Section: Anatomy

Original Research Article

ANALYSIS OF VASCULAR AND NEURAL ANATOMY OF THE HAND IN ADULT CADAVERS: AN ISTITUTIONAL BASED STUDY

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Abstract

Background: Recognizing anatomical variations of the median nerve at the wrist is crucial for addressing traumatic injuries and managing compression syndromes. Hence, this study was conducted to investigate the vascular and neural anatomy of the hand in adult cadavers. **Material & Methods:** An analysis was conducted on a total of 20 adult cadaver hands, previously preserved in a 10% formaldehyde solution, using anatomical dissection methods. Only the left hand of each cadaver was dissected. Statistical analysis was performed using SPSS software. **Results:** The anatomical dissection of 20 adult cadaver hands revealed varying frequencies. Specifically, the highest occurrence was observed in superficial palmar arch type I (20%), with the minimum occurrence in Type VI. **Conclusion:** The highest frequencies were observed in type I of the superficial palmar arch, type II of the median nerve, and type I of the deep palmar arch.

INTRODUCTION

The hand plays an important role in the daily life of humans. The hand enables us to position, orient, and grasp objects by touching them and provides our communication with the outside world.[1] In addition to the innervation of the hand and hand-related structures, which take such an essential place in our lives, its nutrition is also vital. The superficial palmar arch (SPA) and deep palmar arch (DPA), which are formed by the ulnar artery (UA) and radial artery (RA), are the structures feeding the hand.[2] Most of the studies on the SPA have been performed by the anatomical dissection method.[3] Furthermore, there are also studies conducted with angiography and Doppler-ultrasonography methods.[4] In the Turkish population, there are few studies using the anatomical dissection method concerning the SPA and DPA.[5]

Awareness of anatomical variations of the median nerve at the wrist is important in repair of traumatic injuries and treatment of compression syndrome because in these situations, precise dissection of the nerve is mandatory and such variations are not infrequent.[6] The knowledge of variation will prevent damage to the median nerve during the surgical release of the carpal tunnel in patients of carpal tunnel syndrome and reduces on table confusion in cases of the median nerve injury. Standard anatomical books states that at wrist median nerve enters the carpal tunnel deep to the flexor retinaculum and reaches the palm beyond the distal border of flexor retinaculum and divides into lateral and medial branches.[7] The lateral branch gives off a recurrent muscular branch to supply the three thenar muscles and then subdivides into three proper palmar digital nerves to supply the two sides of the thumb and radial side of the index finger. The branch to the index finger provides a branch to the first lumbrical. The medial branch subdivides into two common palmar digital nerves, lateral and medial. The lateral common nerve gives a branch to the second lumbrical and subdivides to supply the adjacent sides of the index and middle finger. The medial common nerve receives a communicating branch from the superficial branch of the ulnar nerve and then subdivides to supply the adjacent sides of the middle and ring finger.[8,9] The vascular structure of the hand, which is a highly complex area, has been investigated in many studies to date.

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Especially with advances in microsurgery, the vascular structure of the hand has become even more important in reconstructive hand surgery.[10,11] Hence, this study was conducted to investigate the vascular and neural anatomy of the hand in adult cadavers.

MATERIALS AND METHODS

An analysis was conducted on a total of 20 adult cadaver hands, previously preserved in a 10% formaldehyde solution, using anatomical dissection methods. All cases with congenital anomalies, deformities and injuries to the hand and wrist were excluded from the study. Only the left hand of each cadaver was dissected. The dissection process involved making two transverse incisions through the wrist fold and finger roots, along with a vertical incision connecting the midpoint of these two incisions, to remove the skin. Subsequently, the subcutaneous adipose tissue was cleared, and the palmar aponeurosis was extracted. The evaluation commenced with an assessment of the presence of the SPA (Superficial Palmar Arch). Following the completion of SPA measurements, the analysis included determining the number of branches from the MN (Median Nerve) and the DPA (Deep Palmar Arch). Statistical analysis was performed using SPSS software.

RESULTS

The anatomical dissection of 20 adult cadaver hands revealed varying frequencies. Specifically, the highest occurrence was observed in superficial palmar arch type I (20%), with the minimum occurrence in Type VI. For the median nerve, type II exhibited the highest frequency (25%), while Type III had the lowest frequency. Similarly, in the deep palmar arch, type I had the maximum frequency (25%), whereas Type III had the minimum occurrence.

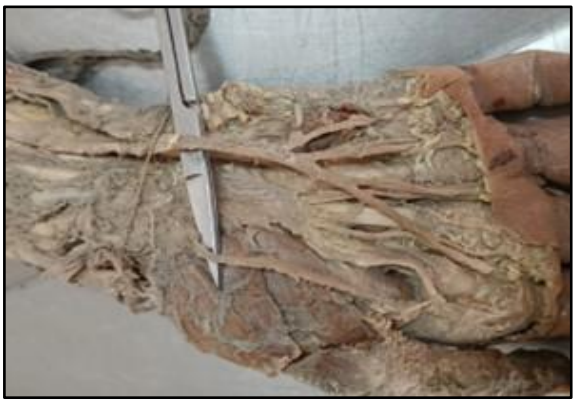

Figure 1: Superficial palmar arch

Table 1: Frequency of types of superficial palmer arch

Types	N (%)
Type I	4 (20)
Type II	1 (5)
Type III	2 (10)
Type IV	1 (5)
Type V	2 (10)
Type VI	0
Type VII	1 (5)

Table 2: Frequency of types of median nerve

Types	N (%)
Type I	3 (15)
Type II	5 (25)
Type III	0
Type IV	1 (5)

Table 3: Frequency of types of deeper palmer arch

Types	N (%)
Type I	5 (25%)
Type II	1 (5%)
Type III	0

DISCUSSION

The extrinsic and intrinsic muscles of the hand provide hand movements. The extrinsic muscles of the hand are innervated by the radial nerve (RN), ulnar nerve (UN), and median nerve (MN). The intrinsic muscles of the hand are innervated by the UN and MN.[2] There are many studies on the innervation of the extrinsic muscles,[12,13] and intrinsic muscles of the hand.[14,15] When the studies on the intrinsic muscles of the hand were examined, it was seen that their dates back to very old times and these studies about the motor innervation of muscles. Hence, this study was conducted to investigate the vascular and neural anatomy of the hand in adult cadavers.

In the present study, the anatomical dissection of 20 adult cadaver hands revealed varying frequencies. Specifically, the highest occurrence was observed in superficial palmar arch type I (20%), with the minimum occurrence in Type VI. A study by Omokawa S et al, thirty fresh cadaver hands were injected with a silicone rubber compound (Microfil) and dissected to examine the vascular and neural

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supplies of the thenar area. In 10 specimens, a selective injection technique was used to determine the extent of skin territory nourished by the superficial palmar branch of the radial artery. The radial aspect of the thenar eminence can provide a new and useful donor source for an innervated and vascularized free- or island-flap transfer for reconstruction of various skin defects of the volar side of the fingers.[16]

In the present study, for the median nerve, type II exhibited the highest frequency (25%), while Type III had the lowest frequency. Similarly, in the deep palmar arch, type I had the maximum frequency (25%), whereas Type III had the minimum occurrence. Another study by Kastamoni et al, investigated the vascular and neural anatomy of the hand in adult cadavers and to determine the normal anatomical structure and variations of these structures. Twenty hands of adult cadavers were examined by the dissection method. After the superficial palmar arch (SPA), the ulnar nerve (UN), median nerve (MN), and deep palmar arch (DPA) were identified, their anatomical structures and variations were evaluated. According to the number of branches they gave off and the course of these branches, the SPA was gathered under seven groups, the nerves were gathered under four groups, and the DPA was gathered under three groups.[17] Rajeev Chaudhary et al, investigated the vascular and neural anatomy of the hand in adult cadavers. The frequency of superficial palmer arch type I, the frequency of median nerve type II and the frequency of deep palmer arch type I was maximum.[18] Neumann M et al, evaluated the anatomical variation of the median nerve at the level of the wrist in the Lithuanian population with a focus on its thenar motor branch based on the classifications of Lanz. A cadaveric study was performed, and 30 wrists of 15 adult Lithuanian cadavers ranging from 70 to 89 years of age were dissected and examined. Eight female and seven male cadavers were included in the study. All hands showed different patterns in comparison to the standard anatomical variation Lanz type 0. The most common result was dedicated to Lanz group 4A. Nineteen out of 30 hands (63%, $p<0.01$) had an accessory branch proximal to the carpal tunnel, while one of these hands showed a third thenar motor branch. Five hands (16%) were dedicated to Lanz group 2 with an accessory branch distal to the carpal tunnel.[19]

CONCLUSION

The highest frequencies were observed in type I of the superficial palmar arch, type II of the median nerve, and type I of the deep palmar arch.

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