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Changing pattern of vascular access use for maintenance haemodialysis in a tertiary hospital in Southern Nigeria

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Abstract

Background: Patients who choose haemodialysis (HD) as a mode of renal replacement therapy require vascular access before initiation of dialysis. The options include a native arteriovenous fistula (AVF), a synthetic graft, and a central venous catheter. Maintaining a well functioning vascular access continues to be one of the greatest challenges in maintenance HD.

Methods: A retrospective analysis of dialysis records and case notes of prevalent HD patients over a six-year period, between July 2009 and September 2014 at the University of Benin Teaching Hospital, Benin City, Nigeria.

Results: A total of 591 patients with ESRD underwent dialysis during the period; male: female ratio of 1.2:1. Predominant age group with ESRD was 30-39 years (30%) and hypertension was the commonest aetiology of ESRD. All patients (100%) commenced HD with femoral catheters in 2009 while 5 (0.8%) commenced with AVF between 2011 and 2014. Only 43 (7.3%) had functional permanent vascular access. There was a progressive increase in the number of patients using (functional) AVF for HD from 2.2% in 2011, 8.5% in 2013 to 9.8% in 2014; with a reduction in the number of patients using femoral catheters from 51.5% in 2011, 41% in 2013 to 32.5% in 2014. Majority of patients (38%) were on tunneled catheters in the 6th year of review (2014).

Conclusion: There is a rising trend towards the use of permanent vascular access among our HD population and a decreasing trend in the use of femoral catheters for HD. Compared with other types of vascular access, there were more patients on tunneled catheters in the 6th year of review (2014).

Keywords: Haemodialysis, End-stage renal disease, Vascular access, Arteriovenous fistula, Tunneled catheters.

Introduction

The prevalence of end-stage renal disease (ESRD) is increasing worldwide.[1-3] Renal replacement therapy (RRT) either in the form of dialysis or kidney transplantation is needed for the survival of persons with ESRD. Due to the high cost of peritoneal dialysis fluid and kidney transplantation, haemodialysis (HD) is the modality of RRT readily available in Nigeria.[4]
Efficient HD requires a well functioning vascular access (VA), which continues to be one of the greatest challenges in maintenance HD.[5] Ideally HD requires two accesses to the circulation: one to remove blood from the body to the dialyzer (the withdrawal access) and the other to return it from the dialyzer to the body (the return

access). An ideal access delivers a flow rate to the dialyzer adequate for the dialysis prescription, has a long use-life, and has a low rate of complications (eg, infection, stenosis, thrombosis, aneurysm, and limb ischemia) despite frequent repetitive use.[6]

There are two main types of vascular access for HD: temporary vascular access via insertion of catheter into blood vessel (femoral vein, subclavian vein, or internal jugular vein), and permanent vascular access (arteriovenous fistula [AVF] and arteriovenous graft [AVG]). Each of these has its own cost of creation, maintenance and treatment of associated complications. Temporary vascular access especially femoral access may be complicated by infection, aneurysm, fibrosis of surrounding tissues, inadvertent injury to femoral artery etc.[6] While tunnelled jugular access have lower rate of infection and better blood flow than femoral access, they may undergo blockage or kinking; which may affect their utility as vascular access.[5-6]

The access type and location that is most desirable for each patient is influenced by characteristics of a patient's arterial, venous and cardiopulmonary systems, the patient's life expectancy and planned duration of CKD stage 5 therapy.[6-8]

Up to 30% of hospital admissions in HD patients are related to vascular access complications, and significant resources, including vascular access monitoring and diagnostic radiology are used to maintain access patency.[9-10] Hence, the type of vascular access used in HD determines, not only the clinical outcome of the treatment, but also the associated morbidity and cost of treatment.[11]

There is paucity of data from sub-Saharan Africa on types of vascular access used by patients on maintenance HD. Therefore, the aim of this study is to evaluate the types of vascular access used by patients with ESRD undergoing maintenance HD at the University of Benin Teaching hospital (UBTH) Benin City, Nigeria, over a six-year period.

Methodology

This was a retrospective study involving review of dialysis records and case notes of prevalent patients with end-stage renal disease (ESRD) who were on maintenance HD at the University of Benin Teaching Hospital, Benin City Nigeria over a six-year period; from July, 2009 - September, 2014. Prevalent patients were defined as all those receiving hemodialysis at the center on July 31 of each year of the study period.

The dialysis unit of the hospital was established in 1999 and provides HD for patients with kidney failure. Those receiving haemodialysis in the unit include patients from the locality where the unit is situated and also from communities in neighboring states (Ondo, Kogi, Delta and Osun states). In a month, the unit offers HD to an average of 6-10 new patients, total of 20-30 patients (old and new) with about 120-155 sessions of HD.

Data for sociodemographic characteristics, aetiology of ESRD, vascular access for HD (at initiation and 2 months later) and total number of sessions of HD were collated. Patients, aged 18 years and above, who were on HD for a minimum of two months were included in the study. All those who were dialyzed due to an acute kidney injury or acute on chronic kidney disease and patients transiently attending our unit during holidays were excluded from the study.

Data was analyzed using SPSS version 21.0 (Chicago, IL). Mean± standard deviation was used to describe continuous variables while proportion was used to describe categorical variables. Appropriate diagrams were used in representing some data.

Results

A total of 789 patients underwent dialysis during the period. Among these, 591 (74.9%)

were diagnosed with end-stage renal disease (ESRD) while 198 (25.1%) were diagnosed with acute kidney injury. Predominant age group with ESRD was 30-39 years (30%). The commonest cause of ESRD among patients seen within the study period was hypertension in 23% of patients. The characteristics of the patients and aetiology of ESRD are as illustrated in table1 and figure 1 respectively while some clinical characteristics over the six-year period is illustrated in table 2. These 591 patients had a total of 4,096 sessions of HD, out of which 851 were done with permanent vascular access. All patients with ESRD on maintenance haemodialysis in the centre get prescription for permanent vascular access but only 42 (7.1%) ever used an AVF for HD within the study period while 1 (0.2%) used an arteriovenous graft for haemodialysis. The types and frequency of vascular access used in the center is shown in table 2. While all the patients commenced HD with femoral catheters in 2009, 5(0.8%) commenced with AVF between 2011 and 2014. One patient had AVF created but had not commenced dialysis for more than one year as her renal function had not reduced to end-stage. There was a progressive increase in the total number of patients using AVF for HD from 2.2% in 2011, 8% in 2012 to 9.8% in 2014 (figure 2) with a reduction in the number of patients using femoral catheters from 51.5% in 2011, 41% in 2013 to 32.5% in 2014.

Among the patients who received HD in 2014, majority of the patients (38%) were on tunneled catheters. This was higher the number utilizing other types of vascular access (Figure 2).

Table 1: Characteristics of the patients

Variable	Frequency (%) n=591
Sex	
Male	319 (54.0)
Female	272 (46.0)
Mean age (SD) = 41.4(12.5) years	
Age categories	
<20	9 (1.1)
20-29	114 (14.4)
30-39	237 (30.0)
40-49	198 (25.1)
50-59	165 (20.9)
≥60	66 (14.4)
Use of Temporary access at initiation of dialysis	586 (99.2)
Use of arteriovenous fistula at initiation of dialysis	5 (0.8)

SD-standard deviation

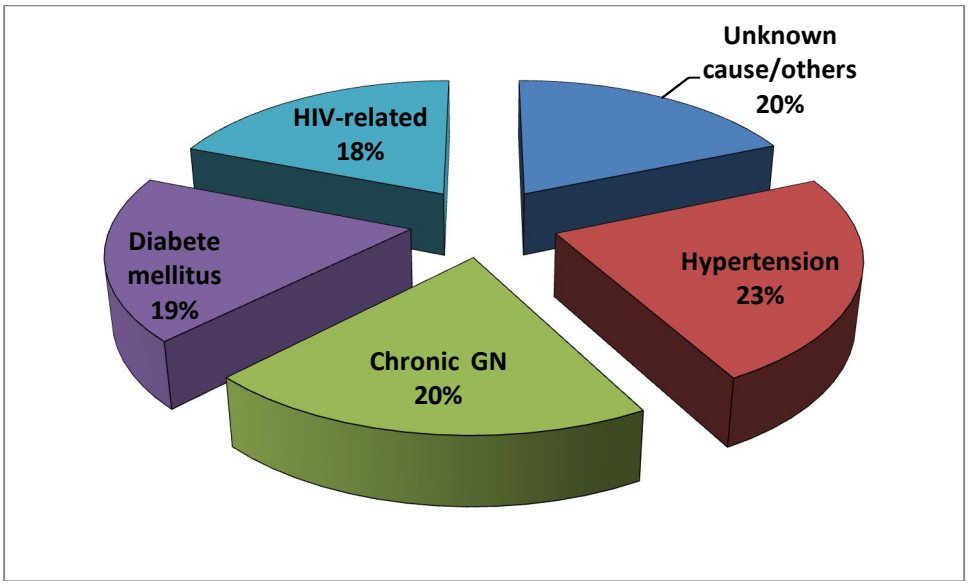

Figure 1: Aetiologies of ESRD seen during the period under review
Others- *Autosomal dominant polycystic kidney disease, Chronic pyelonephritis, ObstructiveNephropathy, Lupus nephritis, Sickle cell disease, Nephrotoxins*

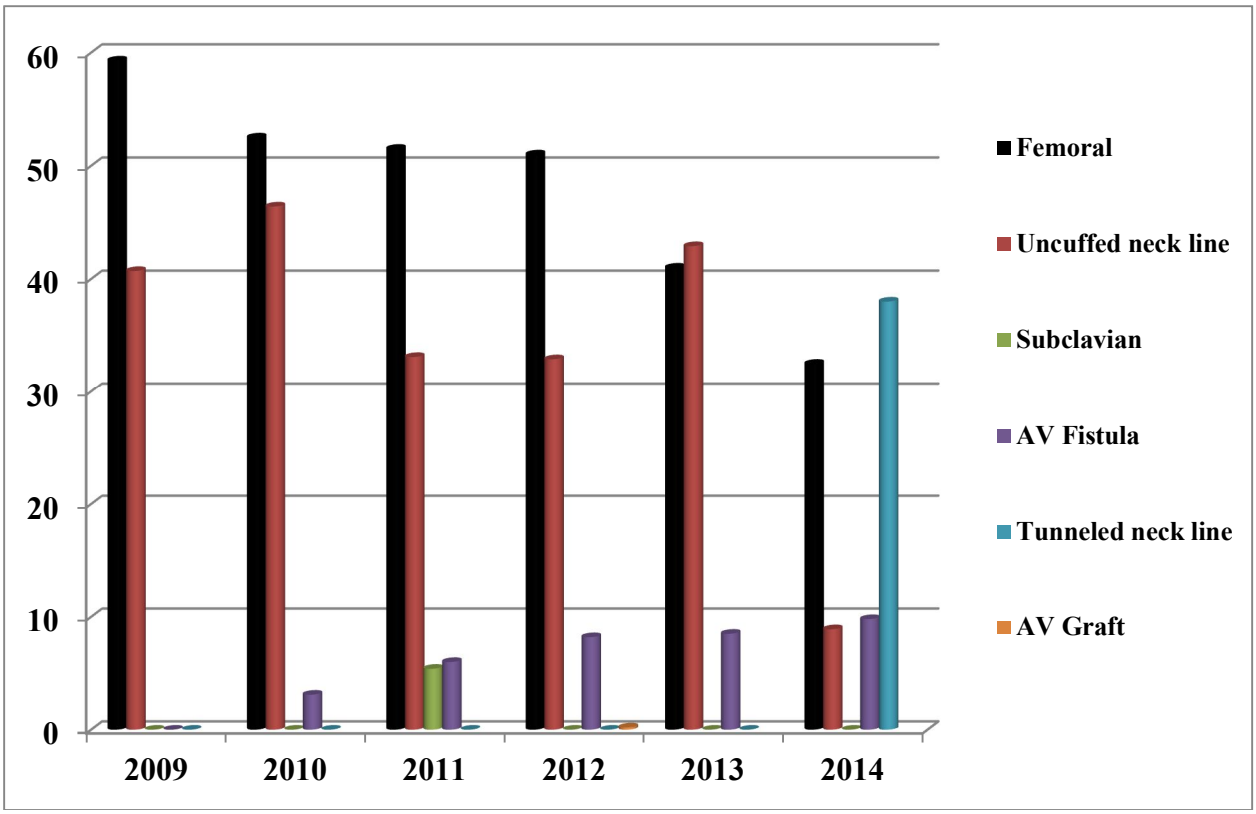

Figure 2: Frequency of different types of vascular access used for haemodialysis according to the year of review.

Table 2: Some clinical characteristics of the patients over the six-year period

Year	Mean age of prevalent patients(SD)	% with diabetes mellitus	% males
2009	42.5 (12.5)	23.3	51.0
2010	42.3 (12.0)	24.9	52.4
2011	43.1 (13.8)	20.3	62.6
2012	44.3 (12.4)	17.1	63.3
2013	43.5 (11.8)	15.7	53.3
2014	44.9 (11.3)	15.1	52.9

Table 3: Types of vascular access used for HD over the period reviewed

Access type	**Frequency (%) N=591**
Temporary access	**498 (84.3)**
Femoral vein access	295 (49.9)
Internal Jugular vein access	199 (33.7)
Tunnelled	30 (5.1)
Non tunneled (uncuffed)	169 (28.5)
Right internal Jugular	163 (27.5)
Left internal Jugular	6 (1.0)
Subclavian access	4 (0.7)
Permanent access (functional)	43 (7.2)
Arteriovenous fistula	**42** (7.1)
Radiocephalic	40 (6.7)
Brachiocephalic	2 (0.3)
Arteriovenous graft	1 (0.2)

Discussion

The main findings of this study were that most patients (99.2%) in our centre commenced dialysis with temporary vascular access. However, there was a progressive increase in the number of patients using permanent vascular access for HD over the years reviewed; up to 7.1% of patients on maintenance hemodialysis had AVF. Finally, there were more patients on tunneled catheters than other vascular access type at the last year of this review.

Vascular access use varies across countries,[12-13] and determinants include gender,[14] patient educational level,[12, 14] presence/absence of peripheral vascular disease and cardiac disease,[12] timing of referral of patient,[12] facility preferences, [15] approaches to vascular access practices and surgeons' practice pattern.[16]

Majority of the patients in our study commenced dialysis with temporary vascular access. This is similar to the study in Lagos[17] and Jos[18], Nigeria, where the initial vascular access for initiation of dialysis was temporary vascular access in all HD patients. This may be because the patients presented late to hospital with uremia needing urgent HD. This had been reported as the commonest mode of presentation of Nigerian patients with ESRD[3, 18-19] and denies the care-giver time to plan and create a permanent vascular access before patient reaches end-stage.

Also most of the patients seen in the initial part of this study were on temporary vascular access (catheters) even after two months of starting HD. However, there was a progressive increase in the number of patients on AVF over the years

in this study. This may be due to more awareness of CKD over the years including early screening and detection by health-care providers. Hence, more patients may have been referred to the nephrologist at early stages of CKD, hence giving the specialist and patient some time to plan for vascular access. Also, in this study, the proportion of diabetics with ESRD decreased over the years while the proportion of male patients increased (table 2). These are factors that favours choice of AVF for HD by both physicians and surgeons and that also predicts successful outcome.[6] This trend towards greater AVF use reported in this study is similar to reports from the Dialysis Outcomes and Practice Patterns Study (DOPPS) among HD patients in Australia, New Zealand and the United Kingdom.[20] However, the study by Malek *et al* among 398 patients undergoing HD in a single centre in Spain over a six-year period showed a significant decrease in the proportion of autologous AVFs and an increase in the proportion of indwelling catheters in both incident and prevalent patients. This change was attributed to a change in age and co-morbidity of the incident population (older age and a higher percentage of diabetics) within the period reviewed, factors not favouring successful AVF.

International guideline for management of chronic kidney disease recommends that individuals with CKD should undergo evaluation for creation of permanent vascular access from CKD stage 4.[21] In addition, AVF should be created in 50% or greater of all incident HD patients and at least 40% of prevalent HD patients.[21] Only 7.3% of the patients on HD ever used a permanent access (AVF an AVG) for HD. This is similar to 6.39% from Enugu,[3] 8.3% from Uyo[22] (both in Southern Nigeria) and 9% reported in Maiduguri in Northern Nigeria.[23] However, it is a far outcry when compared to 30% reported in the United States HD population, 30-50% reported from the Australia, New Zealand data registry[24] and the 50% recommended by the Kidney Disease Outcome Quality Initiative (KDOQI) clinical practice guidelines for vascular access.[21] Mode of patient presentation (early versus late), cost and availability of surgical skill may account for the above differences between countries and centers in the same country.

There were more patients on tunneled catheters than other access types in the last year of this review. The study center started fixing tunneled catheters for patients undergoing HD in February, 2014. Considering the short period between commencement of this procedure and last month of the data collection (September, 2014), the number of patients already utilizing this technology showed how quick the unit embraces advances in practice in a developing world. However, there is a call for caution. Most modern catheters provide adequate blood flow for dialysis. Several reports have shown increased risk of mortality in patients dialyzing with a catheter compared with those using an AV access (fistula or graft).[25-29] This increased risk for mortality in patients using catheters have been reported to be caused by either catheter-related complications or other patient factors associated with having a catheter (sex, race, co-morbidity, serum creatinine level, anthropometric volume, and baseline serum albumin level).[30-33] In addition, the United States Renal Data System (USRDS) has indicated that a significant number of patients do not receive adequate dialysis using tunneled catheters.[34] Also, tunneled catheters have been associated with the very high complication rates,[27, 35-36] rendering justification for their use more difficult as long-term dialysis access.

In conclusion, most of our patients commenced HD with femoral catheters. While all patients commenced dialysis with femoral catheters in 2009, few commenced with AVF in the last two years of this review. There is a rising trend towards the use of AVF among our HD population. Finally, there were more patients on tunneled catheters than other vascular access type at the last year of this review.

Our results may open the way for further researches into the co-morbidities related to the type of vascular access, as well as to develop comprehensive national guidelines for vascular access in HD; as none currently exist. The proportion of ESRD patients on permanent vascular access in this study was 7.3%. Other local studies in Maiduguri, Uyo and Enugu showed the proportion of patients on permanent vascular access to be 9%, 8.3% and 6.39% respectively. This is an area of practice in management of ESRD in our environment that needs improvement.

We recommend that efforts should be directed to either development of guidelines for vascular access use in Nigerian CKD patients or emphasizing adherence to already existing international guidelines.[21, 37] The current guidelines for the detection and management of CKD in Nigeria[38] did not address this issue comprehensively. Much of the US and Canada have been able to modify their trends to AVF creation by successful implementation of the K/DOQI guidelines, and also based on data suggesting an increased mortality and morbidity and a decreased quality of life in patients using indwelling catheters for HD. Secondly, we recommend timely attempts to create a primary fistula before the anticipated need for haemodialysis especially for those in pre-dialytic stage 4. This will allow adequate time for the fistula to mature and will allow sufficient time to perform another vascular access procedure if the first attempt fails, thus avoiding the need for temporary access.[6]

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