



An Eccentric Anatomical Variation of Palmar Vascular Pattern: Report of Surgical Challenging Vascular Variation

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The knowledge of variations in the vascular architecture of hand is of great importance to surgeons, orthopedicians, and plastic surgeons in microsurgical procedures following crush injuries of the hand and amputations. The efficiency of collateral circulation in hand is essential in few peripheral vascular diseases like Raynaud's disease and harvesting of the radial artery for the coronary bypass graft. During routine dissection of the right upper limb of a 55-year-old male cadaver, we observed that the superficial palmar arch (SPA) is formed by the ulnar artery and completed by the first dorsal metacarpal artery. After completing the arch, dorsal metacarpal artery continued as princeps pollicis artery for the thumb. The common palmar digital artery supplying the contiguous side of index and middle fingers passed through the neural loop formed by the proper digital nerve supplying the radial side of the middle finger and joined with the unusually large first palmar metacarpal artery before dividing into proper digital arteries. The first palmar metacarpal artery also gave origin to radialis indicis artery which in turn ran deep to tendons of the index finger to reach index finger. The common palmar digital artery supplying the contiguous side of middle and ring fingers also passed through the neural loop formed by the proper digital nerve supplying the ulnar side of the middle finger. The deep palmar branch of ulnar artery gave proper digital artery to little finger.

Key words: Superficial palmar arch, princeps pollicis artery, radialis indicis artery, palmar digital arteries

INTRODUCTION

Arterial supply of the palm is highly variable. It is derived from two anastomotic arches, superficial, and deep palmar arches formed by the anastomosis between main arteries of the hand that is radial and ulnar arteries and their branches. The superficial palmar arch (SPA) is the primary vascular structure supplying the palm. It is located just deep to palmar aponeurosis and superficial to digital branches of the median nerve, long flexor tendons, and lumbricals. 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.¹ About one-third of the SPA is formed by ulnar artery alone; the second-third by the superficial palmar branch of radial artery and the remaining third by arteria radialis indicis, a branch of either arteria princeps pollicis or the median artery. Three common palmar

digital arteries arise from the convexity of the SPA, each joined by a corresponding palmar metacarpal artery from the deep palmar arch and divide into two proper palmar digital arteries which supply the medial four fingers. The origins of the palmar digital arteries of the thumb are quite variable. The arteria princeps pollicis arises from the radial artery as it turns into the palm to form the deep palmar arch. It may arise from the superficial arch or the first dorsal metacarpal artery.¹ A proper understanding of the arterial variations in the palm would be fundamental for the success of repair procedures in patients with hand trauma, particularly in plastic surgeries or during arterio-grafting. In the present case, we report unusual morphology of SPA as it formed by the ulnar artery and completed by the first dorsal metacarpal artery. After completing the arch, dorsal metacarpal artery continued

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as princeps pollicis artery for the thumb. This variation was accompanied by several other associated vascular variations, persistence of which is the challenge for the hand surgeons.

CASE REPORT

During routine dissection of the upper limb for medical undergraduates, we observed the multiple arterial variations in the right hand of a male cadaver aged about 55 years. The SPA was formed by the branch of ulnar artery and completed by the first dorsal metacarpal artery of the radial artery. After completing the arch, the first dorsal metacarpal artery continued as princeps pollicis artery for the thumb [Figure 1]. The common palmar digital artery of SPA supplying the adjacent sides of the index and middle fingers passed through the neural loop formed by the proper digital nerve of median nerve supplying the radial side of the middle finger and joined with the unusually large first palmar metacarpal artery before dividing into proper digital arteries. The first palmar metacarpal artery also gave origin to radialis indicis artery which in turn ran deep to tendons of the index finger to reach the radial side of the index finger. The common palmar digital artery supplying the adjacent sides of middle and ring fingers also passed through the neural loop formed by the proper digital nerve supplying the ulnar side of middle finger [Figure 2]. The deep palmar branch of ulnar artery gave proper digital artery to little finger.

DISCUSSION

Familiarity with the variations in the vascular patterns resulting from many developmental errors remains a crucial

issue for personnel engaged in reconstructive hand surgery, where these varied patterns act as pivotal points around which successful accomplishment of various advanced surgical procedures revolves. Vascular variations hold immense importance especially for surgeons dealing with innovative microsurgical procedures.

Since SPA is the most frequent vascular channel encountered in most of the procedures and traumatic events, the hand surgeon needs to refer to the variations of the arch if any, before surgical procedures such as arterial repairs, vascular graft applications and pedicle flaps, in order to maintain or not to harm the perfusion of the hand and digits.²

According to Ottone *et al.* the ulnar artery joined with the large first dorsal interosseal artery to form the SPA and supplied thumb and index finger in 8% of cases among 86 dissected cadaveric specimens,³ whereas in our case, it does not supply the index finger. In a study of the dorsal arterial system of the hand, the radial artery divided into three branches between the base of first and second metacarpals in 84.6% specimens: the princeps pollicis artery, the first dorsal metacarpal artery, and the branch to the deep palmar arterial arch.⁴ In our case, first dorsal metacarpal artery communicated with ulnar artery to form SPA then continued as princeps pollicis artery.

Bataineh and Moqattash reported the absence of the common palmar digital artery to the second web space. This space was supplied by the first common palmar metacarpal artery from the deep palmar arch.⁵ A previous study showed that the common palmar digital artery to the second web space did not arise from the superficial arch; instead, it originated from a common trunk that supplied the third web space.⁶ None of the above studies showed that radialis indicis artery originated from the first palmar metacarpal artery as we found.

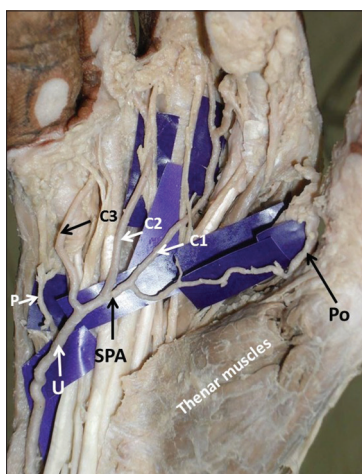


Figure 1: Dissection of the right hand showing the ulnar artery (u) forming the superficial palmar arch. Three common digital arteries (C1, C2, and C3), proper digital artery (p) and princeps pollicis artery (Po) supplying the digit

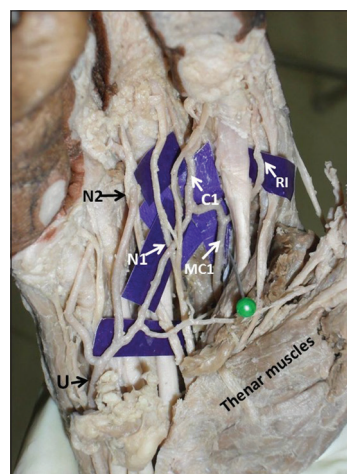


Figure 2: Deep dissection showing the ulnar artery (u), first palmar metacarpal artery (MC1) joining with C1 and giving the radialis indicis artery (RI). Neural loop (N1 and N2) around common digital arteries (C1 and C2), respectively

Vascular variation of palm

Therefore, the multiple vascular variations in the present case are unique and report worthy.

The neural loops are a common occurrence in humans and classified into four topographical types, according to their position relative to the digital arteries: ulnar (in which the ulnar proper palmar digital nerve of the finger is penetrated), radial (in which the radial proper palmar digital nerve of the finger is penetrated), common (in which the common palmar digital nerve of the finger is penetrated), and bridge (in which the neural loop is formed by connecting the ulnar and radial proper palmar digital nerves).⁷ We found ulnar and radial type of neural loop supplying the middle finger.

Embryologically, the subclavian vascular trunk of the developing fetus terminates in a plexiform manner in the developing hand. The radial and ulnar arteries appear next and develop toward the hand where ulnar artery becomes linking artery with the superficial palmar plexus. This plexus persists to form SPA.¹

CONCLUSION

SPA plays a principal role in microsurgeries following crush injuries of the hand. It maintains the collateral circulation in case of obstruction of any of the arteries in hand. The plastic surgeons, hand surgeons should be aware of these variations before attempting surgical procedure like vascular repair, graft application.

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Conflicts of interest

There are no conflicts of interest.

REFERENCES

1. Standring S, Ellis H, Healy JC, Johnson D, Williams A. Gray's Anatomy. 40th ed. London: Churchill Livingstone; 2008. p. 894-903.
2. Tagil SM, Cicekcibasi AE, Ogun TC, Buyukmumcu M, Salbacaka A. Variations and clinical importance of the superficial palmar arch. S.D.U. Týp Fak Derg 2007;14:11-6.
3. Ottone NE, Prum N, Dominguez M, Blasi E, Medan C, Shinzato S, *et al.* Analysis and clinical importance of superficial arterial palmar irrigation and its variants over 86 cases. Int J Morphol 2010;28:157-64.
4. De Rezende MR, Mattar Júnior R, Cho AB, Hasegawa OH, Ribak S. Anatomic study of the dorsal arterial system of the hand. Rev Hosp Clin Fac Med Sao Paulo 2004;59:71-6.
5. Bataineh ZM, Moqattash ST. A complex variation in the superficial palmar arch. Folia Morphol (Warsz) 2006;65:406-9.
6. Onderoglu S, Basar R, Erbil KM, Cumhuri M. Complex variation of the superficial palmar arch – Case report. Surg Radiol Anat 1997;19:123-5.
7. Lee JY, Kim YR, Kim JN, Choi HG, Song WC, Koh KS. Penetration of the digital nerves by the common palmar digital arteries in human cadavers. J Hand Surg Am 2010;35:2022-6.

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