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Case report

A case report on an unusual presentation of right sided vascular and left sided neural variations in upper limbs of a female cadaver

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ABSTRACT

During routine cadaveric dissection a female cadaver presented rare combination of neurovascular variations. Persistent axis artery with number of anomalous communicating vessels including vas aberrans connecting brachial and radial arteries were observed in right arm. In the left arm, variations in the formation of median and musculocutaneous nerves, high division of common palmar digital nerves, bifurcation of proper palmar digital nerves and communicating branches between median and ulnar nerves were observed.

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1. Introduction

Neurovascular variations are commonly observed during routine dissection but text-book descriptions deal with normal vascular supply and innervations [1, 2]. Majority of variations reported in the literature are isolated variations of nerve or artery confined to a particular region i.e. arm/ forearm/hand.

Variations in arterial pattern of upper limb are common and have been reported by several investigators [3-6]. These variations are often associated with anomalies in the arrangement of nerves of the brachial plexus [7, 8]. The presence of superficial brachial artery [3, 9, 10] and the unusual pattern of its branching in the upper arm or forearm have also been reported [6, 11-14]. Aim of present report is to describe an unusual pattern of distribution of right sided arterial and left sided nerve variation in the upper limb of an adult female cadaver.

2. CASE REPORT

During routine dissection for academic purpose anomalies in vessels and branches of brachial plexus were observed in upper limbs. Vascular anomalies (Fig.1&2) observed in right arm are two anomalous common trunks, one originating from third part of axillary artery and second from proximal part of brachial artery from their medial side.

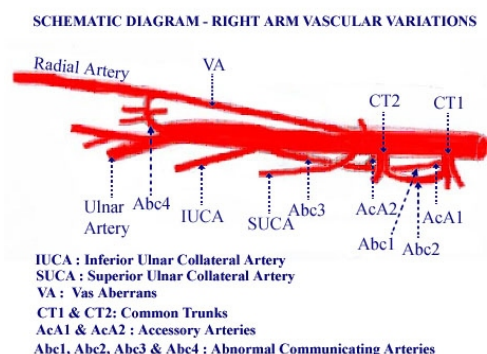
Proximal common trunk divided in to 3 branches viz., anterior circumflex humeral artery, posterior circumflex humeral artery and

a communicating branch. Second common trunk arising from brachial artery divided in to profunda brachii artery and communicating branch.

Two accessory arteries one arising from 3rd part of axillary and another from brachial were observed. These two accessory arteries communicated with one another. Further the second accessory artery communicated with brachial artery distal to the origin of superior ulnar collateral artery.

Vas aberrans or superficial brachial artery originating from front of brachial artery and running parallel to it was observed in the right arm. It communicated with brachial artery at the level of origin of ulnar artery in cubital fossa and further continued as radial artery in forearm. Its caliber was small up to cubital fossa, after that the caliber was normal (Fig. 1 and Fig. 3).

Fig.1 Schematic Diagram – Right Arm Vascular Variations



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Fig.2 RIGHT ARM – Anomalous arteries

CT1 & CT2 : Common Trunks;
AcA1 & AcA2 : Accessory Arteries
Abc1, Abc2 & Abc3 : Abnormal Communicating Arteries
VA:Vas Aberrans S U C A : Superior Ulnar Collateral Artery

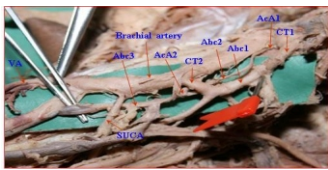


Fig. 3 RIGHT ARM - Vas Aberrans , Inferior Ulnar Collateral Artery, A b c : A b n o r m a l Communicating Artery

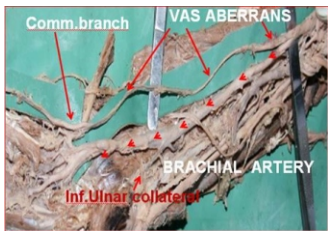


Fig.4 Schematic Diagram: LEFT ARM – NERVE VARIATION

UN: Ulnar Nerve; MN : Median Nerve ; M C N : Musculocutaneous Nerve
MR : Medial Root of Median Nerve; LR : Lateral Root of Median Nerve
FR: Fused Root

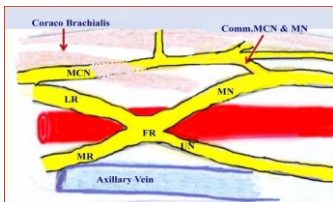


Fig. 5 LEFT ARM – NERVE VARIATION

UN: Ulnar Nerve; MN : Median Nerve ; M C N : Musculocutaneous Nerve
MR : Medial Root of Median Nerve; LR : Lateral Root of Median Nerve
FR: Fused Root

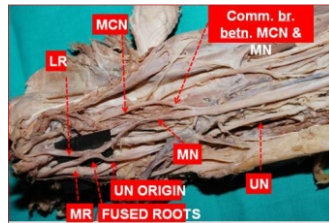


Fig. 6. Schematic Diagram – Left Hand Digital Nerves Variation; UN : Ulnar Nerve; MN : Median Nerve; ADB : Additional Digital Branch; DI : Dual Innervation

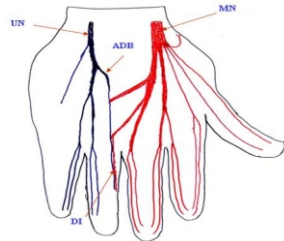
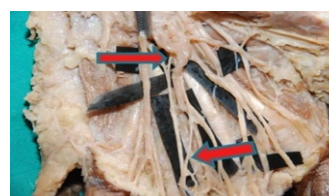


Fig. 7. Left Hand : All proper digital branches from ulnar & median nerves Bifurcated except to Thumb. Division of common digital branches more proximally than usual. (Arrows show division of nerves)



Fig. 8 Left Hand : Communicating branch between ulnar common digital nerve and adjacent median common digital nerve in palm. Dual innervation of radial side of ring finger by both median and ulnar nerves. (Arrows showing communicating branches)



In the left hand, variations were observed in the formation and distribution of median and ulnar nerves. Medial root from medial cord and lateral root from lateral cord of brachial plexus fused and both ulnar and median nerves originated from this fused roots. Communication between median nerve and musculocutaneous nerve was also observed (Fig. 4 and Fig. 5).

Bifurcation of all proper palmar digital nerves except the one supplying the thumb was observed in left palm. Common digital branches of ulnar and median nerves divided more proximal than usual (inter digital clefts) into two proper digital branches. The superficial branch of ulnar nerve gave an additional digital branch apart from each common and proper digital branch. This ulnar additional digital branch innervated the radial side of ring finger, in addition to the normal contribution from median nerve, indicating dual innervation (Fig. 6 and Fig. 7). A communicating branch between the ulnar additional digital branch and the adjacent median digital branch was observed (Fig. 6 and Fig. 8).

3. DISCUSSION

Deviations in normal development of vasculature results in variations in arterial pattern. According to Jurjus et.al [15] anomalous vessels are due to

1. Unusual paths in the primitive vascular plexus.
2. Persistence of vessels that normally obliterate.
3. Disappearance of vessels that are normally retained.
4. Incomplete development of vessels.
5. Fusion and absorption of parts of vessels that is usually distinct.

Embryologically vas aberrans/high division of radial artery/superficial brachial artery/arteria nervi mediana originates from axillary or brachial artery and unites with fore arm arteries as their branches. Developmentally radial artery arises as a branch of brachial artery in arm and establishes communication with brachial artery at or near the origin of ulnar artery. Later the upper portion of the original stem of the radial artery i.e., the part in the arm disappears resulting in one main artery running along the flexor aspect of the arm.

Yang et al., [16] classified superficial brachial artery as

Type I: The superficial brachial artery bifurcating into radial and ulnar arteries in the cubital fossa

Type II: The superficial brachial artery continuing as radial artery.

Type III: The slender superficial brachial artery supplying the arm.

In the present study the arterial variation observed on the right side corresponds to Type II pattern described by Yang et al., [16] and Subhadra devi et al., [17].

There are three possible outcomes of superficial brachial artery according to Melling et.al [18].

It can overtake the territory of the definitive brachial artery

It can form a parallel artery to the definitive brachial artery

It can disappear.

In the present study the superficial brachial artery is running parallel to definitive brachial artery up to cubital fossa and continued as radial after receiving a communicating branch from original brachial artery.

Hemodynamic predominance of certain arterial segments during development determines persistence of superficial brachial artery [6].

The formation of ulnar nerve from two roots is a very rare variation. Normally ulnar nerve originates from medial cord. It also comprises some fibers from C7 via the lateral cord. These fibers form a very thin second root [1]. In our case, the two observed roots of ulnar nerve were of equal thickness as described by Anagnostopoulou et al [19]. Moreover median nerve also originated from the same roots and communicated with musculocutaneous nerve as described by Basar et al [20].

Normally common palmar digital branches of median and ulnar nerves should divide into proper digital branches at the interdigital clefts. In a study conducted by Venkatesan et al [21], the common palmar digital branches of ulnar and median nerves divided more proximally and formed digital neural loops. In our case, the same high division of common palmar digital nerves were observed but they didn't form neural loops instead, the palmar proper digital nerves further divided into two at the interdigital clefts. Moreover, the superficial branch of ulnar nerve gave an additional digital branch apart from each common and proper digital branch. This ulnar additional digital branch innervated the radial side of ring finger, in addition to the normal contribution from median nerve, indicating dual innervations. The variation observed in the distribution of palmar digital branches in the present study is the 4th case to be reported in literature but with absence of neural loop representing a variant form that was not reported earlier in literature.

According to Saddler [22], limb buds appear during 4th week of intrauterine life. The growth and path finding of ventral primary rami of C5-T1 segmental spinal nerves to the target myotomic segmental condensations of developing limb bud is under the influence of specific cell surface receptors, signaling molecules and transcription factors.

In the present study the molecular basis for the variation could be over or under expression or mis-expression of one or more or all of these factors that can lead to variations in the formation and distribution of peripheral nerves.

The present anomalies explained by persistence of embryological vessels may be due to hemodynamic persistence of superficial system over deep system. Genetic causes are important for such variations. Other factors like fetal position in utero, first limb movement or unusual muscular development may be present.

Such type of vascular anomalies increases the chances of damage during common surgical procedures. Unusual cause of superficial brachial artery makes it vulnerable to trauma and bleeding. It can be used as feeding artery to a free flap from skin of arm.

Knowledge of nerve variations helps in interpretation of clinical signs due to nerve compression and also for giving anaesthetic blocks while performing surgeries.

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