

Continuous Renal Replacement Therapy (CRRT)

Treatment and prescription guidance
Frimley and Wexham Park Intensive Care Units
Version 5.0 (Use in line with Unit CRRT protocol Version 5.0)

Commencement of CRRT should be a Consultant decision and clearly documented in the notes
Please note: only Continuous Veno-Venous Haemodialysis (CVVHD) is available



ANTICOAGULATION

DOCUMENTATION

CIRCUIT and FILTER

DIALYSIS SOLUTION

CALCIUM PRE-TREATMENT

DIALYSIS AND BLOOD FLOW RATES

Dialysis Flow Rate equals clearance

DOSE OF ANTICOAGULANT

MONITORING and ADJUSTMENT of TREATMENT

PITFALLS

WARD ROUND DAILY REVIEW

Situations when conventional anticoagulation may be preferred:

- Severe coagulopathy (e.g. CRRT with no anticoagulation)
- Severe hypocalcaemia related to hyperphosphataemia
- Required RRT dose >4L/hr
- Severe hypo- or hypernatraemia
- Recent citrate use resulted in accumulation or poor circuit life
- Patient is receiving systemic anticoagulation (systemic heparin, fondaparinux, argatroban)

PLEASE NOTE: Citrate can be used in conjunction with systemic anticoagulation to achieve satisfactory circuit life. Citrate can be deselected anytime without changing circuit. After switching to other method you should follow the Conventional Anticoagulation Protocol

CITRATE-CALCIUM (Ci-Ca) ANTICOAGULATION

Citrate-Calcium (Ci-Ca) CVVHD 72 Hour Prescription, Administration and Documentation Chart

multiFiltratePRO Kit Ci-Ca HD (AV1000S)

K⁺ ≥ 6.5mmol/L

CiCa K2

Consider higher clearance (e.g. 35mL/kg/hr)

K⁺ < 6.5mmol/L

CiCa K4

Systemic iCa ²⁺ (mmol/L)	< 1.01	1.01 – 1.11	1.12 – 1.20	1.21 – 1.45	> 1.45
Pre-Treatment with Calcium Chloride#	Yes	Yes	No	No	No
Starting Calcium Chloride Dose (mmol/L)	2.0	1.9	1.7	1.5	1.4
Check first systemic iCa ²⁺ and review calcium dose after	2 hours	6 hours	6 hours	6 hours	6 hours

Standard Start-up Flow Rates based on clearance of 25mL/kg/hr				Standard Start-up Flow rates based on clearance of 35mL/kg/hr			
Ideal Body Weight	<60kg	60 – 80kg	>80kg	Ideal Body Weight	<60kg	60 – 80kg	>80kg
Dialysis Flow Rate	1600 mL/h	2000 mL/h	2400 mL/h	Dialysis Flow Rate	2000 mL/h	2600 mL/h	3200 mL/h
Blood Flow Rate	80 mL/min	100 mL/min	120 mL/min	Blood Flow Rate	100 mL/min	130 mL/min	160 mL/min
Citrate Dose	4.0 mmol/L	4.0 mmol/L	4.0 mmol/L	Citrate Dose	4.0 mmol/L	4.0 mmol/L	4.0 mmol/L
Calcium Dose	1.7 mmol/L	1.7 mmol/L	1.7 mmol/L	Calcium Dose	1.7 mmol/L	1.7 mmol/L	1.7 mmol/L

Use higher clearance for hyperkalaemia, severe metabolic acidosis, poisoning (ethylene glycol)

The Ratio of Dialysis Flow Rate : Blood Flow Rate should be 20:1 at the start of Ci-Ca CVVHD

Nurses may only change the flow rates if there was an issue (e.g. vascular access) to troubleshoot. Both Dialysis and Blood Flow Rate should be changed (usually reduced) by the same proportion and clearly documented. Notify medical staff as soon as possible. Changing the flow rates for other reason (to modify clearance) or the Ratio between the two flow rates (to treat metabolic derangement) should be a senior doctor decision.

Post-Filter and Systemic Ionised Calcium should be checked according to Ci-Ca protocol

Check T:I Ratio and ICU Profile daily

More frequent check of T:I Ratio and Systemic Ionised Calcium may be necessary if Citrate Accumulation is suspected (refer to 'Management of Citrate Accumulation' in the protocol)

Citrate Accumulation	↓ syst Ca ²⁺ , ↑ Ca ²⁺ requirements, ↑ Total Calcium (often >3mmol/L), T:I >2.3, ↓ BE, ↓ HCO ₃ ⁻
Filter Clotting/Clogging	↑ BE, ↑ HCO ₃ ⁻ , ↑ syst Ca ²⁺ , ↑ Na ⁺ , ↑ urea/creatinine
Multibic used in error	↑↑ Post-filter iCa ²⁺ , ↑ citrate requirements, ↑ Na ⁺ , ↑ BE, ↑ HCO ₃ ⁻
Metabolic derangement	developing metabolic acidosis or alkalosis → is 20:1 (Dialysis:Blood Flow) Ratio maintained?
See protocol for management	

Ensure **Blood/Dialysate Flow** is at its lowest according to the patient's needs

Ensure that **CiCa K4** is used once hyperkalaemia resolved

Citrate does not provide systemic anticoagulation

Appropriate VTE prophylaxis should be prescribed

Lactate > 8mmol/L or rapidly rising despite fluid resuscitation?

NO

Risk of citrate accumulation?

Acute liver failure
Elevated lactate (>6mmol/L, but fluid responsive)

YES

Trial of citrate anticoagulation is appropriate?

Consultant decision
(close monitoring, see Management of Citrate Accumulation protocol)

NO

YES

CONVENTIONAL (HEPARIN, EPOPROSTENOL OR NO) ANTICOAGULATION

Conventional CVVHD 72 Hour Prescription, Administration and Documentation Chart

multiFiltratePRO HDF (AV1000S)

K⁺ ≥ 6.5mmol/L

MULTIBIC K2

Consider higher clearance (e.g 35mL/kg/hr)

K⁺ < 6.5mmol/L

MULTIBIC K4

Not applicable

Use heparin if there is no contraindications and clotting is normal

Use epoprostenol (prostacyclin) if Platelets < 60

Use no anticoagulation with a Blood Flow of 250mL/min if:

Active bleeding
Patient is at high risk of bleeding

Severe coagulopathy
Confirmed HIT

Always consider
Ci-Ca CVVHD
when filter clots

Dialysis Flow Rate: 1600 – 4800mL/h

Use higher clearance: hyperkalaemia, severe metabolic acidosis, poisoning (ethylene glycol)

Initial Blood Flow: 250mL/min

It may need to be decreased gradually if vascular access is poor

Check ICU Profile daily

Use protocol for heparin infusion and check APTT Ratio accordingly

Filter Clotting	Clots seen in filter, decreasing flows
Heparin induced thrombocytopenia (HIT)	Decreasing platelet count, 4Ts Score
Bleeding	Bleeding point obvious or hidden, ↓ Hb, signs of shock
CiCa Dialysate Fluid has been used in error	Massive drop in Systemic Ionised Calcium
Stop CVVHD immediately, give calcium, change dialysate to Multibic, inform medical team	

Is CRRT still required?

Fluid Balance?

Ensure **Clearance** is at its lowest according to patient's needs

If Filter clots/needs changing consider whether Ci-Ca CVVHD would be appropriate?

Ensure that **CiCa K4** is used once hyperkalaemia resolved