Neonatal Cardiac Case

Oct 2018

Thanks to Dr Martyn Lethbridge from Dept of Anaesthesia in Perth Childrens Hospital for sharing this.
• These cases have been de-identified to protect the identity of the patient and the treating teams.

• These are all real cases and real ROTEMs. The individuals involved in these difficult cases have agreed to anonymously share these with us – thank you for your generosity.

• Successful management of the bleeding patient involves much more than just administration of blood products.

• The primary aim of these cases is to teach the use ROTEM guided blood product therapy. We have deliberately not included a lot of detail about some of the other aspects of management which might detract from this focus.
**CARDIAC/ VASCULAR ROTEM TRANSFUSION ALGORITHM**

- Maintain: Temp > 36°C, pH > 7.3, Ionised Calcium >1 mmol/L, Platelets >70, Hb >70 g/dL.
- Only consider APTT and INR in the presence of heparin and warfarin.

**IS THERE CLINICALLY SIGNIFICANT BLEEDING?**
- Yes: Adjust dose of blood products for patient >30 kg after checking current clinical status.
- No: Observe.

**ROTEN Results in a Minute**
- Protamine 0.5-1 mg/kg
- Re-test in 10 min

**IF SEVERE BLEEDING, PROCEED WITH ALGORITHM**
- Cryoprecipitate 5 units apheresis or
- FIBTEM A5 < 10 mm
- Low Fibrinogen
- Low Coagulation Factors
- Hyperfibrinolysis
- Additional Transaminase 1 gm
- Adjust subsequent dose for renal dysfunction

**IF STILL BLEEDING:**
- Consider SURGICAL PROBLEM and discuss with surgeon and blood bank/hematologist (FVIII)
- Re-check temperature, pH, Ionised Calcium, platelets and haemoglobin
- Consider other contributors to bleeding
  - Platelet inhibitors (do Multiple Platelet Function test)
  - Consider VWD, warfarin (INR), clearance etc.

When clinically possible always complete the algorithm in a stepwise manner and check the ROTEM between steps as indicated. This reduces unnecessary transfusion especially of FFP.

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**ROTEM ANALYSIS AND TREATMENT PLAN**

**Nurse or JMO to circle algorithm used then insert results from ROTEM**

Next circle range (action red range) and use algorithm to create a plan.**

**Date:** / /  
**Time:**

**ALGORITHM USED (circle one):**

- CARDIAC/VASCULAR or GENERAL/OBSTETRIC

**For CARDIAC/VASCULAR start here and do all:**
- INTTEM CT = ............... Below 205 / 205 & Above
- HEPTEM CT = ............... Below 205 / 205 & Above

**For GENERAL/OBSTETRIC start here (this section only):**
- EXTEM A5 = ............... Below 35 / 35-40 / Above 40
- FIBTEM A5 = ............... Below 10 / 10-15 / Above 15
- EXTEM CT = ............... Below 80 / 80-90 / Above 90
- EXTEM ML = ............... Below 5 / 5 & Above

Management Plan: ................................

Please stick this label in the patients progress notes.
**PCH ROTEM Algorithm for Critical Bleeding**

This paediatric algorithm should be used in conjunction with the PCH Critical Bleeding Protocol. Only treat abnormal values if active bleeding or at high risk of bleeding. Repeat ROTEM analysis 10 mins after intervention to assess response.

<table>
<thead>
<tr>
<th>ABNORMAL ROTEM</th>
<th>CRITERIA</th>
<th>DIAGNOSIS</th>
<th>INTERVENTION</th>
<th>Notes</th>
</tr>
</thead>
</table>
| **FIBRINOLYSIS** | Trauma within 3 hrs  
EXTEM A5 ≤ 35mm  
or FIBTEM CT > 600s  
Maximum Lysis ≥ 5% | Hyperfibrinolysis | Tranexamic acid  
15mg/Kg | MAX1g bolus  
Initial dose over 10 mins  
then 2mg/kg/hr over 8 hrs  
Consider repeat bolus dose if pt has lost > 1 blood volume since last dose |
| **PLATELETS FIBRINOGEN** | FIBTEM A5 ≤ 10mm | Low fibrinogen | Cryoprecipitate  
5ml/Kg | Order 1bag (35ml) / 5Kg |
| **PLATELETS FIBRINOGEN** | EXTEM A5 ≤ 35mm  
and Normal Fibrinogen  
FIBTEM A5 ≥ 10mm | Low platelets | Platelets  
10ml/Kg | Ensure fibrinogen corrected first  
FIBTEM A5 ≥ 10mm |
| **FACTORS** | EXTEM CT > 90s  
and Normal Fibrinogen  
FIBTEM A5 ≥ 10mm | Low coagulation factors | FFP  
15ml/Kg | Ensure fibrinogen corrected first  
FIBTEM A5 ≥ 10mm  
Add fibrinogen if EXTEM CT > 140s |

**KEY COMPONENTS**

- **FIBTEM A5** Amplitude 5mins post CT  
Fibrinogen concentration and function
- **EXTEM A5** Amplitude 5mins post CT  
Fibrinogen and platelet concentration and function
- **EXTEM CT** Clotting time  
Thrombin generation
- **ML %** Maximal lysis  
Degree of fibrinolysis over temogram

**ROTEM**

**PAEDIATRIC ORDERING GUIDE**

<table>
<thead>
<tr>
<th>Kg</th>
<th>PRBC</th>
<th>CRYO</th>
<th>PLT</th>
<th>FFP</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt;10</td>
<td>1</td>
<td>2</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>10-20</td>
<td>2</td>
<td>4</td>
<td>1</td>
<td>1</td>
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<td>3</td>
<td>6</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>&gt;40</td>
<td>4</td>
<td>8</td>
<td>1</td>
<td>3</td>
</tr>
</tbody>
</table>

Notes:  
250ml/unit  
35ml/pack  
17ml/pack  
AB FFP 255ml/pack

v1.3 Endorsed by the PCH Department of Anaesthesia and Pain Medicine and the Blood and Blood Products Committee - Sept 2018
History

- This is a tricky one to interpret as it is both a paediatric case and a cardiac case.
- I am neither a cardiac nor paediatric anaesthetist so please send in any comments if you have any!
- I don’t have a paediatric cardiac ROTEM algorithm so have included the draft PCH childrens paediatric general ROTEM algorithm and the Cardiac ROTEM algorithm from Prince of Wales
- Great case and lots to learn! Thanks Martyn!
History

- 3.5 kg neonate
- Surgical repair congenital heart disease
- Temogram 1 – On bypass, prior to coming off – Rotem to assess likely product needs.
FIBTEM A5 = 0mm, EXTEM CT = 150s, EXTEM A5 = 13mm
INTEM CT = n/a HEPTEM CT = 405s

This one is pretty tricky – the patient is a neonate and they are on cardiac bypass with high dose heparin!
However have a go and try and interpret this before you go on!
Interpretation

- **Fibtem A5** – unrecordable – this patient is going to need fibrinogen and probably a lot!
- **Extem A5** – 13mm – also extremely low more than you’d expect from low fibrinogen so will almost certainly also need platelets too.
- **Prolonged CTs** – Hard to interpret as pre-protamine – probably need to reassess after protamine & fibrinogen / platelets.
• Temogram 2 – After 5ml/kg Cryoprecipitate, prior to protamine.
FIBTEM A5 = 2mm, EXTEM CT = 166s, EXTEM A5 = 13mm
INTEM CT = n/a HEPTEM CT = 337s

Still pre-protamine so hard to interprete long CT’s
Almost no improvement with cryo 5ml/kg
Still needs a lot more fibrinogen and probably a dose of platelets
• Temogram 3 – After 20ml/kg Cryo, 20ml/kg Platelets and Protamine given.
FIBTEM A5 = 8mm, EXTEM CT = 69s, EXTEM A5 = 51mm
INTEM CT = 303s HEPTEM CT = 296s

Have a go at interpreting this yourself!
FIBTEM A5 = 8mm, EXTEM CT = 69s, EXTEM A5 = 51mm
INTEM CT = 303s HEPTEM CT = 296s

Heptem CT = INTEM CT – no need for more protamine
Fibtem A5 = 8mm – consider more fibrinogen if patient bleeding
Extem A5 = 51mm – very good
Extem CT = 69s – also very adequate
Take Home Points

1. **Very low** fibrinogen levels (e.g. fibtem A5<6mm) need **larger** doses of fibrinogen to correct the deficit.

Thanks again to Dr Martyn Lethbridge from the Dept of Anaesthesia Perth Childrens Hospital WA for sharing this case.