KT/V and URR and the Adequacy of Hemodialysis in Iranian provincial hospitals : an evaluation study

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Abstract: There are several methods for measuring the adequacy of dialysis and disability in dialysis patients. Kt/V and the Urea Reduction Ratio (URR) are among the worldwide accepted measures. Due to a significant and direct association between the clinical status and mortality of patients and adequacy of hemodialysis services, evaluation of the services and relative factors are necessary. This study measured the adequacy of Hemodialysis in patients hospitalized at Hemodialysis wards of Kohgiloyeh and Boyerahmad province. **Materials and methods**: In this evaluation study, after taking informed consent form 41 eligible patients admitted to hemodialysis units blood samples were taken and blood urea nitrogen and creatinine were measured before and after Hemodialysis. Collected data were analyzed by descriptive (mean, standard deviation) and inferential (one way ANOVA test and t-test) statistical methods. **Results**: The minimum and maximum KT/V indices were 0.45 and 1.77 respectively. Regarding the standard KT/V level 17 patients (41.5 percent) received adequate dialysis services. The minimum and maximum URR were 28% and 75% respectively with an average of 50% ±0.69. Regarding the URR index, 20 patients (48.8 percent) received inadequate dialysis services. **Conclusion**: according to the dialysis adequacy indices (KT/V and URR) nearly half of patients admitted to these Hemodialysis wards received inadequate hemodialysis services that need more supervision and follow up of patients.

Key words: Hemodialysis, Adequacy, Kt/V, URR

Introduction

Cardio-vascular diseases and dialysis inadequacy are the main causes of disability and mortality among dialysis patients and improving the adequacy of dialysis is important in prognosis of the patients. In other words the better dialysis adequacy the better is the quality of life due to less uremic complication on various body organs and also decreased mortality among the patients (Braunwald et al, 2005). Determining factors affecting the quality of dialysis services and introducing methods to improve the indices of the services are essential and will achieved if like any other therapeutic procedure, dialysis services be monitored and evaluated continuously. Determining the clearance of small molecules is one of the accepted methods of efficiency of Hemodialysis because, the relation between the mortality rate and these molecules have been shown in many studies (Nadi, 2002; DOQI, 1997; Daugirdas, 2007). Kt/V and the Urea Reduction Ratio (URR) are among the worldwide accepted methods which are used to determine small molecules (DOQI, 1997). According to the opinion of Renal Physician Association (RPA) and also the National Kidney Quality Initiative (NIQI), using Kt/V is preferable comparing with URR because; it reflects the urea reduction more accurately. According to the NKQI theory, it is recommended for the patients who go under Hemodialysis 3 times a week to preserve their minimum Kt/V and URR above 1.2 and 65.0% respectively. URR is one of the methods of determining the adequacy of Hemodialysis which is used to evaluate the removal rate of waste materials produced by Hemodialysis and is being mentioned as percentage and carrying out by determining the blood urea before and after Hemodialysis (Daugirdas, 2007). Kt/V is a mathematical term that evaluates the quantity of Hemodialysis process and gives a parameter which is related to the clinical signs of patient and it's continuous control specifies the changes in Hemodialysis process primarily and depends upon three parameters of clearance, the period of dialysis and volume of urea distribution (Daugirdas, 2007). Gotch et-al. (2003) in their study showed that, increasing the adequacy of dialysis reduced the mortality rate of Hemodialysis patients (Gotch et al, .2003). Several studies also showed a strong relation between the adequacy rate of Hemodialysis and the clinical results (Hakim, 2004). Termorshuizen (2004) also introduced Kt/V to determine the adequacy of Hemodialysis and suggested the Kt/V equal to 1.2 as the adequacy criterion (Termorshuizen et al,.2004). At present, the Hemodialysis units are operating in many dialysis centers of our country but in spite of the technical progresses in doing dialysis during

recent years; patients go under Hemodialysis, two or three and even one time a week for many years with fixed period without any change. In order to reduce the mortality rate, the number of times and the days of hospitalization of patient, paying the caring expenses by patients, economizing the therapeutic expenses of the country and even increasing the longevity of patient, it is necessary to determine the adequacy of patients Hemodialysis and extends it to an optimal level. considering the aforesaid cases and that no such research has been carried out so far in Hemodialysis wards of Kohgiloyeh and Boyerahmad province, the present research was done aiming to determine the adequacy rate of Hemodialysis of patients hospitalized at Hemodialysis wards of the state.

Materials and Methods

This research is a cross-sectional descriptive study conducted on patients under Hemodialysis from Kohgiloyeh and Boyerahmad province in the year 2009. The study population (41 persons) included all patients under Hemodialysis treatments from dialysis ward of Yasuj city, dialysis ward of Dehdasht city and dialysis ward of Ghchsaran. The present study was carried out obtaining permission from the research assistant of Yasuj University of medical sciences and satisfaction of authorities of mentioned hospitals specially Hemodialysis wards and patients observing all moral points. Inclusion criteria include: Weekly dialysis, ability to tolerate dialysis sessions, using dialysis services provided by the hospitals for at least one year, provided signed informed consent forms, having chronic renal failure. Information on demographic characteristics, blood groups underlying causes of renal failure was collected at the dialysis centers. , Some clinical data collected from the patients hospital files included: duration of dialysis services was taken (year), history of kidney transplantation, method of vascular access, the duration of fistula function (year), serum level of Australian antigen, hemoglobin and hematocrit rate, the number of weekly Erythropoietin injection, receiving, hemodialysis sessions per week, type of Hemodialysis, type of filter used in Hemodialysis, type of Hemodialysis solution, duration of Hemodialysis in each session (minute), patient's weight before and after patients started taking dialysis services, ultra filtration rate of system, Blood Flow Rate, Dialysis Flow Rate and blood pressure of patients before and after Hemodialysis. Before dialysis to be started, 5 cc of clot sample was taken from patient and sent to the laboratory for Blood Urea Nitrogen (BUN) and Creatinine test. After dialysis session was ended, 2 cc of blood was taken from each patient to evaluate BUN before and after dialysis. In order to prevent recirculation of blood sample by low flow rate the machine cycle was adjusted at the rate of 50 ml/second two minutes before sampling.Sample was taken from arterial set. After the laboratory report on BUN received, the URR and Daugirdas ∏ Logarithmic formulas were used to calculate the adequacy of Hemodialysis (4). URR level equal to or more than 65.0% in the hemodialysis patients was considered adequate, between 55.0-65.0% considered near to optimal and less than 55.0% was considered as inadequate. In addition, Kt/V from 1.2 to 1.7, 0.9-1.2 and less than 0.9 were considered optimal, near optimal and inadequate respectively (4). Data was analyzed using one way ANOVA, t and chi-square statistical tests.

Results

In this study, 41 patients were included in the study. 9 patients (22.0%), 17 patients (41.5%) and 15 patients (36.6%) participated in this study from Hemodialysis ward of Shahid Beheshti Hospital of Yasuj city, Shahid Rajjaee Hospital of Ghachsaran city and Imam Khomeini Hospital of Dehdasht city respectively. The age range of participants was 18-83 years with the mean age of 47.07±17.11. Most of participants were married (82.9%) and illiterate (61%). Blood groups were reported as, O$^+$ (51.2%), A$^+$ (31.7%), B$^+$ (9.8%) and O$^-$ (7.3%). Regarding the underlying cause of renal chronic failure, hypertension (HTN) (in 16 patients (39.0%) was reported as the most frequent underlying cause. Other less frequent causes were reported as diabetes Mellitus (22%), unknown causes(22%), Glome rulonephritis (4.9%), positive familial history(4.9%), Pyelonephritis (2.4%), polycystic kidney(2.4%) and autoimmune Lupus disease(2.4%).

The duration of hemodialysis was between 1-12 years (mean 3.32±2.09 years). Out of 41 persons, only 8 (19.5%) had a history of kidney transplantation. They needed Hemodialysis due to rejection of the new kidney. The vascular access method in all patients was arterio-venous fistula with dialysis period of 1-6 years (mean of 2.93±1.5 year). The Australian antigen was negative for all (100.0%) of patients. The mean weight of patients before and after dialysis was 63.44±15.54 kg and 60.44±15.23 kg respectively (P<0.05). The mean systolic and diastolic blood pressure before Hemodialysis was 130.98 and 82.20 mmHg respectively. And after Hemodialysis 116.83 and 73.17 mmHg respectively (P<0.05). The minimum and maximum Creatinine levels were 2.5 and 18.0 mg/dl respectively (mean = 11.14±3.34 mg/dl) The minimum BUN rate before and after dialysis was 35 and 154 mg/dl (mean = 69.9±23.6 in 100). The minimum and maximum BUN rate after dialysis was 15 and 63 mg/dl

respectively (mean= 32.63±11.96 mg/dl) (P<0.05). The adequacy rate of Hemodialysis wards with regard to Kt/V criterion and URR in each hospital is showed in table 1. The one way ANOVA test showed a significant difference between hospitals (P<0.05). Totally, the minimum Kt/V rate was 0.45 and its maximum rate was 1.77 with the mean of 0.94±0.4 at the Hemodialysis wards of Kohgiloyeh and Boyerahmad state. A significant difference was observed between Kt/V and URR with BUN before and after Hemodialysis (P=0.001). Moreover, based on the independent t-test, there was a significant difference between the Kt/V and blood flow rate (P>0.005). There was no significant difference between systolic and diastolic blood pressure before and after Hemodialysis with Kt/V (P>0.05). Also, no significant difference was observed between age, sex and Kt/V (P>0.05). There was no significant difference between dialysis history, weight and systolic and diastolic blood pressure before and after Hemodialysis (P>0.05).

Results showed that Kt/V criterion at all dialysis centers of the state was in the adequate level for only 17 patients (41.5%). Regarding URR criterion, only 13 persons (31.7%) of patients were in the optimal range (table 2).

Discussion and Conclusion

Cardio-vascular diseases and inadequacy of dialysis are the main causes of disability and mortality among dialysis patients. Increasing the adequacy of dialysis positively affect prognosis of dialysis patients (Braunwald et al., 2005,. Monfared, 2006). For dialysis, like any other therapeutic procedures, it is necessary to specify the quality of services.

The present research carried out to determine the adequacy of Hemodialysis of patients referred to the Hemodialysis wards of hospitals in Kohgiloyeh and Boyerahmad province. The results of the research suggested that, based on the Kt/V criterion, the quality of Hemodialysis at Hemodialysis centers of the hospitals is not optimal as, only less than half of patients (41.5%) reached acceptable rate according to Kt/V criterion. Mozafari et al. (2002) showed that, the quality of dialysis in Ardebil province is also not optimal and only 10.0% of patients had adequate rate (Mozafari, 2002). The result of a study by Azar (2009) showed that, on the basis of Kt-V criterion only 45.0% of patients and based on the URR index only 44.0% of patients had optimal dialysis adequacy in Egypt (Azar, 2009). Goth et-al. (2003) also reported that out of 33 patients, the optimal, medium and weak for Kt/V criterion were 38.2%, 17.6% and 41.2% respectively (Gotch et al, .2003). Results of published studies on the adequacy of dialysis suggested that in those who go under dialysis 3 times a week, the level of standard Kt/V showed an inverse association with the uremic complications and hospitalization period (Daugirdas, 2007; . Hojjat, 2009). Regarding the Kt/V criterion, this study suggested that, lower percentage of patients had optimal adequacy of dialysis compared to the study published by Borzo in Hamadan (Borzo etal,.2005). The adequacy of Hemodialysis in Dehdasht seems to be higher compared to hemodialysis centers in Yasuj city. In Gachsaran's Hemodialysis ward, none of the samples had optimal or near optimal quality of dialysis. In study by De Alvaro and his colleagues there was no correlation between KT/V and hospital stay or BUN (De Alvaro, 1992).

Table 1: The Hemodialysis adequacy rate of patients considering the Kt/V and the URR criterion at each dialysis ward separately.

Variable	Kt/V criterion			URR criterion		
Dialysis Ward	optimal No. (Pc.)	near optimal No. (Pc.)	less than optimal No. (Pc.)	optimal No. (Pc.)	near optimal No. (Pc.)	Less than optimal No. (Pc.)
Dehdasht	(73.4) 11	(6.6) 1	(20.0) 3	(66.7) 10	(13.3) 2	(20.0) 3
Yasuj	(66.7) 6	(11.1) 1	(22.2) 2	(33.4) 3	(44.4) 4	(22.2) 2
Ghchsaran	(0.0) 0	(0.0) 0	(0.0) 0	(0.0) 0	(5.9) 1	(94.1)16

Table 2: The Hemodialysis adequacy rate in under studied patients considering the Kt/V and URR criteria.

Adequacy of Hemodialysis	Criterion	Kt/V No. (Pc.)	URR No. (Pc.)
Optimal		(41.17) 17	(31.7) 13
Near optimal		(7.3) 3	(17.0) 7
Less than optimal		(51.2) 21	(51.3) 21
Total		(100.0) 41	(100.0) 41

The results of this study are similar with our results. Various studies showed that, insufficient

prescription, lack of suitable filter, , stenosis of venous end of arterio-venous fistula, weak and

undesirable fistula, non-observance of regular dialysis plan by patient, cardio-vascular diseases, hemodynamic instability, infections, malignancy, recirculation and reuse of dialysis filter are among the main causes of inadequacy of Hemodialysis (Borzou, 2005; De Alvaro, 1992; McCllan, 1998;) that may also be the insufficiency reasons of Hemodialysis quality in Hemodialysis centers in this study. To sum up, this study like some other studies carried out in Iran is an indication of dialysis inadequacy in Hemodialysis patients. Many complications resulting in repeated hospitalization can be prevented by Considering the facilities and available dialysis beds throughout the country and ever-increasing demand, it is difficult to preserve the dialysis rate of patients at an acceptable level. It is recommended to monitor all patients individually and periodically and necessary measures should be taken to improve the adequacy of dialysis and therefore beter quality of life of the patients. It has to be mentioned that body size, the remained renal function, diet receiving rate, accompanying diseases, metabolic severity and excess increment of fluid while dialysis is on going are also important factors affecting quality of dialysis which were not measured in the present study.

Acknowledgement

9/13/2013

References

1. Azar AT. The influence of maintenance quality of hemodialysis machines on hemodialysis efficiency. Saudi J Kidney Dis Transpl 2009; 20:49-56.
2. Borzou R, Ghalyaf M, Amini R, Zandeieh M. Torkaman B. Evaluation of dialysis adequacy in hemodialysis Ekbatan hospital. Journal of Hamadan University of Medical Sciences 2005; 13(4):53-7.
3. Braunwald E, Fauci AS, Kasper DL, Harrison's Principle of internal medicine. 16th ed. New York: McGraw- Hill; 2005; 1653-1667.
4. Daugirdas JT. Chronic hem dialysis prescription: An urea kinetic approach. In: Daugirdas JT, Blake PG. Ing TS. Handbook of Dialysis. 4th ed. Philadelphia: William & Wilkins; 2007; 146.
5. De Alvaro F, Bajo MA, Alvarez-Ude F, Vigil A, Molina A, Coronel F, Selgas R.Adequacy of peritoneal dialysis: does kt/v have the samepredictive value as in HD? A multicenter study. Adv Perit Dial. 1992;8:93-7.
6. Gotch FA, Levin NW, Port FK, Wolf FA, Uehlinger DE. Clinical outcome relative to the dose of dialysis is not what you think: The faiiacy of the mean. Am J Kidney Dis 2003; 30: 1-15?
7. Hakim RM, Depner TA, Parker TF. Adequacy of hemodialysis. Am J Kidney Dis 2004; 20(2):106-23.
8. Hojjat M. Hemodialysis adequacy in patients with chronic renal failure. Iranian Journal of Critical Care Nursing 2009; 2(2): 61-6.
9. McCllan MW, Soucie JM, Flanders WD. Mortality in end- stage renal disease is associated with facility differences in adequacy of hemodialysis. J AM Soc Nephrol 1998; 9(10):1940-7.
10. Monfared A, Oorang Pour R, Kohany M. Assess dialysis adequacy in hemodialysis patients Permanent Razi hospital in Rasht. Journal of Medical Sciences University 2006; 17(65): 44-9.
11. Mozaffari N, Mohammadi M, Dadkhah B, Mahdavi A. Evaluation of dialysis adequacy Hemodialysis in patients referred to Ardabil dialysis center. Journal of Medical Sciences University Health Ardebil 2002; 14: 52.
12. Nadi A, Bashyriyan S, Khosravi M. Evaluation of dialysis adequacy in hemodialysis Ekbatan Hospital. Scientific Journal of Hamadan University of Medical Sciences 2002; 10(3): 27-33.
13. NKF-DOQI. Clinical practice guidelines for hemodialysis adequacy. Am J Kidney Dis 1997; 50: 15-66.
14. Termorshuizen F, Dekker FW, Jeanntte G, Korevaar JC, Boeschote E. Relative contribution of residual renal function and different measures of adequacy to survival in hemodialysis patient. Am Soat Nephrol 2004; 15(4): 1061-70.