Comparison of active vitamin D levels according to taking omega-3 fatty acids in patients with chronic kidney disease

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Introduction & Aims

- Vitamin D converts to 25-hydroxyvitamin D in the liver, and to 1, 25-dihydroxyvitamin D as the active form in the kidney. The level of 1,25-dihydroxyvitamin D decreases according to decreased activity of 1α-hydroxylase caused by reduced renal function in chronic kidney disease (CKD).

  [Keith DS, et al, Arch Intern Med 2004; 164: 659–63]

- Vitamin D deficiency cause secondary hyperparathyroidism, bone mineral disorder, aortic stiffness, coronary artery calcification and consequently increase cardiovascular disease risk and mortality.

  [Guérin AP, et al, Nephrol Dial Transplant 2000; 15: 1014–21]

- Recent report showed that administration of omega-3 fatty acids increased 1,25-dihydroxyvitamin D levels in dialysis patients.

  [An WS, Lee SM, Son YK, et al, Nutr Res. 2012; 32:495-502.]

- The purpose of this study is to evaluate whether administration of omega-3 fatty acids increase 1,25-dihydroxyvitamnin D levels in patients with CKD.

Methods

- We retrospectively analyzed data of CKD patients who have checked 25-hydroxyvitamin D and 1,25-dihydroxyvitamin D simultaneously from March 2009 to March 2013.

- We enrolled patients aged between 20 and 80 years and excluded CKD patients with stage 1, 2, 5.

Results

- The percentage of patients with 25-hydroxyvitamin D levels < 20 ng/mL was 73% and the percentage of patients with 1,25-dihydroxyvitamin D levels < 25 pg/mL was 15.9%.

- Patients taking omega-3 fatty acids were 31 cases (CKD stage 3 : 80.6%) and patients not taking omega-3 fatty acids were 32 cases (CKD stage 3 : 81.3%).

- There was no significant difference of age (59.8±12.7 vs. 64.3±10.1 years), gender (male 48.4% vs. 62.5%), the prevalence of diabetes (25.8% vs. 45.6%), 25-hydroxyvitamin D (16.4±9.0 vs. 21.7±23.1 ng/mL), phosphorus, parathyroid hormone, creatinine (1.63±0.38 vs. 1.75±0.45 mg/dL), glomerular filtration rate (42.3±10.9 vs. 40.3±11.0 mL/min/1.73 m²) and cystatin C (1.80±0.55 vs. 1.89±0.49 mg/dL) between patients taking omega-3 fatty acids and patients not taking omega-3 fatty acids.

- The levels of calcium (9.1±0.5 vs. 8.8±0.5 mg/dL, p = 0.022), hemoglobin (13.4±1.9 vs. 12.2±1.8 g/dL, p = 0.015), and 1, 25-dihydroxyvitamin D (41.3±16.2 vs. 33.7±12.8 pg/mL, p = 0.043) were significantly higher in patients taking omega-3 fatty acids compared to patients not taking omega-3 fatty acids. (Table 1.)

- The 1, 25-dihydroxyvitamin D levels were positively correlated with glomerular filtration rate (r = 0.380, p = 0.002) and hemoglobin levels (r = 0.376, p = 0.003). (Table 2.)

Table 1. General characteristics of patients

	Taking omega-3 fatty acid group (n=31)	Not taking omega-3 fatty acids group (n=32)	P value
Age (years)	59.8 ± 12.7	64.3 ±10.1	0.125
Male Gender (n/%)	15 (48.4)	20 (62.5)	0.315
DM (n/%)	8 (25.8)	13 (40.6)	0.287
BUN (mg/dL)	23.4 ± 8.0	27.1 ± 8.4	0.081
Creatinine (mg/dL)	1.63 ± 0.38	1.75 ± 0.45	0.267
GFR (ml/min/1.73m²)	42.3 ± 10.9	40.3 ± 11.0	0.477
Cystatin C (mg/L)	1.80 ± 0.55	1.89 ± 0.49	0.549
Cystatin C eGFR (ml/min/1.73m²)	40.8 ± 15.4	37.0 ± 11.1	0.344
25(OH) Vit.D3 (ng/mL)	16.4 ± 9.0	21.7 ± 23.1	0.236
1,25-(OH)2 Vit.D3 (pg/mL)	41.3 ± 16.2	33.7 ± 12.8	0.043
25(OH) Vit.D3 Deficiency (n/%)	22 (71)	24 (75)	0.782
1,25-(OH)2 Vit.D3 Deficiency (n/%)	3 (9.7)	7 (21.9)	0.302
iPTH (pg/mL)	100.8 ± 51.2	92.7 ± 52.7	0.676
Hemoglobin (g/dL)	13.4 ± 1.9	12.2 ± 1.8	0.015
Calcium (mg/dL)	9.1 ± 0.5	8.8 ± 0.5	0.022
Phosphorus (mg/dL)	3.6 ± 0.6	3.4 ± 0.7	0.215
Uric acid (mg/dL)	7.5 ± 1.5	7.2 ± 1.8	0.509
Albumin (g/dL)	4.3 ± 0.2	4.2 ± 0.4	0.266
ALP (IU/L)	257 ± 71	262 ± 106	0.809
R.U. P/C ratio (g/g)	1.08 ± 1.46	0.66 ± 0.78	0.164
Total cholesterol (mg/dL)	183.4 ± 47.2	167.6 ± 32.9	0.134
HDL (mg/dL)	47.4 ± 10.7	52.1 ± 13.6	0.207
LDL (mg/dL)	94.6 ± 31.8	88.8 ± 25.4	0.482
Triglyceride (mg/dL)	232 ± 114	148 ± 98	0.008

Table 2. Correlation coefficient with 1, 25-dihydroxyvitamin D

	Correlation coefficient (r)	p value
Hemoglobin (g/dL)	0.376	0.003
Creatinine (mg/dL)	-0.287	0.023
GFR (ml/min/1.73m²)	0.380	0.002
Cystatin C (mg/L)	-0.395	0.005
Calcium (mg/dL)	0.114	0.372
Phosphorus (mg/dL)	-0.170	0.183
iPTH (pg/dL)	-0.246	0.190
Albumin (g/dL)	0.077	0.549

Table 3. Regression analysis with 1, 25-dihydroxyvitamin D

	Univariate analysis		Multivariate analysis	
	OR	p	OR	p
Age (years)	-0.071	0.580		
Omega-3 FA	0.256	0.043	0.225	0.063
Hemoglobin (g/dL)	0.376	0.003		
Creatinine (mg/dL)	-0.287	0.023		
GFR (ml/min/1.73m²)	0.380	0.002	0.362	0.003
25(OH) Vit.D3 (ng/mL)	-0.068	0.600		

Conclusions

- Most patients with CKD stage 3 and 4 had vitamin D insufficiency but their active vitamin D levels were not lower than normal levels.

- Omega-3 fatty acids supplementation may involve with vitamin D activation and anemia prevention in CKD patients and further prospective studies are necessary to confirm the effectiveness of omega-3 fatty acids.

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