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STUDY TO KNOW MORPHOLOGICAL VARIATIONS OF THE RADIAL ARTERY AT THE WRIST AND ITS CLINICAL SIGNIFICANCE IN A TERTIARY CARE HOSPITAL

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Abstract:

Background: *The radial artery in the human forearm is a significant artery. It is near the surface of the forearm's bottom; as the hand's palm points up, so is the radial artery. The radial artery provides oxygenated blood from the lungs to the arm and hand. This is the most prevalent artery used to assess the pulse of a patient due to the size of the radial artery and its closeness to the surface of the arm. At the wrist, where the radial artery is nearest to the surface, the pulse is verified. The radial artery is also frequently used for "Arterial Blood Gas" (ABG) measurement when drawing arterial blood. This is done for three reasons: first, it isn't the arm's only blood provider. The ulnar artery will take over if the radial artery is damaged. Second, access is simple. Third, the radial artery is a superficial artery; this implies that the patient can be readily repaired and is rarely endangered.*

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INTRODUCTION:

Usually the radial artery comes from the brachial artery and starts just below the lower teres major boundary. The current research focuses on the characteristics of the radial artery, which are the internal diameter and external diameter, as well as wall thickness and radial artery location of origin to provide comprehensive information for doctors. The current research consists of a dissection of 68 upper limbs consisting of 34 corpses (14 female and 20 male corpses, 34 rights and 34 left). The age in which the radial artery was explored ranges from 37-96 years. It generally occurs distally to the top margin of the radius head in 82.65%. The angle of radial artery in brachial artery varies from 80 to 300. The radial artery's inner and external diameters discovered to gradually decrease in all instances from proximal to distal. There is a more prominent correct radial artery than left one. Because of its size, the correct radial artery is a good option in artificial arteriovenous fistula. It will improve the achievement rate of artificial arteriovenous fistula by selecting the correct radial artery. To prevent iatrogenic flaws, radiologists and surgeons need to know the morphology of radial artery. A frequent vascular injury may occur during surgery with variable radial artery morphology. Therefore, clinically important is the identification of the radial artery's width, diameter and variable origin rate.

The brachial artery is a direct continuation of the axillary artery that passes distally and laterally just below the lower boundary of teres major and lies medial to biceps brachii and anterior to coracobrachialis and brachialis. The brachial artery moves under the bicipital aponeurosis in the cubital fossa. It ends as it splits into arteries radial and ulnar. Understanding the contents of the cubital fossa may be clinically important. It is the triangular region on the elbow joint's ventral axis that is laterally bounded by pronator teres and brachioradialis. It begins from the superior stage of the humerus ' medial and lateral epicondyles. The neck and bicipital deep fascia shape the cubital fossa aponeurosis roof, while the brachialis and supinator shape the ground. Cubital fossa contents are the median nerve, brachial artery, biceps brachii tendon, and radial nerve from medial to lateral. The brachial artery divided at the apex of the cubital fossa into the radial and ulnar arteries. The radial artery is the smaller of the brachial artery's two terminal branches. The radial artery generally occurs at the radius neck level and runs along the forearm's lateral side. It runs distally in the forearm's anterior portion. It is located deep to brachioradialis in the proximal half of the forearm, in the middle third of the forearm its lateral side is related to the superficial branch of the radial nerve, while in the distal forearm it is only covered by deep fascia, superficial fascia, and skin and lies medial to the brachioradial tendon. The radial artery is situated in the distal forearm instantly lateral to the flexor carpi radialis tendon and directly anterior to the pronator quadratus and the radius distal end. It then moves inferiorly between the adductor pollicis heads and becomes the deep palmar arch that joins the ulnar artery's profound branch.It moves through the anatomical snuff box laterally at the wrist, however, and then between the heads of the first interosseous dorsal. A likewise named vein, the radial vein, accompanies it along its course (Standring; 2005). A frequent vascular injury may occur during surgery with variable radial artery morphology. Identifying the Indian J.Sci. Res ' thickness, diameter and variable origin rate. 11 (1): 024-029, 2015 Clinically important radial artery. Consequently, radial artery diameter may add suggestions to therapeutic problems clinical leadership.

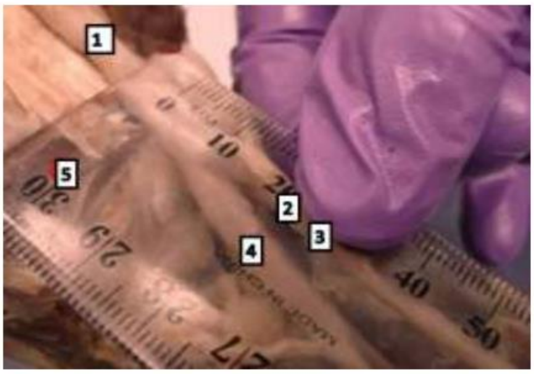

Figure 1: The measurement of the distance of radial artery origin from the superior margin of the head of the radius. 1-Brachial Artery, 2-Head of Radius, 3-Radial Artery, 4-Ulnar Artery, 5-Ruler
Figure 2: The measurement of the angle of radial artery to be taken. 1-Brachial Artery, 2-Protractor, 3-Radial Artery, 4-Ulnar Artery

METHODS:

The current research is a dissection of 34 corpses, including 14 female and 20 male corpses, totalling 68 samples of upper limbs (34 rights, 34 left).The study was conducted In Anatomy Department Of Quaid E Azam medical College Bahawalpur . The age in which the radial artery was explored ranges from 37-96 years. The present research was performed at the University of Dundee, United Kingdom, center for anatomy and human identification. It is under United Kingdom study regulation and rule that has been approved by the institution's chair of anatomy. The picture was taken using a 12 megapixel camera in which the University of Dundee regulations provided authorization to take pictures.This research of dissection was carried out on cadavers used for teaching undergraduate. To expose the muscle compartment of arm and forarm, the skin and fasciae were separated and reflected. Furthermore, to expose the axillary artery, pectoralis major and minor were expressed. Once the axillary artery has been recognized, it must be traced to the lower teres major boundary where the brachial artery starts and passes distally. It is situated medial to brachii biceps and anterior to brachialis and coracobrachialis. A careful review of the bifurcation of the brachial artery into the radial and ulnar artery must be regarded according to the level of the upper margin of the radius head. It targets the origin and internal and external diameters of the radial artery. The measuring tools used in this research are the vernier calliper, ruler and protractor (Figure 1, Figure 2). The means and associated standard deviations (mm) of the external and internal diameters and thickness of the radial artery are measured in three levels for the radial artery (at its origin, the common interosseous artery origin and wrist) in whole cases and both sexes. The angle of origin of the radial artery from the brachial artery was assessed in the cubital fossa. An imaginary line drawn next to the brachial artery was used as a reference point to assess the angles. The inner and outer radial artery diameters (proximal, middle, and distal portions) were also evaluated in the forearm.

RESULTS:

The information were gathered from both 14 female and 20 male limbs: respectively, the mean male and female ages were 81±7.2 and 75.9±16.3. The average total age is 78.9 with 11.9 years standard deviation. All cadavers ' age range was 37 to 96 years. This research involves 68 dissected upper limbs to explore the origin of the ulnar artery, its internal diameter, external diameter, wall thickness, and ulnar artery distance. To evaluate the mean and standard deviation, the information were gathered and calculated. T-tests were conducted to evaluate variations in arterial diameter between men and women on the right and left sides and along the length of the ulnar artery.

In males, 6.82 mm, 6.8 mm and 0-250 respectively were discovered to be the mean and standard deviations as well as the range of origin angle of the left radial artery. Whereas, 19.9 mm, 8.56 mm and 0-290 respectively (Table 1) were discovered to be the mean and standard deviations as well as the variety of radial artery angles on the correct hand. In female, 5.09 mm, 6.21 mm and 00-14.660 respectively were discovered to be the mean and standard deviations as well as the range of origin angle of the left radial artery. Whereas, 4.88 mm, 7.1 mm and 0-190 respectively were discovered to be the mean and standard deviations as well as the range of origin angle of the correct radial artery. The mean and standard deviations as well as the bifurcation angle range of the left ulnar artery observed to be 18.64 mm, 5.63 mm and 0-250 respectively in complete samples. Whereas the mean and standard deviations as well as the variety of right-side ulnar artery bifurcation angles were discovered to be 19.36 mm, 5.5 mm, and 0-290 (Table 1). The range of radial artery angles is therefore 0-290. The mean angle of the radial artery of the left woman is considerably greater than that of the right.

Table 1: The means, the standard deviations and the range of origin angles of radial artery

Radial artery	Side	Mean (mm)	Standard Deviation (mm)	Origin of radial artery Proximal to superior margin of the head of the radius[a]	Origin of radial artery distal to superior margin of the head of the radius*	Range of angle degree of radial artery from brachial artery
MALE	Left	6.82	6.8	0% (0 out of 20)	100% (20 out of 20)	0- 25^0
	Right	19.9	8.56	25% (5 out of 20)	75%	0-29^0
FEMALE	Left	5.09^	6.21	0% (0 out of 20)	100% (14 out of 14)	0^0-14.66^0
	Right	4.88	7.1	0% (0 out of 20)	100% (14 out of 14)	0- 19^0
Total	Left	18.64	5.63	0% (0 out of 20)	100% (34 out of 34)	0- 25^0
	Right	19.36	5.5	14.7% (5 out of 34)	85.3% (5 out of 34)	0-29^0

[a]Origin of radial artery is proximal to superior margin of the head of the radius in 7.35%.
*Origin of radial artery is distal to superior margin of the head of the radius in 82.65%.
^Significantly ($P<0.05$) larger than corresponding right side value.

In male, the means and associated standard deviations (mm) of the external and internal diameters of the right radial artery are greater than the left one whereas the thickness mean of the left radial is greater than the right radial artery at its origin. At the wrist, the means and associated standard deviations (mm) of the external and internal diameters of the left radial artery are greater than the right one. In female, the means and associated standard deviations (mm) of the external diameter and the thickness of the right radial artery are greater than the left side whereas the internal diameter mean of the left radial artery is greater than the right radial artery at its origin. At the wrist, the means and associated standard deviations (mm) of the external and internal diameters of the right radial artery are greater than the left one while the thickness of radial artery is equal in both sides. The internal and external diameter of the radial artery at its origin and at the wrist found to be gradually decreased from proximal to distal in both females and males (Table 2). In total specimens, the means and associated standard deviations (mm) of the internal diameter and thickness of the right radial artery are greater while the external diameter of the left radial artery is greater than the right one at its origin. At wrist, the means and associated standard deviations of the external diameter and thickness of the left radial artery are greater than right one while the internal diameter of the right radial artery is greater than the left one (Table 2). There is also significance($P<0.05$) difference between the male and female values with the males being larger, as well as between right and left side thickness proximally in females.

Table 2: The Means, associated standard deviations (mm) of the external and internal diameters, and thickness of the radial artery at its origin and at the wrist

Radial artery	Side	Mean (SD)		
Male	**Left**	**External**	**Internal**	**Thickness**
	Origin	3.63(0.84)	3.44(0.88)*	0.09(0.02)*
	Wrist	3.62(0.82)*	3.25(0.50)*	0.18(0.16)
	Right	**External**	**Internal**	**Thickness**
	Origin	3.71(0.91)	3.58(0.68)*	0.06(0.11)*
	Wrist	3.59(0.80)*	3.25(0.54)*	0.17(0.13)*
Female	**Left**	**External**	**Internal**	**Thickness**
	Origin	3.20(0.66)	2.90(0.54)	0.15(0.06)**
	Wrist	2.99(0.58)	2.76(0.40)	0.12(0.09)
	Right	**External**	**Internal**	**Thickness**
	Origin	3.25(0.69)	2.87(0.67)	0.19(0.01)
	Wrist	3.04(0.64)	2.80(0.54)	0.12(0.05)
Total	**Left**	**External**	**Internal**	**Thickness**
	Origin	3.45(0.79)	3.22(0.80)	0.12(0.00)
	Wrist	3.36(0.78)	3.05(0.52)	0.16(0.13)
	Right	**External**	**Internal**	**Thickness**
	Origin	3.52(0.85)	3.29(0.75)	0.11(0.05)
	Wrist	3.36(0.78)	3.06(0.58)	0.15(0.10)

*Significantly ($P<0.05$) larger than corresponding female value
**Significantly ($P<0.05$) larger than corresponding right side value

DISCUSSION:

The vascular variation is based on growth or regression of the plexus buds during embryonic development of the limb. Consequently, any errors in the embryonic progression of the buds plexus consequence in multiple differences in both the arterial roots and the course. The vascular upper limb variation varies from 9% to 18.5% (Ciervo et al; 2001). The origin and course variability of radial artery is very prevalent, which can impact both diagnosis and management as well as surgical interferences. Learning the differences in the anatomical vascular gives medical consequences. Accordingly, due to a number of surgical and invasive interferences in the cubital region, it is essential for clinicians to recognize the thickness, diameter, and radial artery variability. This can result in a reduction of iatrogenic errors. In cubital fossa, however, the radial artery generally occurs at the radius neck stage (Standring; 2005) in 21.7% may occur either before or after the radius neck stage in 11.7% or 6% correspondingly (Al-Sowayigh et al; 2013). It generally occurs in 92 percent (Nasr; 2012) after interchondyler line, but it may occur in 10 percent before interchondyler line (Al-Sowayigh et al; 2013).The radial artery therefore originates from brachial or axillary artery before the fossa referred to as a elevated origin. In the present research, the radial artery often appears in 82.65 percent distal to a higher radius head margin. In total instances, however, this rarely occurs in 7.35 percent, which found to be more male and right (Table 1). In addition, the angle of radial artery varies from 80 to 300 depending on the brachial artery. In masculine and right sides, this angle was discovered to be broader (Table 1). At its origin, the mean internal

diameter of the radial artery is 3.3 mm, while at the styloid process it is 3.1 mm. This latest research by Nasr (2012) describes the radial artery's external diameter at proximal to origin and styloid process without detailing the inner diameter that could be helpful data for the artificial arteriovenous fistula method. In the present research, the radial artery's internal diameter is at its origin 3.48 mm while at the wrist it is 3.6 mm. This study is in line with the previous study of studies (Nasr; 2012). In complete samples as well as in males and females, except in the masculine wrist region, the correct outer diameter is bigger than the left one. In males, the outer diameter is greater than in females (Table 2).
Artificial arteriovenous fistula failure rate is associated with radial artery inner diameters varying from 1.5 mm to 2.0 mm (Brimble et al; 2001). During its course, the size of the radial artery reduces from the proximal to distal portion (Yoo et al; 2005). This research therefore involves the radial artery's inner diameter at the cubital and wrist region. The average internal diameter of the radial artery at its origin is 2.5 mm (Chang et al; 1986), whereas the wrists have an average internal diameter of 2.3 mm (Ku et al; 2006). The average internal diameter of the radial artery at its origin in this study is 3.26 mm, while the average internal diameter of the radial artery at the wrists is 3.55 mm. Therefore, the internal diameter reduces in size as the radial artery falls (Table 2). According to a review comparison research of both sexes of radial artery, the inner diameter was discovered to be greater in men than females (Huzjan et al; 2004, Yoo et al; 2005; Tariq et al; 2010). The internal diameter of radial artery discovered to be greater in males than females in the present research, which is an agreement with previous research (Table 2). Based on the comparison of the left and right radial arteries, the mean diameter of the left and right radial arteries was 3.19 mm and 3.28 mm (Huzjan et al; 2004) and correspondingly 2.2 mm and 2.3 mm (Tariq et al; 2010), whereas in the current study it was found to be 2.22 mm and 2.29 mm at the origin and equal at the wrist. Hence, understanding radial artery's morphological characteristics outcomes in reducing iatrogenic flaws. The correct side improves the achievement rate of artificial arteriovenous fistula because of the size of the radial artery. To warn nephrologists and vascular surgeons to boost the success rate of the artificial arteriovenous fistula operation, radiologists must be conscious of both the diameters and wall thickness of the radial artery. This results in improving results and avoiding iatrogenic mistakes in both diagnosis and medical and surgical therapy. It can also assist cardiologists and radiologists in coronary and radiology interference catheterization procedures.

Clinical significance

Variations in the branching pattern of the arteries of the upper extremity have immense clinical and surgical significance [11, 12].
The upper extremity's superficial arteries can be mistaken for veins, so planned intra-arterial injections can become[1, 2]. Similarly, the superficial radial artery found in the current situation may be mistaken for a vein and injection into this artery of certain drugs may trigger reflex vascular occlusion resulting in a catastrophic hand gangrene[13]. Trauma can readily injure the superficial radial artery. It can also be found during forearm flap elevation[14-16].

RA harvesting is a very prevalent operation. In such processes, patients with anatomical RA differences as in the current situation have a considerably reduced puncture and a greater success rate[17]. The RA is used for grafting coronary artery bypass[18] and these differences provide a higher level of achievement.

Such differences can also cause contrast radiographs to be misinterpreted[19]. It can also generate issues during arterial grafting when placing the catheter in angiographic methods. A elevated risk of tissue gangrene or amputation may be associated with arterial thrombosis, which causes ischemia after radial artery cannulation[20].

CONCLUSIONS:

Simultaneous occurrence of differences in the origin and course of superficial radial artery together with the origin of recurrent radial artery from brachial artery found in this situation are clinically important for diagnostic, interventional and surgical processes as outlined in the section of clinical significance. For vascular surgeons, radiologists and anatomists, understanding of the differences of the radial artery is therefore of paramount significance.

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