Dyselectrolytaemia in acute myocardial infarction

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Abstract

The objective of this study was to estimate serum sodium and potassium concentration in patients of acute myocardial infarction, to compare electrolyte levels in cases and controls, and to correlate serum sodium and potassium concentration with prognosis of acute myocardial infarction. Seventy-five patients of acute myocardial infarction were studied with a mean age of 55 years. Twenty-five age and sex matched healthy controls were also included in the study. Serum sodium concentration was not affected in patients of acute myocardial infarction. In patients of acute myocardial infarction, hypokalaemia was present in 29.3% cases. Serum potassium concentration was decreased significantly in patients of acute myocardial infarction with arrhythmia (3.6 ± 0.87). Hypokalaemia was fairly common finding among acute MI patients, while serum sodium concentration showed no significant difference among the two groups. Mortality was more in males (31.4%) as compared to females (19%). Mortality was more in hypokalemic patients (27.2%). Therefore it is recommended that potassium levels which affect the clinical outcomes in patients of acute myocardial infarction should be monitored, and potassium replaced whenever required.

Key words: Myocardial infarction, serum sodium, serum potassium.

Introduction

Acute myocardial infarction is one of the commonest diagnosis in hospitalised patients. It is the leading cause of death worldwide. Sudden cardiac deaths occur worldwide – around 3 million per year. The major determinants of electrophysiological properties of myocardial membrane are sodium and potassium. Electrolyte imbalances after acute myocardial infarction are common. Clinical importance of these imbalances in the era of primary intervention has not been fully understood. In the resting state, the interior of the cell is negative, while outside is positive with a transmembrane potential of -80 to -100 mv.

The intracellular concentration of potassium ions is higher as compared to its extra-cellular concentration, while conversely, the extra-cellular concentration of sodium ions is higher than its intra-cellular concentration. There are four phases of action potential dependent on Na⁺, K⁺, and Ca²⁺. Potassium ions play a very important role in the maintenance of normal cardiac function. Hypokalaemia is seriously toxic to the heart. The role of hypokalaemia in prognosis of myocardial infarction is under evaluation since a long-time. There is a strong association between hypokalaemia and life-threatening arrhythmias. After myocardial infarction, mortality is increased in hypokalaemic patients. According to recent guidelines, we should monitor and replace K⁺ in myocardial infarction even if initial K⁺ appears normal. In one study by Flear et al, hyponatraemia was a common finding among acute MI patients. In some studies, it is mentioned that hyponatraemia is associated with poor outcomes in patients of STEMI. In the era of primary interventions, the clinical outcomes of these electrolyte imbalances has to be fully understood especially in rural areas.

Aims and objectives

This study was taken to estimate serum sodium and potassium concentration in patients of acute myocardial infarction, to compare electrolyte levels in cases and controls, and to correlate serum sodium and potassium concentration with prognosis of acute myocardial infarction.

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 the intensive coronary care unit, irrespective of site of infarction and irrespective of type of arrhythmia were included in the study. The patients were of either sex, between the age group of 31 - 90 years. A detailed history of each patient was obtained. A thorough physical and systemic examination was done in all the patients. Routine blood and urine examinations were done. Blood urea, sugar, SGPT, serum creatinine, and cholesterol were estimated in all the patients.

The first electrocardiogram was taken at the time of admission. Serial electrocardiograms were taken till the patient remained in the hospital or expired. Serum sodium concentration was not affected in patients of acute myocardial infarction.
and potassium were estimated at the time of admission to ICU.

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

**Exclusion criteria:** Patients with renal insufficiency, liver failure, chronic vomiting and diarrhoea patients, adrenal insufficiency, hyperglycaemic MI patients, hypertensive patients on potassium-sparing diuretics were excluded.

**Results**

In the study we have 25 controls and 75 cases with acute myocardial infarction. Table I shows the age and sex distribution of cases.

Table II compares the serum sodium and potassium concentration in the controls and cases. Out of 75 patients of AMI, 54 were males and 21 females with M: F of 18: 7. Serum sodium concentration was not affected in patients of acute myocardial infarction (139.7 ± 2.24) when compared with controls (140.4 ± 2.10). Serum potassium concentration was decreased in patients of acute myocardial infarction (3.6 ± 0.87) as compared to controls (4.4 ± 0.34).

**Table I: Age and sex distribution of cases.**

<table>
<thead>
<tr>
<th>Age group in years</th>
<th>Males</th>
<th>Females</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>31 - 40 yrs</td>
<td>8</td>
<td>0</td>
<td>8 (10.6)</td>
</tr>
<tr>
<td>41 - 50 yrs</td>
<td>16</td>
<td>5</td>
<td>21 (29.1%)</td>
</tr>
<tr>
<td>51 - 60 yrs</td>
<td>18</td>
<td>9</td>
<td>27 (36%)</td>
</tr>
<tr>
<td>61 - 70 yrs</td>
<td>9</td>
<td>7</td>
<td>16 (21.3%)</td>
</tr>
<tr>
<td>71 - 80 yrs</td>
<td>2</td>
<td>0</td>
<td>2 (2.6%)</td>
</tr>
<tr>
<td>81 - 90 yrs</td>
<td>1</td>
<td>0</td>
<td>1 (1.3%)</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>54 (72%)</td>
<td>21 (28%)</td>
<td>100 (100%)</td>
</tr>
</tbody>
</table>

Occurrence of AMI was more in males as compared to females (M:F of 18:7) and between the age group of 51 - 60 yrs.

The lowest potassium level recorded in cases was 2.7 meq/l. Out of 75 patients; hyponatraemia was present only in 2 patients.

Seventy-three patients were normonatraemic. Hypernatraemia was not found in any patient. Out of 75 patients with acute myocardial infarction; hypokalaemia was present in 29.3%, hyperkalaemia in 4% of cases. Sixty-six per cent of cases had normokalaemia. Chart 1 shows the percentage of mortality in relation to serum potassium in patients of AMI. The mortality was more in hypokalaemic patients as compared to normokalaemic patients (27.2% vs 10.4%). There was no mortality in the hyperkalaemic group. The control group reported no mortality.

**Discussion**

Electrolyte imbalances are fairly common in acute myocardial infarction patients when sodium and potassium levels are measured within 48 hours of admission. Serum potassium concentration was significantly reduced in our study when compared to non-infarct control group.

**Table II: Serum sodium and potassium concentration in controls and cases (patients of acute myocardial infarction).**

<table>
<thead>
<tr>
<th>Serum electrolyte concentration</th>
<th>Controls</th>
<th>Cases</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sodium ions</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Range (meq/l)</td>
<td>137 - 144</td>
<td>136 - 144</td>
</tr>
<tr>
<td>Mean</td>
<td>140.2</td>
<td>139.9</td>
</tr>
<tr>
<td>SD</td>
<td>± 2.10</td>
<td>± 2.24</td>
</tr>
<tr>
<td>Potassium ions</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Range (meq/l)</td>
<td>3.9 - 5.0</td>
<td>2.7 - 5.7</td>
</tr>
<tr>
<td>Mean</td>
<td>4.4</td>
<td>3.6</td>
</tr>
<tr>
<td>SD</td>
<td>± 0.34</td>
<td>± 0.87</td>
</tr>
</tbody>
</table>

Serum potassium concentration was significantly decreased in patients of AMI when compared with controls. Statistical student “t” test was applied, p < 0.01 highly significant.

Hypokalaemia was present in a large number of patients. Hyperkalaemia was present in only 3 patients of myocardial infarction.

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\(^7,8\). There is a five-fold increase in incidence of ventricular fibrillation in patients with low potassium\(^1\).

This hypokalaemia is due to stress induced catecholamine response. In such patients this causes increased uptake of K+.
into the cells. Hyperkalaemia is found to be associated with reduced ventricular excitability and complete heart block.

In our study, hyponatraemia was present in only 2 patients. The patients who died were all normonatraemic. In contrast to our study, it is mentioned by Tang et al in his study that hyponatraemia was associated with increased morbidity and mortality in myocardial infarction patients.

A study conducted by Fear et al found hyponatraemia in 45% of patients of myocardial infarction and associated increased mortality. On the contrary, in our study, hyponatraemia was present in only 2 out of seventy five cases; and all patients who died were normonatremic.

Conclusions
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.

Hyponatraemia was not a common finding among acute MI patients.

Therefore it is recommended to monitor especially serum potassium levels and correct them as they have adverse effects on the disease outcome.

References

Are creative minds hyper-sensitive?

*It looks all creative minds are hyper-sensitive. That’s why they create.*

American novelist and Nobel laureate Pearl S. Buck (1892-1973) has this to say:

“The truly creative mind in any field is no more than this: A human creature born abnormally, inhumanly sensitive. To him... a touch is a blow, a sound is a noise, a misfortune is a tragedy, a joy is an ecstasy, a friend is a lover, a lover is a god, and failure is death. Add to this cruelly delicate organism the overpowering necessity to create, create, and create – so that without the creating of music or poetry or books or buildings or something of meaning, his very breath is cut off from him. He must create, must pour out creation. By some strange, unknown, inward urgency he is not really alive unless he is creating.”

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