

Bilateral superficial median arteries

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Bilateral superficial median arteries

The superficial artery has been found in the forearm, which arises from the axillary, brachial, or superficial brachial arteries and crosses over the origin of flexor muscles of the forearm, reaching the palm (Adachi 1928; Bergman et al. 1988). When the superficial artery continues to the normal ulnar artery with the ulnar nerve on the wrist, it is called the superficial ulnar artery, an incidence of ~ 4%. When the superficial artery passes below or superficial to the flexor retinaculum in the middle of the forearm, sometimes continuing to the superficial palmar arch, it is called the superficial median artery, an incidence of ~ 1%. Now we have found a relatively rare anomaly of the superficial median artery in both arms, so we herein discuss its clinical importance and the developmental process of the anomalous arteries.

Superficial median arteries (SMA) were found in both the right and left arms of a 94-year-old Japanese female who died of renal failure. The arteries were discovered during a course on gross anatomy for medical students in 1998.

In the right arm (Fig. 1a, b) the axillary artery did not pierce the brachial plexus, but descended medial and below

1 the brachial plexus and ran downward medial and superficial
2 to the median nerve. The relationship between the brachial
3 plexus and the axillary artery is usually called Adachi's
4 C type (Adachi 1928) in Japan. The present brachial artery
5 is called the superficial brachial artery (8 mm in diameter).
6 It divided into radial and ulnar arteries (7 mm and 6 mm
7 in diameter, respectively) 54 mm distal to the lower margin
8 of the latissimus dorsi. The radial artery coursed downward
9 superficial and medial to the median nerve and at the height
10 of the line between the medial and lateral epicondyles,
11 branched off into the SMA (5 mm in diameter). The radial
12 artery ran along its normal course in the forearm and reached
13 the palm to form the deep palmar arch without the branch
14 of the ulnar artery. The SMA coursed downward superficial
15 to the common origin of the pronator teres, flexor carpi
16 radialis, and palmaris longus muscles under the bicipital
17 aponeurosis and the subcutaneous venous system along the
18 lateral side of the palmaris longus to reach the wrist. At
19 this point it crossed beneath the tendon of the palmaris
20 longus from the lateral side to the medial side, and then
21 passed under the flexor retinaculum or through the carpal
22 tunnel with the median nerve, forming a superficial palmar
23 arch with the ulnar artery. In contrast, the ulnar artery
24 ran downward along the median nerve, branching off into the

1 superior and inferior ulnar collateral arteries, and muscle
2 branches to the biceps brachii and brachialis, and continued
3 to the normal ulnar artery at the cubital fossa, continuing
4 on its normal course to reach the palm.

5 In the left arm also (Fig. 1c, d), the axillary artery
6 did not pierce the brachial plexus and continued to the
7 superficial brachial artery (6 mm in diameter), as in the
8 right arm (Adachi's C type). It coursed downward medial
9 and superficial to the median nerve to reach the cubital
10 fossa, where it branched off into the left SMA (2 mm in
11 diameter). Then, 12 mm after this, the brachial artery
12 divided into the radial and ulnar arteries with their normal
13 courses. The SMA pierced the bicipital aponeurosis,
14 running downward and medianly, superficial to the pronator
15 teres and flexor carpi radialis muscles under the
16 subcutaneous venous system and along the lateral side of
17 the palmaris longus. At the wrist, the SMA crossed under
18 the palmaris longus from the lateral to the medial and passed
19 through the carpal tunnel with the median nerve to reach
20 the palm. Since the anastomosis between the SMA and the
21 ulnar artery was not formed, the complete superficial palmar
22 arch was not formed, but the complete deep palmar arch was
23 formed with the deep branch of the ulnar artery and the radial
24 artery.

1 We could not find the muscular branch from either the
2 right or the left SMA. Moreover, additional variation of
3 the profunda brachii artery was observed in both arms,
4 branching off from the posterior circumflex humeral artery
5 originating from the subscapular artery. This anomaly is
6 sometimes observed.

7 In both sides, the ansa, consisting of the medial and
8 lateral roots of the median nerve of the brachial plexus,
9 was not formed. Anterior divisions of the superior, middle,
10 and inferior trunks fused into one cord, which then divided
11 into the musculocutaneous, median, and ulnar nerves. Thus,
12 the medial and lateral cords were not formed. This pattern
13 of the plexus brachialis is observed at incidences of 1.7%
14 (3/175 arms; Kerr 1918), and 2% (4/200 arms; Hirasawa 1931).

15 We encountered two arms with SMAs out of 200 arms dissected
16 in a gross anatomical course between 1996 and 1998, an
17 incidence of 1%. Incidences of SMA reported by other authors
18 are 0.7% (8/1198 arms) by Adachi (1928), 1% (2/200 fetus
19 arms) and 0% (0/100 adult arms) by Müller (1903), and 0%
20 (0/750 arms) by McCormack et al. (1953). Compared to the
21 reported incidences of the superficial ulnar artery of 0.7%
22 (8/1198 arms, Adachi, 1928), 4% (8/200 fetus arms) and 2%
23 (2/100 arms) by Müller (1903), and 2.3% (17/750 arms) by
24 McCormack et al., the incidences of SMA are relatively lower,

1 and so the anomaly presented here is quite rare.

2 Although the incidence of the SMA is very low, and no
3 clinical case reports on the SMA have been documented
4 previously, to the best of our knowledge, it is very important
5 for clinicians to recognize its presence and the clinical
6 problems associated with it, as is the case with the
7 superficial ulnar artery (Cohen 1948; Hazlette 1949; Thoma
8 and Young 1992; Devansh 1996). The reason for this is that
9 accidental injection in the SMA instead of the vein is
10 possible, since the anomalous artery lies between the flexor
11 muscles and the subcutaneous vein, or the artery can be
12 ligated instead of the vein when a radial artery flap is
13 prepared.

14 In Singer's model (Singer 1933) of the development of
15 the human limb arteries, neither the superficial median nor
16 ulnar arteries appeared, and neither was the superficial
17 median artery described in Poteat's model (Poteat 1986) of
18 the process of formation of the limb artery. On the other
19 hand, the superficial antebrachial artery, corresponding
20 to the superficial median and ulnar arteries, can be found
21 in the reconstruction of the arterial system of the arm in
22 a human embryo by Müller (1903). Based upon Müller's model,
23 the disappearance of the superior, middle, and inferior
24 superficial brachial arteries and the superficial

1 antebrachial artery, and distal parts of the median and
2 interosseous arteries, and the persistence of the deep
3 brachial artery cause the normal arterial system to be
4 constructed (Figs. 2a, b). If the proximal part of the deep
5 brachial artery, the middle superficial brachial artery,
6 an anastomosing part between the superficial antebrachial
7 and ulnar arteries, and a connecting part between the median
8 and interosseous arteries disappear, the remaining
9 arteries form the anomalous arterial pattern observed in
10 the right arm in the present case (Fig. 2c). If, moreover,
11 the rest of the deep brachial artery and the inferior
12 superficial brachial artery shown in Fig. 2c also disappear,
13 the variation observed in the left arm is formed (Fig. 2d).

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20 Figure legends

21 Fig. 1. a) and c) are photographs of the right and left arms,
22 respectively. b) and d) are drawings of the right and left
23 arms, respectively. Asterisks in a) and b) indicate the
24 sites where the superficial brachial artery divides into

1 the radial and ulnar arteries. Arrows in a) and b) show
2 the origin of the superficial median artery from the radial
3 artery. Arrows in c) and d) indicate the site where the
4 superficial median artery branches off from the superficial
5 brachial artery. Arrow heads in a) and c) are lined up along
6 the superficial median artery. Bar: 10 cm.

7 Abbreviations: AA: axillary artery, AN: axillary nerve,
8 BB: biceps brachii, BiA: bicipital aponeurosis, BR:
9 brachioradialis, C: cervical nerve, CB: coracobrachialis,
10 FR: flexor retinaculum, LD: latissimus dorsi, MCN:
11 musculocutaneous nerve, MN: median nerve, FCR: flexor carpi
12 radialis, PL: palmaris longus, PM: pectoralis major, Pm:
13 pectoralis minor, PT: pronator teres, RA: radial artery,
14 RN: radial nerve, SBA: superficial brachial artery, SMA:
15 superficial median artery, SPA: superficial palmar arch,
16 SSA: subscapular artery, SUCA: superior ulnar collateral
17 artery, T: thoracic nerve, TB: triceps brachii, UA: ulnar
18 artery, UN: ulnar nerve.

19 Fig. 2. Drawing of the development of normal and anomalous
20 arteries in the arm. (a) Modified reconstruction of the
21 arterial system of the arm in a human embryo 11.7 mm. long
22 from Müller (1903). The origin of the median artery is
23 changed from the proximal site to the origin of the ulnar
24 artery to the distal site, according to Singer's model of

1 arterial development in the arm (1933). The axial artery
2 consists of the axillary (aa), deep brachial (dba), and
3 interosseous arteries (ioa). It is very important that the
4 arteries in the forearm, the radial (ra), ulnar (ua), and
5 median arteries (ma), anastomose with the superficial
6 brachial (sba) or antebrachial arteries (saba) in one period
7 during development of the arteries. Moreover, the superior
8 superficial brachial artery (ssba) originating from the aa
9 does not pass between the medial and lateral roots of the
10 median nerve, and the middle superficial brachial artery
11 (msba) anastomoses with the dba near the boundary between
12 the axilla and the upper arm. The inferior superficial
13 brachial artery (isba) connects with the dba in the upper
14 arm. spa: superficial palmar arch. (b) The normal artery
15 in the arm is shown as a solid line. The aa continues to
16 the brachial artery corresponding to the dba, which divides
17 into the ra and ua, which branches off into the ioa and ma.
18 (c) Anomalous arteries observed in the right arm are shown
19 as a solid line. The sba continues to the ra, and the saba
20 persists as the superficial median artery (sma). The isba
21 and the distal part of the dba persist to the ua. Thus,
22 the superficial brachial artery divides into the ra and ua
23 in the upper arm. (d) Anomalous arteries observed in the
24 left arm shown as a solid line. The sba branches off into

1 the saba, which persists as the sma, and continues to the
2 ra connecting with the ioa and ua.

