

Case Report

UNILATERAL INCOMPLETE SUPERFICIAL PALMAR ARCH: A CASE REPORT

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ABSTRACT

The functional importance of hand is revealed by its rich vascularity contributed by superficial and deep palmar arches (SPA and DPA). Superficial palmar arch is located superficial to flexor tendons, and deep palmar arch deep to lumbrical muscles. Variations are found more often in SPA than DPA, later being more or less constant. During routine undergraduate dissection, we observed, unilateral incomplete SPA being formed by superficial palmar branches of ulnar and radial artery in the right hand of a male cadaver. These two arteries remained independent without anastomosis forming incomplete arch (SPA). The superficial branch of ulnar artery entered hand superficial to flexor retinaculum and supplied middle, ring and little finger by three branches. The superficial branch of radial artery via its two branches supplied index finger and thumb. Classical SPA formation was seen on left side.

The presence of an incomplete SPA as in this case is a potential danger in RA harvesting for CABG. Variations in SPA play a pivotal role in microvascular surgical procedures of hand, RA interventions and arterial graft applications.

KEY WORDS: Superficial palmar arch, Deep palmar arch, Lumbrical, Anastomosis, Retinaculum, CABG, Microvascular surgery.

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INTRODUCTION

Superficial palmar arch (SPA) is an important arterial anastomotic arcade which is the dominant vascular supply to the majority of the palmar muscles. The high prevalence of variations of SPA makes it an interesting as well as challenging area of study. The arch is localized between the palmar aponeurosis and the long flexor tendons [1]. It is principally formed by the ulnar artery (UA), completed on the lateral side by the superficial branch of radial artery (RA) or arteria princeps pollicis (APP) or arteria radialis indicis (ARI) from RA or median artery

(MA) accompanying the median nerve. The median artery is the axial artery of the superior extremity during early embryonic life. It maintains the SPA while the RA and UA are developing. When the UA and RA are fully developed, the MA disappears. The MA may persist in adult life as antebrachial or palmar median artery, based on their vascular territory. The palmar type is intimately related to the median nerve, reaches the wrist and enters the palm after passing beneath the flexor retinaculum (FR) and may take part in the formation of SPA [2]. A classical type of SPA is

described as direct continuity between UA and the superficial branch of RA [3]. This ensures the presence of collateral supply in hand. UA enters the palm with the ulnar nerve, anterior to the flexor retinaculum and lateral to the pisiform bone. It passes medial to the hook of the hamate, then curves laterally to form an arch that is convex distally and level with a transverse line through the distal border of the fully extended pollicial base [4]. Thereafter it usually communicates with the superficial branch of the radial artery to complete the arch. In incomplete variety of SPA, no anastomosis is seen between the ulnar and radial arteries [5]. Coleman and Anson (1961) classified incomplete SPA into four subtypes, namely type A, type B, type C and type D [6]. Type A incomplete SPA poses vulnerability to digital ischemic changes after trauma or after any intervention related to the radial artery. This variation also assumes importance in obstruction of arteries at the level of wrist occurring in "Hypothenar Hammer Syndrome" and in connective tissue diseases [6]. Knowledge of the frequency of anatomical variations of the arterial patterns of the hand is crucial for safe and successful reconstructive hand surgeries [7], preoperative screening for radial artery (RA) harvesting for myocardial revascularization procedures and also in arterial interventions that include RA cannulation and forearm flaps based on RA. Therefore we report a case of incomplete SPA in a middle aged formalin fixed male cadaver that we came across during routine dissection classes for undergraduate students, in the Department of Anatomy, Medical College Kolkata, India.

Photo 1: Normal SPA (left palm).



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We made the skin incisions, dissected the palmar aponeurosis, flexor retinaculum and deep fascia covering the thenar and hypothenar muscles according to the guidelines prescribed in Grant's Dissector- 15th edition. After this we encountered an incomplete type of SPA in the right hand of the cadaver. The history of the individual and the cause of death were not known. We found the superficial branch of UA entering the hand, superficial to the flexor retinaculum. Thereafter it gave off one proper digital branch to the ulnar side of the little finger and two common digital branches to supply the adjacent sides of middle, ring and little fingers. The superficial palmar branch of radial artery entered the hand superficial to the thenar muscles and then gave off one proper digital branch to the radial side of the thumb and one common digital branch supplying the ulnar side of the thumb and radial side of the index finger. The adjacent sides of index and middle fingers receive their blood supply from the palmar metacarpal branch of the deep palmar arch. On the left side the SPA was complete as the traditional continuity between the superficial branches of the UA and the RA was maintained.

Fig.1: Classical SPA

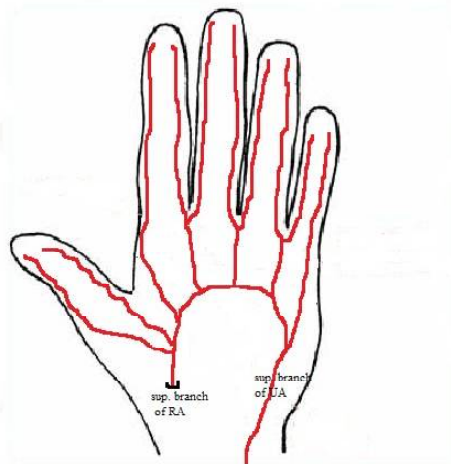


Photo 2: Incomplete SPA(right side).

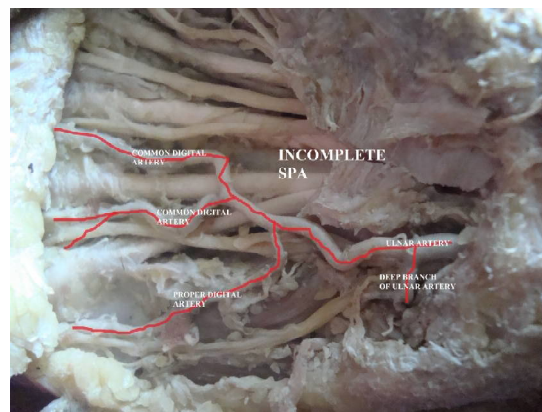


Photo 3: Superficial branch of ulnar artery.

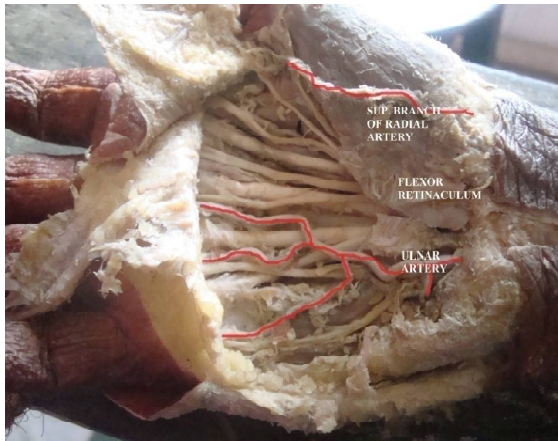


Photo 4: Superficial branch of radial artery.

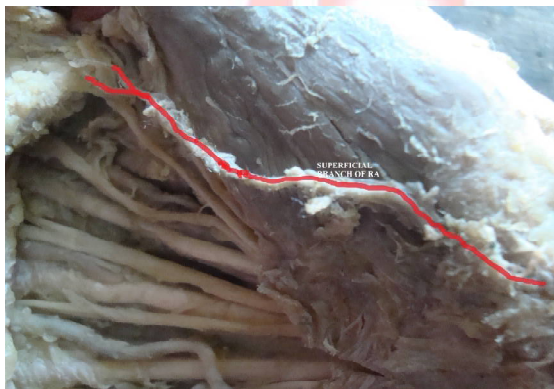
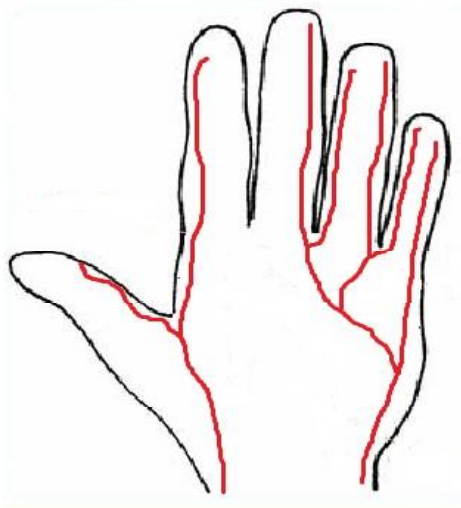


Fig. 2: schematic diagram of superficial palmar arch observed in our case.

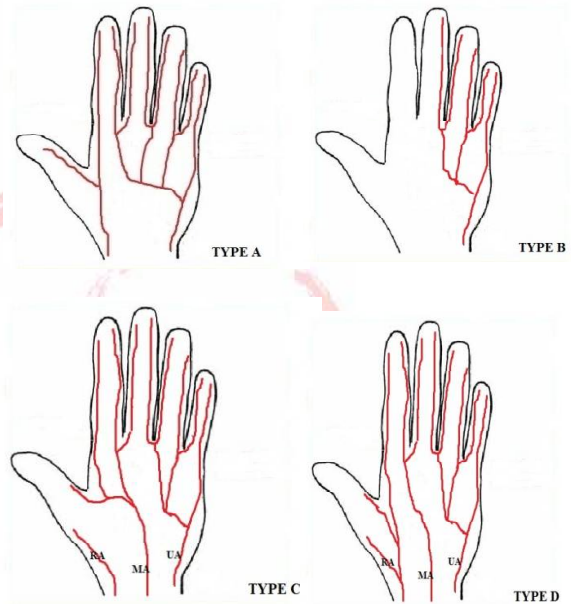


DISCUSSION

Superficial arteries of the hand present many diverse patterns that permit their well defined categorization. Coleman and Anson studied these diversities in 1961 and classified complete SPAs into 5 groups. These authors again typified the incomplete SPAs into 4 categories, namely, Type A, Type B, Type C and Type D [6]. Type A had no anastomosis between superficial branches of RA and UA. In Type B, the SPAs were

solely formed by UA. Type C SPAs were formed by ulnar and median arteries without anastomosis. Type D varieties were contributed by ulnar, median and radial arteries, without any anastomosis between them. In our study we observed an incomplete arch belonging to the 'Type A variety of Incomplete Palmar Arches' of Coleman and Anson's classification.

Fig. 3: Coleman and Anson's classification of incomplete SPAs.



In a 500 hand study by Janevsky et al. , the complete arches were seen in 75% and incomplete arches in 25% of cases [8]. About a third SPA are formed by the UA alone; a further is completed by the superficial branch of RA, and a third either by ARI or by APP or by MA [4]. The traditional classification has been reported to be evident in as many as 55.9% of specimens in the research of Ikeda et al. [9], or as few as 10% of specimens according to Ruengsakulrach et al. [10] SPA alone formed by UA was reported by Coleman and Anson as 37% [6], by Jelacic et al as 10% [7] and by Ikeda et al as 25.5% [9]. The incidence of incomplete SPAs reported are 10%, 16%, 16% and 21.47% of cases in studies of Loukas et al (2005), Patnaik et al (2002), Al turk and Metcalf (1984) and Coleman and Anson (1961) respectively [6,11-14]. Tagil et al noticed that the most consistent incomplete form was the UA alone forming SPA which was seen in about 20% of subjects [15].

There is a report of superficial palmar branch of RA terminating in the thenar muscles without

contributing to the formation of SPA [16]. These arterial variations have enormous importance for vascular graft harvesting, graft applications, free/pedicled flap harvesting in hand surgeries. Therefore prior determination of intact collateral supply of the hand is an essential prerequisite for performing these procedures. Modified Allen's test, Arterial Angiography, Doppler Ultrasound, Photo-plethysmography, can be used to determine the vascular pattern in the palm. The latest reports of Johnson et al [17] on coronary artery bypass graft (CABG) favors the use of an arterial graft, particularly the radial artery as compared to the saphenous vein. The RA contributes greatly to the circulation of hand but in many cases it can be removed as a non-essential vessel, with adequate circulation being provided by the ulnar and in some cases persistent median artery [18]. In this case we are presenting, the only major communication between the radial and the ulnar artery was the formation of deep palmar arch. Therefore in this case, harvesting a graft based on ulnar artery would pose a risk of compromised circulation to most of the palm. These variations should be kept in mind while considering any operative procedure involving this region; otherwise these may result in futile surgical outcome.

Conflicts of Interests: None

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