

The incidence of a superficial arterial pattern in the human upper extremities

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The incidence of superficial arteries was studied in 68 (38 right and 30 left) upper extremities. One right limb of an adult male presented a superficial arterial pattern (2.63%, total 1.47%) resembling a superficial brachio-ulno-radial artery (SBUR). The median nerve crossed the superficial brachial artery (SBA) from the posterior to the medial side and again posterior to the same at the cubital fossa. The superficial brachial artery divided into superficial radial and superficial ulnar arteries, which coursed distally superficial to the muscles but deep to the deep fascia. The superficial radial artery passed deep to the extensor tendons of the thumb. The superficial ulnar artery gave only muscular branches in the forearm. The superficial radial artery gave origin to the radial recurrent artery and the common interosseous trunk. The latter gave origin to a palmar type of median artery, muscular branches, and an artery that divided into anterior and posterior ulnar recurrent arteries. It also gave origin to the anterior and posterior interosseous arteries. The latter provided the interosseous recurrent artery and a branch that coursed towards the olecranon process of the ulna. The knowledge of this variation is important since it may be compromised in surgical procedures of the upper limb.

Key words: upper limb, superficial brachial artery, superficial radial artery, superficial ulnar artery, common interosseous artery

INTRODUCTION

The superficial arteries of the upper extremity may be mistaken for veins, thus becoming a basis for intra-arterial injections [4, 18]. They may also be encountered during elevation of the forearm flaps [5, 6, 8, 17] or misinterpreted in contrast radiographs [14]. These arteries may be superficial or deep to the deep fascia but run superficially to the muscles of the arm and forearm [16]. These superficial arteries include the superficial brachial (SBA), superficial brachio-radial, superficial brachio-ulnar, superficial brachio-ulno-radial (SBUR), superficial brachio-median, and superficial median and superficial radial arteries.

The superficial brachio-radial artery (the high origin of the radial artery coursing over the bra-

chio-radialis or extensor tendons of the thumb) co-exists with a brachial artery and branches into the radial and ulnar or ulnar and interosseous arteries, an anomaly which is rare [15]. Similarly, the superficial brachio-ulnar artery (the high origin of the ulnar artery) also co-exists with a superficial brachial or brachial artery. Superficial brachio-ulno-radial branches at the elbow into radial and ulnar arteries that course superficially to the forearm flexors. This pattern co-exists with the normal brachial artery with an incidence ranging from 0.14% to 1.3% [11]. The present study was planned to investigate the incidence, course, relations and branching pattern of the superficial arteries in the upper extremities.

MATERIAL AND METHODS

In the present study, 68 upper extremities (38 right and 30 left) were studied for the incidence of superficial arteries. During routine dissection observations were made for the presence or absence of any superficial arteries. If they were present, such cases were further dissected and studied in detail.

RESULTS

Of the 68 limbs observed, 1 right limb of an adult male presented a superficial arterial pattern (2.63%, total 1.47%) and this variation could be termed a SBUR. The brachial artery was superficial and in the cubital fossa, it was anterior to the bicipital tendon and the median nerve. The latter passed through a hiatus formed by the ulnar artery and the common interosseous trunk (CIT, *vide infra*) and reached the forearm, thence following a normal course. The superficial brachial artery gave origin to 6 branches (Fig. 1A). The first originated from the medial side 7.5 cm distal to the upper limit of the head of the humerus, supplying the triceps. The *profunda brachii* was a thin artery, which gave 2 muscular branches to the long head of the triceps brachii and continued as a single artery supplying the same muscle. The *profunda brachii* did not

give its terminal branches, the radial and middle collateral arteries. The 3rd and 4th branches were the superior ulnar collateral and inferior ulnar collateral arteries respectively. The latter originated from the lateral side of SBA and then coursed posteriorly to it to the medial side. Another 2 muscular branches originated from the lateral aspect of SBA (Fig. 1A). The superficial brachial then terminated in the radial and ulnar arteries, which were also superficial in the forearm (Fig. 1B).

The superficial ulnar artery gave origin only to muscular branches from the medial aspect and coursed superficially to the forearm flexors, dividing at the wrist into superficial and deep branches (Fig. 2). The superficial palmar arch gave origin to 3 common palmar digital branches. The 4th branch supplied the adjacent sides of the thumb and the index finger. The radial artery was also superficial, lying on the brachio-radialis, but passing distally deep to the extensor tendons of the thumb. The common interosseous trunk was a branch from the superficial radial artery originating 1 cm distal to the bifurcation of SBA (Fig. 2A). The common interosseous trunk coursed disto-medially and provided a muscular branch that supplied the *flexor pollicis longus*, while another branch supplied the *flexor carpi ul-*

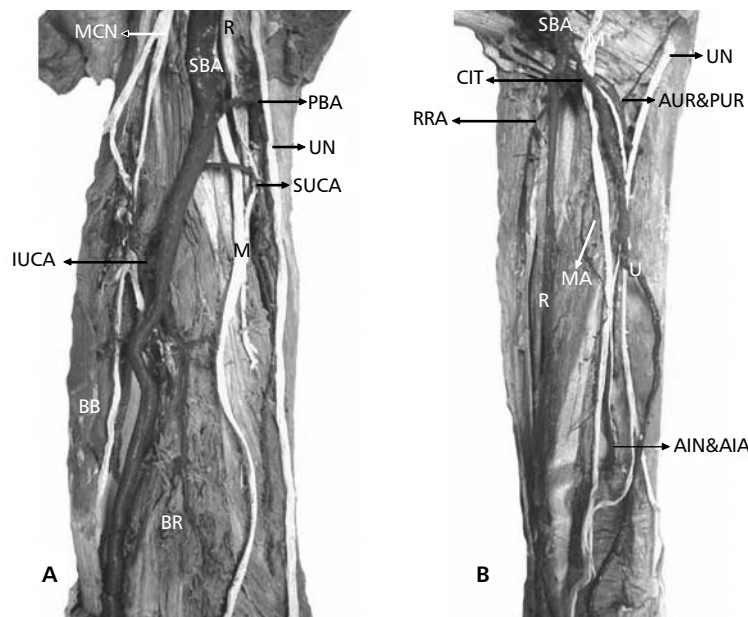


Figure 1 A. The superficial brachial artery (SBA) and its branches. The median nerve (M) has been pulled medially to expose the branches of the SBA. The *profunda brachii* (PBA) was a thin artery. Superior ulnar collateral (SUCA) originated from the SBA considerably below the origin of the PBA. The inferior ulnar collateral artery (IUCA) originated from the lateral aspect of the SBA and then crossed posterior to the same. Other muscular branches are seen in the photograph. The ulnar nerve (UN), the radial nerve (R), the median nerve (M), the musculocutaneous nerve (MCN) and the muscles biceps brachii (BB) and brachialis (BR) are indicated. **B.** Photograph of forearm showing the superficial radial (R) and superficial ulnar (U) arteries. The R gave origin to the common interosseous trunk (CIT) and radial recurrent artery (RRA). The CIT gave origin to the palmar type of median artery (MA), anterior interosseous artery (AIA), and a common stem dividing into anterior (AUR) and posterior (PUR) ulnar recurrent arteries. The median nerve (M), the ulnar nerve (UN) and anterior interosseous nerve (AIN) are indicated.

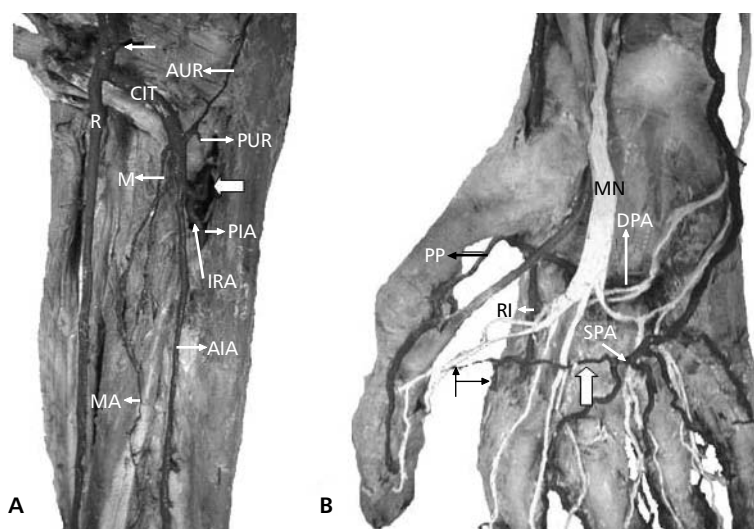


Figure 2 A. Photograph of forearm showing the superficial radial artery (R) and common interosseous trunk (CIT). Note that the ulnar artery has been removed (arrow) to view the CIT and its branches. The CIT gave a branch that divided into anterior (AUR) and posterior (PUR) ulnar recurrent arteries. The posterior interosseous artery (PIA) coursed to the posterior compartment. It gave a branch (open arrow), which coursed towards the olecranon process. The interosseous recurrent artery (IRA) originated slightly distal to that of the former and coursed towards the medial epicondyle. The muscular branch (M), the median artery (MA), and the anterior interosseous artery (AIA) are indicated. **B.** Photograph of the hand showing superficial (SPA) and deep (DPA) palmar arterial arches. The SPA was incomplete and continued (open arrow) laterally over the *radialis indicis* (RI) and divided into two branches (arrows) to supply the thumb and index finger. The superficial radial artery (RA) gave origin to the *princeps pollicis* (PP) and RI separately. The superficial ulnar artery is indicated (UA).

naris. The median artery originated from CIT and accompanied the median nerve up to the wrist (palmar type). Another branch originated from the proximal aspect of CIT, which immediately divided into 2 branches recurring towards the medial epicondyle (ulnar recurrent arteries). The superficial ulnar artery passed through a gap between these 2 ulnar recurrent arteries. The common interosseous trunk then terminated in the anterior and posterior interosseous arteries. The latter gave origin to 1 branch which wound around the ulna and reached the olecranon process. The interosseous recurrent artery also had its origin slightly distal to the origin of the former and coursed towards the lateral epicondyle (Fig. 2A). The superficial radial artery then continued distally and formed the deep palmar arch. There was no superficial branch of the radial and hence the superficial palmar arch was incomplete (Fig. 2B). One branch originated from the deep branch of the superficial radial artery and supplied the thumb. The superficial radial artery also gave the *arteria princeps pollicis* and *arteria radialis indicis* in the first inter-metacarpal space, supplying the thumb and the index finger respectively (Fig. 2B). A branch from the superficial palmar arch coursed laterally across the *arteria radialis indicis* and divided into 2 branches to supply the thumb and the index finger (Fig. 2B).

DISCUSSION

The arterial variation observed in 1 right limb (2.63%) out of a total of 68 limbs (1.47%) examined could be termed a SBUR, although there are qualifications to be made, since it differs from a typical SBUR as defined in earlier studies [9, 16]. The incidence of SBUR reported by previous researchers ranges from 0.14–1.3% (Table 1) and the incidence observed in the present study is comparable. In the present case the axillary artery continued as SBUR, unlike its usual formation as a branch of the former [15]. A normal brachial artery usually accompanies SBUR [15], although this was not observed in the present case. The brachial part of this variation could be compared to a SBA but there were differences. Firstly, the *profunda brachii* was very thin compared to its normal counterpart and, secondly, the distally located origin of the superior ulnar collateral artery was in contrast to its site of origin in normal conditions [7]. The absence of terminal branches of the *profunda brachii* is in agreement with the previous report on SBA [9]. However, the variations in SBA observed in this case contrast with the observations that SBA does not show any further variations [16].

The radial artery was superficial only at its proximal part and then coursed deep to the extensor ten-

Table 1. Incidence of variations in upper limb arteries related to the present study

Reference number	Superficial brachial artery	Superficial radial artery	Superficial ulnar artery	Median artery-palmar type	Superficial brachio-ulno-radial artery
1	(13–25%)	–	–		–
12	–	–	–	(1.5–50%)	
13	1%	18.4%	5%		–
14	9.4%	0.52%	5.2%		1.04%
15	4.9% (3.6–9.6%)	0.52%	–		0.5% (0.14–1.3%)
16	4.8%	0.4%	–	12%	0.6%
19	–	1%	–		–
Present study	–	–	–		1.47%

Numbers in parentheses indicate the incidences referred to by the authors in their publications.

dons of the thumb, hence differing from a typical SRA [15]. Moreover, it showed further differences by giving off CIT and radial recurrent artery from its medial side, which then crossed it superficially. In around 41% of SRAs, an anastomosis has generally been observed with other arteries at the elbow [13], although that was absent in this case. The common interosseous trunk could be a branch of any artery of the forearm [2, 3], although in this case it originated from SRA as a thick branch. When the variation is a SBUR, CIT is formed as a continuation of the co-existing normal brachial artery [15]. The common interosseous artery taking its origin from a high radial artery or, very rarely, from the normal radial artery has been reported [2, 3]. The origin and course of the radial recurrent artery and the origin of a palmar type of median artery from CIT were other differences from the previous reports on this vessel [2]. The palmar type of median artery has been found to be present in around 12% of cases as a branch of any one of the forearm arteries [12] and in around 1% of the cases it was superficial [10]. An additional branch of the posterior interosseous artery coursing towards the olecranon process has not been mentioned in previous reports [2]. This branch might have taken part in the anastomosis around the elbow joint. The arteries of the hand also differed from the normal pattern [7]. The continuation of a superficial arch laterally to supply the thumb and the index finger was another interesting observation associated with SBUR.

The mechanisms of development of this arterial variation are unknown. It may be that when the arteries of the upper limb develop during stages 12–23 [14] of human embryogenesis, some alter-

tations in enlargement, differentiation and the haemodynamics of capillaries result in SBUR. This case is, however, clinically important since the superficial arteries are vulnerable to trauma and intra-arterial injections. Moreover, accurate knowledge of this type of arterial variation is important in reparative surgery of the upper limb.

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