Saudi J Kidney Dis Transpl 2014;25(2):438-442

Saudi Journal of Kidney Diseases and Transplantation

Renal Data from the Arab World

Assessment of Adequacy of Hemodialysis Dose at a Palestinian Hospital

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ABSTRACT. Adequacy of hemodialysis improves patient survival, quality of life and biochemical outcomes and minimizes disease complications and hospitalizations. This study was an observational cross-sectional study that was conducted in July 2012. Blood tests, weight and blood pressure were measured before and after hemodialysis. Single-pool Kt/V and urea reduction ratio (URR) were calculated. The targets based on the National Kidney Foundation Disease Outcomes Quality Initiative (KDOQI) Clinical Practice Guidelines were Kt/V ≥1.2 and URR ≥65%. Of the 64 patients, 41 (64.1%) were males. The mean age of the patients was 58.13 ± 17.2 years. The mean body mass index (BMI) was 25.04 ± 5.01 kg/m^2. The mean Kt/V and URR were 1.06 ± 0.05 and 54.4 ± 19.3, respectively. There was no significant difference between men and women (1.06 ± 0.47 versus 1.04 ± 0.55, *P* = 0.863) and (54.7 ± 19.59 versus 53.81 ± 19.17, *P* = 0.296). Only 25 (39.1%) patients achieved the Kt/V goal and only 22 (34.4%) had target URR, and there was no significant association between hemodialysis adequacy and any of the variables such as sex, age, presence of chronic diseases or BMI. Serum potassium levels post-dialysis were significantly lower in patients who reached the target Kt/V (mean = 3.44 ± 0.48 versus 3.88 ± 0.48, *P* = 0.001). Most patients were inadequately dialyzed and a large percentage of the patients did not attain the targets. Attempts to achieve the desired goals are necessary. It is important to calculate Kt/V or URR and individualize the dialysis doses for each patient.

Introduction

Adequacy of hemodialysis is very important as it can improve patient survival,[1,2] quality of life, biochemical outcomes[3] and minimize disease complications and hospitalizations.[4] Individualizing the hemodialysis prescription based on monthly assessment of single-pool Kt/V would be a useful and practical tool to provide a safe and cost-effective hemodialysis treatment. The National Kidney Foundation Disease Outcomes Quality Initiative (KDOQI) guidelines recommend that the minimum adequate dose of hemodialysis given three times per week to patients with Kr less than 2 mL/min/1.73 m^2 should be a single-pool Kt/V of 1.2 per dialysis. For treatment times less than 5

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h, an alternative minimum dose is a urea reduction ratio (URR) of 65%. Assessment of hemodialysis adequacy is mathematically measured by the Kt/V ratio, where K is the dialyzer clearance of urea, t is the dialysis time and V is the volume of distribution of urea.[5] It has been shown that patients with target Kt/V or URR live longer and suffer less complications.[5-7]

Individualized calculation of hemodialysis dose enables the nephrologist and the clinical pharmacist to define those patients with inadequate dialysis who need collaboration of efforts to minimize disease burden. Assessment of the hemodialysis adequacy is one of the key factors in evaluating the health service system. However, even in European countries, many dialysis centers miss the calculation of Kt/V.[2] Dialysis adequacy is an important determinant of patient outcome and is therefore an important clinical performance indicator. This would provide a good background for effective future planning by healthcare authorities. This study aimed to evaluate the hemodialysis adequacy and extent of achieving some KDOQI targets among the patients with end-stage renal disease (ESRD) on hemodialysis in patients attending the Thabet Hospital, one of the Palestinian hospitals having 11 hemodialysis machines. Last year, the mortality rate among hemodialysis patients was 8.1% in this hospital. The reported mortality rate at other Palestinian hospitals in the West Bank ranged from 3.1% to 73.3%.[8] These values show that studies related to hemodialysis are highly required in our country to optimize the service provided.

Materials and Methods

This was an observational cross-sectional study that was conducted in July 2012. The studied population consisted of all the 64 patients who were on hemodialysis in the hospital. Informed consent was obtained from all the patients.

Data collection

Blood samples were collected from the arterial line immediately before a mid-week single dialysis session before heparin administration in a fasting state and again after the end of the hemodialysis session. The following were measured in blood samples: Hemoglobin, blood urea nitrogen level (enzymatic method, UV-kinetic) and serum electrolytes. Data on demographic and clinical characteristics and measurements of systolic and diastolic blood pressure before and after the dialysis sessions were carried out. The measured height and weight were used to calculate body mass index (BMI). The patients were weighed pre- and post-dialysis to calculate the weight reduction ratio. Single-pool Kt/V and URR were calculated according to the Daugirdas II equation. The targets for the measures were based on the KDOQI Clinical Practice Guidelines, and they were Kt/V ≥ 1.2, URR ≥ 65%[5] and pre-dialysis and post-dialysis blood pressure goals of <140/90 mm Hg and <130/80 mm Hg, respectively.[9]

Statistical Analysis

Statistical analyses were performed using SPSS version 16 (SPSS, Chicago, IL, USA). Means ± standard deviation were computed for continuous data. Frequencies and percentages were calculated for categorical variables. Means were compared using Student's t-test. Categorical variables were compared using the Chi-squared test. All *P*-values were two-sided and $P < 0.05$ was considered statistically significant.

Results

Of the 64 patients, 41 (64.1%) were males. The mean age of the patients was 58.13 ± 17.2 years (range 12–95 years). The mean BMI was 25.04 ± 5.01 (14.7–39.1) kg/m^2, 25 (39.1%) patients had both diabetes mellitus and hypertension and seven (10.9%) patients were hepatitis B positive. Dialysis sessions were three times per week for all patients. The mean duration of hemodialysis sessions was 238.36 ± 12.56 (range 210–265) min. The mean Kt/V and URR for the study patients were 1.06 ± 0.05 and 54.4 ± 19.3, respectively, Pearson cor-

Table 1. Patients' characteristics and their laboratory data.

Characteristic	Mean ± SD (range)
Age (years)	58.13 ± 17.2 (12–95)
Body mass index (kg/m^2)	25.04 ± 5.01 (14.7–39.1)
Pre-dialysis body weight (kg)	70.27 ± 15.7 (39.6–101.4)
Post-dialysis body weight (kg)	67.49 ± 15.17 (37.8–96.6)
Pre-dialysis serum potassium (mEq`/L)	5.52 ± 0.81 (4–7)
Post-dialysis serum potassium (mEq/L)	3.71 ± 0.53 (2–5)
Pre-dialysis serum sodium (mEq/L)	135.0 ± 16.6 (137–145)
Post-dialysis serum sodium (mEq/L)	138.3 ± 2.8 (131–143)
Pre-dialysis serum calcium	4.5 ± 0.49 (3–6)
Post-dialysis serum calcium	4.96 ± 0.38 (4–6)
Kt/V	1.06 ± 0.05
URR %	54.4 ± 19.3
Time period of dialysis, min	238.36 ± 12.57 (210–265)

Kt/V: where K is the dialyzer clearance of urea, t is the dialysis time and V is the volume of distribution of urea, URR %: urea reduction ratio

relation between Kt/V and URR was 0.951 (P <0.0001). There was no significant difference between men and women for Kt/V and URR (1.06 ± 0.47 versus 1.04 ± 0.55, P = 0.863 and (54.7 ± 19.59 versus 53.81 ± 19.17, P = 0.296). Only 25 (39.1%) patients achieved the Kt/V goal and only 22 (34.4%) patients had target URR, and there was no significant association between hemodialysis adequacy and any of the variables such as sex, age, presence of chronic diseases or BMI. Serum potassium levels post-dialysis were significantly lower in patients who reached the target Kt/V (mean = 3.44 ± 0.48 versus 3.88 ± 0.48, P = 0.001). Patients who attained pre-dialysis blood pressure goals of <140/90 mm Hg were 33 (51.6%) and postdialysis goal of <130/80 mm Hg were 31 (48.4%). Table 1 shows patients' characteristics and laboratory data.

Discussion

These days, hemodialysis is the main therapy available for patients with end-stage renal failure. Adequate dialysis is the cornerstone for the well being of each patient. Achievement of the global goals is of paramount importance to improve quality of life, decrease healthcare costs and also decrease morbidity and mortality rates in hemodialysis patients.[1-5] The mean Kt/V and URR for the study patients were 1.06 ± 0.05 and 54.4 ± 19.3, respectively. Only 39.1% of all patients achieved the Kt/V goal and only 34.4% had target URR. The study revealed similar findings to those carried out in other countries such as Iran, where the mean single-pool Kt/V and URR in the studied population was 1.17 ± 0.4 and 61 ± 11.8%, respectively. The single-pool Kt/V was less than 1.2 in 56.7% of the patients. Also, URR was less than 65% in 65.2% of the patients.[5] In a study from Sri Lanka, it was shown that only 39 (28.2%) out of 138 dialysis sessions in 31 patients had a Kt/V value ≥1.2.[10] However, results from the United Kingdom and other countries of Europe were much better. The proportion of patients in the UK who met the UK clinical practice guideline for URR (>65%) increased from 56% in 1998 to 86% in 2010.[11] In Europe in 2004, the mean delivered dose of hemodialysis as measured by normalized urea clearance (Kt/V) varied from 1.28 to 1.50.[12]

In this study, the mean Kt/V and URR were not different between men and women (1.06 ± 0.47 versus 1.04 ± 0.55, P = 0.863). In other studies, these values were significantly lower in men than inwomen.[4,7,13] The mean BMI was 25.04 ± 5.01 (14.7–39.1) kg/m^2. A lower BMI was associated with higher mortality[1]; therefore, it is important to try to reach a suitable BMI.

Pre-dialysis and post-dialysis blood pressure goals were not achieved in a high percentage of patients. This may be related to inadequate

hemodialysis, inadequate antihypertensive medications or non-compliance with the restrictions of sodium and fluid intake. Hypertension confers higher cardiovascular risks in hemodialysis patients; therefore, it is very important to keep it under control.[14]

Dialysis sessions were three times per week for all patients here. This is good because dialysis sessions less than three times per week and duration less than 8 h per week has been reported to be associated with an increased risk of mortality,[7] and the Kt/V was significantly higher in those who received three dialysis sessions per week than those on two dialysis sessions per week in other studies.[15] However, one problem among our patients was the lack of individualization of the time of sessions to attain adequate targets. The cause of this was often due to the high number of patients with respect to dialysis machines and qualified number of medical staff. Thus, it is suggested that for improving outcomes in patients on hemodialysis and promotion of their quality of life, improving the Kt/V value should be achieved by increasing the number of available dialysis machines, giving longer duration for each dialysis and providing adequate vascular access.

Our results give a real-life picture from one center and cannot be generalized to all dialysis centers in the West Bank, but they can be of help in drawing attention to this issue.

According to the KDOQI recommendations, most patients were inadequately dialyzed and a large percentage of the patients did not attain the targets. Attempts to achieve the desired goals are necessary. It is important to calculate Kt/V or URR and individualize dialysis doses. We feel that a multidisciplinary treatment approach should be adopted that assures adequate dialysis having qualified and well-trained physicians, nurses, dieticians and clinical pharmacists.

Conflict of interest: None

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