

Calcium Additive Guideline for Patients Receiving Nightly Nocturnal Hemodialysis

IAMHD Home Hemodialysis Clinical Practice Standards and Procedures

Section: HHD

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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 dose of Calcium to be added to the patient's Dialysate.

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

Nightly Nocturnal Hemodialysis is defined as five (5) or more treatments per week, of a duration of at least 6 hours per treatment (totalling a minimum of 30 hours per week of dialysis)

Calcium – Ca; $[Ca^{++}]$ ionized calcium formula

Calcium Chloride – $CaCl_2$

Phosphate – PO_4

Parathyroid – PTH

3.0 EQUIPMENT

- $CaCl_2$ powder as ordered by Nephrologist
 - 7.45 g/L vial equivalent to an addition of 0.25 mmol/L per 4.5L jug of dialysate
 - 14.8 g/L vial equivalent to an addition of 0.5 mmol/L per 4.5L jug of dialysate
- 4.5L Acid Dialysate jug as ordered by Nephrologist
- Calibrated measuring cup

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4.0 PROCEDURE

RATIONALE

1.	Consider low dose vitamin D analogue to promote calcium (and phosphate) absorption from GI tract, in consultation with the Nephrologist and the dietitian.	Nightly Nocturnal hemodialysis provides an opportunity for the patient to improve their diet, reducing the need to alter the HD treatment.
2.	Consider discharging Nightly Nocturnal Hemodialysis patients on a 1.5 mmol/L calcium baths as the 'baseline' calcium bath or as appropriate for that patient.	In Nightly Nocturnal hemodialysis, the efficiency of the dialysis should reduce the need to remove extra calcium from the patients' blood and may require the addition of extra Ca to avoid negative calcium balance.
3.	Laboratory testing should utilize total calcium levels.	Due to technical difficulties obtaining ionized calcium in a home hemodialysis patient.
4.	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.	To obtain the equivalent to ionized calcium. We recognize that there are other formulae available to correct the calcium, but this formula is simple and relatively reliable. Programs may opt to use another formula, which is reasonable, provided all providers use the same formula consistently.
5.	Calcium, Phosphate, and Albumin levels should be drawn simultaneously.	To ensure validity of the calcium levels, the albumin level at the time the Ca is drawn is required.
6.	Liberalize dietary calcium intake (in consultation with a renal dietitian) when pre-dialysis calcium level (total) falls below 2.3 mmol/L, or post-dialysis calcium levels fall below 2.5 mmol/L.	To reduce the amount of calcium needed to be added to the Dialysate. In extended dialysis the efficiency of the dialysis should reduce the need to remove extra calcium from the patients' blood.
7.	Calcium supplementation should be considered to maintain the following parameters: a. Pre-dialysis calcium level should be in the upper limit of the normal range (i.e. total calcium level pre-dialysis of 2.3 – 2.6 mmol/L) b. Post-dialysis calcium level should be in the mildly hypercalcemic range (i.e. total calcium level post-dialysis of 2.5 – 2.8 mmol/L).	Currently there are no published guidelines for calcium targets in the Nightly Nocturnal Hemodialysis patient. However, due to risk of negative calcium balance with ultrafiltrative losses with this modality result in an opinion based recommendation to increase calcium targets. This opinion has been reviewed by Nightly Nocturnal Hemodialysis programs in both Canada and the USA, and has been endorsed by most programs.
8.	If pre- and post-dialysis total calcium levels are below the ranges indicated in #7 above, commence calcium supplementation into the dialysate.	Addition of Calcium into the dialysate is the preferred method to achieve calcium targets, as this ensures systemic absorption of calcium. Oral supplementation is unpredictable with respect to calcium absorption.

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9.	Recommended initial dose of CaCl ₂ additive is ½ of a 7.45 g/L vial calcium ‘spike’ added to 4.5 L dialysate acid concentrate jug (to raise [Ca ⁺⁺] by 0.125 mmol/L).	To permit cautious achievement of the target calcium levels, as noted above.
10.	Repeat pre- and post-dialysis calcium levels 1 week following initiation of supplementation.	To assess levels and monitor for calcium levels outside of target range (above or below target limits).
11.	If within target range, continue with same amount of additive to every dialysis treatment.	To maintain Ca levels within target range.
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.	To achieve target calcium levels.
13.	When within target range, continue with same volume of CaCl ₂ additive every dialysis treatment.	To maintain Ca levels within target range.
13.	Chronic monitoring of pre- and post-hemodialysis calcium levels should be performed with monthly blood testing.	To maintain Ca levels within target range.

5.0 DOCUMENTATION CONSIDERATIONS

1. Document ‘Certification of Competence’ for the patient in the permanent hemodialysis record.
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 with End-Stage Kidney Failure, on chronic hemodialysis, abnormalities in both calcium and phosphate metabolism are very common. 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 increased dose of dialysis, particularly in patients receiving Nightly Nocturnal Hemodialysis, the spectrum of observed calcium abnormalities changes. This is because of changes in the dietary consumption, the dialysis prescription, in 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 increases (assuming minimum UFR 0.3 L/hour x 8 hours x 5 times per week = 12 L ultrafiltration per week). Each litre of ultrafiltrate is a balanced fluid, and hence the clearance of calcium (assuming total serum calcium = 2.4 mmol/L) is 28.8 mmols. Failure to account for this will result in a negative calcium balance over time, and must be compensated for.

Despite the higher calcium targets used for patients receiving Nightly Nocturnal Hemodialysis, the risk of extra-osseous calcification appears to be reduced, due to an overall improvement in the CaxP 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

Daugirdas, J., Blake, P., & Ing, T., (Eds.). (2001). *Handbook of Dialysis*. Lippincott, Williams & Wilkins, NY.

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

10.0 ENDORSED BY

BCPRA Provincial Medical Advisory Counsel (June 2009)
Provincial IAMHD Program Operations Group (Spring 2009)

¹Disclaimer: The procedure steps may not epic actual sequence of events. Patient/Client/Resident specifics must be considered in applying Interior Health Clinical Practice Decision Support Tools.