



RESEARCH ARTICLE

A Retrospective Analysis of Arteriovenous Fistulas as Hemodialysis Access Surgery in the Perspective of KDOQI (Kidney Disease Outcomes Quality Initiative) Guidelines

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Abstract

Objective: The first choice for hemodialysis access in chronic renal failure (CRF) patients is native arteriovenous fistulas (AVF). In all over the world, the experience and cumulative data gained from CRF patients yielded KDOQI (Kidney Disease Outcomes Quality Initiative) guidelines and it was revised in 2015, stating that the main goal is creating an AVF at the most distal part of the non-dominant arm. The present study aims to represent our experience in AVF operations with preliminary results.

Materials and methods: A total of 54 native AVF surgical procedure was created, by one general surgeon experienced in kidney transplantation, between January 2014 and January 2018, as hemodialysis access surgery for 51 CRF patients referred from Nephrology Department at Umraniye Training and Research Hospital of Health Sciences University. Only patients with previously failed AVF and/or inconclusive physical exam findings were requested preoperative color Doppler ultrasound for arm mapping. All operations were done under local anaesthesia, and a standard Cimino-Brescia shunt was created at the wrist region of non-dominant arm. In case of primary non-function or improper anatomy, AVF was created at antecubital fossa. All anastomoses were done with 6/0 or 7/0 polypropylene (prolene®, Ethicon, USA) and end to side technique was preferred. Demographics, AVF localizations, primary non-function and patency rates, postoperative complications and overall results were recorded from the patient charts.

Results: Twenty-eight were women (54.9%) and 23 were men (45%). Mean age was 61 years (range, 46-78). Thirty-three (61.1%) were radiocephalic AVF at wrist, 19 (35.1%) were brachiocephalic and 2 (3.7%) were brachio basilic at

antecubital region. In case of non-function (no thrill sound heard), a new AVF was created at more proximal region (n = 2, 3.7%), and thrill was heard. While 51 surgical procedures (94.4%) had no complication and the patients were discharged home on postoperative second hour, oozing type bleeding and/or hematoma followed the remaining 3 procedures (5.5%) and these patients were followed up for 24 hours and then discharged. Mean follow-up period was 27 months (range 10-58). One patient with radiocephalic AVF (1.8%) had early postoperative thrombosis and he underwent brachiocephalic AVF procedure. Four patients (7.4%) had arm edema and ecchymosis in the first month postoperatively, but all resolved with medical treatment. One patient (1.8%) had wall-plication procedure due to aneurysm developed at postoperative month 44. AVF was ligated in one patient with steal syndrome (1.8%) at 36. postoperative month. Three patients (5.5%) had infections at their incision site, but all responded well to antibiotherapy. Primary non-function and early thrombosis were only seen in our patients with narrow vein lumens (below 3 mm). The patency rate of AVF was 92.5% during follow-up period.

Conclusions: Both nephrologists and surgeons should follow the clinical guidelines set by KDOQI. Early results of AVF procedures done in our clinic is acceptable when compared to the related English-written literature. A vein with sufficient width (usually at or above 3 mm) seems to be the most important factor for early AVF patency.

Keywords

Chronic renal failure (CRF), Arteriovenous fistula (AVF), Complications, Patency, Kidney transplantation



Citation: Yuksekdag S, Topcu A, Unal E (2019) A Retrospective Analysis of Arteriovenous Fistulas as Hemodialysis Access Surgery in the Perspective of KDOQI (Kidney Disease Outcomes Quality Initiative) Guidelines. Int J Transplant Res Med 5:038. doi.org/10.23937/2572-4045.1510038

Accepted: February 11, 2019; **Published:** February 13, 2019

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Introduction

Although there is an enormous increase in the number of renal transplants, which is the best treatment option for chronic renal failure (CRF) patients, hemodialysis continues to be the main treatment method. Autologous or native arteriovenous fistula (AVF) provides the best hemodialysis access technique because of its relatively low complication rate, longer-term patency and lower costs, when compared to arteriovenous synthetic graft and central venous catheter placement [1]. Kidney Disease Outcomes Quality Initiative (KDO-QI) Clinical Practice Guidelines for Vascular Access have defined the access-related care for patients with end-stage renal disease [1,2]. Therefore, Fistula First policy has been supported by the renal community all over the world. These guidelines emphasize the importance of creating an AVF at the most distal part of the non-dominant arm, allowing a more proximal site for a new fistula creation in case of any primary failure or complication.

Main factor limiting fistula use is the primary failure [3]. Age of the patient, comorbidities such as diabetes, vascular diseases and atherosclerosis, diameters of the lumen of vein and artery, surgical technique applied and finally surgeon's experience are all among the factors affecting patency. Preoperative physical examination of

the arm is mandatory, and colored Doppler ultrasound for mapping of the vessels can be done for selected cases with previous one or multiple AVF failures or when physical exam is inconclusive [4].

The present study was designed to assess the frequency and characteristics of complications of AVF used as vascular access in CRF patients and their effect on fistula outcome.

Materials and Methods

The study was approved by our institution's Ethics Committee(21.11.2018,B.10.1.TKH.4.34.H.GP.0.01/133). A total of 54 native AVF surgical procedure was done between January 2014 and January 2018, for 51 CRF patients referred from Nephrology Department. All AVFs were created by one staff general surgeon who is experienced in kidney transplantation and vascular access surgery. Demographics, AVF localizations, primary non-function and patency rates, postoperative complications and overall results were recorded from the patient charts and follow-up polyclinics.

Physical exams of the vessels (peripheral pulse, the follow-up of vein's shadow on the skin and Allen test) were done in all patients. Only patients with previously failed AVF and/or inconclusive physical exam findings



Figure 1: Wrist region of the non-dominant arm.

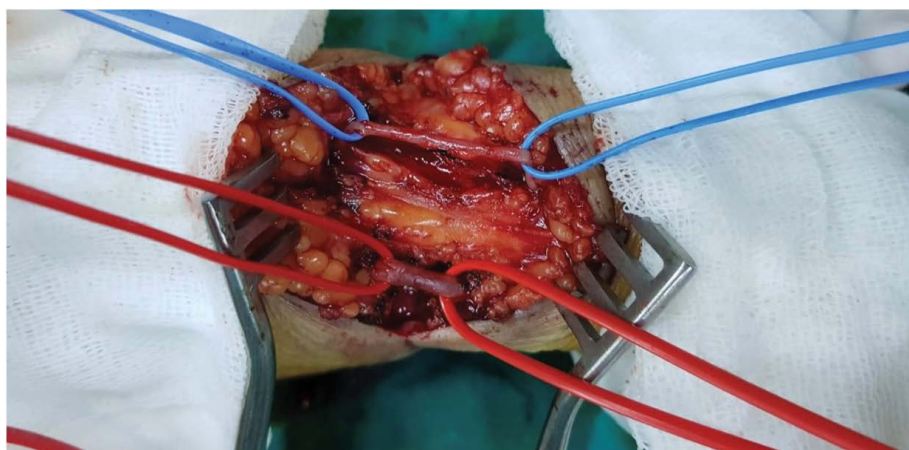


Figure 2: Prepared vein and artery, with blue and red suspenders, respectively.

were requested preoperative color Doppler ultrasound for arm mapping.

All operations were done under local anaesthesia in the operating room. A standard Cimino-Brescia shunt was created at the wrist region of non-dominant arm (Figure 1). After induction of local anesthesia, S-shape 4 cm long incision at wrist and curvilinear shape 4-6 cm long incision at antecubital region were preferred. A proper vein with a diameter above 3 mm was chosen and prepared. Then, the fascia is opened and artery was found and prepared (Figure 2). All anastomosis were done with 6/0 or 7/0 polipropylene (prolene®, Ethicon, USA) and end to side technique was preferred (Figure 3). Venous distention, bruit on palpation of the anastomosis site and thrill sound were our criterias of a successful AVF creation and then the incision is closed with separated mattress sutures. In case of primary non-function or improper anatomy, AVF was created at antecubital fossa at the same session.

Results

A total of 54 native AVF surgical procedure was done in our 51 patients with CRF whom referred from Nephrology Department. Twenty-eight were women (54.9%) and 23 were men (45%). Their mean age was 61 years (range, 46-78). The patients had no previous vascular access surgery and all were in pre-dialysis process.

Thirty-three (61.1%) were radiocephalic AVF at wrist, 19 (35.1%) were brachiocephalic and 2 (3.7%) were brachio-basilic at antecubital region. In case of non-function (no thrill sound heard), a new AVF was created at more proximal region (n = 2, 3.7%), and thrill sound was heard (Table 1). It was noted that both of these patients had narrow vein with a diameter of 2 mm. While 51 surgical procedures (94.4%) had no complication and the patients were discharged home on postoperative second hour, oozing type bleeding and/or hematoma followed the remaining 3 procedures (5.5%), and these patients were followed up for 24 hours in the hospital and then discharged. Mean follow-up period was 27 months (range 10-58).

One patient with radiocephalic AVF (1.8%) had early postoperative thrombosis and he underwent brachiocephalic AVF procedure (Table 1). The diameter of thrombosed vein at this patient was 2.5 mm. Four patients (7.4%) had arm edema and ecchymosis in the first month postoperatively, but all resolved with medical treatment. One patient (1.8%) had wall-plication procedure due to aneurysm developed at postoperative month 44. AVF was ligated in one patient with steal syndrome (1.8%) at 36. postoperative month. Three patients (5.5%) had infections at their incision site, but all responded well to antibiotherapy. The patency rate of AVF in our series was 92.5% during the follow-up period.



Figure 3: Venous distention, after creation of end to side anastomosis.

Table 1: Complications seen and outcome.

Complications	Number (n)	Per cent (%)	Outcome
Early			
Primary non-function	2	3.7	New fistula creation at more proximal region in same session
Oozing type bleeding/hematoma (early postoperative period)	3	5.5	Follow-up/drainage
Early postoperative thrombosis (at postoperative hour 6)	1	1.8	A proximal AVF was created
Arm edema/ecchymosis (first postoperative month)	4	7.4	All resolved with medical treatment.
Infection	3	5.5	All responded well to antibiotherapy
Late			
Aneurysm	1	1.8	Wall-plication procedure applied
Steal syndrome	1	1.8	AVF was ligated

Discussion

It is now well-known that patients who receive dialysis across a patent AVF have lesser complications and longer patency rates than patients with synthetic grafts, venous catheter access and peritoneal catheters. The creation of distal radiocephalic AVF (Cimino-Brescia) has become the gold standard for hemodialysis vascular access, and currently accounts for the majority of all AVF operations. Brachiocephalic and brachio basilic fistulas should be reserved for patients with previously failed distal AVFs or where anatomy is not suitable in the distal. In our series, Cimino-Brescia operation was chosen in over 60% of patients and the ratio is well-correlated with the numbers in the English-written literature [5].

American Institute of Ultrasound in Medicine Practice Guideline revised in 2011 states that the lumen diameter of artery below 2 mm and vein diameter below 2.5 mm lead to higher failure rates [6]. We think that colored Doppler ultrasound is not so helpful in evaluating the vessels in the arm, from our previous experiences. Therefore, all patients should be given a chance of having a distal AVF. In our opinion, the most important predictive criteria for a successful AVF are a detailed patient history and a good physical examination. To our experience, the diameter of vein is more important than that of artery, in contrast to the observation made by Schinstock, et al. where the authors suggested that the major predictor of primary and secondary patency in their cohort study was artery size [7]. We think that a vein with sufficient width (usually at or above 3 mm), venous distention seen after declamping of the vessels, bruit felt on the operation table, and a very high-pitched thrill sound advancing along the vein have a direct relation with success of AVF operation. Primary non-function and early thrombosis were only seen in our patients with narrow vein lumens (below 3 mm).

Primary non-function, early or late vascular thrombosis, infection, venous hypertension and aneurysm, steal syndrome and cardiac failure are among the main complications related to AVF creation [8]. Most large-volume centers report from 9% to 40% early complication rates [9]. In the present study, the complications were as follows; arm edema and ecchymosis in the first month postoperatively, 7.4%, early postoperative oozing type bleeding and/or hematoma, 5.5%, infection at the incision site, 5.5%, primary non-function, 3.7%, early postoperative thrombosis, 1.8%, aneurysm, 1.8% and steal syndrome, 1.8%. Regarding the overall complication rate of 27.5% in our series, our results were comparable with the English-written related literature. In our study, most of the patients (94%) were discharged home on postoperative second hour and only 5.5% of the cases had to stay in the hospital over-night for further observation and follow-up.

The patency rate of AVF in our series was 92.5% during a mean follow-up period of 27 months (over two years). Recent studies report 70 to 90% of early patency rates for native AVFs, but there are other studies declaring disappointing ratios, such as 50 to 70% [10,11]. In Kalman, et al. study, the primary success rate of 466 patients for two years was about 54% [10], while Kazemzadeh, et al. reported the primary patency rate for two and four years as 65 and 48% [11]. Wang and colleagues also expressed the primary patency rate as 64% in 2 years [12]. AVF creation in all patients with CRF in our institution exceeds the target goals of KDOQI Clinical Practice Guidelines and Fistula First Breakthrough Initiative. Our results was being achieved with acceptable rates of early and later on-developed complications (27.5%) and good primary patency rate (92.5%). There was no operative mortality. However, early detection of complications by patients education will absolutely decrease the number of complications and improve the long-term patency rates.

In conclusion, both nephrologists and surgeons should follow the clinical guidelines set by KDOQI, and understand the importance of creating an AVF at the most distal part of the non-dominant arm, allowing a more proximal site for a new fistula creation in case of any primary failure or complication.

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