**Abstract:** In this article we describe a rare variation in the superficial palmar arch (SPA) encountered during routine cadaveric dissection. SPA was formed by the superficial branches of ulnar and radial arteries which provided a proper digital branch to the ulnar side of the little finger and three common palmar digital branches to the medial four digits. Additionally, a first common digital artery was seen to emerge from the radial side of SPA which further divided into the arteria princeps pollicis and arteria radialis indicis. We also found a small communicating branch between the arteria princeps pollicis and the radial artery in the anatomical snuff box. Such arterial variations in the palm due to alteration in the developmental sequence remains a crucial issue in the reconstructive hand surgeries, especially while dealing with the innovative microsurgical procedures, where these varied patterns act as pivotal points around which successful results of various advanced surgical procedures revolve.

**Key Words:** Superficial palmar arch, Radial artery, Ulnar artery, Common digital artery, communicating branch

**Introduction:**

The human hand is highly evolved and has very complex vascular pattern comprising the superficial and deep palmar arches. Superficial palmar arch (SPA), mainly formed by the superficial branch of the ulnar artery, and on the radial side this arterial arcade is completed by the one of the branches of radial artery: superficial palmar branch/arteria princeps pollicis/arteria radialis indicis or by the persistent median artery. In a classical pattern, SPA gives rise to one proper digital artery to the medial side of the little finger and three common digital branches, which further divides in the web space between second, third and fourth figures and gives the proper palmar digital branches to the adjacent sides of medial four fingers. However, there has been ample number of variations in the vascular pattern of the hand as reported earlier. Accordingly, SPA can be classified into complete and incomplete arch. The complete arch is formed mainly by the radial artery in communication with either the ulnar artery, median artery, or both by the ulnar and the median artery. In an incomplete pattern, the arch can be formed by the radial artery alone, radial and the ulnar artery or, by the radial/ulnar and the median artery altogether. In most cases of the anomalous SPA, the variation was seen more on the radial side than on the ulnar side. Variations like superficial palmar branch of the radial artery passing deep to the flexor retinaculum to form the SPA(3), absence of the SPA(4), incomplete development of the SPA (5) and presence of double SPA of the mediano-ulnar variant without superficial palmar branch of radial artery (6) have been reported. Such arterial variations are mainly due to impaired enlargement and/or regression of the embryological capillary network during the development. Such variations are of interest to the surgeons dealing with any reconstructive hand surgeries. Here, in this report, we are documenting an unusual and unreported branching pattern of SPA and its communication with the radial artery in the anatomical snuff box.

**Case Report**

The present unilateral arterial variation in the SPA was noted during the routine dissection of the right hand in the adult female cadaver, in the Department of Anatomy, Kasturba Medical College, Manipal. The SPA was formed by the superficial branch of the ulnar artery and completed by the superficial branch of the radial artery in the radial side. Both these contributors of the SPA were found to enter the palm superficial to the flexor retinaculum. The SPA further provided one proper palmar digital artery and four (instead of three) common palmar digital arteries. The proper digital artery was the most medial branch from the SPA and was...
supplying the ulnar side of the little finger, where as the medial three common palmar digital arteries further divided into proper palmar digital arteries in the corresponding interdigital space to supply the respective sides of the lateral four fingers. Interestingly, an unusual first common palmar digital artery was observed as the most lateral branch from the SPA. The artery had a short course in the palm before it divided into arteria radialis indicis to the radial side of the index finger and the arteria princeps pollicis to the thumb near the first web space (Figure 1).

Figure 1: Dissection of the right palm showing the superficial palmar arch which is formed by the superficial branch (SB) of the ulnar artery (UA) and superficial palmar branch (SPB) of the radial artery (RA). From this arterial arch, four common palmar digital arteries (CDA) and one proper palmar digital artery (PDA) was arising. The first common palmar digital artery further divided into arteria princeps pollicis (APP) and arteria radialis indicis (ARI). A small communicating branch (CB) was connecting the arteria princeps pollicis to the radial artery in the anatomical snuff box.

These two arteries usually arise from the radial artery in the dorsum of the hand. Additionally, just distal to the bifurcation of the 1st common digital artery, a communicating branch was found to emerge from the arteria princeps pollicis. This communicating artery after passing through the first web space entered the dorsum of the hand and then communicated with the radial artery in the anatomical snuff box (Figure 2). Normally, the arteria princeps pollicis is considered as the principal artery of the thumb and will be in larger in size. However, in the present case, it was very thin and surprisingly no other supplementary arteries were found supplying the thumb. A schematic representation of the above mentioned variation is depicted in Figure 3. The arterial pattern in the left hand was found to be normal.

Figure 2: The radial artery (RA) in the anatomical snuff box providing a communicating branch (CB) which runs through the first web space to join the arteria princeps pollicis (APP) in the palm. The arteria princeps pollicis (APP) and the arteria radialis indicis (ARI) were arising from the first common palmar digital artery (1st CDA) of the superficial palmar arch. EPL: Extensor pollicis longus, APL & EPB: Abductor pollicis longus & Extensor pollicis brevis, CV: Cephalic vein.

Discussion

Earlier, in a comprehensive study on the arterial pattern of 750 hands, no incidences of the arteria princeps pollicis and arteria radialis indicis arising from the superficial palmar arch was found.(9) However, Erbil et al has described five cases of SPA providing the blood supply to the thumb and index fingers through the princeps pollicis and radialis indicis arteries.(10) Studies have also shown that the SPA had no contribution from the radial artery and terminated by giving rise to a common trunk for the princeps pollicis and radialis indicis arteries. Thus the thumb was solely supplied by the branches of the SPA which was from the ulnar artery.(11,12) In 2009, Bataineh and his co-workers found several variations in the SPA such as a) the large superficial branch of the radial artery completing the SPA, b) the princeps pollicis and radialis indicis arteries arising from the common palmar digital artery to the second web space c) the SPA, formed mainly by the ulnar artery and completed by a small twig from the deep branch of the radial artery d) common trunk for the palmar digital artery to the ulnar side of the little finger and the common palmar digital artery to the fourth web space e) incomplete SPA, formed medially by the median artery which gave rise to the princeps pollicis and radialis indicis arteries, while lateral half was formed by the ulnar artery.(13) According to Ikeda et al, the artery arising from the SPA to
supply the first web space can be called as the first common palmar digital artery.(14) Another recent study also observed the following variations associated with the SPA: (a) incomplete SPA formed by the ulnar and the radial artery individually (b) the superficial palmar branch of the radial artery running over the thenar muscles terminating in to two palmar digital arteries which supply adjacent sides of the thumb and index finger (c) ulnar side of the thumb supplied by a branch arising from the deep branch of the radial artery (d) the superficial palmar branch of the ulnar artery providing a proper palmar digital branch to ulnar side of the little finger, and two common palmar digital arteries for the medial three fingers.(15)

Even though, there are many reports to show the variations in the origin of the arteries princeps pollicis and arteria radialis indicis and the presence of the first common digital artery from the SPA as the presence of many unreported variations. Here, a complete SPA is formed as mentioned in the classical text books, by the superficial branch of the ulnar artery and the superficial palmar branch of the radial artery. The origin of an additional common digital artery from the complete SPA to the first web space which further divides into arteria radialis indicis and arteria princeps pollicis has not been reported earlier. In addition, in the same hand, existence of a communicating artery between the arteria princeps pollicis and the radial artery in the anatomical snuff box and the absence of any other branches arising from the radial artery in the dorsal of the hand are also new findings in the present observation.

SPA is an arterial anastomosis mainly fed by the ulnar artery. Usually, SPA is completed by the small branches of the radial artery or by the median artery thus believed to contribute very little blood flow to the arch in comparison to the superficial branch of the ulnar artery. Therefore, in case of the ulnar artery occlusion, severity of the ischemic effect on the structures of palm will be depending on the competency in the collateral circulation of the SPA. However, in the preset case, interestingly, both the ulnar and the radial contributions to the SPA seem to be equal as seen by the size of these two arteries.

Therefore, such architecture of the SPA may favor the ample blood flow through the arch in case of occlusion of the either arteries and may fairly maintain the metabolic demands of the palmar tissue, thus preventing the complication like acute ischemia.

The SPA is an important vascular entity for most of the surgical procedures and traumatic events in the hand. Several techniques such as Doppler ultrasound, the modified Allen test, pulse oximetry and arterial angiography can be helpful to identify the unusual vessels in the hand. The knowledge of such arterial variations in the hand is very important and may help to surface mark the superficial palmar arch based on the correlation of size-matched angiograms to fixed landmarks in the hand, (16) during procedures like thumb reconstruction using the radial mid-palmar island flap, (17) treating the digital ischemia, false aneurysm of SPA, while using the Kaplan's Cardinal Line as a Surface Marker for the SPA (18), while using the free or reversed pedicled palmar fasciocutaneous flap for volar hand reconstruction (19), during reverse mid-palmar island flap transfer for fingertip reconstruction (20), during microsurgical peripheral arterial bypass reconstructions to treat the ischemia in case of systemic sclerosis.(21)

References