SHORT COMMUNICATION

VARIABILITY IN SERUM ELECTROLYTES IN DIFFERENT GRADES OF DEPRESSION

ANAND KUMAR SINGH*, PUNAM VERMA*, SUSHMA GUPTA** AND JALAJ SAXENA***

Department of Physiology
*SGRRIM & HS, Dehradun,
**Era’s Medical College, Lucknow
***GSVM Medical College, Kanpur

(Received on March 4, 2010)

Abstract: The present study was planned to assess the variation in serum electrolytes in patients of major depression. A total of 100 patients of 35–45 yrs of age (68 males and 32 females) of depression were compared with the age matched healthy volunteers. Severity of depression was assessed by DSM IV criteria and were graded into mild, moderate and severe depression. In all the subjects serum electrolytes (Na+, K+, Mg++ and Ca++) were assessed quantitatively. All the depression patients were having higher level of Na+, K+, and Ca++ and lower level of Mg++. Multivariate analysis showed that different grades of depression influences statistically significantly levels of serum Mg++ and Ca++ (F_{2,98} for Mg++ = 4.88, P value = 0.001 and F_{2,98} for Ca++ = 5.97, P value = 0.004). No statistically significant difference was observed for Na+ and K+ although their values were higher (within normal limit) in comparison to that of control group. Multiple comparison revealed highly statistically significant difference between the levels of serum Ca and Mg individually between mild and moderate depression ($S_V$ (mild & mod) for Ca++; Mg++ = 7.1; 7.4) moderate & severe depression ($S_V$ (mod & severe) for Ca++; Mg++ = 6.82; 6.92) and mild & severe depression patients ($S_V$ (mild & severe) for Ca++; Mg++ = 7.46; 7.73) with critical value = 6.36. These results indicated the disbalance in the level of serum electrolytes especially of Ca and Mg in accordance with the severity of depression.

Key words: electrolytes depression mild moderate severe depression

INTRODUCTION

Incidence of depression is increasing day by day due to competitive life style of the modern society and a tendency to achieve the best. World Health Report (WHR 2001) estimated that there are about 121 million people world wide suffering from depression. Depression is the type of mood disorder in which there is one or more episodes of
depressed mood or loss of interest for at least two weeks duration accompanied by at least four additional symptoms of depression i.e., change in appetite, weight, sleep and psychomotor energy, feeling of worthlessness, difficulty in thinking and making decisions etc. (1).

According to WHO classification, depression can be classified into mild, moderate and severe, depending on the existence of the number of symptoms, severity of the symptoms and the degree of impairment. Major electrolytes Na⁺, K⁺, Mg²⁺ and Ca²⁺ are involved in transmission of impulses related to neurons in CNS (2). Thus, the role of imbalance of body serum electrolytes has been linked to etiopathogenesis of depression (3, 4). As the critical role played by ion exchange mechanisms in neuronal function, including the metabolism and the release of monoamines implicated in the pathophysiology of affective disorders and also conflicting reports of serum electrolytes in different grades of depression, it seems relevant to measure the level of the main electrolytes (Na⁺, K⁺, Mg²⁺ and Ca²⁺) in depression.

MATERIALS AND METHOD

The study was conducted in the psychiatry outpatient department of Lala Lajpat Rai Memorial and Associated hospital, Kanpur. The present study included 100 patients of 35–45 yrs of age (68 male & 32 female patients) of major depression of unipolar type according to DSM IV criteria (5). The age matched control group included 40 healthy volunteers (23 male and 17 female subjects) mainly from the staff of the LLR & Associated Hospital Kanpur.

Severity of depression was assessed by DSM IV criteria and ICD-10 and Hamilton rating scale and were graded into mild, moderate and severe depression (4). Only those patients were included for the study who were diagnosed with the illness for the first time and yet to receive any treatment (as antidepressants can alter serum electrolytes). There were 14 mild, 29 moderate and 57 severe grade depression patients.

Patients with hypertension, diabetes mellitus, liver & renal disease or having any narcotic drug abuse excluded from the study. Prior to the withdrawal of blood sample a careful history was taken and examination was done in every patient and then classified into mild, moderate and severe cases according to the criteria laid by International classification of disease (ICD-10) by WHO and by using Hamilton rating scale (6, 7). Blood sample in all the cases were drawn between 10 am to 12 am. Serum was separated after double centrifuging at 1200 & 800 rpm for 8 min and 12 min respectively in the department of biochemistry in Laxmipati Singhania Institute of Cardiology, GSVM Medical College, Kanpur.

For quantitative determination of serum Mg²⁺ ‘Calmagite dye’ method was used (8) and for Ca²⁺ ‘Cresolphthalein Complexone’ method was used. Serum Na+ and K⁺ concentration were estimated by Flame Photometry (Medi flame 127).

The study was approved by Ethical Committee and a written informed consent was received from each subject.

RESULTS

The mean age of the control subjects was
The patients suffering from severe depression had lowest serum magnesium level in both sexes. The patients suffering from severe depression had higher serum Ca\(^{++}\) levels as compared to those suffering from mild depression. These changes were observed in both sexes.

The serum potassium levels were lower in patients suffering from mild depression in both sexes higher potassium levels than control were seen in patients suffering from severe depression. This change was observed in patients of both sexes.

Changes in serum sodium levels were marked in female patients of depressions as compared to their male counterparts. There were rise serum sodium levels as compared to control group and this rise was parallel to degree of depression being highest in female patients suffering from severe depression.

**DISCUSSION**

Few reports have been obtained concerning to the plasma concentration of either K\(^+\) or Na\(^+\) in depressed patients. Frazer et al and Widmer J et al (1983) showed a small increase in Na\(^+\) in major depression

<table>
<thead>
<tr>
<th>Subjects</th>
<th>Na(^+) (meq/l)</th>
<th>K(^+) (meq/l)</th>
<th>Mg(^{++}) (mg/dl)</th>
<th>Ca(^{++}) (mg/dl)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Control (n=40)</td>
<td>141.94±1.94</td>
<td>3.65±0.26</td>
<td>2.7±0.26</td>
<td>10.22±0.21</td>
</tr>
<tr>
<td>Patients (n=100)</td>
<td>142.46±1.68</td>
<td>3.70±0.19</td>
<td>1.09±0.24</td>
<td>11.6±0.38</td>
</tr>
<tr>
<td>Mild (n=14)</td>
<td>142.78±1.76</td>
<td>3.54±0.32</td>
<td>1.47±0.13</td>
<td>10.79±0.32</td>
</tr>
<tr>
<td>Moderate (n=29)</td>
<td>141.89±1.76</td>
<td>3.66±0.13</td>
<td>1.21±0.08</td>
<td>11.53±0.22***</td>
</tr>
<tr>
<td>Severe (n=57)</td>
<td>142.68±1.58</td>
<td>3.75±0.15</td>
<td>0.91±0.13***</td>
<td>11.79±0.21</td>
</tr>
</tbody>
</table>
patients (10, 11). Similarly in the present study, Na⁺ and K⁺ level were also found higher than the control group but within normal limit (12). This finding can be supported by the study of Bruinvels et al (1975) who clearly indicated direct involvement of divalent ions Ca²⁺ and Mg²⁺ in increased uptake of catecholamine precursor like L-tryptophan particularly in the normal level of Na⁺ and thus secondarily catecholamines could be the causative factor in the depression (13, 14).

The higher normal K⁺ level, as found in this study, may also be due to decreased Mg²⁺ level, because Mg²⁺ are implicated in Na⁺ and K⁺ permeability and the stability of the internal molecular arrangement of the cellular membrane. Thus, decrease in Mg²⁺ consequently may alter the membrane permeabilities of K⁺ (15).

This study also found out significantly low Mg²⁺ level in depression patients which was linked with severity of depression (16). While other reports mentioned increased Mg²⁺ level in highly depressed patients which is contrary to our findings of decreased Mg²⁺ levels. The reason might be linked to long standing depression in cases of other reports in comparison to this study (17). Mg²⁺ modulate and control cell Ca²⁺ entry and Ca²⁺ release from the sarcoplasmic and endoplasmic reticular membranes and the dietary deficiency of Mg²⁺ was found to be the cause of low K⁺ and high Na⁺ and Ca²⁺ which might be the fact that the patients as our results more or less are same but the dietary aspects of these ions needed to be explored (18, 19).

Thus change in the ion levels found in the present study could be due to dependence of distribution changes of these ions in the different phases of depressive illness and also due to the weakness of ATPase which transport these cations through the cell membrane (20). Clearcut disbalance in the level of Mg²⁺ and Ca²⁺ in the present study prove importance of Mg²⁺ and Ca⁺ in the pathophysiology of major depression (21). Besides these, Na⁺ and K⁺ levels are also altered with increasing severity of depression indicating that the disorders of Na⁺ and K⁺ metabolism might also play role in the pathophysiology of depression.

REFERENCES

2. Levine J, Stein D, Rapoport A, Kutzman L High serum and cerebral spinal fluid Ca/Mg ratio in recently hospitalized acutely depressed patients. Neuropsychobiology 1999; 39: 63–70.


