

BACKGROUND

CKD patients were thought to have hypermagnesemia. However, hypomagnesemia is frequent among diabetics

Guidelines recommend magnesium supplements in diabetics since low magnesium levels are associated with adverse outcomes.

Diuretics and protein pump inhibitors are frequently used in CKD patients and are associated with hypomagnesemia.

OBJECTIVES

To define the prevalence and potential causes and risk factor for hypomagnesemia in CKD.

METHODS

Retrospective study of a cohort of 351 CKD outpatients in a tertiary care hospital center using an electronic database.

Prevalence of hypomagnesemia (S. Mg <1.7 mg/dl), cause (renal vs. non renal) and potential risk factors were investigated.

RESULTS

❖ 60 patients (17) were hypomagnesemic and 87 (24) were hypermagnesemic (Table 1). Prevalence of hypomagnesemia per CKD stage is shown in table 2.

❖ The highest serum magnesium level was 3.02 mg/dl (within a safe range).

❖ The low magnesium group differed from the high magnesium group in age, eGFR, fractional excretion of magnesium (FEMg) and PTH (Table 1).

❖ In a univariate analysis magnesium levels correlated with age (p 0.0001), phosphate (p 0.0006), PTH (p 0.0001), and non-calcium binders (p 0.0001), 1.25 vitamin D or paricalcitol (p 0.0001), and inversely with eGFR (p 0.0001) and oral magnesium (p 0.001).

❖ In a multivariate regression analysis (r² 0.18) magnesium levels correlated with age (p 0.0008), phosphate (p 0.0011), and inversely with eGFR (p 0.0062) and PTH (p 0.0045).

❖ Among the low serum magnesium patients, 53 (88.3%) had a FEMg >2, suggestive of renal magnesium losses.

Table 1. Characteristics of the CKD cohort. n= 351

| Description | Total n. 351 (100%) | Magnesium | | | p value (low vs high) |
|-----------------------------------|------------------------|--------------------|-----------------------|--------------------|--------------------------|
| | | < 1.7 mg/dl (n=60) | 1.7-2.2 mg/dl (n=204) | > 2.2 mg/dl (n=87) | |
| Age (years) | 67.5 ± 14.5 | 64 ± 14 | 66 ± 14 | 72 ± 14 | < 0.01 |
| Male n (%) | 212 (60) | 33 (55) | 132 (65) | 47 (54) | NS |
| DM n (%) | 193 (55) | 37 (62) | 116 (57) | 40 (46) | NS |
| eGFR (ml/min/1.73m ²) | 35 (21-55) | 44 (22.2-80) | 41.5 (24.2-80) | 22 (13-30) | < 0.0001 |
| CKD stage n (%) | | | | | |
| 1-2 | 73 (20) | | | | |
| 3 | 124 (35) | | | | |
| 4 | 107 (30) | | | | |
| 5 | 47 (13) | | | | |
| Serum Calcium (mg/dl) | 9.40 ± 0.53 | 9.30 ± 0.71 | 9.48 ± 0.47 | 9.44 ± 0.50 | NS |
| Serum Phosphorus (mg/dl) | 3.79 ± 0.75 | 3.80 ± 0.60 | 3.60 ± 0.67 | 4.08 ± 0.97 | NS |
| FE. Phosphate (%) | 30 ± 14 | | | | |
| Serum Magnesium (mg/dl) | 1.95 ± 0.35 | | | | |
| FE Magnesium (%) | 5.7 (3.6-9.2) | 5.2 (3.1-9.2) | 5.1 (3.2-8.1) | 7.3 (5.1-12.9) | 0.0068 |
| Intact PTH (pg/ml) | 94 (56-159) | 87 (50-188) | 82 (51-126) | 135 (89-206) | 0.025 |
| 25 OH Vit-D (ng/ml) | 20.45 ± 11.32 | 16.5 (9.3-22.2) | 19.1 (13.2-27.1) | 17.7 (13.3-24) | NS |
| Drugs | | | | | |
| Diuretics n (%) | 196 (56) | 35 (58) | 106 (52) | 55 (63) | NS |
| Ca containing P Binders n (%) | 59 (17) | 11 (18) | 31 (15) | 17 (20) | NS |
| Non Ca containing P binders n (%) | 85 (24) | 16 (27) | 34 (17) | 35 (40) | 0.0001 |
| Nutritional Vit-D n (%) | 171 (49) | 27 (45) | 97 (48) | 47 (54) | NS |
| VDR activators n (%) | 128 (36) | 19 (32) | 58 (28) | 51 (59) | 0.001 |
| PPI n (%) | 133 (38) | 25 (42) | 70 (34) | 38 (44) | NS |
| Oral Mg n (%) | 14 (4) | 5 (8) | 8 (4) | 1 (1) | 0.09 |

Table 2. Prevalence of hypomagnesemia in 351 non-dialysis CKD patients

| CKD stage | Male n (%) | Age (years) | S. Ca (mg/dl) | S. P (mg/dl) | Mg <1.7 mg/dl. n (%) | Mg <1.7 mg/dl + P >4.5 mg/dl. n (%) |
|-----------|------------|-------------|---------------|--------------|----------------------|-------------------------------------|
| 1-2 | 51 (70) | 59 ± 15 | 9.5 ± 0.4 | 3.52 ± 0.5 | 18 (24) | 0 |
| 3 | 74 (60) | 67 ± 13 | 9.5 ± 0.5 | 3.54 ± 0.56 | 19 (15) | 0 |
| 4 | 60 (56) | 72 ± 14 | 9.4 ± 0.6 | 3.84 ± 0.55 | 15 (14) | 3 (3) |
| 5 | 27 (57) | 67 ± 14 | 9.3 ± 0.5 | 4.77 ± 1.07 | 8 (17) | 2 (4) |

CONCLUSIONS

❖ Hypomagnesemia is relatively frequent in CKD patients. There is evidence for a contribution of renal magnesium losses.

❖ Age, hyperparathyroidism, hyperphosphatemia and kidney disease were independent predictors of serum magnesium. We postulate that CKD patients with low magnesium levels may specially benefit from magnesium-containing phosphate binders.

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