

Renal Replacement therapy in COVID +ve or suspected patients

COVID-19 patients may present the following challenges when considering RRT :

1. Septic/HLH/Cytokine storm and are therefore likely to require higher dose RRT in the form of 35mls/kg rather than 25mls/kg
2. Pro-thrombotic and therefore may require additional anticoagulation while on RRT

Setting the RRT dose in COVID +ve patients

- **If using citrate anticoagulation**
 - You may wish to choose a higher dose of RRT than normal (as above)
 - Consider the 35mlg/kg table in the citrate/RRT guideline
 - You may wish to move up the weight categories to further increase the dose of RRT delivered
 - Maximum settings for citrate are blood flow 180mls/min and dialysate flow 3600mls/hour
 - As always, monitor for citrate toxicity
- **If using multibic/heparin**
 - This can deliver a higher dose of RRT compared to citrate which maybe useful in patients with cytokine storm
 - Maximum settings are blood flow 250-450mls/min and dialysate flow of 4800mls/hour

Anticoagulation while on RRT in COVID +ve or COVID suspected patients

- **Step 1:** Determine if any indications for starting systemic IV heparin i.e. suspicion of PE. Have a very low threshold for starting systemic IV heparin in COVID +ve requiring RRT. Furthermore check whether patient in anticoagulation arm of REMAP-CAP study – crossover in this study is allowed but this information may help inform your decisions regarding anti-coagulation.
- **Step 2:** If no indications for IV heparin start on CVVHD using citrate anticoagulation and continue enhanced prophylactic dalteparin, see COVID critical care VTE protocol while monitoring anti Xa levels
- **Step 3:** If clots once on citrate – start treatment dose systemic IV heparin (1000units/ml) as per Critical Care heparin infusion chart for COVID-19 positive patients. Aiming for unfractionated heparin level of 0.3-0.7. This guideline/chart is at the end of this document. Note the Critical Care COVID-19 heparin infusion is weight based which is different from the standard NHS Lothian policy (5000units loading and then 1200units/hour) as COVID patients require more heparin. **Also do not use the standard heparin dosing for RRT circuit anti-coagulation as this is a different concentration of heparin (250units/ml) with a different target APTT(r).**
- **Step 4:** Note IV heparin can be given in addition to citrate anticoagulation or alone with multibic. Determine what would be best and consider stock levels before deciding:
 - **Switch to IV heparin and multibic?**
 - Can give better clearance as maximum dialysate flow rate higher
 - **Continue citrate with IV heparin?**
 - Continuing citrate in addition to IV heparin may prevent clotting and prolong filter life
- Titrate IV heparin using **unfractionated heparin assay (search heparin on trak)** and use chart/guidelines at end of this document. Note APTT ratio can be inaccurate in COVID-19 hence we now use unfractionated heparin assay in these patients.

Action plan if running out of CVVHD machines due to excess demand in COVID Pandemic

- There are concerns that there may not be enough CVVHD machines for the number of patients who require them
- **Continue to use CVVHD as normal until demand exceeds the number of available machines**
- Subsequently follow this protocol (PTO)

1. **UNSTABLE PATIENTS** (Those with hyperkalaemia, life threatening diuretic resistant fluid overload or severe acidaemia)
 - Should receive CVVHD as per normal protocol with a filter change every 72 hours or longer.
2. **STABLE PATIENTS (when not enough CVVHD machines available)**
 - Depending on resources and patient stability they can either receive
 - i. **High dose CVVHD delivered over 12 to 24 hours**
 - This will allow CVVHD machines to be used between different patients however will have a significant impact on consumables.
 - Multibic/heparin **will give better clearance as dialysate flow rate higher**
 - **Beware** – when using citrate for high dose CVVHD patients there is an increased risk of citrate toxicity as higher blood flows than normal are utilised therefore more citrate delivered to patient
 - ii. **Intermittent haemodialysis (IHD)**
 - Try high dose CVVHD delivered over 12 to 24 hours in the first instance
 - Renal are able to provide IHD but will need prior notice preferably > 24 hours
 - IHD can be provided in cubicles 16 and 17 in 118, 117 and 116D as these spaces have the correct water supply – move patient to these areas where possible
 - Remaining 118/116 beds v.difficult to provide IHD as will require a v.bulky reverse osmosis machine from renal
 - **Multibic/heparin vs citrate for High dose CVVHD**
 - Option 1 ***Preferred multibic/heparin*** (will give better clearance as dialysate flow rate higher)
 - Option 2 ***citrate*** (useful if v stable, just for ultrafiltration, no issues e.g. liver)

Need to consider stock levels when deciding between treatment options
 - **Multibic/heparin settings for High dose CVVHD**
 - a. Decide regarding anticoagulation – systemic IV heparin aiming full anticoagulation. Other anticoagulation available.
 - b. Blood flow 250-450mls/minute (initially as tolerated)
 - c. Dialysate flow to 4800mls/hour initially
 - d. Fluid off to 250-450mls/hour (as directed by required fluid balance)
 - **Citrate settings for High dose CVVHD**
 - e. Blood flow to 180mls/min initially
 - f. Dialysate flow to 3600mls/hour initially
 - g. Fluid off to 250-450mls/hour (as directed by required fluid balance)
 - h. Note patients at slightly higher risk of citrate toxicity and hypocalcaemia

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	Authors: Oliver Robinson, Kallirroi Kefala
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****FOR INTENSIVE CARE USE ONLY ****
Adult Heparin Infusion Chart for COVID-19 Patients

Consultant		Name of Patient	
Hospital / Ward		CHI Number	
Weight (kg)		DOB	

Medicine (Approved Name)	Final Concentration	Total Dose	Volume	Route	Prescribed / Transcribed By Sign & print name
Heparin	1000 units/ml	40,000 units	40 mls	IV	

*Please note that in NHS Lothian heparin sodium solution for infusion is available in a ready concentration of 1000units/ml so further dilution is not required. If in doubt, contact pharmacy for advice.

Initiation of therapy

- Check baseline FBC, INR, APTT, urea, creatinine
- Prescribe loading dose and infusion on the patient Main Prescription Chart.
- Loading dose: 80 units /kg (maximum 10,000 units). Administer as a slow IV bolus over 5 minutes. Immediately start continuous infusion of heparin 18 units /kg/hour (maximum 2,250 units/hour). Use actual body weight capped at 125kg.
- For patients with a high risk of bleeding, a lower starting rate may be required

Infusion Rate Instructions

	Date	Time	Rate ml/hr	Prescribed by	Adjusted by	UFH Anti-Xa level (units/ml)	Reason for Change/Comment
Initial Rate							
Change 1							
Change 2							
Change 3							
Change 4							
Change 5							
Change 6							

Dose Adjustment Instructions

TARGET UFH Anti-Xa LEVEL 0.3-0.7 units/ml

Anti-Xa level	INFUSION ADJUSTMENT:	REPEAT UFH Anti-Xa level:
>1.2	Stop for 1 hour and decrease rate by 500 units (0.5ml)/hr	2 hours
0.9-1.2	Decrease infusion rate by 300 units (0.3ml)/hr	6 hours
0.71-0.9	Decrease infusion rate by 200 units (0.2ml)/hr	6 hours
0.3-0.7	No change in infusion rate	next day AM
0.15-0.29	Increase infusion rate by 100 units (0.1ml)/hr	6 hours
0.06-0.14	Increase infusion rate by 200 units (0.2ml)/hr	6 hours
<0.06	Increase infusion rate by 400 units (0.4ml)/hr	6 hours

Other Instructions

- UFH stands for unfractionated heparin (iv heparin)
- UFH-anti-Xa levels are taken in a green citrated tube; fill tube to the level, send to haematology
- To order on TRAK: go to "search for order", click on "order item" then enter "heparin", then click on "Unfractionated Heparin assay All sites": call RIE laboratory to inform sample is coming; WGH and SJH sites must courier samples to RIE lab.(ext 26093, OOH page 6550)
- Check UFH Anti-Xa level 6 hours after initiation, then adjust rate to achieve therapeutic range of **0.3-0.7 units/ml** using the **dose adjustment table** above. Measure the UFH-anti-Xa level 6 hours after each dose change
- Monitor FBC daily and be vigilant for heparin-induced thrombocytopenia
- No IM injections, no non-steroidal anti-inflammatory drugs
- If therapeutic range for UFH-anti-Xa level is not reached within 24 hours, seek advice from haematology
- Do not stop the heparin infusion to check the UFH-anti-Xa sample
- Do not take the UFH-anti-Xa sample from the limb with the infusion (or the same line in the case of central lines)

