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CLINICAL PRESENTATION AND INCIDENCE OF HYPERKALEMIA IN THE PATIENTS WITH END-STAGE RENAL DISEASES ON HEMODIALYSIS AS A MEDICAL EMERGENCY

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Abstract:
Objectives: *The aim of this study is to examine the incidence rate and clinical presentation of the hyperkalemia in the patients with ESRD (End-Stage Renal Diseases) on hemodialysis as a medical emergency and to find out the effectiveness and safety of the 2 hours sessions of hemodialysis as a measure to treat this emergency.*
Methodology: *This research work was carried out in Al-Shifa Hospital Sukkur. The duration of this study was from March 2015 to February 2020. 20 patients suffering from ESRD on HD (Hemodialysis) appearing to ED as medical emergency because of hyperkalemia underwent study for the determination of hyperkalemia's clinical presentation and changes in ECG. Salbutamol nebulization in addition with DW 30.0% 30.0 ml with regular insulin was utilized to buy dialysis time. Calcium gluconate 8.0% 8.0 ml was provided for cardio-protection if specified. We monitored all the patients closely. We measured the level of serum potassium at time of arrival, after 1 hour, at completion of 2 hours of HD and after 12 hours.*
Results: *We performed 208 sessions of dialysis in HDU and 0.70% patients got emergency sessions of dialysis. We performed 20 dialysis for complication of hyperkalemia. The most common complication was breath shortness and average duration since last session of dialysis was 63.710±14060 hours. Average level of serum potassium at the time of arrival to emergency department, 1 hour later, after two hours of dialysis and twelve hours later was 5.1±0.17 mmol/L, 4.210 ± 0.160 mmol/L, 1.260 ± 0.150 mmol/L and 2.310 ± 0.250 mmol/L correspondingly. The average reduction in the level of serum potassium after clinical treatment in emergency department and after 2 hours of treatment was 0.470 ± 0.110 (P value <0.00010) and 2.710 ± 0.100 mmol/L (P value < 0.00010) respectively. Total 2 patients died in emergency department before the start of dialysis.*
Conclusion: *Patients of ESRD may come to the emergency departments with hyperkalemia. If the level of serum potassium is higher than 6 mmol/L or ECG hyperkalemia's findings are there such patients, the patients were provided with ventolin nebulization & dextrose insulin infusion in ED to buy duration for emergency session of dialysis. There are cardio-protective effects of calcium gluconate. A 2-hour session of dialysis as a measure of emergency is much effective and secure in these conditions. The delay can be fatal for the patients.*
Keywords: *Hyperkalemia, Potassium, Calcium Gluconate, Hemodialysis, End-Stage Renal Disease, Nebulization, Chronic Renal Failure.*

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INTRODUCTION:

CRF (Chronic Renal Failure) in need of transplantation or dialysis is called ESRD (End-Stage Renal Disease). There is normal encounter of the patients of ESRD in ED with issues associated with metabolic complications of their renal complications or anomalies related with dialysis [1]. Most frequent reason of death in the patients of ESRD is hyperkalemia. This can be a result of the increase level of serum potassium. Cardiac arrest may be an outcome of hyperkalemia in the patients of ESRD [2].

The associated risk of the cardiac arrhythmias is much high when level of potassium is higher than 6.50 mmol/L or less than 3 mmol/L [3]. We can define the hyperkalemia as level of potassium higher than 5.50 mmol/L which is further classified as; mild (5.50-6.0 mmol/L), moderate (6.10-7.0 mmol/L) and severe (greater than 7.0 mmol/L). The final recourse is emergency dialysis for the patients experiencing potentially lethal type hyperkalemia [4]. This particular research work was carried out to examine the prevalence rate, causes, clinical features and changes in ECG associated with hyperkalemia in the patients of end stage renal diseases visiting ED of our hospital [5]. We also examined the safety and effectiveness of 2 hours sessions of hemodialysis as emergency measure in the confirmed patients of hyperkalemia.

MATERIAL AND METHODS:

This research work was carried out in Al-Shifa Hospital Sukkur and the duration of this research work was March 2015 to February 2020. In this research work, we included all the patients present with ESRD and visited the ED for hemodialysis and emergencies related with ESRD and required sessions of emergency dialysis regardless of their gender, nationality and sex. Patients present with ARF (Acute Renal Failure) and other serious complications were excluded. Complete past history of the patients, their physical examination, ECG, count of complete blood, serum biochemistry and ABG was carried out on their arrival in ED. All the patients present with higher level of serum potassium [greater than 5.50 mmol/L] obtained salbutamol nebulization 5.0 mg [01 ml] in 3.0 ml normal saline, DW 30.0% 30.0 ml with four-unit regular insulin. We provided calcium gluconate 8.0% 8.0 ml if the level of serum potassium was greater than 7 mmol/L or there were ECG alterations due to hyperkalemia. Infusion of sodium bicarbonate was provided only if there was presence of metabolic acidosis of severe nature [ph<7].

We arranged an emergency session of dialysis within ninety minutes of patient's arrival to ED according to the policy of the hospital. We repeated the serum electrolytes before the start of dialysis and at the termination of 2 hours session and twelve hours later. The rate of the dialysate flow was 500.0 ml/min. We used the filters of poly-sulfone hollow fiber dialysis. The rate of blood pump was from 200-300 ml/min. In the duration of dialysis, we monitored all the patients much closely for important signs as ECG and spO2. We admitted all the patients after dialysis till the next scheduled dialysis session. They got discharge after 18 hours of scheduled dialysis. Statistical analysis of the collected information was carried out.

RESULTS:

More than 208 dialysis sessions were carried out in the duration of this research work in our institute for the patients of ESRD. Out of total sessions, 0.70% sessions were for the emergency cases of ESRD who appeared with various complication in ED. ESRD related emergencies included pulmonary edema in 62.15% patients, hyperkalemia in 11.23%, metabolic acidosis of severe nature and tetany in 1.02% each. Total 20 patients got emergency HD for hyperkalemia and the range of age of these patients was 33-70 years with an average age of 33.16±12.10 years. The number of the male and female patients was equal. The range of the duration from the start of HD was 6 months to 7 years with an average duration of 2.73±2.03 years. Time since the last session of hemodialysis was from 2 to 4 days. 22.51% patients were present with hypertensive nephropathy, 16.16% patients were present with DN (Diabetic Nephropathy) & lupus nephritis each, 11.41% patients were present with chronic glomerulonephritis, nephrolithiasis was present in 7.07 patients, 2.32% patients were present with reflux with recurrent UTIs (Urinary Tract Infections) as a causative agent for ESRD. There was not known cause of ESRD in 11.11% patients. The most common symptom was breath shortness present in 61.61% followed by fatigue in 55.05%, generalized weakness in 50.50% and palpitations in 20.7% patients.

Table-I: Serum Potassium at 0, 1, 2 and 12 hours (mmol/L)

	at 0 hour	at 1 hour	at 2 hours	at 12 hours
Minimum	4.3	3.7	1	1.7
Median	5.03	5.05	1.26	2.31
Maximum	5.7	5	2.0	3.0
Mean	5.1	4.21	1.26	2.31
Std. Deviation	0.1712	0.1663	0.153	0.2530
Std. Error	0.06165	0.06062	0.06163	0.107

We found related pulmonary edema in 37.07% patients of hyperkalemia. About the reasons of hyperkalemia in such patients, 20.7% patients have delayed session of dialysis or missed some sessions because of some reasons, 11.61% patients were present with past high potassium diet's intake and we found no apparent cause in 5.5% patients. ECG displayed a peaked T-wave in 11.61% and expanded QRS complex in 11.61% patients. The level of serum potassium at the time of arrival in ED, 1 hour after conservative therapy in ED, 2 and 12 hours after HD is present in Table-1 and Figure-1. 7.07% patients died before the start of HD. There was improvement in the associated symptoms during dialysis and we found no complication during HD. We discharged all the patients after eighteen hours of the scheduled HD. We also advised the patients to prevent this situation in future.

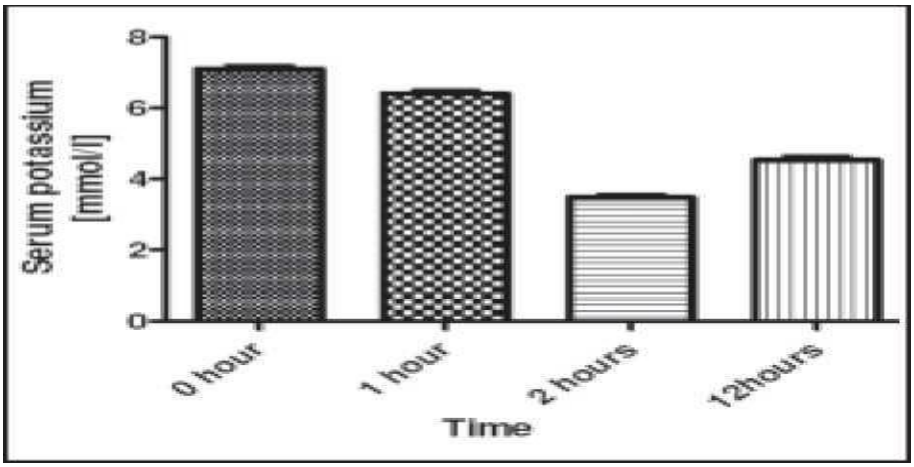

Figure 1

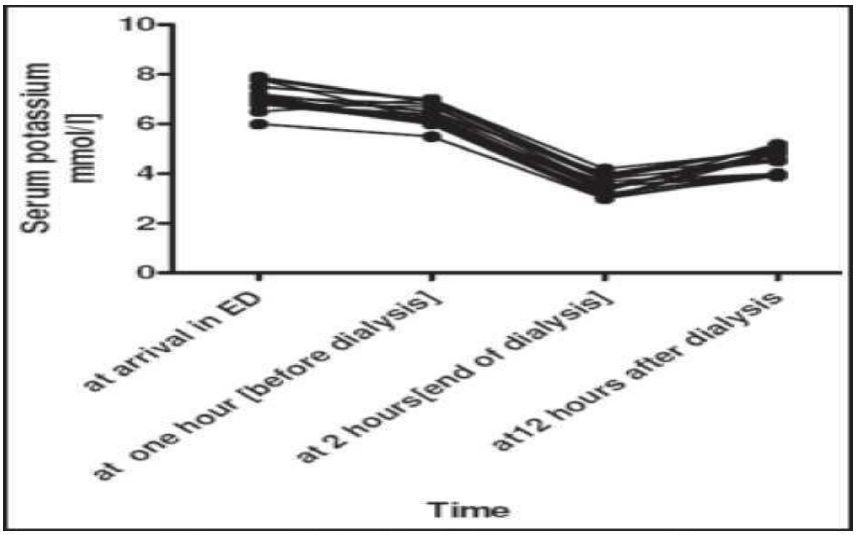

Figure-2: Effect of 2 hours of

Figure 2

DISCUSSION:

It is important for the patients of ESRD to visit ED regularly because of its life-threatening complications. Breath shortness was the most common complaint present in 61.61% patients [6]. Level of total body potassium and plasma potassium increase between sessions of dialysis because of diet intake and incapability of the kidney in excretion of excess potassium [7]. Hyperkalemia associated ECG findings were available in 23.230%. These findings were much consistent with the findings of many other research works conducted in different regions of world [8-11]. Laboratory confirmation in addition with ECG for serum potassium is must for possibility of hyperkalemia [12, 13]. Treatments as calcium gluconate and/or calcium chloride, dextrose water with salbutamol & insulin are only the temporary measures [14]. We utilized the salbutamol nebulization instead of intravenously infusion because this is much safe & quick to manage nebulization in opposition to intravenous regimen utilized by Mushtaq and Masood in their study [15].

Blumberg in his research work stated that maximum reduction in the level of serum potassium takes place in 1st hour of HD and at 3rd hour highest decrease in the level of serum potassium is achieved [16]. But there is variation in the reduction rate of potassium [17,18]. Variation in the removal of potassium during the whole period of dialysis session has been recorded by some other research works [19]. Hous performed HD with potassium free [0], 1 & 2 mmol/L potassium dialysate. There was the highest reduction with potassium free [0] dialysate in their research works [20,21]. We noted a rise in the level of serum potassium [average = 1.030±0.110 mmol/L] at twelve hours after dialysis. Other studies recorded the similar findings. The patients coming to dialysis centers in routine visits and have a high level of serum potassium must be acknowledged about their diet practice.

CONCLUSION:

One of the lives taking complication is hyperkalemia in the patients because of its distinctive symptoms. Professionals working in emergency rooms should think this particular possibility in the patients who are present with this end stage renal diseases. If level of serum potassium is higher than 6 mmol/L or ECG results for hyperkalemia are present, ventolin nebulization in addition with infusion of dextrose-insulin should be provided in emergency department. There is cardio-protective effect of calcium gluconate and it should be provided if there are findings of ECG about hyperkalemia or level of serum potassium is higher than 7 mmol/L. there should be arrangement of emergency dialysis session as soon as possible to remove the excessiveness of potassium. In these particular situation, 2 hours session of emergency dialysis is very safe and effective measure.

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