The relationship between magnesium level and first 72 hours Rankin score and Rankin score in 1 week after an ischemic stroke

Alia Saberi[1], Hamid Reza Hatamian[1], Keyvan Esmaeilzadeh[2], Abtin Heydarzadeh[3]

[1] Poursina hospital, Guilan University of Medical Sciences, Guilan, Iran
[2] Urmia University of Medical Sciences, Urmia, Iran
[3] Faculty of medicine, Guilan University of Medical Sciences, Guilan, Iran

Abstract

Background: We intended to investigate the serum magnesium impact upon the disability after ischemic stroke.

Methods: A total of 67 ischemic stroke patients who less than 6 hours had passed from their attacks participated in this cross sectional study. We have measured their serum magnesium level and determined its correlation with their Rankin Disability Score (RDS) in the first 72 hours (RDS_0) and after 1 week (RDS_{1w}) and its change in this period of time by using nominal regression method and repeated measure ANOVA in SPSS 17.

Results: There was a reciprocal statistical correlation between serum magnesium level and RDS_0 and RDS_{1w}. (P=0.000 & 0.002 respectively). But it hasn't any significant statistical correlation with the changes of this score in this period of time (P=0.513).

Conclusion: Serum magnesium level is a good predictor for patients' abilities that involved by an ischemic stroke.

Introduction

Unfortunately cerebrovascular events including ischemic strokes are disabling disorders and influence on patients function whereas the patients survive. But in practice we see some patients with similar conditions and similar arterial territory involvement but different post stroke functional abilities. So there must be some factors that leave an impression on the cellular injury and the extent of penumbra area and consequently on the patient's function and his prognosis .One of these factors is magnesium [1,2]. In this study we intend to investigate the correlation between the patients' serum magnesium concentration and their disability.

Materials and Methods

A total of patients involved by the ischemic stroke in the territory of right middle cerebral artery who were admitted earlier than 6 hours after the event, after completion informed consent by their attendant, participated in this cross sectional study. The patients involved by seizure, old cerebrovascular accident, hemorrhagic infarct, aphasia, cardiac or respiratory arrest and other neurologic and/or medical disorders, and those patients who treated with antihypertensive drugs to lower their blood pressure to normal range excluded from this study.

In the first 6 hours after stroke from each patient, 2ml of blood was obtained for routine serum analysis. Without cooling the blood, the serum was isolated by centrifuge and serum magnesium level was measured calorimetrically by an auto analyzer.

We classified the patients in 4 groups according to their serum magnesium level; group 1: serum mg <1.6 mg/dl, group 2: 1.7- 1.8 mg/dl, group 3: 1.9- 2 mg/dl,

Corresponding Author: Hamid Reza Hatamian, MD
Department of Neurology, Poursina hospital, Rasht, Iran
Email: dr.hatamian@yahoo.com

group 4> 2 mg/dl, and there must be at least 15 patients in each group. So group 1 included 16, group 2: 17, group 3:16 and group 4: 18 patients and during statistical analysis they were adjusted for age, sex, diabetes mellitus, hypertension, hyperlipidemia and history of smoking in 5 years ago. The patients' disability were measured and scored according to Rankin Disability Score (RDS) in the first 72 hours (RDS_0) and after 1 week (RDS_{1w}). Data were analyzed data by nominal regression analysis method and repeated measure ANOVA in SPSS 17.

Results

A total of 67 patients (41 males and 26 females) with mean age of 69.60 ± 13.58 years who fulfilled all inclusion criteria participated in this study. There wasn't any statistical significant difference between those 4 groups (classified by serum mg level) in age (P-value= 0.839) and in sex (P-value= 0.899). There were reciprocal statistical correlations between the serum magnesium level and Rankin Score$_0$ and Rankin Score$_{1w.}$ (P value = 0.000 and 0.002 respectively; Figure 1&2). But there wasn't any significant statistical correlation between the serum magnesium level and the change of Rankin Score in this period of time (1 week) (P-value= 0.513).

Discussion

In our study the serum magnesium level in the first hours after ischemic stroke or in better word before the event had reciprocal correlation with patient's disability in the first 72 hours and 1 week after the stroke, but it didn't have any correlation with the mean of changes of disability score in this period of time. If the duration of our study was longer, there might be some correlation between serum magnesium level and the change of patients' disability in those periods.

In one study that was performed in 2007 in Romania by Cojocoru et al. serum magnesium level was measured in 40
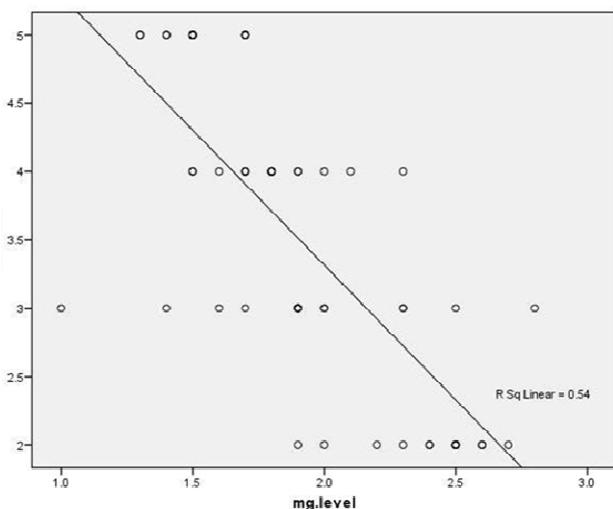

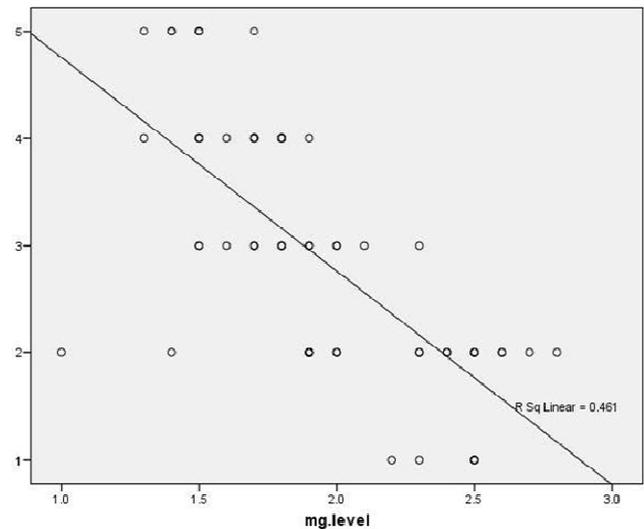**Figure1**. Reciprocal correlation between serum magnesium level and Rankin Score0 (P = 0.000).

Figure2. Reciprocal correlation between serum magnesium level and Rankin Score1W (P= 0.002).

patients involved by ischemic stroke in the 1st 48 hours after the event and their neurologic deficits were assessed in first day and after 48 hours by NIHS Scale and there was a significant statistical correlation between serum magnesium level in the first 48 hours after the stroke and patient's disability ($P<0.05$) [2]. It is worthy of attention that the results of this study is similar to our results, although their measure of disability assessment differed from our measure, (NIHSS vs. RDS). But in another study assigned by Ovbiagele et al. in 2009 in USA the admission magnesium level was not an independent clinical outcome prognosticator [1].

There are some mechanisms for the neuroprotective effect of magnesium; including antagonizing calcium mediated metabolic processes, inhibition of the N- Methyl-D-Aspartate (NMDA) receptors and relaxing vascular smooth muscles [3], inhibition the elevated nitric oxide synthase activity of neurons in the cortex induced by cerebral ischemia [4] and blocking the loss of protein kinase C (PKC) that lead to translocation of PKCα and PKCδ and improving recovery after anoxia [5]. Taking into consideration that magnesium impress on the prevention of neuronal injury extension, in the early phase of stroke , we point to some studies that investigate the role of magnesium of diet and intravenous administration of magnesium in the prevention of neuronal injury. Demougeot C. in 2004 assessed the effect of diets enriched with magnesium and confirmed that the brains of magnesium deficient rats are more susceptible to permanent focal ischemia than rats fed with normal or high magnesium diet [6]. Kennedy RL. in 2004 investigated the efficacy of intravenous administration of magnesium in the first 12 hours after stroke and concludes that magnesium given within 12 hours of acute stroke doesn't reduce the change of death or disability significantly, although it may be of benefit in non-cortical ischemic strokes[7]. This result may be due to the late

administrating of magnesium (12 hours) but according to our study and some other studies the lower disability after an ischemic stroke is depended to higher serum magnesium level in the first hours or before stroke.

Conclusion

Serum magnesium level is a good predictor for patients' abilities in the 1st 72 hours and 1 week after the ischemic stroke. Higher serum magnesium level is accompanied by higher function and better prognosis after an ischemic stroke. It seems that prophylactic use of magnesium can inhibit the more disability in the persons that will be involved by the ischemic stroke in future and can reduce the social, emotional and economical losses among them.

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