

Case Report

Variant Course and Branching Pattern of Arteries in the Right Cubital Fossa: Possible Embryological and Clinical Implications

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Abstract

Variations in the arterial pattern of the upper extremity are numerous and have been documented. Superficially placed arteries in the cubital fossa may be mistaken for cutaneous veins and may lead to intra-arterial injection instead of the intended intra-venous one. This may lead to serious complications like haemorrhage, necrosis of forearm or digits, or arterio-venous fistula. Compression symptoms may occur when arteries run an abnormal course through muscles. We report here a rare observation during routine cadaveric dissection of the right brachial artery passing superficial to the bicipital aponeurosis and then trifurcating 2.5cm distal to the bend of elbow into radial artery, ulnar artery and a recurrent muscular branch to brachialis muscle. Radial artery was observed to pass through pronator teres muscle. Knowledge of these arterial variants is important to vascular surgeons to avoid iatrogenic accidents during grafting, microvascular surgeries and radio-diagnostic procedures. A possible embryological explanation for the arterial pattern observed is being described.

Keywords: Arterial variations in upper limb, brachial artery, radial artery, arterial development

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Introduction

The axillary artery continues as brachial artery at the distal border of the tendon of teres major muscle. The brachial artery ends about a centimeter distal to the elbow joint by dividing into its two terminal branches, radial and ulnar arteries. The artery is superficial in its course being deep to skin, superficial and deep fasciae; the bicipital aponeurosis crosses it anteriorly at the elbow, separating it from the median cubital vein. Radial artery is proximally overlapped anteriorly by the belly of brachioradialis and the distal attachment of pronator teres lies posterior to it (1). Deviations from this normal pattern are often encountered during routine cadaveric dissections. Knowledge of variant upper limb arterial patterns are of immense use to the reconstructive surgeon, radiologists especially during angiographic procedures, orthopaedicians and

anatomists for documentation and understanding the embryological patterns leading to their development.

Case Report

During routine cadaveric dissection on a 57-year-old male, a unilateral variant of brachial artery (BA) was observed. The origin and course of the right BA was normal till the cubital fossa, where it was observed to pass superficial to the bicipital aponeurosis (bap) and deep to the median cubital vein (Fig.1). The BA then trifurcated 2.5cm distal to the bend of elbows into radial artery (RA), ulnar artery (UA) and a recurrent artery (MA). The recurrent artery was observed to ascend lateral to the biceps brachii muscle and terminated by supplying the brachialis muscle. The RA was observed to pass through the humeral head of pronator teres muscle (PT), 1.7 cm distal to its origin,

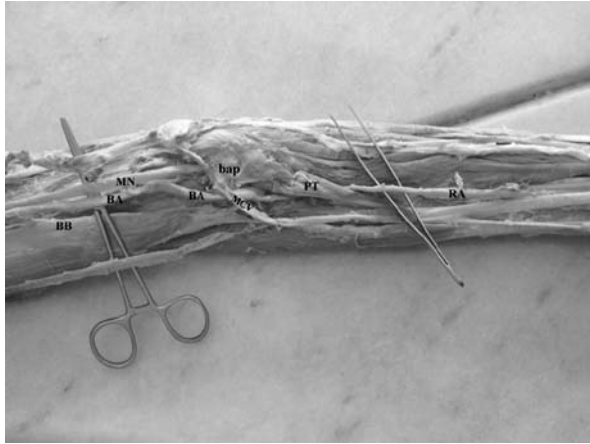


Figure 1: Biceps brachii muscle has been cut (not seen in the picture); pronator teres muscle (PM) is cut and reflected to show the course of radial artery (RA) through its humeral head. Brachial artery (BA) dividing into ulnar (UA), radial (RA) and a recurrent branch (MA). Ulnar artery (UA) passing deep to PT, crossed by a branch from median nerve (MN) going to PM. The MN is seen passing through the ulnar head of PM.

the median nerve (MN) coursed through the ulnar head and the UA passed deep to the ulnar head of PT (Fig.2). The external circumferences measured were; BA (18mm), UA (16mm), RA (8mm) and MA (4mm). There was no variation in the further course and distribution of MN, RA and UA. The course and branching patterns of nerves and arteries was normal in the left upper extremity as described in standard treatise.

Discussion

The arteries of the upper limb present with a large number of variations in course and branching patterns with an incidence of upto 20% (2,3,4). Trifurcations of BA have been reported as isolated cases and usually as high origin of BA, which trifurcates in the arm into RA, UA and common interosseous artery (CIA) (5,6,7,8); into RA, UA and superior ulnar collateral artery (9,10); into RA, UA and radial recurrent artery (11,12); or into UA, CIA and median artery (13). In our case, the right BA trifurcated into RA, UA and a recurrent muscular branch to brachialis muscle which has not been reported in literature so far.

The superficial course of the right BA over the bicipital aponeurosis as observed in our case, predisposes the artery to traumatic injuries in the cubital region leading to ischaemia of forearm which can be easily missed in presence of extensive collateral circulation (14). An intended intra-venous injection into the median cubital vein for blood sampling or



Figure 2: Showing Brachial artery (BA) medial to biceps brachii muscle (BB), passing deep to median cubital vein (MCV) and superficial to bicipital aponeurosis (bap). The median nerve (MN) is seen medial to BA. The MN & the branches of BA are seen passing deep to pronator teres muscle (PM).

drug/ dye introduction may invariably become intra-arterial leading to various complications like haemorrhage, thrombosis or gangrene leading to amputation of distal limb or digits (15,16). Such a superficially placed artery as in our case can be used as a feeding artery for a free flap from the medial arm skin and used for grafting purposes (17).

Variations in the origin and course of the radial artery (RA) has been described in literature (3,18). One case of high trifurcation of BA in the arm and the RA passing deep to PT has been reported (7) but in our case, the RA passed through the muscle and not deep to it. The entrapment of RA by PT could lead to improper perfusion of forearm and hand during all hand and forearm movements. Frequent muscular compressions of RA would ultimately lead to slow ischaemia of forearm and hand leading to weakness of grip, difficulty in palpating the right RA for pulse and misinterpretation of the angiographic picture.

The arteries of the upper limb develop from a capillary plexus by a proximal to distal differentiation involving enlargement and preservation of certain capillary vessels, and the regression of others (19). BA is established till the elbow by stage 17(11-14mm;41 day) of development and the forearm arteries start differentiating from stage 18 (13-17mm;44 day) and by stage 23 (56 day) the skeletal, neural and vascular elements achieve definitive morphology (20). Arterial variations in our case can be best explained on the basis of the theory, that the deviations from the normal pattern of differentiation and regression of certain vessels during stages 17 -23 of development has led to

BA trifurcating and coursing superficial to the developing mesenchyme (bicipital aponeurosis). Research of literature has described the development of the flexor muscles of the forearm from a single mesenchymal mass which ultimately differentiates into two masses, superficial and deep. These differentiate into corresponding flexors groups of forearm muscles (21). The entrapment of RA by PT (superficial flexor) is probably due to incomplete cleavage of the flexor muscle mass.

A very superficially placed brachial artery and an entrapped radial artery by the pronator teres muscle as observed in our case, is definitely an unique presentation and indeed should be kept in mind by the vascular surgeons, physicians, radiologists and interventionists to prevent iatrogenic, diagnostic, therapeutic and procedural accidents.

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