

High Origin of Radial Artery- A Cadaveric Case Report.

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ABSTRACT

Variations in the arterial pattern of the upper limb are very common as observed in many cadaveric and angiographic studies. Knowledge of variations in the origin and course of the radial artery is important because they are used for many diagnostic procedures as well as vascular and reconstructive surgeries like coronary angiography, percutaneous coronary intervention and coronary artery bypass surgery. During routine dissection in our institute, we observed a case of high origin of the radial artery in a 33 year old male cadaver. It was found to be unilateral; on left side, radial artery was taking origin from 3rd part of the axillary artery at the lower border of pectoralis minor before the origin of subscapular artery and anterior circumflex humeral artery. It had a superficial course in the arm crossing the median nerve from medial to lateral side. The further course of this superficial radial artery in the forearm was normal and it terminated by forming a deep Palmar arch in hand. These variations may be of great clinical implications for vascular and plastic surgeons and radiologists. Superficial course of radial artery makes it vulnerable to accidental injuries and elevates the risk of bleeding.

Keywords: Radial Artery, High Origin, Brachial Artery.

INTRODUCTION

The axillary artery is a continuation of subclavian artery at the outer border of the first rib and it continues as brachial artery at the inferior border of the tendon of the teres major muscle. In the arm brachial artery gives muscular branches, the largest being the profundabrachii artery, nutrient artery to humerus and two ulnar collateral vessels, which contribute to the anastomoses around the elbow joint. Brachial artery terminates about a centimeter distal to elbow joint at the level of the neck of the radius into radial and ulnar arteries. Radial artery gives radial recurrent artery and ulnar artery gives anterior and posterior ulnar recurrent and common interosseous arteries in cubital fossa. The radial artery is smaller terminal branch which runs superficially into forearm and terminates in the hand by forming deep palmar arch.^[1]

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Variations in the arterial supply of the upper limb are relatively common with reported frequencies: 11 to 24%.^[2] They can be found at various positions along the axillary, brachial, radial, or ulnar arteries,

as well as in the palmar arches.^[3-6] Among these, the most common variation is the high origin of the radial artery from either the axillary or brachial artery. A high origin of the radial artery is five times more likely to occur from the brachial artery than the axillary artery.^[7] In most of the literature, anomalies of the brachial artery branching are reported as 1.2 times more frequent on right side.^[8] It is worth drawing attention to the high origin of radial artery presented in this case is on the left side and it is taking origin from third part of the axillary artery.

CASE REPORT

During routine practical dissection in our institute by the first year medical students, one case of high origin of the radial artery (HORA) was observed in a 33 yr old male embalmed cadaver [Figure 1]. It was found to be unilateral; on the left side. There was a normal textbook pattern branching arrangement in the first and second segment of the axillary artery. However, in the third segment of the axillary artery, an anomalous artery was taking origin at the lower border of pectoralis minor before the origin of subscapular artery & the anterior circumflex humeral artery. It was taking origin proximal to the roots of the median nerve. It was running superficial to biceps brachii in arm

crossing the median nerve and brachial artery from medial to lateral side.

At cubital fossa, it was superficial to bicipitalaponeurosis but it was deep to the superficial veins. Another important finding was that median cubital vein was continuing as venae comitantes to this artery. The proper brachial artery was giving origin to radial recurrent artery and then it ended by dividing into ulnar and common interosseous artery.

In Forearm and palm, this anomalous artery followed the course of radial artery descending superficially on its lateral side [Figure 2]. In the palm it terminated by forming the deep palmar arch. So this anomalous artery was the case of HORA taking origin from third part of axillary artery due to failure of regression of proximal part of the embryonic superficial brachial artery.

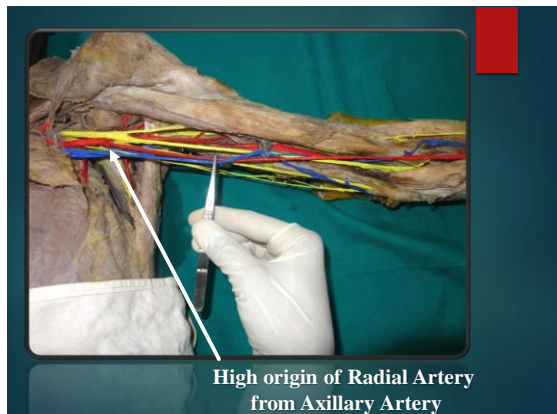


Table 1: Showing high origin radial artery from axillary artery.



Table 2: Showing normal course in arm and forearm

DISCUSSION

Anomalies in the vascular tree of the upper limb are because of their multiple and plexiform sources, the temporal succession of emergence of principal arteries, anastomosis and periarticular networks and functional dominance followed by regression of some paths.^[9] The high origin of the radial artery is the most common arterial variation of upper limb

as observed by Karlsson et al., 1982 showing an incidence of 14.27 % in dissected specimens and 9.75% in angiographic studies.^[10] In a retrospective review by Celik et al. including 81 upper extremity arteriograms, high origin of the radial artery from the brachial artery was the most frequent variation, found in 87.5% of all variations.^[11] This anomalous artery taking origin from an either axillary artery or brachial artery over the intercondylar line, is called superficial brachioradial artery (SBrA, arteriabrachioradialissuperficialis) by Rodriguez-Niedenfuhr et al., 2001 who observed an incidence of SBrA to be 13.8% out of which radial artery originating directly from axillary artery only in 3.12%.^[12] Okoro and Jiburum have reported an incidence of radial artery arising from the axillary artery bilaterally in an adult Nigerian cadaver.^[13] A 36-year-old Japanese woman undergoing chronic hemodialysis presented with a pseudoaneurysm from the high origin of the radial artery in the arm.^[14] Loukas et al. have reported a case of radial artery arising from the thoracoacromial trunk.^[15] Konarik et al. have reported an incidence of 3% in the origin of the radial artery from the axillary artery.^[16]

Embryological Explanation:

According to Arey, variant blood vessels are formed when the developing blood vessels choose an unusual path as developing vessels may fuse with each other forming a single trunk or they develop incompletely. All these changes are dependent on haemodynamics during foetal life.^[17]

- 1) Vessels of upper limb develop from subclavian artery. Distal part of this vessel is called as anterior interosseous artery
- 2) A median artery arises from subclavian and enlarges to reach and anastomoses with anterior interosseous artery
- 3) Ulnar artery arises as 2nd branch of subclavian artery
- 4) Superficial brachial artery arises from original arterial trunk and runs from ulnar to radial side.
- 5) Four more changes occur:
 - a. Median artery retrogresses;
 - b. Anastomotic branch develops just opposite the origin of ulnar artery and connects original trunk to superficial brachial artery;
 - c. Part of superficial brachial artery above the anastomotic vessel retrogresses;
 - d. Anastomotic vessel and remaining part of superficial brachial artery becomes radial artery.

According to stage five of Singer^[18], the most likely possibility in present cases; the anastomotic branch between the original trunk and the superficial brachial artery did not develop, and proximal part of superficial brachial artery failed to

regress leading to persistence of embryonic superficial brachial artery.

CONCLUSION

Thorough anatomical knowledge of the vascular pattern of the upper limb is necessary to avoid complications during not only medical care but day-to-day practice. The presence of superficially located radial artery, as a result of altered embryological development, makes it vulnerable to accidental injuries and elevates the risk of heavy bleeding in some situations for e.g. while dealing with median cubital vein for i.v. injection or cannulation for blood sampling or donation, a slightly deeply placed needle may enter into the radial artery. It may be mistaken as a vein and intravenous injections may cause reflex vascular occlusion leading to gangrene of the hand.

Knowledge about the variations in the origin and course of the radial artery is of great clinical importance in vascular and reconstructive surgeries as well as in angiographic diagnostic procedures. Now-a-days radial artery is used as good vascular conduit for coronary artery bypass grafting, second to the internal thoracic artery. It has a better midterm patency rate in comparison to saphenous vein. Transradial approach is now preferred over transfemoral or transbrachial approach for percutaneous coronary angiography or angioplasty because no major structures are located near radial artery and there exists a dual blood supply to hand, so radial artery occlusion is well tolerated. But coronary procedures through transradial approach may undergo failure because of unusual origin of the radial artery as in case of HORA, radial artery is hypoplastic in the proximal portions posing difficulty in placing a catheter through it. A catheter placed near the terminal end of brachial artery for angiographic study of the forearm may miss HORA, leading to wrong interpretation of angiographic finding related to the radial artery.

Any abnormal vascular pattern of upper limb should be identified before any surgical and diagnostic procedures, but a full work up by CT-angiography is neither feasible nor cost-effective for each patient, therefore these anatomical studies may help radiologists, cardiologists and vascular and orthopaedic surgeons to keep the possibilities of these variations in their minds before doing any procedure and in case of doubt, a colour Doppler ultrasound of the limb should be done.

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