

Study of electrolyte imbalance in AMI

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Abstract

Background: Cardiovascular disease is one of the leading causes of morbidity and mortality across the world. Worldwide there are 3 million sudden cardiac deaths per year due to acute myocardial infarction. Different electrolytes such as calcium, potassium and sodium play an important role in the cell metabolism, electrical conduction and membrane excitability. Serum electrolyte imbalance after an episode of acute myocardial infarction is common. Abnormalities of these electrolytes due to different causes can lead to a significant cardiac life threatening events. **Objectives:** Study aimed to compare the prevalence and pattern of electrolyte imbalance in both cases and controls. **Material and Methods:** This is a prospective study carried out on 90 subjects. Out of these 45 were clinically diagnosed cases of acute myocardial infarction and 45 were age and sex matched healthy controls. Blood samples were collected from all participants and analyzed for Serum sodium, potassium and calcium. **RESULTS:** In AMI patients serum potassium, calcium levels are significantly low while serum sodium level is low but showed no significant difference among cases and controls. **Conclusion:** Electrolyte imbalance maximally seen in Calcium. Hypocalcaemia was present in around half of total cases. Hypokalaemia was evident in a large number of patients in the early phase of AMI. Therefore it is recommended that calcium and potassium levels which affect the patients of acute myocardial infarction should be monitored, and potassium replaced whenever required.

Key Words: Electrolyte imbalance, myocardial infarction, hypocalcaemia, hypokalaemia, hyponatraemia.

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Received Date: 24/11/2017 Revised Date: 19/12/2017 Accepted Date: 04/01/2018

DOI: <https://doi.org/10.26611/1002513>

Access this article online

Quick Response Code:	Website: www.medpulse.in
	Accessed Date: 08 January 2018

low and extracellular Na is high and K is low. There are 4 phases of action potential dependant on sodium, potassium and calcium. After an episode of acute myocardial infarction serum electrolyte imbalances are common^{3,4}.

1. Hyponatremia is defined as serum sodium concentration <133 mEq/L. Hyponatremia is relatively common in patients with acute MI⁵.
2. Hypokalaemia is defined as serum potassium levels <3.5 mEq/L. Potassium ions are very important as it maintains normal cardiac function⁶. Hypokalaemia is seriously fatal to the heart⁷. After myocardial infarction, mortality is increased in hypokalaemic patients⁸. The prevalence and role of hypokalaemia in myocardial infarction has been under investigation for a long time. Several studies have shown association between hypokalaemia with increased occurrence of cardiac arrhythmias in AMI patients⁹. The sudden cardiac death after MI (death within 1 hour) is mainly due to alteration in the environment at the level of myocytes and purkinje fibres that are mainly

INTRODUCTION

Cardiovascular disease is one of the leading causes of morbidity and mortality across the world. Worldwide there are 3 million sudden cardiac deaths per year due to acute myocardial infarction¹. World Health Organization has declared cardiovascular disease as a modern epidemic². Electrophysiological properties of myocardial membrane are associated with major electrolytes like Serum sodium, potassium and calcium. The sarcolemma having Na-K AT Pase pump exports Na from the cell out and imports K inside the cell against their concentration gradient. Thus intracellular K is relatively high and Na is

regulated by electrolyte imbalances and autonomic nervous system activity¹⁰.

- Since calcium is involved in the regulation of a variety of events leading to Coronary artery disease such as coronary spasm, thrombosis formation and disruption of atherosclerotic plaque. During MI, calcium handling between sarcoplasmic reticulum and myofilaments is disrupted and calcium is diverted to the mitochondria causing oedema¹¹.
- AIMS and OBJECTIVES: This study was taken to estimate serum sodium, potassium and calcium concentration in patients of acute myocardial infarction and to compare electrolyte levels in cases and controls.

MATERIAL AND METHODS

Study design: It is a prospective clinical study carried out on cases and controls between 35-70yrs. **Study site:** the study was carried out at medicine intensive care unit of Dr. Shankarrao Chavan Govt. Medical College and Hospital, Nanded. **Study population:** This study was carried out on 90 patients out of which 45 were cases of MI and 45 were taken as healthy controls with the following criteria:

Inclusion Criteria

- Cases: Included 45 clinically diagnosed and angiographically proven cases of AMI.
- Controls: Data was obtained from patients who were admitted to general wards of Dr.S.C. GMC Hospital with minor illness and without myocardial disease or without systemic illness that affect electrolytes.

Exclusion Criteria

- Patients with renal failure, liver failure, chronic vomiting and diarrhoea patients, adrenal insufficiency, hyperglycaemic MI patients, hypertensive patients on potassium-sparing diuretics were excluded.
- Laboratory Work: Three milliliters of left cubital venous blood was drained by a sterile syringe, put in clean capped plane bulb.
- Serum was used, samples were protected from light during processing and storage.
- Hemolyzed samples were excluded.
- Serum sodium, potassium were determined by direct ion selective electrode methods by using electrolyte analyzer. Estimation of serum calcium was done by using commercial kits of Biolab and carried out on semi autoanalyser.

Statistical Analysis: For the statistical analysis SPSS package was used in the study. All values were expressed

as mean \pm SD. For all analysis 'p' value $<$ 0.05 was defined as significant.

RESULTS

In our study population, 67% (n=60) were male and 33% (n=30) were female. Out of these 22% (n=20) patients died during first seven days. Amongst the patients died 13% (n=12) were male while 9% (n=8) were female.

Table 1: Showing comparison of serum electrolytes between cases and controls

Parameters	Cases	Controls	p value
Sr.Sodium	132.75 \pm 14.19	141.37 \pm 5.38	$>$ 0.05
Sr.Potassium	3.26 \pm 0.30	4.41 \pm 0.47	$<$ 0.05
Sr.Calcium	8.80 \pm 0.58	10.75 \pm 0.63	$<$ 0.05

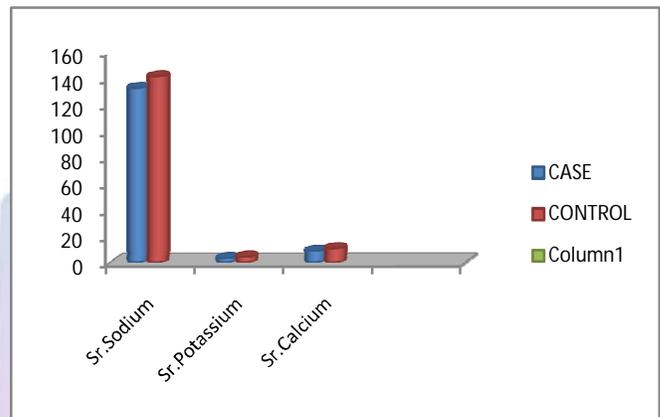


Figure 1: Graphical presentation of serum electrolyte level between case group and control group

DISCUSSION

Electrolyte imbalances are fairly common in the acute MI patients. When measured on admission, the sodium, potassium and calcium levels were found to be significantly reduced in our study as compared to non-infarct controls. Mean sodium level of the patients survived was 141.37 \pm 5.38 and in patients who died was 132.75 \pm 14.19. So, it was found that mortality was higher in patients with hyponatremia. Flear *et al* showed 45% of infarcted patients had hyponatremia and were associated with increased mortality¹². Hypokalaemia was found to be associated with increased risk of ventricular tachycardia in our study and in studies by Dyckner *et al* and Erik *et al*^{13,14}. There is a five-fold increase in incidence of ventricular fibrillation in patients with low potassium¹⁵. Calcium ions play a vital role in excitation-contraction of the cardiac muscle fibres¹⁶. Furthermore hypocalcaemia impairs myocardial contractility and there are several reports of congestive heart failure caused by severe hypocalcaemia¹⁷ and cardiomyopathy in long-standing hypocalcaemia¹⁸.

CONCLUSION

Electrolyte imbalance was maximally seen in Calcium. Hypocalcaemia was present in around half of total cases. Hypokalaemia was present in large number of patients with acute myocardial infarction, mostly due to catecholamines response in such patients. It has been associated with increased mortality in MI patients. From this study we conclude that there was increased mortality in patients with hyponatremia, but p value was non significant.

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Source of Support: None Declared
Conflict of Interest: None Declared