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ORIGINAL ARTICLE

Comparative Study Between Using of Synthetic Arteriovenous Fistula and Fistula Between the Brachial Artery and Vein for Hemodialysis in Patients With Exhausted Superficial Veins

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Abstract

Background: **The high morbidity, mortality, and economic burden associated with end-stage renal disease (ESRD) make is a serious hazard to public health. Dialysis access, once established, must be carefully maintained. When it comes to providing care for patients with ESRD, vascular surgeons play a vital role in facilitating hemodialysis access.**

Aim and objectives: **A study comparing the outcomes of dialysis through a native brachial artery-brachial vein arterio-venous fistula versus a prosthetic brachio-axillary graft in cases with chronic renal failure and depleted upper extremity superficial venous accesses.**

Patients and methods: **A total of 60 individuals with ESRD took part in the study's prospective randomized trial. The vascular surgery portion of the study took place at Al-Azhar University's Al-Hussein and Sayed Galal Hospitals in Cairo. The duration of the study was between 6 months and 1 year.**

Result: **The rate of problems is similarly low in both groups. When comparing the patency rates of the two groups, there is no discernible difference. After 12 months, disease-free survival was 66.7 % in group A and 63.3 % in group B, with a log rank test of 0.86.**

Conclusion: **In cases with chronic renal failure and depleted upper extremity superficial venous connections, a brachial artery-brachial vein arterio-venous fistula used as a native access for dialysis is as successful as a brachio-axillary graft used as a prosthetic vascular access.**

Keywords: Brachial artery and vein, End-stage renal disease (ESRD), Exhausted superficial veins, Hemodialysis, Synthetic arteriovenous fistula

1. Introduction

High mortality and healthcare costs are connected with end-stage renal disease (ESRD), making it a serious public health concern. Dialysis access must be established and maintained as soon as possible. The majority of the work in the treatment of individuals with ESRD is done by vascular surgeons who are responsible for creating and preserving access to hemodialysis.[1]

Hemodialysis cases with chronic renal failure need permanent vascular access. Primary vascular access for incident ESRD patients is the radial artery-cephalic vein arteriovenous fistula, with proximal native fistulae or arteriovenous grafts in the upper extremities functioning as secondary vascular accesses.[2]

With an aging dialysis population and an increasing number of persons with end-stage renal illness, surgeons are increasingly confronted with access challenges, such as depleted upper extremity access sites.[2]

There is consensus that the best hemodialysis access is one that lasts a long time, has little risk of

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infection, and requires only infrequent revision surgery to keep its patency. Several studies use statistical analysis to conclude that autogenous arteriovenous fistula and prosthetic arteriovenous graft have the same patency rates.[3] Autogenous arteriovenous fistula, on the other hand, outperformed prosthetic arteriovenous grafts in several studies.[4]

Biological grafts have been shown to have better outcomes in terms of patency, complications, and cost than PTFE grafts when comparing the two. Studies recommend adopting native AVFs as the first line of treatment.[5]

2. Patients and methods

A total of 60 individuals with ESRD and venous exhaustion in the upper extremities participated in this prospective, randomized investigation. The research was carried out in the Al-Hussein and Sayed Galal Hospitals of Al-Azhar University in Cairo. Patients were separated into two equal groups: group (A): 30 pateints unredwent brachio-vena commitant arteriovenous fistula for the purpose of hemodialysis and group (B): 30 pateints underwent brachio-axillary graft for the purpose of hemodialysis.

Inclusion criteria: All cases with ESRD on regular dialysis with exhausted upper limb superficial veins in need for permenant access for hemodialysis.

Exclusion criteria: Those whose superficial veins are healthy enough to create a fistula, Patients who have had brachial artery ligation before, Patients with severe hypotension, patients with small vena cava sizes, and patients with a history of central venous blockage on the same side.

2.1. Methods

Chest radiography, electrocardiograms, echocardiograms, and duplex ultrasounds of the venous and arterial systems in both upper limbs, as well as a complete medical history, were performed on all patients.

Preoperative Assessment: All patients will get a Doppler/duplex scan. Both the arterial and venous systems might be seen during the duplex scan procedure. In addition to finding obliterated veins or veins that are not a good fit for a procedure, this technology can also detect obstructed vessels in the upper limb.

Follow-up of patients: Patency, graft function, and complications were assessed on the first post-operative day, then again after 1 week, 1, 3, 6, 9 months, and after 1 year.

Table 1. Sociodemographic characteristics of the two studied groups.

	Group A ($n = 30$)	Group B ($n = 30$)	t/χ^2	*P*
Age (y)				
Mean ± SD	52.85 ± 11.65	51.64 ± 12.72	0.384	0.702
Sex				
Male	16 (53.3 %)	18 (60 %)	0.272	0.602
Female	14 (46.7 %)	12 (40 %)		
BMI (kg/m^2)				
Mean ± SD	25.3 ± 2.51	25.88 ± 2.64	0.872	0.387
Disease duration (years)				
Mean ± SD	8.65 ± 3.71	9.13 ± 4.49	438	0.662

3. Results

Table 1.

Table shows no significant difference among the two groups concerning age, sex, BMI and disease duration Table 2.

This table demonstrate that there is no significant difference among the two groups concerning comorbidities Table 3.

Table 2. Comorbidities distribution among the two studied groups.

	Group A ($n = 30$) N (%)	Group B ($n = 30$) N (%)	χ^2	*P*
Smoking	13 (43.3 %)	11 (36.7 %)	0.278	0.598
DM	15 (50 %)	14 (46.7 %)	0.067	0.796
HTN	14 (46.7 %)	17 (56.7 %)	0.601	0.438
Heart diseases	8 (26.7 %)	6 (20 %)	0.373	0.542
Dyslipidemia	9 (30 %)	10 (33.3 %)	0.077	0.781

Table 3. Routine laboratory parameters of the two studied group.

	Group A ($n = 30$)	Group B ($n = 30$)	t	*P*
Hemoglobin (g/dl)				
Mean ± SD	11.56 ± 1.55	11.69 ± 1.46	0.546	0.586
TLC (10^3/μl)				
Mean ± SD	10.91 ± 2.38	11.64 ± 2.51	1.89	0.061
PLT (10^3/μl)				
Mean ± SD	327.15 ± 67.41	316.95 ± 52.72	1.07	0.288
Albumin (g/dl)				
Mean ± SD	3.59 ± 0.355	3.45 ± 0.444	1.57	0.118
ALT (U/l)				
Mean ± SD	31.42 ± 13.56	34.38 ± 11.60	0.909	0.367
AST (U/l)				
Mean ± SD	32.09 ± 13.01	30.38 ± 10.9	0.552	0.583
Serum creatinine (mg/dl)				
Mean ± SD	4.16 ± 1.35	3.85 ± 1.24	0.926	0.358
BUN (mg/dl)				
Mean ± SD	133.82 ± 34.75	129.41 ± 39.18	0.461	0.646
Calcium (mg/dl)				
Mean ± SD	8.68 ± 1.34	8.39 ± 1.27	0.862	0.393
Phosphate (mg/dl)				
Mean ± SD	5.24 ± 1.08	5.03 ± 0.854	0.835	0.407
PTH (ng/l)				
Mean ± SD	623.7 ± 323.4	687.38 ± 351.9	0.768	0.485

Table 4. Complications and outcome of the two studied groups.

	Group A ($n = 30$)	Group B ($n = 30$)	χ^2	P
Failure	6 (20 %)	8 (26.7 %)	0.373	0.542
Thrombosis	6 (20 %)	9 (30 %)	0.8	0.371
Hematoma	2 (6.7 %)	2 (6.7 %)	–	1
Infection	2 (6.7 %)	4 (13.3 %)	0.741	0.389
Steal	1 (3.3 %)	0	1.02	0.315
Venous hypertension	0	2 (6.7 %)	2.07	0.150
Mortality	2 (6.7 %)	5 (16.7 %)	1.47	0.228

When comparing standard laboratory parameters between the two groups, there is no discernible difference Table 4.

This table shows that there is no significant difference among the two groups concerning complications Table 5.

There is no statistically significant difference in patency rates among the two groups, as shown in the table Fig. 1, Table 6.

4. Discussion

With an aging dialysis population and a rise in the life expectancy of patients with ESRD, surgeons are increasingly faced with complex access difficulties, such as depleted upper extremity access sites and central venous outflow obstruction from prior catheterization.[6]

Table 5. Patency rate of the twq studied groups.

	Group A ($n = 30$)	Group B ($n = 30$)	χ^2	P
3 months	28 (93.3 %)	27 (90 %)	0.218	0.640
6 months	27 (90 %)	26 (86.7 %)	0.162	0.688
9 months	24 (80 %)	24 (80 %)	–	1
12 months	20 (66.7 %)	19 (63.3 %)	0.073	0.787

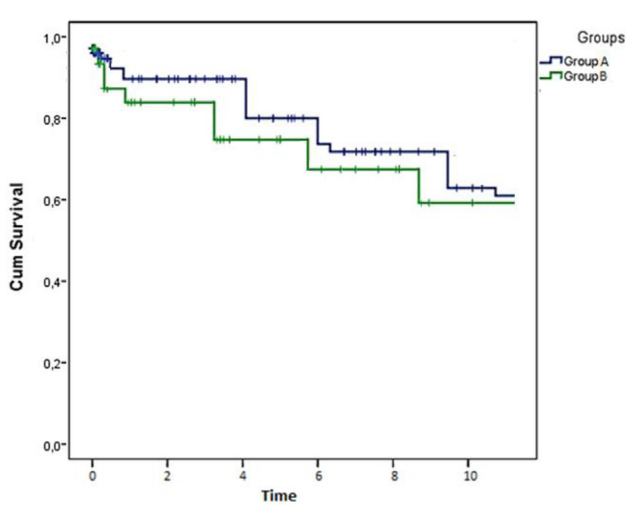

Fig. 1. Patency-free survival as shown by the Kaplan Meier method for the two groups.

Table 6. Patency-free survival.

	Mean	SE	95 % CI	Log Rank test	Survival at 12-months
Group A	6.902	2.132	5.599–8.619	0.708	66.7 %
Group B	5.724	1.145	3.833–7.615		63.3 %

Disease free survival after 12-months was 66.7 % in group A and 63.3 % in group B with log rank test of 0.86.

Using well selected models, Egypt has a great chance to significantly lower the prevalence of renal failure (both chronic and acute). This is due to the fact that many of the root causes of kidney failure can be avoided. If these efforts are effective, they may cut the incidence by as much as 40 %.[7]

4.1. The main results of the present study were

Age, sex, body mass index, and sickness duration presented no statistically significant differences among the two groups.

There has not been a study comparing the use of a brachial artery-brachial vein arterio-venous fistula as a native access for dialysis to a brachio-axillary graft as a prosthetic vascular access in cases with chronic renal failure and depleted upper extremity superficial venous accesses.

Pham et al.'s study corroborates ours by showing that there was no significant difference in age or gender among the groups who had arteriovenous fistula creation using the brachial artery and the brachial vein and those who underwent creation using an arteriovenous graft.[8]

Similarly, Kim et al. found that 31 patients had BVAVF procedures performed while the study was ongoing. Age and gender made no difference.[8]

According to the results of this investigation, neither group was significantly different from the other with respect to the presence of comorbidities.

The findings of Pham et al., who didnot find any evidence of significant variations among the BVAVF and AVG groups for the presence of diabetes mellitus or hypertension, corroborated our findings.[8]

Similarly, 108 patients were identified in the study by Lioupis and colleagues 45 of whom had a brachiobasilic arteriovenous fistula (BBAVF), 15 of whom had autogenous brachial vein-brachial artery access (ABBA) and 48 of whom had an extended polytetrafluoroethylene (ePTFE) brachioaxillary AVG. Comorbidities (such as diabetes, hypertension and ischaemic heart disease) were similar among the patient groups.[9]

In this study, There was no discernible difference between the two groups on standard laboratory tests. The rate of problems is similarly low in both groups.

Pham and colleagues study corroborates ours by showing no statistically significant differences in primary failure (28%nt verses 34 % $P = .6$), vascular steal syndrome (3 % vs. 6 % $P = 1$), or total complications (3 % vs. 9 % $P = .6$).[8]

Fermawi et al. found no statistically significant difference among brachial-axillary and axillary-axillary AVGs in terms of wound infection, steal syndrome, or arm swelling 6 months after surgery. They discovered that AVGs implanted in the axillary artery carried a far higher risk of steal syndrome than those implanted in the brachial artery. However, because of the small sample size, they could not be sure how severe the steal syndrome was or what treatments had been tried.[10]

Gonzalo et al. found that BBAVF had a lower rate of total complications and re-interventions than BAG (106 % vs. 37 % $P = .001$ and 67.5 % vs. 13.8 % $P = .008$, respectively).

According to our findings, there is no statistically significant difference in the patency rate among the two groups. With a log rank test of 0.86,[11] the rate of disease-free survival after 12 months was 66.7 % in group A and 63.3 % in group B.

The primary endpoint of primary functional aided patency at 1 year was not statistically different between the two groups (45 % vs. 25 % $P = .04$), corroborated by the study by Pham et al. However, BVAVFs showed greater 1-year primary patency (62 % vs. 25 % P .01), 1-year primary aided patency (66 % vs. 41 % $P = .05$) and a lower rate of interventions needed to maintain or improve functionality after commencement of access usage (10 % vs. 44 % P .01). The 1-year secondary functional patency for BVAVFs and AVGs was 52 % and 47 %, respectively ($P = .7$).[8]

Functional patency for 1 year was 9 (90 %) in cases with one stage and 20 (100 %) with 2 stages in the study by Hussien Salama, after excluding early failure and thrombosis.12-month primary patency for axillary artery AVGs was lower than that for upper arm brachial artery AVGs (54 % vs. 63 % $P = .03$), and secondary patency was lower for axillary artery AVGs than for upper arm brachial artery AVGs (81 % vs. 89 % $P = .007$).[10]

Tang and colleagues conducted a meta-analysis and found that the primary patency, secondary patency, and primary assisted patency rates for tAVF were considerably higher at follow-up.[12] Kotsis and colleagues found that the primary patency percentage at 12 months ranged from 24 % to 77 %.[13]

4.2. Conclusion

Patients with chronic renal failure and limited superficial venous accesses in the upper extremities may benefit from using a brachial artery-brachial vein arterio-venous fistula as a native access for dialysis, as suggested by this study.

Disclosure

The authors have no financial interest to declare in relation to the content of this article.

Authorship

All authors have a substantial contribution to the article.

Conflicts of interest

The authors declared that there were no conflicts of interest.

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