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RENAL RESCUE: PHARMACIST ESSENTIALS FOR CONTINUOUS RENAL REPLACEMENT THERAPY

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Disclosure

I do not have a vested interest in or affiliation with any corporate organization offering financial support or grant monies for this continuing education activity, or any affiliation with an organization whose philosophy could potentially bias my presentation (within the last 12 months).

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Objectives

Pharmacist objectives:

- Differentiate between modalities of continuous renal replacement therapy (CRRT)
- Discuss pharmacokinetics considerations of medication use in patients receiving CRRT
- Compare different CRRT anticoagulation strategies

Technician Objectives:

- Discuss the indications for CRRT in critically ill patients.
- Recognize important pharmacy operations for uninterrupted CRRT runs

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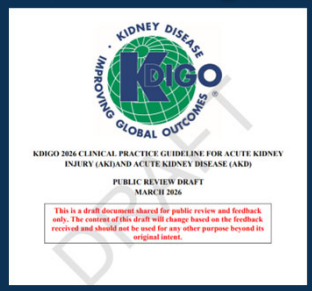

https://kdigo.org/wp-content/uploads/2026/03/KDIGO-2026-AKI-AKD-Guideline-Public-Review-Draft-March-2026.pdf

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Background

- Acute kidney injury (AKI) is associated with high morbidity and mortality in critically ill patients
- Large number of ICU patients require initiation of renal replacement therapy (RRT)
- An international survey evaluated the use of each RRT for AKI patients in the ICU
  - 80% of patients on CRRT
  - 17% of patients on iHD
  - 3% of patients on peritoneal dialysis or slow continuous ultrafiltration

AKI: acute kidney injury
ICU: intensive care unit
CRRT: continuous renal replacement therapy
RRT: renal replacement therapy
iHD: intermittent hemodialysis

Semin Dial. 2009;22(2):114-22
N Engl J Med. 2012;367(26):2505-14

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Definition of Acute Kidney Injury (AKI) (AKIN vs RIFLE criteria)

AKI staging	Urine output	RIFLE	
Serum creatinine	(common to both)	Class	Serum creatinine or GFR
Stage 1 Increase of more than or equal to 0.3 mg/dl (≥26.5 μmol/l) or increase to more than or equal to 150% to 200% (1.5- to 2-fold) from baseline	Less than 0.5 ml/kg/h for more than 6 hours	Risk	Increase in serum creatinine × 1.5 or GFR decrease >25%
Stage 2 Increased to more than 200% to 300% (>2- to 3-fold) from baseline	Less than 0.5 ml/kg per hour for more than 12 hours	Injury	Serum creatinine × 2 or GFR decreased >50%
Stage 3 Increased to more than 300% (>3-fold) from baseline, or more than or equal to 4.0 mg/dl (≥354 μmol/l) with an acute increase of at least 0.5 mg/dl (44 μmol/l) or on RRT	Less than 0.3 ml/kg/h for 24 hours or anuria for 12 hours	Failure	Serum creatinine × 3, or serum creatinine >4 mg/dl (>354 μmol/l) with an acute rise >0.5 mg/dl (>44 μmol/l) or GFR decreased >75%
		Loss	Persistent acute renal failure=complete loss of kidney function >4 weeks
		End-stage kidney disease	ESRD >3 months

AKIN: Acute Kidney Injury Network
RIFLE: Risk, Injury, Failure, Loss, End-stage kidney disease

Kidney Int Suppl 2012;2:1-138.

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Indications for renal replacement therapy initiation

- **A**cidosis
- **E**lectrolyte imbalances (hyperkalemia)
- **O**verload (volume, e.g. pulmonary edema)
- **U**remia
- **I**ntoxication
- **O**liguria/ anuria

Kidney Int Suppl 2012;2:1-138.

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Types of renal replacement therapy in ICU

Inpatient renal replacement therapy

- **Intermittent hemodialysis (IHD)**
- **Prolonged intermittent renal replacement therapy (PIRRT)**
- **Continuous renal replacement therapy (CRRT)**

** Peritoneal dialysis (PD) typically not initiated inpatient*

Shainkhouni S et al. Surg Clin N Am 2022;102:181-198

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IHD vs CRRT in the ICU

	IHD	CRRT
Which patients?	Typically, hemodynamically stable	• Hemodynamically unstable • At risk of increased intracranial pressure or cerebral edema
Advantages	• Rapid removal of toxins and low molecular weight substances • Treatment of choice for life-threatening intoxications and hyperkalemia • Allows for down-time for procedures etc • Reduced exposure to anticoagulation	• Continuous removal of toxins ("slow and steady") • Less effects on hemodynamics • More controlled volume removal • Superior overall volume removal over course of treatment
Disadvantages	• Hemodynamic instability with rapid volume removal • Dialysis disequilibrium → risk of cerebral edema	• Labor intensive for ICU nurses • Need for anticoagulation • Limited patient mobility • Significant downtime with interruptions • Risk of hypothermia

Kidney Int Suppl 2012;2:1-138.

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CRRT goals of therapy

- **Controlled volume management**
- **Acid-base disorder management**
- **Solute clearance**

Shainkhouni S et al. Surg Clin N Am 2022;102:181-198.

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CRRT functions

Volume removal

- Termed "ultrafiltration"
- Helps manage volume overload
- Goal determined by ICU and nephrology
- Titrated by ICU nurse at bedside as tolerated

Solute removal

- Mechanisms:
  - Diffusion
  - Convection
- Removes toxins
- Inadvertently also removes medications and micronutrients
- Dose determined by nephrology and adjusted daily

Neyra J et al. Seminars in Dialysis 2021;34:432-39.
Teixeira JP et al. CJASN 2023;18:256-69.

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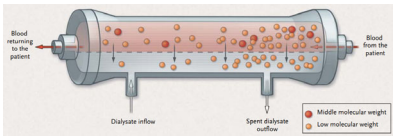
CRRT solute removal mechanism: Diffusion

- **Diffusion**
  - CRRT modality:
    - CVVHD
    - CVVHDF (+ convection)
- **MOA:**
  - Concentration gradient
- **Fluids:**
  - Only dialysate fluid
    - Does not touch blood
  - No replacement fluid
- **Clearance:**
  - Small molecules



Tolwani A. N Engl J Med 2012;367:2505-14.

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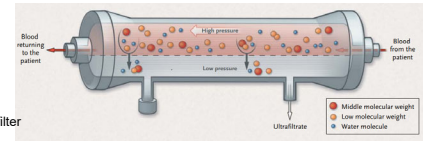
CRRT solute removal mechanism: Convection

- **Convection** (hemofiltration)
  - CRRT modality:
    - CVVH
    - CVVHDF (+ diffusion)
- **MOA:**
  - "Solute drag"
  - Pressure gradient
- **Fluids:**
  - Replacement fluid (pre or post filter or both)
    - Comes in direct contact with blood
  - No dialysate fluid
- **Clearance:**
  - Small and mid size molecules



Tolwani A. N Engl J Med 2012;367:2505-14.

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CRRT modalities: How are solutes cleared?

Continuous veno-venous hemofiltration (CVVH)	Continuous veno-venous hemodialysis (CVVHD)	Continuous veno-venous hemodiafiltration (CVVHDF)
Mechanism: Convection	Mechanism: Diffusion	Mechanism: Convection + Diffusion
Replacement fluid only	Dialysate fluid only	Replacement and dialysate fluids

Tolwani A. N Engl J Med 2012;367:2505-14.

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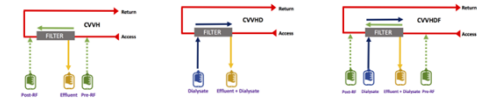
CRRT modalities: How are solutes cleared?

Continuous veno-venous hemofiltration (CVVH)	Continuous veno-venous hemodialysis (CVVHD)	Continuous veno-venous hemodiafiltration (CVVHDF)
Replacement fluid only	Dialysate fluid only	Replacement and dialysate fluids

Post-RF: post filter replacement fluid
Pre- RF: prefilter replacement fluid



Tolwani A. N Engl J Med 2012;367:2505-14.
Dosing Continuous Renal Replacement Therapies (CRRT): What is Enough? - Renal Fellow Network Accessed 6.15.26

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Example of CRRT machine and CRRT fluids

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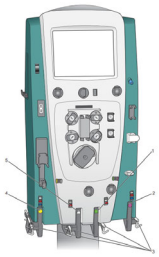
CRRT Machine PrismaFlex®

1. **Green square:** Dialysate scale
2. **Purple octagon:** Replacement scale
3. Scale carrying bar assembly
4. **Yellow circle:** Effluent scale
5. **White triangle:** Pre-blood pump (PBP) scale



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Premixed dialysate and replacement fluids

- **2 compartment 5L bags**
  - Electrolytes (Na, Cl, K, Mg, Phos, dextrose, Ca)
  - Fluids
  - RN to break seal and mix before immediate use
- **Different types**
  - PrismaSol
    - Does not contain phosphate
  - PrismaSate
    - Does not contain phosphate
  - Phoxillum
    - Contains phosphate, no dextrose
- **Important to know the composition of the fluids on formulary**

Table 1. Composition of solutes in serum, dialysate, and CRRT solutions

Analyte	Normal Serum Concentration[a]	Standard IHD Dialysate	Commercially Available Phosphate-Free CRRT Solutions[b]	Commercially Available Phosphate-Containing CRRT Solution
Sodium, mEq/L	136–145	137[c]	130[d], 140	140
Potassium, mEq/L	3.5–5.0	2, 3[e]	0, 2, 3, 4	4
Calcium, mEq/L	2.3–2.5[f]	2, 2.5, 3[e]	0[d], 2.5, 3	0[d], 2.5
Magnesium, mmol/L	0.66–1.07	0.75	1, 1.5	1.5
Chloride, mEq/L	98–106	104–106	106–120.5	114.5, 122
Acetate, mEq/L	—[g]	4	0	0
Lactate, mEq/L	0.7–1.8	0	0–3	0
HCO_3, mEq/L	23–28	35[e]	25[d], 35	22[d], 32
Dextrose, mg/dl	70–99[h]	100	100	0
Phosphate, mg/dl	1.12–1.45[h]	0	0	1.2

Ranges and multiple entries in the dialysate and CRRT solutions reflect the manufacturer's labels, or the ability to change the concentration by the prescriber. CRRT, continuous RRT; IHD, intermittent hemodialysis; HCO_3, bicarbonate; —, no data.
[a]Normal serum concentrations obtained from UpToDate. Minor variations are present among laboratories.
[b]Minor variations in electrolyte concentrations may occur depending on the manufacturer.
[c]Other concentrations are available.
[d]Zero calcium and lower sodium and bicarbonate concentration are used during citrate anticoagulation.
[e]Serum ionized calcium (usual units in laboratory reports are mmol/L [divide mEq/L by two] or mg/dl [multiply mEq/L by two]).
[f]Serum acetate is not clinically measured.
[g]Serum glucose.
[h]Serum phosphate is measured as mg/dl. The normal serum phosphorus concentration is 3.4–4.5 mg/dl (1.12–1.45 mmol/L).

A Diverse Portfolio of Pre-Mixed CRRT Solutions | Vantive for Healthcare Professionals - Kidney care and beyond Accessed on 5/22/2026. CJASN 2022;17:631-633.

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Volume management on CRRT

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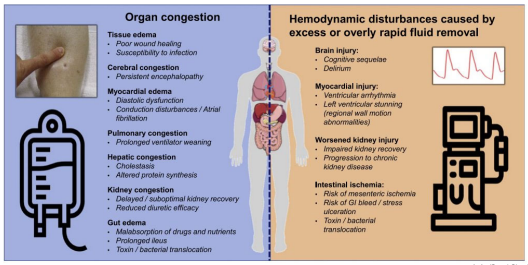
Sequelae of volume overload and rapid removal



Ieaira JP et al. Blood Purif 2023;52:857-79.

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Volume management on CRRT

- **Clinical assessment**
  - Team to set volume goals for the day
  - Terminology: "net even", "net negative 50", "net positive 50"
  - Nurse calculates hourly intake, calculates how much volume to pull off CRRT the following hour
- **Daily weights + signs of volume overload** (physical exam, imaging etc)
- **Evaluate total Ins**
  - Infusions – any benefit to concentrate medications?
  - Any nutrition adjustments?
    - Enteral nutrition: volume of flushes
    - Parenteral nutrition: volume of total parenteral nutrition (TPN)
- **Interpret vasopressor requirements more accurately**

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Solute removal via CRRT

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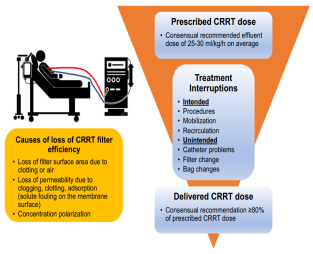
Solute removal: Effluent rate

- Clearance measured as removal of urea from plasma into ultrafiltrate (effluent fluid)
- Typically expressed in **ml/kg/hr**
- **What dose?**
  - 20-25ml/kg/hr for patients with AKI requiring CRRT
  - Prescribed vs delivered: Due to an expected ~ 20% downtime, a prescribed effluent rate of 25-30ml/kg/hr is recommended
- **What weight?**
  - No consensus on admission vs. ideal vs current weight especially in setting of altered volume of distribution in critical illness



Neyra J et al. Seminars in Dialysis 2021;34:432-39.

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Different CRRT Modalities and Effluent Rate Calculation

Modality	Mechanism of solute removal	Fluids used	Effluent rate (mL/h)
Continuous veno-venous hemodialysis (CVVHD)	Diffusion	Dialysate fluid	Dialysate fluid rate (mL/h) + hourly fluid removal rate (mL/h)
Continuous veno-venous hemofiltration (CVVHF or CVVH)	Convection	Replacement fluids	Prefilter replacement fluid rate (mL/h) + postfilter replacement fluid rate (mL/h) + hourly fluid removal rate (mL/h)
Continuous veno-venous hemodiafiltration (CVVHDF)	Diffusion and convection	Dialysate + replacement fluids	Prefilter replacement fluid rate (mL/h) + postfilter replacement fluid rate (mL/h) + dialysate fluid rate (mL/h) + hourly fluid removal rate (mL/h)

Neyra J et al. Seminars in Dialysis 2021;34:432-39.

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Medication Dosing in CRRT

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Physiochemical properties key to CRRT removal

- **Molecular weight (MW)**
  - Smaller size medications are easier to remove
- **Volume of distribution (Vd)**
  - Small Vd (<0.3L/kg) = hydrophilic medication
  - Hydrophilic medications are prone to CRRT removal
- **Protein binding (PB)**
  - Highly protein bound medications (> 90%) are not likely to be removed by CRRT

Seminars in Dialysis 2021;34:480-88.

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Sieving Coefficient (SC) & Saturation Coefficient (SA)

- Term describing the ability of medication to pass through a CRRT filter membrane
  - Estimated as 1 minus protein binding
  - Actual SC/SA = $[Drug_{ultrafiltrate}]$ / $[Drug_{plasma}]$
- Ranges from 0 to 1
  - 0: does not cross membrane
  - 1: easily crosses membrane
- **Saturation coefficient** – term used for continuous veno-venous hemodialysis (concentration gradient)
- **Sieving co-efficient** – term used for continuous veno-venous hemofiltration (pressure gradient)
- Can use either coefficient when calculating clearance for CVVHDF

Seminars in Dialysis 2021;34:480-88.

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Renally cleared ≠ Dialyzable ≠ Nephrotoxic

Medication	Renally Cleared	Dialyzable	Nephrotoxic
Digoxin	✓	Large Vd	
Midazolam	✓	Large Vd	
Beta- lactams	✓	✓ (small Vd & MW + low PB)	
Levetiracetam	✓	✓ (small Vd & MW + low PB)	
			✓
Amphotericin B			✓
Vancomycin	✓	✓ (small Vd & MW + low PB)	✓

Vd: volume of distribution
MW: molecular weight; PB: protein binding

Semin Dial. 2021 Nov;34(6):480-488.
Kidney Int Rep. 2021 May 13;6(8):2033-2048.

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Considerations for Antimicrobials in CRRT

Medication	Vd (in AKI on CRRT) (L/kg)	Molecular Weight (g/mol)	Protein binding (%)	Observed SC/SA	Potential Impact
Cefepime	0.48	480.6	~20	0.86	Easily removed
Meropenem	0.2	383.5	2	0.8	Easily removed
Tazobactam	0.5	300.3	~30	0.76	Easily removed
Piperacillin	0.4	516.5	30	0.5	Potential for accumulation
Vancomycin	1.4	1449.2	50	0.7	Varying degrees of removal
Daptomycin	0.23	1620.7	90-96	0.13	Minimally removed

SC: sieving coefficient; SA: saturation coefficient

Semin Dial. 2021 Nov;34(6):480-488.

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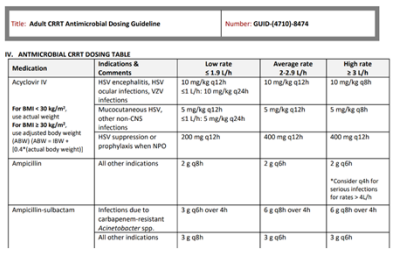
Orlando Health Antimicrobial CRRT Dosing Example



Title: Adult CRRT Antimicrobial Dosing Guideline — Number: GUID-(4710)-8474

IV. ANTIMICROBIAL CRRT DOSING TABLE

Medication	Indications & Comments	Low rate ≤ 1.9 L/h	Average rate 2-2.9 L/h	High rate ≥ 3 L/h
Acyclovir IV	HSV encephalitis, HSV ocular infections, VZV infections	10 mg/kg q12h ≤1 L/h: 10 mg/kg q24h	10 mg/kg q12h	10 mg/kg q8h
For BMI < 30 kg/m², use actual weight. For BMI ≥ 30 kg/m², use adjusted body weight (ABW) (ABW = IBW + [0.4*(actual body weight)])	Mucocutaneous HSV, other non-CNS infections	5 mg/kg q12h ≤1 L/h: 5 mg/kg q24h	5 mg/kg q12h	5 mg/kg q8h
	HSV suppression or prophylaxis when NPO	200 mg q12h	400 mg q12h	400 mg q12h
Ampicillin	All other indications	2 g q8h	2 g q6h	2 g q6h *Consider q4h for serious infections for rates > 4L/h
Ampicillin-sulbactam	Infections due to carbapenem-resistant Acinetobacter spp.	3 g q6h over 4h	6 g q8h over 4h	6 g q8h over 4h
	All other indications	3 g q8h	3 g q6h	3 g q6h

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Non-Antibiotic Medication Dosing Considerations

	High Protein binding	Large Vd	Removed by CRRT	Titrated to effect	TDM
Phenytoin	✓				✓
Phenobarbital			✓		✓
Valproic acid	✓		✓		✓
Levetiracetam			✓		+/-
Benzodiazepines		✓		✓	
Propofol		✓		✓	
Fentanyl		✓		✓	
Warfarin	✓				✓
Digoxin	✓	✓			✓
Lidocaine	✓				+/-

Vd: volume of distribution; TDM: therapeutic drug monitoring.

Kidney Int Rep. 2021 May 13;6(8):2033-2048.

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Circuit Patency in CRRT

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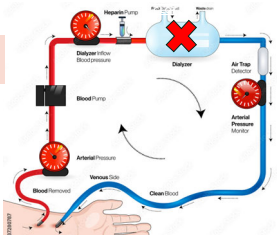
Importance of Circuit Patency in CRRT

Activation of platelets and the coagulation cascade → fibrin deposition and clotting of the circuit

Contact of blood with the extracorporeal circuit → activation of platelets and the coagulation cascade



Dialyzer/hemofilter clotting is considered CRRT "downtime"

CRRT "downtime" consequences:
- Anemia due to circuit blood loss
- Interruption in therapy

Chest. 2019;155(3):626-638.

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Anticoagulation for Circuit Patency

Regional citrate	• Preferred option per KDIGO guidelines
Systemic anticoagulation	• Systemic heparin infusion or direct thrombin inhibitor infusion
Regional anticoagulation	• Regional heparin
No anticoagulation	• Prefilter dilution

Kidney Int Suppl 2012;2:1-138.
Seminars in Dialysis. 2021;34:416–422.

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Regional Citrate Anticoagulation (RCA)

- **How does it work?**
  - **Calcium** in the blood can cause clotting inside the CRRT circuit (cofactor in coagulation cascade)
  - **Citrate** binds calcium and therefore removes it from the circuit + inhibits platelet aggregation and activation, hence decreasing clotting and interruptions
  - Most citrate- calcium complex is removed in the effluent
  - Therefore, calcium must be replaced systemically for the patient to prevent patient hypocalcemia
- **Relative contraindications to RCA**
  - Liver failure, hypercapnia, hyperlactatemia
- **Adverse effects of RCA**
  - Calcium level derangements and metabolic derangements
- **Patient still needs DVT prophylaxis**

Seminars in Dialysis. 2021;34:416–422.

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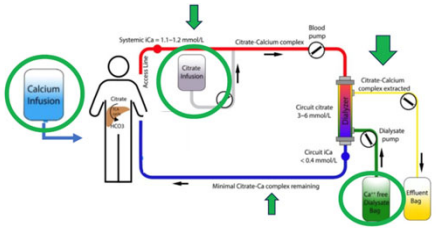
CRRT Circuit with RCA



- **Citrate solution** is hung on the white scale of the CRRT machine (pre-blood pump) and rates adjusted on CRRT machine
- **Calcium chloride/gluconate infusion** is given to patient via Alaris pump via a central venous catheter

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Citrate Therapy Monitoring

- **Citrate infusion running into the CRRT machine** titrated to post-filter ionized calcium
  - Post filter ionized calcium drawn from the CRRT circuit
  - Goal levels 0.35-0.45 (goal: keep calcium content low in the circuit)
- **Calcium infusion administered to the patient** titrated to "peripheral" ionized calcium
  - "Peripheral" ionized calcium drawn from the patient
  - Goal levels 1.1-1.3 (goal: restore patient's calcium stores to prevent life-threatening hypocalcemia)
- **Safety reminders for citrate protocol**
  - CRRT cannot start until IV calcium chloride/ gluconate infusion is started
  - If CRRT is stopped, the IV calcium chloride/ gluconate infusion must be stopped
  - Calcium infusion requires central access

Seminars in Dialysis. 2021;34:416–422.

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RCA solutions Compared to Other Fluids

Components	Citrate-free Solutions					Citrate-containing Solutions					
	PrismaSol BGK, B22GK, or BK	PrismaSATE BGK, B22GK, BK, or BzK	Phoxillum BK or B22K	PureFlow B RFP 400-456	Duosol 4551-4556	4% Sodium Citrate	ACD-A	Regiocit	Prismocitrate 10/2	Prismocitrate 18/0	Citra-HF Pre
Na^+, mEq/L	140	140	140	130 or 140	140 or 136	408	225	140	136	140	139.9
K^+, mEq/L	4, 2, or 0	4, 2, or 0	4	4, 3, 2, or 0	4, 2, or 0	—	—	—	—	—	3
Ca^{++}, mEq/L	0, 2.5, or 3.5	0, 2.5, or 3.5	0 or 2.5	0, 2.5, or 3	0 or 3	—	—	—	—	—	—
Mg^{++}, mEq/L	1, 1.2, or 1.5	1, 1.2, or 1.5	1.5	1 or 1.5	1 or 1.5	—	—	—	—	—	0.5
HCO_3^-, mEq/L	32 or 22	32 or 22	32 or 22	35 or 25	35, 32, or 25	—	—	—	—	—	—
Lactate, mEq/L	3	3 or 0	—	—	—	—	—	—	—	—	—
Cl^-, mEq/L	108-120.5	108-120.5	114.5 or 122	108.5-120.5	107.5-117	—	—	86	106	86	104
Dextrose, mg/dL	100 or 0	110 or 0	—	100	100 or 0	—	2,230	—	—	—	90
Trisodium citrate, mmol/L	—	—	—	—	—	136	75	18	10	18	13.3
Citric acid, mmol/L	—	—	—	—	—	—	38	—	2	—	—

No citrate formulation is currently approved by the US Food and Drug Administration for CKRT anticoagulation, and such use is considered off-label. Both 4% sodium citrate and ACD-A are used as anticoagulants infused into the CKRT circuit in the prefilter position, whereas Regiocit, Prismocitrate solutions, and Citra-HF Pre are dilute citrate solutions formulated in 5 L bags designed for use as alternatives to standard CKRT solutions. In the United States, 4% sodium citrate and ACD-A are generic agents with multiple manufacturers. PrismaSol, PrismaSATE, Phoxillum, and Regiocit are manufactured by Baxter International (Deerfield, IL). PureFlow B solutions are manufactured by NxStage Medical (Lawrence, MA), a subsidiary of Fresenius Medical Care (Bad Homburg, Germany). Duosol solutions are manufactured by B Braun (Bethlehem, PA). PrismaSol is marketed and regulated in the United States as a replacement fluid (ie, as a drug) and may be used as either replacement fluid or dialysate. PrismaSATE, PureFlow B, and Duosol are marketed and regulated as dialysate only (ie, devices rather than drugs) and are only authorized for use as dialysate. Regiocit is only FDA-approved under emergency use authorization (EUA). Prismocitrate solutions (Baxter) and Citra-HF Pre (Nordic Medcom, Espoo, Finland) are only available outside the United States. Table © 2024 Ashita Tolwani, MD and Rajesh Speer, PharmD and is reproduced with permission of the copyright holder. Abbreviations: ACD-A, anticoagulant citrate dextrose solution A; CKRT, continuous kidney replacement therapy.

Am J Kidney Dis. 2025. 85(6):767-786.

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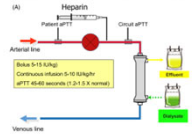
Systemic Anticoagulation

- **Heparin**
  - Alternative in patients with a contraindication to citrate or with indication for anticoagulation
  - 12-18 units/kg/hr continuous infusion administered IV to patient
    - If used for CRRT anticoagulation only, order **non-bolus heparin infusion**
  - Dialysate/replacement fluid must contain Ca^{2+}
  - Monitor AntiXa (goal: 0.3-0.6 IU/mL) or aPTT (goal: 57-88 s)

Direct thrombin inhibitor
- Argatroban or bivalirudin are recommended in patients with heparin induced thrombocytopenia
- Dialysate/replacement fluid must contain Ca^{2+}
- Monitor aPTT per institutional protocol



Seminars in Dialysis. 2021;34:416–422.

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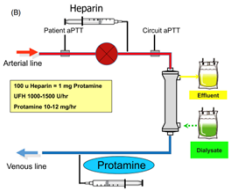
Regional Heparin

- 1000–1500 units/hr of heparin is infused pre-filter with or without post-filter protamine at 10–12 mg/hr
- Anticoagulation of circuit only
- DVT prophylaxis



Semin Dial. 2021;34(6):416-422

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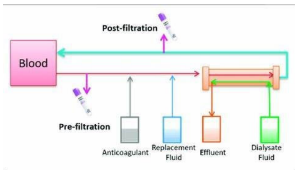
Prefilter Dilution

- Alternative strategy considered in high bleed risk patients or during drug shortages
- **Mechanism:**
  - Reduction of blood viscosity and reduced hemoconcentration through fluid dilution
- **Agents:**
  - Pre-blood pump NaCl infusion: 100-200 ml/hr
  - Pre-filter replacement fluid: 1000-4000 ml/hr
- DVT prophylaxis



Kidney International Supplements 2012; 2(1)

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CRRT circuit patency summary

Strategy	Dialysate and replacement fluids	Monitoring	Adjunct therapies
Regional citrate anticoagulation	ZERO calcium fluids	•Post filter iCal from CRRT machine → titrate citrate gtt •Peripheral iCal from patient → titrate Ca gtt	•Calcium chloride/ gluconate infusion •Patient needs DVT prophylaxis
Prefilter sodium chloride	Ca containing fluids	NA	•Patient needs DVT prophylaxis
Full anticoagulation (e.g. heparin or argatroban)	Depends on whether pt is also on citrate or not (may not need citrate)		

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Role of Pharmacists in CRRT

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Caring for the ICU patient while on CRRT

Effluent dose

- Is the effluent dose changing? Why?
  - Think: original indication for CRRT initiation (e.g. ↑ lactate, ↑ ammonia, metabolic acidosis)
- Medication dosing
- Electrolyte management (repletion needed?)

Volume removal dose

- Patient's desired vs actual volume status (clinical correlates: e.g. pulmonary, cardiac, hepatic congestion)
- Manage your intake volume
  - Example: concentrating infusions
- Hemodynamics
  - Understand vasopressor trends

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Caring for the ICU patient across the kidney continuum

AKI (no RRT) → AKI (CRRT) → CRRT cessation

What is patient's renal function at CRRT cessation?
Any plans for intermittent hemodialysis?

- Medication dosing
- VTE prophylaxis or management
- Nutrition management
- Electrolyte management (and related therapies)
- Volume management (RRT vs pharmacological vs none)

Clin J Am Soc Nephrol. 2023;18(8):1080-1088.

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Pharmacist as an integral part of a successful CRRT program

- Familiarize oneself with CRRT practice at home institution (what machine, what modality)
- Partner with nephrology for protocols and EMR builds
  - Review anticoagulation practices
  - Review dialysate and replacement fluid "formulary"
- Partner with nursing for education
- Work with infectious disease colleagues on CRRT anti-microbial dosing guideline
- Discuss therapeutic drug monitoring algorithms with ICU pharmacists

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Questions?

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RENAL RESCUE: PHARMACIST ESSENTIALS FOR CONTINUOUS RENAL REPLACEMENT THERAPY

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Saturday, August 8th 2026

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