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Research Article

### AN OBSERVATIONAL RESEARCH STUDY TO ASSESS THE INCIDENCE OF HYPERKALEMIA IN END-STAGE RENAL DISEASE (ESRD) PATIENTS AS A MEDICAL EMERGENCY

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**Abstract:**

**Objectives:** This study is designed to discover the incidence and clinical arrangement of hyperkalemia in the role of clinical emergency in patients who are suffering ESRD on hemodialysis. It is an effort to take an account of the safety and worth of two-hours hemodialysis treatment for the sake of emergency precautions.

**Methodology:** We conducted this research at the Emergency and Hemodialysis Department of Mayo Hospital, Lahore (March 2016 to August 2017). We selected (22) patients, to examine the clinical statistics of hyperkalemia and ECG fluctuations, suffering from ESRD under the treatment of hemodialysis reporting to the ED as a clinical emergency as a result of hyperkalemia. For dialysis, we used salbutamol nebulization along as well as (50%) DW (50 ml) with recurrent insulin. For precaution, (10%) Calcium gluconate (10 ml) was given for cardioprotection if reported. Though researchers observed all the patients carefully. Moreover, we calculated the level of serum potassium on patients' admission, one hour after and on the accomplishment of two-hours dialysis and after twelve hours respectively.

**Results:** We recorded total (20,848) dialysis spell in HDU and out of the total one hundred and ninety-two (0.92%) were emergency dialysis spells. Among them, we noted (22) sessions for hyperkalemia. The study revealed that deficiency in breathing was the most general symptom and till the last session meantime was (65.91 ± 16.08) hours. Additionally, the total mean serum potassium at arrival in emergency department was (7.10 ± 0.39 mmol/L), after one-hour (6.41 ± 0.38 mmol/L), after two hours of session (3.48 ± 0.37 mmol/L) and after (12) hours later it was (4.53 ± 0.47 mmol/L). On the other hand, total mean a decline in serum potassium after clinical therapy in ED (0.69 ± 0.13) with p-value (< 0.0001) and two hours later it was (2.93 ± 0.12 mmol/L) with the value of p was (< 0.0001). Moreover, two patients could not survive in the ED before the start of the dialysis session.

**Conclusion:** Researchers observed many ESRD in ED suffering from hyperkalemia. We reached to the conclusion that if the quantity of serum potassium is greater than (6.0 mmol/L) or hyperkalemia is reported through ECG among reporting patients, providers must ensure the provision of dextrose-insulin combination and Ventolin nebulization in ED to spare some time for an emergency dialysis session. We also determined cardioprotective effect of calcium gluconate. To conclude, in cases of emergency, two-hour dialysis session is effective and safe to restore the learning situation of patients. Later on, doctors may conduct other spells on successive days. We observed a delay in treatment is one cause of the fatality.

**Keywords:** End Stage Renal Disease (ESRD), Hemodialysis, Hemodialysis Unit (HDU), Emergency Department (ED), Dextrose Water (DW) and Hyperkalemia.

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**INTRODUCTION:**

End-stage renal disease (ESRD) is a lethal illness that requires instant transplantation or dialysis because of chronic renal failure (CRF) and such patients very often face metabolic complications regarding their renal disease. The hyperkalemia is a fatal disease for the patients of ESRD (end-stage renal disease). ESRD usually appears as a result of negligence in dialysis and carelessness in the diet of patients. Acidemic in the serum also generate a high frequency in serum potassium but body potassium does not change. Hyperkalemia also causes cardiac arrest in ESRD or CRF patients. If the quantity of potassium increases from (6.5 mmol/ L) or lowers than (3.0 mmol/L), it enhances the risk of cardiac arrhythmias. Such patients are those who are previously diagnosed with low serum calcium or ischemic heart disease [1 – 3]. If the potassium level increases from (5.5 mmol/L) it turns to the hyperkalemia. This value further shows the division as; (5.5 – 6.0 mmol/L) as mild, (6.1 – 7.0 mmol/L) as moderate and for severe the value is (7.0 mmol/L and greater) [4]. In suffering such disease, patients usually show the symptoms of paralysis, fatigue, weakness and palpitations etc. [5]. In case of complete failure of renal, doctors take dialysis session as an emergency measure because hyperkalemia has potential leading to death. Therefore, specialists recommend some other therapy initiatives to acquire some time when dialysis becomes inevitable for the severe cases among patients [4 – 5]. This research aims at the examination of factors, medical symptoms, the case reported, and changes in ECG reports regarding hyperkalemia among the patients who are brought in the emergency department of the hospital. Moreover, we also determined the safety and effectiveness of two-hours emergency hemodialysis session for such reported cases.

**METHODOLOGY:**

We conducted this research at the Emergency and Hemodialysis Department of Mayo Hospital, Lahore (March 2016 to August 2017). We included all those patients, who are diagnosed with ESRD and came to attend the emergency department for emergency dialysis sessions, irrespective of their sex, age and nationality. We did not include the patients who had an acute failure of renal. On the arrival of patients in ED, we collected the entire history of patients regarding physical examination, blood count, ECG and serum biochemistry- uric acid, uric acid, chloride, blood sugar, BUN, sodium and potassium. We treated the patients who are diagnosed with high serum potassium greater than (5.5 mmol/L) with fifty percent DW (50 ml) with four-unit normal insulin and (5 mg) salbutamol nebulization (1 ml). We gave

the patients with ten percent calcium gluconate (10 ml) who reported with the changes in their ECG or whose serum potassium was higher than (7.0 mmol/L). The patients who had serious metabolic acidity (pH under 7.0), we gave them the infusion of sodium bicarbonate. Our hospital has had the policy that to arrange the emergency dialysis within ninety minutes of the admission of patients in the emergency department. We treated the cases accordingly. We also repeated serum electrolytes before the start, after the two-hour session and even after twelve hours' session. We used and FF1 as acid and bicarbonate as a buffer in dialysis and concentrated with dialysate potassium (2 mmol/L). During the practice, we observed the flow of dialysate as (500 ml/min). We also applied polysulfide hollow fibre dialysis filters. During the session, we closely examined the rate of the blood pump that is recorded between (200 – 300 ml/min). We also recorded the critical signs like ECG and  $spO_2$ . We kept the patients under close observation even after their initial dialysis sessions. On the completion of necessary treatments, we discharged the patients in the next eighteen hours if they showed complete improvement in their condition. We analyzed the data on Graph pad stat mate (Prism – V).

**RESULTS:**

We studied (20,848) dialysis sessions of the patients with ESRD during research time span. Within these cases, one hundred and ninety-two (0.92%) sessions, we conducted as an emergency. Among these emergencies, one hundred and sixty-two (84.37%) reported with pulmonary oedema and twenty-two (11.45%) with hyperkalemia. Whereas two came up under severe metabolic acidosis & tetany. Twenty-two patients whose age ranged from (35 – 90) took emergency dialysis for hyperkalemia and their mean age was  $(55.18 \pm 14.32)$  years. These cases had an equal number of females and males. We recorded five patients (22.73%) with hypertensive nephropathy, four (18.18%) with lupus nephritis each and diabetic nephropathy, three (13.63%) experienced prolonged glomerulonephritis, two (9.09%) underwent nephrolithiasis, one (4.54%) facing reflux with repeated urinary tract infections that lead to ESRD. As for as the symptoms are concerned, we noted fatigue among seventeen (77.27%), palpitations among nine (40.90%), breath problem in eighteen (81.81%) and generalized weakness in sixteen (72.72%) patients. Suffering from hyperkalemia, out of these, nine patients missed their session due to some social reasons. The history of seven patients displayed a high intake of potassium diet. Whereas, six patients, did not come

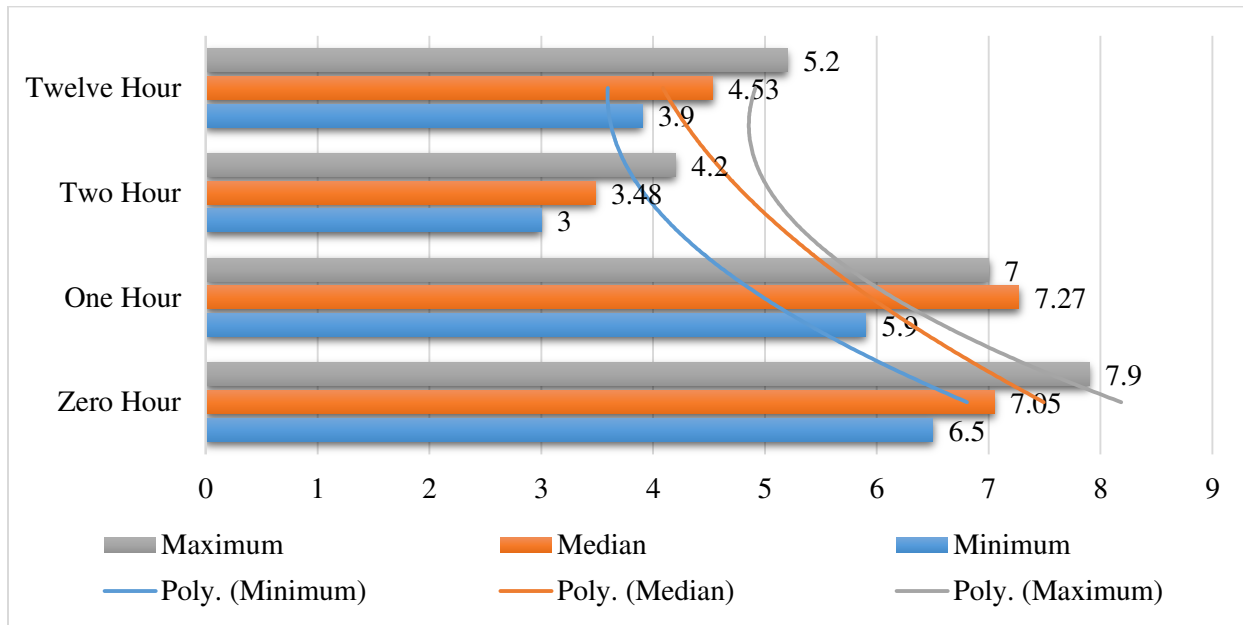
up with any noticeable cause.

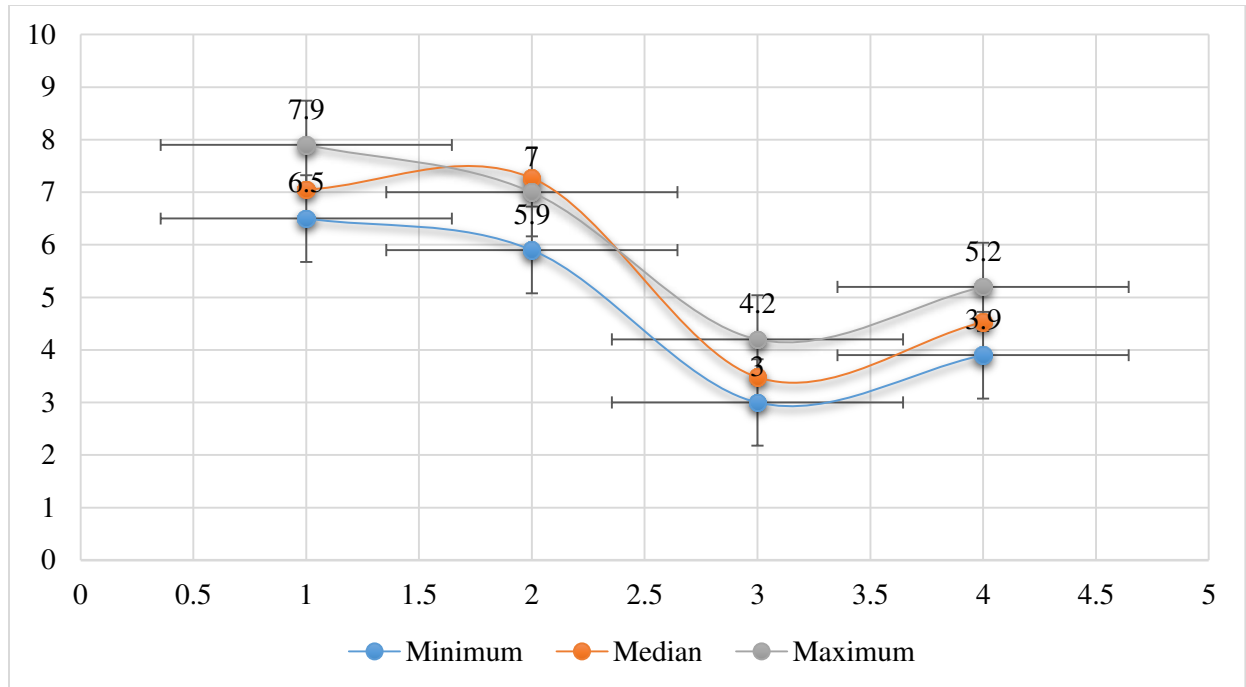
We determined a peaked T-wave among seven (31.81%) and widened QRS in three (13.63%) patients through ECG. Moreover, two (9.09%) patient did not survive before dialysis. Therefore, no patient showed any complication during dialysis and

all improved in the symptoms. We discharged all the patients within eighteen hours after taking necessary action in order to overcome the disease and advised them to take special care of the symptoms in future.

**Table:** Serum Potassium at 0, 1, 2 & 12 hours (mmol/L)

Time	Minimum	Median	Maximum	Mean	SD	Standard Error
Zero Hour	6.5	7.05	7.9	7.1	0.393	0.08387
One Hour	5.9	7.27	7	6.41	0.389	0.08284
Two Hour	3	3.48	4.2	3.48	0.375	0.08385
Twelve Hour	3.9	4.53	5.2	4.53	0.475	0.109





### DISCUSSION:

During the period of study, a number of patients reported in ED with major of minor symptoms leading to ESRD. Some of them displayed the severity of the case and some were not observable. So, it is important to determine the past history of patients in terms of dialysis sessions, renal failure and hyperkalemia. During the eight years of study, we did one hundred and ninety-two emergency dialysis session in total out of (20,848) sessions. Only twenty-two patients, we diagnosed with hyperkalemia among all (192) emergency sessions. Eighteen reported shortness of breath and thirteen had associated pulmonary oedema. The delay from any cause and carelessness in the diet also lead to hyperkalemia, therefore, we could not diagnose any apparent cause of disease in (27.27%) cases. Specialists recommend emergency dialysis for the patients who report in ED and complain of missed or delayed session. Kidneys become unable to excrete the excess of potassium that causes a noticeable increase in body and plasma potassium [4, 6, 7]. Many types of research have reported similar results in their studies around the world [8 – 11].

Therefore, only ECG is not capable to diagnose the presence of hyperkalemia, rather, it also mandatory to take confirmation from laboratory [12 – 13]. Whereas, if ECG reports indicate the presence of hyperkalemia in ESRD patient, then it is mandatory to conduct quick dialysis session instead of waiting for laboratory reports [15 – 18]. Some delays are

inevitable, though we recommend taking some necessary action to limit the quantity of potassium in the body. For that purpose, we recommend the intakes of calcium chloride or calcium gluconate, dextrose water that can help to buy some time for the patients [14 – 17]. Mushtaq & Masood used nebulization instead of an intravenous regimen that is easy to administer [18]. We second to their methodology in this regard. We conducted a two-hours dialysis session to remove the excess of potassium.

Through our research, we came up the generalize that serum potassium decreased from  $(6.41 \pm 0.38 \text{ mmol/L})$  to  $(3.48 \pm 0.37 \text{ mmol/L})$  after dialysis that found the difference of  $(2.93 \pm 0.12 \text{ mmol/L})$  and the value of  $p$  (0.0001). Blumberg claimed that the maximum decrease in serum potassium occurs in the first hour of dialysis and the next three hours of treatment can achieve the maximum decline. To validate their claim, they researched on fourteen stable hemodialysis patients. Other researchers also coded the same claim that validated our findings. Some researchers pointed out that the patients with potassium higher than (7.0 mmol/L) on the pre-dialysis time period must observe potassium control resin4 and more numbers of sessions for anticipatory precautions [23 – 24].

### CONCLUSION:

Hyperkalemia has had the potential harm to the lives of patients, and many times hard to diagnose with the

help of symptoms. It is a silent killer and quiet invader. Therefore, doctors must consider all the precautions during their services in the emergency department to tackle such lethal disease. Because this study shows a greater possibility of the attack without any symptom or signs. Moreover, in some odd times, it reported some death cases. We recommend the utilization of dextrose-insulin infusion with ventral in nebulization in case of high (6.0 mmol/L) serum potassium reported through laboratories or ECG. To achieve cardioprotective effect, we recommend calcium gluconate when serum potassium is increased from (7.0mmol/ L). to remove the excess of potassium, an emergency session of dialysis can be helpful. Moreover, a two-hour emergency session is useful and secure. Later on, the regular session can overcome the inabilities of patients.

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