Original Research Article

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 hypokalaemia 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. 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: 41-60 years, 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 χ² 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. |
|-----------------|------------------|---------|-----------------|
| Potassium value (mmol/l) | Hypokalemia | Normal | Total |
| Numbers | 4618 | 200 | 4818 |
| Males | 2816 | 60.2% | 140 | 4.7% | 2956 | 61.35 |
| Females | 1802 | 58.9% | 60 | 3.2% | 1862 | 38.65 |
| <20 years | 442 | 9% | 21 | 10% | 463 | 9.6% |
| 21-40 years | 1079 | 24 | 40 | 20% | 1119 | 23.2 |
| 41-60 years | 1666 | 36 | 86 | 43% | 1752 | 36.4 |
| >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% |
| Arrhythmia | 8 | 14.8% | 6 | 11.2% | 14 | 24% |
| Myocardial Infarction | 18 | 33.3% | 3 | 5.6% | 21 | 38.9% |
| Cardiac Insufficiency | 4 | 7.4% | 2 | 3.7% | 6 | 11.1% |

| Chi square and p value | χ² was 11.412, DF was 4 and P value is 0.022. |
|-----------------------|-----------------------------------------------|
| χ² was 15.321, DF is 12 and P value is 0.224. |
| χ² test is 35.315 DF is 20 and P value 0.018. |
**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. 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. Hypokalemia is associated with decrease in myocardial membrane permeability resulting in arrhythmia and sudden cardiac arrest which is similar to our results.

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. 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.

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.

**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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**Conflict of interest:** None declared

**Ethical approval:** The study was approved by the institutional ethics committee

**REFERENCES**

1. Keld Kjeldsen. Review Hypokalemia and sudden cardiac death. Exp Clin Cardiol. 2010;15(4):e96-e99.
2. Paice BJ, Paterson KR, Omara OF, Donnelly T, JM. Gray, D H. Lawson. Record linkage study of hypokalaemia in hospitalized patients. Postgrad Med J. 1986;62:187-191.
3. Milliez P, Girerd X, Plouin PF, Blauner J, Safar ME, Mourad JF. Evidence for an increased rate of cardiovascular events in patients with primary aldosteronism. J Am Coll Cardiol 2005;45:1243-8.
4. Mulatero P, Bertello C, Rossato D, Mengozzi G, Milan A, Giarone C, et al. Roles of clinical criteria, computed tomography scan, and adrenal vein sampling in differential diagnosis of primary aldosteronism subtypes. J Clin Endocrinol Metab. 2008;93:1366-71.
5. Schulman M, Narins RG. Hypokalemia and cardiovascular disease. Am J Cardiol. 1990;65:4E-9E.

6. Krakaurer R, Lauritzen M. Diuretic therapy and hypokalemia in geriatric outpatients. Danish Med Bulletin. 1978;26.

7. Singhi S, Marudkar A. Hypokalemia in a pediatric intensive care unit. Indian Pediatr. 1996;33(1):9-14.

8. Catena C, Colussi G, Nadalini E, Chiuch A, Baroselli S, Lapenna R, et al. Cardiovascular outcomes in patients with primary aldosteronism after treatment. Arch Intern Med. 2008;168:80-5.

9. Healy JJ, McKenna TJ, Canning BS, Brien TG, Duffy GJ, Muldowney FP. Body composition changes in hypertensive subjects on long-term oral diuretic therapy. Br Med J. 1970;1(5698):716-9.

10. Down PE, Polak A, Rad R, Mead JA. Fate of potassium supplements in six patients receiving long term diuretics for oedematous disease. Lancet. 1972;ii:721.

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