



## Superficial Brachial artery - Clinical significance in Median nerve entrapment

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### Abstract-

The presence of the Superficial Brachial Artery is not uncommon. Varied incidence, origin, course and termination are described in the literature. Attempts are made to co-relate with embryology and to classify this variation into different categories. The present case report describes coexisting anatomical variations in the neurovascular topography within the axillary fossa and arm. The presence of the Superficial Brachial Artery originating from the second part of the axillary artery was observed. Atypical common stem for the Anterior Circumflex Humeral Artery, Posterior Circumflex Humeral Artery and Profunda brachii was also found. The presence of SBA can cause median nerve entrapment and result in the neuropathy. Being superficial, it is vulnerable to the trauma and can be mistaken for vein in various clinical procedures. Hence variations of the brachial plexus and median nerve relationships with the axillary and brachial artery like SBA are significant to anatomists, radiologists, anaesthetists and surgeons.

**Key Words:** - Superficial Brachial Artery, Axillary artery, Brachial artery, brachial plexus, Median nerve, Profunda brachii artery, Median nerve entrapment

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### Introduction

In the upper limb arterial tree, axillary artery continues as brachial artery from the lower border of Teres major muscle. Normally the median nerve occupies an anterolateral position to the brachial artery at its proximal aspect, whereas the medial cutaneous nerve of the forearm and the ulnar nerve occupy a medial position to the artery proximally [1].

When the brachial artery is superficial to the median nerve it is called as Superficial Brachial Artery (SBA) [2, 3]. Adachi first defined the superficial brachial artery (SBA) as the brachial artery that runs over the surface of the median nerve (MN) [4]. Presence of SBA is not uncommon when reviewed literature. The incidence reported varies from 1% to 25% [5].

The presence of SBA holds great clinical significance. SBA is vulnerable to injury being superficial in its course [6]. Accidental intra-arterial injections can cause thrombosis or gangrene. SBA can be source for feeding artery to a free flap from medial arm skin [7]. Although there are many forms of SBA anomalies, all are closely related to the MN. The

SBA can occasionally cause MN compression and resultant symptoms, and this condition usually requires surgery [8].

The presented report describes coexisting anatomical variations in the neurovascular topography within the axillary fossa and arm. In this case, the second part of axillary artery divided into two equivalent trunks and one of the trunks continued as Superficial Brachial artery. Median nerve roots were found one above and below to the point of division of second part of axillary artery which can lead to median nerve compression. Variations of brachial plexus and median nerve relationship with the axillary and brachial artery may be important to anatomists, radiologists, anaesthetists, and surgeons [9].

### **Case Report**

In the routine anatomical dissection of a 30 years old male cadaver, we found a deviation in the branching pattern of axillary artery. Axillary artery continued as subclavian artery from the outer border of first rib. We found superior thoracic artery arising from the first part of the axillary artery. To our surprise, the second part of axillary artery was divided into two equivalent arterial trunks. In between these two trunks, roots of median nerve were observed arising above and below the point of origin of the two trunks.

One of the arterial trunks was common stem for Subscapular artery, Posterior Circumflex Humeral Artery (PCHA), Anterior Circumflex Humeral Artery (ACHA) and Profunda Brachii Artery. PCHA accompanied the axillary nerve along its course and entered the quadrangular intermuscular space.

Another arterial trunk was Superficial Brachial Artery (SBA). SBA traversed through arm without giving any branches and divided into two terminal branches ulnar artery and radial artery in the cubital fossa. Rest of the arterial tree in forearm and hand was normal.

### **Case Discussion**

The presence of Superficial Brachial Artery [SBA] is not uncommon but the varied origin and division of SBA is mentioned in the literature. In present case, SBA originated from the second part of axillary artery. Mc Cormack [2] et al in their study found 7 cases of SBA out of which in only one case SBA originated from the axillary artery while in remaining six cases it originated from the brachial artery.

In our case the two trunks from the second part of the axillary artery had completely replaced brachial artery. One of the trunks was SBA while other trunk served as common stem for arteries supplying axilla and arm. Our case is similar to case reported by author De Garis et al [10] and Author Edward Clarke et al. [11]. Author David Kachlik [12] in case series of SBA reported a case where instead of bifurcation, trifurcation of axillary artery is found where in axillary artery trifurcated into SBA, Posterior circumflex humeral artery and subscapular artery.

In literature, few cases reported SBA along with rudimentary brachial artery. This rudimentary brachial artery terminated in one of the brachial artery branch. Author Yoshinaga reported one such case of SBA where rudimentary brachial artery terminated as Inferior ulnar collateral artery [13]. This rudimentary brachial artery terminating into Profunda brachii and Superior ulnar collateral artery have also been mentioned in few reported cases [14]. Author Adachi had stressed on the presence of the rudimentary brachial artery and said that sometimes this artery is very small hence can be neglected and special attention to be made to reveal it [4].

In present case report, the Posterior Circumflex Humeral Artery [PCHA] originated from another trunk arising from the second part of the axillary artery. Some authors described the presence of SBA along with deep brachial artery where deep brachial artery was the source of origin of PCHA and other arteries of axilla and arm [10,15,16].

Author Hee-Jun Yang et al [17] in their study classified SBA into three categories –

Category –I –

Type Ia: the SBA emerged proximal to the stem of the sub scapular artery, anterior humeral circumflex artery, and posterior humeral circumflex artery.

Type Ib: the SBA emerged from the axillary artery distal to the stem of the subscapular artery, proximal to the stems of the humeral circumflex arteries. In this type, the subscapular artery arose from the second part of the axillary artery, not third.

Type Ic: the SBA emerged after the direct appearance of the thoracodorsal artery from the second part of the axillary artery.

Type II: SBA was found on seven sides. This artery continued as the radial artery.

Type III: the slender superficial brachial artery supplied the arm musculature and ended in the arm

As per this classification, the present case report can be categorized into Type Ia.

Fuss et al. [18] divided the SBA into three subtypes, SBA superior, SBA media, and SBA inferior, as per its relation with the median nerve. The SBA superior rises between the medial cord and lateral cord of the brachial plexus or rises medially to these cords. The SBA media rises between the medial cord and lateral cord of the brachial plexus in which the median nerve forms more distally than normal ones. The SBA inferior rises medially to the median nerve. As per this classification, present case SBA can be described as SBA superior. It arose between medial and lateral cord and passed medial to these cords.

Adachi [4] classified SBA into two types Medial SBA and Lateral SBA depending on its relation to the medial cord of brachial plexus.

In the present case, SBA terminated in the cubital fossa by dividing into radial and ulnar artery. Authors Sennayake et al [19], Dartnel et al [20] and Shilpa [21] reported termination of SBA as ulnar artery only while author Nakatani T [22] reported a case of SBA terminating as Common interosseus artery.

When tried to correlate the SBA variation embryologically, the Axillary artery and its branches are derived from the axial artery, being a distal continuation of the seventh intersegmental artery on both sides of the body [12]. Every vascular variation can be traced back to an embryological origin. The arterial system of the upper limb develops as a capillary network at Day 26 which pierces the condensed nervous tissue within future axilla at Day 28 – the circulatory system of the bud can be characterized as a capillary network. On Day 50, the SBA is defined and on Day 52, the entire limb acquires a mature appearance.

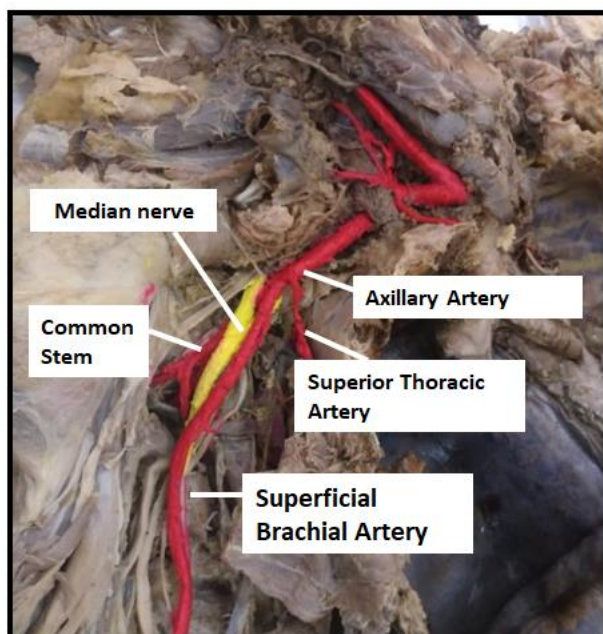
Arey [23] and Jurjus [24] mentioned explanations to the variations as it can be the choice of unusual paths in the primitive vascular plexus or the persistence of vessels which are normally obliterated or the disappearance of vessels which are normally retained the fusion and absorption of parts which are normally distinct. Manners Smith [25] opined that many of the variations which are noted in man, represent a retention or the reappearance of primitive patterns and this is in consonance with the view that ontogeny repeats phylogeny.

The knowledge of SBA is clinically important. SBA can be source for feeding artery to a free flap from medial arm skin [7]. SBA being superficial is more prone to trauma. If by mistake any intra-arterial injections or drugs are given, it can lead to gangrene. Being superficial in course SBA can be mistaken for vein in some clinical procedures [6,7].

The presence of SBA may be a potential cause of Median nerve (MN) compression. This may help to explain the cause of idiopathic MN neuropathies. As per author Liu et al [26] the SBA can impinge on the median nerve. The pulsatile pressure can be applied to the nerve trunk. This may trigger ectopic stimulation of sensory fibers, leading to severe pain, sensory neuropathy, and motor disturbance. This can cause symptoms like numbness and pain of the thumb, middle finger, and index finger as well as can lead to the atrophy of the opponens pollicis muscle [22, 26].

## Conclusion

Presence of SBA holds great clinical significance. Considering its superficial course and vulnerability to trauma or damage in clinical procedures and association with brachial plexus, the knowledge of this variation is must for anatomists, radiologists, anaesthetists and surgeons.



[Figure showing origin of SBA from the second part of Axillary artery and median nerve between the two arterial trunks]

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