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## BILATERAL VARIATION IN THE VASCULAR PATTERN OF PALM- A CASE REPORT

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### ABSTRACT

A bilateral variation in the pattern of arterial supply of the palm was observed during routine dissection of a 65 years old male cadaver. The right hand received blood supply by ulnar, radial and median arteries, with an arch of communication between radial and median arteries. In the left hand superficial palmar arch was formed mainly by ulnar artery and completed by first dorsal metacarpal branch of radial artery. In both hands deep branch of radial artery and a branch from ulnar proper digital branch of little finger formed the deep palmar arch. Knowledge of arterial variations provides an important source of information for vascular surgeons for safe surgical procedures in the hand.

**Keywords:** superficial palmar arch, deep palmar arch, ulnar artery, radial artery, median artery.

### INTRODUCTION

Arterial supply to the human hand is derived from two main anastomotic channels, superficial and deep palmar arches. They are formed by radial and ulnar arteries, which account for high vascularity of the palm. So wounds of the palm bleed profusely but heal rapidly because of this rich anastomosis. Superficial palmar arch is mainly fed by ulnar artery alone or completed by superficial branch of radial artery, by the arteria radialis indicis, a branch of arteria princeps pollicis or by the persistent median artery<sup>1</sup>. Very rarely it is formed by anastomosis of median artery with radial artery. This type of arch was described as median –radial type of superficial palmar arch<sup>2</sup>. SPA shows a

number of variations that it is difficult to establish a type<sup>3</sup>.

Deep palmar arch is formed by anastomosis of the deep palmar branch of the radial artery with the deep palmar branch of the ulnar artery. Jaschtschinski<sup>4</sup> and Coleman and Anson<sup>1</sup> described its variations. Variations of deep palmar arch are less common compared to superficial palmar arch<sup>1,5</sup>. So an injury to the ulnar artery or the superficial palmar arch may compromise the arterial supply of the fingers, particularly if there is an insufficient anastomosis between the superficial and deep palmar arches<sup>6</sup>.

Thus familiarity of the possible variations in arterial pattern of hand is especially important for the vascular surgeons while performing reconstructive hand surgeries for restoration of the normal function of the hand.

### Case report

During regular dissection for undergraduate medical students, bilateral variations of superficial palmar arch and deep palmar arch were identified in a 65-year-old male cadaver.

In the right hand, beneath the palmar aponeurosis there were three vessels. From medial to lateral side they were ulnar, median and radial arteries respectively. Ulnar artery gave one proper and two common digital arteries, which supplied the medial 2½ fingers. Arteria nervi mediana, a branch of ulnar artery, accompanied by the median nerve passing deep to flexor retinaculum was found to be giving a common digital branch that supplied radial side of the middle finger and ulnar side of the index finger. Superficial palmar branch of the radial artery gave a common digital branch that supplied the radial side of index finger and the ulnar side of the thumb. A loop of communication existed between the radial artery and the arteria nervi mediana (median artery) but not with the ulnar artery. (Fig:1)

In the left hand, one proper and four common digital arteries were branched out from the ulnar artery. Through these branches, the ulnar artery supplied entire palm except radial side of thumb, which got its nutrition from the radial artery. The superficial palmar arch was completed by the first dorsal metacarpal artery in the first digital web space. First dorsal metacarpal artery was a branch of radial artery, before it pierced 1<sup>st</sup> dorsal interossei muscle. These variant types of arterial anastomosis should be kept in mind while performing hand surgeries. (Fig.1),(Fig.2)

Deep palmar arch in both the upper limbs was formed between deep branch of radial artery, which entered the palm through 1<sup>st</sup> dorsal metacarpal space piercing the 1<sup>st</sup> dorsal interosseus muscle and inferior deep branch arising from ulnar proper palmar digital artery of little finger. Deep branch

of ulnar nerve accompanied the arch and supplied interossei and adductor pollicis muscles. (Fig.3)

### DISCUSSION

The arterial supply to the hand and its variations were being reported since a long time. Jaschtschinski<sup>4</sup> in his study on 200 subjects, classified superficial palmar arch into complete and incomplete types based on the anastomosis between the vessels. Complete SPA was ulnar type (38%), radioulnar type (27%) and mediano ulnar type (3%) and radio-mediano-ulnar (0.5%). He also mentioned the absence of superficial palmar arch.

A very rare type of superficial palmar arch termed median –radial type existed between median artery and radial artery<sup>2</sup>.

Superficial palmar arch was classified into Group I (Complete arch) and Group II (Incomplete arch)<sup>1</sup>

Group I was further divided into five types: Type A: The classical radio ulnar arch formed by superficial branch of radial artery with large superficial branch of ulnar artery.

Type B: This arch is formed entirely by ulnar artery supplying thumb and index finger.

Type C: Mediano ulnar arch formed between ulnar artery and median artery.

Type D: Radio-mediano-ulnar arch, in which three vessels enter into the formation of arch.

Type E: It consists of a well-formed arch initiated by ulnar artery and completed by a large vessel derived from deep arch.

Group II: An incomplete arch exists when the arteries forming superficial arch do not anastomose or when the ulnar artery fails to reach the thumb and index finger. It was subdivided into

Type A: No anastomosis between superficial palmar branch of radial artery and ulnar artery.

Type B: Only the ulnar artery forms superficial palmar arch.

Type C: Superficial vessels receive contributions from both median and ulnar arteries but without anastomosis.

Type D: Radial, median and ulnar artery all give origin to superficial vessels but do not anastomose.

The median artery forming superficial palmar arch may arise from ulnar, anterior interosseous, common interosseous and from radial arteries<sup>7</sup>.

This persistent median artery has an embryological correlation. The ante brachial pattern of median artery ends at the level of forearm and the palmar pattern where the artery accompanying the median nerve in the forearm and extending down to the palm supplying the digits<sup>8</sup>.

A dorsally arising small radial artery branch, coined as dorsalis pollicis artery by Agur and Lee<sup>9</sup> might complete superficial palmar arch. McCormack et al.<sup>10</sup> also reported a small vessel arising dorsally from the radial artery passing into the palm to join the ulnar artery in 51% of the hands studied. First dorsal metacarpal artery often had a fascial course on the dorsal surface of the index head of first interosseus muscle, this artery can be easily injured in an intervention over the carpometacarpal joint of the thumb, when approached from the dorsum of this joint<sup>11</sup>.

In the present case, right hand showed a complete radio-median type of superficial palmar arch as described by Keen<sup>2</sup>. Along with this rare arch, ulnar artery was also present in the hand without any communication with the other two vessels.

In the left hand, an ulnar-radial type of complete arch existed between ulnar artery and first dorsal metacarpal artery of radial artery coming from the dorsum. An arch was seen in the first digital web space. Eventhough it was not falling in any of the major classifications of superficial palmar arch, a dorsal artery completing the arch

was described by Agur and Lee<sup>9</sup> McCormack et al<sup>10</sup>

Deep palmar arch:

Coleman and Anson<sup>1</sup> had classified deep palmar arch as follows:

Group I: Complete arch, further divided into 4 types.

Type A: The deep palmar arch is formed by the deep palmar branch of the radial artery, which anastomoses with superior deep palmar branch of ulna artery. The latter follows the deep branch of ulnar nerve into the palm.

Type B: The commonest pattern of deep palmar arch that existed between deep palmar branch of radial artery with the inferior deep palmar branch of ulnar artery.

Type C: Both (superior & inferior) deep palmar branches of ulnar artery join the deep palmar branch of radial artery to complete the arch.

Type D: It is formed by superior deep palmar branch of the ulnar artery, which anastomoses with an enlarged superior perforating artery of the 2<sup>nd</sup> inter metacarpal space.

Group II: Incomplete arch, further divided into:

Type A: The inferior deep branch of ulnar artery anastomoses with the perforating artery of the 2<sup>nd</sup> interspace without any communication with deep palmar branch of radial artery.

Type B: The deep branch of ulnar artery ends in an anastomosis with perforating artery of 3<sup>rd</sup> interspace as deep palmar branch of radial artery anastomoses with the perforating artery of the 2<sup>nd</sup> interspace.

Mezzogiorno<sup>12</sup> identified the deep palmar arch patterns as radioulnar (66.7%), radial-anastomotic (21.67%), radial (8.33%), and ulnar (3.33%). Olave<sup>13</sup> explained two groups of deep palmar arches. In group I the radial artery passed through the first interosseous space anastomosing with one or two deep palmar branches. These deep palmar branches originated from the ulnar artery, ulnar proper palmar digital

artery of the little finger or the common palmar digital artery of the fourth interosseous space. In group II, the artery passed through the second interosseous space, anastomosing with one deep palmar branch, rarely with two deep palmar branches.

In the present case both limbs showed the commonest variety of complete deep palmar arch (type B). This complete radio-ulnar type of deep palmar arch existed between deep palmar branch of radial artery, which passed through the first dorsal interosseous muscle anastomosing with deep palmar branch of ulnar artery. This deep palmar branch of ulnar artery was arising from proper digital branch of little finger as explained by Olave.<sup>13</sup>

### Embryology

Shin Matsumoto<sup>14</sup> explained the arterial supply of the early upper limb bud as subclavian-axillary-brachial trunk. The main arterial supply to the developing hand consisted of the brachial and interosseous arteries that terminated in a capillary plexus. A branch of the trunk-median artery, temporarily replaced interosseous artery in supplying the hand. The connection between superficial brachial artery and median artery became the main route of blood supply for the finger arteries up to the adult stage. Subsequently ulnar and then radial arteries are formed from the axis artery at the end of arterial development and median artery regresses. Ulnar artery joined the ulnar end of the superficial palmar arch, radial artery with deep palmar arch. Persistence of any of these vessels leads to variations.

### Conclusion:

The detailed knowledge of arterial arches of the human hand, a prehensile organ, is important to vascular surgeons while correcting any traumatic events in the hand. Success of surgical procedures depends on the healthy function of the arterial arch that exists between radial and ulnar arteries in

order to maintain normal blood flow to the hand and digits. Otherwise it leads to ischemia of soft tissues of the hand which is the bane of mankind.

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## ABBREVIATIONS

ANM- ARTERIA NERVI MEDIANA

FR- FLEXOR RETINACULUM

FDMA- FIRST DORSAL METACARPAL ARTERY

DPA- DEEP PALMAR ARCH

IDP.Br- INFERIOR DEEP PALMAR BRANCH OF ULNAR  
ARTERY

RA- RADIAL ARTERY

SPA- SUPERFICIAL PALMAR ARCH

UA- ULNAR ARTERY

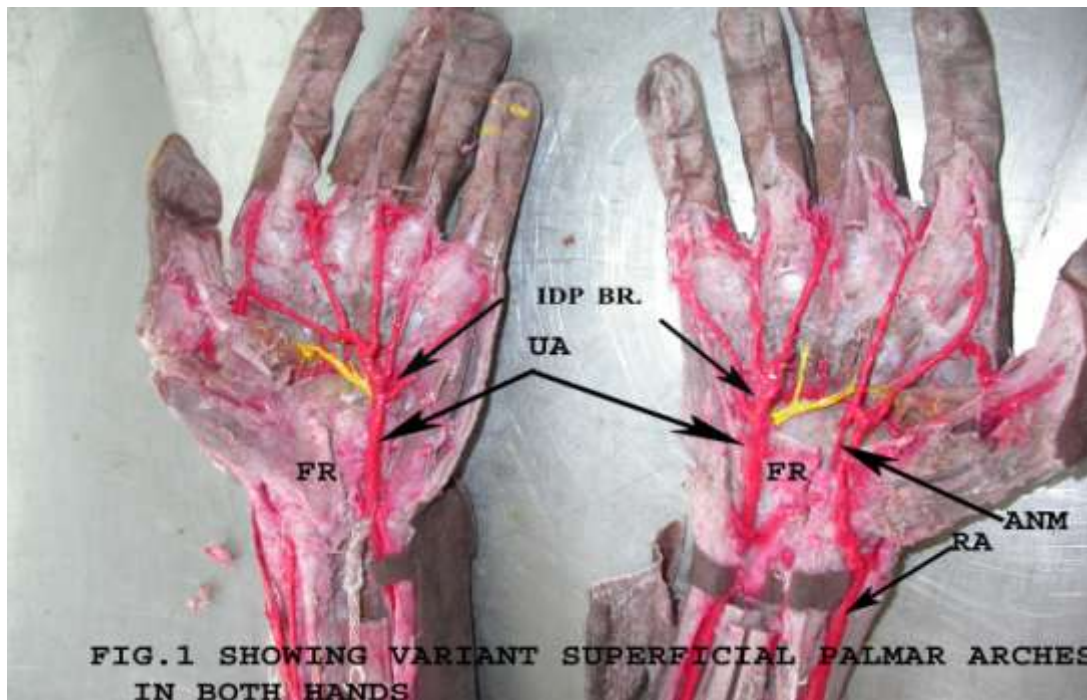
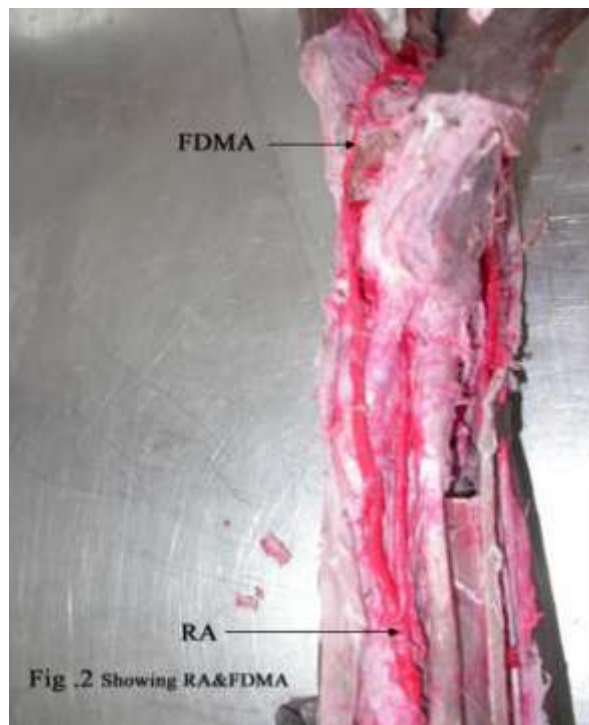
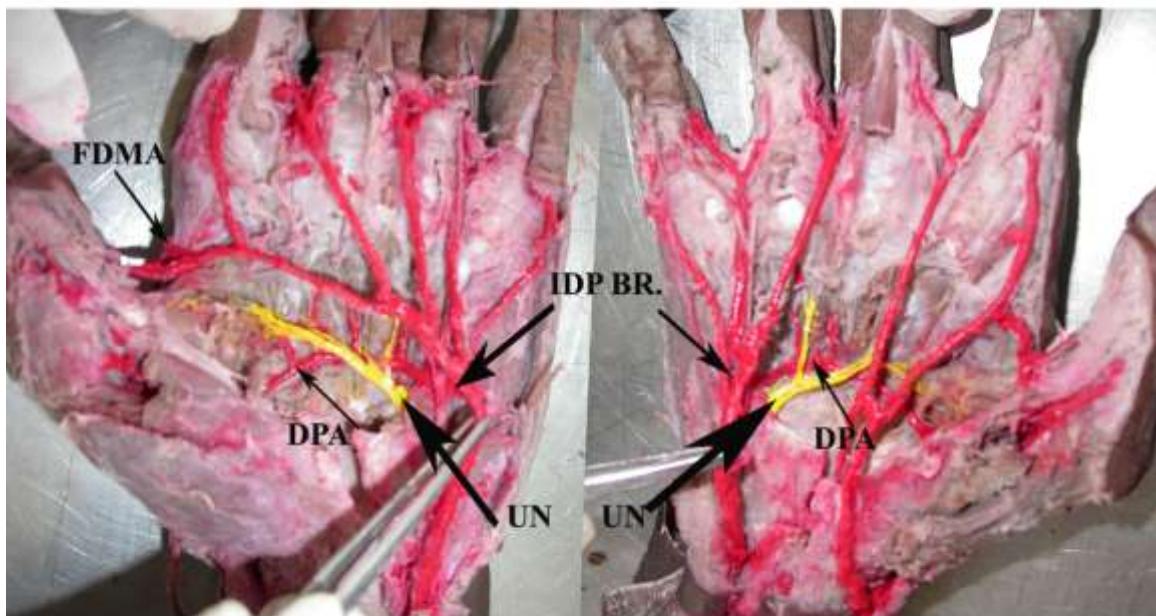


Fig.1-showing two different types of superficial palmar arches in the left and right hands



**Fig:2 Showing radial artery and First dorsal metacarpal artery in the left hand**



**FIG.3 SHOWING VARIANT DEEP PALMAR ARCHES IN BOTH HANDS**

**Fig.3-showing variant deep palmar arches in both hands**