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Research article *Medical research*

A clinical study on the management of hyperkalemia in a secondary care hospital, Palakkad, Kerala

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ABSTRACT

Background

To study the management of hyperkalemia association between potassium monitoring and serious hyperkalemia associated adverse outcomes among the patients with diabetes mellitus, CKD, IHD, hypothyroidism and anemia**.**

Materials and methods

The study was designed as a hospital based prospective study. A total of 264 patient case data entry form were collected from the medical records department and they are included in the study.

Results

The hyperkalemic events, 32.95% more occurred in patients were in age group of 61 to 70 years. The rate of hyperkalemia was higher in patients with diabetes mellitus among individual treated with 33.33% of insulin. Patients who experienced hyperkalemia were more likely to be male and 85.95% patients' showed severity at mild level. 81.43% therapies recommended elimination of potassium from the body by the use of diuretics.

Conclusion

Hyperkalemia is a significant problem among the patients with diabetes mellitus, hypertension, CKD, IHD and hypothyroid. Various therapeutic options exit for the immediate treatment of the condition including insulin, diuretics, calcium carbonate, calcium gluconate, sodium bicarbonate, salbutamol and calcium polystyrene sulfonate. Prevention currently rests largely upon compliance with diet and a thoughtful use of medication regimen.

Keywords: Potassium, Prospective study, Severity, Diuretics, Prevention

INTRODUCTION

Potassium is the most abundant intracellular cation and plays a key role in the cellular function of nerve and muscle tissue. Potassium disorders are relatively common in clinical practice. Hypokalemia and hyperkalemia are important electrolyte abnormalities, as both may contribute to the development of serious or life-threatening cardiac arrhythmias and death, especially in patients with cardiovascular or renal disease. Hyperkalemia generally develops with impaired renal function, and individuals with heart failure, diabetes mellitus and advanced chronic kidney disorders are at greatest risk [1]. Maintenance of serum potassium in the normal range depends on both excretion of potassium out of the body, as well as potassium shifts between the extracellular and intracellular compartments.

Potassium level between 5.1-6.0mEq/l reflects "mild" hyperkalemia, is often associated with "peaked" T-waves. "Moderate" hyperkalemia indicates 6.1-7.0mEq/l and associated with a prolonged PR interval, flattened P-wave, QRS complex widening. Finally" severe" hyperkalemia >7.0mEq/l, associated with a total absence of P-waves; intraventricular, fascicular, and bundle branch blocks [2]. Hyperkalemia is caused by excessive potassium intake, renal failure, hypoaldosteronism, congenital adrenal hyperplasia, congestive heart failure, acidosis, anemia, diabetes mellitus and drugs like Amiloride, Spironolactone, Cyclosporine, Trimethoprim, Aspirin, Heparin, Mannitol, Digoxin, Beta blocker, Calcium channel blocker, Angiotensin-II receptor blockers.

Hyperkalemia that occurred during the treatment with Renin angiotensin system blockade (RAS) in chronic kidney disease patients due to discontinuation of RAS blockade, reduction or maintenance of doses of RAS blockade with supportive management for potassium reduction [3]. It impairs ammonium production and transport in the proximal tubule, as well as ammonium transport in the thick ascending limb of henle loop and the medullary collecting duct, thus decreased net acid excretion and leads to metabolic acidosis [4]. Hyperkalemia is a common clinical condition that can induce deadly cardiac arrhythmias. Electrocardiographic manifestations of hyperkalemia vary from the classic sine-wave rhythm, which occur in severe hyperkalemia, to nonspecific repolarization abnormalities seen with mild elevation of serum potassium in cardiac arrhythmia [5].

Diabetes mellitus is conditions were the body is unable to produce insulin; this triggers the fat cells to break down and release ketones. Ketones are chemicals that increase the acidity of blood. High blood acidity combined with high blood sugar acts to force the potassium in your body cells to move out into blood. Therefore the potassium content in blood increases [1]. Medications that interferes with urinary excretion by inhibiting the renin-angiotensin system is one of the most common causes of hyperkalemia in patient with hypertension. Medications like ACE inhibitors, Angiotensin blockers and Beta blockers [7].

METHODOLOGY

Study Site

The study was conducted at a Private Hospital, Palakkad District. It is a 100 bedded Super Specialty Hospital and a major referral cardiac centre in Palakkad. They focus on providing quality medical care to people in and around Palakkad region. The hospital was situated in a quiet peaceful atmosphere and having a dedicated and well experienced medical staff. The authorization for conducting this study was obtained from the general manager of the hospital.

Study Design

The study was designed as a hospital based prospective study. A predesigned data entry form was used to obtain and evaluate the data's.

Study Period

The data collection was carried out for a period of four month (August 2017- November 2017).

Study Population

A total of 264 patient data entry forms were collected and they are included in the study.

STUDY CRITERIA

Inclusion Criteria

All in patients having hyperkalemia were included in the study.

Exclusion criteria

Cases which does not contain relevant information and cases which are referred to higher centers for treatment.

DATA COLLECTION METHOD

The data collection was carried out for a period of four months, with the help of a pre-designed patient data entry form. All inpatients having hyperkalemia were included in the study. The datas were collected from the Medical Records Department. The pharmacist intervention was done after the data collection. Adverse Drug Reactions and Drug Interactions was checked from CIMS, Drug Interaction Checker software etc.

RESULTS

Table 1: Distribution according to age

Sl. No	Age(Years)	Number of patients(n=264)	Percentage (%)
1	≤30	0	0
2	31-40	6	2.27
3	51-60	11	4.16
4	41-50	40	15.15
5	61-70	87	32.95
6	71-80	63	23.86
7	81-90	55	20.83
8	≥90	2	0.75

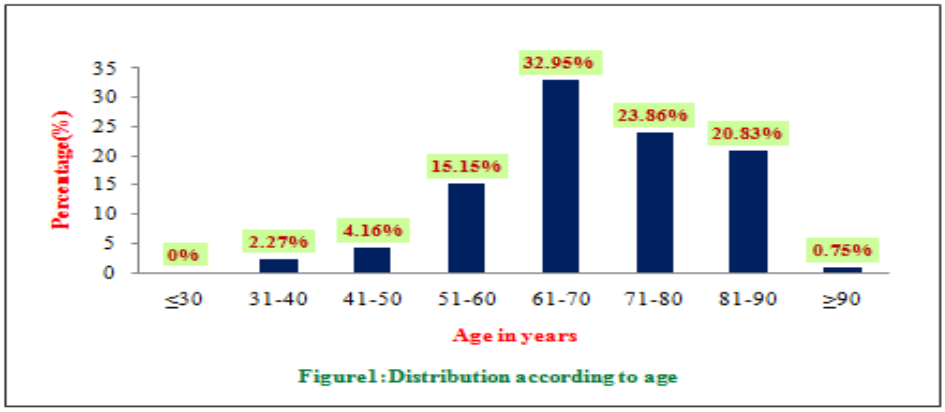

Figure1:Distribution according to age

Table.1 and Figure.1 represents the age wise distribution of patient with hyperkalemia in which 32.95% patients were in the age group of 61-70 years. Whereas, 23.86% patients were included in the age group of 71-80 years and 20.83% were included in age group of 81-90 years. In this 15.15%, 4.16%, 2.27% patients were in the age groups of 51-60 years, 41-50 years, 31-40 years respectively. But only 0.75% patients were in the age group >90 years and there is no evidence on incidence of disease in the age <30 years.

Table 2: Distribution according to gender

Sl. No.	Gender	Number of patients (n=264)	Percentage (%)
1	Male	163	61.74
2	Female	101	38.24

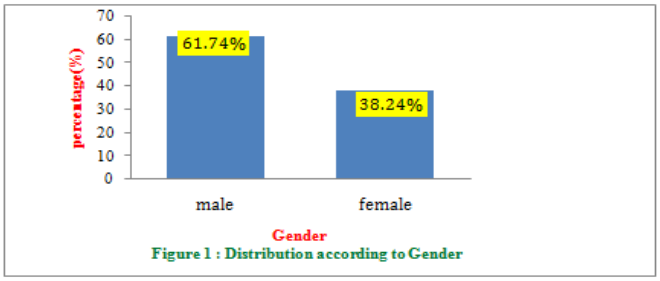

Figure 1 : Distribution according to Gender

Table 2 and Figure 2 represent the distribution of patients according to gender, in which 62.12% patients were male and 37.87% patients were females, it represents that the risk of incidence of disease is high in males than that of females.

Table 3: Distribution according to Past medical history

Sl. No.	Past medical history	Number of patients (n=264)*	Percentage (%)
1.	Diabetes mellitus	178	67.42
2.	Hypertension	160	60.60
3.	Ischaemic heart disease (IHD)	135	51.13
4.	Chronic kidney disease (CKD)	40	15.15
5.	Anaemia	2	0.75
6.	Heart failure	25	9.46
7.	Thyroid disorders	20	7.57
8.	Others	50	18.93

**n=264; Total will not corresponds to 100% because of multiple diseases.*

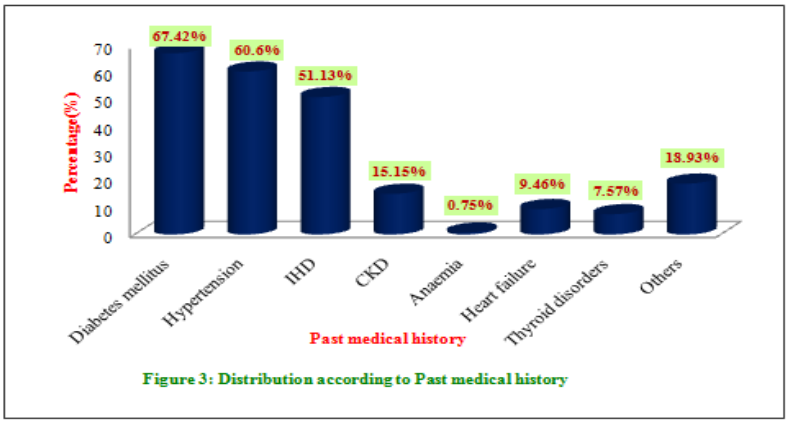

Figure 3: Distribution according to Past medical history

Table 3 and Figure 3 shows the distribution according to past medical history in which 67.42% patients having past medical history of diabetes mellitus, 60.60% with hypertension, 51.13% with Ischemic heart disease and 15.15% with chronic kidney diseases 9.46% having heart failure and 7.57% having thyroid disorders. But only 0.75% patients having the past medical history of anaemia, 18.93% patients having incidence of other disorders except above mentioned.

Table 4: Distribution according to Blood pressure

Sl. No.	Blood pressure	Types		Number of patients (n=264)*	Percentage (%)
1	Systolic Blood pressure on Date of admission	i.	Prehypertension	73	27.6
		ii.	Normal Hypertension	68	25.7
		iii.	Stage 1 Hypertension	61	23.7
		iv.	Stage 2 Hypertension	62	23.4
2	Diastolic Blood pressure on Date of admission	i.	Prehypertension	66	25
		ii.	Normal Hypertension	108	40.9
		iii.	Stage 1 Hypertension	56	21.2
		iv.	Stage 2 Hypertension	34	12.8
3	Systolic Blood pressure on Date of discharge	i.	Prehypertension	86	32.5
		ii.	Normal Hypertension	103	39.01
		iii.	Stage 1 Hypertension	51	19.3
		iv.	Stage 2 Hypertension	24	9.09
4	Diastolic Blood pressure on Date of discharge	i.	Pre-Hypertension	68	25.7
		ii.	Normal Hypertension	116	43.9
		iii.	Stage 1 Hypertension	70	26.5
		iv.	Stage 2 Hypertension	10	3.7

**n=264; Total will not corresponds to 100% .*

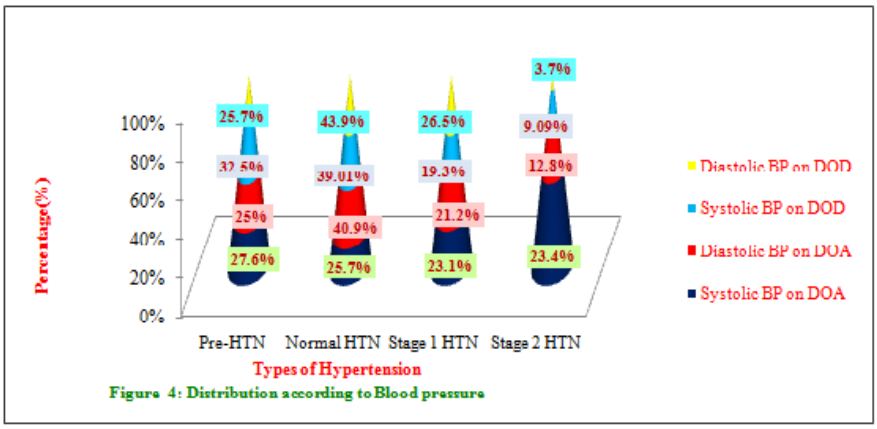

Figure 4: Distribution according to Blood pressure

Table 4 and Figure 4 show distribution according to blood pressure. 27.6% patients have pre-hypertension in systolic BP on date of admission and 39.01% patients shows normal hypertension diastolic BP on date of discharge, but 40.9% shows normal hypertension in diastolic BP on date of admission and 43.9% are shows normal hypertension in diastolic BP on date of discharge.

Table 5: Distribution according to Etiological factors

Sl. No.	Etiological factors	Number of patients(n=264)*	Percentage (%)
1	Drugs	119	45.07
2	Diseases	181	68.5
3	Food habits	11	4.16
4	Adverse drug reactions	198	75
5	Drug interactions	46	17.42

**n=264; Total will not corresponds to 100% because of multiple factors.*

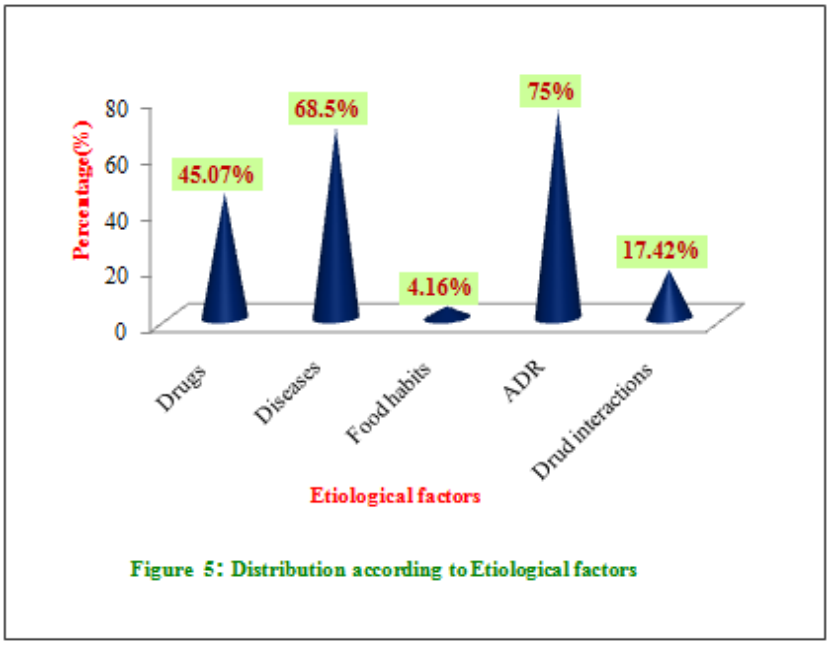

Figure 5: Distribution according to Etiological factors

Table 5 and Figure 5 indicates the distribution of patients according with etiological factors such as drugs, diseases, food habits, adverse drug reactions, drug interactions. These observations represent that 68.5% patients had etiology of diseases, 45.07% with drugs and 75% with adverse drug reactions. Only 17.42% were included in drug interactions and 4.16% is caused by food habits.

Table 6: Distribution according to incidence of hyperkalemia

Sl.No	Parameters	Number] of patients (n=264)*	Percentage (%)
1	Drug induced		
	i. Angiotensin converting enzyme inhibitors (ACEI)	94	35.60
	ii. Calcium channel blockers (CCBs)	95	35.98
	iii. Spironolactone	76	28.78
2	Disease induced		
	i. Diabetes mellitus	178	67.42
	ii. Hypertension	164	62.12
	iii. Ischaemic heart disease (IHD)	152	57.57
	iv. Chronic kidney disease (CKD)	40	15.15
	v. Congestive heart failure (CHF)	2	0.75
	vi. Thyroid disorders	22	8.33
3	Asymptomatic	15	5.68

**n=264; Total will not corresponds to 100% because of multiple causes.*

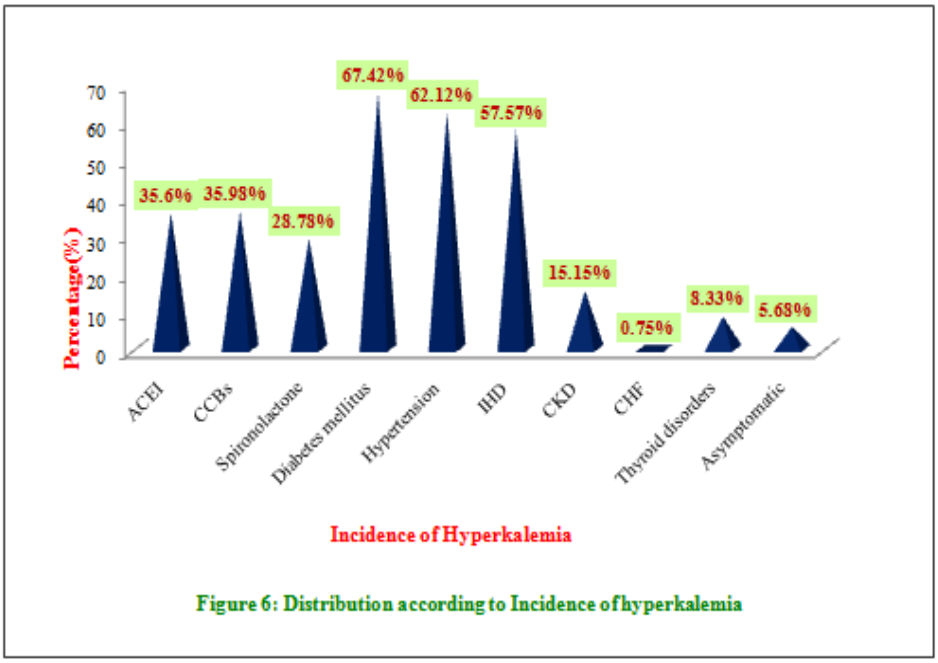

Figure 6: Distribution according to Incidence of hyperkalemia

Table 6 and Figure 6 represent the distribution according to incidence of hyperkalemia on the basis of drug induced, disease induced and asymptomatic causes. 35.60% patients had hyperkalemia with the use of ACEI, 35.98% by the use of CCBs and 28.78% by Spironolactone. But in disease induced causes, 67.42% patients were with diabetes mellitus and 62.12% were with hypertension.

Table 7: Distribution according to potassium level

Sl.No.	Potassium level	Number of patients (n=264)	Percentage (%)
1	Mild	219	82.95
2	Moderate	37	14.01
3	Severe	8	3.03

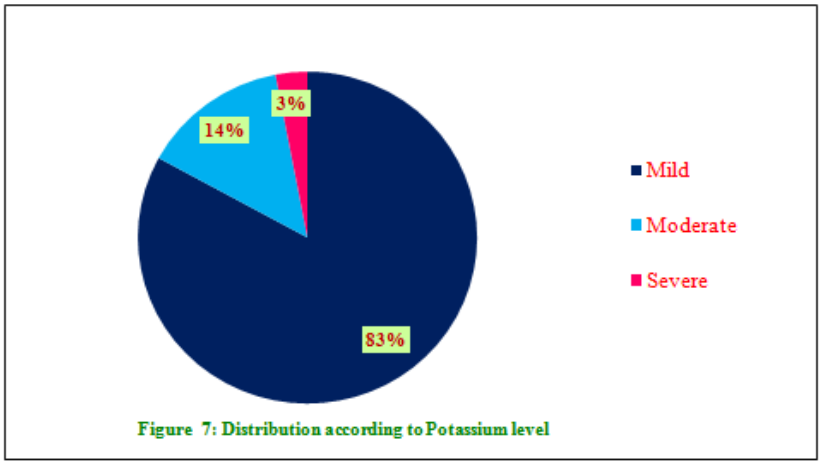

Figure 7: Distribution according to Potassium level

Table 7 and Figure 7 shows the distribution of patients according to potassium levels. In this study 82.95% patients having mild hyperkalemia, 14.01% having moderate hyperkalemia. But only 3.03% of patients show severe hyperkalemia. Study indicates the incidence on severity basis and shows more patients are having mild hyperkalemia and severe hyperkalemia occur in rare cases.

Table 8: Distribution according to Abnormal laboratory values

Sl.No.	Laboratory values	Increase(n=264*)	Percentage(%)	Decreased(n=264*)	Percentage(%)
1	Hemoglobin (g/dl)	0	0	165	62.5
2	Serum creatinine (mg/dl)	98	37.12	7	2.6
3	Urea (mg/dl)	94	35.6	9	3.4
4	ESR (mm/hr)	104	39.3	43	16.2
5	Serum Na^+(mg/dl)	1	0.3	86	32.5

**n=264; Total will not corresponds to 100% because of multiple abnormal lab values.*

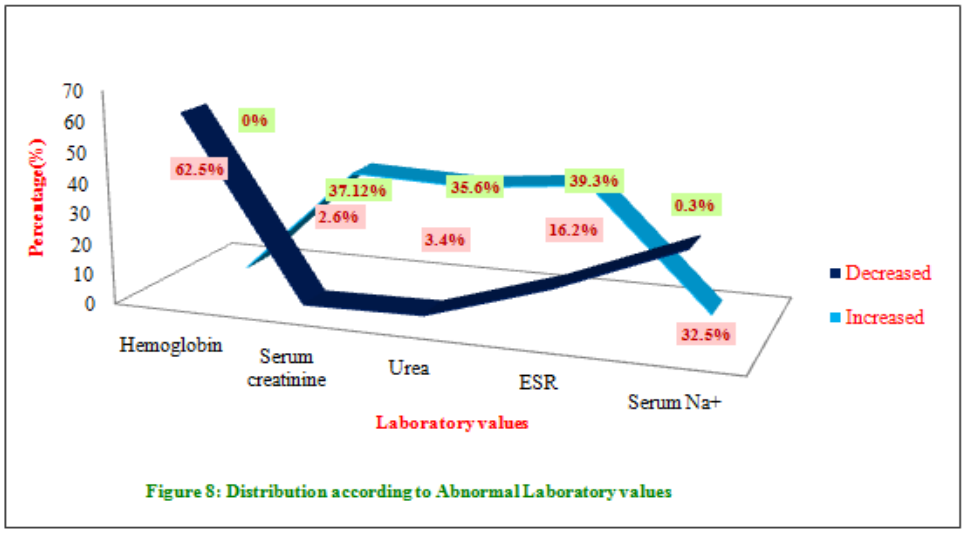

Figure 8: Distribution according to Abnormal Laboratory values

Table8 and figure 8 indicates the distribution of patients with abnormal laboratory values, from which 62.5% patients shows decreased hemoglobin level and 32.5% shows abnormality in serum sodium level. Similarly, 16.2%, 3.4%, 2.6% patients shows abnormality in ESR, urea, and serum creatinine respectively.

Table 9: Distribution according to Signs and Symptoms of Hyperkalemia

Sl.No.	Parameters	Numberof patients (n=264)	Percentage (%)
1	Patients with signs and symptoms of hyperkalemia	60	22.7
2	Patients without signs and symptoms of hyperkalemia	204	77.2

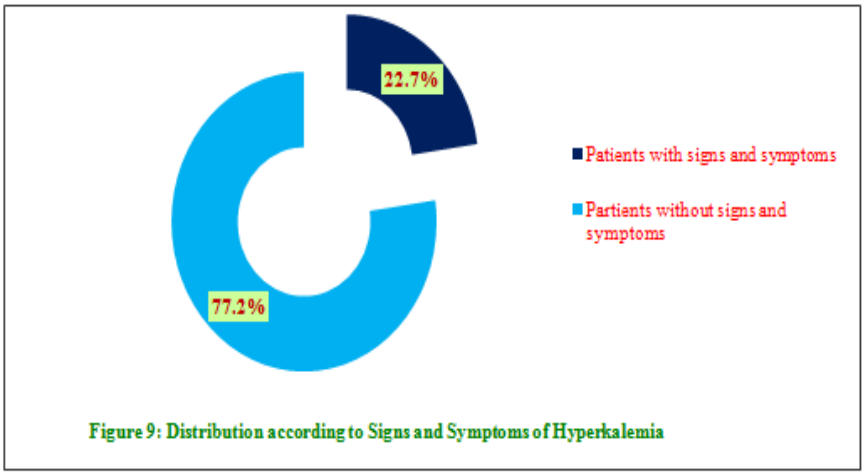

Figure 9: Distribution according to Signs and Symptoms of Hyperkalemia

Table 9 and Figure 9 represent distribution of patients according to signs and symptoms of hyperkalemia. These observations indicates 77.2% patients do not shows any signs and symptoms of hyperkalemia and only 22.7% shows signs and symptoms of hyperkalemia. Study shows that in hyperkalemia patients the signs and symptoms occurs due to many other diseases and usually hyperkalemia symptoms are less likely to occur.

Table 10: Distribution according to Management of hyperkalemia

Sl No.	Parameters	Number of patients (n=264)*	Percentage (%)
1	Calcium carbonate	2	0.75
2	Calcium gluconate	6	2.27
3	Furosemide	176	66.66
4	Insulin	90	34.09
5	Calcium polystyrene sulfonate	13	4.92
6.	Salbutamol	53	20.07

**n=264; Total will not corresponds to 100% because of multiple drugs.*

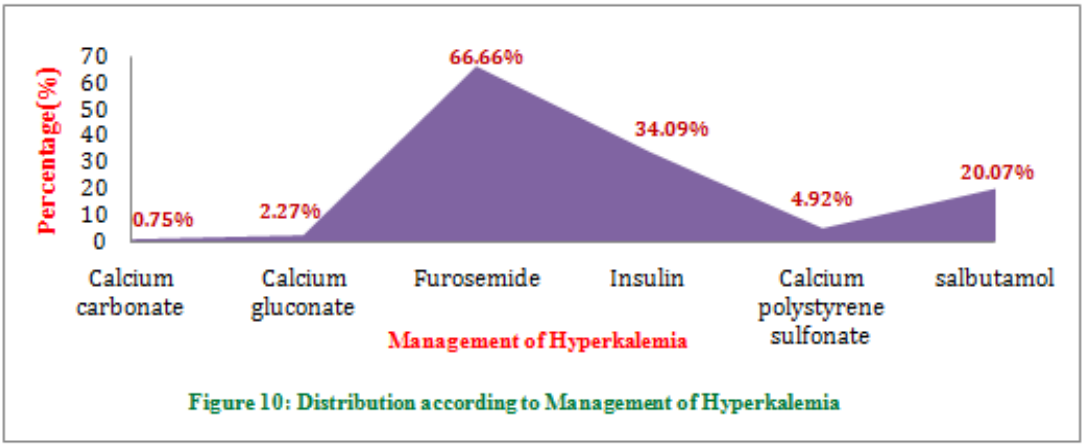

Figure 10: Distribution according to Management of Hyperkalemia

Table 10 and Figure 10 shows distribution according to management of hyperkalemia by drugs such as Calcium carbonate, Calcium gluconate, Furosemide, Insulin, Calcium polystyrene sulfonate and Salbutamol. 66.66% patients prescribed with Furosemide, 34.09% patients were with Insulin injection, 20.07% patients prescribed with Salbutamol. 4.92% were given with Calcium polystyrene sulfonate, 2.27% with calcium gluconate and only 0.75% patients are prescribed with Calcium carbonates.

Table11: Distribution according to Duration of therapy

Sl. No.	Duration of therapy (Days)	Number of patients (n=264)	Percentage (%)
1	1	14	5.30
2	2	110	41.66
3	3	66	33.33
4	4	36	13.63
5	5	15	5.68
6	6	1	0.37

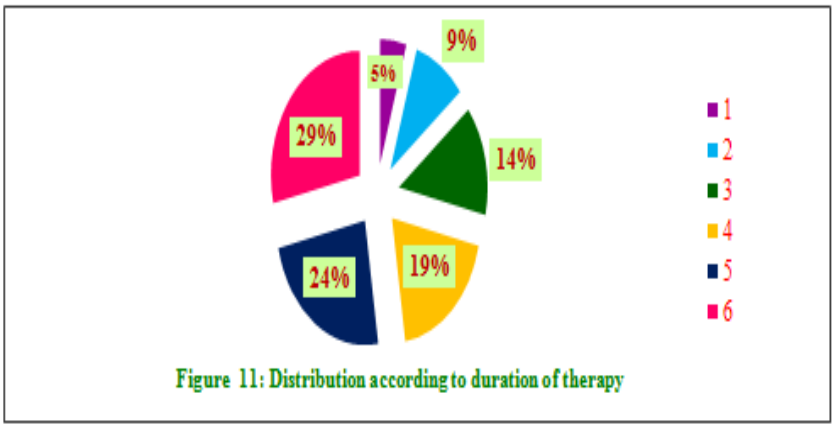

Figure 11: Distribution according to duration of therapy

Table 11 and Figure 11 shows distribution according to duration of therapy, in which 41.66% patients having duration of therapy about 2 days. 33.33% patients takes about 3 days, 13.63% patients about 4 days, 5.68% takes about 5 days and 5.30% having duration of therapy about one day, but 0.37 % patients takes about 6 days.

Table12: Distribution according to Treatment Approaches

Sl. No.	Parameters	Numberofpatients(n=264)*	Percentage (%)
1.	Stabilizing the myocardium	8	3.03
2.	Shifting of K^+ into intracellular space	151	57.19
3.	Elimination of K^+	215	81.43

**n=264; Total will not corresponds to 100% because of multiple treatment approaches.*

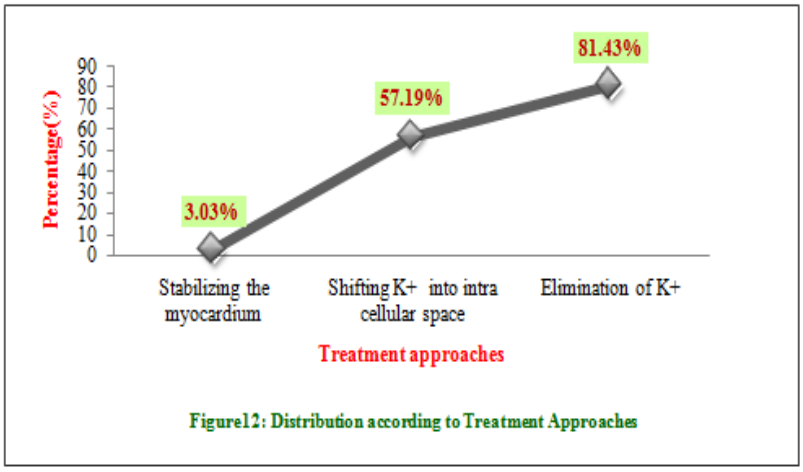

Figure12: Distribution according to Treatment Approaches

Table 12 and Figure 12 indicate distribution of drugs according to the treatment approaches given to the patients. 3.03% patients are treated with drugs which stabilizing the myocardium and 57.19% patients were treated with drugs which causes shifting of potassium into intracellular space. But largely, 81.43% patients are prescribed with drugs which cause the elimination of potassium from body through urine.

Table13: Distribution according to Rationality

Table13.1: According to Drug Interactions

Sl.No.	Drug interactions	Number of patients(n=264)	Percentage (%)
1.	Patients with Drug interactions	258	97.72
2.	Patients without Drug interactions	6	2.27

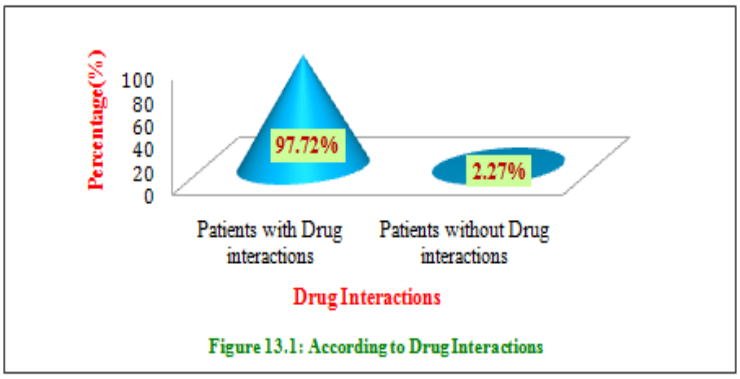

Figure 13.1: According to Drug Interactions

Table 13.1 and Figure 13.1 indicates distribution according to rationality on the basis of drug interactions in which 97.72% patients having drug interactions and 2.27% patients have no drug interactions.

Table13.2: According to Severity of Drug interactions

Sl.No.	Severity of Drug interactions	Number of patients(n=264)*	Percentage (%)
1.	Mild	159	60.22
2.	Moderate	262	99.24
3.	Severe	89	33.71
4.	Moderate and severe	147	55.68

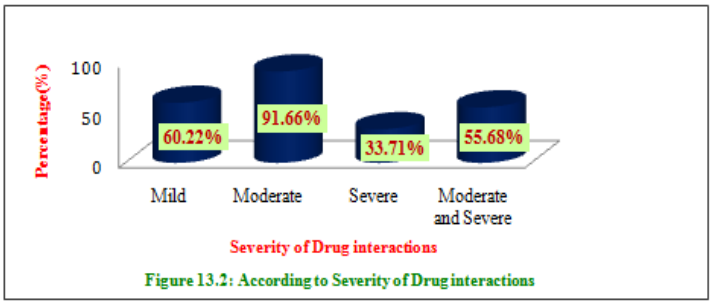

Figure 13.2: According to Severity of Drug interactions

**n=264; Total will not corresponds to 100% because of multiple interactions.*

Table 13.2 and Figure 13.2 indicates distribution according to severity of drug interactions in which 60.22% patients having mild drug interactions, 99.24% patients having moderate interactions and 33.71% patients having severe drug interactions. 55.68% patients occurs both moderate and severe drug interactions.

Table13.3: According to drug interactions with hyperkalemia

Sl. No.	Drug interactions	Number of patients (n=264)	Percentage (%)
1	Drug interactions with hyperkalemia	50	18.93
2	Drug interactions without hyperkalemia	214	81.06

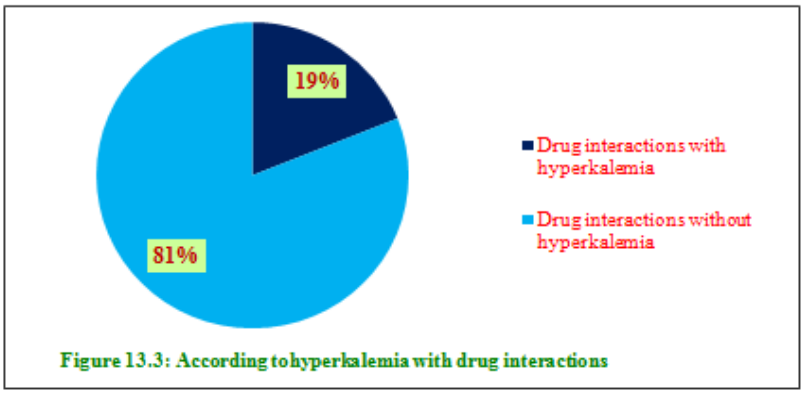

Figure 13.3: According to hyperkalemia with drug interactions

Table 13.3 and Figure 13.3 represent distribution according to hyperkalemia with drug interactions in which 18.93% patients having drug interactions with hyperkalemia and 81.06% patents had no drug interactions with hyperkaemia.

Table13.4: According to Adverse drug reactions

Sl. No.	Adverse drug reactions (ADR)	Number of patients (n=264)	Percentage (%)
1	Patients with ADR	264	100
2	Patients without ADR	0	0

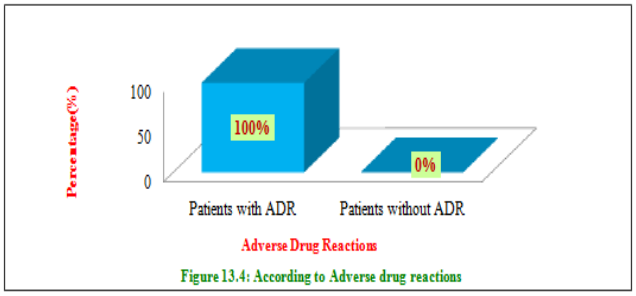

Figure 13.4: According to Adverse drug reactions

Table 13.4 and Figure 13.4 shows that distribution according to adverse drug reactions, in which 100% patients were having adverse drug reactions.

Table13.5. According to adverse drug reactions with hyperkalemia

Sl.No.	Adverse drug reactions (ADR)	Number of patients(n=264)	Percentage (%)
1	ADR with hyperkalemia	154	58.33
2	ADR without hyperkalemia	110	41.66

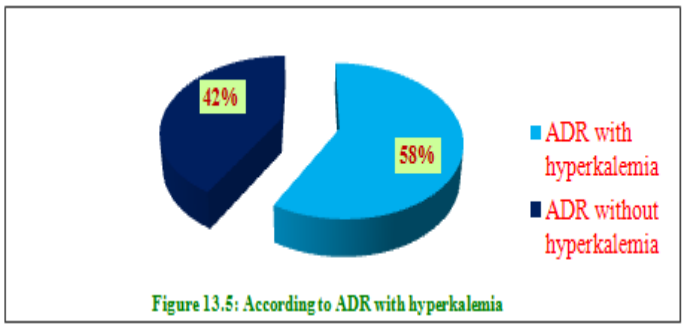

Figure 13.5: According to ADR with hyperkalemia

Table 13.5 and Figure 13.5 represent distribution according to adverse drug reactions with hyperkalemia. In this study shows 58.33% patients having ADR with hyperkalemia and 41.66% patients shows ADR without hyperkalemia.

Table 13.6: According to Prescription

Sl.No.	Parameters	Number of patients (n=264)*	Percentage (%)
1	Right drug	264	100
2	Right dose	149	56.4
3	Right time	264	100
4	Right dosage form	253	95.8
5	Right route	264	100
6	Right regimen	264	100

**n=264 Total will not corresponds to 100%*

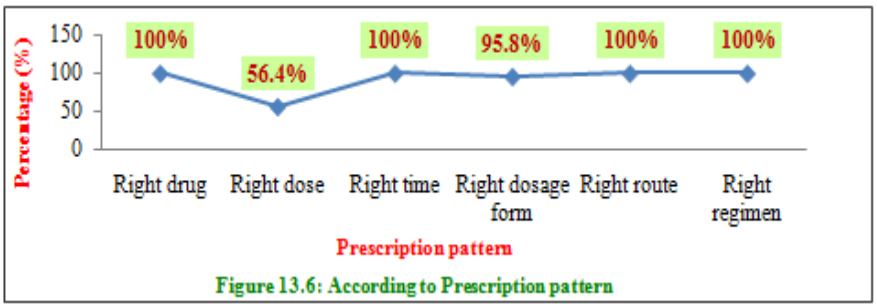

Figure 13.6: According to Prescription pattern

Table 13.6 and Figure 13.6 indicates the distribution according to rationality of prescription in which the prescription provides right drug for all the patients (100%) but at right dose and dosage regimen only for 56.6% and 95.8% patients respectively. The prescription also provides drugs at right time through right route.

Table 14: Distribution according to commonly used drugs in various disease conditions

SI. No.	Various medical conditions	Commonly used drugs	No patients [*n=264]	Percentage (%)
1	Anemia	a. Calcium carbonate	5	1.89
		b. Calcium gluconate	4	1.51
		c. Sodium bicarbonate	4	1.51
		d. Furosemide	129	48.86
		e. Insulin	90	34.09
		f. calcium polystyrene sulfonate	13	4.92
		g. salbutamol	50	18.93
2	Diabetes mellitus	a. calcium carbonate	2	0.75
		b. Calcium gluconate	3	1.13
		c. Sodium bicarbonate	4	1.51
		d. Furosemide	113	42.8
		e. Insulin	88	33.33
		f. Calcium polystyrene sulfonate	7	2.65
		g. Salbutamol	33	12.5

3	Hypertension	a. calcium carbonate	2	0.75
		b. Calcium gluconate	3	1.13
		c. Sodium bicarbonate	4	1.51
		d. Furosemide	111	42.04
		e. Insulin	63	23.86
		f. Calcium polystyrene sulfonate	9	3.4
		g. Salbutamol	38	14.39
4	Ischemic heart disease	a. Calcium carbonate	1	1.13
		b. Calcium gluconate	0	1.13
		c. Sodium bicarbonate	2	0.75
		d. Furosemide	117	44.31
		e. Insulin	62	23.48
		f. calcium polystyrene sulfonate	8	3.03
		g. salbutamol	41	15.53
5	Chronic kidney disease	a. Calcium carbonate	1	0.37
		b. Calcium gluconate	0	0
		c. Sodium bicarbonate	2	0.75
		d. Furosemide	26	9.84
		e. Insulin	15	5.68
		f. calcium polystyrene sulfonate	20	0.75
		g. salbutamol	6	2.27
6	Hypothyroidism	a. Calcium carbonate	1	0.37
		b. Calcium gluconate	1	0.37
		c. Sodium bicarbonate	0	0
		d. Furosemide	10	3.78
		e. Insulin	13	4.9
		f. calcium polystyrene sulfonate	4	1.51
		g. salbutamol	3	1.13

**n=264 Total will not corresponds to 100% due to multiple disease conditions.*

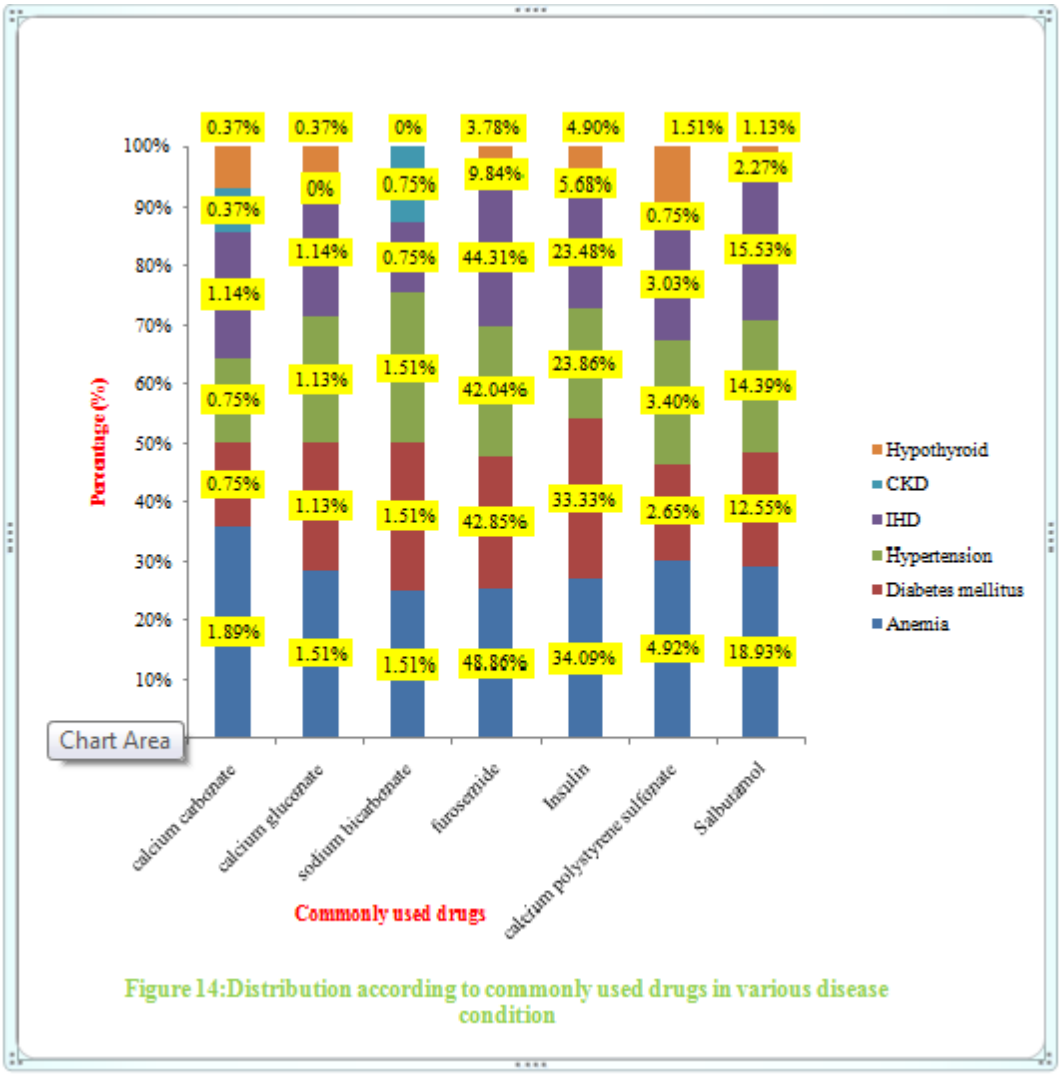

Figure 14:Distribution according to commonly used drugs in various disease condition

Table 14 and figure 14 represents the distribution according to commonly used drugs in various medical conditions were anemia were treated with 1.09% of calcium carbonate, and 1.51% of calcium gluconate and sodium bicarbonate,34.09% of insulin,4.92% of calcium polystyrene sulfonate and 18.93% of salbutamol but 48.86% were treated with furosemide. In case of diabetes mellitus and hypertension,0.75% were used in calcium carbonate and 1.13% calcium gluconate and 1.51% of sodium carbonate but 42.8% were treated with furosemide. In case of IHD, CKD and hypothyroidism cases were treated with furosemide.

DISCUSSION

Table 1 and graph 1 indicates the distribution according to age. In the present study, it was observed that 32.95% of patient were in age 61 to 70 years. Allan j Collins et al [1]., conducted a study and the result was in between the age group <65 years had notably higher rate of mild to moderate to severe hyperkalemia. When compared to those age 50-64 years. The another study was conducted by Akshay S Desai et al [16], on the risk of hyperkalemia increased in the age of ≥75 years. In the previous study by Dr. Rathri Roopavathi et al [15]. Correlated of serum potassium level with CKD IV and V were increased risk in age group of 49.7±21.4 years. In a study by Ju-hyun et al [19]., determine the effect of RAS blocked maintenance on renal protective in CKD patient with hyperkalemia who were in 61.8±14.5 years. The epidemiological variations and study population might be reason for this change.

Table 2 and graph 2 indicates the distribution according to the gender. According to the study,

62.15% were males. Ina study by Ju- Hyun et al [19]., 56% were males while in a study done by Dr Rathri Roopavathi et al [15]., in the study included 45 cases of CKD on conservative treatment out of which 24 were men and 21 were women. The author study Akshay et al [16]., the risk of hyperkalemia increased with male gender. But there was 58% were female, Allan J Collins et al [1]., shows they have significantly higher tendency to develop hyperkalemia. This variation may due to the diverse population receiving medical care or not.

Table 3 and graph 3 indicates the distribution according to the past medical history. According to the subjective findings 67.42% of patient had diabetes mellitus and 60.60% of hypertension had the risk of Akshay S Desai et al [16]., mention that patient had the risk of hyperkalemia increased in symptomatic heart failure patients with past medical history of diabetes mellitus , hypertension, CKD. N karunsree et al [18]., found that out of 38 cases 17 had hypertension and 12 patient associated diabetes mellitus. Allan j Collin et al [1] conducted study in which 21% patient had history of diabetes mellitus. The difference may be due to community variations and past histories.

Table 4 and graph 4 represents the distribution according to blood pressure. According to their clinical laboratory findings 27.6% of patients had systolic blood pressure and 40.9% patients had normal diastolic blood pressure at the time of admission. Joy. M. weinberg et al [7]. There was a wide range of systolic blood pressure with mean of 150 mmhg. In nondiabetic patient with CKD disease receiving antihypertensive therapy with risk of hyperkalemia.

Table 5 and graph 5 indicates distribution according to etiological factor in the present study it was observed that 75% of patients had adverse drugs reaction the use of medication. Hiroyuki et al [14]., identify that the use of medications like NSAID, Beta blocker , potassium salt substitute their ADR which are known risk factor for hyperkalemia. While the study conducted by Joy.M. Weinberg et al [7]., concluded that after the initiation of antihypertensive therapy the risk of hyperkalemia greatest with ACE inhibitor to use intermediate with beta blocker and lowest with CCB . The present study was supported by Akshay et al [16]., determined that the cause of hyperkalemia in a broad population of heart patients with increase the incidence with background use of ACE inhibitor, spironolactone, Candesartan.

Table6 and graph6 represents the distribution according to incidence of hyperkalemia. According to this study the majority of patients were found to be disease induced, especially 67.42% of diabetes mellitus. Another study supported to present observation that conducted by Allans j Collins [1] and akshay et al [16]., patients had high risk in background of diabetes mellitus, hypertension and CKD.

Table7 and graph 7 shows that distribution according to potassium level. In this study, 82.95% patients had mild hyperkalemia on the basis of severity. Allan j Collins [1]., conducted study was notably higher range severity of mild to moderate to severe hyperkalemia. This variation occurs may due to difference in the potassium level and the study populations.

Table8 and graph 8 distribution according to abnormal laboratory values. According to clinical laboratory findings 62.5% patients had decreased hemoglobin level and found to be anemic and 39.3% patient had elevated ESR. Dr. Rathriparith et al [15]., mention that 56% patients were in stage V were the mean value of blood urea , serum creatinine, serum potassium are raised above normal in all CKD patients . The variation is due to the epidemiological and diseased conditions.

Table 9 and graph 9 distribution according to signs and symptoms of hyperkalemia. In the present observation study was found that 77.2% patient had hyperkalemia symptoms are less likely to occur. N Karunasree et al [18] conducted study among 30 patients 8 were asymptomatic (26.66%). 22 show varied symptoms related to both their underlying disease and symptoms pertaining to hyperkalemia (73.34%). 22.34% patients had complained nausea, vomiting, headache & dizziness. The variation in the study due to the severity of the hyperkalemia and study population.

Table10 and graph10 distribution according to management. According to this study 66.66% patients were manage by furosemide. Allan j Collins et al [1] 19% of the study population thiazide and loop diuretic therapy were associated with mild and mod- severe hyperkalemia. Joy.M.weinberg et al [7] found that the 75% patients diuretics were used for an average of 75% of follow up visits. After controlling for the most

GFR, use of diuretics was associated with a reduction in the probability of hyperkalemia by 59%. Michael H.alderman et al [11] conducted study on the clinical significance of incidence hypokalemia and hyperkalemia in hypertensive patients. And treatment should often included loop and thiazide type diuretic greater than 13% of patients with low to moderate doses of diuretic. However is that the cardioprotective action of diuretic use are unaffected by consequent but treatable alteration in serum potassium.

Table 11 and graph 11 distribution according to duration of therapy in study, 41.66% patient were relieved within the 2 day after the drug therapy, N Karunasree et al [18] showed that all patient showed reduction in the serum potassium level ranging from 0.15 to 4.6 with a mean value of 1.636 reduction of less than 1 milliequivalent in 9 cases, 1.2 milliequelence per liter in 12 cases and 2.3 milliequelence in 3 cases and greater than 4 milliequelence in 1 case.

Table 12 and graph 12 distribution according to treatment approaches another important findings in the study was 81.43% patients had a treatment on elimination of potassium. Allan j collins et al [1] and joy. M. Weinberg et al [7] conducted study show that the elimination of potassium by using diuretics.

Table 13 and graph 13 distributions according to rationality 97.72% of patient with drug interaction out of 81.0% without hyperkalemia. Hiroyuki et al [14] identify that the use of medication like NSAID, beta blocker, potassium salt substitute and their ADR which are the known risk factors for hyperkalemia. N Karunasree [18] conducted study found that are different modalities of treatment which either redistribute potassium from the body. Among the measures that tent to effect the redistribution of potassium in the body. Intravenous insulin are most practiced. IV calcium gluconate brings about rapid change with early onset of action. IV sodium bicarbonate is an effective unless there is coexistence acidosis and beta- agonist in oral cation exchange resin also eliminates potassium from the body. But are useful only in known emergency situations.

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CONCLUSION

The study concluded, hyperkalemia was seen in majority of patents having age group 61 to 70 years and males were prone to hyperkalemia. The causes for the incidence of hyperkalemia was found to be food habits, diseases like diabetes mellitus, hypertension, heart disease, chronic kidney disease, anemia, thyroid disorder and drugs induced like NSAID, spironolactone, ACE inhibitors, calcium channel blockers, heparin and some cases arises from the adverse drug reactions and drug interactions. The severity was seen to be at mild level in which patient had a potassium level 5.12 to 6.0 mEq/l. Diuretics were recommended as the first line drug therapy, according to the study the patients were treated with furosemide by eliminating potassium from the body. It was found that the therapeutic effect occur within two days of hospitalization. To decrease the severity of hyperkalemia , an awareness to the patients must be done about restricted potassium diet, drugs induced and disease induced complications.

The research was conducted as a single site study. So for more accurate results, the study population must be enlarged and multiple site studies have to be performed.

REFERENCES

[1]. Allan J. Collins, Bertram pitt, Nancy Reaven et al., Association of Serum Potassium with All-Cause Mortality in Patients with and without Heart Failure, Chronic Kidney Disease, and/or Diabetes. American journal of Nephrology. 47, 2017, 213-221.

[2]. Michael Allon, Nirupama putcha,. Management of Hyperkalemia in Dialysis Patients. 20(5), 2007, -439.

[3]. Anja Lehnhardt, Markusj.Kemper. Pathogenesis, diagnosis and management of hyperkalemia. 26, 2011, 377-384.

[4]. Fiona E. Karet, Mechanisms in Hyperkalemic Renal Tubular Acidosis. 20, 2009, 251-254.

[5]. Walter A. Parham et al., Hypertension variable. 33, 2006, 40-47.

[6]. Klemm SA et al., The syndrome of hypertension hyperkalemia with normal GFR (Gordon's syndrome): is the increased proximal sodium reabsorption. 14(6), 1991, 551-558.
[7]. Joy M. Weinberg, Mlawrence J. Appel, George Bakris et al., Risk of Hyperkalemia in Nondiabetic Patients with Chronic Kidney Disease Receiving Antihypertensive Therapy. 169(17), 2009, 1587-1968.
[8]. Marsha A. Raebel, Colleen Ross, Stanley Xu et al., Diabetes and Drug-Associated Hyperkalemia: Effect of potassium Monitoring. 25(4), 2010, 326-333.
[9]. Juan Jesus Carrero, Erik Nilsson,Alessandro Gasparini et al., Incidence and determinants of hyperkalemia and hypokalemia in a large healthcare system. 245, 2017, 277-284.
[10]. Anil K. Mandal, Management and Prevention of Hyperkalemia Diabetes. 3(1), 2016, 1-3.
[11]. Michael H. Alderman et al.,Clinical Significance of Incident Hypokalemia 12 And Hyperkalemia in Treated Hypertensive Patients in the Antihypertensive and Lipid-Lowering Treatment to Prevent Heart Attack. Trial. 59, 2012, 926-933.
[12]. Kamel S. Kamel et al., Optimal Dose and Method of Administration of Intravenous Insulin in the Management of Emergency Hyperkalemia: A Systematic Review. 11(5), 2016, 1-12.
[13]. Lisa M. Einhorn, Min Zhan, Van Doren Hsu et al., The frequency of hyperkalemia and its significance in chronic kidney disease. 169(12), 2009, 1156-1162.
[14]. Hiroyuki Yamamoto, Yuki Saito, Hideki Makajima et al. , of and risk factors for newly diagnosed hyperkalemia after hospital discharge in non-dialysis-dependent CKD patients treated with RAS inhibitors. 12(9), 2017, 1-11.
[15]. Dr.Rathiroopavathy, Dr Ajamanjulla devi , Dr Kalai Selviet, Correlation of serum potassium level with chronic kidney disease-an observation study. 5(2), 2014, 667-673.
[16]. Akshay S. Desai, Karl Swedverg, John J.V.Mc Nurray et al., Incidence and Predictors of Hyperkalemia in Patients with Heart Failure. 50(20), 2007, 1959-1966.
[17]. Juan-Jesus Carrere, Ghassan Bandak,Yingying Sang et al., Hyperkalemia after Initiating Renin-Angiotensin System Blockade: The Stockholm Creatinine Measurements (SCREAM) Project. 2017.
[18]. N. KarunaSree , R.Narasimha Rao, Salbutamol Nebulization in the Treatment of Hyperkalemia. 2(4), 2011, 104-118.
[19]. Ju –Hyun lee, Young Eum Kwon, Jung Tak Park et al., The effect of rennin – angiotensin system blockade on renal protection in chronic kidney disease patients with hyperkalemia. Journal of the renin- angiotensen aldosterone system. 15(4), 2014, 491-497.

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