

## A STUDY ON SUPERFICIAL PALMAR ARCH AND IT'S VARIATIONS

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**ABSTRACT: INTRODUCTION:** Knowledge of the frequency of anatomical variations of arterial pattern of hand is crucial for safe and successful hand surgical approach, diagnostic and therapeutic procedures. The superficial palmar arch is a major blood supply to the hand. Various anomalous patterns in the superficial arch of hand are reported. The superficial palmar arch is formed predominantly by ulnar artery with a contribution from superficial branch of radial artery.

**OBSERVATIONS:** Superficial palmar arch is dissected within the palm and observed from its origin to termination. Variations in its origin, branches were observed. A classic superficial palmar arch was found in 10% [5/50]. Out of dissected specimens complete arch found in 67% and incomplete arch was 33%. Incomplete arch is formed by ulnar artery alone. It supply four and half fingers and give five branches. Majority of arches is supplied by three and half fingers and gives four branches. **DISCUSSION:** Many attempts have been made to classify these variations. A complex classification of superficial palmar arch by Coleman & Anson [1961]. Since then, many other classification have been suggested by different authors [Karlsson & Niechajev, 1982; al-Turk & Metcalf, 1984; Doscher et al. 1985; Ruengsakulrachh et al. 2001;] provides simplest understanding of distribution of the arches. Although the classical pattern of the arch occurs infrequently, anatomical presence of a complete superficial palmar arch varies from 84% to 66% [Coleman & Anson]. This incidence was lower in the current study and might be a reflection of sample size [52 hands]. The median artery was found in 10% of the hands, similar frequency to that reported by McCormack et al. [1953].

**KEYWORDS:** Arterial system,<sup>1</sup> Anomalous branching,<sup>2,3</sup> embryonal Arterial system,<sup>4,5</sup> surgical implications.<sup>6</sup>

### INTRODUCTION:

- Vascular anatomy of the hand is complex, challenging area and has been the subject of many anatomical studies.
- Knowledge of the frequency of anatomical variations of arterial pattern of hand is crucial for safe and successful hand surgical approach, diagnostic and therapeutic procedures.
- The superficial palmar arch is a major blood supply to the hand.
- Various anomalous patterns in the superficial arch of hand are reported.
- The superficial palmar arch is formed predominantly by ulnar artery with a contribution from superficial branch of radial artery, and however in some radial artery may be absent; instead with either princeps pollicis, radial indicis, median artery.

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**CLASSIFICATION OF COLEMAN AND ANSON (1961)<sup>(7)</sup>:** It is classified into two groups.

**GROUP 1:** Complete arch (78.5%) is further divided into five types.

**TYPE A:** The classical radio ulnar arch formed by superficial palmar branch of radial artery and ulnar artery [34.5%].

**TYPE B:** This arch is entirely by ulnar artery [37%]

**TYPE C:** Medio-ulnar arch [3.8%]

**TYPE D:** Radio- mediano ulnar arch [1.2%]

**TYPE E:** This arch initiated by ulnar artery and completed by a vessel from Deep arch [2%]

**GROUP 2:** Incomplete arch- when the contributing arteries from ulnar artery Fails to form an arch; it is incomplete. It can be further divided into 4 types:

**TYPE A:** both superficial palmar branches of radial and ulnar artery take part in supply but fail to anastomose [32%].

**TYPE B:** only the ulnar artery forms the arch but is incomplete in sense that it does not supply thumb and index [13.4%].

**TYPE C:** superficial vessels receive contribution from the both median and ulnar arteries but without anastomosis [3.8%].

**TYPE D:** radial, median and ulnar arteries all give origin to superficial vessels but don't anastomose [1.1%].

**The above classification was considered for present study;**

## **SCOPE & OBJECTIVES:**

- The objective of present study was to evaluate these arterial variations,<sup>(8)</sup> with special attention to the superficial palmar arch contributing vessels and its major branches.
- The purpose of study was to add new information on the variations of these vessels with respect to the presence or absence of a complete superficial palmar arch and to correlate the findings with laterality information.
- Variations in the ulnar artery branches which supply the fingers are utmost important in ischemia.
- Harvesting radial arteries for use as arterial bypass conduits, one of the risks associated with hand collateral circulation.
- This study has been taken up because superficial palmar arch and its variation including the collateral circulation are having a lot of surgical importance and it is of major help to the vascular surgeons.

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- Through the study was mainly confined to morphology of formation of superficial palmar arch and its variations an attempt is made in this direction to study the arch from its information to its termination.
- The study has been taken carefully so that the data collected by an anatomist can render to the progress of art and science of surgery is to discuss the difficulties to which surgeons are exposed.

## MATERIAL & METHODS:

- 52 hands from 26 embalmed human cadavers were studied. Variations of palmar arches were recorded. This study was carried out during routine dissections sessions for medical students in Siddhartha medical college, Vijaywada.
- Among 52 hands 12 hands dissection study carried out at NRI medical college, chinnakakani, Guntur.
- The cadavers were formalin fixed; skin was carefully dissected to avoid overlooking any contribution of superficial vessels to the palmar arch. All arteries and nerves distal to the elbow joint were identified and dissected on either side of limbs.
- Anomalous tortuosities, dilatations, aneurysms or occlusive disease tissue were discarded at the beginning of the study.
- An anatomically normal superficial palmar arch was defined and noted with certain variations.
- The dissected palms with vessels insitu were serially tagged using plastic tokens with numbers on either side of upper limbs and preserved in formaldehyde solution.

## OBSERVATION:

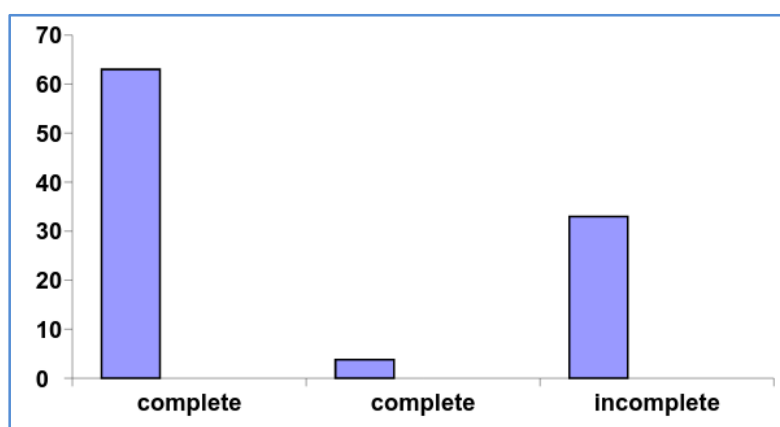
- Superficial palmar arch is dissected within the palm and observed from its origin to termination. Variations in its origin, branches were observed.
- A classic superficial palmar arch was found in 10% [5/50]. Out of dissected specimens complete arch found in 67% and incomplete arch was 33%.

Type of Arch	Arteries Forming arches	No. of Specimens	%
Complete	Radial & ulnar	33	63
Complete	Ulnar & median	2	3.8
Incomplete	Ulnar artery	17	33

Table 1: Superficial palmar arch

In completed arch formed by ulnar artery alone, which in majority of cases supplies 3½ fingers.

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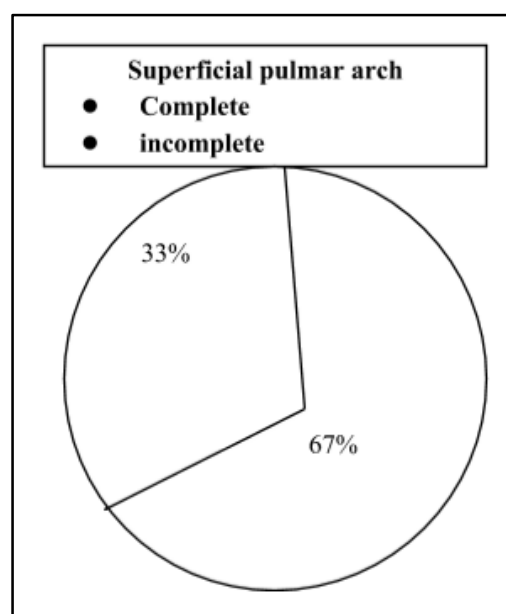
**Graph 1**

Incomplete arch is formed by ulnar artery alone. It supply four and half fingers and give five branches. Majority of arches is supplied by three and half fingers and gives four branches.

Type of Arch	No. of Specimens	%
Complete	35	67
Incomplete	17	33

**Table 2: Superficial palmar arch**

The following shows the percentage of the total specimens.



**Graph 2**

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	Complete (%)	Incomplete (%)
Coleman & Anson <sup>(7)</sup>	78.5	21.5
Ikeda <sup>(9)</sup>	96.4	3.6
Ruengsa kularch <sup>(10)</sup>	66	34
Present study	63	33

TABLE 3: Superficial palmar arch

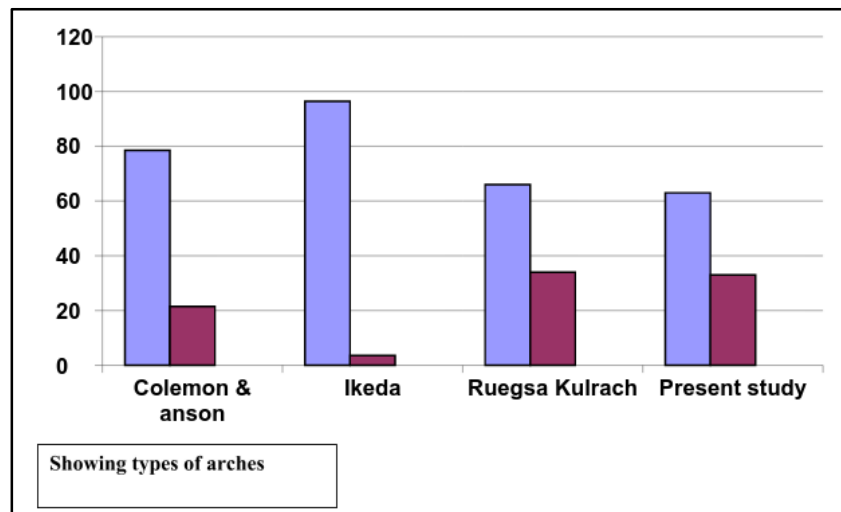
Among the observations of specimens done complete arch formed by radial artery in some, ulnar artery and medial artery in few specimens.

## DISCUSSION:

- Superficial palmar arch and its branches supply the hand. The vascular patterns of the palmar arches<sup>(11)</sup> and their inter connecting branches present a complex and challenging area of study.
- Many attempts have been made to classify these variations. A complex classification of superficial palmar arch by Coleman & Anson [1961].<sup>(7)</sup> Since then, many other classification have been suggested by different authors [Karlsson & niechajev, 1982; al<sup>(12,13)</sup> Turk & Metcalf, 1984<sup>(14)</sup>; Doscher et al. 1985; Ruengsakulrachh et al. 2001;<sup>(10)</sup> provides simplest understanding of distribution of the arches.
- The variations observed in this study were congenital/developmental in origin.
- Although the classical pattern of the arch occurs in frequently, anatomical presence of a complete superficial palmar arch varies from 84% to 66% [Coleman & Anson].<sup>(7)</sup> This incidence was lower in the current study and might be a reflection of sample size [52 hands].
- The median artery was found in 10% of the hands, similar frequency to that reported by McCormack et al. [1953].<sup>(15)</sup> Although o' Sullivan & Mitchell [2002]<sup>(16)</sup> suggested that absence of palmaries long us tendon was present in all cases examined here.
- Right superficial palmar arch, described in literature, showing all the branches in the current study.
- An incomplete superficial palmar arch<sup>(17)</sup> formed only by the ulnar artery in the above 1<sup>st</sup> specimen.
- A superficial palmar arch in which the median artery substituted the radial artery to complete the arch in the 2<sup>nd</sup> specimen.

## TABLE FOR DISCUSSIONS:

Author	Complete	Incomplete
Coleman & Anson	78.5	21.5
Ikeda	96.4	3.6
Ruengsa kularch	66	34
Present study	63	33



**Graph 4**

## Prevalence of persistent median artery:

Sl. No	Author of the year	% age
1.	Tandler et al (1887)	16%
2.	Adachi (1928) <sup>(2)</sup>	8%
3.	Misra (1955)	8.4%
4.	Coleman & Anson (1961) <sup>(7)</sup>	9.9%
5.	Keen (1961) <sup>(18)</sup>	9.5%
6.	Anson (1966) <sup>(4)</sup>	8.0%
7.	Karlsson (1982) <sup>(13)</sup>	4.0%

Coleman and Anson (1961) classified the superficial palmar arch in 2 groups.

**GROUP 1:** Complete arch (Found in 78.5% cases) is further divided into five types:

**TYPE A:** The classical radio ulnar arch formed by superficial palmar branch of radial artery and the larger ulnar artery (34.5%).

**TYPE B:** This arch is formed entirely by ulnar artery (37%).

**TYPE C:** Media no – ulnar arch is composed of ulnar artery and an enlarged median artery (3.8%) (8% by Anson, 1966).

**TYPE D:** Radio- mediano - ulnar arch in which 3 vessels enter into formation of the arch (1.2%).

**TYPE E:** it consists of a well formed arch initiated by ulnar artery and completed by a large sized vessel derived from deep arch (2%).

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## GROUP II:

**TYPE A:** Both superficial palmar branch of the radial artery and ulnar artery take part in supplying the palm and fingers but in doing so fail to anastomose (3.2%).

**TYPE B:** Only the ulnar artery forms the superficial palmar arch but arch is incomplete in the sense that it does not supply the thumb and the index finger (13.4%).

**TYPE C:** Superficial vessels receive contribution from both median and ulnar arteries but without anastomosis (3.8%).

**TYPE D:** Radial, median and ulnar arteries all give origin to superficial vessels but don't anastomose (1.1%).

## SUMMARY & CONCLUSION:

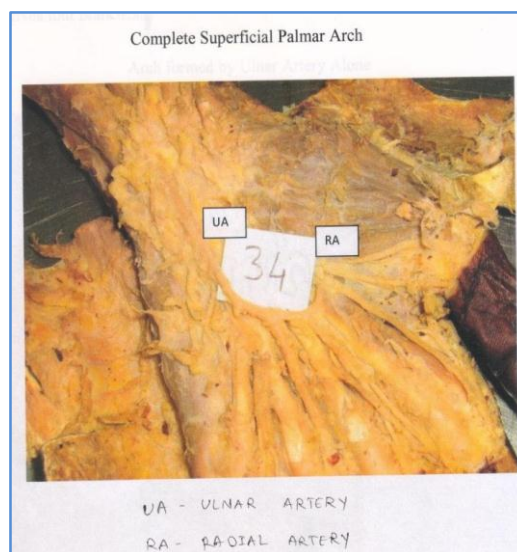
- Variations in the termination of radial and ulnar arteries are common. Although the classic type of the superficial palmar arch occurs relatively infrequently, there is always a significant anastomosis between the radial and ulnar artery in hand.
- In the absence of vascular disease, harvesting the radial artery should be a safe procedure.
- The variations in the present study may have resulted from the median artery, identifying the median artery as one of the causes for carpal tunnel syndrome is crucial for proper management.
- In addition the palmar arterial network arrangements are intricate.
- In addition of any variation in the arterial pattern of hand using Doppler us, oximetric techniques acquire great importance in various surgical interventions in the hand.
- The results of the present study have been discussed in detailed and comparative study has been discussed in detailed and comparative study has been made with available data.
- Further, in the present study, median artery shows forming superficial palmar arch 2% of cases.
- To conclude the findings of the present study may be useful for vascular surgeons at large.

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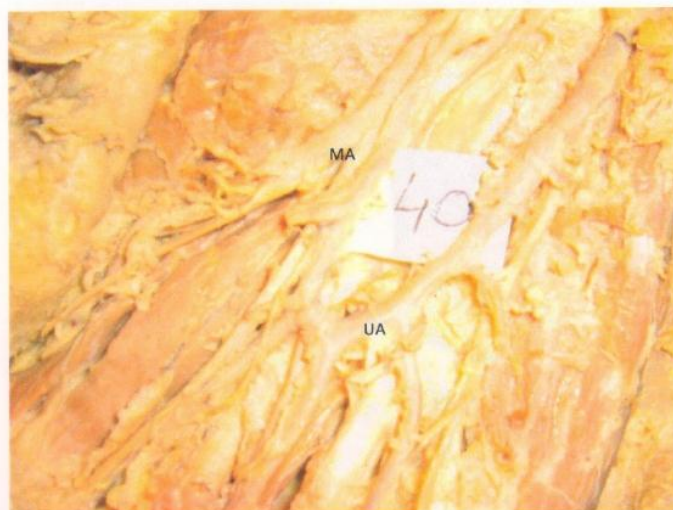
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Photograph showing Superficial Palmar Arch formed by Ulnar Artery and Median Artery



UA - ULNAR ARTERY  
MA - MEDIAN ARTERY

Incomplete arch is formed by ulnar artery alone. It supply four and half fingers and gives five branches. majority of arches is supplied by three and half fingers and gives four branches.

Arch formed by Ulnar Artery Alone



Incomplete Superficial Palmar Arch

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