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EFFICACY OF HEMODIALYSIS DEPEND UPON KT/V IN DIYALA PROVINCE-IRAQ

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ABSTRACT

Back ground: kidney disease is ranked_3rd amongst life threatening disease in world, after cancer and heart disease, about 200000 people goes to end stage renal failure yearly in the world while the million people are affected annually with non fatal kidney disease, **Patients & method:** data taken from the 70 patients admitted to the renal unit &medical department unit of Baqubah teaching Hospital "45 were male and 25 were female.. this Study conductbetween 28 septmeber 2014 to 15th march 2015. **Objective:** for determining the adequacy of dialysis by depends on the Kt/V method. **Results:** in our study I take 70 patient of chronic renal failure (CRF) collected (45 were male& 25 were female) for determining the adequacy of dialysis by depends on the Kt/V methodthere was 41 people reach the target of urea clearance of Kt/V during online measure of dialysis there total percentage is (58.57%) from total 70 patient.

KEYWORD: efficacy, hemodiyalysis, Kt/v.

INTRODUCTION

Chronic renal failure is a progressive loss in function over aperoid of months to years, and usually become symptomatic when the GFR is less than 10 mL/min.[1] The most common cause of death in people with chronic kidney disease is cardiovascular disease rather than renal failure.[2] Kidney diseases rank 3rd amongst life threatening disease, after cancer and heart disease.[3] The common Causes of Chronic Renal Failure; 1- Diabetic nephropathy. 2- Hypertensivenephrosclerosis. *3*- Glomerulonephritis. *4*- Renovascular disease (ischemic nephropathy). *5*- Polycystic kidney disease. *6*- Reflux nephropathy and other congenital renal diseases. *7*- Interstitial nephritis, including analgesic nephropathy. *8*- HIV-associated nephropathy. *9*-Transplant allograft failure (“chronic rejection”).[2] the patient requires renal replacement therapy which may involve a form of dialysis but ideally constitutes a kidney transplantin united state 35,000 death are attributed yearly due disease. The rate of kidney disease mortality in united states has increased by 52% in past 16 years and continues to be higher in blacks than whites.[4]

so all patients with CRF on dialysis should be checking to assess the efficacy of dialysis — The National Cooperative Dialysis Study (NCDS) established that the timed average urea concentration and the protein catabolic rate (PCR) were important determinants of morbidity and mortality in hemodialysis patients.[5,6] In particular, well-nourished patients with a more intensive dialysis prescription and a lower timed average BUN had a better outcome. In a patient with little or no urine output, the PCR (in g/day) is equal to the sum of the dialysis and stool losses of urea, protein, and amino acids. These losses (the PCR) are roughly equal to protein intake when a patient is in a steady state with a relatively constant predialysis BUN.Gotch later used a mechanistic analysis of these data and showed that the Kt/V of urea was an important measure of clinical outcome.[7] Urea was chosen by the NCDS as the clearance marker for the Kt/V since it is a reflection both of dietary protein intake and of the efficiency of removal of small uremic toxinsIndividualizing the hemodialysis prescription to a particular patient's needs using Kt/V can be a useful tool in providing a safe and cost-effective dialysis treatment. This can be accomplished with **urea kinetic modeling**, which allows for variations in dialysis time, use of larger, high efficiency, high-flux dialyzers, and optimization of dietary protein need. Urea kinetic modeling is a method for verifying that the amount of dialysis prescribed (the prescribed Kt/V) equals the amount of dialysis delivered (the effective Kt/V). Kinetic modeling also quantifies the amount of urea generated, which is a marker of the protein catabolic rate and therefore of protein intake.

DEFINITION AND CALCULATION OF KT/V

In medicine, *Kt/V* is a number used to quantify hemodialysis and peritoneal dialysis treatment adequacy.

- *K* - dialyzer clearance of urea.
- *t* - dialysis time.
- *V* - volume of distribution of urea, approximately equal to patient's total body water.

K, obtained from the manufacturer in mL/min, and periodically measured and verified by the dialysis team) multiplied by the duration of the dialysis treatment (**t**, in minutes) divided by the volume of distribution of urea in the body **V**, in mL), which is approximately equal to the total body water. The correction of total urea removal (Kt) for volume of distribution is important because, in a large patient, a given degree of urea loss represents a lower rate of removal of the total body burden of urea (and presumably of other small uremic toxins).

As stated in the 2006 K/DOQI guidelines, the preferred method for measurement of the dialysis dose is by formal kinetic urea modeling.[8] The different methods that can be used to calculate this parameter.

Computer models(that's we choose for search)— The perception that calculation of the Kt/V requires the use of advanced mathematics had retarded its acceptance and use. However, computer software packages can be purchased separately or as an integral component of the dialysis machine.

When supplied with simple clinical information (predialysis and postdialysis weights, ultrafiltration volume, hematocrit, and predialysis and postdialysis BUN), computer programs will perform the necessary computations and print the Kt/V, PCR, and other data in a readable format that can be used to alter the dialysis prescription if necessary. Furthermore, current hemodialysis machines have built-in computers that gather and store clinical data during dialysis (blood pressure, blood flow rate, dialysis flow rate, nursing entries of body weight, etc). These data becomes the basis of the urea modeling program.

Statistical models— If a computer modeling program is not available, a simple approach that achieves nearly the same results can be obtained with a hand held calculator and a few simple equations. The central and most important measurement for these models is the ratio of the postdialysis to predialysis BUN; more complex models add the refinements of accounting for urea generated during the dialysis procedure and for dialysis-induced changes in total body water. Both urea generation and fluid removal during dialysis increase the postdialysis BUN. As a result, models that ignore urea generation and volume changes yield a lower value for Kt/V, since it appears that dialysis has been less efficient.

By comparison, a postdialysis urea sample that reflects the equilibration of muscle and blood urea is called an equilibrated sample, representing the blood and muscle cell pool of urea within the body (eg, the double pool of urea). Given that the urea concentration measured with the equilibrated sample is higher than that observed in the nonequilibrated sample, the equilibrated, double pool Kt/V is lower than the nonequilibrated, single pool Kt/V. This difference is approximately 0.21 for the usual range of delivered doses of hemodialysis[9], and decreases with longer hemodialysis treatment times (t).

Continuous peritoneal dialysis is an equilibrated condition; however, most studies of hemodialysis patients utilize single pool, nonequilibrated Kt/V. Unless otherwise stated, the Kt/V referred to herein is the single-pool, nonequilibrated value.

The following formula and accompanying nomogram has little systematic error for Kt/V values between 0.7 and 2.0, a range that covers the currently recommended Kt/V goals[10,11]: (Eq. 1) Kt/V = -ln (R-0.03)+[(4-3.5R)x(UF÷W)]

Where UF is the ultrafiltration volume in liters, W is the postdialysis weight in kg, and R is the ratio of the postdialysis to predialysis BUN. This formula also appears to be valid in children, including those less than 30 kg in weight.[12] A calculator capable of performing natural logarithms is required to determine the Kt/V.

The formula for the Kt/V in the following calculator also takes the length of the dialysis session into consideration (calculator 1).

Urea reduction ratio— A simpler model uses the urea reduction ratio (URR).
(Eq. 2) URR = (1-[postdialysis BUN÷predialysis BUN])

Thus, the URR is 0.6 if the postdialysis BUN is 40 percent that of the predialysis value. Other investigators have used the percent reduction in urea (PRU), which involves the same calculation as the URR except that the result is multiplied by 100 to be expressed as a percentage.

Several different equations have been proposed to estimate the Kt/V from the PRU.[13,14]
Kt/V = (0.026xPRU)-0.460
Kt/V = (0.024xPRU)-0.276

As an example, a postdialysis BUN that is 40 percent of the predialysis value corresponds to a PRU of 60 percent and aKt/V of 1.10 and 1.16, respectively.

Because of its ease of calculation, the URR is frequently utilized in epidemiologic studies. One study evaluated the correlation between various demographic characteristics and a URR of less than 65 percent, a hemodialysis dose that is less than the currently recommended minimum amount[15] Among all variables analyzed, heavy patients (as defined by body weight in the heaviest quartile) were those most likely to receive inadequate dialysis (odds ratio of 6.1).

These equations, although reasonably accurate, are not a substitute for the more complete formula noted above in Equation 1[16,18] Although the URR is useful as an epidemiologic tool, its efficacy in individual patients is more limited because of a relatively broad range of Kt/V that may be seen at a given URR. One study found that a median URR of 0.62 was associated with a median Kt/V of 1.12.[17] However, Kt/V values below 1.0 (indicating underdialysis) and above 1.30 (indicating adequate dialysis) were each seen in 10 percent of cases with this URR.

This variability is due in part to urea removal with ultrafiltration, which is not considered in the URR. A large ultrafiltration requirement alone can raise the Kt/V by 0.2[17] Formulas have been published that attempt to correct for this and other effects.[19]

Nevertheless, as previously mentioned, there are other advantages to using formula kinetic modeling and not the URR. Measuring the Kt/V provides guidance concerning which elements of the prescription require modification to achieve the target dialysis dose. As an example, technical problems with the hemodialysis session should be considered when the V derived from formal modeling differs from the V obtained via other equations; such information is not available if the clinician relies upon the URR alone.

These and other similarly derived equations correlate reasonably well with the more rigorous urea kinetic modeling when the Kt/V and PCR are in the normal or expected range[10] They are most accurate when the true Kt/V is between 0.7 and 1.3 (URR of approximately 40 to 65 percent), the dialysis time is three to five hours, and total body water is 50 to 60 percent of body weight.

It was developed by Frank Gotch and John Sargent as a way for measuring the dose of dialysis when they analyzed the data from the National Cooperative Dialysis Study.[2] In hemodialysis the US National Kidney Foundation *Kt/V* target is ≥ 1.3, so that one can be sure that the delivered dose is at least 1.2. In peritoneal dialysis the target is ≥ 1.7/week.[20]

AIM OF STUDY

for determining the adequacy of dialysis by depends on the Kt/V method. alsoto help assess the causes of a low Kt/V or URR(urea reduction rate). And show how we can treat or manage the causes of low Kt/v And to help in compare between online method and traditional method that depend on calculation equation and laboratories

MATERIAL AND METHOD

data taken from the 70 patients admitted to the renal unit &medical department unit of Baqubah teaching Hospital this Study conductbetween 28 septmeber 2014 to 15th march 2015 and collected 70 patient "45 were male and 25 were female take full history and examine all patients andconcentrate on ageweightsexcauses of renal failureduration of renal failure and duration of dialysis and checking the patients and dialysis machines We depend on online measure of Kt/v and we did some change during dialysis to reach target such as change pump of blood or increase time of dialysis.

RESULTS

In our study I take 70 patient of chronic renal failure (CRF) collected (45 were male& 25 were female) for determining the adequacy of dialysis by depends on the Kt/V method there was 41 people reach the target of urea clearance of Kt/V during online measure of dialysis there total percentage is (58.57%) from total 70 patient **SO.**

The P value equals 0.0032, this difference is considered to be very statistically significant there was 22 male (31.43%) and 19 female (27.14%) and there is two type of connection to machine is either fistula or double lumen and we get the following result we saw that there is 31 fistula and 25 patient from total reach the target equal to (80.64%) from total patient that have fistula connection the double lumen patient is 39 the number of patient reach the target is only 16 patient (41.02%) from total double lumen patient.

Table 1: Show a totally 70 patients included in this study 45 patients are male &25 patients female.

Sex	No.of pt	Percentage
Male	45	64.82%
Female	25	35.72%
Total	70	100%

P value equals 0.0084 the difference is considered to be statistically significant.

Table 2: Show a numbers of patient reach the target &patient they did not reach the target.

Sex	No.of pt reach The target	P value	Percentage
Male (45)	22		31.43%
Female25)	19		27.14 %
Total (70)	41	0.0032	58.57%

The P value equals 0.0032, this difference is considered to be very statistically significant.

Table 3: Show patient with fistula connection and patient with double lumen.

Type of connect	No.of pt	Percentage
Fistula	31	44.29%
Double lumen	39	55.71%
Total	70	100%

Table 4: Shown patient with fistula connection number with percent of patient they reach target.

Fistula connect	No.of pt	Percentage
Male	12	48%
Female	13	52%
Total	25	100%

Table 5: Shown patient with fistula connection number with percent of patient they did not reach target.

Fistula connect	No. of pt	Percentage
Male	6	100%
Female	0	0%
Total	6	100%

Table 6: Shown patient with Double lumen connection number with percent of patient they reach target.

Double lumen connect	No.of pt	Percentage
Male	9	56.25%
Female	7	43.75%
Total	16	100%

Table 7: Shown patient with Double lumen connection number with percent of patient they didnot reach target.

Double lumen connect	No.of pt	Percentage
Male	17	73.92%
Female	6	26.08%
Total	23	100%

DISCUSSION

In our study 70 patient of chronic renal failure (CRF) collected (45 were male& 25 were female)for determining the adequacy of dialysis by depends on the Kt/V method there was 41 people reach the target of urea clearance of Kt/V during online measure of dialysis there total percentage is (58.57%) from total 70 patientthere was 22 male (31.43%) and 19 female (27.14%) and there is two type of connection to machine is either fistula or double lumen and we get the following result we saw that there is 31 fistula and 25 patient from total reach the target equal to (80.64%) from total patient that have fistula connectionthe double lumen patient is 39 the number of patient reach the target is only 16 patient (41.02%) from total double lumen patient our study and these percentage of patients reach the target of urea clearance of Kt/v agree with a study done by NKF-DOQI.[21] to assess the causes of a low Kt/V or URR was published in the 2000 K/DialysisOutcomes Quality Initiative (K/DOQI) clinical practice guidelines[21], and in our study Suggested initial steps include an assessment of.

- Fistula integrity. (because we saw high percentage of patient with fistula connection reach the target.)
- Treatment duration. Common errors associated with dialysis time that is less than prescribed include a late arriving patient, the late initiation of dialysis by staff, early termination because of patient request or clinical events, blood leak, needle difficulties, and excessive triggering of machine alarms.
- Methods of obtaining BUN samples. Technical errors resulting in an incorrectly low predialysis BUN or a high postdialysis BUN may result in a decreased Kt/V.
- Dialysis machine and patient specific variables associated with a low Kt/V. These include inadequate machine calibration, low blood flow rates, episodes of hypotension requiring changes in treatment, overestimation of dialyzer clearance, and others.

A secondary assessment should be performed if the initial analysis does not lead to the quick identification of the cause of or correction of a low Kt/V. This may involve the incorporation of additional measures to improve effective hemodialysis treatment times, correct errors in blood sampling, or improve dialyzer clearance. Attempts to improve clearance may include an assessment of extracorporeal pressures, kinetic modeling of other patients using the same dialyzer model and Kt/V prescription, measures to decrease dialyzer clotting and fistula recirculation, and calibration of blood and dialysis flows. The use of two dialyzers in series or parallel may be another method to significantly improve clearance.[22,23]

If the primary problem is cardiopulmonary recirculation or delayed transfer of urea out of the cells, then urea clearance of the blood delivered to the dialyzer is already at near maximal levels. As a result, increasing dialyzer size, blood flow, or dialysate flow will produce only a marginal improvement. The only way to compensate for the reduced efficiency of urea removal is to increase the time on dialysis.

A generally similar approach has been suggested by other international societies.[24]

Conclusion and recommendation

- The Kt/V is a method for determining the adequacy of dialysis. The Kt/V is defined as the dialyzer clearance of urea (**K** obtained from the manufacturer in mL/min, and periodically measured and verified by the dialysis team) multiplied by the duration of the dialysis treatment **t** in minutes) divided by the volume of distribution of urea in the body **V**, in mL), which is approximately equal to the total body water. The correction of total urea removal (Kt) for volume of distribution is important because, in a large patient, a given degree of urea loss represents a lower rate of removal of the total body burden of urea (and presumably of other small uremic toxins). (See 'Definition and calculation of Kt/V' above.)
- A simpler model to determine dialysis adequacy uses the urea reduction ratio (URR). The URR is frequently utilized in epidemiologic studies, however, its efficacy in individual patients is more limited because of a relatively broad range of Kt/V that may be seen at a given URR. (See 'Urea reduction ratio' above.)
- There is no universally accepted target value for the Kt/V. We aim for a target single-pool Kt/V of

approximately 1.4 to 1.6. These levels are consistent with the 2006 K/DOQI guidelines for hemodialysis patients with minimal residual renal function (less than 2 mL/min per 1.73 m^2.

- Residual renal function facilitates the regulation of fluid and electrolyte balance, and may enhance survival. The 2006K/DOQI clinical practice guidelines suggest that the minimally adequate dose of dialysis can be reduced among patients with residual kidney function of greater than 2 mL/min per 1.73m^2 although the minimum single-pool Kt/Vcan be no lower than 60 percent of the minimum target for those without residual renal function.
- An assessment of the dialysis dose in stable hemodialysis patients is performed once per month by most clinicians, although more frequent measurements may more accurately assess or adjust the dialysis dose.
- The search for causes of a low Kt/V or URR includes an assessment of fistula integrity, treatment duration, possible technical errors in the method of obtaining BUN samples, and dialysis machine- and patient- specific variables such as inadequate machine calibration, low blood flow rates, hypotensive episodes that require changes in treatment, and overestimation of dialyzer clearance. Measures should be incorporated to improve effective hemodialysis treatment times, correct errors in blood sampling, or improve dialyzer clearance.(See 'Algorithm' above.)

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