10.5152/turkjnephrol.2025.24784

Original Article

Turkish Journal of Nephrology

Outcomes of Basilic Vein Transposition Arteriovenous Fistula under Local Anesthesia: A Single-Center, Retrospective, Observational Study

Manharsinh Rajput[1], Chetan Prajapati[2], Sohil Shah[2]

[1]Department of Urology, Institute of Kidney Diseases and Research Center, Ahmedabad, India
[2]Institute of Kidney Diseases and Research Center, Ahmedabad, India

ABSTRACT

Background: People now recognize chronic kidney disease (CKD) as a significant global public health problem. According to the ICMR report on India: Health of the Nations (2017), CKD is the ninth most common cause of death in India. Chronic kidney disease has become more common and burdensome over time, moving from the 30th to the 20th place in terms of disability-adjusted life years (DALYs) between 1990 and 2016. In these patients, ensuring adequate vascular access is critical for achieving effective hemodialysis. The aim of this study was to assess the rates of patency and complications associated with basilic transposition arteriovenous (AV) fistulas.

Methods: This retrospective study included all patients (n = 350) who underwent basilic vein transposition (BVT) at our center from January 2017 to 2022, excluding pediatric cases, AV grafts, and 2-stage basilic transposition. We collected the data from the hospital database and entered it into MS Excel for analysis.

Results: The mean age was 44.09 ± 13.92 years. The most frequent postoperative complications included immediate post-operative bleeding (1.43%), post-hemodialysis bleeding (1.14%), draining vein insertion site stenosis (3.71%), ischemic steal (3.43%), and wound infection (2.29%). The primary patency rates at 1 year and 2 years were 94.86% and 92.58%, respectively. The secondary patency rates at 1 year and 2 years were 96.29% and 93.23%, respectively.

Conclusion: Our study findings indicate the technique's dependability and efficiency as a secure vascular access choice for hemodialysis in people with CKD.

Keywords: Basilic vein transposition, arteriovenous fistula, chronic kidney disease

Corresponding author: Manharsinh Rajput ✉ manhar.urologist2020@gmail.com

Received: April 11, 2024 **Revision Requested:** July 4, 2024
Last Revision Received: August 7, 2024 **Accepted:** August 8, 2024 **Publication Date:** January 1, 2025

Cite this article as: Rajput M, Prajapati C, Shah S. Outcomes of basilic vein transposition arteriovenous fistula under local anesthesia: a single-center, retrospective, observational study. *Turk J Nephrol.* 2025;34(1):42-46.

INTRODUCTION

Chronic kidney disease (CKD) is emerging as a prominent worldwide public health concern. The 2017 India: Health of the Nation's States report, published by the Indian Council of Medical Research (ICMR), explicitly emphasized the worldwide prevalence of CKD. CKD in India has become the ninth leading cause of mortality, moving up from the 30th to the 20th position in terms of disability-adjusted life years (DALYs) between 1990 and 2016. The growing frequency underscores the necessity for effective management strategies.[1] The fundamental aspect of treating persons with advanced CKD is efficient hemodialysis, which relies on having suitable vascular access. In 1997, the National Kidney Foundation–Dialysis Outcomes Quality Initiative (NKF-DOQI) established guidelines that advocate for the use of autogenous arteriovenous (AV) fistulas as the recommended therapy for these patients.[1] The basilic vein transposition (BVT) arteriovenous fistula (AVF), which was first reported by Dagher F et al in 1976, has a prominent position in the range of vascular access options. Vascular access guidelines, on the other hand, generally regard BVT as the third-line treatment choice for hemodialysis, behind brachiocephalic and radiocephalic AVFs.[2] Procedures for

basilic transposition are usually carried out under general (GA) or regional anesthesia (RA). However, there is an increased risk of perioperative and postoperative complications for patients with end-stage kidney disease. Despite its effectiveness, GA raises issues since it induces stress, which may result in hypotension and eventual fistula thrombosis.[3] As an appealing substitute for GA, RA offers benefits including hemodynamic stability and stress response minimization. Through its sympathectomy action, RA also causes venous and arterial dilatation; however, its influence on patency rates is still being studied.[4] It should be highlighted, however, that RA has drawbacks as well, including insufficient anesthesia and the possibility of problems including bleeding, infection, or accidental intravenous or arterial injection. The literature has reported a number of BVT procedures, each having advantages and disadvantages. Our method for superficializing the basilic vein under local anesthesia is shown and discussed in this article, along with our results on long-term patency rates.

MATERIAL AND METHODS

The primary objectives of this retrospective cohort study, conducted from October 2023 to January 2024, were 2-fold. Initially, using local anesthetic, our objective was to meticulously assess the occurrence of complications after BVT. Next, we examined both the primary and secondary patency rates of these surgically created fistulas. Inclusion criteria encompassed patients presenting with thrombosed or unsuitable cephalic veins, as well as those with failed radiocephalic and brachiocephalic fistulas. Conversely, exclusion criteria comprised individuals who had undergone a 2-stage basilic transposition procedure, the pediatric population, patients with a history of previous prosthetic graft placement, and cases deemed lost to follow-up.

After obtaining ethical approval from the Institute of Kidney Disease and Research Center (approval number: IKDRC-ITS EC/App/15Sep 2023/07, date: September 15, 2023), data retrieval was initiated. Records of basilic transposition surgeries, including intraoperative findings, complications, and follow-up, were retrieved from the database maintained by the AVF OT coordinator. Additionally, all patients were contacted via phone. Data were then collected and entered into an MS Excel file. In our study, we analyzed the parameters of age, co-morbidities, primary patency, secondary patency, and complications (specifically bleeding and infections) following BVT. We conducted assessments on all patients through physical examination and Doppler ultrasound. Upper limb venous system mapping was done using ultrasound. When feasible, the non-dominant arm is preferred when using the basilic vein, which has a diameter greater than 2 mm. After surgery, routine follow-up appointments were planned for 2 weeks, 6 weeks, 6 months, a year, and 2 years to check for problems and to assess primary and secondary patency. Primary patency was defined as the interval during which the fistula was mature and functional without the need for further intervention. Secondary patency was defined as the entire interval during which the fistula was usable for dialysis. Maturation was defined as the enlargement of the vein to the point at which cannulation with 2 needles and dialysis with flows of 350 mL/min was possible. Informed consent was not obtained from the patients since the study has been conducted retrospectively.

Surgical Technique

We used a mixture of 10 mL bupivacaine (0.5%), 20 mL lignocaine with adrenaline (2%), and 30 mL distilled water for local anesthesia during the superficialization of the basilic vein procedure. Using a skin marker, we preoperatively marked the basilic vein, brachial artery, and subcutaneous tunnel. An 8-10 cm incision is made over the preoperatively marked basilic vein site in the arm. We identified the basilic vein, isolated it, and then ligated it. We marked the basilic vein on the ventral surface to prevent twisting. Next, we divided the basilic vein distally at the level of the antecubital fossa. Hydro-distension was done using heparinized saline. We identified and dissected the brachial artery. We created a subcutaneous tunnel, then transposed the basilic vein through it. We performed end-to-side anastomosis using a 7-0 prolene suture in a continuous pattern. We placed no drain in the subcutaneous tunnel. With a continuous Vicryl 3-0 suture, we re-approximated the deep fascia. Finally, the skin was closed. Approximately 1-10 hours post-surgery, we discharged the patients. Typically, we discharge the patient following a 1-hour period of observation. However, if the patient is experiencing pain or any discharge then we extend the duration of observation. This surgical technique ensures proper handling of the basilic vein and brachial artery, meticulous anastomosis, and appropriate wound closure, all under local anesthesia for patient's comfort and safety. We do not use any antiplatelet or anticoagulation postoperatively.

RESULTS

350 Basilic transposition surgeries were performed at our institute between 2017 and 2022. A mean age of 44.09 ± 13.92 years was observed. Of the total, 42.9% were female and 57.1% were male. In accordance with our protocol, which prioritizes the non-dominant left arm, 69.7% of patients had the surgery done on the left side and 30.3% on the right. The following pre-existing comorbidities were often noted: neurological diseases (0.86%), diabetes (14.29%), and hypertension (86%). Every fistula allowed for 335 dialysis sessions on average.

MAIN POINTS

- Basilic vein transposition is possible under local anesthesia, with excellent primary and secondary patency rates.
- In addition to that complications are very few and easily manageable.
- Basilic vein insertion site stenosis is a common site for stenosis and fistula failures. However, fistuloplasty and stenting can manage the condition.

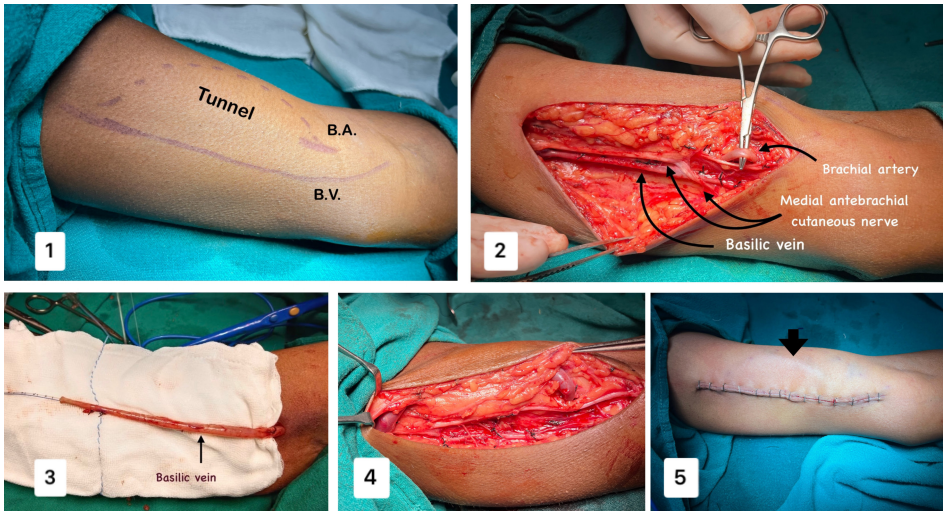

Figure 1. Operative steps. 1. Prepoerative vascular mapping, 2. Vessels identified and dissected, 3. Basilic vein hydro distension, 4. Basilic vein transposition and anastomosis. 5. Transposed basilic vein.

Common postoperative complications included immediate postoperative bleeding (1.43%), post-hemodialysis bleeding (1.14%), draining vein insertion site stenosis (3.71%), ischemic steal (3.43%), and wound infection (2.29%). Five patients experienced immediate postoperative bleeding (<48 hours) and required re-exploration. These cases exhibited generalized oozing of blood, which was effectively managed using diathermy. Four of these patients were obese, and they were all on anticoagulants. All 5 patients had preoperative blood pressures more than 150/110 mmHg, and 2 of them also had diabetes. In cases (n = 4) where patients presented to the emergency department with post-hemodialysis bleeding, ligation of the basilic vein near the anastomosis was necessary. In one patient, ligation of the brachial artery was required. No ischemic changes were observed postoperatively. Five patients experienced an early wound infection (less than 7 days), which was treated with a 7-day oral amoxicillin-clavulanate regimen. Among these cases, 3 patients required re-suturing due to wound gaps. Later, 3 patients developed wound infections after a few weeks, necessitating ligation of the basilic vein and closure of the fistula due to sloughing of the entire anastomosis. Twelve individuals had mild types of ischemic steal syndrome; none of them needed treatment. Seven of the 13 patients with stenosis at the draining vein insertion location had stents placed. Notably, we found that the basilic vein insertion site was the most often affected area by thrombosis and stenosis, which frequently resulted in fistula failure. It is unknown what the precise cause is. Nonetheless, altered flow characteristics, the angle at which the basilic vein inserts, or compression by surrounding fascia might be the cause. At 1 year and 2 years, the primary patency rates were 94.86% and 92.58%, respectively. At 1 year and 2 years, the secondary patency rates were 96.29% and 93.23%, respectively. As a salvage treatment, balloon angioplasty and stent placement was done.

DISCUSSION

In this study, we investigated the outcomes of BVT AVF, with the goal of reducing the need for anesthesia and improving the surgical approach and postoperative care. The primary patency rates at 1 year and 2 years were 94.86% and 92.58%, respectively. The secondary patency rates at 1 year and 2 years were 96.29% and 93.23%, respectively, with a minimal complication rate. Our findings indicate that BVT under local anesthesia is a viable and effective approach. Patients in our cohort who had an astounding 956 successful sessions via this vascular route showed remarkable persistence of their AV fistula. This remarkable longevity not only underscores the effectiveness of the AV fistula but also highlights its crucial role in providing sustained and reliable hemodialysis for our patients. Fistula outcomes are significantly influenced by individual patient variables, such as age, comorbidities, and past access history. Optimizing success rates and minimizing complications may be achieved by customizing the surgical technique and postoperative care to each patient's specific requirements.

Table 1. Comparison of Primary and Secondary Patency Rates

Study	No. of Cases	Primary Patency (%)		Secondary Patency (%)	
		1 year	2 years	1 year	2 years
Current study	350	94.86	92.58	96.29	93.23
Korkut AK et al	350	92	78	93	81
Glass C et al	217	40	26	72	65
El Sayed et al	170	52	NR	58	NR
Harper et al	168	59	NR	66	NR
Basavanthappa R et al	94	84	NR	NR	NR

Table 2. Comparison of Complications

	Wound Complications (%)	Bleeding (%)	Thrombosis (%)	Aneurysm (%)	Steal Syndrome (%)
Current study	2.29	2.57	3.71	4	3.43
Korkut AK et al[7]	5.7	4.9	53	9.1	7.1
Glass C et al[8]	5	7	16	7	5
Harper et al[9]	19	13	29	4	11

The primary and secondary patency rates in the present research either equal or surpass those seen in the literature (Table 1). In contrast to our method, which uses a single incision, tunnel formation, and no drain, the research by Korkut AK et al[7] used 2 incisions, no drain insertion, and no tunnel creation. Additionally, wound-related complications were higher in their patients. Unlike us, Glass et al[8] used many skipped skin incisions together with the development of a distinct subcutaneous tunnel. Other studies used the single incision technique described by Dagher.[9,10] The variation in methods used may explain the disparities in results, especially in terms of the occurrence of wound-related problems and the duration of fistula survival (Table 2). In Harper et al's research, thrombosis and wound-related problems were more prevalent. The reasons for the high early failure and complication rates are multifactorial. The age of the patient and the presence of other medical conditions have been shown to have a substantial impact on the patency of AVFs. The median age of patients in this series was 61, with 39% of patients being 65 years or older, which indicates the increasing age of the dialysis population. Meticulous dissection, proper hemostasis, thorough painting with betadine, and sterile technique all contribute to reducing early wound-related complications.[9]

The choice of anesthesia type can significantly influence patient outcomes. In our study, utilizing local anesthesia for BVT contributed to reduced perioperative risks and enhanced patient comfort. This contrasts with studies such as Glass C et al,[8] EL sayad et al,[10] Leong BD et al[11] where the majority patients underwent surgery under GA, potentially impacting postoperative recovery and fistula performance. Glass C et al[8] found that the most common cause for failure of the fistula to mature was central venous stenosis.[8] However, in our study, it was basilic vein insertion site stenosis and thrombosis. The primary and secondary patency rates were poor compared to our study. In the study by EL Sayed et al, 78 fistulae failed (45.9%). Following initial placement, 72 interventions in 41 patients (24.1%) were done to restore or maintain function. Long-term follow-up data from our study demonstrate the need for ongoing surveillance and intervention to maintain fistula function. Similar findings were done by EL Sayed et al,[10] a significant proportion of patients required interventions post-procedure to address complications and maintain adequate access. Our investigation identified basilic vein insertion site stenosis and thrombosis as primary causes of mature fistula failure. This emphasizes the importance of careful assessment and management of the vein insertion site during surgical procedures. Various studies highlighted similar findings, with interventions required for arterial and venous stenosis, central venous stenosis, and subclavian steal syndrome.[7,8,10]

Our observations lead us to conclude that certain steps, as described below, improve outcomes: (1) Dissection of the basilic vein in the axilla, as close as possible to the insertion site. (2) Hydrodistension of the basilic vein with heparin-mixed saline. (3) Creating a wide tunnel with a wide entry and exit for the vein in the tunnel. (4) Keeping the vein mesentery and marking the vein ventrally to avoid twisting of the vein. (5) Applying a clamp over the basilic vein near the axilla and performing hydro-distension to check for twisting of the vein in the tunnel. Patients with a history of multiple double lumen catheters (DLCs) or permacath insertions should also undergo a preoperative neck Doppler or CT venogram. As advancements continue in vascular access procedures, future studies may explore refinements in techniques such as hydro-distension and tunnel creation. Investigating the role of imaging modalities like Doppler and CT venography in preoperative planning could further enhance surgical outcomes and reduce complications.

Limitations

The study is retrospective based on medical records. Surgeries were performed by different surgeons. However, all surgeons were experienced (>1000 AV fistula surgeries). Additionally, comparative studies with randomized control groups could provide deeper insights into the efficacy of specific surgical techniques and anesthesia approaches.

Our study demonstrates that BVT AVF, performed under local anaesthesia, shows favorable outcomes in terms of both primary and secondary patency rates. These results highlight the effectiveness and safety of this technique as a reliable vascular access option for hemodialysis in patients with CKD.

Data Availability Statement: The data that support the findings of this study are available on request from the corresponding author.

Ethics Committee Approval: Ethics committee approval was received for this study from the ethics committee of Institute of Kidney Disease and Research Center (approval number: IKDRC-ITS EC/App/15Sep 2023/07, date: September 15, 2023).

Informed Consent: N/A.

Peer-review: Externally peer-reviewed.

Author Contributions: Concept – M.R.; Design – M.R.; Supervision – C.P., S.S.; Resources – M.R.; Materials – M.R.; Data Collection and/or Processing – M.R.; Analysis and/or Interpretation – M.R.; Literature Search – M.R.; Writing Manuscript – M.R.; Critical Review – C.P., S.S.

Declaration of Interests: The authors have no conflict of interest to declare.

Funding: The authors declared that this study has received no financial support.

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