Research Article VARIATIONS OF RADIAL ARTERY-A CADAVERIC STUDY

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ABSTRACT

There is wide range of variations in the arteries of superior extremity including radial artery. High origin of radial artery is most common variation among them. This study was done to find out the variations in origin of radial artery and their incidence. Ninety upper limbs from 45 formalin-fixed cadavers were dissected meticulously to expose the origin of radial artery. Out of 90 specimens, 78 (86.6%) had normal bifurcation of the brachial artery at the level of neck of radius. High origin of radial artery was found in 3 (3.33%) cases while high bifurcation of brachial artery above the interepicondylar line was found in 9(10%) cases. Knowledge of the variations in the origin of radial artery is important as they are used in cardiac catheterization for angioplasty, pedicle flaps or arterial grafting.

Key words- Aberrant, High origin, Radial artery, Variation,

INTRODUCTION

Radial artery is one of the terminal branches of the brachial artery. The radial artery usually appears to be the direct continuation of the brachial artery. It begins about 1cm distal to the bend of the elbow at the level of the neck of the radius and just medial to the tendon of biceps brachii. Then it descends along the lateral side of forearm up to wrist, where it is palpable between flexor carpi radialis medially and the salient anterior border of the radius. The artery is accompanied by a pair of venae comitantes along its entire extent. The radial artery enters the hand between the two heads of first dorsal interosseous muscle and then appears in the palm, between the oblique and transverse heads of the adductor pollicis. At the base of fifth metacarpal it anastomoses with the deep branch of the ulnar artery, completing the deep palmar arch.^[1]

Materials and Methods-The upper limb of 45 cadavers which were embalmed using 10% formalin making it a total of 90 specimens were used for this study. The study technique consisted of meticulous dissection.

In each cadaver, the upper limb was in abducted and laterally rotated position. An incision was made on the front of the arm from the tip of acromion process of the scapula up to the cubital fossa in the midline to expose the brachial artery and its venae comitantes. Then the incision was extended in the antecubital region along the medial border of biceps tendon and further extended up to the wrist. Skin and superficial fascia were reflected from the deep fascia by blunt dissection. The deep fascia including bicipital aponeurosis was incised vertically and biceps tendon retracted laterally to

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expose the contents of the cubital fossa. This was accomplished more easily when the elbow was flexed slightly to allow the relaxation of muscles. Brachial artery was exposed between the tendon of biceps and median nerve. The site of bifurcation of brachial artery was clearly exposed and the position of radial artery was noted.

RESULTS

Variations in the origin of radial artery were studied in 90 specimens belonging to 45 cadavers. Of these 45 cadavers, 3 were females. Of the 90 upper limbs dissected 45 belonged to right side and 45 belonged to left side.

The radial artery was present in all the specimens dissected. Out of 90

specimens, 78 (86.6%) had normal bifurcation of the brachial artery and the origin of radial artery was below the level of interepicondylar line (IEL). In 12 out of 90 upper limbs dissected, there was variation in the origin of radial artery. In 3(3.33%) out of 12 specimens, high origin of radial artery from the brachial artery i.e. above the interepicondylar line (IEL) was noted (photograph-2). In these cases the brachial artery bifurcated at the level of neck of radius into ulnar artery and common interosseous artery. Out of these 3 cases, 1 was from right side and 2 were from left side. In 9 (10%) cases out of 12, there was high bifurcation of brachial artery into radial artery and ulnar artery and hence high origin (photograph-1). of radial artery



Photograph 1: High bifurcation of brachial artery (1) into radial (2) and ulnar (3) artery in upper $1/3^{rd}$ of right arm.

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Photograph 2: High origin of right radial artery (1) from brachial artery (2). The later bifurcated at the level of neck of radius into ulnar artery (3) and common interosseous artery (4).

DISCUSSION

According to Karlsson and Niechajev, prevalance of anatomic variations in the arteries of upper limb based on autopsy reports, is quite variable from 14% to 19.5%.^[2]

McCormack studied the arterial patterns in 750 upper extremities and observed that instances of origin of radial artery proximal to intercondylar line formed by far the largest group of variations. In his study, he found the above pattern in 14.27% of all specimens and 77 % of all the variations. He categorized variations of radial artery in two groups. In 2.13% of specimens radial artery arose from the axillary artery and in 12.4 % of specimens it arose from the brachial artery.^[3]

Mullan studied the variation in the bifurcation of brachial artery in 30 Caucasian cadavers. He recorded the bifurcation of brachial artery with reference to interepicondylar line. He had found high bifurcation in 15% (9/60).^[4]

Bergman studied arterial patterns in 610 upper extremities. He had observed the usual textbook description of the axillary artery continuing as brachial artery in 80% specimens. However he had found a major variation i.e. a high proximal division of brachial artery into radial and ulnar arteries. This variation could occur at any point in the normal course, but was most common in the upper third of arm and least common in the middle third of arm. The radial artery arose from the brachial artery more proximally than usual, from the axillary artery, or from the brachial artery lower than the bend of elbow, but this low division of the brachial artery was rare.^[5]

Gonzalez described bilateral high origin of the radial artery, where the axillary artery divided into anterior and posterior branches, the anterior branch being the high origin of radial artery and posterior branch, the proper brachial artery.^[6]

Rodriguez-Baeza et al studied the arterial patterns in 23 upper extremities and categorized the high origin of radial artery into two groups depending on whether a median artery was present or not. In three cases there was high origin of radial artery with the presence of median artery but the

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origin of radial artery was different in each case. In this pattern radial artery arose from upper third, middle third and lower third of the brachial artery. In four cases there was high origin of radial artery without median artery, in two cases it arose from axillary artery, whereas in others it arose from upper third of brachial artery.^[7]

Clinical importance: Coronary Artery Bypass Graft (CABG) is the revascularization surgery that requires harvesting of autografts. The graft vessel most frequently used is internal thoracic artery or great saphenous vein. Because of some reason if great saphenous vein or internal thoracic artery cannot be used, the radial artery may be used for CABG.^[8]

The knowledge of the arterial variations of the superior extremity is useful while performing certain surgical procedures. When a surgeon fails to recognize and ligate aberrantly originating radial arteries running in the depth of wounds, it can lead serious to haemorrhage.^[3] As one can get confused with veins, which can lead to accidental injection of anaesthetic agent(Pentothal sodium) in the artery leading to distal necrosis of the limb. In the radiological diagnostic studies for peripheral vascular diseases injection of contrast medium in the brachial artery sometimes may lead to opacification of palmar arches without the opacification of radial artery. This may lead to erroneous diagnosis of occlusion of radial artery without considering the possibility of high origin of radial artery. Similarly during the ascending catheterization, the interventional radiologist needs to take into account the variation in the origin of radial artery before concluding their study.^[9]

Embryological basis of variation: The axis artery of the upper limb is derived from lateral branch of 7th intersegmental artery (subclavian artery). The proximal part of

axis artery forms the axillary and brachial arteries while distal part persists as anterior interosseous artery and median artery. During initial phase of development, radial artery arises from the brachial artery more proximally than ulnar artery. Later on new connection develops between radial artery and brachial artery at the level of origin of ulnar artery. Obliteration of upper part of radial artery proximal to the origin of ulnar artery takes place with persistence of a new connection forming definite origin of radial artery at the origin of ulnar artery. High up division of the brachial artery is due to persistence of vessels which normally obliterate and disappearance or failure of development of vessel which normally persists. This reversal of normal process of vascular development is largely due to altered local hemodynamic environment.¹⁰

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