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Basilic Vein Transposition versus Basilic Vein Elevation: A Comparative Study in terms of Wound Infection, Limb Oedema, Hematoma and Primary Patency Rates

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ABSTRACT

Objective: To compare the results of basilic vein elevation with basilic vein transposition in terms of wound complications and patency rates.

Study Design: Quasi-experimental study.

Place and Duration of Study: Vascular Surgery Department, Combined Military Hospital, Rawalpindi Pakistan, from Jan 2021 to Jan 2022.

Methodology: Ninety-four patients participated in the study, with 47 in each Group. Patients in the basilic vein elevation (BVE) Group underwent single-stage elevation, whereas 34 underwent two-stage elevation. The patients were closely followed for a year after the first successful dialysis from the fistula at three months, six months and 12-months period. The primary patency rates were comparable in both Groups.

Results: The mean age of participants was 52.46± 13.54 years, ranging from 23-76 years. There were 7(7.4%) patients in whom fistula failed to mature, out of which 4(8.5%) were from the Basilic Vein Transposition (BVT) Group, and 3(6.4%) were from the BE-Group. There were fistula salvage attempts in all cases, and 4(4.3%) fistulas were salvaged 2(4.3%) in each group. 3(3.2%) fistulas were declared as primary failure. There were 17(37.8%) complications in the BVT-Group and 27(58.7%) in the BE-Group (*p*-value= 0.046).

Conclusion: Various techniques have been related to brachiobasilic fistula creation with variable results in terms of post-operative complications and primary patency rates. Basilic vein transposition has a lower complication rate than basilic vein elevation.

Keywords: Arteriovenous fistula, Basilic vein transposition, Basilic vein, Hemodialysis access.

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INTRODUCTION

Easy access to the vasculature is key to successful long-term survival in patients with chronic renal failure (CRF) undergoing hemodialysis.[1] Chronic kidney disease is a global burden. A substantial increase was noted in the age-standardized incidence of end-stage kidney disease (ESKD) treated by renal replacement therapy, with dialysis and kidney transplantation increasing by 43·1% and 34·4%, respectively.[2,3] Hemodialysis is a very common treatment modality for ESKD. Hemodialysis can be done through tunnelled or non-tunnelled Central venous catheters (CVCs) or preferably by arteriovenous fistulas (AVFs).[4] Primary, secondary or tertiary access is used as per the availability. Recently, endovascular arteriovenous fistula creation has also been performed, which needs more randomized trials to assess its feasibility and safety.[5] Brachiobasilic fistula is used as preferred to synthetic graft placement in case of failed radiocephalic and brachiocephalic fistulas. Creation of Brachiobasilic fistula further needs basilic vein superficialization for easy access for hemodialysis as it lies deep to the deep fascia in the upper arm.[6] Whenever access veins are deep, they require superficialization using simple elevation, transposition or lipectomy.[7,8]

There are various techniques to elevate the basilic vein in Stage 2 after fistula creation in Stage 1, with variable results regarding patency rates, surgical site in infection, oedema, hematoma formation and thrombosis of the fistula vein. It has been observed that there are no differences in patency and failure rates between single-stage and two-stage basilic vein transposition.[9,10]

We compared the two techniques of superficialization of the basilic vein after brachiobasilic fistula creation in a single stage or stage 2 procedure. Either superficialization or tunneled transposition technique was used. Both techniques were compared to see the complications and advantages.

METHODOLOGY

The quasi-experimental study was conducted at Vascular Surgery Department, CMH Rawalpindi, from

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January 2021 to January 2022 after ethical approval was taken from the Institutional Review Board (IRB ref. no.238/1/22). The sample size was calculated, keeping the percentage of exposed fistulas to any complication was 28.6%.[11]

Inclusion Criteria: Patients of either gender diagnosed with chronic kidney disease stage-5, referred by a treating nephrologist, aged 23-76 years, presenting to the Outpatient Department were included in the study.

Exclusion Criteria: Patients with poor quality basilic vein, poor inflow artery, patients with shortness of breath & requiring urgent hemodialysis, patients with coagulopathy, patients with central vein stenosis, patients with disabling acute stroke, patients with severe ischemic heart disease and cardiac pacemakers in place were excluded.

Sampling Technique was consecutive non-probability sampling.Patients were evaluated with Doppler ultrasound for their eligibility for brachiobasilic fistula creation. Superficial arm veins and central veins, along with the arterial system, were evaluated for patency, diameters, and quality of vessel wall. Single-stage basilica vein elevation was done in some cases where the diameter of the vein was 4mm. Local anaesthesia was used in all patients. End-to-side anastomosis with prolene 6-0 suture was created between the basalic vein and distal brachial artery. The basilic vein was harvested in all cases up to the axillary crease. The median antebrachial cutaneous nerve was saved. The size of the anastomosis was kept per protocols to avoid steal syndrome. In the Basilic Vein Elevation Group (BVE), a skin flap was raised anterolaterally on the upper arm and the vein was anchored anteriorly to the underlying deep fascia and excessive subcutaneous tissue using either ligated tributaries or fascial slings to avoid falling back of the vein medially at the skin suture line after the closure of the wound. BVE was done at the same time as arteriovenous anastomosis creation or after 4-6 weeks (Figure-1).

Figure-1: Basilic Vein Elevation (BVE) in second stage by raising Skin Flap

The basilic vein was elevated almost 8-10 cm to acquire adequate length for hemodialysis access. The basilic vein was similarly harvested in the second Group (BVT Group). Basilic vein transposition was done as a second-stage procedure at 4 to 6 weeks in all the patients after the creation of arteriovenous anastomosis in the first stage. After harvesting, it was transected proximally near the arteriovenous anastomosis and then tunnelled in the subcutaneous layer and was marked before tunnelling to avoid kinks and twists (Figure-2). The transposed vein was anastomosed to the proximal transected portion of the same vein by venovenous anastomosis after tunnelling and making sure of any kinks. There was an adequate thrill in all the cases. The wound was closed in layers. Patients were discharged the day after surgery or the same day after observation for a few hours. In our series, balloon angioplasty and maturation were not utilized. All patients were evaluated by post-operative ultrasound between the second and fourth post-operative days and followed up for one year.

Figure-2: Basilic vein Transposition(BVT) in Second Stage

Primary patency is defined as the point at which the fistulas were functioning for dialysis up to the time of the first failure and secondary patency is defined as the interval from the time of access placement, includeing the secondary intervention, until access abandonment.

Statistical Package for Social Sciences (SPSS) version 25.0 was used for the data analysis. Quantitative variables were expressed as Mean±SD and qualitative variables were expressed as frequency and percentages. Independent sample t-test and Chi-square test were applied to explore the inferential statistics. The *p*-value lower than or up to 0.05 was considered as significant.

RESULTS

A total of 94 cases participated in the study, 47 in each Group. However, 13(27.7%) patients in the BVE

Group underwent single-stage elevation, whereas 34 (72.3%) underwent two-stage elevation. The mean age of participants was 52.46±13.54 years, ranging from 23 to 76 years. There were 60(63.8%) males and 34(36.2%) females in study. The most common co-morbid in patients was diabetes in 38(40.4%), hypertension in 32 (34%) and Ischemic heart disease in 10(10.6%). 69 (73.4%) cases had a double lumen catheter inserted during surgery, and 8(8.5%) had it on the ipsilateral side. The brachiobasilic fistula was created on the left side in 76(80.9%) patients, and in 18(19.1%) patients, it was done on the right side. The mean number of prior fistulas was 1.4±0.807. It was created primarily in 9(9.6%) patients who did not have any prior fistula and as secondary access in rest. The further distribution of these variables in Groups is shown in Table-I.

Table-I: Demographic Characteristics between different Groups (n=94)

Variables	Basilic Vein Transposition-Group (n=47)	Basilic Vein Elevation-Group (n=47)		*p*-value
		BVE-Single Stage(n=13)	BVE-Two Stage(n=34)	
Age (years)	53.17±13.8	42.23±12.61	55.38±11.89	0.009
Gender				
Male Female	29(61.7%) 18(28.3%)	8(17%) 5(10.6%)	23(48.9%) 11(23.4%)	0.845
Co-Morbids				
None Diabetes Hypertension Ishemic heart disease	7(14.9%) 18(38.3%) 17(36.2%) 5(10.6%)	4(8.5%) 4(8.5%) 4(8.5%) 1(2.1%)	3(6.4%) 16(43.1%) 11(23.4%) 4(8.5%)	0.671
Double Lumen Catheter				
Yes No	34(72.3%) 11(27.7%)	11(23.4%) 2(4.3%)	24(51.1%) 10(21.3%)	0.606
Site of Procedure				
Left Right	37(78.7%) 10(21.3%)	12(25.5%) 1(2.1%)	27(57.4%) 7(14.9%)	0.526
Previous Fistulas	1.43±0.88	1.31±0.75	1.41±0.74	0.897

There was no per-operative mortality during the study. Ho-wever, there were a total of 7(7.4%) patients in whom fistula failed to mature, out of which 4(8.5%) were from the BVT Group and 3(6.4%) were from the BVE Group. It was statistically insignificant (*p*-value 0.694). There were fistula salvage attempts in all cases, and 4(4.3%) fistulas were salvaged 2(4.3%) in each Group. 3(3.2%) fistulas were declared as primary failure. During the study period, 44(48.4%) suffered some complications. There were 17(37.8%) complications in the BVT Group and 27(58.7%) in the BVE Group. This diff-erence was significant (*s* value=0.046), shown in Table-II. The patients were closely followed for a year after the first successful dialysis from the fistula at three months, six months and 12 months period. The rate primary patency rate is shown in Table-III. There was no difference between the Groups regarding patency at three months (*p*-value=0.716), six months (*p*-value= 0.413) and 12 months (*p*-value=0.247).

Table-II: Frequency various complications in the two Groups (n=44)

Primary Patency	Basilic Vein Transposition-Group (n= 17)	Basilic Vein Elevation-Group (n=27)	*p*-value
Edema	2(11.8%)	3(11.1%)	0.046
Hematoma	8(47.1%)	10 (37%)	
Thrombosis	4(23.5%)	9(33.3%)	
Infection	2(11.8%)	2(7.4%)	
Nerve Damage	-	2(7.4%)	
Venous Hypertension	1(5.9%)	-	
Steal	-	1(3.7%)	

Table-III: Primary patency rate at 3, 6 and 12 months in two Groups (n=91)

Primary Patency	Basilic Vein Transposition–Group n= 45	Basilic Vein Elevation–Group n=46	*p*-value
Three months	42(93.3%)	42(91.3%)	0.716
Six months	32(71.1%)	29(63%)	0.413
Twelve months	26 (57.8%)	21(45.7%)	0.247

DISCUSSION

Chronic kidney disease prevalence varies widely. The Basilic vein is used as a hemodialysis access site after failed or unavailable radiocephalic and brachiocephalic fistula access. This vein lies deep to the deep fascia in the medial side of the upper arm, making cannulation at the time of hemodialysis technically challenging. In our study, the overall complications rate between basilica vein elevation and transposition Groups were statistically significant (*p*-value= 0.046). Wound infection developed in two patients in either Group. Woo *et al*. bed wound infection in 8% cases of prosthetic conduits as arteriovenous grafts (AVG) compared to 2% in basilic vein transposition Group showing infection rate being more with the prosthetic conduit than basilic vein transposition. [11] Helava *et al*. reported no wound infection with basilic vein elevation.[12] Wereported 4.4% infection rate using native basilic vein as hemodialysis access which is comparable regardless of the technique of superficialization. Wound infection can be lowered by using appropriate aseptic technique, prophylactic antibiotics, layered closure of the wound, minimizing the dissection and creation of flaps and controlling systemic infection along with strengthening the immune system in patients with end-stage kidney disease. We report 8.8%

cases of thrombosis in the transposition Group and 19.6% in the elevation Group. Venoplasty was attempted and resulted in fistula salvage in 4.3% of cases. Rego *et al*. described fistula thrombosis in 5.4%cases of two-stage basilic vein thrombosis.[13]

In our setup, most patients who are candidates for brachiobasilic fistula creation has central venous catheters already placed in the same arm at some point during the hemodialysis period, making it quite common to have some central vein stenosis that becomes apparent at the time of fistula creation. Primary patency is described as the interval from the time of access placement to any intervention designed to maintain or re-establish patency or to access thrombosis or the time of measurement of patency.[14,15] In our study, comparing primary patency rates at one year between BVT vs BVE Groups was statistically insignificant (57.8% vs 45.7%). Hossny described a year cumulative primary patency rate of 70% in the stage BVE Group vs 80% in the BVT Group. Kim *et al*. described a comparable primary patency rate in the BVT vs BVE Group (64.8% vs 77.5%) at one year.[16] Li *et al.* showed a higher primary patency rate with basilic vein elevation.[17] Drouven *et al*. compared basilic vein transposition with the forearm looped PTFE graft with a significantly higher primary patency rate with native vessel use as compared to the prosthesis.[18]

In summary, basilic vein is a good alternative to the nonavailability of superficial arm veins for hemodialysis access before considering the prosthetic access. There are various techniques reported in the literature with variable results. Both techniques can be used depending on the local expertise and experience of the operating surgeon.

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CONCLUSION

Arteriovenous fistula via second-stage basilic vein transposition is a good option with fewer post-operative complications than basaltic vein elevation. Primary patency rates are comparable in both Groups.

Conflict of Interest: None.

Authors Contribution

Following authors have made substantial contributions to the manuscript as under:

AM & ABS: Data acquisition, data analysis, critical review, approval of the final version to be published.

SAA & MJ: Study design, drafting the manuscript, data interpretation, critical review, approval of the final version to be published.

MIK & KSK: Concept, data acquisition, drafting the manuscript, approval of the final version to be published.

Authors agree to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved.

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