

## Incomplete Superficial Palmar Arch: A case report

Prakash Billakanti Babu

### ABSTRACT

Superficial palmar arch is an arterial arch and a dominant vascular structure of the palm. It is defined as the anastomosis between the superficial branch of the ulnar artery and superficial palmar branch of the radial artery. Arteria radialis indicis (ARI) and arteria princeps pollicis (APP) are often the branches of radial artery after it passes on the dorsal aspect of the carpus. The author here reports a unique variation in the right hand of an adult male cadaver, in which superficial palmar arch is alone formed by superficial branch of ulnar artery and giving origin to arteria radialis indicis and arteria princeps pollicis. In hand surgeries like vascular graft applications, arterial repairs, free and/or pedicled flaps, clinicians should be aware of these variations.

**Keywords:** arteria princeps pollicis, radialis indicis, superficial palmar arch

### INTRODUCTION

The general pattern of arterial supply of the hand consists of two systems for the palmar aspect, superficial palmar arch (SPA) and deep palmar arch (DPA) and a single system for the dorsal aspect - the dorsal carpal arch. The anastomosis between radial and ulnar arteries through superficial and deep palmar arches in the palm plays a significant role through collateral circulation in some diseases of the palm. The SPA is a dominant vascular structure of the palm. It is located just deep to palmar aponeurosis and superficial to digital branches of the median nerve, long flexor tendons of the forearm and lumbricals of the palm.<sup>1</sup> The SPA is formed by superficial branch of ulnar artery passing superficial to flexor retinaculum and then curving laterally to form an arch, lying just deep to palmar aponeurosis. About one third of the superficial palmar arch is formed by ulnar artery alone; the second third by superficial palmar branch of radial artery (RA) and the remaining third by arteria radialis indicis (ARI), a branch of either arteria princeps pollicis (APP) or the median artery.<sup>2</sup> From the convexity of SPA three common palmar digital arteries arise and each one divides into two proper palmar digital arteries. These run along the contiguous sides of all four medial fingers (except the radial side of the index and ulnar side of the little fingers) to supply them. The palmar digital artery for the ulnar side of the little

finger leaves the arch under the cover of palmaris brevis muscle. The radial side of the index finger is supplied by ARI and the thumb by APP both of these are branches of radial artery.<sup>2</sup> An incomplete SPA has an absence of communication or anastomosis between the vessels constituting the SPA.<sup>3</sup> As SPA is the principal vascular structure of the palm, the knowledge about its possible variations has gained more importance in microsurgical techniques, reconstructive hand surgeries and those concerned with restoration of the functional anatomy of the hand. The following case report highlights one such variation of SPA.

### CASE REPORT

During routine dissection of upper limb in an adult male cadaver on the right side, a unique variation in the formation of superficial palmar arch was observed. SPA was formed exclusively by superficial branch of the ulnar artery, without the contribution from any other vessel. Ulnar artery entered the palm by coursing in front of flexor retinaculum, just distal to the retinaculum it gave a deep branch and continued as SPA. It was an incomplete arch, occupying almost normal position but it supplied palmar aspect of all the fingers. It gave a digital branch to the ulnar side of little finger, second, third and fourth common palmar digital arteries which divided into digital branches to supply the second, third and fourth inter digital spaces and then continued as the first common palmar digital artery to the interdigital

cleft between index finger and the thumb, and this digital artery was dividing into APP and ARI (Fig. 1). The superficial palmar branch of radial artery (SPRA) was small and terminated by nourishing the thenar muscles without any contribution to the SPA. The only major communication between radial artery and deep branch of ulnar artery was completion of deep palmar arch which is the major route for collateral circulation.

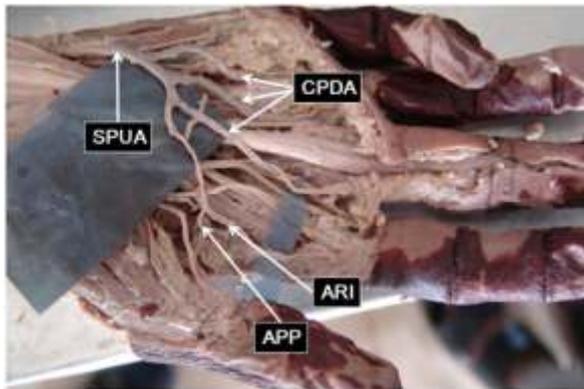


Fig.1. Photograph showing formation of superficial palmar arch by the superficial branch of ulnar artery only.

SPUA : Superficial palmar branch of ulnar artery  
 ARI : Arteria radialis indicis  
 APP : Arteria princeps pollicis  
 CPDA : Common palmar digital arteries

## DISCUSSION

The SPA is a dominant vascular structure of the palm but anatomical variations in the formation of superficial palmar arch are not uncommon and are numerous and well documented. Gellman et al., classified the SPA into two categories as complete and incomplete.<sup>3</sup> In case of complete arch there will be an anastomosis between vessels constituting it, which is absent in incomplete arch. The reported frequency of incomplete arch varies: Ikeda (3.6%), Coleman and Anson (21.5%), and Janevski et al. (25%).<sup>4,5,6</sup> SPA

formed by ulnar artery only (ulnar dominance) was reported by Jelcic et al. 10%, Ikeda et al. 25.5%, and Coleman and Anson 37%.<sup>4,5,7</sup> Tagil et al. observed that the most consistent incomplete form was the ulnar artery alone forming SPA which was seen in 20% of subjects.<sup>8</sup>

Mc Cormack et al. in their comprehensive study on the arterial pattern of 750 hands did not find the origin of the APP and ARI arteries from the superficial palmar arch.<sup>9</sup> Erbil et al. have in their study mentioned that "Five cases are described where the first webs pace of the hand received arteries only from the superficial palmar arch."<sup>10</sup> None of these branches was large enough to deserve the name princeps pollicis artery. Gajisin and Zbrodowski did not refer to many branches from the SPA supplying the first web space out of 200 specimens study.<sup>1</sup> They did not mention the nomenclature of APP and ARI to the arteries supplying thumb and index fingers, if they were not from the deep palmar arch. There is a report of SPRA of the radial artery terminating in the thenar muscles without any contribution to the SPA.<sup>11</sup> Turk and Metcalf found that in addition to the common palmar digital arteries to the II, III and IV<sup>th</sup> interdigital spaces, they found a branch from the SPA supplying the ulnar side of the thumb and the radial side of the index finger and they named it as the first common metacarpal artery.<sup>12</sup> The nomenclatures of the arteries originating from SPA supplying the thumb and index fingers have to be discussed because of their surgical importance. 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.<sup>4</sup> Mc Cormack et al. also reported a small vessel arising dorsally from the radial artery passing into the palm to join the ulnar artery in 51% of the hands studied.<sup>9</sup>

In hand surgeries like surgical procedures of thumb in the cases similar to present case, ligation of radial artery may not be sufficient to stop the profuse bleeding since major blood supply was coming from the SPA. In vascular graft applications arterial repairs, free and/or pedicled flaps clinicians should be aware of these variations, because in most of the traumatic events and the surgical procedures of the hand the SPA plays an important role.<sup>8</sup> Even while making incisions to evacuate pus from the hand, special attention should be paid to the superficial position of termination of ulnar artery and SPA.<sup>13</sup> Techniques like Doppler ultrasound, modified Allen test, pulse

oximetry and arterial angiography or a combination of the standard Allen test and ultrasonography can be used to identify the vascular pattern of the palm.<sup>14</sup> In cases of ulnar skin flaps damage to ulnar artery may present a risk. Interference with an efficient blood supply may results in inefficient utility of the movements of fingers and the hand.

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#### AUTHOR NOTE

Prakash Billakanti Babu, Associate Professor, Anatomy Department, Kasturba Medical College, Manipal University, Manipal, Karnataka-576104, India. Contact- 91-9880780271, Email: [billakantibabu@yahoo.co.in](mailto:billakantibabu@yahoo.co.in)  
(Corresponding Author)

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