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The Assessment of Hemodialysis Adequacy among ESRD Patients in Ilorin using Urea Reduction Ratio

Chijioke A, Aderibigbe A, Rafiu MO, Olanrewaju TO and Makusidi AM

Renal Unit, University of Ilorin Teaching Hospital, Ilorin.

ABSTRACT

Urea Reduction Ratio (URR) is a measure of adequacy of delivered dose of dialysis expressed as a percentage reduction in blood urea level after a session of dialysis which is mathematically related to Kt/V. Although Kt/V is recommended as the best measure of dialysis adequacy, URR is the most utilized because of its simplicity with both methods having similar predictive power in terms of patient outcome.

In Nigeria, there is paucity of data on adequacy of haemodialysis and few available reports show that inadequate dialysis is common. Since inadequate dialysis contributes significantly to poor patient survival, a one year retrospective appraisal of patients on maintenance haemodialysis at University of Ilorin

Teaching Hospital (UITH), Ilorin was carried out to determine the adequacy of dialysis and patient outcome.

All patients with end stage renal disease (ESRD) and were regular on at least twice weekly haemodialysis of 4 hours per session were included in the study. Data was analyzed with SPSS version 16.

Twelve out of 33 patients (36.4%) with ESRD on maintenance haemodialysis met the inclusion criteria. The mean age of the patients was 48.25 ± 17.85 with male to female ratio of 2:1. Majority were retired civil servants (33.3%), followed by serving civil servants (25.0%) and students (16.7%). The etiological factors of ESRD were Hypertensive nephrosclerosis (41.7%), CGN (33.3%), Diabetic nephropathy (25.0%) and chronic allograft dysfunction (8.3%). Mean URR was 41.83 ± 16.30% and overall mortality was 66.7%. The factors that contributed to inadequate dialysis and poor outcome were late presentation, uremic bleeding, septicemia, repeated blood transfusions and inability to sustain thrice weekly haemodialysis due to poor finances.

In conclusion, inadequate haemodialysis is common in our patients and is associated with high mortality. Major contributory factors to poor outcome were ignorance and poor socioeconomic status There is need to intensify awareness program on early diagnosis of Chronic Kidney Disease. We recommend some form of renal replacement subsidy in the current National Health Insurance Scheme of the Federal Government.

Keywords: *ESRD, Haemodialysis adequacy, Ilorin, Nigeria*

INTRODUCTION

Dialysis adequacy refers to the delivery of a dose of dialysis considered high enough to promote an optimal long term outcome [1]. An asymptomatic, physically active, well nourished, well haemoglobinized and normotensive patient are recognizing indices for assessing adequate dialysis from clinical perspective[2] [2]. Urea Reduction Ratio (URR) as a method of measuring adequate dialysis that correlate with patient outcome was first popularized by Lowrie and Lew in 1991[1]. It is a measure of adequacy of

Corresponding author : Dr. Rafiu M.O, Renal Unit, University of Ilorin Teaching Hospital, Ilorin.

delivered dose of dialysis expressed as a percentage reduction in blood urea level after a session of dialysis. It is mathematically related to Kt/V and both can be derived from each other with some amount of precision by various equations or a normogram[3].

Although Kt/V is recommended as the best measure of dialysis adequacy, URR is the most utilized because of its simplicity and the fact that it has similar predictive power to Kt/V in terms of patient outcome [4,5]. A URR of 65% which corresponds with Kt/V of 1.2 is the minimum acceptable dose in the standard thrice weekly hemodialysis if the residual kidney function is < 2ml/min/1.73m^{3}[3,6]. However, in patients with better residual renal function or those having more than thrice weekly dialysis, a lower value of URR may be acceptable[6]. The delivery of adequate dose of dialysis is an efficient way of reducing mortality of patients on maintenance hemodialysis[4]. A comparison of delivered dose with expected dose of dialysis can be used to analyze dialysis treatment, dialyzer clearance, troubleshooting and quality control activities[2].

There is no unified data system for recording and analyzing URR from various dialysis units in tropical developing countries in contracts to developed world. In Europe and America, they have European Renal Registry (ERAR) and the United State Renal Data system (USRDS) for recording, analyzing and publishing data on URR values. The few available reports showed that inadequate dialysis is common and patients' survival is very poor.[7,8] It was for this reason that a one year retrospective appraisal of patients on maintenance haemodialysis at University of Ilorin Teaching Hospital Ilorin was carried out to determine adequacy of delivered dose of dialysis and patient outcome

PATIENTS AND METHODS

All case files of patients that met the criteria for ESRD and had haemodialysis between January and December 2009 were retrieved from the records. These are patients in stage five chronic kidney disease with GFR persistently below 15mls/min/ 1.73m^{2} for three months and/or already on dialysis[9,10]. Patients that had regular 4 hourly session of dialysis for at least twice a week in two consecutive months were included in the study. Information on duration of illness before presentation, presence of uraemic bleeding, septiceamic illness, number of units of blood transfusion and socio economic status of the patients were obtained from the records. Vascular access was by femoral cannulation(66.7%), internal jugular cannulation(25%), and arterovenous fistular(8.3%).

The blood flow rate for the dialysis sessions was between 200 to 300ml/min while dialysate flow rate was 500ml for all patients. The ultrafiltration coefficient (Kuf) of dialyzers were between 7.9 to 13.7ml/hr/mmHg. The pre and post dialysis blood samples were taken at each index hemodialysis session. Predialysis blood sample was taken before commencement of each dialysis session. In patients with access catheter in-situ, 5mls of blood sample was initially taken from the arterial catheter and discarded before another 5mls syringe was used to take sample for estimation of predialysis blood urea nitrogen to avoid the dilution effect of saline and heparin.

At the end of each dialysis session, the dialysate flow is shut off for 3 minutes while the blood flow went at full tilt. The blood sample for post dialysis urea estimation was taken about 3 minutes after dialysis from the arterial sampling port to remove the effect of access recirculation. The urea reduction ratio (URR) for each index dialysis session was calculated for each patient using the formula i.e. [1- U_{post}/ U_{pre}] x 100, where $U_{pre=}$predialysis blood urea concentration and U_{post}=post dialysis blood urea concentration. The means of all the predialysis and post dialysis blood urea of the patients were calculated from which the mean URR of all the dialysis session was derived. Data was analyzed using SPSS version 16. The frequency of nominal variables and the mean ± standard deviation of numerical variable were generated.

RESULTS

Twelve out of 33 patients (36%) with ESRD met the inclusion criteria. These 12 patients had a total of 110 hemodialysis sections during the study period. The mean age of the patients was 48.25 ± 17.85 with male to female ratio of 2:1. Four (33.3%) of these patient were retired civil servants, 3 (25.0%) were serving civil servants, two (16.7%) were students, the remaining three were each, a legal practitioner, a trader and a clergy. The etiological factors of ESRD were Hypertensive nephrosclerosis in 5 (41.7%) of the patients, CGN in 4 (33.3%), Diabetic nephropathy in 2 (16.7%), and Chronic allograft dysfunction in 1 (8.3%). None of the patients was able to sustain

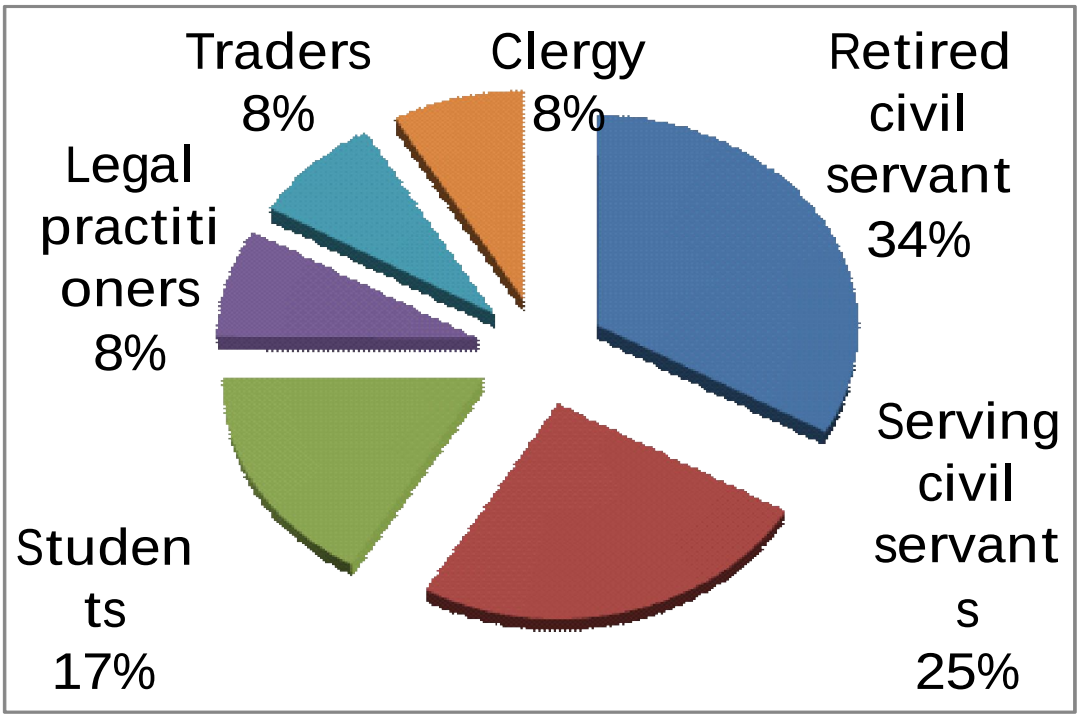

Fig 1: Occupational distribution of patients

thrice weekly hemodialysis sessions. Mean pre-dialysis and post dialysis urea were 25.29 ± 11.87 mmol/l and 14.78 ± 8.10mmol/l respectively. The mean URR was 41.83 ± 16.30% and overall mortality was 66.7%.

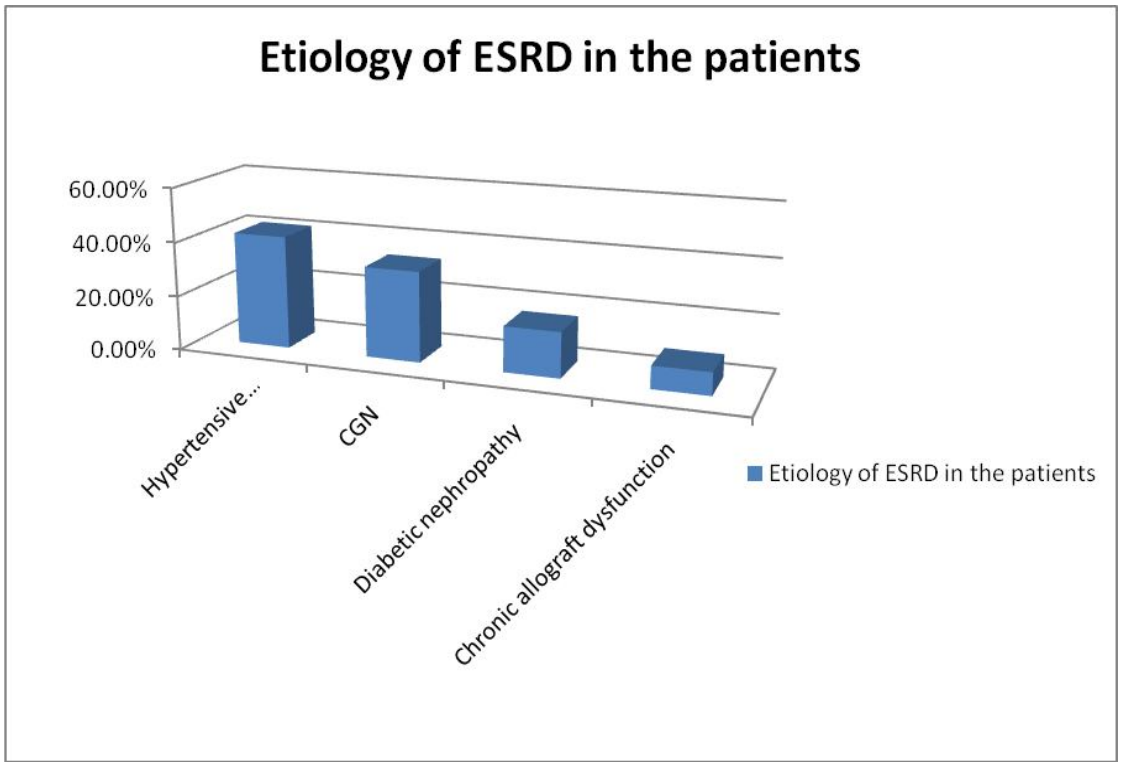

Fig 2: Etiology of ESRD in the patients

DISCUSSION

The mean URR of 41.83% in this study is clearly below the KDOQI 2006 recommendation[6]. Study from developed countries have alluded to the fact that dialysis is inadequate in most patients receiving haemodialysis[11-13]. Inadequate haemodialysis not only result in poor patient survival, but also leads to anaemia, malnutrition, functional impairment and frequent hospitalization that culminate in an increased health care cost[14-17]. The factors that appear to have contributed to inadequate dialysis and poor outcome in our patient were late presentation, uremic bleeding, septicemia, repeated blood transfusion and inability to sustain recommended thrice weekly haemodialysis due to poor finances.

Our study showed that most common cause of ESRD in patients on maintenance haemodialysis in Ilorin was systemic hypertension followed by CGN and Diabetic Nephropathy. An earlier study in this center which looked into the causes of ESRD found CGN to be the commonest cause in our environment[18]. The disparity is probably due to inclusion criteria utilized in this present study. These patients who could afford haemodialysis constituted about 20% of the general pool of ESRD in our unit.

The observed difference may also be a reflection of the fact that majority of the patients with CGN are of lower socioeconomic status and therefore could not afford maintenance haemodialysis. Majority of the patients in this study were retired civil servants, followed by serving civil servants. Retired civil servants are more likely to have financial support from their children, while those still in service may get support from their employers. This could explain why these patients were able to afford hemodialysis at least for a while. The mean age of our study subjects is similar to that of Nepalese patients undergoing maintenance haemodialysis in a cross-sectional study[19]. However, the mean URR of the patients in Nepal study was 65.3% with Kt/V of 0.99 [19]. Although the URR in the Nepal is better than our finding of 41.8%, their Kt/V of 0.99 still demonstrated inadequate dialysis. This shows that Kt/V is actually a better reflection of dialysis adequacy because of the adjustment for ultrafiltration, urea generation and urea rebound[20]. In a related study from another center in Nigeria, Agaba *et al*[7] found a mean URR of 45.3 ± 8.6% which is in accord with our mean URR value. The similarity in both studies may be due to identical vascular access, clinical features and socioeconomic characteristics of these patients. The cost of haemodialysis was borne by patients and their relatives in both studies because the National Health Insurance Scheme in Nigeria does not include cost of haemodialysis. This is particularly disturbing as most Nigerian can hardly afford the cost of dialysis. In addition to under dialysis, chronic inflammation measured by C- reactive protein and malnutrition determined by serum albumin, prealbumin and body mass index are common in Nigerian patient on chronic hemodialysis[8]. Low serum albumin concentration has been identified as a predictor of mortality in patients on maintenance hemodialysis[21]. In our study, effect of nutritional status and chronic inflammation were not assessed because most of the patients did not have the necessary parameters that could be used in this retrospective analysis. This calls for detailed prospective studies on nutritional status and chronic inflammatory changes among our chronic kidney failure patients on maintenance hemodialysis.

CONCLUSION

Our study showed that inadequate hemodialysis is common and is associated with high mortality rate. Major contributory factors to poor outcome were ignorance, late presentation and poor socioeconomic status of these patients. There is need to intensify awareness programs on early diagnosis of chronic kidney disease. We recommend incorporation of renal replacement therapy subsidy into the current National Health Insurance Scheme of the Federal Government.

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