

## Association Between The Presence Of Vascular Calcification And Serum Magnesium In Hemodialysis Patients

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### Abstract :

**Background :** Vascular calcification in a risk factor for cardiovascular mortality in hemodialysis patients. Low magnesium levels have been reported to have strong association with vascular calcification in hemodialysis patients. The aims of this study was to examine the association between serum magnesium levels and vascular calcification in hemodialysis patients. **Methods:** We studied 60 stable patients undergoing maintenance hemodialysis for more than 3 years. Vascular calcification was evaluating using lumbal lateral x-rays. Blood was drawn to measure serum magnesium levels. **Results:** This study included 60 patients, 38 male and 22 female, aged 25-68 years. Vascular calcification was present in 65% of the patients. Mean serum magnesium level was  $2,12 \pm 0,29$  mg/dl. Serum magnesium was not statistically lower in patients with vascular calcification than in those without ( $2,12 \pm 0,27$  vs  $2,13 \pm 0,33$ , p value 0,87,  $>0,05$ ). **Conclusions:** There was no significant association between the presence of vascular calcification and serum magnesium in hemodialysis patients.

**Keywords:** Hemodialysis, Magnesium, Chronic Kidney Disease, Vascular Calcification

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### I. Introduction

Hemodialysis patients have a high prevalence of vascular calcification, and cardiovascular disease is the leading cause of death in this population. Vascular disease prevention is therefore important, with the aim to reduce the incidence of cardiovascular morbidity and mortality. While at least some traditional coronary risk factors (e.g. increased age, dyslipidaemia, diabetes and smoking) play a role in hemodialysis patients, several non-traditional factors associated with CKD are also likely to be involved. These include anaemia, uraemic toxins, oxidative stress, protein glycation and carbamylation and the disorder of mineral and bone metabolism (CKD-MBD). (Ziad, 2012).

Although being part of CKD-MBD, magnesium's role in CKD-MBD has been underestimated and generally neglected. Magnesium's role in the pathogenesis of vascular calcification has not been extensively studied. Nonetheless, several in vitro and animal studies points towards a protective role of magnesium through multiple molecular mechanisms. Magnesium is a natural calcium antagonists and both human and animal studies have shown that low circulating magnesium levels are associated with vascular calcification in hemodialysis patients. (Kamal, 2010). In this study, we examined serum magnesium levels and aortic abdominal calcification in hemodialysis patients.

### II. Methods

This cross-sectional study was conducted in Rasyida Hemodialysis Center, Medan 2018. We recruited 60 patients on maintenance hemodialysis for this study. All patients were on regular hemodialysis for more than 3 years and had no acute illness at the time of the study. Patients used 0,5 mmol/L magnesium dialysate concentrations. (John 2012). Each subject gave informed written consent to participate in the study. Lumbal lateral x-ray was performed on each patient. The lumbal lateral x-ray were analyzed by a radiologist who were unaware of the clinical background of the patients. and the results were expressed using abdominal aorta calcification (AAC) scoring (Eero 2008).

Blood samples were drawn prior to roentgenography to measure magnesium, albumin, calcium, phosphate levels. Serum calcium and magnesium levels were corrected according to serum albumin levels. The mean values of these measurements were used for analysis. The unpaired t-test, chi-square test, mann-whitney test, and fisher test were used to compare clinical parameters between patients with and without vascular calcification. The correlation of magnesium serum and AAC score, was analysed using spearman corellation test. Result of statistical analysis is significant if p value  $< 0.05$ .

### III. Results

The study included 60 patients. The baseline characteristics of included patients are outlined in table 1. The mean age of patients was 56 years, 38 patients (63,3%) were male and 21,7% were diabetic. Mean serum magnesium was 2,12 mg/dl and median AAC score 4 (minimum score 0, maximum score 21). The mean serum phosphate was 5,4 mg/dl. The median time on dialysis was 56 months. More patients used PPI (58,3%). Clinical and biochemical profiles of the patients enrolled in the study are shown (table 2). There were 39 patients with vascular calcification (group 1) and 21 patients without vascular calcification 9 (group 2). There were no significant differences in HD duration, diabetic status, serum calcium, serum phosphate, serum magnesium between the two group. This study revealed that elderly people had more aortic calcification.

**Table 3.** Correlation of Magnesium serum and AAC score

Variable	r	p
Magnesium	-0,026	0,845
AAC score		

Table 3 shows that there was no significant correlation between magnesium serum and AAC score.

**Table 1.** Baseline characteristics

Age (years)	56 (26-69)
Sex (male)	38 (63,3%)
BMI (kg/m <sup>2</sup> )	23(18,5-43)
Serum Calcium (mg/dl)	10(8,4-11,6)
Serum Phosphate (mg/dl)	5,4±0,66
HD duration (months)	56(36-142)
Diabetes	13(21,7%)
Serum magnesium (mg/dl)	2,12±0,29
Serum albumin (g/dl)	3,95±0,34
Aortic calcification score	4(0-21)
PPI used	35(58,3%)

**Table 2.** Characteristics of the studied patients group with (group 1) and without (group 2) vascular calcification

Characteristics	Group 1 (n=39)	Group 2 (n=21)	P Value
<b>Age (Years,%)</b>			
<50	9 (37,5%)	15 (62,5%)	0,001 <sup>a</sup>
50-60	14 (82,4%)	3 (17,6%)	
>60	16 (84,2%)	3 (15,8%)	
<b>HD duration (years,%)</b>			
3-5	20 (60,6%)	13 (39,4%)	0,430 <sup>a</sup>
5	19 (70,4%)	8 (29,6%)	
Corrected serum calcium (mg/dl, mean±SD)	9,8±0,64	9,6±0,73	0,189 <sup>b</sup>
Phosphate (mg/dl, mean±SD)	5,4±0,63	5,3 ±0,72	0,765 <sup>c</sup>
Corrected serum magnesium (mg/dl, mean±SD)	2,12±0,27	2,13± 0,339	0,870 <sup>c</sup>
<b>Diabetic status (%)</b>			
DM	9 (69,3%)	4 (30,8%)	1,000 <sup>d</sup>
No DM	30 (63,8%)	17 (36,2%)	

<sup>a</sup>Chi-square test <sup>b</sup>Mann-Whitney test <sup>c</sup>T-test <sup>d</sup>Fisher-test

### IV. Discussion

Our data demonstrate that there was no significant association between the presence of vascular calcification and serum magnesium in hemodialysis patients. The result of this study differ from some previous studies that have been done. (Amber 2017).

Study conducted by Kamal et al reported that the mean serum magnesium level in the group with vascular calcification was 2,36±0,26 mg/dl, while in the group without was 3,21±0,32 mg/dl (p value 0,001). (Kamal 2010) These results concluded that the mean serum magnesium levels were significantly lower in the group with calcification than those without. The same conclusion was also reported by Ishimura et al, Tzanaki et al and Amber et al.

This study illustrated the presence of calcification tendencies at lower magnesium levels, although these results were not statistically significant. In addition, this study found that there is a negative correlation direction, meaning that there is a contrary direction between magnesium levels with AAC scores (the higher

AAC scores, the lower magnesium levels), although the correlation strength is very weak (-0,026) and not statistically significant (p value 0,845 >0,05).

This study has several limitations when compared to previous studies, this study smaller and only involved 60 patients, while previous studies involved 390 patients.(Ishimura 2007) In addition this study was cross sectional, where the design of this study did not have a time dimension and the measurement of various variable is only done once. Therefore further research is needed with larger samples or with different study designs, such as analytic observational studies (case controls), which have a stronger causal relationship than cross sectional studies.

Another limitation of this study that this study did not exclude patients whose taking PPI, since known that PPI can cause hypomagnesemia in hemodialysis patients. (Paraish 2015) This study also did not measure dietary magnesium intake. (Angel 2013). In addition, this study measured total magnesium levels, and did not specifically look at the ionized magnesium fraction. (Angel 2013) This study also did not determine whether intima or media calcification, since it is known that media calcification is often found in patients with chronic kidney disease, due to metabolic disorders, electrolytes and pH balance. (Jayalath 2005) Lastly, this study involved only one radiologist. (Jayalath 2005)

## V. Conclusion

In conclusion, in this study using a cross-sectional design, have shown that there was no significant association between the presence of vascular calcification and serum magnesium in hemodialysis patients. Further research is required.

**Competing Interests:** The authors have no conflicts of interest to declare

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