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Evaluation of Serum Value of Magnesium in Patients with Acute Coronary Syndrome (ACS) and its Relationship with Occurrence of Arrhythmias

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Abstract: This study was designed to assess the association between arrhythmias and serum Mg level in patients with acute coronary syndrome. Our study was cross-sectional one. In this study, we measured serum Mg level in first 24h of admission in 182 patients with acute coronary syndrome. The mean age of patients was 64.5 years. The frequency of sex male was more than female (54.9%). Results of serum magnesium values showed that 43 cases (23.6%) were suffering from hypomagnesaemia and 139 cases (76.4%) were with normal magnesium level. The prevalence of arrhythmias among our study group was as follows: 54.4% with no arrhythmias and 45.6% with arrhythmias. Among 43 patients with hypomagnesaemia 23 cases had arrhythmia and 20 cases had not. From other side, in patients with normal magnesium level 60 cases (43.2%) had arrhythmia and 79 cases (56.8%) had not. In this study there was no significant association between serum Mg levels with occurrence of arrhythmias in patients with acute coronary syndrome.

Key words: Serum Magnesium · ACS · Arrhythmia · Heart.

INTRODUCTION

The definition of acute coronary syndrome depends on the specific characteristics of each element of the triad of clinical presentation (including a history of coronary artery disease), electrocardiographic changes and biochemical cardiac markers. An acute coronary syndrome may occasionally occur in the absence of electrocardiographic changes or elevations in biochemical markers, when the diagnosis is supported by the presence of prior documented coronary artery disease or subsequent confirmatory investigations [1].

The immediate management of a patient with an acute coronary syndrome is determined by the characteristics of the presenting electrocardiogram and in particular, the presence or absence of ST segment elevation. In combination with the clinical presentation, an ST segment elevation acute coronary syndrome (acute ST elevation MI) is defined by the presence of ≥1 mm ST elevation in at least two adjacent limb leads, ≥2 mm ST elevation in at least two contiguous precordial leads, or new onset left bundle branch block. These patients are initially managed with emergency reperfusion therapy [1].

In the absence of ST segment elevation (non-ST segment elevation acute coronary syndrome); patients are initially managed without emergency reperfusion therapy.

Magnesium (Mg) has a very important role in proper functioning of the human body, especially the cardiovascular system. Magnesium deficiency in the body is associated with different risk factors for cardiovascular diseases and atherogenesis such as increasing oxidative stress, cytokine synthesis, nitrogen oxides and mediators of inflammation and adhesion molecules on micro vascular endothelial cells [2, 3]. It was proven that 6.9 - 11% of hospitalized patients with acute myocardial infarction and 65% of patients in intensive care units have a lack of Mg [4, 5]. A possible role of magnesium in the etiology of ischemic heart disease is still not sufficiently clear and it is likely that several mechanisms are involved. Previous studies have demonstrated that increased intake of dietary magnesium may lower blood triglyceride level and increase high-density lipoprotein (HDL) cholesterol levels [6]. The main objective of present study was to evaluate serum value of magnesium in patients with acute coronary syndrome and its relationship with occurrence of arrhythmias in these patients hospitalized in CCU section of Vali-e-asr hospital of Zanjan, Iran during 2006-2010.

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MATERIALS AND METHODS

In present study which was cross-sectional type of studies, blood samples were taken from 187 admitted patients in CCU section during 2006-2010. Prior the study, the document of patients was assayed and first evaluations were carried out. In this period, the serum level of electrolytes such as potassium and magnesium were measured in these patients. In the laboratory, the method which is used for measurement of electrolytes was photometric test using Xylidyl blue. Finally, data were analyzed by SPSS.

RESULTS

Of 187 patients, 3 had heart failure and 2 weren't in the ACS age range so 5 patients were excluded from the study. The age range of patients was given in table 1.

The serum value of magnesium in the patients was evaluated (Table 2).

Based on table 3, 83 patients (45.6%) had several types of arrhythmias and 99 patients (54.4%) had no arrhythmia.

In this study, based on PV=0/411 there was no significant difference between hypomagnesaemia and occurrence of arrhythmia in ACS.

Also, all risk factors that can be a bias in the results also were assayed and accordingly, 154 patients (84.6%) had no risk factor and 21 patients (11.5%) had concurrent high blood pressure, 7 patients (3.8%) had other risk factors such as diabetes, previous history of surgery, coronary artery bypass graft (CABG) and i.e. for assessment of serum value of magnesium based on age, patients were divided into the 3 groups as shown in table 4.

Table 1: Age range and its frequency in ACS patients

	Frequency	
Age	Absolute frequency	Relative frequency
<50	26	14.3
50-70	94	51.6
>70	62	34.1
Total	182	100

Table 2: Serum value of magnesium in the understudying patients

	Frequency	
Magnesium level	Absolute frequency	Relative frequency
<2 mmol/lit	43	23.6
≥2 mmol/lit	139	76.4
Total	182	100

Table 3: distribution of occurred arrhythmias in the patients during the study

	Frequency	
arrhythmia	Absolute frequency	Relative frequency
Atrial A.	34	18.7
Ventricular A.	46	25.3
Block	3	1.6
Total	83	45.6

Table 4: Serum values of magnesium based on patients age

		Magnesium		
Age		<2 mmol/lit	=2 mmol/lit	Total
<50	No.	6	20	26
	%	23.1	76.9	100
50-70	No.	25	69	94
	%	26.6	73.4	100
>70	No.	12	50	62
	%	19.4	80.6	100
Total	No.	43	139	182
	%	23.6	76.4	100

In this study, based on P=0.422 there was no significant difference between hypomagnesaemia and occurrence of ACS. Same results were obtained about potassium.

DISCUSSION

Magnesium deficiency is believed to have adverse cardiovascular consequences that are broad and complex, although a link between dietary Mg intake and the risk of coronary heart disease has not been clearly identified [7]. In another study, subjects who reported a lower dietary magnesium intake had significantly lower serum magnesium concentrations than those who reported higher dietary magnesium intake and, in some cases, had a significantly higher frequency of supraventricular beats. There was a slight relationship between dietary magnesium intake and a reduced risk of CHD in male subjects; however, there was no noted decrease in the development of CHD disease in women who had high magnesium intra cardiovascular disease [8]. Also, more than 50% of patients with heart failure had inadequate intakes of magnesium [9]. On the other hand, some studies do not support the hypothesis that magnesium intake reduces the development of CHD; although a slight inverse association with stroke cannot be ruled out [10]. The results of some studies suggest that intake of magnesium might have a modest inverse association with the risk of CHD among males [11].

In one study by Stevanovic *et al.* [12], revealed that dietary intake of magnesium is associated with reduced risk of coronary heart disease among Serbian population.

Shechter [13] stated that magnesium supplementation improves myocardial metabolism, inhibits calcium accumulation and myocardial cell death; it improves vascular tone, peripheral vascular resistance, afterload and cardiac output, reduces cardiac arrhythmias and improves lipid metabolism. Magnesium also reduces vulnerability to oxygen-derived free radicals, improves human endothelial function and inhibits platelet function, including platelet aggregation and adhesion, which potentially gives magnesium physiologic and natural effects similar to adenosine-diphosphate inhibitors such as clopidogrel. The data regarding its use in patients with acute myocardial infarction (AMI) is conflicting. Although some previous, relatively small randomized clinical trials demonstrated a remarkable reduction in mortality when administered to relatively high risk AMI patients, two recently published large-scale randomized clinical trials (the Fourth International Study of Infarct Survival and Magnesium in Coronaries) failed to show any advantage of intravenous magnesium over placebo. Nevertheless, there are theoretical potential benefits of magnesium supplementation as a cardio protective agent in CAD patients, as well as promising results from previous work in animal and humans. These studies are cost effective, easy to handle and are relatively free of adverse effects, which gives magnesium a role in treating CAD patients, especially high-risk groups such as CAD patients with heart failure, the elderly and hospitalized patients with hypomagnesemia. Furthermore, magnesium therapy is indicated in life-threatening ventricular arrhythmias such as Torsades de Pointes and intractable ventricular tachycardia [13].

Ueshima [14] showed that the lower blood concentrations of Mg (2+) may be a result of serious cardiac ischemia. According to the large-scale clinical trials, the efficacy of Mg administration to the patients with acute myocardial infarction has not been established; however, supplementary Mg may keep blood Mg (2+) level adequately and protect cardiac injury from cardiac ischemia.

Shaikh and Karira [15] also showed that low serum magnesium level is associated with heart failure.

In conclusion, our results showed no significant relationship between hypomagnesaemia and occurrence of ACS or arrhythmias that is incompatible with other researches so we suggest that: Other researches in relation among magnesium and ACS are needed and assessment of serum value of magnesium in other heart disease.

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