Research Paper Medical Science

The Effect of Electrolyte Imbalance on Ecgs In Chronic Kidney Disease Patients: Pre And Post Haemodialysis At Tertiary Care Hospital, Bhopal

Rajaram barde ASSISTANT PROFESSORDEPT. OF MEDICINE GMC BHOPAL.M.O DEAPRTMENT OF CARDIOLOGY GMC BHOPAL

Sudha alawe

ABSTRACT

Objectives: The aim of this study is to assess the effect of serum electrolyte imbalance causing ECG changes such as QTc during haemodialysis (HD). Prospectively, Fourteen haemodialysis patients with ESRD had ECG and serum electrolyte tested before and after HD.

material and Methods

this prospective study,conducted in dialysis unit of medicine department at gandhi medical college bhopal which included 40 patients of ESRD and undergoing haemodialysis treatment twice per week.

The mean duration for sessions of the dialysis was 4 hours. The patients were normally treated with a bicarbonate dialysate . The patients were dialysed using Polysulfone-based dialysis membrane (Haemodialysis Apparatus b brown in dialysis unit of medicine department at gandhi medical college bhopal .

Blood samples were obtained from each patient just before the haemodialysis session and 10 minutes after the session for measurements of serum level of K+ and Ca+2 as well as serum level of urea and creatinine as described in the dialysis outcomes quality initiative guidelines. In addition, a standard 12-leads ECG recorded before dialysis and 20 minutes after the dialysis in supine position. Kenz Cardio 302 three channel ECG machine was used for all patients. Potassium and the rest of the electrolyte were analysed .

Results: All electrolytes changes before and after hemodialysis were shown to be statistically significant analyzed by paired Student's test. In ECG QT interval and T-wave amplitude changes statistically significantaly pre HD and post HD.

Conclusion: All electrolyte changes before and after HD are statisticallysignificant. QTc and QT interval decreased after HD.

KEYWORDS HD,ECG, electrolytes, end-stage renal failure

INTRODUCTION

cardiovascular disease is a major cause of mortality and morbidity among subjects on hemodialysis. It is responsible for up to 50% of deaths among subjects on dialysis.[1] Cardiac arrhythmias are frequent among thehemodialysispopulation, particularly during and immediately after a dialysis session. [2]

These arrhythmias may be caused by the rapid changes in intracellular and extracellular electrolytes during the dialysis session. [3] Hyperkalaemia (serum K^+> 5 mmol/L) is a relatively common finding in patients with end-stage renal disease (ESRD). Severe Hyperkalaemia might occur in 10 -19% of haemodialysis (HD) patients [4], it has been shown by several studies that a sudden shift and decrease in serum K^+ causes arrhythmia especially in patients undergoing dialysis [5,6]._HD has been reported to determine an increase in QTc interval [7] which is a risk factors that predispose to severe ventricular arrhythmias and sudden death [8].

Material and Methods

this prospective study,conducted in **dialysis unit of medicine department at gandhi medical college bhopal** which included 40 patients of ESRD and undergoing haemodialysis treatment two times per week.

The mean duration for sessions of the dialysis was 4 hours. The patients were normally treated with a bicarbonate dialysate which contained the following electrolyte concentration: K^+, 2.0 mmol/L; Mg^{2+}, 1.0 mmol/L ; Ca^{2+}, 1.75 mmol/L; Na^+, 135 mmol/ and HCO3 32 mmol/L. Blood flow rate was 250–300 ml/minute with a dialysate flow of 500 ml/min. The patients were dialysed using Polysulfone-based dialysis membrane (Haemodialysis Apparatus B BROWN) in DIALYSIS UNIT DEPARTMENT OF MEDICINE BHOPAL .

Patients with ischemic heart disease (according to detailed medical history and ECG findings), ECG changes of atrial fibrillation, left ventricular hypertrophy or left bundle branch block (LBBB) and those on anti-arrhythmic medication were excluded from the study.

Blood samples were obtained from each patient just before the haemodialysis session and 10 minutes after the session for measurements of serum level of K^+ and Ca^{+2} as well as serum level of urea and creatinine as described in the dialysis outcomes quality initiative guidelines[9]. In addition, a standard 12-leads ECG recorded before dialysis and 20 minutes after the dialysis in supine position. Kenz Cardio 302 three channel ECG machine was used for all patients. Potassium and the rest of the electrolyte were analysed .

Electrocardiograms (ECG)

The interpretation of ECG was performed by measuring the amplitude of the T and R waves, QT and R-R intervals. All QT intervals were corrected for heart rate (QTc) by dividing the QT interval to the square root of the R–R interval (Bazett's formula; QTc = QT/√R-R). The ECG readings were measured manually after magnification according to Higham and Campbell [10] recommendation. All the ECGs were reviewed and interpreted by a single cardiology consultant based at department of cardiologygandhi medical college bhopal

Statistical analysis

All statistical analyses were performed using SAS version 8.2. Differences in quantitativeparameters before and after HD were compared respectively, by the pair student t test and the Fisher exact probability test.

A "p" value<0.05 was determinedas statistically significant.

Results

In our study 30 patients out of 40 were male(75%) and 10 patients were female (25%)(TABLE-1)Maximum patients belong toage between 41-50 years(32.5%)(TABLE-2). Electrolytes[-

Ca+,Po4+,Na+,K+] and ECG QT interval, QTc interval ,R-R interval ,T amplitude ,R amplitude] Changes before and after hemodialysis are shown in (TABLE-3)

TABLE-1 GENDERWISE DISTRIBUTION OF PATIENTS
Total Patients-40

gender	No.	%
Male	30	75
female	10	25

TABLE-2 AGE WISE DISRIBUTION OF PATIENTs
total pts-40

Age(yrs)	Total pts -40	%	male	%	female	%
>18 -30	05	12.5	03	7..5	02	5
31 -40	10	25	08	20	02	5
41 -50	13	32.5	10	25	03	7.5
>51	12	30	09	22.5	03	7.5

Table 3: Effects of HD on serum electrolytes and ECG parameters

	Pre-HD	Post-HD	Sig
QT interval(ms)	370.2 ± 42.1	369.3 ± 42.9	0.006
QTc interval(ms)	428.04±58	408.91 ± 63.38	0.1748
R-R interval(ms)	747.3 ± 153.5	834.8 ± 84.1	NS
T amplitude(mm)	4.33±1.89	3.18±1.11	0.045
R amplitude (mm)	9.01 ± 2.9	9.7±2.5	NS
Ca^{2+} (mg/dL)	9.04±0.57	10.57±.99	0.0001
Po+4(mg/dl)	4.90±1.68	2.08±.53	0.0001
Na+	136.09±4.01	140.30±2.12	0.0001
K^+ (mmol/L)	5.24±0.87	3.93±0.69	0.007

DISCUSSION

In this study we examined the change of electrolyte mainly K^+ during haemo-dialysis in patients with ESRD. These patients usually present with hyperkalemia.

Hyperkalemia reduces the resting membrane potential, slows the conduction velocity and increases the rate of repolarization.

Hypokalemia on the other hand increases the resting membrane potential, and increases the duration of action potential and refractory period, which are potentially arrhythmogenic [11].

All these changes are the signs of membrane instability and cardiac arrest or ventricular fibrillation may follow and thus this situation usually requires careful and prompt management [12].During haemodialysis there is quick shift of serum K^+ which leads to hypokalemia and this might lead to the ECG changes [13]. The main change is increase of the QTc interval which is a marker of the ventricular repolarization and its prolongation has been associated with increased risk of sudden death in both pathological [15] and healthy[16] populations.

In our study the main significant ECG changes are the increase of QTc duration and decrease the amplitude of the T wave. These findings are compatible with a study done by Tarif et al [12]. There was significant correlation between these ECG changes (i.e. QTc) and serum K^+ level before haemodialysis but this relation could not be found at the end of haemodialysis. Therefore, we could not prove any significant association between all these variables after dialysis.

The most important influencing factor on the serum K^+ level during haemodialysis is the concentration of K^+ in the dialysate as well as the duration of dialysis, type of the dialyzer and blood flow rate. Therefore, using standardised dialysate for all patients without considering the electrolyte values before the haemodialysis might have serious effect. It is appropriate for the dialysate to be tailored for each patient.

Conclusion: chronic renal failure patients under hemodialysis are more susceptible to cardiac arrhythmias and sudden death especially during d after hemodialysis,
All electrolyte changes before and after HD are statisticallysignificant. QTc and QT interval decreased after HD.

Limitation of study:
causes of chronic kidney disese not studied.
body weight before and after HD not studied**.**

REFERENCES

1. De Lima J, Sesso R, Abensur H et al.Predictors of mortality in long-termhemodialysis patients with a low prevalence of co morbid conditions. Nephrol. Dial. Transplant 1995; 10 (9): 1708-1713.
2. Familoni O, Alebiosu C, Ayodele O et al,Effects and outcome of hemodialysis on QT intervals and QT dispersion in patients with chronic kidney disease. Cardiovasc J S Afr 2006 Jan-Feb; 17(1):19-23.
3. Krachler M, Scharfetter H, and Wirnsberger G.Exchange of alkali trace elements in hemodialysis Patients: a comparison with Na(+) and K(+). Nephron 1999; 83(3):226-36.
4. Tzamaloukas AH, Avasthi PS. Temporal profile of serum potassium concentration in nondiabetic and diabetic outpatients on chronic dialysis. Am J Nephrol. 1987;7(2):101-9.
5. Buemi M, Aloisi E, Coppolino G, Loddo S, Crasci E, Aloisi C, et al. The effect of two different protocols of potassium haemodiafiltration on QT dispersion. Nephrol Dial Transplant. 2005 Jun;20(6):1148-54.
6. *Gussak I, Gussak HM. Sudden cardiac death in nephrology: focus on acquired long QT syndrome. Nephrol Dial Transplant. 2007 Jan;22(1):12-4.*
7. *Covic A, Diaconita M, Gusbeth-Tatomir P, Covic M, Botezan A, Ungureanu G, et al. Haemodialysis increases QT(c) interval but not QT(c) dispersion in ESRD patients without manifest cardiac disease. Nephrol Dial Transplant. 2002 Dec;17(12):2170-7.*
8. *Schouten EG, Dekker JM, Meppelink P, Kok FJ, Vandenbroucke JP, Pool J. QT interval prolongation predicts cardiovascular mortality in an apparently healthy population. Circulation. 1991 Oct;84(4):1516-23.*
9. *National Kidney Foundation. NKF-DOQI clinical practice guidelines for hemodialysis adequacy. Am J Kidney Dis 1997;30:S15-66.*
10. *Higham PD, Campbell RW. QT dispersion. Br Heart J. 1994 Jun;71(6):508-10.*
11. Webster A, Brady W, Morris F. Recognising signs of danger: ECG changes resulting from an abnormal serum potassium concentration. Emerg Med J. 2002 Jan;19(1):74-7.
12. Tarif N, Yamani H, Bakhsh AJ, Al-Wakeel JS, Sulaimani F, Memon NA, et al. Electrocardiography and serum potassium before and after hemodialysis sessions. Saudi J Kidney Dis Transpl. 2008 Jan;19(1):47-53.
13. Covic A, Diaconita M, Gusbeth-Tatomir P, Covic M, Botezan A, Ungureanu G, et al. Haemodialysis increases QT(c) interval but not QT(c) dispersion in ESRD patients without manifest cardiac disease. Nephrol Dial Transplant. 2002 Dec;17(12):2170-7. 15.Cargill RI, Barr CS, Coutie WJ, Struthers AD, Lipworth BJ. C-type natriuretic peptide levels in cor pulmonale and in congestive heart failure. Thorax. 1994 Dec; 49 (12): 1247-9.
16. Barr CS, Naas A, Freeman M, Lang CC, Struthers AD. QT dispersion and sudden unexpected death in chronic heart failure. Lancet. 1994 Feb 5;343(8893):327-9.