Secondary Hyperparathyroidism in Adult Chronic Hemodialysis Patients-Prevalence and Clinical Aspect

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Abstract

Background

Secondary hyperparathyroidism (SHPT) is a common complication of chronic kidney disease (CKD).

Aim

The exact prevalence of secondary hyperparathyroidism in chronic hemodialysis patients in Somalia is unknown. In this study, we aim to determine the prevalence of SHPT in chronic hemodialysis patients in Mogadishu, Somalia.

Method

This retrospective analysis was done at Mogadishu Somali Turkey training and research hospital, Somalia's largest dialysis center. All > 18-year-old hemodialysis patients from the last year were included. The research excluded parathyroidectomy and steroid, phenytoin, and phenobarbitone individuals. This analysis covered 195 patients. Calcium, phosphate, albumin, vitamin D, urea, creatinine, and other electrolytes were also tested.

Results

Our study included 195 patients who met the inclusion criteria. The mean age was 56.0 ± 17.4 with 49.2% men and 50.88% females. End-stage kidney disease (ESKD) was caused by hypertension in 64.1% of patients and diabetes in 30.8%. The mean hemodialysis time was 7.8 ± 1.3 hours per week and for duration 39.6 ± 15 months. The mean iPTH concentration was 458.59 ± 636.96 pg/mL, phosphate was 4.24 ± 2.15 mg/dL, corrected calcium was 8.70 ± 0.97 mg/dL, and calcium phosphate product was 36.60 ± 19.78 mg/dL. The mean vitamin D concentration was 33.53 ± 19.70. we found that the prevalence of secondary hyperparathyroidism is 65.6%.

Conclusion

We conclude that there is high prevalence of secondary hyperparathyroidism in chronic hemodialysis patients in Somalia and that measures that predict vitamin D response, including sestamibi parathyroid scan and gland volume, should be studied further to prevent this high prevalence.

Introduction

Around 13.3 million individuals worldwide are afflicted with CKD each year, with 85% occurring in developing countries. Kidney disease is responsible for around 1.7 million fatalities per year (1). As a result of high costs and a scarcity of competent workers, renal replacement therapy (RRT) is not widely available in most of Sub-Saharan Africa (SSA), which contributes to high rates of morbidity and mortality (2).

Chronic kidney disease- mineral bone disorder (CKD-MBD) is a systemic condition characterized by biochemical (calcium, phosphate, PTH, and vitamin D) and bone turnover abnormalities and extra-skeletal calcification. The biochemical abnormalities that characterize CKD- MBD is considered to as secondary hyperparathyroidism(3). The key processes are decreased amounts of calcitriol and ionized calcium in early renal failure, and decreased numbers of vitamin D and calcium receptors in the gland, making it more resistant to calcitriol and calcium (4). Phosphate causes

parathyroid gland hyperplasia and enhances parathyroid (PTH) hormone synthesis and secretion independently of calcium and calcitriol (5). To maintain normal bone modeling, a degree of secondary hyperparathyroidism must exist as a trade-off (6). However, there is no consensus on the optimal intact parathyroid hormone (iPTH) level that will maintain normal bone turnover (7).

The possibility that PTH may have a significant pathogenetic role in the development of metastasizing calcification, peripheral vascular disease, calcific valvular heart disease, and cardiac mortality has also been suggested(8–10).

Bone pain, myopathy, muscular weakness, pruritus, extra skeletal calcifications, spontaneous tendon fracture, calciphylaxis, and skeletal abnormalities have all been reported to be manifestations of secondary hyperparathyroidism (11).

Somalia has seen an increase in the number of people suffering from kidney disease in recent years, due to changes in diet, diabetes mellitus and blood pressure that are not treated properly. A study by Sarı Ö and Bashir(12) found that patients admitted to the Mogadishu Somali Turkey Training and Research hospital's internal medicine department, 44.2% had acute or chronic kidney disease.

The aim of this study was to assess the prevalence and the clinical aspect of secondary hyperparathyroidism in chronic hemodialysis patients in Somalia.

Patients And Method

This retrospective cross-sectional study was carried out at the hemodialysis center of Mogadishu Somali Turkey training and research hospital, which is the largest hemodialysis center in Mogadishu, Somalia.

The ethics committee of Mogadishu Somali Turkey Training and Research Hospital has reviewed and approved the study, data was collected from the dialysis center’s health records. Due to the retrospective nature of the study, informed consent was waived. This study was conducted in accordance with Helsinki declaration.

Inclusion Criteria

All patients >18 years, on routine hemodialysis for the last 12 months have been included in the study.

Exclusion Criteria

Parathyroidectomy patients, as well as those on steroids, phenytoin, or phenobarbitone, were excluded from the study. Around 195 patients who met the criteria were included in this study.

Due to some circumstances relating to the financial affordability of the patients, some were receiving hemodialysis once per week, while others received twice or thrice per week. iPTH levels were analyzed together with corrected calcium, phosphate, albumin, vitamin D, urea, creatinine, and other electrolytes.

The results are expressed as mean ± S.D. The correlation coefficient between measured variables and iPTH was calculated using Pearson correlation coefficient. Probability values less than 0.05 were considered statistically significant. The statistical package SPSS (Statistical Package for the Social Sciences) was used.

Results

We have recruited 195 patients who fulfilled the inclusion criteria of our study. There were 49.2% males and 50.8% females, with a mean age of 56.0 ± 17.4. Hypertension caused end-stage kidney disease (ESKD) in 64.1% of the patients

and diabetes in 30.8% of the patients. The mean hemodialysis duration was 7.8 ± 1.3 hours per week and the mean duration on routine hemodialysis was 39.6 ± 15.0 months (Table 1).

The mean iPTH concentration was 458.59 ± 636.96 pg/mL, phosphate 4.24 ± 2.15 mg/dL, corrected calcium 8.70 ± 0.97 mg/dL, and the mean calcium phosphate product was 36.60 19.78 mg/dL. The mean vitamin D levels concentrations was 33.53 ± 19.70 (Table 5).

We observed that 14.4% of patients had iPTH levels within the normal range, 20% had levels below 100 pg/mL, and 65.6% had iPTH levels above 200 pg/mL. The mean iPTH for these groups was 59,161, and 469 pg/dL, respectively (Table 3). Only time on hemodialysis showed a positive significant correlation with iPTH (Table 4). We didn't find any significant different in iPTH between diabetics and non-diabetics (Table 2).

Table 1
Sociodemographic and clinical characteristics of the patients.

Variable	**All patients N = 195**
Age Group in Years n (%)	
14–24	21 (10.8)
25–34	15 (7.7)
35–44	16 (8.2)
45–54	35 (17.9)
55–64	45 (23.1)
≥ 65	63 (32.3)
Gender n (%)	
Male	99 (49.2)
Female	96 (50.8)
Cause of ESRD n (%)	
Hypertension	126 (64.1)
Diabetes Mellitus	60 (30.8)
Obstructive Nephropathy	6 (3.1)
Adult polycystic kidney disease	4 (2.1)
Time dialysis per week (hours), mean ± Sd	7.8 ± 1.3
Duration of HD (months), mean ± Sd	39.6 ± 15.0

Table 2
Biochemical and dialysis variables in diabetic and non-diabetic patients

Variables	DM+ (n = 60)	DM- (n = 135)	*p*
Age (years), Mean ± Sd	56.0 ± 17.4	52.8 ± 18.8	0.272
Male gender (n, [%])	31 (51.7)	68 (50.4)	0.878
Duration of HD (months), Mean ± Sd	38.2 ± 13.5	40.2 ± 15.5	0.381
Ca (mg/dl), Mean ± Sd	8.8 ± 0.7	8.7 ± 1.0	0.630
P (mg/dl), Mean ± Sd	3.8 (5.6–3.1)	3.8 (4.9–2.9)	0.449
Ca x P (mg/dl), Mean ± Sd	32 (48 – 25)	31 (41 – 23)	0.331
iPTH (pg/ml), Mean ± Sd	280 (613 – 141)	308 (550 – 150)	0.948

Table 3
Mean iPTH in different groups (N = 195) of the patients

Variables	N (%)	Mean iPTH (pg/ml), mean ± Sd
Low iPTH (< 100)	39 (20%)	59 (38–80)
Normal iPTH (100–200)	28 (14.4%)	161 (139–185)
High iPTH (> 200)	128 (65.6%)	469 (302–763)

Table 4
Variables correlating with iPTH levels

Parameters	r (P value)	
	Total population	High iPTH
Calcium	-0.064 (0.371)	0.033 (0.710)
Phosphate	0.036 (0.617)	0.057 (0.528)
Ca X P	0.027 (0.711)	0.074 (0.408)
Age	-0.052 (0.468)	-0.011 **(0.900)**
Time of HD (months)	0.230 (**0.001**)	0.236 **(0.007)**

Table 5
Bone biochemicals factors of the patients

Factor	Mean ± SD
Phosphate (mg/dL)	4.248 ± 2.15
Corrected Calcium (mg/dL)	8.70 ± 0.97
Calcium Phosphate Product	36.60 ± 19.78
iPTH (pg/mL)	458.59 ± 636.96
Vitamin D (ng/mL)	33.53 ± 19.70

Discussion

In our study, we analyzed data from 195 patients who underwent routine hemodialysis for at least 12 months in the largest dialysis center in Somalia. We found that 65.6% had iPTH levels above 200 pg/mL, with the mean iPTH of 458.59 ± 636.96. There is no agreement on the optimal level of PTH for maintaining bone turnover, however it is commonly acknowledged to be in the range of 100–200 pg/mL (13). We found a prevalence of secondary hyperparathyroidism in hemodialysis patients of 65.6% at a cutoff level of 200 pg/mL, which is lower than the prevalence rate of 78% found by Ali Odwa et al.(13) but higher than the prevalence rate of 50% found by Salem (14) using the same cutoff level of iPTH.

Although there may be unmeasured confounding factors, the difference can be explained by the difference in time on hemodialysis, which Salem underestimated in his study, while Ali Owda et al. had more time on hemodialysis. Similar to Neff et al. (15), we discovered that the duration of hemodialysis is a key determinant of parathyroid disease. To reflect for this effect, we included patients who had been on hemodialysis for at least 12 months in our study. Our findings are consistent with previous studies and explain the high prevalence of hyperparathyroidism in our patients. In order not to overestimate, we have excluded patients who have factors that are known to raise the PTH level.

Numerous studies have correlated serum levels of intact PTH > 400 pg/mL (about six times the upper limit of normal of 65 pg/mL) to the high-turnover bone diseases osteitis fibrosa and mixed uremic osteodystrophy (16, 17). PTH suppression to less than two times the upper limit for the specific PTH assay is not recommended since it is related to an increased risk of adynamic bone disease (18).

PTH levels should be kept within specific ranges, according to various national and international clinical practice guidelines, because uncontrolled SHPT can affect patient outcomes (18). Vitamin D receptor activators (VDRAs) were the cornerstone of therapy for SHPT until a few years ago (19). However, because VDRAs increase calcium and phosphorus absorption in the intestine, and the parathyroid response to VDRAs is significantly reduced in advanced SHPT, their therapeutic value has been limited (20). Cinacalcet hydrochloride, an alternative for the treatment of SHPT, improves the sensitivity of the parathyroid calcium-sensing receptor (CaSR) by allosterically modulating it (21). Despite advancements in medication treatment for SHPT, surgical parathyroidectomy (PTx) remains the definitive therapy for refractory SHPT, lowering PTH levels and alleviating symptoms associated with severe SHPT (22). In our study, 17 (8.7%) of hemodialysis patients had refractory secondary hyperparathyroidism with serum iPTH > 1000 pg/mL, despite calcitriol, the first synthetic physiological VDRA, was the only available medical treatment for secondary hyperparathyroidism in our hospital.

Conclusion

We conclude that there is high prevalence of secondary hyperparathyroidism in chronic hemodialysis patients in Somalia, and that parameters that predict vitamin D response, such as sestamibi parathyroid scan and gland volume, should be evaluated further in order to reduce this high incidence. The treatment of secondary hyperparathyroidism in patients with CKD remains an important aspect of their management.

Declarations

Ethics approval and consent to participate

The ethics committee of Mogadishu Somali Turkey Training and Research Hospital has reviewed and approved the study with the reference number of MSTH/7122, data was collected from the dialysis center's health records. Due to the retrospective nature of the study, informed consent was waived.

Competing interests

Authors declare no conflict of interest.

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Availability of data

The datasets used and/or analyzed during the current study are available from the corresponding author on reasonable request.

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Not applicable

Abbreviations

SHPT-Secondary hyperparathyroidism

CKD-chronic kidney disease

ESKD-End-stage kidney disease

RRT- renal replacement therapy

MBD-mineral bone disorder

iPTH-intact parathyroid hormone

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