Primary and assisted primary patency rates of forearm-loop graft versus radiobasilic with transposition: a retrospective comparative study

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Introduction
There were forearm-access surgeries other than a radiocephalic arteriovenous fistula (AVF), but they are not popular in practice. We retrospectively reviewed patients who underwent either forearm-loop graft or a radiobasilic AVF for primary and assisted primary patency rates.
Patients and methods
In total, 43 patients in the period of January 2014 till January 2020, underwent a forearm access other than a radiocephalic AVF, 24 (group A) patients underwent a forearm-loop graft, and 19 (group B) underwent a radiobasilic AVF with basilic transposition in the forearm. Patients were followed up for 24 months, trials of reestablishing patency were recorded to assess primary and primary-assisted patency rates.
Results
There was no statistically significant difference between both groups as regards the demographic data. The mean operative time for group A was 93.92±8.17 min, while in group B, it was 109.84±14 min, which was a statistically significant result. Technical success was achieved in 100% in both groups, while successful dialysis was achieved in 100% of cases in group A, and 89.5% in group B. The mean time for cannulation was shorter in group A being 20.42±2.69 days compared with 43.11±8.45 days in group B (a statistically significant result). Primary patency rates for group A at 3, 6, 12, 18, and 24 months were 95.83, 79.17, 58.33, 41.67, and 33.33%, respectively, while in group B, they were 89.47, 84.21, 73.68, 63.16, and 52.63%, respectively. There was a statistically significant difference between both groups in the primary-assisted patency rate at 24 months (group A was 58.33%, while group B was 89.47%, P=0.0391).
Conclusion
Performing a forearm access other than a radiocephalic gives the patient an option before converting to an upper-arm access. Basilic transposition was a better option as regards primary patency and assisted patency rates if it is feasible, if compared with forearm-loop graft. But forearm-loop graft has the advantage of less operative time and earlier cannulation compared with basilic vein transposition.

Keywords:
basilic transposition in the forearm, forearm-loop graft, radiobasilic arteriovenous fistulae

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Introduction

The life expectancy of patients with end-stage renal disease has increased in the past few years. So, patients on hemodialysis are more likely to need more than one access during their lifetime [1,2]. It is recommended to start with a radiocephalic wrist or forearm arteriovenous fistula (AVF) and preserve the upper arm for future access. However, patients may not be suitable candidates for distal AVF creation due to diseased radial artery or inadequate cephalic vein [3,4]. When it is not suitable to create a wrist AVF, current guidelines recommend upper-arm AVF if there is a suitable vein, if not, we can revert to an upper-arm synthetic graft [5–7].

Studies are limited regarding the effect of forearm-loop arteriovenous graft on upper-arm superficial veins. Theoretically, proceeding with a forearm-loop graft before creating an upper-arm access (brachiocephalic or brachiobasilic AVF), may aid in the maturation of upper-arm veins (cephalic and basilic veins), which makes it feasible for an upper-arm AVF [8]. On the other hand, the results of synthetic graft materials are still inferior to natural

veins [9,10]. Basilic vein in the forearm is underused in creating a vascular access although it was described in creating access with radial or ulnar arteries [11–14].

Patients and methods

From the period of January 2014 to January 2020, we reviewed patients presenting at Ain Shams University Hospitals who underwent a forearm access other than a radiocephalic AVF. There were 43 patients who underwent either a radiobasilic with basilic transposition in the forearm or a forearm-loop graft. We reviewed the patient demographics, comorbidities, previous access, preoperative duplex scanning, operative time, and follow-up regarding primary and assisted primary patency rates.

Patients were divided into two groups, group A: patients who underwent forearm-loop graft, group B: patients who underwent radiobasilic with basilic transposition. Twenty-four patients were in group A, while in group B, there were 19 patients.

Preoperatively, patients were subjected to careful history taking, examination, and duplex ultrasound to assess target vein and artery diameter and patency.

Informed consent was obtained from patients for data collection and for the procedure as is standard according to the local Institutional Review Board's approval.

We excluded patients with nonpalpable peripheral radial pulsations, inadequate vein diameter less than 2.5 mm, and the presence of any occluded segment in the target vein.

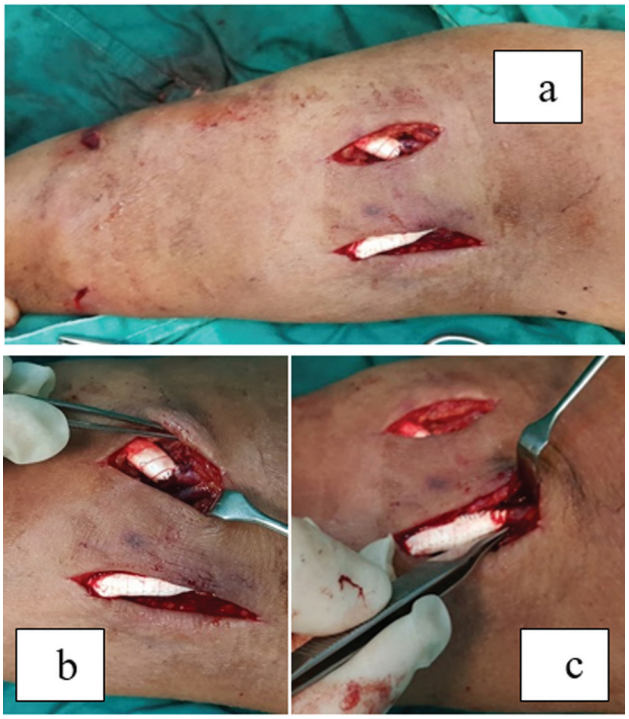
Procedure

All surgical procedures were performed under local infiltration anesthesia using 1% lidocaine not exceeding the maximum allowable dose according to patient's body weight. The local anesthetic was given by the surgeon after draping of the patient.

Group A

Exposure of the brachial artery and either the cephalic or basilic vein (according to the preoperative plan) in the cubital fossa. A subcutaneous tunnel was performed in a loop fashion, and a 6-mm polytetrafluoroethylene (PTFE) graft was tunneled through. An end-to-side arterial and venous anastomosis was performed using a running 5/0 polypropylene (Fig. 1).

Figure 1



(a) Tunneled forearm-loop graft. (b) End-to-side anastomosis to the brachial artery. (c) End-to-side anastomosis to the cephalic vein.

Group B

Through three or four separate longitudinal incisions, dissection of the basilic vein was undertaken. Tributaries of the basilic vein were ligated and perfused with heparinized saline. Then the basilic vein was transposed anteriorly through a tunnel in the volar aspect of the forearm to be anastomosed to the radial artery (Fig. 2).

Definitions

Technical succeess was defined as having a thrilling access at the end of the surgical procedure, while clinical success was the ability to perform a complete dialysis session from the access without any procedure for assissted maturation. Primary patency was defined as the interval from the time of access creation, until any intervention designed to maintain or to re-establish patency, access thrombosis, or time of measurement of patency. Primary-assisted patency was defined as the interval from the time of access creation, until access thrombosis or the time of measurement of patency, including interventions designed to maintain patency of the access.

Follow-up

Patients were followed up for 3, 6, 12, 18, and 24 months with assessment of primary and primary-assissted patency rates.

Figure 2

(a) Basilic vein in the forearm. (b) Dissection of the basilic vein through multiple incisions. (c) Basilic vein after transposition (black arrow) to be anastomosed to the radial artery.

Table 1 Demographic data

	Group A (24) *n* (%)	Group B (19) *n* (%)	*P* value
Age	37.46±8.99	29.36±6.73	0.0022
Sex			
Male	21 (87.5)	17 (89.5)	1.0000
Female	3 (12.5)	2 (10.5)	
Diabetes mellitus			
Yes	9 (37.5)	3 (15.79)	0.1741
No	15 (62.5)	16 (84.21)	
Hypertension			
Yes	19 (79.17)	15 (78.95)	1.0000
No	5 (20.83)	4 (21.05)	

Results

We reviewed 43 patients from January 2014 to January 2020, who matched our inclusion criteria, 24 patients underwent forearm-loop graft for dialysis, while the other 19 underwent radiobasilic AVF with transposition of the basilic vein to the volar aspect of the forearm. The demographic data of these patients are shown in Table 1.

There was no statistically significant difference between both groups as regards age, sex, and comorbidities. As regards the history of previous access surgeries, in group A, 18 (75%) had previous access [13 (54.2%) radiocephalic, five (20.8%) brachiocephalic], while in group B, 16 (84.21%) had previous access [14 (73.68%) radiocephalic, two (10.53%) brachiocephalic]. This history was in the same limb in which we performed the new access.

The mean operative time for patients in group A was 93.92±8.17 min, while in group B, it was 109.84 ±14 min, with a *P* value of less than 0.0001, which was a statistically significant result.

Technical success was achieved in all cases (100%) in group A and group B, while clinical success was achieved in 100% of cases in group A, while in group B, it was achieved in 17 (89.5%) patients because the other two patients needed balloon-assisted maturation.

We calculated the mean time for the access to be cannulated and it was found to be 20.42±2.69 days in group A, while in group B, it was 43.11±8.45 days, with a *P* value of less than 0.0001, which was a significant result.

Patients were followed up by signs of inefficient dialysis and duplex ultrasound, patients were subjected to procedures to maintain patency of the access in the form of thrombectomy and intraoperative angiography for group A, or balloon dilatation for group B. We calculated the primary and primary-assisted patency rates as shown in Tables 2 and 3.

Discussion

In our study, we have chosen to compare between two access modalities done in the forearm (forearm-loop graft vs. radiobasilic with basilic transposition). We found that the time needed to create a forearm-loop graft is less than that needed to create a radiobasilic

Table 2 Primary patency rates

	Group A (*N*=24) [*n* (%)]	Group B (*N*=19) [*n* (%)]	
3 months	23 (95.83)	17 (89.47)	0.5751
6 months	19 (79.17)	16 (84.21)	1.0000
12 months	14 (58.33)	14 (73.68)	0.3487
18 months	10 (41.67)	12 (63.16)	0.2231
24 months	8 (33.33)	10 (52.63)	0.2304

Table 3 Primary-assisted patency rate

	Group A (*N*=24) [*n* (%)]	Group B (*N*=19) [*n* (%)]	
3 months	24 (100)	19 (100)	1.0000
6 months	24 (100)	19 (100)	1.0000
12 months	22 (91.67)	17 (89.47)	1.0000
18 months	19 (79.17)	17 (89.47)	0.4370
24 months	14 (58.33)	17 (89.47)	0.0391*

*Statistically significant result.

with basilic transposition, this was due to extensive dissection needed to expose and ligate the tributaries of the basilic vein. Also, the time needed to start cannulation of the graft was much less than that needed to cannulate the basilic vein.

The basilic vein as well may need balloon-assisted maturation before cannulating it. But the primary and primary-assisted patency rates for the basilic vein are higher, although they were not statistically significant, except the primary-assisted patency rate at 24 months.

Literature showed that the advantages of synthetic graft creation include quicker time to cannulation, shorter catheter dependence, and cannulating the graft may be technically less difficult than cannulating a natural vein, especially in obese patients and the elderly. In addition, converting failed graft to a secondary natural fistulae in the upper arm reduced catheter days and the patency is similar to AVFs created in other locations [15–19].

Inspite of the common belief, it was found that forearm-loop graft performs in the same manner as upper-arm grafts, and serves and maintains the function needed by patients having regular dialysis [20].

Kritayakirana *et al.* [21] reported in his retrospective descriptive study a primary patency rate of 74% at 6 months, 59% at 1 year, and 32% at 2 years among 33 patients enrolled in this study with a median size of the brachial artery and outflow vein of 3 mm.

Keuter *et al.* [22] reported, in their randomized controlled trial comparing basilic vein transposition in the upper arm directly with PTFE forearm loop, significantly higher patency rates with regard to 1-year primary patency (46 vs. 22%) and 1-year primary-assisted patency (87 vs. 71%) for the basilic vein transposition group; no significant differences were found with regard to 1-year secondary patency rates (89% for the basilic vein transposition group vs. 85% for the PTFE loop group) [22].

Fitzgerald *et al.* [23] concluded that, although upper-arm fistulae and forearm grafts share similar early patency rates, upper-arm fistulae may be a better choice for chronic hemodialysis access because of a lower incidence of complications and nonelective reinterventions.

Drouven *et al.* [24] reported a significantly higher 2-year primary-assisted patency rate that was 72.7±6.5% for the basilic vein transposition group compared with 47.6±6.2% for the PTFE-loop group ($P<0.01$).

Itoga *et al.* [8] reported that primary patency rates at 6 months, 1 year, and 2 years were significantly lower for forearm-loop graft compared with upper-arm fistulae (52 vs. 67%, 39 vs. 55%, and 25 vs. 41%, $P<0.01$). Also, a failed forearm-loop graft aided in the creation of a successful upper-arm fistulae.

Using the basilic vein either in a straight or a looped fashion was described by Glowinski *et al.* [13], with a cumulative patency of 93% after 1 year, 78% after 2 years, and 55 after 3 years.

Uzun *et al.* [25] reported a mean fistula-maturation time of 45.2±10.7 days (range, 28–59 days), in the study over basilic vein transposition on the forearm with a patency rate of 90.5% during the follow-up period of 25.3±9.8 months.In the presence of inadequate superficial veins, Fumagalli *et al.* [26]

performed a forearm graft between the brachial artery and the brachial vein, they showed a primary patency rate at 12, 24, and 36 months of 49.5, 29.5, and 19.5%, respectively. They concluded that it was an efficient access and helps in preserving proximal vessels for future access.

Forearm basilic transposition is a reasonable option as a dialysis access, although it is difficult to harvest, especially in patients who underwent previous access surgery in the same upper limb. It showed no significant difference in primary, assisted primary and secondary patency when it was compared with basilic transposition in the upper arm [27].

Conclusion

Performing a forearm access other than a radiocephalic gives the patient an option before converting to an upper-arm access. Basilic transposition was a better option as regards primary patency and assisted patency rates if it is feasible, if compared with forearm-loop graft. But forearm-loop graft has the advantage of less operative time and earlier cannulation compared with basilic vein transposition.

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Conflicts of interest

There are no conflicts of interest.

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