BPG 03: Continuous Renal Replacement Therapy (CRRT)

Statement of Best Practice

*Patient’s requiring Continuous Renal Replacement Therapy (CRRT) will receive appropriate therapy to meet their individual needs, optimising comfort and with the minimal adverse effects.*

1: Introduction

Continuous renal replacement therapy (CRRT) acts in place of failing kidneys by withdrawing excess fluid and waste from the body. CRRT allows slow continuous removal of fluid and waste from the body to regulate its volume, chemical composition and pH. This minimises dangerous electrolyte imbalance, the risk of hypotension and arrhythmias¹ making this therapy particularly suitable for patients who are critically ill. CRRT is a common supportive renal replacement therapy for critically ill patients with acute kidney injury (AKI).

2: Indications for Starting Therapy

2.1 Classical ‘renal’ indications for starting renal replacement therapy (RRT) are²:
- Rapidly raising serum urea and creatinine of the development of uremic complications
- Hyperkalaemia unresponsive to medical management
- Severe metabolic acidosis
- Diuretic resistant pulmonary oedema
- Oliguria or anuria

2.2 ‘Non-renal’ indications for starting RRT are²:
- Management of fluid balance e.g. in cardiac failure
- Clearing of ingested toxins
- Correction of electrolyte abnormalities
- Temperature control
- Removal of inflammatory mediators in sepsis.

3: Standards of Care

3.1 Preparation

3.1.1 Where possible, explain and discuss the procedure with the patient. If the patient lacks capacity to make decisions the practitioner must act in the patient’s best interest and this should be documented.
3.1.2 Ensure identified renal catheter in situ.

3.1.3 Prescription available for CRRT

3.1.4 Equipment available

3.1.5 Prime the circuit using the prescribed solution, following the manufacturer’s instructions.

3.1.6 Assess the patient’s fluid status, blood pressure, heart rate, cardiac rhythm, central venous pressure, cardiac output (if being measured) and dosages of any vasopressor drugs being administered. Identify any potential risk of haemodynamic instability on commencement of CRRT.

3.1.7 Observe vascular access site for signs of infection

3.1.8 Check vascular access for patency and blood flow to ensure that the vascular access will allow adequate blood flow to achieve the prescribed CRRT.

3.2 Commencement of CRRT

3.2.1 Prior to connecting the CRRT lines, program the primed CRRT machine (according to manufacturer’s guidelines) and attach anticoagulation infusion as prescribed.

3.2.2 Check correct patient against CRRT prescription

3.2.3 Measure the patient’s temperature and set the fluid warmer to an appropriate temperature

3.2.4 Put on apron, use PPE, wash hands, apply sterile gloves and open sterile dressing pack

3.2.5 Remove caps form the two hubs at the end of the double-lumen Vascath and using as ANTT swab ports with 2% chlorhexidine gluconate in 0% isopropyl alcohol and allow to air dry

3.2.6 Apply a 5ml syringe to each lumen and one at a time release the Vascath and withdraw 5ml of blood. Check for clots by emptying the syringe on to some sterile gauze, if clots present repeat the process. Then re-clamp and remove the syringe.

3.2.7 Connect the renal replacement tubing: red tubing to the red lumen in the double-lumen access Vascath; blue tubing to the blue lumen on the double-lumen access Vascath.

3.2.8 Ensure double-lumen clamps and tubing clamps are open.

3.2.9 Start CRRT machine blood pump, increase speed slowly. Aim to increase the blood pump speed to the prescribed level, usually 200mL/min².

3.2.10 If blood flow is inadequate consider swapping the access tubing (that is red tubing) to the blue lumen and blue return tubing to the red lumen. (Note: a 3-10% recirculation could occur)

3.2.11 Once prescribed blood pump speed is established start prescribed replacement fluid and/or dialysate.

3.2.12 Observe the patient’s fluid status, blood pressure, heart rate, cardiac rhythm, central venous pressure and cardiac output (if being measured).
### 3.3 Managing the patient on CRRT

**3.3.1** Continuously observe and monitor the patients vital signs and fluid status.

**3.3.2** Monitor blood urea, creatinine and electrolytes. Consider the need to change potassium levels in replacement fluids and alter doses of replacement phosphate.

**3.3.3** Monitor blood clotting / citrate and titrate anticoagulation or treatment as per Trust policy.

**3.3.4** Observe access entry site.

**3.3.5** Monitor CRRT circuit. Keep circuit free from obstruction, kinks and accidental clamping.

**3.3.6** Observe circuit for the presence of air in the circuit.

**3.3.7** Ensure the tubing remains securely connected.

**3.3.8** Monitor and document CRRT machine pressures, such as access and return pressures, TMP (transmembrane pressures) and pre-filter pressures.

**3.3.9** Monitor and respond to all CRRT alarms.

**3.3.10** Calculate and document hourly fluid totals.

### 3.4 Disconnection of CRRT

**3.4.1** Collect all necessary equipment.

**3.4.2** Put on apron, use PPE, wash hands and apply sterile gloves and open sterile dressing pack.

**3.4.3** Clamp access lumen (red Lumen) on Vascath.

**3.4.4** Disconnect access tubing (red tubing) form the double-lumen Vascath and using ANTT connect access tubing to 0.9% sodium chloride.

**3.4.5** Commence disconnection according to manufacturer’s guidelines, following the CRRT machine on-screen instructions.

**3.4.6** Swab access hub with 2% chlorhexidine gluconate in 70% isopropyl alcohol and allow to air dry.

**3.4.7** Attach 5ml syringe and withdraw blood from access lumen of the Vascath.

**3.4.8** Flush access lumen with 10mL of 0.9% sodium chloride and then administer prescribed anticoagulant.

**3.4.9** Apply sterile cap to access hub.

**3.4.10** Once all blood returned to patient and CRRT blood pump stopped, clamp return lumen (blue lumen) on Vascath.
3.4.11 Disconnect return tubing (blue tubing) from the double-lumen Vascath and swab access hub with 2% chlorhexidine gluconate in 70% isopropyl alcohol and allow to air dry.

3.4.12 Attach 5ml syringe and withdraw blood from return lumen of the Vascath.

3.4.13 Flush access lumen with 10ml of 0.9% sodium chloride and then administer prescribed anticoagulant.

3.4.14 Apply sterile cab to return hub.

3.4.15 Ensure VASCATH clamps are on securely.

3.4.16 Discard used circuit appropriately in line with national and local waste disposal guidelines.

3.4.17 Document, sign, date and time the CRRT discontinuation.

**Education and Training**

All staff performing in CRRT should have received the appropriate training and be able to demonstrate competence in accordance with local trust policies.

**References**


**Group Membership**

Julie Platten NoECCN
Lesley Durham NoECCN
NoECCN Benchmarking Fast Focus Group
## Problem solving – Continuous Renal Replacement Therapy

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<th>Suggested Action</th>
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| **Low access pressure** (negative pressure generated to remove blood from the patient)** | • VASCATH is sucking against a vessel wall  
• VASCATH lumen is partially clotted or fully clotted  
• Lumen is kinked or clamped | Make sure both lumens and all tubing are straight and unclamped | 1. Reposition the patient and/or VASCATH with a little external manipulation to maintain alignment.  
2. Swap the access and return tubing  
3. Temporarily reduce the blood pump speed  
4. Clamp off tubing and access lumen and attempt to aspirate lumen with a syringe to remove a clot. If clot is removed and good flow is restored, flush access lumen with 0.9% sodium chloride, reconnect tubing and release clamp. If clot is not removed and cannot be withdrawn, consider stopping the CRRT by returning the blood, followed by re-siting the VASCATH |
| **High return pressure** (pressure generated to return the blood back to the patient)** | • VASCATH lumen is clotted or occluded  
• Lumen or line is kinked, clamped  
• Circuit clotted | Make sure all the lumens and tubing are straight and unclamped | 1. Reposition the patient and/or VASCATH  
2. Clamp off tubing and VASCATH return lumen and attempt to aspirate lumen with a syringe to remove clot. If clot is removed and good flow is restored, flush access lumen with 0.9% sodium chloride, reconnect tubing and release clamps. If clot is not removed and cannot be withdrawn, consider stopping the CRRT by returning the blood, followed by re-siting the VASCATH.  
3. If circuit clotting, prepare to discontinue treatment. |
| **Low return pressure** (pressure generated to return the blood)** | • Low blood pump speed  
• Return tubing disconnected | Ensure tubing is securely connected | 1. Increase blood flow rate to prescribed rate  
2. If disconnected attach tubing to VASCATH |
| **High transmembrane pressures (TMP)** (reflects the positive pressure inside the fibres and negative pressure outside the filter)** | • Rapid rise in TMP:  
  • Filtrate tubing or bags occluded by a clamp or kink  
  **Slow rise in TMP:**  
  • Filter clotting slowly  
  **High TMP from the beginning of treatment:**  
  • Ratio of pressure between blood flow | Ensure tubing is straight and unclamped.  
Consider increasing pre-dilution rate on commencing of next treatment (particularly if CRRT circuit prematurely clotted on | 1. Remove the kink or unclamp the tubing or bag  
2. Consider increasing pre-dilution rates and decreasing post-dilution rate. Then, if the TMP decreases, continue treatment. If TMP continues to rise, discontinue CRRT (to return blood to patient to prevent blood loss). Consider more pre-dilution on commencement of next CRRT.  
3. Increase the blood flow speed or decrease the |
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<th>and replacement fluid is too high. previous treatments)</th>
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<td><strong>High pre-filter</strong> (positive pressure generated in the circuit immediately before the blood enters the haemofilter)</td>
<td>• Tubing kinked&lt;br&gt;• ‘Return chamber’ clotting&lt;br&gt;• Filter clotting</td>
<td>Ensure tubing is straight&lt;br&gt;Consider more pre-dilution on next CRRT</td>
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<td><strong>Air detected</strong> (air or microfoam in CRRT tubing prior to returning blood to the patient)</td>
<td>• Air in the tubing returning to the patient&lt;br&gt;• Blood level is too low in ‘return chamber’&lt;br&gt;• Return tubing is not in the air detector clamp correctly</td>
<td>When setting up the circuit ensure air detector is securely fitted&lt;br&gt;When priming, ensure that all air is cleared from the circuit.</td>
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<td><strong>Blood leak</strong> (traces of blood in the ultra-filtrates this sometimes discoloured (usually rosé))</td>
<td>• Filter membrane ruptured causing a leak of blood into the ultra-filtrate&lt;br&gt;• Blood leak detection chamber not correctly in housing&lt;br&gt;• Sensor in housing unclean</td>
<td>When setting up the circuit, ensure blood leak detection chamber is housed in the correct position and machine sensor cleaned.</td>
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<td><strong>Fluid balance</strong> (deviation in weight from the values set by the operator)</td>
<td>• Fluid bags moving or swinging below the machine&lt;br&gt;• Fluid bags not connected properly&lt;br&gt;• Fluid tubing are kinked or clamped</td>
<td>Ensure tubing is straight and free from obstruction.&lt;br&gt;Ensure fluid replacement bags and ultra-filtrate bags are unclamped</td>
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1. Prepare to end treatment
2. Prepare to end treatment and consider more pre-dilution on next treatment
1. Remove air with a syringe
2. Using a syringe manually raise the blood level in the return chamber. This will remove the excess air.
3. Place tubing correctly within the air detector.
1. Cease treatment and change filter and circuit
2. Replace chamber and housing
3. Clean the sensor in housing and replace the chamber

4. Do not override the balance alarm, always identify the cause.
