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Risk Factors And Vascular Access For End Stage Renal Disease (ESRD) In Southern Nigeria

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Abstract
Background*: End stage renal disease (ESRD) is the irreversible dysfunctional activities of the kidney, of which mortality is inevitable in the absence of dialysis or kidney transplant. Vascular access is critical in the dialysis of ESRD patients. The Vascular Surgeon plays a crucial role in the provision of vascular access for haemodialysis in this group of patients.*
Objective*: To determine the causes of End stage renal disease (ESRD) in patients who presented for haemodialysis vascular access interventions.*
Materials and Methods: *A prospective cross-sectional study conducted at public and private healthcare facilities in Port Harcourt, Rivers state, from March 1, 2017 to February 29, 2024. The parameters considered were patients' demography, causes of ESRD and type of treatment received. Data were collected using pre-designed semi-structured pro-forma and analyzed with statistical packages for social sciences (SPSS) version 25. Results are presented as frequency tables and percentages.*
Results*: A total of 309 ESRD patients were recruited for the study. Of these, 201 (65.05%) were male, 108 (34.95%) were female, the most frequent age group was 41-60 years 149 (48.22%). The most observed causes of ESRD were hypertension in 155 (50.16%) patients, diabetes mellitus in 52 (16.83%) patients, and Human Immunodeficiency Virus (HIV) in 35 (11.3%). About two-thirds 198 (64%) had dialysis catheter insertion, 87 (28%) had arteriovenous fistula (AVF), while 24 (8%) had both interventions done. The majority 82 (94.25%) of the patients had primarily successful AVF procedures for the AVF group and 198 (100%) of those for catheter insertion were successful. The common complications were 12 (3.9%) catheter blockage / thrombosis, secondary failure of AVF in 10 (3.2%) patients, 8 (2.6%) tunneled catheters exit wound infections, primary failure of AVF in 5 (1.6%) patients, poor catheter flow in 5 (1.6%) patients, AVF site infection in 3 (1%) patients, and 1 (0.3%) patient with left arm edema.*
Conclusion: *This study revealed the common causes of ESRD to be hypertension, diabetes mellitus, and retroviral disease (RVD), with hypertension being the most frequently implicated in our environment.*
Keywords*: End stage renal disease, Hypertension, Diabetes mellitus, Dialysis, Vascular access.*

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I. Introduction

End stage renal disease (ESRD) is the irreversible dysfunctional activities of the kidney, to which mortality is inevitable in the absence of dialysis or kidney transplant. [1] According to the Kidney Disease Improving Global Outcomes (KDIGO) foundation guidelines for the management of chronic kidney disease (CKD), there are five levels of the disease, for which ESRD is the final stage.[2] Typically, ESRD is established when a chronic kidney disease (CKD) patient has a glomerular filtration rate (GFR) of less than 15mL/min.[2] However, a patient might still be diagnosed with ESRD when renal replacement therapy (RRT) is needed even at higher GFR levels.[3]

The incidence of ESRD has been on the global increase over the years, although significant differences exist among countries.[4] Globally, the ESRD response is quite complex and affected by socioeconomic status, culture, religious beliefs, and national disease prevalence of the various countries.[5] According to the United States Renal Data System (USRDS), about 2.4 million people were treated for ESRD in 2016 as reported by various countries that send data to the USRDS.[6] Furthermore, the 2019 Global Kidney Health Atlas released by the International Society of Nephrology (ISN) showed that the global diagnosis of new ESRD patients was 144 persons per million in the general population (PPM).[7] The highest ESRD population has been reported in Asia, with about one-third of the global CKD patients living in China and India.[8,9] Large CKD population are also recorded in USA, Russia, Bangladesh, Indonesia, Pakistan, Japan, Vietnam, Brazil, Mexico, and Nigeria; with each country having over 10 million confirmed cases of CKD respectively.[9,10]

In Nigeria, a comprehensive data is still lacking for the epidemiology of ESRD. Many patients with this condition do not have access to treatment at tertiary facilities and hence most of the data for determining the ESRD incidence are neither reported nor documented .[11] However, the Nathan Kidney foundation as at the year 2011 estimated that over 27 million Nigerians were living with CKD , with an incidence of 15,000 and prevalence of 45,000 cases annually.[12] Several authors have reported their findings on the epidemiology of CKD in several parts of the country. Some population-based studies have been conducted in Southern and Northern Nigeria respectively.[13] A prevalence of 18% was reported in a local community in Southwest Nigeria,[14] while 11% was reported in the Southeastern part of Nigeria.[15]Furthermore, a prevalence of 26% had been documented for CKD in Northwest Nigeria.[16] Ulasi et al[15] had reported that ERSD was responsible for 8% and 42% of total admissions and renal cases respectively, at a tertiary health facility in Southeastern Nigeria.

Hypertension and glomerular diseases have been implicated in the aetiology of CKD in sub-Saharan Africa, with hypertension, diabetes mellitus, and chronic glomerulonephritis among the most prominent causes in Nigeria.[17.] Other risk factors in Nigeria include age, obesity, use of traditional medicines, long term usage of non-steroidal anti-inflammatory analgesics and family history of renal disease.[15,18] The progression of CKD results in ESRD, therefore the risk factors for ESRD development had been established. These risk factors include older age, diabetes mellitus, hypertension, non-white race, proteinuria, elevated serum creatinine levels, reduced GFR rate, obesity, use of analgesic, tobacco smoking, chronic renal insufficiency, family history of kidney disease, low socioeconomic status and hyperuricaemia.[1,19] Therefore, as vascular surgeons who encounter renal patients presenting for vascular access for haemodialysis, we set out to determine the causes of ESRD from our experience.

II. Materials And Methods

Study Site

The University of Port Harcourt Teaching Hospital (UPTH) and the Rivers State University Teaching Hospital (RSUTH) in Rivers state, Southern Nigeria. They serve as referral centres for all levels of health care in Rivers and neighbouring states including Bayelsa, Imo and Abia. The institutions have specialist units that are made up of consultants, specialist senior registrars, and registrars, and teams of experienced nurses. Patients with diagnosed ESRD were reviewed and subsequently managed across two teaching hospitals and eight private hospitals in Port Harcourt, Rivers state.

Methods

This is a prospective cross-sectional survey of 309 patients who presented to public and private institutions in Port Harcourt between March 1, 2017, to February 29, 2024. The patients were selected by convenient sampling technique. A pre-designed semi-structured interviewer administered questionnaire was used to obtain patients' demography, cause of ESRD and type of treatment received after obtaining informed written consent.

Data Analysis

Data was entered into a MS Excel spreadsheet and analyzed using statistical packages for social sciences (SPSS) version 25. Results are presented in frequency tables and percentages.

Ethical Considerations

Ethical approval for the study was obtained from the Ethics and Research Committee of the University of Port Harcourt Teaching Hospital and from the management of the private health institutions. Each participant was assigned a unique identifier number to ensure anonymity and ease of identification. The data collection tools were checked daily for accuracy and completeness.

III. Results

A total of 309 patients were seen from March 1, 2017, to February 29, 2024, at these health facilities. Table 1 shows that 201 (65.05%) of the patients were males, while 108 (34.95%) were females. The most frequent age group were 41-60 years (48.22%) and 61-80 years (28.16%). Table 2 shows the frequency of occurrence of disease in the study population, with hypertension and diabetes mellitus being the most frequently implicated. Patients with hypertension as the only cause of ESRD were 155 (50.16%), followed by 52 (16.83%) having diabetes mellitus, and 35 (11.3%) patients had HIV alone. On the other hand, both hypertension and diabetes mellitus were found as causes in 28 (9.1%) patients, hypertension, and HIV in 10 (3.2%) patients while 7 (2.3%) patients had hypertension, diabetes and HIV as the causes of ESRD.

Interventions carried out are presented in figure 1. About two-third 198 (64%) of the patients had dialysis catheter insertion, 87 (28%) had arteriovenous fistula (AVF), while 24 (8%) had both interventions

done. As presented in table 3, common complications were 12 (3.9%) catheter blockage / thrombosis, secondary failure of AVF in 10 (3.2%) patients, 8 (2.6%) tunneled catheters exit wound infections, primary failure of AVF in 5 (1.6%) patients, poor catheter flow in 5 (1.6%) patients, AVF site infection in 3 (1%) patients, while 1 (1%) patient had left arm edema. Primarily successful AVF procedures for the AVF group was recorded in 82 (94.25%), 198 (100%) of those for catheter insertion were successful and the combined procedures in 24 (7.8%) patients were primarily successful.

Table 1: Demographic Characteristics (n=309)

Variables	Frequency(n)	Percent (%)
Age range (years)		
≤ 20	19	6.15
21-40	50	16.18
41-60	149	48.22
61-80	87	28.16
≥80	4	1.29
Sex		
Male	201	65.05
Female	108	34.95

Table 2: Distribution of disease in the study population (n=309)

Variables	Frequency (n)	Percent (%)
HTN	155	50.16
DM	52	16.83
HIV	35	11.33
HTN + DM	28	9.06
HTN + HIV	10	3.24
HTN + HIV + DM	7	2.26
Polycystic kidney disease		1.94
AGN	4	1.30
Acute Renal Failure	3	0.97
Prostate cancer	3	0.97
SLE	3	0.97
Sickle cell disease	2	0.65
Posterior Urethral Valve	1	0.32

HTN = hypertension; DM = diabetes mellitus; HIV = Human immunodeficiency virus; AGN = Acute glomerulonephritis; SLE = systemic lupus erythematosus

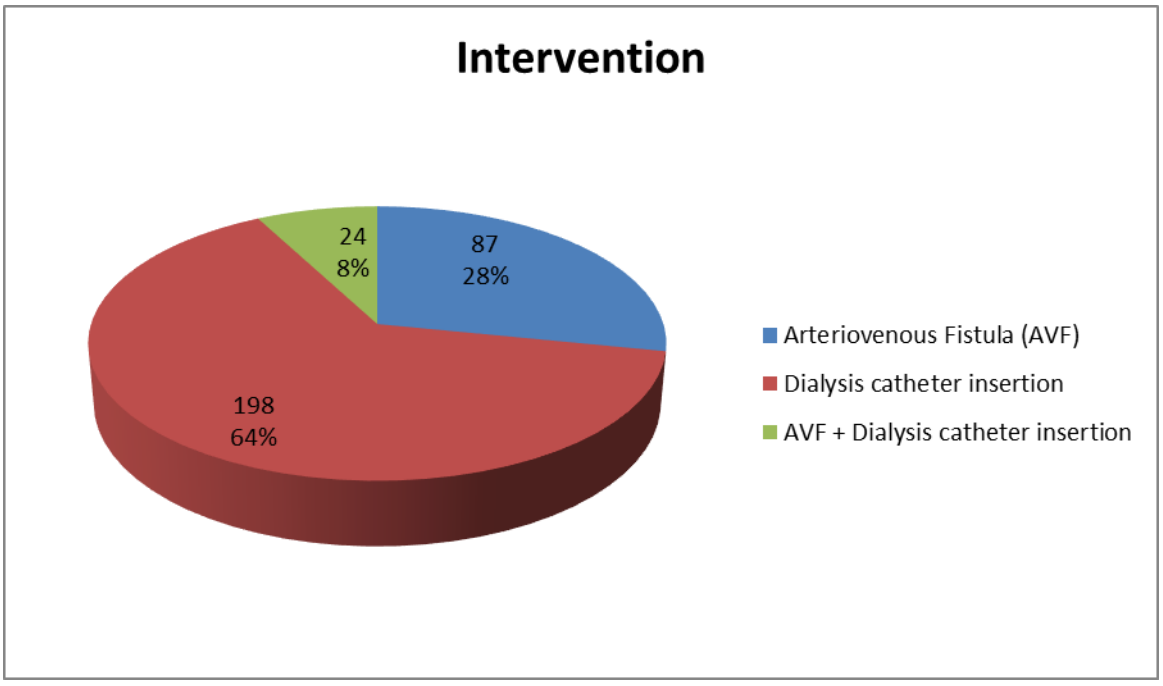

Fig 1: Type of intervention received.

Table 3: Complications and outcome

Outcome	Frequency	Percentage (%)
Catheter insertions		
Catheter blockage / thrombosis (n=309)	12	3.88
Tunneled Catheter exit wound infection (n=309)	8	2.59
Poor Catheter flow (n=309) Successful catheter insertion alone(n=198) Successful combined catheter insertion and AVF(n=24)	5 198 24	1.62 100 100
AVF Procedures		
Secondary failure of AVF (n=309)	10	3.24
Primary failure of AVF (n=309)	5	1.62
AVF Site Infection (n=309)	3	0.97
Left arm edema from AVF (n=309) Primarily successful AVF alone (n=87) Successful combined AVF & catheter insertion(n=24)	1 87 24	0.32 94.25 100

AVF = Arteriovenous fistula

IV. Discussion

End stage renal disease (ESRD) is a disease that has been documented across various age groups from children to the elderly. As shown in this study, patients as young as 9 years and as old as 84 years were diagnosed with ESRD respectively. Previous study by Shrestha et al[20] also showed that the mean age for ESRD patients ranged from 15 - ≥ 70 years, which showed that children as well as adults do suffer from ESRD. In this study, it was observed that majority of the patients were between 41-60 years, which agrees with the reports of Van Pottelbergh et al,[21] that patients between 50-64 years are at a higher risk of developing ESRD than the other age groups, especially 65-80 years and more than80 years respectively. Although Dada et al[22] also reported a frequency of 46% among chronic kidney disease (CKD) patients among the 41-60 age group at a tertiary hospital in Nigeria, this is quite relevant since CKD had been investigated to be a precursor for ESRD development. However, this is contrary to Shrestha et al[20] that observed that majority of the ESRD patients were between 61-75 years at a tertiary facility in Nepal.

Although, gender had not been established as a risk factor for ESRD development in patients with kidney diseases, however majority of the ESRD patients in this study were males. This is like the findings of Nawaz et al,[23] Jothi et al,[24] and Weldetensae et al[25] who reported in their respective studies that more males were diagnosed with ESRD.

Hypertension, diabetes mellitus, and other kidney diseases have been implicated in the etiology of ESRD or its progression. Although all the 309 ESRD patients in this study have had some interventions from the nephrology unit, especially haemodialysis sessions, however the proportion of patients with specific disease showed that 50.16% of these patients had hypertension. Furthermore, 16.83% had diabetes mellitus and 11.33% had HIV (HIVAN), while other less common disease conditions were polycystic kidney disease, acute glomerulonephritis (AGN), acute renal failure, prostate cancer, systemic lupus erythematosus (SLE), sickle cell disease, and posterior urethral valve.

The study showed that hypertension was the leading cause of ESRD as was seen in 200 patients. Hypertension as a major risk factor among kidney disease patients in Nigeria have been previously reported by Wachukwu et al,[17] Ulasi et al,[15] Olanrewaju et al,[13]and Dada et al.[22]Therefore, it was not surprising to see majority of our ESRD patients having hypertension as a co-morbidity. Although, diabetes mellitus also plays a role in the manifestation of ESRD, several studies suggest that its incidence is not as high as that of hypertension in Nigeria, just as seen in our patients.[23-25]

Haemodialysis is a crucial procedure in preserving the lives of kidney disease patients, especially those with CKD and ESRD who would need kidney transplant.[25] To consistently perform haemodialysis, vascular access needs to be created. In fact, vascular access has been linked with the rate of survival in patients undergoing dialysis.[26] In this study all our patients had vascular access interventions with the creation of arteriovenous fistula (AVF), insertion of tunneled dialysis catheter or both. Dialysis catheter alone was used for majority of the patients, , while either AVF alone or both interventions were used for the rest of the patients. The guidelines for vascular access practice supports the use of AVF over dialysis catheter due to its lower risk of infections, mortality, or cardiovascular complications.[27-29] The major reasons for the frequent usage of the dialysis catheter over AVF in this study could be attributed to ease of use, as the catheter could be used for dialysis immediately after insertion, while the Fistula takes two to three months to mature before use. Availability of the catheters; and the financial capacity of the patients, as they cover the entire cost themselves are additional reasons. However, the most common complications were catheter blockage / thrombosis, secondary failure of AVF tunneled catheters exit wound infections, primary failure of AVF, , poor catheter flow , AVF site infection , and left arm edema. At the end of the study, primarily successful AVF procedures

was reported in majority of the patients, while it was successful for all patients who had catheter insertion and all those with combined procedures.

V. Conclusion

The causes of End Stage Renal Disease (ESRD) could be diverse even from the vascular access surgeons' point of view, ranging from major to minor causes. This study revealed the major causes of ESRD to be hypertension, diabetes mellitus, and retroviral disease (RVD), with hypertension being the leading cause in our environment.

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Conflicts of Interest

The authors have no conflicts of interest to declare.

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