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Assessment of dialysis adequacy among hemodialysis patients

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Abstract---Objective:- the study aimed to assess dialysis adequacy among hemodialysis patients with end-stage renal disease. Methodology: A descriptive non-probability (purposive sample) of (174) male and female hemodialysis patients in al-Najaf al-Ashraf city of patients with end-stage kidney disease and undergoing hemodialysis. Most patients were diagnosed with ESRD > one year ago from those who have spent more than twelve months on maintenance hemodialysis schedule. Data collected through using of a well-designed questionnaire consist of Three, part one consists of sociodemographic contain (7) items, and part two consists of medical data contain (7) items, Data was obtained from the patients undergoing hemodialysis by the interview. which include The form was based on preliminary assessment which checked the factor that influenced duration of disease, period of session hemodialysis, complication of hemodialysis and the adequacy of hemodialysis. The study was conducted at AL-Najaf AL-Ashraf City /AL Sadder Medical City and AL-Hakeem General Hemodialysis Center the study was begun from September 9th 2021 to June 22th 2022. Data was analyzed by using of descriptive data analysis (frequencies, percentages, mean, standard deviation, person correlation). Results: The results of measurement of adequacy of 174 patient, about (35.1%) achieved adequate and (64.9%) did not achieve adequacy. The mean hemodialysis efficacy indicators that was calculated with the formula Spkt/V about (1.07). and KT/V is more than 1.2, Kt/V levels were not associated with patient (demographic data and clinical data).

Conclusion: The study found that following hemodialysis sessions, hemodialysis is insufficient in study result, which might be due to expense, co-morbidity, or late presentation to the hospital.

Keywords---assessment dialysis adequacy, hemodialysis, chronic kidney disease, urea.

Introduction

Assessment of hemodialysis adequacy is an important indicator to assess the effectiveness of hemodialysis measures that can affect the patient's quality of life with chronic kidney disease. (Faridah et al., 2021). Patients with end-stage renal disease (ESRD) are unable to sustain life without dialysis support. Hemodialysis is the transport process by which a solute passively diffuses down its concentration gradient from one fluid compartment (either blood or dialysate) into the other. (Somji et al., 2020) The purpose of dialysis is to provide enough removal of uremic solutes and fluid that accumulate in kidney failure to maintain health and quality of life: more specific goals include control of uremic symptoms, maintenance of safe electrolyte levels, prevention of nutritional decline, and optimum long term mortality. (Ashby et al., 2019). Hemodialysis prevents death but does not cure kidney disease and does not compensate for the loss of endocrine or metabolic activities of the kidneys. More than 90% of patients requiring long-term renal replacement therapy are on chronic hemodialysis (Johansen et al., 2021). Hemodialysis adequacy is one of the key factors in evaluating the health services provided for hemodialysis patients. (Kaviannezhad et al., 2016). The amount of dialysis that a patient receives and the amount of uremic toxin removal can impact morbidity and mortality. Hemodialysis is recommended at least two to three times in a week and the time of dialysis (which is the time the patient stay on dialysis per session) ranges from two to four hours. Several factors determine the time of dialysis these include kidney function, amount of waste in the body, level of salts, co-morbidity and bodyweight yet. (Batubo et al., 2020). The normal functioning kidney excretes urea, a nitrogenous waste product. The buildup of urea in people with ESRD causes uremia; hemodialysis is used to eliminate urea and other hazardous compounds from the blood. Urea kinetic modeling is a method of detecting urea concentration changes in dialysis patients during and between dialysis sessions, as well as monitoring dialysis performance. (Cleary & Drennan, 2005). The adequacy of dialysis can reduce mortality, increase longevity, and improve the quality-of-life in patients undergoing hemodialysis (Kalender & Tosun, 2014) The adequacy of hemodialysis refers to how well toxins and waste products are removed from the patient's blood and has a major impact on their well-being. Studies have indicated an increase in morbidity and mortality among patients with inadequate dialysis. The urea removal indexes help to calculate the adequacy of hemodialysis. Since the cost of hemodialysis is high and entails significant patient time, it is important that hemodialysis should be done adequately. (Somji et al., 2020). The urea removal score helps to calculate the adequacy of hemodialysis. The urea removal score include urea reduction ratio (URR), single-pool (sp Kt/V), equilibrated (e Kt/V), and the weekly standard index (std Kt/V). This study used sp Kt/V to calculate hemodialysis adequacy. Single-Pool Index (spKt/V) The spKt/V index is defined as

the amount of serum that is cleared from urea via the distribution volume , Parameter K is the dialyzer blood water urea clearance that is provided by the filter (measured as liters per hour), t is the duration of the hemodialysis session in hours, and V is the volume of urea distribution in combination with the body water in liters. The National Kidney Foundation-Kidney Disease Outcomes Quality Initiative (NKF-KDOQI) 2006 guidelines recommend $\text{spKt/V} > 1.2$.(Hasan et al., 2021) . The purpose of this study is to assess the adequacy of hemodialysis among ESRD Patients undergoing hemodialysis in AL -Najaf city.

Methodology

A descriptive anon-probability (purposive sample) of (174) patients (81) male, (93)female with end -stage kidney disease and undergoing hemodialysis. The study was conducted at AL-Najaf AL-Ashraf City /AL Sadder Medical City and AL-Hakeem General Hemodialysis Center the study was begun from September 9th2021 to June 22th 2022. study was carried out in order to achieve the study objectives. the aims of this study to assessment of dialysis adequacy among hemodialysis patient. The criteria for the selection of the study were (patients who undergoing hemodialysis at least one year, patients they are medically stable, who agreed to participate in the study, The age of all participants is between 16 years old and older years and Alert patients; free from any change in the level of consciousness, both sexes, and free from any psychiatric illness) . Patients that had regular 3 hourly sessions of dialysis. Demographic variables contained the information regarding age, sex, residence, marital status, educational status, occupational status, and income. It also includes the clinical variables such as duration of disease ,period of session and some common complication that secure during hemodialysis (hypotension ,Infection ,Itching, Nausea and vomiting and finally muscle cramps). And part of indexes dialysis adequacy Formia. Dialysis adequacy was calculated by using kt/v formulae.

SP Kt/V

$-\ln (\text{Ratio}-0.03) + [(4-(3.5 \times \text{Ratio})) \times (\text{UF}/\text{Wt})]$, in which Ratio is post BUN/pre BUN, UF is ultrafiltration volume, and Wt is post dialysis weight, Sp: Single pool, Log n is the natural logarithm .Blood specimen were collected before and after hemodialysis session process one monthly to measure the blood urea about (3 ml) of blood draw , put in the special tube and send for the privet laboratory test.

Anthropometric measurements

The patients' weight in kilograms before and after dialysis sessions, dialysis session duration, ultrafiltration volume, was collected for all patients.

Specimen collection

Pre-dialysis blood samples were withdrawn into tubes from all subjects at the start of the study .Both predialysis and postdialysis urea samples were withdrawn before and after the same session of HD . Blood sample was collected for pre and post dialysis analysis of urea from the 174 patients. 3 ml of the blood was obtained from each patient before the index dialysis session for the

determination of the pre-dialysis urea and at the end of each dialysis session, blood sample for the determination of post-dialysis urea was also obtained about three minutes after the dialysis from the arterial sampling port in order to avoid the effect of access recirculation. Clotted blood was centrifuged to separate serum and was used for the estimation of urea. Data collected was analyzed using statistical package for social sciences (SPSS) . Frequencies and percentages were calculated.

Result

Table (1): Distribution of the observed frequencies and percent of Demographical Characteristics for Study Sample

variables	Rating	Frequency	Percent
Age	<= 16	1	0.6
	17 - 26	18	10.3
	27 - 36	28	16.1
	37 - 46	53	30.5
	47 - 56	37	21.3
	57 - 66	22	12.6
	67 - 76	13	7.5
	77 - 86	2	1.1
Mean + S.D.		44.80 ±14.19	
Gender	Male	81	46.6
	Female	93	53.4
Level of Education	Illiterate	45	25.9
	Read and write	63	36.2
	Primary school	30	17.2
	Intermediate school	24	13.8
	Preparatory school	6	3.4
	Instituted	2	1.1
	College	4	2.3
Monthly Income	Insufficient	39	22.4
	Sufficient	135	77.6
Residency	Rural	80	46.0
	Urban	94	54.0
Marital Status	Single	31	17.8
	Married	137	78.7
	Divorced	3	1.7
	Widowed	3	1.7
Occupation	Retired	8	4.6
	House wife	82	47.1
	Employee	13	7.5
	Jobless	27	15.5
	Free job	44	25.3

Table (2): Distribution of the observed frequencies and percent of Clinical Data Characteristics for Study Sample

variables		Rating	Frequency	Percent
Duration of Disease		one year	18	10.3
		2-6 years	132	75.9
		7-11 years	22	12.6
		12-16 years	2	1.1
Mean + S.D.			3.93 ±2.54	
Period of Session		2 hours	4	2.3
		3 hours	95	54.6
		4 hours	75	43.1
Mean + S.D.			3.38±0.52	
Complications of Dialysis	Hypotension	Yes	140	80.5
		No	34	19.5
	Infection	Yes	15	8.6
		No	159	91.4
	Itching	Yes	36	20.7
		No	138	79.3
	Nausea and Vomiting	Yes	68	39.1
		No	106	60.9
	muscle cramps	Yes	114	65.5
		No	60	34.5

Table (3): Relationship between Dialysis Adequacy and patients' Clinical Characteristics

Variables	Chi-Square	P-value
Duration of disease	1.714	0.6 NS
Period of session	2.593	0.2 NS
Hypotension	0.136	0.8 NS
Infection	1.635	0.2 NS
Itching	2.017	0.1 NS
Nausea and vomiting	1.059	0.3 NS
Muscle cramps	0.462	0.4 NS

Table (4): Relationship between Dialysis Adequacy and patients' Demographic Characteristics

Variables	Chi-Square	P-value
Age	7.113	0.4 NS
Gender	1.170	0.2 NS
Level of education	6.591	0.4 NS
Monthly income	1.607	0.2 NS
Residency	0.388	0.5 NS
Marital status	3.723	0.2 NS

Occupation	3.326	0.5 NS
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Table (5): Summary of Final dialysis Adequacy

variables	Rating	Frequency	Percent	Mean	Std. Deviation	Assess.
Final dialysis Adequacy Assessment	Inadequate	113	64.9	1.07	0.33	Inadequate
	Adequate	61	35.1			
	Total	174	100.0			

N(174) , dialysis adequacy (1.2 or more)

Discussion

ESRD is a serious condition that is spreading over the world. (Hill et al., 2016) It may be mostly due to the accumulation of uremic toxins in the early stages of chronic kidney disease, which cause uremic symptoms such as dry skin, sleep trouble, itching, numbness/tingling, decreased interest in sex, and bone/joint pain, which can disrupt patients' everyday activities. (Danquah, 2009) . The most widely utilized material in clinically assessing small molecule clearance is urea. Urea may be swiftly eliminated from the body by high-efficiency dialysis because it is a tiny, highly diffusible molecule.(Daugirdas, 2013) .The most prevalent treatment option for this stage is HD, which involves removing massive quantities of uremic toxins with the goal of improving quality of life. (Makusidi et al., 2014) . The average urea kinetic measurements (Kt/v) in this investigation were (1.07). This shows that ESRD patients do not meet The National Kidney Foundation's Kidney Disease Outcomes Quality Initiative's hemodialysis treatment objective (KDOQI) For thrice-weekly hemodialysis patients, a target single pool Kt/V (spKt/V) of 1.4 each hemodialysis session is recommended, with a minimum delivered spKt/V of 1.2. (Daugirdas et al., 2015) . This study found results that were comparable to those found in an Iranian study called "Evaluation of dialysis adequacy in hemodialysis patients: A comprehensive review." According to their findings, the majority of Iranian patients have KT/V and URR levels that are much below what is considered optimal. They also have dialysis properties that are undesired. (Barzegar et al., 2016). The finding of a study done in Erbil they found all other receiving insufficient HD treatment usually on twice weekly around 3 h for each session (64.8%). (Saeed & Sinjari, 2018) ,another study in Irani "Adequacy of dialysis in Iranian patients undergoing hemodialysis : a systematic review and meta-analysis" in their study results that The mean of adequacy of dialysis indices among Iranian patients is below the standard levels and it is necessary to consider measures to improve dialysis effectiveness.(Dehvan et al., 2018) . Several factors were that affected the dialysis adequacy during this study This may be attributed to various reasons such as economic statues , accessibility to reach to the center of dialysis , patient undesirable , deficiency of machines, time difficult , and difficulty in transportation. this result is agreement with (Saeed & Sinjari, 2018),(Kaysen et al., 2012) . and The results in this study, therefore, indicate inadequate hemodialysis dose in ESRD patients in undergoing hemodialysis. Many variables impact Kt/V, including daily protein consumption, failure to account for postdialysis urea rebound, and residual renal function. (Bozkurt et al., 2018) . For this reason, should be giving information about dialysis adequacy of patients, it is not acceptable as a gold standard .the

result of this study showed There were no statistically significant relationship between Dialysis Adequacy and there Clinical Characteristics in HD patients, ($p > 0.05$).also there are no statistically significant relationship between Dialysis Adequacy and there demographical data in HD patients, ($p > 0.05$) Accordingly, to (Nemati et al., 2017). found no significant association between patients' age and dialysis efficiency, however their study showed no significant association between dialysis duration and dialysis efficiency indexes (Kt/V and URR).

Conclusions

Serum urea levels are increased in CKD patients. The accumulation of waste causes a variety of consequences and accelerates the disease's course. In comparison to the suggested The National Kidney Foundation's Kidney Disease Outcomes Quality Initiative, this study found insufficiency of hemodialysis among ESRD patients having hemodialysis in Al-Najafi city (KDOQI). The financial expense of hemodialysis, co-morbidity, and late presentation of patients to the hospital were the key contributing factors.

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