Continuous renal replacement therapy (cRRT) Prescription, observations & record of therapy PLEASE, DO NOT RECORD this information anywhere else	Patient's Name			
	Date of birth		Gender (circle)	M / F
	St George's Hospital No.			
	NHS number			
PLEASE complete this form for **EVERY** cRRT **CIRCUIT** used. Keep completed forms with the ICU charts for the audit team.		PLEASE affix a patient's sticker if available		

1. Patient information – TO BE COMPLETD BY PRESCRIBING Dr

Height cm	measured? ☐ OR estimated? ☐	Actual body weight Kg	source?
Ideal body weight (IBW) Kg	use look up chart ***OR*** free smart phone app such as Qx calculate		

2. Indication(s) for cRRT - please tick ALL that apply **- TO BE COMPLETD BY PRESCRIBING Dr**

Hyperkalaemia ☐	**most recent** K^+	mmol/l	Time & date of sample	rapidly rising↗? ☐
Acidosis ☐	**most recent** pH		Time & date of sample	high dose vasoactive drugs in use↗? ☐
Uraemia ☐	**most recent** urea	mmol/l	Time & date of sample	rapidly rising↗? ☐
Fluid overload ☐	*as indicated by:*	Hypertension ☐ BP = / mmHg	Hypoxaemia ☐ PaO_2 kPa FiO_2 %	
		Severe oedema ☐ affecting?	Estimated cumulative +ve fluid balance litres	
Other ☐	*please describe*			
☐ First episode of cRRT OR ☐ ongoing cRRT during a single ICU episode OR ☐ in place of chronic RRT (PD / iHD)				
Decision to commence cRRT made by (print name)		Date and time of decision		

↗ **For definitions see back page**

3. cRRT prescription - current evidence suggests that 15ml/kg/hr over 24 hours is the minimum effective "dose" or "rate". To offset / mitigate against stoppages / loss of circuits etc it is recommended that patients be commenced at **20ml/kg/hr** BUT have the dose(rate) titrated to achieve pre-defined endpoints (see page 12).
All calculations should use ideal rather than actual body weight. - **TO BE COMPLETD BY PRESCRIBING Dr** **FOR GUIDANCE SEE BACK PAGE**

Size of "kidney": HF12 (small) ☐ **OR** HF19 (large) ☐	**Target blood pump speed** ml/min	**First fluid bag:** K^+ = 0 ☐ **OR** K^+ = 4.0mmol/l ☐
Dose / rate: 20ml/kg/hr ☐ 15ml/kg/hr ☐ OR other ml/kg/hr	ENTER **IBW** kg x **dose** ml/kg/hr =	ml/hr referred to below as ***A***

Mode	**Standard starting settings**	**Value for this patient (ml/hr)★**	**Standard starting settings**	**Value for this patient (ml/hr) ★**
☐ CVVH(F)	Predilution = ***A*** ÷ 3		Post replacement = ***A*** ÷ 3 x 2	
☐ CVVHDF	Counter current = ***A*** ÷ 2		Post replacement = ***A*** ÷ 2	

Fluid removal: rate ml/hr ☐ ***OR*** fluid balance target (state + or -) ml ☐ by (date & time)

PLEASE record all changes in box 8 on page 6

Anticoagulation (refer to page 9) - MUST be prescribed on drug chart

Platelet count x10^9/L | HIT (score see table →)

☐ prime with heparin ☐ heparin infusion (target APTTr 1.5-2.0) ***OR***

☐ alternative strategy (detail AND reasoning below) e.g. therapeutic anticoagulation.

Category	0 point	1 point	2 points
Thrombocytopaenia	< 30% fall **OR** nadir < 10 x 10^9/L	30-50% fall **OR** nadir 10-19 x 10^9/L	>50% fall **OR** nadir ≥ 20 x 10^9/L
Timing of decrease in platelet count	< 4 days (no recent heparin)	> 10 days **OR** fall ≤ 1 day **AND** prior heparin ex-posure > 30 days ago	5-10 days **OR** ≤ 1 day but heparin in last 30 days
Thrombosis or other sequelae	None	Progressive / recurrent thrombosis **OR** non-necro-tizing skin lesions **OR** Possible thrombosis	Proven thrombosis **OR** Skin necrosis **OR** Anaphylaxis
Other causes of thrombocytopaenia	Definite	Possible	None evident

Set replacement fluid temp. to °C	**Prescribed by (PRINT and sign, date and time)**

★You MAY wish to use an alternative calculation such as 90% predilution and 10% post replacement - see back page for guidance ★

Indication and prescription agreed by ICU consultant (PRINT name)

PLEASE turn over and complete boxes 4a, b and c.

4. Electrolyte, VTE and drug therapies management during cRRT - PRESCRIBING Dr

a. The following electrolytes MAY become deranged (fall outside the normal range) ionised calcium (iCa^{2+} measured on blood gas analyser), magnesium (Mg) and phosphate (PO_4^{3-}). If this occurs please record the date and time this problem was recognised and document the action taken e.g. $MgSO_4$ 20mmol given over 2 hrs.

Date & time	Problem and action	by (PRINT name)

b. Please document how venous thromboprophylaxis should be delivered during cRRT - tick ALL that apply

TED stockings ☐	Calf compressors ☐	Circuit anticoagulation ☐	Unfractionated heparin S/C BD ☐	Low molecular weight heparin S/C OD ☐	Systemic anticoagulation ☐	Other

c. Please document any changes to dose AND / OR frequency made to optimise **ANTIBIOTIC OR ANY OTHER DRUG THERAPY**. NOTE - for most antibiotics whose dose is reduced in renal impairment, the dose should be INCREASED during cRRT to the same as that for patients with normal renal function. If in doubt PLEASE contact one of the ICU pharmacy team.

Date & time	Changes to antibiotic / drug therapy	by (PRINT name)

5a. Pre-treatment checklist - Vascath - there are 3 sizes of vascaths available, a 15cm for RIGHT IJ/subclavian, a 20cm for LEFT IJ/subclavian and a 24cm for femoral use. You MUST ensure the correct size is used at the correct site. Dialysis lines with a THIRD, small, central lumen (for drug administration in longterm term patients) are also available. To assess the adequacy of flow you MUST be able to easily withdraw AND inject 20mls of blood in <3s without interruption to flow. **NURSE**

Site	**Type / make**	**Length**	**Inserted on**
Locked with 5,000units/ml heparin ☐ **on (date & time)**		**Flow adequate in RED lumen** ☐ **& BLUE lumen** ☐ **both aspiration and return**	

5b. Pre-treatment checklist - Filter - Stop time should be the connection time. NOTE RED to BLUE & BLUE to RED connection MAY dramatically reduce treatment efficacy as treated blood is recirculated **- NURSE**

Priming AND recirculation for >20 mins with 10,000units of heparin in 1L of 0.9%NaCl ☐ ***OR*** (details)	**Start time**	**Stop time**
Connection: RED to RED & BLUE to BLUE ☐ ***OR*** RED to BLUE & BLUE to RED ☐ if the latter then why?		

6. Record of replacement fluid type / mixing / checking / administration. NOTE use K^+ free bags if serum K^+>5.5mmol/l. PLEASE document bags DOWN then across **- NURSE**

Date	Time	K^+ in fluid		Mixed by	Checked by	Given By	Date	Time	K^+ in fluid		Mixed by	Checked by	Given By	Date	Time	K^+ in fluid		Mixed by	Checked by	Given By
		0	4.0						0	4.0						0	4.0			
		☐	☐						☐	☐						☐	☐			
		☐	☐						☐	☐						☐	☐			
		☐	☐						☐	☐						☐	☐			
		☐	☐						☐	☐						☐	☐			
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		☐	☐						☐	☐						☐	☐			
		☐	☐						☐	☐						☐	☐			
		☐	☐						☐	☐						☐	☐			

Patient's name	**MRN**

Patient's name	MRN	Page 4 of 12

7a. Filter observation chart - FIRST 24 HOURS OF TREATMENT - NURSE

Hours	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
Time																								
BPS																								
AP																								
RP																								
TMP																								
Hep																								
aPTTr																								
FF%																								
FR%																								
Fluid loss																								

KEY - **BPS** = blood pump speed, **AP** = access pressure, **RP** = return pressure, **TMP** = transmembrane pressure, **Hep** = heparin ***OR*** alternative anticoagulation infusion rate in ml/hr, **FF%** = filtration fraction % (found in the MORE screen option), **FR%** = filtration ration % (found in the MORE screen option, **Fluid loss** = fluid loss total as displayed on screen. **NOTE** if totals reset at any stage, detail this as a CHANGE see next page and restart entries at 0.

7b. Filter observation chart - SECOND 24 HOURS OF TREATMENT - NURSE

Hours	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48
Time																								
BPS																								
AP																								
RP																								
TMP																								
Hep																								
aPTTr																								
FF%																								
FR%																								
Fluid loss																								

KEY - **BPS** = blood pump speed, **AP** = access pressure, **RP** = return pressure, **TMP** = transmembrane pressure, **Hep** = heparin ***OR*** alternative anticoagulation infusion rate in ml/hr, **FF%** = filtration fraction % (found in the MORE screen option), **FR%** = filtration ration % (found in the MORE screen option, **Fluid loss** = fluid loss total as displayed on screen. **NOTE** if totals reset at any stage, detail this as a CHANGE see next page and restart entries at 0.

7c. Filter observation chart - THIRD 24 HOURS OF TREATMENT - NURSE

Hours	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72
Time																								
BPS																								
AP																								
RP																								
TMP																								
Hep																								
aPTTR																								
FF%																								
FR%																								
Fluid loss																								

KEY - **BPS** = blood pump speed, **AP** = access pressure, **RP** = return pressure, **TMP** = transmembrane pressure, **Hep** = heparin ***OR*** alternative anticoagulation infusion rate in ml/hr, **FF%** = filtration fraction % (found in the MORE screen option), **FR%** = filtration ration % (found in the MORE screen option, **Fluid loss** = fluid loss total as displayed on screen. **NOTE** if totals reset at any stage, detail this as a CHANGE see next page and restart entries at 0.

7d. Filter observation chart - UP TO MAXIMUM FILTER CIRCUIT LIFE - NURSE

Hours	73	74	75	76	77	78	79	80																
Time																								
BPS																								
AP																								
RP																								
TMP																								
Hep																								
aPTTr																								
FF%																								
FR%																								
Fluid loss																								

KEY - **BPS** = blood pump speed, **AP** = access pressure, **RP** = return pressure, **TMP** = transmembrane pressure, **Hep** = heparin ***OR*** alternative anticoagulation infusion rate in ml/hr, **FF%** = filtration fraction % (found in the MORE screen option), **FR%** = filtration ration % (found in the MORE screen option, **Fluid loss** = fluid loss total as displayed on screen. **NOTE** if totals reset at any stage, detail this as a CHANGE see next page and restart entries at 0.

8. Record of review and changes - Please document ALL changes to machine settings INCLUDING changes to heparin infusion rates as a result of APTTr results (continued overleaf) - **NURSE OR PRESCRIBING Dr**

Date & time	Conclusion of review. Record of changes and rationale. Decided by (PRINT name)

8. Record of review and changes (continued) - Please document ALL changes to machine settings INCLUDING changes to heparin infusion rates as a result of APTTr results (continued overleaf) - **NURSE OR PRESCRIBING Dr**

Date & time	Conclusion of review. Record of changes and rationale. Decided by (PRINT name)

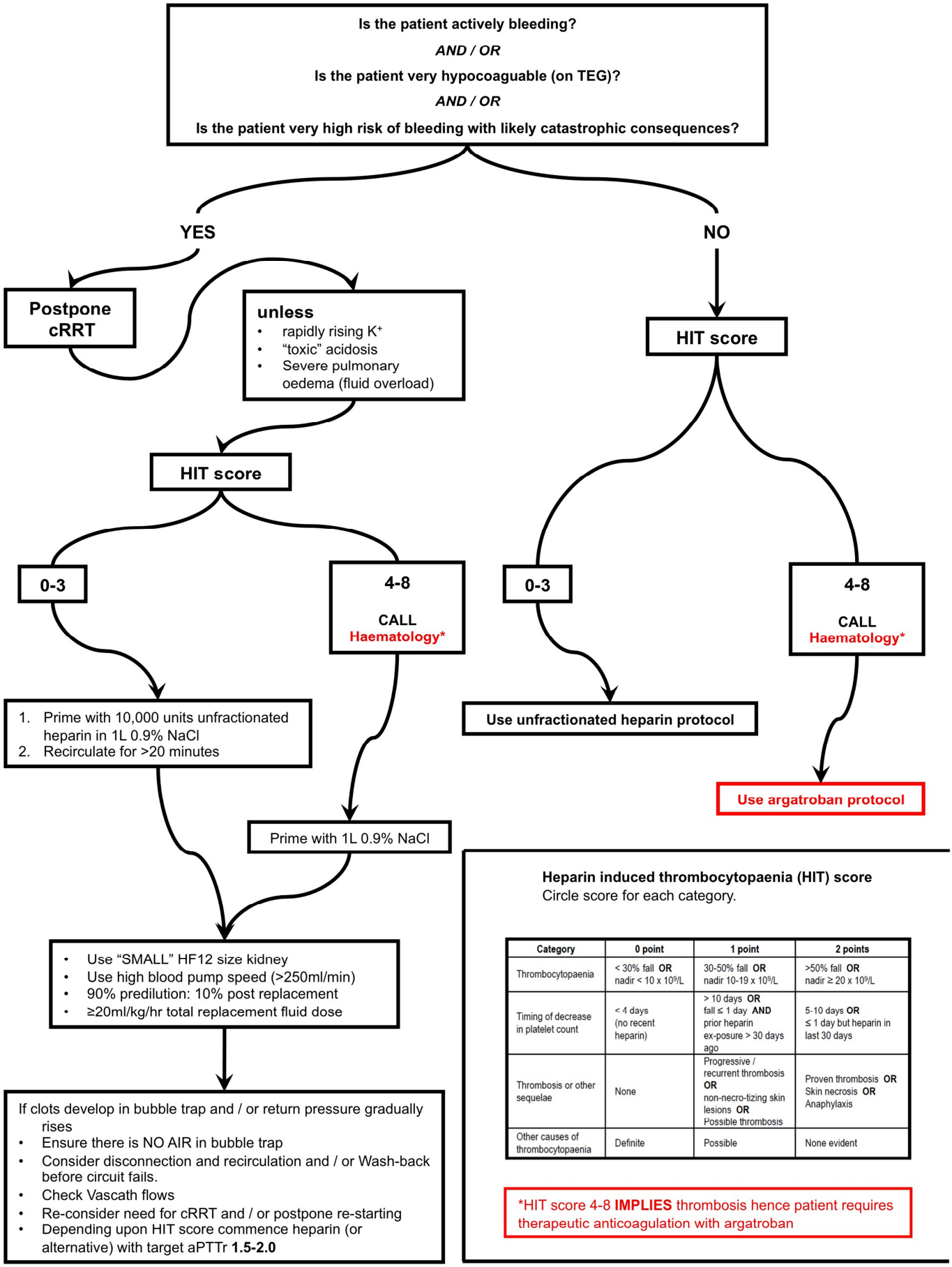
9. Cessation of cRRT, post cRRT considerations and checklist - NURSE

Date & time Rx stopped / circuit failed	Circuit washed back YES ☐ NO ☐	If **NO, CONSIDER** if the patient requires a check full blood count AND pRBC transfusion
Reason for cRRT cessation (as much detail as possible)		
Post cRRT considerations and checklist		
Give patient time off cRRT? What are the indications to restart cRRT? Could the patient have intermittent haemodialysis or haemodiafiltration?		
Is the vascath a problem? If so, what is the solutuion? "Lock" and label the vascath with 5000units per ml unfractionated heparin?		
Does the patient need a change to, OR plan for, anticoagulation therapy OR VTE prophylaxis?		
What is the target fluid balance for the next period of time? Are any changes to fluid or nutrition therapy required to achieve this?		
Are any changes to drug dosing or frequency of administration needed?		
What is the long term renal plan?		

"WHY DO WE HAVE THIS CHART?"

1. **cRRT is our most expensive therapy, in terms of consumables (circuit PLUS replacement fluid).**
2. **Current data suggest our circuit life is on average only 15 hours - it should be between 48 and 80 hours.**
3. **We don't know why we appear to be so poor at keeping filters going because we don't record a diagnosis of the failure.**
4. **We have no idea have effectively we deliver this therapy.**
5. **We should document why we start therapy as there appears to be significant variability in the threshold for doing so.**
6. **We don't appear to titrate the therapy to any pre-defined endpoints.**
7. **We don't clearly prescribe what we want.**
8. **We don't record what changes we make and why.**
9. **We don't know how many blood products, especially pRBCs we use as a consequence of unplanned filter loss.**
10. **We are inconsistent at dose adjusting antibiotics and other drugs during and after cRRT**
11. **We are inconsistent at VTE drug prophylaxis during and after cRRT**

Decision tree for circuit anticoagulation for cRRT



Heparin induced thrombocytopaenia (HIT) score
Circle score for each category.

Category	0 point	1 point	2 points
Thrombocytopaenia	< 30% fall **OR** nadir < 10 x 10^9/L	30-50% fall **OR** nadir 10-19 x 10^9/L	>50% fall **OR** nadir ≥ 20 x 10^9/L
Timing of decrease in platelet count	< 4 days (no recent heparin)	> 10 days **OR** fall ≤ 1 day **AND** prior heparin ex-posure > 30 days ago	5-10 days **OR** ≤ 1 day but heparin in last 30 days
Thrombosis or other sequelae	None	Progressive / recurrent thrombosis **OR** non-necro-tizing skin lesions **OR** Possible thrombosis	Proven thrombosis **OR** Skin necrosis **OR** Anaphylaxis
Other causes of thrombocytopaenia	Definite	Possible	None evident

*HIT score 4-8 **IMPLIES** thrombosis hence patient requires therapeutic anticoagulation with argatroban

Protocol for using unfractionated heparin in cRRT circuit

Is therapeutic anticoagulation required?

YES

1. Prime filter with 10,000 units unfractionated heparin in 1L 0.9%NaCl
2. Recirculate for >20 minutes
3. Check baseline aPTTr. Alert doctor if >2.0
4. Prepare syringe. Add **25,000** units unfractionated heparin to 50ml normal saline = **500** units/ml.
5. Use standard **PINK** heparin infusion supplementary drug chart

Start heparin **INTO PATIENT**
Give 5,000 unit bolus then commence infusion @ 2ml/hr (1,000units/hr)

- **Target aPTTr 1.5-3.5**

Monitoring frequency
- Send aPTTr sample 4 hours after initiation and every dose change or any other circuit change
- If stable, send aPTTr sample every 12 hours

DO NOT COMMENCE cRRT UNTIL aPTTr 1.5-3.0

aPTTr	ACTION
< 1.2	increase by 0.8ml/hr (400units/hr)
1.2 - 1.4	increase by 0.4ml/hr (200units/hr)
1.5 - 3.5	**NO CHANGE**
3.6 - 4.1	reduce by 0.1ml/hr (50units/hr)
4.1 - 4.6	reduce by 0.2ml/hr (100units/hr)
4.7- 5.2	reduce by 0.4ml/hr (200units/hr)
5.3- 5.9	reduce by 0.6ml/hr (300units/hr)
≥ 6.0	stop for 1 hour, reduce by 1.0ml/hr (500units/hr)

NO

1. Prime filter with 10,000 units unfractionated heparin in 1L 0.9%NaCl
2. Recirculate for >20 minutes
3. Check baseline aPTTr. Alert doctor if >2.0
4. Prepare syringe. Add **10,000** units unfractionated heparin to 50ml normal saline = **200** units/ml.

Start heparin **INTO FILTER CIRUIT**
@ 2ml/hr (400units/hr)

- **Target aPTTr 1.5-2.0**

Monitoring frequency
- Send aPTTr sample 4 hours after initiation and every dose change or any other circuit change
- If stable, send aPTTr sample every 12 hours

aPTTr	ACTION
< 1.2	increase by 2.0ml/hr (400units/hr)
1.2 - 1.4	increase by 1.0ml/hr (200units/hr)
1.5 - 2.0	**NO CHANGE**
2.1 - 2.5	reduce by 0.5ml/hr (100units/hr)
2.6 - 3.1	reduce by 1.0ml/hr (200units/hr)
3.2- 4.3	reduce by 1.5ml/hr (300units/hr)
4.4- 4.9	reduce by 2.0ml/hr (400units/hr)
≥ 5.0	stop for 1 hour, reduce by 3.0ml/hr (600units/hr)

Troubleshooting – part 1
If filter circuit clots despite aPTTr >1.5-2.0
- Use "SMALL" HF12 size kidney
- Use high blood pump speed (>250ml/min)
- 90% predilution: 10% post replacement
- ≥20ml/kg/hr total replacement fluid dose
- **Consider** increasing target aPTTr to 2.0-3.0

&

Troubleshooting – part 2
If clots develop in bubble trap and / or return pressure gradually rises
- Ensure there is NO AIR in bubble trap
- Consider disconnection and recirculation and / or Wash-back before circuit fails.
- Check Vascath flows
- Re-consider need for cRRT and / or postpone re-starting
- **Consider** increasing target aPTTr to 2.0-3.0

Protocol for using Argatroban

1. Check baseline aPTTr. If >1.2 discuss with Haemotology SpR
2. Prepare syringe. Add 0.5ml from vial (2.5ml / 250mg) to 50ml normal saline = 1mg/ml. MAKE 5 syringes from each vial
3. Commence infusion into the PATIENT, via either peripheral or central venous line at 0.5mcg/kg/min

PATIENT

- **Target aPTTr 1.5-3.0**

Monitoring frequency

- Send aPTTr sample 4 hours after initiation and every dose change or any other circuit change
- If stable, send aPTTr sample every 12 hours

aPTTr	ACTION
< 1.5	increase by 0.1mcg/kg/min
1.5 - 3.0	NO CHANGE
≥ 3.0	stop for 2 hours then restart infusion at 50% of the previous infusion rate

Actual body weight (kg)	Infusion rate (ml/hr) using dilution of 1mg/ml [0.5microgram/kg/min]
50	1.5
60	1.8
70	2.1
80	2.4
90	2.7
100	3.0
110	3.3
120	3.6

FILTER

- **DO NOT COMMENCE cRRT UNTIL aPTTr 1.5-3.0**
- Prime with 1L 0.9%NaCl
- Use “SMALL” HF12 size kidney
- Use high blood pump speed (>250ml/min)
- 90% predilution: 10% post replacement
- ≥20ml/kg/hr total replacement fluid dose

If clots develop in bubble trap and / or return pressure gradually rises

- Ensure there is NO AIR in bubble trap
- Consider disconnection and recirculation and / or Wash-back before circuit fails.
- Check Vascath flows
- Re-consider need for cRRT and / or postpone re-starting
- Consider increasing argatroban infusion rate and targeting a higher (e.g. 2.5-3.0) aPPTr

Argatroban is a, short acting, synthetic, direct thrombin inhibitor with anticoagulant and antiplatelet activity. Argatroban is about 54% bound to plasma proteins. Metabolism, mainly hydroxylation and aromatisation, takes place in the liver, with the main metabolite having weak anticoagulant activity. Anticoagulant effects are seen immediately upon starting infusion; steady-state concentrations occur within 1 to 3 hours and are maintained until the infusion is stopped or the dose adjusted. The terminal elimination half-life of argatroban is between 39 and 51 minutes. It is excreted primarily in the faeces, via the bile as metabolites and as unchanged drug. About 16% of a dose is excreted unchanged in the urine, and at least 14% unchanged in faeces.

No specific reversal therapy is available beyond discontinuing the infusion. In patients with hepatic or multi-organ failure, full reversal of anticoagulant effects may take longer than 4 hours. Seek haematology advice for symptomatic treatment as required.

GUIDANCE NOTES

MEDICAL MANAGEMENT OF ACUTE OLIGO / ANURIC RENAL FAILURE

- Optimise renal perfusion (intravascular volume, cardiac output, renal perfusion pressure)
- Actively manage fluids, electrolytes and drugs to avoid iatrogenic / preventable injury
  - Avoid indiscriminate / untargetted fluid boluses
  - Avoid maintenance fluids in excess of needs / losses
  - Avoid excessive loading of Na, Cl, K and PO_4
  - Consider the effects of altered drug pharmacokinetics
- Manage hyperkalaemia (see definition below) with **CONTINUOUS** insulin (actrapid) infusion staring at 2units/hr together with a continuous infusion of dextrose (20-50mls of 10% peripherally OR 10-30ml of 20% via a central venous line).
  - **DO NOT** give a "one off" infusion of 10-15units of insulin in 50ml of 50% dextrose as this results in **REBOUND** hyperkalaemia within 30-60minutes and frequently causes problematic dysglycaemia.
  - In the event of ECG changes, give 20mls of 7.35% (10mmol) of $CaCl_2$, preferably over 10 minutes via a central venous line.
  - CONSIDER the use of adjunctive medical therapies such as IV sodium bicarbonate 1.4% (peripherally) or 8.4% (centrally)
- To manage worsening renal acidosis (bicarbonate loss) give IV sodium bicarbonate 1.4% (peripherally) or 8.4% (centrally)
- Frusemide may aide in the management of fluid overload in **non-oliguric** patients **BUT** has no beneficial effect on disease progression or outcome of acute oligo/anuric renal failure [1]. If used indiscriminately, it can worsen outcome by reducing renal perfusion.
- "Low dose" dopamine has no place in the prevention or treatment of acute renal failure [2].

COMMON INDICATIONS FOR INITIATING / CONTINUING cRRT

- Hyperkalaemia (K^+ >6.5mmol/l **OR** K^+ >5.5mmol/l and rapidly rising at >0.25mmolhr for 2 or more hours). **This is time critical. USE potassium free replacement fluid**
- Correction of severe / unresolving acidosis (pH <7.1) in particular, acidosis associated with cardiovascular compromise (shock i.e. end organ hypoperfusion) / high vasoactive drug requirements (noradrenaline >0.5mcg/kg/min / dobutamine >10mcg/kg/min).
- Uraemia (urea >40mmol/l or rising by >12mmol/24hrs)
- Fluid overload causing severe hypertension ***and / or*** problematic oedema (e.g. abdominal compartment syndrome) ***and / or*** contributing to hypoxaemia / poor lung compliance.
- Other indications include encephalopathy, hyperpyrexia (note even with maximal circuit warming, patients usually loose a minimum of 1°C core body temperature during cRRT)

SIZE OF KIDNEY AND TARGET BLOOD PUMP SPEED

- There are 2 sizes of kidney available HF 12 (1.2m^2) and HF19 (1.9m^2). The default option should be HF12 with a target blood pump speed of ≥250ml/min.
- If clearance targets are not achieved with an HF12 and / or the patient is very tall / muscular / catabolic then use an HF19 **BUT** the target blood pump speed should be ≥300ml/min.
- Failure to achieve the target blood pump speed results in blood stasis + haemoconcentration within the kidney and both treatment failure and circuit loss due to clot obstruction within the kidney.

MODES OF cRRT

- Haemofiltration (convection only - CVVH) - usual mode - BECAUSE, permits predilution hence longer circuit life AND convection has greater efficiency than diffusion
- Haemodiafiltration (convection and diffusion - CVVHDF) - when enhanced SMALL solute clearance is needed e.g. when CVVH fails to achieve target goals in 6-24 hours ***or*** some drug overdoses (e.g. salicylate) -
- Slow continuous ultra-filtration (SCUF) - if fluid removal is all that is required - USE CVVH, 10ml/kg/hr, split 90% predilution + 10% post replacement, NOT "SCUF" setting on machine in order to preserve circuit life.

NOTE - our current machines can switch mode of cRRT at **any time**.

PRESCRIBING cRRT

- For patients, in whom their metabolic derangement is felt to be contributing to their acute condition / instability, **START** at a DOSE of 20ml/kg/hour of "replacement fluid". This fluid principally contains sodium bicarbonate - Na 140mmol/l HENCE be very cautious if the patient's Na is <130 or >150mmol/l.
  - **Actively titrate dose AND / OR mode to achieve predefinied goals of therapy**
  - **Suggested goals:**
    - **K^+ <6.0 mmol/l within 2 hours (using potassium free replacement fluid)**
    - pH rising by 0.5 within 6 hours
    - MINIMUM SOLUTE CLEARANCE should be 12mmol/l of urea every 24 hours
    - Fluid balance goals will depend upon the patient's ability to tolerate removal
- For all other scenarios start at 15ml/kg/hour of "replacement fluid".
- Our standard starting practice for CVVH is to apportion 1/3 of "replacement fluid" as "pre-dilution" and 2/3 as "post replacement".
- Our standard practice for CVVHDF is to apportion half of the "replacement fluid" as the counter current and half as "post replacement".
- Our standard practice is to set fluid removal at a MINIMUM of 50mls/hr. The rate of fluid removal can be increased up t o a maximum of 2000ml/hr
- Circuit anticoagulation:
  - Unless the patient is known or suspected to have a hypersensitivity to unfractionated heparin (including heparin induced thrombocytopaenia), circuits should be primed with a dilute heparin solution (10,000 units in 1000ml of 0.9% NaCl).
  - **PLEASE** ensure that there is **NO AIR** in the bubble trap as any air-blood interface is highly thrombogenic
  - The circuit should then be placed in "RECIRCULATION" mode for a minimum of 20 minutes before connection to a patient (UNLESS treatment is time critical).
  - Once connected, first line therapy is a continuous infusion of unfractionated heparin into the proximal end of the circuit. The usual dose is 400-1,000 units per hour. The target aPTTr is 1.5-2.0.
  - HOWEVER, if the patient requires THERAPEUTIC anticoagulation - ensure the target is set and achieved.
  - In problematic circuits, minimising the procoagulant stimulus by maximising the blood pump speed and increasing the proportion (up to 90%) of replacement fluid that predilutes the patient's blood should also be considered.
- cRRT circuits have a maximum 80 hour lifespan. Unplanned, premature circuit loss, usually through problematic vascular access, is both very expensive and commonly results in 10-20g/l loss in the patient's [Hb], necessitating pRBC transfusion. Do **everything** possible to avoid this and seek specialist help early.
- Whenever a circuit dose fail and / or reaches the end of its life, always consider a period **OFF** cRRT to assess the patient's renal recovery.

HOW TO TROUBLESHOOT cRRT

- Ask for help from a "champion user"
- Use the BLUE on screen HELP
- There is troubleshooting guide on the ICU website - www.gicu.sgul.ac.uk/resources-for-current-staff

References

1. Girbes AR: Prevention of acute renal failure: role of vaso-active drugs, mannitol and diuretics. Int J Artif Organs 2004, 27(12):1049-1053. http://www.ncbi.nlm.nih.gov/entrez/15645615
2. Schenarts PJ, Sagraves SG, Bard MR, Toschlog EA, Goettler CE, Newell MA, Rotondo MF: Low-dose dopamine: a physiologically based review. Curr Surg 2006, 63(3):219-225. http://www.ncbi.nlm.nih.gov/entrez/16757377