

Primary Success of Bifurcated Vein Patch Arteriovenous Fistula and Brescia-Cimino Methods

Jalal Vahedian,¹ Amir Mohsen Jalayifar,² Mohammad Reza Keramati,¹ Fatemeh Nabavizadeh,³ Mohammad Vahedian

¹Department of Surgery,
Firoozgar Hospital, Tehran
University of Medical Sciences,
Tehran, Iran

²Department of Surgery,
Shahid Beheshti University of
Medical Sciences, Tehran, Iran

³Department of Physiology,
School of Medicine, Tehran
University of Medical Sciences,
Tehran, Iran

⁴Department of Orthopedic
Surgery, Emam-Khomeini
Hospital, Tehran University of
Medical Sciences, Tehran, Iran

Keywords. chronic kidney
failure, arteriovenous fistula,
hemodialysis

Introduction. For continuous hemodialysis, an appropriate vascular access, mostly through an arteriovenous fistula (AVF), is crucial. The Brescia-Cimino (BC) method is a common surgical method for AVF creation. However, this method is sometimes not possible, due to a small venous diameter or its wide distance from the artery. We evaluated the success rate of bifurcated vein patch (BVP) technique as an alternative method to BC for AVF placement in hemodialysis patients.

Materials and Methods. Candidates for AVF vascular access for hemodialysis were assigned into 2 groups of 50 patients, and AVF was placed using the BC method in one group and the BVP method in the other group. Immediate AVF thrill after the operation, first-day postoperation thrill, weighting period, and nursing staff satisfaction for hemodialysis were compared between the BC and BVP methods.

Results. Although the weighting period in the BVP group was longer than that in the BC group, other parameters were similar between the two groups. The AVF thrill intensity after the operation was good to excellent in 87% of the cases with the BC method and good in 95% of those with BVP. Satisfaction of dialysis nursing staff during hemodialysis was reported as 87% good and 4% average in the BC group and 75% good and 20% average in the BVP group.

Conclusions. Bifurcated vein patch can be an appropriate alternative technique for cases in which the commonly used BC method is not possible for AVF placement.

IJKD 2012;6:124-8
www.ijkd.org

INTRODUCTION

With advancement of medical knowledge for management of chronic kidney failure and increased number of older patients, creation of a proper vascular access has become a common practice. The National Kidney Foundation Kidney Disease Outcomes Quality Initiative introduced useful methods for vascular access for hemodialysis.^{1,2} Importance of a proper fistula for hemodialysis is comparable to successful kidney transplantation for these patients.

The first autogenous method for hemodialysis was introduced in 1966 by Brescia and Cimino in the distal forearm between the distal radial artery and the cephalic vein (distal radiocephalic method or the BC method).³ Since then, various methods of arteriovenous fistula (AVF) creation has been used which are different in surgical technique and location of the fistula. The BC method, however, is the gold standard for AVF because of its technique and good long-term outcomes. In cases with no suitable vein for fistula in the wrist area, antecubital

region can be tried. If no suitable vein was found in all regions, a synthetic graft is used.

As a result of variability in quality and diameter of the veins and the arteries and their relations, the surgeon's decision play an important role in choosing a proper location for fistula and leads to placement of more functional fistulae. Proper venous diameter and quality are crucial anatomic properties needed for creation of a successful AVF. The vein should be at least 3 mm in diameter and the quality should not be impacted by previous blood sampling. Additionally, a short distance between the vein and its adjacent artery is important. Therefore, a narrow vein with a long distance from the artery will result in a difficult AVF placement and impact its outcome.^{4,5} This study evaluated a technique, termed *bifurcated vein patch (BVP)*, in which a bifurcated vein is used to create a proper AVF.

MATERIALS AND METHODS

In this clinical trial, a total of 100 patients were evaluated. Patients with chronic kidney failure that were candidates for hemodialysis were included. Sampling was done using continuous nonrandomized method. The patients were placed in 2 groups based on clinical decision of the surgeon based on preoperative and intraoperative findings of vascular condition and anatomy. The AVF was created using the BC method in 50 patients with veins of proper diameter, quality, and distance from the artery. In another 50 patients who did not meet these criteria for the BC, the BVP was utilized. Physical examination in all of the patients included inspection and palpation of the vessels, Tap test, upper limb pulses, Allen test, and comparison of blood pressure in both upper limbs. Additionally Doppler ultrasonography was performed in the patients to evaluate anatomy of the vessels and diameters of the veins and arteries in selected cases. Informed consent was taken from patients after getting detail information regarding the operation. All the operations were done by one surgeon, using 7-0 prolene suture and Loupe magnification ($\times 3$) in a referral center affiliated to a medical university. The operation was performed under local anesthesia using 1% lidocaine. After exploration and releasing the vein and its bifurcation from surrounding tissue, each branch were cut 1-cm long and split in the antimesentric region,

to be applied as a venous patch (Figures 1 and 2). The venous patch was anastomosed to the side of the radial artery.

Data on demographic characteristics, underlying medical conditions, intraoperative AVF thrill, early postoperative thrill (24 hours after the operation), waiting period till 1th hemodialysis, and nursing staff satisfaction from fistula during hemodialysis were evaluated. Intraoperative and early postoperative presence and intensity of thrill were evaluated by a surgeon. Thrill intensity was categorized as 1 (failure), indicating no thrill or pulse; 2 (poor), presence of pulse without thrill; 3 (average), presence of thrill up to 5 cm from the anastomosis; 4 (good), presence of thrill 5 cm to 10 cm from the anastomosis; and 5 (excellent), and presence of thrill up to more than 10 cm from the anastomosis. The efficacy of the fistula was evaluated by clinical examination (thrill palpation)



Figure 1. Top, Preoperative mapping of veins in the distal arm. **Middle and Bottom,** Bifurcated vein patch arteriovenous (radiocephalic) anastomosis.

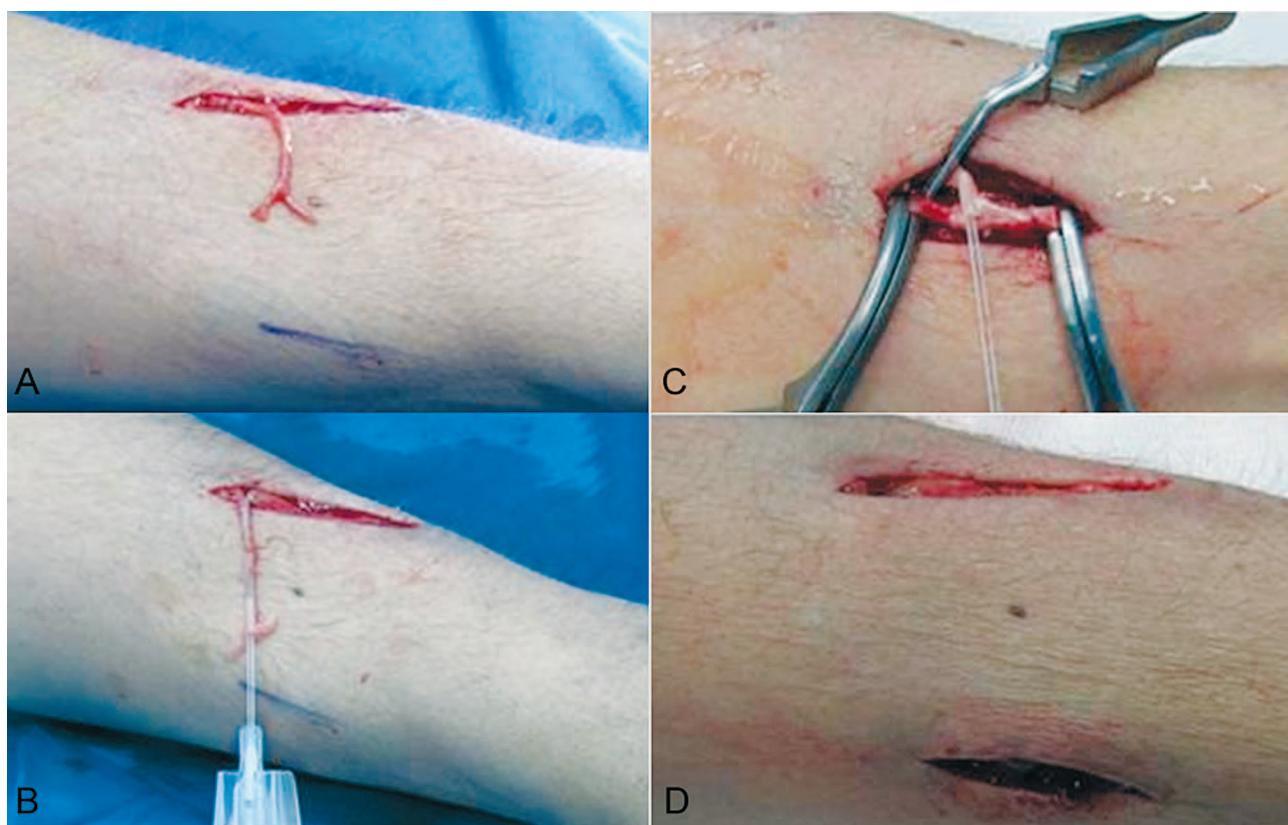


Figure 2. **A** and **B**, Preparation of a small but bifurcated vein. **C**, Bifurcated vein patch arteriovenous anastomosis after approximation of the vein to the artery via subcutaneous tunnel. **D**, Final of operation.

and hemodialysis satisfaction. After the waiting period for maturation of the fistula for initiation of dialysis, the fistula was assessed by inquiring from the dialysis nursing staff.

Since we could not follow up many patients who return to local dialysis units and considering several confounding factors that affect AVF placement success after initiation of dialysis, this study was primarily designed to clinically evaluate the fistula up to the waiting period and initiation dialysis.

RESULTS

All of the 100 participants completed the study. Patients in the two groups were comparable in terms of age, gender, and clinical characteristics (Table). Thirty patients (60%) in the BC group had a history of previous hemodialysis with other access methods than AVF. In the BVP group, 36 (72%) had a history of previous dialysis before referral. In both groups, diabetes was the most common single underlying medical condition leading to kidney failure (Table).

In the evaluation of intraoperative thrill intensity

in the BC group, 13% had excellent, 74% had good, and 13% had average intensity of thrill. The BVP group showed no cases of excellent thrill, but 95% had good thrill and 5% had average thrill. Examination 24 hours after the operation revealed 14% excellent, 78% good, and 9% average thrill

Demographic and Clinical Data of Patients With Bifurcated Vein Patch (BVP) and Brescia Cimino (BC) Arteriovenous Fistulae

Characteristic	BVP	BC
Mean age, y	57 (30 to 89)	56 (18 to 88)
Gender		
Male	26 (52)	22 (44)
Female	24 (48)	28 (56)
Diabetes mellitus	10 (20)	10 (20)
Hypertension	5 (10)	5 (10)
Diabetes mellitus and hypertension	16 (32)	18 (36)
Urinary tract infection	3 (6)	2 (4)
Vesicourethral reflux	4 (8)	4 (8)
Multiple myeloma	4 (8)	3 (6)
Multicystic kidney disease	2 (4)	2 (4)
Systemic lupus erythematosus	1 (2)	0
Gout	0	1 (20)
Unknown	5 (10)	5 (10)

intensity in the BC group, while the BVP group showed 15% excellent, 80% good, and 5% average thrill intensity. Satisfaction of dialysis nursing staff during hemodialysis was reported as 87% good, 4% average, and 9% poor in the BC group. The information in the BVP group was 75% good, 20% average, and 5% poor. The average latency period for maturation of fistula for hemodialysis was 79.5 days (range, 45 to 120 days) and 55.6 days (range, 30 to 90 days) in the BVP and BC groups, respectively.

DISCUSSION

In this study, we compared outcomes of AVF placement using BVP and BC methods. For this comparison, previous studies have applied the "primary patency rate" which shows competency of fistula capable of a successful dialysis as the main outcome measure. This variable can be assessed in various intervals following the operation; for instance, after a period of 1-year following the operation, the primary patency ratio will be calculated.⁶⁻⁹ In our region, this variable cannot be properly evaluated because due to long distances between the home city of patients and referral centers for vascular surgery, most of the patients prefer to return to their home city for hemodialysis following discharge from the referral hospital, and therefore, long-term postoperative assessment of this variable is not possible. Thus, we used 4 major variables including intraoperative and postoperative thrill latency period of maturation and nursing staff satisfaction with AVF for initiation of dialysis at our center.

Although in some studies, no differences have been reported,¹⁰ in some others, various methods has shown different primary patency rate for various methods of fistula placement.^{6,7,9,11,12} In our study, most of the patients in both the BC and BVP groups showed acceptable intraoperative thrill intensity (13% excellent and 74% good in the BC group versus 95% good and 5% average in the BVP group). Moreover, early postoperative (after 24 hours of surgery) thrill intensity was also satisfactory (14% excellent, 78% good, and 9% average in the BS group versus 15% excellent, 80% good, and 5% average in the BVP group). Additionally, the latency period for maturation of fistula showed a significant difference between the two groups (average of 79.5 days versus 55.6

days in BVP and BC groups, respectively). These findings are comparable with other studies in which a 1- or 2-year follow-up for primary patency rate has been evaluated.

Primary patency rate for the BC method has been reported to be 46% in the first and 37% in the second postoperative years. This data for primary patency rate for brachiocephalic arteriovenous fistula has been reported to be 39% in the first year.¹² We assessed nursing staff satisfaction after a significant period following the operation (at least after the latency period). This parameter, which can be a proxy indicator of function of fistula, showed no significant difference between the two groups of our patients with BC and BVP fistulae. In some studies, blood flow exactly following the operation has been used as a variable to predict future function of fistula.⁹ Blood flow has been documented using Doppler ultrasonography.⁹ This diagnostic method is not available in many centers, and therefore physical examination for thrill can be an alternative for evaluation of fistula. Although long-term follow-up was not possible for our patients, outcome and function of fistula in at least 3 months following the operation showed that more than 70% of fistulae were functioning well. With respect to the fact that the BVP method was carried out for the patients in whom the BC method and side-to-side anastomosis had not been possible due to anatomic limitations, it was shown that BVP method and end-to-side anastomosis resulted in similar outcomes. Therefore, utilization of BVP method in selected cases is an appropriate alternative to other methods.

More than two-third of our patients had undergone dialysis before referral with hemodialysis or peritoneal dialysis. In this regard, the National Kidney Foundation Kidney Disease Outcomes Quality Initiative recommendation about placement of fistula before hemodialysis should be considered. Although these data need further studies, it seems that only a small fraction of patients are referred for fistula placement. Causes of this problem should be sought and efforts should be done to introduce fistula as the choice method for dialysis. Other limitations of our study were lack of long-term follow-up and application of qualitative variables for evaluation of fistula. It is recommended that further studies with longer follow-up duration in addition to quantitative follow-up methods such

as Doppler ultrasonography be done to compare various methods of fistula placement. Additionally, quantitative methods for inclusion or exclusion of patients will be helpful.

CONCLUSIONS

As a result of variability in quality and diameter of veins during placement of an AVF, the surgeon's decision plays an important role in selecting an appropriate surgical technique leading to placement of a more functional fistula. In difficult situations, especially for small diameter veins, utilization of BVP technique is an appropriate and efficient alternative for the BC method.

ACKNOWLEDGEMENTS

Authors would like to thank Ms Hedayati, dialysis nurse, who helped greatly in performing hemodialysis and continuous follow-up of patients.

CONFLICT OF INTEREST

None declared.

REFERENCES

1. National Kidney Foundation. DOQI clinical practice guidelines for vascular access, 2000. *Am J Kidney Dis.* 2001;37:s137-81.
2. National Kidney Foundation. DOQI clinical practice guidelines for vascular access. National Kidney Foundation-Dialysis Outcomes Quality Initiative. *Am J Kidney Dis.* 1997;30:s150-91.
3. Brescia MJ, Cimino JE, Appel K, Hurwich BJ. Chronic hemodialysis using venipuncture and a surgically created arteriovenous fistula. *N Engl J Med.* 1966;275:1089-92.
4. Moini M, Williams GM, Pourabbasi MS, et al. Side-to-side arteriovenous fistula at the elbow with perforating vein ligation. *J Vasc Surg.* 2008;47:1274-8.
5. Flu H, Breslau PJ, Krol-van Straaten JM, Hamming JF, Lardenoye JW. The effect of implementation of an optimized care protocol on the outcome of arteriovenous hemodialysis access surgery. *J Vasc Surg.* 2008;48:659-68.
6. Torina PJ, Westheimer EF, Schanzer HR. Brachial vein transposition arteriovenous fistula: is it an acceptable option for chronic dialysis vascular access? *J Vasc Access.* 2008;9:39-44.
7. Arroyo MR, Sideman MJ, Spergel L, Jennings WC. Primary and staged transposition arteriovenous fistulas. *J Vasc Surg.* 2008;47:1279-83.
8. Schild AF, Perez E, Gillaspie E, Seaver C, Livingstone J, Thibonnier A. Arteriovenous fistulae vs. arteriovenous grafts: a retrospective review of 1,700 consecutive vascular access cases. *J Vasc Access.* 2008;9:231-5.
9. Koksoy C, Demirci RK, Balci D, Solak T, Köse SK. Brachiobasilic versus brachiocephalic arteriovenous fistula: a prospective randomized study. *J Vasc Surg.* 2009;49:171-7.
10. Berman SS, Mendoza B, Westerband A, Quick RC. Predicting arteriovenous fistula maturation with intraoperative blood flow measurements. *J Vasc Access.* 2008;9:241-7.
11. Field M, MacNamara K, Bailey G, Jaipersad A, Morgan RH, Pherwani AD. Primary patency rates of AV fistulas and the effect of patient variables. *J Vasc Access.* 2008;9:45-50.
12. Weale AR, Bevis P, Neary WD, Boyes S, Morgan JD, Lear PA, Mitchell DC. Radiocephalic and brachiocephalic arteriovenous fistula outcomes in the elderly. *J Vasc Surg.* 2008;47:144-50.

Correspondence to:

Mohammad Reza Keramati, MD
E-mail: dr_morezak@yahoo.com
Fax: +98 21 8893 6974

Received August 2011

Revised November 2011

Accepted November 2011