

Role of serum phosphorus in patients of chronic kidney disorder

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Abstract:

Hyperphosphatemia in chronic kidney disease (CKD) patients is a potentially life altering condition that can lead to cardiovascular disorder and metabolic bone disease . Under normal physiological condition, in healthy individuals phosphate is freely filtered through the glomerulus. In chronic kidney disease serum phosphorus levels start to increase and continue increasing as these patients reach end-stage of the disorder. The aim of this study was to determine the association of serum Phosphorus levels with the progression of chronic kidney disease. In our study we compared the level of serum phosphorus in CKD patients and compared it with normal healthy controls. Hyperphosphatemia was observed in cases group and was found to be statistically significant. High serum phosphorus has been shown to be associated with a more rapid decline of renal function in patients with chronic kidney disease.

Keywords: serum phosphorus, chronic kidney disease, glomerular filtration rate, osteoporosis, hyperphosphatemia.

Introduction:

Phosphorus levels remains almost constant at approximately 3.8 mg/dL in people with normal kidney function. Serum phosphorus levels stay relatively constant through the influence of multiple factors—such as parathyroid hormone, fibroblast growth factor 23, and vitamin D—on the kidney, bone, and digestive system. The kidney plays a major role in phosphate homeostasis .¹ The kidneys excrete the total net amount of absorbed phosphate (13 mg/kg/day). Under normal physiological condition, in healthy individuals phosphate is freely filtered through the glomerulus. Studies have shown that even people with normal kidney function are sometimes found to have levels ranging between 1.6 mg/dL and 6.2 mg/dL. It does the same in those with decreased kidney

function until the glomerular filtration rate (GFR) decreases below 30 mL/min/1.73 m² representing chronic kidney disorder (CKD).² After this serum phosphorus levels start to increase and continue increasing as these patients reach end-stage of the disorder.³ It is also associated with increased prevalence of cardiovascular diseases and mortality rates. Once kidney function has deteriorated to end-stage disease, maintaining normal serum phosphorus requires dietary restrictions, phosphate-binding medications, and dialysis.⁴

Hence we evaluated the levels of serum phosphorus on the patients of CKD and normotensive subjects.

Material and Methods:

The study was carried in the department of Biochemistry and central investigation laboratory in MGM Hospital, Aurangabad. Institutional ethical committee clearance was obtained for the study. Written and informed consent were taken from the patients for the study. In the present study, we investigated the serum phosphorus level in patients with chronic kidney disease and compared them with control subjects.

Sample Size Cases- 30 chronic kidney disease patients from MGM College and Hospital, Aurangabad
Controls- 30 healthy controls.

Inclusion criteria : Patients age over 18 years, diagnosed case of chronic kidney disease , not on dialysis, not secondary to a kidney transplant failure.

Methods The blood samples (3 ml fresh blood) were drawn and collected in a clean, disposable plastic tube from anterior cubital vein under aseptic condition for estimation of serum phosphorus from both cases and control subjects. Estimation of serum phosphorus was done by Vitros 5600.

Statistical analysis: The data were evaluated by SPSS statistical package version 20.0. The results obtained were statistically analyzed by using student t-test. Value of Vitamin C was given in mg/dl. MDA levels were given in nmol/ml. Systolic and diastolic blood pressure was measured in mm of Hg. All Values were expressed as mean \pm standard. The results were considered significant when $p < 0.05$.

Result:

The mean age of the patients for this study was (57 \pm 2.5) and controls was (65 \pm 3.2).

Table 1 shows the mean values of serum phosphorus in cases and controls. The mean serum phosphorus levels of cases and controls were 5.73mg/dl and 3.82mg/dl respectively, which were significantly higher as compared

with the control groups. ($P=0.001$). It also shows that the number of females were more in the cases group as compared to control.

Table 1: Mean of age and serum phosphorus levels in cases and Controls.

Parameter	Cases (n=30)	Controls (n=30)	p-value
Age (yrs)	57±2.5	65±3.2	0.005
(Male: Female)	11:19	17:13	-
Serum Phosphorus (mg/dl)	5.73±0.76	3.82±0.25	0.001

Values are given as mean ± SD.

p-value <0.05 considered as statistically significant.

Compared with controls who maintained good control of serum phosphorus (Table 1), those with hyperphosphataemia were younger, with a greater predominance of women.

Discussion:

Phosphorus is filtered freely in the glomerulus and then it is reabsorbed in the proximal tubule under the effect of various hormones.⁵ The amount of reabsorbed phosphorus is the main regulator of the serum phosphorus levels in subjects with normal renal function, or moderately reduced glomerular filtration rate. The main compensatory mechanism for the deficit in urinary phosphorus excretion, inherent in the loss of renal function, is increased tubular excretion fraction.^{6,7}

Women included in this study tended to have higher levels of serum phosphorus than men. The female sex has been reported in some⁸ but not all studies as a determinant of hyper-phosphataemia. Estrogen play a significant role in the handling of phosphorus, due to modifying the synthesis of PTH, vitamin D and even by directly reducing the expression of tubular transporters,^{9,10} so that all these changes favour renal excretion of phosphorus. In addition, male hypogonadism is associated with increased serum phosphorus levels and a decrease in renal excretion fraction.¹¹

Conclusion:

In conclusion, hyperphosphataemia is a common finding in advanced stages of CKD. In addition to renal function, other factors such as female sex was associated with higher concentrations of serum phosphorus. This

study demonstrates that serum phosphorus levels are independent determinants of the rate of progression of CKD. High serum P levels are strongly and independently associated with a more rapid decline of renal function in patients of CKD.

Therefore, these results suggest to investigate whether adequate control of phosphorus slows the progression of CKD.

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