



BRACHIO-RADIAL AND BRACHIO-ULNAR ARTERIES IN UPPER 1/3rd PART OF ARM: A CASE REPORT

Anatomy

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ABSTRACT

Brachial artery is main source of blood supply to upper limb which is used routinely to assess blood pressure, pulse doppler ultrasonography measurements and other procedures. Aim of this case study to make aware about high termination of brachial artery into radial (brachio-radial) and ulnar (brachio-ulnar) arteries. During routine dissection, we observed a case of an unusual high origin of radial and ulnar arteries in upper third of right arm in a 64 year old male cadaver. Radial artery originated as medial branch in the upper third of the arm while ulnar artery originated as lateral branch. Just above elbow radial artery crossed ulnar artery and median nerve from medial to lateral and after that it passed deep to bicipital aponeurosis to reach lateral side of forearm. High bifurcation of brachial artery may create difficulties during various procedure. Therefore sound knowledge of variations of brachial artery is important.

KEYWORDS

Brachial artery, Ulnar artery, Radial artery, Brachio- radial, Brachio-ulnar

INTRODUCTION:

The brachial artery (BA) is the main source of blood supply to the upper limb which begins at the lower border of the teres major and terminates in to radial artery (RA) and ulnar artery (UA) in the cubital fossa at the level of the neck of the radius¹. Sometimes, these arteries may terminate more proximal than what is usually seen and can display a high origin from the brachial artery or even from the axillary artery^{2,3}.

Arterial variations of upper limb are often encountered; either in routine dissections, autopsies or during surgery accidentally and incidence varies from 18.53% to 20%^{2,4}. BA may bifurcate as usual or it may trifurcate into the radial, ulnar and common interosseous arteries¹. Rodríguez-Niedenfuhr et al. studied the arterial pattern variations in the upper limb and proposed that the term 'brachio' should be prefixed to name of the artery (i.e. high origin of radial artery is termed as "brachioradial artery" and high origin of ulnar artery is termed as "brachioulnar artery") which originate in the arm^{4,5}.

Distal part of the BA is used routinely to assess blood pressure and pulse Doppler ultrasonography measurements². Diverging course and location of the upper arm arteries may be injured during cannulation and it may result in thrombosis or gangrene. BA cannulation is performed in various interventional surgical, radiological, diagnostic procedures and therapeutic management like coronary artery disease, aortic, peripheral vascular disease, and chronic renal failure^{6,7}. Asound knowledge of the normal and variation of arterial anatomy of the upper limb is clinically important because this is a site of frequent injury and of various surgical and invasive procedures^{8,9}. Aim of this case study to make aware about high termination of brachial artery into radial (brachio-radial) and ulnar (brachio-ulnar) arteries and their superficial divergent course in lower part of arm with correlation with embryology and probable clinical insight.

Case Report:

During routine dissection of upper limb for first year MBBS students at our institute, we observed a case of an unusual high origin of radial and ulnar arteries in the upper third of the right arm in a 64 year old male cadaver (Fig. 1a).

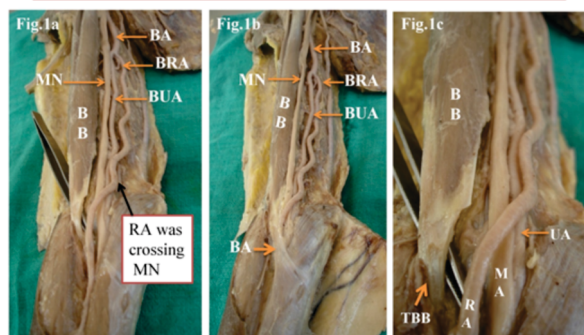
Course of Brachial artery: The brachial artery begins at the lower border of teres major and run downward for 1.5 cm. Then it terminated into medial and lateral branches (Fig. 1 a). Profunda brachii was given 0.5 cm below the lower border of teres major.

Course of Radial artery: RA originated as the medial branch of the BA in the upper third of the arm while the UA originated as lateral branch. RA was more tortuous as compared to UA. Median nerve (MN) was related laterally to both arteries and the relationship between these three structures was MN- UA – RA from lateral to medial (Fig 1 a). Just above the elbow the RA crossed the UA and MN from medial to

lateral and after that it passed deep to bicipital aponeurosis to reach the lateral side of forearm (Fig. 1b). In lower part of arm it was superficial till it passes deep to bicipital aponeurosis. RA after crossing the MN and UA entered into cubital fossa where the sequence of normal structure was changed. Structures present in cubital fossa from lateral to medial are tendon of biceps brachii- radial artery- median nerve- ulnar artery (Fig. 1c). Course of RA was normal in forearm.

Course of Ulnar artery: The UA was given off laterally from brachial artery in the upper third of the arm. It ran downward with lesser tortuosity. Here it was medial to median nerve and lateral to radial artery up to the upper part of lower one third of arm (Fig 1a). It was crossed superficially by tortuous RA from medial to lateral side. MN was related laterally to the UA in cubital fossa. The UA passed deep to the deep head of the pronator teres muscle (Fig. 1a, b, c). Rest of the course was normal.

High division of BA along with intermingling of content of cubital fossa



Legends:

Figure 1a: Showing the high division of brachial artery (BA) in to Brachio- radial (BRA) and Brachio- ulnar arteries (BUA)
MN- Median nerve, Biceps brachii- BB

Figure 1b: Showing the radial artery (RA) passing deep to bicipital aponeurosis (BA) MN- Median nerve, BRA- Brachio- radial artery, BUA- Brachio- ulnar artery

Figure 1c: Showing the intermingling of various structures in cubital fossa TBB- Tendon of biceps brachii, RA- Radial artery, MN- Median nerve, UA- Ulnar artery

DISCUSSION:

The BA is the main source of irrigation of upper limb. Normally, it terminates in the cubital fossa at the level of the neck of the radius into the RA laterally and the UA medially¹. High division of BA may occur at any point in its normal course and has been reported by many

researchers^{9,10,11}. High division of BA was reported by Satyanarayana et al¹⁰ and noted that the BA divided into a lateral radial artery and a medial ulnar artery which was in contrast with our case report. We observed a case in which the BA bifurcated into a RA medially and an UA laterally and similar finding was observed by Sing et al. in 2017¹¹. Moreover, in our case the radial artery was tortuous, superficial in lower part of arm where it cross the median nerve from medial to lateral and pass deep to bicipital aponeurosis in contrast to that described by Sing et al.¹²

Shetty et al. described a case where the BA divided into the radial and ulnar arteries in a manner similar to that described in our study. However, the RA crossed the UA and MN in the arm, in contrast to our case in which the RA crossed to the UA and MN just above the elbow¹³. However, our case differs from those described by other authors in terms of its superficial course in lower 1/3rd part of arm and cubital fossa where it was passing deep to bicipital aponeurosis.

The embryological basis of high origin of radial and ulnar arteries

The axis artery of the upper limb is derived from the seventh inter-segmental artery. The proximal part of the axis artery forms the axillary artery which continues as the brachial artery and its distal part remain as the anterior interosseous artery and deep palmar arch. The radial and ulnar arteries are the last arteries to appear in the forearm and appear as sprouts of axis artery. At first, the RA arises more proximal than the UA from the main trunk and crosses in front of the median nerve. Later, the RA establishes a new connection with the main trunk at or near the level of origin of the ulnar artery. The upper portion of its original stem usually disappears. Thus, the radial and ulnar arteries arise at the same level. Alterations in the morphogenesis during the embryological life may result in variations both origin and the course of the arteries of the upper limb¹⁴.

CONCLUSION:

Presence of brachioradial and brachio-ulnar arteries (i.e. high BA bifurcation) may create difficulties for percutaneous brachial artery catheterization, difficulties while measuring blood pressure. It is also prone to damage during orthopedic and plastic surgeries. Chances of atherosclerosis are more in tortuous arteries. The radial artery is commonly used for coronary grafting. Lack of awareness of such variations of the radial artery could lead to failure of procedure as seen in our case. If an artery is superficial (as in our case RA was superficial in lower one third and cubital fossa) then it is at risk during intravenous injections, infusion, venipuncture and interventional procedures. Furthermore, intermingling of RA, MN, UA in cubital fossa and above it could lead to it being damaged during orthopedic and plastic surgeries, repair of peripheral nerves in the arm and traumatic injuries of arm and elbow.^{15,16} Therefore, it is important to have a sound knowledge of anatomical variations and course of the upper limb arteries before any procedure.

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