



# PROVINCIAL STANDARDS & GUIDELINES



## NxStage Nursing Manual

Created: August 2015

Revised: December 2016

Approved by the Home Hemodialysis Committee

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## IMPORTANT INFORMATION

This BCPRA guideline/resource was developed to support equitable, best practice care for patients with chronic kidney disease living in BC. The guideline/resource promotes standardized practices and is intended to assist renal programs in providing care that is reflected in quality patient outcome measurements. Based on the best information available at the time of publication, this guideline/resource relies on evidence and avoids opinion-based statements where possible; refer to [www.bcrenalagency.ca](http://www.bcrenalagency.ca) for the most recent version.

**For information about the use and referencing of BCPRA provincial guidelines/resources, refer to <http://bit.ly/28SFr4n>.**

## Introduction

### Expansion of Home Hemodialysis Program

The BC Provincial Renal Agency (BCPRA) and the health authority renal programs have operated a single home hemodialysis machine program, initially using the Gambro AK 95 and then the Baxter/Gambro AK 96 hemodialysis machine. These machines have provided high quality dialysis treatments and patients have been well supported in their homes.

The BCPRA is expanding its home hemodialysis program by introducing a new home hemodialysis machine.

The NxStage home hemodialysis machine will not replace the current Baxter/Gambro hemodialysis machine. The goal of a two machine model is to expand home hemodialysis to a wider group of patients and to increase overall numbers of patients who may benefit from home dialysis in BC. Therefore, a machine selection tool has been created to assist programs in assessing the need for a NxStage machine.

To be considered for NxStage, certain clinical considerations must be met. Please complete the [Appendix 1: NxStage Machine Selection Tool](#).

### 1.0 NxStage Background

In conventional, high efficiency hemodialysis, the objective is to deliver as much therapy (and clearance) in a minimum 4 hours, 3 times a week. With this objective, high efficiency refers to clearance per unit TIME. As a result, conventional dialysis uses large volumes of water to achieve targeted clearance.

NxStage therapy achieves clearance by using dwell time of the dialysate in the dialyzer itself. This occurs when the blood flow is high in relation to the dialysate flow. Dialysate saturation exceeds 90% when blood flow is 3 or more times the dialysate flow.

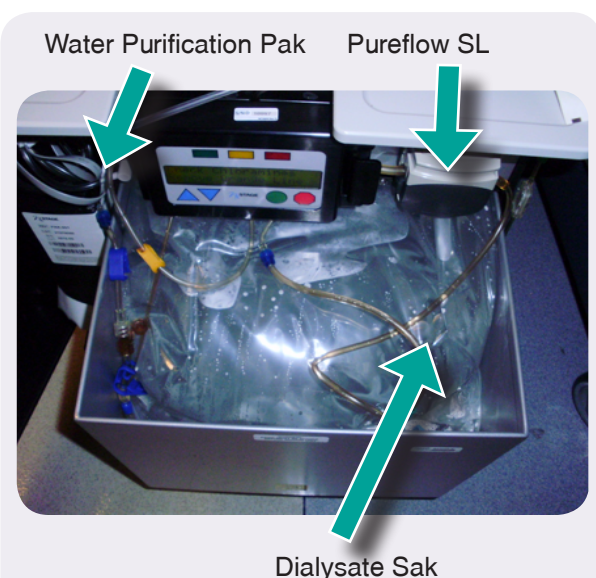
When dialysate saturation approaches 100%, the treatment dose approximates clearance treatment time and is approximately equal to the volume of dialysate exchanges. Similar to PD, dosing is expressed in the volume of dialysate.

## 2.0 Dialysate

### Dialysate Composition

There are limited options for altering the electrolyte content of the dialysate. The composition of dialysate is:

- Lactate – 40 or 45 mEq/L
- Potassium – 1.0 mEq/L or 2.0 mEq/L
- Sodium – 140 mEq/L
- Calcium – 3.0 mEq/L
- Magnesium – 1.0 mEq/L
- Chloride – 105 mEq/L
- Dextrose – 100 mg/dL



**Pureflow SL is designed to incorporate all water purification and the dialysate mixing elements into one integrated unit.**

PureFlow SL generates dialysate 40, 50 and 60 litre batches from pre-packed concentrate that must be used within 72 hours of initiation of production. There is approximately 250mls of overfill to allow for setup.

NxStage does not use glucose as the osmotic fluid removal agent- all new ultrafiltration is pressure driven (versus osmotic).

### Lactate-Based Dialysate

Most conventional hemodialysis machines use bicarbonate-based dialysate. Therapies using prepackaged fluid, like PD and NxStage, use lactate-based dialysate. Lactate is more amenable than bicarbonate because it will not precipitate and therefore has longer shelf stability. Lactate is converted by the patient rapidly into bicarbonate (primary by the liver) but also by the skeletal muscle.

NxStage lactate formulations include 40 and 45 mEq/L. Target pre-treatment bicarbonate levels of 22-25 mEQ.

Lactate is a 50% larger molecule than bicarbonate and thus the rate at which it diffuses across the dialyzer membrane is slightly lower. A higher concentration helps to ensure adequate buffer replenishment.

Therapy on NxStage leads to a higher elevation of serum lactate at the end of treatment, which returns to baseline levels soon after treatment.

Endogenously produced lactate associated with anaerobic status (i.e., shock) can be critical to the patient. **This is not the case** with the lactate buffer as levels will return to normal in a few hours post dialysis.

It is possible that some patients (i.e. liver failure) may not be able to adequately convert lactate to

bicarbonate in a timely basis. Patients subject to this risk should be followed closely. Failure to convert lactate would likely manifest as:

- a) A persistent acidotic state
- b) A measurable sustained elevation of plasma lactate levels

## Dialysate Temp

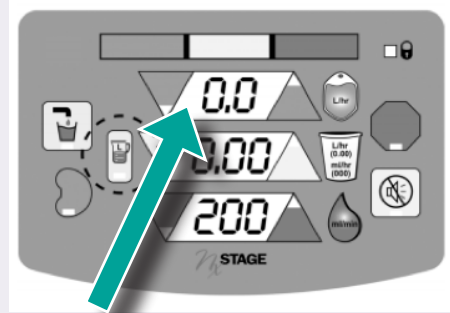
The dialysate temp will be cooler if the ambient temperature is cooler. The warming system is based on numbers, ranging from 12 (cooler) to 20 (warmer).

Please note: the PureFlow SL will only alarm and go into bypass if the dialysate temperature is low at  $\sim 33.0^{\circ}\text{C}$  or high at  $\sim 43^{\circ}\text{C}$ .

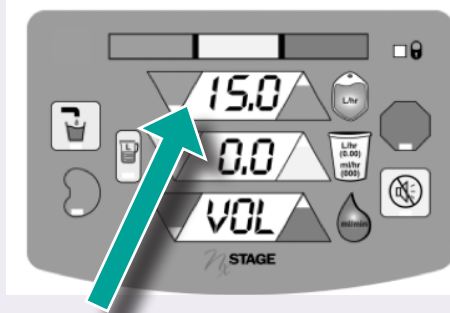
*Check the dialysate temperature with your hand prior to each dialysis. **Do not unplug or move the machine after production of the dialysate, as the warmer will not heat the dialysate.***

If the machine was unplugged overnight, do not use the dialysate. It will be too cold for the patient. The machine will not alarm to warn you of this.

## 3.0 Dialysate Rate and Volume



The dialysate flow rate is set lower than conventional machine as the flow rate is to theoretically maximize the dialysate at a 100% efficiency. The maximum dialysate flow rate for the NxStage machine is 12.0L/hr.



The dialysate volume refers to the amount of prescribed dialysate to be used per dialysis treatment.

How does the dialysate flow translate into the dialysate flow of a conventional hemodialysis machine?

As an example:

$$12\text{L/hr} = 12000\text{mls/hr}$$

$$\frac{12000\text{ mLs/hr}}{60\text{ min}} = 200\text{mls/min}$$

$$60\text{ min}$$

### 4.0 Extracorporeal Circuit

The amount of blood in the NxStage Cartridge or the extracorporeal circuit is 191mls. Rinse back volume is set for 277mls. If the rinse back volume needs to be increased or decreased, divide the desired amount by 191.

**Example:**

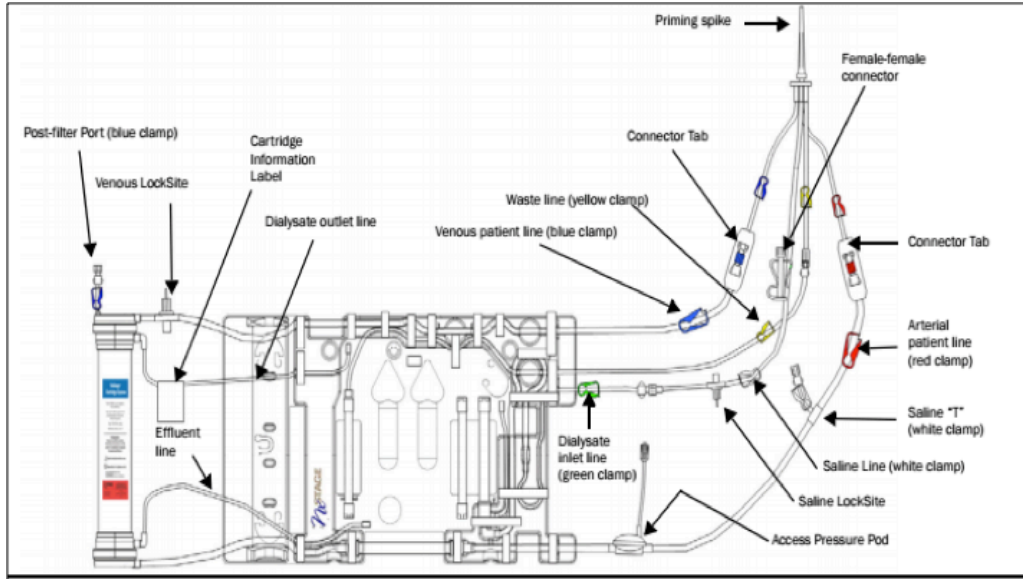
Divide desired amount by 191

- 277mLs = 1.45
- 220mLs = 1.15
- 191mLs = 1.0

System setting number 13 allows the user to change the rinse back factor. The default setting is a multiplier of 1.45 with the extracorporeal circuit volume of 191mL. Please refer to the NxStage System One user guide for more details on system settings.

## 5.0 Cartridges

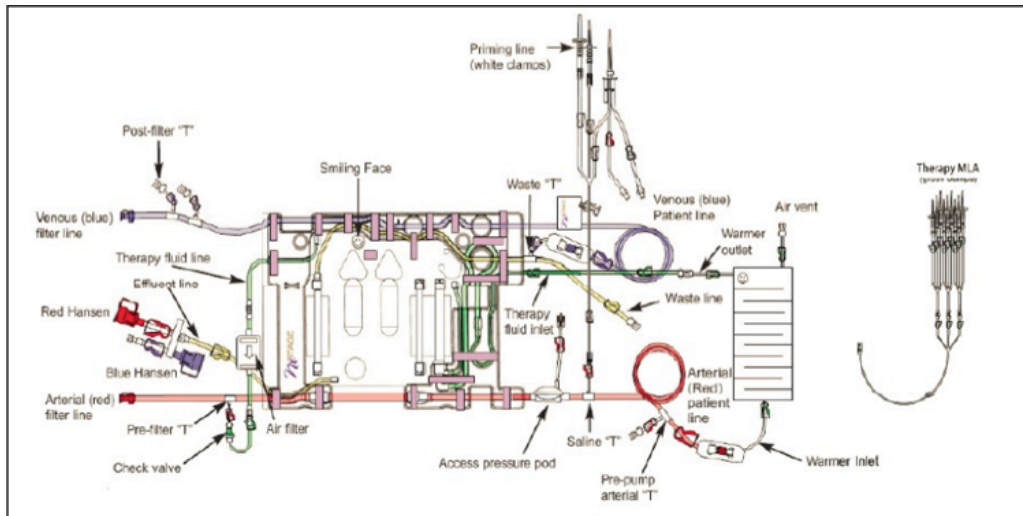
### CAR-172C



The cartridge system is gamma sterilized; ETO or e-Beam sterilization methods are NOT used in any NxStage products. 172-C cartridge has a NxStage dialyzer attached. Please refer to the NxStage User guide for more information.

### CAR 124-C

Cartridge 124-C allows the user to attach a desired dialyzer to the cartridge.



Please refer to NxStage User guide for more information.

Dialyzer substitution should not be a Polyethersulfone membrane, which is the dialyzer membrane used in the 172-C cartridge.

## 6.0 System Settings

System settings are set in the cycler according to the patient's treatment prescription.

If the training machine is not used for the initial home installation or if a replacement cycler is needed, the system settings will need to be changed to reflect the patient's prescription. Please refer NxStage One User Guide- Appendix A System Settings.

## 7.0 Anticoagulation

Please refer to [Appendix 2: NxStage Heparin Protocol](#).

The most responsible nephrologist will prescribe systemic heparin anticoagulation for therapy. For shorter treatments, anticoagulation may be achieved with an initial loading dose only. This may be due to the fact that the patient has a shorter run, and treatment may be complete within or close to the typical half-life.

Another factor is that there are no blood/air interfaces within the NxStage cartridge, so clots have difficulty forming. For extended dialysis, a syringe pump may be required. Please refer to [Appendix 3](#) for operating details of the Smiths Medfusion 5000™ syringe pump.

### Smiths Medfusion 5000™ Syringe Pump



## 8.0 Flow Fraction

Flow fraction is a NxStage word/term, only used for NxStage dialysis.

Flow fraction (FF) defines level of dialysate saturation.

Flow fraction is the ratio of effluent flow divided by blood rate flow.

Because effluent flow rates are expressed in L/hr and blood flow in ml/min, the following formula is used to estimate FF:

Flow Fraction (FF) =

$$\frac{[\text{Dialysate Flow (L/hr)} + \text{UF Flow (L/hr)}] *}{1000\text{mL/L}}$$

System setting "1-Maximum FF" should be set at 200 for a maximum flow fraction rate.



## 9.0 Blood Flow

It is recommended that a blood flow rate (Qb) of at least 250mls/min or higher (ideally 300-350mls/min) should be used for treatment. This is to counterbalance the low dialysate volumes associated with low dialysate flow (QD). Due to this fact, the counter-current pass of blood across the dialyzer has to be higher than the dialysate flow to achieve clearances.

An increase in blood flow allows an increase in effluent rates, which inversely relates to time. For example: Increasing the blood flow from 350 to 400 allows a 15% increase in effluent flow rates, allowing therapy to be delivered in approximately 13% less time.

### Arterial pressure

Note: the Cycler displays the arterial pressure without the negative sign; therefore, a more negative reading is displayed as a larger positive number.

## 10.0 Alarms

There are two important alarms that should be taught to patients during training and reinforced routinely. *It is important to demonstrate this to patients.*

### Creating an Alarm 10

1. Inject 2cc of air into the Post Dialyzer Port.
2. Provide assistance as needed to correctly resolve the alarm.
3. Explain the air recovery process. Pressing

the **TREATMENT** key the first time shows the Caution 12 and allows the patients time to observe that the air is out of the blood lines. *The blood pump is running at 50mls/min, though the cyclor displays the last commanded blood flow rate (i.e. 300-400mls/min).*

4. You must complete the air recovery procedure by pressing **TREATMENT** a second time to clear Caution 12 and return blood flow to desired rate. If you try to increase the pump speed by pressing the **BPS** arrow, all information will be erased from the **RATE** screen.

### Creating an Alarm 11

1. You should be in **TREATMENT** mode to create this alarm.
2. Inject 2 cc of air into the saline "T" instead of the post dialyzer port.
3. Provide assistance as needed to correctly resolve Alarm 11,
4. When Caution 12 is displayed, the blood flow rate is displayed at 100mls.min. **REMEMBER** the **TREATMENT** key must be pressed a second time to complete air recovery procedure and resume prescribed flow rate.

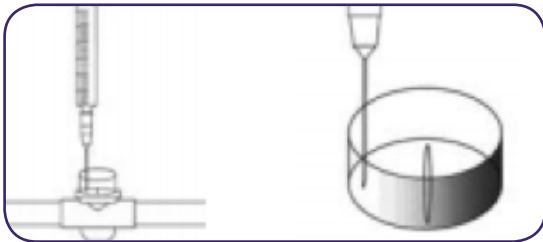
## 11.0 Giving Medications

### Erythropoietin-Stimulating Agents (ESAs)

Most patients are instructed to give erythropoietin-stimulating agent (ESA) via SQ method. This allows for better absorption of the medication. However, if a patient requests the

medication to be given IV, this can be given via the medication injection port located on the saline line. To administer ESA medication:

1. Clean the cap with alcohol before removing
2. Remove small protective cap and place on a sterile 2x2.
3. Insert the needle so it pierces the membrane as close to the edge of the Saline Locksite as possible as demonstrated in photo below. Do not use a needle gauge greater than 25 gauge. Do not puncture the Saine LockSite more than twice.
4. Recap medication port.



5. Run 10 mls (5-6 seconds) of normal saline through arterial line to flush medication into system.
6. Document that the medication has been given.

### **Iron Infusions**

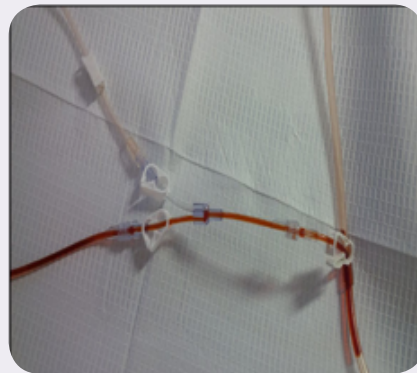
Check patient's allergy record.

1. Have patient sign IV iron waiver prior to infusion at home.
2. Prepare IV iron as per protocol.
3. Pull air out of IV bag by inverting bag and withdrawing air with a syringe (this will prevent air entering the system)

4. Spike Normal Saline mini bag and allow medication to run to the end of the line.
5. Attach "Y" connector to IV line and prime the Y connector



6. Remove saline line from the "T" clamp on the NxStage cartridge. Attach saline line to the other side of the "Y" connector.
7. Attach Y connector to saline "T" clamp.



One side of the Y connector is medication (i.e. iron or antibiotic) and the other side of the Y connector is saline. **Ensure saline line stays clamped during medication infusion.**

8. Ensure saline is clamped.
9. Slowly start IV infusion using gravity method. Ideally, iron should be infused over a 2-hour period.

### Antibiotic Infusion

Check patient's allergy record.

1. Prepare IV antibiotic as per protocol.
2. Pull air out of IV bag by inverting bag and withdrawing air with a syringe (this will prevent air entering the system)
3. Spike Normal Saline mini bag and allow medication to run to the end of the line.
4. Attach Y connector to IV line and prime the "Y" connector.



5. Remove saline line from the "T" clamp on the NxStage cartridge. Attach saline line to the other side of the "Y" connector.
6. Attach Y connector to saline T clamp.



One side of the Y connector is medication (i.e. iron or antibiotic) and the other side of the Y connector is saline. **Ensure saline line stays clamped during medication infusion.**

7. Ensure saline is clamped. Open the saline "T" clamp.
8. Slowly start IV infusion using gravity method. Refer to antibiotic protocol for infusion time.

### 12.0 Transonic

Ensure correct dialysis tubing has been selected on the Transonic monitor. (NxStage CAR 172)

#### Infusion Method- Recirculation

Refer to Transonic Operators Manual for recirculation and access flow procedure

1. Open normal saline infusion line and allow 10 cc's (5-6 seconds) of saline to be administered.
2. Clamp normal saline infusion line and monitor pressures.
3. Record transonic reading.

#### Infusion Method- Access Flow

1. Stop pump.
2. Clamp arterial and venous lines.
3. Reverse arterial and venous lines as per transonic protocol.
4. Open clamps.
5. Start pump.
6. Wait until transonic is ready and desired pump speed has been reached.
7. Open normal saline infusion line and allow 10 cc's (5-6 seconds) of saline to be administered.
8. Clamp normal saline infusion line and monitor pressures.
9. Wait for transonic reading, once transonic

has been read, stop the pump, close clamps and re-reverse lines to appropriate needles.

10. Open clamps and restart pump and record reading.

### 13.0 Pureflow SL and Water Testing

The PureFlow SL requires chlorine/chloramines testing after preparation of each batch of dialysate. Once a batch is made, no change to the chemical composition can occur with respect to chlorine and chloramines. If the test fails, the patient must drain the batch, install and prime a new PAK and then prepare another batch.

The key purification components of the Pure Flow SL tm include:

- Carbon Filter reduces organic contaminants, chlorine, chloramines, iron, hydrogen sulfide, and heavy metals.
- Dual Bed DI (De-Ionization) Resin that removes ionic contaminants (anions and cations) such as mercury, lead, magnesium, silver, calcium, nitrates, sulfates, chlorine and fluorine.
- Mixed Bed DI Resin that polishes the intermediate product water for ionic contaminants.
- Ultrafilter Array that removes bacteria and endotoxins.

In addition to the PAK, the PureFlow SL water purification process includes:

- Ultraviolet Light in the Control Unit for bacterial control and for breaking down chlorine and chloramines for removal by the carbon filter.

- Sediment Filter that removes large particles in the source water.

Source: NxStage Dialysate Preparation Primer

#### Monthly Dialysate Sampling

PureFlow SL Dialysate Sacks (DTK-001) are used to draw a sample of dialysate from the SAK.

NxStage will contact SGS Canada to supply a patient with a 3-month supply of kits. The kit includes all supplies required, except for the DTK-001 kits.

The nurse will supply the patient with the DTK-001 sack. The DTK sacks come in a box of 24 and have a shelf life of 24 months.

The patient is requested to notify NxStage when they have used their last kit. 3 courier boxes will be sent to the patient's home, and the educator will provide DTK-001 sacks to the patient.



## **Instructions for Dialysate Testing**

1. Dialysate samples will be done once a month using dialysate sampling. Purolator will be able to pick up samples Monday through Thursday. For Purolator pick-up please call (1-888-744-7123) one day prior to sampling to arrange pick-up. (or samples can be dropped off at a local Purolator Depot).
2. Sampling should occur as late as possible while allowing time for Courier pick-up/drop off to occur. Samples need to be received at the Laboratory within 28 hours.
3. Fill out the Client Information / Report to section including all email addresses that those results need to be sent to.
4. Place samples and paperwork back in box and seal.
5. Place return Purolator form and air sticker to the outside of the box.
6. Keep samples refrigerated or cool until shipping. Ice bottles / packs may also be included with sample bottles to help maintain temperatures during transit. It is recommended that ice packs not be used in winter months to reduce the risk of samples freezing in transit.

SGS report will send the results to the HHD educator and the educator will notify the changes if anything needs to be done. **The SGS report will provide the acceptable ranges.**

## **Source Water**

When a new patient has been identified, NxStage will conduct a home inspection and provide initial source water sampling. At this time a source water sample will be drawn. If water quality meets Drinking Water Standards, the patient can start training on the NxStage system. Once the patient has completed training and dialyzing at home, the water will need to be retested periodically.

- Well water will be tested every 6 months.
- City water will be tested every 12 months.

If further testing is required, please refer to [Appendix 4: HHD Patient Home Assessment and Water Results-NxStage](#).

## **14.0 References**

NxStage (2006) NxStage Hemodialysis Therapy; Basic Primer

NxStage (2012) NxStage Pureflow SL User Guide; Software Versions 1.13, 1.14 and 1.15

NxStage (2013) NxStage System One User Guide; Software Versions 4.3, 4.4, 4.5, 4.6 and 4.7

NxStage (2013) NxSteps. Simple Steps for Success at Home, Nurse's Training Guide

## NxStage Nursing Manual: Appendix 1

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### Home Hemodialysis NxStage Machine Selection Tool

*To be completed after patient assessed for home hemodialysis eligibility.*

Date \_\_\_\_\_

HA Renal Program/HHD program name \_\_\_\_\_

Patient Name \_\_\_\_\_ or addressograph sticker above

The goal of a 2 machine model is to expand home hemodialysis to a wider group of patients and to increase overall numbers of patients who may benefit from home dialysis in BC. Therefore, a tool has been created to assess the need for a NxStage machine. Please consider the following criteria in your machine selection.

Please consider the following factors when choosing the NxStage machine:

Does the patient have a stable vascular access and sustain a BPS of 300ml/min?	Yes/No
Can the patient dialyze with a K 1 or K 2 bath?	Yes/ No
Can the patient tolerate a lactate buffer? (i.e. liver damage)	Yes/ No
No known history of thrombocytopenia?	Yes/No

**Please check the appropriate boxes (any or all that apply) and fax the results to Clair Hsieh at (604) 875-7366.**

	Does the patient's home require extensive plumbing and electrical renovations to operate a conventional machine?
	Does the patient's home have a non-municipal water source?
	Is the patient on a septic system?
	Does the patient live in a rental property?
	Is the home unable to support a conventional machine?
	Will supply storage be an issue?
	<i>Peritoneal Dialysis patients:</i> Is the patient failing PD and would like to remain on independent dialysis?
	Does the patient have limited mobility?
	Does the patient have limited dexterity?
	Will learning a conventional machine be a challenge?
	Does this patient want to travel while on home hemodialysis?
	<i>Home Hemodialysis patients on a conventional machine:</i> Is the patient at risk of transferring to in centre hemodialysis due to burnout?

## NxStage Nursing Manual: Appendix 2

Please go to [www.BCRenalAgency.ca](http://www.BCRenalAgency.ca) for the most updated version of the Heparin Protocol



## PROVINCIAL STANDARDS & GUIDELINES

### Heparin Protocol NxStage

Created: August 2016

Approved by the BCPRA Home Hemodialysis Committee and Medical Advisory Committee

Guideline created by:



In conjunction with:



## NxStage Nursing Manual: Appendix 2

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## NxStage Nursing Manual: Appendix 2

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### 1.0 Practice Standard

#### Dialysate Composition

- The Home Hemodialysis (HHD) patient educator will review patient bloodwork.
- Under the direction of the Nephrologist, the HHD patient educator determines the dose of heparin to be delivered to patient on each hemodialysis run
- The HHD patient educator will have the necessary knowledge and skills to perform and teach the heparin procedure competently to patient.
- 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 Equipment

#### For Heparin Loading Dose

- Heparin 1:1000 unit vial
- 3mL-10ml syringe for drawing up the heparin for the bolus
- 21 gauge needle

#### For Heparin Running Dose

- Heparin Pump
- 20 mL luer lock syringe for delivery of heparin during the hemodialysis treatment with heparin pump
- 21 gauge needle

## NxStage Nursing Manual: Appendix 2

Please go to [www.BCRenalAgency.ca](http://www.BCRenalAgency.ca) for the most updated version of the Heparin Protocol

### 3.0 Procedure & Rationale

	Procedure	Rationale
1	Starting dose of heparin as per prescribing nephrologist's orders.	
2	For clotting of the filter/cartridge <b>within first hour of treatment</b> , increase Heparin bolus dose by 500 units (= 0.5 cc) per run, to a maximum of 3000 units (= 3 cc).	<b>IF CLOTTING PERSISTS FOLLOWING THESE INSTRUCTIONS, PATIENT SHOULD CONTACT THE HOME HEMODIALYSIS PATIENT EDUCATOR, WHO WILL DISCUSS WITH THE MOST RESPONSIBLE NEPHROLOGIST.</b>
3	For clotting of the filter/ cartridge <b>after the first hour of the treatment</b> , discuss with prescribing nephrologist. The use of a heparin pump may be necessary.	
4	If bleeding occurs at any time, the nephrologist should be notified immediately.	Nephrologist may need to alter patient prescription and will need to be aware if patient suddenly requires emergency medical attention.
5	When adequate anticoagulation has been achieved (defined as clot-free filter/Nx Stage Cartridge), heparin requirements should be reviewed by the most responsible nephrologist at the next follow-up clinic.	To see if the required dose of heparin can be reduced. Excessive heparin can lead to bone demineralization.
6	In the event that the patient commences systemic anti-coagulation for any reason, the patient must immediately notify the Home Hemodialysis Nurse.	To review with the most responsible nephrologist regarding ongoing heparin requirements.
7	<p>Blood work should be reviewed on a regular basis with respect to the platelet count. In the event that the platelet count drops below 100:</p> <ul style="list-style-type: none"> <li>• The heparin should be immediately discontinued (including priming and dwelling solution for cuffed catheters), and advice sought from the most responsible Nephrologist regarding anti-coagulation requirements.</li> <li>• In the event that the cause is felt to be due to Heparin-Induced Thrombocytopenia (HIT), as evidenced by a positive HIT assay, all heparin (including catheter-locking solutions) should be discontinued. The most responsible Nephrologist should document this adverse reaction (including an updated allergy status form) in the permanent dialysis record.</li> </ul>	<p>The most responsible nephrologist will be notified as soon as possible to facilitate establishment the etiology of the thrombocytopenia to protect patient from excessive uncontrolled bleeding</p> <p>4% citrate should be ordered to lock HD CVC</p> <p><b>Allergy to heparin to be documented and communicated to renal team to prevent a reoccurrence of Heparin-Induced Thrombocytopenia</b></p>
8	If warfarin or other anticoagulant started, notify the most responsible nephrologist.	The most responsible nephrologist needs complete information on the patient.

## NxStage Nursing Manual: Appendix 2

Please go to [www.BCRenalAgency.ca](http://www.BCRenalAgency.ca) for the most updated version of the Heparin Protocol

### 4.0 Documentation Considerations

1. Document on Training Checklist as permanent record of training.
2. Process, as per other medication orders. Ensure the correct dosage is recorded on the patient's Kardex and in the HD treatment field in PROMIS
3. Document any significant findings observed with respect to clotting parameters in the extra-corporeal circuit.
4. Document communications with most responsible Nephrologist.

### 5.0 Special Considerations

When blood comes into contact with foreign surfaces, including blood tubing and dialyzers, the clotting mechanism of blood is activated. This clotting mechanism is activated through the adhesion and aggregations of platelets on these foreign surfaces. The platelets become damaged by contact with a foreign surface. As a result of this damage, platelet factors are released which cause the platelets to stick and start the clotting process. The extrinsic clotting cascade may then continue to significant thrombus formation and clotting of the extracorporeal (dialysis) circuit.

**NOTE:** There is an intrinsic clotting pathway initiated by rupture of vessels within the body (GI bleed, aneurysm) and an extrinsic clotting pathway, which is initiated by contact with air or foreign material.

Heparin is considered the anticoagulant drug of choice in the hemodialysis setting. Heparin binds to circulating anti-thrombin III, which then combines with the enzymes of various coagulation factors leading to the inactivation of these factors at the platelet membrane. Heparin has little effect on platelet-surface interaction.

The half-life of heparin is 30 to 120 minutes. Heparin's effects may be reversed with the use of protamine sulphate. Protamine sulphate can be used in "regional heparinization". (For a review of the various methods of anticoagulation refer to references below).

Typical undesirable side effects of heparin include: pruritus, allergy, osteoporosis, hyperlipidemia, thrombocytopenia and excessive bleeding. Careful controlled use of heparin may minimize some of the side effects.

**NOTE:** Bone and joints: prolonged therapeutic doses > 3 months have been associated with osteoporosis and spontaneous vertebral fractures.

PTT results are an objective method of monitoring effectiveness of heparinization. For information regarding bedside heparin monitoring devices see the references below.

**NOTE:** INR/PT are used to objectively monitor the effectiveness of the anticoagulant effects of warfarin (Coumadin).

## NxStage Nursing Manual: Appendix 2

Please go to [www.BCRenalAgency.ca](http://www.BCRenalAgency.ca) for the most updated version of the Heparin Protocol

### 6.0 Assessment Requirements

Clear evidence of persistent (more than one episode, especially with our long term hemodialysis patients) clotting of the hemodialysis extracorporeal system needs to be apparent before increasing the heparin dose due to the significant long-term side effects of heparin. Significant clotting would include a rating of “3-4” for the NxStage dialyzer.

The new hemodialysis patient may not experience clotting to the extracorporeal system. However the a long-term hemodialysis patient may have the occasional clotting that may not require a change in heparin dose, because:

- the clotting episode may be due to slower pump speeds,
- or more than usual blood pump stoppages that day,
- difficulty needling the access which activates the clotting cascade,
- more than his/her usual fluid removed leading to an increased hematocrit hence increased stickiness of the blood.

### 7.0 References

Core Curriculum for Nephrology Nursing, 6th Edition. (2015) American Nephrology Nurses' Association (ANNA).

Daugirdas, John T; Blake, Peter G; Ing, Todd S; Gallieni, Maurizio.(2014) Handbook of Dialysis, 5th Edition. (2014). Lippincott, Williams &Wilkins, NY.

Kallenbach, Judith Z. (2015) Review of Hemodialysis for Nurses and Dialysis Personnel, 9th Edition. Mosby Inc.

The National Kidney Foundation Kidney Disease Outcomes Quality Initiative (NKF- KDOQI) 2006, Clinical Practice Guidelines For Vascular Access

### 8.0 Sponsors

This BCPRA guideline/resource was developed to support equitable, best practice care for patients with chronic kidney disease living in BC. The guideline/resource promotes standardized practices and is intended to assist renal programs in providing care that is reflected in quality patient outcome measurements. Based on the best information available at the time of publication, this guideline/resource relies on evidence and avoids opinion-based statements where possible; refer to [www.bcrenalagency.ca](http://www.bcrenalagency.ca) for the most recent version.

Developed by:

- BCPRA Home Hemodialysis Educators Group

Approved by:

- BCPRA Home Hemodialysis Committee
- BCPRA Medical Advisory Committee

## Quick Reference Card to the MedFusion 3500® Syringe Pump

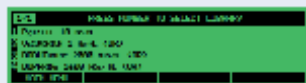
**PDD is Programmed Dose Delivered.** This option will have to be enabled in the PharmGuard™ Interface software. It is available by selecting "Change to Dose" under the "Options" soft key selection. PDD is an accumulation of the dose that has been delivered from a specific drug program. It is only available for continuous weight based infusion modes. This total includes the loading dose, bolus dose, and maintenance dose of the infusion. It is useful for documentation of specific medication dosing that has been delivered to a patient.



### Quick Library Programming:

Quick Library is an option that can be set up in a Configuration from the PharmGuard™ medication safety software.

- With a Quick Library, starting an infusion can be as quick as Profile – Drug Selection – Start Infusion.
- Should a user need to change the dose at the patient's weight that was pre-set, using the soft keys can enable them to do so.



### Program Options

**Options:** Applies to the current infusion only.

**Loading Dose:** Ability to allow a specific loading volume or dose to be delivered. Dose will be programmed and delivered in the parameters of that specific infusion. Loading dose must be enabled for the specific drug for this feature to appear on the pump and will be delivered before the start of the main infusion.

**Bolus Dose:** Ability to allow a specific bolus volume or dose to be delivered. Dose will be programmed and delivered in the parameters of that specific infusion. Bolus dose must be enabled for the specific drug for this feature to appear on the pump.

**Periodic Callback Alarm:** Allows programming of an alarm to be generated at a programmed period of time. It can be set in either hours or minutes. The maximum allowable time is 8 hours.

**Standby:** Allows pre-programming of an infusion then postponing the start for a programmed interval of time. Standby mode begins when entering the time parameters. Do not press the Start key until it is time to start the infusion. The pump does not automatically start at the end of the standby period. The pump will sound an alarm notifying the clinician that Standby mode has ended. The infusion can be started at any time during standby by pressing the Start key.

**Delayed Start:** Ability to pre-program an infusion then postpone the start for a programmed interval of time. Delayed start mode begins after entering the time parameters. The pump will automatically start the infusion at the end of the delayed start time. The infusion can be started at any time during delayed start by pressing the Start key.

**Volume Limit:** Allows a specific volume limit to be determined for an infusion. Once the pump has delivered the volume limit, the pump will alarm and stop. This is only available for continuous infusions.

**KVD:** Ability to allow a KVD (Keep Vein Open) rate to be delivered between infusions. A volume limit must be programmed for KVD to function. KVD rates are determined by the minimum flow rate for the syringe currently being used and the current infusion rate, whichever is less.

**Override Alarm Loudness:** Ability to override the profile selection for a specific infusion. Able to select from a higher or lower value. The alarm cannot be totally disabled.

**Override Occlusion Limit:** Ability to override the profile selection for a specific infusion. Able to select from a higher or lower value.

**Toggle FlowSentry™ Pressure Monitor:** Ability to override the profile selection for a specific infusion. Will either disable or enable FlowSentry™ monitor.

**Toggle Near Empty Tone:** Ability to override the profile selection for a specific infusion. Will either disable or enable Near Empty Tone.

**Toggle Empty Tone:** Ability to override the profile selection for a specific infusion. Will either disable or enable Empty Tone.

**Toggle PVD/PDD:** Ability to have one or the other display on the pump during infusions. PVD is an acronym that means Programmed Volume Delivered. PDD is an acronym that means Programmed Dose Delivered.

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### Quick Reference Card

Medfusion® 3500  
Syringe Pump  
Version 5.0.0



1. Display
2. Loading Protocol
3. Loading Profile
4. Syringe Barrel Clamp
5. Syringe Barrel Change Slot
6. Syringe Barrel Lock
7. Syringe Barrel Cover
8. Syringe Barrel Insert
9. All-Alarm Control on Med Fusion pump
10. Keypad

For detailed instructions, specifications, warnings, and additional information on the Medfusion 3500 pump and PharmGuard™ medication safety software, please refer to the operator's manual.

Note: The following specific instructions apply to demonstrate pump functions/options for the Medfusion 3500 syringe pump, version 5.0.0. The custom status alarm may or may not display on your pump, depending on how your facility has configured the PharmGuard™ medication safety software.

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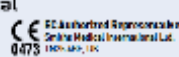
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## Quick Guide to the MedFusion 3500® Syringe Pump

### Check the pump totals

The totals are set to zero when the pump is switched on, but can be recalled, for example if the pump is being used on the same patient.


- TVD - total volume delivered - accumulates from one infusion to another.
- PVD - program volume delivered, or
- PDD - program dose delivered (for mass units) - shows what has been delivered with the current programmed infusion settings, since the pump was switched on.

### Administering a bolus

The pump can deliver a preset amount as a bolus, at the fastest rate for the syringe, or at a rate you enter. The values for bolus dose and bolus time can be entered as part of the programming sequence; or from the Options menu; or entered when you administer the bolus.

Deliver a bolus while the pump is infusing

- Press **ENT**.  
If a dose has been set up, it is displayed.
- Press **YES** to start delivering the bolus dose as displayed, or press **CHG BOLUS** to change the dose or time.



### Check/change the Occlusion limit setting

You can change the Occlusion limit setting before starting the infusion, or if you pause the infusion and press **OPTIONS**.

- To check the setting, press **OPTIONS** to display the Options menu.
- Press a number to choose **VERRIDE OCCL LIMIT**. The screen shows the current Occlusion limit setting.
- If the setting is correct for the infusion press **ENT**. To change the occlusion limit, press a number to select Low, Normal or High, then press **ENTER** to continue.

### Start the infusion


- The screen shows all the programmed settings. Read the screen to verify that these are correct.
- Press the green **START** button to start the infusion.
- The running screen shows the occlusion trend graph.


### Set up or change a bolus dose

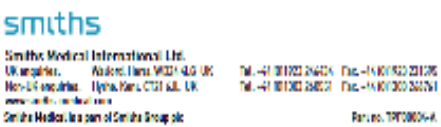
- If no bolus has been set up, or if you press **CHG BOLUS**, the pump displays the bolus dose and time screens, so you can enter the required dose.
- To see these bolus screens before starting the infusion, press **OPTIONS** to display the Options menu, then press the number for **BOLUS DOSE**.

### Switching on

- Connect the pump to the AC or DC supply.
- Press **ENT** to switch on the pump, then observe the self test. When this is complete the pump will show the **MAIN MENU - the Delivery Mode screen**:

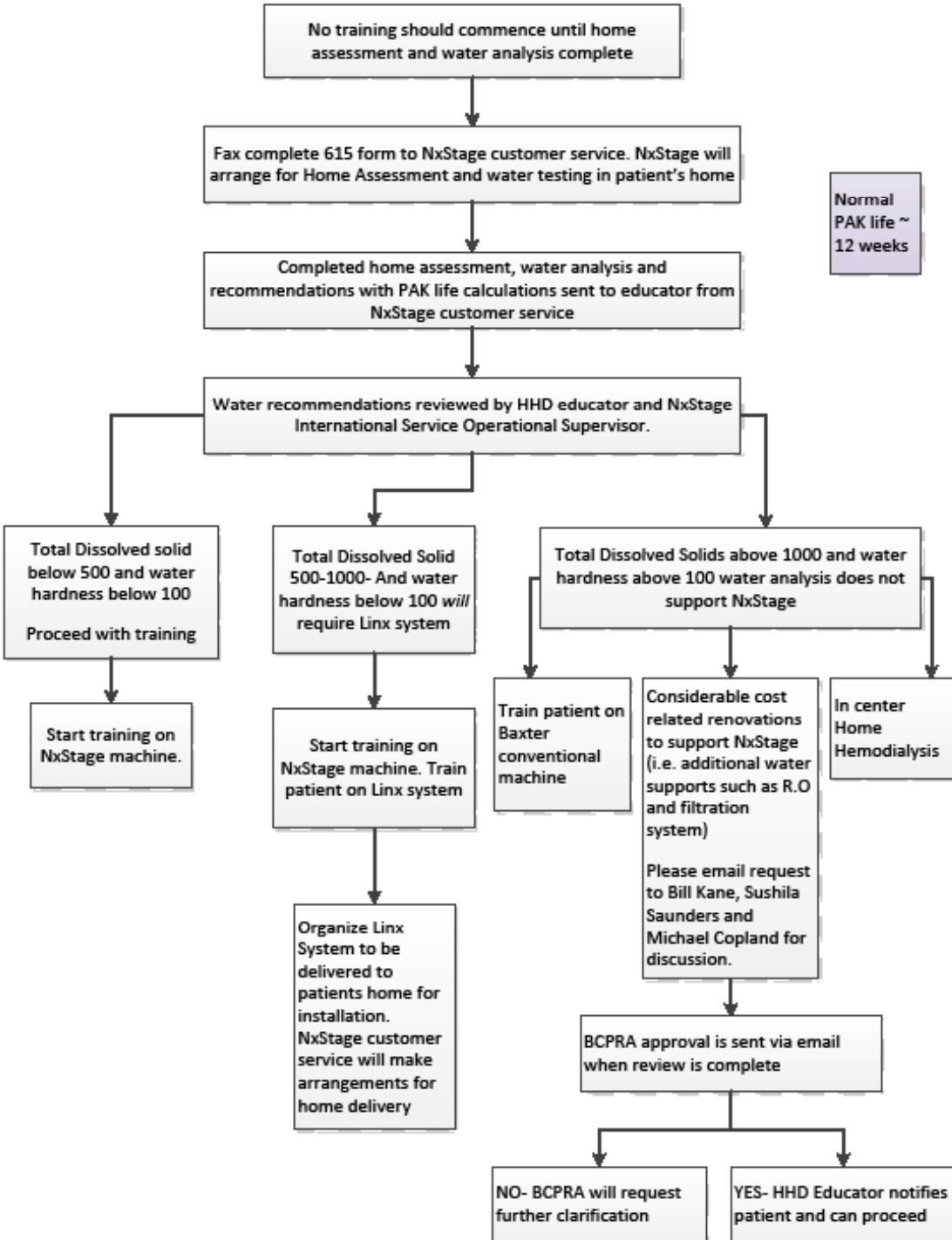






# NxStage Nursing Manual: Appendix 4

## HHD PATIENT HOME ASSESSMENT AND WATER RESULTS -NXSTAGE



Normal PAK life ~ 12 weeks

Updated May 2015