



Variant Course and Branching Pattern of Radial Artery Along with Variation in the Completion of Superficial Palmar Arch

KEYWORDS

Radial artery, dorsal metacarpal arteries, deep palmar arch, arteria nerve mediana, anterior interosseous artery.

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ABSTRACT

In the hand variation in the completion of the superficial palmar arch is quiet common but the variation we found is quiet different from routine variations. Having knowledge regarding new variations is very important for surgeons and radiologists who involve in the various procedures and surgeries in the region of hand that is the reason we bring forward and publish this variation. In our routine cadaveric dissection in the department of anatomy, Osmania Medical College, Hyderabad, Telangana state, india. We found this variation. In this study we found variant course and branching pattern of radial artery along with variation in the completion of superficial palmar arch. Persistent median artery completing the palmar arch and continuing along with the median nerve up to the common interosseous artery, where it appears as direct branch from the common interosseous artery. Common interosseous artery appears as trifurcating into anterior interosseous artery, posterior interosseous artery and median artery which accompanying the median nerve and completing the superficial arch. It is essential to know such type of variation also possible.

INTRODUCTION:

Normally in the hand superficial palmar arch is formed by continuation of superficial branch of ulnar artery which is completed by one of the branches of radial artery mostly by superficial palmar branch of radial artery or sometimes one of the branches of radial artery in the palm either by arteria radialis indicis or arteria princeps pollicis. But in this study we found different course of the radial artery along with variation in branching pattern and completion of superficial palmar arch. Normally radial artery in the distal part of the forearm winds round the lateral side of forearm after giving superficial palmar branch and enter into the anatomical snuff box. In the anatomical snuff box it gives dorsal carpal branch which is going to take part in the formation of dorsal carpal arch which in turn gives rise to 3 dorsal meta carpal arteries which supplies 2,3,4th interosseous spaces. Usually 1st dorsal metacarpal artery arises from radial artery. In addition to this dorsal carpal branch it also gives arteria radialis indicis and princeps pollicis arteries while it dips down into the first interosseous space and continues as deep palmar arch which is completed by deep branch of ulnar artery.

METHOD :

This study was carried out in the span of three years on 30 human cadavers in routine cadaveric dissection for 1st MBBS students in the Osmania medical college, Hyderabad. Dissection instruments were used for dissection of entire upper limb according to the steps of Cunningham's manual and variations were noted. Out of 30 human cadavers we found this variation in one body. Same variation was found in the both limbs of the same cadaver and variations were noted.

RESULT:

In this present study we found this variation in one body out of 30 cadavers. Variations we found are same in both

limbs of the body. Out of 60 limbs we found this anomaly in two limbs of the same cadaver. In this study we found abnormal course and branching pattern of radial artery in the distal part of forearm along with variation in the completion of superficial palmar arch. In this study we found radial artery in the distal part of forearm winds round the lateral side of forearm and enters into the anatomical snuff box without giving the superficial palmar branch which usually completes the superficial palmar arch. After entering into the anatomical snuff box it is not following its routine course where it gives arteria radialis indicis and princeps pollicis while dipping down and entering into the palm in the 1st interosseous space between interossei in that space and continues as deep palmar arch instead of that it passes deep to the 2nd and 3rd compartment tendons of extensor retinaculum and dips into the 2nd interosseous space (instead of dipping into 1st interosseous space) and continues as a deep palmar arch while doing so it gives 1st dorsal metacarpal artery while it crosses the anatomical snuff box then this passes deep to tendons of extensor carpi radialis longus, extensor carpiradialis brevis and extensor pollicis longus tendons before dipping into the 2nd interosseous space it gives 2nd dorsal metacarpal artery for the 2nd interosseous space and 3rd interosseous artery takes origin from the deep palmar arch and coming out from the 3rd interosseous space running dorsal to interossei of 3rd space, all these dorsal metacarpal arteries pass dorsal to interossei in the respective spaces and join common digital arteries of the 1st, 2nd, 3rd interosseous spaces respectively before they divide as proper digital arteries. In this cadaver we didn't find any dorsal carpal arch which usually gives all these dorsal metacarpal arteries. Instead of that radial artery giving all these dorsal metacarpal arteries that means here radial artery replacing the dorsal carpal arch and giving dorsal metacarpal arteries directly without giving dorsal carpal branch (which is going to form the dorsal carpal arch). In this cadaver radial

artery dipping down into the 2nd interosseous space and continuous as deep palmar arch. This deep palmar arch is completed by a branch coming from the medial proper digital branch of little finger (which is a most medial branch from superficial palmar arch). Other branches of deep palmar arch are same. We want to stress that in the anatomical snuff box radial artery is not giving the routine branches those are the dorsal carpal branch, arteria radialis indicis, princeps pollicis artery in the 1st interosseous space instead of that just crossing and going to the 2nd interosseous space by passing deep to 2nd and 3rd compartment tendons of extensor retinaculum.

In the palm we found ulnar artery along with ulnar nerve passing superficial to the flexor retinaculum. Ulnar artery is continuous as superficial palmar arch from the distal border of flexor retinaculum without giving any deep branch (which is usually completes the deep palmar arch). On the radial side of the palm this superficial palmar arch is completed by one artery which is going deep to the flexor retinaculum and accompanies the median nerve. We concluded this is arteria nerve mediana which is a remnant of axis artery which accompanies the median nerve. When we traced this artery up to the cubital fossa we found this appears to be arising from the common interosseous artery. In the cubital fossa common interosseous artery arising from the ulnar artery as usual but common interosseous artery showing trifurcation instead of bifurcation as anterior and posterior interosseous arteries we found the third branch that is accompanying the trunk of median nerve, we concluded that as arteria nerve mediana which is completing the superficial palmar arch by passing deep to flexor retinaculum along with the median nerve. In the branching pattern of superficial palmar arch we found variation. From medial to lateral, we found one proper digital artery along the medial side of little finger and three common digital arteries for 4th, 3rd, 2nd spaces respectively, each common digital artery divides into two proper digital arteries for the adjacent sides of digits. In addition to these we found one common trunk arising from the superficial palmar arch, this common trunk after giving two muscular branches it divides into two terminal branches, one of the two terminal branches of the common trunk going along the radial side of the index finger as arteria radialis indicis, the other terminal branch going towards the thumb as arteria princeps pollicis which in turn dividing into two proper digital branches. One of the two proper digital branches of arteria princeps pollicis passes along the medial side of thumb as medial proper digital artery for the thumb, other proper digital branch winds round the adductor pollicis muscle in the first interosseous space and reenter into the thumb deep to the adductor pollicis muscle, while doing so it receives 1st dorsal metacarpal artery (which arises from the radial artery in the anatomical snuff box) and continuous as lateral side of the thumb as lateral proper digital artery for thumb.

Major variations in this limb are:

1. superficial palmar arch is completed by branch of common interosseous artery which accompanies median nerve (arteria nerve mediana).
2. common interosseous artery showing trifurcation instead of bifurcation
 - a. Anterior interosseous artery
 - b. Posterior interosseous artery
 - c. Arteria nerve mediana
3. common trunk arising on radial side of superficial palmar

arch giving the radialis indicis artery and arteria princeps pollicis artery (instead of coming from the radial artery).

4. Radial artery not giving any contribution for completion of superficial palmar arch.
5. radial artery replacing the dorsal carpal arch and giving all three dorsal metacarpal arteries.
6. Instead of dipping down into the 1st interosseous space, it dips down into 2nd interosseous space and continuing as deep palmar arch.
7. Deep palmar arch is completed by branch from the medial proper digital artery of little finger not by deep branch of ulnar artery and there is no separate deep branch from ulnar artery.

DISCUSSION AND CONCLUSION:

During embryological development the axis artery of the upper limb bud is derived from the lateral branch of the seventh intersegmental artery. The main arterial trunk grows outwards along the ventral axial line and terminates in a capillary plexus of the developing hand. Digital arteries arise from the capillary plexus. Proximal part of the main trunk remains and forms axillary and brachial arteries and its distal part persists as the anterior interosseous artery. A median artery develops later from the anterior interosseous and grows along the median nerve to communicate with the palmar plexus there after the anterior interosseous artery regresses distally from the capillary plexus which is now fed by the median artery. Close to the bend of the elbow the axis artery gives rise to the radial and ulnar arteries. Meanwhile palmar capillary plexus differentiates into superficial and deep palmar arches. The ulnar artery establishes communication with the superficial arch and the radial artery establishes communication with deep arch after winding round the dorsum of the hand through the first intermetacarpal space.

The latest reports of Johnson et al (1998) on Coronary artery bypass graft (CABG) favors the use of an arterial graft, in particular the radial artery, as compared to saphenous vein². The radial artery contributes greatly to the circulation of the hand but in many cases it can be removed as a non-essential vessel, with adequate circulation being provided by the remaining ulnar and in some cases, persistent median artery {Starnes et al.(1999)³}. The median artery (MA) is the axis artery of the superior extremity during early embryonic life. It maintains the superficial palmar arch (SPA) while the radial and ulnar arteries are developing⁴. When the ulnar and radial arteries are fully developed the median artery disappears⁵. The median artery may persist in adult life as antebrachial or palmar median artery, based on their vascular territory. The palmar type is intimately related to median nerve and reaches the wrist and enters the palm by passing beneath the flexor retinaculum (FR) and may take part in the formation of SPA {Claassen H, Schmitt O, Wree A (2008)⁶}. The median artery due to its close proximity to median nerve can be involved in several clinical disorders like carpal tunnel syndrome^{6,7,8}, anterior interosseous nerve syndrome⁹ and pronator syndrome⁵. The SPA is classified into two categories complete or incomplete. An arch is said to be complete, if an anastomosis is found between the vessels contributing to it. An incomplete arch has an absence of a communication or anastomosis between the vessels constituting the arch. This classification is currently in use and provides the simplest understanding of the anatomic distribution of the arches¹⁰. Coleman and Anson (1961)¹¹ observed the complete form in 78.5% and incomplete form in 21.5% of 650 hands. Ikeda et al (1988)¹², demonstrated

96.4% complete and 3.6% incomplete forms. The median artery as a component of the SPA has been described in the literature. Coleman and Anson (1961) observed median – ulnar and radial –median-ulnar type of SPA in 3.8% and 1.2% of subjects respectively. Ikeda et al (1988) observed that the radial – median - ulnar type of SPA was absent in their study, and the median – ulnar type was found in 0.9% of subjects. In the present study we observed that the radial – median- ulnar type of SPA was absent. Adachi (1928: quoted by Keen 1961) recorded the median – ulnar type of SPA in 9% of subjects.¹³ The percentages of hands in which the median artery made a contribution to the superficial palmar arch were reported to be 2.2% in Janevskis (1982) work which in the present study was found to be 4%.¹⁴ The origin of median artery has been previously described as arising from common interosseous, anterior interosseous and ulnar arteries frequently^{15,16}. It can also arise from brachial artery or its branches¹⁷. Very rarely, the median artery arose from the RA as suggested by Acarturk et al (2008)¹⁸ whereas in our study the median artery was taking origin from common interosseous artery.

In this case median artery persist and completing the superficial arch on radial side by passing deep to flexor retinaculum. From radial side of the superficial arch gives a common trunk which divides into arteria radialis indicis and princeps pollicis. Radial artery instead of going into 1st space going to the second space and continue as deep palmar arch. It is essential to know such type of variation also possible.

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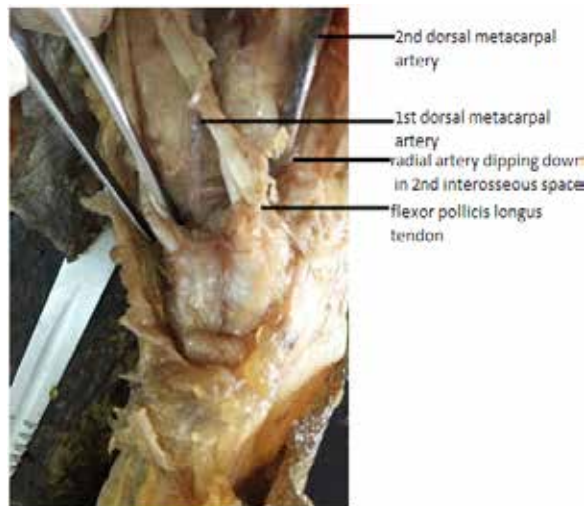


figure.1 showing variant course of radial artery in the dorsum of hand

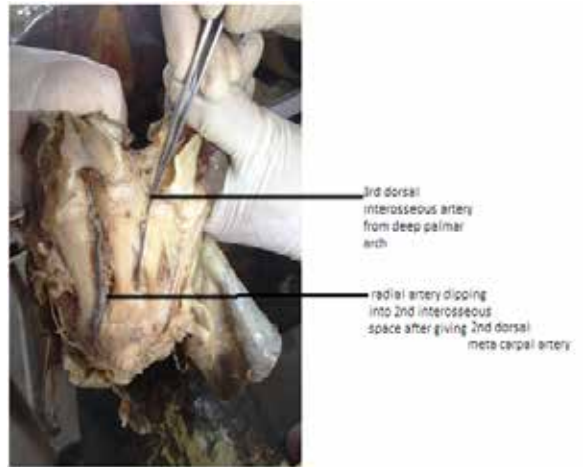


Figure 2 showing 3rd dorsal meta carpal artery arising from deep palmar arch and radial artery dipping into 2nd interosseous space.

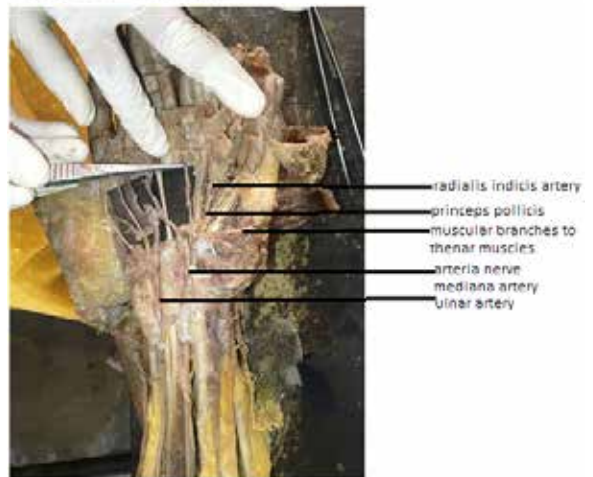


figure.3: showing formation of superficial palmar arch formed by continuation of ulnar artery and completed by arteria nerve mediana on radial side.

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