

Complications of femoral access for hemodialysis: A surgical perspective

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Abstract

Background: Vascular access, especially arteriovenous fistula (AVF), is critical for patients requiring haemodialysis. Due to delayed diagnosis, late referral, poverty and limited availability of competent access surgeons, many patients commence haemodialysis without an AVF, hence the frequent use of venous catheters.

Objectives: To assess the pattern of complications associated with repeated femoral punctures for haemodialysis.

Materials and Methods: This is a multicentre prospective study conducted at the Cardiovascular units of the University of Port Harcourt Teaching Hospital, Port Harcourt and Federal Medical Centre, Umuahia between January 2017 and December 2022. 66 patients were recruited for the study. Data obtained were patients' demography, complications of femoral access, surgical approach and outcome.

Results: 15 patients presented with severe lower limb pains and inability to walk, 10 with fibrosis/ hardening of the skin of both groins, 8 with skin infection at the repeated puncture sites, 12 had Pseudoaneurysm of the superficial femoral artery (SFA), 6 had iatrogenic femoro-femoral Arteriovenous Fistula (AVF) of the SFA and superficial femoral vein (SFV), 5 had groin abscess. All the patients had internal jugular venous catheters inserted. Some patients had Fogarty catheter thrombectomies and interposition Great Saphenous Vein (GSV) graft repairs, while some others had successful takedown of the AVF, Fogarty thrombectomy and direct prolene 6/0 repair of the vein & arterial wall defects. All those that underwent surgical treatment had successful recovery.

Conclusion: Femoral vein cannulation, apparently easy to perform, should not be used as the vascular access of choice for chronic haemodialysis.

Keywords: Complications; Femoral Access; Pseudoaneurysm; Superficial Femoral Artery; Superficial Femoral Vein

1. Introduction

Haemodialysis is a temporary intervention for kidney patients who need kidney transplantation and a rather permanent intervention for those with end-stage renal disease (ESRD) without any hope of renal transplantation¹. However, the life span of patients undergoing haemodialysis still remains comparatively shorter compared to those of the general population with similar demographic factors². A good and functional vascular access site is important for performing haemodialysis, and this access site should have a characteristic minimum blood flow rate of 350ml/min⁴. The overall quality of dialysis is hugely dependent on the functionality of the vascular access and poor access site could result in increased complications and eventual death⁵.

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Catheters including short- and long-term ones, arteriovenous fistula (AVF) and arteriovenous graft (AVG), may be used to create vascular access before haemolysis can be conducted³. A temporary vascular access can be created by inserting a catheter percutaneously into a large vein⁶. Moreover, the access sites must have a low complication rate and ideal for long term use⁷. AVF is considered the gold standard for vascular access due to its associated low complications, low maintenance and reduced surgical interventions for patency³.

In conditions where acute vascular access is required, cannulation of the femoral vein is quite a safe method, especially when a haemodialysis is to be done temporarily⁸. Additionally, femoral access through the vein is considered a good alternative when temporary dialysis catheter is to be inserted, due to its low bleeding risk and no need for radiological observations after insertion⁹.

Complications associated with vascular access accounts for 16-25% of admissions among haemodialysis patients¹⁰, while 50% of hospitalization expenses are incurred in ESRD patients because of vascular access complications as well¹¹. Investigative techniques such as colour flow Doppler, duplex sonography, Doppler ultrasound and ultrasonography have been reportedly used as accurate and non-invasive techniques to assess the structure and functions of AVF, AVG or catheters used in vascular access¹⁰. In our subregion, there is limited data on the complications arising from the use of femoral access for haemodialysis. Hence, in this study, we sought to assess the spectrum of complications associated with repeated femoral punctures for haemodialysis among ESRD patients that were managed at the two centres.

2. Materials and methods

2.1. Study Site

This was a multicentre study conducted at the Cardiovascular units of the University of Port Harcourt Teaching Hospital, Port Harcourt and Federal Medical Centre, Umuahia.

2.2. Methodology

This was a prospective study that involved data collection from January 1, 2017, to December 31, 2022. The 66 patients managed were recruited for the study after obtaining written consent. Data were entered into pre-designed pro-forma specifically for this purpose. The variables obtained were patients' demographic characteristics, complications of femoral access, surgical approach and outcome.

2.3. Data Analysis

The data were collected using pro-forma, entered into an excel spreadsheet and analyzed using statistical packages for social sciences (SPSS) version 25. Descriptive statistics were summarized using mean, median, frequency percentage and standard deviation as appropriate. Results are presented in frequency tables and percentages.

3. Results

A total of 66 patients were managed during the period under review. Of these, 42 (63.64%) were males and 24 (36.36%) were females, as shown in table 1, while table 2 shows the complications of repeated femoral puncture for hemodialysis. 15 (22.73%) of the patients had severe lower limb pains and inability to walk, 12 (18.18%) had Pseudoaneurysm of the superficial femoral artery (SFA), 10 (15.15%) with fibrosis / hardening of the skin of both groins, 8 (12.12%) with skin infection at the repeated puncture sites, 6 (9.09%) had iatrogenic femoro-femoral Arteriovenous Fistula (AVF) of the SFA and SFV, 5 (7.58%) had groin abscess, 4 (6.06%) had groin hematoma, 4 (6.06%) had a combination of SFA pseudoaneurysm and iatrogenic SFA-SFV fistula, while 2 (3.03%) had SFV thrombosis.

The surgical intervention in figure 1 revealed that all 66 (100%) had tunneled dialysis catheter insertion; 9 patients with abscess and haematoma were successfully managed with incision and drainage. 12 patients with pseudoaneurysm had surgical fogarty catheter thrombectomy and repair using Great Saphenous Vein (GSV) reconstructed grafts because of size differences. 6 patients with iatrogenic AVF had successful takedown of the fistulae, fogarty thrombectomy and direct prolene 6/0 repair of the venous and arterial walls. 2 of the 4 patients with combined AVF and pseudoaneurysm had successful takedown of the AVF, fogarty thrombectomy and reconstructed GSV interposition graft repair of the pseudoaneurysm, while the other 2 declined surgery.

The surgical outcome in figure 2 showed that 66 patients had successful tunneled dialysis catheter insertion, 31 had successful surgeries, while 2 patients died without having surgeries. The groin swelling as observed in a patient with

pseudoaneurysm is shown in figure 3, while surgical slide showing site of injury in the right femoral artery (FA), clamped femoral artery proximal and distal to point of injury is shown in figure 4.

Table 1 Demography of patients (n=66)

Parameter	Frequency (n)	Percentage (%)
Age Group (years)		
20-29	5	7.58
30-39	11	16.67
40-49	18	27.27
50-59	13	19.70
60-69	10	15.15
70-79	6	9.09
80-89	3	4.54
Mean	50.86	
Gender		
Male	42	63.64
Female	24	36.36

Table 2 Complications associated with femoral access site (n=66)

Complications	Frequency (n)	Percentage (%)
Pains and inability to work	15	22.73
SFA Pseudoaneurysm	12	18.18
Skin Fibrosis / Hardening	10	15.15
Puncture Site Skin Infection	8	12.12
Iatrogenic SFA-SFV Fistula	6	9.09
Groin Abscess	5	7.58
Groin Hematoma	4	6.06
SFA Pseudoaneurysm + Iatrogenic SFA-SFV Fistula	4	6.06
SFV Thrombosis	2	3.03

*SFA=superficial femoral artery; SFV=superficial femoral vein

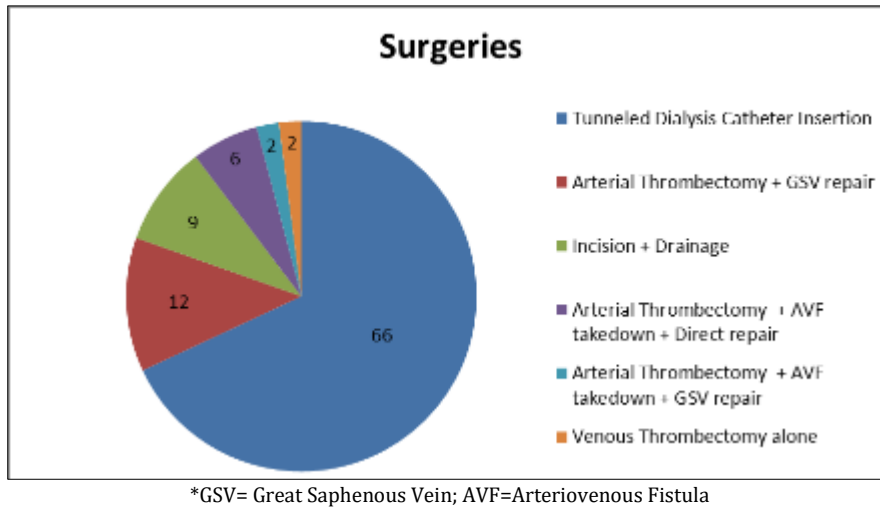


Figure 1 Surgical interventions for patients (n=66)

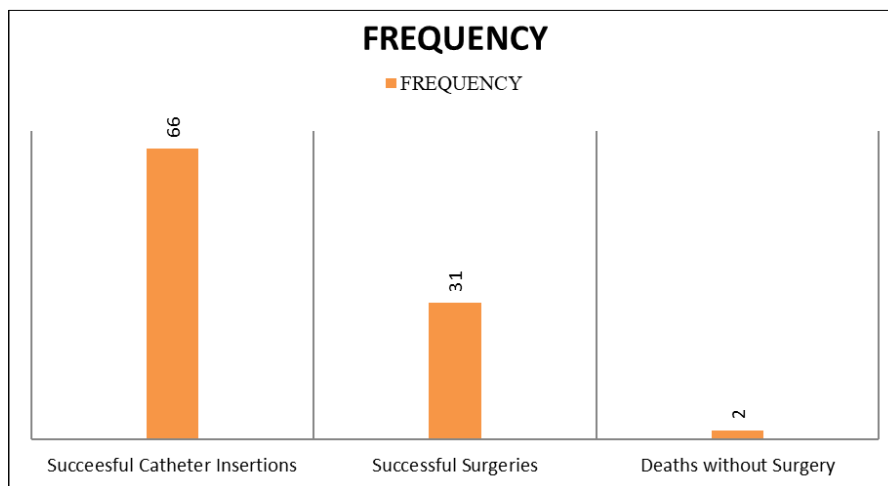


Figure 2 Surgical outcomes (n=66)



Figure 3 Groin swelling in a patient with Pseudoaneurysm



Figure 4 Surgical slide showing site of injury in the Right femoral artery (FA), clamped femoral artery proximal and distal to point of injury

4. Discussion

The demography of the patients in this study showed that more males were affected, with a mean age of 50.86 years, and it was more prevalent in the 40-49 years age group. The mean age and the age distribution further indicate that most patients with kidney-disease undergoing haemodialysis are in the older age group. This is quite similar to the findings of Hemanchandar,¹² who reported predominantly males with a mean age of 51 years in a study conducted for vascular access in haemodialysis patients in India. Adib-hajbagheri et al¹³ similarly documented more males than females, with an older mean age of 55 years, which still correlated with our findings.

Complications including bleeding, access site haematoma, pneumothorax, pleural haematoma, air embolus, infections, thrombosis, vasoconstriction, had been enumerated as some of the associated complications with dialysis catheters,¹⁴ while higher infection rates, stenosis and thrombosis are peculiar to the femoral vein.¹⁵ In this study, the observed complications were at the femoral access sites in all the patients. The most frequent complications were pains and inability to walk, superficial femoral artery (SFA) pseudoaneurysm fibrosis and skin infection at puncture sites. Other less frequent complications were Iatrogenic SFA-SFV Fistula, groin abscess, groin haematoma, SFA pseudoaneurysm with Iatrogenic SFA-SFV Fistula and SFV Thrombosis.

The occurrence of lower limb pain and difficulty in walking observed could be attributed to inadvertent trauma to the femoral nerve in an attempt to repeatedly puncture the femoral vein for haemodialysis among these patients.

The incidence of pseudoaneurysms as a femoral access complication have been previously reported in haemodialysis patients. Alonso et al¹⁶, Rocznik et al¹⁷, Lin et al¹⁸, and Joshi et al¹ reported 0.6%, 0.8%, 11.8% and 15.6% incidences of pseudoaneurysm as a complication of femoral access respectively in their various studies. Although, these were lower than the 18.18% incidence obtained in this study. The variation may be attributable to the differences in the expertise of those who carried out these repeated femoral punctures and the facilities available to them at their different locations.

The 12% infection rate at the catheter site in this study is similar to the 13% reported by Adib-hajbagheri et al¹³ but less than the 40% documented by El Minshawy et al¹⁰ in the studies conducted at Iran and Egypt respectively. The lower infection rate in this study could be attributed to the constant monitoring of the puncture sites, repeated changing of the temporary catheter and administration of prophylactic antibiotics. The reported groin haematoma in this study is consistent with the findings of El Minshawy et al¹⁰, although, a lower incidence of 0.5% was reported as compared to the 6% in this study. Conversely, a study by Rocznik et al¹⁷, in Poland showed an incidence of 11% for haematoma, which was quite higher than the 6% obtained in this study. However, the 3% incidence of SFV thrombosis in this study is lower than the 7.5% previously reported by El Minshawy et al.¹⁰

Before the onset of surgical interventions, 100% of the patients first received tunneled internal jugular vein dialysis catheter to provide immediate alternative route for haemodialysis procedure. Moreover, the insertion of tunneled dialysis catheters rested the groins of the patients with complications such as severe pains and inability to work,

puncture site infection and skin hardening/fibrosis and with the administration of analgesics and antibiotic, healing was achieved. Surgical interventions such as arterial thrombectomy and GSV repair; incision and drainage; arterial thrombectomy, AVF takedown and direct repair; venous thrombectomy, were all conducted to remedy these complications in our study. All the 9 patients with abscess and haematoma were successfully managed with incision and drainage, antibiotics and repair of injured vessel wall as indicated. The 12 patients with pseudoaneurysms had Fogarty catheter thrombectomies and interposition Great Saphenous Vein (GSV) graft repairs, while the AVF group (8 patients) had successful takedown of the AVF, Fogarty thrombectomy and direct prolene 6/0 repair of the vein and arterial wall defects. The two patients in DVT group had venotomy and Fogarty catheter thrombectomy.

The surgical outcome in this study was quite good, as 64 patients who consented and underwent surgical interventions all made full recoveries. Although, 2 (3.03%) mortalities were recorded, this was among 2 of the 4 patients with combined pseudoaneurysm and AVF complications who declined surgery and died of clinically diagnosed pulmonary embolism within 4 weeks of the diagnosis.

5. Conclusion

Femoral vein cannulation, though apparently simple and easy to perform, should not be used as the vascular access of choice for chronic haemodialysis because of its complication profile. Optimal training and retraining of personnel involved in femoral puncture and use of ultrasonographic guidance should reduce the risk of complications from femoral puncture. Patients with ESRD should have AVF fashioned in the pre-dialysis stage, as this will reduce the use of catheters.

Compliance with ethical standards

Acknowledgement

The authors would like to acknowledge all the patients who despite the discomfort agreed to take part in the study.

Disclosure of conflict of interest

The authors declare no conflicts of interest.

Statement of ethical approval

Ethical approval for the study was obtained from the ethics and review board of the University of Port Harcourt Teaching Hospital, Port Harcourt and Federal Medical Centre, Umuahia.

Statement of informed consent

Informed consent was obtained from all individual participants included in the study.

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