## Prescription and observation record for use during the trial of the Fresenius Multifiltrate Pro using regional citrate anticoagulation on GICU / CTICU

1. Patient eligibility:
   - The decision to use the Fresenius Multifiltrate Pro with regional citrate anticoagulation must be made by the Consultant of the week in daylight hours.
   - For the purposes of the trial, contraindications to using citrate are:
     - Sustained / refractory to replacement, systemic hypocalcaemia PRIOR to cRRT initiation - defined as a blood ionised calcium (blood gas) ≤1.00mmol/l (despite attempted IV replacement) AND the presence of any of: long QT, problematic cardiac dysrhythmia; refractory / unstable cardiogenic and/or vasoplegic shock
     - Patients who require systemic anticoagulation for any reason
     - Patients with fulminant liver failure - defined as a recognised liver insult AND a high lactate + low glucose + elevated INR
     - Patients with a metabolic alkalosis (defined as an arterial pH >7.45)
     - Patients with a serum sodium <135 or >145mmol/l (trisodium citrate is the circuit anticoagulant thus a rapid rise in serum sodium AND / OR hypernatraemia can be induced)
   - General contraindications to using the Fresenius Multifiltrate Pro in the context of the trial are any Patient who needs emergency / time critical cRRT (defined as life threatening hyperkalaemia / acidosis / fluid overload / other) AND / OR is considered to be physiologically or biochemically unstable (in the opinion of the consultant).

2. Please define the goals of cRRT and amend these AT LEAST every 24 hours (or more often - as indicated by the patient's clinical condition / biochemistry)

| **Date and time** | **Goals - e.g.**<br>**normalisation of pH within 6-12 hours**<br>**urea clearance of 12-18mmol/l in 24 hours**<br>**fluid balance of MINUS1,500mls in 24 hours starting at MINUS 100ml / hour)** | **Print & sign** |
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3. Treatment initiation, escalation / de-escalation strategy
PLEASE DO NOT DEVIATE FROM THE RATES / RATIOS BELOW UNLESS DISCUSSED WITH A CONSULTANT AND THE FRESENIUS CLINCIAL EXPERT TEAM

- Start all patients on the height based CVVHD protocol in Table 1 - which is based upon an approximate dose of 25ml/kg/hour ideal body weight and a dialysate to blood flow ratio of 20:1.
- If normalisation of potassium / pH AND / OR clearance of urea is inadequate INCREASE the dialysate AND blood flow by 3 rows [e.g. if starting in row 6 change settings to row 9].
- If normalisation of potassium / pH AND / OR clearance of urea is still inadequate, INCREASE the dialysate AND blood flow by another 2 rows [e.g. go from row 9 settings to row 11 settings].
- To de-escalate if clearance in excess of targets DECREASE the dialysate AND blood flow by 3 rows [e.g. go from row 6 settings to row 3 settings]. Repeat this decremental step if clearances remain in excess of targets.
- The maximum rate of fluid removal (ultrafiltration) should not exceed 15% of blood flow unless authorised by a consultant and discussed with the Fresenius clinical expert team
- The starting dose of CITRATE is 4.0 mmol/l
- The starting dose of CALCIUM is 1.7 mmol/l
- Set the fluid warmer to 37˚C and titrate to the desired patient core temperature as appropriate.

**Table 1**

| | A<br>MEASURE | B<br>eIBW based on A | C<br>Starting Dose ~25ml/kg/hour based on B | D<br>= C / 20 | E<br>= D x 60 x 0.15 |
|---|---|---|---|---|---|
| **Row No.** | **Patient height range (cm) [feet & inches]** | **Gender neutral estimated ideal body weight (kg)** | **Dialysate flow (ml / hour)** | **Blood flow (ml / min)** | **Max fluid removal rate (ml / hour)** |
| 1 | | | 1000 | 50 | 450 |
| 2 | | | 1200 | 60 | 540 |
| 3 | **<150<br><4' 11"** | <48 | 1400 | 70 | 630 |
| 4 | **150-159<br>4' 11"- 5' 2"** | 48-55 | 1600 | 80 | 720 |
| 5 | **160-169<br>5' 3"- 5' 6"** | 56-65 | 1800 | 90 | 810 |
| 6 | **170-179<br>5' 7"- 5' 10"** | 66--77 | 2000 | 100 | 900 |
| 7 | **180-189<br>5' 11"- 6' 2"** | 78-89 | 2200 | 110 | 990 |
| 8 | **≥190<br>≥6' 3"** | ≥90 | 2400 | 120 | 1080 |
| 9 | | | 2600 | 130 | 1170 |
| 10 | | | 2800 | 140 | 1260 |
| 11 | | | 3000 | 150 | 1350 |
| 12 | | | 3200 | 160 | 1530 |

## 4. PRESCRIPTION

| DATE | TIME | Patient's Name | | | |
|---|---|---|---|---|---|
| Height | | Date of birth | | Gender (circle) | M / F |
| IDEAL BODY WEIGHT (as per Table 1) | | St George's Hospital No. | | | |
| INITIAL GOALS SET IN 2. | **(tick)** | 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 | | |

| Fluid | Volume | Rate | Print & sign |
|---|---|---|---|
| Ci-Ca dialysate | 5000ml | As per protocol (table 1) | |
| Potassium concentration | mmol/l | | |
| Phosphate concentration | mmol/l | | |
| 4% Trisodium CITRATE | 1500ml | As per protocol (table 2) | |
| CALCIUM chloride (Fresenius) | 1000ml | As per protocol (table 2) | |
| | | | |
| Ci-Ca dialysate | 5000ml | As per protocol (table 1) | |
| Potassium concentration | mmol/l | | |
| Phosphate concentration | mmol/l | | |

Please ensure the following are prescribed in Cerner

- "10mmol of $Ca^{2+}$" (either 50mls of 10% calcium gluconate = 11.25mmol $Ca^{2+}$ OR 10mls of calcium chloride = 10mmol $Ca^{2+}$ - given as per our IV prep guide). Rate of administration may need to be increased to treat citrate induced hypocalcaemia
- Unfractionated heparin 5,000units s/c 12 hourly as thromboprophylaxis (unless contra-indicated OR alternative strategy e.g. therapeutic systemic anticoagulation)
- Antibiotic doses are as for NORMAL RENAL FUNCTION (i.e. eGFR>60ml/min)
- Magnesium, potassium and phosphate replacement as per standard protocols.

5. Monitoring ionised calcium in the circuit AND the patient (in place of APTT for heparin)
   - Circuit anticoagulation if achieved by continuous citrate infusion (just distal to the access line) with reversal achieved by continuous infusion of calcium chloride (just proximal to the return connection).
   - Prior to starting cRRT, ensure an arterial or venous blood gas has been performed within 2 hours to ensure $iCa^{2+}$ is between 1.0 and 1.3mmol/l. If outside this range seek consultant advice.
   - Following commencement, check the circuit (post filter) $iCa^{2+}$ after 5-10 mins and titrate according to Table 2. Thereafter ensure both circuit and patient $iCa^{2+}$ is checked every 6-8 hours (maximum interval).

**Table 2**

| Postfilter *ionised* calcium (mmol/L) | Change of the citrate dose (citrate/blood) |
|---|---|
| >0.40 | Increase by 0.2 mmol/L and inform physician |
| 0.35-0.40 | Increase by 0.1 mmol/L |
| 0.25-0.34 | No change (typical target range) |
| 0.20-0.24 | Decrease by 0.1 mmol/L |
| <0.20 | Decrease by 0.2 mmol/L and inform physician |

| Systemic *ionised* calcium (mmol/L) | Change of the calcium dose (citrate/blood) |
|---|---|
| >1.35 | Decrease by 0.4 mmol/L and inform physician |
| 1.21-1.35 | Decrease by 0.2 mmol/L |
| 1.12-1.20 | No change (typical target range) |
| 1.00-1.11 | Increase by 0.2 mmol/L |
| <1.00 | Increase by 0.4 mmol/L and inform physician |

Patient name and MRN

| Observation chart - Day of therapy ONE | DAILY: ratio of total (unadjusted) serum Ca to ionised $Ca^{2+}$ [target <2.25] |
|---|---|

| Hour | Blood flow rate ml/min | Dialysate | | Citrate dose mmol/l | Filter $iCa^{2+}$ mmol/l | Calcium Infusion mmol/l | Patient $iCa^{2+}$ mmol/l | Access pressure | TMP | Return pressure | Fluid removal ml/hr | Balance ml |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | ml/hr | Bag change | | | | | | | | | |
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Patient name and MRN

| Observation chart - Day of therapy TWO | DAILY: ratio of total (unadjusted) serum Ca to ionised $Ca^{2+}$ [target <2.25] |
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| Hour | Blood flow rate ml/min | Dialysate | | Citrate dose mmol/l | Filter $iCa^{2+}$ mmol/l | Calcium Infusion mmol/l | Patient $iCa^{2+}$ mmol/l | Access pressure | TMP | Return pressure | Fluid removal ml/hr | Balance ml |
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| | | ml/hr | Bag change | | | | | | | | | |
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Patient name and MRN

| Observation chart - Day of therapy THREE | DAILY: ratio of total (unadjusted) serum Ca to ionised $Ca^{2+}$ [target <2.25] |
|---|---|

| Hour | Blood flow rate ml/min | Dialysate | | Citrate dose mmol/l | Filter $iCa^{2+}$ mmol/l | Calcium Infusion mmol/l | Patient $iCa^{2+}$ mmol/l | Access pressure | TMP | Return pressure | Fluid removal ml/hr | Balance ml |
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| | | ml/hr | Bag change | | | | | | | | | |
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