RESEARCH ARTICLE

Variations in basilic vein anatomy in patients undergoing haemodialysis access surgery: A cross-sectional study

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Abstract

Objective: To explore different anatomical variants of basilic veins in patients undergoing haemodialysis access surgery.

Method: The descriptive, explorative, cross-sectional study was conducted from February 2023 to February 2024 at the Aga Khan University Hospital, Karachi, and comprised patients undergoing haemodialysis access surgery. Basilic vein anatomy was identified on preoperative ultrasound and documented with its type as type I = basilic vein joining brachial vein in the axilla, type II = basilic vein joining one of two brachial veins in mid/ lower arm. and type III = basilic vein joining single brachial vein in arm. Data was analysed using SPSS 19.

Results: Of the 131 patients (200 limbs) with mean age 59.03+/-14.93 years, 68(51%)were males and 63 (48%) were females. Overall, 142(71%) limbs were diagnosed as having type I basilic vein, followed by 54(27%) type II and 4(2%) type III. There was no association noted for basilic vein anatomy with either gender or hand dominance ($p>0.05$).

Conclusion: In patients undergoing haemodialysis access surgery, the most common type of basilic vein anatomy was type I

Key Words: Brachio-Basilic transposition arteriovenous fistula, Dialysis access, Anatomical variation, Basilic vein

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Introduction

Patients presenting with end-stage renal disease (ESRD) require access in the form of arteriovenous fistula (AVF) or graft for dialysis. Various options exist for such patients, preferably utilising autogenous veins in the arms for AVF. In the arm, the basilic vein is a good alternative for AVF in patients in whom distal veins in the forearm and cephalic vein in the arm have been either exhausted or deemed unsuitable due to poor quality.[1,2] However, the uniqueness of basilic vein lies in its deep course and for creating a fistula with the brachial artery in the arm, it has to be transposed in a subcutaneous tunnel, providing easier cannulation sites for dialysis access. The resulting fistula is thus termed brachio-basilic transposition AVF (BBTAVF).[1] For a successful BBTAVF, a deep understanding of its anatomy, including its variant form, is crucial.

The basilic vein commences medially in the hand, from the dorsal venous network, running through the ulnar side of the forearm, becoming anterior below the cubital fossa, and joining the medial cubital vein which connects it to the cephalic vein. It then passes along the medial border of biceps brachii muscle, alongside the anterior and posterior components of medial cutaneous nerve. It then perforates the deep fascia and joins the medial brachial vein to continue as the axillary vein.[3-6]

The complete absence of the basilic vein is rare, seen in 0.5-1% of population. [7,8] Accessory basilic vein is also a rare occurrence.[9] Three anatomical variations of basilic vein in the arm have recently been described in a study[10] on the basis of duplex scanning as: type I = basilic vein unites with the brachial vein in the axilla, type II = basilic vein unites with the brachial vein at lower third of arm which are paired, and type III = basilic vein unites with single brachial vein at lower or middle-third of the arm. The prevalence of these types was identified in 426 arms in 290 patients, and it was found to be 66% for type I, 17% for type II and 17% for type III.[10]

The implications of variant basilic anatomy are profound, as it may be of consequence during creation of haemodialysis access, especially when a single brachial vein with type III anatomy is used. This would end with the arm losing its single deep brachial venous drainage at the cost of basilic transposition and the resulting hindrance to venous drainage of the arm will result with significant upper extremity oedema. Not only would the oedema cause major discomfort to the patient, but it would be problematic for creating a future access with a graft. This was shown in a study by Kaiser et al.[11]. Unrecognised anatomy later caused significant distress to

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the patient in the form of arm oedema which was of such clinical significance that the graft had to be ligated to relieve the patient of such misery, underlining the importance of identifying the variant anatomy at the time of preoperative planning when considering a patient for BBTAVF. Since standard texts of anatomy do not mention such an important description of variant anatomy of the basilic vein, further work is needed to be done in this domain. The current study was planned to explore the variant anatomy of basilic vein in patients undergoing haemodialysis access surgery in an urban tertiary care setting.

Patients and Methods

The descriptive, exploratory cross-sectional study was conducted from February 2023 to February 2024 at Aga Khan University Hospital (AKUH), Karachi, after approval from the institutional ethics review committee. The sample was raised using consecutive, non-probability sampling technique. Those included were patients undergoing angio-access surgery. Patients who had already undergone BBTAVF and those not willing to participate were excluded. Written informed consent was obtained from all the participants.

Patients planned for access surgery for haemodialysis at AKUH routinely undergo preoperative ultrasound venous mapping by the attending surgeon in the clinic or in the preoperative area. This is done to evaluate the patency and diameter of the vein. In the current study, basilic vein anatomy was documented with its type at the time of assessment. Patients demographics, including age, gender, height, weight, body mass index (BMI), side of the limb examined, and hand dominance, were recorded using a predesigned proforma.

The sample size was calculated using the World Health Organisation (WHO) calculator[12], while assuming cumulative prevalence 50%10, with precision 7% power 80% and confidence level 95%.

Data was analysed using SPSS 19. Continuous variables were expressed as means +/- standard deviation. Qualitative variables were presented as frequencies and percentages. To assess differences in mean values among the three anatomical groups, analysis of variance (ANOVA) was performed. Fisher's exact test was used to determine association between qualitative variables. $P<0.05$ was considered significant.

Results

Of the 131 patients (200 limbs) with mean age 59.03+/-14.93 years, 68(51%)were males and 63 (48%) were females. Overall, 100 (76%) patients were dialysis-dependent and 34(17%) had previous surgery done on the examined site (Table 1).

Table-1: Demographic and clinical characteristics (n=131).

Patient Demographics	n (%)
Mean Age (+/- SD) years	59.03 +/- 14.9
Mean body mass index (Kg/m^2)	26.45 +/- 4.84
Gender	
Male	68 (51%)
Female	63 (48%)
Hand Dominance	
Right	128 (98%)
Left	3 (2%)
Co-morbidities	
Diabetes mellitus	82 (62%)
Ischaemic heart disease	44 (33%)
Cerebrovascular disease	10 (7.6%)
Dialysis dependent	100 (76%)

SD: Standard deviation.

Table-2: Type of basilic vein anatomy (n=200 arms).

Type of Basilic Vein	n(%)
Type I	142 (71%)
Type II	54 (27%)
Type III	4 (2%)

The most common basilic vein anatomy was type I in 142(71%) limbs, followed by type II 54(27%) and type III 4(2%) (Table 2).

Table-3: The association of basilic vein anatomy type with gender and hand dominance.

	Type 1	Type II	Type III	p Value
Gender				
Male (n=110)	80 (%)	29	1	>0.99
Female (n=90)	62	25	3	
Hand Dominance				
Right (n=196)	139	53	4	>0.99
Left (n=4)	3	1	0	

The basilic anatomical variation had no significant association with gender and hand dominance (Table 3).

Discussion

The current study explored the variants of basilic vein anatomy in patients who were being planned for angio-access for haemodialysis. The three anatomical variants were identified on ultrasound, and type I was found to be the most common (71%). The results were in line with an earlier study.[10] The earlier study had a mixed (retrospective and prospective) design and evaluated 290 patients (426 arms) from 2005 to 2010. All patients were assessed by a vascular surgeon or a registered vascular technologist. No association of basilic vein anatomy was seen with gender, side of the arm examined or ethnicity. Type I anatomy was noted in 66% patients[10].

Baptista-Silva et al.[2] studied the anatomy in great detail by means of cadaveric dissection in 26 arms (13 cadavers). They did not label the different types of basilic vein, but broadly described basilic vein with straight course in the arm forming axillary vein within the axilla (type I) which was seen in 23.1% patients. The other variant joined the medial brachial vein (53.8%) or brachial vein (23.1%) in the arm[2].

Similar to type III anatomy, Sadeghi et al.[13] described a case of variant anatomy, where the cephalic vein joined the basilic vein in mid-arm, with no separate brachial vein in a six-month-old boy.

Knowledge about the basilic vein anatomy in the preoperative evaluation is paramount to the success of the dialysis access as well as to preserve options for future arteriovenous bridge graft. Basilic vein variation may lead to complications during BBTAVF, as reported by Kaiser et al[11].

If one encounters type III basilic vein anatomy in preoperative evaluation, the patient should be counselled regarding the risks of significant postoperative arm oedema. The other alternative remains to offer such patients a brachio-axillary bridge graft.

The current study, to our knowledge, is the first to prospectively explore the subject in Pakistani population. However, the current study has limitations as it was conducted at a single tertiary care centre, which has affected the generalisability of the findings. Multi-centre studies are needed to validate the current results.

Conclusion

The type of basilic vein anatomy found most commonly was type I (71%) among Pakistani patients undergoing haemodialysis access. In planning haemodialysis access, surgeons should be mindful of the variant anatomy.

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