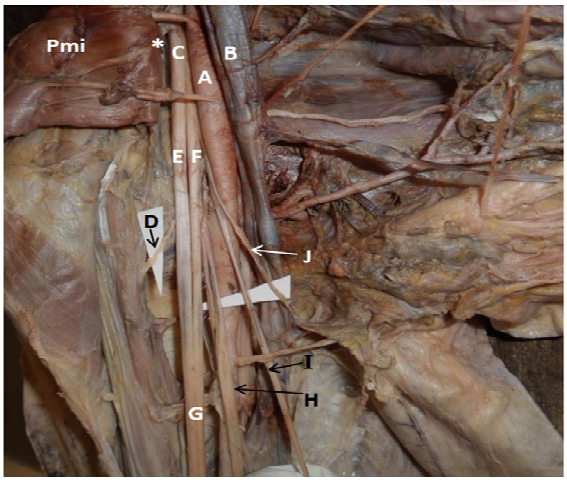
Variations of BP in regards to its formation, branching pattern and distribution are reported. Researchers also encountered the unusual branching patterns of AA [2-13]. Study of anatomical variations involving BP and AA are

of great clinical significance. It is utilitarian for clinical diagnosis of BP injuries, axillary neuromuscular block and surgical approach for shoulder region. In the present case, we reported a unilateral (right) variation of BP, branching pattern of AA and MN with absence of MCN.

CASE REPORT

During routine anatomy dissection, the medial cord and lateral cord of the right brachial plexus was found to be replaced by a common cord lying on a lateral side of second part of the right axillary artery in an adult male cadaver (Figure 1). This common cord was found to give a branch to coracobrachialis, lateral and medial roots of the median nerve, ulnar nerve, medial cutaneous nerve of arm and forearm. A single branch to pectoral muscles was raised, and it pierced the pectoralis minor and supplied both pectoral muscles. The branch to coracobrachialis was thin, originating from a lateral side of the common cord. It passed beneath the lateral root of the median nerve and innervated the coracobrachialis. The median nerve was formed by the union of two roots, i.e., medial and lateral which were arising from the common cord. The two roots were found to unite at the lower border ofteres major muscle. Ulnar nerve, medial mcutaneous nerve of arm and forearm were arising from a medial side of the common cord and were crossing the third part of the axillary artery from lateral to medial side (Figure 1). The posterior cord was found to be having the usual course.

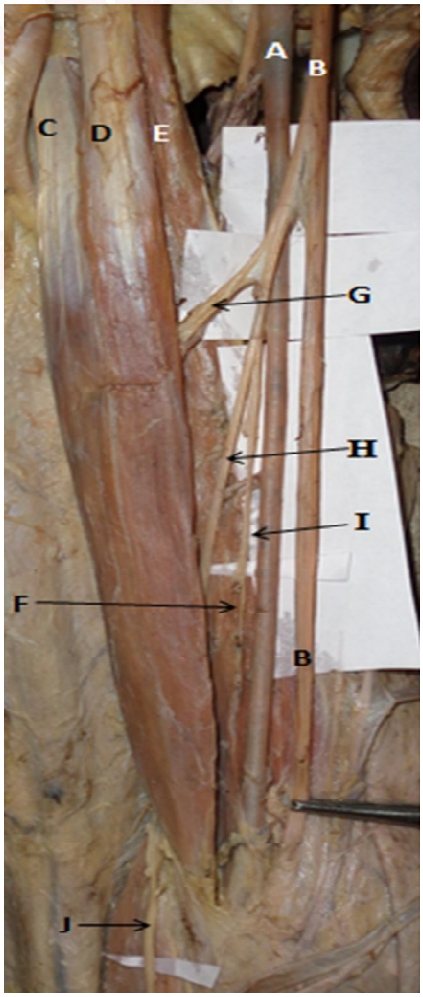
Fig. 1: Variant right brachial plexus showing a combined cord, on lateral side the axillary artery, replacing medial and lateral cord.



A: Axilllary artery, B: Axillary vein, C: Combined cord, D: a branch to coracobrachialis, E: lateral root of the median nerve, F: medial root of median nerve, G: Median nerve, H: Ulnar nerve, I: Medial cutaneous nerve of forearm, J: Medial cutaneous nerve of arm, *: Branch to Pectoral muscles, Pmi: Pectoralis minor

A branch was found to arise from median nerve in the middle of the arm which divided into three branches as superior, middle and inferior (Figure 2). Superior branch was found to supply biceps brachii, inferior branch to brachialis muscle while the central branch was continuing as the lateral cutaneous nerve of forearm. The lateral cutaneous nerve of forearm passed between biceps brachii and brachialis muscles in the arm. It emerged 3 cm proximal to elbow joint from the lateral border of biceps brachii to become superficial (Figure 2).

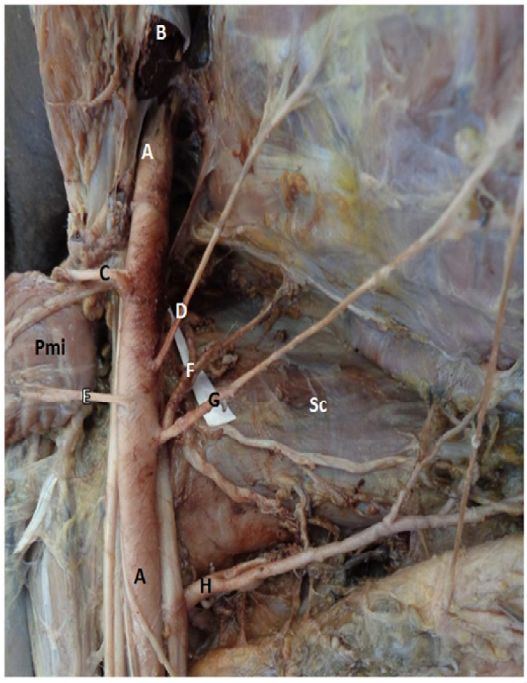
Fig. 2: Unusual branch of the Median nerve (B) in arm divides into superior (G), middle (H) and inferior (I) branches. Superior branch supplies biceps brachii, inferior branch to brachialis muscle while the middle branch continues as lateral cutaneous nerve of forearm (J).



A: Axillary artery, C: Long head of biceps brachii, D: Short head of Biceps brachii, E: Coracobrachialis, F: Brachialis

In the same cadaver, the right axillary artery was also found variant (Figure 3). It showed an absence of first usual branch, i.e., superior thoracic artery thus making the acromiothoracicartery as the first branch. A branch arising from the medial surface of second part of axillary artery passed deep to the pectoralis minor muscle and had a similar course to that of the superior thoracic artery, and it supplied that muscle and the thoracic wall. Another branch arising from the anterior surface of the second part of the axillary artery was found to supply the pectoralis minor muscle. After giving these branches another variant branch (trunk) arose from the posteromedial surface of the second part of the axillary artery. It divided into anterior and posterior branches. The anterior branch took the course of a typical lateral thoracic artery while the posterior further divided into two branches which ended by supplying the subscapularis muscle on anterior surface (Figure 3). Left brachial plexus and left axillary artery had a usual course.

Fig. 3: Variant branching pattern of the right axillary artery.



A: Axillary artery, B: Axillary vein dissected, C: Acromiothoracic artery, D: Branch from the second part of axillary artery with similar course to that of superior thoracic artery, E: Branch of second part of the axillary artery supplying the pectoralis minor muscle (Pmi). F, G: Variant branch (trunk) arose from second part of the axillary artery dividing into anterior (G) and posterior (F) branches. H: subscapular artery, Sc: Subscapularis muscle.

DISCUSSION

Several variations of MCN and MN have been reported [2–6] including unilateral or bilateral absence of MCN. The complete absence of MCN have been reported by Bergman et al. in 2%, by Nasr AY in 3.3%, by Bhojak NR et al in 4%, while by Jamuna M in 6%, cases [3-6]. It was observed that in cases where MCN are found to be absent, the unusual pattern of lateral cord or MN are present which takes over the role of MCN to supply the muscles of the anterior compartment of an arm, and ultimately continued as the lateral cutaneous nerve of forearm [7]. In the present case report also it was noted that the fibers from MN supplied muscles of the anterior compartment of the arm except coracobrachialis and also continued as the lateral cutaneous nerve of forearm. Here the branch of the combined cord to coracobrachialis muscle is most probably representing the MCN on the right side.

Uglietta (1989) reported variations in the major arteries of the upper extremities to be 11-24% [8]. Twenty-three different types of the AA by the origins of the branches have been described earlier [9]. The course and branching pattern of the AA vary with race, sex and ethnic groups [10]. There is a greater tendency in the Negro than in the white persons towards clumping of the branches and arising in common [11]. The variant origin of 3 branches, i.e., thoracoacromial artery, collateral artery and subscapular artery from 2nd part of the AA has been stated in the literature [12]. The origin of a common trunk giving rise to the lateral thoracic artery and subscapular artery has been described by Swamy Ravindra et al [13]. CT angiography, MR angiography and isotope perfusion scanning are useful techniques for vascular imaging of axillary vessels, but the various patterns may lead to confusion in interpretation [9].

Variations of BP and AA may be supported by the views of the development of upper

limb. Evolutionary sight aids the absence of the MCN. In the lower vertebrates like amphibians, reptiles and birds, there is only one trunk which represents MN and supplies all the muscles of the anterior compartment of the arm [7]. Developmentally, the lateral branch of 7th

intersegmental artery enlarges to form the main artery (axis artery) of the developing upper limb bud. The proximal part of this axial artery is recognized as the AA, followed by the brachial and interosseus arteries. Other arteries of the upper extremities develop as sprouts [14]. Five Hox D genes regional expression is responsible for the development of the upper limb muscles in the fifth week of intrauterine life from paraxial mesoderm. The motor axons arrive at the base of the limb bud, and they mix to form BP. The growth cones of axons continue into the limb bud, and they are regulated by the expression of chemoattractants and chemorepellents in a coordinated fashion. The trophic substances attract the correct growth cones or support the viability of the growth cones that happen to take the right path. Trophic substances include brain derived neurotrophic growth factor, c-kit ligand, neutrin-1, neutrin-2, etc. Any abnormality either in the signalling trail between mesenchymal cells and developing neuronal progress or circulatory factors at the time of fission of cords of BP possibly will result in the potential deviation of the branching pattern of BP [2].

CONCLUSION

The increasing use of invasive, diagnostic and interventional procedures in cardiovascular diseases and axillary block dissection makes it important that the type and frequency of neurovascular variations should be well documented and understood. The present case is rare as it is showing the contemporaneous variation in the BP and AA.

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Conflicts of Interests: None

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