

## **AN ANALYSIS OF DIFFERENCES IN THE SUPERFICIAL PALMAR ARCH AND THEIR CLINICAL AND ANATOMICAL IMPORTANCE USING CADAVERS.**

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### **Abstract**

Numerous diseases, both traumatic and non-traumatic, might have an impact on the hand vasculature. As the vascular pattern of the hand has many variations, a precise grasp of arterial anatomy is important for preoperative diagnosis, surgical technique, and postoperative result.

In light of recent interest, the current study was conducted in order to study the morphology of the superficial palmar arch and also to establish the clinical and anatomical significance of the variations in these arches and their impact on the hand vasculature.

Palmar superficial arches were categorised based on two main types of arches - complete and incomplete. In the current study, incomplete arches were detected in 20.88 percent of the hands and complete arch was observed in 79.12 percent of the hands.

A rare but possibly fatal consequence is hand ischemia following radial artery cannulation. Knowing differences in hand circulation dynamics is important for effectively minimising the problems during palm surgery planning.

**Keywords:** *Complete and incomplete arch, Hand circulation, Traumatic, Palmar arch, Vasculature*

### **Introduction**

Vascular injury to the hand is more frequent, creates a significant level of morbidity, and has serious functional repercussions. Even the tiniest hand injuries require appropriate medical attention in order to lower this risk. However the vascular anatomy of hand is complicated and difficult because there are many previously identified variants which are complex and challenging due to a high prevalence of previously identified variations. Palmar arches show a high degree of variability, of which the superficial palmar arch forms the major blood supply of the hand shows greater variation [1].

Sound knowledge of anatomy is essential to the physician and therapists in dealing the hand injuries in order to provide the best quality care.

Conventionally, the hand receives its blood supply from superficial palmar arch (SPA) which is typically an anastomosis with a deep palmar arch that supplies blood to all of the fingers. It is primarily formed by branch of the ulnar artery and is finished laterally by a radial artery branch [2].

According to multiple authors, a persistent median vessel or interosseous vessel that occasionally communicates with SPA is found in 4%, 9.9%, and 14% of hands. However, the pattern of the arch, which might or might not be finished, determines this ancillary circulation. The efficacy of collateral circulation is crucial in the pathophysiology of peripheral vascular disease. Ineffective collaterals could cause hand ischemia while harvesting radial arteries as well.

It makes sense to think that changes in SPA morphology could affect hand surgery. Therefore, it is necessary to assess the vascular pattern using a modified Allen's test as well as other radiological screening techniques before undergoing any surgical operation. Unfortunately, uncontrolled vasospasm and reactive vasodilatation after dye injection can occasionally make angiographic interpretation of small vessels unreliable; in these circumstances, radiologists may have difficulty evaluating arteries while anatomical studies may be able to provide helpful information about vascular territories. A thorough understanding of the circulatory dynamics of the hand, including any potential variances, would be essential in clinical practise given the recent advancements in microsurgery in revascularization, re-implantation, and composite tissue transfer.

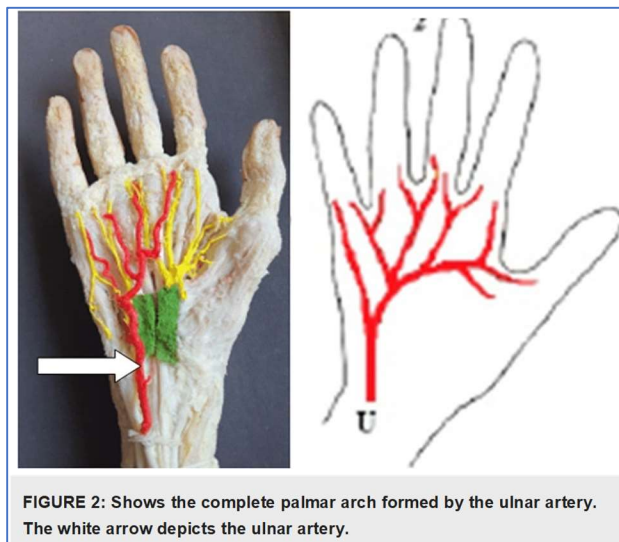
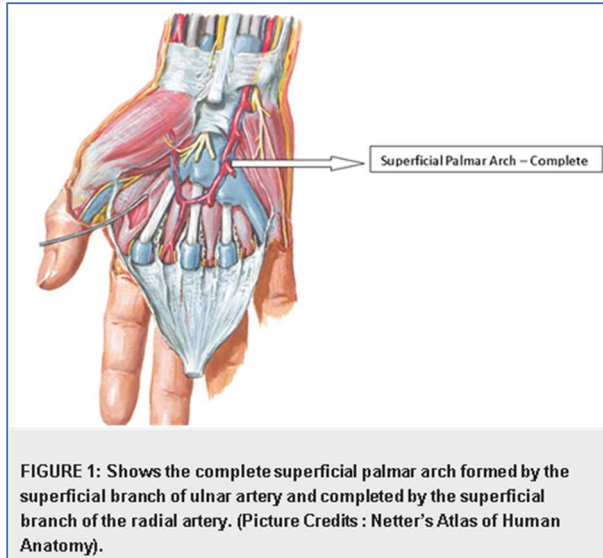
The current study tried to revisit the morphological specifics of SPA and give clinico-anatomical connections in the perspective of updating the atypical configurations.

### **Materials and Methods**

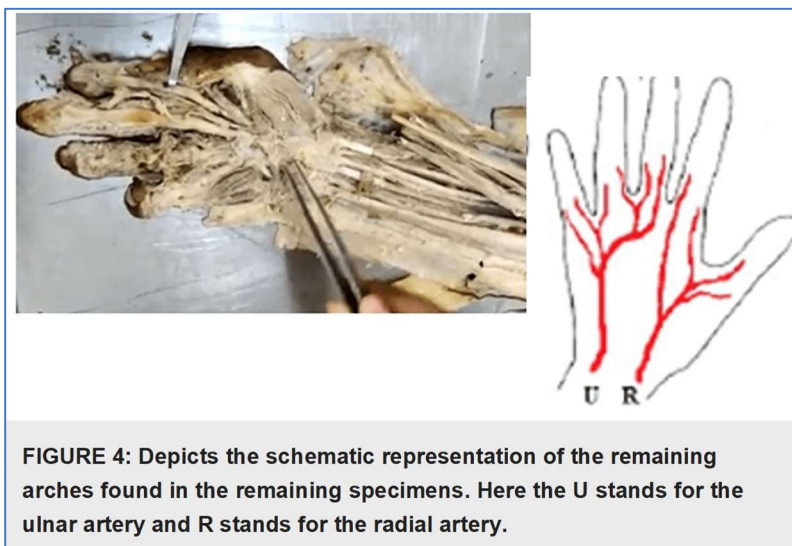
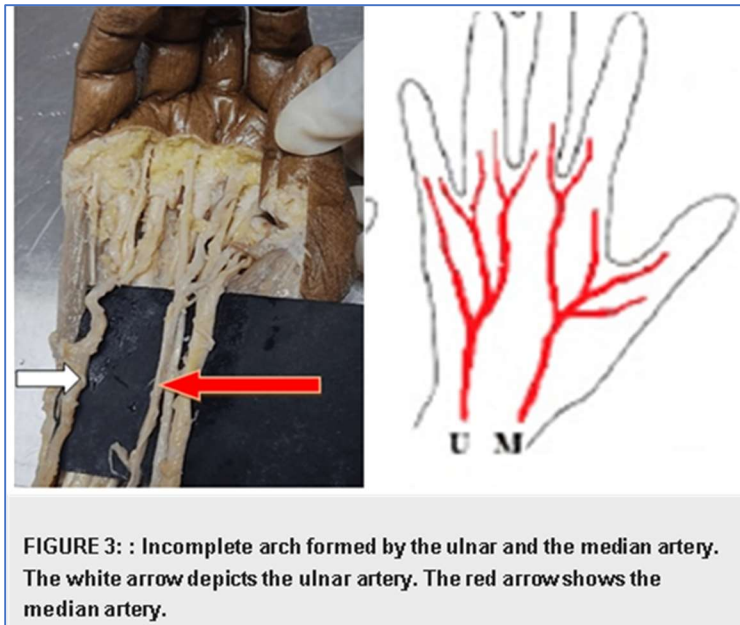
A total of 30 hands from 15 embalmed cadavers were examined. The hands with any deformity, fractures, trauma or any surgeries performed on the upper extremity were excluded from the study. Hands were dissected out using the normal dissection procedure, paying close attention to the SPA and the veins that contribute to it. Flexor retinaculum between the thenar and hypothenar muscles was split for greater exposure. The radial, ulnar, and median arteries were recognised and kept close to the wrist, if they were present. They were observed, and their morphology and branching pattern were recorded. To learn more about the feeder arteries of the fingers, digital branches were investigated and followed up to the digits. Variations were meticulously photographed and documented.

### **Results**

The present study was carried out on 30 dissected specimens and complete and incomplete arches were noted. The complete superficial palmar arch was observed in most of the cases. Among the 30 hands about 79.12 % of the hands showed complete superficial palmar arches and the remaining 20.88 % showed incomplete arches.



A variety of arches are incomplete. In the current study, one of the specimens contained the incomplete arch created by the median artery and ulnar artery. Other specimens revealed the missing arches between the radial and ulnar arteries.



### Discussion

Since the radial artery was first harvested for use as an arterial graft during coronary artery bypass surgery, the significance of variations in SPA has been emphasised. The division of SPA into complete and partial arches is a crucial tool for comprehending the anatomy of the vascular distribution of the palm [3]. The abnormalities of blood vessels may result from unexpected development patterns in the primitive vascular plexuses, including the persistence of vessels that would otherwise vanish, a lack of development, or the fusion and absorption of typically persistent sections [4]. Complete SPA was seen in 78.5% of the instances by Coleman and Anson [5], 84% of the cases by Al-Turk and Metcalf [6], 96.4% of the cases by Ikeda et al, and 90% of the cases by Loukas et al [7] and Gokhroo et al. in 75% cases [8]. In a 1988 stereoscopic arteriographic investigation of 220 specimens, Ikeda et al. discovered 55.9% of the classical kind of complete radial-ulnar arch, which we discovered in 57.81% of instances. The frequency of the ulnar subtype

of complete arch reported by previous authors is moderate to [9]. On the other hand, the ulnar artery entirely constituted 50% of the SPAs. Previously, 16.6% of cases of radial-ulnar and median-ulnar double arches were documented [10]. In 6% of cases, according to Patnaik et al., the proximal arch was complete but the distal one was not [11]. In order to rebuild the deficiencies, a number of local flaps can be created based on knowledge of the vascular anatomy of the digits [12]. In the present study, out of the 30 specimens which were dissected, complete arches were found in 79.12% of the cases. Due to differences found in these arches, blood flow may still be impeded despite the high prevalence of entire arches when any contributing vessel is cut off. Therefore, it is essential for hand surgeons to have a thorough understanding of the vascular pattern of the palm, its dominance, and its distributions to digits.

### Conclusion

In fact, the hand's extensive arterial anastomosis causes excessive bleeding from its wounds, but for the same reasons, healing happens relatively quickly. Because of this, when creating incisions, the arch that is positioned on the surface has long drawn special attention. Even though modern morphological evaluation uses improved imaging techniques, anatomical references are still frequently required to ensure the correctness and reliability of radiological interpretation. All of these facts must be used to support surgical reconstruction decisions.

### Additional Information

#### Disclosures

Human subjects: All authors have confirmed that this study did not involve human participants or tissue.

Animal subjects: All authors have confirmed that this study did not involve animal subjects or tissue. Conflicts of interest: In compliance with the ICMJE uniform disclosure form, all authors declare the following: Payment/services info: All authors have declared that no financial support was received from any organization for the submitted work. Financial relationships: All authors have declared that they have no financial relationships at present or within the previous three years with any organizations that might have an interest in the submitted work. Other relationships: All authors have declared that there are no other relationships or activities that could appear to have influenced the submitted work.

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