ISSN: 0975-8585

Research Journal of Pharmaceutical, Biological and Chemical Sciences

A Case Report of Superficial Brachial Artery with Its Embryological Basis and Clinical Significance.

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ABSTRACT

Variations of the arterial pattern in the upper limb have been the subject of many anatomical studies due to their high incidence. The knowledge of arterial variations of upper limb is important because it is frequent site of injury. Brachial artery is principal artery of the arm and it is important in cardiac catheterization for angioplasty, pedical flaps and arterial grafting. Accurate knowledge and relationships of major arteries and their variations is important in the field of radiology, orthopedic, vascular and plastic surgeries, reparative surgery in the arm, forearm and hand. One such variation is superficial brachial artery. In the present study, during routine dissection of undergraduates we observed in the left arm of male cadaver that brachial artery after its normal origin coursed superficial to median nerve and terminated into the radial artery and the ulnar artery in the cubital fossa. The ulnar artery coursed normally, while the radial artery coursed superficially in the forearm. A case of such rare variation with its embryological basis and clinical significance is presented and discussed.

Keywords: superficial brachial artery, radial artery, ulnar artery

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ISSN: 0975-8585

INTRODUCTION

Brachial artery is principal artery of arm, following the axillary artery. The brachial artery usually begins as a continuation of axillary artery at the inferior border of the tendon of teres major and ends about a centimeter distal to elbow joint at the level of the neck of the radius by dividing into radial and ulnar arteries. The artery is crossed superficially by the median nerve from lateral to the medial side.

Occasionally the artery divides proximally into two trunks, which may reunite. Frequently it divides more proximally than usual and this unusually short segment brachial artery may bifurcate as usual or it may trifurcate into radial, ulnar, and common interosseous arteries [1].

The other variation is the superficial brachial artery. The superficial brachial artery is so called because it runs superficial to the median nerve, whereas usually the brachial artery runs deep to the median nerve. The superficial brachial artery may replace the main trunk or it may be trunk running parallel and deep into the median nerve in the normal position [2]. These superficial brachial arteries may continue in the cubital fossa and bifurcate as usual into the radial and the ulnar arteries, both the radial and the ulnar arteries running a superficial course in the forearm, with the deep division continuing in the forearm as the Interosseous complex [3]. Another type of variant is also seen, where the brachial artery gives a superficial branch in the arm, which continues in the forearm as the common interosseous artery, while the brachial artery divides into the radial and the ulnar arteries at the normal position [4].

The main objective of the present study is to document superficial brachial artery with its high division into radial and ulnar artery in the proximal 1/3of the arm and to correlates embryological basis and clinical significance of such variation.

CASE REPORT

During routine dissection of undergraduates in the dissection hall of Anatomy Depatrment,MGM Medical college, Navi Mumbai, India we observed in the left arm of 53year male cadaver that the brachial artery after its normal origin, coursed superficial to median nerve and divided into the radial artery and the ulnar artery in the cubital fossa. The ulnar artery coursed normally,while the radial artery coursed superficial to forearm flexor muscles.

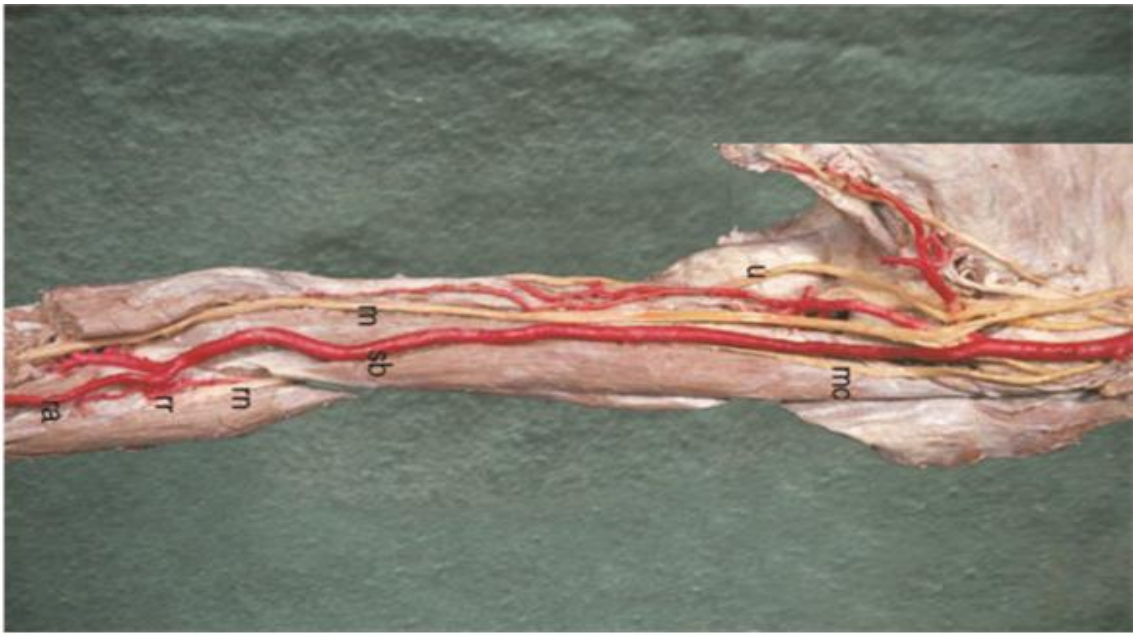


Figure 1: Showing superficial brachial artery

Sb-Superficial brachial artery, ra-Radial artery, mc-Musculocutaneous nerve, m-Median nerve, u-Ulnar nerve, rn-Radial nerve.

ISSN: 0975-8585

DISCUSSION

Superficial brachial artery is named so because it runs superficial to median nerve and replaces the main trunk.

According to Yang et al [5] superficial brachial arteries may be classified into three types:-

- Type I: The superficial brachial artery bifurcating into the radial and ulnar artery in the cubital fossa after giving off muscular branches in the arm.
- Type II: The superficial brachial artery continuing as the radial artery. It is also termed as superficial radial artery. The ulnar artery in such cases comes as continuation of the usual brachial artery which passes deep to the median nerve.
- Type III: The slender superficial brachial artery supplies the arm musculature and ends in the arm itself. The main brachial artery bifurcates into radial and ulnar arteries as usual.

In the present case, brachial artery finding similar to type I of this classification in that the superficial brachial artery bifurcated terminally into the radial and the ulnar artery in the cubital fossa.

Majority of authors given a prevalence rate of superficial brachial artery varying from 0.2% to 25 % but without specifying its pattern.

A pattern similar to the one found in the present case, i.e.brachial artery passing superficial to median nerve and bifurcating into radial and ulnar artery in the cubital fossa has been reported earlier in left arm by Keen [3] in 3.6% and Lengele and Dhem [6] in 0.8% of population. Similar observation of superficial brachial artery in the right arm has been reported in 17% of cases by Fuss et al [7], 11.9% by Baeza et al [8].

Neelamjit K et al [9] reported bilateral superficial brachial artery with its origin, course and termination were different in both the limbs. On the left side, the brachial artery in the middle 1/3rd of arm, coursed superficial to median nerve and on the right side it divided in upper 1/3rd of arm into superficial and deep arteries. Former coursed superficial to median nerve and terminated in cubital fossa by dividing into the radial and ulnar artery while the latter coursed deep to median nerve and continued as common interosseous artery. While in present case, our findings are unilateral.

Superficial brachial artery with its high division into the radial artery and ulnar artery at the level 5cm above the intercondylar line was reported by Singla RK et al [10]. While in present case, superficial brachial artery is bifurcated in cubital fossa.

Finally, any arterial variation can have both morphological and clinical significance. Cardiologist, radiologist, or vascular surgeons involved in the procedure should be attentive to these possibilities of anatomical alteration and require, in case of doubt, a colour Doppler ultrasound of the limb. The case reported here may be of interest to angiologists and radiologists, as well as vascular surgeons.

EMBRYOLOGICAL BASIS

Arterial variations can be explained on the basis of embryogenic development. According to Feinberg, ectodermal mesenchymal interactions and extracellular matrix components within the developing limb bud are controlling the initial patterning of blood vessels. [11] Some inductive factors from the limb mesenchyme cause the changes in the blood vessel pattern. Arey [12] is of the view that anomalous blood vessels at any site in the body may arise due to:

- The choice of unusual paths in primitive vascular plexus.
- The persistence of vessels normally obliterated.
- The disappearance of vessels normally retained.
- Incomplete development.
- Fusions and absorption of the parts usually distinct.

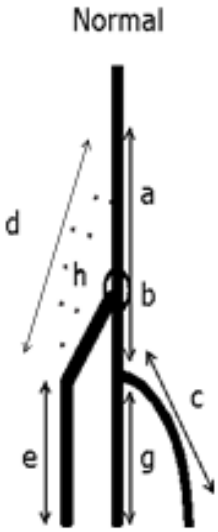
ISSN: 0975-8585

The development of the entire arterial tree of the upper limb occurs in stage wise fashion. Development of brachial artery has been described in the following five stages by Singer [13]:

- Stage I: The lateral branch of seventh intersegmental artery, i.e., subclavian artery extends to the wrist and terminates by forming capillary plexus; its distal portion forms the anterior interosseous artery.
- Stage II: Median artery arises from the anterior interosseous artery grows along the median nerve to communicate with palmar capillary plexus. By this time the anterior interosseous artery undergoes regression.
- Stage III: The ulnar artery arises from brachial artery and unites distally with the existing median artery to form superficial palmar arch.
- Stage IV: The superficial brachial artery develops in axillary region from the axial trunk and traverses the medial surface of the arm, runs diagonally from the ulnar to the radial side of the forearm to the posterior surface of the wrist to divide over the carpus into digital branches.
- Stage V: Three changes occur simultaneously

    - The median artery regresses to a small slender vessel, familiar in adult life as the arteria nervi mediana.
    - The superficial brachial artery gives off a distal branch which anastomoses with the superficial palmar arch formed already.
    - At the elbow, an anastomotic branch develops between the main trunk of brachial artery and the existent superficial brachial artery. The distal part of superficial brachial artery enlarges to form the radial artery where as the proximal portion of superficial brachial artery atrophies correspondingly.

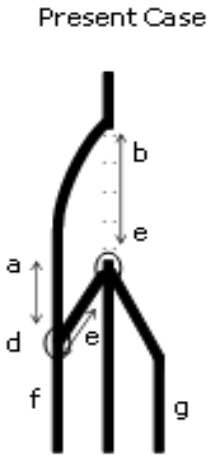
In the present case (Figure 3) it seems that during Singer stage V the distal part of superficial brachial artery (Figure 2, a) failed to disappear but the distal portion of brachial artery (Figure 2, b) atrophied. The brachial artery which usually bifurcates at c (Figure 2,c), now bifurcates at d (Figure 2, d). The communication between superficial brachial artery and brachial artery (Figure 2, e) which usually forms proximal part of radial artery now forms proximal part of ulnar artery.



Normal
a) Part of axial artery which forms brachial artery
b) Part of axial artery which forms proximal ulnar artery
c) Trunk of origin of ulnar artery
d) Part of superficial brachial artery which disappears
e) Part of superficial brachial artery which forms radial artery
f) Communicating branch between superficial brachial artery and brachial artery which forms proximal part of radial artery
g) Terminal part of primitive axial artery
h) Point of bifurcation of brachial artery

Figure 2.Embryological explanation of superficial brachial artery (Normal)

ISSN: 0975-8585



Present Case
a) Distal Part of superficial brachial artery.
b) Distal portion of brachial artery.
c) Point at which brachial artery usually bifurcates.
d) Point of bifurcation of brachial artery in present case.
e) Communication between superficial brachial artery and brachial artery which will form proximal part of ulnar artery
f) Radial artery
g) Ulnar artery

Figure 3: Embryological explanation of superficial brachial artery in present case.

Clinical Importance

The upper extremity is frequent site of injury. The knowledge of arterial variations is important especially in the field of radiology, orthopedic, vascular and plastic surgeries.

The superficial brachial artery, as well as the superficial position of the ulnar and the radial arteries not only makes them more vulnerable to trauma and thus to bleeding, but also makes them more accessible to cannulation, if needed. These arteries may also be mistaken for a vein. An accidental intra-arterial injection via the superficial brachial artery can cause thrombosis or gangrene, leading to amputation of the arm or fingers [14].

Furthermore, the presence of superficial brachial artery can cause misinterpretation of incomplete angiographic images. Doppler ultrasound provides a confident diagnosis of this anatomical variation. The presence of superficial brachio-ulno-radial type of arterial pattern may be of immense clinical significance since its presence can facilitate a skin flap which can be used for various plastic and reconstructive surgeries [15].

Variation of the brachial artery and its branching pattern is of significance in cardiac catheterization for angioplasty, pedicle flaps, or arterial grafting. Any abnormal positions or divisions of the brachial artery should be identified before surgery [16].

CONCLUSION

Superficial brachial artery as noted in the present case is not a rare variation.The case can be explained in the light of embryological development.In addition,knowledge of such variation is important clinically. Diagnostically, it may disturb the evaluation of angiographic images. Interventionally, accidental puncture of superficial placed arteries may occur while attempting venipuncture. Surgically, it is important in both orthopedic and plastic surgery operations.

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