| MANUAL: | | POLICY #: | | | |
|---|---|---|---|---|---|
| SUBJECT: | **Guidelines for initiation, maintenance and discontinuation of continuous renal replacement therapy (CRRT) in (Surgical) ICU patients** | EFFECTIVE DATE: | | | |
| | | REVISED DATE: | | | |
| | | AUTHORIZED APPROVAL: | | | |
| PERSONNEL COVERED: | **Nursing and physician care providers of relevant patients in intensive care unit environments** | PAGE: | 1 | OF | 5 |

**PURPOSE**

The purpose of these guidelines is to define the indications for starting and stopping CRRT in (surgical) ICU patients and to describe nursing responsibilities for initial set-up and maintenance of the therapy and related patient care. CRRT is a resource- and labor-intensive modality that allows continuous removal of toxins and fluids in ICU patients who may not tolerate other forms of dialysis.

**DEFINITION**

- *Acute kidney injury (previously acute renal failure)* is defined by any of the following:
    - Increase in SCr by >0.3 mg/dl (>26.5 mol/l) within 48 hours
    - Increase in SCr to >1.5 times baseline, or
    - Urine volume <0.5 ml/kg/h for 6 hours.
- *CRRT* uses a highly porous blood filter and an extracorporeal blood circuit for filtration of intravascular fluid and dissolved waste products 24 hours/day. CRRT is achieved by the following techniques.
    - *Slow continuous ultrafiltration (SCUF)* provides for the removal of fluid by filtration with minimal clearance of toxins, as no replacement fluid is used to dilute plasma concentration.
    - *Continuous venovenous hemofiltration (CVVH)* uses replacement fluid to dilute toxins in plasma as the toxins are removed with the ultrafiltrate. Clearance of toxins is through the process of convection based on particle size where small and medium molecules are sieved out across a pressure gradient.
    - *Continuous venovenous hemodialysis (CVVHD)* uses a dialysate (and no replacement fluid) to remove toxic waste and fluid of small molecules (such as urea) through the process of diffusion across a concentration gradient.
    - *Continuous venovenous hemodiafiltration (CVVHDF)* combines the above two modalities to remove toxins via convection and diffusion, using both dialysate and replacement fluid.
    - An effluent volume of 20-25 mL/kg/h should be delivered by CRRT.
    - The same fluid is typically used for dialysis and replacement. Lactate solutions are generally avoided in patients with liver failure and lactic acidosis. Bicarbonate-based solutions are preferred. Replacement fluid may be given pre- or post-filter. Pre-filtration replacement extends filter life, but is of lower efficiency and requires a higher ultrafiltration rate.
- Intermittent therapies can be both slowed and extended and include *Sustained Low Efficiency Dialysis (SLED).* SLED is a hybrid technique that uses a conventional hemodialysis machine instead of a CRRT machine. A treatment lasts 8-12 hours with lower blood and dialysate flow rates. The dialysate is from concentrated rather than commercially bought dialysis solutions. SLED uses saline hemofiltration, eliminating the need for anticoagulation. Finally, it is more cost effective in comparison to CRRT. ICU patients undergoing SLED should have:
    - Use of dialysate with a sodium concentration of 145 mmol/L or greater not buffered by acetate
    - Use of dialysate temperature of 35-37 degrees C

- Fluid priming in an isovolemic state
- Initiation without ultrafiltration, if hemodynamically unstable

| Modality/Feature | Fluid used? | Blood flow | Replacement fluid rate | Dialysis fluid rate |
|---|---|---|---|---|
| **SCUF** | none | 100 ml/min | N/A | N/A |
| **CVVH** | Replacement only | 150 ml/min | 1000 ml/hr up to 8.0L | N/A |
| **CVVHD** | Dialysis only | 150 ml/min | N/A | 1000 ml/hr * |
| **CVVHDF** | Both | 150 ml/min | 1000 ml/hr up to 8.0L | 1000 ml/hr * |
| **SLED** | Non-proprietary dialysate | 200 mL/min | N/A | 300 mL/min |

- Patient fluid removal up to 2L/hr

*Or 23/41 mL/min to get to 20/35 mL/kg/hr up to 8L/hr

**POLICY**

- This policy governs the following:
  - The indications for initiating and discontinuing CRRT and SLED:
    - *Indications for CRRT*:
      - Acute kidney injury with cardiovascular instability
      - Acute kidney injury with septicemia
      - Acute kidney injury with cerebral edema or suspicion for cerebral edema (e.g. hepatic encephalopathy)
      - Acute kidney injury with rhabdomyolysis
      - Potentially for acute hepatic failure in the absence of acute kidney injury as previously described to prepare for liver transplantation
    - *Contraindications to initiation or continuation of CRRT*
      - Appropriate for conventional intermittent hemodialysis or SLED
      - Patient and/or family desire palliative care only
      - Terminal disease with no reasonable expectations for recovery
      - Irreversible liver failure in a patient who is not a candidate for liver transplantation

- RRT should be initiated emergently when there are life-threatening changes in fluid, electrolyte and acid-base balance. RRT should be started based on the presence of conditions that can be modified with RRT and based on trends in laboratory tests, rather than single values.

- CRRT should be discontinued when it is no longer required, either because intrinsic kidney function has recovered to the point that it is adequate to meet patient needs, or because RRT is no longer consistent with the goals of care.

- The initial set-up and maintenance of the CRRT and SLED:

    - A formal nephrology consultation must be obtained prior to initiating dialysis with a signed consent form.

    - CRRT orders will be utilized for all patients and desired net loss and/or fluid therapy will be indicated in the MD order and approved by the ICU team.

    - The initial set-up of the CRRT system will be performed by the hemodialysis nurse in conjunction with the intensive care unit nurse. Subsequent management of the CRRT circuit, patient monitoring and disconnection from therapy will be by the ICU nurse with a minimum nurse: patient ratio of 1:1. SLED will be managed by the dialysis nurse with a minimum nurse: patient ratio of 1:1.

    - The hemodialysis nurse will be available for consultation during the course of the procedure.

    - Anticoagulation will be used if a patient does not have an increased bleeding risk or impaired coagulation. If possible, citrate anticoagulation will be used. Heparin will be used for those with contraindication to citrate (e.g. those with liver failure). Argatroban will be used in those with heparin induced thrombocytopenia and contraindication to citrate anticoagulation. Alternatively, fondaparinux may be considered.

**EQUIPMENT**

- Hemodialysis catheter will be inserted sterilely and managed aseptically with site inspection and dressing changes as per ICU routine. An uncuffed nontunneled dialysis catheter is preferred, unless a cuffed and tunneled catheter is already present or it is determined that the patient will likely be a candidate for long-term dialysis. When choosing a vein for insertion of a dialysis catheter in patients with AKI, these sites will be used in order of preference:
    - Right jugular vein
    - Femoral vein
    - Left jugular vein
    - Subclavian vein—dominant side

  Catheters will be placed using ultrasound-guidance.
- CRRT machine

**PROCEDURE**

- Prior to initiation of therapy, the ICU physician or designee will verify the correct placement of the access catheter.

- Priming will be performed twice by the ICU nurse. Heparinized saline will be utilized, unless contraindicated. If the patient is hemodynamically unstable, the second prime will be performed with colloids.

- Anticoagulation will be performed as per physician order.

- The patient will be weighed daily

- Vital signs and hemodynamics will be monitored and recorded hourly or as ordered

- Temperature will be monitored and recorded every 2-4 hours. Warm fluid therapy and active rewarming will be utilized as indicated.

- Intake and output will be recorded hourly on the ICU flowsheet as will: access, venous and effluent pressures, replacement fluid, dialysis, blood flow and patient fluid removal rate and daily cumulative total of patient fluid removed.

- Laboratory work will be ordered by the ICU team to include daily CBC, bid chemistry and coagulation profile.

- The ICU and/or nephrology team will be notified of abnormal laboratory results, signs of clotting in the CRRT system (high transmembrane, balance chamber or effluent pressures or low venous pressure), blood leaks and signs of infection at the access site.

**PERFORMANCE REVIEW**

The ICU director along with the multidisciplinary team will meet on a regular basis to identify and address issues through quality assurance and continuous quality improvement activities. The SICU database will track relevant patient data. This information will be reviewed and discussed regularly to identify opportunities for improvement.

**DISCLAIMER**

These clinical guidelines may not be appropriate for all patients under all circumstances. New information and evidence may become available that renders their content less valid. Practitioners must utilize their clinical judgment to determine what is helpful to them and what is appropriate.

**REFERENCE(S)**


- Brochard, L, Abroug F, Brenner M, et al. An Official ATS/ERS/ESICM/SCCM/SRLF Statement: Prevention and management of acute renal failure in the ICU patient: An international consensus conference in intensive care medicine. Am J Resp Crit Care Med, 2010; 181: 1128-1155.

- Kelly JA, Lameire N and the KDIGO Work Group. KDIGO Clinical Practice Guideline for Acute kidney injury. Kidney International, 2012; Vol 2, Supplement 1.

**RELATED POLICIES AND PROCEDURE(S)**

- Monitoring guidelines
- Surgical consent policy and order set

| **Effective/Revision Dates for Policy # <insert policy number>** | | |
|---|---|---|
| Effective: | 00/00/0000 | <replace with revising committee name> |
| Revised: | 00/00/0000 | |
| | 00/00/0000 | |
| | 00/00/0000 | |
| Keywords: | | |