

Princeps pollicis artery arising from the superficial palmar arch

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ABSTRACT

We present a 48-year-old male cadaver in which the right superficial palmar arterial arch had no contribution from the radial artery and terminated by giving rise to a common trunk for the princeps pollicis and radialis indicis arteries. The dorsal radial artery of the thumb was absent and no arterial supply was provided by the radial artery. Accordingly, the entire arterial supply to the right thumb was provided by the superficial palmar arch, which was composed solely of the ulnar artery, which received no collateral supply from the radial artery system. Considering that the arterial supply of the thumb in the present case was solely provided by the superficial palmar arch, a potential hazard could exist in the event of traumatic injury to the ulnar artery.

Keywords: princeps pollicis artery, radial artery, radialis indicis, superficial palmar arch,

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INTRODUCTION

The princeps pollicis artery (PPA) arises from the radial artery as it turns into the palm to form the deep palmar arch. It descends on the palmar aspect of the first metacarpal under the oblique head of the adductor pollicis, lateral to the first palmar interosseus muscle, after which the artery divides into two branches. The PPA is the usual nutrient supply to the first metacarpal bone and thumb.⁽¹⁾ According to Hollinshead, the PPA 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.⁽²⁾ Several additional variations have been reported.

CASE REPORT

We present a 48-year-old male cadaver in which the right superficial palmar arterial arch had no contribution from the radial artery and terminated by giving rise to a common trunk for the PPA and radialis indicis

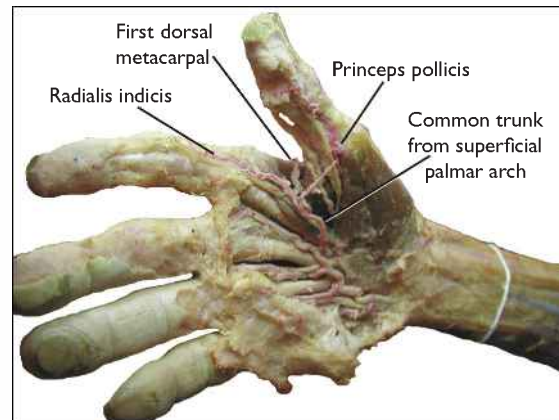


Fig. 1 Photograph of the dissected specimen shows the variations. Note the common trunk arising from the superficial palmar arch and trifurcating into the radialis indicis, first dorsal metacarpal and princeps pollicis arteries.

artery. The common trunk arose from the superficial palmar arch at the point of origin of the first lumbrical from the tendon of the flexor digitorum profundus. After travelling radially and distally for 1.1 cm, the common trunk trifurcated (Fig. 1). The most medial of the three branches continued along the radial aspect of the index finger as the radialis indicis. The middle branch continued around the lateral border of the first dorsal interosseus muscle as the first dorsal metacarpal artery to reach the dorsal surface of the hand. The PPA arose as the third branch, which after recurring slightly, coursed along the distal border of the transverse head of the adductor pollicis, giving a small branch to the first metacarpophalangeal joint. The PPA then continued along the medial border of the thumb providing its sole nutrient supply by way of a terminal trifurcation into the dorsal ulnar, palmar ulnar and palmar radial arteries of the thumb. The dorsal radial artery of the thumb was absent, and no arterial supply was provided by the radial artery. Accordingly, the entire arterial supply to the right thumb was provided by the superficial palmar arterial arch, which was composed solely of the ulnar artery, which received no collateral supply from the radial artery system. This unilateral variation was identified in a 48-year-old male, who had died in a car accident. No other variations, trauma or previous surgical procedures were observed in the upper limb. Its arterial system was injected with red latex and dissected.

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DISCUSSION

The systematic arterial patterns of the hand were first described by Manners-Smith.⁽³⁾ Adachi,⁽⁴⁾ Anson⁽⁵⁾ and Murakami et al⁽⁶⁾ went on to report the arterial patterns of the index finger and those of the palmar metacarpal arteries and the PPA. The arterial supply of the thumb can arise from a combination of the PPA, the first common palmar digital artery of the superficial palmar arch and the first dorsal metacarpal artery.⁽⁷⁾ The pattern of anastomoses of these three arteries is very complex when they pass near the metacarpophalangeal joint. The PPA is generally considered the largest source for the palmar arteries of the thumb.^(5,6) Adachi classified variations of this artery by its relation to the adductor pollicis muscle.⁽⁴⁾ Murakami et al found Adachi's classification simple, and thus proposed a classification based on the origin and proximal course of the PPA. Their classification involved three major types and four intermediate, rather anomalous types.⁽⁶⁾

In 1910, Manners-Smith proposed two theories for the cause of the variations in the arteries of the upper limb. Manners-Smith performed a comparative study of the arteries of the limb in different groups of primates and came to the conclusion that many of the variations in the upper limb arteries that occur in human subjects represent a retention or a reappearance of primitive patterns, which are normally found in the gorilla, chimpanzee and other primates.⁽³⁾ Embryologically, an inhibition of the development of the vessels at different stages of the embryonic period causes congenital anomalies of the upper limb arteries.⁽⁷⁾

Loukas et al reported that the superficial palmar arch was derived solely from the ulnar artery with no contribution from radial elements in 35% of the cases.⁽⁸⁾ By comparison, Jelacic et al reported that the superficial palmar arch communicated with a branch of the radial artery in 85% of the specimens.⁽⁹⁾ Ikeda et al reported that the palmar ulnar artery arose from the PPA in 72% of the specimens, whereas the palmar radial artery arose from the PPA in 76% of the specimens. Furthermore, they reported the absence of the dorsal radial artery of the thumb in 36.5% of cases, and no cases in which the dorsal ulnar artery arose from the superficial palmar arch or its branches.⁽⁷⁾ To the best of our knowledge, this is the first reported case where the dorsal ulnar, palmar

ulnar and palmar radial arteries of the thumb all arose from the PPA after its origin from the superficial palmar arterial arch. This particular arterial pattern resulted in the entire circulation of the thumb being provided by the superficial palmar arch with no collateral supply from the radial system.

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 PPA further along the arterial tree, is damaged. Parks et al highlighted four case reports where occlusion of the radial artery or surgical manipulation of the PPA led to pain, paraesthesia, or gangrene of the thumb and index finger.⁽¹⁰⁾ Although the thumbs survived in these cases, jeopardising the arterial supply of the thumb could have been avoided with a knowledge of such arterial anatomy. Considering that the arterial supply of the thumb in the present case was solely provided by the superficial palmar arch, a potential hazard could exist in the event of traumatic injury to the ulnar artery. It remains important to continually report significant anatomical vascular variations, so that clinicians are aware of these anomalies and thus avoid the potential consequences associated with them.

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