

HAEMODIALYSIS PRACTICE IN A RESOURCE-LIMITED SETTING IN THE TROPICS

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SUMMARY

Background: Objective: To provide information on the challenges of haemodialysis in a resource limited setting in South-Western Nigeria.

Methods: This is a 5 year audit of all haemodialysis sessions carried out at the renal unit of the Ladoke Akintola University Teaching Hospital (LAUTECH), Osogbo, Nigeria.

Results: A total of 225 patients were offered haemodialysis (HD) during this period with age range of 10 to 85 years (mean age of 49 years \pm 16.25). There were 155 males and 70 females (male to female ratio of 2.2:1). Chronic kidney failure accounted for 180 (80%) of the cases while acute kidney injury (AKI) constituted 45 (20%) of the cases offered haemodialysis. The sessions of HD in both cases ranged from 1 to 27 with an average of 3 sessions. Hypotension is still the commonest intradialytic complication at our setting while diabetic nephropathy is rapidly emerging as a major cause of end stage renal disease at our setting requiring HD. As seen in other parts of the tropics sepsis, nephrotoxins and pregnancy related cases still accounted for a large percentage of AKI cases requiring haemodialysis. Only three patients were able to afford haemodialysis support for more than three months.

Conclusion: Haemodialysis still remains a veritable option in renal replacement therapy. Problems encountered were similar to many other settings in the tropics. Intensive efforts should still be geared at preventing the risk factors for both acute kidney injury and chronic kidney disease in our environment.

Keywords: Haemodialysis, practice, tropics, Resource limited

INTRODUCTION

Renal replacement therapy is the ultimate therapeutic option in both acute kidney injury and chronic kidney disease. It could either be via dialytic therapy (haemodialysis or peritoneal dialysis) or with preference for renal transplantation in end stage kidney failure (ESKF). Indications for dialysis include; clinical factors such as symptomatic uraemia, uraemic pericarditis, acute pulmonary oedema especially in the setting of

anuria or oliguria and biochemical factors such as severe hyperkalemia (serum potassium $> 6.5\text{mmol/l}$), intractable acidosis especially with serum bicarbonate $< 12\text{mmol/l}$, azotemia with serum creatinine $> 500\mu\text{mol/l}$ and serum urea $> 20\text{mmol/l}$, and hypercatabolic state defined as daily rise in serum urea $> 10\text{mmol/L}$, serum creatinine $> 100\mu\text{mol/L}$ with rising potassium of $> 1\mu\text{mol/L/day}$.¹ Haemodialysis facilities are available in at least 50 centers in Nigeria (as at the time of this report), most of them are located in the capital/major cities and majority (90%) are government owned while 10% are privately owned.²

There is no full government subsidy for haemodialysis and there is no subsidized provision under the National Health Insurance Scheme (NHIS). In a setting where the per capita income of the ordinary citizen is less than one United States dollar/day³, most patients can barely afford the cost of a session of haemodialysis (approximately 155 US dollars/ session). Morbidity and mortality is still high especially in patients with ESRD on maintenance HD in the tropics using our setting as a surrogate, while HD is known to significantly influence survival in patients with acute renal failure.⁴ This review is a 5 year audit of Haemodialysis services at the Nephrology unit of the Department of medicine of the LAUTECH Teaching Hospital, Osogbo, Nigeria over a 5 year period.

The dialysis unit of the LAUTECH Teaching Hospital Osogbo, Nigeria provides renal replacement services, that is, it provides both acute and maintenance haemodialytic support to patients with both chronic kidney failure (CKF) and Acute kidney injury in failure (stage 3 AKI) to at least 1.5 million people in 6 catchments states both in the South-western and North-central regions of Nigeria. It commenced operations in January 2005.

PATIENTS AND METHODS

This is a 5-year audit of all patients who had haemodialysis between 7th January 2005 and 7th January 2010 at the LAUTECH Teaching Hospital, Osogbo, Nigeria.

The logbook and computer databases of dialysis sessions and ward records were used for the analysis. The data obtained from these records included the age, sex, primary diagnosis of the patient, dates of dialysis, vascular access used, number of dialysis sessions, intradialytic complications (if any) and eventual outcome. The primary diagnoses were as made by the managing attending nephrologists.

Patients were dialysed with Dialog R heamodialysis system by *B Braun Inc, 2003, Melsungen AG* with a bicarbonate buffer based dialysate with a blood flow rate of between 200 to 300ml/min and dialysate flow of 500ml/min. All were dialysed using 1.6m² and 1.8m² surface area hollow fibre polysulfone membrane dialysers and they all had conventional HD for an average of four to five hours. The ultrafiltration coefficients (Kuf) of dialysers were between 7.9 to 13.7ml/hr/mmHg.

A set of general definitions in addition to some other established clinico-pathological indices formed the basis of diagnoses in this study as itemized below; Chronic kidney disease (CKD) was defined as kidney damage evidenced by structural or functional abnormalities or a persistent decline in glomerular filtration rate to less than 60ml/1.73m² or normal GFR plus evidence of kidney damage (most commonly albuminuria, haematuria or abnormal renal ultrasound for three or more consecutive months) irrespective of cause⁵ while end stage kidney failure (ESKF) represents the end of the continuum of the spectrum of chronic kidney disease.⁶

End stage kidney failure was defined by estimated Glomerular Filtration Rate (eGFR) less than 15ml/min/1.73m², bilateral shrunken kidneys on ultrasound scan and presence of clinical features of uremia (such as hypertension, anaemia and bone disease) and need for dialysis.⁷ Acute renal failure (a subset of the spectrum of acute kidney injury) was defined as an acute deterioration in renal excretory function, with a serum urea > 10mmol/litre and/or a rise in serum creatinine (Scr) by ≥ 0.3mg/dl or a percentage increase in Scr of ≥ 50% from baseline using the Acute Kidney Injury Network(AKIN) criteria.⁸

Long standing hypertension was diagnosed on the basis of a previous history of hypertension, loud aortic component of the second heart sound, presence of trace or 1+ proteinuria, absence of casts and evidence of hypertensive retinopathy on fundoscopic examination.

Chronic glomerulonephritis was diagnosed based on a history of age less than 35years, with a past history of acute or post infectious glomerulonephritis or nephrotic

syndrome, progressive oedema, anaemia, hypertension, presence of haematuria and urinary red cell/granular casts, azotemia and renal ultrasound scan showing bilaterally shrunken kidneys with poor corticomedullary differentiation. Diabetic Nephropathy was diagnosed based on a history of diabetes mellitus, diabetic retinopathy, proteinuria, hypertension, anaemia and normal or increased renal size on ultrasound.⁹ Consumption of herbal medications (in the form of plant/animal origin) and other alternative toxic medications were generally classified as nephrotoxins.

Sepsis is defined as a microbiological focus of infection and deterioration of the clinical state evidence by at least one of the following; Temperature > 39⁰C on two or more occasions; and Leucocytosis > 10 X 10⁹ /lit, and; Positive blood culture.¹⁰

Pregnancy related cases included all cases of pre-eclampsia, eclampsia, septic abortion and bleeding conditions (antepartum and postpartum haemorrhages). The data management and analyses were carried out using the SPSS for windows (statistical package for social sciences version 12.0, 2005). Descriptive analyses were carried out by calculating the number and percentage for categorical data, and the mean and standard deviation for continuous data.

RESULTS

Three hundred patients with chronic kidney disease and 80 patients with acute kidney injury were managed at our unit over 5 years. One hundred and eighty (60%) out of the 300 patients had chronic kidney failure necessitating HD while 45 (56.2%) out of the 80 patients with AKI seen required HD. Seven hundred and eighty-one dialysis sessions were offered to the 225 patients with both CKF and AKI during this period (Table 1).

Table 1: Comparing a 5 year pattern of HD in Osogbo with two other centres located in south western Nigeria

	IBADAN¹²	LAGOS¹⁵	OSOGBO
No. of Year Reviewed	3 years	5 years	5 years
No. of patients	158	245	225
Total no. of Dialysis sessions	1,452	NA*	781
M:F	112:46	75:42	155:70
Age Range	15-81	13-76	10 – 75
CKF	141	117	180
ARF	17	98	45
No. of patients affording HD more than 12 months	3	3	3

NA*- Not available

There were 155 (68.9%) males and 70 (31.1%) females with a male preponderance in the ratio of 2.2:1. There were more males affected in both the AKI/CKD groups. Also for AKI, the highest number of people were those in the 50-60year age group as opposed to 31-40, 41-50 up to 70 years.

The number of haemodialysis sessions ranged from 1 to 10 for the AKI cases and 1 to 27 for the CKF cases, with an average of 3 sessions/patients. Vascular access was mainly by femoral or internal jugular cannulation. Only 15 of the 180 CKF patients presented de-novo with Arterio-venous fistulas and all were referral cases from other centres.

Out of the 180 CKF patients, 2 received 3 sessions of HD/week, 2 had 2 sessions/week, 40 patients had 1 session /week, while 136 patients had inconsistent pattern varying from every 10 days to as high as once in 21 days. Also with regards to the CKF patients, 114 patients (63.3%) had less than 5 sessions of haemodialysis; 54(30%) had between 5 and 10 sessions and the remainder between 11 and 20 sessions of dialysis spanning 3 years with substantial financial support from non-governmental institutions and corporate organizations.

For the 45 AKI patients, 17 had 1 HD session (10 died after the first session, while 7 recovered renal function), 15 patients had thrice weekly 4-5hours sessions of intermittent HD) , 5 patients had twice weekly HD while 8 patients had infrequent IHD sessions over 3 weeks.

Table 2: Showing the pattern of distribution of the Aetiologies in CKF and AKF

	AETIOLOGY	NUMBER (%)
Chronic Kidney Failure	Hypertension	70(38.8%)
	Chronic Glomerulonephritis	52(28.8%)
	Diabetes Mellitus	40(22.2%)
	Autosomal Dominant Polycystic Kidney Disease	5(2.7%)
	Lupus Nephritis	2(1.1%)
	Others(unknown)	11(6.1%)
	Total	180(100%)
Acute Kidney Injury (In Failure)	Sepsis syndrome	16(35.5%)
	Pregnancy related cases	12(26.6%)
	Nephrotoxins	8(17.7%)
	Diarrhoeal illnesses	4(8.8%)
	Acute Glomerulonephritis	3(6.6%)
	Snake bite	1(2.2%)
	Rhabdomyolysis(burns)	1(2.2%)
	Total	45(100%)

Long standing hypertension was seen in 70 (38.8%) and this accounted for majority of the patients with CKF followed by chronic glomerulonephritis 52 (28.8%) and diabetic nephropathy 40(22.2%) (Table 2). However, in the last 2 years, there has been an upsurge in the cases of nephropathy with at least 2 new cases of diabetes mellitus presenting commonly in CKD stages 4 and 5 at our unit (personal observation).

Sepsis syndrome accounted for 16 (35.5%) of the 45 patients with acute kidney injury while pregnancy/post-partum related cases (i.e. pre-eclampsia, septic abortions, post-partum haemorrhage) accounted for 10 (22.2%) of the cases. Others included toxins, 6(13.3%), hypervolemia from diarrhoeal illnesses; 4(8.8%), acute glomerulonephritis 3(35.5%), snakebites 1(2.2%) and rhabdomyolysis from major burns (1) (2.2%).

The average presenting serum haematological/biochemical parameters for both AKI and CKD (Table 3) shows haematocrit of 28%, serum urea of 14.3mmol/l, serum potassium of 5.5mmol/l, serum bicarbonate of 22mmol/l and serum creatinine of 300µmol/lit for the former (AKI) and haematocrit of 18%, serum urea of 30mmol/l, serum potassium of 6.5mmol/l, serum bicarbonate of 18mmol/l and serum creatinine of 925µmol/l for the latter (CKD).

Table 3: showing the presenting haematological and biochemical parameters.

Average (presenting) laboratory parameter	Acute kidney failure	Chronic kidney failure
Haematocrit (%)	28(±7.9)	18(±5.9)
Urea (mmol/l)	14.3(±3.6)	30(±10.3)
Creatinine (µmol/l)	300(±90)	900(±300.3)
Bicarbonate (mmol/l)	22(±4.8)	18(±6.2)
Potassium (mmol/l)	5.5(±2.2)	6(±3.6)

The mortality by cause of AKI showed that muscle cramps were seen in 21 patients (2.68%), sudden death in 5 patients, while majority, 566 (72.47%) had no complications.

Out of the 180 patients with chronic kidney failure, 4 were transplanted, 41 patients were lost to follow up, 131 patients did not survive, and no patient was converted to peritoneal dialysis while 3 patients are presently on maintenance haemodialysis.

DISCUSSION

Haemodialysis still remains the commonly utilized renal replacement therapy option in the tropics even though other technologically less advanced forms of renal replacement therapy such as peritoneal dialysis

are still available in some centres in South Africa, Sudan, and Egypt.^{11,12,13,14,15}

We offered haemodialysis to 225 patients over a five year period. There is an apparent increase in patients presenting for haemodialysis when compared with a similar work earlier done in Lagos two decades ago in which 245 patients were dialysed.¹⁵ Even at that time there were only three dialysis centres providing dialytic services for close to 5 million people when compared with over 20 centres in the region in the last five years. This reflects the increasing number of patients presenting with kidney related ailments over the last half decade.

A 2 year study of haemodialysis done earlier at the same centre in Osogbo suggested an exponential increase in patients presenting for hemodialysis.¹⁶ Although from other studies most of them can barely afford the cost of HD which is known to cost an average of \$22,320 (at \$155/session) for one patient that requires 3 sessions of HD a week for one year. Most of our patients therefore turn to “alternate sources” for treatment (i.e. spiritual homes and native traditional practitioners) and this often resulting in poor outcomes. 63.3% of the CKD patients had less than a total of 5 sessions of HD and this is similar to the works reported in Sagamu, Nigeria by Alebiosu et al in which 61.8% had less than 3 sessions of HD.¹⁷ Chronic glomerulonephritis, long standing hypertension and diabetic nephropathy cases were the primary diagnosis in patients presenting with end stage renal disease needing renal replacement therapy in the form of haemodialysis at our centre and which have been reported in similar works done in virtually all other centers in the tropics.^{16,17,18,19,20}

There is a noticeable rising trend in the preponderance of diabetic nephropathy cases presenting in end stage renal disease, majority of them often presenting with associated foot syndrome and were mainly uraemic at presentation.²¹ This is as a result of increasing urbanization and westernization and changes in life-style.²² The triad of septicaemia, nephrotoxins and pregnancy related cases constituted the majority of the acute kidney injury cases who presented at our centre for haemodialysis and this trend is similar to other cases seen elsewhere in the tropics.^{3,14,23,24,25} Nephrotoxins in forms of mixtures of herbal concoctions which were mainly undefined and the incidence of such cases were often noticed to increase during alternative medicine “trade fairs” in the respective localities and these virtually present with oliguria as in most other cases seen.^{4,24}

We also noticed a rising trend in pregnancy related acute renal failure with post dialysis mortality approaching almost 95% in instances of postpartum eclampsia related cases who presented for haemodialysis. They were mainly unbooked and late referral cases who were first seen outside our setting and this pattern has been reported in other studies.²⁶ This also reflects the high levels of maternal mortality rate in Nigeria (estimated at 1000/100,000 live births) which unfortunately is said to be the second highest in the world.²⁷ Nigeria is said to contribute 10% of the global maternal mortality figure despite the fact that it only constitute 1.7% of the world’s population.

Other obstetrics associated incidents seen during these periods included complications of unsafe abortion and post partum haemorrhage. Mostly seen in the age bracket of 25- 37 years and were mainly primigravidas. Most of the eclamptic patients were initially managed at unregistered nursing/maternity homes and standard health centres in which the antenatal care is often poor in terms of screening for urinary proteins and hypertension. Similar reasons also account for the cases of septic abortion and these were mainly performed by unskilled professionals with concomitant use of nephrotoxic medications.²⁸

Very few of our CKD patients (30 out of 180) were able to afford erythropoietin injection as seen in other centres and previous works.^{2, 16} Anemia is a major problem among our patients and it is known that this is a major cardiovascular risk factor for mortality and morbidity in patients, on the long run, most of them are often lost to follow up due to insufficient funds or ending up buying herbal haematinics which were often nephrotoxic and hence the vicious cycle continues.

In terms of complications, intradialysis hypotension (IDH) is the most frequent complication observed during HD and occurs in 15- 50% of dialysis sessions²⁹. In our practice it accounted for 15.38% of cases dialysed for a number of reasons, apart from the fact that we use bicarbonate based buffering solutions. It is expectedly common amongst our diabetics with ESRD and also seen in our elderly patients.²²

Intradialysis rigors, possibly as a result of mild blood transfusion granulocyte reaction or as a result of possible pyrogen reaction possibly from water contamination, were also commonly seen during HD.

This similar trend have earlier been reported at another centre in the Nigeria³⁰, hence adequate maintenance and routine mandatory monthly microbiology/biochemical audit of dialysis water and dialysate is strongly advocated for all dialysis centres .

CONCLUSION

Challenges over the period under review still remain the long interval between patient's presentation and the need to commence dialysis. The high cost of machine maintenance services, incessant work disruption by industrial disputes and poorly developed infrastructures via unsteady supply of treated water and electricity remains a challenge. Hence there is a need for full government intervention by way of cost shared insurance and more non-governmental involvement in haemodialysis service coupled with local sourcing or increased subsidy on dialysis hardware's.

Ultimately in view of the pervading challenges in developing countries with regards to poverty and the resultant suboptimal haemodialysis delivery due to constraints in resources, there is a compelling need in the tropics for active preventive services especially in terms of more proactive health education highlighting the risks involved in the consumption of unregistered / poorly defined "herbal remedies" and the benefits of proper hygiene and lifestyle behavioural modification.

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