EFFECTS OF DIALYSIS ON P DISPERSION AND P WAVE DURATIONS

Original Research article

DİYALİZİN P DİSPERSİYONU VE P DALGA SÜRESİNE ETKİLERİ

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ABSTRACT

Purpose: AF is also common among hemodialysis patients and is associated with high mortality. P wave dispersion have been shown to be a predictor of AF in several clinical conditions. The objective of our study was to determine the effects of dialysis on P wave dispersion and P wave durations among non diabetic patients with end-stage renal disease on chronic hemodialysis.

Materials and methods: We studied P max , P min and P dispersion in 96 patients (46 men and 50 women, mean age 50.56 ± 15.6) with chronic renal failure undergoing hemodialysis. P dispersion was calculated as difference between maximum and minumum p wave duration. Twelve-lead ECGs were recorded at the beginning and at the end of each session. Ionic parameters checked during the study.

Results: P dispersion did not show any significant change (42.76±17.6 vs 43.88±17.31, p = 0.50). Likewise P dispersion , P maximum (103.14±16.8 vs 104.35±16.42 , p=0.43) , P minimum (60.38±16.1 vs 60.47±16.7 ,p =0.90) and P mean (83.89±15.16 vs 84.01±15.69 , p =0.91) did not show any significant difference before and after dialysis. Potassium (4.97±0.55 vs 3.41±0.46 p = 0.01) and calcium (8.71±0.85 vs 8.54±0.74) levels decreased significantly during dialysis session.

Conclusion: According to our findings dialysis process does not cause significant increase in P dispersion and P wave duration.

Key words: *Atrial fibrillation; P wave dispersion; hemodialysis.*

ÖZET

Amaç: AF hemodiyaliz uygulanan son dönem böbrek yetmezliği (SDBY) hastalarında da sık karşılaşılan ve mortaliteyi arttıran bir hastalıktır. P dalga dispersiyonunun pek çok klinik tabloda AF'yi öngördüğü belirlenmiştir. Bu çalışmadaki amacımız hemodiyaliz uygulanan SDBY hastalarında hemodiyaliz sürecinin P dispersiyonuna ve P dalga sürelerine etkisini araştırmaktır.

Gereç ve yöntemler: Çalışmaya 96 (46 erkek , 50 kadın ,ortalama yaş 50.56 ± 15.6 yıl) hemodiyaliz hastasının hemodiyaliz öncesi ve sonrasında 12 derivasyonlu elektrokardiyografileri (EKG) çekilerek P maksimum, P minimum, P ortalama ve P dispersiyonu değerleri hesaplandı. Hemodiyaliz öncesi ve sonrası serum elektrolit seviyeleri belirlendi.

Bulgular: Hemodiyaliz öncesi ve sonrasında çekilen EKG'lerden hesaplanan P dispersiyonunda belirgin bir değişiklik gözlenmedi (42.76±17.6, 43.88±17.31, p = 0.50). Benzer şekilde P maksimum (103.14±16.8 - 104.35±16.42, p=0.43) , P minimum (60.38±16.1 - 60.47±16.7, p =0.90) ve P ortalama (83.89±15.16-84.01±15.69, p =0.91) değerleri de hemodiyaliz öncesi ve sonrasında belirgin değişiklik göstermedi. Hemodiyaliz sürecinde potasyum (4.97±0.55 - 3.41±0.46 p = 0.01) ve kalsiyum (8.71±0.85-8.54±0.74) seviyeleri beklendiği şekilde, istatistiksel olarak belirgin düşüş gösterdi.

Sonuç: Sonuç olarak çalışmamız diyaliz sürecinin P dispersiyonu ve P dalga süreleri üzerinde belirgin bir etkisinin olmadığını gösterdi.

Anahtar kelimeler: *Atriyal fibrilasyon; P dalga dispersiyonu; hemodiyaliz.*

INTRODUCTION

Atrial fibrillation (AF) is a highly prevalent (13%) arrhythmia in patients with chronic renal insufficiency on hemodialysis. History of congestive heart failure, valvular heart disease, left atrial enlargement, systemic hypertension and advanced age are independently associated with AF. The conditions mentioned above are frequent among end stage kidney disease patients especially receving hemodialysis (1).

P wave dispersion (PWD) is defined as the difference between the maximum and minimum P wave durations. PWD is an electrocardiographic parameter that reflects inhomogenous and discontinious atrial conduction of sinus impulses (2,3). Prolonged P wave duration and increased PWD have been reported to be associated with an increased risk for AF (4,5,6). The response of P wave duration and PWD to hemodialysis may be variable and mediated by an interplay of electrolytic shifts and electrophysioloic and extracardiac mechanisms associated with the alleviation of fluid overload (7).

The purpose of our study was to evaluate the effects of hemodialysis on P wave durations and P wave dispersion.

PATIENTS AND METHODS

Eigthy-seven non-diabetic patients (43 males and 44 females , mean age 49.65±15.7) with end- stage kidney disease on hemodialysis treatment were selected. The study population had no impulse generation or conduction defect or previous episode of AF. All patients were in sinus rhythm during the study. Exclusion criteria were; current atrial fibrillation, no P wave on ECG or no clear point of return to the isoelectric line. The underlying causes for chronic renal failure were chronic glomerulonephritis (n=37) , hypertensive nephrosclerosis (n=7), amiloidosis (n=2) , polycystic kidney disease (n=5), obstructive nephropathy (n=3) and unknown etiology (n=33). Medications taken by patients were as follows ; in sixteen (18.4%) beta-blockers,

in seventeen (19.5%) angiotensin converting enzyme inhibitors , in fifteen (17.2%) calcium antagonists.

Hemodialysis sessions were carried out in Standard settings (4008-B, Fresenius Medical Care, Germany), F 5 and F 7 HPS polysulfone (Fresenius Medical Care, AG.D-61343 Bad Hamburg, Germany) for 3.5–4 hours, three times per week.
Bicarbonate dialysate fluids contained 140 mMol/L sodium, 2.0 mMol/L potassium, 1.5 mMol/L calcium, and 1.0 mMol/L magnesium. During the sessions no drugs were administered, except for isotonic NaCl and sodium heparin. Blood pressure and heart rate of all patients were obtained immediately before and after hemodialysis session. Blood samples were drawn before and after hemodialysis sessions for the determination of serum potassium, sodium, calcium. The amount of ultrafiltration performed during hemodialysis sessions were noted.

Prior to hemodialysis two-dimensional and M-mode echocardiographic examinations were performed with Hewlett-Packard 2000 system with a 2.5 MHz transducer. Left atrial dimensions and left ventricular ejection fraction were measured from parasternal long-axis view as suggested by the American Society of Echocardiography (8).
All subjects underwent a conventional 12-lead ECG examination immediately before the hemodialysis session and at the end within 20 minutes. Simultaneous 12-lead ECGs were recorded by means of 12-channel ECG equipment (Hewlett Packard Page Writer 200i; M1071A, China), at a paper speed of 25 mm/s. On every occasion, the ECG was obtained in a comfortable supine position. During ECG recordings, all patients breathed freely and did not speak. ECG electrodes were not changed or renewed during or after haemodialysis. For measurement of P wave duration, the 12-lead ECG printouts were enlarged on the same photocopier by a factor of three. P wave duration was measured with calipers in all 12 leads by one observer in order to exclude inter-observer variability. P wave duration was measured from the first electrical activity to the offset at the junction between the end of P wave deflection and the isoelectric line. P wave dispersion was defined as the difference between the maximum and minimum value of P wave duration. Three consecutive cardiac cycles were measured and averaged.

The study was approved by the local ethics committee and all participants gave informed consent.

STATISTICAL ANALYSIS

All statistical analysis were performed by SPSS 15.0 for Windows (Chicago, IL, USA). All data were expressed as mean ±SD. Statistical analysis was carried out using a paired Student's t test for continous variables. A P value <0.05 was considered statistically significant. Spearman's correlation test was used to explore correlation with P dispersion and clinical characteristics and electrolytes

RESULTS

Clinical and demographic variables have been shown **Table 1**.

Table 1. *Baseline Clinical and Echocardiographic Characteristics of the Study Population* .

Mean age (years)	49.65±15.52
Sex (female)	44(50.6)
Time of dialysis (years)	10.47±6.0
Systolic blood pressure (mmHg)	128.2±15.6
Diastolic blood pressure (mmHg)	82.7±10.1
Hypertension n (%)	27 (31.0)
Coronary artery disease n (%)	9 (10.3)
Hyperlipemia n (%)	12 (13.8)
Beta blocker (%)	16 (18.4)
ACE inhibitor (%)	17 (19.5)
Calcium blocker (%)	15 (17.2)

Abb: ACE,angiotensin converting enzyme

Mean left atrium diameter was 3.87±0.57mm and left ventricular ejection fraction was 57.99±8.29 %. Electrocardiographic measurements and serum electrolyte levels befor and after hemodialysis are given in **Table 2**.

	Before dialysis	After dialysis	P value
Potassium (mMol / L)	4.97±0.55	3.42±0.46	**0.001**
Calcium (mMol / L)	8.71±0.85	8.54±0.74	**0.001**
Phosphate (mMol / L)	2.30±0.35	1.71±0.41	**0.001**
Sodium (mMol/L)	137.2±2.9	136.8±2.8	0.81
Magnesium(mMol/L)	0.82±0.30	0.81±0.29	0.79
P maximum (ms)	102.90± 16.92	104.83±16.39	0.22
P minimum (ms)	60.29± 16.23	59.87±16.67	0.82
P dispersion (ms)	42.61±16.23	44.95±16.67	0.23
Mean P waveduration(ms)	83.89±15.16	84.01±15.69	0.91

Table 2. *Serum Electrolytes and P wave Measurements Before and After dialysis*.

P dispersion remained stable after hemodialysis (42.61±16.23 ms vs 44.95±16.67 ms , p=0.23). Likewise P dispersion P max (102.9±16.92 ms vs 104.83±16.39 , p=0.22) and P min. (60.29 ± 16.23 ms vs 59.87± 16.97 ms, p =0.82) did not show any significant change compared to predialysis values. Mean P wave duration was also stable during hemodialysis session (83.89±15.16 ms vs 84.01±15.69 ms , p=0.91) **(Fig. 1).**

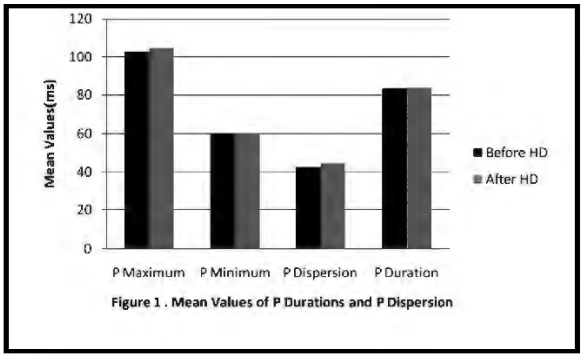

Figure 1 . Mean Values of P Durations and P Dispersion

Durig hemodialysis serum potassium, calcium and phosphate levels decreased significantly.

According to Spearman's correlation analysis P dispersion after dialysis was significantly correlated with post dialysis calcium concentration (r=0.24, p=0.02) and inversely correlated with left atrium diameter (r = -0.24 , p =0.02). P dispersion after hemodialysis did not correlate significantly with age, duration of hemodialysis, serum potassium levels, left ventricular ejection fraction. Predialysis P dispersion did not correlate significantly with any parameter.

DISCUSSION

AF is a common arrhythmia among end stage renal disease patients undergoing hemodialysis program. Prolonged P wave duration and increased P dispersion have been reported to be associated with an increased risk for AF in various clinical settings (9,10). PWD increases significantly during hemodialysis sessions. This may increase the risk of AF episodes during hemodialysis (11).

In our study we have demonstrated nonsignificant differance in P wave maximum duration, P wave minimum duration and P wave dispersion after hemodialysis sessions compared to the predialysis period. AF is more prevalant among hemodialysis patients compared to peritoneal dialysis patients and majortiy of arrhythmia episodes occur during hemodialysis sessions (11,12). In the light of these facts investigators performed several studies to find out simple electrocardiographic markers to predict atrial fibrillation among end stage renal disease patients.

There are several studies exploring the effects of hemodialysis on P wave duration and P wave dispersion but results are controversial and sample sizes are small. Szabo et al. (13) investigated the effect of hemodialysis on P wave dispersion in

twenty – eight nondiabetic patients and reported that P wave dispersion increased after hemodialysis. However when they subgrouped the patients they noticed that increase in P dispersion was only observed among patients with enlarged left atrium (>45 mm). Compared to Szabo's study group our patients had smaller left arium diameter (38.7±0.5 mm vs 44.1±6.9 mm). Ischemic heart disease was also more prevelant in Szabo's group compared to our patients (64 % vs 10%). Tezcan et al. (14) studied thirthy-two hemodialysis patients and reported increased P wave dispersion and maxiumum P wave duration after hemodialysis. Hypertension prevalance was higher compared to our group among Tezcan' s patients (52% vs 31 %). In the other study Drighil et al. (15) reported that P dispersion and P wave durations were stable in their study. Ozben et al. (16) reported that increase in P wave durations and P disperion returns back to the predialysis values after hemodialysis session.
Similar to latter two studies we did not find any significant difference between P wave dispersion and P wave durations before and after hemodialysis. Likewise P wave measurements, baseline characteristics of our patients were similar with Drighil and Ozben's groups. Significant increase in P dispersion among Tezcan and Szabo's groups may be releated to the higher rate of hypertensive and ischemic heart disease patients.

Different results from mentioned above studies may be releated to the very different baseline clinical and demographic characteristics of study groups. Increase in P dispersion and P durations during electrolyte imbalance course especially hypocalemic period among hypertensive, diabetic or CAD patients will not be a surprising finding . So such studies cannot be used for general dialysis population.

Despite lack of significant change during hemodialysis in PWD and P dispersion, long term follow up studies should be performed to determine the predictive values of these parameters on AF among hemodialysis patients.

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