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Original Article

Brachiobasilic Fistulas Superficialization with Minimal Incisions: A New Approach by Very Good Outcomes

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Abstract

Background: Failure of cannulation due to the unavailability of deep veins is one of the complicated problems for chronic hemodialysis patients. By using superficialization, the veins with larger caliber and intact intima will be available for continuing the dialysis process. Brachio-Basilic superficialization with Minimal Incision (BBMI) is a proposed method that its patency and results are explored in the current study.

Methods: Thirty hemodialysis patients with two-step superficialization indication were evaluated. For BBMI, first by using sonography, basilic vein pathway was marked and with three small incisions matured basilic vein explored and transected near pervious anastomosis and transposed from new subcutaneous tunneling and re-anastomosed the vein. In a definitive time period up to 6 months, the study variables were evaluated.

Results: There were 11 females and 19 males. The minimum and maximum ages were 29 and 92. Technical success was 100%. After passing several successful dialysis sessions from the superficialized vein, 2 patients (6.7%) encountered unsuccessful cannulation due to thrombosis, and one of thrombosis events was due to hypotension. These cases were whom with the shortest interruption between surgery and dialysis initiation (18 and 25 days; mean±SD=28.63 ±7.36 days). There were no cases of infection and pseudoaneurysm. Furthermore, 1 case (3%) experienced wound dehiscence that managed using proper wound care.

Conclusion: BBMI could be utilized safely with a high patency. This method has the lowest complications. The minimal side effects are affected by predisposing factors that should be clarified precisely in future studies and by gathering more evidence.

Keywords: Brachial artery, Basilic vein, Hemodialysis, Minimal incision, Superficialization

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Introduction

The brachiobasilic arteriovenous fistula was first described in 1976 by Dagher *et al* as an important alternative for patients who failed to have any effective fistula according to other types of fistulas (1).

Superficialization involves cutting from the wrist to the proximal forearm of the brachiocephalic or brachiobasilic fistulas, connecting the vascular branches, moving them over adipose tissue and subsequently transferring them (2). In general, superficialization methods include tunnel transposition, elevation, lipectomy, and liposuction (3). Such interventions are essentially necessary for End-Stage Renal Disease (ESRD) patients under chronic dialysis. Sashi Inkollu *et al* believed that routine vascular surgery techniques consist of the operation of Flap Elevation Procedure (FEP) and lipectomy. The FEP method requires a long incision along a vein that is to be superficial. In the lipectomy method, however, the superficial fat is removed and the skin is allowed to fall deeper into the vein. They mentioned that the results of minimum incision are patent and durable which makes this method excellent for cannulation. In this method, the location of vein was marked using ultrasonography and it was possible to access the vein using two incisions of 2-3 *cm* with a distance about 10-12 *cm*. Then, a deep vein incision in the layers of fascia, anastomosis, tunneling and superficialization was conducted (4).

Side effects of vascular superficialization can be categorized as early (primary) and delayed (secondary) complications; for instance, long-term swelling of the arm, wound infection, hematoma, necrosis and pseudoaneurysm. Cannulation can be carried out 3-4 weeks later, when the surgical incisions have healed and there is some fibrous area around the fistula to help hemostasis by using a needle; this is known as maturation step (5).

The present study was designed to evaluate the superficialization method with minimal incisions that seems to reduce the side effects related to long- and full-incision observed in other methods. Since there is still no consensus among vascular surgeons and experts to choose the best fistula surface treatment method, we have examined the results of Brachio-Basilic superficialization with Minimal Incision (BBMI) to determine its patency and safety in an Iranian ESRD population.

Materials and Methods

After acceptance in our institute ethical committee (ethical code: IR.SBMU.MSP.REC.1399.02), the study population included dialysis patients with chronic kidney disease who needed fistulas for venous cannulation. These patients were required to receive intravenous fistula based on indications from the dialysis department. The patients were included in the study if they their written consent was obtained before intervention. Inclusion criteria for superficialization comprised renal insufficiency, brachiobasilic fistulas, and at least 4 weeks maturation time elapsed since the initial operation of the embedding fistula. Furthermore, the size of the basilic vein should be at least 6 *mm* and the flow should be observed more than 300 *cm/sec* on the ultrasound. Exclusion criteria were: a history of superior vena cava syndrome and history of any surgery on the patient's arm in fistula site.

Ultimately, 30 patients were enrolled and underwent ultrasound. The location of basilic vein was determined along the entire route of the brachiobasilic vein. Surgery was performed under a regional block or sedation followed by a minimal incision on each patient, by a specialist in this field. A two-step method of superficialization was adopted: in the first session, we made the brachiobasilic anastomosis and waited 4 weeks for maturation; in the second session, maturation of fistula and its direction was confirmed using sonography followed by superficialization of basilic vein. The success rate was assessed by touching the thrill along the entire length of the superficialized vein on the day of surgery and the day after surgery. Patients were followed at 2 and 4 weeks after surgery and if the superficial vein was suitable for dialysis, patients were reevaluated. After successful dialysis, patients were monitored for 6 months to assess the dialysis status, thrombosis, and fistula patency plus wound status. Complications, if occurred, during the operation and until the end of the study were monitored and recorded.

All patients were subjected to standard clinical examination conditions prior to the operation, and standard procedures for patient preparation in terms of nursing and clinical care were conducted, and no process was performed beyond the usual procedures.

Based on the type of research, statistical tests of independent samples t-test were utilized to compare the mean of parametric variables between male and female groups. Pearson Correlation test was also used to evaluate the correlation of the parametric variables in the study. Figure 1 represents the surgery with a minimal incision performed on one of the enrolled patients in the current study.

Results

Among 30 enrolled patients, 11 were women and 19 were men. Descriptive data and comparisons are shown in table 1. Statistically, there was no meaningful difference between men and women participants (p=0.86). Also, the mean Body Mass Index (BMI) of population was 25.87 ± 2.43; for women, it was 27 ± 2.7 and for men, it was 25.21 ± 2.05 kg/m^2. There was no significant difference between two genders BMI (p=0.051); however, the BMI of women was about 1.8 units higher than that of men. The mean time interval between brachiobasilic vein superficialization and dialysis onset in patients was 28.63 ± 7.36 days.

Technical success rate of superficialization of BBMI was 100% and no adverse events occurred. Six months after the superficialization of brachiobasilic fistulas, about 7% (2 of 30 patients) had fistula failure; one case due to thrombosis and fistula blockade whereas the other because of hypotension, after several successful dialysis sessions. Therefore, the patency of this method is 100%. In the early stages and after 6 months, it is at least 93%.

No infection occurred during the follow-up period and only one case experienced wound dehiscence. In addition, there was no case of opening wound just after superficialization surgery. It should be noted that the patient was treated with appropriate care and antibiotics.

As all patients had 100% BBMI patency, evaluation of technical success of superficialization surgery with the rest study variables are not possible; *i.e.* between patients with high and low BMI or males and females. Therefore, it is important to note that the technical success rate of BBMI is not dependent to the BMI and patients' gender. Furthermore, the time interval between BBMI operation and the onset of dialysis showed insignificant association. Correlation analysis showed that three variables including the patients' age, BMI and the time interval between BBMI and dialysis onset result in no significant associations (Table 2).

Figure1. Brachiobasilic fistula superficialization procedure on an ESRD patient.

Table 1: Comparison of male and female for the age, BMI and the time interval between BBMI superficialization procedures and dialysis onset

Variable	N	Mean±SD	p-value
Age (year)	Female	62.36±10.22	0.860
	Male	61.31±17.78	
BMI (*Kg/m2*)	Female	27.00±2.70	0.510
	Male	25.21±2.05	
The time interval between BBMI and dialysis onset	Female	28.82±7.75	0.919
	Male	28.53±7.34	

Table 2. Correlation estimations between studied variables for BBMI superficialization

Studied variable		BMI	The time interval between BBMI to dialysis onset
Age	r	0.122	0.177
	p-value	0.520	0.350
BMI	r		-0.153
	p-value		0.421

Body Mass Index-BMI

Discussion

In the present study, a minimally invasive method was used to superficialization of the brachiobasilic vein, the advantage of which was the least damage to the patient's tissues while sufficient patency for dialysis of ESRD patients. In the BBMI method adopted by the researchers, three separate skin incisions were made on the hand; the basilic vein was freed from surrounding tissue. Then, it was cut and inserted in a new subcutaneous tunnel and re-anastomosed, and the cannulation success was assessed.

Overall, the findings suggest that this could be at least 100% successful in the early stages. Failures can be due to the cannulation process, dialysis status and duration, clot formation and repeated needling during medical and nursing interventions. Also, factors such as haste in using superficial vessels or underlying factors may predispose a person to thrombosis. Considering the time interval between superficialization and dialysis onset from the superficialized vein, we can find out that one of the two patients, who failed to continue dialysis due to the thrombosis after several successful sessions, is a person with dialysis initiation at the day 18 after BBMI. The second person was an 81-year-old woman with normal BMI who began dialysis 25 days after BBMI superficialization and failed continuing dialysis due to the hypotension, after several successful sessions.

However, the mean time interval between brachiobasilic vein superficial surgery and dialysis onset among patients was 28.63 ± 7.36 days. Therefore, it may be argued that early initiation of dialysis using a superficial vein can lead to a risk of failure to thrive dialysis. However, this should be carefully considered using future studies. Assessing such issue requires stronger evidence from a larger statistical population.

Therefore, in short, surface minimization of brachiobasilic vein with minimal incision, as a completely successful method, with few complications and suitable efficacy for ESRD patients requiring long-term cannulation, can be considered as a comprehensive approach. In cases of ineffectiveness or failure of this adjuvant therapy, attention should be paid to variables such as the time interval between BBMI and clinical conditions or the type of treatment.

A 61-year-old woman with obesity has been described by Marlin Wayne Causey *et al* as having arterial-vascular fistulas in her hand and was diagnosed by ultrasound. The patient's problem was the absence of inaccessible suitable vein for dialysis. Finally, the patient was able to have dialysis of the vein using liposuction and vascular superficiality, which were monitored simultaneously with ultrasound. She was followed for 1 week, 4 weeks, and 6 weeks, and had no particular problem during this time, in addition to the fact that his treatment process was going well (6). Marlin Wayne Causey *et al* study was a case report, but in the present study, we followed 30 patients under BBMI and for 6-months; there were no serious complications or problems in any patient. Failure to continue using fistulas for dialysis has been hasty in initiating the use of superficialized veins or as an underlying cause of low blood pressure.

In 2018, a retrospective review of data from a medical center evaluated the survival rate of fistulas resulting from arterial-vascular displacement of brachiobasilic in 103 patients undergoing one-stage and two-stage surgery. The rate of failure in the single-step method was 24% and in the two-step method, it was 21%; therefore, there were no differences between the one-step and two-step methods, essentially. Finally, the rate of fistula retention during 12-month follow-up was 70% in the single-stage method, 90% in the two-stage method, and 23% in the failure rate (7).

Korkut *et al* reported that the creation of a brachiobasilic fistula was a great way to better access

the vein in patients whose dialysis is difficult. They examined 375 patients with brachiobasilic fistula surgery, 350 patients were hemodialysis individuals. Also, Korkut *et al* described the method as to first make a 2-*cm* incision in the ante-cubital fossa to find the brachial vein and basil vein; then, a 4- to 6-*cm* incision is made to access areas close to the basilica vein. After that, the lateral branches of the basilic vein are removed and the veins are connected by cutting this second area. The basil vein was placed in the ante-cubital fossa area and above the fascia area in the form of a whole tunnel in the same anatomical area. The mean follow-up time for patients was 48 months (minimum to maximum: 2-84 months). The average time interval between operations and vein use was 52 days (minimum to maximum 25-75 days) and bleeding occurred in 3 patients (0.9%). After evaluating the patients for 1, 2, 3, and 4 years, the initial fistula retention rate was 92, 78, 64, and 54%, respectively. The rate of secondary fistula retention for these years was 93, 81, 66 and 56%, respectively. The researchers believed that the superficiality of the brachiobasilic vein is a logical and alternative method of basil vein transplantation. They also stated that procedure required minor skin and surgical incisions. Also, long-term vein residue was good and acceptable (8).

In 2001, Zielinski *et al* evaluated patients with a retrospective study over a period of approximately six years and examined 12 patients undergoing delayed surface fusion of brachiobasilic fistulas. The average time to use a superficial vein was 22.4 months. The researchers declared that the superficiality of the brachiobasilic vein was a very successful practice in the early stages, with minimal side effects (9).

Ivan D. Maya *et al* in a prospective study based on 678 described patients with vein superficialization have shown that brachiobasilic superficialization was the most effective method for fistula transposition, noting that it could be very useful due to lower failure than vessels transplantation and with fewer interventions, although has its complexities (10). Our results also demonstrated the success of the minimally invasive brachiobasilic vein superficialization method.

Conclusion

In the present study, it was found that minimally invasive brachiobasilic vein superficialization could be a useful method for facilitating dialysis patients. Therefore, considering that the unavailability of a vein suitable for dialysis of ESRD patients is one of the most important challenges in their treatment, the mentioned method is recommended. However, our results were different and significant regarding the studies compared in that the postoperative side effects were well taken into account and discussed. Also, it is worth noting that due to the nature of the present study, it was not possible to utilize a control group. However, in the case of multicenter research, the results of vein superficialization approaches for ease of application can be evaluated.

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This article has ethical code number of the Ethics

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