A Case Report of Very Severe Hyperphosphatemia (19.3 mg/dL) in a Uremic Patient Taking Honey and Persimmon Vinegar

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We report a case of severe hyperphosphatemia in advanced CKD with poor compliance. A 55-year-old male patient with underlying type 2 diabetes mellitus, hypertension, and chronic kidney disease presented emergently with general weakness and altered mental status. The creatinine level was 14 mg/dL (normal range: 0.5-1.3 mg/dL) 2 months prior to consultation, and he was advised initiation of hemodialysis, which he refused. Subsequently, the patient stopped taking all prescribed medications and self-medicated with honey and persimmon vinegar with the false belief it was detoxifying. At the time of admission, he was delirious, and his laboratory results showed blood urea nitrogen level of 183.4 mg/dL (8-23 mg/dL), serum creatinine level of 26.61 mg/dL (0.5-1.3 mg/dL), serum phosphate level of 19.3 mg/dL (2.5-5.5 mg/dL), total calcium level of 4.3 mg/dL (8.4-10.2 mg/dL), vitamin D (25(OH)D) level of 5.71 ng/mL (30-100 ng/mL) and parathyroid hormone level of 401 pg/ml (9-55 pg/mL). Brain computed tomography revealed non-traumatic spontaneous subdural hemorrhage, presumably due to uremic bleeding. Emergent hemodialysis was initiated, and hyperphosphatemia and hypocalcemia were rectified; calcium acetate and cholecalciferol were administered. The patient's general condition and laboratory results improved following dialysis. Strict dietary restrictions with patient education were implemented. Multifaceted interventions, including dietary counseling, administration of phosphate-lowering drugs, and lifestyle modifications, should be implemented when encountering patients with CKD, considering the extent of the patient's adherence.

Key Words: Hyperphosphatemia, Chronic kidney disease, Dietary counseling, Case report

INTRODUCTION

Chronic kidney disease (CKD) is a major public health burden, with rising global prevalence and many complications1). The risk of CKD-mineral and bone disorder (MBD) is increased in patients with CKD2). CKD-MBD syndrome includes anomalous laboratory test results, bone fragility, and vascular calcification and is associated with increased risks of morbidity and mortality3).

Hyperphosphatemia, in particular, has been associated with increased mortality risk in CKD-MBD patients4,5). Hyperphosphatemia occurs late in the course of CKD, as adaptive responses fail to maintain mineral homeostasis6). Renal phosphate excretion in CKD is maintained by increased levels of parathyroid hormone (PTH) and fibroblast growth factor 23 (FGF23), up to a certain extent. However, as CKD progresses and the glomerular filtration rate (GFR) decreases,
phosphate retention occurs, and mineral homeostasis even-
tually fails\(^6\, ^7\). Excessive retention of phosphate can cause
adverse events such as vascular calcification, parathyroid
gland hyperplasia, uremic bone disorders, and cardiovascular
events\(^8\). Therefore, phosphate control is essential in CKD
patients. It is recommended to limit dietary phosphate in-
take among patients who have CKD stage 3 and above\(^2\, ^9\).
Phosphate levels can be further managed through renal
replacement therapy (through hemodialysis) and the use
of phosphate-binding drugs, calcitriol, and active vitamin
D analogs.

Herein, we report a case of severe hyperphosphatemia
in a patient with advanced CKD with poor compliance and
poor dietary control.

**CASE REPORT**

A 55-year-old male patient was transferred to the emer-
gency department with general weakness and a change in
mental status. The patient had been taking medication for
type 2 diabetes mellitus (DM) and hypertension (HTN) for
10 years. The patient was also treated at a local clinic for
CKD. The creatinine level (normal range: 0.5-1.3 mg/dL) was
6.14 mg/dL 10 months ago and had risen to 14 mg/dL 2
months ago. He was advised to start hemodialysis, which
he refused at that time. Subsequently, the patient stopped
taking all his medications and self-medicated with honey
and persimmon vinegar for 3 weeks, assuming this was
a detoxifying regimen. The day before transfer, he suffered
from loss of consciousness and was admitted at a local
clinic.

At the time of transfer, his blood pressure was 160/80
mmHg, heart rate was 70 beats/min, respiratory rate was
20 breaths/min, body temperature was 36.5°C, and oxygen
saturation was at 100% with oxygen supplementation at
2 L/min via nasal cannula. Physical examination revealed
dry mouth, dry skin, decreased skin turgor, and tremors
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dry mouth, dry skin, decreased skin turgor, and tremors
of the upper extremities. The day of admission, his labo-
atory results were as follows: white blood cell count,
4,700/μL (4,000-8,000/μL); hemoglobin level, 5.5 g/dL (12-18
g/dL); blood urea nitrogen level, 183.4 mg/dL (8-23 mg/dL);
serum creatinine level, 26.61 mg/dL (0.5-1.3 mg/dL); serum
sodium level, 136 mEq/L (136-146 mEq/L); serum osmolality,
Table 1. Laboratory results of the patient before and after 3 times dialysis

| Variables                        | Before dialysis | After dialysis |
|----------------------------------|-----------------|----------------|
| BUN (8-23 mg/dL)                 | 183.4 mg/dL     | 40.6 mg/dL     |
| Serum creatinine (0.5-1.3 mg/dL) | 26.61 mg/dL     | 8.64 mg/dL     |
| Serum phosphate (2.5-5.5 mg/dL)  | 19.3 mg/dL      | 4.3 mg/dL      |
| Serum total calcium (8.4-10.2 mg/dL) | 4.3 mg/dL     | 6.8 mg/dL      |
| WBC (4,000-8,000/μL)             | 4,700/μL        | 7,900/μL       |
| Hemoglobin (12-18 g/dL)          | 5.5 g/dL        | 8.1 g/dL       |
| Na (136-146 mEq/L)               | 136 mEq/L       | 137 mEq/L      |
| Serum osmolality (280-295 mOsm/Kg) | 349 mOsm/Kg   | 285 mOsm/Kg    |
| Cl (98-110 mEq/L)                | 95 mEq/L        | 99 mEq/L       |
| pH (7.35-7.45)                   | 7.27            | 7.391          |
| HCO3 (21-28 mmol/L)              | 12.6 mmol/L     | 23.4 mmol/L    |

Abbreviations: BUN, blood urea nitrogen; WBC, white blood cell; Na, sodium; Cl, chloride.

in the course of SDH.

On day 3 after admission, the femoral catheter was discontinued and a tunneled dialysis catheter was inserted via the right jugular vein for maintenance of hemodialysis. Two tablets of calcium acetate (710 mg) were administered three times a day for treatment of hyperphosphatemia and hypocalcaemia, with combined calcium and cholecalciferol (100 mg/1,000 IU) twice daily for treatment of hypocalcaemia and vitamin D deficiency. Olmesartan, amlodipine, and hydrochlorothiazide (40 mg/10 mg/12.5 mg) were also initiated as combination therapy, along with carvedilol, at 32 mg, all administered once daily for blood pressure control. Supplements of vitamin B and C were provided once a day, and ferrous sulfate (80 mg as iron), two tablets per day, was also administered.

The final clinical diagnosis was end-stage renal disease (ESRD) with severe hyperphosphatemia, with SDH secondary to uremic bleeding. The patient’s general condition and laboratory results improved following dialysis, including creatinine, phosphate, and calcium levels (Table 1). Strict dietary restriction was implemented, and patient education was provided to the patient to prevent hyperphosphatemia and hyperkalemia. The timeline of the patient’s clinical course is shown in Figure 2.

All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee(s) and with the Helsinki Declaration (as revised in 2013). Written informed consent was obtained from the patient for publication of this manuscript and any accompanying images.

**DISCUSSION**

We presented a case of severe hyperphosphatemia in a patient with advanced CKD with poor clinical and lifestyle adherence. The patient should have started dialysis several months ago, but refused therapy and self-medicated with honey and persimmon vinegar for 3 weeks under the false impression of its detoxifying effects. One hundred grams of persimmon contains 17 mg phosphorus, while both honey and vinegar are also rich in phosphorus10). It is recommended to limit dietary phosphate intake in those with CKD stages 3 to 5 and to initiate dietary counseling at these stage10). In addition, in patients with advanced CKD, complex treatment using drugs that include phosphate binders, calcitriol, and active vitamin D analogs is important. In previous papers, hyperphosphatemia (16.5 mg/dL) was reported...
in hemodialysis patient undergoing hemicolectomy surgery and not taking phosphate binder\textsuperscript{11}. In another paper, hyperphosphatemia (17.9 mg/dL) caused by sodium phosphate enema in patient with CKD and liver cirrhosis was reported\textsuperscript{12}. To our knowledge, this report is the highest level with hyperphosphatemia in patients with CKD.

Maintaining phosphate balance is critical for CKD patients. Phosphate is required for cell metabolism, bone structure, and protein synthesis\textsuperscript{6,13}. About 60-80\% of the dietary phosphate is absorbed by the intestine. Approximately 85\% of phosphate is in the bone in the form of crystalline calcium phosphate. Bone is an important regulator of phosphate homeostasis and can either release or absorb phosphate\textsuperscript{14}. FGF23, a phosphatonin produced by osteocytes and osteoblasts, promotes urine phosphate excretion and decreases the synthesis of 1,25-dihydroxyvitamin D (1,25(OH)\textsubscript{2}D)\textsuperscript{15}. Decreased 1,25(OH)\textsubscript{2}D levels, in turn, stimulate PTH secretion. The stimulation of FGF23 secretion appears to arise from increased serum 1,25(OH)\textsubscript{2}D levels and increased dietary phosphate intake. As CKD progresses, phosphate retention occurs, and phosphate homeostasis is maintained by FGF23 by increasing urinary phosphate excretion and decreasing gut phosphorus absorption. PTH also inhibits phosphate reabsorption in the renal proximal tubule. PTH and 1,25(OH)\textsubscript{2}D enhance the liberation of phosphate from bone.

In advanced CKD, mineral homeostasis fails due to an imbalance in phosphate intake and renal excretory capacity\textsuperscript{6,7}. Phosphate retention induces PTH secretion, and PTH levels are markedly increased. PTH, in turn, enhances bone resorption by releasing more phosphate. The resulting hyperphosphatemia contributes to the development of vascular calcification, and hyperphosphatemia is an independent risk factor for cardiovascular disease\textsuperscript{14,15}. Hyperphosphatemia also contributes to exacerbation of CKD\textsuperscript{7}.

Therefore, phosphate control is essential in CKD patients. Phosphate control not only prevents disease progression but also improves the patient’s quality of life. A multifaceted intervention, including dietary counseling, phosphate-lowering drugs, and lifestyle modification, should be provided to patients with CKD considering the extent of patients’ adherence to treatment goals. Our patient had poor adherence and had false beliefs in folk remedies, and eventually developed severe hyperphosphatemia with a serum phosphate level of 19.3 mg/dL. The patient improved with medication and dialysis.

In conclusion, phosphate control is essential for CKD patients at stages 3 to 5 of the disease. We suggest for advanced CKD patients to be provided multifaceted interventions, to prevent complications and slow disease progression. Adequate phosphate control can improve patient prognosis.

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