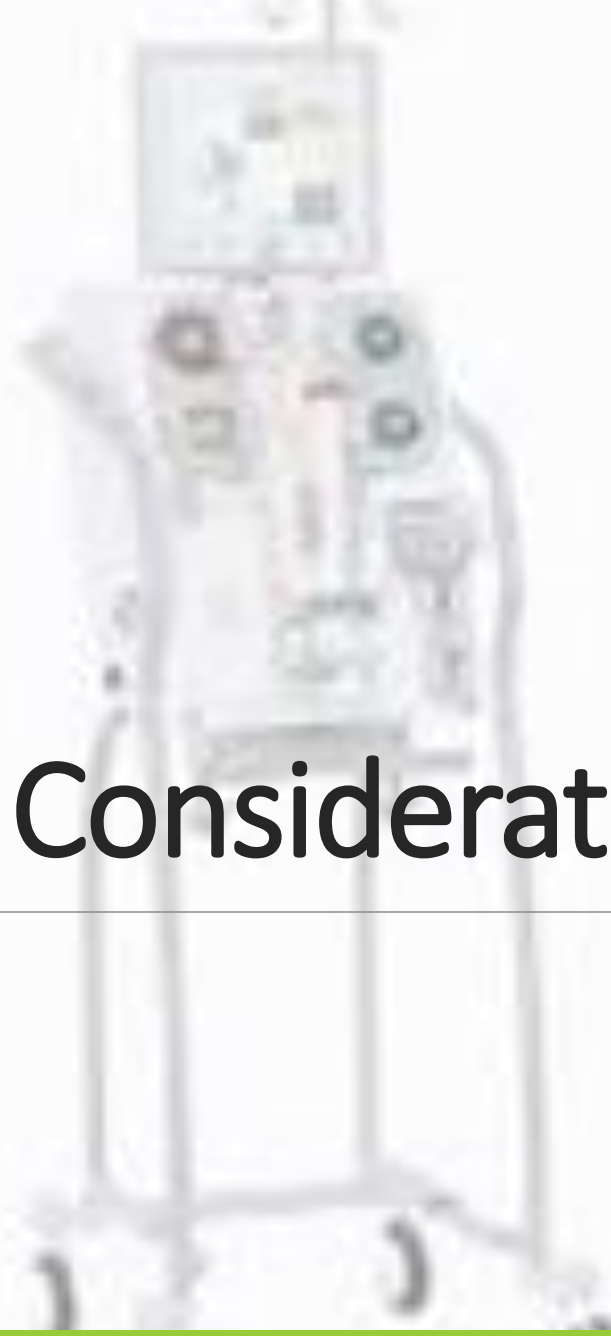


Nursing Considerations

CJ 2019

Considerations

SAFETY CHECKS

PRESCRIPTION

Access

Infection control

Monitoring

Temperature Control

Anticoagulation

Fluid management

Observations

Nutrition

Air Embolus

Safety Checks

GOLDEN RULE NUMBER 1

Complete safety checks as FIRST PRIORITY every shift

Check settings & prescription

Correct PPE including face visor

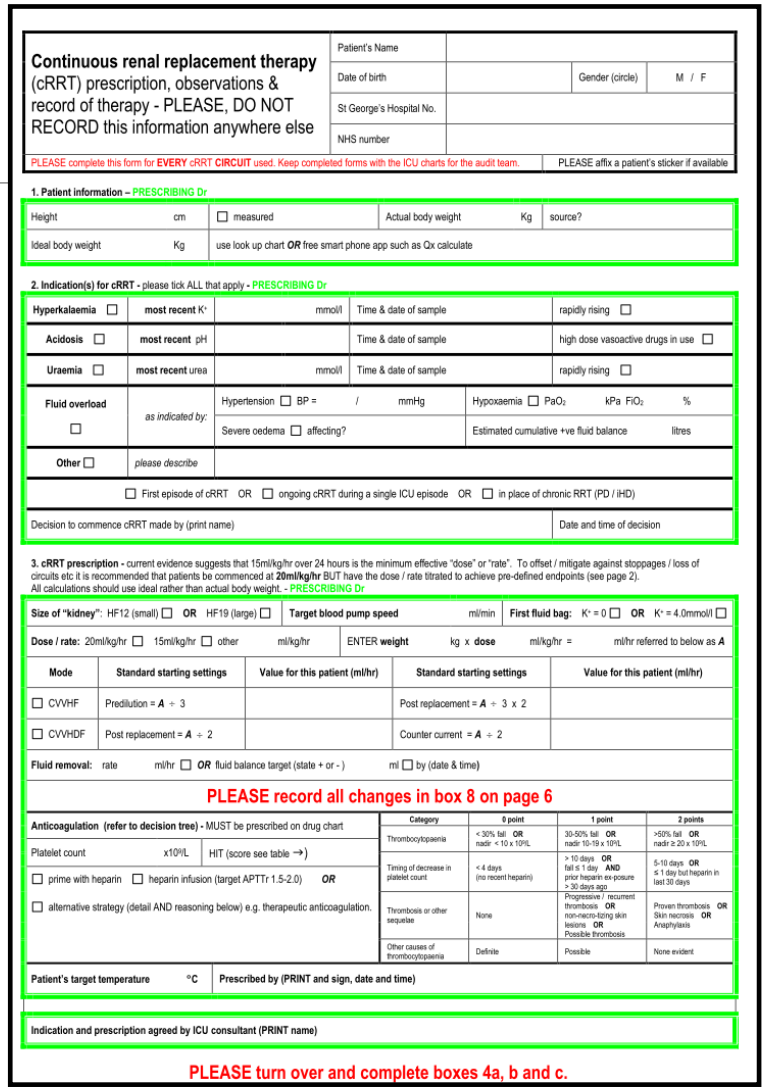
Equipment to recirculate available (1L fluid bag & spike & 3 way tap OR spike with y-connector)

Prescription

Each filter circuit should be prescribed on fresh CRRT Prescription & Monitoring form

Green = Docs

Blue = Nurse



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 – PRESCRIBING Dr

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

2. Indication(s) for cRRT - please tick ALL that apply - 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

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 2). All calculations should use ideal rather than actual body weight. - PRESCRIBING Dr

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 ☐ other ml/kg/hr	ENTER **weight** 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)
☐ CVVHF	Predilution = ***A*** ÷ 3		Post replacement = ***A*** ÷ 3 x 2	
☐ CVVHDF	Post replacement = ***A*** ÷ 2		Counter current = ***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 decision tree) - 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

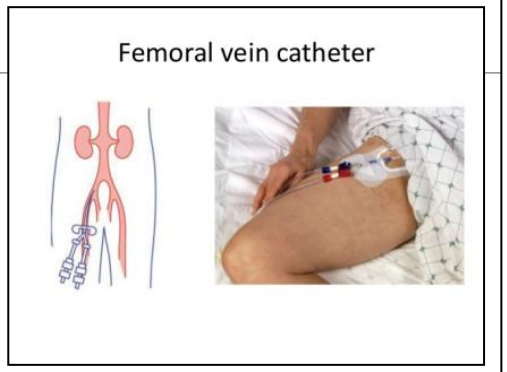
Patient's target temperature °C	**Prescribed by (PRINT and sign, date and time)**

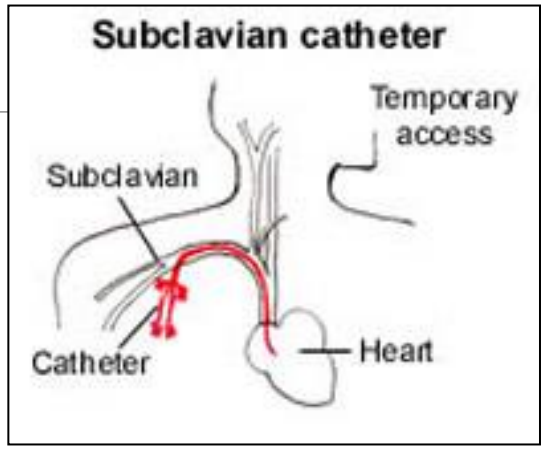
Indication and prescription agreed by ICU consultant (PRINT name)

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

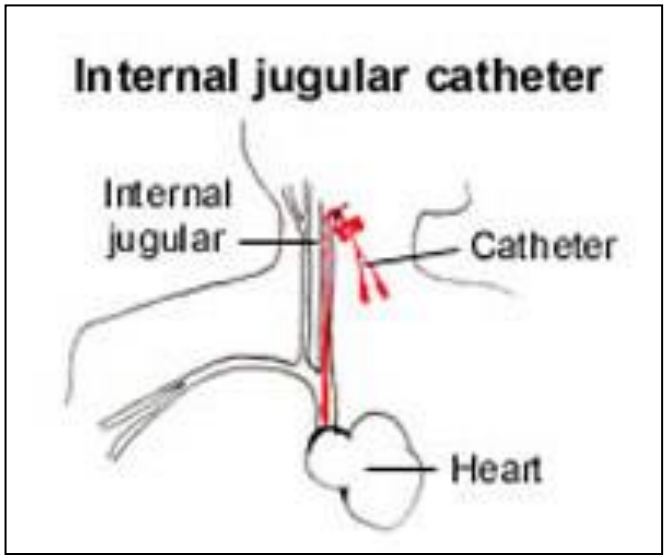
Access

VenousVenous

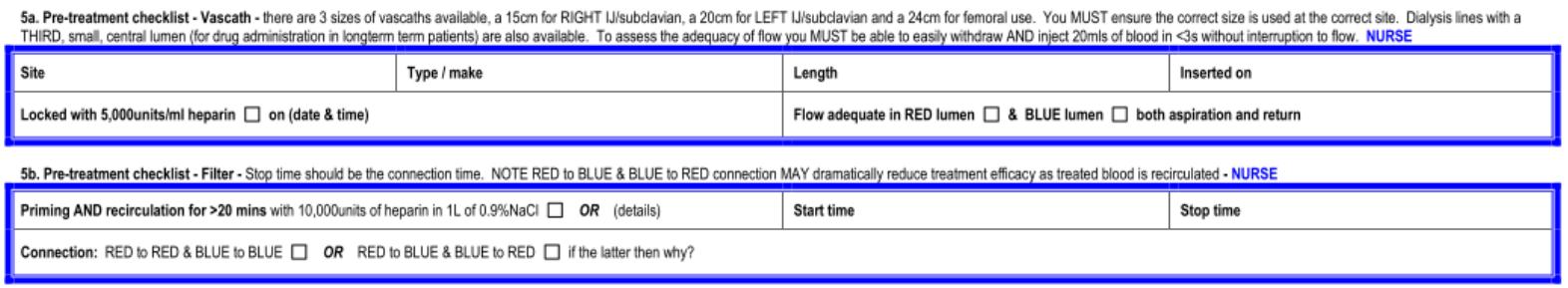




Blood is withdrawn from the proximal lumen *(arterial side*) and returned through the distal lumen *(venous side)*



Pre-treatment checklist - Vascath



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?		

3 sizes of Vascath:

- 15cm – Right I.J./subclavian
- 20cm – Left I.J./subclavian
- 24cm - Femoral

Check that you are using the right line for the right site!!

‘Trialsysis Lines’ available if you need an extra lumen for access

Assess Flow Adequacy

You must be able to easily withdraw *AND* inject 20mls of blood in less the 3 secs

If unable to do so – refer to docs & NIC.

Don’t start the filter before taking advice

Document on audit form

Unused VasCath?

Should be heplocked with 5000iu of heparin with volume stated on the side of the VasCath

Label, Label, Label – *no-one wants to give heparin rather than adrenaline in an emergency!!*

Document

Coag concerns?? Discuss with senior medical team

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?		

SWAPPING LUMENS CAN LEAD TO RECIRCULATION & REDUCED CLEARANCE

Infection

Patients with AKI have an increased susceptibility to infection

Infection is cited as the principle cause of death in CKD patients requiring haemodialysis

CVC’s have been identified as the principle cause of infection.

Hooking up or off CRRT…?

Surgical-ANTT

Main Critical Aseptic Field

Sterile Gloves

PPE

Line Care

ChloraPrep for skin cleansing

Asceptic Non Touch Technique

Transparent film dressings

- *able to visualise and monitor site for inflammation / bleeding.*

7 days if dry & intact or as needed

Monitoring

Cardiac Monitoring, BP, SpO2, RR ***continuous temperature monitoring***

Fluid Balance

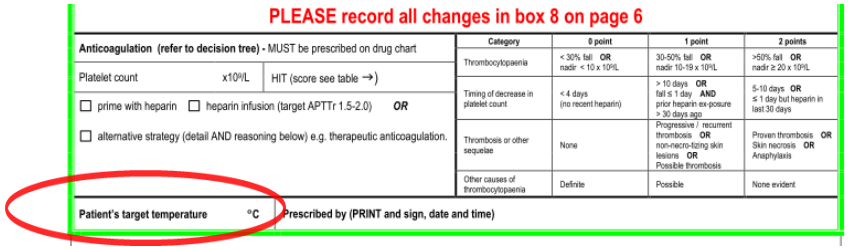
Add up hourly

Find out fluid balance aim on ward round

Bloods

- *Clotting (Anti-coag)*
- *Biochemistry – electrolytes…*

Temperature



PLEASE record all changes in box 8 on page 6

Anticoagulation (refer to decision tree) - MUST be prescribed on drug chart

Platelet count x10⁹/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.

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Thrombocytopaenia	< 30% fall **OR** nadir < 10 x 10⁹/L	30-50% fall **OR** nadir 10-19 x 10⁹/L	>50% fall **OR** nadir ≥ 20 x 10⁹/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
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Other causes of thrombocytopaenia	Definite	Possible	None evident

Patient's target temperature °C | **Prescribed by (PRINT and sign, date and time)**

Lower body temperature by as much as 4C due to heat loss via extracorporeal circuit – **110 -200ml blood outside the body at any time.**

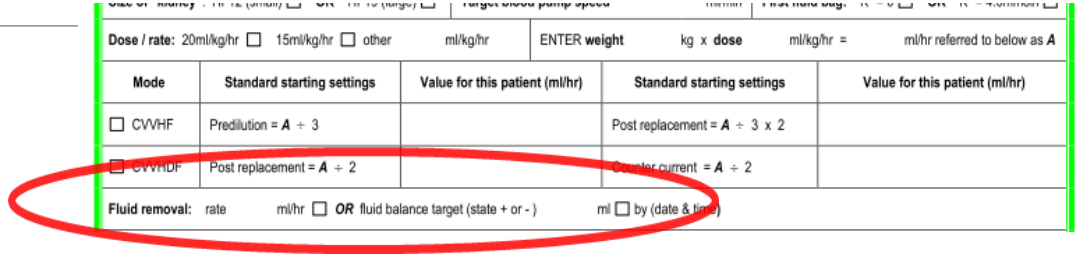
Hypothermia: disruption of enzyme function - clotting, dysrhythmias

Need continuous temperature monitoring

Replacement fluids warmed via filter – *never ever switch off the heater!*

Use warming blanket if insufficient response

Fluid Management



Dose / rate: 20ml/kg/hr ☐ 15ml/kg/hr ☐ other ml/kg/hr		ENTER weight 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)**
☐ CVVHF	Predilution = A ÷ 3		Post replacement = A ÷ 3 x 2	
☐ CVVHDF	Post replacement = A ÷ 2		Counter current = A ÷ 2	
Fluid removal: rate ml/hr ☐ ***OR*** fluid balance target (state + or -) ml ☐ by (date & time)				

Most patients undergoing CRRT are oliguric, anuric or volume overloaded.

Fluid management typically involves calculation of patients intake (infusions, feed etc) + fluid loss via filter. (Also – insensible losses – e.g. loss of circuit, sweating, GI losses.)

Fluid loss and Fluid balance aims should be ***stated explicitly on prescription form and monitored hourly on ICU chart & Obs form.***

Replacement Fluid

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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		☐	☐						☐	☐						☐	☐			
		☐	☐						☐	☐						☐	☐			

- Use potassium free bags if K+ >5.5
- Need to check & sign

Observations

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.

Workshop later…!

Anticoagulation

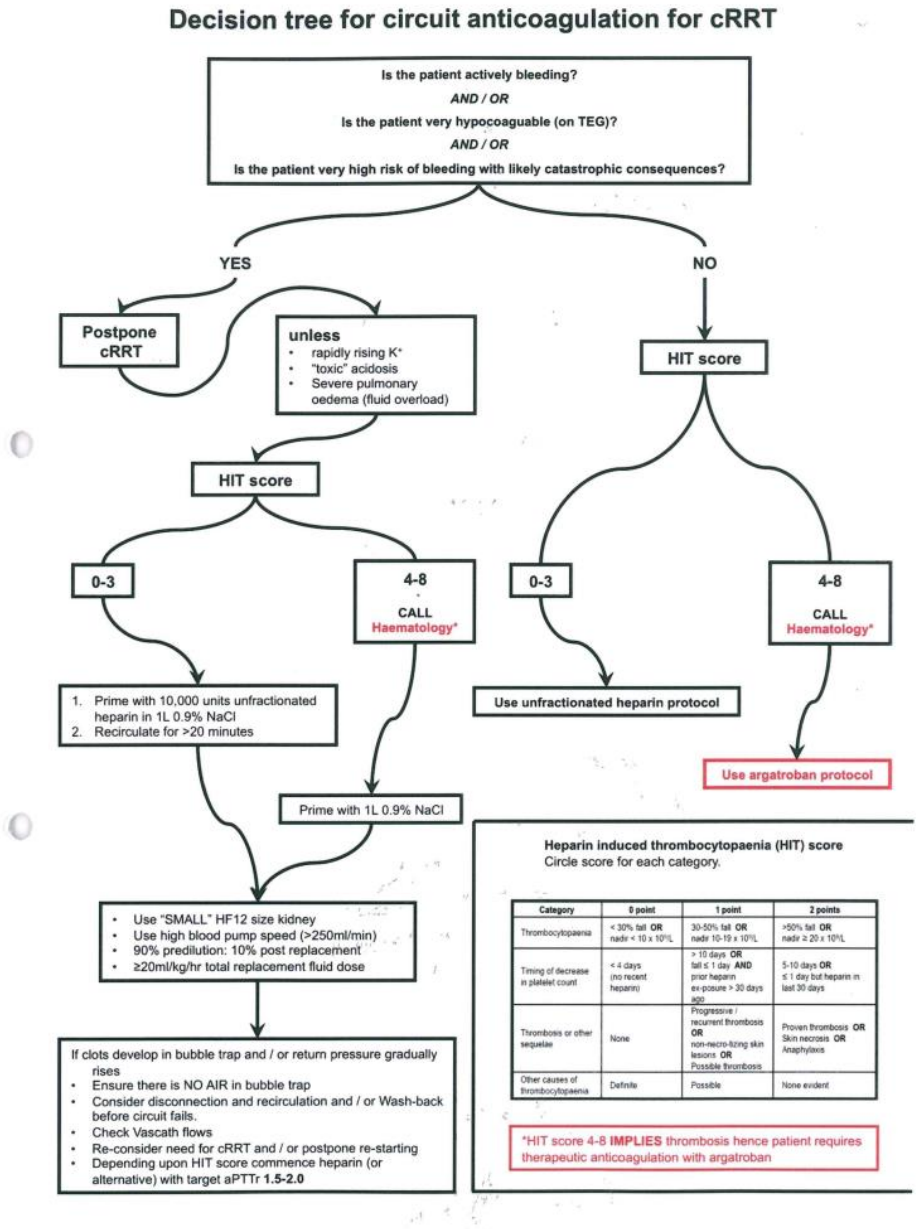
AIM: To prevent clotting of extracorporeal circuit without harming the patient

WHY? Clotting processes begin as soon as the blood hits the circuit.

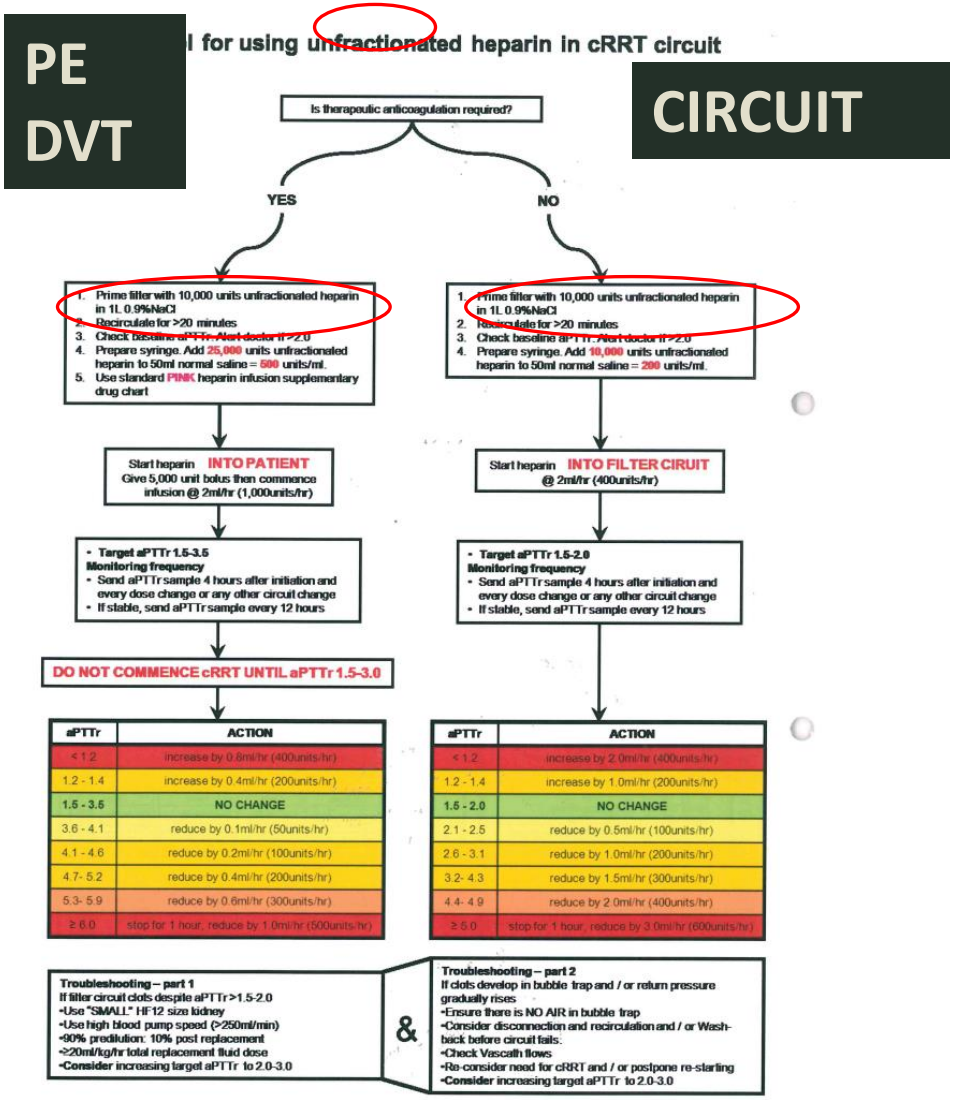
HOW??

- Prime filter circuit with saline containing heparin if patient has normal clotting profile.
- Heparin infusion administered via filter.
- Follow the protocols on prescription chart
- Clotting deranged? – Check with Docs

Decision Tree



Heparin


PE
DVT
l for using unfractionated heparin in cRRT circuit
CIRCUIT
Is therapeutic anticoagulation required?
YES
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 25,000 units unfractionated heparin to 50ml normal saline = 500 units/ml.
5. Use standard PINK heparin infusion supplementary drug chart
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 PATIENT
Give 5,000 unit bolus then commence infusion @ 2ml/hr (1,000units/hr)
Start heparin INTO FILTER CIRUIT
@ 2ml/hr (400units/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
• 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
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)
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

Argatroban

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

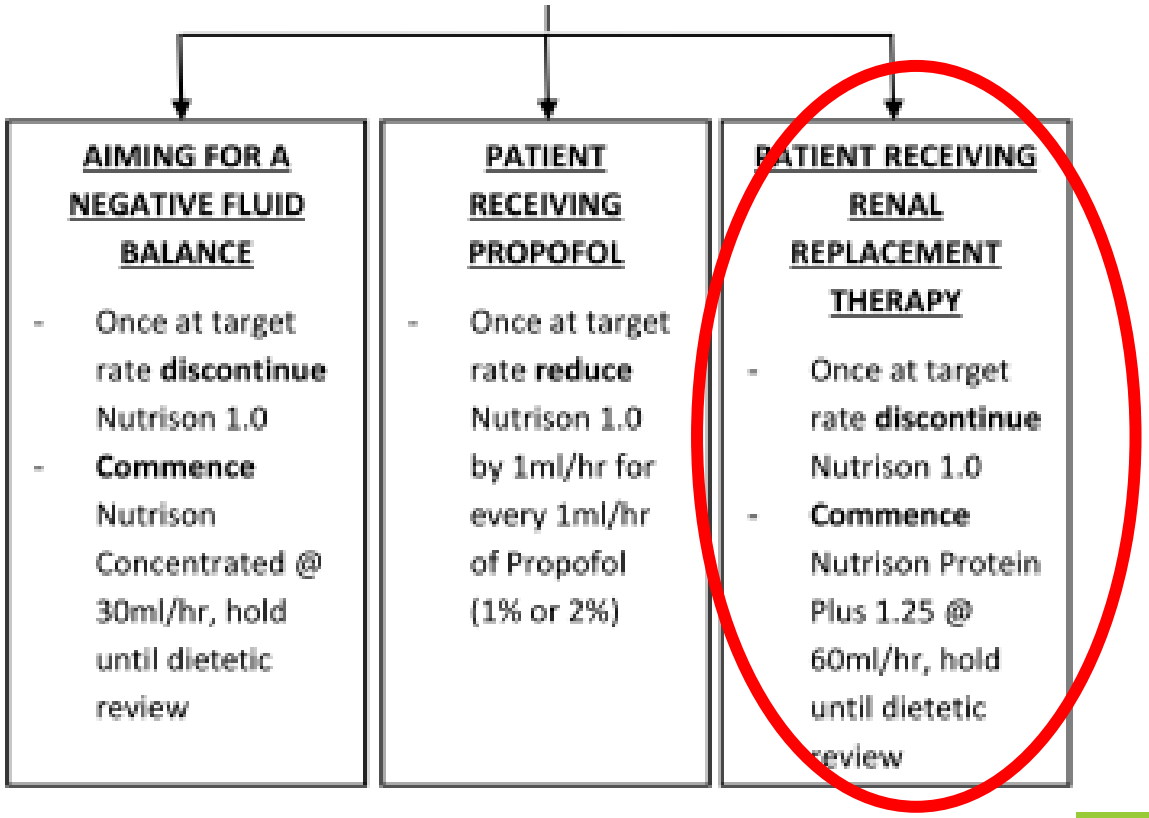
If clots develop in bubble trap and / or return pressure gradually rises

- 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.

Nutrition


AIMING FOR A NEGATIVE FLUID BALANCE
- Once at target rate **discontinue** Nutrison 1.0
- **Commence** Nutrison Concentrated @ 30ml/hr, hold until dietetic review
PATIENT RECEIVING PROPOFOL
- Once at target rate **reduce** Nutrison 1.0 by 1ml/hr for every 1ml/hr of Propofol (1% or 2%)
PATIENT RECEIVING RENAL REPLACEMENT THERAPY
- Once at target rate **discontinue** Nutrison 1.0
- **Commence** Nutrison Protein Plus 1.25 @ 60ml/hr, hold until dietetic review

Air Embolus

Can occur if a patient receives air in the blood returned

In built air detectors – even microbubbles

If the systems safety mechanisms are bypassed a patient can recieve an air embolus

Air can also occur if the access cannot provide the blood flow programmed: ***the blood pump will run but a vacuum is created causing air to move through the circuit***

Continually assess the circuit tubing for the presence of air

Summary

Safety checks at the start of the shift

Use the prescription chart – it's really useful!

If you're not sure – ask!!

Questions?