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EVALUATION OF ELECTROLYTE IMBALANCE IN MYOCARDIAL INFARCTION PATIENTS AT TERTIARY CARE CENTER

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ABSTRACT

Background: Cardiovascular disease is among the leading causes of mortality and morbidity across the globe. According to the World Health Organization (WHO), cardiovascular disease as a non-communicable disease is a modern epidemic. Acute myocardial infarction (AMI) is one of the manifestations of cardiovascular disease leading to mortality and morbidity. **Material & Methods:** The present case-control study was conducted at of our tertiary care hospital, with a study duration of six months from January 2018 to June 2018. We enrolled 50 patients with AMI and 50 healthy controls in the present study. Clearance from Institutional Ethics Committee was taken before the start of the study. **Results:** There were 38 male and 12 female patients in the present study. Mean age of male patients was found to be 58.12 ± 14.28 and female patients was 51.27 ± 13.26. We found a statistically significant difference among serum concentration of sodium between control (94.315±4.372 mmol/L) and case group (83.598±5.424 mmol/L). There was a non-significant difference observed related to serum potassium and serum chloride concentration. We found statistically significant difference among serum concentration of serum calcium (p-value = .004) and magnesium (p-value = .001). **Conclusion:** Assessment of serum electrolytes is very significant and important for the diagnosis and prognosis of acute MI. The present study shows that lower values of serum sodium were reported in patients with acute MI as compared to healthy controls.

Keywords: Acute MI, Hypokalemia, Hyponatremia, Serum electrolytes

INTRODUCTION

Cardiovascular disease is among the leading causes of mortality and morbidity across the globe. According to the World Health Organization (WHO), cardiovascular disease as a non-communicable disease is a modern epidemic. Acute myocardial infarction (AMI) is one of the manifestations of cardiovascular disease leading to mortality and morbidity. In Indian scenario, the magnitude of ischemic heart disease (based on clinical and ECG criteria) among adult population was estimated approximately 96.7 per 1000 population in urban areas and 27.1 per 1000 population in rural areas **(1)**. Several systemic and metabolic changes seen in acute myocardial infarction. These include serum electrolytes changes, increased plasma concentrations of catecholamines, changes in serum concentrations of free fatty acids, glucose, cortisol, glycerol, and cyclic-AMP **(2)**.

Serum sodium, potassium, and calcium are three major electrolytes associated with the myocardial membrane's electrophysiological properties. Based on these three, there are four different phases of the action potential. Serum electrolyte dysfunction or imbalance

after an acute episode of myocardial infarction are common and documented. These electrolytes also play a prognostic role in patients for myocardial infarction **(3)**. Hyponatremia defined as serum sodium levels less than133 mEq/L. Hyponatremia is found commonly in patients with AMI and also in cases of STEMI and NSTEMI, and the severity of hyponatremia is proportional to the risk of mortality **(4)**.

Hypokalemia defined as serum potassium levels less than 3.5 mEq/L. Hypokalemia is demonstrated with AMI and also a predictor of hospital mortality and morbidity particularly of arrhythmias and in some cases associated with larger infarcts. Recent studies found that K levels should be monitored in the patient with MI and heart failure, even if serum K levels appear normal at the time of admission **(5)**.

Serum calcium is involved in the mechanism of a variety of pathophysiological process leading to CAD such as coronary spasm, disruption of atherosclerotic plaque and thrombosis formation **(6)**.

Hypophosphatemia is associated with left ventricular dysfunction, and low levels of magnesium lead to a local release of myocardial catecholamines which result in loss of selective permeability of sarcolemmal membrane **(7)**.

Hence, the present study was conducted to evaluate electrolyte imbalance among patients of MI and also to evaluate their prognostic value in the outcome of AMI.

MATERIALS & METHODS

The present case-control study was conducted at of our tertiary care hospital, with a study duration of six months from January 2018 to June 2018. A sample size of 100 was calculated at 95% confidence interval at 10% acceptable margin of error by epi info software version 7.2. Clearance from Institutional Ethics Committee was taken before the start of the study. We enrolled 50 patients with AMI and 50 healthy controls in the present study. Written informed consent was taken from all the study participants. Blood samples were collected from both the groups for serum electrolytes, i.e., Na+ and K+ on the day of admission within 12 hours with all aseptic precautions. Electrolytes were measured by ISE autoanalyzer along with Quality control. Data analysis was carried out using SPSS v22. All tests were done at alpha (level significance) of 5%; means a significant association present if the p-value was less than 0.05.

RESULTS

In the present study, A total of 50 patients of acute myocardial infarction were enrolled for the study. Fifty healthy controls of same age group were also enrolled for study so that we comparatively evaluate the serum electrolytes among both the groups. There were 38 male and 12 female patients in the present study. Mean age of male patients was found to be 58.12 ± 14.28 and female patients was 51.27 ± 13.26. The maximum number of patients were seen in the age group 51-60 (34%), followed by age group 61-70 (30%). The least number of lesions were seen in the age group of 31-40 years. The numbers of patients were 12% in above 70 years age group. (Table 1)

Table 1: Distribution of study participants according to age.

Age group (years)	No. of patients (%)
31-40	6
41-50	18
51-60	34
61-70	30
71and above	12

In the present study, we found a statistically significant difference among serum concentration of sodium between control (94.315±4.372 mmol/L) and case group (83.598±5.424 mmol/L). There was a non-significant difference observed related to serum potassium and serum chloride concentration. We found statistically significant difference among serum concentration of serum calcium (p-value = .004) and magnesium (p-value = .001). The serum sodium, potassium, chloride, calcium levels were found to be lower in the acute MI patients; however serum magnesium levels were found to be raised in the acute MI patients. (Table 2)

Table 2: Distribution of various thyroid lesions in males and females.

Serum electrolytes	Case (mmol/L)	Control (mmol/L)	p-value
Sodium	83.598±5.424	94.315±4.372	0.001
Potassium	4.352±1.156	4.651±1.324	0.645
Chloride	73.438±5.641	78.475±5.869	0.270
Calcium	3.681±0.432	4.387± 1.278	0.004
Magnesium	5.814±3.264	2.674±1.251	0.001

DISCUSSION

In the present study, A total of 50 patients of acute myocardial infarction were enrolled for the study. Fifty healthy controls of same age group were also enrolled for study so that we comparatively evaluate the serum electrolytes among both the groups. There were 38 male and 12 female patients in the present study. Mean age of male patients was found to be 58.12 ± 14.28 and female patients was 51.27 ± 13.26. The maximum number of patients were seen in the age group 51-60 (34%), followed by age group 61-70 (30%). The least number of lesions were seen in the age group of 31-40 years. The numbers of patients were 12% in above 70 years age group. Similar results were found in a study conducted by Ketan et al. and found that male predominance among study participants **(8)**. Similar results were found in a study conducted by Ramasamy R et al. among 60 patients of acute MI and 100 healthy controls and found the same pattern of distribution among study participants **(9)**.

Serum sodium, potassium, and calcium are three major electrolytes associated with the myocardial membrane's electrophysiological properties. Based on these three, there are four different phases of the action potential. Serum electrolyte dysfunction or imbalance after an acute episode of myocardial infarction are common and documented. These electrolytes also play a prognostic role in patients for myocardial infarction **(13)**. Hyponatremia defined as serum sodium levels less than133 mEq/L. Hyponatremia is found commonly in patients with AMI and also in cases of STEMI and NSTEMI, and the severity of hyponatremia is proportional to the risk of mortality **(14)**.

In the present study, we found a statistically significant difference among serum concentration of sodium between control (94.315±4.372 mmol/L) and case group (83.598±5.424 mmol/L). There was a non-significant difference observed related to serum potassium and serum chloride concentration. We found statistically significant difference among serum concentration of serum calcium (p-value p-value = .004) and magnesium (p-value p-value = .001). Similar results were found in a study conducted by Vamne A et al.et al. among 120 patients of acute MI and 120 healthy controls and found a statistically significant difference in serum sodium and potassium levels and reported low serum sodium and potassium levels compared to healthy controls across all the age groups **(10)**.

Similar results were found in a study conducted by Patil S et al. among 100 patients of acute MI and 100 healthy controls and found that 27 patients of acute MI were reported to be hyponatremic with lowest serum value of 125 mEq/L. This difference was also statistically significant (p-value = .001) when we compared both the case and control groups. The mean value of serum potassium was 3.81±0.48 mEq/L. Twenty-four patients were reported to have hypokalemia with a significant association (p-value = .0402) with the lowest serum potassium value of 2.6 mEq/L. The mean value of serum calcium was 8.51±0.66 mg/dl. Forty-nine patients were reported to have hypocalcemia with a significant association (p-value = .0206) with the lowest serum calcium value of 7.2mg/dl. The mean serum value of PO4 among the case group was 3.25±0.6 mg/dl and mean serum value of Mg among the case group was 2.03±0.32 mg/dl. There was no statistically significant difference was found in serum values of PO4 and Mg among both the groups **(11)**.

Acute myocardial infarction (AMI) is one of the manifestations of cardiovascular disease leading to mortality and morbidity **(15)**.

In Indian scenario, the magnitude of ischemic heart disease (based on clinical and ECG criteria) among adult population was estimated approximately 96.7 per 1000 population in urban areas and 27.1 per 1000 population in rural areas **(16)**. Several systemic and metabolic changes seen in acute myocardial infarction. These include serum electrolytes changes, increased plasma concentrations of catecholamines, changes in serum concentrations of free fatty acids, glucose, cortisol, glycerol, and cyclic-AMP **(17)**.

In the present study, we found serum sodium; potassium, chloride, calcium levels were found to be lower in the acute MI patients, however serum magnesium levels were found to be raised in the acute MI patients. Similar results were found in a study conducted by Rathore V et al. among 50 patients of acute MI and 50 healthy controls and found that Both serum sodium and serum potassium levels were significantly found lower in patients of acute MI compared to control group ($p<0.001$) **(12)**.

CONCLUSION

We concluded from the present study that a lower value of serum sodium was reported in patients with acute MI as compared to healthy controls. Assessment of serum electrolytes is very significant and vital for the diagnosis and prognosis of acute MI.

We also conclude that normal serum levels of magnesium can prevent the occurrence of hypertension. Hence, the evaluation of serum sodium levels among cases of acute MI should be done as early as possible on the admission of the patients to the emergency department.

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