The Egyptian Journal of Hospital Medicine (October 2022) Vol. 89 (2), Page 7676- 7679

Brachial Artery-Brachial Vein Fistula as An Alternative to Brachial Artery- Axillary Vein Prosthetic Graft Fistula In Patients With Exhausted Superficial Veins

Michael S. Ayad, Mostafa M. Abdelghany, Mostafa M. Hussein, Moamen M. Nagy
Department of Vascular Surgery, Faculty of Medicine, Minia University. Minia, Egypt
***Corresponding author:** Michael Samuel Ayad**, Mobile: (+20)** 01228722786**, E-Mail:** micsam1984@yahoo.com

ABSTRACT

Background: The life expectancy of chronic renal failure patients has been prolonged. So the patient may need multiple access during his life, and exhaustion of the cephalic and basilica veins obligates the surgeon to plan for another access site. **Objective:** To compare the two types of access which to do first.

Patients and Methods: Patients who underwent a brachial artery-brachial vein autogenous arteriovenous fistula (BVAVF) from August 2018 to August 2021were compared with those who received an arteriovenous graft (AVG) during the same period. This study included forty end-stage chronic renal failure patients with exhausted cephalic and basilic veins who were divided into two equal groups, Group (A) with brachial artery brachial vein fistula in one stage or two stages approach, and Group (B) patients with brachial artery axillary vein polytetrafluoroethylene (PTFE) graft.

Results: The mean age ± SD was 53.5±16.5 and 56.8±13 in Groups A and B respectively with a non-significant correlation. In Group (A), one case needed surgical repair of an aneurysm after two months, one case needed surgical repair of a pseudo aneurysm after eight months, and one case needed venoplasty of an innominate lesion after seven months. So, the primary assisted patency was 40% after eighteen months. In Group (B), two cases suffered from thrombectomy of the graft one after fourteen months and the other after eight months, one case suffered from venoplasty of an innominate lesion after seven months while one case needed surgical repair of pseudoaneurysm. So, the primary assisted patency in Group (B) was 70% after eighteen months.

Conclusion: AVG has a higher primary patency and assisted primary patency than BVAVF but this needs more randomized trials to confirm.

Keywords: Brachial Artery-Brachial Vein Fistula, Brachial artery- axillary vein Prosthetic Graft and PTFE.

INTRODUCTION

The National Kidney Foundation Disease Outcomes Quality Initiative guidelines recommend AVGs for patients with inadequate cephalic or basilica veins to support AVF placement[(1)].

In the case of a patient whose cephalic and basilic veins are exhausted, we look for another native access for hemodialysis. As an autologous substitute, the brachial artery-brachial vein arteriovenous fistula (BVAVF) has become more popular. The evidence comparing BVAVFs with AVGs in patients who are otherwise not candidates for a standard AVF, however, is sparse [(2)].The present work aimed to compare the two types of access which to do first.

PATIENTS AND METHODS

Study design:

This is a prospective comparative study to compare two types of access BVAVFs and AVGs in end-stage chronic renal failure patients.

Study duration:

This study is a multicentric study conducted at Minia University Hospital, Elrae Elsaleh hospital, and Elhekma Hospital from August 2018 to August 2021.

Study population:

This study included 40 end-stage chronic renal failure patients on regular hemodialysis.

Inclusion criteria: All cases of end-stage renal disease, and haven't adequate superficial venous anatomy in the upper limb to support AVF, who gave accepted consent.

Exclusion criteria: Patients who refuse consent, and have adequate superficial venous anatomy in the upper limb to support AVF.

Technical notes:

Group (A) we need a brachial vein diameter of two mm at minimum. Anastomoses are performed in an end vein-to-side artery technique with at least an arteriotomy of six mm.

A longitudinal incision was made along the medial side of the upper arm to perform some BVAVFs in one step, which involved dissecting the vein, ligating and dividing its tributaries up to the axillary vein, positioning the transposed vein in the newly formed subcutaneous tunnel beneath the skin, and performing an anastomosis.

The other BVAVFs were carried out in two stages, with the anastomosis being created during the initial surgery and the transposition occurring four to six weeks later. Two different techniques were used to transpose BVAVFs: the less common technique involved making a similar incision but transecting, tunneling, and re-anastomosing the vein at the level of the previous anastomosis. The first technique involved making a longitudinal incision along the upper arm and placing the transposed vein in a newly created subcutaneous tunnel. When a BVAVF showed a flow of 600 mL/min on duplex ultrasound imaging and had a minimum intraluminal diameter of 6 mm, it was deemed to be mature.

Received: 15/07/2022
Accepted: 18/09/2022

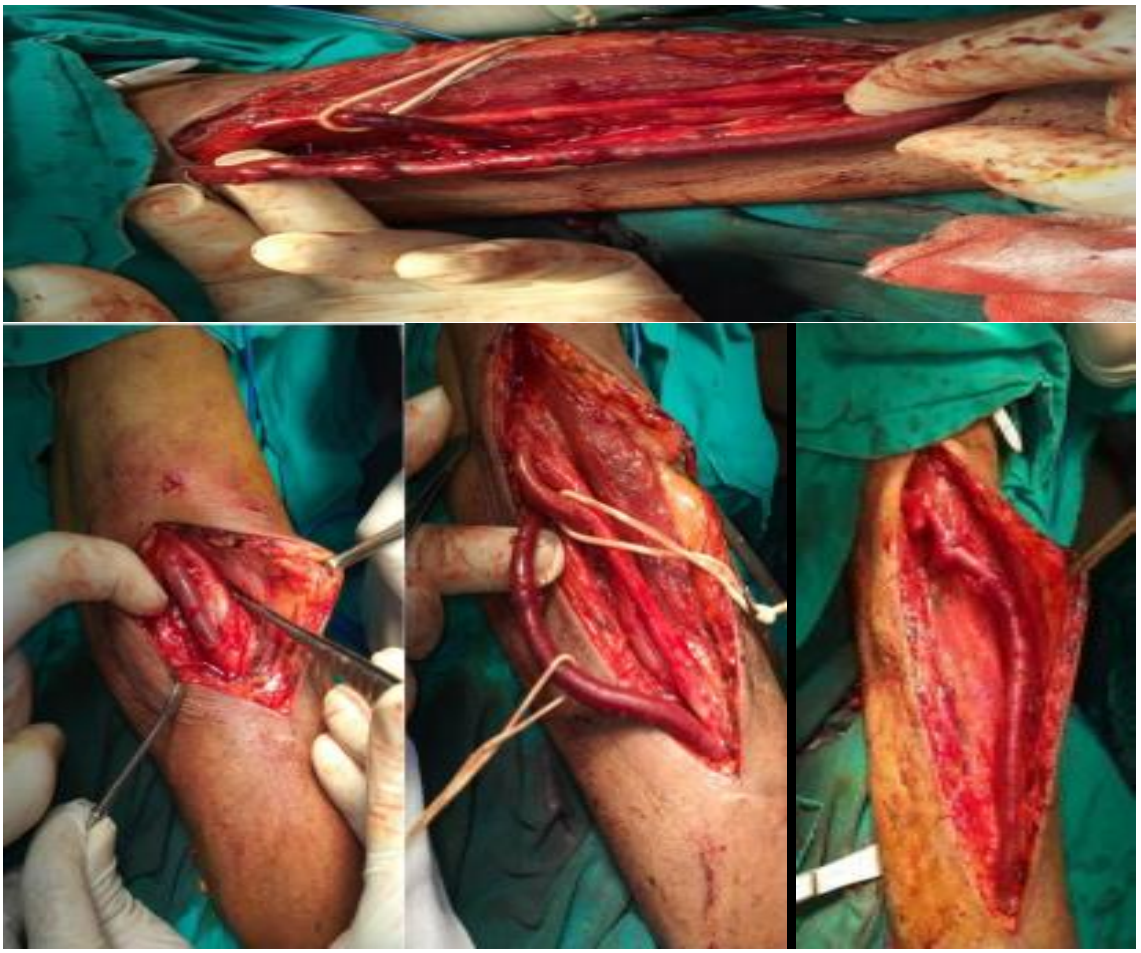

Fig. (1): Superficialization of the brachial artery venacommitant.

Utilizing a 6mm polytetrafluoroethylene (PTFE) graft, an AVG group is conducted. All AVGs are conducted in a C-shaped tunnel from the brachial artery to the axillary vein.

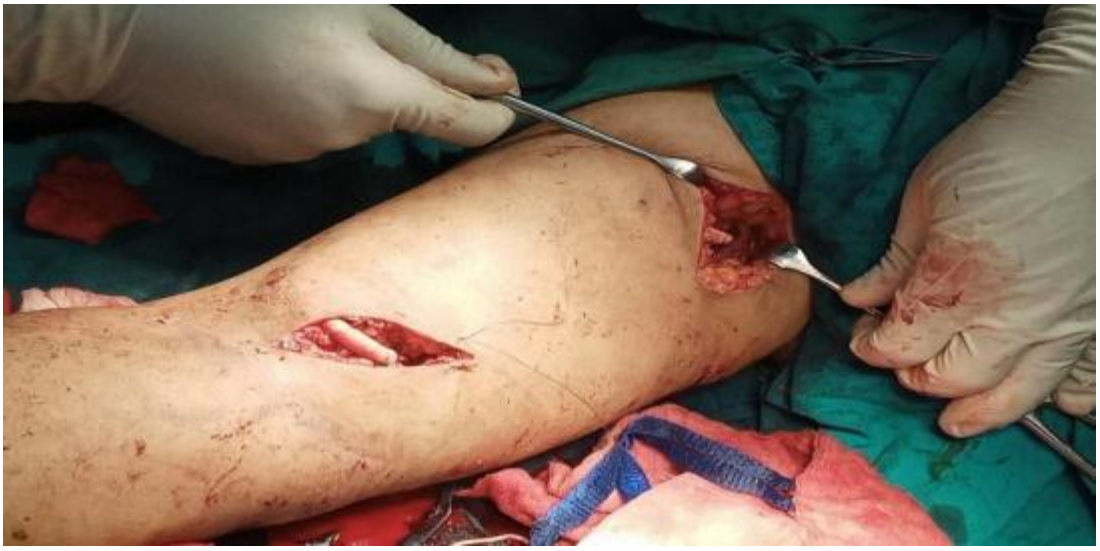

Fig. (2): PTFE graft between the brachial artery and axillary vein

Ethical consent:

Minia University Faculty of Medicine's ethics committee gave its approval for this study, which was carried out following the guidelines outlined in the Declaration of Helsinki. All study participants gave their informed consent.

Statistical analysis

Statistical Package for Social Sciences (SPSS) version 22 for Windows was used to code, process, and analyze the obtained data (IBM SPSS Inc, Chicago, IL, USA). Using the Shapiro Walk test, the distribution of the data was examined for normality. Frequencies and relative percentages were used to depict qualitative data. To determine differences between two or more sets of qualitative variables, use the Chi-square test (2). Quantitative information was presented as mean SD (Standard deviation). Two independent groups of normally distributed variables were compared using the independent samples t-test (parametric data). A p-value less than 0.05 was regarded as significant.

RESULTS

In our study, forty patients were divided into two groups, group (A) contained twenty patients with brachial vein brachial artery fistula, and group (B) contained twenty patients with brachial artery axillary vein polytetrafluoroethylene (PTFE) graft. In group (A) the age ranged between (18-75 years) with a Mean ± SD (of 53.5±16.5).

In group (B) the age ranged between (20- 71 years) with a Mean ± SD (of 56.8±13) with a non-significant P-value. In group (A) thirteen patients (65%) were males and seven cases (35%) were females, while in group (B) fourteen patients (70%) were males, and six cases (30%) were females, with a non-significant p-value. The maturation time of the brachial vein brachial artery fistula group took from sixty to ninety days to get mature and can be cannulated but in PTFE graft needed only fifteen to thirty days to get mature.

Table (1): Patient's demographic data.

		Brachial vein, Brachial Artery Fistula	AV Graft	P-value
Age	Range	(18-75)	(20-71)	0.484
	Mean ± SD	53.5±16.5	56.8±13.4	
Sex	Male	13(65%)	14(70%)	0.736
	Female	7(35%)	6(30%)	
DM	No	12(60%)	14(70%)	0.507
	Yes	8(40%)	6(30%)	

***: Significant level at P-value < 0.05**

In group (A), venous hypertension occurred in five cases (25%), while in group (B) it occurred in three cases (15%), with a non-significant p-value. In group (A), steel did not occur but in group (B) it occurred in one case only, with a non-significant p-value. In group (A), infection occurred in two cases (10%), while in group (B) it occurred in four cases (20%), with a non-significant p-value.

In group (A) seroma occurred in one case (5%), while in group (B) it occurred in three cases (15%), with a non-significant p-value. In both groups, a pseudo-aneurysm occurred in one case only. In group (A) an aneurysm occurred in one case (5%) while in group (B) it occurred in two cases (10%), with a non-significant p-value. In group (A) hematoma occurred in three cases (15%), while in group (B) hematoma did not occur. In group (A) thrombosis occurred in nine cases (45%), while in group (B) it occurred in five cases (25%), with a non-significant p-value.

Table (2): The appeared complications in both groups

		Brachial vein, Brachial artery Fistula	AV Graft	P-value
Venous hypertension	No	15(75%)	17(85%)	0.429
	Yes	5(25%)	3(15%)	
Steel	No	20(100%)	19(95%)	1
	Yes	0(0%)	1(5%)	
Infection	No	18(90%)	16(80%)	0.661
	Yes	2(10%)	4(20%)	
Seroma	No	19(95%)	17(85%)	0.605
	Yes	1(5%)	3(15%)	
P. aneurysm	No	19(95%)	19(95%)	1
	Yes	1(5%)	1(5%)	
Aneurysm	No	19(95%)	18(90%)	1
	Yes	1(5%)	2(10%)	
Hematoma	No	17(85%)	20(100%)	0.231
	Yes	3(15%)	0(0%)	
Thrombus	No	11(55%)	15(75%)	0.185
	Yes	9(45%)	5(25%)	

***: Significant level at P value < 0.05**

In our study primary patency of group (B) ranged from two to eighteen months with a Mean± SD13.1±3.1 Median/(IQR) 16/(7.3-18), while in group (A) it ranged from two to eighteen months with a Mean ± SD 9.1±2.3 Median/(IQR) 7/(4.3-16.5), with a significant p-value.

Table (3): Primary patency:

		Brachial vein, Brachial artery Fistula	AV Graft	P-value
1ry patency	Range	(2-18)	(2-18)	**0.042***
	Mean ± SD	9.1±2.3	13.1±3.1	
	Median/(IQR)	7/ (4.3-16.5)	16/ (7.3-18)	

***: Significant level at P value < 0.05**

DISCUSSION

Assisted primary patency:

In group (A)one case needed surgical repair of an aneurysm after two months, one case needed surgical repair of a pseudo aneurysm after eight months, and one case needed venoplasty of an innominate lesion after seven months. Thus primary assisted patency in group (A) was eight cases 40% after eighteen months.

In group (B)two cases needed thrombectomy of the graft, one after fourteen months and another after eight months. Another case needed venoplasty of an innominate lesion, one case after seven months, and one case needed surgical repair of pseudoaneurysm. Thus the primary assisted patency in group (B) was fourteen cases (70%) after eighteen months.

After exhausting the cephalic, and basilica veins in end-stage chronic renal failure patients, there is still controversy about the next optimal vascular access procedure [(3-4)].

Currently, either an autogenously BVAVF or AVG is advised. According to several studies, the BVAVF treatment is superior to the AVG method because of higher patency rates and fewer interventions [(5-6)]. These studies, however, only include results from accesses that were initially successful; primary failure instances were left out of the study. This could lead to an overestimation of BVAVFs' successes in comparison to AVGs because they neglected to consider problems with access creation and maturation [(7-8)].

A BVAVF is more challenging to create than other AVFs. Compared to the cephalic or basilic vein, the brachial vein has much thinner walls, making it more susceptible to kinking, twisting, and damage. It has numerous tributaries, many of which require ligation and division because they are so small. The brachial vein may run underneath the median nerve and is permanently attached to the brachial artery.

The brachial vein takes longer than the basilic vein to develop. Therefore, even though we establish the BVAVF with a minimum threshold of 2 mm.

In our opinion, the BVAVF should always be carried out in two steps. The literature supports the two-stage strategy 9. Lastly, because of its depth (especially in large arms), we usually always transect the fistula (which is established at the elbow), transpose it, and conduct a new anastomosis to the brachial artery above the elbow to superficialize the BVAVF [(9)].

The BVAVF take a long period to get mature so should be considered in end-stage chronic renal failure patients referred early, to allow for maturity before their onset of hemodialysis, because of the long catheter time associated with 50% incidence of catheter-related sepsis, Greenberg et al showed a benefit for BVAVFs if patients were referred 3 months before their onset of HD[(10)].

CONCLUSION

Dissection of the brachial vein is very difficult and time-consuming. Its construction can delay the use of prosthetic grafts or long-term catheters (essentially important for patients with a very high risk of infection and in diabetic patients) early planning and construction are required because of the extended period for maturation of the brachial vein and the need for a longer time to be arterialized.

In our study, AV graft is better than vena commitant but we can use vena commitant when the graft is not available, we need a more randomized trial to confirm that.

Financial support and sponsorship: Nil.
Conflict of interest: Nil.

REFERENCES

1. **Sidawy A, Gray R, Besarab A *et al.* (2002):** Recommended standards for reports dealing with arteriovenous hemodialysis accesses. Journal of Vascular Surgery, 35(3):603-10.
2. **Morosetti M, Cipriani S, Dominijanni S *et al.* (2011):** Basilic vein transposition versus biosynthetic prosthesis as vascular access for hemodialysis. Journal of Vascular Surgery, 54(6):1713-9.
3. **Sgroi M, Patel M, Wilson S *et al.* (2013):** The optimal initial choice for permanent arteriovenous hemodialysis access. Journal of Vascular Surgery, 58(2):539-48.
4. **Keuter X, De Smet A, Kessels A *et al.* (2008):** A randomized multicenter study of the outcome of brachial-basilic arteriovenous fistula and prosthetic brachial-antecubital forearm loop as vascular access for hemodialysis. Journal of Vascular Surgery, 47(2):395-401.
5. **Papanikolaou V, Papagiannis A, Vrochides D (2009):** The Natural History of Vascular Access For Hemodialysis: A Single Center Study of 2,422 Patients. Journal of Vascular Surgery, 50(2):468-9.
6. **Pflederer T, Kwok S, Ketel B *et al.* (2008):** A Comparison of Transposed Brachiobasilic Fistulae with Nontransposed Fistulae and Grafts in the Fistula First Era. Seminars in Dialysis, 21(4):357-63.
7. **Allon M, Daugirdas J, Depner T *et al.* (2006):** Effect of Change in Vascular Access on Patient Mortality in Hemodialysis Patients. American Journal of Kidney Diseases, 47(3):469-77.
8. **Lee T, Barker J, Allon M (2005):** Tunneled Catheters in Hemodialysis Patients: Reasons and Subsequent Outcomes. American Journal of Kidney Diseases, 46(3):501-8.
9. **Biuckians A, Scott E, Meier G *et al.* (2008):** The natural history of autologous fistulas as first-time dialysis access in the KDOQI era. Journal of Vascular Surgery, 47(2):415-21.
10. **Greenberg J, May S, Suliman A *et al.* (2008):** The brachial artery-brachial vein fistula: Expanding the possibilities for autogenous fistulae. Journal of Vascular Surgery, 48(5): 1245-50.