

Effect of dialysis duration on serum calcium and phosphorous in hemodialysis patients

Abstract

In many countries, physicians follow clinical guidelines for mineral bone disorders to control secondary hyperparathyroidism associated with serum calcium and phosphorous level in patients maintaining hemodialysis (HD).¹ The current research was conducted among 34 patients with chronic renal insufficiency on maintenance HD to study serum Phosphorous, Calcium, Alkaline phosphatase changes in maintenance hemodialysed patients.

Keywords: renal insufficiency, renal dialysis, calcium, phosphorous, biomarkers

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Seyyed Mohsen Hosseinejad,^{1,6} Mehrdad Aghaei,^{2,6} Gholamreza Roshandel,³ Fateme Sadat Hosseinejad,⁴ Atiyeh Moazzeni,⁵ Robabeh Salehi,^{6,7} Saeid Amir Khanlou^{5,6,7}

¹Student Research Committee, Golestan University of Medical Sciences, Gorgan, Iran

²Golestan Rheumatology Research Center, Golestan University of Medical Sciences, Gorgan, Iran

³Golestan Research Center of Gastroenterology and Hepatology, Golestan University of Medical Sciences, Gorgan, Iran

⁴Student Research Committee, School of Public Health, Shahrood University of Medical Sciences, Shahrood, Iran

⁵Hemodialysis Ward, 5th Azar Hospital, Golestan University of Medical Sciences, Gorgan, Iran

⁶Clinical Research Development Unit (CRDU), Sayyad Shirazi Hospital, Golestan University of Medical Sciences, Gorgan, Iran

⁷Hemodialysis Ward, Sayyad Shirazi Hospital, Golestan University of Medical Sciences, Gorgan, Iran

Correspondence: Saeid Amir Khanlou, Clinical Research Development Unit (CRDU), Sayyad Shirazi Hospital, Golestan University of Medical Sciences, Gorgan, Iran, Tel 00989398387874, Email Drsam74ir@gmail.com

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Abbreviations: P, Phosphorous; Ca, Calcium; ALP, alkaline phosphatase; BMD, bone mineral density; CKD-MBD, chronic kidney disease-mineral and bone disorder; HD, hemodialysis; ESRD, end stage renal disease

Introduction

Chronic renal insufficiency is associated with changes in mineral and bone metabolism biochemistry and density.^{2,3} In many countries, physicians follow clinical guidelines for mineral bone disorders to control secondary hyperparathyroidism associated with serum calcium and phosphorous level in patients maintaining hemodialysis (HD).¹ With the begin of hemodialysis, histological marks of secondary hyperparathyroidism could be seen in bones of over 50 percent⁴ of end stage renal disease (ESRD) patients, skeletal defects identified as Chronic Kidney Disease-Mineral and Bone Disorder (CKD-MBD) (the so called as renal osteodystrophy) consist of some types of bone tissue lesions, such as the most widespread high bone turn-over disease but also the a dynamic bone disease.^{5,6}

Other less common bone diseases such as osteomalacia, aluminum-related bone disease, fluorosis and strontium overload or mixed types also have been pronounced.⁴

It is well recognized that bone mineral density (BMD) is decreased in patients suffering chronic renal failure and they have higher fracture risk.^{7,8} Uremic patients frequently reveal high serum concentration of biochemical markers.³

The aim of current research is to study serum Phosphorous (P), Calcium (Ca), alkaline phosphatase (ALP) changes and other indices in hemodialysed patients.

Methods

Participants

Thirty four patients, 16 postmenopausal female and 18 male, on maintenance HD were involved in the current study after obtaining their informed consent. The study was conducted in Golestan University of Medical Sciences, Gorgan, Iran during the period February-May 2018. Patients mean age was 57.8 with range of 43-73 years old, with the mean HD duration of 40 months (range: 11-204 months). All of our patients were treated by conventional HD 3-4 hours, three times in a week. None of the patients had a past history of renal transplantation or parathyroidectomy, history of radiographic evidence of rib, vertebral or hip fracture. At the time of the assessment, none of the patients, especially the postmenopausal women, were receiving or had received previously oestrogen or raloxifene, bisphosphonates, calcitonin, PTH or corticosteroids agents. None of the participants took vitamin K or aluminum hydroxide. There was no clinical nor biological sign for other bone disease such as osteomalacia, Paget's disease, malignancy or liver diseases.

Biochemistry

Morning pre-midweek hemodialysis blood samplings were

collected from the arteriovenous fistula after a 12hr fasting. The serum obtained after centrifugation was kept in aliquots at -20°C until analyzed, with measurements made instantly after defrosting.

Serum calcium, phosphorus, creatinine, and total alkaline phosphatase etc. were assessed routinely using an automatic analyzer.

Statistics

All obtained results are presented as mean \pm SD, unless otherwise indicated. Correlations between variables were calculated using simple linear regression and $p < 0.05$ was considered as statistically significant. Comparison of variables was done using chi-square and/or student t-test analysis.

Results

Demographic and biochemical data of thirty four patients, consisting of 18 male and 16 postmenopausal female, on maintenance HD were investigated.

Table 1 depicts the demographic data for the 34 patients and table 2 for the 18 male patients. Table 2 represents the biochemical data for all 34 patients.

The results of our study also showed that with dialysis increase, the serum biomarkers of Ca, P and Alkaline phosphatase decrease; the correlations were statistically significant.

Table 1 Age and time-on-dialysis of the participants

	Mean \pm SD	Range (Yrs.)
Age(year-old)	57.8 \pm 12	31-78
Duration of dialysis(month)	40.2 \pm 48	11-204

Table 2 Biochemical data in all patients

	Mean	Std. Deviation
Dialysis duration(month)	40.29	48.3
Calcium (mg/dl)	8.53	0.79
Phosphorus (mg/dl)	5.812	1.72
Alkaline phosphatase (U/l)	462.18	202.76
Hemoglobin(mg/dl)	1.14	1.46
Creatinine (mg/ml)	8.65	2.13
Sodium (mEq/l)	139.18	3.34
Fasting Blood Sugar(mg/dl)	106	47.87
Platelet(*103 μ l)	173.18	68.13

Discussion

The existed data about the influence of hemodialysis among ESRD patients is limited; most of the studies have been dedicated to predialysis, HD and renal transplanted patients and occasional information is accessible for patients on peritoneal dialysis, hemofiltration and hemodiafiltration.⁹⁻¹¹

In our study simple regression analysis showed no correlation between serum sodium and dialysis duration. Similarly, no correlation was found between age and serum biomarkers.

Serum Ca and P displayed a significant correlation only with duration of HD as expected which were in line with other previous reports.^{1,11-13} The differences between our results in comparison with other previous studies may be because of our limited sample size.

Conclusion

Remarkably, the duration of hemodialysis does act to disturb bone related serum biomarkers like ALP, Ca, and P; with some patients remaining outside the standard range for serum calcium and phosphorus range, practical guidelines and adequate treatment should be followed to reduce any other further risk of secondary hyperparathyroidism and its complications. Besides, the impact of other factors on bone metabolism and bone mineral density changes in HD patients importantly remains to be illuminated with further studies.

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Conflict of interest

The author declares there is no conflict of interest.

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