



A CASE REPORT OF VARIANT FORMATION AND DISTRIBUTION OF SUPERFICIAL PALMAR ARCH

JOS HEMA LATHA

Department of Anatomy, STANLEY MEDICAL COLLEGE AND HOSPITAL

Abstract : A rare variation of unilateral incomplete superficial palmar arch was observed during routine dissection, in a 55 year old female cadaver. The superficial palmar arch was formed exclusively by superficial branch of ulnar artery. The arch gave rise to a proper palmar digital artery to ulnar side of little finger, three common palmar digital arteries to the medial three web spaces, and a common trunk which gave rise to a proper palmar digital artery to radial side of thumb and first common palmar metacarpal artery which in turn divided into two proper palmar digital arteries to radial side of index finger and ulnar side of thumb. In this case there is no anastomosis between ulnar artery with radial artery or median artery (ulnar predominance). As superficial palmar arch is a main vascular structure of the palm, sound anatomical knowledge regarding the possible variations in its formation and branching pattern is important for surgeons dealing with reconstructive hand surgery and those concerned with functional anatomy of the hand.

Keyword : Superficial palmar arch, ulnar artery, radial artery, hand surgery, anatomical variations, palmar digital artery.

INTRODUCTION:

Superficial palmar arch, also known as Arcus Volaris Superficialis is the dominant vascular structure of the hand. One third of the superficial palmar arch is formed by ulnar artery alone; one third completed by superficial palmar branch of radial artery; an additional third is completed by either arteria radialis indicis, arteria princeps pollicis or by the median artery. Three common palmar digital arteries arising from the convexity of superficial palmar arch and proceed distally. Each artery is joined by corresponding palmar metacarpal artery from the deep palmar arch and then divided into two proper palmar digital arteries. They run along the contiguous sides of medial four fingers to supply them. The palmar digital artery for medial side of little finger leaves the arch under palmaris brevis. The radial side of index finger is supplied by arteria radialis indicis and the thumb is supplied by arteria princeps pollicis. Both are branches of radial artery. Knowledge in variations of vascular pattern of hand gained importance in microsurgical techniques, reconstructive hand surgeries, preoperative screening of radial artery harvesting for myocardial revascularizations.

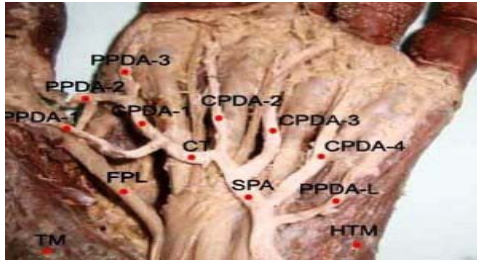
CASE REPORT:

Variation in the formation and branches of superficial palmar arch was noted during routine dissection of palmar aspect of the left hand in a 55 year old female cadaver.(Pic 1,2) Ulnar artery

entered the palm by passing superficial to flexor retinaculum. Then the artery turned laterally deep to palmaris brevis forming an incomplete superficial palmar arch. Superficial palmar arch was formed exclusively by the superficial branch of ulnar artery. There was an absence of communication between superficial branch of ulnar artery with radial artery or median artery. Superficial palmar arch as soon as its formation, gave a branch to ulnar side of little finger. Three common palmar digital arteries arose from the convexity of arch, supplied the contiguous sides of little, ring, middle and index fingers by the division of each common palmar digital artery into two proper palmar digital arteries. From the lateral side of the arch a common trunk arose which gave rise to a proper palmar digital artery to radial side of thumb and first common metacarpal artery which in turn divided into two proper digital arteries to radial side of index finger and ulnar side of thumb. The superficial terminal branch of radial artery terminated by supplying the thenar muscles. Through the incomplete superficial palmar arch, the ulnar artery supplied the palmar aspect of all the digits. In the right side, the superficial palmar arch was normal in its formation and branches.



Picture 1 showing Incomplete Superficial Palmar Arch SPA - Superficial Palmar Arch TMThenar Muscles HTM-Hypothenar Muscles FPL-Flexor Pollicis Longus tendon CPDA 1 - Common Palmar Digital Artery 1 (first common palmar metacarpal artery) CPDA 2 -Common Palmar Digital Artery 2 CPDA 3 -Common Palmar Digital Artery 3 CPDA 4 -Common Palmar Digital Artery 4 PPDA 1 -Proper Palmar Digital Artery to Radial side of thumb PPDA 2 -Proper Palmar Digital Artery to Ulnar side of thumb PPDA 3-Proper Palmar Digital Artery to Radial side of index finger PPDA L -Proper Palmar Digital Artery to Ulnar side of little finger



Picture 2 showing closer view of Incomplete Superficial Palmar Arch SPA-Superficial Palmar Arch TM-Thenar Muscles HTM-Hypothenar Muscles FPL-Flexor Pollicis Longus tendon CPDA 1 - Common Palmar Digital Artery 1 (first common palmar metacarpal artery) CPDA 2 -Common Palmar Digital Artery 2 CPDA 3 -Common Palmar Digital Artery 3 CPDA 4 -Common Palmar Digital Artery 4 PPDA 1 -Proper Palmar Digital Artery to Radial side of thumb PPDA 2 -Proper Palmar Digital Artery to Ulnar side of thumb PPDA 3-Proper Palmar Digital Artery to Radial side of index finger PPDA L -Proper Palmar Digital Artery to Ulnar side of little finger

DISCUSSION:

The classification of superficial palmar arch into a complete and incomplete category (Fig 1) based on the presence or absence of a communication between the vessels contributing to its formation was mentioned as early by Jaschtschinski. This classification system provides the simplest understanding of anatomical distribution of these arteries (1). In complete arch there will be an anastomosis between vessels constituting it. There will be an absence of communication or anastomosis between the vessels constituting it in incomplete arch (2). Three types of superficial palmar arch were described by Adachi (3): ulnar type in 59%; radioulnar type in 32%; medioulnar type in 9% based on the nomenclature reflecting the vessels taking part in its formation. In an incomplete arch ulnar artery do not anastomose with radial artery or median artery.

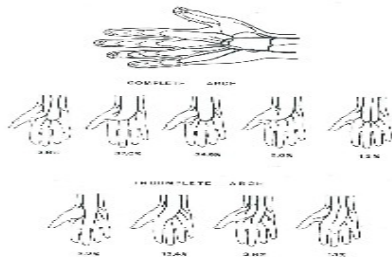


Fig 1 - Schematic illustration of complete and incomplete superficial palmar arch

According to Coleman (4) there were four main types of arch , Type A: Both superficial palmar branches of ulnar artery and radial artery take part in supplying the palm and fingers, but in doing so fail to anastomose and seen in 3.6% Type B: Only the ulnar artery forms the superficial palmar arch but the arch is incomplete in sense it does not supply the thumb and index finger and seen in 13.4% of cases. Type C: Superficial vessels receive contribution from both ulnar artery and median artery but without anastomosis and seen in 3.8% of cases. Type D: Radial artery, ulnar artery and median artery all give origin to superficial vessels but do not anastomose and seen in 1.1% of cases. The present study did not belong to any type as all the digits were supplied by ulnar artery. They also reported 78.5% of complete arch and 21.5% of incomplete arch in 650 cases. Janevski et al

reported incomplete arch in 75% and complete arch in 25% in 500 specimens (5). Ikeda et al reported 96.4% of complete arch and 3.6% of incomplete arch in stereoscopic arteriographic study of 200 cadavers (6). A detailed study of the arterial pattern in 200 formalin- fixed hand was undertaken and the incidence of incomplete and complete superficial palmar arch was 10% and 90% respectively (7). Superficial palmar arch formed alone by ulnar artery (ulnar dominance) was reported by Coleman and Anson (4) as 37% , Jelcic et al (8) as 10%, and by Ikeda et al (6) as 25.5% and Tagil et al (9) noted it in 20%. More over another study revealed the incidence of incomplete superficial palmar arch in 4.5% (10) Erbil et al had described the superficial palmar arch providing blood supply to thumb and index finger through arteria princeps pollicis and arteria radialis indicis in five cases in their study (11).

There is a contradiction in the origin of the blood supply to the hand. Gajisin and Zbrodowski did not mention the nomenclature of arteria princeps pollicis and arteria radialis indicis to the arteries supplying the thumb and index fingers if they were not from the deep palmar arch (12). In the present case also the arteries supplying the thumb and index fingers were not from the deep palmar arch. Karlsson and Niechajev, (13) in their study of blood supply to the hand, demonstrated the presence of the princeps pollicis artery in all 139 cases studied. In contrast, the princeps pollicis artery was found in 56% of 50 cases in a study by Al Turk and Metcalf (14). In addition, the arteries to the thumb and index finger were not referred as princeps pollicis and radialis indicis arteries unless they originated from the deep palmar arch (14). However, Ikeda et al (6) named the artery arose from the superficial palmar arch supplying the first web space as first common metacarpal artery. Al Turk and Metcalf found that in addition to common palmar digital arteries to the 2nd, 3rd, 4th interdigital space, there was a branch from superficial palmar arch supplying ulnar side of thumb and radial side of index finger and they named it as 1st common metacarpal artery (14). In the present case the blood supply to the ulnar side of thumb and radial side of index finger was provided by the first common metacarpal artery arising from common trunk. Another study described that the blood supply to the radial side of thumb was provided by a branch of deep division of radial artery (10). In the present case a proper palmar digital artery arose from common trunk and supplied the radial side of thumb. Bataineh ZM reported superficial palmar branch of radial artery terminated within thenar muscles (15). In the present case also, the superficial palmar branch of radial artery terminated by supplying thenar muscles.

CONCLUSION:

The implications of such varied vascular pattern hold immense importance especially for surgeons dealing with innovative microsurgical procedures for reconstructive surgeries of the hand. Harvesting radial artery for use as arterial by-pass conduit poses the need to look specifically for variations in collateral circulation like presence of incomplete superficial palmar arch. Currently the methods of assessing hand circulation include the modified Allen test, Doppler Ultrasonography and photo plethysmography. Doppler study is a useful tool in preoperative screening for radial artery harvesting for myocardial revascularization. This variation alerts the hand surgeons during their procedures.

REFERENCES:

- 1.Jaschtschinski SN (Morphologie and Topographie des Arcus Volaris Sublimis and Profundus des Menschen) Anat Hofte 1897; 7:161-88 German.
1. 2 .Gellman H, Botte MJ, Shankwiler J, Gelberman RH (2001), Arterial patterns of the deep and superficial palmar arches. Clin Orthop 383:41-46.

2. 3 . Adachi B (Das Arteriensystem der Japaner): Zn: Anatomie der Japaner. Vol I Kyoto: Verlag der Kaiserlich 1928, German.
3. 4.Coleman SS, Anson BJ (1961) Arterial patterns in the hand based upon a study of 650 specimens. Surg Gynecol Obstet, 113:409-424
4. 5.Janevski BK, Angiography of the upper extremity. The Hague, Martinus Nijhoff. 1982; 73-122
5. 6.Ikeda A, Ugawa A, Kazihara Y, Hamada N (1988), Arterial patterns in the hand based on a three dimensional analysis of 220 cadaver hands. J Hand Surg, 13 A:501_509
6. 7 .Loukas M, Holdman D (2005), Anatomical Variations of the superficial and deep palmar arches. Folia Morphol,64:78-83
7. 8. Jelcic N,Gajcin S, Zbrodowski A, Arcus Palmaris Superficialis, Acta Anat (basel). 1988; 132:187-190
8. 9.Tagil SM, Cicekcibasi AE, ogun TC, Buyukmumcu m, Salbacak A, Variations and Clinical importance of the superficial palmar arch. Fakultesi Dergisi: 2007; 14:11-16
9. 10 .Dhar P, Lall K Singapore Med J 2008; 49 (9) : 245
- 10 11.Erbil M, Aktekin M, Denk CC, Onderoglu S (1999) Arteries originating from the superficial palmar arch: five cases: Surg Radiol Anat, 21:217-220
- 11 12.Gajisin S, Zbrodowski A. Local vascular contribution of the superficial palmar arch.(Basel) 1993; 147:248-251
- 12 13.Karlsson S, Niechajev IA (1982) Arterial Anatomy of the upper extremity. Acta Radiol Diag, 2:115-121
- 13 14. Al-Turk M, Metcalf WK (1984). A study of the superficial palmar arteries using the Doppler Ultrasonic flowmeter. J Anat, 18:27-32
- 14 15. Bataineh ZM, Moqattash ST. A complex variation in the superficial palmar arch. Folia Morphol (Warsz) 2006; 14: 11-16