1.0 PRACTICE STANDARD

To provide guidelines to the healthcare providers as to when and how to supplement the nightly nocturnal hemodialysis prescription with additional calcium.

The healthcare providers will review patient’s blood work and under the direction of the nephrologist will determine the management plan for calcium metabolism management.

The registered nurse educators will have the necessary knowledge and skills to perform and teach the protocol competently.

The patient will demonstrate an understanding of the procedure, and have documentation included on the chronic dialysis clinic chart confirming successful certification in this procedure.

2.0 DEFINITIONS AND ABBREVIATIONS

Extended Duration Hemodialysis is defined as equal to or greater than 24 hours of hemodialysis treatment time per week irrespective of frequency of treatments and/or duration of each treatment time.

Calcium – Ca; [Ca++] ionized calcium formula
Calcium Chloride – CaCl₂
Phosphate – PO₄
Parathyroid – PTH

3.0 EQUIPMENT

- CaCl₂ powder as ordered by nephrologist
  - 7.45 g/L vial equivalent to an addition of 0.25 mmol/L per 4.5 L jug of dialysate
  - 14.8 g/L vial equivalent to an addition of 0.5 mmol/L per 4.5 L jug of dialysate
- 4.5 L acid dialysate jug as ordered by nephrologist
- Calibrated measuring cup
## 4.0 PROCEDURE & RATIONALE

<table>
<thead>
<tr>
<th><strong>PROCEDURE</strong></th>
<th><strong>RATIONALE</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>1.</strong></td>
<td><strong>Target range for pre-dialysis serum calcium level is between 2.3 – 2.6 mmol/L.</strong></td>
</tr>
<tr>
<td><strong>2.</strong></td>
<td><strong>Discharge extended duration hemodialysis patients on a 1.5 mmol/L calcium baths as the ‘baseline’ calcium bath or as appropriate for that patient.</strong></td>
</tr>
<tr>
<td><strong>3.</strong></td>
<td><strong>Laboratory testing should utilize total calcium levels.</strong></td>
</tr>
<tr>
<td><strong>4.</strong></td>
<td><strong>As a correction factor for determining total calcium, add 0.2 mmol/L to measured calcium for each 10 g/L drop in albumin below 40 g/L. No correction factor is required for albumins in excess of 40 g/L.</strong></td>
</tr>
<tr>
<td><strong>5.</strong></td>
<td><strong>Calcium, phosphate, and albumin levels should be drawn simultaneously.</strong></td>
</tr>
<tr>
<td><strong>6.</strong></td>
<td><strong>If pre-dialysis calcium remains below 2.3 mmol/L despite Ca bath 1.5 mmol/L, consider the addition of a vitamin D analogue to promote calcium (and phosphate) absorption from GI tract, in consultation with the nephrologist and the dietitian. Repeat levels 1 week after addition of vitamin D analogue.</strong></td>
</tr>
<tr>
<td><strong>7.</strong></td>
<td><strong>If despite the addition of vitamin D analogue to the dialysate calcium bath of 1.5 mmol/L the pre-dialysis calcium remains below 2.3 mmol/L, consider adding oral calcium supplementation using CaCO₃ on empty stomach. Repeat levels of calcium, phosphate and albumin after 1 week.</strong></td>
</tr>
<tr>
<td><strong>8.</strong></td>
<td><strong>If pre-dialysis total calcium levels are below 2.3 mmol/L despite the use of a vitamin D analogue, oral calcium supplementation and the use of a 1.5 mmol/L calcium dialysate bath, commence calcium supplementation into the dialysate.</strong></td>
</tr>
</tbody>
</table>
### 4.0 PROCEDURE & RATIONALE

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<tr>
<td>9. Recommended initial dose of CaCl₂ additive is ½ of a 7.45 g/L vial calcium ‘spike’ added to 4.5 L dialysate acid concentrate jug (to raise [Ca²⁺] by 0.125 mmol/L).</td>
<td>To permit cautious achievement of the target calcium levels, as noted above.</td>
</tr>
<tr>
<td>10. Repeat pre-dialysis calcium levels 1 week following initiation of supplementation.</td>
<td>To assess levels and monitor for calcium levels outside of target range (above or below target limits).</td>
</tr>
<tr>
<td>11. If within target range, continue with same amount of additive to every dialysis treatment.</td>
<td>To maintain Ca levels within target range.</td>
</tr>
<tr>
<td>12. If after supplementation as noted in item #9 the blood calcium level remains below target range, repeat steps 9–10, until within target range. Then proceed to #13 below.</td>
<td>To achieve target calcium levels.</td>
</tr>
<tr>
<td>13. When within target range, continue with same volume of CaCl₂ additive every dialysis treatment.</td>
<td>To maintain Ca levels within target range.</td>
</tr>
<tr>
<td>14. Chronic monitoring of pre-hemodialysis calcium, phosphate and albumin levels should be performed with monthly blood testing.</td>
<td>To maintain Ca levels within target range.</td>
</tr>
</tbody>
</table>

### 5.0 DOCUMENTATION CONSIDERATIONS

2. Document ‘Independent Hemodialysis Calcium Additive’ changes in the Doctor’s Orders sheet on the permanent hemodialysis record.
3. Process as per other medication and dialysis prescription orders. Ensure the correct amount is recorded and updated on the patient Kardex, and in the hemodialysis treatment field in PROMIS database.
4. Document patient’s response to treatment, as reported by the patient.
5. Document communications with nephrologist.
6. Notify equipment vendor of additives to concentrates, to allow for adjustment of machine conductivity limits, if needed.
6.0 SPECIAL CONSIDERATIONS

In the treatment of patients on chronic hemodialysis, abnormalities in both calcium and phosphate metabolism are very common and are interrelated. Phosphate management is covered in a separate clinical guideline.

In patients on dialysis, abnormalities of calcium levels can be either that the serum calcium level is too low (hypocalcemia), or too high (hypercalcemia). Calcium derangements are due to many factors, including alteration in vitamin metabolism (i.e. vitamin D deficiency), alteration in hormonal functions (i.e. altered parathyroid hormone homeostasis), and changes caused by medications (i.e. calcium-containing phosphate binders).

With the extended duration hemodialysis protocols the spectrum of observed calcium abnormalities changes. This is because of changes in the dietary consumption, the dialysis prescription, the medication requirements (i.e. elimination of phosphate binders), and normalization of the hormonal milieu (i.e. suppression of PTH). Additionally, the weekly volume of ultrafiltrate is often significantly increased. As each litre of ultrafiltrate is a balanced electrolyte solution, there is the potential for significant ultrafilterative calcium losses. Failure to account for this will result in a negative calcium balance over time.

Despite the higher calcium targets endorsed for patients receiving extended duration hemodialysis, the risk of extra-osseous calcification appears to be reduced, due to an overall improvement in the CaP product (primarily because of an improvement in phosphate levels). The risk of vascular calcification in nightly nocturnal hemodialysis is not known at this time, and is the source of ongoing research.

7.0 REFERENCES


National Kidney Foundation Dialysis Outcomes Initiative [KDOQI Guidelines].


8.0 DEVELOPED BY

Home Hemodialysis Educators
Renal Educators

9.0 REVIEWED BY

Provincial Medical Director, Home Hemodialysis Program
Home Hemodialysis Educators
Renal Dietitians

10.0 ENDORSED BY

BCPRA Provincial Medical Advisory Committee (June 2013)

Disclaimer: The procedure steps may not depict actual sequence of events. Patient/client/resident specifics must be considered in applying IAMHD Home Hemodialysis Clinical Practice Standards and Procedures.