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ORIGINAL RESEARCH

ROLE OF SERUM MAGNESIUM LEVELS IN CHRONIC HEART FAILURE

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ABSTRACT

Background: The present study was conducted for evaluating the role of serum magnesium levels in chronic heart failure.

Materials & methods: A total of 100 patients with chronic heart failurenormal sinus rhythm were included in the present study. Blood samples were obtained and serum magnesium levels were assessed in all the patients. On the basis of magnesium levels, all the patients were divided into two study groups; 41 patients with normal magnesium levels (>2mEq/L) and 59 patients with low magnesium levels (≤ 2 mEq/L). Profile was compared among the two study groups. All the results were recorded in Microsoft excel sheet and were analysed by SPSS software.

Results: Significant higher proportion of subjects were diabetic among low magnesium level group. Age and diabetic status were found to be significantly correlated with low magnesium levels. Blood pressure was significantly higher among subjects with low magnesium levels. Non-significant results were obtained while correlating serum potassium levels and Left ventricular ejection fraction with magnesium status.

Conclusion: Low serum magnesium levels were predictor of deranged cardiac and biochemical profile in chronic heart failure patients.

Key words: Cardiac, Heart failure, Magnesium

INTRODUCTION

In heart failure (HF) patients, various factors, such as hyperactivity of the renin-angiotensin system (RAS), influence of drug therapy (loop and thiazide diuretics), undernutrition, and others, can causes hypokalemia and hypomagnesemia. These conditions are well known to increase the risk of arrhythmia and sudden death. When diuretics in the treatment of HF, hypomagnesemia can lead to complications, which complicates arrhythmia and causes refractory hypokalemia; thus, the serum magnesium (sMg) concentration levels of HF patients should be determined. Hypomagnesemia has been reported to be an independent risk factor for cardiovascular disease, and replacement therapy is considered necessary in terms of long-term prognosis.[1- 3]

Magnesium is the second in abundance intracellular ion. The relationship between magnesium and cardiovascular system, arterial hypertension, central nervous system, skeletal muscles and pregnancy, is an already established knowledge. The main part of total body magnesium is concentrated in the bones, only 1% is in the serum while the 31% is in the intracellular space diluted in the cytoplasm or conjuncted to enzymes or ATP.Normal values of serum magnesium are considered those between 0.75 and 1.5 mmol/L. Values below the threshold of 0.75 mmol/L are defined as hypomagnesemia.[4- 6]Hence; the present study was conducted for evaluating the role of serum magnesium levels in chronic heart failure.

MATERIALS & METHODS

The present study was conducted for evaluating the role of serum magnesium levels in chronic heart failure. A total of 100 patients with chronic heart failurenormal sinus rhythm were included in the present study. Blood samples were obtained and serum magnesium levels were assessed in all the patients. On the basis of magnesium levels, all the patients were divided into two study groups; 41 patients with normal magnesium levels (>2mEq/L) and 59 patients with low magnesium levels (≤ 2 mEq/L). Profile was compared among the two study groups. All the results were recorded in Microsoft excel sheet and were analysed by SPSS software.

RESULTS

Mean age of the patients with normal and low magnesium levels was 63.6 years and 59.1 years respectively. 68.29 percent of the patients of the normal magnesium group and 69.49 percent of the patients of the low magnesium group were males. Mean BMI of the patients of the normal magnesium and low magnesium group was 25.3 Kg/m^2 and 28.4 Kg/m^2 respectively. Significant higher proportion of subjects were diabetic among low magnesium level group. Age and diabetic status were found to be significantly correlated with low magnesium levels. Blood pressure was significantly higher among subjects with low magnesium levels. Non-significant results were obtained while correlating serum potassium levels and Left ventricular ejection fraction with magnesium status.

Table 1: Comparison of demographic variables

Variable	Normal magnesium levels (n=41)	Low magnesium levels (n=59)	p-value
Mean age (years)	63.6	59.1	0.000*
Males (%)	68.29	69.49	0.125
Mean BMI (Kg/m^2)	25.3	28.4	0.001*
Diabetes (%)	21.95	47.46	0.000*
SBP (mm of Hg)	122.3	136.5	0.002*
DBP (mm of Hg)	75.9	83.1	0.001*

Table 2: Comparison of Cardiogenic and biochemical variables

Variable	Normal magnesium levels (n=41)	Low magnesium levels (n=59)	p- value
Serum creatinine (mg/dL)	1.6	1.1	0.000*
Serum potassium (mEq/L)	4.5	4.2	0.125
Left ventricular ejection fraction (%)	33.5	34.5	0.225

DISCUSSION

Coronary artery disease is one of the major causes of death in most industrialized and also other countries. Despite newer medical treatments as well as interventional and surgical techniques, mortality is still significant. In addition to medical treatments for this disease, many patients with the coronary artery disease need surgical treatment. Coronary artery bypass graft is an effective procedure to reduce or eliminate symptoms of angina. However, despite being effective, it also has special complications during and following surgery. One of the most common early complications after open heart surgery is atrial and ventricular arrhythmias, which leads to increased mortality and morbidity in the postoperative period. This complication by increasing hospital stay, it also raises the involved economic costs. The use of cardiopulmonary bypass, as one of the essentials for coronary bypass graft, results in decreased serum magnesium level. Hypomagnesemia is a relatively common electrolyte disorder in hospitalized patients with associated arrhythmias.[6- 10]Hence; the present study was conducted for evaluating the role of serum magnesium levels in chronic heart failure.

Mean age of the patients with normal and low magnesium levels was 63.6 years and 59.1 years respectively. 68.29 percent of the patients of the normal magnesium group and 69.49 percent of the patients of the low magnesium group were males. Mean BMI of the patients of the normal magnesium and low magnesium group was 25.3 Kg/m^2 and 28.4 Kg/m^2 respectively. Ceremuzyński Let al assessed the role of electrolyte imbalance in cardiac arrhythmias associated with congestive heart failure.A total of 588 consecutive patients were screened for eligibility. A total of 78 patients entered and 68 patients completed the study. On admission, hypomagnesemia was found in 38% and excessive magnesium loss in 72% of patients. Serum magnesium levels were lower and urine magnesium excretion was greater in patients with complex ventricular arrhythmias, both on admission and after treatment for heart failure. Intravenous administration of magnesium caused a significant decrease in the number of ventricular ectopic beats ($P < 0.0001$), couplets ($P < 0.003$) and episodes of nonsustained ventricular tachycardia ($P < 0.01$).Hypomagnesemia, probably related to increased urine magnesium excretion, is an essential feature of heart failure associated with complex ventricular arrhythmias.[11]

In the present study, significant higher proportion of subjects were diabetic among low magnesium level group. Age and diabetic status were found to be significantly correlated with low magnesium levels. Blood pressure was significantly higher among subjects with low magnesium levels. Non-significant results were obtained while correlating serum potassium levels and Left ventricular ejection fraction with magnesium status.Rooney MR et al evaluated cross-sectional associations of serum Mg with burden of atrial arrhythmias [atrial fibrillation (AF), premature atrial contractions (PAC), supraventricular tachycardia (SVT)],

and ventricular arrhythmias [premature ventricular contractions (PVC), non-sustained ventricular tachycardia (NSVT)] over 2-weeks of ECG monitoring.We included 2,513 ARIC Study visit 6 (2016-2017) participants who wore the Zio XT Patch—a leadless, ambulatory ECG-monitor—for up to 2-weeks.Participants were mean±SD age 79±5 years, 58% were women and 25% black. Mean serum Mg was 0.82±0.08 mmol/F and 19% had hypomagnesemia (<0.75 mmol/F). Serum Mg was inversely associated with PVC burden and continuous AF. The AF association was no longer statistically significant with further adjustment for traditional lifestyle risk factors, only the association with PVC burden remained significant. There were no associations between serum Mg and other arrhythmias examined. They found little evidence of independent cross-sectional associations between serum Mg and arrhythmia burden.[12] However; further studies are recommended for better exploration of results.

CONCLUSION

Low serum magnesium levels were predictor of deranged cardiac and biochemical profile in chronic heart failure patients.

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