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An Unusual Formation of the Superficial Palmar Arch and its Clinical Significance

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ABSTRACT

Variations of the arteries of the upper limb are an often encountered phenomenon and have been widely described in case reports and studies over the years. The superficial palmar arch (SPA) is the main source of blood supply to the palm and digits. The classical SPA is formed by an anastomosis between the superficial branches of the radial and ulnar artery, although a number of other variations have been described. Herein, we present a peculiar formation of the SPA between the superficial branch of the ulnar artery and a communicating branch from the princeps pollicis artery. We also noted an unusual origin of the radialis indicis artery from the SPA. According to the classifications of SPA variations, the observed SPA was type II or a dominant ulnar subtype of the non-arch type. The knowledge of arterial variations in the hand is important for the successful conduction of surgical and diagnostic manipulations in the hand and is therefore of interest to anatomists and clinicians.

Keywords: *Superficial palmar arch, arterial variations, upper limb, hand surgery, clinical significance.*

INTRODUCTION

Variations of the arteries of the upper limb are an often encountered phenomenon and have been widely described in case reports and studies over the years due to their important significance for hand surgery and diagnostic manipulations.[1-5] The superficial palmar arch (SPA) is an arterial structure, which provides the major source of blood supply to the palm and the digits.[6] It is situated below the palmar aponeurosis and superficially to the long flexor tendons, the lumbrical muscles and the palmar digital branches of median nerve.[6,7] The classic superficial palmar arch is described as an anastomosis between the superficial branch of the ulnar artery and the superficial palmar branch of the radial artery.[6,7] The superficial branch of the ulnar artery, however, can be completed by the princeps pollicis artery, the radialis indicis artery or the median artery.[6] According to literature data, the following types of SPA exist: type I (ulnar type) where the arch is formed by the ulnar artery alone; type II (radio-ulnar type), also known as the classical type and type III (median-ulnar or median-radial type), where the median artery forms part of the SPA.[7,8] Other variations include a superficial palmar branch of the radial artery passing deep to the flexor retinaculum, absence of the SPA, incomplete development of the SPA, doubled SPA, and princeps pollicis and radialis indicis arteries arising from SPA.[6] Herein, we present a case report of an unusual formation of the SPA as an anastomosis between the superficial branch of the ulnar artery and the princeps pollicis artery with peculiar blood supply of the radial surface of the index finger.

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CASE REPORT

The finding was made during routine upper limb dissections of a 72-year-old male cadaver of Caucasian origin from the autopsy material available at the Department of Anatomy, Histology and Embryology, Medical University of Sofia, Bulgaria. The dissection was approved by the Medical Legal Office and the Local Ethics Committee. The body was preserved by an injection of a formalin-based preservative (10% formalin) and stored at -40°C.

The present case report describes a variant SPA which was observed in the right upper limb of a 72-year-old male cadaver. The SPA was formed by an anastomosis between the superficial branch of the ulnar artery and a communicating branch from the princeps pollicis artery which passed beneath the tendon of the flexor pollicis longus muscle and the muscle body of the flexor pollicis brevis muscle before completing the arch. After the removal of the skin and the subcutaneous fat tissue, the palmar aponeurosis and the adjacent palmaris brevis muscle were dissected. We observed a superficial branch of the ulnar artery arising in a usual way from the ulnar artery. It curved in radial direction and its course was traced along the surface of the palm towards the thenar. We then dissected and moved aside the adductor pollicis muscle and observed an unusual anastomosis between the described superficial branch of the ulnar artery and a communicating branch from the princeps pollicis artery. The SPA formed in such way gave rise to three common palmar digital arteries which provided blood supply to the ulnar surface of the index finger, the IIIrd digit, the IVth digit and the radial surface of the Vth digit and a proper palmar digital artery to the ulnar surface of the Vth digit. Another peculiar finding was a branch arising from the SPA and passing along the radial surface of the index finger. We deduced that this branch provided blood supply to the radial surface instead of the classical radialis indicis artery [Figure 1].

Figure 1: Photograph of the wrist and hand. The course of the superficial palmar arch is indicated by arrowheads. The location of the ulnar artery is indicated by an arrow, bullet points show the direction of the common digital arteries, while the asterisk indicated a branch arising from the SPA and passing along the radial surface of the index finger.

DISCUSSION

A study of 200 upper limbs showed a complete SPA in 90% of cases, while the remaining 10% possessed an incomplete palmar arch.[9] The group with complete SPA was divided into five subgroups. In type I (40%), the SPA was formed by an anastomosis between the superficial palmar branches of the radial and ulnar artery (classical morphology). Type II (35%) was formed entirely by the ulnar artery. Type III (15%) was formed by an anastomosis between the ulnar and median artery. Type IV (6%) was formed by a complex anastomosis between the ulnar, radial, and median arteries. Type V (4%) was formed as an anastomosis between a communicating branch, arising from the deep palmar arch (DPA) and the SPA.[6,9] Although commonly associated as the classical anastomosis, it is interesting to note that the SPA which is formed by the linkage between the superficial palmar branches of the radial and ulnar arteries may not always be the most commonly observed morphology.[7] According to another classification, the variations of the blood supply to the hand can be classified into an arch type (58%) with ulnar-radiopalmar and ulnar-radial subtypes and non-arch type (42%) with dominant ulnar and codominant subtypes.[10] Regardless of the specific variation, it has been proposed that the ulnar artery always takes part in the blood supply of the hand, whether it forms the SPA or not.[10] This study also hypothesised that any variations of the SPA depend entirely on variations observed in the radial artery.[10] The present case report is mostly similar to type II,[9] or the ulnar pattern of the dominant ulnar subtype in the non-arch group.[10] However, the SPA in the present case report showed an anomalous branching pattern, in the sense that the radialis indicis artery was found to arise in an unusual way from the described SPA rather than the princeps pollicis artery. We have found no other reports in literature regarding such origin of the radialis indicis artery, although this artery can sometimes arise in a similar way midway through the communication between the radial artery and the SPA,[11] or together with the princeps pollicis artery from the superficial branch of the radial artery before it communicates with the corresponding superficial branch from the ulnar artery.[12]

The knowledge of arterial anatomy is important in graft surgeries, especially when arteries of the upper limb are harvested for coronary artery bypass grafts.[13] Recent advances in the microsurgical procedures for reconstructive hand surgery have necessitated a clear understanding of the arterial variations.[7,14] The use of the radial artery as an arterial bypass conduit has

increased significantly in recent years.[7] Considering that the harvesting of the radial artery is an invasive procedure, potential risks should always be borne in mind, as cases of hand ischemia after the arterial removal have been reported.[9] A recent study suggested that colour Doppler can be used to evaluate the presence of arterial variations.[15] The lack of collateral flow through the ulnar artery is a contraindication for the clamping of the radial artery because it can lead to gangrene of the digits in the non-arch type, which is the type of SPA observed in the presented case report.[10]

CONCLUSION

The arterial variations in the hand are found often and present an important issue for the conduction of safe and successful hand surgery and diagnostic manipulations. Therefore, knowledge of the branching patterns and arterial structures of the hand is vital for the patient and is also of interest to anatomists and clinicians. The case report presented herein describes an interesting and unusual structure of the SPA which to the best our knowledge has not been reported in literature yet.

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