

## Case Report

# Presence of Rare Arterial Arcade at 1st Web Space in the Right Hand and Its Possible Clinical Complications

Anitha G, Naveen K (✉), Srinivasa SR, Snigdha M, Satheesha NB

Department of Anatomy, Melaka Manipal Medical College (Manipal Campus), Manipal University, Manipal, Karnataka State, 576104 India.

### Abstract

The thumb muscles require a rich blood supply due to extensive usage of the thumb to do daily chores. The thumb is solely supplied by the branches of the radial artery in most of the individuals. However, there are occasions where it is also supplied by the branches of the palmar arches of the hand which generally do not supply the lateral part of the hand. In the present case, the superficial palmar arch in addition to its normal branches, gave origin to a common trunk which traversed towards the web space between the pollex and the index finger. As it approached the base of the pollex, it divided into arteria radialis indicis and an arteria princeps pollicis. The arteria radialis indicis supplied the lateral side of index finger while, the arteria princeps pollicis further divided into a palmar branch and a dorsal branch. The palmar branch supplied the medial side of the pollex and the dorsal branch communicated with the 1st dorsal metacarpal artery, thus forming an arterial arcade at the base of the pollex. Proper understanding of the common arterial variations in the palmar arterial arches would be fundamental to the success of repair procedures in patients with hand trauma, particularly in plastic surgeries or during arteriography.

**Keywords:** Arteria princeps pollicis, superficial palmar arch, arteria radialis indicis, first dorsal metacarpal artery

### Correspondence:

Naveen Kumar, Department of Anatomy, Melaka Manipal Medical College (Manipal Campus), Manipal University, Manipal, Karnataka State, 576104 India. Tel: +91 9880548636 Email: naveentonse@gmail.com

Date of submission: 22 Sept, 2012

Date of acceptance: 26 Dec, 2012

### Introduction

Superficial palmar arch (SPA) is an arterial arcade that lies just beneath the palmar aponeurosis. It presents an important anastomosis between the ulnar and radial arteries. The possible contributions to SPA by radial artery are through its superficial palmar branch, radialis indicis or princeps pollicis arteries. Occasionally, median artery may also contribute (1). The principal branches of SPA are four palmar digital arteries. The most medial is the proper palmar digital artery to the medial side of the little finger. The other three common palmar digital arteries pass to the inter-digital clefts where each receives corresponding palmar metacarpal arteries from the deep palmar arch and divides into two proper palmar digital arteries to the adjacent sides of two fingers. The proper palmar digital arteries to each finger form a rich anastomosis in the pulp of the finger and in the nail bed.

Normally arteria princeps pollicis (APP) and arteria radialis indicis (ARI) are given off in the palm from the radial artery. While APP divides into 2 branches to supply the palmar surfaces of both sides of thumb, ARI supplies radial side of index finger. When the former branches arise by a common trunk then they are termed as palmar metacarpal arteries. In the present case, we report a variation in the normal anatomy of the arteries around the thumb.

### Case Report

During routine cadaveric dissection of the right palm, a unilateral variation in the origin, course and distribution of the arteries supplying the pollex and index finger were observed.

The superficial palmar arch in addition to its normal branches, gave origin to a common trunk which ran towards the 1st web space between the pollex and

the index fingers (Fig 1). As it approached the base of the pollex, it divided into ARI and APP.

The ARI supplied the lateral side of index finger. The APP further divided into palmar (PB) and dorsal (DB) branches. The PB supplied the medial side of the pollex and the DB communicated with the 1st dorsal metacarpal artery, thus altogether forming an arterial arcade at the base of the pollex (Fig 2). The classical APP was absent.

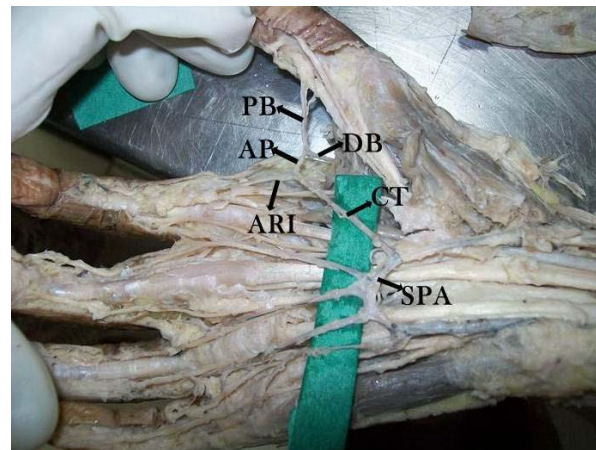
This unusual arterial anastomoses in the 1st web space is of utmost clinical importance particularly during draining thenar space abscess.

### Discussion

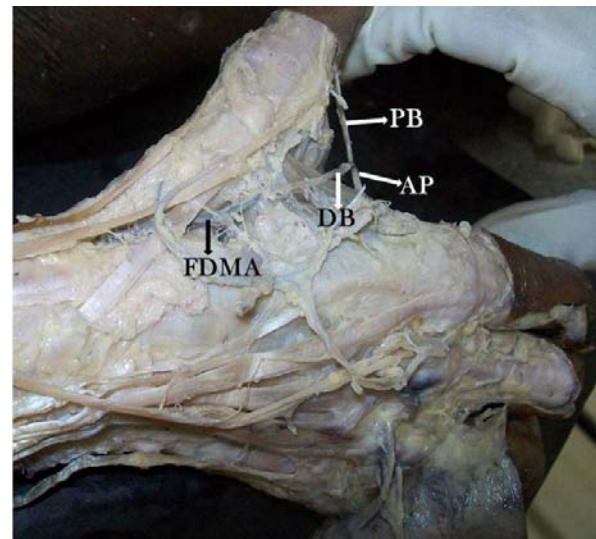
The palm has a complex vascular architecture. In order to maintain the continuous blood supply for the performance of precise activity of its small muscles, rich arterial anastomoses are formed by communicating arteries. Presence of such arterial network is most probably predetermined genetically and maintained after birth (2). The thumb muscles are mostly supplied by the superficial branches of the radial artery (3). APP, branches of 1st dorsal metacarpal artery and radial artery are the chief arterial sources of thumb. The APP is generally considered the largest source for the palmar arteries of the thumb.

The APP may arise from the deep palmar arch (4), or it may also arise from a common trunk with the ARI (5). A study conducted by Al-Turk and Metcalf in 1984 (6), on SPA, a branch from SPA supplied the medial side of the thumb and lateral side of the index finger in 42% of cases. They named this branch as arteria digitalis palmaris communis primus. Erbil M et.al, in 1999 (7) reported arterial supply to the thumb and index fingers through princeps pollicis and radialis indicis arteries arising from SPA in 5 cases.

In the present case, we observed unusual branching of SPA to the first web space, as reported by the other authors. But contrary to other reports, the dorsal branch of APP anastomosed freely with the 1st dorsal metacarpal artery (FDMA) in the first web space. Radial artery gave origin to FDMA, just before it entered into the palm through the space between the two heads of first interosseous muscle. The fascial course of the FDMA is clinically important as it is susceptible to injury in an intervention over the carpometacarpal joint of the thumb (8). Dorsal skin of the digital or metacarpal areas is used as a reverse dorsal digital and metacarpal flap for the reconstruction of various skin defects of the volar side of the fingers. Recognition of arterial branches contributing to the volar and dorsal arterial networks of the fingers is important



**Figure 1:** Palm dissection demonstrating the branches of superficial palmar arch (SPA). A common trunk (CT) arising as an additional branch, further divided into arteria radialis indicis (ARI) and arteria princeps pollicis (AP). AP further branched to palmar branch (PB) and dorsal branch (DB).



**Figure 2:** Arterial arcade at the base of pollex by palmar branch (PB), dorsal branch (DB) and its communication with 1st dorsal metacarpal artery (FDMA).

while taking these flaps (9). Dorsal skin flap raised on FDMA is usually used to reconstruct the various skin defects of thumb (10). Using of skin flap on FDMA in the cases similar to ours, should be avoided because of its communication with the APP. Any injury to this communication may interfere with the efficient blood supply to the thumb and it may affect its movements. Radial artery is usually ligated during the surgical procedures of thumb. Its ligation in cases similar to the present case, may invite unexpected bleeding since major blood supply for the thumb was coming from the superficial palmar arch.

In a comparative study on the arteries of limb in different groups of primates performed by Manners-Smith in 1910 (11) stated that, many of arterial

variations in the limb occur in the human represent a retention or a reappearance of primitive patterns which are normally found in different primates like gorilla, chimpanzee etc. Ikeda et al. in 1988 (12) postulated the embryological basis for the anomalous pattern of arteries of upper limb. According to them, it could be by an inhibition of the development of the vessels at different stages of the embryonic period.

Knowledge of the arterial arches of hands, their formation and source of supply can be of much importance to medical and surgical practitioners. In various vascular reconstructive surgeries although the radial artery is used as arterial graft, detailed knowledge of arterial anastomoses in the palm is important to prevent vascular jeopardy to the palm muscles.

Clinically, the arterial blood supply of the thumb is important. Parks et al. in 1978 (13) highlighted four case reports where occlusion of the radial artery or surgical manipulation of the APP led to pain, paraesthesia, or gangrene of the thumb and index finger. Although the thumbs survived in these cases, jeopardising the arterial supply of the thumb could have been avoided with knowledge of such arterial anatomy (14).

### Conclusion

In summary, the knowledge of the current case may avoid unexpected bleeding in procedures such as draining abscess from the thenar space. Hence, it is 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.

### References

1. Williams PL, Bannister LG, Berry MM. Gray's Anatomy. 38th Ed. New York: Churchill Livingstone; 2000, pp-1544.
2. Bataineh ZM, Moqattash ST. A complex variation in the superficial palmar arch. *Folia Morphology (Warsz)* 2006; 65:406-409.
3. Ikeda A, Matsumoto S, Yoshii I, Ikeda K. Comparative anatomical studies of arteriographs of the hand and foot in primates including man. *Kaibogaku Zasshi* 1993; 68(3):263-280.
4. Moore KL, Dalley AF. Clinically Oriented Anatomy. 5th edition. Philadelphia: Lippincott Williams & Wilkins. 2005, 838
5. Hollinshead WH. Anatomy for Surgeons. The Back and Limbs. 2nd Ed. New York: Harper and Row, 1969.
6. Al-Turk M, Metcalf WK. A study of superficial palmar arteries using Doppler ultrasonic flow meter. *J Anat* 1984;138 (Pt 1):27-32
7. Erbil M, Aktekin M, Denk CC, Onderoglu S, and Surucu HS. Arteries of the thumb originating from the superficial palmar arch: five cases). *Surg Radiol Anat* 1999;21(3):217-20.
8. Wilgis EFS, Kaplan EB. The blood and the nerve supply of the hand. In: Morton Spinner, ed. Kaplan's Functional and Surgical Anatomy of the Hand. 3rd Ed., Philadelphia: J.B. Lippincott Company, 1984, pp-206.
9. Pelissier P, Casoli V, Bakhach J, Martin D, Baudet J. Reverse dorsal digital and metacarpal flaps: a review of 27 cases. *Plast Reconstr Surg* 1999;103(1):159-65
10. Sherif MM. First dorsal metacarpal artery flap in hand reconstruction. Anatomical study. *J Hand Surg Am* 1994; 19(1):26-31.
11. Manners-Smith T. The limb arteries of primates. *J Anat Physiol* 1910;45(Pt 1):23-64.11.
12. Ikeda A, Ugawa A, Kazihara Y, Hamada N. Arterial patterns in the hand based on three-dimensional analysis of 220 cadaver hands *J Hand Surg Am* 1988;13(4):501-509.
13. Parks BJ, Arbelaez J, Horner RL. Medical and surgical importance of the arterial blood supply to the thumb. *J Hand Surg* 1978; 3:383-385
14. Loukas M, Tubbs S, Louis RG Jr, Apaydin N. Princeps pollicis artery arising from the Superficial palmar arch. *Singapore Med J* 2009;50(11):e391-392.