

## One-Stage Versus Two-Stage Brachio-Basilic Arteriovenous Fistula for Dialysis Access

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### Abstract

**Background** An upper arm brachio-basilic arteriovenous fistula (BBAVF) is a dependable, autogenous, one-stage or two-stage access to a hemodialysis system. Each technique has benefits and cons, according to past research. In this research, the difference between one and two phases of brachio-basilic arteriovenous fistula was rigorously evaluated for access ripening, patency, postoperative problems and patient type appropriate for each treatment. **Methods:** This research comprised 50 regularly split patients with end stage renal disease (ESRD) in Group A, 25 of whom had one stage brachio-basilic arteriovenous fistula (BBAVF) and Group B, 25 of whom had two stage BBAVF patients. **Results:** The diameter of the target vein was statistically considerably bigger than that of group B. A statistically significant difference between the two groups was not shown by the main failure rate. The period of primary functional patenting, primary function patenting and secondary functional patenting in days in group B were substantially longer. In group B the proportion of primary functional patentability, primary functional patentability and secondary functional patentability in days were much longer. The incidence of complications between the cases in both groups was not statistically significantly different. Age, DM, HTN and vein diameter reduction <3mm were linked with factors for failure of BBAVF. **Conclusion:** before using prosthetic grafts Brachio-basilic fistulas should be examined. Their development using a two-stage approach should lead to better patenting rates along with other advantageous advantages.

**Keywords:** Brachio-Basilic, Arteriovenous, Fistula, Dialysis.

### 1. Introduction

There the number of people with renal failure needing renal replacement treatment is increasing step by step. It may be supplied through dialysis or renal transplantation. Renal transplantation is nowadays considered a preferred option, but kidney donors are not readily accessible and the kidney transplantation facility is not accessible at each centre; hemodialysis and angio-access requirements are thus increasing. Hemodialysis may be necessary before transplantation and after transplantation in the event of rejection. This is why the main treatment method for people with renal failure is hemodialysis[1].

Dagher et al. originally reported the brachio-basilic fistula in 1976. The procedure has been changed since its description by centrally integrating more of the brachial vein. But failure leaves the patient with a much larger scar. For this reason, during the last 15 years, a two-stage strategy has been presented and implemented increasingly[2].

The BBVF includes movement, superficialisation and brachial artery anastomosis of the basil vein. BBVF was originally defined as a single (main) process with a superficialization, or with rerouting inside the incision, of the basil vein.. BBVF has been established two decades ago with brachio-basilic AVF performing in the first phase followed by second stage superficialization after many weeks, again in the form of transposition or elevation. There are various benefits to two-stage treatments. Firstly, arterialization interval facilitates the stage translation as the basil vein is expanded (usually 6–10 mm). Secondly, arterialisation of the interval makes progressed transposition safer by perhaps boosting use rate since it might fail to superficialize in a single-stage surgery a tiny (i.e., <4–5 mm) and thin-walled basil vein. Third, the interval arterialization elongates the basil vein that gives cancellation longer. Fourth, these

consequences may be addressed before transposition in the event of stealing syndrome or venous hypertension following staggered operation. These improvements should be offset by the inherent delay in the BBVF stage [3].

There is now some evidence to justify stage BBVF; randomized-controlled single-centre (RCT) trials have demonstrated increased ripening rates with procedural steps compared with primary operations.

Asthiovenous anastomosis at the initial stage of transposed BBV fistula and the official transposition after several weeks were recommended. Interval arterialization facilitates staggered transposition, since the basil vena is larger and its walls are thicker, and not tiny or friable. A tiny, thin-walled basil vein may also be twisted in the transposition tunnel, or squeezed with a blood pressure, or may be shorter needing more proximal anastomosis. In the instance of stealing or venous hypertension after primary transposition of BBV fistula, there was no advantage in doing prolonged and difficult procedure. These issues may be treated in staggered treatments before transposition is carried out. The clear drawback from proceedings is the significant delay in the usage of Transposed BBV fistula[3].

The purpose of this research was to evaluate the difference in access maturation, patentability, postoperative complications and type of patient suited for each stage and two stage of brachio-basilic arteriovenous fistula. procedure.

### 2. Patients and methods

This is a prospective cloned clinical envelope randomised study done to investigate the difference in access maturation, patentability, post-operative sequelae (infection, haematoma, thrombosis, stenosis) between one and two stage of Brachium-Basic arteriovenous fistula and patient type.

This study was carried out in 50 patients on regular dialysis at Benha University Hospital and Tanta Health Insurance Hospital from Jan 2020 to Jan 2021.

This research comprised a total of 50 patients with end-stage renal disease (ESRD) who required Brachio-Basic Arteriovenous Fistula for regular hemodialysis or expected hemodialysis. The instances were divided into two groups:

- Group A: 25 patients with brachio-basic arteriovenous fistula in one stage (BBAVF).
- Group B: Including 25 patients with superficialization underwent two step BBAVF.

Criteria for inclusion: • patients 40 to 70 years of age of both sexes, • patients currently on hemodialysis with chronic renal disease, or with predicted hemodialysis.

- Patients with celestial vein not suited for building radiocephalic or brachiocephalic fistule.
- Basil venous diameter higher than 2 mm in diameter and ultrasound compressible.

Exclusion criteria: • Patient with basil thrombosis if BBAVF failed.

- A patient's cephalic vein was eligible for building the radiocephalic or brachiocephalic fistula.
- The basil vein was not adapted for use because it was smaller than 2mm or had intrinsic lesions on the ultrasonography of duplexity.
- The basil vein had previously been expanded by a prior fistula, an arteriovenous wrist or elbow, drained into the basil vein by doppler-echography.

Prior to participation in the research, written informed consents were collected from all participants.

The whole design research was authorised by the Ethical Scientific Committee of the University of Benha University, Faculty of Medicine.

All patients have been treated to detailed history, clinical examination and laboratory evaluation

#### Pre-operative evaluation:

- Duplex ultrasound preoperative vessel mapping was performed with a minimum and maximum Basilic Venus diameter, after applying the tourniquet, including the media antecubital (basic) diameter.
- Drainage patterns of previous AVFs (radio-cephalic and brachio-median) leading to a basil expansion was identified in particular.

Details of operation:

- One-stage BB fistulae techniques:
- One-stage procedure under regional anaesthetic was conducted.
- A 5-cm incision finds the basil vein in the ante cubital fossa.
- Proximally and vertically the incision was prolonged and the deep underlying fascia was opening.
- The basilic vein was mobilised till the axillary vein was joined.

A meticulous dissection and preservation of the median cutaneous nerve of the forearm.

After side branches were linked, the basil vein was tunnelled subcutaneously, utilising Roberts' forceps Fig. (1). An arteriovenous anastomosis in the brachial artery was end-to-end performed Fig. (2).



Fig. (1) Roberts Artery Forceps, 300mm.



Fig. (2) One stages BBAVF.

- **Techniques of two stage BB fistulae:**

The first stage of the two-stage procedure was performed under local anesthesia by formation of the arteriovenous anastomosis with minimal disturbance of the basilic vein Fig. (3).

After 4 to 6 weeks (vein maturation), a flow assessment of the AVF by duplex scanning was made to determine if revision of the anastomosis was necessary at the second stage.

The second stage was performed under regional anesthesia. The entire length of the basilic vein was mobilized, a "subcutaneous flap" was created, and the vein was positioned anterolaterally. Usually, a further 2 weeks was required before the AVF can be used Fig. (4).

**Postoperative assessment:** Postoperative clinical Duplex ultrasonography examination and vascular mapping were conducted after 6 weeks following surgery.

- Results:

- 1- Early failed

- Early failure has been defined as failure in the one-stage group within 1 month following the surgery.

- This included failure in the two-stage group before secondary phase and then 1 month after 2nd stage.

- 2- Primary and secondary patentability

- The key outcomes at 12 months of follow-up were primary and secondary patentability.

- Primary patenting was defined as a gap between the development of fistula and any open or percutaneous interventions, fistula failure, thrombosis or abandonment.

- Secondary patenting is defined as the period between creation and cessation of access.

- Complications 3-

- In the 3-month follow-up, we also assessed the incidence of wound infection, stealing, upper tip edoema, hematoma, thromboses and venous hypertension.

- Wound infection has been characterised as antibiotic treatment, incision, drainage or fistula ligation.

- Analysis of statistics:

Data have been given to the computer and analysed using version 22.0 of IBM SPSS software. Qualitative data with number and % were described. Quantitative data for non-parametric data were defined using median (minimum and maximum) and mean default parametric data after establishing normality with the Kolmogrov-Smirnov tests. Meaning of the findings obtained was evaluated at (0.05) level. Qualitative information: Chi-square test for 2 or more groups, Fischer Fischer The Chi-Square test was accurate when more than 25% of cells count fewer than 5 in 2\*2 tables, Two categories of quantitative data: Parametric tests: student t-tests have been used to compare 2 separate groups, Tests Non-Parametric: Whitney-Mann A test was used to compare two separate groups, Regression analysis: The study of individual and multivariate regression was used to evaluate dependent and independent risk variables related to regression. binary outcome.



**Fig. (3)** Stage 1 of the stages of the two stages BBAVF.



**Fig. (4)** Stage 2 of the stages of the two stages BBAVF.

**3. Results**

The mean age of the cases in group A was 61.73± 13.64 years and in group B was 59.13 ± 11.78 years with no statistically significant difference between the two groups (p = 0.216). There were 14 males (56%) and 11 females (44%) in group A and 12 (48%) males and 13 (52%) females in group B with no statistically significant difference between the two groups. The BMI didn't reveal any significant difference between the two groups table (1).

The target artery diameter in group A was 4.2 ± 1.1 mm which was higher as compared with group B (4.1 ± 1.1 mm), but it didn't achieve a statistically significant difference between the two groups (0.437). The target vein diameter in group A was 4.2 ± 1.3 mm which was larger as compared with group B (3.6 ± 1.1 mm) with high statistically significant difference between the two groups (<0.001) table (2).

Regarding the primary outcomes in the two study groups, the early postoperative flow rate in group A was

1185 ± 424 ml/min which was higher as compared with group B (1156 ± 405 ml/min) but it didn't achieve a statistically significant difference between the two groups (0.437).

The primary failure was detected in 7 cases (28%) in group A as compared with 8 cases (32%) in group B with no statistically difference between the two (p= 0.386) table (3).

The primary functional patency in group A was 225.12 ± 46.8 days versus 263.24 ± 52.1 days in group B with statistically significant difference between the two groups (p= 0.015). The assisted primary functional patency in group A was 186.4 ± 36.7 days versus 275.2± 50.01 days in group B with statistically significant difference between the two groups (p= 0.001). The secondary functional patency in group A was 205.4 ± 31.6 days versus 295.7 ± 45.5 days in group B with statistically significant difference between the two groups (p= 0.005) table (4).

**Table (1)** Demographic data in the two study groups.

Items	Group A (one stage BBAVF) n= 25	Group B (Two stage BBAVF) n= 25	p-value
Age (years)	61.73± 13.64	59.13 ± 11.78	0.216
Sex			
-Male	14 (56%)	12 (48%)	0.163
-Female	11 (44%)	13 (52%)	
BMI (kg/M <sup>2</sup> )	28.35 ± 3.89	27.83 ± 3.87	0.552

P: probability.

Continuous data expressed as mean ± SD.

Categorical data are expressed as number (percentage within group)

\*: Statistically significant (p< 0.005)

**Table (2)** Artery and venous diameters in the two study groups.

	Group A (one stage BBAVF) n= 25	Group B (Two stage BBAVF) n= 25	P
Target artery diameter (mm)	4.2 ± 1.1	4.1 ± 1.1	0.437
Target vein diameter (mm)	4.2 ± 1.3	3.6 ± 1.1	<0.001*

Continuous data expressed as mean ± SD.

\*: statistically significant when P < 0.05

**Table (3)** Primary outcomes in the two study groups according to survival.

Items	Group A (one stage BBAVF) n= 25	Group B (Two stage BBAVF) n= 25	p-value
Flow rate postoperative after 6 weeks (ml/min)	1185 ± 424	1156 ± 405	0.164
Primary failure	7 (28%)	8 (32%)	0.386

P: probability.

Continuous data expressed as mean ± SD.

Categorical data are expressed as number (percentage within group)

\*: Statistically significant (p< 0.005)

By following up of the cases at 1 year, in group A, primary functional patency was maintained in 18 cases (72%), assisted primary functional patency in 19 cases (76%) and secondary functional patency in 20 cases (80%) while in group B, primary functional patency was maintained in 21 cases (84%), assisted primary functional patency in 23 cases (92%) and secondary functional patency in 24 cases (96%) that was significantly higher as compared with group A ( $p=0.019$ ). Fig (5).

The complications occurred in the two study groups. In group A, infection in 2 cases (8%), hematoma

in 2 cases (8%), thrombosis in one case 1 (4%), steal syndrome in 1 case (4%) and stenosis in 5 cases (20%). In group B, infection in 1 case (4%), hematoma in 2 cases (8%), thrombosis in 3 cases (12%), steal syndrome in 2 cases (4%) and stenosis in 6 cases (24%) Fig. (6).

The univariate regression analysis, increasing age, DM, HTN and decrease vein diameter  $<3\text{mm}$  was associated risk factors for BBAVF failure, but with multivariate regression analysis, none of them were shown to be independent risk factors for BBAVF failure.

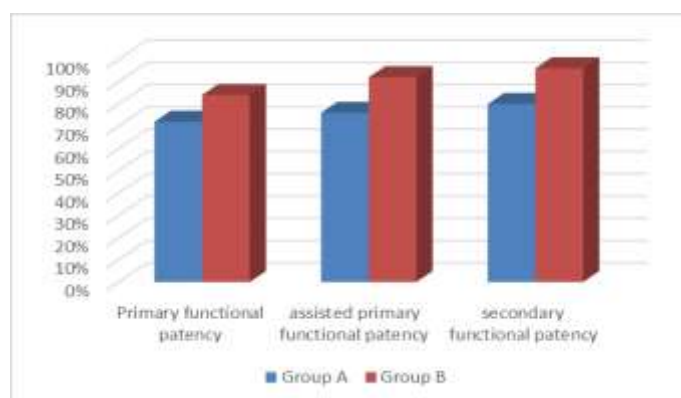
**Table (4)** Functional patency in the two study groups.

Items	Group A (one stage BBAVF) n= 25	Group B (Two stage BBAVF) n= 25	p-value
Primary functional patency (Days)	225.12 $\pm$ 46.8	263.24 $\pm$ 52.1	0.015*
assisted primary functional patency (Days)	186.4 $\pm$ 36.7	275.2 $\pm$ 50.01	0.001*
secondary functional patency (Days)	205.4 $\pm$ 31.6	295.7 $\pm$ 45.5	0.005*

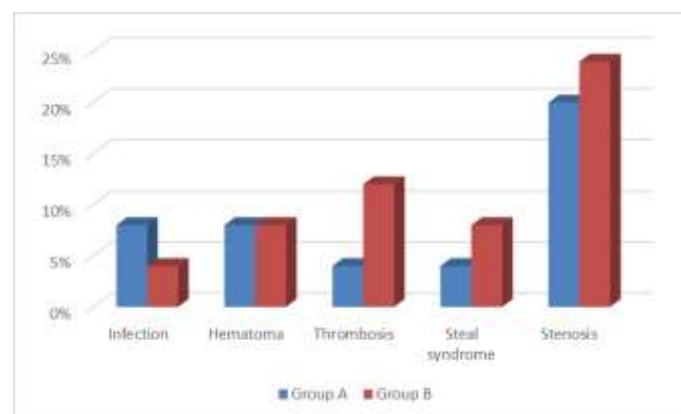
P: probability.

Continuous data expressed as mean  $\pm$  SD.

\*: Statistically significant ( $p < 0.005$ )



**Fig. (5)** Functional patency rates in the two study groups at 1 year.



**Fig. (6)** Complications in the two study groups at 2 years.

#### 4. Discussion

In the present investigation, the main failure was discovered in Group A in 7 instances (28 percent) compared to 8 instances (32 percent) in Group B with no significant differences between the two ( $p=0.386$ ) regarding the main results for the two research groups. In Group A, the first postoperative flow rate was  $1185 \pm 424$  ml/min, which was above group B ( $1156 \pm 405$  ml/min), but the difference was not statistically significant among the two groups (0.437).

Maya et al. [4] examined the clinical results of upper arm vascular access retrospectively in 678 AVF patients. The reported percentage of primary access failures in the transposed BBAVF group was 15%-18% and the primary access failure rate in men compared to females was substantially lower.

Vrakas et al.[5] examined the results of one-stage and two-stage BBAVF in 141 patients with 149 brachiocephalic transpositions. A total of 65 patients got one-stage operation and 84 got two-stage operation. There was no difference in the main failure rate between the two groups, but the one-stage surgery had a 3.2 times larger likelihood of total failure in multivariate analysis. The probability of failure in men was 2.7 times higher, although the difference was not statistically significant.

In our study, in group A, primary functional patenting was maintained in 18 cases (72 per cent), primary functional assisted patenting was maintained in 19 cases (76 per cent) and secondary functional patentcies in 20 cases (80 per cent) while primary functional patenting was maintained in group B in 21 cases (84 per cent), primary and functional patenting was assisted in 23 cases (92 per cent)

Similarly, the major functional patentability of Vrakas et al.[5] was between 1 and 2 years for the 1-stage group, 71% and 53% compared with 87% and 75% in the 2-stage group. Helped The primary functional patentability in the 1 and 2 years for the 1-stage group was 77% and 57% compared to 95% and 77% in the 2-stage group; the secondary functional patenting for the 1 and 2-stage group was 79% and 57% compared to 95% and 77% in the 2-stage group.

This was in line with Kakkos et al.[3] who observed that there were 68 days and 132 days respectively during one-stage and two-stage techniques to mature.

This was also agreed with another Sheta et al. meta-analysis,[2] which examined 37 trials on a one-stage vs a two-stage BBAVF study. The main one-year patent rate and the frequency of complications were equal across the two treatments. The secondary patent rate was nonetheless greater in the two-stage procedure at one year (79 percent versus 85 percent).

Generally, a high maturation rate with two-stage technique is reported in most published research. Salama H.[6] reported that one year after elimination of early failure and thrombosis the functional patent was 90% in one phase and 100% in two phases. In Reynolds et al.[7] this is 78% for one stadium and 84% for two stadiums.

Other research found increased patenting rates in the one-stage group, on the other hand. In the Agarwal et

al. study[8] their 1-stage patients were more mature than patients with two phase BVT fistula (90% vs. 75%  $P = 0.02$ ). Syed et al. [7] reported similar findings for improved primary and cumulative patencies in a 1-stage, primary-patented group at 1, 2, and 3 years (82% vs. 67%), (81% vs. 27%) and (51% vs. 18%) while (secondary patency for 1, 2 and three years (91% , 80% and 58% for 1-stage BVT, and 81%, 61% and 45% for 2-stage BVT), respectively. In this investigation, no variations in vein diameter between the two groups have been found.

Bashar et al.[1] conducted a meta-analysis of 8 published studies comparing one-stage and two-stage BBAVF results. The research included data from 849 individuals in 366 (42.6 percent) and 493 (57.4 percent) individuals with 859 fistulae using one- and two-stage methods. There was no substantial difference in rates of successful maturation and patenting between the two procedures. The incidence of injury infection, haematoma and stealing syndrome between the two groups was identical.

In another research by Shibutani et al.[10], BBAVF was transposed in 24 individuals. The average follow-up was 18 (3-40) months. The principal patent rate reported for one or two years of follow-up was 89.7% and 69.0% respectively. The secondary rates of patentability were 95.7% and 73.6% respectively.

The disparity might be explained by the fact that in the majority of these studies the patency rate statistics were provided as percentages, with the absence of clearly identified denominators. Definitions employed in each patent rate studies (primary, primary and secondary aided) also vary significantly.

#### 5. Conclusion

Brachio-basilic Before using prosthetic grafts, fistulas should be considered. Its production via a two-stage approach may lead with other technological benefits to higher patentability rates. The rates of complications were statistically equivalent to those of the one-stage surgery. The two-stage technology has also been proven to be more suitable for day-case surgery. This may have substantial consequences for patient satisfaction and cost.

#### References

- [1] K. Bashar , "One-stage vs. two-stage brachio-basilic arteriovenous fistula for dialysis access: a systematic review and a meta-analysis," *PLoS One*, vol. 10, pp. 0120154, 2015.
- [2] M. Sheta , "One-versus two-stage transposed brachio-basilic arteriovenous fistulae: A review of the current state of the art," *J. Vasc. Access*, vol. 21, pp. 281–286, 2020.
- [3] S. K. Kakkos , "Randomized controlled trial comparing primary and staged basilic vein transposition," *Front. Surg.*, vol. 2, pp. 14, 2015.
- [4] I. D. Maya, J. C. O'Neal, C. J. Young, J. Barker-Finkel, and M. Allon, "Outcomes of brachiocephalic fistulas, transposed brachio-basilic

- fistulas, and upper arm grafts," *Clin. J. Am. Soc. Nephrol.*, vol. 4, , pp. 86–92, 2009.
- [5] G. Vrakas, F. Defigueiredo, S. Turner, C. Jones, J. Taylor, and F. Calder, "A comparison of the outcomes of one-stage and two-stage brachio-basilic arteriovenous fistulas," *J. Vasc. Surg.*, vol. 58 , pp. 1300–1304, 2013.
- [6] M. Hussien Salama, "Comparative Study between one-stage and two-stage Brachio Basilic Arteriovenous fistula as a Hemodialysis Access procedure," *Al-Azhar Med. J.*, vol. 45, pp. 483–491, 2016.
- [7] T. S. Reynolds et al., "A comparison between one- and two-stage brachio-basilic arteriovenous fistulas," *J. Vasc. Surg.*, vol. 53, pp. 1632–1639, 2011.
- [8] A. Agarwal, M. Mantell, R. Cohen, Y. Yan, S. Trerotola, and T. W. Clark, "Outcomes of Single-Stage Compared to Two-Stage Basilic Vein Transposition Fistulae," in *Seminars in dialysis*, 2014, vol. 27, pp. 298–302.
- [9] F. A. Syed et al., "Comparison of outcomes of one-stage basilic vein transpositions and two-stage basilic vein transpositions," *Ann. Vasc. Surg.*, vol. 26, pp. 852–857, 2012.
- [10] S. Shibutani, H. Obara, S. Ono, T. Kakefuda, and Y. Kitagawa, "Transposed brachio-basilic arteriovenous fistula," *Ann. Vasc. Dis.* vol. 2, p. oa-13, 2013.