

## Outcome for upper limb arterio-venous fistula creation with transposition technique

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**Abstract: Objective:** to examine the outcome of transposed autogenous arterio-venous fistula in the upper limb. **Methods:** It is a randomized controlled clinical trial was conducted in the vascular surgery unit at Al-Hussein university hospital in the period from October 1st, 2016 till March 30th, 2017. The study included 20 patients suffering from end stage renal diseases on regular dialysis but they are obese and there superficial veins aren't detected by physical examination but have suitable diameter by duplex for creation of arteriovenous fistula. **Results:** Primary 6-month patency among the transposed veins was 90 %. Failure rates for all transposed fistulas were low, not exceeding 15%. Rate of surgical complications was 15%, which included hematoma, wound infection, and steal syndrome. **Conclusion:** With an increasing need for AVF creation, our study demonstrated that the transposition technique is superior to previously published literature in hemodialysis access creation. Our study had a low morbidity rate and all AVFs were able to be used at a range of 4-6 weeks postoperatively. The primary 6-month patency rates were acceptable. Because of the low primary failure rate, our study showed that, in our experience, the transposition technique is superior to that shown in previously published literature in hemodialysis access creation. [Omar Moukhtar Ibrahim, Mohamed Hussein Mohamed, and Elsayed Elsheshtawy Ali. **Outcome for upper limb arterio-venous fistula creation with transposition technique.** *N Y Sci J* 2017;10(8):29-33]. ISSN 1554-0200 (print); ISSN 2375-723X (online). <http://www.sciencepub.net/newyork>. 5. doi:[10.7537/marsnys100817.05](https://doi.org/10.7537/marsnys100817.05).

**Keywords:** Outcome; limb arterio; venous; fistula; creation; transposition; technique

### 1. Introduction:

AVF creation in children and adolescents is associated with acceptable long-term durability, primary failure rate and maturation time. Considering the waiting time and limited kidney graft survival, placement of AVFs should be considered primarily even in patients expected to receive transplantation (Kim, Min et al. 2016).

Obese patients present a challenge because their superficial veins often run relatively deep to the skin. Because of their course deep to the skin, the standard autogenous radio cephalic and brachiocephalic accesses may not be able to be cannulated by the dialysis technologists even though they are sufficiently dilated. This potential problem can be overcome by transposing the "superficial" cephalic vein (forearm or arm segments) immediately deep to the dermis. We have used a similar technique to tunnel the basilic vein and prosthetic grafts when constructing either a brachio-basilic or prosthetic access, respectively (Huber and Seeger, 2006).

The number of obese end-stage renal disease patients, who frequently have type 2 diabetes, is continuously increasing. Obese and diabetic patients belong to a group with an increased risk of autogenous arteriovenous fistula placement failure due to advanced arteriosclerosis and reduced accessibility of forearm vessels because of excessive fat tissue. (Weyde et al., 2008).

Patients with mature but inaccessible fistulas were salvaged by superficialization. This population

had significantly higher BMI, less hypertension, and female prevalence. Identifying these patients is important because salvage of their fistula can prevent premature progression to alternate autogenous arteriovenous access procedures (Nathanie et al., 2009).

### 2. Patients and methods:

This randomized controlled clinical trial was conducted in the vascular surgery unit at Al-Hussein university hospital in the period from October 1<sup>st</sup>, 2016 till March 30<sup>th</sup>, 2017.

The study included 20 patients suffering from end stage renal diseases on regular dialysis but they are obese and there superficial veins aren't detected by physical examination but have suitable diameter by duplex for creation of arteriovenous fistula.

Before fistula creation, each patient underwent upper limb vessels examination. Pulse and blood pressure were assessed. Veins were initially assessed by tourniquet placement on the arm.

In each patient, upper limb Veins were localized by ultrasound guide to confirm diameter of the veins and subsequent necessity for transposition. In the event of difficulties in vessel visualization duplex scanning was performed to reveal appropriate vessel diameter.

#### Inclusion criteria:

Patient on regular hemodialysis with Cephalic vein in obese patient which is not accessible for needle puncture.

Basilic vein in patient with thrombosed cephalic vein.

Basilic vein in patient with inadequate diameter of cephalic vein.

**Exclusion criteria:**

Patient with central venous obstruction.

Patient with adequate diameter of cephalic vein which accessible for needle puncture.

Co morbidity of arterio venous fistula creation.

**Patient evaluation:**

Clinical evaluation. Duplex assessment.

**3. Results:**

**Table 1.** Patient characteristics, associated morbidity and access characteristics in studied cases.

Sex	N	%
Male	12	60
Female	8	40

Average age of the studied sample was 52.7 ± 16.4 years, distributed as 12 male and 8 females.

Beside end stage renal disease there were associated comorbidities. Hypertensive patients were 18 (90 %). Diabetic patients were 13, 7 patients were Non-insulin dependent and 6 were insulin dependent.

**Table 2.** Associated morbidity.

Associated comorbidity		
HTN	18	90
Types of diabetes		
Non-insulin dependent	7	35
insulin dependent	6	30
Not Diabetic	7	35

The transposed arteriovenous fistula was done for 20 patients. Eight patients have it on the right side. Twelve patients have it on the left upper limb.

Most patients (11/20; 55%) were hemodialysis dependent at the time of their AVF creation and were dialyzing using a temporary catheter, with a mean of one catheter placement before AVF creation.

Body mass index of the studied patients was 27.19 ± 5.3 (Mean ± SD). Past history of smoking is shown as the following:

**Table 3. Smoking and BMI**

Characteristic	Transposed veins (20)
Non smoker	14/20 (70 %)
Smoker	6/20 (30 %)
BMI (Mean ± SD)	27.19 ± 5.3

The number of temporary catheters before access ranged from 0 to 3 catheters. The average number of months of hemodialysis, via catheter or previous AVF, before access transposition is described in table below.

**Table 4. Time of HD before AVF creation and Catheters before access**

Characteristic	Transposed veins (20)
Time of HD before AVF creation, months	3.5 ± 5.0
Catheters before access	0-3 <sup>a</sup>

Data are presented as number (%) except where otherwise noted. <sup>a</sup>Median (range). <sup>b</sup>Mean± SD.

The number of previous access creations (AVF) before vein transposition ranged from 0 to 3. Thus, most of these patients had 0 or 1 previous AVF access placements before inclusion in our study.

Most of the transposed AVFs were not for the first AVF. In 9 patients the transposition was for the second fistula. In 6 patients the transposed AVF was for the third. First fistula transposition was only for five patients.

**Table 5. Frequency of access before transposition**

Frequency of access		
First	5	25
Second	9	45
Third	6	30

Number of transposed AVFs was 20 cases. 17 of them were basilic vein and 3 cases were for cephalic vein.

All transposed, matured primary access AVFs were used after a range of 4-6 weeks of creation.

Rate of primary 6-month patency among the transposed veins was 90 % (18 from 20 patients).

Failure rates for all transposed fistulas were low, not exceeding 15%. Some AVFs were never used, largely because of death before requiring hemodialysis.

**Table 6. Outcomes of arterio-venous fistula (AVF) with transposition:**

	Vein transposition, %
Failed	2/20 (10 %)
Not used	1/20 (5 %)
Surgical ligation	0/20 (0)

One AVF occluded before 30 days after transposition, one occluded after successful cannulation and adequate hemodialysis and one

additional AVF was never used (patient died before using the AVF).

There was a low rate of surgical complications (15%), which included hematoma, wound infection, and steal syndrome.

**Table 7. Postoperative complication**

Postoperative complication	Transposed veins (20)
Hematoma	1/20 (5 %)
Wound infection	1/20 (5 %)
Steal syndrome	1/20 (5 %)

**Table 8. Early and late complications**

	N	%		N	%
<b>Early complications</b>			<b>Late complications</b>		
Thrombosis	0	0.0	Steal	2	8.0
Hematoma	2	8.0	Stenosis	0	0.0
Wound infection	1	4.0	Venous hypertension	1	4.0

#### 4. Discussion:

Over the last four decades, advancements in hemodialysis and overall patient care have resulted in significantly improved survival in patients with end-stage renal disease (**Pozzoni P, 2004**). As a result, the prevalence of patients receiving hemodialysis is rising at approximately 8% per year. (**NIH Consensus Statement, 1993**). These recommendations were based on data suggesting that autogenous fistulas have significantly better initial patency rates and require fewer procedures to maintain patency. (**Gibson KD, 2001**), (**Oliver MJ, 2004**), (**Perera GB, 2001**), (**Hodges TC, 1997**).

This mandate to increase the percentage of autogenous hemodialysis access prompted a renewed interest in BTX.

Dagher et al. first described BTX in 1976 and found a patency rate of 70% at 8 years. (**Dagher F, 1976**.) and (**Dagher F, 1986**).

Previous reports describe a wide range of patency rates, ranging from 83% at 2 years (**Rao RK, 2004**) to 47% at 1 year. (**Hossny et al., 2003**) Some of this discrepancy may be because of varying definitions of patency and failure to differentiate between fistulas that are achieving satisfactory dialysis from those that are merely open. (**Hodges TC, 1997**), (**Sidawy et al., 2002**).

The mechanism of failure in our matured BTXs is interesting: 25 failed after maturation, (**NIH Consensus Statement, 1993**) (44%) of which failed because of stenosis within the body of the vein. It may be that dissecting the vein out and tunneling it subcutaneously predisposes to venous stenosis within the basilic vein, especially at the transition point

between the tunneled and in situ vein. Alternatively, failure in the body of the vein may be related to cannulation technique.

Our patient population had a high prevalence of obesity, increased age, and have hemodialysis before AVF creation. Despite moderate to high rates of these known predictors of AVF failure, our study did not have a high AVF failure rate.

The transposition technique is important for several reasons in relation of each type of AVF.

Previously published non-maturation AVF failure rates have been as high as 60.7% (**Sgroi MD et al., 2013**).

A unique aspect of our transposition technique in preoperative planning included a confirmatory intraoperative duplex US examination. The intraoperative duplex US was used to confirm patency, diameter of the target vessels, and in planning the location of the skip incisions for vein harvest.

A physical examination that consisted simply of placing one finger on either side of the AVF to estimate the diameter was sufficient to identify AVFs of inadequate size and flow. As outlined earlier, if the AVF did not meet specific criteria, the patient was sent for an immediate duplex US examination.

Our study showed that the average time to usage of the transposed access ranged from 4-6 weeks postoperatively, compared with 9.9 weeks reported by Rao et al. (**Rao RK et al., 2004**).

Our complication rate was higher than that of Rao et al (15% vs 9%, respectively).

(**Rao RK et al., 2004**) Previously published primary patency rates of 90 % for transposed AVF at 6 month are similar to our results. (**Woo K et al., 2007**) and (**Stone PA et al., 2012**).

This is likely because of small sample size of our study. By having patients return for a postoperative visit at 4 weeks, adequate AVFs were able to be cannulated early and potentially problematic AVFs were identified early and scheduled for intervention. The low rates of surgical complications, and high patency rates were likely attributable to the low variability in surgical technique in this study.

This study adds significant data on the functional patencies, and complications. The primary functional patency of vein transposition in this study at 6 months is comparable to reports published within the last 10 years. (**Wolford et al, 2005**), (**Segal et al., 2003**), (**Korkut et al., 2010**).

Several studies have shown older age is a significant factor in access failure, as well as obesity. (**Korkut et al., 2010**).

The reported complication rate for vein transposition remains high, between 43% and 71%. (**Hossny et al., 2003**), (**Taghizadeh et al., 2003**), (**Kakkos et al., 2010**) (**Murphy et al., 2000**). The 15

% overall complication rate in this study is much better than such findings.

The patency rates of vein transposition fistulae have already been well described. A 2006 systematic review and metaanalysis reported average primary patency of vein transposition to be 72%, at 1 year. (Dix et al., 2006). Murphy et al. reported cumulative secondary patency rates for vein transposition of 73%, 53%, and 43% at 1, 2, and 3 years, respectively (Murphy et al., 2000). Our patency rate in this study reached 90 %.

Most of the surgeries were conducted by the same surgeon, which thus eliminated potential sources of bias in choice of technique for AVF creation.

### Conclusion

With an increasing need for AVF creation, our study demonstrated that the transposition technique is superior to previously published literature in hemodialysis access creation. Our study had a low morbidity rate and all AVFs were able to be used at a range of 4-6 weeks postoperatively.

The primary 6-month patency rates were acceptable. Because of the low primary failure rate, our study showed that, in our experience, the transposition technique is superior to that shown in previously published literature in hemodialysis access creation.

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