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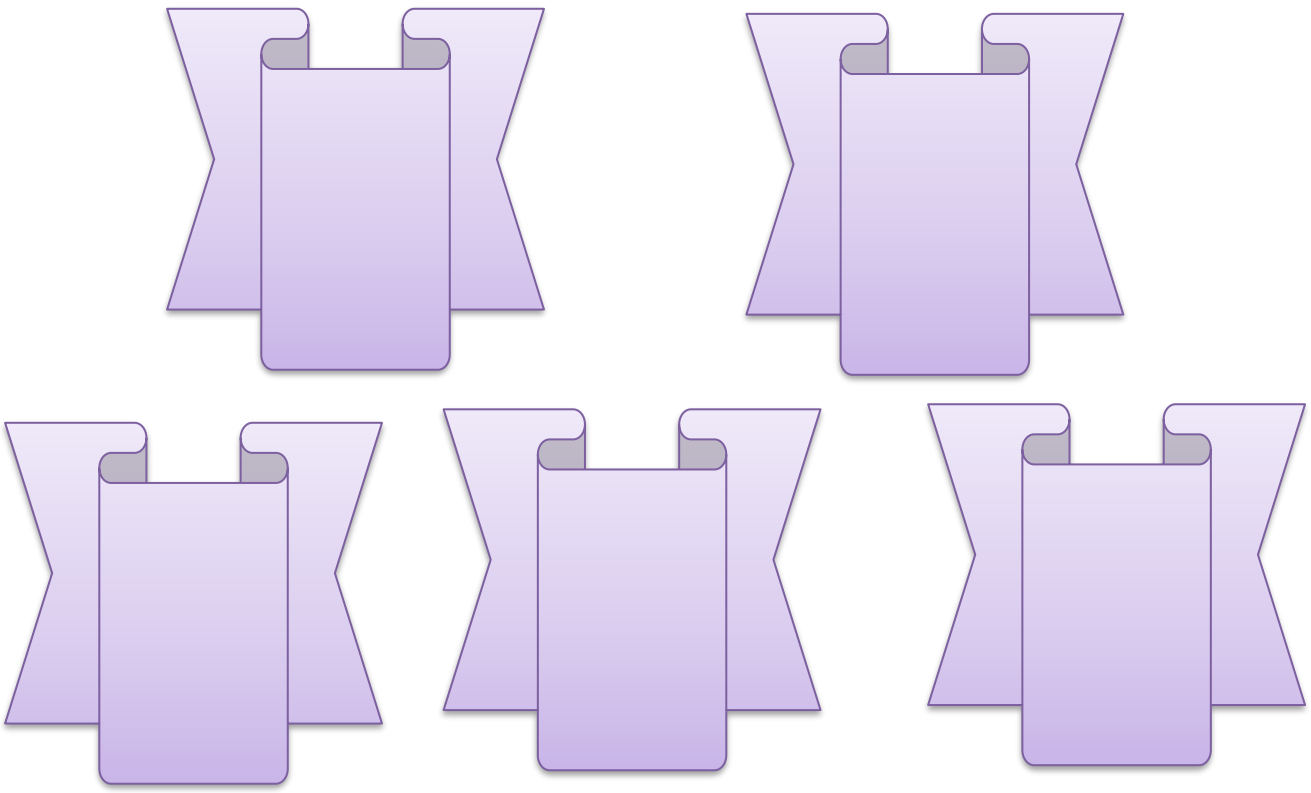

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Original Article

Comparative Study between Different Modalities of Creation of Radiocephalic Arteriovenous Fistula Around the Wrist for Hemodialysis

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ABSTRACT

Background: It has been shown that an arteriovenous fistula [AVF] is better for hemodialysis patients than central venous catheters and arteriovenous grafts in terms of morbidity and death.

Aim of the work: This study aims to compare the safety and effectiveness of the anatomical snuffbox AV fistula versus the usual radio cephalic fistula at the wrist for hemodialysis.

Patients and Methods: Our study is a prospective interventional study that included 40 patients on hemodialysis scheduled for A-V fistula formation. Patients were classified into two groups; Group [A]: 20 patients who underwent standard Wrist Arterio Venous Fistula, [WAVF], and Group [B]; 20 patients who underwent AV fistula at the anatomical snuffbox [SB].

Results: Clinical data, and demographics of the two groups were similar [p-value > 0.05]. After six weeks of intervention the AVF was found to be patent in 85.7% of the patients in WAVF group, and in 88.6 % of the patients in SBAVF group with no significant difference between the two groups [P value = 0.7]. In WAVF group showed one case of mild steel syndrome, and ecchymosis, and three cases of edema which resolved spontaneously. Two cases of infection responded to systemic and local management. While in the SBAVF group there was one case of ecchymosis and edema which resolved without intervention. Also, two cases of infection responded to systemic and local management.

Conclusion: When a cephalic vein is anatomically inaccessible, or if a secondary surgery requires access to the wrist, the SBAVF can be used to preserve those vessels.

Keywords: Arteriovenous Fistula, Hemodialysis, Radiocephalic, Snuffbox.

INTRODUCTION

Hemodialysis patients with chronic renal failure need consistent vascular access, and an arteriovenous fistula [AVF] is the gold standard for this. Good patency and low complication rates have been reported for an end-to-side modification of the original Brescia Cimino fistula between the radial artery and cephalic vein immediately proximal to the wrist [1]. Many people with renal failure requiring hemodialysis treatment for the rest of their lives, making a loss of vascular access a catastrophic event [2].

Hemodialysis patients have been using the radio cephalic arteriovenous fistula [RCAVF] as autologous vascular access since the 1960s [3]. Once it has been established Advantages include low complication rates and a high rate of long-term survival Achieved [4]. As a result, the RCAVF is the easy option when creating an autologous hemodialysis fistula. However, primary failure is common in the RCAVF because of thrombosis or immaturity in the aortic root. Variation exists greatly in estimates of primary failure, primary patency, and subsequent patency [5].

The first arteriovenous fistula should be established as far distally as possible. In 1969, **Rassat *et al.*** [6] were the first to describe an anatomical snuffbox with a radio cephalic AV fistula. Although it has been suggested by a number of authors, the elbow is the farthest distal site for an AV fistula in the upper limb.

Patients on hemodialysis should prioritize obtaining a radio-cephalic arteriovenous fistula [RC-AVF] as their vascular access of choice. However, not all patients can have RC-AVF established due to arterial complications, a poor or missing venous system, or both [7].

Compared to other fistula sites, RC-AVF often has greater permeability and fewer problems. There are some highly complicated and hard-to-solve dysfunctions associated with this fistula. Resolving RC-AVF issues presents a significant challenge to the vascular surgeon and necessitates an individual approach and the identification of potential solutions. Ultrasound vascular network analysis is essential for determining the optimal approach for each access in patients with complex AVF [8].

This study was performed to evaluate the relative efficacy and safety of Radiocephalic and anatomic snuffbox AVFs for hemodialysis in end-stage renal failure. The purpose of this research was to compare the anatomical snuffbox AV fistula and the typical radiocephalic fistula at the wrist for hemodialysis in terms of safety and efficacy.

PATIENTS AND METHODS

This is an interventional study that included 40 Hemodialysis patients scheduled for A-V fistula formation at the vascular surgery department of Al-Azhar University Hospital, New Damietta. Our research adhered to the principles of the Helsinki Declaration. Ethical approval was obtained from the Institutional Review Board of Damietta Faculty of Medicine, Al-Azhar University. Our data was confidentially protected. We recruited the patient after taking an informed consent according to the following criteria:

The inclusion criteria include; 1] All renal failure patients who required the creation of AVF. 2] Age ≥ 20 years.

The exclusion criteria include; 1] upper limb chronic ischemia. 2]Thrombophilia. 3] Previous deep venous thrombosis of the upper limb. 4] cannulation of the vein that will be used in AVF creation within 2 weeks before its use. 5] Acute or chronic infection of the upper limb. 6] Thoracic outlet syndrome, and hypotension.

Data collection: All patients in this study underwent the following; medical history taking, clinical examinations, laboratory investigations, and radiological investigations such as duplex ultrasound of the vascular system of the upper limb. All patients had been examined by vascular surgery consultant. Vital signs were measured before the procedure in all patients. The participants were divided into two groups: Group [A]; which included 20 patients who underwent standard radiocephalic fistula at the wrist [WAVF]], and Group [B], which included 20 patients who underwent anatomical snuffbox AV fistula [ASBAVF].

Surgical procedure

Radio-cephalic Fistula: The radial artery and cephalic vein were used to produce the fistula [end to side]. Doppler investigations were performed both before and after surgery to show the rate, volume, depth, and diameter of blood flow and to determine when AVF had matured.

Anatomical Snuffbox Fistula: Under local anesthetic, a fistula was created in the non-dominant arm's snuffbox. A 3–4 cm long skin incision was made above the anatomical snuffbox, allowing for easy access to the veins and arteries. A fistula from one side to the other was opened. There was an expectation of a satisfying thrill whenever the system was operating well. Using a No. 2 or No. 3 embolectomy catheter was able to restore patency in some cases of acute failure. We followed patients after their initial AVF dialysis to evaluate their overall results and any issues that may have arisen.

Statistical Analysis: Statistical analysis was performed using SPSS 23.0. Qualitative data were presented as numbers and percentages and the Chi-square test was used to compared it. Quantitative data were presented as the mean, and SD, and the independent T-test was used to compare it.

RESULTS

Demographics of the patients, and clinical data were shown in table [1]; the difference between the 2 groups were not significant [p-value >0.05]. In terms of the vessel diameters used for the construction, the mean arterial diameter in WAVF group was 2.4±0.2 mm, and in SBAVF group was 2.2± 0.3 mm with no significant difference between the 2 groups [p value = 0.07]. Also, the mean venous diameter was similar in both groups [p value = 0.9].

As regards the patency of the fistula; the percentage of the patients who had patent fistula after 6 weeks of intervention was found to be higher in SBAVF group [88.6%] than WAVF group [85.7%], however, this difference is not significant statistically [p-value = 0.7] [table 2].

Table [2] shows the reported complications in each study group, the most commonly reported complications were edema, infection, steel syndrome, bleeding, pseudoaneurysm, and ecchymosis with no significant difference between the 2 groups [p-value > 0.05].

In the WAVF group, there was one case of mild steel syndrome, one case of ecchymosis, three cases of edema which resolved spontaneously, and two cases of infection that responded to systemic and local management. While in the SBAVF group there was one case of ecchymosis and edema which resolved without intervention. Also, two cases of infection responded to systemic and local management.

Table [1]: Demographics, and clinical data of the patients

Variable		WAVF [n = 20]	SBAVF [n = 20]	*P value*
Age [years]	Mean ± SD	49.1 ± 11	47.2 ± 14	0.083[a]
Sex, n [%]	Male Female	20 [57.1%] 15 [42.9%]	19 [54.3 %] 16 [45.7 %]	0.8[b]
Arteriovenous Diameter [mm] [Mean ± SD]	Arterial	2.4±0.2	2.2± 0.3	0.075[a]
	Venous	2.7±0.1	2.7± 0.2	0.97[a]

[a]: independent t test. [b]: Chi-square test.

Table [2]: Comparison of AVF Patency between studied groups

Variables	WAVF	SBAVF	P Value [b]
Patency, n [%]			
within 6 weeks	31 [88.6%]	33 [94.3%]	0.39
After 6 weeks	30 [85.7%]	31 [88.6%]	0.72
Complications. n [%]			
Bleeding	1 [2.9%]	1 [2.9%]	1
Infection	2 [5.7%]	2 [5.7%]	1
Steal syndrome	1 [2.9%]	0	0.31
Edema	3 [8.6%]	1 [2.9%]	0.3
Pseudoaneurysm	1 [2.9%]	0	0.31
Ecchymosis	1 [2.9%]	1 [2.9%]	1

[b]: Chi-square

DISCUSSION

The creation of an AVF is the gold standard for providing long-term, dependable vascular access for chronic renal failure patients on hemodialysis [1]. Some authors compared the results of radiocephalic AVFs that are far away from the heart to those that are closer to the heart, like those on the upper arm. They all came to the same conclusion: AVFs that are closer to the patient do better [9-11].

Advantages of SBAVF include; it gives access to a long segment of arterialized veins and decrease damage of the proximal vessels. Also, SBAVF is possible in almost fifty percent of the patients, and has good long-term patency if it is matured [12]. Several factors affect the outcome of SBAVF, such as gender, signs of atherosclerosis, vein diameter, diabetes, and age. These aspects should be taken into account when planning access [13].

The majority of patients [48%] in a study by **Hull *et al.*** [14] had suitable anatomy for AVF implantation in the snuffbox. Forty-seven percent of the screened limbs had vessels that were parallel, within 1.5 mm of each other, >2 mm in diameter, and straight. While the artery and vein sizes were smaller in SBAVF, the primary patency at 6 weeks was >80%, similar to that of WAVF. We found primary patency in SBAVF within 6 weeks was 94.3% and 88.6% in WAVF, while after 6 weeks was 88.6% in SNAVF and 85.7% in WAVF group.

In study of **Letachowicz *et al.*** [12]. Primary patency at 3 months was 89% for SBAVF and 84 for WAVF [P = .48]. **Al-Jaishi *et al.*** [15] just did a review, and they found that 23% of primary surgeries fail. The rate of primary patency was 60% after one year and 51% after two years. The rate of secondary patency was 64% after one year and 71% after two years.

Most SBAVFs and half of WAVFs would be thrown out if we used the criteria provided by **Wong *et al.*** [16], which require an arterial lumen diameter of 2.0 mm for appropriate arterial inflow and a venous luminal diameter of 2.5 mm for good venous outflow. Using microsurgery and preventative hemostasis, within patients with a distal radial artery internal diameter of 1.6 mm, **Pirozzi *et al.*** [17] performed 28 radiaocephalic AVFs. 68 % of primary patency and 96 % of secondary patency were maintained at 12 months.

Even though the techniques for making an anastomosis at snuffbox, and wrist are seemed to be similar, there are some differences. Since the vein runs parallel to the artery, there is much less chance that the vein will twist. Finally, SBAVF is beneficial because it lessens neointima growth, the anastomosis angle is lower, and local flow patterns are restored [18]. Nevertheless, difficulties arise because the snuffbox artery is narrower, and the field is smaller [19]. SBAVF in our study had lower vessel diameters than WAVF, although the difference was not statistically significant. Consistent with the findings of **Letachowicz *et al.*** [12].

We are cognizant of the fact that not all incident dialysis patients can benefit from SBAVF. By comparison to the whole dialysis community, our patients tended to be younger and to have a lighter load of comorbidities. It is possible to execute an AVF through the snuffbox if the vessels in the wrist are healthy enough. That AVFs should be placed as far away from the heart as possible is a generally accepted practice.

Three patients with access malfunction or thrombosis had successful WAVF creation after SBAVF failure. **Wolowczyk *et al.*** found that in their extensive series of patients with SBAVF failure, 45% were successful [20].

The lack of randomization, small sample size, and single-center follow-up in this trial are all major caveats. We propose that the SBAVF be highlighted more prominently as a potential primary vascular access option in future vascular access guidelines.

Conclusion: By creating an SBAVF, blood veins in the wrist are preserved for use in future procedures or in cases when the cephalic vein is anatomically unavailable. Compared to AVFs in the wrist, snuffbox AVFs have satisfactory patency rates. We advocate using SBAVF as primary vascular access, especially in young patients without comorbidities.

Conflict of Interest and Financial Disclosure: None.

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