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ORIGINAL ARTICLE

Estimation of Urea Reduction Ratio in Dialysis Patients Per Session and Adequacy of Dialysis

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ABSTRACT

Background: Chronic kidney disease is a condition in which the kidney is no more able to remove waste from the body. Through hemodialysis, the excess water and waste from the blood are removed such as urea and creatinine. The urea reduction ratio is a measure of the proportionate reduction in urea blood nitrogen throughout dialysis. It is an acceptable, easy and simple method globally to find dialysis adequacy that how much urea is removed from the body. Our study was aimed at assessing the targets to achieve the urea reduction ratio (URR), in chronic kidney disease patients who underwent hemodialysis.

Methods: The pre-dialysis and post-dialysis blood samples were collected from 80 hemodialysis patients. A Performa was filled, blood pressure was monitored before mid and at the end of the session, weight was monitored and ultrafiltration for the adequacy of the dialysis. The urea reduction ratio (URR) was calculated by (pre dialysis urea – post-dialysis urea) divided by pre-dialysis urea and it is expressed in percentage.

Results: The mean urea reduction rate (URR) was 74% (adequate URR is >65%). The results of the pre-dialysis and post-dialysis serum urea levels. There was a significant reduction in these parameters, thus suggesting the adequacy of the dialysis. There was the achievement of the target goal. But the inadequacy was also seen at 54.7%.

Conclusion: The targeted urea reduction ratio was achieved in the setup of Khyber teaching hospital, but for inadequacy, they need a lot of follow-up and supervision.

Keywords: Urea reduction ratio, dialysis, hemodialysis, chronic kidney disease

INTRODUCTION

Chronic kidney disease is a condition in which the kidney is no more able to remove waste from the body. Chronic kidney disease (CKD) is irreversible, moderately, and usually total loss of activity with a temporal length of event proceeds from 120 days to 12 months. Completely loss of renal activity is called End-stage renal disease (ESRD). For continuity renal replacement therapy and kidney transplant is necessary[1]. Dialysis is a procedure that removes waste products from the blood such as urea and creatinine and excess water from the body in acute renal failure and chronic renal failure patients, in the dialyzer which is also known as an artificial kidney, contains a membrane called semi-permeable membrane[2]. Dialysis is required for critically ill patients who unexpectedly lost their renal activities or for the largely firm sufferer who dissipated their renal activity forever[3]. The dialysate is a decontaminated solution of mineral ions. Urea and other unwanted products, such as potassium and phosphate, diffuse into the dialysate solution. However, concentrations of best mineral ions (e.g. sodium) are the same as those of usual plasma to restrict deficiency[4].

Urea Reduction Ratio (URR) is also marked as a simple and important indicator. The fundamental component of both indexes is blood urea, which is nearly all variables for the evaluation and approximation of hemodialysis adequacy[5]. Clinical indexes account for the additional successful procedures of dialysis: better health, better adjustment of pressure in arteries, fine accommodation of fluid equilibrium, and lack of uremic signs[6].

URR that act process about estimating adequate dialysis correspond among long-suffering outgrowth. It is a rate of the adequacy of distributes quantity of dialysis demonstrated that act a percent decrease now blood urea even afterward a sitting appropriate to dialysis. Particular accurately interconnected through Kt/V as well as one another as it may be obtained against one by one another for few numbers based on accuracy over diverse comparison either nomogram[7]. Even if Kt/V act prescribed at that time the first-rate estimation as concerns dialysis adequacy, URR act the better apply for the reason that as regards particular ease as well as the certainty a well known it gets same prognostic capability directed towards Kt/V now detail as regards patient end product[8]. The URR about sixty-five percent (65%) communicate for Kt/V about 1.2 continue to the least reasonable dosage now the regular three times in a week HD in case that balance renal function act as less than 2ml/min/1.73m. After all, now patients with superior leftover kidney function either particular to get more than thrice weekly dialysis, a lesser rate of URR might be there adequate. The transfer of satisfactory dosage for dialysis is a resourceful technique for decreasing the death ratio of patients on upkeep HD[9]. The "K-DOQI guidelines" suggest the smallest amount of single pole (sp) Kt/v about which accords to a URR of 65.0% for hemodialysis three times in seven days. Here investigation continues to accomplish by evaluating the dialysis adequacy concerning patients covered by HD[10].

To reduce either discontinue pump procedure: a. "reduce UFR into bottom, fixed least dialysate flow rate, keep blood flow to 50–100 ml/minute", as well as b. "after 20 seconds take the sample from arterial line or after 20 seconds stop blood pump and take a sample from the arterial needle after faster arterial and venous lines"[11]. If the urea reduction ratio undervalues the transfer dosage based on dialysis, here equip a freedom cause as a well-known palliative against under-treatment. A similar might be supposed based on the usual binary estimate about Kt/V, whatever along doesn't part in direction of explaining affecting "ultra-filtered volume"[12]. Particle movement acts possibly a fitter method ("than clearance") about determining dialysis. In case dialysate as well as blood movement ratio continue to remain persistent, the go head removal through the "1st hour" about a dialysis inclination acts the similar that in the very last hour. Although the blood urea engrossment act next to its high level by begin of dialysis, anyhow, particles transferring resolve as enough better through the 1sthour than during the 4th. Urea reduction ratio seizes here through the description, however for Kt/V computation, every one demolition be same despite the quantity of solute cleared[13].

One of the most basic in dialysis patients is low dialysis adequacy, kinds of vascular access play a key part in this circumstance. Therefore, in the nearby study, we proposed to estimate vascular access kind of permanent catheter, fistula, and graft in words of dialysis adequacy and to determine the most accurate kinds of vascular access in dialysis patients[14]. High death and disease rates to go HD cases accept last the same as a difficulty. Inadequate HD is solitary of the majority principal reason for mortality as well as morbidity now dialysis-dependent patients.

The inadequate prescription of HD increases the content of hospitalization, as well as the price, charged by lying to the patients[15]. Therefore, this study aims to estimate of urea reduction ratio in dialysis patients per session adequacy of dialysis.

MATERIALS AND METHODS

This prospective study was conducted for 4 months from February to May 2018 at Khyber Teaching Hospital Peshawar. A concern form was taken from the Head of the registrar of the hospital and the blood sampling was started with the permission of the Human Resource Center of the hospital. A total number of 80 dialysis patients were included in the study. The non-Probability Convenient Sampling technique was used for this study. This sample selection criterion was adopted to obtain the desired participants easily during the observation time which met the characteristics of the research subjects. All age chronic kidney disease patients who depend on dialysis were included.

This study was approved by the institutional ethical review commission and the written consent was taken in English but the verbal consent was taken in Pashto and Urdu from the entire participants. The study protocol and the use of data for the research were fully explained to the patients to get fully informed consent. The information acquired from the participants through interviewing information was filled in a Performa, by HR of the investigators. The Performa contained the name, gender, age, vascular access, address, contact number, UF goal, duration of the dialysis**,** pre and post-weight, pre-mild, and post Blood pressure.

Clinical examinations were carried out at the dialysis unit basic infection control procedure in hand hygiene and personal protective equipment PPE was adopted. During data collection following things are used gloves, gel tubes, syringes, a weight machine, and a BP set. Data were collected using standardized validated Performa.

Pre-dialysis sampling technique: The sample is taken directly from an arterial needle before starting any saline or heparin or from a central venous catheter after withdrawing at least 0.01L of blood.

Post-dialysis sampling technique: Slow/stop pump techniques: a. reduce ultrafiltration rate (UFR) to zero, set minimum dialysate flow rate, change blood flow to 50–100 ml/minute, and after 20 seconds take the sample from the arterial port or stop pump after 20 seconds and take a sample from an arterial needle or arterial port after clamping arterial and venous lines.

All collected data were entered and analyzed through Microsoft Excel 2016. The mean and standard deviation were noted and proportions were determined in percentages.

RESULTS

A total of 80 hemodialysis patients were included of which 53.8% (n=43) patients were male and 46.2% (n=37) were female patients (Table 1). The recruited hemodialysis patients were distributed into different groups based on age. The highest number of hemodialysis patients were found in age groups of 41-50 years and 51-60 years with a proportion of 21.3% in each age group, followed by the age group 21-30 years with 18.8%. 15% of patients were found in the age group 31-40 years. The least number of hemodialysis patients were determined in the age group 10-20 years, 61-70 years, and 71-80 years with proportions of 11.2%, 11.2%, and 1.2% (Table 2).

Different types of Angio-access were used in hemodialysis patients including arteriovenous fistula, double lumen catheter, intra-jugular access, and reverse and femoral double lumen catheter. Arteriovenous fistula was used in majority patients with 56.2% (n=45), followed by femoral double lumen catheter in 15% (n=12), double lumen catheter in 12.5% (n=10), and intra-jugular angioaccess were used in 10% (n=8) hemodialysis patients. While the least were reverse double lumen catheters in 6.3% (n=5) were used in hemodialysis patients (Table 3). Blood flow rate in hemodialysis patients were also determined in which 300ml/min major blood flow were noted in 43.7% (n=35), followed by 250ml/min were noted in 28.8% (n=23), 200ml/min were found in 18.7% (n=15), 350ml/min obtained in 6.3% (n=5), and 400ml/min noted in 2.5% (n=2) hemodialysis patients (Table 4).

Table 1: Gender-based distribution of hemodialysis patients

Gender of patients	Male	Female	Total
Number of patients	43	37	80

Table 2: Age-based distribution of hemodialysis patients

Age (Years) of Patients	Number of Patients % (n)
10-20	11.2 (9)
21-30	18.8 (15)
31-40	15.0 (12)
41-50	21.3 (17)
51-60	21.3 (17)
61-70	11.2 (09)
71-80	01.2 (01)
Total patients	100 (80)

Table 3: Proportion of Angioaccess of Hemodialysis patients

Angioaccess for HD	Number of patients % (n)
AVF	56.2 (45)
DLC	12.5 (10)
Reverse DLC	06.3 (05)
Femoral DLC	15.0 (12)
Intra jugular	10.0 (08)

AVF: Arteriovenous Fistula; DLC: double lumen catheter; HD: Hemodialysis

Table 4: Blood flow rate in hemodialysis patients

Blood flow rate	Number of patients % (n)
200 ml\min	18.7 (15)
250 ml\min	28.8 (23)
300 ml\min	43.7 (35)
350 ml\min	06.3 (05)
400 ml\min	02.5 (02)

Table 5: The size of dialyzer used for different hemodialysis procedures

Dialyzer size	Number of patients % (n)
F4	1.2 (n=01)
F6	48.8 (n=39)
F8	50 (n=40)

F4: Fresenius 4; F6: Fresenius 6; F8: Fresenius 8

Table 6: The dialyzer member used for different hemodialysis procedures

Dialyzer membrane	Number of patients % (n)
Fresenius polysulfone	71.2 (n=57)
Fresenius Helix one	28.8 (n=23)

Table 7: Duration of procedure of hemodialysis

Duration of procedure	Number of patients % (n)
2hrs	05 (n=04)
3hrs	95 (n=76)

Table 8: Urea reduction ratio in hemodialysis patients

Urea Reduction Ratio	Number of patients % (n)
41 to 50 %	10.0 (n=08)
51 to 60 %	22.5 (n=18)
61 to 70 %	43.8 (n=35)
71 to 80 %	13.8 (n=11)
81 to 90 %	01.2 (n=01)
91 to 100 %	08.8 (n=07)

Different sizes of dialyzers were used for the hemodialysis procedure. Fresenius 4 (F4) type were used in more with percentage of 50% (n=40), followed by Fresenious 6 (F6) type having 48.8% (n=39). Whereas the least was used a Fresenious 8 (F8) type having 1.2% (n=1) (Table 5). Two types of dialyzer members were used for the hemodialysis process including

Fresenious polysulfone (71.2%) and Fresenious Helix (28.8%) (Table 6).

The duration of the hemodialysis procedure was also determined. The normal duration was noted as 3 hours (95%) and 2 hours (5%) (Table 7). Urea reduction ratio was also obtained in hemodialysis patients. The highest proportion was the urea reduction ratio obtained in 61-70% in 35 hemodialysis patients, followed by a 51-60% urea reduction ratio noted in 18 hemodialysis patients. Urea reduction ratio obtained of 71-80%, 41-50%, 91-100%, and 81-90% in 11, 08, 07, and 01 hemodialysis patients respectively (Table 8).

DISCUSSION

Hemodialysis is regarded as the most effective treatment for people with chronic renal disease in order to prolong survival. Basic characteristics including male and female sex, the length of the dialysis treatment, rising age, the length of the dialysis treatment, and the existence of co-morbidity are included as predictors, as previously reported. Additionally, dietary and inflammatory variables as well as characteristics connected to dialysis are considered predictors. The urea reduction ratio is employed in this prospective research as a gauge of adequate dialysis. In this study, the urea reduction ratio was 65 percent in accordance with KDOQI recommendations for hemodialysis patients.

The outcome shows that the mean URR ranged from 54.7 to 70.0. Whereas 15% of patients have a urea reduction ratio that is 54.7% below the advised value and 23% of patients have attained the goal urea reduction ratio (URR), which is 65 percent fulfilling the criteria of KDOQI guidelines. 4 percent of patients had urea reduction ratios greater than 70%. 4 percent of patients receive the superior dialysis therapy, which is in the range of 98.

The effectiveness of hemodialysis is influenced by a number of variables, including age, angioaccess, blood flow, dialyzer size, membrane permeability, and co-morbid conditions[16]. This problem might be attributed to angioaccess problems with recirculation, patient body surface area, insufficient machine evaluation, poor blood flow rate, hypotension, and hypertension. Adequacy is also influenced by socioeconomic level and nutritional status[17]. The dietary state of these patients is a significant predictive factor and has the potential to be used as a prognostic index during medium- to long-term dialysis. The estimated muscle mass based on percent CGR is another independent prognostic factor. Malnutrition is a complex condition that is made worse in dialysis patients by uremic toxin buildup, a weak inflammatory response brought on by poor membrane biocompatibility, anorexia, and the loss of glucose, amino acids, and other vital nutrients during dialysis[18].

The mean urea reduction ratio (URR) in Nepal was 65.3% in 2009[19], whereas analogous research on the URR in Nigeria found values ranging to 45.3%[20]. The similarities between the two studies may be attributable to the same vascular access. In relation to these research, the Khyber Teaching Hospital's dialysis setup demonstrates the sufficiency of the procedure. Some reports are not sufficient. These are also brought on by fistula failure, low venous pressure in DLC, femoral line infections, or blood circulation in it. In contrast to femoral and reverse double lumen catheter, arteriovenous fistula and double lumen catheter demonstrate sufficient dialysis in this investigation.

This research had 83 patients receiving a regular dosage of hemodialysis; about 55 of the patients received AVF, 20 received DLC, and 5 received reverse DLC, in which the male to female urea reduction ratio was greater. The subpar dialysis may be brought on by an underlying illness or a consequence from dialysis. Due to the acute intradialytic hypotension, some of the patient's dialysis has been discontinued. Some of the patients were picked up earlier than expected. However, the machines' loss of conductivity and the water supply system's significant circuit failures ahead of schedule posed the biggest issues. During therapy, some people get hypertension; the cause is uncertain. Additionally, the machine's shortcomings prevent it from achieving the intended result, and the clearance is insufficient. Or the clearance is not completed and the urea creatinine recirculates back into the circulation due to a mechanical deficiency in the dialyzer membrane.

Even if being older than 70 years old is one of the contributing variables, some individuals maintain a blood flow of less than 250 ml per minute. The patient's socioeconomic situation and nutritional state, however, are the most important factors. The other problem is that weight is not properly assessed before and after dialysis, and blood pressure is not measured halfway through or at the end of the session. The staff is not paying enough attention to the patient as a result of patients eating during dialysis treatments, which consequently causes intra-dialytic hypotension. It is crucial to choose highly biocompatible membranes and purified dialysate to reduce inflammatory reactions. A number of recommendations forbid the use of dialysis membranes that encourage leukocytosis, an inflammatory response, and fast complement activation.

The net result of this study is limited to Khyber teaching hospital patients only not to the entire city of Peshawar or either location. Because the study was prospective, the results should only be used when talking about the center from which data was collected. These results should only apply to the Khyber teaching hospital of Peshawar. The other limitation of this study was the exclusion of patients and the age of CKD. The other limitation in this study was male to female. The patients for this study contain an equal number of males and females the association of inadequacy and cause should remain the same for both genders and the probability of CKD hem study patients remain the same in both sexes.

CONCLUSION

Our study shows better dialysis treatment but up to some extent they are inadequate in chronic kidney disease patients admitted to Khyber teaching hospital of KP. The major contributing factors were recirculation co-morbid factors, poor nutritional status, cost, angioaccess, and blood flow. Therefore advanced research and utilization of a new treatment approach are very important. The staff should be aware of all factors of inadequacy and should be educated about recirculation, blood flow, machine management, and complication during dialysis. The staff should give proper attention to the patient and the dialysis should be finished at its proper time. The periodic assessment of the patient in the dialysis unit should be performed for those who receive inadequate dialysis is very important.

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