An Anatomical Variation of Median Artery of Forearm and Palm: Cadaveric Study into its Origin and Course

Khan GA, Shrestha A

Department of Anatomy

Chitwan Medical College,

Bharatpur, Chitwan, Nepal.

Corresponding Author

Gulam Anwer Khan

Department of Anatomy,

Chitwan Medical College,

Bharatpur, Chitwan, Nepal.

E-mail: aanwer227@gmail.com

Citation

Khan GA, Shrestha A. An Anatomical Variation of Median Artery of Forearm and Palm: Cadaveric Study into its Origin and Course. *Kathmandu Univ Med J.* 2022;80(4):443-7.

ABSTRACT

Background

The median artery (transitory artery) represents the forearm's embryonic arterial axis. At 8th week of gestation retreats into a little canal that supplies the median nerve. Later, ulnar and radial arteries take its place. Adults may still have it in either a palmar or an antebrachial pattern. The persistent median arteries are a long, angular arterial that extends to the hand's palmar surface. The median artery only partially recedes in the antebrachial type.

Objective

To identify the median artery distribution in the adult Nepalese population.

Method

Twenty-five adult human cadavers' left and right upper limbs undergone to descriptive research. The persistent median artery was exposed according to the Cunningham's Manual of Practical Anatomy.

Result

The forearm and hand arteries in each of the fifty upper limbs from the twenty-five formalin-embalmed human cadavers were studied. Among fifty upper limbs, persistent median arteries were found in six (twelve percent) of them. One percent of a cadaver's right and left limbs had bilateral persisting median arteries (ante brachial). Persistent median artery of the ante brachial type that arises from the anterior interosseous artery in a right upper limb. Persistent median artery emerging from the posterior interosseous arteries were visible in one right upper limb.

Conclusion

The study showed persistent median artery of ante brachial type. The posterior interosseus artery is the source of the majority of antebrachial type. A median artery piercing the median nerve was discovered.

KEY WORDS

Ante brachial, Carpal tunnel variation, Median nerve, Palmar, Persistent median artery

INTRODUCTION

Median artery is an embryonic arterial axis of the forearm. It regresses into a little channel that supplies median nerve at eight weeks of gestation. Later ulnar and radial arteries replaced it. In adults it may persist either in palmar or ante brachial pattern. The long palmar pattern extents to the palm of hand. The ante brachial type is an incomplete regression of the median artery.[1]

The median artery is a transitory vessel during early embryonic life and after the eighth week of gestation is regressed by undergoing apoptosis to become as the arteria comitans nervi median. The median artery in adult life can be categorized into two different patterns, antebrachial and palmar which is large, long artery and reaches the palm.[2]

The median artery is a transitory vessel that represents the arterial axis of the forearm during the early embryonic life. It normally regresses after the second embryonic month to become a small slender artery, the commitansnervi median.[3]

A right human forearm showed persistence of the median artery in combination with anomalies of the median nerve and of the palmar circulation. The median nerve formed a ring enclosing the median artery, gave off its 3rd palmar digital branch in the forearm, and had a high palmar cutaneous nerve origin and a double thenar supply.[4]

About a third of the superficial palmar arches are formed by the ulnar artery alone; a further third are completed by the superficial palmar branch of the radial artery and the remaining third either by the arteria radialis indicis, or a branch of arteria princeps pollicis or by the median artery.[5]

The clinically important superficial median artery is a graft vessel. The knowledge of their anatomical pattern is beneficial in understanding upper limb vascularization and determining the potential surgical risks.

METHODS

A descriptive, conventional study using conventional sampling method was conducted at Department of Anatomy, School of Medical Sciences, Chitwan Medical College, Kailashnagar, Bharatpur -5, Nepal. The study was conducted from fifth May 2022 to thirtieth July 2022. Ethical approval (Reference no: CMC-IRC/079/080-002) was granted from IRC Of CMC. Both Upper limbs of twenty-five formalin embalmed adult human cadavers were studied. The dissection of limb as per the dissection guidelines which were given by the Cunningham's Manual of Practical Anatomy, to expose the median nerve and its whole course from its formation till its termination. The two transverse incision was given at the level of condyle of humerus in cubital fossa and at the level of flexor retinaculum of wrist.

An incision was made joining the mid-point of first two incisions made. After reflection of skin superficial fascia and deep fascia, the median artery was well traced. Similarly, the persistent median artery was traced till its termination. SPSS 20 version and Epidata 3.1 version for data analysis and entry. Damaged and Putrefied cadavers are kept under exclusion criteria.

RESULTS

Arteries of forearm and hand were examined in all fifty upper limbs of both of twenty-four formalin embalmed human cadavers. Persistent Median arteries were observed in six limbs (twelve percent) of all fifty upper limbs. In both right and left limb of single cadaver (one percent) the persistent median arteries (ante brachial) were bilateral. Out of the six upper limbs, one right upper limb has persistent median artery were ante brachial type arising from anterior interosseous artery. Out of Remaining five, four left upper limbs and one right upper limb showed persistent median artery arising from posterior interosseous artery. The ante brachial types were found to be slender, tapered and terminated in distal third of the forearm passing underneath the pronator quardatus. The palmar type of persistent interosseous median artery was not found in any upper limbs. A small thin interosseous artery was found piercing median nerve in right upper limb. No any persistent median artery was found crossing over the flexor retinaculum.

Table 1. Table showing prevalence variation of median artery

No of cadavers (n=50)	Persistent Median Artery (n=6)	Normal variation (n=44)
100%	6 (12 %)	44 (88%)

Table 2. Table showing variation of persistent median artery

Persistent median artery (n=6)	
Right (n=2)	Left (n=4)
2 (33.33 %)	4 (66.66%)

Figure 1. Figure of right upper limb showing persistent median artery (black lined), median nerve (yellow lined), radial artery (green lined) and ulnar artery (red lined)

Table 3. Table showing type of persistent median artery

Persistent median artery (n=6)	
Ante brachial type (n=6)	Palmar type (n=0)
6 (100%)	-

Table 4. Table showing origin of ante brachial type

Ante brachial type (n =6)	
Arising from posterior interosseous artery (n=5)	Arising from anterior interosseous artery (n=1)
5 (83.33%)	1 (16.66%)

Figure 2. Figure of right upper limb showing persistent median artery (blacked marked, ante brachial type) arising from anterior interosseous artery: (red marked) brachial artery, (maroon marked) median nerve, (yellow marked) ulnar artery and (green marked) radial artery.

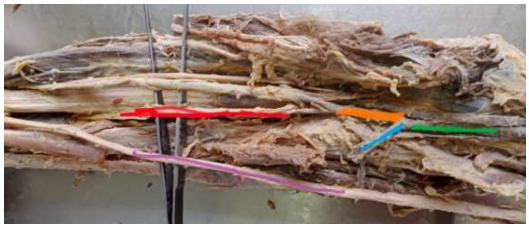

Figure 3. Figure of left upper limb showing Persistent Median Artery (ante brachial type) arising from Posterior Interosseous Artery: (red marked) persistent median artery arising from Posterior Median Artery, (green marked) brachial artery, (sky blue marked) Radial artery, ulnar artery (orange colored) and (purple marked) Median nerve.

Table 5. Table showing median artery piercing median

Median artery piercing median nerve(n=1)
1 (100%)

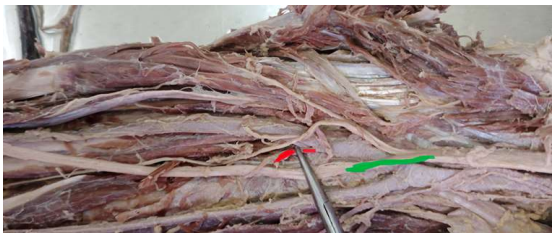

Figure 4. Picture of left upper limb Showing Small Branch of Persistent Median Artery (Red Marked) Piercing the Median Nerve (Green Marked).

DISCUSSION

The present study showed that only antebrachial type (six in number) of persistent median artery. Out of which five were arising from anterior interosseous artery and remaining one arising from posterior interosseous artery. One small branch of persistent median artery was found piercing the median nerve. The findings were in close proximity to the findings of past researches.

Bijannejad et al. conducted a study for ten years on persistent median artery in carpal tunnel and anastomosis with superficial palmar arch.[2] The result of the study showed that only one palmar variant of persistent median artery was found in but was arising directly from brachial artery. Singla et al. reported-on study "Prevalence of the Persistent Median Artery" that out of sixty upper limbs of thirty cadavers four limbs showed antebrachial type of persistent median artery and three upper limbs showed palmar type of persistent median artery.[3] This difference with present study in results could be due to racial, ethnicity and geographical variations.

Sanudo et al. reported that palmar variants of persistent median artery were found during routine cadaveric dissection.[4] Palmar variants were long. thin and slender passing deep under the flexor retinaculum. The difference in findings of study could be due to variation in race ethnicity, environment and life style. Gupta et al. reported that one out of seventy-five specimen of hand showed palmar variety of persistent median artery.[5] Natis et al. reported on regular routine dissection performed of seventy-two upper limbs of thirty-six cadavers that palmar type of persistent median artery was found in two right upper limb of one female and male cadavers.[6]

Henneberg et al. studied ninety-six forearms (forty-seven left and forty-nine right) of sixty-four African cadavers died between 1988 to 1989 (fifteen female and forty-nine male).[7] The study showed that twenty-three males (31.3 percent) and three (fifteen percent) female cadavers possess persistent median artery. Out of forty-nine right forearms eleven (22.4 percent) possessed persistent median artery and out of forty-seven left forearms fifteen (31.9 percent) possessed persistent median artery.

Agrawal et al. reported-on study conducted over two years on fifty-two hands of fifty-two cadavers out of twenty-six hands having variation showed the incidence of persistent median artery was found in six hands (11.53 percent).[8] Alexander et al. reported-on study conducted on left upper limb of formalin preserved fifty-to-sixty-year adults showed that palmar variants of persistent median artery were observed.[9] Raviprasanna et al. conducted a study on fifty human cadavers from 2011-2013.[10] Out of fifty human cadavers, four median arteries (eight percent) were arising from anterior interosseous artery (palmar variant).

Niedenfuhr et al. conducted a study on two hundred forty forearms showed that twenty-nine out of two hundred forty (twelve percent) possessed palmar variants of persistent median artery.[11] Nejad et al. stated about a study conducted on left upper extremity of adult male cadavers, persistent median artery (palmar variants) was found in two to eight percent cadavers.[12] Most of Persistent median artery arises from common interosseus artery and anterior interosseus artery. Only 3.8 percent arises from brachial artery. Shree et al. conducted a cadaveric study on forty upper extremities of twenty cadavers.[13] Out of forty cadavers, two and half percent (right forearm of female cadavers) showed palmar type of persistent median artery.

Patnaik et al. concluded from their study that the persistent median artery originated from the ulnar artery in the cubital fossa.[14] It pierced the median nerve, descended anterior to the nerve in a common sheath and passed deep to the flexor retinaculum. An accessory head of flexor pollicis longus, which is a usual finding associated with the persistent median artery, was seen in one forearm. The superficial palmar arch was not seen in any specimen with persistent median artery. In all the specimens with persistent median artery, the lateral half of the palm and lateral two and half digits were supplied by it, whereas the medial half of palm and the medial two and half digits were supplied by the ulnar artery.

Haladaj et al. mentioned that out of the one hundred twenty-five upper limbs, Persistent median artery was found in five specimens (four percent of the total number of limbs).[15] In the carpal tunnel, the artery occupied the anterolateral position (two cases), the anterior position (two cases) or the anteromedial position (one case) in relation to the median nerve. Two types of superficial palmar arches with significant contributions from the persistent median artery were observed in the studied material: complete medio-ulnar arch and an incomplete arch without a connection between the territories of the ulnar and median arteries. The mean ratio of the diameter of the Persistent median artery (PMA) to the diameter of ulnar artery.

A study by Claassen et al. found that large median artery in 7.4 percent cases.[16] The median arteries took their origin from the ulnar artery or the common interosseous artery. In one case, the median artery pierced the median nerve in its course under the pronator teres. The outer diameters of the median arteries varied between 1.5 mm and 2.0 mm. The radial arteries were not replaced in any of their cases with a large median artery.

Kopuz et al. showed that no any persistent median artery was found in thirty-five Turkish adult cadavers.[17] This could be due to variation in topography, geographical location, food habits and climatic conditions. Pratap et al. concluded that the persistent median arteries on both sides were arising from ulnar artery, accompanied the median nerve and contributed to the superficial palmar arch which supplied the lateral two and half fingers.[18] Persistent median artery may be present asymptomatically in most of the individuals but it may lead to compression symptoms of median nerve when artery is subjected to compression.

The study with limited sample size which represents the limited sample population conducted in limited study period.

CONCLUSION

The results of the study showed that presence of persistent median artery (ante brachial type). Most of ante brachial type of persistent median artery arise from posterior interosseous artery. A single median artery was found to pierce the median nerve. The results of the research were in close proximity with previous research findings.

ACKNOWLEDGEMENT

We would like to thank the ethical committee of Chitwan Medical College for providing us the consent to conduct this study at this esteemed institute. We would also like to whole heartedly thank the administration and department without whom the study would not have been possible.

REFERENCES

1. Arey LB. Developmental anatomy, (w.) Textbook and laboratory manual of embryology. WB Saunders Company. Philadelphia-London; 1965.
2. Bijannejad D, Azandeh S, Javadnia F, Gholami MR, Gharravi AM, Zhaleh M. Persistent median artery in the carpal tunnel and anastomosis with superficial palmar arch. *Case Reports Plast Surg Hand Surg*. 2016 Apr 18;3(1): 25-7.
3. Singla RK, Kaur N, Dhiraj GS. Prevalence of the persistent median artery. *J Clin Diagn Res.* 2012 Nov;6(9):1454-7.
4. Sanudo JR, Chikwe J, Evans SE. Anomalous median nerve associated with persistent median artery. *J Anat.* 1994 Oct;185 (Pt 2) (Pt 2):447-51.
5. Gupta C, Kalthur SG, Nair N, Pai SR. A morphological study of variations in superficial palmar arches of the hand. CHRISMED J Health Res. 2015 Apr 1;2(2):140.
6. Natsis K, Iordache G, Gigis I, Kyriazidou A, Lazaridis N, Noussios G, et al. Persistent median artery in the carpal tunnel: anatomy, embryology, clinical significance, and review of the literature. *Folia Morphol (Warsz).* 2009;68(4):193-200.
7. Henneberg M, George BJ. High incidence of the median artery of the forearm in a sample of recent southern African cadavers. *J Anat*. 1992 Feb;180 (Pt 1) (Pt 1):185-8.
8. Agarwal P, Gupta S, Yadav P, Sharma D. Cadaveric study of anatomical variations of the median nerve and persistent median artery at wrist. *Indian J Plast Surg*. 2014 Jan;47(1):95.
9. Alexander JG, Leal MC, Baptista JDS. Persistent median artery inside the carpal tunnel: description and surgical implications. *Autops Case Rep*. 2020 Sep 2;10(4):e2020209.
10. KH R, Dakshayani KR. Persistent median artery in the carpal tunnel. *Int J Anat Res.* 2014;2(3):589-93.
11. Rodriguez-Niedenfuhr M, Vazquez T, Parkin IG, Sanudo JR. Arterial patterns of the human upper limb: update of anatomical variations and embryological development. *Eur J Anat.* 2003 Jul 1; 7:21-8.
12. Nejad DB, Azandeh S, Gholami MR, Gharravi AM, Zhaleh M. Superficial palmar arch with Persistent median artery. *J Anat Soc India.* 2016 Dec 1;65(2):175-6.
13. Shree B, Khullar M, Kumar A, Singh Z. Study of Palmar Type of Median Artery and its Fate. *Int J Anat Res*. 2015 Jul-Sep; 3(3): 1267-72.

14. Patnaik M, Paul S. Persistent median artery of the forearm and palm: a cadaver study into its origin, course, fate and clinical significance. *Ital J Anat Embryol*. 2016;121(1):88-95.

15. Haładaj R, Wysiadecki G, Dudkiewicz Z, Polguj M, Topol M. Persistent median artery as an unusual finding in the carpal tunnel: its contribution to the blood supply of the hand and clinical significance. *Med Sci Monit.* 2019;25:32.

16. Claassen H, Schmitt O, Wree A. Large patent median arteries and their relation to the superficial palmar arch with respect to history, size consideration and clinic consequences. *Surg Radiol Anat*. 2008; 30:57-63.

17. Kopuz C, Gülman B, Bariş S. Persistent Median Artery: An Anatomical Study in Neonatal. *Acta Anat Nippon.* 1995 Dec;70(6):577-80.

18. Prathap Kumar D, Kulkarni R. Persistent palmar pattern of Median artery bilaterally. *Int J Anat Res.* 2013;1(2):43-5.