

**Research Article**

## **VARIATIONS IN SUPERFICIAL PALMAR ARCH**

**\*K. Vijaya Lakshmi and B. Narasinga Rao**

*\*Department of Anatomy, Maharajah's Institute of Medical Sciences, Nellimarla*

*\*Author for Correspondence*

### **ABSTRACT**

Knowledge of Arterial arches of hand is very important for trauma care surgeons as well as microvascular surgeons. Variations encountered in these are so numerous. In the present case the left upper limb of a 50 year old male cadaver was dissected. Skin was carefully dissected and so much so the subcutaneous fascia and the superficial palmar arch have been exposed along with its contribution of superficial palmar branch of ulnar artery with 2 arterial loops on the radial side unlike the normal contribution of a single branch of radial artery or a branch from PPA or a branch from RI. 2 arterial loops are having communication with it and thus completing the SPA in this case. Princeps pollicis and radialis indicis arose from the communication along with the dorsal metacarpal artery. Familiarity with the variations in the vascular pattern is desirable as various vascular patterns resulting from a number of developmental errors and became a crucial issue for surgeons engaged in reconstructive hand surgery, these varied patterns act as pivotal points around which successful accomplishment of various advanced surgical procedures revolve. The arterial supply to the left thumb is provided by the 1<sup>st</sup> dorsal metacarpal artery.

**Key Words:** *Arteria Radialis Indicis, Arteria Princeps Pollicis, Dorsal Metacarpal Artery, Superficial Palmar Arch*

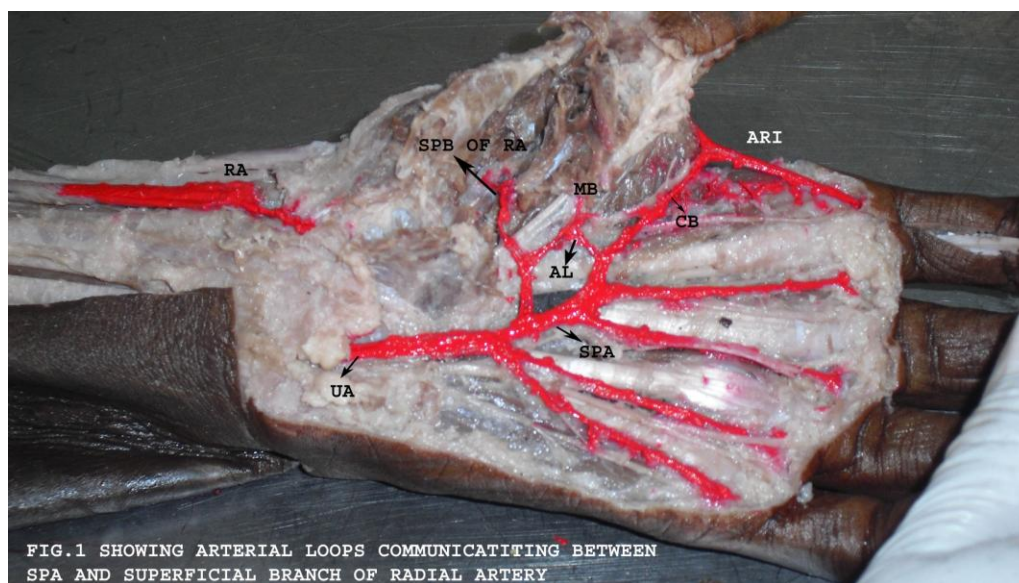
### **INTRODUCTION**

Arterial supply to the man's hand, his most important earning tool is derived from two anastomotic arches, superficial and deep formed by the anastomosis between two main arteries of forearm i.e. radial, ulnar & their branches; in the palm. These were studied as early as (1753) by Haller, a swiss anatomist & poet, while variations were described by Tiedman (1831) which were explained later, on the ontogenic basis by Meyer (1881) and Singer (1933). The anatomy of the palmar vascular arches and their variations, being one of the most challenging anatomical areas, have long intrigued clinicians and radiologists. Besides gross dissections and cast techniques, angiography, ultrasonography and Doppler studies have been incorporated in order to understand the complex but fragile vascular patterns of the palmar region. Recent advances in innovative microsurgical procedures for reconstructive hand surgeries have necessitated an in-depth understanding of these vascular patterns, the comprehensive knowledge of which remains the key issue in determining the appropriate technical feasibility of surgical interventions and successful outcome of the same. Conventionally, the superficial branch of the ulnar artery (SUA), the superficial palmar branch of the radial artery (SPRA) with an arterial loops are described as contributing vessels in the formation of superficial palmar arch (SPA) with the ulnar artery as the main feeding vessel. The arch is formed by superficial terminal branch of ulnar artery and can be completed on lateral side by superficial palmar branch of radial artery or arteria princeps pollicis (APP) or arteria radialis indicis (ARI) or median artery which accompanies the median nerve. From the convexity of superficial palmar arch (SPA) three common palmar digital arteries will 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. According to Hollinshead (1969) the arteria princeps pollicis (APP) may alternatively arise directly from the deep palmar arch, or it may also arise from a common trunk with the radialis indicis and while both are typically derived from the radial artery, they commonly have collateral circulation available to them from the ulnar artery by way of the superficial palmar arch or one of its branches.

## Research Article

### CASES

The work carried out during routine dissection sessions for medical students in the Anatomy Department, at Maharajas Institute of Medical Sciences, Nellimarla, constituted the material for the study. The left upper limb of a 50 year old male cadaver was dissected. Skin along with subcutaneous tissue is dissected out to expose the vessels contributing to the superficial palmar arch. Exposure of the palmar arches is achieved following classical incisions & dissection procedures provided by Cunningham's Manual of Practical Anatomy, (Romanes, 1999). Palmar aponeurosis is exposed and separated from the flexor retinaculum, divided proximally and reflected distally cutting the septae which pass backwards from its edges. This exposed the superficial palmar arch which is cleaned to study the pattern. Superficial palmar arch formed by superficial branch of ulnar artery which is completed by the 2 arterial loops on the radial side unlike the normal contribution of a single branch of radial artery or a branch from arteria princeps pollicis (APP) or a branch from arteria radialis indicis (ARI) (Fig. 1).



**Figure 1: showing arterial loops between superficial palmar arch and superficial branch of radial artery**

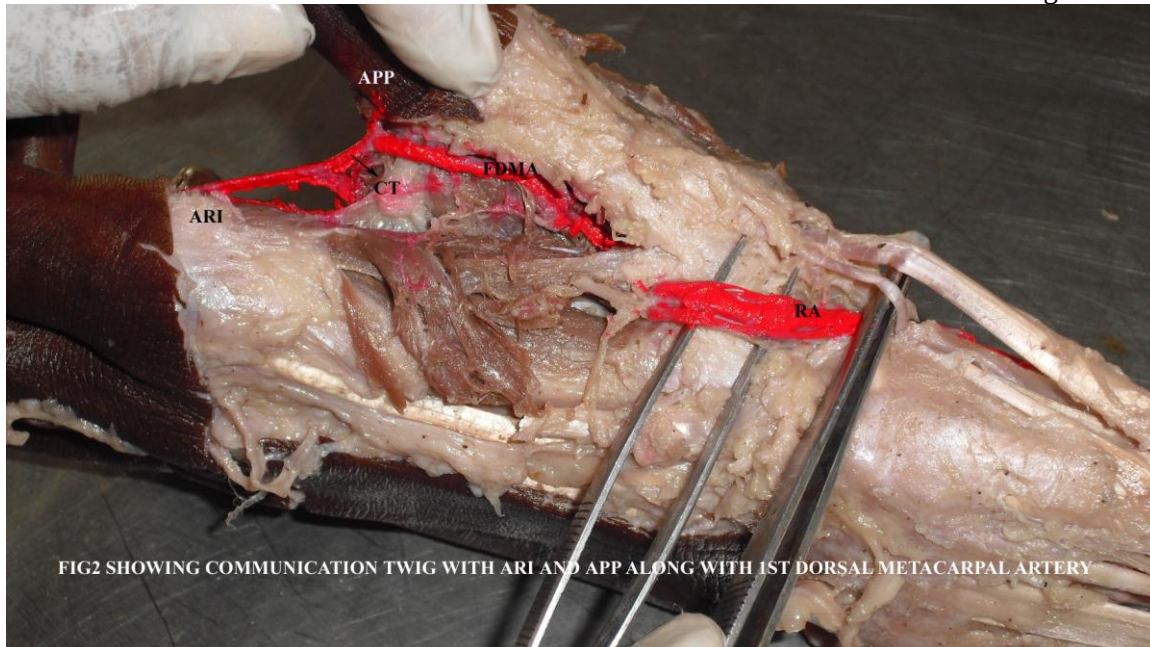
The arch is giving rise to 1 proper branch supplying the ulnar side of the little finger and 3 common palmar branches and each common palmar branch dividing into 2 palmar digital branches supplying to the radial side of the little finger, ring and middle fingers and to the ulnar sides of the ring, middle, and index fingers. The arterial loops which are existing between the superficial branch of radial artery and superficial branch of ulnar artery are giving rise to muscular branches to the thenar group of muscles and a communicating branch to arteria radialis indicis. 1<sup>st</sup> dorsal metacarpal artery a branch arising from the superficial branch of radial artery in its course in the anatomical snuff box in the 1<sup>st</sup> dorsal interosseous space is completing the SPA. A small communicating twig is observed between princeps pollicis and radialis indicis. The arterial supply to the left thumb is coming from the 1<sup>st</sup> dorsal metacarpal artery (Fig. 2)

### DISCUSSION

The systematic arterial patterns of the hand were first described by Manners-Smith (1910) Adachi(1928) Anson(1950) and MurakamiT etal (1969) reported the arterial patterns of the index finger and those of the palmar metacarpal arteries and the arteria princeps pollicis (APP). The arterial supply of the thumb can arise from a combination of the APP, the first common palmar digital artery of the superficial palmar

## Research Article

arch and the first dorsal metacarpal artery. Gellman *et al.* (2001) classified the SPA into two categories as complete and incomplete. In complete arch there will be an anastomosis between vessels constituting it. There will be an absence of a communication or anastomosis between the vessels constituting it an



**Figure 2: showing communication twig with ARI and APP along with 1<sup>st</sup> dorsal metacarpal artery.**

incomplete arch. This classification is simple and understandable for many anatomists and researchers and is currently in use. Coleman and Anson (1961) found 21.5 arteries in five cases in their study. Gajisin and Zbrodowski (1993) did not refer to many branches from the SPA supplying the first web space out of 200 specimens study. 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 superficial palmar branch of the radial artery terminating in the thenar muscles without any contribution to the SPA. Turk and Metcalf (1984) found that in addition to the common palmar digital arteries to the II, III, and IV 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. The nomenclatures of the arteries originating from SPA supplying the thumb and index fingers have to be discussed because of their surgical importance. Clinically, the arterial blood supply of the thumb is important. Many have presumed that the “collateral supply” is sufficient if the radial artery, and in turn, the APP further along the arterial tree, is damaged. The present study showed that the princeps pollicis and radialis indicis are coming from the small arterial arcades communicating with dorsal metacarpal artery from the radial artery and thin muscular branches piercing thenar muscles, where there is no variation seen in the deep palmar arch of the same hand and also there is no variation seen on the superficial palmar arch and deep palmar arch of the right hand.

## ACKNOWLEDGEMENT

Authors acknowledge the immense help received from the scholars whose articles are cited and included in references of this manuscript. The authors are also grateful to authors / editors / publishers of all those articles, journals and books from where the literature for this article has been reviewed and discussed.

## REFERENCES

Hallar AV (1753). *Incomes Anatomical Fasciculus*. VI. Gottingae. A Vanden back.

### Research Article

**Tiedman F(1831).** *Manual of Angiology*. Translated by Knox, R. Edinburg.

**Meyer H Con (1881).** *Der Grand typus des Rete, der Handnurzel und deFusswurzel*. *Archives of Anatomy & Physiology* **45** 23-64

**Singer E (1933).** *Embryological patterns persisting in the arteries of the arm*. *Anatomical Record* **55** 406-413.

**Hollinshead WH (1969).** *Anatomy for Surgeons. The Back and Limbs Second edition* New York.

**Manners-Smith T (1910).** The limb arteries of primates. *Journal of Anatomy and Physiology* **45** 23-64.

**Adachi B (1928).** [*Das Arteriensystem der Japaner*]. Band I. Kyoto Maruzen Company German.

**Anson BJ (1950).** *Atlas of Human Anatomy. First edition* Philadelphia WB Saunders Company.

**Murakami T, Takaya K and Outi H (1969).** The origin, course and distribution of arteries to the thumb, with special reference to the so-called A. *princeps pollicis*. *Okajimas Folia Anatomy Japan* **1969; 46:123-37**.

**Gellman H, Botte MJ, Shankwiler J and Gelberman RH (2001).** Arterial patterns of the deep and superficial palmar arches. *Clinical Orthopaedics and Related Research* **383** 41–46.

**Coleman SS and Anson BJ (1961).** Arterial patterns in the hand based upon the study of 650 specimens. *Surg Gynecol Obstet* **113** 409-424.

**AI-Turk M and Metcalf WK Anat J (1984).** A study of the superficial palmar arteries using the Doppler Ultrasonic Flowmeter. **138**(1) 27-32.

**Gajisin S, Zbrodowski A, and Acta Anat(Basel) (1993).** *Local vascular contribution of the superficial palmar arch*. **147** 248-51.