The Absence of Superficial Palmar Arch with Persistence Median Artery: A Case Report

Behnaz Valipour1,2, Hamid Tayefi Nasrabad1, Kobra Velaei1, Ahad Ferdowsi Kh1, Khadijeh Dizaji Asl1

1. Dept. of Anatomical Sciences, Faculty of Medicine, Tabriz University of Medical Sciences, Tabriz, Iran
2. Dept. of Histopathology, Tabriz Branch, Islamic Azad University, Tabriz, Iran

ABSTRACT

The prominence of the hand function is underlined fundamentally by its rich vascular system. The superficial palmar arch incredibly provides hand with the blood supply, which is normally formed by the ulnar artery and superficial palmar branch of the radial artery. In the current case, the unilateral absence of superficial palmar arch with the rare presence of the median artery was reported, which was noticed in the right hand of a male cadaver during a routine educational dissection. The awareness of particular variations in hand blood supply during hand operations leads in preventing surgical mistakes.

Keywords: Hand, Persistence Median Artery (PMA), Superficial Palmar Arch (SPA)

Introduction

In the upper extremity, the brachial artery arising from the axillary artery passes through intermuscular septum as the powerful blood source toward the cubital fossa. In the cubital fossa at the level of the neck of radius, it subdivides into the radial and ulnar arteries. The following duplicate system serves as an important source of arterial supply (1). In due course, the hand is supplied by the terminal branches of the ulnar and radial arteries through the superficial and deep palmar arch (SPA and DPA). The SPA is a specific arterial arch that is located between the palmar aponeurosis and the long flexor tendons. Typically, the SPA is composed of a terminal branch of the ulnar artery and the superficial (palmar) branch of the radial artery. Ulnar artery enters the palm anteriorly to the flexor retinaculum then passes medial to the hook of the hamate and curves laterally for the anastomosis with the superficial (palmar) branch of the radial artery (2,3). Three common palmar digital arteries (CPDA) give rise to the SPA and finally supply blood for the contiguous sides of 2, 3, 4, and 5th fingers. The radial side of the index finger and the thumb are supplied by the branches of the radial artery. Additionally, the thenar and hypothenar regions, lumbrical muscles, and skin of palm gain some branches from the SPA (4). The vascular pattern of the palmar arches is complicated.

Numerous classifications are reported based on various studies. SPA is characterized into two categories: complete (with anastomosis in arteries) and incomplete arch (without anastomosis in arteries) (5). Therefore, the median artery associated with the median nerve (MN) appears as a temporary artery during the embryonic period to provide blood supply to the hand. After appearing ulnar and radial arteries in the 8th week of gestation, the median artery retrogrades to the small vessel accompanying the median nerve or disappears completely (6). Persistence of the median artery in adult life occurs in 4% of cases and may compress the MN in hand. The complexity of the vascular pattern in hand has gained more attention among researchers. A high frequency of SPA variations is of great clinical importance for surgical approaches. Knowledge about variations of arteries in hand helps the surgeon to carry out a comprehensive assessment during surgery. In the current case, a unilateral Mediano-ulnar type of incomplete SPA is reported for emphasizing awareness of such variation in academic and clinical intentions.

Case Report

Volume 27, November & December 2019

During routine dissection of the upper extremity for undergraduate students in the department of anatomy in the Medical Faculty of Tabriz University, a unilateral variation of SPA was noticed in the right hand of an Iranian male cadaver, which was embalmed in formalin solution for 6 months in order to fixate. The dissection of the upper extremity was performed to exhibit the whole muscles, arteries, and vessels based on Cunningham’s manual of practical anatomy instructions (7). On the right side of the forearm area, three major artery branches were observed in the lower part of the cubital fossa (Figure 1). Between radial and ulnar arteries, the third major branch that is associated with the median nerve was considered as a median artery, which persists in only 4% cases of adults. However, the interosseous artery did not develop and accompanied by an interosseous nerve branch. Therefore, the median artery originated directly from the ulnar artery. The dissection process continued toward the hand to clear the terminal branches of these arteries. Surprisingly, the SPA was missed in the palm area, and the radial artery did not appear in the SPA. Median artery instead of radial artery irrigated the first and second interosseous spaces by 2 common palmar digital arteries. Then, the third and fourth common palmar digital arteries separately came from an ulnar artery, the medial side (Figure 2). More investigation was subsequently performed for exposing DPA. However, DPA did not involve any variations (Figure 3).

Figure 1. Arteries in the lower part of the cubital fossa
RA: Radial Artery, MA: Median Artery, UA: Ulnar Artery, MN: Median Nerve, UN: Ulnar Nerve

Figure 2. In the absence of SPA situation, MA instead of RA irrigated the first and second interosseous spaces; however, the third and fourth common palmar digitals separately came from UA
RA: Radial Artery, MA: Median Artery, UA: Ulnar Artery, MN: Median Nerve, UN: Ulnar Nerve

Figure 3. The absence of SPA with normal DPA
In 2009, reported a rare variation in
some factors, the princeps policies and radialis
vessels like the median artery, which normally
may be due to initial persistence network of fetus
movements of fingers and hands. Variations in the SPA
circulation. Hence, incomplete superficial palmar is
the surgical procedures or occluding artery on one side of
second interosseous spaces. Accidental injury during
uniquely as the common palmar digital for the first and
persistent median artery (PMA) was terminated
third found in which the ulnar artery directly supplied the
interosseous spaces except for the second space
artery. In addition, the ulnar artery supplied the most
indicis and ulnar artery
incomplete type that has been formed by the median
which superficial palmar arch was found in an
Bataineh reported in 84.4% of the cases in another study
remaining 3.6% in 96.4% of the cases and incomplete arch in the
Ikeda A et al. (1988), the complete arch was recorded
4% of the cases and incomplete arch in the
remaining 3.6% (11). However, a complete arch was
reported in 84.4% of the cases in another study (12).
Bataineh et al., in 2009, reported a rare variation in
which superficial palmar arch was found in an
incomplete type that has been formed by the median
and ulnar artery. The princeps policies and radialis
indicis arteries have been originated from a median
artery. In addition, the ulnar artery supplied the most
interosseous spaces except for the second space (13).
In the present case report, an incomplete arch was
found in which the ulnar artery directly supplied the
third and fourth interosseous spaces. Also, the
persistent median artery (PMA) was terminated
uniquely as the common palmar digital for the first and
second interosseous spaces. Accidental injury during
surgical procedures or occluding artery on one side of
the wrist could be compensated by collateral
circulation. Hence, incomplete superficial palmar is
important concerning the clinical aspect (5). Inefficient
blood supply may induce digital ischemia and disturb
movements of fingers and hands. Variations in the SPA
may be due to initial persistence network of fetus
vessels like the median artery, which normally
undergoes regression in the embryonic period. PMA
can originate from different sources, such as brachial,
ulnar, radial, or interosseous arteries (14). In the
present study, PMA raised from the ulnar artery.
Clinically, MN may be compressed by the pressure of
PMA; consequently, compressive neuropathies like
Carpal Tunnel Syndrome (CTS) may happen (6).
Embryological anatomical studies have suggested that
the presence of the PMA may be explained with some
theories. One distinct possibility is the retention of
primitive patterns as a branch of the embryological
axial artery. Another hypothesis explains that, in a
proximal-to-distal differentiation pattern, the upper
limb arteries develop from an initial capillary plexus.
Variations in the formation of SPA or PMA may be a
result of the differentiation, maintenance, and
enlargement of certain capillary vessels while others
undergo regression (6). Although the exact mechanism
of this variation has not been identified, some factors,
such as chemical factors, developmental arrest in early
stages, fetal position in the uterus, and genetic factors,
have been suggested to be involved in this variation
(15,16). Knowledge of SPA variations or PMA is
vitally important because of the contribution to many
surgical and diagnostic problems.

**Discussion**

Human hand anatomy is the primary focus of
surgeries and radiologist due to its complexity in
vascularization and crucial role in microvascular
surgery. Arterial supply for hand is derived from two
superficial and deep palmar anatomic arches. SPA
is the principal vascular structure of the palm. Many
ttempts have been made to find the appropriate
classification of vascular pattern in the hand region (8).
The most famous one is the classification of Coleman
and Anson based on which the superficial palmar arch
has been classified into two groups, Group I and Group
II, and each group has been divided into several
subtypes (Table 1) (9). The predominant type is Group
I (Type A), a superficial palmar branch of radial artery
anastomosis with ulnar artery to form the arch. In the
present study, the incomplete superficial arch has been
discovered. This current variation in SPA fits into the
Type C (Group II) category, according to Coleman and
Anson classification (10). In a study conducted by
Ikeda A et al. (1988), the complete arch was recorded
in 96.4% of the cases and incomplete arch in the
remaining 3.6% (11). However, a complete arch was
reported in 84.4% of the cases in another study (12).
Bataineh et al., in 2009, reported a rare variation in
which superficial palmar arch was found in an
incomplete type that has been formed by the median
and ulnar artery. The princeps policies and radialis
indicis arteries have been originated from a median
artery. In addition, the ulnar artery supplied the most
interosseous spaces except for the second space (13).
In the present case report, an incomplete arch was
found in which the ulnar artery directly supplied the
third and fourth interosseous spaces. Also, the
persistent median artery (PMA) was terminated
uniquely as the common palmar digital for the first and
second interosseous spaces. Accidental injury during
surgical procedures or occluding artery on one side of
the wrist could be compensated by collateral
circulation. Hence, incomplete superficial palmar is
important concerning the clinical aspect (5). Inefficient
blood supply may induce digital ischemia and disturb
movements of fingers and hands. Variations in the SPA
may be due to initial persistence network of fetus
vessels like the median artery, which normally
undergoes regression in the embryonic period. PMA
can originate from different sources, such as brachial,
ulnar, radial, or interosseous arteries (14). In the
present study, PMA raised from the ulnar artery.
Clinically, MN may be compressed by the pressure of
PMA; consequently, compressive neuropathies like
Carpal Tunnel Syndrome (CTS) may happen (6).
Embryological anatomical studies have suggested that
the presence of the PMA may be explained with some
theories. One distinct possibility is the retention of
primitive patterns as a branch of the embryological
axial artery. Another hypothesis explains that, in a
proximal-to-distal differentiation pattern, the upper
limb arteries develop from an initial capillary plexus.
Variations in the formation of SPA or PMA may be a
result of the differentiation, maintenance, and
enlargement of certain capillary vessels while others
undergo regression (6). Although the exact mechanism
of this variation has not been identified, some factors,
such as chemical factors, developmental arrest in early
stages, fetal position in the uterus, and genetic factors,
have been suggested to be involved in this variation
(15,16). Knowledge of SPA variations or PMA is
vitally important because of the contribution to many
surgical and diagnostic problems.

**Table 1. The classification of superficial palmar arches according to Coleman and Anson (from references 9)**

<table>
<thead>
<tr>
<th>Group</th>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
<th>E</th>
</tr>
</thead>
<tbody>
<tr>
<td>Complete Arch (I)</td>
<td>Superficial palmar branch of radial artery + larger ulnar artery (4%)</td>
<td>Entirely by the ulnar artery (56%)</td>
<td>Ulnar artery + enlarged median artery</td>
<td>Radio-Mediano-ulnar arch</td>
<td>Ulnar artery + large-sized vessel derived from deep arch (22%)</td>
</tr>
<tr>
<td>Incomplete Arch (II)</td>
<td>Superficial palmar branch of the radial artery + ulnar artery (4%)</td>
<td>Ulnar artery only (10%)</td>
<td>Superficial vessels of median + ulnar arteries (4%)</td>
<td>Superficial vessels of Radial + median + ulnar arteries</td>
<td></td>
</tr>
</tbody>
</table>

**Conclusion**

It is noteworthy to consider this variation before any
surgical practice or other interference in the hand
region. Also, these relationships may have contributed
to the diagnosis and treatment of various tunnel
syndromes related to the MN or its branches.

**Acknowledgment**

The authors wish to thank all those who donate their
bodies to advance the education and research.

**Conflict of Interest**
Authors declared no conflict of interests.

References


How to Cite This Article:


Download citation:

BibTeX | RIS | EndNote | Medlars | ProCite | Reference Manager | RefWorks