CARDIAC ARRHYTHMIA IN DIALYSIS PATIENTS

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Abstract

INTRODUCTION: Dialysis patients have high mortality rate which half of them is due to cardiac arrhythmias. Some clinicians fear dialyzing patients because of new arrhythmias occurrence during dialysis which may cause sudden deaths. Controlling the most common arrhythmias and managing the causes can help to reduce the mortality in these patients.

METHODS: All patients who have done dialysis in two centers in Kerman were studied. The known cardiac patients and consumers of antiarrhythmia drugs were excluded. The patients were monitored 24 hours before dialysis and during dialysis.

RESULTS: The Mean age of patients was 47.9 year. The most common arrhythmias found before and during dialysis Were PVC and PAC (64% and 40% respectively). The prevalence of AF rhythm was 2.7%. QT interval has no significant increase in dialysis patients. There was no significant relation between PAC and PVC numbers before and during dialysis. The prevalence of these arrhythmias did not have significant relationship with Ions changes, the duration and quality of dialysis, severity of anemia and also demographic factors.

CONCLUSION: Arrhythmias rate did not increase during dialysis so the dialysis itself is not a leading risk factor for arrhythmias.

Keywords: Arrhythmias, Dialysis, QT interval.

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Introduction

Cardiovascular diseases are responsible for more than 4o% of death in dialysis patients (DP) and the burden of their morbidity is high. [1] Some studies showed that CVD mortality is about 9% per year in dialysis patients which is 30 times more that annual community mortality. Some patients death suddenly which indicate deaths due to serious arrhythmia. [2]

It is documented that if QT interval (the QT interval is a measure of the time between the start of the Q wave and the end of the T wave in the heart's electrical cycle) be pathologically more than the normal range in healthy individuals leads to dangerous arrhythmia and increases mortality rate.[3] Many factors such as cardiac electrical disturbance, Antiarrhythmia drugs, phenothiazins, tricyclic and quadric cyclic anti depression drugs, lithium and Antibiotics (Ampicillin, Erythromycin) can lead to QT interval increase. [4,5]

Kidney dysfunction in DP lead to Ion level abnormalities and the Ca^{2+}, K^{+} and Mg Ion balance will be disturbed. This imbalance affects heart cell's rest membrane potential and therefore causes changes in QT interval. Increased QT interval can cause most arrhythmias in DP and lead to death. [6]

Most clinicians avoid dialyzing poor prognosis patients because of new arrhythmias occurrence probability during dialysis and sudden death. In this study we evaluate the arrhythmias occurred during dialysis and compare it with 24 hours before dialysis.

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Also we hare measured QT interval, ejection fraction, electrolytes levels and hemoglobin (Hb) in the patients and assessed it's relation with arrhythmia.

Methods

The survey was done on all hemodialysis patients in Shafa hospital and Kerman Special Diseases Center from October 2005 to April 2006. There were no exclusion criteria related to the duration of dialysis, the first time of dialysis and the main cause of dialysis. Patients with known diseases such as myocardial Infarction, cardio myopathy and Valvular heart disease were excluded from study. Also patients who consume anti arrhythmia, phenothiazine and antidepressant drugs and antibiotics (which might affect QT interval) were excluded.

80 patients were entered to study. One patient had permanent pacemaker and was excluded. Four patients died during the study and four patients did not cooperated and left the study. Holter monitoring of a patients was unreadable because of artifacts.

Finally 70 patients were studied. The aim of study was explained to patients and their families. All patients consented to the study.

12 lead standards Electro cardiographs were done and QT interval was measured in lead II by the cardiologist (authors) before dialysis. QT interval was adjusted according to *Bazett's formula.* ($QTc=\frac{QT}{\sqrt{RR}}$). M mode, two-dimensional echocardiography (ATL-6) was done for all patients to assess pericardial effusion and ejection fraction. Holter monitoring (Holter B.M.S) has been done 24 hours before dialysis and during dialysis. The holter monitoring results were assessed by the cardiologist and they have recorded the arrhythmias and their frequencies before and during dialysis.

Cardiac Arrhythmia (irregular heartbeat or abnormal heart rhythm) were detected. Premature Atrial Contraction (PAC) and premature ventricular contraction (PVC) are the most common arrhythmias. PVCs are a very common form of arrhythmia, and can occur in both individuals with and without heart disease. In this study clinically significant arrhythmia was considered as detecting greater than 700 ventricular extrasystoles in 24 hour electrocardiograph. [7]

Electrolytes and Biochemical tests such as Na, Ca, Mg, BUN, Cr and HCT have been done before and after dialysis.

Results

In this study 38 men and 32 women were assessed. The Mean age of patients was 47.9 year. The main characteristics of samples are shown in table [1]. The most common cause of dialysis in our study was hypertension.

TABLE 1. The main characteristics of Study Groups.

Variables	(N=72)
Age (M±SD)	47.9 ± 16.1
Etiology Renal Disease (%)	
Diabetes	20(27.4%)
HTN	26(35.6%)
Other	27(37.0%)
Duration of Hemodialysis	
Mean (months)	28.8
Range (months)	1-180
EF (%)	
Abnormal	14 (19.2 %)
Normal	59 (80.8%)
LVH (%)	31 (42.5%)
AF (%)	2 (2.7%)
Pericardial effusion (%)	30 (41.1%)

The most common arrhythmias found before and during dialysis Were PAC (40%) and PVC (64%).

But there was no significant relation between PAC and PVC numbers before and during dialysis and also between these arrhythmias and demographic factors (table 2 and 3).

Qt interval has no significant increase in DP. The prevalence of AF rhythm was 2.7%.

Discussion

The Mean age of patients was 47.9 ± 16.1 year which is lower than other studies. In other studies the mean age of patients has been reported from 38.2 year in 1997 to 52.5 in 2007. [1,8,9] It seems better control and management of disease leading to dialysis leads to later presentation of renal complications. Probably in next decade we will have the same change in our country as chronic diseases such as hypertension and diabetes are controlling better.

The most common cause of dialysis was hypertension in our study but the statistics show that diabetes is the most common cause in developing countries.[3]

The prevalence of AF arrhythmia was 2.7% in our study. AF rhythm has been reported approximately 12 %.(10) Maybe the lower AF is due to lower mean age of our patients. Increasing age will increase the prevalence of AF even in non dialysis individuals. [11] The dialysis has no effect of incidence of new AF. None of patients had AF during dialysis.

TABLE 2. The effect of multiple factors on PVC and PAC during dialysis.

Variables		PVC		PAC	
		Adjusted β	Unadjusted β	Adjusted β	Unadjusted β
Age (M±SD)	47.9 ± 16.1	0.03	0.561	0.15	1.05
QTc Interval (ms)	0.40 ± 0.4	-0.02	-96.28	0.2	565.34
Hematocrit (%) (M±SD)	30.7 ± 6.5	0.16	6.47	0.01	-0.222
P(mg/dl) (M±SD)	5.1 ± 1.7	-0.06	8.98	-0.06	-2.44
BUN (mg/dl) (M±SD)	116.2 ± 28.1	-0.06	-0.52	-0.08	-0.108
Cr (mg/dl) (M±SD)	5.9 ± 1.9	0.16	22.4	-0.04	-2.28
K (mEq/l) (M±SD)	5.3 ± 1.0	-0.09	-23.3	-0.03	2.43
Ca (mg/dl) (M±SD)	8.7 ± 1.2	-0.07	-15.65	-0.12	-11.715
Mg (mg/dl) (M±SD)	3.4 ± 0.9	-0.09	-24.8	-0.12	-15.36
Na (mg/dl) (M±SD)	135.8 ± 5.9	0.05	2.25	-0.1	-2.715
EF< 50 (%)	14 (19.2 %)	-0.07	-1.65	0.11	0.527
LVH (%)	31 (42.5%)				
AF (%)	2 (2.7%)				
Pericardial effusion (%)	30 (41.1%)				

TABLE 3. Frequency of Arrhythmia Before and During Dialysis

PVC		
Before dialysis	57.1 ± 183.2	P= 0.708
during dialysis	63.9 ± 264.9	Z= -0.374
PAC		
Before dialysis	405.8±1560.7	P= 0.061
during dialysis	64.5 ±117.8	Z= -1.87

The dialysis duration was lower (1-180 month) in this study. The mean duration of dialysis was 9-218 months in developing countries. It's maybe due to higher annual mortality rate of our patients. [8]

QTc did not increase in our study (QTc = 40 ± 4 msec). In a study in Europe QTc was 43 ± 2 msec and the patients who had more arrhythmia had higher QT. [6] shorter dialysis duration and lower electrolytes disturbances may affect QT in our patients. Long dialysis, even if performing perfectly can cause Ions imbalance and lead to QT changes.Ca^{2+}, K^{+}, Mg^{2+} ions role in QT interval is so various and complex, so the QT variation are not easily explained. hyperkalemia leads to shorter QT interval in primary stage. Hypocalcaemia can increase QT interval and Hypermagnesemia can increase QT and arrhythmia. [8]

Some studies has reported Hematocrit (Hct) 22.8 ± 5, but it was 30.7 ± 6.5 in our patients. It shows that the anemia severity is lower in our patients. The lower anemia rate is due to shorter dialysis period. Anemias can worse the myocardial ischemia and leads to arrhythmia. [8]

A study carried out in Poland showed that the prevalence of cardiac arrhythmias in peritoneal dialysis is lower and PVC has been detected in 30-43.3% of patients and supra ventricular arrhythmias were seen in 40- 56.7%. They conclude that peritoneal dialysis does not provoke or aggravate arrhythmia. [12]

Silent myocardial ischemia and ventricular arrhythmias in patient during dialysis has been well recognized. In a study Holter monitoring showed silent MI in 22% cases during hemodialysis. A significant increase happened in the frequency of ventricular arrhythmias during and after dialysis. It claims that Silent myocardial ischemia is an arrhythmogenic process and predisposes a clinically significant ventricular arrhythmia during and after dialysis. [9]

We found no statistically significant differences between patients with and without ventricular arrhythmia in urea, calcium, kalium and magnesium blood concentrations but there was a statistically significant difference between groups for creatinine values. Another study indicated that ventricular arrhythmia appears in the majority of hemodialysed patients and that hemodialysed intensifies arrhythmogenic influence of irreversible renal failure on heart. It is also possible that non-adequate hemodialysed might

be responsible for induction of ventricular heart arrhythmias during and after dialysis. [13]

HD is potentially arrythmogenic procedure in patients with preexisting cardiac disease [14]. Maybe the lower incidence rate of arrhythmia is due to exclusion of the patients with cardiac disease history. There was only one study which confirmed our results and showed that chronic hemodialysis did not enhance the risk of malignant arrhythmias in patients with ESRD.

Our limitation in this study was Holter monitoring device deficiency. If we had more Holters we could compare the QT interval and arrhythmias (PAC and PVC) of the patients with a control group so our results were more precious.

PAC and PVC are the most common arrhythmia in DP before and during dialysis. Their prevalence did not have significant relationship with Ions changes, the dialysis quality, severity of anemia and the duration of dialysis.

The number of arrhythmias did not increase during dialysis in patients with no history of cardiac diseases so the dialysis itself is not a leading risk factor for arrhythmias.

But if there is a patient with the history of arrhythmia, ischemia or Left ventricular hypertrophy (LVH), he should be monitored during hemodialysis or undergo peritoneal dialysis in order to reduce the arrhythmia risk.

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