Original Research Article

Risk Factor Analysis of Vitamin D Insufficiency in End-Stage Renal Disease in CKD Patients: An Institutional Based Study

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Abstract

Background: The number of end stage renal disease (ESRD) patients on renal replacement therapy (RRT) is increasing all over the world, diabetes mellitus (DM) being the leading cause. Hence; the present study was conducted for assessing the risk factor of vitamin d insufficiency in end-stage renal disease in CKD patients. **Materials & Methods:** A total of 100 CKD patients were enrolled. Complete demographic and clinical details of all the patients were obtained. Blood pressure was measured with a brachial sphygmomanometer. Prescribed doses of oral vitamin D analogue (alfacalcidol) were recorded. Alfacalcidol was administered when serum calcium was less than 8.5 mg/dL and serum intact parathyroid hormone (PTH) higher than 150 pg/mL after titration with CaCO3. Blood samples were obtained, and serum profile was evaluated. All the results were recorded, and Microsoft excel sheet. **Results:** Mean BMI was significantly higher among the patients with 25(OH)D < 15 ng/mL in comparison to the patients with 25(OH)D ≥ 15 ng/mL. Mean calcium levels was significantly lower among the patients with 25(OH)D < 15 ng/mL in comparison to the patients with 25(OH)D ≥ 15 ng/mL. Mean haemoglobin levels was significantly lower among the patients with 25(OH)D < 15 ng/mL in comparison to the patients with 25(OH)D ≥ 15 ng/mL. Mean triglycerides levels was significantly higher among the patients with 25(OH)D < 15 ng/mL in comparison to the patients with 25(OH)D ≥ 15 ng/mL. **Conclusion:** From the above results, the authors concluded that vitamin D deficiency affects a significant proportion of CKD patients with end stage renal disease. BMI, Calcium levels, haemoglobin and triglycerides were significant risk factors associated with vitamin d insufficiency in end-stage renal disease in CKD patients.

Key words: End-stage renal disease, Vitamin D

Introduction

The number of end stage renal disease (ESRD) patients on renal replacement therapy (RRT) is increasing all over the world, diabetes mellitus (DM) being the leading cause. In the last decade the prevalence of ESRD attributed to diabetic kidney disease (DKD) increased 2.5-fold. On the other hand, ESRD patients treated with hemodialysis (HD) have a 7-fold higher mortality rate as compared to the general population and in ESRD-DM population the mortality increases even more. According to 2013 USRDS data only 50% of the ESRD-DM patients on HD are surviving at 3 years and only 30% are alive at 5 years of therapy. Increased prevalence of traditional cardiovascular disease (CVD) risk factors in ESRD patients and CVD mortality do not entirely explain the very high all-cause mortality rate of these patients. It is well established that in CKD patients, the Framingham risk equation, which estimated cardiovascular disease risk based on traditional risk factors (i.e. age, gender, diabetic status, smoking status, serum total cholesterol level, systolic blood pressure, and left ventricular hypertrophy by electrocardiography) is insufficient to predict all of the cardiovascular disease risk in CKD patients[1-3].

Vitamin D is a prehormone obtained through the diet or via skin synthesis. It is subsequently activated in a sequential 2-step process, involving first 25-hydroxylation in the liver to produce 25-(OH) vitamin D and then 1-hydroxylation, which until recently was thought to occur primarily in the kidney, to produce the active product 1,25 vitamin D or calcitriol. The traditional dogma was that the 1,25 renal-activated end-product was responsible for all of the effects of the active vitamin D hormone in the body and that these effects were restricted to regulation of bone and mineral metabolism[4-7]. Hence; the present study was conducted for assessing the risk factor of vitamin d insufficiency in end-stage renal disease in CKD patients.

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Materials & methods

The present study was conducted in Department of Biochemistry, Darbhanga Medical College, Darbhanga, Bihar (India) for assessing the risk factor of vitamin d insufficiency in end-stage renal disease in CKD patients. A total of 100 CKD patients with end-stage renal disease were enrolled. Complete demographic and clinical details of all the patients were obtained. Blood pressure was measured with a brachial sphygmomanometer. Prescribed doses of oral vitamin D analogue (alfacalcidol) were recorded. Alfacalcidol was administered when serum calcium was less than 8.5 mg/dL and serum intact parathyroid hormone (PTH) higher than 150 pg/mL after titration with CaCO3. Blood samples were obtained, and serum profile was evaluated. All the results were recorded, and Microsoft excel sheet and were analysed by SPSS Software.

Results

A total of 100 subjects were enrolled. Mean age of the patients with 25(OH)D ≥ 15 ng/mL and 25(OH)D < 15 ng/mL was 63.5 years and 61.5 year respectively. Non-significant results were obtained while comparing the age and gender-wise distribution between patients divided on the basis of Vitamin D levels. Mean BMI was significantly

higher among the patients with 25(OH)D < 15 ng/mL in comparison to the patients with 25(OH)D ≥ 15 ng/mL. Mean calcium levels was significantly lower among the patients with 25(OH)D < 15 ng/mL in comparison to the patients with 25(OH)D ≥ 15 ng/mL. Mean haemoglobin levels was significantly lower among the patients with 25(OH)D < 15 ng/mL in comparison to the patients with 25(OH)D ≥ 15 ng/mL. Mean triglycerides levels was significantly higher among the patients with 25(OH)D < 15 ng/mL in comparison to the patients with 25(OH)D ≥ 15 ng/mL. BMI, Calcium levels, haemoglobin and triglycerides were significant risk factors associated with vitamin d insufficiency in end-stage renal disease in CKD patients.

Table 1: Risk factors of vitamin D deficiency

Variables	25(OH)D ≥ 15 ng/mL [n=43]	25(OH)D < 15 ng/mL [n=57]	p- value
Mean age (years)	63.5	61.5	0.12
Males (n)	23	29	0.87
BMI (Kg/m^2)	21.3	25.4	0.00*
Calcium levels (mg/dL)	9.5	8.1	0.00*
Haemoglobin (g/dL)	13.3	11.8	0.01*
Triglycerides (mg/dL)	123.8	161.7	0.03*

Discussion

The key function of vitamin D includes the maintenance of calcium and phosphorus homeostasis, thereby promoting bone mineralization. The two forms of Vitamin D exists, 1) vitamin D2 (ergocalciferol), and 2) vitamin D3 (cholecalciferol).1 In the liver, Vitamin D (also known as steroid hormone), is hydroxylated to 25 hydroxylated vitamin D {25(OH)D}, which is the major articulating metabolite of vitamin D. In the kidney, the 25(OH)D is tranformed to 1,25-dihydroxy vitamin D [1,25(OH)2D], i.e. the active form by a 1-hydroxylase enzyme present in the kidney. This helps to maintain bone and muscle health through the regulation of calcium metabolism. Serum 25(OH)D concentrations are measured to clinically assess the status of vitamin D because it reflects both intakes as well as endogenous production[5-8]. Hence; the present study was conducted for assessing the risk factor of vitamin d insufficiency in end-stage renal disease in CKD patients.

A total of 100 subjects were enrolled. Mean age of the patients with 25(OH)D ≥ 15 ng/mL and 25(OH)D < 15 ng/mL was 63.5 years and 61.5 year respectively. Non-significant results were obtained while comparing the age and gender-wise distribution between patients divided on the basis of Vitamin D levels. Mean BMI was significantly higher among the patients with 25(OH)D < 15 ng/mL in comparison to the patients with 25(OH)D ≥ 15 ng/mL. Mean calcium levels was significantly lower among the patients with 25(OH)D < 15 ng/mL in comparison to the patients with 25(OH)D ≥ 15 ng/mL. Multiple observational studies have shown low levels of both 25(OH)D and 1,25(OH)2D in patients with CKD and ESRD. Many factors may account for low levels of 25(OH)D in kidney disease, including the loss of vitamin D binding protein in the urine, ineffective synthesis in the skin upon exposure to ultraviolet B radiation, and likely reduced nutritional intake and sun exposure[9-12].

In the present study, mean haemoglobin levels was significantly lower among the patients with 25(OH)D < 15 ng/mL in comparison to the patients with 25(OH)D ≥ 15 ng/mL. Mean triglycerides levels was significantly higher among the patients with 25(OH)D < 15 ng/mL in comparison to the patients with 25(OH)D ≥ 15 ng/mL. BMI, Calcium levels, haemoglobin and triglycerides were significant risk factors associated with vitamin d insufficiency in end-stage renal disease in CKD patients. Low 25(OH)D levels in patients with CKD and ESRD have been associated with a higher risk of all-cause mortality and a faster progression of kidney disease. In the general population, low 25(OH)D levels have also been associated with all-cause mortality, cardiovascular events, peripheral vascular disease, hypertension, congestive heart failure, and the later need for renal replacement therapy. Low 1,25(OH)2D levels have been associated with all-cause mortality. The studies of vitamin D levels are all potentially confounded by sicker patients having low vitamin D levels because of less sun exposure or poor nutrition. Therefore, randomized trials are required to test whether supplementation of vitamin D may affect outcomes[8-13]. Echida Y et al identified the risk factors for vitamin D deficiency in predialyzed patients with chronic kidney disease (CKD). An observational study of 135 outpatients with stage 3-5 CKD was undertaken. The 25(OH)D-deficient group had a higher body mass index (24.1±4.2 kg/m(2) vs. 22.5±4.0 kg/m(2), p=0.0322), and had more diabetic patients (27.9% vs. 3.6%, p=0.0003). The multivariate analysis revealed that body mass index (odds ratio=2.758; 95% CI, 1.048-7.721; p=0.0398), the presence of diabetes (odds ratio=7.792; 95% CI, 1.808-55.439; p=0.0043), lower hemoglobin concentration (odds ratio=0.297; 95% CI, 0.099-8.732; p=0.821), higher serum levels of non-HDL cholesterol (odds ratio=3.570; 95% CI, 1.449-9.442; p=0.0053) and triglyceride (odds ratio=2.447; 95% CI, 0.779-1.776; p=0.0258) were the factors associated with low 25(OH)D levels. Vitamin D deficiency was common among the predialysis CKD patients, and the factors identified as being associated with vitamin D deficiency were diabetes and obesity[14].

Conclusion

From the above results, the authors concluded that vitamin D deficiency affects a significant proportion of CKD patients with end stage renal disease. BMI, Calcium levels, haemoglobin and triglycerides were significant risk factors associated with vitamin d insufficiency in end-stage renal disease in CKD patients.

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