Hypomagnesaemia in critically ill patients with haematological malignancies

Silvio A. Ñamendys-Silva1,2, Paulina Correa-García3, Francisco J. García-Guillén3, Julia Texcocano-Becerra1, Gisela Colorado-Castillo3, Abelardo Meneses-García4 and Angel Herrera-Gómez5

1Head, Department of Critical Care Medicine. Instituto Nacional de Cancerología. Mexico City, Mexico. 2Department of Critical Care Medicine. Instituto Nacional de Ciencias Médicas y Nutrición Salvador Zubirán. Mexico City, Mexico. 3Department of Critical Care Medicine. Instituto Nacional de Cancerología. Mexico City, Mexico. 4Director. Instituto Nacional de Cancerología. Mexico City, Mexico. 5Medical Director. Instituto Nacional de Cancerología. Mexico City, Mexico.

Abstract

Introduction: There is currently little information regarding the incidence of hypomagnesaemia and its impact on the prognosis of critically ill patients with haematological malignancies.

Objective: This study sought to describe the incidence of hypomagnesaemia in critically ill patients with haematological malignancies admitted to an oncological intensive care unit (ICU).

Methods: A total of 102 critically ill patients with haematological malignancies, who were 18 years of age and admitted to the ICU between January 2008 and April 2011, were included in this study. Hypomagnesaemia was defined as a serum magnesium concentration below 1.7 mg/dl.

Results: The incidence of hypomagnesaemia at admission or during the first 24 hours of stay in the ICU was 22.5% (23/102). The hospital mortality rates of patients with and without hypomagnesaemia were 47.8% and 60.7%, respectively.

Conclusion: The incidence of hypomagnesaemia in critically ill patients with haematological malignancies was 22.5%. Mortality in the ICU and in the hospital was similar in patients with and without hypomagnesaemia.

DOI:10.3305/nh.2014.30.1.7151


Correspondence: Silvio A. Ñamendys-Silva, MD, MSc, FCCP. Department of Critical Care Medicine. Instituto Nacional de Cancerología. Av. San Fernando, 22. Col. Sección XVI. Delegación Tláhuac. 14080 México City, México. E-mail: snamendys@incan.edu.mx

Introduction

Electrolyte abnormalities are a common medical problem in critically ill patients. During their stay in the intensive care unit (ICU), these patients have alterations in serum sodium, potassium, magnesium, chloride and phosphorus. The normal plasma concentration of magnesium is between 1.7 and 2.3 mg/dl. Its absorption occurs in the gastrointestinal tract at the level of the jejunum and ileum, and 80% of magnesium is excreted by 80% glomerular filtration, with 60% of this being reabsorbed in the proximal tubule. The observed rate of hypomagnesaemia in critically ill patients is 60%. Hypomagnesaemia is defined as serum magnesium values below 1.7 mg/dl. Most episodes of hypomagnesaemia in critically ill patients are asymptomatic; however, when serum magnesium values are less than 1.2 mg/dl signs, then symptoms occur, such as lethargy, confusion, coma, convulsions, ataxia, nystagmus, prolongation of the QT on the electrocardiogram, and atrial and ventricular arrhythmias. Additionally, hypokalaemia can occur simultaneously. Causes of hypomagnesaemia in critically ill patients with haematological malignancies include: administering total parenteral nutrition for an extended period of time, nasogastric suction, diarrhoea, vomiting and the use of certain drugs (loop diuretics, aminoglycosides, cyclosporine, amphoterin B, cisplatin). At present, there is little information regarding the incidence of hypomagnesaemia and its impact on the prognosis of critically ill patients with haematological malignancies. The aim of this study was to describe the incidence of hypomagnesaemia in haematological oncology patients admitted to the ICU.

Methods

This study is a sub-analysis of an observational prospective cohort study conducted between January 1, 2008 and April 30, 2011, which was previously approved by the Bioethics Committee of Instituto Nacional de Cancerologia (INCan), and the need for informed consent was waived. The INCan is located in Mexico City, Mexico. The ICU at INCan is a mixed unit with six adult medical–surgical beds that are exclusively used for oncology patients. At least one intensivist and six nurses are on duty 24 hours a day (eight-hour shifts). The nurse - patient ratio is 1:1. Daily review of patients admitted to the ICU is performed by a multidisciplinary team that include medical staff and nurses, oncologists, haematologists, surgeons, infectious disease specialists and nutritionists. Approximately 300 patients per year are admitted to the ICU.

All patients over 18 years with haematologic malignancies admitted to the ICU during the study period were included. The demographic, clinical and laboratory variables were collected during the first day of ICU stay. The length of stay in the ICU, and the total length of hospital stay were recorded. Hypomagnesaemia was defined as a serum magnesium concentration below 1.7 mg/dl.

Statistical Analysis

Continuous variables were expressed as the mean ± standard deviation or as the median and interquartile range if the distribution of data was not normal.

To compare continuous variables Student’s t-test or the Mann Whitney U test according to the sampling distribution was used. For the analysis of categorical variables, the chi-square test or the Fisher exact test was used. Survival curves were estimated by the Kaplan-Meier method. Survival data were compared using the log-rank test (log-rank test). In all cases, a value of p < 0.05 was considered statistically significant. SPSS 21.0 was used to analyse data.

Results

One hundred two patients with haematological malignancies were included in this study. The incidence of hypomagnesaemia at admission or during the first 24 hours of ICU stay was 22.5% (23/102). Eighty-seven patients required mechanical ventilation (85%). Of the patients who had magnesium concentrations below 1.7 mg/dl, none had arrhythmias during their stay in the ICU (table I).

The median serum magnesium level for the entire group of patients was 2.1 mg/dl, with the medians of normal magnesium and hypomagnesaemia group at 1.5 and 2.2 mg/dl, respectively (p < 0.001). Patients with hypomagnesaemia had lower serum potassium levels compared with patients with normal serum magnesium (table II).

The hospital mortality in patients with and without hypomagnesaemia was 47.8% and 60.7%, respectively (table I). Figures 1 and 2 show the survival curves of critically ill patients with and without hypomagnesaemia during the ICU stay and hospital stay.

Discussion

Hypomagnesaemia is a common finding in hospitalised patients. The present study shows that 22.5% of patients with haematological malignancies admitted to the ICU have a serum magnesium concentration below 1.7 mg/dl. Different authors have reported a prevalence of hypomagnesaemia between 20 and 61%. Other studies have presented a prevalence of hypomagnesaemia higher than that found in our study. Similar to the results of this work, Reinhart et al. reported that the incidence of hypomagnesaemia was
Table I

Clinical characteristics of critically ill patients with haematological malignancies with and without hypomagnesaemia

<table>
<thead>
<tr>
<th>Variables</th>
<th>Hypomagnesaemia (Yes) n = 23</th>
<th>Hypomagnesaemia (No) n = 79</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age, years, mean ± SD</td>
<td>47.3 ± 18.8</td>
<td>41.6 ± 17.6</td>
<td>0.186</td>
</tr>
<tr>
<td>Men, n (%)</td>
<td>14 (60.8)</td>
<td>39 (49.3)</td>
<td>0.331</td>
</tr>
<tr>
<td>Female, n (%)</td>
<td>9 (39.1)</td>
<td>40 (56.6)</td>
<td></td>
</tr>
<tr>
<td>APACHE score, mean ± SD</td>
<td>18.4 ± 7.2</td>
<td>17.2 ± 5.4</td>
<td>0.491</td>
</tr>
<tr>
<td>SOFA score, mean ± SD</td>
<td>10 ± 4</td>
<td>9.7 ± 3.8</td>
<td>0.746</td>
</tr>
<tr>
<td>Length of stay in ICU (days), median (IQR)</td>
<td>2 (2-11)</td>
<td>4 (1-9)</td>
<td>0.497</td>
</tr>
<tr>
<td>IMV, n (%)</td>
<td>20 (86.9)</td>
<td>67 (84.8)</td>
<td>0.990</td>
</tr>
<tr>
<td>Arrhythmias, n (%)</td>
<td>0 (0)</td>
<td>3 (3.7)</td>
<td>0.999</td>
</tr>
<tr>
<td>ICU mortality, n (%)</td>
<td>11 (47.8)</td>
<td>36 (45.5)</td>
<td>0.848</td>
</tr>
<tr>
<td>Hospital mortality, n (%)</td>
<td>11 (47.8)</td>
<td>48 (60.7)</td>
<td>0.279</td>
</tr>
</tbody>
</table>

SD = standard deviation, APACHE II = Acute Physiology and Chronic Health Evaluation, SOFA = Sequential Organ Failure Assessment, ICU = intensive care unit, IQR = interquartile ranges IMV = invasive mechanical ventilation.

Table II

Other biochemical variables in critically ill patients with haematological malignancies with and without hypomagnesaemia

<table>
<thead>
<tr>
<th>Variables</th>
<th>Hypomagnesaemia (Yes) n = 23</th>
<th>Hypomagnesaemia (No) n = 79</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sodium, mEq/L</td>
<td>138.2 ± 6</td>
<td>139.1 ± 5.8</td>
<td>0.523</td>
</tr>
<tr>
<td>Potassium, mEq/L</td>
<td>3.8 ± 0.80</td>
<td>4.2 ± 0.88</td>
<td>0.04</td>
</tr>
<tr>
<td>Chlorine, mEq/L</td>
<td>109.7 ± 6.9</td>
<td>110.1 ± 6.9</td>
<td>0.826</td>
</tr>
<tr>
<td>Phosphorus, mEq/L</td>
<td>4.5 (3.6-5)</td>
<td>4 (2.5-5)</td>
<td>0.234</td>
</tr>
<tr>
<td>Creatinine, mg/dL</td>
<td>0.9 (0.55-1.5)</td>
<td>0.9 (0.58-1.5)</td>
<td>0.968</td>
</tr>
<tr>
<td>Glucose, mg/dL</td>
<td>119 (104-137)</td>
<td>125 (101-159)</td>
<td>0.575</td>
</tr>
</tbody>
</table>

Log-rank test, p = 0.740

Fig. 1.—Shows the survival curves of critically ill patients with haematological malignancies with and without hypomagnesaemia during the stay in the intensive care unit.
20% in critically ill patients admitted to the ICU, and the mean concentrations of magnesium were less than that found in our group of patients with haematologic malignancies. Although it has been reported that hypomagnesaemia is a risk factor for the development of arrhythmias, in our study, the group of patients with hypomagnesaemia did not experience serious arrhythmias during their stay in the ICU. Often, patients with hypomagnesaemia have hypokalaemia. The patients in our study with hypomagnesaemia had significantly lower potassium levels. The association between hypomagnesaemia and mortality varies from study to study. Soliman et al. reported that critically ill patients on admission or during their stay in the ICU, develop low serum magnesium and have a mortality of 19 to 35%, respectively. The study by Safavi et al. showed a significant difference in the ICU mortality between patients with and without hypomagnesaemia at admission (55% versus 33%). Limaye et al. reported that the mortality rate in critically ill patients with hypomagnesaemia is significantly higher than in patients without hypomagnesaemia (57% versus 31%). Agus reported that magnesium correction does not improve the prognosis of patients with hypomagnesaemia. In our study, no statistically significant difference was observed in the mortality rate in the ICU and in the hospital between the groups with and without hypomagnesaemia.

The present work has the following limitations: the sample is relatively small and the experience of a single centre is presented.

Conclusions

The incidence of hypomagnesaemia in critically ill patients with haematological malignancies was 22.5%. The patients who presented with hypomagnesaemia also had potassium concentrations significantly lower than patients without hypomagnesaemia. Mortality in the ICU and in the hospital was similar in patients with and without hypomagnesaemia.

Acknowledgements

We thank the INCan (Mexico City) ICU nurses and medical staff who were involved in the care of these patients.

Conflict of interest

The authors declared that they have no conflict of interest.

References