

# Patient Safety During Renal Support for ICU Patients with AKI

Samantha S. Taylor, RN, BScN CNCC(C)

Gambro Intensive Care Therapy Specialist  
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I have no actual or potential conflict of interest in relation to this program or presentation.



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## Challenges of AKI in critical care

- ◆ Caring for Critically ill patients with acute kidney injury (AKI) can be challenging
- ◆ Therapies such as Continuous Renal Replacement Therapy (CRRT) and Intermittent Hemodialysis (IHD) utilized in Critical Care are considered highly specialized interventions
- ◆ Critical Care nurses must possess thorough knowledge and skills to safely manage these complex treatments
- ◆ It is important to understand the patient's condition and know how to respond to adverse events that can occur with RRT

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**Patient Safety with RRT**  
**We've come a long way!**



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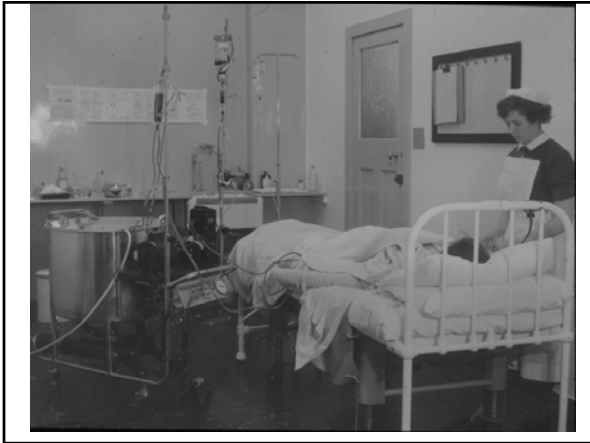
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## Safety

Most common adverse events reported for patients receiving RRT center around:

- ◆ Heparin and bleeding
- ◆ Dosage and calculation issues
- ◆ Filter issues
  
- ◆ There are also others

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## Anticoagulation - Heparin

Monitor for any adverse effects of anticoagulation including:

- ◆ Hemorrhage
- ◆ Formation of hematomas
- ◆ Thrombocytopenia
- ◆ HITT
- ◆ Activated Clotting time (ACT) or Partial Thromboplastin Time (PTT), monitoring must be readily available
- ◆ ACT monitoring can provide results in minutes
- ◆ PTT results from the lab can take much longer. Delays can result in administration of too much Heparin

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## Anticoagulation - Heparin

Under dosing may lead to:

- ◆ Shorter filter life
- ◆ Clotted filter
- ◆ Patient blood loss
- ◆ Decreased delivered dose

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## Anticoagulation - Citrate

Trisodium citrate is an alternative anticoagulant to Heparin and requires more nursing time and closer monitoring

Access to rapid processing of lab values is important for diligent monitoring of :

- ◆ Circuit post filter ionized calcium
- ◆ Patient's ionized calcium
- ◆ Patient's total calcium
- ◆ Electrolyte and acid base balance

Essential for prevention of adverse events and to ensure patient receives appropriate dose of citrate in the circuit and IV calcium infusion

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## Citrate Anticoagulation

- ◆ Approximately **30%** of the citrate is dialyzed off during RRT
- ◆ Therefore to prevent citrate toxicity, use caution with isolated ultrafiltration (CVVH) when citrate is utilized for anticoagulation

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## Changing anticoagulation

- ◆ Changing anticoagulation while running CRRT or IHD can cause complications if performed incorrectly
- ◆ Calcium must be added/removed to dialysate, pump speed adjusted accordingly (CRRT), calcium infusion initiated/deleted, and correct anticoagulant placed in circuit

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## Central line infections

- ◆ Can lead to severe sepsis in patients undergoing RRT
- ◆ Prevented by utilizing strict aseptic technique and asking a colleague for assistance when initiating treatment



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## Hypotension

Severe hypotension accompanies 20-30% of hemodialysis sessions in patients with ARF.

Prevented by:

- ◆ Choice of CRRT/IHD
- ◆ Ensuring a colleague to assist when initiating treatment
- ◆ Gradually increasing blood pump speed
- ◆ Ensuring physicians orders for colloid, crystalloid and/or vasopressors are complete and available prior to initiation of treatment

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## Hypotension

If an adverse event occurs (i.e., access problems, or hemodynamic instability):

- ◆ one nurse must focus on the patient when the other will troubleshoot the lines and machine and return the blood from the circuit to the patient if required

If the patient becomes hypotensive during treatment:

- ◆ **call for help**
- ◆ blood pump speed should be decreased
- ◆ minimum weight loss activated (especially important for IHD)
- ◆ patient placed supine
- ◆ administration of colloids/crystalloids or pressors

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### Preparing Solutions

- ◆ When preparing dialysate solution or mixing dialysate/replacement bags, a “systematic approach” should be utilized
- ◆ It is easy to get distracted and make medication errors

**CAUTION**  
BLASTING AREA  
KEEP AWAY

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### CO<sub>2</sub>

- ◆ CO<sub>2</sub> evaporates from NaHCO<sub>3</sub> in Prismocal bags making it more acidic once outside bag is opened placing the patient at risk for acidosis
- ◆ PrismOcal bags are stable for:
  - 24 hrs if the outer wrapper is opened
  - 12 hours if more than the Sodium bicarbonate in pouch A is added to bag

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## Fluid Removal

- ◆ Actual fluid removal for CRRT should be compared to the hourly fluid removal volume that was programmed
- ◆ If there is a discrepancy of greater than 30 mL for 2 consecutive hours, then the run time should be checked (check specific unit policy)
- ◆ If the run time is close to 60 min, then there may be a problem (i.e., clamped lines, bag may be resting on an object, etc)

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## Alarms, Alarms, Alarms

- ◆ If alarms are ignored or bypassed without determining the cause, mechanical failure may occur
- ◆ By bypassing alarms without correcting the cause, the operator is creating a safety hazard
- ◆ Prompt attention to alarms and knowledge of troubleshooting can also prevent loss of circuit and blood loss to the patient
- ◆ Nurses need to be able to return blood through the machine or manually in an emergency

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## Alarms, Alarms, Alarms

- ◆ Knowledge of how to determine when the circuit is beginning to clot so blood return can be completed prior to circuit clotting, can prevent patient blood loss – troubleshooting
- ◆ Ensuring patent dialysis lines before initiating treatment will also prevent alarms and circuit/patient blood loss

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### Treatment Modes

- ◆ Initiation of CRRT or IHD treatment options requires education to ensure their safe use by nurses and other health professionals
- ◆ Maintaining CRRT or IHD expertise normally requires at least 12 procedures per year, with each procedure lasting at least five to seven days

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### Treatment Modes

- ◆ Ongoing education and practice is important in maintaining competency, especially in centers where frequency of use is low
- ◆ Consistent ordering of modalities is also important. If protocols are modified, nurses need to be informed of the changes ahead of time and educated on the change in practice and effects on treatment and patient monitoring (i.e. Changing from CVVHDF to CVVH if using citrate may result in hypocalcemia)

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### Air Embolus

- Air embolus should be detected by the air detector on the circuit but can occur if
- ◆ the air is not removed from circuit during priming
  - ◆ if there is a loose connection
  - ◆ if access is poor, a vacuum is created

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## Air Embolus

Prevention:

- ◆ Connections are tight
- ◆ Air is removed
- ◆ Lines are patent before beginning treatment
- ◆ Ensure ongoing assessment of circuit throughout treatment
- ◆ Troubleshooting

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## Ethylene Oxide

- ◆ Ethylene Oxide (Eto) is a safe and economical bactericidal gas used for sterilization but allergic reactions can occur if dialyzer if not properly primed
- ◆ Patient connection should occur shortly after priming
- ◆ If the system is primed ahead of time, ensure a final prime just before initiating treatment as EtO leaches from the circuit

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## Nephrotoxic Medications

Medications that can be nephrotoxic include:

- ◆ Diuretics
- ◆ Ace Inhibitors
- ◆ Beta blockers
- ◆ Vasodilators (Decrease in renal perfusion)
- ◆ Non-steroidal anti-inflammatories (allergic interstitial nephritis).
- ◆ IV contrast agents (impaired intrarenal hemodynamics)
- ◆ Aminoglycosides, amphotericin, cisplatin (tubular toxicity)

These medications must be closely monitored to ensure no further damage to the already injured kidney occurs

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## Disequilibrium Syndrome

more common in the IHD population than CRRT,  
but is a potentially life threatening complication

Symptoms:

- ◆ Headache
- ◆ Nausea
- ◆ Muscle cramps
- ◆ Irritability
- ◆ Agitation

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## Disequilibrium Syndrome

Prevention is the mainstay of therapy

Predisposing factors:

- ◆ New patients just being started on hemodialysis are at greatest risk, particularly if the BUN is markedly elevated
- ◆ Severe metabolic acidosis
- ◆ Older age
- ◆ Pediatric patients
- ◆ Presence of other central nervous system disease such as a pre-existing seizure disorder

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## Hypothermia

CRRT :

- ◆ ST 100 circuit contains = **231 mL** ( 152 + 79 ml for blood warmer tubing)
- ◆ ST 150 = **268 mL** ( 189 + 79 ml for blood warmer tubing)
- ◆ Dialysate and replacement fluids are at room temp

IHD :

- ◆ circuit holds 320 mL

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## Hypothermia

Effects of hypothermia include:

- ◆ Dysfunction of clotting factors and platelets
- ◆ Activation of fibrinolysis
- ◆ Cardiac arrhythmias
- ◆ Depending on the type of RRT utilized, anywhere from 231mL to 320mL of blood is contained in the circuit
- ◆ Warming of the dialysate and/or blood is essential to prevent the effects of hypothermia

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- ◆ There are challenges in safely caring for a critically ill patient with AKI undergoing RRT
- ◆ Critical care nurses trained in the prevention and treatment of potential complications are essential in the safe delivery of RRT

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**IN A NUTSHELL....  
KNOW WHAT YOU ARE  
DOING AND WHY!!**

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