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Detection of Cardiac Disarrhythmia with Patients Post-Haemodialysis in Dialysis Center of General Kirkuk Hospital

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Abstract
Background : Cardiovascular disease (CVD) is a most common complication and cause of death in patients with end stage renal disease (ESRD). Arrhythmias are complications that are frequently observed in patients attending to hemodialysis varies between 17 to 76%. Increased QT intervals dispersion is predisposing to ventricular arrhythmias and sudden cardiac death.**Objective** : The main objective of the study is to detect the cardiac disarrhythmia with patients at post-hemodialysis and to assess the effect of hemodialysis (HD) on corrected QT (QTc) intervals and their dispersions (QTd) in chronic hemodialyzed patients.**Methods: A** descriptive study a purposive (non-probability) sample of (60) patients were undergoing hemodialysis was carried out at Kirkuk general hospital/ dialysis center, from December 2013 to 28 March 2014. The study sample consisted of 60 patients undergoing hemodialysis (61.7% males and 38.3% females), whose mean age was 66.79±13.16 years. All of them underwent electrocardiograms performed after one dialysis session. On a second phase, ECG was performed pre –post hemodialysis .12-leads standard ECG were recorded using a Mortara instrument 1246, (USA) electrocardiograph at paper speed of 25 mm/s and 10 mm/mV, and a blood specimen was drawn to measure plasma electrolytes pre –post a single hemodialysis session. Results were tested for normality and expressed as mean ± SD,. Comparisons were made using *t* test or Mann-Whitney test (electrolyte values).**Results** :Post-dialysis arrhythmia showed 20(33.3%) of participants are suffer from Sinus bradycardia and 15 (25%) of them are suffer from irregularity with possible premature atrial contraction. The mean of pre and post dialysis R-R intervals was (780.11±90.75 ms pre-HD vs. 811.16±81.45 post-HD, respectively ($p>0.05$). The mean of corrected QT cmax intervals increased significantly from 383.11±11.95 msec pre-HD vs. 422.16±18.70 msec post-HD, ($p<0.05$). The mean of QTc dispersion increases from 47.56±9.85 ms pre-HD to 59.25±11.93 ms post-HD ($p<0.05$) respectively. The changes in serum potassium and calcium levels were related with QT interval prolongation. a statistical high significant difference of serum Changes ((Potassium, Calcium, and Urea) at pre-post hemodialysis with mean± SD (5.09±0.70 vs 3.96±0.54 , 7.34±0.90 vs 7.72±0.60 , 59.88±9.50 vs 21.97±4.81) respectively .**Conclusions**: This study showed that QTc_{max} and QT dispersion, markers of risk for arrhythmias and sudden death, are elevated in hemodialysis patients, and rise pos-dialysis.QTc interval and dispersion increase in HD patients.
Keywords: Chronic renal disease, Hemodialysis, QT interval, Arrhythmia

Introduction:

Cardiovascular disease (CVD) is a most common complication and a chief cause of death in patients with end stage renal disease (ESRD) accounting for 45% to 50% of causes of death in ESRD patients. In ESRD patients, mortality due to CVD is 10~30 times higher than in the general population. 80% patients on maintenance homodialysis (MHD) had cardiovascular complication. [1]

Paroxysmal atrial fibrillation attack is one of most common tachyarrhythmia in MHD patients. Paroxysmal atrial fibrillation attack not only can affect the dialysis to proceed smoothly, but also it can increase the death risk in MHD patients. In the Dialysis Outcomes and Practice Patterns Study. These arrhythmias may be caused by the rapid changes in intracellular and extracellular electrolytes during the dialysis session.[2]

There are much data in literature concerning the relationship between hemodialytic treatment and QT dispersion; for example, in patients with kidney failure, the variability of ventricular repolarization can be expressed by an increase of the QT interval and QT dispersion. [3,4]. Some authors observed that the mean value of QT interval measured on a 12 derivations ECG is influenced by hemodialysis. This finding suggests a better control of electrolytic balance (especially potassium).[5] Maintenance hemodialysis (HD) patients have frequent electrolyte abnormalities, such as highly fluctuating levels of potassium, ionized calcium, magnesium and other divalentions .[6]

During dialysis, potassium is removed 85% by diffusion and 15% by convection. Hypokalemia is seen more often in dialysis patients and especially in those whose predialysis K levels are normal and who are administered a sodium profile technique [5]. Hypokalemia creates tendency to arrhythmia just like hyperkalemia. In order to avoid hypokalemia, the level of K in the dialysate should be arranged for each patient and the intracellular and extracellular shifts of K should be borne in mind. [7]

Arrhythmias are complications that are frequently observed in patients attending to hemodialysis. They mostly occurred during and after dialysis. Prevalence of arrhythmia varies between 17 to 76% .[5] An increase in the heart rate was 30% of the patients at the end of the hemodialysis. [8]

Arrhythmia etiology of the hemodialysis patient group is multi-factorial. The dialysis therapy itself may lead to changes that can alter excitability of myocardium. Dialysis may be pro-arrhythmic as it changes the fluid composition in the body, the PH and the concentrations of heat and electrolytes. Patients with chronic kidney diseases who are undergoing a dialysis therapy are prone to arrhythmia since they usually have ischemic heart disease. Prevalence of atrial fibrillation as one of the arrhythmia types was reported to be 27%, which is way above 0.5-1% seen in the general population .[9] Another two types of arrhythmia, the complex ventricular arrhythmia and premature ventricular complexes, in particular increase the mortality and morbidity. [10]

Atrial fibrillation (AF) is one of the most frequent arrhythmias in clinical practice. Its prevalence in the general population is reported to be in the range of 0.5% to 1% and is strongly associated with increasing age, with nearly 4% of persons 60 years and older and 9% of persons 80 years and older having been diagnosed with permanent AF .[11]

Methodology

Initially, this study's project was submitted to the Kirkuk general hospital / Dialysis Center for approval. After that, patients with End Stage of Renal Disease (ESRD) on hemodialysis at that center were instructed about this study A descriptive study A purposive (non-probability) sample of (60) patients who were undergoing hemodialysis was carried out at Kirkuk general hospital/ dialysis center from December 2013 to 28 March 2014. The 60 patients undergoing hemodialysis provided written informed consent to participate in this study. On a second phase, ECG was performed pre –post hemodialysis. The inclusion criteria were as follows: patients with ESRD undergoing hemodialysis; patients accepting their participation in the study; and sinus rhythm on ECG. 12-lead ECG were performed at rest in all individuals pre –post hemodialysis (up to 15 minutes pre –post the session) sixty patients with chronic renal failure on arrange of three-times-a-week hospital hemodialysis were randomly selected, 12-leads standard ECG were recorded using a Mortara instrument 1246, (USA) electrocardiograph at paper speed of 25 mm/s and 10 mm/mV, and a blood specimen was drawn to measure plasma electrolytes pre –post a single hemodialysis session. ECG ware performed with the patient lying at 45° using adhesive electrodes. ECG were coded and analyzed blindly for QT intervals by one observer using a digitizer. The QT interval was measured from the onset of the QRS complex to the end of the T wave. When T waves were inverted, the end was taken at the point where the trace returned to the T-P baseline, The QT intervals (in milli seconds [ms]) for each lead were measured manually by one observer using calipers. The difference between the maximum and the minimum of QT interval was noted as QT dispersion (QT d).

Routine biochemistry electrolytes levels laboratory tests, including potassium, calcium (K +, Ca ++) and urea, were measured pre- and post-dialysis, 30 minutes before and after HD. Simple descriptive statistics was used for the characterization of the sample and respective distribution of the variables. Statistical analyses were performed using the Statistical Package for the Social Sciences (SPSS) version 17.0® program for Windows®. Results were tested for normality and expressed as mean ± SD,. Comparisons were made using *t* test and Mann-Whitney test (electrolyte values). The relationship of the mean of differences between intervals and dispersions in groups (pre-HD and post-HD) were analyzed using ANOVA.

Results:

Table 1: **Distribution of Sociodemographic Characteristic for Participants (patients) (n=60)**

	Item	Ferq.	%
Age	30-39	9	15%
	40-49	11	18.3
	50-59	13	21.7
	60-69	17	28.3
	70-79	10	16.7
	Total	60	100%
	$\bar{x} \mp S.D$	53.83 ∓ 13.54	
Sex	Male	28	46.7
	Female	32	53.3
Education level	(Illiterate)Not read and Write	10	16.7
	Read and Write	9	15
	Primary School Graduate	25	41.7
	Intermediate School Graduate	12	20
	Secondary School Graduate		
	Institute and College Graduate	4	6.6
Occupation	Employed Governmental	6	10
	Self employed	11	18.4
	Retired	13	21.7
	House wife	26	43.3
	Out of work (Jobless	4	6.6
Marital Status	Single	12	20
	Married	42	70
	Divorced	6	10
	Widow	zero	zero
Residential Area	Urban	34	56.7
	Suburban & Rural	26	43.3

Table 1 reveals that the most 17(28.3%) of study sample are within the age group (60 -69) with mean and standard deviation (53.83 ∓ 13.54), Concerning to the gender 32 (53.3%) of participants are female while male is 28 (46.7%). Relative to the education level 25 (41.7%) of patient's primary school graduate, the table also show 42 (70 %) of participants are married and 34 (56.7 %) of them residential area in urban.

Table 2 : Distribution of Hemodialysis characteristic of participants (patients) . (n=60)

	Item	Freq.	%
maintenance dialysis	≤ 6M- 1year	30	50
	1year -2year	14	23.4
	2year -3year	12	20
	3year -4year	4	6.6
	$\bar{x} \mp S.D$	1.6 ∓ 0.00	
Weekly dialysis	3 time	60	100
Number dialysis/week	1st	19	31.7
	2nd	29	48.3
	3rd	12	20
dialysis Time/hours	3h	35	58.3
	2h	14	23.4
	2.5 h	8	13.3
	4h	3	5

Table 2 show 30 (50 %) , 29 (48.3%) , 35 (58.31%) of study sample are suffers from (maintenance dialysis, Number dialysis/week and dialysis time/hours) respectively. All participant had three time weekly

dialysis .

Table 3 : Electrolytes changes measured variables before and after Hemodialysis (n=60)

Variable	Pre hemodialysis (Mean±SD)	Post hemodialysis (Mean±SD)	p value
Potassium (mM/L)	5.09±0.70	3.96±0.54	<0.000
Calcium (mg/L)	7.34±0.90	7.72±0.60	<0.001
Urea (g/l)	59.88±9.50	21.97±4.81	<0.000

Relative to the electrolytes the table 3 show a statistical high significant difference of serum Changes ((Potassium, Calcium, and Urea) at pre-post hemodialysis with mean± SD (5.09±0.70 vs 3.96±0.54 , 7.34±0.90 vs 7.72±0.60 , 59.88±9.50 vs 21.97±4.81) respectively .

Table 4: The results of the measured variables after hemodialysis (n=60)

Variable	Pre-HD (Mean±SD)	Post-HD (Mean±SD)	p-value
QTc (msec)	383.11±11.95	422.16±18.70	0.02
QTcd (ms)	47.56±9.85	59.25±11.93	0.03
R-R (ms)	780.11±90.75	811.16±81.45	0.119

Table 4 show There is no significant differences between the RR intervals (780.11±90.75 ms pre-HD vs. 811.16±81.45 post-HD; p>0.05). There are significant differences between the QTc (msec) (383.11±11.95 msec pre-HD vs. 422.16±18.70 msec post-HD; p<0.05). The QTc dispersion increases from 47.56±9.85 ms pre-HD to 59.25±11.93 ms post-HD (p<0.05).

Table 5: Distribution Post-Dialysis Dis-arrhythmia.

	Item	No.	%
Dis-arrhythmia	Sinus tachycardia	12	20
	Sinus bradycardia	20	33.3
	Premature atrial contraction	9	15
	Ventricular Premature complexes	6	10
	Supra ventricular tachy cardia	3	5
	Irregularity with possible premature atrial contraction	15	25
	Atrial fibrillation	6	10
	Right bundle branch block	5	8.3

Table 5 show 20(33.3%) of participants are suffer from Sinus bradycardia and 15 (25%) of them are suffer from Irregularity with possible premature atrial contraction, another type of arrhythmia is denoted like (Premature atrial contraction, Ventricular Premature complexes, Supra ventricular tachycardia, Atrial fibrillation) with percentage {9(15%) ,6(10%) ,3(5%) ,6(10)} respectively.

Discussion

Arrhythmia is a disturbance in regular heart rate and/or rhythm due to change in electrical conduction or automaticity. Some arrhythmias can be described as minor arrhythmias which do not usually need treatment, while other major arrhythmias which should be treated as soon as possible.[12]

Ventricular arrhythmias are frequently observed in patients undergoing hemodialysis. One of the most important pathogenetic elements involved in the onset of intra-dialytic arrhythmias is the alteration in electrolytes concentration, particularly calcium and potassium.[5]

The results of this study reported that the mean age and SD of study sample was (62.46 $\mp$ 10.5), In addition to that table one demonstrates that the highest percentages 45(34.61%) of age factor for Clients were reported at (61-70) group . (table-1)

The patients' ages ranged from 30 to 87 years (mean age, 66.79 ± 13.16 years), and, of the 47 patients studied, 29 (61.7%) were males.[13]

Age is by far the most important risk factor in developing cardiovascular or heart diseases, with approximately a tripling of risk with each decade of life. It is estimated that 82 percent of people who die of coronary heart disease are 65 and older. At the same time, the risk of stroke doubles every decade after age.[14]

This study demonstrated There is no significant differences between the RR intervals (780.11±90.75 ms pre-HD vs. 811.16±81.45 post-HD; p>0.05), but There are significant differences between the QTc (msec) (383.11±11.95 msec pre-HD vs. 422.16±18.70 msec post-HD; p<0.05). The QTc dispersion increases from 47.56±9.85 ms pre-HD to 59.25±11.93 p<0.05). (table-4)

This study revealed that QTc dispersion is higher in hemodialysis patients and rises post-dialysis to levels comparable to those seen acutely following myocardial infarction, Because QT dispersion reflects non-

homogeneous recovery of ventricular excitability, the results suggest that dialysis patients may be at higher risk of reentrant arrhythmias, and that this risk rises in the immediate post-dialysis period, and suggest that dialysis patients may be at higher risk of reentrant arrhythmias, and that this risk rises in the immediate post dialysis period. Our study like the result of others study showed an increase of QTc dispersion post hemodialysis which might increase the risk of lethal ventricular arrhythmias [15.] Some authors observed that the mean value of QT interval measured on a 12 derivations ECG is influenced by hemodialysis.[16] Further-more, there are much data in literature concerning the relationship between hemodialytic treatment and QT dispersion; for example, in patients with kidney failure, the variability of ventricular repolarization can be expressed by an increase of the QT interval and QT dispersion. [4] The researcher accepts that the measurement of QT dispersion by a manual observer is prone to error. We have attempted to minimize any error by using a single blinded observer for all ECG pre-and post-dialysis, by measuring the QT interval in three complexes from each lead and using the average of these measurements. However, the mechanisms responsible for the increased QT dispersion post-dialysis are unclear.

This study revealed that the mean of serum potassium levels decreased from 5.09±0.7 to 3.96±0.54 mM/L($p<0.05$) and the mean of calcium levels decreased from 7.34±0.9 to 7.72±0.6 mg/L($p<0.05$). and the mean of urea levels from 59.88±9.50to 21.97±4.81g/L ($p<0.05$), (table-3)

The study in agreement with others who reported that The factors influencing QTc interval dispersion are the large amount of or rapid potassium removal, low calcium dialysate, intracellular magnesium overload, rapid bicarbonate gain and also patient with acute myocardial infarct, presence of ischemic heart disease, left ventricular hypertrophy in HD patients.[17]

This study showed 20 (33.3%) of participants are suffer from Sinus bradycardia and 15 (25%) of them are suffer from Irregularity with possible premature atrial contraction, another type of arrhythmia are denoted like (Premature atrial contraction , Ventricular Premature complexes , Supra ventricular tachycardia , Atrial fibrillation) with percentage { 9(15%) ,6(10%) ,3(5%) ,6(10)} respectively (table-5) .Our study smiller to others who revealed that there is a significant bidirectional association between chronic renal disease (CRD) and cardiovascular disease; Recent evidence similarly suggests that there are close relationships between arrhythmias and CRD.[18]

Conclusions

This study showed that QTc_{max} and QT dispersion, markers of risk for arrhythmias and sudden death, are elevated in hemodialysis patients, and rise pos-dialysis. QTc interval and dispersion increase in HD patients. Because QT dispersion reflects a non-homogeneous recovery of ventricular excitability. The incidence of ventricular arrhythmias among HD patients has been shown to be elevated, which may be life threatening. Additional larger studies are required to assess the importance of QT dispersion on cardiovascular outcome in chronic renal failure, and for intervention studies to reduce sudden death in this high-risk population.

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