Renal Support using the Fresenius 5008 Machine

Date Created: April 2014
Version:
Purpose
To ensure safe and effective treatment of patients using the Fresenius 5008 Machine

Intended Audience
Registered Nurses working permanently in intensive care
A medical officer must prescribe the Fresenius setting prior to the commencement of therapy

Expected outcomes
Staffs at Nepean ICU are able to use Fresenius 5008 safely including:
Strict adherence to aseptic technique is observed due to risk of bacterial contamination.
Ensuring water quality standards are met.

Definitions

**HD** *Haemodialysis*: Removal of small molecules by diffusion with dialysate to the ultrafiltrate compartment.

**HF** *Haemofiltration*: Removal of small and larger solutes by convection

**HDF** *Haemodiafiltration* Combination of diffusion (haemodialysis) and convection (haemofiltration)

**Osmosis**: The movement of water through a semipermeable membrane from a compartment with lower concentration of solutes to a compartment with a higher solute concentration

**Diffusion**: The movement of molecules from a high concentration to a lower concentration across a semipermeable membrane

**Convection**: The bulk movement of solvent (plasma water) across the membrane drags solutes with it

**Ultrafiltration**: The removal of water by the use of hydrostatic pressure. The pressure on the blood side of the membrane is greater than the pressure on the other side, pushing the water to the other side.

**Conductivity**: Measurement of all of the positively charged electrolytes in the dialysate fluid (Na, K, Ca, Mg)

Procedure
The haemodialysis procedure has numerous distinct steps:

i. Testing the 5008 machine
ii. Preparation of the dialysis concentrates
iii. Preparation of the Extracorporeal Blood Circuit
iv. Priming the Blood Circuit
v. Priming the Dialysis side
vi. Setting treatment Parameters
vii. Treatment/ Initiating Dialysis
viii. Discontinuing Dialysis
ix. Discarding the Extracorporeal Circuit
x. Disinfecting/Cleaning the dialyser

**Knowing the Screen of 5008; an Overview**

![Screen of 5008](source: Fresenius Medical Care Manual 2012)
1. **Operating Mode (display)**
   Displays the operating mode of the system (e.g. Dialysis). In addition, a progress bar is displayed, depending on the operating mode, e.g. in the Rinse mode.

2. **Dialysate Flow (display)**
   - Flow turned on – waves green (grey bar is moving)
   - Bypass - waves green (grey bar is not moving)
   - Flow turned off- waves grey

3. **Status button** – displays system condition data. Once pressed screen will display, software version, error memory, cleaning status, device information, calibration status and network status.

4. **Message button (display/button)** – allows retrieval of information, warnings and alarms

5. **Information** – displays information on the current procedure

6. **Heparin (display)**
   - Pump switched On (drop green) grey bar is moving.
   - Pump switched Off (drop grey)

7. **Patient ID** (patient identification – display/button) Treatment data sheet in addition to Patient card. (Stores 3 previous treatments)

8. **Blood Flow (display/button)** combined with rocker switch to increase or reduce effective blood flow.

9. **UF Timer I/O** (button) Button for starting/stopping ultrafiltration and the timer function.

10. **Emergency** (button)

11. **Blood Pressure** (display/button)

12. **Options Menus** (button) Via the Options menu button, it is possible to program up to four option menus with direct access.

13. **Heparin** (button) (display only, of selected in the Operator Setup)

14. **Menu Bar** Corresponding menu opens automatically during operation or touch button for accessing respective menu.

15. **Menu Section:**
    Appropriate data is displayed in the centre of the screen for each menu.
    Indicators/buttons/diagrams/graphs are displayed depending on the Setup.
16. **Pressure Display** (display/button)

- ART (arterial pressure)
- VEN (venous pressure)

Both numerical and graphical values are displayed.

17. **Status Bar:**

The fields in the status bar are:

- Grey in the normal operating mode
- Orange during the functional test (T1 test) and rinse procedure of the extracorporeal blood circuit, until the minimum rinse volume is achieved.
- Yellow during the cleaning programs

### Examples of Data Entry (numeric key pad)

1. Touch the Prescr.Na field
2. Enter desired Na value
3. OK to accept
4. C button to correct

![Example of Data Entry](image)

1. Touch the VEN field
2. 2a Adjustment of alarm limit
   2b Adjustment of window position
3. Rocker switch to adjust the desired value
4. OK to accept
5. C to correct

![Example of Data Entry](image)
Preparation for Dialysis.

1. Transfer Fresenius 5008 machine to the bedside. *Please remember that Fresenius outlets are at beds 1, 9-12, 21-24.*

2. Attach both black hose to the outlet provided for dialysis

Water Supply

3. Turn water supply ON for dialysis in Renal Dialysis Plantroom.

4. Switch ON GREEN button on the right hand side corner of Aqua B

   The Aqua B displays ....

   STANDBY       Rinse
   Automatic

   Then

   Press the P key until the screen display.....

   SUPPLY

   Then

   Press the ✓ to confirm SUPPLY....

   The screen displays               Permeate Supply......

   The RO is now supplying permeate for dialysis
Test for chlorine in the water

Water is tested for Chlorine Free and Total using the HACH Pocket Colorimeter II
Obtain water sample for chlorine testing from the port after the carbon filter as shown in the picture.
Follow the directions on water testing found in RO room.
Ensure result is recorded with patient sticker on test result sheet found on trolley & in patient’s notes.

Equipment required for setting up circuit

5008 AV600S Kit, contains following items
- AV-Set ONLINEplus AVM 5008-R (circuit)
- The type of filter: AV6000S
- Bibag® 900g (5008)
- Potassium Modifier 100mL (2mmol)
Setting up the circuit

1. Switch on the machine by pressing the Power key located on the top left corner of the control panel.
   Press the ON/OFF key
   \textit{Ensure the machine has been disinfected within 24 hours by pressing status key and follow prompts. If it has not been disinfected within 24 hours machine must have heat disinfection cycle prior to use.}

2. In the Selection Screen: TREATMENT and DISINFECTION is shown.
   Press TREATMENT …. The T1 test starts automatically
   (The system automatically switches to the BLOOD SYSTEM menu)
   \textit{You are able to connect lines on the machine while the T1 test is being carried out.}

3. Connect Bibag and the Part A concentrate container as shown in the picture.

4. After successful completion of the T1 test, start inserting the blood lines. \textit{Blood lines may be inserted before completion of T1 test up to connecting the SafeLine into the substituate port and venous blood line into the rinse port. This can only be
performed after completion of T1 test. (The T1 self-tests all functions against pre-set parameters, warning signals will prompt correction).

5. Preparing the extracorporeal blood circuit (inserting the arterial and the venous line)
Open the doors of the Extracorporeal blood Circuit Module

**Arterial Line**

1. Insert the line guide into the blood pump until a signal is heard - the arterial pressure dome will open and a diagram should appear on the screen. *Do not wind the tubing onto the pumps this will be done by the machine after closing doors.*
2. Insert the arterial blood line into the line holder
3. Connect the arterial blood line into the lower port of the dialyser.
4. Insert the arterial pressure dome into the arterial pressure measurement unit.
5. Insert the arterial blood line into the arterial occlusion clamp and then insert tubing into the BVM unit and close the flap. Tubing is then inserted into the red temperature unit, (the last 2 steps are not shown in the diagram). The arterial line will eventually be connected to the SafeLine for priming but until then to ensue the tubing end remains sterile hang the patient end onto the dialyser holder.
6. Heparin syringe: use only 20mL syringes and ensure it is correctly inserted into the pump and locked (Heparin concentration is 500us/ml = 10 000us Heparin in 20ml Normal Saline)

**Venous Line**

7. Insert the venous bubble chamber in the level detector
8. Optical detector/ air bubble detector- ensure the line is completely inside the line housing
9. Insert the venous blood line into the venous occlusion clamp and then into the temperature unit (not shown in diagram). Keep end of venous blood line sterile until ready to insert into rinse port (done after T1 test is complete)
10. Insert the venous blood line into the line holder
11. Connect the venous blood line to the upper port of the dialyser
12. Connect the venous pressure line to the venous pressure connector

**SafeLine**

13. Insert the SafeLine™ line into the substitute pump until a signal is sounded – tubing will wind onto pump after doors are closed.
14. Insert the SafeLine™ into the line holder
15. Connect the arterial patient access line to the SafeLine™ (using blue connector on tubing)
16. Connect the substitute connector on the SafeLine into the substitute port by:
a) Pull and turn the substitute catch counterclock wise until it clicks into place  
b) Push substitute connector firmly into the substitute port. Pull and turn the substitute catch clockwise until it sits on connector.

17. Attach supplied rinse connector onto the venous blood line and insert into the rinse port. This is similar to above steps. Close rinse port. Ensure blood lines are NOT clamped.

18. Close the doors.

19. The system automatically switches to the **Preparation Screen**

20. **Connect dialyser coupling** (message will appear on the screen) open shunt door

- The dialysate supply line (red) is connected to the venous blood outlet side of the dialyser - **Red to red**

- The dialysate return (blue) is connected to the arterial blood outlet side of the dialyser – **Blue to blue**

- Close the shunt door
Message: Priming/ Rinsing will appear, touch the START button. Status Bar will remain orange until the minimum rinse volume of 500 ml has been reached.

If not yet done the parameters for dialysate, UF and the Heparin pump may now be checked/set.

**Parameters**

Enter the treatment parameters manually:

Example in HDF treatment:

- UF goal – 3000mls (Amount of total fluid to be removed in mls)
- UF time - 4hours (Time taken to remove the total fluid)
- Prescribe Na (sodium) – standard 140mmols
- Prescribe bicarbonate – standard 28mmols

Potassium concentrate in dialysate is either - 2mmols (no added K+ to the container) / 4mmols / 6mmols (K+ added to the concentrate container)

*(Sodium, bicarbonate and potassium are prescribed by the medical team)*

- Temperature – standard 38 °C
- Blood flow rate 200ml/min
- Dialyzer class – AV 6000S
- Heparin for infusion (as per unit policy).
Prepare the heparin infusion (if ordered) in the 20mls syringe by drawing up 10 000 units of Heparin (2 ampoules of 5 000 units) and top up to 20ml with normal saline poly-ampules. The concentration should be 500 units per ml. Affix additive label to 20mls syringe.

**Treatment**

**Patient Connection**

- Ask another nurse to assist you with the connection.
- Wash hands and prepare trolley by wiping with neutral detergent
- Open CVC ON/OFF Pack. OR Dressing Pack
  - Add chlorhexidine in alcohol (Pink)
  - Add 2 x normal saline 0.9% ampoules/ syringes if needed
- Pour chlorhexidine into one of the pots on the sterile field to soak the gauze.
- Perform aseptic hand wash and put on sterile gloves.
- Wrap chlorhexidine soaked gauze around each of the lumen of the Vascath.
- Draw up 10ml of normal saline into 2 of your 10ml syringe
- Aspirate 5ml of blood from each of the lumen – to remove the Heparin Lock.
- Flush each lumen with 10ml normal saline 0.9%

Ask the second nurse to disconnect the arterial blood line from the SafeLine™.

- Connect the SafeLine™ either before the dialyszer (predilution) or after the dialyzer (postdilution).
• The second nurse passes the arterial line (red) to connect to the patient’s red lumen vascath while maintaining aseptic technique.
• Ask the second nurse to remove the venous blood line from the rinse port (blue) and the rinse connector so it can be connected to the blue lumen of the vascath maintaining aseptic technique.
• Close the rinse port.
• Make sure the clamps on the vascular catheter, access and return lines are all open.
• Ensure that the luerlock connections on the vascular catheter are secure and tightened.

Commencing treatment
• Confirm all the treatment settings against the order with the assisting nurse.
• Record baseline observation prior to treatment.
• Start the blood pump by pressing the CONFIRM button.
• Once the optical detector senses the blood. Message appears on the screen. Message: Blood detected – Dialysis START.
• Slowly increase the blood pump speed, monitoring the access pressure of the circuit and also monitor the blood pressure and heart rate of the patient, till it reaches an optimal level of 200ml/min. The blood pump speed has to run according to the tolerance of critically ill patient and can be reduced if the patient is not coping with the speed however bear in the mind the loss of clearance efficacy and higher clotting risk.
• Heparin bolus if ordered is given just as the blood is being withdrawn from the patient during connection. Or engage the automatic option on 5008 and Heparin will be automatically bloused.

During treatment
Patients in intensive care are usually critically ill and haemodialysis may cause major affect to their baseline observation. Therefore it is very important to maintain regular hourly observation on Intensys (Flow chart). Document all mandatory observations on commencement of treatment and hourly thereafter.
Patients are monitored on their cardiac rhythm, heart rate, peripheral pulses, skin turgor, capillary return, blood pressure, temperature, blood sugar level, neurological
status, peripheral saturation, fluid balance, respiratory rate and any respiratory support that the patient is receiving (pt may or may not be mechanically ventilated).

After commencement of treatment it is essential to take below stated observation from Fresenius 5008 machine and record them in the Intensiy under the “INTERMITTENT HAEMODIALYSIS” flow chart hourly.

- Dialysate Rate
- Heparin
- Patient APTT
- Blood Flow
- Arterial Pressure
- Venous Pressure
- Trans Membrane Pressure (TMP)
- Hourly Ultrafiltrate
- Fluid Output – enter hourly fluid removed in output chart.

**Discontinuing the treatment**

Once the treatment goal is achieved, the message will appear on the screen *Treatment goal achieved*, with *Dialysis Continue – Reinfusion Start*.

The decision to continue or reinfuse is made by the medical team based on the patient’s serology and pathology reports obtained just before the treatment goal time.

1. To end the treatment – Press the *Reinfusion* menu
2. Blood pump stops
3. On the Reinfusion Screen *Message* appears “Online reinfusion: Connect the SafeLine to the port at the BVM.arterial blood line. Unclamp white clamp.
4. Now press OK menu, blood pump starts to return blood to the patient. When access line is fairly clear of blood clamp access line. Blood pump will continue to reinfuse through the return circuit. If “error” alarm appears before the access line is clamped – clamp access line and continue reinfusion.
5. Once completed – the screen will show: *Blood lines Remove*. Clamp both the vas cath lumens and ensure access and return lines are clamped before pressing remove blood
lines. Machine will remove all lines automatically from pumps once confirmed. Blood lines may remain

6. Prepare the sterile field (open the OFF pack), wash hands and put on sterile gloves. Disconnect the lines from vas cath (aseptically) and pass it to the assisting nurse

7. Withdraw 10mls of blood using empty 10ml syringe from each lumen.
8. Using 10ml of normal saline, undo the clamp, flush the lumen, then re-clamp the lumen.
9. Prepare heparin lock for both lumen.
10 Draw 5000 units of heparin in 1ml to dilute in 5ml normal saline. (1000units of heparin in 1 ml normal saline)
11. Flush in the heparin lock to both lumen as indicated on each lumen.
12. Apply the sterile red caps to both lumen.
13. Press Remove menu, and the blood lines will be removed automatically. Keep the doors closed while waiting.
14. Empty the dialyzer: Place the inlet dialyzer coupling (red) on the red colour coded and the blue coupling on to the blue colour coded – then close the shunt door.
15. Remove the Bibag® and close the flap.
16. Discard the blood line in the yellow bin.

Cleaning and Disinfection
Internal cleaning and disinfection of Fresenius 5008 is fairly automated after some basic requirements are fulfilled.

The following basic requirements must be fulfilled before the start of a cleaning program:

i. The dialysate inlet tube (red) is in the shunt interlock
ii. The dialysate outlet tube (blue) is in the shunt interlock.
iii. Shunt door closed
iv. The concentrate suction tube (red) is connected to the rinse chamber.
v. The bicarbonate suction tube (blue) is connected to the rinse chamber.
vi. Concentrate flap and bicarbonate flap closed
vii. The indibag® flap must be closed
viii. The optical detector does not sense blood.
ix. Only with ONLINEplus™. The substitute port and the rinse port must be closed
Any failure to comply with the basic requirements will be indicated by a message on the display.

**Surface Cleaning**

The exterior of the haemodialysis system and the options used must be cleaned and disinfected with a cleaning and disinfecting agent.

**Additional Cleaning**

Fresenius Medical Care Australia has recommended an additional cleaning cycle using a non-scented sodium hypochlorite based solution (Bleach) in these instances:

1. **Post treatment of a patient known to have Hepatitis BsAg positive (surface antigen positive) or someone deemed to be at high risk of blood borne virus.**
   A bleach cleaning cycle is performed after the disinfection cycle followed by another disinfection cycle. *The machine must not be used on another patient until after completion the bleach clean and it has been tested for residual bleach.*

2. **Blood leak has occurred during the dialysis treatment.**
   Fresenius strongly recommends performing a cleaning cycle using bleach immediately after the completion of treatment followed by a disinfection cycle using Citrosteril.

3. **After a plasmapheresis (plasma exchange)**
   As above.

4. **If the machine is used for haemofiltration and or haemodiafiltration treatments.**
   If the equipment is used mainly for haemofiltration and or haemodiafiltration, it is recommended that an additional cleaning cycle (bleach) on weekly basis to remove possible biomaterial deposits.
   Please note: A cleaning cycle using bleach does not replace a disinfection cycle. Fresenius Medical Care Australia strongly recommends performing disinfection with Citrosteril before each dialysis treatment.

**How to start cleaning program**

1. Ensure bleach is connected at the rear of the device. Tubing from the degreasing outlet should be connected into the bleach bottle.
2 Go into **CLEANING** menu
3 Select the desired cleaning program – degreasing
4 Press the **START** key

*Please remember after a degreasing program the machine must be tested for residual bleach before being used again.*

**Turning the Fresenius 5008 Off**

Press the **On/Off** key for approximately 3 seconds, the **On/Off led** will start flashing indicating the system is on standby mode.

**Turn off the water supply**

**Risk Rating**

Medium

**Risks of Non-Compliance**

*Hypotension*
*Infection*
*Electrolytes imbalance*

**Implementation Plan**

New procedure placed in ICU Communication Book
Electronic file loaded onto ICU website
Education and in service provided to relevant staff

**Education Notes**

**Nursing care of patient**

Vascular Access

- The first stage is the insertion of a double lumen catheter, known as a VASCATH, which is inserted aseptically into either internal jugular, subclavian or femoral vein.
- Patients in intensive care are susceptible to infection due to depressed immune system so it is imperative that this is performed aseptically and the catheter is inspected each shift for signs of infection and the dressing integrity is maintained as per NLBMLHD policy [http://mscu-web09/nbmt_documentv2/SearchFiles/NBMT-PROC101063.pdf](http://mscu-web09/nbmt_documentv2/SearchFiles/NBMT-PROC101063.pdf)
- During the insertion of catheter, inform the patient that his head will be covered with the sterile drape. Make sure the patient is comfortable and reassurance given.
Blood Results

- During renal replacement therapy, it is very important to check the effective clearance of solutes, electrolytes imbalance, urea, creatinine, liver function, coagulation and full blood count level. It is to compare before, during and after the treatment. Most intensive care patients will have an arterial line or central line available, formal bloods including EUC, FBC, COAGs and electrolytes can be taken. Regular arterial blood gases also show the patient’s acid-base balance, as well as some electrolyte, particularly potassium.

**NORMAL BLOOD VALUES:**

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Range</th>
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<tbody>
<tr>
<td>Na</td>
<td>135 – 145 mmol/L</td>
</tr>
<tr>
<td>K+</td>
<td>3.5 – 5.0 mmol/L</td>
</tr>
<tr>
<td>HCO3</td>
<td>23 – 29 mmol/L</td>
</tr>
<tr>
<td>Urea</td>
<td>2.5 – 7.0 mmol/L</td>
</tr>
<tr>
<td>Creatinine</td>
<td>60 – 120 umol/L</td>
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Most renal failure patients have high potassium level, check with the medical team as to how much potassium is added to concentrate container.

Coagulation

- Coagulation levels need to be monitored as it can put patient in to risk of bleeding. Coagulation level should be taken prior to the commencement of dialysis. According to Nepean Hospital Intensive Care Unit’s Heparin Anticoagulation in Renal Replacement Therapy, the heparin infusion ideally should not increase the patient APTT, i.e. the patient’s systemic APTT should be < 60 seconds while the circuit is heparinised. APTT needs to be monitored every 4 hourly, till it stabilises.

Hypothermia

- Since the extracorporeal circuit and the infusing intravenous fluid are exposed to room temperature it is normal to see the patient’s temperature drop upon the commencement of treatment, even though the Fresenius 5008 and other dialysis machines have internal heating facility.
Nursing care requires consistent monitoring for signs of hypothermia and uses warm blankets and warmed up infusion fluid if possible.

Cardiac Monitoring

Continuous cardiac monitoring is necessary as initial fall in blood pressure is simulated as hypovolaemia symptoms, which may also increase the heart rate. This is a response to a decrease in cardiac output, triggers the baroreceptors in the arch of the aorta and the carotid sinus.

Fluid Balance

Fluid balance maintenance is a key nursing responsibility in managing RRT. Most machines now available to provide RRT incorporate a mode selection program, which includes an automatic fluid balance system (Elliott et al., 2011). This ensures delivery of a fluid prescription based on the input provided by the programming nurse (Elliott et al., 2011). As many litres of fluid may be exchanged in an hour (25-35 ml/kg), the default setting is usually a net machine balance, where all fluids administered as either dialysate or replacement are recovered or balanced (Elliott et al., 2011). The machine cannot, however, include fluids administered or expelled directly from the patient, so a fluid maintenance schedule must be established. This schedule is also based on input and output being equal (Elliott et al., 2011).

Positioning

Positioning of patients is vital for the maintenance of the patency of vascular access during RRT. Normally CRRT patients remain in bed on their back or slightly turned on side. While 4 hourly turning of patients in necessary to relieve pressure area and skin integrity maintenance, extreme care should be exercised during these procedures.

References and Related Policies


Fresenius Medical Care, 2011, Disinfection of Fresenius Medical Care 4008 and 5008 series haemodialysis machines

### Version History

<table>
<thead>
<tr>
<th>Revision Date</th>
<th>Version</th>
<th>Amendments</th>
</tr>
</thead>
<tbody>
<tr>
<td>April 2014</td>
<td>1</td>
<td>Procedure adapted to conform with Fresenius 5008. Educational notes and references updated.</td>
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