



Research Journal of Pharmaceutical, Biological and Chemical Sciences

A Morphological Study of Variations in the Origin and Course of Radial Artery

Chandni Gupta^{1*}, Vikram Palimar², Murlimanju BV³, Vaishali R Shetti¹

¹Department of Anatomy, Kasturba Medical College, Manipal University, Manipal, India, 576104

²Department of Forensic Medicine, Kasturba Medical College, Manipal University, Manipal, India, 576104

³Department of Anatomy, Kasturba Medical College, Manipal University, Mangalore, India, 575004

ABSTRACT

Coronary artery bypass grafting is a widespread means of treating advanced coronary artery disease. Radial artery grafting has gained wide acceptance as compared with other arterial grafts. It is crucial to understand the anatomic details of radial artery to avoid complications. The objectives were to examine the origin and course of the radial artery. The study included 75 adult formalin fixed upper limbs. Variations in the origin and course of radial artery were noted down and photographed. We observed that in 2.66% and 2.66% of cases radial artery was originating from the medial side of the brachial artery and from axillary artery. In 1.33 % of cases we found the course of radial artery was abnormal. This study on origin and course of radial artery offer distinctive findings. Therefore, it will be of immense help to surgeons planning to harvest radial artery for coronary artery bypass grafting.

Keywords: radial artery, brachial artery, ulnar artery.

**Corresponding author*

Email:chandnipalimar@gmail.com



INTRODUCTION

Radial artery is smaller than ulnar artery yet it is a more direct continuation of brachial artery. It begins 1 cm distal to the bend of elbow (i.e. at the level of neck of radius). Brachioradialis lies lateral to the radial artery throughout the length, pronator teres is medial to the proximal part of artery and tendon of flexor carpi radialis is medial to distal portion. At the level of wrist it is palpable between flexor carpi radialis medially and anterior border of radius laterally. It then curls posterolaterally round the carpus between the lateral carpal ligament and abductor pollicis longus and extensor pollicis brevis. It crosses the scaphoid bone and trapezium (in the anatomical snuff box) and as it passes between the heads of the first dorsal Interosseous it is crossed by the tendon of extensor pollicis longus. Between the thumb extensors it is crossed by the cephalic vein and digital branches of radial nerve which supply the thumb and index finger. In the hand it passes through the first interosseous space where it pierces the head of 1st dorsal interossei muscle then it enters the palm deep to oblique head of adductor pollicis and then between the two heads (oblique and transverse) of adductor pollicis muscle [1].

Coronary artery bypass grafting (CABG) is a widespread and established means of treating advanced coronary artery disease. Owing to various anatomical and practical characteristics, the radial artery represents a potential conduit that may be both technically and clinically advantageous compared with other arterial grafts. During recent years there has been an increased interest in the radial artery as an entry route during coronary angiography and percutaneous coronary interventions. The use of the radial artery (RA) has become a topic of renewed interest [2].

Most patients need grafting of three coronary systems which need a full length of radial artery i.e approx 20-24cm in males and 2cm less in females. So, the radial artery is harvested from its origin till the wrist with a single incision. Left radial artery is harvested in right handed individual and vice-versa. The incision starts laterally 2cm above the wrist and extends medially to the interline of the elbow. Anatomical variations of radial artery require slight technical changes. Rarely the radial artery originates either from the proximal brachial artery or from the axillary artery (14% of cases). This variation is clinically relevant since if the origin of radial artery is not found in the elbow, the incision should not be extended further proximally [2].

An abnormality in the origin and course of radial artery does not preclude it for using as a graft, it just requires slight changes in the operative technique. The size of radial artery always matches with that of coronary artery, except in some female cases (<0.5%) where there is severe hypogenesis and the diameter is less than 1.5mm inspite of spasm release maneuvers and this constitutes a contraindication [2].

An intimate knowledge of arterial anatomy of upper extremities and its common variations is indispensable to limb surgeons. Appreciation of variations in the upper extremity vasculature is essential to prevent injury, thrombosis, gangrene and even amputation of limbs, particularly in patients requiring dialysis or undergoing arteriography. For both surgical and

routine patient care accurate knowledge of course and relations to surrounding structures is of great importance. For the above mentioned reasons the following study was undertaken to document the normal & variant anatomy of the radial artery in the adult human cadaver in the South Indian population, which would help the clinician in better patient care.

MATERIALS AND METHODS

The study included 75 formalin fixed upper limbs which were obtained from the department of anatomy. Among them 17 upper limbs were of male cadavers and 9 were of female cadavers and 49 were isolated upper limbs. The specimens were dissected by using scalpel, forceps (blunt, sharp and toothed). An incision was made in the upper limb from axilla till the wrist and the skin and deep fascia of the forearm from the axilla to the proximal margin of flexor retinaculum were exposed in layers. Then a transverse incision was made just proximal to the flexor retinaculum, and the flaps of fascia were reflected. Then the brachioradialis was separated and the tendons of abductor pollicis longus and extensor pollicis brevis were retracted without any injury to the surrounding structures. Then the brachioradialis and the extensor carpi radialis longus muscle were exposed to separate the extensor and flexor groups of muscles. In the groove between these muscles the radial artery was identified & cleaned from its origin, noting its course. Any variations of the above were noted and recorded.

RESULTS

VARIATIONS IN THE ORIGIN OF RADIAL ARTERY

In this study we observed that radial artery originated from the medial side of the brachial artery about 16 cm above the intercondylar line in 2 cases (i.e in 2.66% of cases) and from axillary artery in 2 cases (i.e in 2.66% of cases) (Table:1;Fig.1-3).

Table1: Showing list of sites of origin of radial artery

Site of origin	number	percentage
normal	71	94.8
From brachial artery in the middle of arm	2	2.66
From axillary artery in the axilla	2	2.66
Total abnormal	4	5.2

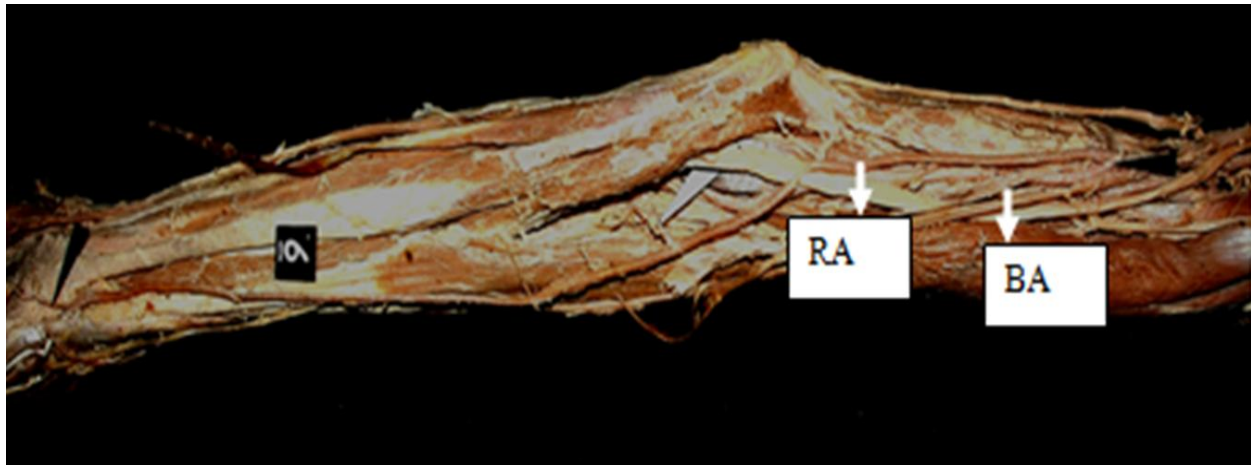


Figure 1: Origin of radial artery from brachial artery in the middle of arm. RA- Radial artery, BA – Brachial artery

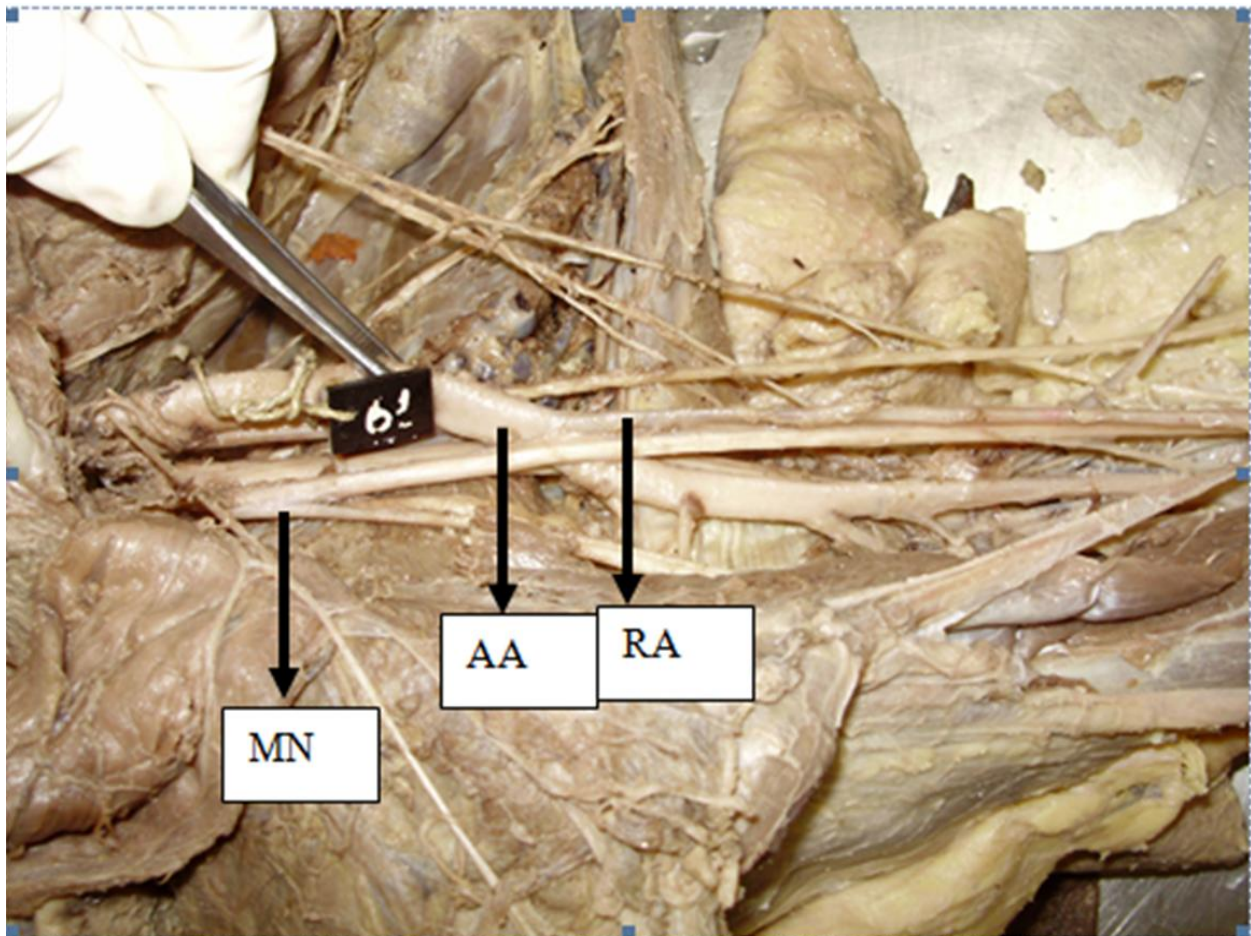


Figure 2: Radial artery arising from 3rd part of axillary artery in the axilla. RA- Radial artery, AA – Axillary artery, MN – Median nerve

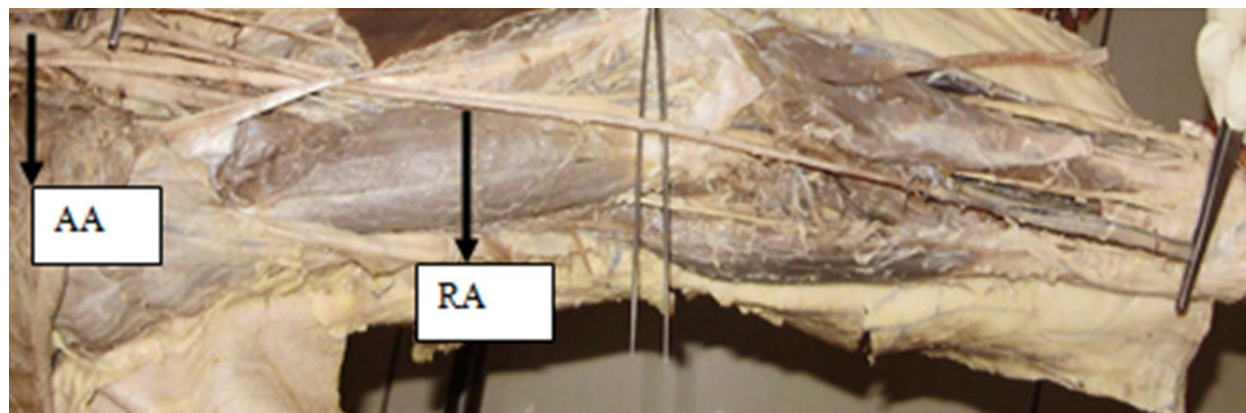


Figure 3: Course of the radial artery (arising from 3rd part of axillary artery) in the axilla and forearm. RA- Radial artery, AA – Axillary artery, MN – Median nerve

VARIATIONS IN THE COURSE OF RADIAL ARTERY

In one case it was seen that radial artery was passing superficial to the anatomical snuffbox and crossed superficial to the tendon of the extensor pollicis longus muscle (Fig.4) There were two cases in which radial artery was originating from the medial side of the brachial artery about 16 cm above the intercondylar line in an unusual manner. In the cubital fossa the artery descended in front of the anterior surface of the median nerve. Moreover, just after passing the intercondylar line the artery crossed the median nerve anteriorly and descended in its normal anatomical course in the anterior aspect of the forearm (Table:2).

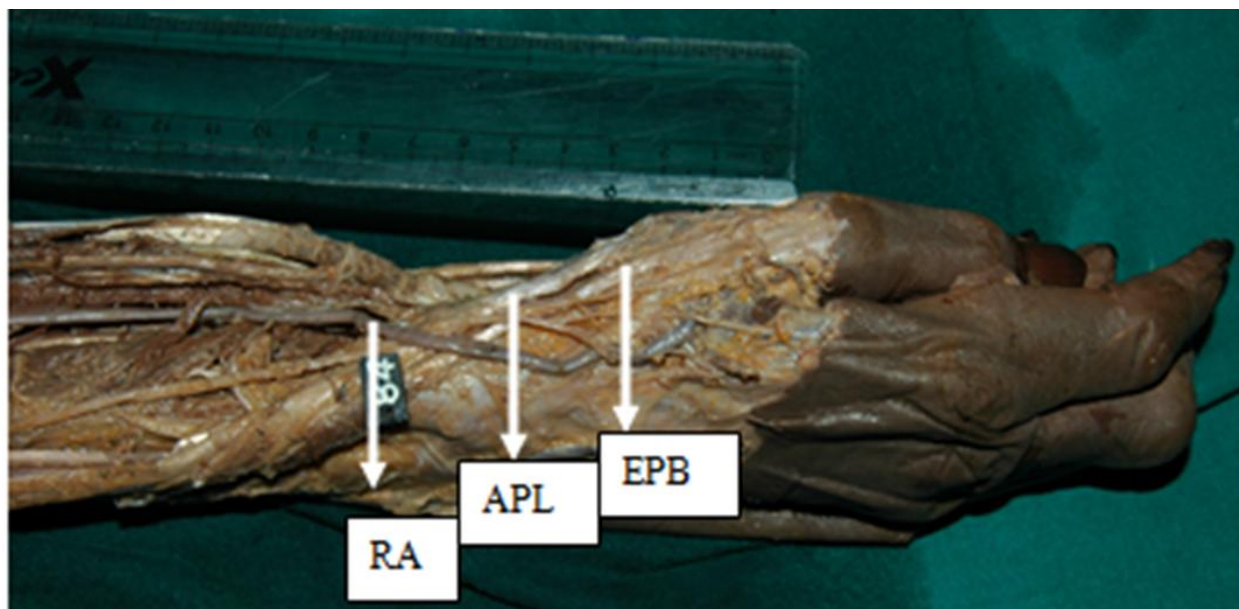


Figure 4: Abnormal course of radial artery. Here radial artery is going superficial the tendons of abductor pollicis longus and extensor pollicis brevis muscles while going to the dorsum of hand. RA- Radial artery, EPB - Extensor pollicis brevis muscle, APL - Abductor pollicis longus muscle

Table 2: Showing course of the radial artery

Course	number	percentage
normal	70	93
Going above the tendons on dorsum of hand	1	1.33
In middle of arm	2	2.66
In axilla	2	2.66

DISCUSSION

Variations in the arterial pattern of the upper limb have frequently been observed both in routine dissections and in clinical practice. The present study was conducted on 75 formalin fixed upper limbs to detect the variations in origin and course of the radial artery.

VARIATIONS IN THE ORIGIN OF RADIAL ARTERY

In this study origin of the radial artery was looked upon. The origin can be either from brachial artery at its normal point i.e. at the level of neck of radius or it can be high origin either from brachial in the middle of arm or from axillary artery in the axilla (Fig 1-3). In this study high origin of radial artery was found in 5 % of cases while Karlsson et al found it in 10 % of cases and Uglietta et al found it in 7 % of cases [3, 4]. In this particular study we got radial artery originated from the medial side of the brachial artery about 16 cm above the intercondylar line in 2 cases (2.66% of cases) which is similar to the case reported by Keller et al, Deligonul et al, Cox and Griswold, Yang hee-jun et al and Yucel, Baeza et al found 6 cases out of 150 cases in which radial artery arose from the proximal part of brachial artery [5-10].

Table 3: Comparison of origin of radial artery in different studies

Authors	Origin from brachial artery	Origin from axillary artery
Keen J.A (1961)	5.9%	Not done
Karlsson S, Niechajev IA (1982)	3%	0.4%
Uglietta John P, Kadir Sandoon (1989)	7%	2%
Baeza A Rodríguez et al (1995)	4%	0.66%
Niedenfuhr M. Rodriguez et al (2001)	23%	10.4%
Niedenfuhr M. Rodriguez et al (2003)	14%	Not done
Yang Hee-Jun et al (2008)	2.3%	Not done
In present study (2011)	2.66%	2.66%

We observed radial artery originated from the axillary artery in 2 cases (2.66% of cases) which is similar to the case reported by Compta and Bellaterra [11]. Baeza et al found 1 cases out of 150 cases in which radial artery arose from axillary artery [10]. In this study there was a case of bifurcation of axillary artery in its 3rd part into radial artery and brachio ulnar similar to case was also found by Patnaik et al [12]. The findings of this study were in accordance with the dissection study done by Baeza et al [10]. We observed 4 cases out of 75 cases with high origin of radial artery. They got 7 cases of high origin of radial artery. Niedenfuhr et al (2001) observed

high origin of radial artery in (brachioradial artery) 53 out of 384 upper limbs ($13 \pm 8\%$) [13]. 12 cases (23%) brachioradial artery originated from the axillary artery. In this study we observed the same finding in 2 cases. They found in 40 cases it arose from brachial artery in this study we found in 2 cases (Table: 3).

VARIATIONS IN THE COURSE OF RADIAL ARTERY

In the present study one variation in the course of radial artery was observed (Fig.4). It was seen that radial artery was passing superficial to the anatomical snuffbox and crossed superficial to the tendon of the extensor pollicis longus muscle similar to a case found by Keen and Sachs found 5 cases in which radial artery coursed superficial to the anatomical snuffbox and crossed superficial to the tendon of the extensor pollicis longus muscle [14,15].

Patnaik et al found an anomalous course of radial artery [12]. They found that at the level of base of 2nd metacarpal, radial artery turned distally to dip into the 2nd intermetacarpal space coursing between the two heads of 2nd dorsal interosseous muscle. But In present study there was no such case.

In the present study superficial radial artery was found in 1 case out of 75 cases i.e in 1.33 % of cases and Niedenführ et al (2003) in 0.4 % of cases [16]. In their study there are 2 radial arteries originated from the medial side of the brachial artery about 16 cm above the intercondylar line in an unusual manner. In the cubital fossa the artery descended in front of the anterior surface of the median nerve. Moreover, just after passing the intercondylar line the artery crossed the median nerve anteriorly and descended in its normal anatomical course in the anterior aspect of the forearm. But Pelin et al found an unusual course of the radial artery where the radial artery originated from the medial side of the brachial artery and crossed the median nerve twice in an unusual manner 8 cm below the point at which the deep brachial artery arose and 12 cm above the intercondylar line [17].

Present extensive dissection based study on origin and course of radial artery offer distinctive findings and also comparison with previous reports. Therefore, it will act as an valid documentation and will be of immense help to surgeons planning to harvest radial artery for coronary artery bypass grafting.

REFERENCES

- [1] Standerling S. Gray's Anatomy. The anatomical basis of clinical practice. 39th ed. Elsevier Churchill Livingstone, London; 2005; 867-878, 925-929.
- [2] He-wei-guo. Arterial grafting for coronary artery bypass surgery. 2nd Ed. Springer 2006; 151-155.
- [3] Karlson S and Niechajev IA. Acta Radiologica diagnosis 1982; 23:115-121.
- [4] Uglietta JP, Kadir S. Cardiovascular and Interventional Radiology 1989; 12:145-148.
- [5] Keller FS, Rosch J, Dotter CT and Porter JM. Am J Roentgenology 1980; 134:169.



- [6] Ubeydullah D, Gregory G, Morton KJ, Vandormaelet M. Catheterization and Cardiovascular diagnosis 2005; 14(1): 44-45.
- [7] Cox GW and Griswold JA. J Anatomy 1991; 22(2):119-120.
- [8] Yang Hee-J, Gil Young-C, Jung Won-S, and Lee Hye-Y. J Korean Medicine Science 2008; 23(5): 884–887.
- [9] Hilmi YA. Acta med Okayama 1999; 53(2):61-65.
- [10] Rodríguez BA, Nebot J, Ferreira B, Reina F, Pérez J, Sañudo JR and Roig M. J Anatomy 1995; 187:473-479.
- [11] Compta XG, Bellaterra. J Hand Surgery 1991; 16A:293-296.
- [12] Patnaik VVG , Kalsey G, Rajan KS. J Anat Soc India 2001; 50(2):166-169.
- [13] Rodriguez NM, Vazquez T, Nearn L, Ferreira B, Parken I, Sanudo JR. J Anatomy 2001; 199(5):547-566.
- [14] Keen JA. Am J Anatomy 1961; 10:245-261.
- [15] Sachs M. Acta Anatomica 1987; 128:110-123.
- [16] Rodriguez NM, Vazquez T, Parkin IJ, Sanudo JR. Eu J Anatomy 2003; 1:21-28.
- [17] Pelin C, Zagyapan R, Mas N, Karabay G. Folia morphologie 2006; 65(4):410-413.