## **Original Research Article**

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# Association between hypokalemia and cardiovascular diseases among hospitalized patients in tertiary care teaching hospital in North Karnataka: a retrospective study

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#### **ABSTRACT**

**Background:** Potassium is an extremely crucial element in maintaining the normal charge between intracellular and extracellular space. Normal cellular function is maintained through potassium homeostasis. The normal range of plasma potassium is 3.5 to 5.1 mmol/L. The deviation both hypo and hyperkalaemia are associated with cardiovascular diseases especially cardiac arrhythmia. The objective was to study the association of hypokalaemia on cardiovascular diseases.

**Methods:** During this one year of retrospective study socio-demographic profile of the patients were collected from the medical record section of hospital. The participants were grouped into four classes based on the serum potassium levels as, Group A: < 2 mmol/L, group B: 2-2.49 mmol/l, group C: 2.5 - 2.9 mmol/L, group D: 3 - 3.49 mmol/L and group E (control group) 3.5 to 5.1 mmol/L. The participants were also grouped as those suffering from cardiovascular diseases and those with non-cardiovascular diseases.

**Results:** In our study 4818 records were categorized into 5 groups including control group. Males (61.35%) were slightly more than female (38.65%). The mean age group was 43±4 years. Results revealed that there was positive association between the sexes. Females were more commonly associated as compared to males. Hypokalaemia among cardiovascular diseases was only 22.2% as compared to non-cardiovascular diseases. The mean systolic (142±8) and diastolic Blood pressure (92±2) among cardiovascular diseases was slightly higher as compared with the non-cardiovascular diseases.

**Conclusions:** Hypokalaemia is significantly associated with myocardial infarction when compared with other disorders. Hypokalaemia was more commonly associated with cardiovascular diseases as compared with non-cardiovascular diseases.

Keywords: Arrhythmias, Cardiovascular diseases, Hypokalaemia, Potassium

#### INTRODUCTION

Globally millions of deaths are caused due to sudden cardiac arrest and these are elevated by interplay between substrate and triggering factors, of which hypokalemia in heart cell is the major risk factor. Hypokalemia refers to

a condition in which concentration of potassium in blood is lower than 3.6 mmol/L.

Causes of hypokalemia are: Depletion of potassium due to increased loss of potassium as well as decreased intake of potassium, potassium shift in case of administration of catecholamines, insulin and beta- adrenoceptor agonists. Hypokalemia accounts for more than 20% of hospitalized patients suffering from cardiac rhythm, blood pressure and cardiovascular morbidity rate resulting in increased mortality.<sup>2</sup> The present retrospective study was carried out to investigate the effect of hypokalemia on cardiovascular diseases among patients admitted in tertiary care hospital in north Karnataka.

#### **METHODS**

This was a 1 year retrospective hospital based study carried out at a tertiary care hospital in north Karnataka. The study participants whose serum potassium level up to 5 mmol/l were included in the study. A total sample size of 4818 who fit into the inclusion criteria were grouped into 5 categories including the control group. Group A constituting potassium values less than 2 mmol/L, group B contains potassium levels 2 to 2.49 mmol/l, group C contains potassium levels 2.5 to 2.9 mmol/L group D contains potassium levels 3 to 3.49 mmol/L and group E contains normal levels of potassium values for control group. The following data were collected from the records i.e. patients demographic profile, primary diagnosis, symptoms, laboratory test results, treatment, potassium supplementation, surgeries, and other morbidity conditions.

The data was analyzed using the percentage with regard to age distribution comprising of 4 groups, group 1: <20 years, group 2: 20-40 years, group 3: 41-60years, and group 4: >60 years. Hypokalemia patients are grouped into two classes with regards to primary diagnosis as those with cardiovascular diseases and those with non-cardiovascular diseases like cancer, gastrointestinal, genito-urinary, respiratory and other disorders. Results were analyzed by  $\chi^2$  test applied across the five groups of

patients studied comparing groups A, B, C and D individually with normokalemic subjects. P value less than 0.05 was taken as statistically significant.

#### **RESULTS**

Out of total 4818 cohorts, males (61.35%) were slightly more as compared to females (38.65%). The mean age of the cohort was 43±4 years. Majority of them belonged to age group of 41-60 years (36.4%) while <20 years were compromised only 9.6%. Co morbidities associated with hypokalemia were cancer (100%), cardiovascular diseases (72.2%), gastrointestinal diseases (80.3%), genito-urinary diseases (83.5%), respiratory diseases (81.6%) and other diseases (75%).

There was positive association between the hypokalaemia and sex, hypokalaemia <2.5mmol/l was more among females as compared to males. The association was statistically significant with p value <0.05.

Collected data were also distributed with respect to patients age, on analysis we found age group between 40 to 60 and above 60 years were most affected by hypokalaemia as compared to adults between 20 to 40 years of age. Less than 20 years of age groups individuals were least affected with 9.6%. The association was statistically insignificant.

The prevalence of cardiovascular diseases was 22.2%. Hypokalaemia seen among of cardiovascular diseases was 16.3%. The mean age was 42±2years, mean systolic blood pressure 142±8, mean diastolic blood pressure 92±2 and mean BMI was 24±3, among cardiovascular diseases as compared with non-cardiovascular diseases patients. Hypokalaemia was significantly associated with myocardial infarction with p value less than 0.02.

Table 1: Distribution of participants based on the serum potassium level.

Hypokalemia Normal Total

Value (mmol/l) Less than 3.5 3.5-5.5

Set	Hypokalemia		Normal		Total		Chi gayana and n value
Potassium value (mmol/l)	Less than 3.5		3.5-5.5				Chi square and p value
Numbers	4618		200		4818		
Males	2816	60.2%	140	4.7%	2956	61.35	χ2 was 11.412, DF was
Females	1802	58.9%	60	3.2%	1862	38.65	4 and P value is 0.022.
<20 years	442	9%	21	10%	463	9.6%	
21-40years	1079	24	40	20%	1119	23.2	χ2 was 15.321, DF is 12
41-60 years	1666	36	86	43%	1752	36.4	and P value is 0.224.
>60 years	1430	31	55	27%	1485	30.8	
Cardiovascular	39	22.2%	15	27.7%	54		
Angina pectoris	9	16.6%	4	7.4%	13	24%	χ2 test is 35.315 DF is
Arrythmia	8	14.8%	6	11.1%	14	24%	20 and P value 0.018.
Myocardial Infarction	18	33.3%	3	5.6%	21	38.9%	
Cardiac Insufficiency	4	7.4%	2	3.7%	6	11.1%	

Table 2: Distribution of subjects as per the presence of cardiovascular diseases with the non-cardiovascular disease patients.

Set	Car dise	diovascular ases	Non-card diseases	Non-cardiovascular diseases			Chi square and p value
Numbers	54	1.1%	4764	98.8%	4818		
Potassium value (mmol/l) Less than 3.5	39	22.2%	200	77.8%	239		
Males	28	51.8%	2928	61.5%	2956	61.35	$\chi^2$ was 11.412, DF was 4
Females	26	48.1%	1836	38.5%	1862	38.65	and 'P' is 0.022.
<20 years	2	3.7%	461	9.7%	463	9.6%	- · · · · · · · · · · · · · · · · · · ·
21-40years	8	14.8%	1111	23.3%	1119	23.2	$\chi^2$ was 15.321, DF is 12 and P value is 0.224.
41-60 years	10	18.5%	1742	36.6%	1752	36.4	and P value is 0.224.
>60 years	6	11.1%	1479	31%	1485	30.8	
Mean AGE	42±2	2	51±4		NA	NA	
Mean SBP	142	<u>+</u> 8	124±6	124±6		NA	
Mean DBP	92±2	2	76±4		NA	NA	
Mean BMI	24±3	3	22±2		NA	NA	

#### DISCUSSION

In this retrospective cohort study majority of the hypokalemia patients were male as compared to female. The findings were similar to the studies carried out by Paul Milliez et al in France among cardiovascular patients with aldosterone.<sup>3</sup> Our study revealed that hypokalemia was seen in only 22.2 percent of cardiovascular diseases patients whereas the recent studies carried out by Mulatero et al and E. Born-Frontsberg et al revealed that hypokalemia was seen in more than 50% of cardiovascular diseases.<sup>4</sup> Hypokalemia is associated with decrease in myocardial membrane permeability resulting in arrhythmia and sudden cardiac arrest which is similar to our results.<sup>5</sup>

It has been reported that hypokalemia is independently associated with severity of arrhythmias in patients with acute myocardial infarction, and chronic hypokalemia is not associated with higher incidence of intra operative dysrhythmias. 6.7 In the present study only 6% of hypokalemic patients were suffering from cardiovascular disorders. The prevalence of myocardial infarction was higher in the present study as compared with other cardiovascular diseases. A recent study conducted by Catena et al also revealed that cardiovascular diseases was significantly associated with primary aldosterone level and essential hypertension. 8

Mean systolic and diastolic blood pressure among cardiovascular diseases was higher as compared to non-cardiovascular diseases participants. Myocardial infarction was statistically associated with hypokalemia as compared to other complications. This is similar to study carried out by Heally and Down which revealed that there was only hypokalemia was more commonly associated with primary cardiovascular diseases.<sup>9,10</sup>

#### **CONCLUSION**

That although hypokalemia was significantly associated among cardiovascular diseases there is a need to consider other co morbidities and effect of diuretics and other medications on hypokalemia.

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