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Topographical variations of cubital fossa venous chiasma among voluntary blood donors: A Cross-Sectional Study

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Abstract

Background: The superficial veins in the cubital fossa show variations across different populations. The cubital fossa is a common site for venous access in diagnostic, surgical, and therapeutic procedures. Lack of knowledge and difficulty in observing and assessing these patterns of superficial venous chiasma in the cubital fossa pose a challenge to health professionals performing venipuncture. The current study aimed to analyse the different patterns of superficial veins in the cubital fossa, which is paramount for phlebotomists in diagnostic and therapeutic purposes.

Materials and Methods: The study was conducted on 108 blood donors aged between 19 and 50 in a voluntary blood donation camp. A sphygmomanometer cuff was applied above the elbow crease for one to three minutes to visualise the veins. The patterns of veins were then observed and analysed, and photographs were taken for further detailed study.

Results: Four types of venous patterns were identified. Patterns were divided into four categories: N type (56.4%), M type (27.8%), Arch type (12.9%), and O type (2.8%).

Conclusion: The most common pattern observed in our study was N-type (56.4%). This study contributes to the understanding of venous anatomy and has practical applications in health care practice and medical education, making it a valuable learning resource in anatomy.

Keywords: Cubital fossa; Blood donors; Phlebotomy; Blood donation; Variations

1. Introduction

Cubital fossa veins are commonly preferred for routine clinical procedures because they are easily accessible and held by the bicipital aponeurosis [1,2,3,4]. These veins have various patterns of anastomoses among different individuals. The cubital fossa is a noticeable depression on the anterior aspect of the elbow. Deeper within is a space filled with varying amounts of fat, located anterior to the distal part of the humerus at the elbow joint [4,5]. The central superficial veins of the cubital fossa include cephalic, basilic, median cubital and median antebrachial. Various studies have documented different patterns and percentages of occurrence for superficial cubital veins across different races [1,4,6-8]. The cephalic vein, which is the preaxial vein of the upper limb, runs along the lateral side of the forearm. In contrast, the basilic vein, which is the postaxial vein of the upper limb, is located medially. The cephalic vein gives rise to the median cubital vein, which receives a communicating branch from the deep forearm veins and then extends medially to merge with the basilic vein [2,4,6].

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The median cubital vein is preferred for venipuncture over the cephalic and basilic veins, even though the latter are more superficially located. The cephalic vein is prone to rolling and slipping during venipuncture and is located near the lateral antebrachial cutaneous nerve. In contrast, the median cubital vein is stabilised by a perforating deep vein anchored to the bicipital aponeurosis, preventing it from rolling. Additionally, the bicipital aponeurosis protects by separating the vein from the underlying brachial artery and median nerve, making it a safer and more reliable guide for venipuncture [1].

The superficial veins of the cubital fossa are the most commonly used for blood sampling, blood transfusions, and intravenous injections [6,9-12]. These veins are also utilised to guide cardiac catheters into the heart chambers to collect blood samples, perform angiography, and insert dialysis catheters [1,6]. Healthcare professionals may inadvertently damage nearby neurovascular structures when attempting to access the veins. Poorly managed procedures can lead to injuries, including bruising, hematoma, and sensory disturbances in the area [2,7,10].

Understanding venous patterns in the cubital fossa is essential for healthcare professionals. Thus, the study evaluates patterns of superficial veins in the cubital fossa among voluntary blood donors in a blood donation camp.

2. Materials and Methods

This observational study was conducted on blood donors in a voluntary blood donation camp. The subjects included 108 blood donors aged between 19 and 50 years, which included 93 males and 15 females. Routine protocol for phlebotomy was followed as per Practical WHO guidelines during venipuncture. Cubital fossa was observed for the patterns of superficial veins after applying and inflating the sphygmomanometer cuff above the elbow crease for one to three minutes to expose veins for observation. The visibility was ensured correctly. Patterns of veins were studied in detail, and photographs were taken for documentation and thorough study. Ethical clearance was obtained from the Institutional Ethics Review Board, and informed consent was obtained from all participants included in the study.

2.1. Statistical Analysis

Data were expressed in frequencies and percentages.

3. Results

In the present study, four major types of superficial venous patterns of the cubital fossa were observed, namely N type, M type, Arch type, and O type.

Table 1 Types of superficial venous arrangement in the cubital fossa (n=108)

S. No	Types of patterns of veins	Observation
1	N Pattern	The median cubital vein originates from the cephalic vein and runs obliquely upward towards the medial side, where it joins the basilic vein.
2	M Pattern	The median antebrachial vein divides into the median cephalic and median basilic veins, joining the cephalic and basilic veins, respectively.
3	Arch Pattern	Median cubital vein was found to be present as a venous arch with convexity facing downwards.
4	O type	There was no communication between the basilic and cephalic veins, as they ran parallel throughout their course in the forearm and arm.

In the present study, donors were predominantly male (93) and female (15) (Fig. 1,2). Median cubital vein joining cephalic to basilic vein (N type) was the most common pattern observed in 61(56.4%) subjects. M type was the second most common pattern observed in 30(27.8%) subjects, followed by Arch type in 14(12.9%) and O type in 3(2.8%) subjects, respectively (Fig. 3-10).

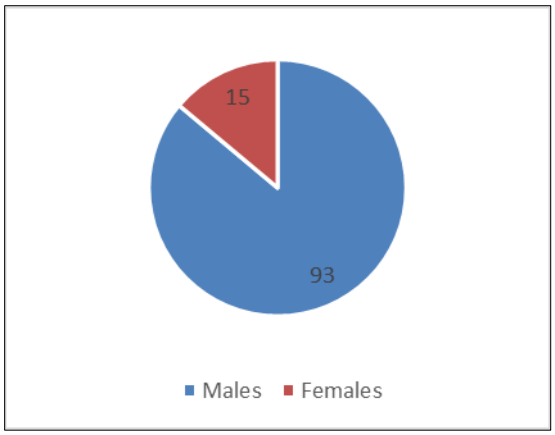


Figure 1 Gender-wise distribution of blood donors

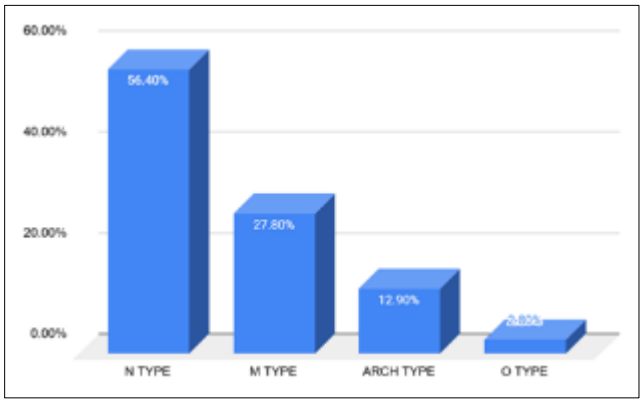
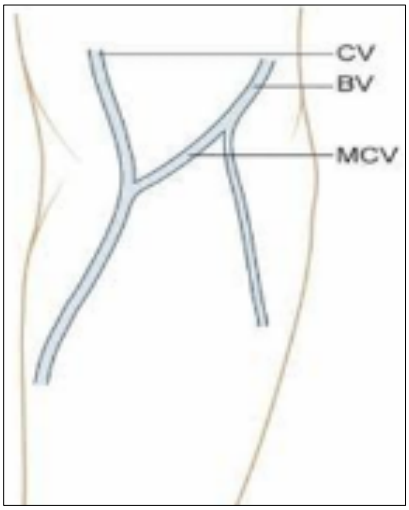


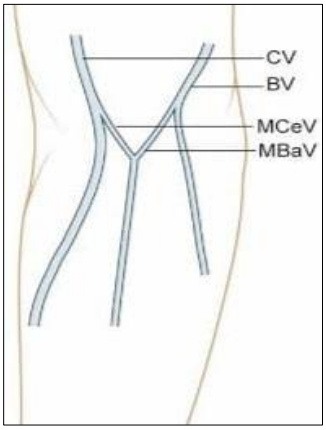
Figure 2 Different patterns of veins in blood donors



Source: Akhil J, Sontakke YA, Kumar DV. Variations in the Median Cubital Vein: A Conceptual Review. Academia Anatomica International. 2021;4(2):23–9

Figure 3 Usual pattern of median cubital vein - MCV joining cephalic and basilic veins (N-type)

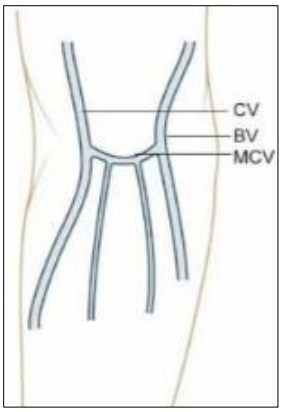
Figure 4 N-Type



Source: Akhil J, Sontakke YA, Kumar DV. Variations in the Median Cubital Vein: A Conceptual Review. Academia Anatomica International. 2021;4(2):23–9

Figure 5 MCV replaced by median basilic and median cephalic veins (M-type)

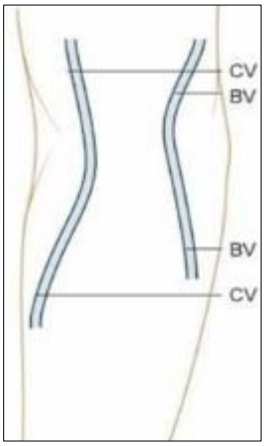
Figure 6 M-Type



Source: Akhil J, Sontakke YA, Kumar DV. Variations in the Median Cubital Vein: A Conceptual Review. Academia Anatomica International. 2021;4(2):23–9

Figure 7 MCV as venous arch

Figure 8 Arch Type



Source: Akhil J, Sontakke YA, Kumar DV. Variations in the Median Cubital Vein: A Conceptual Review. Academia Anatomica International. 2021;4(2):23–9

Figure 9 No communication between basilic and cephalic veins (O-type)

Figure 10 O-Type

4. Discussion

During embryonic development, veins form from a capillary plexus and gradually enlarge into fewer, larger channels. Genetic and hydrodynamic factors significantly influence the final arrangement of these veins, which can lead to variations in the venous pattern of the cubital fossa [10]. Our study was purely observational and descriptive. In the current study, 108 blood donors were included, consisting of 93 males and 15 females, aged between 19 and 50 years. Our analysis revealed that the most common venous pattern was N type (56.4%), followed by M type (27.8%), and the least common patterns were Arch type (12.9%) and O type (2.8%), respectively.

Our study findings align with those of Hamzah AA et al. and Hassan A et al., who identified N-type as the most common pattern among most participants [7,8]. The study by Hamzah AA et al. involved participants from three major ethnic groups: Malays, Chinese, and Indians. Among these, N Type was the most common pattern among Malays and Indians. At the same time, M-type was the most frequently observed pattern in the Chinese group [8]. Significant differences in population percentages were observed, varying by geographical location.

In a study by Ghasem G.M et al., the N-type was the most commonly observed pattern and was categorised as Type 2 [6]. A survey by Vasudha T.K. in Karnataka, India, reported five types of venous patterns in the cubital fossa based on venous anastomosis. In their findings, N-type was the most common pattern (96% in living subjects), consistent with the results of our study [12]. Jiwane et al. reported the N type (51%) as the most common venous pattern in a study in India [9]. A high percentage of the N-type pattern was also observed in a survey conducted by Melaku T et al. among the southern Ethiopian population [10].

A study by Das M. et al. identified six types of venous patterns labelled A to F. The most common pattern was type A (similar to the M alphabet), which differs from the findings in our current study. However, the least common pattern was type D, which resembles the letter "O," aligning with the findings of our study [3]. In a study conducted in India by Dhan et al., the M type was reported as the most common venous pattern, discordant from our study [4]. Contrary to our findings, a study by G. Rana on Nepalese blood donors reported the M pattern as the most common, followed by the N pattern [5]. Considerable anatomical variability of superficial veins in the upper limb is reflected in the diverse classification systems proposed by different authors [6].

5. Conclusion

This study on venous patterns in the cubital fossa among voluntary blood donors is significant for several reasons. This knowledge is essential for health care professionals and those involved in venipuncture and blood donation procedures, as it helps them identify and access veins more effectively. It provides valuable insights into the variations in venous anatomy within this region, contributing to a deeper understanding of human anatomy. Classifying these patterns can aid in the development of standardised techniques for venipuncture, as different patterns may require different approaches. Used as a teaching tool to enhance the anatomy curriculum, students can learn about real-world variations in venous anatomy, improving their clinical skills and knowledge.

Limitations

The usage of newer illuminator devices may help better visualise the venous pattern.

Compliance with ethical standards

Disclosure of conflict of interest

The authors declare that there is no conflict of interest regarding the publication of this paper.

Statement of informed consent

Informed consent was obtained from all individual participants included in the study.

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