

# Anomalous superficial palmar arch: a cadaveric study with clinical implications

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## Abstract

**Introduction:** The superficial palmar arch (SPA) is mainly formed by the ulnar artery with some contribution from the radial artery. As the name suggests, the SPA is arch shaped, but variation in its shape is not uncommon.

**Material and methods:** The pattern of the SPA was observed on both sides of 25 upper limbs (n=50) of human cadavers in the Department of Anatomy.

**Results:** We observed anomalous SPA in a single specimen. The SPA crossed superficial to the flexor retinaculum of the hand and, at a distance of approximately 2.5 cm from the flexor retinaculum, instead of taking an arched course, it traversed a straight course towards the digits. It gave off only two common palmar digital branches instead of the normal three digital branches. These two branches supplied the region between the third and fourth and the fourth and fifth digits respectively. The blood supply to the rest of the digits was from the branches of the radial artery. The radial artery did not give a superficial palmar branch to complete the superficial palmar arch.

**Conclusions:** A knowledge of vascular anatomy and its pattern may be useful for graft surgeries, especially when the arteries of the upper limb are harvested for coronary artery grafts. Abnormal architecture of the palmar arch may be important for hand surgeons performing superficial dissections and the radiologists performing the angiographic procedures.

**Key words:** superficial, palmar, arch, artery, palm, variation, anomaly.

## Introduction

Usually the ulnar artery begins at the neck of the radius as one of the terminal branches of the brachial artery, traverses a course deep to the antebrachial flexor muscles and passes superficial to the flexor retinaculum of the hand. The ulnar and radial arteries contribute mainly to the formation of the SPA and the deep palmar arch (DPA) respectively. Any variation in the vascular supply may have important clinical implications.

The anastomosis between the ulnar and the radial arteries is important for maintaining adequate blood supply to the palm and its digits. The arterial supply to the hand has been well documented in various research studies [1-4]. Variations of the SPA are not uncommon and past research studies have described such variations of SPA in detail [5-7]. As long as there is an effective anastomosis of the radial and the ulnar arteries,



**Figure 1.** Comparison of normal and abnormal superficial palmar arch in plastinated specimens. A – photograph of right dissected palm with normal superficial palmar arch showing: U – ulnar artery, 1 and 2 – two branches from the arch. A third branch arose while the arch was completed. The arch is shown with multiple arrows. B – photograph of left dissected palm with abnormal superficial palmar arch showing: U – ulnar artery, 1 and 2 – two branches from the arch. The arch is characteristically absent and the straight course of ulnar artery is observed



**Figure 2.** Photograph of left dissected palm with abnormal superficial palmar arch (same as in Figure 1B) showing: U – ulnar artery, 1 and 2 – two branches from the arch. The straight course of the artery is marked with a long arrow

grafting operations may be performed easily, but in the presence of inadequate anastomosis the harvesting of grafts may be difficult, thereby posing a challenge to the surgeons.

Numerous anomalies pertaining to the ulnar artery have been described in the literature, i.e. duplication, higher origin or even its total absence [8-11]. In the present study, we describe an anomalous SPA which was not arched but instead the ulnar artery traversed a straight course to give branches to the fourth and fifth digits.

Although variations of this type have been reported in the past, we did not observe any associated anomalies such as higher bifurcation of

the brachial artery, early bifurcation of the median nerve or absence of the palmaris longus muscle concurrently in a case of anomalous SPA, as documented by previous research workers [8, 10, 12]. The present study reports an isolated case of variation in the pattern of SPA with only two palmar branches and discusses its clinical implications.

## Material and methods

Over a span of three years, both sides of twenty-five human cadavers (n=50) were dissected in the Department of Anatomy, Maulana Azad Medical College, New Delhi and the Department of Anatomy, Universiti Kebangsaan Malaysia, to observe any anomalous pattern of SPA. The SPA was carefully dissected in all the specimens and its relations and topographical anatomy were studied in detail. Appropriate photographs were taken (Figures 1, 2).

## Results

We observed the anomalous pattern of SPA only in the left palm of a male cadaver (2%). No history of the individual could be obtained. The SPA crossed superficial to the flexor retinaculum of the hand and, at a distance of approximately 2.5 cm from the flexor retinaculum, instead of taking an arched course, it traversed a straight course towards the digits. Interestingly, it gave off only two common palmar digital branches ('1' and '2' in Figure 1) instead of the normal three digital branches. These two branches supplied the region between the third and fourth and the fourth and fifth digits respectively. The blood supply to the rest of the digits was from the branches of the radial artery. The radial artery did not give a superficial palmar branch to complete the superficial palmar arch. Thus the normal arched pattern of the SPA was not observed in this case. No other associated anomalies were observed.

## Discussion

Textbooks of anatomy describe the fact that in about one third of cases the SPA is formed by the ulnar artery alone, in a further third of cases it is completed by the superficial palmar branch of the radial artery, and in the remaining one third of cases by the arteria radialis indicis, which is usually a branch of the arteria princeps pollicis or the median artery [4]. Three common palmar digital arteries arise from the convexity of the SPA distally on the 2<sup>nd</sup>-4<sup>th</sup> lumbrical muscles and each is joined by the palmar metacarpal artery (branches from the deep palmar arch) and divides into two proper palmar digital arteries which traverse the contiguous sides of four fingers [4]. Interestingly, in the anomalous SPA, we did not observe it to exhibit any arched pattern and there were only two common palmar digital arteries

(labelled as 1, 2 in Figures 1, 2) originating from it instead of the normal three. The fourth and the fifth digit received blood supply from the branches of SPA, with the other digits receiving their blood supply from the deep palmar arch. The ulnar artery instead of completing the arch pattern of the SPA simply branched into two common palmar digital branches. A similar case was reported earlier in which the authors observed a median artery, ulnar artery giving only two branches and absence of the 1<sup>st</sup> palmar metacarpal artery, but in the present case we observed an anomalous SPA with two palmar digital branches [13]. This is a rare variation which may have immense clinical importance.

The SPA is known to exhibit variations, and in 2.5% of cases it may be absent in individuals [9, 14]. We have observed an anomalous SPA in 2% of cases, which is very similar to past studies. There was a similar study on the absence of superficial palmar arch with associated anomaly of the ulnar artery, i.e. ulnar artery passing deep to the flexor retinaculum, but such associated anomalies were not observed in the present study [15]. A common associated anomaly described in the literature is absence of the palmaris longus muscle with an anomalous SPA, but we did not observe any absence of palmaris longus [12].

Hand surgeons should be aware of the normal anatomy of all palmar digital vessels and nerves. Often, a longitudinal incision is made by the surgeon in order to expose the flexor sheaths. Any inadvertent injury to an anomalous arrangement of blood vessels may prove to be fatal.

During radial artery cannulation the two major complications which have to be looked into are thromboembolic events and inadequate palmar collateral circulation, which may give rise to ischaemia [16]. The permeability of many palmar arches is visualized by Doppler ultrasound [16]. Thus, proper anatomical knowledge of the blood vessels may also be beneficial to radiologists.

In conclusion, the present study was a humble attempt to highlight the anomalous pattern of the SPA which may be important for surgeons, clinicians and academicians in day-to-day practice.

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