

An Assessment of the Contributing Arteries in Superficial Palmar Arch Formation and Variations in its Formation

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Received: 10-03-2022 / Revised: 15-04-2022 / Accepted: 25-05-2022

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Conflict of interest: Nil

Abstract

Aim: To study contributing arteries in superficial palmar arch formation and variations in its formation.

Material & Methods: Study was done on 20 formalin (10%) embalmed adult cadavers, 15 males & 5 females (40 sides). Decomposed, amputated, injured and specimens from children were excluded from study.

Results: SPA was formed by superficial branch of ulnar artery only in 5 cases out of 40 (12.5%). SPA was formed by superficial branch of both ulnar and radial artery in 28 cases out of 40 (70%).

Conclusion: The arch formation is highly variable. Knowledge of contribution to the SPA will be helpful to the reconstructive hand surgical procedures such as arterial repairs, vascular graft applications and reimplantations.

Keywords: Superficial palmar arch, morphology, digital vascular supply, clinico-anatomical correlation

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Introduction

Human hand is highly evolved in terms of its complexity and variation. It is beyond doubt that, in this medical era vascular anatomy of human hand is of importance in medical, surgical and radiological sciences [1].

Knowledge of the variations in the arterial supply of hand is essential in advent of microvascular surgery for revascularisation, replantation and composite tissue transfers.

Hand has derived its arterial supply, from two anastomotic arches, superficial and deep palmar arches which are formed between two main arteries of forearm i.e.

radial, ulnar and their branches, in the palm.

The Vascular patterns of the palmar arches and their interconnecting branches present a complex and challenging study. Many attempts have been made to classify these variations. One of the first reports that presented a classification of palmar arches was the classic work of Coleman and Anson [1].

The superficial palmar arch is an anastomosis fed mainly by the ulnar artery. The later enters the palm with the ulnar nerve, anterior to the flexor retinaculum and lateral to the pisiform. It passes medial to the hook of the hamates, and then

curves laterally to form an arch, convex distally and level with a transverse line through the distal border of the fully extended pollicial base. About a third of the superficial palmar arches are formed by the ulnar alone; a further third are completed by the superficial palmar branch of the radial artery and a third by the arteria radialis indicis, a branch of arteria princeps pollicis or the median artery. The superficial palmar arch is covered by palmaris brevis and the palmar aponeurosis and it is superficial to flexor digiti minimi, branches of the median nerve and to the long flexor tendons and lumbricals [2].

About a third of the superficial palmar arches are formed by the ulnar artery alone; a further third are completed by the superficial palmar branch of the radial artery; and a third by the arteria radialis indicis, a branch of either arteria princeps pollicis or the median artery. [3] So there are different views on contributing arteries and completeness of arch formation in different books. So aim of this study is to

note usually contributing arteries and variations related to superficial palmar arch (SPA) formation.

Material & Methods:

Study was done on 20 formalin (10%) embalmed adult cadavers, 15 males & 5 females (40 sides). Decomposed, amputated, injured and specimens from children were excluded from study.

Methodology

Vertical incision was taken on Palm and skin reflected laterally. Palmar aponeurosis was identified with palmaris longus (PL) tendon. PL tendon was cut and aponeurosis reflected distally. Median and ulnar nerve & their branches in relation to arteries forming superficial palmar arch & flexor retinaculum were dissected meticulously till digital branches.

Results:

SPA was formed by superficial branch of ulnar artery only in 5 cases out of 40 (12.5%) (Figure 1).

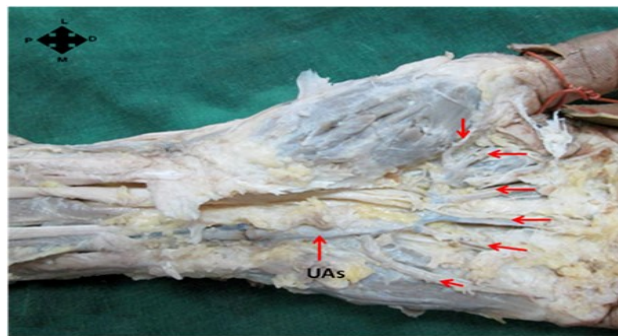


Figure 1: Illustration showing incomplete superficial palmar arch formed by superficial branch of ulnar artery (UAs) only, supplying 5 fingers

SPA was formed by superficial branch of both ulnar and radial artery in 28 cases out of 40 (70%) (Figures 2 and 3).

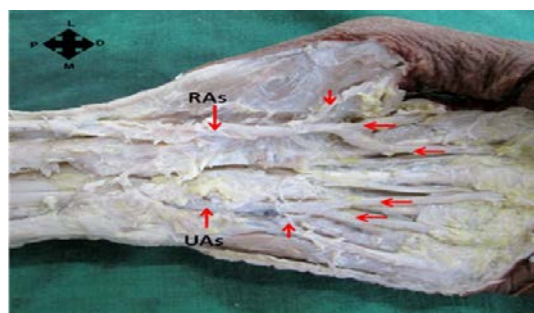


Figure 2: Illustration showing complete superficial palmar arch formed by superficial branch of ulnar artery (UAs) and superficial branch of radial artery (RAs) supplying 5 fingers

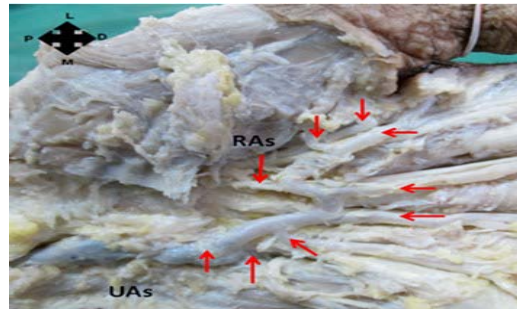


Figure 3: Illustration showing incomplete superficial palmar arch formed by superficial branch of ulnar artery (UAs) and superficial branch of radial artery (RAs) supplying 5 fingers

SPA was formed by superficial branch of ulnar and persistent median artery in 6 cases out of 40 (15%) (Figure 4).

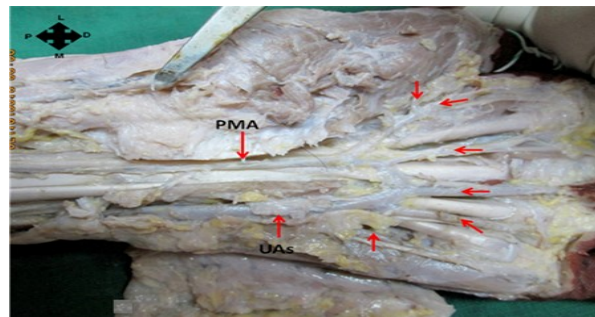


Figure 4: Illustration showing complete superficial palmar arch formed by superficial branch of ulnar artery (UAs) and persistent median artery (PMA) supplying medial 4 fingers.

And in 1 case SPA was formed by superficial branches of ulnar and radial arteries with persistent median artery (2.5%) (Figure 5).

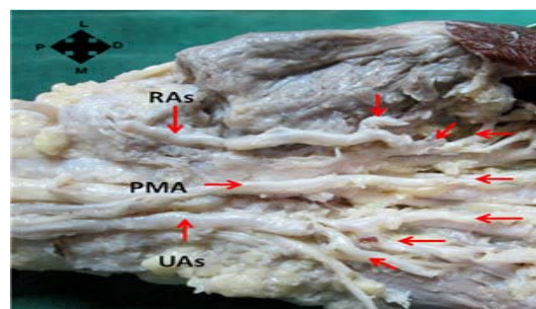


Figure 5: Illustration showing incomplete superficial palmar arch formed by superficial branch of ulnar artery (UAs), persistent median artery (PMA) and superficial branch of radial artery (RAs) supplying 5 fingers

Discussion:

The importance of variations in SPA is highlighted since the time of harvesting

radial artery as arterial graft for coronary artery bypass grafting. A key guide to understand the anatomy of the arterial

distribution of palm is the classification of SPA into complete and incomplete arches (Mbaka et al) [4]. The anomalies of blood vessels may be due to unusual paths in the primitive vascular plexuses in the form of either persistence of vessels normally disappearing or incomplete development or fusion and absorption of parts usually persisting (Arey) [5]. Complete SPA was observed by Coleman and Anson [6] in 78.5 % cases, Al-Turk and Metcalf [7] in 84% cases, Ikeda et al. [8] in 96.4 % cases, Loukas et al. [9] in 90 % cases and Gokhroo et al. [10] in 75% cases.

Some authors like Ozkus et al., [11] have also reported absence of superficial palmar arch but such a scenario is quite a rare finding which suggests that the superficial palmar arch is always present. The present study predominantly shows complete type of superficial palmar arches which is in correlation with studies of Mozersky et al., [12] Higgins and Hayden [13] (On acronecrosed hands) Al Turk and Metcalf [14] except the works of Lippert H [15] and Mc Minn and Hutchings [16].

Mamatha Tonse et al observed mediano ulnar type of complete arch in 12% [17]. Takkallapalli Anitha et al in their study found median artery contribution to SPA in 6% of specimens, of which 4% showed complete mediano ulnar type and 2% showed incomplete mediano ulnar type. [18] In study by Archana, persistent median artery taking part in SPA was found in 15% specimens, of which 7.5% specimens is of complete mediano ulnar, 2.5% is of complete radio mediano ulnar type and 5% specimens is of incomplete mediano ulnar type. [19]

Although many variant patterns of the palmar arterial arches have been observed in the forming arteries and their branches, anastomosis was found between the radial and ulnar arteries in 70% of the cases of the deep palmar arch. This suggests that, from an anatomic perspective, it can be safe to sacrifice the radial artery in procedures such as radial artery harvesting

and radial artery flap transfer. Moreover, the radial artery can be used for transradial access in coronary and neuroendovascular interventions. However, it is recommended to use Allen's test, Doppler ultrasound, and oximetry technique to assess hand circulation before performing any invasive procedures on the radial artery [20, 21,22].

Conclusion:

There have been several variations in the developing arteries and their branches of the palmar arterial arches. The radial and ulnar arteries were anastomosed, suggesting that they were completed. Deep palmar arch patterns were divided into two groups based on how we classified them. Surgeons may perform safe hand vascular repairs with the use of this knowledge and the morphometric data from the arch. An evaluation of the hand's vascular insufficiency is necessary before any arterial intervention is performed.

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