**Frequency of hypomagnesemia in adult patients with diabetic ketoacidosis**

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**Objective:** To determine the frequency of hypomagnesemia in patients presenting with diabetic ketoacidosis.

**Methodology:** This cross sectional study was conducted at Medical Unit-IV, Jinnah Hospital, Lahore from February 15, 2017 to August 16, 2018. A total of 265 cases of diabetic ketoacidosis with age between 15 to 50 year and both gender were included in the study. Patients were inquired for their demographics which include age, gender and address. Magnesium level was measured within 10 hours of presentation.

**Results:** Out of 265 patients, 143(54%) were male. Mean age of patients was 20.06±4.13 years. Mean duration of disease was 3.96±2.51 years. Hypomagnesemia was found in 157 (59.2%) patients.

**Conclusion:** A high frequency of hypomagnesemia was noted during treatment in patients with diabetic ketoacidosis. (Rawal Med J 202;45:39-41).

**Keyword:** Hypomagnesemia, diabetic ketoacidosis, diabetes mellitus.

**INTRODUCTION**

Diabetic ketoacidosis (DKA) is a common metabolic disorder and an acute complication of diabetes mellitus (DM). It is commonly seen in emergency departments and critical care units. Main pathophysiology is inadequate insulin production in the body. This leads to impaired utilization of glucose as source of energy and increased metabolism of fat stores of the body. This eventually causes accumulation of by-products of fat breakdown including ketones, the main chemicals involved in DKA. Precipitating factors include inadequate insulin dose, stressful conditions like severe infection or other illness, severe dehydration, or some combination of these circumstances. While most cases occur in patients with type 1 DM, it can also occur in patients with type 2 DM. It can be initial presentation of DM, especially for patients with type 1. An multinational study reported the prevalence of DKA at diagnosis of type 1 or type 2 diabetes in youth of 30.2%, 29.1%. Prevalence was found to be higher in those diagnosed at a younger age (P<0.0001) and highest in those between the ages of 0 and 4.

Hypomagnesemia is a frequent electrolyte disorder in diabetic patients and diabetic ketoacidosis. Different mechanisms are described to contribute in hypomagnesemia including osmotic diuresis, insulin induced intracellular shift of magnesium, other electrolyte disorders such as hypokalemia or hypophosphatemia and urinary magnesium (Mg2+) losses related to acidosis. Mg2+ is an essential electrolyte required for important body processes including ATP utelization, various functions of cell membrane, ion channels, enzymes and mitochondria, and protein synthesis. Among all the derangements, altered function of excitable membranes is the most clinically significant.

Clinically, these derangements translate into disturbances in cardiovascular system and central nervous system. Cardiovascular system manifestations range from QT interval changes on electrocardiogram to fatal arrhythmias while central nervous system manifestations include asthenia, confusion, coma and seizures. All of these complications can arise in DKA and hypomagnesemia can be a contributing factor. In addition, hypomagnesemia induces other electrolyte disorders including hypocalcemia, hypokalemia,
and hypophosphatemia. Once found, hypomagnesemia should be treated to prevent its complications. In Pakistan, no study has documented this electrolyte disorder in adult population of DKA. Therefore, this study aimed to determine prevalence of hypomagnesemia in DKA.

**METHODOLOGY**

This cross sectional study was conducted at Medical Unit-IV, Jinnah Hospital, Lahore from February 15, 2017 to August 16, 2018. An Informed consent was taken from all patients. A total of 265 patients of DKA with age between 15 to 50 year and both gender were included in the study. Diagnosis was confirmed according to standard guidelines. Patients who were previously taking diuretics, those with history of recent ingestion of magnesium containing products e.g. antacids and patients with advanced chronic kidney disease were excluded from the study.

Patients were inquired name, age, gender, address and phone number. Later on blood sample was drawn from the patients after initial resuscitation at 10 hours of presentation and sent for the magnesium level. Hypomagnesaemia was noted as per operational definition.

**Statistical analysis:** The quantitative variables like age, magnesium level and duration of diabetes of the patient were presented by calculating mean and standard deviation. The qualitative variables like gender and hypomagnesemia were presented as frequency and percentages. Data was stratified for age, gender and duration of diabetes. Post stratification chi square test was applied keeping p<0.05 as significant. All data were analysed using SPSS version 20.0.

**RESULTS**

Out of 265 patients, 143(54%) were male. Mean age of patients was 20.06±4.13 years. Mean duration of disease was 3.96±2.51 years. Hypomagnesemia was found in 157(59.2%) patients. Hypomagnesaemia was found in 157(59.2%) patients and 108(40.8%) did not have it.

**Table. Hypomagnesaemia and demographic characteristics of study population.**

<table>
<thead>
<tr>
<th>Hypomagnesaemia</th>
<th>Present</th>
<th>Absent</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age Group</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>≤20 years</td>
<td>105 (39)</td>
<td>74 (27)</td>
<td>179 (66)</td>
</tr>
<tr>
<td>&gt;20 years</td>
<td>52 (19.6)</td>
<td>34 (12.8)</td>
<td>86 (32.4)</td>
</tr>
<tr>
<td>Gender</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>84 (31.7)</td>
<td>59 (22.2)</td>
<td>143 (53.9)</td>
</tr>
<tr>
<td>Female</td>
<td>73 (27.5)</td>
<td>49 (18.5)</td>
<td>122 (46%)</td>
</tr>
<tr>
<td>Duration of Diabetes</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>≤5 years</td>
<td>119 (44.9)</td>
<td>80 (30.2)</td>
<td>199 (75.1)</td>
</tr>
<tr>
<td>&gt;5 years</td>
<td>38 (14.3)</td>
<td>28 (10.6)</td>
<td>66 (24.9)</td>
</tr>
</tbody>
</table>

Data were stratified for age and it was noted that among patients with age ≤20 years, 105(58%) were having hypomagnesemia while those with age group >20 years, 52(60%) were having lower magnesium level (p=0.80) (Table). Similarly, there was no difference of disease among male and females, 84(58%) vs. 73(59%), (p=0.90). Duration of diabetes was also no effect modifier for the patients (p=0.77).

**DISCUSSION**

Diabetic ketoacidosis is hyperglycemic crisis that is manageable yet potentially fatal if not treated properly. Given its economic impact related to the treatment and associated morbidity, effective management and prevention is important. Appropriate management includes making the correct diagnosis using clinical criteria and laboratory investigations and properly directing fluid and electrolyte replacement and insulin therapy coordinated with feedback obtained from meticulous patient monitoring and laboratory investigations. During the treatment, various complications may arise including electrolytes imbalance and should be anticipated with appropriate measures at hand to deal with them. Hypomagnesemia in DKA can be attributed to pre-existing deficiency or treatment related effect. In our study, 59.02% patients were found to have hypomagnesemia after 10 hours of treatment. This percentage is higher compared with a recent retrospective analysis by Barski et al in which hypomagnesemia was reported to occur in 46.2% of adult patients suffering from severe DKA. An older study by Martin et al found prevalence of 55% after 12 hours of treatment.
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While population characteristics and study method may contribute to difference in results, our study is in general agreement with the findings of previous studies and indices that hypomagnesemia a very common metabolic abnormality associated with DKA. It also dictates that given the high disease burden of DKA in tertiary care hospitals, management algorithms should be updated and should incorporate routine testing of magnesium levels along with other electrolytes. However, our study did not involve comparison of magnesium levels found in patients with DKA with stable DM patients, patients admitted in high dependency units with other complications of diabetes like hyperosmolar hyperglycemic state or non-diabetic patients. Therefore, a causal relationship of these findings cannot be specifically ascribed to DKA. Furthermore, benefits of magnesium replacement in these patients are not clear and further studies are required to see whether these findings duplicate and to find impact on morbidity or mortality in patients with DKA.

CONCLUSION

Hypomagnesemia occurred in a large proportion of patients with diabetic ketoacidosis during treatment.

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