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ANOMALOUS PALMER ARCH: A CASE REPORT

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ABSTRACT
The superficial palmar arch is formed by superficial terminal branch of ulnar artery and completed on radial side by either of the superficial palmar branch of radial artery, arteria princeps pollicis, arteria radialis indicis or arteria nervi mediana. It lies beneath the palmar aponeurosis and in front of long flexor tendons, lumbricals and palmar digital branches of median nerve. We report a case of bilateral anomalous palmar arches found during routine dissection of superior extremity of a sixty- five year old male cadaver. In this case, the medial end of the arch was formed as usual by superficial terminal branch of ulnar artery. But at the radial side, the arch was not completed by any of the arteries. Instead, it was terminated by forming the interdigital artery for the web space between middle and index fingers. The arteria princeps pollicis and arteria indicis are arising from the deep palmar arch. The knowledge of anatomical variation has immense importance during diagnostic procedures (angiography) as well as during vascular surgery of hand.

INTRODUCTION

The arterial supply of the hand on the volar aspect consists of two systems, viz, superficial and deep palmar arches. The superficial palmar arch is mainly contributed by ulnar artery, passing superficial to flexor retinaculum, then curving laterally to form an arch, lying just deep to palmer aponeurosis [1]. This arterial arcade is the dominant vascular structure of palm. It is located just deep to palmer aponeurosis and is superficial to digital branches of median nerve, long flexor tendons of forearm and lumbricals of palm [2] from the convexity of the superficial arch, three common palmar digital arteries arises, each dividing into two proper palmer digital arteries. They run along the adjacent sides of medial four fingers to supply them. The radial side of the index finger is supplied by the radialis indicis artery and the thumb is supplied by arteria princeps pollicis, both of them being the branches of Radial artery. Coleman & Anson [3] had classified superficial palmer arch as, one third being formed by ulnar artery alone, in another one third cases it is completed by superficial palmer branch of radial artery and in rest one third cases it is completed either by arteria radialis indicis or arteria princeps pollicis or by persistent median artery.

The anastomosis between ulnar and radial arteries in hand is significant, because it plays an important role in collateral circulation in any disease condition of palm. The knowledge of anatomical variations in vasculature of palm is essential for surgeons and radiologists during diagnostic angiography and various surgeries of hand.

CASE REPORT

The routine dissection on upper limb of a formalin preserved cadaver of an aged male revealed an anomalous pattern of superficial palmer arch. The medial end of the superficial arch was formed by the superficial terminal branch of ulnar artery as usual. But, on the radial side, the arch was not completed by joining with any branches from the radial artery. Instead, it is terminated by forming the inter digital artery for the web space between middle and index finger (FIGURE). As the ulnar artery is not

anastomosing with any branch from radial artery, the superficial arch in this case can be designated as incomplete variety.

Four palmer digital arteries arose from the convexity of the arch. The most medial one supplies the ulnar side of the little finger. The remaining three branches formed common digital arteries that proceeded towards the web and joined with palmer metacarpal arteries from the deep arch. Each artery then divides into two proper palmer digital arteries to supply the adjacent fingers. The most lateral pair of palmer digital arteries are the terminal branches of the arch on the radial side. The arteria princeps pollicis and arteria radialis indicis were arising from the radial artery as usual and supplied the thumb and index finger. The pattern of arterial distribution was same on left and right sided palms. Hence, the anomaly of the superficial palmer arch was bilateral. The vasculature of the superior extremity of the subject was otherwise normal.

DISCUSSION

The traditional definition of superficial palmer arch consists of anastomosis between superficial palmer branch of radial artery and ulnar artery. The ulnar artery, after entering the palm, divides into superficial and deep branches. The superficial branch is the direct continuation of the ulnar artery and main contributor of the superficial palmer arch, which joins with any branch of radial artery to complete the arterial arcade. But, in the present case, the arch is not complete because it has not joined any radial arterial branch.

This arch can be classified as Group II or incomplete variety according to Coleman & Anson's classification of superficial palmer arch. Adachi described this type of arch as Type A: Ulnar type-- in which contribution from radial artery is absent or minimal [4]. Huber classified this type of arch as Type 2 where there is no true and the participating arteries failed to anastomose and giving rise independently to the digital branches [5].

Arey [6] opined that the anomalies of blood vessels develop because of:

1. Unusual pathway of primitive vessels.
2. Persistence of vessels normally obliterated.
3. Disappearance of vessels normally retained.
4. Incomplete development.
5. Fusion and absorption of distinctive parts.

Senior [7] was of view that, when embryo is 18 mm in length, ulnar artery joins with median artery forming superficial palmer arch. This arch then gives rise to the digital branches. In a 23 mm embryo, superficial brachial artery becomes radial artery and establishes communication with superficial palmer arch.

In the present case, the anomaly of the palmer arch can be explained by either disappearance of a segment of ulnar superficial branch originally joining with radial artery or incomplete development of one segment of ulnar artery. The portion of radial artery, interconnecting with the ulnar arterial branch may have undergone the same fate of disappearance or incomplete development. Thus, the ulnar arterial system failed to anastomose with radial arterial system.

Clinical Significance

The knowledge of exact pattern of vasculature of hand is essential for performing superficial dissection and proper interpretation and performance of diagnostic angiography and therapeutic surgery in case of ischemic changes in digits and orthopaedic surgeries on hand. In case of incomplete palmer arch, as in the present case, both ulnar and radial arteries will behave as end arteries. So, any procedure on radial and ulnar arteries should be planned carefully, and any ischemic complications of the digits must be kept in mind. It is mandatory to conduct the investigations like Allen's test, angiography and colour Doppler studies of the hand before undertaking any invasive procedures including the vascular surgeries. The knowledge of variation of vascular patterns of hand gained more importance in microsurgical techniques, reconstructive hand surgeries, radial artery harvesting for myocardial revascularisation, etc. A lack of knowledge of such type of variations may complicate these procedures [8].

Allen's Test

This is a clinical test to determine whether the hand is supplied normally by both radial and ulnar arteries via an anastomosis. The hand is elevated and the subject is asked to make a fist for 30 seconds. Pressure is applied on

both ulnar and radial arteries. Still elevated, the fist is released. It should appear blanched. Then ulnar pressure is released and colour of the palm is expected to return in 7 seconds. If colour returns, Allen's test is negative. If it fails to return, the test becomes positive and ulnar supply is considered to be insufficient. Therefore, the radial artery cannot be safely pricked or canulated. The test is repeated by relieving pressure from radial artery to check adequacy of radial supply [9].

CONCLUSION

In a country like India, with high rate of road traffic accidents, and increasing needs of surgical reconstruction procedures of hand and vascular graft application, the knowledge of anatomical variation of superficial palmer arch is essential. The detailed concept about complex anatomical structures in hand and upper extremity is essential for verifying the validity of various surgical procedures under practice and to define new ones.

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