

Patterns of superficial venous arrangement in the cubital fossa of adult Nigerians

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Abstract

Background: The cubital fossa is a common site for the removal of venous blood for analysis, transfusion, and intravenous therapy. The superficial venous return from the upper limb follows two or three major superficial veins, which are extremely variable; these include the cephalic, basilic, median cubital, and antebrachial veins and their tributaries.

Objective: This anthroposcopic study was to determine the patterns of superficial venous arrangement in the cubital fossa of adult Nigerians.

Materials and Methods: One hundred and thirty-five subjects (100 males and 35 females), aged between 20 and 27 years, were studied. The judgment sampling technique was employed. A tourniquet was firmly tied at the midarm level and the conspicuous superficial veins were diagrammatized and photographed with a camera.

Results: Ten types of venous pattern arranged in six groups were noted. The most common pattern observed was the median antebrachial vein, dividing into median cephalic and median basilic veins, which join the cephalic and the basilic veins, respectively, with a variation. The result showed bilateral difference between the incidence of each type in males and females with the male values being statistically higher ($P < 0.05$).

Conclusion: Appreciation of these venous patterns is useful to the medical and paramedical workers, especially in conditions that require venepuncture.

Key words: Arrangement, cubital fossa, superficial veins

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Introduction

Veins are conveniently grouped as superficial and deep, but these are widely interconnected; both groups have valves, which are numerous in deep veins.^[1] The superficial veins are close to the surface of the body, i.e., they are subcutaneous in the superficial fascia; it is used to differentiate veins that are far from the surface, known as deep veins.^[1] Superficial veins are not paired with any artery and their anatomical disposition varies widely unlike the deep veins, which accompany arteries between the muscles in the limb with the same name of the artery close by and are more or less constant in position.

The superficial venous return from the upper limb follows two or three major superficial veins, which are extremely variable. The superficial veins include the cephalic, basilica, median cubital, and antebrachial veins and their tributaries. Most of these veins originate in the subcutaneous tissue on the dorsum of the hand from the dorsal venous network.^[1]

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. The three boundaries of the fossa

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are superiorly an imaginary line connecting the medial and lateral epicondyles, medially the mass of the flexor muscles of the forearm arising from the common flexor attachment on the medial epicondyles, most superficially the pronator teres, laterally, the mass of extensor muscles of the forearm arising from the lateral epicondyles and superior condylar ridge, and most superficially the brachioradialis.^[2]

The floor of the cubital fossa is formed by the brachioradialis and supinator muscles of the arm and forearm overlying the capsule of the elbow joint respectively. The roof of the cubital fossa is formed by the continuity of brachial and antebrachial (deep) fascia reinforced by the bicipital aponeurosis, subcutaneous tissue, and skin.^[3]

The pattern of veins in the cubital fossa varies greatly. In approximately 20% of people, the median antebrachial vein divides into medial basilic and median cephalic veins; which join the basilic and cephalic veins, respectively. In these cases, a clear “M” formation is produced by the cubital veins; more commonly the vein forms an “H” pattern with the cephalic and basilica veins making up the sides. It is important to observe and remember that either the median cubital or median basilic veins, whichever pattern is present, crosses superficial to the brachial artery from which it is separated by the bicipital aponeurosis. In obese people, a considerable amount of fatty tissue may overlie the vein.^[2]

Very few studies have been carried out to determine the patterns of arrangement of superficial veins over the cubital fossa of Nigerians. Therefore, this study was conducted to determine these patterns among adult Nigerians.

Materials and Methods

This research is an observational study, which is purely descriptive, and was done among 135 students of Anambra State University, Uli Campus, Anambra, Nigeria. The subjects were aged between 20 and 27 years. All the subjects with prominent superficial veins were included in the study. Excluded were those with thick subcutaneous tissue layer or having cut or wound within the cubital region.

Procedure for data collection

While standing or sitting with each arm placed on a table, the subject had a tourniquet tied around his arm at approximately the mid arm level. The tourniquet was firm enough to occlude the veins, but allow for pulsation of the radial artery. Three to five minutes after application of tourniquet, the occluded superficial veins, now conspicuous, were diagrammatized and photographed with a camera. Each subject had two drawings: one for the right upper limb and the other for the left upper limb. Sex and age were recorded. The clear visualization of the veins was enhanced by:

- Holding the arms pointing downwards before application of tourniquet.
- Clenching of the fist on and off to enhance venous return towards the proximal part of the arm.
- Massaging of the forearm and gently tapping of the tissue to promote vasodilatation.
- Daylight or fluorescent tube was used as the argon bulb light presented false positive result.

Types of superficial venous arrangement

The cubital veins are classified into six main groups based on the classification of del Sol *et al.*^[4] Most of these groups have subgroups consisting of minor variations based on the following criteria:

Type A

M shaped pattern of arrangement of superficial veins at the cubital fossa, consisting of minor M variation: Type A1 is the typical M shaped pattern formed by division of median antebrachial vein into the median cephalic and median basilic veins, which join the cephalic and basilic vein respectively; and Type A2 is a variation where the median cephalic vein does not link with the cephalic vein.

Type B

Variations of N shaped pattern of arrangement of superficial veins in the cubital fossa. Type B1 is a variation of the N shaped arrangement in which the cephalic vein springs from the median cubital vein, which joins the basilic vein. Type B2 is also a variation in which the cephalic vein continues superomedially as the median cubital vein, which drains into the basilic vein, median antebrachial vein drains into the basilic vein, and proximal cephalic vein does not exist. Type B3 is a variation of N shaped pattern in which the cephalic vein is present.

Type C

H shaped pattern of arrangement of superficial veins in the cubital fossa.

Type D

Pattern in which only the basilic vein and cephalic veins are present and there is no communication between the two veins.

Type E

Pattern in which veins run superomedially from the lateral to the median aspect of the forearm. Type E1 is a variation in which the cephalic vein runs from lateral to medial where it continues as the basilic vein and Type E2 where a number of veins run superomedially from the lateral aspect of the arm.

Type F

Pattern in which median antebrachial vein is doubled.

Statistical analysis

Data was expressed as mean \pm SD.

Level of significance was considered at $P < 0.05$.

Results

One hundred and thirty-five subjects comprising 100 males and 35 females were studied. A total of 270 arms (right and left) were examined for superficial cubital venous patterns. The mean age of the subjects 21.09 ± 8.34 and 22.39 ± 1.44 with age range of 20 to 27 years were noted for male and female subjects, respectively.

Ten types of venous arrangements were observed for the studied population. These were classified into six major groups and some with subgroups representing minor variations. The major types are A, B, C, D, E, and F with the main features of M shaped pattern [Figure 1]; N shaped pattern [Figure 2]; and H shaped pattern [Figure 3]. These respectively represented patterns in which only the cephalic and basilic veins are present; pattern in which vein(s) run superomedially from lateral aspect of the arm; and pattern in which median antebrachial vein is doubled.

The major types are further divided into subtypes based on variations from the typical main patterns. Thus, type A is subdivided into subtypes A_1 and A_2 with the pattern as follows; A_1 is the typical "M" shaped pattern formed by divisions of median antebrachial vein into the median cephalic and median basilic veins, which join the cephalic vein and basilic vein respectively; 29 right arms and 28 left arms in the males had this pattern; 10 right arms and 8 left arms in the females also had this pattern. A total of 75 (27.8%) of the subjects had this pattern.

Type A_2 is a variation of "M" shaped pattern with a median cephalic vein that did not link with the cephalic vein. Six right arms and seven left arms in the males showed this pattern while only one left arm in the females showed the same pattern. Fourteen (5.2%) subjects had this pattern overall.

Type B is subdivided into B_1 , B_2 , and B_3 .

Type B_1 is a variation of the "N" shaped arrangement in which the cephalic vein springs from the median cubital vein, which joins the basilic vein. Numerous tributaries from the forearm drain into the median cubital vein: accessory vein is present. Thirteen right arms and seven left arms in the males had this pattern while three right and four left arms showed this pattern in females. A total of 27 (10%) of the cases exhibited this pattern.

Type B_2 is a variation of the "N" shaped arrangement in which the cephalic vein continues superomedially as the median cubital vein, which drains into the basilic vein, and



Figure 1: Photograph showing M shaped pattern formed by division of median antebrachial vein into median cephalic vein and median basilic vein, which join the cephalic and basilic veins, respectively



Figure 2: Photograph showing N shaped pattern of arrangement in which the cephalic vein springs from the median cubital vein, which joins the basilic vein



Figure 3: Photograph showing an H shaped pattern resulting from presence of a horizontal venous connection between cephalic vein and basilic vein

the proximal cephalic vein does not exist. Six right arms and 10 left arms in the males and three right arms and three left arms in the females were observed to have this pattern. This pattern constituted 22 (8.2%) of all the cases.

Type B₃ is a variation of the “N” shaped arrangement in which the median antebrachial vein runs superomedially to drain into the basilic vein, and the cephalic vein is present. This pattern was observed in four right arms and 17 left arms in males and two right arms and four left arms in the females. Twenty-seven (10%) of studied cases had this arrangement.

Type C₁ [Figure 3] is an “H” shaped pattern resulting from the presence of a horizontal venous connection between cephalic vein and basilic vein. This pattern was seen in five right arms and two left arms of male subjects but was not seen in females. It constituted 7 (2.6%) of the studied cases.

Type D₁ [Figure 4] is a pattern in which only the basilic and cephalic veins are present with no communication between the two veins. This pattern was seen in three right arms and two left arms in the males while in females, it was seen in three right arms and three left arms. A total of 11 (4.1%) subjects had this.

Type E₁ [Figure 5] is a pattern in which the cephalic vein runs from lateral to medial where it continues as the basilic vein; no proximal cephalic and distal basilic veins. This pattern was observed in four right arms and three left arms of males and five right arms and two left arms of females. This was 14 (5.2%) of the cases studied.

Type E₂ [Figure 6] is a pattern in which a number of veins run superomedially from the lateral aspect of the forearm. Twenty-four right arms and 20 left arms had this pattern in males while four right arms and six left arms had this pattern in females. Fifty-four (20%) of all the cases had this pattern.

Type F [Figure 7] is a pattern in which the median antebrachial vein is duplicated; cephalic vein and basilic veins are diminished or absent. In males, six right arms and four left arms had this pattern while in females it was five right arms and four left arms. On the whole, 19 (7%) cases had this arrangement.

It was observed that out of 135 of the total sample, 35 (25.9%) of the studied cases (both males and females) had the same type of pattern in both arms while the remaining 100 (74.1%) had different patterns in each arm. Of the 35 females, 8 (22.9%) had the same type of pattern while 27 (27%) of 100 males also had the same type of pattern.

The superficial cubital veins in the males were much more prominent than those of the females.



Figure 4: Photograph showing pattern in which only the basilic and cephalic veins are present and no communication between the two veins



Figure 5: Photograph showing pattern in which the cephalic vein runs from lateral to medial where it continues as the basilic vein; no proximal cephalic vein and distal basilic vein



Figure 6: Photograph showing pattern in which a number of veins run superomedially from lateral aspect of forearm

Discussion

The result from the study shows that gender influences the distribution of superficial venous patterns. This proposition is based on comparative studies among populations and between sexes in which some venous patterns are highly distributed in a given race than in the other or more common in a particular sex than in the other.

In the present study, the most common pattern of cubital venous arrangement is type A [Table 1], where the median cephalic and median basilic veins join the cephalic and basilic vein respectively. This group has a general incidence of 33% [Table 2]. Thirty five percent and 27.1% in males and females respectively. These findings are comparable to the studies done by Sohler *et al.*,^[5,6] in Africans (38.1%), Singh *et al.*,^[7] in Nigerians (24.3%) and Charles^[8] in Americans (27%).

There is a clear contrast when compared with the incidence observed in Indians (51%) by Tewari *et al.*,^[9] and the Japanese (1%) by Okamoto.^[10] The two types classified under this group include A₁ and A₂ among which A₂, 75 (27.8%) is the most common among the studied population.



Figure 7: Photograph showing pattern in which the median antebrachial vein is duplicated; cephalic vein and basilic veins are diminished or absent

Table 1: Distribution of superficial cubital veins per types in males				
Type	Number per right arm	Number per left arm	Total per type for both arms	Percentage of total per type
A	35	35	17	35
B	23	34	57	28.5
C	5	2	7	3.5
D	3	2	5	2.5
E	28	23	51	25.5
F	6	4	10	5

In the type B, where the median cubital vein is present and links the cephalic and basilic veins in a number of variations, there is general incidence of 28.1%, while in males the incidence is 28.5% and in females 27.1%. This displays a sexual dimorphism. The findings in the present study contrast with that of Berry and Newton^[11] in the British (53%) and Tewari^[9] in Indians (16%). There is a clear contrast when compared with the findings of Matumoto^[12] in Japanese (84%) and in Americans (70%) by Charles^[8] and Singh *et al.*^[7] in Nigerians (62% in males and 49% in females). The three subtypes in this group include B₁, B₂ and B₃. B₁ and B₃ are the most common with equal distribution of 10% [Table 3]. The incidence of type B₃ is significantly higher in males 10.5% than in females 8.6% and type B₂ is higher in females (8.6%) than in males (8%) [Tables 4 and 5]. However, type B₁ shows equal distribution of 10% in both sexes [Table 3].

Type E has subtypes E₁ and E₂, and there is a general incidence of 25.2% in the total sample studied. Type E₂ (20%) has a higher distribution than type E₁ (5.2%). Type E₂ has an incidence of 22% in males and 14.3% in females. Type E₁ has an incidence of 5.3% with females having higher values of 10% than males (3.5%).

Type C recorded an incidence of 2.6% in the total sample, and of this males had 3.5% while females recorded none.

Table 2: Distribution of superficial cubital veins per type for both sexes				
Type	Number per right arm	Number per left arm	Total per type for both arms	Percentage per type
A	45	44	89	33
B	31	45	76	28.2
C	5	2	7	2.6
D	6	5	11	4.1
E	37	31	68	25.2
F	11	8	19	7

Table 3: Distribution of superficial cubital veins per sub-type for both sexes				
Sub-type	Number per right arm	Number per left arm	Total per sub-type for both arms	Percentage per sub-type
A1	39	36	75	27.8
A2	6	8	14	5.2
B1	16	11	27	10
B2	9	13	22	8.2
B3	6	21	27	10
C1	5	2	7	2.6
D1	6	5	11	4.1
E1	9	5	14	5.2
E2	28	26	54	20
F1	11	8	19	7

Table 4: Distribution of superficial cubital veins per sub-type in males

Sub-type	Number per right arm	Number per left arm	Total per sub-type for both arms	Percentage per sub-type
A1	29	28	57	28.5
A2	6	7	13	6.5
B1	13	7	20	10
B2	6	10	16	8
B3	4	17	21	10.5
C1	5	2	7	3.5
D1	3	2	5	2.5
E1	4	3	7	3.5
E2	24	20	44	22
F1	6	4	10	5

Table 5: Distribution of superficial cubital veins per sub-type in females

Sub-type	Number per right arm	Number per left arm	Total per sub-type for both arms	Percentage per sub-type
A1	10	8	18	25.7
A2	0	1	1	1.4
B1	3	4	7	10
B2	3	3	6	8.6
B3	2	4	6	8.6
C1	0	0	0	0
D1	3	3	6	8.6
E1	5	2	7	10
E2	4	6	10	14.3
F1	5	4	9	12.5

Type D showed an incidence of 4.1% in the total sample. The females had 8.6% incidence while males had 2.5%. Type F with an incidence of 7% in the total population appeared to be more common in females (12.9%) than in males (5%).

For types A, B, C, D, E, and F, the incidence were 33%, 28.1%, 2.6%, 4.1%, 25.2%, and 7% respectively.

Types A, B, C, and E were more common in males while types F and D were higher in females.

There appear to be little or no studies done yet on the incidence of types C, D, E, and F by researchers.

Conclusion

The study of the pattern of superficial cubital veins in our environment would assist medical and paramedical workers in performing venepuncture or venesection. Awareness of the uncommon cubital venous patterns and their incidence makes for a more direct approach to these veins, especially under emergency conditions.

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