Basilic Vein Elevation for Arteriovenous Fistula Creation: Results of 60 Cases Following 1 Year

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Abstract

Basilic vein elevation (BVE) is a procedure where the basilic vein (BV) is surgically exposed, mobilized, and elevated into a more superficial position for the purpose of facilitating arteriovenous fistula (AVF) cannulation. The purpose of this study is to review the use of BVE as an adjunct to fistula maturation.

Between January 2009 and December 2013, 60 patients received BVE. After performing the anastomosis between brachial artery and BV, the elevated vein was placed just anterior to the surgical incision, 3 to 4 mm deep. Patients' morbidity, mortality, and patency rates were evaluated.

Keywords

- basilic vein elevation
- arteriovenous fistula
- brachial artery

The 90-day mortality was 0%. Maturation rates were 91.6%. The mean time to maturation was 52 days (range, 25–75 days). Primary patency rate at 12 months was 90% and secondary patency rate was 95%. The mean vein size was 4.5 ± 0.5 mm.

AVF surgery via BVE offers satisfactory results in patients with chronic hemodialysis.

An arteriovenous fistula (AVF) is the preferred vascular access for hemodialysis, offering lower morbidity, mortality, and cost compared with graft or catheters. Up to 50% AVF fail to mature primarily because of problems with fistula cannulation. Basilic vein elevation (BVE) is a single-stage procedure that places the location of the fistula within the incision at a superficial position to facilitate AVF cannulation. In this study, the BVE was utilized at a single institution, and the results were then analyzed.

Methods

Between January 2009 and December 2013, 60 patients received BVE (26 males, 34 females; age range, 17–82 years). In 11 cases, BVE was the primary intervention and 49 patients had previously undergone failed radiocephalic and brachiocephalic fistula operations. The most frequently associated diseases with renal insufficiencies were hypertension in 42 patients (70%) and diabetes in 21 patients (35%).

Preoperatively, all patients were examined via Doppler ultrasonography. The basilic, cephalic, and subclavian veins and arterial system were evaluated for stenosis and occlusion. Indication of single staged BVE was the diameter of the BV > 4 mm.

All procedures were performed under local anesthesia. The 5000 U heparin was used during surgery. The distal brachial artery was used for inflow. A longitudinal incision was used for harvesting the basilic vein. The median antebrachial cutaneous nerve was carefully spared. Anastomosis was completed using an end-to-side technique with 6.0 Prolene suture. In all cases, the size of anastomosis was 6 to 8 mm to reduce the risk of steal syndrome. After performing the anastomosis between the brachial artery and BV, the vein was elevated with minimal change in anatomical location, and fascia and subcutaneous tissue layers were closed with absorbable separated suture. The elevated vein was then placed just anterior to the surgical incision, 3 to 4 mm deep, and skin was closed (► Fig. 1). By mobilizing the 8 to

10 cm of BV, adequate length could be obtained for cannulation. Good quality of AVF was achieved if there was the presence of a thrill of BV. The kinking and twisting were avoided by visual inspection of the exposed BV. Patients were discharged the day after surgery. In our series, the balloon angioplasty and maturation were not utilized.

Postoperatively, acetylsalicylic acid was used as antiplatelet therapy for the following 30 days. All patients were evaluated by postoperative ultrasound between the 2nd and 4th postoperative days. All patients were followed-up for 12 months and any complications were recorded.

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 including the secondary intervention until access abandonment.

Results

Maturation rates were 91.6%. The mean time to maturation was 52 days (range, 25–75 days). A total of 55 patients underwent hemodialysis. Poor arterial flow was detected in five patients (8.3%).

The 90-day mortality was 0%. Two patients (3.3%) died 12 months after the BVE due to causes unrelated to operative events (6 and 9 months after operation). Our study includes the follow-up of these patients.

Postoperative complications of single staged BVE are listed in ►Table 1. Bleeding from anastomosis occurred in one patient (1.6%) and was controlled with additional Prolene 6.0 sutures. No wound infection or hematoma occurred. In seven patients (11.7%), the edema of the upper extremity disappeared 10 to 14 days after the surgery. In two patients (3.3%), arterial steal syndrome was observed and treated by

Table 1 Postoperative data

Complication	N	%
Bleeding	1	1.6
Infection	0	0
Hematoma	0	0
Regressive edema of upper arm	7	11.7
Arterial steal syndrome	2	3.3
Thrombosis	6	10

distalization of arterial inflow. The vein was ligated at the brachial artery anastomosis and extended to the proximal radial artery as inflow.

In all cases, the reason for fistula failure was thrombosis, which occurred in six patients (10%). In one case, the cause of thrombosis was aneurismal dilatation of BV with turbulent outflow, and in few cases it was phlebitis, secondary to vein puncture. Thrombectomy was successful in three cases. Three elevated brachio basilic fistulas (5%) were abandoned. Primary patency rate at 12 months was 90% and secondary patency rate was 95%.

The mean diameter of BV was 4.5 ± 0.5 mm.

Discussion

The median forearm vein drains venous blood from subcutaneous tissue of the front of the wrist and forearm. It divides at the elbow into cephalic and basilic veins. When the radiocephalic and brachiocephalic fistulas fail, the option for vascular access is the brachio basilic AVF formation with vein transposition or simple elevation.^{1,2}

Radiocephalic and brachiocephalic fistula is the first choice for AVF operations.³ However, access via brachio basilic fistula has become the procedure of choice when superficial veins are unavailable.⁴ The basilic vein is deeply positioned, and generally free of puncture with a large diameter and high patency and maturation rates.⁴ The principal disadvantage of the brachio basilic fistula creation is the deep location of the BV. Transposition or elevations of BV facilitate the vein puncture procedure. Elevation is a simple superficialization procedure where the fistula is surgically exposed, mobilized, and elevated to a more superficial position to facilitate AVF cannulation.⁵ Authors have demonstrated an increase in maturation rates of deeply positioned veins with the help of the elevation procedure.

Kakkos et al^{6–8} suggested an individualized approach to choose the method for performing the BV transposition. BV transposition fistulae have good initial maturation rates (87%) with good functional patency rates (72% at 1 year).⁹ Studies revealed significantly higher primary and secondary patency rates, and lower infectious complications of brachio basilic AVF than the arteriovenous grafting.^{10–12} A randomized multicenter study recommended the utilization of brachio basilic AVF if radiocephalic and brachiocephalic AVF creation is impossible, or when these types of access have already

Fig. 1 (A) Elevated basilic vein placed just anterior to the surgical incision. (B) Matured basilic vein successfully cannulated 40 days after surgery.

failed.¹³ This study showed significantly higher primary and secondary patency rates of brachio basilic AVF.

Yuksel et al¹⁴ performed 170 BVE procedures and observed satisfactory results in patients with chronic hemodialysis. The study of Korkut et al¹⁵ presented the results of 350 BVE with primary patency rates of 92, 78, 64, and 54% at 1, 2, 3, and 4 years. Secondary patency rates were 93, 81, 66, and 56%. BVE is a logical alternative method for BV transposition. Davis et al performed 66 BVE in pediatric patients and showed good patency rate of 83.3%.¹⁶

Blood flowing through the fistula is determined by the sum of the flow resistance of the arterial system between the left ventricle and the anastomosis, the flow resistance of the anastomosis itself, and the flow resistance of the venous system between the anastomosis and the right atrium.¹⁷ The cause of poor arterial inflow may be poor arterial caliber, atherosclerotic vessel.¹⁸

In our opinion, the minimal change in venous anatomical location following BVE has hemodynamic advantage compared with transposition, and visual control of the BV location and orientation avoid kinking or twisting of the fistula.

The study of Humphries et al revealed a high risk of extravasation and hematoma in the elevated vein group.¹⁹ The prevalence of hematoma in the elevated fistula was because of difficult cannulation of the BV. The advantage of BE over transposition is the avoidance of vein kinking and tunnel bleeding.²⁰

Life-table analysis by Hossny²⁰ showed no difference between the two groups regarding cumulative primary patency and secondary patency. Cumulative secondary patency rate at 1 year was 86.7% for the transposition group and 87.1% for the elevation group. Cumulative secondary patency at 2 years was 82.8% for the transposition group and 69.2% for the elevation group.

In general, the various techniques for creating brachio basilic AVF are associated with good patency rates, and most related complications can be treated without the loss of the fistula.²⁰

Conclusion

AVF surgery via single staged BVE offers satisfactory results in patients with chronic hemodialysis. Our study revealed good maturation and patency rates for BVE procedure. BVE is a logical alternative method of BV transposition.

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