Serum Phosphorus Level and Pill Burden Are Inversely Associated With Adherence in Patients on Hemodialysis

Steven Wang, MS; Thomas Alfieri, PhD; Peter Braunhofer, MS; Britt Newsome, MD, MPH, MSPH

1DaVita Clinical Research, Minneapolis, MN, USA; 2Vifor Fresenius Medical Care Renal Pharma, Glattbrugg, Switzerland; 3Denver Nephrology, Denver, CO, USA

Introduction

• Mineral and bone disorders are a serious problem among hemodialysis (HD) patients.
• Markers of mineral and bone disorders, including hyperparathyroidism, hypercalcemia, and secondary hyperparathyroidism, have been associated with increased risk of hospitalization and mortality.1
• The National Kidney Foundation Kidney Disease Outcomes Quality Initiative (NKF-KDOQI)2 specifies that serum phosphorus levels should be maintained in the 3.5-5.5 mg/dL range through dietary restrictions and use of phosphate binder medications. However, only 41%-64% of dialysis patients are able to attain this target.

Methods

• Outcome variables assessed were mean MPR, mean phosphorus level, and percentage of patients in range were stratified by phosphate binder pill burden with adherence (as measured by MPR), serum phosphorus levels, and percent of patients in range were stratified by phosphate binder pill burden with adherence (as measured by MPR), serum phosphorus levels, and percent of patients in range were stratified by phosphate binder pill burden and MPR.

Results

• A total of 8,616 patients with order information in the pharmacy management program database were included in the analysis. Patient characteristics are presented in Table 1.

• MPR was calculated and stratified by patient pill burden (Figure 1). Overall, mean weighted MPR levels were low: from 0.51 in the group with the lowest pill burden (0-3 pill/day) to 0.42 in the group with the highest pill burden (>12 pill/day).

• Mean serum phosphorus levels were also negatively associated with MPR (p < 0.001, Figure 2).

• Within most pill burden strata, lower MPR was associated with a higher proportion of patients achieving KDOQI target phosphorus levels (Figure 3).

Conclusions

• Data on phosphate binder use from an LDO pharmacy management program show that overall MPR is low (0.42-0.51), and that MPR increases as pill burden decreases, supporting the hypothesis that lower pill burden is associated with higher adherence.

• Patients with higher MPR tended to have lower phosphate laboratory values and were more likely to achieve KDOQI targets for serum phosphorus levels.

• Phosphate binders with lower pill burden may therefore help improve patient compliance and phosphorus control.

References


Acknowledgments

We extend our sincere appreciation to the healthcare providers in more than 1,800 DaVita clinics who work every day to take care of patients and also to ensure the extensive data collection on which our work is based. We also thank DaVita Clinical Research (DCR), and specifically acknowledge Ali Al-Hamli, PhD, of DCR for editorial contribution in preparing this poster. DCR is committed to advancing the science and practice of kidney care.

This study was funded by Vifor Fresenius Medical Care Renal Pharma. Correspondence: Steven Wang@daivita.com

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National Kidney Foundation Spring Clinical Meetings, 24-26 April 2013, Orlando, FL

Table 1: Patient Characteristics

<table>
<thead>
<tr>
<th>Race/Ethnicity</th>
<th>N</th>
<th>Mean ± SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>White</td>
<td>3,875</td>
<td>45.0%</td>
</tr>
<tr>
<td>Black</td>
<td>1,327</td>
<td>15.0%</td>
</tr>
<tr>
<td>Hispanic</td>
<td>1,327</td>
<td>15.0%</td>
</tr>
<tr>
<td>Asian</td>
<td>1,252</td>
<td>15.0%</td>
</tr>
<tr>
<td>Native American or Alaskan</td>
<td>64</td>
<td>0.7%</td>
</tr>
<tr>
<td>Native Hawaiian or Pacific Islander</td>
<td>87</td>
<td>1.0%</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Primary Cause of End-Stage Renal Disease</th>
<th>N</th>
<th>Mean ± SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Diabetic Kidney Disease</td>
<td>2,785</td>
<td>44.4%</td>
</tr>
<tr>
<td>Hypertensive Kidney Disease</td>
<td>2,782</td>
<td>43.2%</td>
</tr>
<tr>
<td>Other/Etiology</td>
<td>1,567</td>
<td>33.7%</td>
</tr>
<tr>
<td>Polycystic Kidney Disease</td>
<td>192</td>
<td>2.2%</td>
</tr>
</tbody>
</table>

Figure 1: Weighted MPR Stratified by Pill Burden

Figure 2: Mean Phosphorus Levels Stratified by MPR

Figure 3: Mean Phosphorus Levels and Percentage of Patients with Phosphorus in Target Range by Pill Burden and MPR

Methods

• Patients were ≥18 years old, Medicare recipients on phosphate binder monotherapy, receiving in-center HD ≥3 times per week, continuously enrolled in the LDO pharmacy management program. The study period was 1 January 2007 to 30 June 2011.

• Patients were excluded if they were receiving peritoneal dialysis, home HD, or nocturnal HD or were enrolled in the automatic refill system for phosphate binders, were receiving the powder or sachet formulation of sevelamer; or had serum phosphorus levels ≥3.0 mg/dL.

• Patients were followed from first phosphate binder prescription fill for 1 year or until a censoring event occurred. Patients were censored on switching phosphate binder type, phosphorus levels <3.0 mg/dL, discontinuing HD, or death.

• MPR was defined as:

   \[
   \text{MPR} = \frac{\text{Number of Days in Order Period}}{\text{Days of Medication Available}}
   \]

   Where MPR = 1.0 is optimal (most adherent) and MPR of 0 is worst (least adherent).

   Days of Medication Available was calculated as (number of days of medication supplied in the period) - (number of days of medication left over at end of period).

• Outcome variables assessed were mean MPR, mean phosphorus level, and percentage of patients in phosphate binder range (0.5 mg/dL). Mean MPR was stratified by pill burden, while mean phosphorus level and percent of patients in range were stratified by phosphate binder pill burden and MPR.

• General Linear Models (GLM) were used to assess associations between strata and outcome variables. Mean phosphorus levels and percent of patients in range were stratified by phosphate binder pill burden with adherence (as measured by MPR), serum phosphorus levels, and percent of patients in range were stratified by phosphate binder pill burden and MPR.

Objective

This retrospective, observational analysis assessed the association of phosphate binder pill burden with adherence (as measured by MPR), serum phosphorus levels, and serum phosphorus goal attainment in patients of a large dialysis organization (LDO) in the US.