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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 for the most recent version.

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.

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.

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

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 acidic 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 ~ 33.0 °C or high at ~43 °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:

12L/hr = 12000mls/hr

12000 mls/hr = 200mls/min

60 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 increased or decreased, divide 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.

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) = 

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

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

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.
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.

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

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 contaminates.
• 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

**Home Hemodialysis NxStage Machine Selection Tool**

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

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**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.

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<table>
<thead>
<tr>
<th>Question</th>
<th>Yes/No</th>
</tr>
</thead>
<tbody>
<tr>
<td>Does the patient’s home require extensive plumbing and electrical renovations to operate a conventional machine?</td>
<td></td>
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<tr>
<td>Does the patient’s home have a non-municipal water source?</td>
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<tr>
<td>Is the patient on a septic system?</td>
<td></td>
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<tr>
<td>Does the patient live in a rental property?</td>
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<tr>
<td>Is the home unable to support a conventional machine?</td>
<td></td>
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<tr>
<td>Will supply storage be an issue?</td>
<td></td>
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<tr>
<td><strong>Peritoneal Dialysis patients:</strong></td>
<td></td>
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<tr>
<td>Is the patient failing PD and would like to remain on independent dialysis?</td>
<td></td>
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<tr>
<td>Does the patient have limited mobility?</td>
<td></td>
</tr>
<tr>
<td>Does the patient have limited dexterity?</td>
<td></td>
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<tr>
<td>Will learning a conventional machine be a challenge?</td>
<td></td>
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<tr>
<td>Does this patient want to travel while on home hemodialysis?</td>
<td></td>
</tr>
<tr>
<td><strong>Home Hemodialysis patients on a conventional machine:</strong></td>
<td></td>
</tr>
<tr>
<td>Is the patient at risk of transferring to in centre hemodialysis due to burnout?</td>
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</tbody>
</table>
Heparin Protocol

 NxStage

 Created: August 2016

 Approved by the BCPRA Home Hemodialysis Committee and Medical Advisory Committee

 Guideline created by:

 BC Renal Agency

 In conjunction with:

 [List of organizations]

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

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For information about the use and referencing of BCPRA provincial guidelines/resources, refer to http://bit.ly/28SFr4n.
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
### 3.0 Procedure & Rationale

<table>
<thead>
<tr>
<th>Procedure</th>
<th>Rationale</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>1.</strong> Starting dose of heparin as per prescribing nephrologist's orders.</td>
<td></td>
</tr>
<tr>
<td><strong>2.</strong> For clotting of the filter/cartridge <em>within first hour of treatment</em>, increase Heparin bolus dose by 500 units (= 0.5 cc) per run, to a maximum of 3000 units (= 3 cc).</td>
<td><em>IF CLOTTING PERSISTS FOLLOWING THESE INSTRUCTIONS, PATIENT SHOULD CONTACT THE HOME HEMODIALYSIS PATIENT EDUCATOR, WHO WILL DISCUSS WITH THE MOST RESPONSIBLE NEPHROLOGIST.</em></td>
</tr>
<tr>
<td><strong>3.</strong> For clotting of the filter/cartridge <em>after the first hour of the treatment</em>, discuss with prescribing nephrologist. The use of a heparin pump may be necessary.</td>
<td></td>
</tr>
<tr>
<td><strong>4.</strong> If bleeding occurs at any time, the nephrologist should be notified immediately.</td>
<td>Nephrologist may need to alter patient prescription and will need to be aware if patient suddenly requires emergency medical attention.</td>
</tr>
<tr>
<td><strong>5.</strong> 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.</td>
<td>To see if the required dose of heparin can be reduced. Excessive heparin can lead to bone demineralization.</td>
</tr>
<tr>
<td><strong>6.</strong> In the event that the patient commences systemic anti-coagulation for any reason, the patient must immediately notify the Home Hemodialysis Nurse.</td>
<td>To review with the most responsible nephrologist regarding ongoing heparin requirements.</td>
</tr>
</tbody>
</table>
| **7.** 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:  
  * 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.  
  * 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. | 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  
  4% citrate should be ordered to lock HD CVC  
  *Allergy to heparin to be documented and communicated to renal team to prevent a reoccurrence of Heparin-Induced Thrombocytopenia*                                               |
| **8.** If warfarin or other anticoagulant started, notify the most responsible nephrologist. | The most responsible nephrologist needs complete information on the patient.                                                               |
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).
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


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 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

Program Options

Options: Apply to the current infusion only

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

Baseline Dose: Ability to alter a specific baseline volume or dose to be delivered. Dose will be programmed and delivered in the parameters of the specific infusion. Dose must be entered for the specific drug for the feature to appear on the pump and will be delivered before the start of the main infusion.

Relay Outputs: Ability to control specific drug delivery or to deliver a programmed amount of liquid to a non-specific device or device with the assistance of a computer system.

Volume Limits: Allows a specific volume limit to be set for each syringe. The pump will stop delivering when the volume limit is reached. Volume limits are set for each syringe and can be adjusted by the user.

KVP: Ability to allow a KVO which allow stop. The pump will deliver a programmed amount of liquid to a non-specific device or device with the assistance of a computer system.

Overdrive: Allows the pump to deliver a programmed amount of liquid to a non-specific device or device with the assistance of a computer system.

Quick Library Programming:

QuickLibrary is an option that can be used to set up a protocol program in the Pharmacist’s medication system. It allows for the creation of a protocol program that can be used to administer medications in a specific order. The protocol program can be adjusted to meet the needs of the patient and can be stored for future use.

Volume Limits:

Allows a specific volume limit to be set for each syringe. The pump will stop delivering when the volume limit is reached. Volume limits are set for each syringe and can be adjusted by the user.

KVP: Ability to allow a KVO which allow stop. The pump will deliver a programmed amount of liquid to a non-specific device or device with the assistance of a computer system.

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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.
1. TVD - total volume delivered
2. PVD - program volume delivered
3. SPD - program dose delivered
4. DSD - dose delivered
5. TMD - total minutes delivered
6. PMD - program minutes delivered
7. SM - start mode
8. DMI - dose mode indicator
9. TEM - total elapsed minutes
10. PEM - program elapsed minutes

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 entered as part of the programming sequence; or from the Options menu, or entered when you administer the bolus.
1. Press 
2. If a dose has been set up, it is displayed.
3. 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.
1. In the setting, press OPTIONS to display the Options menu.
2. Press a number to choose OVERRIDE OCL LIMIT.
3. If the setting is correct for the infusion press SELECT.

Start the infusion
The screen shows all the programmed settings. Read the screen to verify that these are correct.
1. Press the green button to start the infusion.
2. The running screen shows the occlusion limit settings.

Switching on
1. Connect the pump to the AC or DC supply.
2. Press to switch on the pump, then observe the cell test. When this is complete the pump will show the MAIN page.

Options to select the mode
1. C - CRYST
2. E - LIT
3. M - MKS
4. M - MSY
5. M - MUL
6. NORM - ONS
7. DURATION - ONS
8. SERIAL - ON/OFF

Appendix 3
**HHD Patient Home Assessment and Water Results - NXSTAGE**

No training should commence until home assessment and water analysis complete.

Fax complete 615 form to NXSTAGE customer service. NXSTAGE will arrange for Home Assessment and water testing in patient’s home.

Completed home assessment, water analysis and recommendations with PAK life calculations sent to educator from NXSTAGE customer service.

Water recommendations reviewed by HHD educator and NXSTAGE International Service Operational Supervisor.

**Total Dissolved solids below 500 and water hardness below 100**
- Proceed with training
- Start training on NXSTAGE machine.

**Total Dissolved Solids 500-1000**
- And water hardness below 100 will require Linx system
- Start training on NXSTAGE machine. Train patient on Linx system

**Total Dissolved Solids above 1000 and water hardness above 100**
- Water analysis does not support NXSTAGE
- Considerable cost related renovations to support NXSTAGE (i.e. additional water supports such as R.O and filtration system)
- Please email request to Bill Kane, Sushila Saunders and Michael Copland for discussion.

In center Home Hemodialysis

Organize Linx System to be delivered to patients home for installation. NXSTAGE customer service will make arrangements for home delivery.

BCPRA approval is sent via email when review is complete

**NO - BCPRA will request further clarification**

**YES - HHD Educator notifies patient and can proceed**