



Correlation of serum magnesium with serum levels of 25-hydroxyvitamin D in hemodialysis patients

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Abstract

To find the association of serum magnesium levels, with serum 25-hydroxyvitamin D levels, in patients on regular hemodialysis, we conducted a study on 41 stable hemodialysis patients. We found a significant positive correlation of serum magnesium with 25-OH vitamin D ($r=0.40$ $p=0.009$). While magnesium deficiency increases serum fibroblast growth factor 23 concentration. Thus, the positive association of magnesium deficiency and fibroblast growth factor 23, further indicate the significance of magnesium and vitamin D deficiency, especially in hemodialysis patients.

Keywords: Hemodialysis, Magnesium, 25-Hydroxyvitamin D

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Introduction

25-hydroxyvitamin D (25-OH vitamin D) is the main circulating metabolite of vitamin D (1). While the biological active form of vitamin D is 1,25(OH)₂ vitamin D, synthesized in the kidney, it is broadly accepted that the measurement of circulating 25(OH) vitamin D offers better evidence with respect to the patients' vitamin D status (1,2). Recently, various studies have shown the role of plasma 25(OH) vitamin D levels in mineral metabolism dysregulation in chronic renal failure. It has been found that a moderate reduction in plasma 25(OH) vitamin D levels plays a role in the development of secondary hyperparathyroidism in patients on hemodialysis, while a greater reduction in plasma 25(OH) vitamin D levels is related to osteomalacia and with the risk of emerging osteoporosis. It has been also found that, plasma 25(OH) vitamin D deficiency has been associated with adverse cardiovascular outcomes in epidemiologic studies. Magnesium is the dominant intracellular cation (1-3). Magnesium acts as a catalyst or activator for various intracellular enzymatic reactions, predominantly those which depend upon ATP, and the magnesium-ATP complex is a key intermediate substrate (4-8). Hypomagnesemia has been associated with cardiovascular risk factors and increased co-morbidity including hypertension, dyslipidemia and atherosclerosis. Various epidemiological investigations and clinical trials have

detected an inverse association between blood pressure and serum magnesium (9-12). Also, hypomagnesemia aggravates both atrial and ventricular arrhythmias (9-12). Changes in serum magnesium may influence some clinical features of patients on hemodialysis (4-12). While, renal excretion is the main route of elimination of magnesium from the body, a positive magnesium balance would be found in patients with kidney failure. However, the magnesium balance may be normal or even decreased in hemodialysis patients. This is possibly due to decreased dietary intake associated with worsened intestinal absorption. Impaired absorption of magnesium appears to be related to deficient synthesis of the active metabolite of vitamin D by the nonfunctioning kidneys (12-17). This study, therefore aimed to find the association of serum magnesium levels, with 25-hydroxyvitamin D levels, in patients on regular hemodialysis.

Patients and Methods

Patients

This is a cross-sectional study conducted in the hemodialysis section of Shahrekord University of Medical Sciences in Shahrekord, Iran. Patients with any active or chronic infection were excluded from the investigation.

Laboratory methods

The serum magnesium, calcium and phosphorus levels

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■ Implication for health policy/practice/research/medical education

To find the association of serum magnesium levels, with serum 25-hydroxyvitamin D, in patients on regular hemodialysis, we conducted a study on 41 stable hemodialysis patients. We found a significant positive correlation of serum magnesium with 25-OH vitamin D. While magnesium deficiency increases serum fibroblast growth factor 23 concentration. Thus, the positive association of magnesium deficiency and fibroblast growth factor 23, further indicate the significance of magnesium and vitamin D deficiency, especially in hemodialysis patients.

were measured using standard kits. Serum 25-OH vitamin D levels was assessed by the ELISA method using DRG kits of Germany (normal range, 25 to 125 nmol/L). The efficiency of hemodialysis was assessed by calculating the urea reduction rate (URR).

Ethical issues

1) The research followed the tenets of the Declaration of Helsinki; 2) informed consent was obtained; 3) the research was approved by the institutional review board.

Statistical analysis

For statistical analysis, descriptive data are expressed as mean (SD). Comparison between the groups was conducted using a Student's *t*-test. Statistical correlations were assessed using a partial correlation test. Statistical analysis was performed separately on females, males, diabetics, and non-diabetic individuals. All statistical analysis were performed using SPSS 11.5 (SPSS Inc., Chicago, IL, USA). Statistical significance was fixed at a $p < 0.05$.

Results

The total patients were 41 (males= 26, females= 15). Of them, there were 29 non-diabetic and 12 diabetic patients. The mean (SD) age of the study patients was 46 (17.6) years. The length of hemodialysis was 29.5 (34.7) months. The mean of serum magnesium and serum 25-OHvitamin D were 2.48 (0.41) mg/dl, and 7.6 (9.45) nmol/l, respectively. No significant difference was seen in the levels of serum magnesium, calcium, phosphorus, alkaline phosphatase and 25-hydroxyvitamin D between diabetics and non-diabetics ($p > 0.05$). No significant differences of serum magnesium, calcium, phosphorus, alkaline phosphatase and serum 25-hydroxyvitamin D were existed between males and females ($p > 0.05$). A significant positive correlation of serum magnesium and 25-OH vitamin D ($r = 0.40$ $p = 0.009$) was seen. This correlation was strongly positive in non-diabetic, diabetic,

female, and male groups individually.

Discussion

In this study, we found the significant positive correlation of serum magnesium with serum 25-hydroxyvitamin D levels in study patients. This correlation was strongly positive in non-diabetic, diabetic, female, and male groups studied population. To test the relationship of serum magnesium and vitamin D levels in 330 students, Kelishadi *et al.*, detected the significant positive association of magnesium with 25(OH) D serum level (18). Likewise, Gandhe *et al.*, conducted a study to examine the possible association of vitamin D3, and magnesium in type II diabetes mellitus patients. They noticed to a positive correlation of vitamin D with serum magnesium levels. They interpreted that, vitamin D levels can also affects the magnesium status (19). Fibroblast growth factor-23 is linked to the atherosclerosis and cardiovascular mortality in hemodialysis patients and healthy subjects (20,21). It was found that, magnesium deficiency increases serum fibroblast growth factor 23 (FGF23) levels too (20,21). Thus the positive association of magnesium deficiency and fibroblast growth factor 23 (20,21), further indicate the significance of magnesium and vitamin D deficiency, especially in hemodialysis patients.

Conclusion

There was a significant positive correlation of serum magnesium with serum 25-OH Vitamin D levels in hemodialysis patients. Magnesium deficiency increases serum fibroblast growth factor 23 concentration. Thus the positive association of magnesium deficiency and fibroblast growth factor 23, further indicate the significance of magnesium and vitamin D deficiency, especially in hemodialysis patients.

Author's contribution

HN is the single author of the manuscript.

Conflict of interests

The author declared no competing interests.

Ethical considerations

Ethical issues (including plagiarism, data fabrication, double publication) have been completely observed by the author.

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