

Unilateral Variations in Upper Limb Arterial System: A Case Report with Literature Review

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ABSTRACT

In a female cadaver unilateral variations were found in upper limb arterial system - as (1) high-up origin of ulnar artery at arm, (2) persistent prominent *arteria nervii mediana* or median artery, (3) common interosseous artery branching out of brachial artery. Literature review revealed these coexistent anomalies as the consequence of aberrant finalization of the path chosen by axis arterial network in embryonic life.

Keywords: Axis artery, *Arteria nervii mediana*, Ulnar artery

CASE REPORT

On dissection of superior extremity in 70-years-old female cadaver the brachial artery found to provide a superficial branch medially in the arm, continued down parallel to the ulnar nerve in forearm representing the ulnar artery [Table/Fig-1].

In the cubital fossa, the stem of brachial artery terminates by dividing in radial and common interosseous arteries [Table/Fig-2]. The common interosseous artery further provides the posterior and anterior interosseous branches. That anterior interosseous artery, just after its origin, gave off the median artery or *arteria nervii mediana* running parallel to the median nerve with an unusual thick caliber, and its own trunk became slender and followed the anterior interosseous nerve [Table/Fig-3].

In the palm, that high-up originated ulnar artery and the *arteria nervii mediana* completed the superficial palmar arch; whereas the deep palmar arch was contributed by the deep branch of the ulnar artery (scheduled to arise deep distal to the flexor retinaculum as in the normal course) and the radial artery [Table/Fig-4].

However, even after the minute dissection in fellow side, no anomalous arterial distribution could be noted.

DISCUSSION

In the usual course, the brachial artery gets divided into the ulnar and radial branches in the cubital fossa, which finally flows in the palm to form the palmar arterial arches. The anterior and posterior interosseous arteries are the branches of common interosseous artery which arises from the ulnar artery in forearm. The *arteria nervii mediana* (or median artery) persists as a *vasa nervorum* to median nerve with its origin from the anterior interosseous artery. [1]

On the contrary, here the ulnar artery got its origin quite high-up in the arm from brachial artery seen to flow unbranched till the palm, where it provides a deep branch and follows the usual path to form the palmar arch. In addition, the main brachial arterial stem on bifurcation in cubital fossa provides the radial artery (as usual), and common interosseous artery. The median artery derived from anterior interosseous artery with wider diameter ultimately contributes to the superficial palmar arch (unusual).

Following the classical description of Singer E [2], and Arey LB [3], it is clearly evident that, initially, in the embryonic life a vascular network settles in stage-wise appearance and disappearance sequences to establish the axial artery of the limb.

At first (stage I) the lateral branch of seventh intersegmental artery, i.e., the subclavian artery extends up to the wrist as the axis artery



Fig 1

[Table/Fig-1]: Demonstrates the high-up origin of ulnar artery (UA) in arm (red arrow) from the brachial artery (BA); much proximal to cubital fossa.

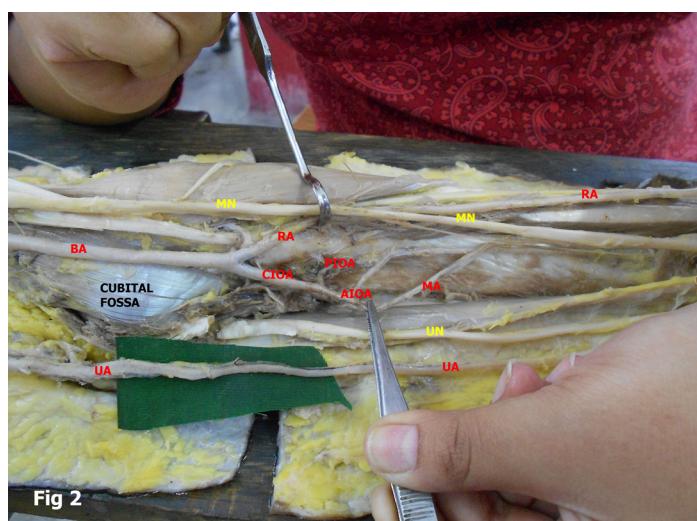


Fig 2

[Table/Fig-2]: Demonstrates the arterial pattern in Cubital fossa. Ulnar artery (UA) flows along medial border parallel to ulnar nerve (UN). The brachial artery (BA) branches to Radial artery (RA) and Common interosseous artery (CIOA); The CIOA bifurcates to Posterior interosseous artery (PIOA) and in Anterior interosseous artery (AIOA); The AIOA later then provides a branch as Median artery (MA), which runs parallel to Median nerve (MN).

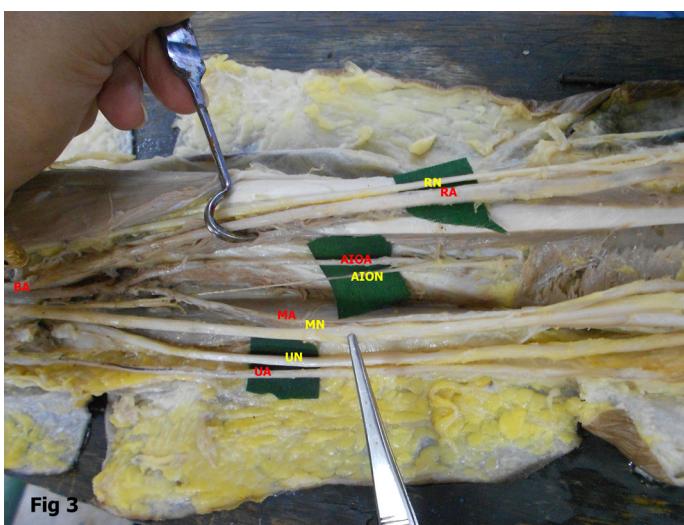


Fig 3

[Table/Fig-3]: Arterial arcade in Forearm- Fours sets of “neuro-arterial” system could be seen
 Most medially Ulnar artery (UA) & Ulnar nerve (UN)
 Then Median nerve (MN) & Median artery (MA)
 In deeper plane Anterior interosseous artery (AOA) & Anterior interosseous nerve (AION)
 Laterally Radial artery (RA) & Radial nerve (RN)

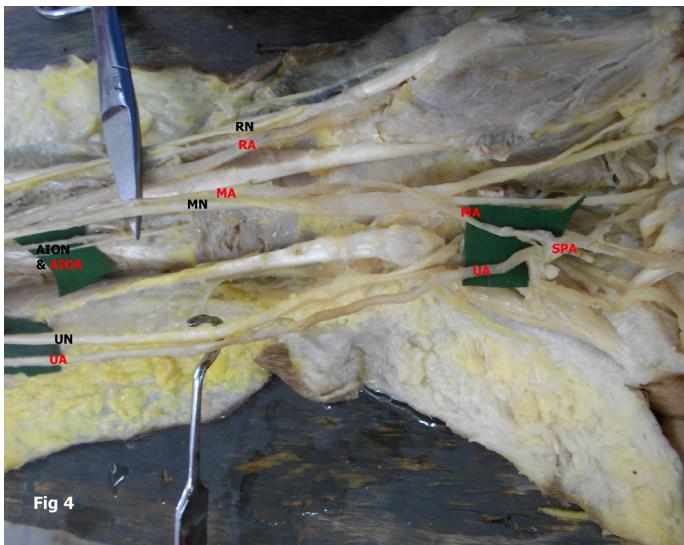


Fig 4

[Table/Fig-4]: Arteries in palm- the superficial palmar arch (SPA) getting contributed by Ulnar artery (UA) & Median artery (MA)

of upper limb, where it terminates by dividing into terminal branches for the fingers forming a capillary plexus. The proximal portion of it forms axillary and brachial arteries respectively, whereas distal portion persists as the ‘anterior interosseous artery’ of forearm. Then (stage II) a ‘median artery’ arises from the anterior interosseous artery, grows along the median nerve to communicate with palmar capillary plexus to feed it. By this time the anterior interosseous artery undergoes regression. After it (stage III) the ‘ulnar artery’ arises from brachial artery in forearm and unites distally with the existing median artery to form superficial palmar arch. Later (stage IV) a ‘superficial brachial artery’ develops in the axillary region from the axial trunk and traverses the medial surface of the arm, runs diagonally from the ulnar to the radial side of the forearm to the posterior surface of the wrist to divide over the carpus into digital branches. Finally (stage V) three successive changes occur to choose the final arterial tree as:

- the superficial brachial artery gives off a distal branch anastomosing with the superficial palmar arch formed already and the ‘median artery’ regresses to a small slender vessel, familiar in adult life as *arteria nervi mediana*.

- At the elbow an anastomotic branch develops between the main trunk of brachial artery and existent superficial brachial artery, which later enlarges to form the ‘radial artery’ with the distal portion of the superficial brachial artery.
- Proximal portion of the superficial brachial artery atrophies correspondingly [4].

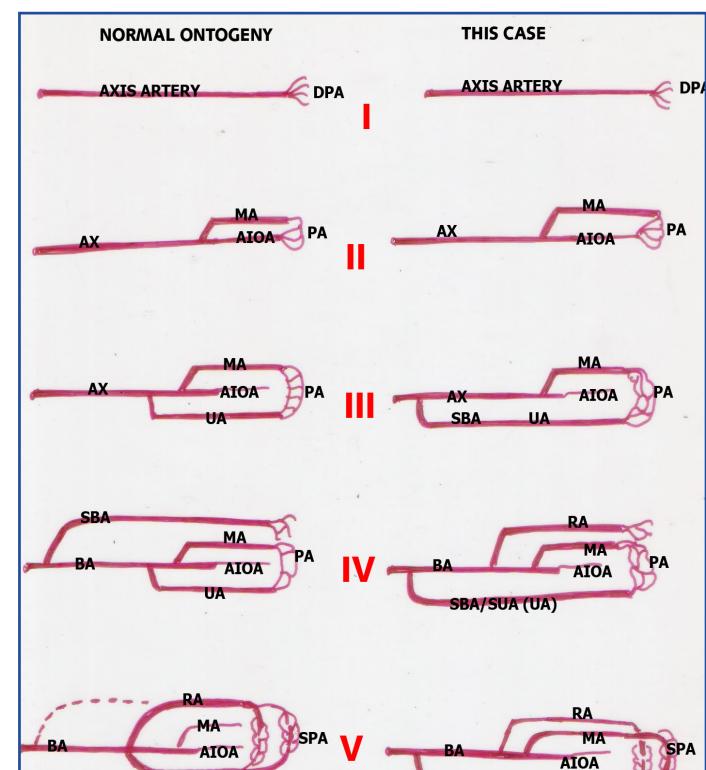
The unusual path chosen by the arterial arcade, here, in their sequential appearance and disappearance of the arteries of upper limb, results finally the arterial variation, which can be explained here as:

Variation in third stage: From the trunk of brachial artery instead of the ulnar artery getting originated, the radial artery takes its origin.

Variation in fourth stage: The superficial brachial artery instead of its development to lateral side, originated in the medial side of arm to join the palmar capillary plexus; and appeared as the ulnar artery in adult life.

Variation of final stage: The scheduled anastomosing branch near the elbow possibly didn’t develop, resulting in no communication of brachial with ulnar artery near cubital fossa. Secondly, the ‘median artery’ instead of getting regressed, persisted upto its contribution of superficial palmar arch [Table/Fig-5].

This high-up origin of ulnar artery was previously noted in earlier researches done by Aharinejad S et al., [5], Pattanaik VVG et al., [6], Satyanarana N et al., [7], Roy H et al., [8], Venkata RV et al., [9], Banerjee A et al., [10], Dave MR et al., [11], in their case studies, where they have explained it in light of similar ontogenetic error either in the form of aberrant sprouts of axis artery or regression of those channels which should have been persistent and persistence of those channels which should have been regressed. They have explained such variations with erroneous ectodermal-mesenchymal interaction responsible for angiogenesis in the upper limb.



Stage wise formation of axis arterial arcade of upper limb highlighting present case

[Table/Fig-5]: Demonstrates the ontogenetic stages of formation of upper limb arterial tree highlighting the present case.

[DPA: Digital palmar arch]; [AIOA: Anterior interosseous artery]; [MA: Median artery]; [AX: Axis artery]; [PA: Palmar arch]; [SBA: Superficial brachial artery]; [SUA: Superficial ulnar artery]; [UA: Ulnar artery]; [RA: Radial artery]; [SPA: Superficial palmar arch]

CONCLUSION

The superficial course of ulnar artery seeks special attention for its probability of damage in superficial wounds either accidental or iatrogenic, as while performing intravenous cannulation. Secondly, such a persistent *arteria nervii mediana* (median artery) widely contributing to palmar arches, while passing underneath the carpal tunnel, may get compressed in a pathogenic situation (carpal tunnel syndrome) resulting in simultaneous neuro-vascular crisis for digits. Thus, reporting such a case not only claims attention to anatomists, but also seeks importance to surgeons.

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