



Transposition of basilic vein in forearm for arteriovenous fistula creation: Our mid-term results

Arteriyovenöz fistül oluşturmak için ön kol bazilik ven transpozisyonu: Orta dönem sonuçlarımız

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ABSTRACT

Background: In this study, we aimed to present our mid-term results of basilic vein transposition in the forearm to create an arteriovenous fistula.

Methods: Between January 2015 and October 2017, a total of 21 patients (13 males, 8 females; mean age 54.2±11.3 years; range, 32 to 74 years) with an adequate basilic vein and radial arterial systems who underwent basilic vein transposition in the forearm were retrospectively analyzed. All operations were performed under local anesthesia and mild sedation. The basilic vein was harvested using a single incision from elbow joint to wrist as an *in situ* vein graft. If the harvested basilic vein did not extend easily to the radial artery in the wrist region, the saphenous vein was harvested to extend arteriovenous fistula tract.

Results: The mean follow-up was 25.3±9.8 (range, 2 to 32) months. All patients underwent arteriovenous access surgery using transposed basilic vein in the forearm. In all patients, except for two, transposed basilic vein in the forearm stayed patent during follow-up with a patency rate of 90.5%. The mean fistula maturation time was 45.2±10.7 (range, 28 to 59) days.

Conclusion: If cephalic vein diameters are too small for arteriovenous fistula creation, basilic vein system in the medial surface of the forearm may be considered a favorable option.

Keywords: Arteriovenous fistula, basilic vein, forearm, patency.

ÖZ

Amaç: Bu çalışmada, arteriyovenöz fistül oluşturmak için ön kol bazilik ven transpozisyonuna ilişkin orta dönem sonuçlarımız sunuldu.

Çalışma planı: Ocak 2015 - Ekim 2017 tarihleri arasında bazilik ven ve radyal arteriyel sistemi yeterli olan ve ön kol bazilik ven transpozisyonu yapılan toplam 21 hasta (13 erkek, 8 kadın; ort. yaş 54.2±11.3 yıl; dağılım, 32-74 yıl) retrospektif olarak incelendi. Tüm ameliyatlar lokal anestezi ve hafif sedasyon altında yapıldı. Bazilik ven, dirsekten el bileğine kadar tek bir insizyondan *in situ* ven grefti olarak hazırlandı. Hazırlanan bazilik ven, bilek bölgesindeki radyal artere kolayca uzanmadıysa, fistül yolunu uzatmak için safen ven çıkarıldı.

Bulgular: Ortalama takip süresi 25.3±9.8 (dağılım, 2-32) ay idi. Hastaların tümüne ön kol bazilik ven transpozisyonu ile arteriyovenöz erişim cerrahisi uygulandı. İki hariç hastaların tümünde takip süresince %90.5'lik açıklık oranı ile ön koldaki transpoze edilen bazilik ven açıldı. Ortalama fistül olgunlaşma süresi 45.2±10.7 (dağılım, 28-59) gün idi.

Sonuç: Sefalik ven çapları arteriyovenöz fistül oluşturmak için çok küçük ise, ön kolun mediyal yüzeyindeki bazilik ven sistemi uygun bir seçenek olarak düşünülebilir.

Anahtar sözcükler: Arteriyovenöz fistül, bazilik ven, ön kol, açıklık.

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Hemodialysis is one of the most essential methods for treatment of chronic renal insufficiency. Patients who are candidates for hemodialysis should be evaluated for arteriovenous fistula (AVF) creation. Superficial veins are examined by physical examination and Doppler ultrasonography (USG), whether they are suitable for AVF. Mostly, vascular surgeons concentrate on cephalic vein (CV) system in upper extremities, as it is the easiest way for cannulation in hemodialysis. If the CV is not suitable for creation of AVF, other choices should be considered, including basilic vein (BV) superficialization in arm and arteriovenous graft (AVG) implantation. These complex operations may cause increased morbidity with decreased patency rates and infection and have certain technical limitations. Basilic vein in the forearm can be evaluated for creation of AVF as an autogenous hemodialysis access.^[1]

In the present study, we present our mid-term results of BV transposition in the forearm to create AVF as a simple alternative to radiocephalic or brachiocephalic AVFs rather than other complex choices.

PATIENTS AND METHODS

This retrospective study included patients who underwent arteriovenous access surgery using transposed BV in the forearm in our clinic between January 2015 and October 2017. In all patients, CV system was inadequate for the creation of an AVF, based on physical examination and Doppler USG findings. Their CV systems were in small size (<1.5 mm) or thrombosed due to prior access surgery. Also, the BV system diameter was >2.5 mm in the forearm region. However, in some of these patients, the BVs remained 5 to 10 cm short. The saphenous veins were used to extent their length to make anastomosis to radial arteries as possible as distally in the wrist region. This strategy ensured more length for cannulations.

Among all patients who were consulted for AVF creation, 86 had inadequate CV systems for creation of AVF. After a careful evaluation of the veins, a total of 21 patients (13 males, 8 females; mean age 54.2±11.3 years; range, 32 to 74 years) with adequate BV and radial arterial systems who underwent BV transposition in the forearm were included.

A written informed consent was obtained from each patient. The study protocol was approved by the Dışkapı Yıldırım Beyazıt Training and Research Hospital Ethics Committee. The study was conducted in accordance with the principles of the Declaration of Helsinki.

Surgical technique

The BV system in the forearm was mapped through physical examination and Doppler USG preoperatively in all patients. Under local anesthesia with 1% lidocaine and mild sedation, BV was harvested using a single incision from elbow joint to wrist as an *in situ* vein graft (Figure 1). Heparinized saline was used to dilate the vein gently. If harvested BV did not extend easily to the radial artery in the wrist region, we harvested the saphenous vein to extend the AVF tract following the administration of the additional local anesthetics to the surrounding tissue of targeted saphenous vein. Radial artery was found via a longitudinal incision at the wrist area and prepared for anastomosis. A subcutaneous tunnel on the volar aspect of the forearm was created. Saphenous vein diameters were examined and marked by Doppler USG preoperatively to harvest the most suitable segment during the operation. Prepared BVs (lengthened by saphenous vein or not) were transposed to the radial arteries through subcutaneous tunnels in the flexor surface of the forearm, and an end-to-side anastomosis was performed with radial artery (Figure 2).

Statistical analysis

Statistical analysis was performed using the MS Excel version 2010 software (Microsoft Corp.,



Figure 1. Harvesting basilic vein in forearm using a single incision from elbow joint to wrist.



Figure 2. Prepared basilic vein in forearm transposed to radial artery through subcutaneous tunnel in flexor surface of forearm.

Redmond, WA, USA). Continuous variables were expressed in mean \pm standard deviation (SD) and median (min-max), while categorical variables were expressed in number and frequency.

RESULTS

The mean follow-up was 25.3 ± 9.8 (range, 2 to 32) months. Seven patients had previous AVF operations.

In six patients, BV was not long enough to make an anastomosis to the radial artery in the wrist region and the BV was extended with reversed saphenous vein graft in these patients. Of all patients, one underwent revision for early postoperative hematoma. All patients discharged in the postoperative third day. Clinical examination of all patients revealed satisfactory thrill during discharge from the hospital.

During follow-up, we determined maturation failure in one patient in the postoperative second month and AVF thrombosis in three patients (at two months in two and at 15 months in one). Successful percutaneous thrombectomy were performed to thrombosed AVFs. However, one of these patients failed again in very early period after the procedure and alternative approaches were selected. In all patients, except for two patients, the transposed BV in the forearm stayed patent during follow-up with a patency rate of 90.5%. The mean fistula maturation time was 45.2 ± 10.7 (range, 28 to 59) days. Demographic and clinical data of the patients are shown in Table 1.

DISCUSSION

According to the 2018 Clinical Practice Guidelines of the European Society for Vascular Surgery, it is recommended as Class I indication that patients with a glomerular filtration rate less than 30 mL/min/1.73 m² (Stage 4 chronic kidney disease) should be referred to a nephrologist and/or surgeon for creating vascular access. Therefore, replacement of a permanent dialysis access should be performed three to six months prior to the estimated initiation time of hemodialysis.^[2] Previous studies have shown

Table 1. Demographic and clinical data of patients

Variable	Basilic vein transposed in forearm (n=21)			
	n	%	Mean \pm SD	Range
Age (year)			54.2 \pm 11.3	
Gender				
Male	13	61.9		
Hypertension	9	42.8		
Diabetes mellitus	14	66.7		
Coronary artery disease	4	19		
Tobacco use	6	28.6		
Peripheral artery disease	2	9.5		
Hyperlipidemia	5	23.8		
Follow-up (months)			25.3 \pm 9.8	2 to 32

SD: Standard deviation.

that autogenous conduits for hemodialysis are more advantageous compared to prosthetic access in terms of improved patency rates and a lower risk of infection.^[3] Basilic vein transposition in the forearm, as an autogenous conduit, may be considered, if simple radiocephalic or brachiocephalic AVFs are not possible due to poor quality of veins or previous failures.

Necessary evaluations which must be performed before placement of a permanent hemodialysis access include physical examination and Duplex USG of the upper extremity arteries and veins. In the literature, for successful AVF creation, vein diameters must be at least 2.0 to 2.5 mm.^[4] Radiocephalic fistulas created in veins less than 2.0 mm in diameter have 16% primary patency at three months versus 76% for those with veins greater than 2.0 mm.^[4] A preoperative arterial diameter less than 1.6 mm is also associated with a high failure rate in radiocephalic fistulas.^[5] In other reports, minimum diameter of 2.0 mm is required for successful fistulas.^[6]

Superficial veins should be examined carefully by vascular surgeons with application of a proximal tourniquet. Upper extremity and non-dominant arm have priority for AVF creation. In AVF constructions, distal sites should be preferred first by vascular surgeons for future uses of proximal options.^[7] If forearm veins are not suitable for AVF constructions, the possibility of antecubital region and upper arm (brachiocephalic AVF and transposed brachiocephalic AVF) should be considered, respectively. If none of these options is available, a graft and long-term catheter placement is the next step for permanent dialysis access.^[2]

The BV transposition in the forearm may be a reserved option, particularly for secondary AVFs.^[8] It is also a better option before brachiocephalic AVF in extremely obese patients, if its diameter greater than 2.5 mm and its length permits us to use it as an AVF tract. Based on our experience, BV transpositions were successful in 19 of 21 patients (90.5%) and 19 patients have still functioning AVFs.

Until now, many of techniques have been developed to create functional and long-standing vascular access. The BV transposition in the forearm approach has a number of remarkable features: similar results to radiocephalic AVFs, preserving more proximal veins for future use, delaying more complex choices, similar complication rates (i.e., maturation failure, thrombosis, or infection) to radiocephalic AVFs, and providing more place for cannulation, as well as offering more comfort with less steal syndrome than brachiocephalic AVFs.

On the other hand, the most serious disadvantage of this method is that it requires a long surgical incision in the forearm, although healing occurs rapidly with no complaints. Accordingly, none of the patients had wound site complication in our study.

The retrospective design, absence of control group, relatively small sample size and the lack of quantitative measurements of AVF are the main limitations of our study.

In conclusion, our study provides valuable insights into basilic vein transposition in the forearm as an alternative to conventional vascular access surgery. Midterm results of basilic vein transposition in the forearm are satisfactory and surgeons should consider the possibility of this technique, particularly in case of failed cephalic vein fistulas.

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