TUN Directorate Home Therapies Department

Nocturnal Home Haemodialysis Policy

Document Number: 37	Reason for Change: New Guideline
Original Date of Approval: N/A	Originally Approved By: N/A
Recent Date of Approval: September 2012	Approved By: Renal Guideline Committee
Date Effective From: September 2012	Superseded Documents: Nil
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SECTION 1

1.0 Introduction

The Home Haemodialysis Programme was re-established at Beaumont Hospital in 2009 and following its success Nocturnal Home Haemodialysis is now being included in the programme.

All nurses working in Beaumont Hospital and caring for Home Haemodialysis patients will follow this policy.

Aim/Purpose of the Guidelines

These guidelines inform all staff working within the home therapies department on how to set up a patient at home on nocturnal home haemodialysis treatment. This type of dialysis is considered the most effective form of haemodialysis, and has been shown to improve quality of life and reduce complications. This document is based on the best available evidence and has been developed to optimise patient care and to standardise Nocturnal Home Haemodialysis nursing practice.

1.2 Scope of Guidelines

These guidelines apply to all staff working within the TUN directorate in Beaumont Hospital who are involved in the care of patients who are on home dialysis treatment.

Section 2

2.0 Definitions

Nocturnal home haemodialysis (NHD) is an intensive renal replacement therapy that provides prolonged treatment duration in the home environment. It is self-administered for 6-8 hours on 3-7 nights per week, providing between 30 and 45 hours of dialysis. interest in this method of dialysis is increasing due to the growing body of evidence demonstrating the numerous physiological benefits associated with it.

It has been shown that nocturnal dialysis given 5 to 6 times per week appears to remove the need for phosphorus binders, adequately controls phosphorus levels in almost all patients, and often requires the addition of phosphorus to the dialysate to prevent hypophosphatemia (Pierratos 2005). In a six month randomized trial (n=51) comparing frequent nocturnal haemodialysis (5-6 times/week) to conventional haemodialysis (3 times/week), researchers reported that frequent nocturnal haemodialysis improved left ventricular mass, reduced the need for blood pressure medications, improved some measures of mineral metabolism and improved selected health-related quality of life measures. Anemia control was not affected by nocturnal haemodialysis (Culleton, 2007).

Pauly (2010) also lists the following benefits with nocturnal haemodialysis:

- Better blood pressure management with less need for blood pressure medications.
- Avoidance of intradialytic hypotension (i.e. low blood pressure during dialysis).
- More energy and less 'wash-out' after treatment.
- Decreased prevalence of sleep apnea or improvement in severe cases of sleep apnea.
- Less expensive overall for the health system due to lower rates of hospitalisation and savings on nursing.
- Less dietary restrictions—*e.g.,* phosphate binders, renal failure food restrictions.
- More control over the dialysis treatment schedule and greater life satisfaction.

2.1 Roles and Responsibilities

(Please see Beaumont Home Haemodialysis Policy)

- It is the responsibility of the lead nurse to provide education to nurses working in the Home Therapies Unit and to maintain an up to date list of nurses who have done so.
- It is the responsibility of the lead nurse to provide education to nurses working in the acute and maintenance haemodialysis units on the procedure to follow when issues arise out of hours with patients on Nocturnal Home Haemodialysis.
- It is the responsibility of the nurse to make a judgement as to whether he/she is competent to carry out Home Haemodialysis. The nurse should review his/her practice on a regular basis, thereby maintaining a high level of skill through regular practice. Each nurse is accountable for ensuring that his/her skill and competence is maintained (An Bord Altranais).
- It is the responsibility of the home therapies nurse to ensure she/he adheres to the renal policies that are relevant to the care of a haemodialysis patient i.e. Haemodialysis treatment guidelines, anti-coagulation guidelines, the management of the AVF/CVC etc.

2.2 Principles

The Department of Nephrology, Dialysis and Transplantation has a responsibility to ensure hospital guidelines are developed where appropriate and implemented effectively. It is intended as a guideline towards best practice for all members of the multidisciplinary team involving the care of nocturnal home haemodialysis patients.

Section 3

3.0 Inclusion Criteria

- The candidate should be successfully on the home haemodialysis programme for at least one year before being considered, in consultation with the nephrologist, for NHD.

- The candidate should have a stable medical condition, be stable on home haemodialysis, and have displayed excellent compliance with the home dialysis programme.

- Vascular access should preferably be by AVF but CVC access will be considered.

- Patients must be settled in their home with no plans of moving house.

- They must have a stable home environment with adequate water, power and space in their house.

- The candidate should be confident in the therapy and need to accept responsibility for their own treatment.

3.1 Site Preperation

- The home therapies nurse in conjunction with the patient and company technician will decide on the best room for the nocturnal dialysis, if it differs from the original set-up.

- The company supplying equipment and back-up should be informed of potential NHD candidates in advance to allow them time to assess changes to HD machines settings that will be required once the patient goes on.

- This includes the company Home Haemodialysis Nurse Advisor, company technicians, and the company support services.

3.2 Equipment for the Home

Equipment for NHD is essentially the same as for home haemodialysis with the addition of the following (all supplied by the company):

- A blood leak detector unit and sensor patches for each candidate.
- A supply of phosphate enemas due to the potential need to add phosphate (Appendix 1) to the dialysate concentrate bag.
- Anti-coagulation must be in the form of a Heparin infusion due to the increased length of treatment time (Appendix 2).
- Specific dressings are also required to prevent needle dislodgement.

All equipment should be demonstrated to the patient and a patient competency form completed for each new step (Appendix 3 and 4). The home therapies nurse should preform the initial order and the patient can follow on.

3.3 Patient Education and NHD Process

1. The patient should be trained within the hospital home therapies unit. They should be assessed medically before training and during training if required. Dietetic input is also essential.
2. Training should comprise of at least a minimum of three days for six to eight hours per day, in consultation with the medical team. This is to assess bloodwork pre and post each dialysis in terms of phosphate, calcium, potassium, and coagulation, and will form the basis for the need for addition of components to the dialysis concentrate or change of anti-coagulation.
3. Blood pressure and weight should be taken pre and post treatment.
4. Initially full bloods should be taken before NHD training, and depending on results addition of phosphate may be required.
5. If evidence of clotting review anti-coagulation.
6. The patient must be shown the blood detector device and be competent in its use before discharge. It must be stressed the importance of using it every treatment to prevent blood loss.
7. Dialysate flow rate should be set at 300mls/min and blood flow should not exceed 200mls/min.
8. The patient should be competent and confident within the unit before being signed off for NHD at home. The general rules of home dialysis

apply that if feeling unwell or have a low blood pressure they should inform the unit immediately and hold off on treatment.

9. The Home Haemodialysis–Treatment Parameters Form specifying individual patient parameters must be completed and kept in patients' files.
10. The home therapies nurse should visit the patient at least within the first week at home to assess the home situation.

3.4 Ongoing Assessment of the NHD Patient

- 2-3 monthly home visits should continue for the NHD patient. This can be extended depending on an individual basis.

- The patient must keep a written record of their treatment including pre and post blood pressures and weights, and ultrafiltration rates as before on home haemodialysis.

- The health care provider should provide 24 hour cover for technical issues and the home therapies unit should provide phone assistance. Patients should always be advised to attend their local Emergency Department in an emergency, and if non-emergency issues arise overnight treatment should be discontinued and the unit contacted the following morning.

- Bloods should be sent to the home therapies department on a weekly basis

  PRE HD -2 brown spun bottles for U&E, LFT's, Ferritin, Iron Studies, CPM, Corrected Calcium, Protein and Albumin and one FBC bottle for Haemoglobin.

  POST HD -1 brown spun bottle for post urea and post corrected calcium and phosphate (including albumin).

SECTION 4

REFERENCE DOCUMENTS:

Culleton BF, Walsh M, et al. Effect of frequent nocturnal hemodialysis vs conventional hemodialysis on left ventricular mass and quality of life: a randomized controlled trial. JAMA. 2007;298(11):1291-9.

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Appendix 1 Phosphate Addition for Nocturnal Home Haemodialysis

1.0 PRACTICE STANDARD

- To provide guidelines to the Healthcare Providers as to when and how to supplement the nightly nocturnal haemodialysis prescription with additional phosphate.
- The Healthcare Providers will review patient's blood work and under the direction of the Nephrologists will determine the dose of phosphate to be added to the patient's Dialysate.
- The Home Dialysis staff 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 to explain the procedure.
- The patient will have supplementary training on the addition of phosphate to dialysate bags and will be deemed competent in the procedure by Home Dialysis staff prior to discharge.

2.0 DEFINITIONS AND ABBREVIATIONS

Nightly Nocturnal Haemodialysis 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 mls 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 bag of acid dialysate solution

Calibrated syringe

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.	Liberalise 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) predialysis 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).

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 bloods 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 postdialysis 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 predialysis 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 haemodialysis 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 nursing notes.
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 haemodialysis, 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.

With conventional (thrice weekly) haemodialysis, 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 Haemodialysis, 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 haemodialysis.

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 is 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 Haemodialysis 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 blood monitoring (pre- and post-dialysis) is recommended.

Patients receiving Nightly Nocturnal Haemodialysis appear to have a reduced risk of extra osseous calcification when compared to conventional haemodialysis patients. The risk of vascular calcification in Nightly Nocturnal Haemodialysis 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).

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Appendix 2

Anticoagulation

Contact with a foreign surface leads to clotting of blood, because of the activation of intrinsic pathways of platelets. Prevention of clotting is necessary for effective treatment. It enables the passage of blood through the dialyzer and prevents clotting of the dialyzer fibres. Clotted fibres reduce the effective surface area, and thus reduce dialysis efficiency or may result in significant blood loss.

Anticoagulation with heparin is the standard treatment utilized to prevent thombosis (clotting) in the extracorporeal circuit during the dialysis treatment.

A. IV ANTICOAGULATION

HEPARIN SODIUM

Heparin exerts its anticoagulant activity by reversibly binding to antithrombin III (AT III), accelerating the ability of AT III to neutralize thrombin and factor X. The undesired side effects of heparin include pruritus (itch), allergy, osteoporosis, hyperlipidemia, thrombocytopenia (heparin associated antibody formation), and excessive bleeding.

The half-life of heparin is approximately 30 – 120 minutes. Any problems with bleeding should be reported to the staff of the home hemodialysis unit. Consequently, the dose administered during the dialysis treatment may require adjustment.

Routine Heparin Dose:
Bolus - 1000 units (1ml)
Heparin Hourly Rate - 1000 units / hour (1ml / hour)

The bolus and/or hourly rate of heparin may be increased by 500 units (.5ml) if clotting of the circuit is noted.

Visualization of the circuit can best be accomplished by rinsing the system with **normal saline** solution. An undesired effect of utilizing this method to visualize

the circuit may be that a clot can be propelled into the dialyzer causing complete clotting of the system. Arterial and venous pressure readings may change as a result of clotting within the circuit depending on the location of the clot.

Signs of clotting in the extracorporeal circuit:

- Extremely dark blood
- Streaks in the dialyzer
- Foaming with subsequent clot formation in chambers
- Rapid filling of transducer monitors with blood
- Presence of clots at arterial or venous headers
- Arterial and/or venous pressure alarms
- Dialysate pressure alarms
- Transmembrane membrane pressure (TMP) alarm

Evaluation of clotting during routine heparinization:

A small incidence of inadvertent clotting in the circuit is expected and generally does not necessitate a change in heparin prescription. When clotting occurs it is useful to evaluate the likely cause. Often the underlying cause may be correctable. However, recurrent clotting warrants reevaluation and adjustments in heparin dosing.

Technical or Operator – Induced factors resulting in clotting:

Dialyzer Priming

- Retained air in dialyzer (due to inadequate priming or poor priming technique)
- Poor priming of the heparin line
- Air in the heparin syringe

Heparin Administration

- Incorrect heparin pump setting for constant infusion
- Incorrect bolus
- Delayed starting of heparin pump
- Heparin line kinked

Vascular Access

- Inadequate blood flow due to needle/catheter positioning or clotting
- Excessive access recirculation

- Frequent interruption of blood flow due to inadequate delivery or machine alarm complications

Factors that potentiate clotting of the extracorporeal circuit (Blood Lines):

- Low Blood Flow
- High Hemoglobin
- Dialysis Access Recirculation
- High Ultrafiltration Rate
- Intradialytic Blood Transfusion
- Drip chamber complications Air in chambers, foam formation, turbulence.

Appendix 3 and 4

A. Redsense Competency Form (Nocturnal Dialysis)

Competency	Date:	Date:	Date:	Date:	Date:	Date:	Date:	Date:	Date:	Date:
Patient is able to apply the Redsense sensor patch										
Understands the principles of the machine										
Can activate the alarm										
Patient aware when machine has alarmed and action plan										
The patient needles are secured well										
Patient has been given the manual to read										
Patient informed of charging the unit										

O=Observed, U= understands, D =Demonstrated, C=Competent

In our opinion an adequate level of understanding had been achieved in this section

Nurse Signature Print Name Date

Patient Signature Print Name Date

Competency Definition

-Patient is able to use the redsense unit safely and is able to secure the sensor patch correctly.

-The center of the patch should be directly over the access point. Ensure the sensor patch does not cover the wings of the needle

-Patient understands that the redsense unit should be used on every nocturnal dialysis session.

-Patient understands the actions to be taken in the event that the alarm has been activated.

-Red light on unit and a continuous two toned alarm indicates that blood has dripped onto the sensor either because the needle has pulled out or there has been a leakage.

-Yellow light at the exclamation mark indicates one of the following: Moisture or the unit is broken.

-Yellow light at the battery warning symbol indicates the battery needs to be charged.

-Green light indicates that the monitor is functioning the correct way,

-Patient is aware that the unit can only be charged while not in use, this takes four hours.

B. Administering the phosphate to the Dialysate.

Competency	Date:	Date:	Date:	Date:	Date:	Date:	Date:	Date:	Date:	Date:
Aware of sign and symptoms of hypophosphatemia										
Collect equipment										
Able to administer correct dose										
Ensures the dialysate is mixed well										
Able to change dialysate flow										

Key O = Observed P = Practiced C = Competent

In our opinion a level of competency had been achieved in this section

Nurse Signature Print Name Date

Patient Signature Print Name Date

Competency definitions

Hypophosphatemia	is aware of the signs and symptoms - Slow pulse - Muscle weakness - Numbness - Irritability - Confusion - Double vision - Haemolysis
Collect equipment:	aware of what equipment is needed
Phosphate enema	is safely able to administer an even dose to the concentrate bag as prescribed
Dialysate Flow of 300	ensures that the dialysis machine is set