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Feasible Vascular Access for Hemodialysis and their Complications in 100 Patients (2016 - 2020)

Kassem Mohammed Zaier MBChB, FICMS in Cardiothoracic & Vascular Surgery
Kassemzaier@ymail.com
Jalal Jaafar Abdulhussein MBChB, FICMS in Cardiothoracic & Vascular Surgery
jalal.alzubaidy@gmail.com
Amjed Abdulridha Alhilo MBChB, FICMS in Cardiothoracic & Vascular Surgery

Abstract

Background: Veno-Arterial handling is an important clinical issue in the management of chronic hemodialysis patients. Several complications may occur during treatment period. **Aim:** The aims of this study were to determine the most feasible AVF site to be created for hemodialysis and their possible complications that may occur during treatment period. **Patients and Methods:** A cross sectional comparative study was conducted in Ibn – Alnafees teaching hospital retrospectively , Department of Thoracic and Vascular Surgery from 2016-2012. Necessary approvals were taken from the hospital adminstration regarding data collection . One hundred patients with end stage renal disease were included in this study after signing a consent form. An arteriovenous fistula was created in different sites preparing them for chronic haemodialysis program. The evaluations were based on the most feasible site for AVF, complications that may occur during the treatment period in different sites. **Results:** Most of the patient (98%) had successful creation of arteriovenous fistula, only two patients (2%) were not fit. The most two common approaches were, Brachiocephalic and radiocephalic which represent 70% and 20% respectively, followed by Anterior transposition of Basilica vein,4%, Autogenous saphenous vein graft 2% while Gore-Tex graft and Femorofemoral Gore-Tex Loop graft represent only 1% for each. Complications were seen in (15%) of the patients. Fistula failure was seen in 3 patients, Wound infection 2 patients, Temporary edema 2 patients, Hematoma 2 patients and one patient for each of the following complications, Continuous serous discharge, Steal syndrome, Sudden closure, False aneurysm formation, Aneurysmal dilatation of the veins and Huge limb swelling. **Conclusion:** Radiocephalic and the brachiocephalic AVF are the two types of vascular access with the longest duration of function and Radiocephalic is the most feasible site.

Key Words: Arteriovenous fistula ,bracchiocephalic arteriovenous fistula , brescia cimino , vascular access for hemodialysis

Introduction

Hemodialysis is the most prevalent modality of renal replacement therapy in uremic patients (1), Vascular access (VA) is the lifeline, and a major risk factor for bloodstream infection, hospitalization, and mortality in hemodialysis patients (1-4). Its failure is a main cause of failure in hemodialysis (5) and a major complication which accounts for about 20% to 30% of hospitalization (6), cause of the high morbidity and mortality among uremic patients receiving hemodialysis (3, 4, 7-10). Therefore, VA handling is an important clinical issue in the management of chronic hemodialysis patients. The permanent types of VAs used for hemodialysis include native arteriovenous fistula (AVF), synthetic arteriovenous graft (AVG) and tunneled cuffed catheter (TCC) (1-4). The risk factors for VAF are stenosis, thrombosis, and infection (8), therefore the aim of this study was to determine the feasible sites for AVF, to evaluate its success and complication which may occur during the treatment period.

Study design

A cross sectional comparative study was conducted in Ibn-Alnafees teaching hospital retrospectively , Department of Thoracic and Vascular Surgery from 2016-2020. One hundred patients with end stage renal disease were included in this study after signing a consent form.

Patients and Methods

Necessary approvals were taken from hospital adminstration regarding data collection . An arteriovenous fistula was created in different sites Preparing patients with end stage renal disease for chronic hemodialysis program. In the majority of patients end to side AVF was used mostly in this study especially in the two most commonly used approaches which are brachiocephalic and radio cephalic AV fistula**.** Side to side anastomosis was used with distal limb ligation.

In anterior transposition of the basilica vein a long segment of the vein was mobilized and transposed anteriorly to a subcutaneous location for easier use as AV access.

In autogenous vein or Gore-Tex graft, the anastomosis was end to side with the radial artery at the wrist while the other end was sutured to any of the available veins at the cubital fossa. The autogenous saphenous vein or the synthetic graft is laid down in a subcutaneous tunnel to be used as an AV access and the synthetic graft diameter was 4 mm as usual. The sutures used were non absorbable polypropylene monofilament (prolene) 6/0 and in radio cephalic AV fistula 7/0 prolene is preferable.

Antibiotics were routinely used postoperatively until all the stitches removed which may needs two weeks. In some patients especially with the presence of small veins we use temporarily low dose of subcutaneous heparin for 24-48 hours.

Maturation of these fistulae excluding the synthetic graft may take as early as three weeks and as late as three months depending on the state of the artery and vein being used and the general condition of the patient and the synthetic graft haemodialysis can be started as early as one week postoperatively.

Evaluations were base on the most feasible sites for AVF creation and the most common complication that may occur during the treatment period in different sites.

Statistica analysis :

The frequency in the percentage has been done by use of Excel sheet.

Results

Demographic findings

Sixty three patients out of hundred (63%) were males and 37 (37%) were females as shown in (Fig 1).

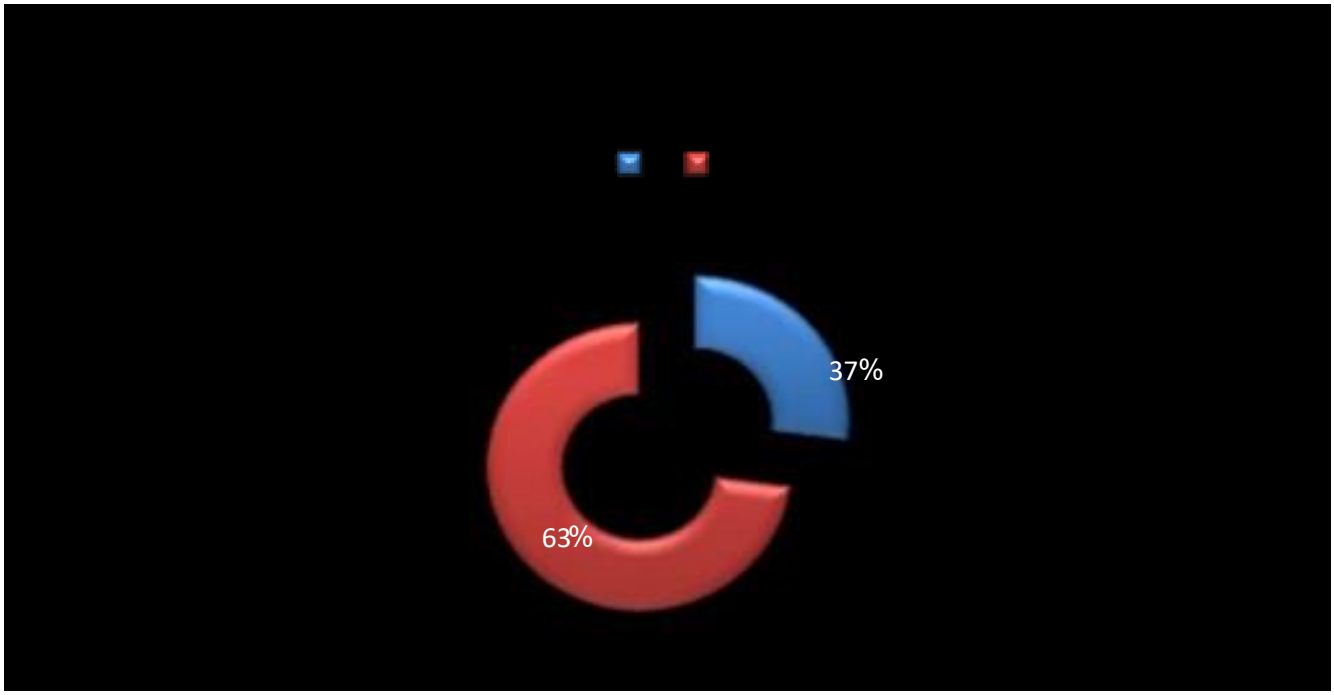

Figure 1:

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Patients age were ranged from 12-70 years. In age group (30-40) years were 30 patients (30%) which represent the most common group, followed by (40-50), 24(24%) as shown in (Table 1).

Table 1: Age distribution of 100 patients

Age group (years)	No.	Percent
10-20	5	5%
21-30	20	20%
31-40	30	30%
41-50	24	24%
51-60	12	12%
61-70	9	9%

Clinical finding

Most of the patients (98%) had a successful creation of the AV fistula with a nice maturation of the veins and the patients were scheduled on chronic haemodialysis program. Two patients (2%) of our study were not fit for this procedure (Fig 2).

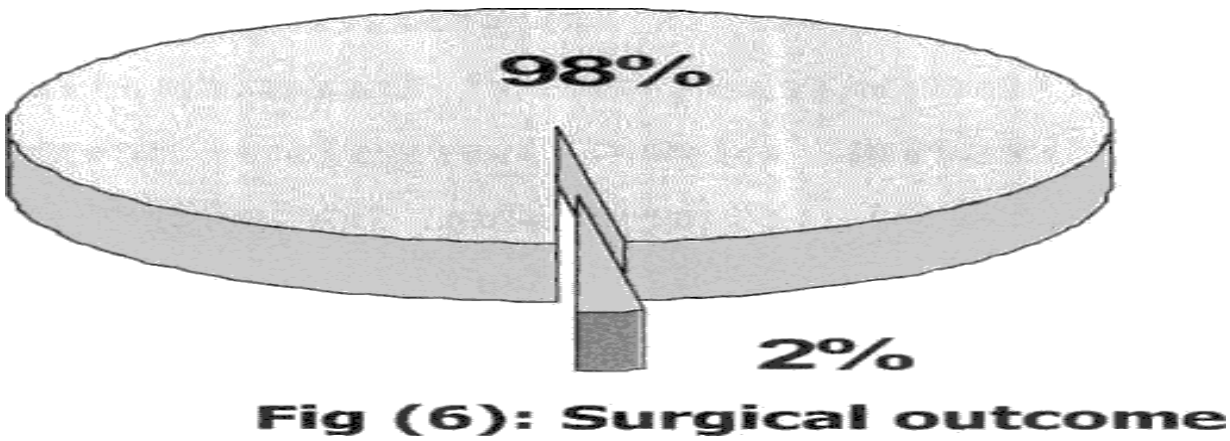

Figure 2: The success rate of AFV creation (98% success and 2% failure)

Most often the surgery was conducted under local anesthesia to avoid all risks of general anesthesia in a chronically ill patients. General anesthesia has been used in a few patients specially those

uncooperative or below 15 years of age however; these patients got benefit when inhalation anesthetics drugs such as Flu thane was used as it induces vasodilatation which is very beneficial in young patients with small veins.

Arteriovenous fistula sites: Radiocephalic arteriovenous fistula was feasible in twenty patients (20%) and the rest of the patients (80%) other approach's (Table 2).

Table (2): Approaches in AV Fistula

Approaches	No. of patients	percent
Brachiocephalic	70	70%
Radiocephalic	20	20%
Anterior transposition of Basilica vein	4	4%
Autogenous saphenous vein graft	2	2%
Gore-Tex graft	1	1%
Femorofemoral Gore-Tex Loop graft	1	1%
Unfit for AV access	2	2%

Table (2) shows that the brachiocephalic AV fistula is the most commonly used approach in this study and the technique most commonly used is end to side anastomosis creating fistula with a small diameter less than 0.5 cm to avoid the risk of steal syndrome .This type of AV Fistula has been used in 70 % of the patients and the second most common approach was the radio cephalic which was adopted in twenty patients (20%) while the rest of our patients were provided with other approaches such as anterior transposition of basilica vein or autogenous saphenous vein graft or Gore-Tex graft anastomosed between radial artery at the wrist and one of the veins at the elbow. In one patient a Gore-Tex graft (Access Graft) anastomosed as a loop graft between femoral artery and femoral vein (end to side) and implanted subcutaneously.

Complications was resulted in (15%) of our patients as shown in table 3. Failure of the fistula was seen in three patients in the early postoperative days. Two of them were postoperative wound infection occurred in two patients, temporary edema was seen in two patients, haematoma formation occured in two patients, continuous serous discharge seen in one patient, steal syndrome with distal limb ischemia only seen in A 70 years old diabetic patient. Sudden unexpected occlusion of the AV fistula occurred in only one patient which was well functioning before. False aneurysm formation occurring at the site of AV fistula was seen in only one patient following leakage of blood at the anastomotic site which on exploration was seen to be partially disrupted. Huge limb swelling distal to the fistula seen in a patient

with side to side anastomosis. Aneurysmal dilatation of the vein was seen in one patient, the aneurysmally dilated vein was reaching up to the axillary and subclavian veins creating a clear danger of continuous bleeding following puncturing for the purpose of hemodialysis.

Table 3 Complication following AVF Procedure

Complications	Number of patients
Fistula failure	3
Wound infection	2
Temporary edema	2
Haematoma	2
Continuous serous discharge	1
Steal syndrome	1
Sudden closure	1
False aneurysm formation	1
Huge limb swelling	1
Aneurysmal dilatation of the veins	1

Discussion

Patients with end stage renal failure should commence a regular dialysis treatment with permanent access to the circulation by the an AV fistula to avoid the need for initial haemodialysis employing temporary vascular access [(9).]

Uraemic patients are in utmost need for some form of vascular access if they are in need to be scheduled for chronic haemodialysis program as vascular access continues to cause problems in a proportion of haemodialysed patients. Its complications are a major cause of hospitalization with the resulting financial consequences and human suffering [(10).]

As the mean age of haemodialysis patients is increasing fewer patients will have suitable blood vessels for creation of Brescia Cimino fistula and an increased uses of graft implant is to be expected [(11).]

In this study only two patients (2%) were not fit for AVF due to there were no suitable veins available as they were mostly thread like veins not suitable for anastomosis so the incision was closed and these

patients were provided with alternative procedures such as Scrubner's shunt or subclavian or internal jugular vein double lumen catheters.

There are many choices or techniques for performing vascular access, the simplest one that offer reasonable success should be used such as radiocephalic AV fistula .It should be always chosen before brachiocephalic or basilica vein or saphenous vein graft. All these should be considered as a back-up procedure to be used in case of failure of the simplest fistula. It has been found that the radiocephalic and the brachiocephalic AV fistulae are the two types of vascular access with the longest duration of function .although a high rate of initial failure is seen with the radiocephalic AV fistulae and in our study the radiocephalic AV was only feasible in 20 out of hundred patients because these patients were presented early and most of their veins were not traumatized yet The rest of the patients (80%) have multiple venous punctures or repeated intravenous canula placement rendering this approach is not applicable so alternative approaches were used. Brachio cephalic fistulae were performed in 70 patient so both constitute the majority of our patient which is comparable to other study [(12)].

The advantages of radiocephalic AV fistula is that it gives a long segment of arterialized vein for needling and preserves proximal vessels however; it was only feasible in (20%) of our patients in agreement with other studies [(13)]

To select the best location for AV fistula the surgeon must be sure that the vein to be used is adequate to promote success of the fistula, the remaining arterial supply should be adequate to avoid distal limb ischemia, the artery should not be interrupted, the anastomosis should be made as peripheral as possible, if more central location is needed the anastomosis should be made small enough to avoid steal syndrome and finally the length of the arteriotomy should not exceed the diameter of the artery .

In some patients especially with the presence of a small veins we use temporarily low dose of subcutaneous heparin for 24-48 hours aiding the maintenance of the vein patency during the early critical period.

In side to side anastomosis distal limb was ligated to avoid obstruction of the venous valve which will hinder the flow leading to stagnation with consequent thrombosis and fistula failure in addition, without closing the distal limb there will be an augmented flow distally in the limb with the resultant limb edema and venous hypertension. The occasional use of general anesthesia is recommended| in a very young or uncooperative patient as confirmed by other studies to use general anesthesia in young and difficult patient (problematic patient)

Complications

Vascular access related complications are important causes of morbidity and several recent reports suggest that antiphospholipid antibodies may cause frequent thrombotic complications [13].

Complication rate was seen in only (15%) of patients in our study and most of these complications were successfully treated with no mortality rate, this

result is comparable to other studies . Failure of the fistula was seen in three patients in the early postoperative days which were managed successfully by reopening and removal of the obstructing thrombus .

Postoperative wound infection occurred in two patients due to failure to take the prescribed antibiotics in the presence of depressed immunity, increasing susceptibility of the uraemic patients to infection, these patients responded well to heavy antibiotics administration and frequent change of dressings .

Temporary edema was seen in two patients due to immobilization of patient's limb which subside gradually and completely by limb elevation and encouraging mobility.

Haematoma formation was seen in two patients due to multiple oozing sites due to impaired clotting mechanism of these patients which nicely responded to releasing one of the stitches and haematoma evacuation.

Continuous serous discharge was seen in one patient which may be due to extensive dissection and trauma to lymphatic vessels which ceased spontaneously and suddenly after two weeks of frequent daily dressing under antibiotic cover .

Steal syndrome with distal limb ischemia was only seen in one elderly uraemic diabetic patient 70 years old, although a small fistula was created however; if it affect the hand circulation badly, necessities emergency re-exploration and closure of the fistula with restoration of the arterial continuity to save the limb .

Closure of the AV fistula occurred only in one patient which was nicely functioning fistula,the reason behind this failure was that, the patient slept overnight on the operated side with the resultant complete cessation of the fistula when examined on the morning, however; the patient refused another attempt to correct the situation surgically.

False aneurysm formation occurred at the site of AV fistula in one patient which was treated by evacuation of the clot and securing the leakage site.

Huge limb swelling distal to the fistula was seen in a patient with side to side anastomosis, explained mostly due to too much flow distally which required reoperation and ligation of the distal limb of the fistula that resulted in a quick postoperative subside of the swelling.

Aneurysmal dilatation of the vein was seen in one patient, in which heparin was given as a routine procedure in addition, this type of fistula led to impending heart failure which was cleared during the first two years following the creation of the **Av** access, treatment was done by closure of the fistula with resection of the aneurysm ally dilated vein.

Conclusion and Recommendations : Brachiocephalic AVF was the most feasible one followed by radiocephalic, however; the second is mostly recommended if the condition fulfill its creation as it is simple, gives a long segment of arterialized vein for needling and preserves proximal vessels. Measures preoperatively (avoiding trauma , selection and proper planning with Doppler mapping) , intraoperatively (meticulous technique and hemostasis , etc) , and postoperatively (patient education , good follow up , early diagnosis and management of complications) guide the success of AVF creation and durability .

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