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Original Article

A STUDY OF SERUM ELECTROLYTES SODIUM AND POTASSIUM IN RELATION TO ARRHYTHMIAS AFTER ACUTE MYOCARDIAL INFARCTION

Verma Shubhangi^a, Vikki^b, Sharma SK^c

^aAssociate Professor in Medicine, ^bAssistant Professor in Medicine, ^cProfessor & Head Department of Medicine, Muzaffarnagar Medical College, Muzaffarnagar

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ABSTRACT

Objectives To estimate serum sodium and potassium concentration in patients of acute myocardial infarction with and without arrhythmias and to correlate them with the frequency of occurrence and prognosis of arrhythmias. **Material and Methods** Seventy five patients of acute myocardial infarction with and without arrhythmias were studied with a mean age of 55 yrs. Twenty five age and sex matched healthy controls were also included in the study. **Results** Serum sodium concentration was not affected in patients of acute myocardial infarction with and without arrhythmia. In patients of acute myocardial infarction, hypokalemia was present in 29.3% of cases. Serum potassium concentration was significantly decreased in patients of acute myocardial infarction with arrhythmias. (3.9±0.87) as compared to patients of acute myocardial infarction without arrhythmias (4.3±0.46). Previous medication with diuretics was associated with hypokalemia (75%) without affecting the serum sodium concentration. After acute myocardial infarction, tachyarrhythmias (16%) were more commonly present like ventricular premature beats, ventricular tachycardia and ventricular fibrillation. Hypokalemia was more commonly associated with ventricular premature beats (13.6%) ventricular tachycardia (18.1%) and ventricular fibrillation (9%), while hyperkalemia was associated with complete heart block (40%). Mortality was more in males (31.4%) as compared to females (19%) and in patients with ventricular tachycardia and ventricular fibrillation associated with hypokalemia (27.2%). **Conclusions:** In acute myocardial infarction hypokalemia may be an important predictor of life threatening arrhythmia and should be treated whenever detected.

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1. Introduction

Over the last 200 years, various aspects of atherosclerotic heart disease have been studied. Acute myocardial infarction is the foremost and leading cause of death all over the world not only in the developed but also in developing countries. Sudden cardiac deaths occur worldwide around 3 millions per year.¹

In majority of the patients with acute myocardial infarction, one of the commonest cause of death is life threatening arrhythmias. Many inorganic salts especially of alkaline elements including sodium and potassium have been tried experimentally in the control of the cardiac rhythm.^{2,3}

It is very interesting that the cardiac cell is permeable to potassium ions even in resting state but permeability to sodium ions is increased only after excitation.⁴

So it is not surprising that the relationship of these serum electrolytes and cardiac function has become an investigational pursuit for the clinicians dealing with myocardial infarction.⁵

AIMS AND OBJECTIVES

To estimate serum sodium and potassium concentration in patients of acute myocardial infarction with and without arrhythmias and to correlate them with the frequency of occurrence and prognosis of arrhythmias.

MATERIAL AND METHODS

Twenty five age and sex matched healthy controls were selected for estimation of the serum sodium and potassium concentration with electro-cardiographic recordings.

The seventy five patients of acute myocardial infarction admitted to intensive coronary care unit, irrespective of site of infarction and irrespective of type of arrhythmia were included in the study.

* Corresponding Author : **Dr. Shubhangi Verma**
Associate Professor, Department of Medicine
Muzaffarnagar Medical College, Muzaffarnagar, U.P, India
shubhangi.verma@rediffmail.com

The patients were of either sex, between the age group of 31-90 yrs. Detail history of each patients was obtained. Thorough physical and systemic examination were done in all the patients. Routine blood and urine examination were done. Blood urea, Sugar, SGPT, Serum creatinine and cholesterol were estimated in all the patients.

First electrocardiogram was taken at the time of admission. Serial electrocardiograms were taken till patient remained in the hospital or expired. Serum sodium and potassium were estimated in the following manner.

Sample A – At the time of admission to ICCU

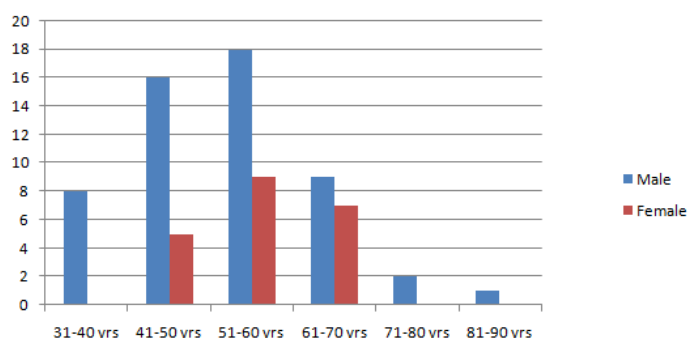
Sample B – At the time of development of arrhythmia or after 24 hours of admission if arrhythmias were not present.

The serum sodium and potassium concentration were studied by Flame photometer.

The reference values for serum sodium and potassium concentration were taken from Clinical chemistry by TITZ.

RESULTS

In the study we have 25 controls and 75 cases with acute myocardial infarction.



Out of 75 patients of AMI 54 males and 21 females with M : F of 18:7

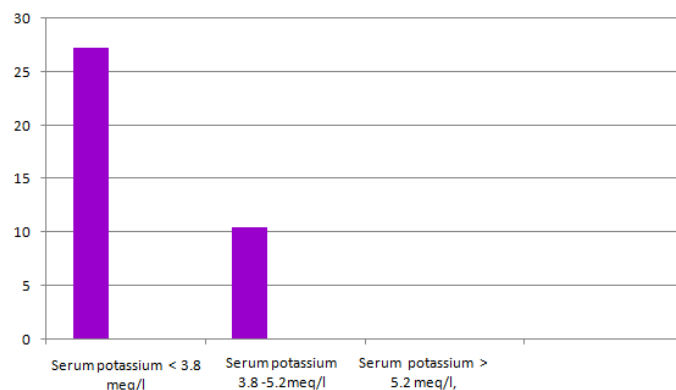
Occurrence of AMI was more in males as compared to females and between the age group of 51 – 60 yrs

Table 1 Compares the serum sodium and potassium concentration in the controls and cases. Previous medication with diuretics was associated with hypokalemia.

Serum Electrolyte concentration	Controls		Cases		AMI
	Without Sample A	With Sample A	Without Sample B	With Sample B	
Sodium Ions					
Rang (Meq/l)	137 –144	128 – 144	132 – 144	136 – 144	137 – 142
Mean	140.2	139.5	140.6	139.9	139.7
SD	2.10	2.6	2.43	2.24	1.5
Potassium Ions					
Rang (Meq/l)	3.9 – 5.0	3.5 – 5.6	3.5 – 5.7	2.9 – 5.7 *	2.7 – 5.7 **
Mean	4.4	4.3	4.3	4.0	3.9
SD	0.34	0.47	0.46	0.82	0.87

Serum potassium concentration was significantly decreased in patients of AMI with arrhythmias when compared with patients of AMI without arrhythmias and control.

Chart 2: Percentage of mortality in relation to serum potassium in patients of AMI



Mortality was more in hypokalemic group (27.2%) as compared to normokalemic group (10.4%).

$$X^2 = 3.96, p < 0.05 \text{ applied.}$$

There is strong association between change in serum potassium concentration and mortality

Previous medication with diuretics was associated with hypokalemia

The occurrence of ventricular tachy-arrhythmias was more as compared to supra ventricular tachy-arrhythmias (20.8%).

Complete heart block was present more commonly as compared to other types of blocks (12.5%). Ventricular premature beats were more commonly seen with left bundle branch block as compared to other types of blocks.

Out of 12 patients with tachy-arrhythmias 83.3% were hypokalemic and 16.6% were normokalemic. Ventricular premature beats (13.6%) and ventricular fibrillation (9%) were present only in the hypokalemic group.

Ventricular tachycardia was present in 18% of hypokalemic group as compared to 2% of normokalemic group.

Complete heart block was present in 40% of hyperkalemic group as compared to 2% of the normokalemic group.

Mortality was more in males (31.4%) as compared to females (19%) & in patients with ventricular tachycardia and ventricular fibrillation associated with hypokalemia (27.2%).

Mortality was more in hypokalemic group as compared to normokalemic group (27.2% vs 10.4%)

There was no mortality in hyperkalemic group.

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DISCUSSION

The occurrence of myocardial infarction was more in males as compared to females in our present study. The predilection of acute myocardial infarction for male sex in present study is in agreement with the studies by Dyckner,T et al and Erik,J^{etal (6,7)}

The serum sodium concentration was not affected in patients of acute myocardial with or without arrhythmias in present study, Similarly Anderson,E,.M.^{etal} failed to establish any relation between change in serum sodium concentration and cardiac arrhythmias.⁽⁸⁾

Seum potassium concentration was decreased significantly in patients of acute myocardial infarction with arrhythmias in our study. Solmon et al and Hulting, J et al also observed hypokalemia in patients of acute myocardial infarction in their studies.^(9,10)

In present study, ventricular premature beats were present only in hypokalemic group while T, Dyckner et al and Erik,J^{etal} observed higher incidence of ventricular premature beats in hypokalemic group as compared to normokalemic and hyperkalemic group.^(6,7)

Highest incidence of ventricular tachycardia was observed in hypokalemic group by Dyckner^{etal} and Erik,J^{etal} and Solmon et al^(6,7,9). In our study also ventricular tachycardia was present in significant number of patients with hypokalemia.

In present study, ventricular fibrillation was present only in hypokalemic group, similarly

Friedensohn,A.^{etal},Duke, M^{etal} and others observed higher incidence of ventricular fibrillation in hypokalemic group.^(11,12)

Complete heart block was present significantly more in hyperkalemic group as compared to normokalemic group in our study. Similarly, Dyckner ,T^{etal} observed highest incidence of complete heart block in hyperkalemic group as compared to normokalemic group.⁽⁶⁾

It is mentioned by Anderson,K.E^{etal} that only extreme variations in concentration of sodium ions not compatible with life were needed to affect cardiac rhythm.⁽¹³⁾ Similarly in present study all patients with acute myocardial infarction with arrhythmias who expired were normonatremic.

In studies by Norderhuag ,J^{etal} and Dyckner,T^{etal} mortality was increased in patients of ventricular tachycardia and ventricular fibrillation associated with hypokalemia. The present study is in agreement with above studies, mortality was more in patients of ventricular tachycardia and ventricular fibrillation associated with hypokalemia^(11,6)

CONCLUSIONS

Seventy five patients of acute myocardial infarction with and without arrhythmias were studied with mean age of 55 yrs. And male : female ration 18:7.

Serum sodium concentration was not affected in patients of acute myocardial infarction with or without arrhythmias.

Serum potassium concentration was decreased significantly in patients of acute myocardial infarction with arrhythmias.

Previous medication with diuretics was associated with hypokalemia.

Hypokalemia was more commonly associated with ventricular premature beats and ventricular fibrillation while hyperkalemia with complete heart block.

After acute myocardial infarction mortality was more in patients with ventricular fibrillation and ventricular tachycardia associated with hypokalemia.

Hence it is concluded that the" Hypokalemia is an important predictor of life threatening arrhythmias occurring in acute myocardial infarction and should be treated whenever detected."

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