DOI: https://doi.org/10.53350/pjmhs211581871

ORIGINAL ARTICLE

Extent of Fall in Serum Potassium by Medical Therapy in End Stage Renal Disease

SADAF SARWAR[1], TAHIR ULLAH KHAN[2], ATIF MASOOD[3], FAISAL AMIN BAIG[4] ARSALAN NAWAZ[5], MAIDA NAZIR[6]
[1]Senior Registrar, Department of Medicine, Sir Ganga Ram Hospital, Lahore
[2,5]Assistant Professor, [3,4]Associate Professors, [6]Senior Registrar, Department of Medicine University of Lahore Teaching Hospital
Correspondence to Dr Tahir Ullah Khan, E-mail: tahirnurar69@gmail.com, Cell: 0332-9930269

ABSTRACT

Aim: To observe the mean alteration in potassium levels one-hour post-antihyperkalemic treatment in end stage renal disease patients presenting with hyperkalemia.
Study design: Quazi interventional (experimental) study.
Place and duration of study: Department of Medicine, Sir Ganga Ram Hospital Lahore from 28th June 2018 to 27th December 2018.
Methodology: Sixty patients of both genders with age range between 14 to 70 years having stage 5 CKD (thrice-weekly dialysis dependent) for at least 6 months with raised serum potassium (>5.5 mEq/L). These patients were given medical treatment in the form of salbutamol nebulization, injectable calcium gluconate, and 100ml 25% dextrose water solution neutralized with Humulin R Insulin 12 units. Serum potassium was reassessed 1 hour after the treatment. Mean change in serum potassium was observed and was compared across various subgroups of patients. A written informed consent was taken from each patient.
Results: In the current study, mean age of our studied population was 50.6±10.4 years with male-gender dominance (81.7%). Mean ESRD duration was 11.8±3.7 months while the mean BMI was 27.6±3.6Kg/m2. 15 (25.0%) patients were obese. The serum potassium level at presentation ranged from 5.6mEq/L to 6.9mEq/L with a mean of 6.25±0.39mEq/L. The serum potassium level 1 hour after medical treatment ranged from 4.8mEq/L to 6.3mEq/L with a mean of 5.58±0.43mEq/L. This change in mean serum potassium was significant (p-value<0.001) on paired sample t-test. The change in serum potassium level ranged from 0.5-0.9mEq/L with a mean of 0.676±0.123mEq/L. Similar mean change in serum potassium level was observed when stratified for age, gender, BMI and duration of ESRD.
Keywords: End Stage Renal Disease, Hemodialysis, Hyperkalemia, Medical Treatment.

INTRODUCTION

End stage kidney disease (ESKD) is defined as chronic kidney dysfunction having GFR <15ml/minute and requiring renal replacement therapy in the form of hemodialysis or kidney transplant is termed as end stage renal disease (ESRD)[1]. Patients suffering from end stage kidney disease are at risk of fatal complications like pulmonary edema, severe metabolic acidosis, metabolic encephalopathy, uremic pericarditis and hyperkalemic cardiac arrest[2]. Among the metabolic and electrolyte abnormalities, the most life-threatening complication of ESRD is hyperkalemia frequently observed in patients after missed dialysis session or poor dietary compliance[3]. The cause of hyperkalemia in ESRD patients is metabolic acidosis and can lead to sudden cardiac arrest due to ventricular arrhythmias[4]. Potassium levels more than 5.5meq/L is termed as hyperkalemia. Patients may not be having symptoms, or a variety of manifestations (weakness, paresthesias, palpitations, paralysis, and easy fatigability). Urgent dialysis is a final stay of management in patients presenting with potentially lethal hyperkalemia non-responding to medical treatment in patients with limited renal reserve and capacity to metabolize different end products, most of which are detrimental to human health when accumulated inside the body. In clinical practice, arrangement and initiation of dialysis may take some time. Therefore, in such a scenario where dialysis is likely delayed, initiating medical treatment to lower serum potassium levels is of paramount importance and could prove life-saving[5,6].

Ahmad et al.[6] in his study observed mean change in serum potassium in dialysis dependent chronic kidney disease patients to be 0.69±0.13mEq/L 1 hour after medical treatment. Available literature regarding medical treatment of hyperkalemia in ESRD patients reveals that it not only helps in avoiding catastrophic cardiac events due to high serum potassium levels but also helps you buy time in such an emergency condition.

The current study is designed to measure the mean drop in potassium levels one-hour post-antihyperkalemic treatment, a parameter not previously explored. This study will help us generate guidelines regarding optimum medical treatment of hyperkalemia in ESRD patients.

MATERIALS AND METHODS

This Quasi experimental study was conducted at Department of Medicine, Sir Ganga Ram Hospital, Lahore o after approval from Institutional Ethical Committee over a period of 6 months from 28th June 2018 to 27th December 2018 and 60 patients were enrolled. Both male and female patients, aged 14-70 years, with end stage renal disease and on maintenance hemodialysis (3 cycles/week) for more than last six months with serum potassium more than 5.5mEq/L at presentation were included in this study. Patients excluded from the study were those with acute renal failure not undergoing hemodialysis, hemodynamically unstable patients (blood pressure

Received on 12-02-2021
Accepted on 03-07-2021

<90mmHg systolic or <60mmHg diastolic), Serum potassium more than 7.0mEq/L or electrocardiographic changes suggestive of hyperkalemia (tall tented T waves, widening of QRS complex, PR prolongation, sinus bradycardia and conduction blocks). All the collected data was entered and analyzed through SPSS version 20.0. Data has been stratified for age, gender, duration of ESRD and BMIto address effect modifiers and post-stratification t-test has been applied taking p-value ≤0.05 as statistically significant.

RESULTS

The age of the patients ranged from 32 years to 70 years with a mean of 50.6±10.4 years. There were 49(81.7%) male and 11(18.3%) female patients with a male to female ratio of 4.5:1. The duration of ESRD ranged from 6 months to 19 months with a mean of 11.8±3.7 months while the BMI ranged from 22.1Kg/m^2 to 34.4 Kg/m^2 with a mean of 27.6±3.6 Kg/m^2. 15 (25%) patients were obese (Table 1).

Table 1: Demographic information of the patients (n=60)

Variable	No.	%
Age (years)		
32 – 50	27	45.0
51 – 70	33	55.0
Gender		
Male	49	81.7
Female	11	18.3
Duration of ESRD (months)		
6 – 12	34	56.7
13 – 19	26	43.3
BMI (kg/m^2)		
Non-obese	45	75.0
Obese	15	25.0

Table 2: Means of serum potassium level (mEq/L) at presentation and 1 hour after medical treatment

Serum potassium level	At presentation	1 Hour after medical treatment
	6.25±0.39	**5.58±0.43**
P value	0.001	

Table 3: Comparison of mean change in serum potassium level (mEq/L) 1 hour after medical treatment in age, gender, duration of ESRD and BMI (n=60)

Variable	No.	Change in serum potassium	P value
Age (years)			
32 – 50	27	0.675±0.123	0.958
51 – 70	33	0.677±0.125	
Gender			
Male	49	0.677±0.127	0.877
Female	11	0.671±0.107	
Duration of ESRD (months)			
6 – 12	34	0.678±0.127	0.895
13 – 19	26	0.674±0.120	
BMI (kg/m^2)			
Non-obese	45	0.678±0.124	0.823
Obese	15	0.670±0.122	

The serum potassium level at presentation ranged from 5.6mEq/L to 6.9mEq/L with a mean of 6.25±0.39mEq/L. The serum potassium level 1 hour after medical treatment ranged from 4.8mEq/L to 6.3mEq/L with a mean of 5.58±0.43mEq/L. This change in mean serum potassium level was significant (p-value<0.001) on paired sample t-test. The change in serum potassium ranged from 0.5-0.9mEq/L with a mean of 0.676±0.123mEq/L (Table 2). Similar mean change in serum potassium level was observed across various subgroups of patients based on patient's age, gender, BMI and duration of ESRD (Table 3).

DISCUSSION

Mean age of the studied population in our study was 50.6±10.4 years. A similar mean age of 51.88±15.2 years was observed by Mahmud et al[7] in patients of ESRD, on hemodialysis at Dow University of Health Sciences, Karachi. Biswas et al[8] reported a similar mean age of 50.1±14.6 years among Bangladeshi such patients. Our results were also in accordance with a study conducted by Arslan et al[9] where mean age of 49.3±13.2 years was observed. A mean age of 49.8±9.1 years was noted in a study in Turkey[10] and 49±10 years in Brazilian population of ESRD.[11] Markovitis et al.[12] reported relatively higher mean age of 58.16±18.5 years in such patients in Israel while Lindner et al[13] reported it to be 56±20 years in Switzerland.

A male gender predominance among ESRD patients was observed in our study with a 4.5:1 (male: female) ratio. Sezai et al[14] reported similar male gender predominance in ESRD patients in Japanese population where male: female ratio was 4.7: 1 was observed. In an Indian study[15], this ratio was 3.3:1 while Oh et al[16] reported it to be 3.1:1 in ESRD patients in Korea. Goldfarb et al[17] reported much higher male to female ratio of 6:1 in American CKD patients.

In the present study, mean BMI of our ESRD patients to be 27.6±3.6 Kg/m^2 and 15 (25.0%) patients were obese. In another local study Mahjabeen et al[18] observed similar mean BMI of 27.75±4.22 Kg/m^2 among patients with ESRD. Jessani et al[19] also reported similar mean BMI of 25.8±5.5 Kg/m^2 among ESRD patients in local population. Tanaka et al[20] observed similar mean BMI of 26.1±2.9 Kg/m^2 while Sezai et al[21] observed similar frequency of obesity and reported it to be 25.0% and 27.5% respectively in Japanese ESRD patients.

We observed that the mean alteration in potassium levels one-hour post-antihyperkalemic therapy was 0.68±0.12 mEq/L. Similar mean change in serum potassium level was observed when data was stratified for patient's age, gender, Body mass index (BMI) and ESRD duration. Our observations were in almost similar to the observation of Ahmad et al[6] where a mean change in serum potassium to be 0.69±0.13 mEq/L 1 hour after medical treatment was noted.

CONCLUSION

Among hyperkalemic ESRD patients on regular hemodialysis, mean serum potassium level dropped significantly 1 hour after medical treatment which establishes that this simple medical treatment can be lifesaving in hyperkalemic ESRD patients waiting for dialysis.

Conflict of interest: Nil

REFERENCES

1. Watnick S, Dirkx T. Kidney Disease. In: McPhee SJ, Papadakis MA, Eds. Rabow MW, editors. Current medical diagnosis and treatment. 52ND ed. New York: Mc Graw Hill; 2014; 898-937.
2. 2, Mitch WE. Chronic kidney disease. In: Goldman L, Schafer AI, eds. Cecil Medicine. 24th ed. Philadelphia: Saunders Elsevier; 2011; 132: 810-17.
3. Mushiyakh Y, Dangaria H, Qavi S, Ali N, Pannone J, Tompkins D. Treatment and pathogenesis of acute hyperkalemia. JCHIMP 2011;1:7372.
4. Mozos I. Laboratory markers of ventricular arrhythmia risk in renal failure. BioMed Res Int 2014;2014:509204.
5. Mushiyakh Y, Dangaria H, Qavi S, Ali N, Pannone J, Tompkins D. Treatment and pathogenesis of acute hyperkalemia. J Commun Hospital Intern Med Perspect2011;1:10.
6. Ahmad Z. Hyperkalemia as a medical emergency in patients with ESRD on hemodialysis. Pak J Med Sci 2010;26:117-22.
7. Mahmud HM, Siddiqui M, Bashir B, Ali SF, Baloch AA, Masroor M. Hemodialysispatients profile at Dow University of Health Sciences, Karachi, Pakistan. Pak J Med Sci 2014;30(6):1327-30.
8. Biswas RS, Kashem MA. Etiological survey of chronic kidney disease patients on maintenance hemodialysis in different centers of Chittagong, Bangladesh. J Integr Nephrol Androl2016;3:118-20.
9. Arslan D, Aslan G, Sifil A, Cavdar C, Celebi I, Gamsari T, et al. Sexual dysfunction in male patients on haemodialysis: Assessment with International Index 6f Erectile Function (HEF). Int J Impot Res 2002;14:539-42.
10. YeniçerioGlu Y, Kefi A, Aslan G, Cavdar C, Esen AA, Camsari T, et al. Efficacy and safety of sildenafil for treating erectile dysfunction in patients on dialysis. BJU Int 2002;90(4):442-5.
11. Seibel I, Poli De Figueiredo CE, Teloken C, Moraes JF. Efficacy of oral sildenafil in haemodialysis patients with erectile dysfunction. J Am Soc Nephrol 2002;13:2770-5.
12. Markovits N, Loebstein R, Halkin H, Bialik M, Landes-Westerman J, Lomnicky J, et al. The association of proton pump inhibitors and hypomagnesemia in the community setting. J Clin Pharmacol 2014;54(8):889-95.
13. Lindner G, Funk GC, Leichtle AB, Fiedler GM, Schwarz C, Eleftheriadis T, et al. Impact of proton pump inhibitor use on magnesium homoeostasis: a cross-sectional study in a tertiary emergency department. Int J Clin Pract 2014;68(11):1352-7.
14. Sezai A, Soma M, Nakata K, Hata M, Yoshitake I, Wakui S, et al. Comparison of febuxostat and allopurinol for hyperuricemia in cardiac surgery patients (NU-FLASH Trial). Circ J 2013;77(8):2043-9.
15. Sircar D, Chatterjee S, Waikhom R, Golay V, Raychaudhury A, Chatterjee S, et al. Efficacy of febuxostat for slowing the GFR decline in patients with CKD and asymptomatic hyperuricemia: a 6-month, double-blind, randomized, placebo-controlled trial. Am J Kidney Dis 2015;66(6):945-50.
16. Oh YJ, Park ES, Ahn SS, Lee KY, Byun SJ, Pyo JY, et al. Safety and efficacy of febuxostat in advanced CKD patients with hyperuricemia. Br Med J 2017;76(2):THU0467.
17. Goldfarb DS, MacDonald PA, Gunawardhana L, Chefo S, McLean L. Randomized controlled trial of febuxostat versus allopurinol or placebo in individuals with higher urinary uric acid excretion and calcium stones. Clin J Am Soc Nephrol 2013;8(11):1960-7.
18. Mahjabeen W, Khan DA. Independent relationship of hyperuricemia with chronic kidney disease. J Islamabad Med Dent Coll 2014;3(1):7-10.
19. Jessani S, Bux R, Jafar TH. Prevalence, determinants, and management of chronic kidney disease in Karachi, Pakistan - a community based cross-sectional study. BMC Nephrol 2014;15:90.
20. Tanaka K, Nakayama M, Kanno M, Kimura H, Watanabe K, Tani Y, et al. Renoprotective effects of febuxostat in hyperuricemic patients with chronic kidney disease: a parallel-group, randomized, controlled trial.Clin Exp Nephrol 2015;19(6):1044-53.
21. Sezai A, Soma M, Nakata K, Osaka S, Ishii Y, Yaoita H, et al. Comparison of febuxostat and allopurinol for hyperuricemia in cardiac surgery patients with chronic kidney disease (NU-FLASH trial for CKD). J Cardiol 2015;66(4):298-303.