



A CASE REPORT ON ABSENT RADIAL ARTERY

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ABSTRACT

During routine dissection for the first MBBS students, we observed that the radial artery was absent in the right upper limb of a 70 years old, donated embalmed male cadaver in the Department of Anatomy, K.J. Somaiya Medical College, Sion, Mumbai, India. In the lower part of the arm, brachial artery divided into ulnar and common Interosseous artery. Anterior interosseous artery was large in size. Deep to pronator quadratus, it turned laterally and reached the dorsum of the hand, where its lateral branch supplied the thumb and index finger and its medial branch dipped into the palm at the second inter metacarpal space. Superficial palmar arch was absent. Digital arteries from the medial and lateral branches of ulnar artery supplied the fingers. Embryological basis is presented.

Key words: Brachial artery, Anterior interosseous artery, Common Interosseous artery, Radial artery, ulnar artery.

Access this article online		
Home page: http://www.mcmed.us/journal/ijacr	Quick Response code 	
DOI: http://dx.doi.org/10.21276/ijacr.2017.4.3.7		
Received: 25.02.17	Revised: 12.03.17	Accepted: 25.03.17

INTRODUCTION

Brachial artery which is the main arterial supply to the arm ends in the cubital fossa, at the level of the neck of the radius by dividing into radial and ulnar arteries. Radial artery appears as a direct continuation of the brachial artery while the ulnar artery shows a slight medial convexity. Radial artery then descends along the lateral side of the forearm between the Flexor Carpi Radialis tendon and the Brachioradialis tendon in the distal one-third of the forearm. Here it is covered only by the superficial fascia, subcutaneous tissue and skin, so that it is easy to palpate and is palpable against the lower part of the anterior surface of the radius. It then curls postero-laterally round the carpus beneath the tendons of abductor pollicis longus and extensor pollicis brevis, lying in the anatomical snuff-box, and reaches the first inter metacarpal space,

between the heads of the first dorsal interosseous muscle. From here it enters the palm and forms the deep palmar arch with the deep branch of the ulnar artery [1]. Ulnar artery, the second terminal branch of the brachial, reaches the medial side of the forearm and then passes vertically down, crossing the flexor retinaculum and then continues across the palm as the superficial palmar arch. One third of the superficial palmar arches are formed by the ulnar artery alone, another one third are completed by the superficial palmar branch of the radial, and another third either by the arteria radialis indicis or a branch of arteria princeps pollicis or by the median artery.

The common interosseous artery, is a short branch of the ulnar artery given out just distal to the radial tuberosity, at the proximal border of the interosseous membrane, it divides into the anterior and posterior interosseous arteries. Anterior interosseous artery descends on the anterior aspect of the interosseous membrane with the median nerve's anterior interosseous branch deep to flexor digitorum profundus. Proximal to pronator

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quadratus, it pierces the interosseus membrane to reach the back of the forearm, where it anastomoses with the posterior interosseous branch.

MATERIAL AND METHODS

During routine dissection for the first MBBS students, I observed that radial artery was absent in right upper limb of a 70 years old, donated embalmed male cadaver in the Department of Anatomy, K.J. Somaiya Medical College, Sion, Mumbai, India.

Observations:

The brachial artery divided in the middle of the arm into ulnar and common interosseous arteries. (Fig.1). There was no Radial artery. There was no other artery travelling distally on the radial side of the forearm. Deep to the Pronator Teres, the common interosseous artery, divided into anterior and posterior interosseus arteries. The posterior interosseus artery passed to the back of the forearm above the interosseus membrane. The anterior interosseus artery appeared to be a direct continuation of the common interosseus artery and had the same caliber as the common interosseus artery. It passed in front of the interosseus membrane till the proximal border of the

pronator quadrates muscle. Deep to the pronator Quadratus, it turned laterally passing deep to flexor pollicis longus, then deep to abductor pollicis longus, extensor pollicis brevis, and extensor pollicis longus and reached the dorsum of the hand after crossing the anatomical snuff box. The ulnar artery, common interosseous artery and the anterior interosseous artery supplied the muscles of the front of the forearm. The anterior interosseous artery then divided into two branches. The lateral branch gave digital branches to the thumb and index finger. The medial branch entered the second inter metacarpal space and formed the Deep Palmar Arch. It was a complete arch completed by a branch of the ulnar artery. The ulnar artery passed superficial to pronator Teres. In the lower one third of the front of the forearm, it divided into a lateral deep and a medial superficial branch. The lateral branch passed deep to the flexor retinaculum and gave digital branches to the lateral two and a half fingers. The medial branch passed superficial to the flexor retinaculum and gave digital branches to the medial two and a half fingers. Superficial Palmar Arch was absent. A twig from the medial branch accompanied the deep branch of ulnar nerve and completed the deep palmar arch.

Figure 1. Photographic representation of Brachial Artery terminating into Ulnar & Common Interosseous Arteries.



Figure 2. Normal Development of Radial Artery Old Theory (Singer 1933)

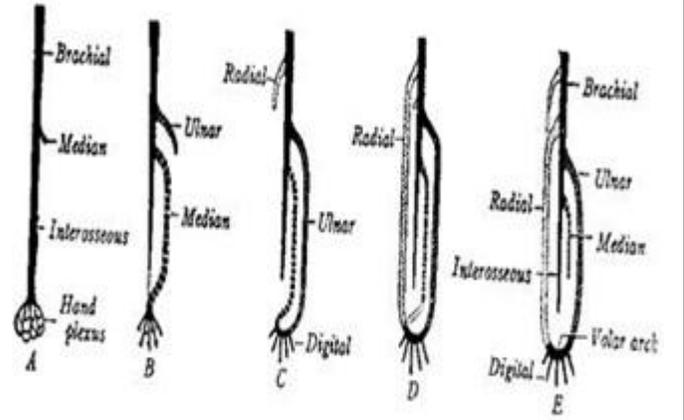


Figure 3. Normal Development of Radial Artery Old Theory (Singer 1933)

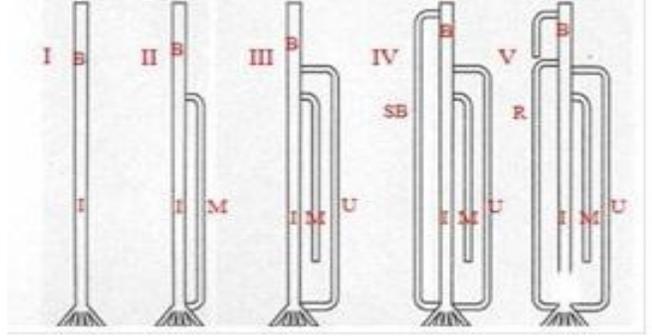
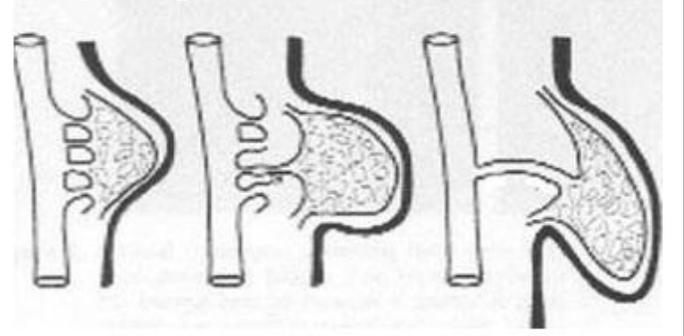


Figure 4. Normal Development of Radial Artery - New Theory (Rodriguez - Niedenuhr 2003)



DISCUSSION

Miscellaneous variations of the arterial pattern of the upper limb are common and have been reported earlier. (Charles 1894; Coleman and Anson, 1961; Kadanoff and Balkansky (1966), Cowles 2001, Lippert and Pabst, 1985; Poteat, 1986; Rodriguez- Beaza et al, 1995; Suganthy et al, 2002. Supernumerary accessory branches may arise from the brachial artery like brachial artery divides more proximally than usual into radial, ulnar, and common interosseous arteries or radial artery arising proximally, leaving a common trunk for ulnar and common interosseous; or sometimes the ulnar artery arising proximally, radial and common interosseous forming the other division; the common interosseous may also arise proximally [2]. However, case reports on the absence of unilateral radial artery, and the congenital absence of bilateral radial arteries was rare.

In 1894, Charles, first reported an aged male specimen with the absence of radial artery and observed anterior interosseous artery instead in the right upper limb. The left radial artery was normal [3].

In 1986, Poteat (1986), reported the case of a Caucasian female subject with absence of left radial artery. They found that her left upper limb arterial system was developed primitively with the anterior interosseous artery as the chief blood supply to the forearm and hand. The anterior interosseous artery terminated by bifurcating into medial and lateral terminal branches and the lateral terminal branch entered the palm similar to a normal radial artery. Her right side showed an unremarkable pattern of arterial distribution [4].

In the Kadanoff and Balkansky (1966) case, the lateral terminal branch formed the deep palmar arch, instead of the superficial palmar arch as in the Poteat case [5]. In 2001, Cowles found a 44-year-old man with congenital absence of right radial artery from a right upper extremity angiography. He had a normal ulnar artery and a small interosseous artery, and his entire right hand was perfused by only the right ulnar artery. The report, however, did not mention the left upper extremity angiography [6].

In 2002, Suganthy reported the case of a south Indian female subject with the absence of right radial artery. On the right upper limb, they observed that the brachial artery divided into the ulnar artery and large interosseous artery, whereas the radial artery was not observed. Similar to the previous report, the left extremity was not mentioned either [7].

In 2006, Yalcin [8] also reported a case of absence of the left radial artery. During the dissection of the right and left upper limbs of a 70-year-old female specimen, combined vascular anomalies were found. On the left arm, the absence of a radial artery with the presence of a lateral inferior superficial brachial artery and large anterior interosseous artery were observed. On the

right, a trifurcation of the brachial artery was observed. It branched to the radial, ulnar and one muscular artery at the proximal one-third of the humerus [8]. In our case, anterior interosseous remained as a dominant artery, while the ulnar arteries were very small in size. Both anterior interosseous artery and ulnar artery supplied blood to the forearm and hand.

In the present case, the superficial palmar arch is absent. The anterior interosseous artery of the present case, after reaching the dorsum of the hand crossing the anatomical snuffbox, dips to the palm in the second inter metacarpal space and forms a somewhat deep palmar arch.

The anterior interosseous remains as a dominant artery not replaced by a median artery and while the ulnar artery developed, most of radial artery regressed or was not formed. The developing terminal part of the anterior interosseous artery had joined a vessel somewhat corresponding to the course of the distal part of radial artery and replaced the radial artery, from the dorsum of the hand to the palm. When the median artery persists as a major vessel to the hand, the ulnar artery and radial artery are always present, but when the anterior interosseous artery persists as a major vessel, only the ulnar artery is present in the hand [9]. The arterial pattern observed in this case is primitive as the anterior interosseous artery is the dominant supply of the forearm.

Embryological Basis

In early stages of development, a single axis artery supplies the upper limb. The seventh cervical intersegmental artery forms the axis artery of the upper limb and persists in the adult to form the axillary, brachial, and interosseous arteries. At a later stage, the median artery takes over the place of the main artery of the forearm while the axis artery remains as the small anterior interosseous artery. Still later, two new arteries i.e. ulnar and radial take over from the median as the main vessels of the forearm and the median artery persists only as a small vessel running along the median nerve.[9,10, 11]

Clinical Significance

There will be absence of radial pulse. Carpal tunnel syndrome may occur due to compression of the deep branch of ulnar artery within carpal tunnel. There could be misinterpretation of incomplete angiographic pictures and problems in brachial artery catheterization [12,13]. The radial artery is used for the access of CAG and PCI, as well as for coronary artery bypass surgery. The clinical significance of potential vascular problems in this sort of specimen must be noted. In such cases there would be an absence of radial pulse available at the normal site but a strong pulse over the dorsal aspect of the wrist joint, due to the large anterior interosseous artery in the dorsum of the hand [14]. Such arteries may also present a hazard to venipuncture, as do anomalous arteries in the cubital fossa

[15,16]. The superficial location of the ulnar artery in the present case, can lead to intra-arterial injections or ligation instead of the vein in the cubital fossa.

CONCLUSION

The case reported here may be of significance to angiologists, radiologists as well as physicians, surgeons, especially traumatologists and vascular surgeons. The finding has a clinical relevance considering the frequency of procedures in this region. Some examination, such as color Doppler imaging of arteries in upper extremity even arterial angiography, may be performed before cardiac catheterization or coronary artery bypass surgery.

ACKNOWLEDGEMENT:

Authors are thankful to Dean Dr. Vinayak Sabnis Sir for his support and encouragement. Authors are also thankful to Mr. M. Murugan, Mrs. Pallavi Kadam, Mr. Shivaji Dalvi, Mr. Kishor Rangle, Mr. Shankush Adkhale,

Mr. Sanjay Shinde, Mr. Kishor Baradiya and Mr. Panduj for their help. Authors also acknowledge the immense help received from the scholars whose articles are cited and included in references of this manuscript. The authors are also grateful to authors / editors / publishers of all those articles, journals and books from where the literature for this article has been reviewed and discussed.

CONFLICT OF INTEREST

The authors declare that they have no conflict of interest.

STATEMENT OF HUMAN AND ANIMAL RIGHTS

All procedures performed in human participants were in accordance with the ethical standards of the institutional research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards. This article does not contain any studies with animals performed by any of the authors.

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Cite this article:

Niriksha Ravi, Sharadkumar P. Sawant, Shaheen Rizvi. A Case Report On Absent Radial Artery. *International Journal Of Advances In Case Reports*, 4(3), 2017, 121-124. DOI: <http://dx.doi.org/10.21276/ijacr.2017.4.3.7>



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