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Study on the Course and Variations in Termination of Brachial Artery in Human Foetuses

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Abstract

Knowledge of variation and termination of brachial artery is essential during investigation and Surgery Anatomy of the brachial artery and its termination have been extensively researched by many in adults, very few in foetuses, hence the present study was undertaken in 36 fetal upper limb. The brachial artery was studied after dissecting the upper limb. 13 foetuses (36.1%) out of 36 foetuses showed variation and the most common variation was superficial brachial artery seen in 7 foetuses (19.44%), trifurcation and quadrification in 1 foetus (2.77%), double brachial arteries in one feotus. One full term foetus also showed a median artery on the right forearm which was arising from the common interrosseous artery and peirces the median nerve. Therefore, understanding the formation, termination of the brachial artery is crucial for surgeons and clinicans to avoid possible errors during surgery and interpretation.

Keywords: Brachial Artery, Feotus, Quadrification, Superficial Brachial Artery, Trifurcation, Upper Limb

Introduction

Brachial artery, a continuation of axillary artery at lower border of teres major and ends by dividing into radial and ulnar artery at cubital fossa at the level on neck of radius.[1]It shows variations in 26%.[2] However Sudarshan Babu KG et al,[3] mention that variations in brachial artery are so many that it becomes a rule rather than an expectation. These were seen in the form of superficial brachial artery, different types of origin of profunda brachi artery, superior & inferior ulnar collateral artery, and also trifurcation.[2] The term accessory brachial artery is used for the extra brachial artery. Embryologically it is due to the persistence of more than one intersegmental cervical artery which does not deteriorate but persists and can even enlarge its diameter.[4] As compared to the main brachial artery, it is placed superficially and medially.[5] Accessory

brachial artery caused failure of the transradial or transulnar catheterization intervention due to its prevailingly narrow lumen.[6] Superficial brachial artery is so called because it runs superficial to median nerve, whereas it runs usually deep to median nerve. [7] In a very rare situation, brachial artery may be absent as reported by Ciervo A et al.[8] A high origin of the radial artery is reported to be the commonest variation in the arterial pattern of upper limb with an incidence of 14.27% in dissected specimens[9] whereas high origin of the ulnar artery is quite uncommon.[10] Presence of variant vessels may increase the risk and complications during some procedure, but it may be beneficial to some others e.g., a variant superficial vessel is easily approachable during catheterization. [11]

Materials and methods

36 numbers of human foetuses (i.e.72 upper limbs) were collected from Obstetrics & Gynecology department R.I.M.S, Imphal, after prior permission from the ethical committee. Immediately the foetuses were emerged in 10% formalin for two weeks for fixation. Upper limbs free from external congenital anomalies were selected for the study of the brachial artery. Dissection of the upper-limbs was carried out in axilla, front of the arm, back of the arm, and in cubital fossa by following the conventional steps of dissection. Brachial arteries -their course, termination and the branches were examined thoroughly. Photographs were taken for record. The findings were discussed and compared with those of the previous workers.

Results

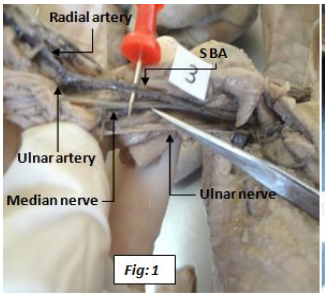
Out of 36 foetuses, 13 foetuses (36.1%) showed variations of brachial artery. Variations encountered were superficial brachial artery in 7 foetus (19.44%), high division into brachioradial and brachioulnar artery in 3 foetus (8.33%), trifurcation & quadrification in 1 foetus (2.77% each), double brachial arteries (2.77%), and median artery piercing the median nerve (2.77%). Seven foetuses (5 unilateral & 2 bilateral), showed superficial brachial artery which terminates in cubital fossa by dividing into radial and ulnar artery. These arteries had superficial course and run superficial to median nerve (Fig: 1). Three foetuses (all unilateral) showed high division of brachial artery into brachioradial and brachioulnar artery in the upper part of the arm. Brachioradial artery crossed the median nerve anteriorly from medial to lateral side (Fig: 2). A 30 weeks foetus showed bilateral double brachial artery. For the laterally placed brachial artery, the term lateral brachial artery or main brachial artery was used. Similarly the term medial brachial artery or accessory brachial artery was used for the medially placed artery. Lateral brachial artery was larger than the medial brachial artery and terminates by bifurcating into radial and ulnar artery. The medial brachial artery was smaller and ends by supplying the skin around elbow(Fig: 3). In one 38 weeks old foetus, the left brachial artery ended by giving off four terminal branches (i.e. Quadrification) into ulnar artery, common interosseous artery, radial artery and a unnamed cutaneous branch (Fig: 4). Same foetus on the right side showed trifurcation of brachial artery into radial artery, ulnar artery, and common interosseous artery (Fig: 5). We also encountered a median artery in a full term foetus on the right forearm which was arising from the common interosseous artery and then pierced the median nerve (Fig: 6).

Discussion

Different authors reported different percentage of variations of brachial artery. According to Patnaik et al, [12] variations of brachial artery is 26% whereas Niedenfuhr MR et al,[7] reported the same as 35.5%. In

the present study, we found that 36.1% of brachial artery showed variations in the form of superficial brachial artery, high division into brachioradial and brachioulnar artery, trifurcation, and quadrification. This present finding can be compared with the finding reported by Niedenfuhr MR et al.[7] Superficial brachial artery is a consistent embryonic vessel that plays an important role in the normal morphogenesis of the upper limb.[13] Genetic influences are deemed to be prevalent causes of such variations, although factors like foetal position in utero, first limb movement or unusual musculature cannot be excluded.[14] Most common variation seen in the present study is in the form of superficial brachial artery (19.44%). Many authors reported different incidence of superficial brachial artery in their studies. Sudarshan Babu KG et al,[3] Patnaik et al,[12] & Skopakoff C,[15] reported the incidence of superficial brachial artery as 11.57%, 6%, and 19.7% respectively. So the present finding regarding the incidence of superficial brachial artery is almost similar with the incidence reported by Skopakoff C,[15] however it is much higher than the incidence reported by Sudarshan Babu KG et al,[3] Patnaik et al.[12] Keen JA,[16] subdivides the superficial brachial artery into 2 types. In type A: superficial brachial artery continues to the cubital fossa and bifurcates as usual into radial and ulnar artery, whereas in type B the superficial brachial artery continues as radial artery as high origin of radial artery. In our study we encountered only type `A` variety of superficial brachial artery. Rosse CR et al,[17] stated that in approximately 30% of the individuals there are two brachial arteries in the arm. The two arteries reunite in the cubital fossa and again divide into radial and ulnar artery.[5,17] In our study we do came across a case of double brachial artery in one foetus but there was no communication between the two arteries as reported by Rosse CR et al [17] *and Chakravarthi KK* et al.[5] In present study, the laterally placed brachial artery (main brachial artery) is larger and ends by bifurcating into radial and ulnar artery in cubital fossa whereas medially placed brachial artery (accessory) is smaller and terminates by supplying the skin around elbow. Talalwah WA,[18] Rohilla A et al,[19] Vanitha et al,[20] and many others has, reported high division of brachial artery into brachioradial and brachioulnar artery. Kirksey L,[21] has blamed the case of unrecognized high division as one of the caused for dialysis acess failure. In the present study we are reporting three cases of unilateral high division of brachial artery into brachioradial and brachioulnar artery. Murugapermal G and Rajendra SM, [22] reported two cases of trifurcation of brachial artery. In the first case it trifurcates into radial artery, ulnar artery, and profunda brachii artery. However in second case it trifurcates into radial artery, ulnar artery, and common interosseous artery. Patnaik et al,[2] and Reddy CK et al, [23] also reported a case of trifurcation of the brachial artery into radial artery, ulnar artery, and radial recurrent artery. The trifurcation seen in the present study is similar with the second case of trifurcation reported by Murugapermal G and Rajendra SM, [22] however it differs from the trifurcation reported by Patnaik et al, [2] & Reddy CK et al [23] as the third branch seen in the present study being the common interosseous artery. We also encountered a case of quadrification (terminating into four branches) of brachial artery into radial artery, ulnar artery, common interosseous artery, and the unnamed cutaneous artery. Also, we incidentally encountered a case of median nerve being pierced by median artery which was arising from common interosseous artery.

No relevant literature found in order to discuss the above two findings.



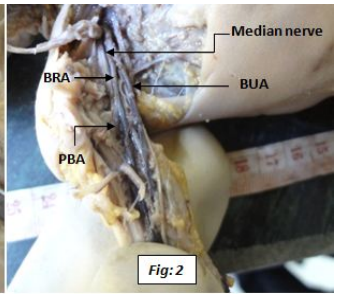
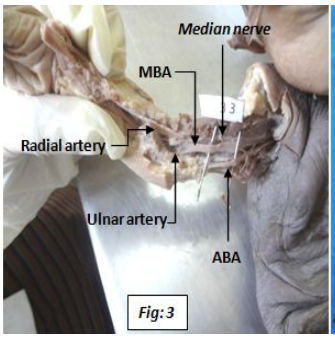


Fig: 1: Showing superficial brachial artery (SBA) dividing as usual into radial and ulnar artery in cubital fossa. Note that it runs superficial to median nerve.

Fig: 2: Showing high division of brachial artery into brachioradial artery (BRA) and brachioulnar artery (BUA). Note that profunda brachii artery (PBA) is arising from middle part of brachioradial artery.



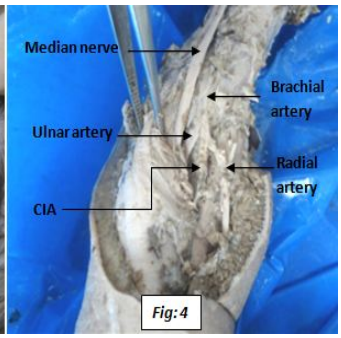
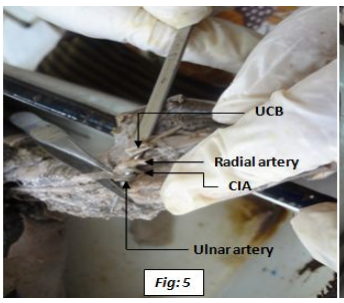


Fig: 3: Showing double brachial artery. The larger laterally placed artery is the main brachial artery (MBA) which bifurcates into radial and ulnar artery in cubital fossa; whereas the smaller medially placed is the accessory brachial artery (ABA) which ends by supplying the skin around the elbow.

Fig: 4: Trifurcation of brachial artery into radial artery, ulnar artery, and common interosseous artery (CIA) in cubital fossa.



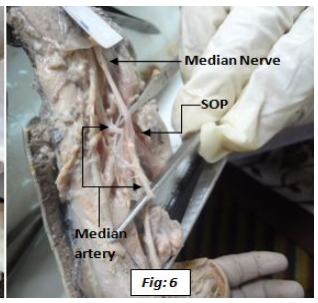


Fig: 5: Showing quadrification of brachial artery into radial artery, ulnar artery, common interosseous artery (CIA), and unnamed cutaneous branch (UCB) at cubital fossa.

Fig: 6- Showing median artery piercing the median nerve. Note that the arrow pointing at the site of penetration (SOP) of median nerve by median artery.

Conclusion

Variations in arterial pattern of upper limb have clinical and surgical significance. Superficial brachial artery may be confused as vein during any clinical procedures. High division of brachial artery causes difficulty while measuring blood pressure. So variations of brachial artery should be kept in mind during any clinical procedures to avoid fatal complications.

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