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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 phosphate.

The Healthcare Providers will review patient's blood work and under the direction of the Nephrologist will determine the dose of phosphate 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 - CaCl₂

Phosphate – PO₄

Parathyroid – PTH

3.0 EQUIPMENT

- Sodium Phosphate enema aqueous solution
 - Each 15 cc of Sodium Phosphate Enema aqueous solution contains 20.7 mmol of PO₄³⁻, and will therefore raise phosphate concentration to 4.6 mmol/L when added to 4.5 L jug of acid dialysate solution
- Calibrated measuring cup

4.0 PROCEDURE

RATIONALE

1.	Sequentially eliminate phosphate binders when pre-dialysis phosphate levels fall below 1.4 mmol/L, or post-dialysis phosphate levels fall below 1 mmol/L.	Efficiency of Nightly Nocturnal Hemodialysis is associated with substantially increased phosphate clearance, thereby reducing total body phosphate load.
2.	Liberalize dietary phosphate intake, in consultation with a renal dietitian, when pre-dialysis phosphate levels fall below 1.4 mmol/L, or post-dialysis phosphate levels fall below 1 mmol/L.	Efficiency of Nightly Nocturnal Hemodialysis is associated with substantially increased phosphate clearance, allowing a less restricted phosphate diet.
3.	Laboratory testing should include pre- and post-phosphate levels.	Goal is to achieve an appropriate phosphate balance, with both pre- and post-dialysis target ranges.
4.	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. Simultaneous measurements allow adjustments to be made accounting for both calcium and phosphate variables
5.	Initiate phosphate supplementation if, despite implementation of (1) and (2) pre-dialysis phosphate levels remain at or below 1.2 mmol/L, or post-dialysis phosphate levels remain at or below 0.8 mmol/L.	Hypophosphatemia is associated with significant risks, including muscle cramping and bone disease.
6.	Start Phosphate supplementation by adding 15 mL (= 20.7 mmol) of Sodium Phosphate Enema aqueous solution to a full 4.5 litre dialysate acid concentrate jug, to raise concentration in dialysate jug to 4.6 mmol/L).	Phosphate supplementation may not be achievable by dietary modification alone. Addition of Phosphate into the dialysate is the preferred method to achieve phosphate targets, as this ensures systemic absorption of phosphate. Oral supplementation is unpredictable with respect to phosphate absorption.
7.	Target levels for Phosphate are as follows: Pre-dialysis : 1.2 – 1.6 mmol/L Post-dialysis: 0.8 – 1.0 mmol/L	To maintain phosphate levels within safe and physiological ranges.
8.	Measure pre- and post-dialysis phosphate levels 1 week following initiation of supplementation. May need to do blood levels sooner if any symptoms of hypophosphatemia appear.	To assess levels and monitor for phosphate levels outside of target range (above or below target limits).

Phosphate Additive Guideline for Patients Receiving Nightly Nocturnal Hemodialysis

9.	If measurement in #7 is below target range, increase Sodium Phosphate Enema aqueous solution by 15 mL (=20.7 mmol) to full 4.5 litre dialysate acid concentrate jug, and repeat pre- and post-dialysis bloodwork 1 week later.	To assess levels and monitor for phosphate levels outside of target range (above or below target limits).
10.	Continue to titrate phosphate supplementation in same manner – addition of another 15ml (= 20.7 mmol) of Sodium Phosphate Enema aqueous solution to a full 4.5 litre dialysate acid concentrate jug, and repeat pre- and post-dialysis bloodwork 1 week later until target levels are achieved.	To assess levels and monitor for phosphate levels outside of target range (above or below target limits).
11.	When target range is achieved, continue with same volume of Sodium Phosphate Enema aqueous solution with every dialysis treatment. Exception is for first run after day without dialysis as pre-dialysis phosphate may have accumulated.	To assess levels and monitor for phosphate levels outside of target range (above or below target limits). Due to enhanced dietary phosphate, and elimination of phosphate binders, phosphate may re-accumulate if dialysis treatments missed.
12.	Chronic monitoring of pre- and post-hemodialysis calcium and phosphate levels should be performed with monthly blood testing.	To assess levels and monitor for phosphate levels outside of target range (above or below target limits), and avoid consequences of unrecognized hyper- or hypophosphatemia.

5.0 DOCUMENTATION CONSIDERATIONS

1. Document “Certification of Competence” for the patient in the permanent training record.
2. Document “Independent Hemodialysis Phosphate Addition Guideline” changes in Doctors Orders sheet on the permanent hemodialysis record.
3. Process, as per other medication orders. Ensure the correct amount is recorded on the patients Kardex and in the HD treatment field in PROMIS.
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, there is a tendency to retain phosphate, despite aggressive dietary counselling (and adherence). Control of hyperphosphatemia is important for a variety of reasons, including bone health and normalization of parathyroid gland activity. Additionally, it is being recognized that hyperphosphatemia, as well as some of the interventions used to control phosphate levels may contribute to the accelerated vascular disease which is so prevalent amongst patients on dialysis.

Phosphate Additive Guideline for Patients Receiving Nightly Nocturnal Hemodialysis

With conventional (thrice weekly) hemodialysis, the weekly clearance of phosphate by the dialysis circuit is inadequate to maintain a neutral phosphate balance. As such, measures that restrict the food choices (to minimize phosphate intake), and the use of phosphate binders (to bind with free phosphate in the GI tract to inhibit absorption) are often required.

With Nightly Nocturnal Hemodialysis, phosphate removal by the dialysis procedure is dramatically increased. In many patients, the degree of phosphate clearance is such that dietary restrictions and phosphate binding medications are reduced or eliminated. Despite these manoeuvres, there remains the risk of phosphate depletion with these treatments, which can contribute to musculoskeletal symptoms (cramping, weakness), and potentially overtime contribute to renal osteodystrophy. To avoid hypophosphatemia, supplemental phosphate may need to be considered for patients receiving nocturnal hemodialysis.

Oral supplementation with phosphate is challenging, and results in an unpredictable absorption of the phosphate. It may also be associated with side effects, including abdominal complaints such as diarrhoea. Intravenous supplementation is complicated, and should be done in a supervised setting.

Given this, phosphate supplementation through the dialysate fluid (in the form of Sodium Phosphate Enema aqueous solution) will be added in the setting of hypophosphatemia, defined as level <0.8 mmol/L either pre- or post-dialysis treatment, after the following conditions have been met:

1. Sequential discontinuation of phosphate binders
2. Dietary counselling about ways to enhance phosphate intake via liberalization of dietary choices
3. Documentation indicating that the liberalized diet has been attempted by patient.

The phosphate supplementation will be gradually titrated to achieve pre- and post-dialysis phosphate targets. The recommended target range for phosphate levels in Nightly Nocturnal Hemodialysis patients are as follows:

- Pre-dialysis: Phosphate levels of 1.2 – 1.6 mmol/L
- Post-dialysis: Phosphate levels of 0.8 – 1.0 mmol/L

Once phosphate levels are within target range, monthly bloodwork monitoring (pre- and post-dialysis) is recommended.

Patients receiving Nightly Nocturnal Hemodialysis appear to have a reduced risk of extra-osseous calcification when compared to conventional hemodialysis patients. This is despite higher calcium targets (please see "Calcium Additive Guideline). The reduced risk appears to be 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).

Gutzwiller, J. et al. (2002) Estimating phosphate removal in haemodialysis: an additional tool to quantify dialysis dose. *Nephrology Dialysis and Transplantation*, 17(6), 1037-1044.

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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