

“We Don't Seem To Find the Ulnar Artery in This Cadaver”: An Aberrant Origin of Ulnar Artery

Erick J. Mazyala¹, Mary Ndibalema¹, Emmanuel Kimwaga¹, Sifael Msuya¹, Antony Lukanima¹, Ndulu Magelle¹, Mathayo Joshua¹

¹Department of Anatomy, School of Medicine, Catholic University of Health and Allied Sciences (CUHAS), P.O. Box 1464, Bugando, Mwanza, Tanzania.

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ABSTRACT

Aberrant origin of ulnar artery that potentially changes its normal anatomical relationship is considerable rare. But when present, it must never be overlooked before carrying invasive procedures on the anteromedial aspect of the arm and forearm by the clinician. This would avoid unprecedented iatrogenic loss of part or entire distal part of the upper limb due to loss of arterial blood supply. While doing the normal dissection of the left upper limb on the 35 year old female cadaver, medical students saw a strangely and superficially placed ulnar artery that arose from the brachial artery way up within the upper part of the middle 3rd of the arm. This superficial ulnar artery coursed within the deep brachial and ante-brachial fascia, making it superficial to all flexor muscles of the flexor compartment of the forearm. It only resumes its normal course at the wrist joint distally. The brachial artery coursed normally and bifurcated at the cubital fossa to give radial artery laterally and common interosseous artery medially. On the other hand, the right upper limb had normal arterial patterning.

Keywords: Ulnar artery, brachial artery, bicipital aponeurosis, radial artery, common interosseous artery, anterior and posterior interosseous artery, superficial palmar arch.

INTRODUCTION

The normal arterial patterning of the upper limb has been thoroughly described from various anatomical and surgical textbooks and other scientific publications.^[1-4] Brachial artery is a continuation of the axillary artery below the inferior border of the teres major.^[1-4] It tends to give profunda brachii artery, nutrient humeral artery, upper and lower collateral ulnar arteries apart from muscular and cutaneous branches within the arm.^[1-5,7-8,14] Anterior and slightly distal to elbow joint, brachial artery bifurcates to give rise to radial artery laterally, and the larger of the two branches, ulnar artery medially.^[1-5] In most cases, bifurcation of the brachial arteries tends to occur at the level of the neck of the radius within the cubital fossa.^[1-4] Immediately, ulnar arteries normally give common interosseous artery as the principal branch within the cubital fossa before continuing as ulnar artery deep to pronator teres, flexor carpi radialis, palmaris longus, and flexor digitorum superficialis.^[1-2,4] At the proximal inch of the artery in cubital fossa, it related medially to the median nerve.^[1-2,4] The median nerve crosses later anteriorly to the vessel and

become separated from it by the medial head of the pronator teres muscle.^[1] At the distal aspect of the forearm, ulnar artery is anterior to the flexor digitorum profundus and in the interval between the flexor digitorum superficialis and flexor carpi ulnaris.^[1-2,4] In the lower two 3rd, the ulnar artery relates medially to the ulnar nerve. The two structures then course together superficial to the flexor retinaculum lateral to pisiform bone, the nerve being anterior to the vessel within Guyon's tunnel.^[1] The artery gives small anterior and posterior carpal branches before bifurcating into superficial and deep branches.^[1] The superficial branch, a continuation of ulnar artery in the palm, forms the major part of the superficial palmar arch that is completed laterally by a superficial branch of the radial artery.^[1-2,4] The deep palmar branch anastomoses with the deep branch of the radial artery to form the deep palmar arch.^[1-2,4]

Name & Address of Corresponding Author

Erick J. Mazyala
Department of Anatomy, School of Medicine, Catholic University of Health and Allied Sciences (CUHAS), P.O. Box 1464, Bugando, Mwanza, Tanzania.
Email: mazyala@gmail.com

CASE REPORT

While doing normal dissection session on the left upper limb of a 35 year old female cadaver, the 1st year medical students saw an artery on the medial aspect of the wrist joint and antero-medially to flexor retinaculum. One of the medical students asked one of the authors whether it was Ulnar artery or not. The author affirmed that it was indeed ulnar artery.

“If that is the ulnar artery, then what can this be?” another medical student perplexedly asked while pointing at the bifurcation site of the brachial artery (BA) deep within the cubital fossa. The author, while attending to the student query, he noted the brachial artery (BA) ending by bifurcating into laterally placed radial artery (RA) and medially and more deeply ending branch, the common interosseous artery (CIA) which ended shortly by bifurcating into large anterior and posterior interosseous arteries. Seeing this, the author, went back to the ulnar artery (UA) and followed it proximally. This time he noted that, it was unusually superficial to the superficial muscles of flexor compartment of the forearm and within antebrachial and brachial fascia throughout its length. Furthermore, this ulnar artery sprouted from the brachial artery on the upper aspect of the middle 3rd of the medial brachium. Proximal to the origin of ulnar artery, the brachial artery gave profunda brachii artery (PBA), which shortly bifurcated and accompanied radial nerve (RN) along the radial groove within posterior brachial compartment [Figure 2-4]. The ulnar artery branched from the brachial artery two centimeters below the origin of profunda brachii [Figure 3 & 4]. This high originating and superficially placed ulnar artery after branching from the brachial artery, it pierced the brachial fascia and assumed a more superficial course throughout its entire length passing just beneath the brachial and antebrachial fascia [Figure 1, 8-9]. At its origin, it was smaller (3mm diameter) and gradually enlarged in the forearm as it received anastomosing branches from anterior interosseous artery [Figure 1,8,9, & 10]. At the cubital fossa, it passed superficial to pronator teres and deep to the bicipital aponeurosis [Figure 1, 8, & 9]. The brachial artery bifurcates at the cubital fossa to give radial artery laterally and common interosseous artery medially [Figure 5, 6, & 7]. The common interosseous artery (5mm in diameter) was larger than the brachial part of the superficial ulnar artery. However, it was almost of same diameter to the middle and distal antebrachial part of the ulnar artery (4.5-5 mm in diameter) [Figure 5,6,7 & 9]. The common interosseous artery terminates by bifurcating into the large anterior interosseous artery and slightly smaller posterior interosseous artery 20 mm from its origin at

the brachial artery, [Figure 5, 6, & 7]. Several anastomotic branches from anterior interosseous artery were seen to anastomose with superficial ulnar artery, which accounted for the distal enlargement of the later [Figure 9]. The superficial ulnar artery after passing underneath the bicipital aponeurosis, it maintain its superficial course, obliquely crossing superficial to the pronator teres, flexor carpi radialis and palmaris longus muscles [Figure 7, 8 & 9]. At the antero-medial aspect of the left wrist joint just proximal to the flexor retinaculum it resumes its normal anatomical relationship with the ulnar nerve and immediately give rise to deep palmer branch before continuing to form the superficial palmar arch with the superficial palmar branch of the radial artery laterally [Figure 10].



Figure 1: Showing the medial part of the left arm and forearm with superficially placed ulnar artery (unlabeled arrows) that pass underneath the bicipital aponeurosis (arrow head). Note that ulnar artery passes superficial to pronator teres (PT) and flexor carpi radialis (FCR) muscles.

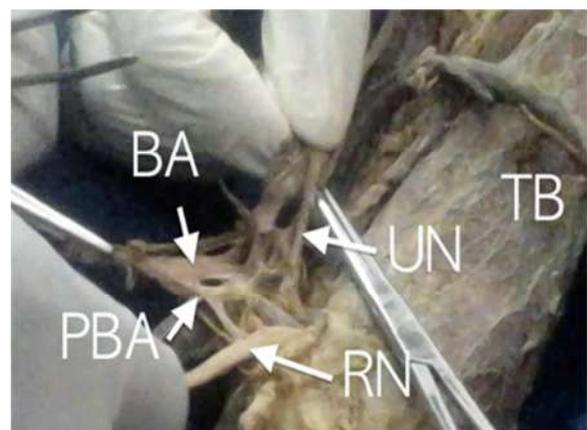


Figure 1: Showing medial aspect of the left arm. Note that brachial artery (BA) giving profunda brachii artery (PBA) which immediately bifurcates and accompany radial nerve (RN) as it enters the posterior brachial compartment in the radial groove. UN=ulnar nerve, TB=triceps brachii muscle.



Figure 3: showing medial aspect of the left arm. Note the high origin of the superficial ulnar artery (SUA) distal to the origin of profunda brachii artery (PBA) from the brachial artery (BA). BB = biceps brachii muscle, MCN = musculocutaneous nerve.



Figure 6: Showing the deep aspect of the left cubital fossa. Note that the brachial artery (BA) bifurcates at left cubital fossa into radial artery (RA) and common interosseous artery (CIA). 20 mm distal to its origin, common interosseous artery bifurcates into anterior interosseous artery (AIA) and posterior interosseous artery (PIA). PT = pronator teres



Figure 4: The high origin of superficially placed ulnar artery (SUA) originate 20 mm distal to the origin of profunda brachii artery (PRBA) at the brachial artery (BA). The diameter of SUA proximally was 3mm, and 4-5 mm distal to the cubital fossa. Note the position of the ulnar nerve (UN), radial nerve (RN), basilic vein (BV) and triceps brachii muscle. TB=triceps brachii muscle.

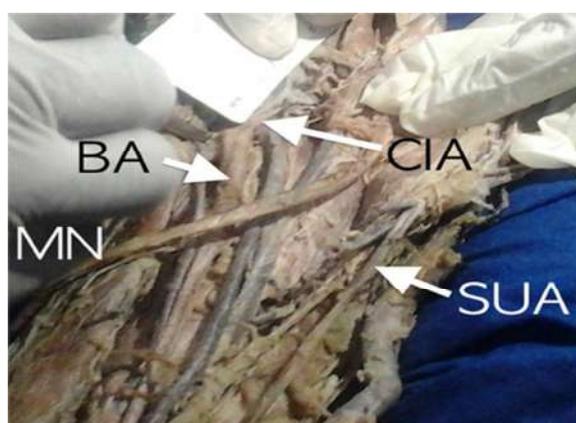


Figure 7: The deep aspect of cubital fossa. The left common interosseous artery (CIA) bifurcates into anterior interosseous artery (AIA) and posterior interosseous artery (PIA) 20 mm distal to bifurcation of brachial artery (BA). The diameter of the CIA (5mm) was 2mm larger than the proximal SUA (3mm) Note the position of superficially placed ulnar artery. (SUA). MN= median nerve.

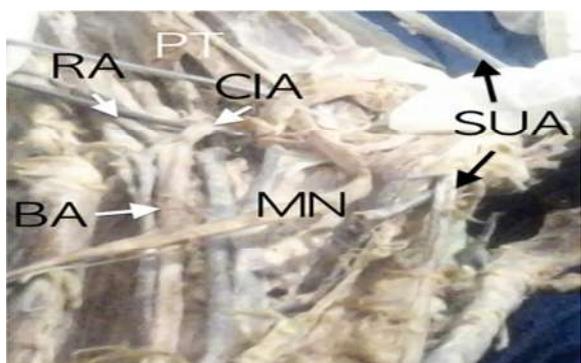


Figure 5: Shows the deeper aspect of the left cubital fossa. Note that, Brachial artery (BA) bifurcates to give radial artery (RA) laterally and common interosseous artery (CIA) instead of ulnar artery medially. Pronator teres (PT) has been incised and reflected to reveal these structures. Also note the location of superficially placed ulnar artery (SUA). MN= median nerve (its proximal reflected laterally)



Figure 8: The anterior part of the forearm, showing superficially placed ulnar artery (arrowed). PT = pronator teres.

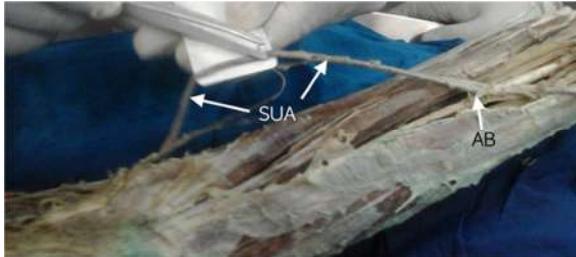


Figure 9: In the anterior part of the forearm, superficial ulnar artery (SUA) is superficial just within the ante-brachial fascia but superficial to all muscles of flexor compartment of the forearm. As it descends to the antero-medial aspect of the flexor retinaculum, it constantly receiving anastomotic branches (AB) from volar interosseous artery and hence is marked enlarged to about the same size as the common interosseous artery (5mm).



Figure 10: Showing the distal end of superficial ulnar artery (SUA) as it divides to give deep branch (DB) and continue as ulnar artery (UA) to form superficial palmar arch (SPA) together with superficial branch of radial artery (SBoRA). Ulnar nerve cut and reflected medially.

DISCUSSION

Variations of ulnar arteries described by various reports can be summarized in terms of numerical alteration (absent, present normal or present but duplicated) and spatial variations.^[1-15] The presence of median artery or the interosseous and radial arteries generally compensate for the numerical ulnar variation involving absence of ulnar artery.^[11] Duplication mostly occurs in the presence of high origin of superficial ulnar artery (SUA).^[11] These high origins of ulnar artery would also result to spatial ulnar variation by altering anatomical relationship of the resulted ulnar artery. High originating SUA may arise from the axillary artery or brachial artery.^[11,14] Normal brachial bifurcation would give radial and another normal ulnar artery within the cubital fossa.^[11] This would result to numerical variation involving

duplicated states of ulnar arteries.^[1,11] There will be SUA arising high up and another, the normal or deep ulnar artery from bifurcation of brachial artery, which may or may not reach the hand.^[11] When it fails to reach the hand it becomes rudimentary and forms ulnar recurrent arteries and some muscular branches.^[11] However, high bifurcation of brachial artery may result to variations on both radial and ulnar arteries with or without duplication of these vessels.^[8,11,14] In most cases when brachial artery bifurcates within the arm, most brachial blood supply would come from the brachio-ulnar artery and they tend to follow the normal course from cubital fossa distally.^[4,8,11,14] Spatial ulnar artery variation presents as aberrant origins ranging from the axillary artery, brachial artery or 1 distal to the level of radial neck.^[1,4,8,10,11] In our case [Figure 1-10] as in other reported cases,^[4-13] the high origin of ulnar artery, introduced uncommon spatial ulnar artery anatomical relationship. The ulnar artery assumed a superficial course throughout its brachial and ante-brachial course except that it passed deep to bicipital aponeurosis and barely under the antebrachial fascia. Other authors have also reported the same finding.^[9,11] Some of these studies reported the SUA passing within superficial fascia.^[2,6,10,12] Such change in anatomical relationship has serious clinical implications to medical professionals who go by the book. Majority of studies reported about the occurrence of SUA are from India.^[2-3,5-10,12,14] It has rarely been reported from African population.^[4] The current indigenous black African case is stressing the fact that aberrant origin of ulnar arteries is not limited to Indian population and non-indigenous Africans. Observations from studies done elsewhere has shown that, the diameter of arteries including the ulnar arteries tends to decrease proximal-distally.^[1,4] In our case the SUA was seen to enlarge distally possibly due to the presence of several anastomotic branches arose from volar interosseous artery that augmented it, [Figure 9]. This presentation is in agreement to Reddy S et., who also reported a smaller caliber of SUA compared to radial and common interosseous artery.^[12] This finding however, contradicts report by Ball L et al who found the SUA to be larger than all terminal branches of the brachial artery.^[2] The length of the common interosseous artery originating from the ulnar artery is normally of about 10 mm.^[1] In the present case the common interosseous artery extended 20 mm in length as it originates higher up at the bifurcation site of brachial artery. Moreover, abnormal position of the ulnar artery in superficial plane changed the ramification of collateral ulnar branches. Normally, the anterior and posterior ulnar recurrent branches receive the upper and lower ulnar collateral branches from the middle part of the brachial artery.^[1,4,11] In the present case, they were all absent. High origin of

superficially placed ulnar artery is relatively uncommon phenomena. Our anatomy laboratory has dissected 134 cadavers, with 268 upper limbs and this variation has only been seen on the left upper limb of this 35-year-old female cadaver, accounting for 0.74%. This occurrence is lower compared with various Indian studies that reported; 0.17-2%,^[2, 14] and 2.7%.^[11] Moreover, Devanashi M S et al., found relatively higher prevalence of about 9.12%, showing that our finding is much lower compared to the other populations.^[13] SUA variation may occur as an isolated as part of other variations within the upper limb vasculature.^[11] It also can occur unilateral or bilateral. Majority of these variation are unilateral.^[1-2, 5-6, 9-14] There are conflicting reports on the preponderance of right or left sides, some reported right preponderance while other reported lack of predilection.^[4, 11, 13] Interestingly, some report have shown bilateral occurrence with preponderance to female subjects.^[11]

Implication of the presence of SUA

The occurrence of this superficial ulnar artery apart from being confused with superficial veins during surgical and venipuncture procedures are potentially prone to trauma involving the arm and the forearm. A moderate superficial laceration of antero-medial aspect of the arm and forearm could potentially rupture this artery resulting to massive arterial bleeding which may lead to ischemia to the distal aspect of the upper limb and potential hemorrhagic shock and death to the patient. Unknowingly, a surgeon expecting normal patterning of ulnar artery may disregard SUA during surgical procedures on the antero-medial aspect of the arm and forearm. Such disregard may lead to loss of function to the distal aspect of the upper limb especially to the medial aspect of the hand. Inexperienced phlebotomist can easily confuse the SUA especially at cubital fossa where it passes just underneath the median cubital vein and may inadvertently be injected with irritating drug purported for venipuncture leading catastrophic consequences, ranging from partial to complete loss of the distal part of the upper limb. However, the presence of SUA is also blessing to both, patients and surgeons planning harvesting fasciocutaneous forearm flap. It offers an easy superficial surgical approach to the surgeon and enhances rapid recovery to patients.^[15]

CONCLUSION

Even though the presence of the SUA is rare, this term is relative. Ignorance of its existence even to just one patient is too many because of catastrophic

consequences that it may bring. Presence of SUA must be ruled out from every patient undergoing any invasive procedure on the arm and forearm to prevent unwanted iatrogenic consequences that may be due to this omission. This can simply be done checking for any pulsatile blood vessels along the antero-medial aspect of the arm or perform vascular Doppler prior to invasive procedures.

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