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ORIGINAL ARTICLE

Anatomical Variations and Vascular patterns of Superficial Veins in the Cubital Fossa and its Clinical implications among pre-clinical Medical Students of North India

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Abstract

Background: Cubital fossa is the site where the venous accesses for diagnostic, surgical and therapeutic procedures are frequently made where vascular anatomy is highly variable**.** The purpose of this study was to study variations of the vascular pattern of superficial veins in the Cubital Fossa among medical students in SKIMS Medical College, Srinagar. **Material and Methods:** The study was conducted on 100 preclinical medical students with equal participation of males and females. After taking proper consent, in a proper supine position, tourniquet was applied about 10 cm above the elbow joint for about 2 to 3 minutes until all the veins of the upper limb became prominent. After that, pattern of veins was observed in the cubital fossa and photographs were taken with a digital camera. **Results:** Venous patterns are subject to variations. Mainly Four patterns of superficial veins were identified in the present study. Type- I venous pattern was most common pattern seen in both males and females (45%) followed by Type -3 (31%), Type- 2 (17%) and Type- 4 pattern (7%). Statistically, the pattern of different types of superficial veins in cubital fossa was non-significant when compared to males to females. **Conclusion:** Knowledge of common cubital venous patterns and their incidence is very useful for those performing various procedures around the cubital fossa, limited not only to venipuncture or venisection but also infusion, transfusion and cardiac interventional procedures and procedures done especially under emergency conditions.

Keywords: Vascular, Variations, Cephalic, Basilic, Superficial.

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Introduction

The cubital fossa is seen superficially as a depression on the anterior aspect of the elbow. Deeply, it is a space filled with a variable amount of fat anterior to the most distal part of the humerus and elbow joint.[1] Cubital fossa is the site where the venous accesses are frequently made. Superficial veins at this site display variations in their pattern among different populations.[2] The main superficial veins of the cubital fossa include cephalic, basilic, median cubital, and median antebrachial. The cephalic vein is the longest vein of the upper limb, which normally originates from the lateral end of the dorsal venous network of the hand are subject to considerable variations in their course.[3,4] Basilic and cephalic veins begin its course around the wrist and continue towards the upper region of the forearm. Venous accesses are frequently made in cubital fossa. These superficial veins are the most common

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site for venipuncture. In cubital fossa the arrangement of the superficial veins, varies considerably. Different patterns and percentages of occurrence of superficial cubital veins have been reported in various races.[5-9] The awareness of anatomical variations in the course of these superficial veins is important to avoid complications such as local inflammation, hematoma, thrombus, sensory changes that can occur by injuring the nearby neurovascular structures while trying to access into the veins. Variation in pattern have been classified into several types by investigators, some of the patterns resembling the alphabetical letters like M, N and I.[10] Knowing the normal anatomy of regions and patterns of variation in distribution of vessels is important for a vascular surgeon, cardiac surgeon, anesthesiologist and a medical resident for diagnostic, surgical and therapeutic procedures. For procedures like Coronary artery bypass grafting, cardiac catheterization, transfusion procedures and fistulae creation, the interventionist has to be well aware of the vascular patterns. Venous approach for procedures like cardiac pacemaker and defibrillation can also be done via veins. Preoperative venous mapping is also done in many cases. Cubital veins are also used to introduce cardiac catheters from cardiac chambers to obtain blood samples and for cardio-angiography.[3] To plan dialysis access in a given patient, it's essential to understand the anatomy patterns of the cubital superficial veins.[11] Median cubital vein is used for blood sampling. Intravenous injections are also given through these veins. Health professionals might injure the nearby neurovascular structures while trying to access into the veins. This injury causes local inflammation, hematoma, thrombus, infection, bruising and sensory changes.[12] However, relatively rare, but potentially serious complications including nerve injury and mistaken arterial punctures have been reported.[13] Thus, the purpose of this study was to observe the variations in superficial vein patterns in cubital fossa and to report the most common pattern noted in healthy preclinical medical students.

Material and Methods

This descriptive/ observational study was conducted during 2021-2022 among 100 pre-clinical students of SKIMS Medical College, Srinagar which imparts undergraduate medical training as well as post graduate training in selected departments. The subjects included 100 pre-clinical medical students between 18 to 26 years of age which included 50 males and 50 females. All healthy subjects with prominent superficial veins were included in the study. The subjects with thick subcutaneous tissue layer or having cut or wound within the cubital region were excluded. The students were explained the procedure and purpose of study. After obtaining informed verbal consent all participants were requested to expose their upper limb. No active intervention was done. In a proper supine position, tourniquet was applied about 10 cm above the elbow for about 2 to 3 minutes. After applying tourniquet, participants were asked to do active exercises till all the veins became visible for observation. The visibility was properly ensured. Pattern of veins was studied by the faculty in a detailed manner and photographs were taken using a digital camera.

Types of superficial venous arrangement [Figure-1]

Venous arrangement around cubital fossa is highly variable. It was noticed and seen that the cubital veins are mainly classified into four main groups based on previous study with following criteria:

Type 1: In this pattern Median cubital vein arise from cephalic vein a few centimeters below elbow joint and passes obliquely upward to medial side to join basilic vein a few centimeters above elbow joint and receives tributaries from the front of the forearm.

Type 2: In this pattern Median antebrachial vein joins basilic vein without establishment of communication between cephalic and basilic vein.

Type 3: In this pattern Cephalic vein runs from lateral to medial where it joins basilic vein and receives tributaries from the front of the forearm; no proximal cephalic vein.

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Type 4: In this pattern Median antebrachial vein divides into median cephalic and median basilic veins in cubital fossa which joins cephalic and basilic veins, respectively. The data were entered and analyzed using SPSS version 16 software. Descriptive statistical analysis was performed. Chi-Square test was used to assess the association of superficial venous pattern in cubital fossa with gender. $P < 0.05$ was considered as statistical significance.

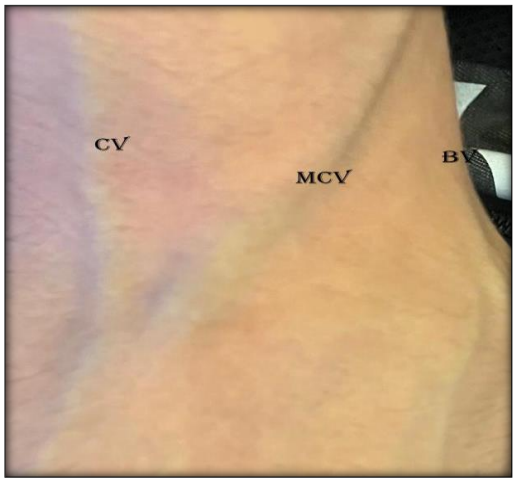
Results

The faculty made the observations after examining superficial veins in cubital fossa**.** We found four types of pattern of superficial veins in cubital fossa in our subjects**.** Median cubital vein joining cephalic to basic vein (Type I) was most common pattern seen in 57 subjects and commonest both males (30) and females (27) [Figure-2]. Type 3 patterns were second most common pattern observed in both genders males (9) and females (13). Type 2 pattern was detected 10 subjects. Type 4 pattern was noticed in 11 subjects. Statistically, the pattern of different types of superficial veins in cubital fossa was non-significant when compared to males to females ($p>0.05$). [Table -1].

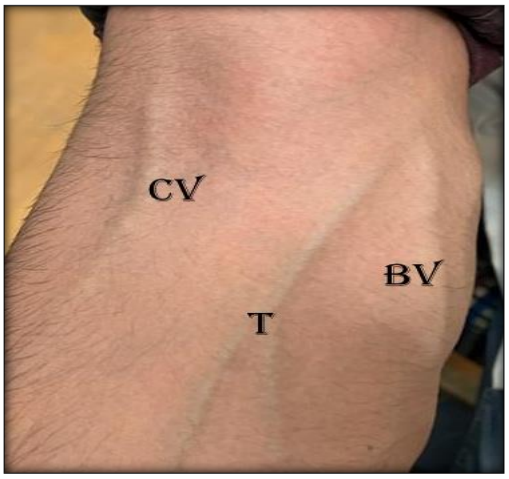
[Figure-3&4] shows various types of venous patterns among male and female subjects respectively.

Table 1: Prevalence of venous patterns in cubital fossa

Gender	Type 1	Type 2	Type 3	Type 4	P value
Male (n=50)	30 (60%)	4 (8%)	9 (18%)	7 (14%)	>0.05 (Non-significant) Chi square test
Female (n=50)	27 (54%)	6 (12%)	13 (26%)	4 (8%)	



Type-1 Pattern (N)



Type-2 Pattern

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Type-3 Pattern Type-4 Pattern (M)

Figure 1: Types of superficial venous arrangement

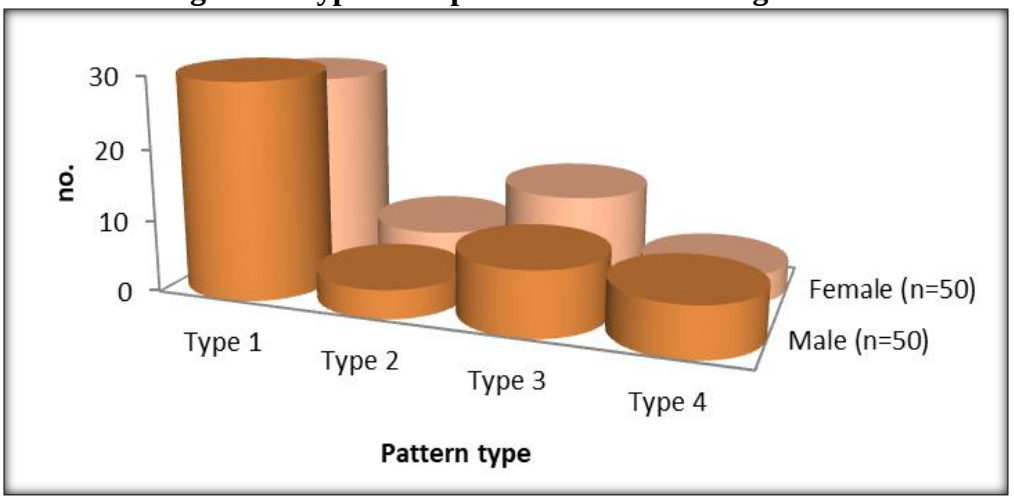

Figure 2: Comparison between venous patterns among male and female subjects

Figure 3: Types of venous patterns among male subjects

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Figure 4: Types of venous patterns among female subjects

Discussion

The superficial veins are located between the two layers of superficial fascia and accompanied by cutaneous nerves and superficial lymphatics. Knowledge of relations and patterns around cubital fossa is important. There may be difference in lengths, anastomosis and anatomic patterns which has oblivious consequences in all procedures involving this region. The superficial and deep veins of upper limb have valves and these veins are interconnected to each other. Cubital fossa is an important anatomical region, Superficial veins of cubital fossa which is a depression on the anterior aspect of the elbow is the common site for drawing blood samples and for giving intravenous injections under emergency conditions. The variation in arrangement of the superficial veins in the Cubital fossa and the occurrence of different patterns has been reported in various races. In our study four different patterns in the superficial veins in the cubital fossa were reported.

Type 1 pattern in which the cephalic vein runs from medial to lateral side to join the basilic vein was most common pattern in both genders. Type 4 pattern in which median antebrachial vein divides into median cephalic and median basilic vein in the cubital fossa to join the cephalic and basilic vein respectively was the least common pattern seen. In our study venous pattern of the right cubital fossa of upper limb was not influenced by gender.

The findings of our study were similar to the study by Hamzah AA et al.[14] showing type 1 to be the most common and the type 4 to be the least common variation was reported and a biostatical study of Wasfi FA et al.[15] on the arrangement of the superficial veins of the cubital fossa observed type 1 pattern in majority of participants followed type 3 and type 2. Also, high percentage of type 1 pattern was observed by studies conducted by Faraj and Eman,[16] among Jordanians (48.5%), Dharap et al.[17] among Malaysians (68%) and Hyunsu et al,[18] among Koreans (50.1%).

However, a study by Melaku T. et al,[2] showed that superficial venous patterns in cubital fossa were related with sex. The occurrences of type 2 and type 3 venous patterns were more common in males than females. The pattern of different types of superficial veins in cubital fossa in the present study was non-significant when compared to males to females. The findings of our studies were similar to studies,[3,14,19] where it was reported that sex had no effects on the patterns of cubital veins. Contradictory to our findings, previous studies reported that superficial cubital venous patterns were also statistical significant association with sex. [9,10,20,21]

On the whole, it was found that variations in cephalic vein are lesser than variations in basilic vein. [22] Varicosities can also effect these veins and their anastomosis and for cosmetic

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reasons can be removed.[23] Genetic and hydrodynamic factors play an important role in the final patterns of veins which results in the different patterns observed.[19]

Conclusion

Variations of normal anatomy are important to be known. Human Anatomy is not static. There are considerable variations in origins, insertions and patterns in human anatomy. These have consequences in surgery. Surgeons, Radiologists, Anatomists and medical students should especially be aware of these variations especially in procedures such as blood sampling, Coronary artery bypass grafting, cardiac catheterization, transfusion procedures, fistulae creation and infusion. The knowledge of the arrangement of superficial veins in the cubital fossa is very important for health professionals as well as vascular surgeons. There is every possibility of damaging structures under emergency conditions. The knowledge of variations of basilic and cephalic veins decrease the incidence of complications associated with different medical procedures. Proper Knowledge of Variations in patterns can help in preventing undesired injury and improve quality and safety of procedures involving this area.

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ISSN: 0975-3583,0976-2833 VOL13, ISSUE 08, 2022

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