

Redo arteriovenous fistula in end stage kidney disease: Risk factors and outcomes in Taiz – Yemen

Abstract

Background: Reliable vascular access is fundamental for patients undergoing chronic hemodialysis. Although Arteriovenous Fistulas (AVFs) remain the preferred access modality due to superior long-term patency and lower complication rates, access failure remains common, necessitating redo AVF procedures.

Objective: To evaluate outcomes of redo AVF creation and identify risk factors associated with failure in patients with End-Stage Renal Disease (ESRD).

Methods: This prospective observational study included 86 ESRD patients who underwent 98 redo AVF procedures between August 2021 and August 2023 at the Cardiovascular and Kidney Transplantation Center, Taiz, Yemen. Patient demographics, comorbidities, fistula configuration, complications, maturation, and patency rates were analyzed. Patients were followed for six months postoperatively.

Results: Brachiocephalic AVFs constituted the majority of redo procedures (60.2%), followed by brachio basilic (28.6%), radiocephalic (5.1%), and arteriovenous grafts (5.1%). The overall maturation rate was 92.9%. Thrombosis was the most frequent complication (16.3%). Primary patency rates at 1, 3, and 6 months were 98%, 91.8%, and 82.7%, respectively.

Conclusion: Redo AVF creation is a feasible and effective strategy for maintaining long-term hemodialysis access, even in resource-limited settings. Early detection and prompt management of complications—particularly thrombosis—are crucial to optimizing outcomes.

Keywords: Arteriovenous fistula • Hemodialysis access • Redo AVF • Patency • ESRD • Complications

Introduction

Chronic Kidney Disease (CKD) represents a major global health burden, affecting approximately 13.4% of the world's population. It is estimated that 4.9–7.1 million patients worldwide progress to ESRD and require kidney replacement therapy [1].

Kidney transplantation is the preferred treatment option for ESRD. Kidney transplantation remains the optimal treatment for ESKD, offering significantly lower mortality and improved quality of life compared with long-term dialysis [2]. However, due to limited organ availability and socioeconomic constraints particularly in low-resource settings hemodialysis remains the predominant treatment modality for most patients.

Vascular access is the cornerstone of effective hemodialysis and is often described as the patient's "lifeline." Among available access options, native AVFs are preferred because of superior durability, lower infection rates, and better long-term patency compared with central venous catheters and arteriovenous grafts [3]. Nevertheless, AVF creation and maintenance continue to pose significant clinical challenges. Primary failure, early thrombosis, poor maturation, and late complications frequently necessitate repeat interventions [4].

Redo AVF creation represents a complex subset of vascular access surgery, requiring meticulous preoperative planning and careful patient selection. Failure of vascular access

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is associated with increased morbidity, repeated hospitalizations, higher healthcare costs, and reduced quality of life [5]. These challenges are particularly pronounced in resource-limited settings, where access to advanced endovascular interventions may be limited [6].

In Yemen, and particularly in Taiz city, the burden of ESRD continues to rise amid ongoing healthcare system constraints. The Cardiovascular and Kidney Transplantation Center in Taiz serves as a referral center for complex vascular access procedures, including redo AVFs. However, local data regarding outcomes and predictors of failure remain scarce.

This study aims to evaluate the outcomes of redo AVF creation and identify associated risk factors for failure in patients with ESRD in Taiz, Yemen.

Materials and Methods

This prospective observational study was conducted at the Cardiovascular and Kidney Transplantation Center in Taiz, Yemen, over two years from August 1, 2021, to August 31, 2023. A total of 98 redo AVF procedures in 86 patients with ESRD who required redo AVF creation were included. Redo AVF was defined as a new fistula created following the failure or dysfunction of a previously established vascular access.

All patients were followed for a minimum of six months postoperatively in the outpatient clinic. Fistula maturation, patency, and complications such as thrombosis, infection, and access failure were recorded. Maturation was defined as successful use of the AVF for dialysis, confirmed by clinical and ultrasound evaluation.

Statistical analysis was performed using SPSS software version 24. Descriptive statistics were used to summarize demographic and clinical variables. Associations between potential risk factors and AVF outcomes were analyzed using appropriate statistical tests, with a p-value<0.05 considered statistically significant.

Results

During the study period, a total of 98 redo arteriovenous access procedures were performed on 86 patients with end-stage renal disease at the Cardiovascular and Kidney Transplantation Center in Taiz, Yemen.

Demographically, about 47 (54.6%) were constructed in men while 39 (45.3%) in women with a male to female ratio of 1.2:1. The age follows the normal distribution with regards to the gender variation in our patients. The mean age of our patients was 46.9 ± 14.7 year; with most common age group (41-60) years with (51%). The mean weight of our patients was (49.96 ± 8.69) kg.

Of 98 redo AVFs procedures were performed, categorized based on anatomical location Brachiocephalic AVF had 60.2%, Brachiobasilic AVF had 28.6%, Radiocephalic AVF had 5.1% and Arteriovenous Grafts (AVG) had 5.1%

The most common comorbidity in our patients was hypertension in 70 (71.4%), followed by Diabetes Miletus (DM) in 24 (24.5%), Ischemic Heart Disease (IHD) and Peripheral Arterial Disease (PAD) in 7 (7.1%) patients. Smoking and chewing Qat were found in 11(11.2%) and 4 (4.2%) patients respectively (Table 1).

Table 1: Distribution of comorbidities and associated risk factors among study participants, highlighting hypertension as the most prevalent condition.

Comorbidities	Frequency	Percentage
Comorbidities		
HTN	70	71.4%
DM	24	24.5%
PAD	7	7.1%
IHD	7	7.1%
CVA	2	2%
Risk factors		
Chewing Qat	11	11.2%
Smoking	4	4.1%
Note: HTN: Hypertension; DM: Diabetes mellitus; IHD: Ischemic Heart Disease; CVA: Cerebrovascular Accident; PAD: Peripheral Arterial Disease		

In the involved cases in this study majority of patients 50 (51%) had left non-dominant arm, while 48 (49 %) for right arm. The distribution of the access types was Brachiocephalic AVF with 59 procedures (60.2%), Brachiobasilic AVF with 28 procedures

(28.6% increased use of brachiocephalic arteriovenous fistulas improves functional primary patency), Radiocephalic AVF with 5 procedures (5.1%) and Arteriovenous Grafts (AVG) with 5 procedures (5.1%) (Table 2).

Table 2: Baseline characteristics of redo arteriovenous fistula patients showing access side distribution and fistula configuration patterns.

Baseline characteristics	Frequency	Percentage
Access side of Redo AVF	7	7
Left	50	51%
Right	48	49%
Redo fistula configuration	7	7
Snuff box AVF	0	0%
Radiocephalic AVF	5	5.1%
Brachiocephalic AVF	59	60.2%
Brachio basilic AVF	28	28.6%
Brachio brachial AVF	1	1%
AVG	5	5.1%

The overall maturation rate of redo AVFs was 92.9%, indicating that the majority of fistulas became suitable for effective hemodialysis within the follow-up period. The primary complication observed was thrombosis, which occurred in 16.3% of patients and was

the leading cause of access failure. Other complications, such as infection or bleeding, were observed less frequently and were managed conservatively or with minor interventions (Table 3).

Table 3: Postoperative complications following redo arteriovenous fistula creation, with thrombosis being the most frequent adverse outcome observed.

Complication	Frequency	%
Thrombosis	16	16.3%
Infection	8	8.2%
Bleeding	5	5.1%
Noninfectious fluid collections (Seroma/Lymphocele)	2	2%
Aneurysmal degeneration	2	2%
Hematoma	1	1%
Venous hypertension	1	1%
Steal syndrome	0	0
Ischemic neuropathy	0	0

Follow-up over six months in the outpatient clinic confirmed sustained AVF patency in the majority of patients, with only a small percentage requiring additional interventions or transition to

alternate access methods such as grafts or central venous catheters (Table 4).

Table 4: Maturation rates, immediate and primary patency outcomes at 1, 3, and 6 months, and kidney transplantation status.

	Frequency	Percentage
Maturation		
Yes	91	92.9%
No	7	7.1%
Immediate patency		
Yes	96	92%
No	2	8%
Primary patency 1st month		
Yes	96	98%
No	2	2%

Primary patency 3 month		
Yes	90	91.8%
No	8	8.2%
Primary patency 6 month		
Yes	81	82.7%
No	17	17.3%
Kidney transplantation		
Yes	5	5.1%
No	93	94.9%

Discussion

The findings of this study demonstrate that redo AVF creation can achieve high maturation and patency rates, even in a resource-limited setting such in Taiz, Yemen. The overall maturation rate of 92.9% is comparable to rates reported in other studies. For instance, national and international data often report AVF maturation rates ranging from 60% to 80%, particularly in patients with previous access failure or comorbid conditions [7,8]. When comparing our maturation rate to previous studies, our results appear favorable. A study presented at the AVF 2023 Annual Meeting demonstrated a technical success rate of 96.6% using advanced surgical techniques.

Similarly, the *Annals of Vascular Surgery* reported high success rates exceeding 90% in selected patients with adequate vessel quality and proper planning. Conversely, other studies have shown lower outcomes. Thakur et al. [9], reported a maturation rate of only 62.85% in redo AVFs, compared to 79.18% in primary AVFs.

The relatively high success rate in this study may be attributed to the experienced surgical team, proper preoperative ultrasound vascular mapping, and diligent postoperative follow-up. The predominance of brachiocephalic AVFs (60.2%) likely contributed to the favorable outcomes [9] as this type of access is often associated with higher flow rates and improved maturation compared to distal AVFs [10,11].

The findings of this study revealed that HTN was the most common comorbidity among patients undergoing redo AVF procedures, with a prevalence of 71.4%. This is consistent with Almalki et al. [12], a study conducted in Taif, Saudi Arabia, which found that hypertension was the most common chronic disease among hemodialysis patients 41.7%.

Thrombosis, identified as the most common complication in 16.3% of patients, aligns with reported complication rates in similar studies, which cite thrombosis incidence ranging from 10% to 20% following AVF procedures [13]. Early detection and management of thrombosis are crucial to maintaining AVF functionality and reducing the need for additional interventions.

The results also highlight the importance of structured follow-up in the outpatient setting. Continued monitoring enabled timely identification of complications and ensured sustained access patency, emphasizing that surgical success must be coupled with long-term care for optimal outcomes.

Future studies should explore the role of patient-related factors such as age, gender, diabetes, vascular anatomy, and laboratory parameters in predicting AVF outcomes. Additionally, long-term follow-up beyond six months could provide more insight into

secondary patency and access survival over time.

Conclusion

Redo AVF creation is a safe, feasible, and effective option for maintaining durable hemodialysis access in patients with ESRD. High maturation rates and acceptable complication profiles can be achieved even in resource-constrained settings. Early detection and management of complications particularly thrombosis remain essential for optimizing outcomes. Larger studies with longer follow-up are recommended to further refine predictors of success.

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