

# Study of variant superficial palmar arch entirely formed by the ulnar artery

Sonal Govindwar<sup>1</sup>, Swapna Chavan<sup>2\*</sup>

<sup>1</sup>Assistant Professor, Nanded Rural Dental College & Research Center, Nanded, Maharashtra, INDIA.

<sup>2</sup>Assistant Professor, Department of Anatomy, HBT Medical College, and Cooper Hospital, Vile Parle, West Mumbai, Maharashtra, INDIA.

Email: [sonal.govindwar@gmail.com](mailto:sonal.govindwar@gmail.com), [swapna.chavan2012@gmail.com](mailto:swapna.chavan2012@gmail.com)

## Abstract

Superficial Palmar Arch is an arterial arcade and a dominant vascular structure in the palm. It is defined as the anastomosis between the superficial branch of the ulnar artery and superficial palmar branch of the radial artery. In ulnar dominant complete superficial palmar arch, the ulnar artery does not anastomose with radial artery and it terminates by supplying thumb and index finger. In the present study, this type of variation was found in 30.43% of the hands. This is in contrast to the classical superficial palmar arch normally described where the arch is completed on the radial side by superficial palmar branch of radial artery. In accordance with the present study, a feature that is present in 50% of the specimens cannot be called as a rare. In these cases, without an efficient collateral circulation, ulnar artery occlusion may cause claudication and gangrene in the digits and has clinical significance.

**Key Words:** Superficial palmar arch, ulnar dominant complete superficial palmar arch, collateral circulation, anastomosis.

## \*Address for Correspondence:

Dr. Swapna Chavan, Assistant Professor, Department of Anatomy, HBT Medical College, and Cooper Hospital, Vile Parle, West Mumbai, Maharashtra, INDIA.

Email: [swapna.chavan2012@gmail.com](mailto:swapna.chavan2012@gmail.com)

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## INTRODUCTION

Superficial Palmar Arch is an arterial arcade and a dominant vascular structure in the palm. It is defined as the anastomosis between the superficial branch of the ulnar artery and superficial palmar branch of the radial artery. In ulnar dominant complete superficial palmar arch, the arch is entirely formed by ulnar artery and supplies thumb and index finger without communicating with radial artery. In these cases, potential hazard could exist to the digits including thumb and index finger in the event of traumatic injury to the ulnar artery.<sup>1</sup> Due to its superficial nature, the arterial arch is too constantly exposed to mechanical injuries<sup>2</sup>. The ulnar supplied

superficial palmar arch, when interrupted, is most likely to cause digital symptoms<sup>3</sup>. Jaschtschinski SN (1896)<sup>4</sup> in his study of 200 hands, found the arch formed entirely by ulnar artery which supplies thumb and index finger in 38% of the specimens. Coleman SS, Anson BJ (1961)<sup>5</sup> found the incidence of complete arch formed entirely by ulnar artery in 37%. MAJ Mozersky DJ *et al* (1973)<sup>6</sup> noted the ulnar dominant arch in 88% of the hands they studied by ultrasonic evaluation in 70 young volunteers. Earley MJ (1986)<sup>7</sup> noted the incidence of complete arch formed entirely by ulnar artery in 20% of the hands. Gellman H *et al* (2001)<sup>8</sup> found the incidence of complete arch formed entirely by ulnar artery in 31.1 % of the hands. The incidence of complete arch formed entirely by ulnar artery is seen to vary from 20 to 88%, though this is not the classical pattern normally described. The present study was to evaluate the % of cases in which ulnar artery forms the arch entirely and supplies the thumb and index finger. In these cases without an efficient collateral circulation, ulnar artery occlusion may cause claudication and gangrene in the digits and has clinical significance. Recent improvements in microsurgical techniques have increased the necessity of better understanding of the vascular pattern of the hand.

## MATERIALS AND METHODS

A total of 46 embalmed adult human cadaver hands were dissected. A horizontal incision was made at the wrist joint. A vertical incision was made from the middle of this incision upto the 3rd metacarpophalangeal joint. A horizontal incision was made along the root of the fingers. The skin of the palm was reflected. The palmar aponeurosis was removed to reveal the superficial palmar arch and its branches. The arch and its branches were clearly demonstrated by the dissection of the surrounding adipose tissue and the removal of the digital branches of median and ulnar nerves from the palm. The arches were painted in red using artist oil colour. The arches formed

entirely by the ulnar artery without anastomosing with radial artery, and supplying the thumb and index finger were noted.

## RESULTS

Complete superficial palmar arch formed entirely by ulnar artery and supplying the thumb and index finger was found in 14 out of 46 hands with an incidence of 30.43%. (Fig.1 and 2). This is contrast to the classical superficial palmar arch normally described, where the arch is completed on the radial side by superficial palmar branch of radial artery. A feature that is present in 30.46% of the hands may not be called as a variation.

**Table 1:** Observation of percentage of ulnar type of superficial palmar arch in respective studies

authors	% of specimens with ulnar dominant complete arch
Jaschtschinski SN 1986 <sup>4</sup>	38%
Coleman SS and Anson BJ 1961 <sup>5</sup>	37%
MAJ Mozersky DJ <i>et al</i> <sup>6</sup>	88%
Earley MJ <sup>7</sup> 1986	20%
Gellman H <i>et al</i> <sup>8</sup> 2001	31%
Present study	30.43%



**Figure 1**



**Figure 2**



**Figure 3**

### Legend

**Figure 1:** Incomplete superficial palmar arch; **Figure 2:** Incomplete superficial palmar arch; **Figure 3:** Incomplete superficial palmar arch entirely formed by the superficial branch of the ulnar artery.

## DISCUSSION

Coleman SS and Anson BJ (1961)<sup>5</sup> classified the arches into complete arches, when the contributing arteries to the superficial palmar arch anastomosed with each other or the ulnar artery itself forms the arch and supplies thumb and index finger. They grouped the complete arch formed by ulnar artery as Complete Type B and found it in 37% of the cases. The present study follows their grouping of complete arches. Tandler J (1897)<sup>9</sup> in a study of 130 specimens found that the final termination of superficial branch of ulnar artery in the palm is usually an artery which supplies both radial side of index finger and ulnar side of the thumb. He called this as first common volar digital artery. Coleman SS and Anson BJ<sup>5</sup> supported their study. The present study is in accordance with their observations. Little JM *et al* (1973)<sup>10</sup> noted that the

circulatory dynamics in the hand follow a very variable pattern, the ulnar artery being the dominant source of supply in most hands. They concluded that collateral circulation in the hand would generally maintain viability of fingers when either radial or ulnar artery was occluded at the wrist. However, they found that in 9% of the hands, there was drastic disturbance of circulation on occlusion of ulnar artery. They suggested that the variation in collateral adequacy in the hand may explain ischaemic phenomena seen in some patients with the hammer hand syndrome. Hypothenar hammer syndrome occurs in persons who use hand as a hammer. Any finger could become ischaemic following occlusion of ulnar artery or superficial volar arch depending upon the pattern of branching present in the superficial arch and the distribution of digital arteries Conn J *et al* (1970)<sup>11</sup>.

Loukas M *et al* (2009)<sup>1</sup> reported a case of complete superficial palmar arch which had no contribution from radial artery and terminated by giving rise to a common trunk for the princeps pollicis and radialis indicis arteries. They stated that as the arterial supply of thumb in this case is solely provided by superficial palmar arch, a potential hazard could exist in the event of traumatic injury to the ulnar artery. Mookambica RV *et al* (2010)<sup>12</sup> reported a case where the superficial palmar arch was formed exclusively by superficial branch of ulnar artery, without contribution by any other vessel. Ulnar artery continued as the first common digital artery to the interdigital cleft between index finger and thumb and this digital artery was dividing into APP and ARI. They called this type of arch as incomplete SPA based on Gellman classification of palmar arches. They stated that the nomenclature of arteries originating from SPA and supplying thumb and index finger have to be discussed because of their surgical importance. In hand surgeries like vascular graft applications, arterial repairs, free/pedicle flaps clinicians should be aware of these variations, because in most of the traumatic events and the surgical procedures of the hand, SPA plays an important role. In case of ulnar skin flaps, damage to the ulnar artery may present a risk. Interference with an efficient blood supply may result in inefficient utility of the movements of fingers and hand. Superficial Palmar Arch is the main vascular structure of palm. Hence knowledge about the variation in its pattern is important for surgeons dealing with reconstructive hand surgeries and restoration of functional anatomy of hand. To conclude, it is important to continually report significant anatomical variations so that clinicians are aware of these anomalies and thus avoid the potential.

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