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BILATERAL VARIATIONS IN PATTERNS OF BRANCHING OF THE AXILLARY ARTERY AND PRESENCE OF COMMUNICATIONS BETWEEN MEDIAN AND MUSCULOCUTANEOUS NERVES

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ABSTRACT

During routine dissection, was found bilateral arterial y nervous variations in a 60 years old male embalmed cadaver. First part of axillary artery did not give any branch, the second part of axillary artery gave off only three branches: Lateral Thoracic artery, thoracoacromial artery and large common trunk which later gave off thoracodorsal, circumflex scapular artery, subscapular, Posterior circumflex humeral artery. The third part of axillary artery gave off only anterior circumflex humeral artery. In both right and left arm the musculocutaneous nerve fused with the median nerve almost 5 cm proximal to elbow joint after the emergence of lateral cutaneous branch for forearm. It is important to be aware of this variations while planning a surgery in the region of axilla o arm, as these arteries and nerves are more liable to be injured during operations.

KEYWORDS: Anatomical Variations, Axillary Artery, Common Trunk, Median Nerve, Musculocutaneous Nerve

INTRODUCTION

The arterial system of upper limb begins with the axillary artery, a continuation of subclavian artery from the outer border of first rib to the lower border of teres major. The artery is divisible into three parts by pectoralis minor muscle as it crosses the artery anteriorly: The first part gives superior thoracic artery. The second part gives lateral thoracic (LT) and thoracoacromial (TAC) arteries. The third part gives three, subscapular (SS), anterior circumflex humeral (ACH) and posterior circumflex humeral (PCH) arteries.

The axillary artery continues as brachial artery distal to the lower border of teres major muscle [1-2].There is an extensive collateral circulation associated with the branches of subclavian and axillary artery, particularly around the scapula. This clearly becomes of clinical significance during injury of the axillary artery. It is common to find variations in the branching pattern of axillary artery. Many of its branches may arise by a common trunk or a branch of the named artery may arise separately. The variations of the axillary artery branching pattern has anatomical as well as clinical and surgical relevance given the proximity to the shoulder joint and humerus as well as the neurovascular supply to the deltoid muscle [3-7].

To form the median nerve trunk from lateral (C6,7) and medial (C8, T1) cord of brachial plexus the two root of median nerve emerge and unite embracing the third part of axillary artery, either anterior or lateral to it. The lateral root often being smaller than medial one, the median nerve usually passes lateral to axillary artery and continues in upper arm

as lateral to brachial artery [8]. Musculocutaneuos nerve (C5, 6, 7) a branch of the lateral cord of the brachial plexus in the axilla, initially accompanies the third part of the axillary artery and pierces the coracobrachialis muscle and supplies the coracobrachialis. Next it appears in between biceps and brachialis muscles, supplies them and just below the elbow it pierces the deep fascia lateral to the tendon of biceps brachii and extends further downward as the lateral cutaneous nerve of the forearm [9]. Usually, there will be no communication between the musculocutaneous and the median nerves. In this paper, described a case of bilateral axillary artery variations combined with communication between the musculocutaneous and the median nerves.

MATERIALS AND METHODS

The described arterial anatomic variations and nerve were found in the right upper limb and left side of a male cadaver of 60 years of age during routine dissection in the Morphology Laboratory at the University of Pamplona developed by training medical students. The history of the individual and the cause of death are not known. The topographic details of the arteries and nerves were examined by casual dissection and the variations were recorded and photographed.

RESULTS

The first part of axillary artery did not give any branch. The superior thoracic artery was absent. The second part of artery gave three branches: (a). Thoracoacromial artery that showed usual pattern. It emerged at the upper border of pectoralis minor muscle and was divided into four branches namely acromial, deltoid, clavicular and pectoral, all followed usual course. (b). Lateral Thoracic artery (c). A large common trunk that down and laterally. This common trunk gave following branches:

- Thoracodorsal artery
- Subscapular artery
- Posterior circumflex humeral artery
- Circumflex Scapular artery

All these arteries had a normal course and relations. The third part of axillary artery had only one branch i.e. Anterior circumflex humeral artery. This artery wound around the humerus anteriorly and ended intertubercular sulcus of humerus by dividing into ascending and descending branches without anastomosing with posterior circumflex humeral artery.

The posterior circumflex humeral artery, which was a continuation of the common trunk from the second part of axillary artery along with axillary nerve entered quadrangular space and wound around the humerus posteriorly, then it was divided into upper and lower branches deep to the deltoid muscle and ended by supplying shoulder joint and deltoid muscle. This arterial distribution described anatomical variables were observed in both armpits **(figures 1 and 2)**

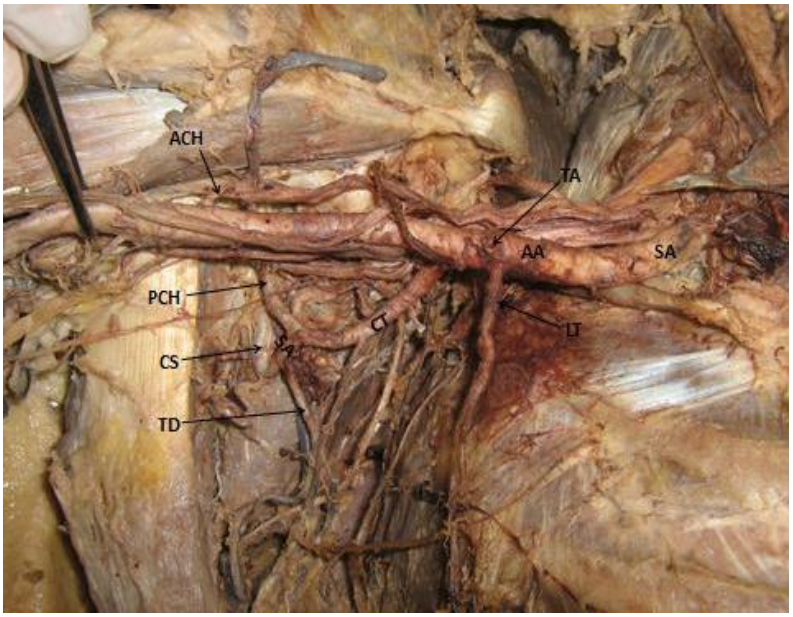

Figure 1: Variations of Arterial System at Axilla in Right Upper Limb. Abbreviations: SA- Subclavian Artery, AA- Axillary Artery, TA- Thoracoacromial Artery (Source), LT- Lateral Thoracic Artery, CT- Common Trunk: SA- Subscapular Artery, TD-Thoracodorsal Artery, CS-Circumflex Scapular Artery, PCH- Posterior Circumflex Humeral Artery, ACH- Anterior Circumflex Humeral Artery

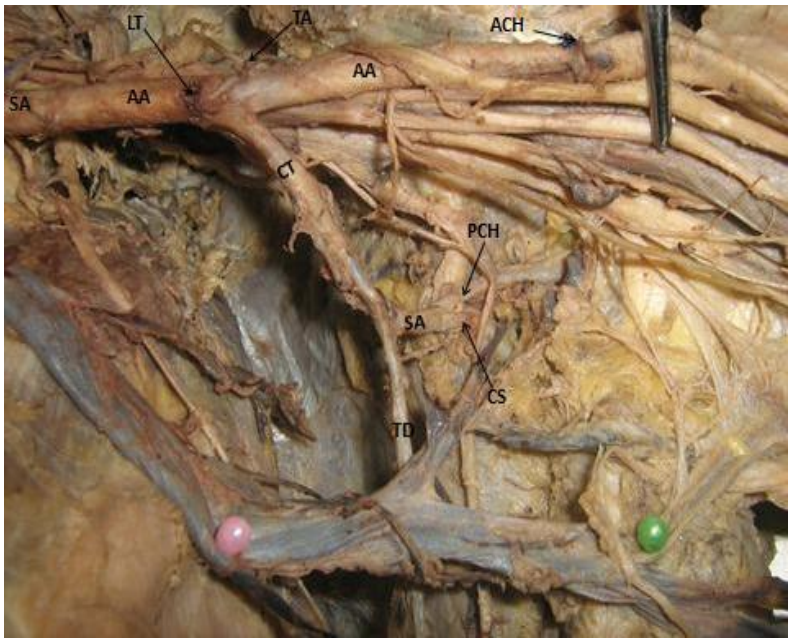

Figure 2: Variations of Arterial System at Axilla in Left Upper Limb. Abbreviations: SA- Subclavian Artery, AA- Axillary Artery, TA- Thoracoacromial Artery, LT- Lateral Thoracic Artery (Source), CT- Common Trunk: SA- Subscapular Artery, TD-Thoracodorsal Artery, CS-Circumflex Scapular Artery, PCH- Posterior Circumflex Humeral Artery, ACH- Anterior Circumflex Humeral Artery

The musculocutaneous nerve presented an unusual connection with median nerve, was noted almost 5 cm proximal to elbow joint, after emit its usual muscular branches and the emergence of lateral cutaneous branch for forearm. This nervous patterns distribution described as anatomical variables were observed in both arms **(figures 3 and 4)**

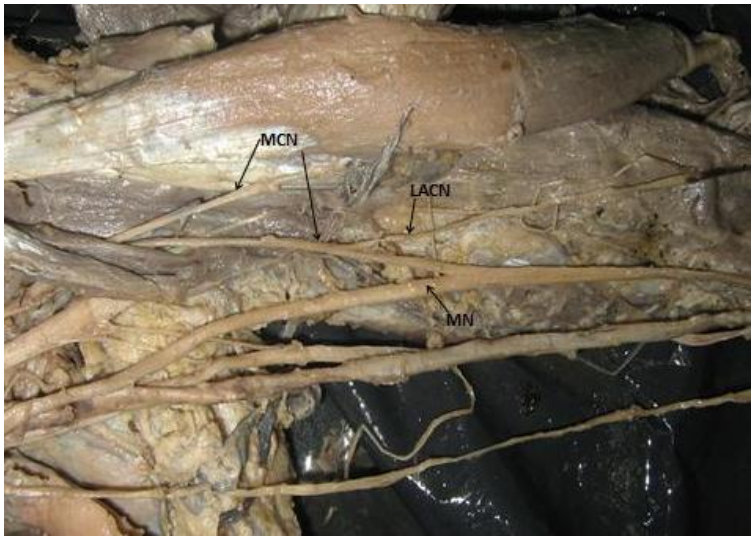

Figure 3: Left Arm Variations. The Musculocutaneous Nerve Fused with the Median Nerve. Abbreviations: MCN– Musculocutaneous Nerve, MN–Median Nerve, LACN- Lateral Antebrachial Cutaneous Nerve

Figure 4: Right Arm Variations. The Musculocutaneous Nerve Fused with the Median Nerve. Abbreviations: MCN– Musculocutaneous Nerve, MN–Median Nerve, LACN- Lateral Antebrachial Cutaneous Nerve

DISCUSSIONS

Anatomic variations in the major arteries of the upper limb have been reported. It is not uncommon to find the variation in the branching pattern of axillary artery [2,10-15]. Such anomalous branching pattern may represent persisting branches of the capillary plexus of the developing limb buds and their unusual course may be a cause for concern to the vascular radiologists and surgeons and may lead to complications in surgeries involving the axilla and the pectoral regions. Presence of a large common trunk as a branch of the axillary artery is worth considering: a) during antegrade cerebral perfusion in aortic surgery, b) while creating the bypass between axillary and subclavian artery in case of subclavian artery occlusion, c) while treating the aneurysm of axillary artery, d) while reconstruction of axillary artery after trauma, e) while treating the axillary hematoma and brachial plexus palsy, f) while considering the branches of the axillary artery for the use of microvascular graft to replace the damaged arteries, g) while creating the axillary-coronary bypass shunt in

high risk patient, h) during surgeries involved in breast augmentation, i) radical mastectomy, j) catheterization/cannulation of axillary artery for various purposes, k) while treating the axillary artery thrombosis, l) while analyzing the axillary region using imaging system or ultrasonography, j) while using the medial arm skin as free flap, k) during surgical intervention of fractured upper end of humerus and shoulderdislocations [(13)].

Venieratos et al. [(16)] studied 79 cadavers and found communications between musculocutaneous nerve (MCN) and median nerve (MN) in 22 cadavers. They reported the following three types of communications between MCN and MN, in relation to coracobrachialis muscle (CBM). In Type I: the communication was proximal to the entrance of the MCN into the CBM (9/22); in Type II: the communication was distal to the muscle (10/22) and in Type III: the nerve as well as the communicating branch did not pierce the muscle (3/22). So, according to this classification the present case falls into Type III where neither the nerve nor the communicating branch pierces the CBM, but in the present case four such communicating branches were found. Choi et al [(17)] showed that such communications have been broadly classified into three types. In type I: the MCN and MN were fused; in type II: there was one connecting branch between the MCN and MN and in type III: two connecting branches were present between the MCN and MN. In the present case report, the musculocutaneous nerve in upper third of the arm, passed medially downwards and joined the MN. It can be considered as the double lateral root of the MN or in other words the MN nerve can be said to be formed by three roots: a) one from the lateral cord; b) one from the MCN; c) and the third from the medial cord. These variations have clinical importance in post- traumatic evaluations and exploratory interventions of the arm for peripheral repair. The Knowledge of the possible communications between musculocutaneus and median nerves is also important in the anterior approach for the fractures de humerus and regional nerve blocked, is important while evaluation of clinical neurophysiology, planning a surgery after trauma and understanding of median and musculocutaneous nerve dysfunction. The presence of the multiple variations is worth of note not only for anatomist but also for clinicians. Because the upper extremity is a frequent site of injury, various surgical and invasive procedures are performed in this region; consequently, it is of utmost importance to be aware of such variations. The anatomical variations and abnormalities of the upper limb have become significant because of physicians may encounter such abnormalities during imaging with computed tomography and magnetic resonance. Also, these variations are important in order to define the anatomical features of each in relation to the clinical diagnosis and for surgical procedures. Therefore, it should be kept in mind during routine dissection studies, and surgical/ diagnostic procedures [(18)]

CONCLUSIONS

The knowledge of these arterial variations is necessary for the surgeons considering the frequency of procedures performed in this region. The review of literature shows many variations, in which two or more branches arising from the common trunk are reported. However, all the branches of axillary artery (except superior thoracic) arising from a separate collateral branch and bilaterally is not reported adequately except for few cases. The increasing use of invasive diagnostic and interventional procedures in cardiovascular diseases makes it important that the type and frequency of vascular variations are well documented and understood. Branches of the upper limb arteries have been used for coronary bypass and flaps in reconstructive surgery. Accurate knowledge of the normal and variant arterial pattern of the human upper extremities is important both for reparative surgery and for angiography.

Connection between the MCN and MN are apparently not rare, and it is possible that the combined lesion of the MCN and part of MN would occur in injury of the lateral cord of the brachial plexus. Lesions of the communicating nerve

may give rise to patterns of weakness that may impose difficulty in diagnosis. Clinically injury to MCN proximal to the anastomotic branch between MCN and MN may lead to cause particular and unexpected symptoms presentation of weakness of forearm flexors and thenar muscles. Variable interconnections between MCN and MN nerve have to be considered in diagnosis of nerve lesions in axillary and arm regions. Compound MCN and MN nerve neuropathy would occur in lesions of the interconnecting branches. Variations that were observed in the present study involving MN and MCN might be of some importance to the surgeons, anatomist, anesthesiologist, and radiologist. Knowledge of this variation may prove valuable in traumatology as well as in relation to repair operations.

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