

Paediatric Code Red:

Children's Massive Haemorrhage Protocol

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Paediatric Massive Haemorrhage Protocol

- Massive haemorrhage with signs of hypovolaemic shock or with no likelihood of control
- Anticipated or actual blood loss of 40 ml/kg

If trauma, call 2222. State "Paediatric code red trauma call" and give location. Inform Damage Control Surgeon to attend urgently. Call the Blood Transfusion Laboratory (the "Lab") ext 4577 or bleep 8286:

- "I am activating the Paediatric code red protocol"
- Patient identification – Hospital Number, name & date of birth and (estimated) weight of child
- Patient location – RSCH ED resus or main theatres or location in the Royal Alexandra Children's Hospital.
- Name and contact details of Communication Lead for ongoing communication
- Order **Paediatric code red pack**

Team Leader to:

- Nominate a member of the team to act as Communication Lead
- Nominate the Code Red Porter to convey blood samples and blood components
- Nominate a Blood Coordinator to ensure "right blood, right patient" and full traceability documentation

The Lab will prepare the Paediatric code red pack.

Non-group specific packed red cells will be available immediately

Lab staff will ring Communication Lead with results of urgent investigations including ROTEM results and to inform them that blood components are ready.

Communication lead will ring the Lab if they require further components before the first pack is used up.

Ensure the Lab is informed if **ONCOLOGY PATIENT** or **IMMUNOSUPPRESSED** if irradiated blood is required.

- Insert 2 x IV or IO access
- Take bloods for Group & screen, FBC and coagulation screen with fibrinogen level and ROTEM at baseline. Need 3.5 ml citrate for ROTEM (ensure a minimum of 1 ml EDTA sample sent for crossmatch as a priority – use purple top paediatric bottle)
- Use bloodhound labelling or handwritten if not available – minimum patient identifiers UNK F/ M with unique Trust ID, ideally name / DOB / ID.
- Give 15 mg/kg Tranexamic acid (max 1 g) intravenously over 10 minutes then infuse 2 mg/kg/hour (max 125 mg/hour)
- Use 10 ml/kg warmed normal saline boluses until emergency blood available or Paediatric code red pack arrives

Availability of Blood for Collection

O Neg blood for girls,

O Pos blood for boys:
Immediate

Cross matched blood:
45 minutes

Fresh Frozen Plasma:
30 minutes to thaw

Cryoprecipitate:
30 minutes to thaw

Platelets:

Immediate if on site

Replacement delivery up to 2 hours

Attempt to get second group and save sample before starting the Paediatric code red pack.

Give Blood → Cryo → Blood → FFP in 10 ml/kg aliquots
Blood aliquots to be given sequentially, not concurrently

Ongoing bleeding?

Take bloods – FBC, U+E, INR, APTT, fibrinogen, gas, ROTEM and second G&S if not already obtained.
Reassess blood loss and response to treatment
Ensure clear plan for definitive haemorrhage control

Give Platelets 10 ml/kg after 40 ml/kg blood products
Give Blood → Cryo → Blood → FFP in 10 ml/kg aliquots
Blood aliquots to be given sequentially, not concurrently

Resolution of bleeding

- Stand down of protocol
- Ensure documentation complete
- Return unused bags to lab within 2 hours

- Aim core temperature > 36°C
- Aim for platelets > 75 x10⁹/L
- Aim for fibrinogen > 2 g/L
- Aim for INR / APPT ratio < 1.5
- Aim Hb 80 – 100 g/L

- Keep base deficit < 6 mmol/L
- Keep ionised Ca > 1 mmol/L
- Keep K < 6.0 mmol/L

Paediatric code red pack

	Dose	
	Child	Adult (≥ 60 kg)*
Blood (PRC)	10 ml/kg	See adult code red protocol
Cryoprecipitate	10 ml/kg	
FFP	10 ml/kg	
Platelets	10 ml/kg	

*Child ≥ 60 kg = manage as per adult protocol

Paediatric Massive Haemorrhage Protocol

Paediatric code red Children's massive haemorrhage protocol

Definition

A volume requirement associated with trauma of > 20ml/kg in the first hour of treatment is deemed massive haemorrhage. A massive transfusion is > 40 ml/kg of blood (half of a child's blood volume).

The Paediatric code red call should be activated in cases where there is:

- Massive haemorrhage with signs of hypovolaemic shock or with no likelihood of control
- Anticipated or actual blood loss of 40 ml/kg

Scope of protocol

The Paediatric code red call is a mechanism to ensure rapid and appropriate fluid resuscitation in a child with major, life-threatening haemorrhage. This is likely to be an extremely uncommon event making a protocolled response important. This protocol is only for use in the Royal Sussex County Hospital or Royal Alexandra Children's Hospital.

Activation of the Paediatric code red call ensures:

- Rapid release of blood and blood components from the laboratory under the control of the most senior paediatric trained or emergency department doctor.
- Lab staff are aware of patients with massive haemorrhage at the earliest opportunity.
- Complications of massive transfusion are recognised and dealt with.

Effective communication between team members is crucial.

Laboratory testing

The lab allow blood products out for a code red call on the understanding that the most senior paediatric trained or emergency department doctor will and must ensure that blood is taken *before any is given*. The lab must also be informed if the child has already received blood.

Failure to do this will have serious consequences for future transfusions.

Paediatric Massive Haemorrhage Protocol

Core team members

- Most senior paediatric trained or emergency department doctor – the Team Leader
- Laboratory staff member
- Communication Lead – will usually be the circulation doctor in a trauma
- Code Red Porter – will need to be requested urgently in cases of non-trauma via the estates and facilities help desk on extension 3250
- Blood co-ordinator – will usually be one of the RSCH ED or RACH Nurses

Activation Process

TRAUMA

Communication will occur between the designated Communication Lead (will usually be the circulation doctor) on a contact number to be defined on first contact, and the laboratory **phone ext. 4577 or bleep 8286**.

1. The Paediatric code red trauma call is activated by:
 - a. The Trauma Team Leader, based on credible pre-hospital information received (usually via HEMS), or the status of the patient on arrival or during resuscitation.
 - b. Transfusion staff, as a result of blood analysis or transfusion requirements.
 - c. Children's critical care unit or Paediatric surgery consultant identifying acute or ongoing massive blood loss in a child who has sustained trauma.
2. The designated Communication Lead contacts the laboratory with the relevant information.
3. The pre-transfusion sample is taken after the arrival of the patient.
4. The Code Red Porter is dispatched to the laboratory to give sample and collect packs.
5. The Damage Control Surgeon is contacted to attend urgently in addition to the paediatric major trauma team.

NON-TRAUMA

Communication will occur between the most senior paediatric trained doctor (the Team Leader or delegated Communication Lead) on a designated contact number to be defined on first contact, and the laboratory **phone ext. 4577 or bleep 8286**.

Paediatric Massive Haemorrhage Protocol

1. The paediatric code red call is activated by the Team Leader identifying acute or ongoing massive blood loss in a child who has NOT sustained trauma.
2. The Team Leader or a delegated Communication Lead contacts the laboratory with the relevant information.
3. The pre-transfusion sample is taken.
4. The Code Red Porter is dispatched to the laboratory to give sample and collect packs.

The Team Leader or a delegate must inform the laboratory if the patient is an **ONCOLOGY PATIENT** or **IMMUNOSUPPRESSED** for irradiated blood. A discussion will need to be had when limited stocks are depleted regarding priority of blood product over irradiation benefit (see Appendix 1.).

Blood products in paediatric massive haemorrhage protocol

Paediatric code red pack

	Dose	
	Child	Adult ≥ 60 kg*
Packed red cells	10 ml/kg	See adult code red protocol below
Cryoprecipitate	10 ml/kg	
FFP	10 ml/kg	
Platelets	10 ml/kg	

One BSUH unit

= 250 ml PRC
= 250 ml FFP
= 200 ml cryoprecipitate
= 200 ml platelets

*Child ≥ 60 kg = manage as per adult protocol

Adult protocol

Pack A and pack B	Pack C
4 units packed red cells	4 units packed red cells
4 units fibrinogen (either cryo or Riastap)	1 pool of platelets

Give 4 units cryo + 4 units PRC then give pack B.

Aim for 1 red: 1 yellow

Dose and order of products

10 ml/kg aliquots

Blood → Cryoprecipitate → Blood → Fresh frozen plasma → Platelets →
Blood → Cryoprecipitate → Blood → Fresh frozen plasma → Platelets →

Paediatric Massive Haemorrhage Protocol

Blood aliquots to be given sequentially rather than concurrently, as per APLS guidance.

Blood results guide ongoing treatment. **Lab staff may advise based on ROTEM results.**

Aim for 1 red cells: 1 yellow

A note about blood products:

Packed red cells

Start with O Negative for girls, O Positive for boys. Switch to type specific when cross matched – takes around 45 minutes.

Cryoprecipitate

Cryoprecipitate needs defrosting before issue. Takes around 30mins (plus allow for time transit). Do not put cryoprecipitate in fridge after defrosting as can precipitate.

Fresh Frozen Plasma (FFP)

FFP needs defrosting before issue. Takes around 30 mins (plus allow time for transit).

Platelets

Stored at ambient temperature. **DO NOT REFRIGERATE.**

Since platelets have short shelf life of 5 days only the blood bank has limited supplies of platelets and has to order additional units from the Blood centre as needed.

Documentation

Use the Paediatric code red call check-list.

Check against empty bags / labels.

Stand down

The Laboratory will check if further blood products are required on a continuous basis. The Team Leader will answer with “yes”, or “no, stand down”. The decision to stand down will rest with Team Leader.

Unused packs will go back to the laboratory within 2 hours.

Paediatric Massive Haemorrhage Protocol

Management principles

Airway and breathing

- Provide 100% supplemental oxygen with facemask and non-rebreathe bag until definitive airway is obtained
- Arrange intubation and ventilation. Consider use of cuffed ET tube, especially in trauma.

Circulation

- 2 x large bore intravenous cannulae
- Intra-osseous (IO) access is suitable if peripheral IV access is poor, inaccessible or delayed.
- In lower limb, pelvic or abdominal trauma, beware of use of lower limb venous access as infused products may be lost through damaged vessels.

Take baseline blood samples for blood group and X-Match, venous blood gas, FBC, coagulation screen including fibrinogen level, ROTEM (3.5 ml citrate sample), U&E, LFT, amylase, and glucose.

Do not delay medical or surgical treatment to obtain arterial access.

Give **Tranexamic acid** 15 mg/kg (maximum 1 gram) over 10 minutes then infuse 2 mg/kg/hour (max 125mg/hr).

Massive haemorrhage control

- Direct pressure and elevation; pressure dressings; tourniquets to external haemorrhage
- Search for sources of internal haemorrhage in the chest, abdomen, pelvis and femur. Consider intracerebral haemorrhage.
- Use pelvic sling to splint suspected pelvic fractures.
- Surgical intervention – liaise with Paediatric Surgeons / Orthopaedic Surgeons / Damage Control Surgeons for definitive haemorrhage control.

If the child has a known clotting disorder, please contact GOSH (020 7405 9200) and ask for registrar on call for haematology (clotting / haemophilia) to discuss ongoing management.

Paediatric Massive Haemorrhage Protocol

Actively manage complications of massive transfusion

Hypothermia

- Aim core temperature > 36°C
- Use fluid warmer, Bair hugger, warm humidified breathing circuit

Coagulopathy

- Aim for platelets > 75 x 10⁹/L
- Aim for fibrinogen > 2 g/L
- Aim for INR / APPT ratio < 1.5

Aim for Hb 80 - 100 g/L

Acidosis

- Keep base deficit < 6 mmol/L
- Use 1-2 ml/kg sodium bicarbonate
- Lactate > 2 mmol/L predictor of mortality

Hypocalcaemia

- Keep ionised Ca > 1 mmol/L
- Use 0.5 ml/kg 10% calcium gluconate [0.11 mmol/kg] (max 20 ml) slow intravenous injection over 5-10 minutes

Hyperkalaemia

- Keep K < 6.0 mmol/L
- Use 10 ml/kg 10% dextrose with 0.1 units/kg insulin

Paediatric Massive Haemorrhage Protocol

Paediatric Code Red check list

Action point		Completed?	Time
Plan for haemorrhage control			
2 x vascular access IV or IO			
First blood sample taken			
Second blood sample taken			
Tranexamic acid, 15mg/kg			
Warmed Packed Red Cells 10 ml/kg	1.		
	2.		
	3.		
	4.		
	5.		
	6.		
	7.		
	8.		
	9.		
	10.		
Warmed Cryoprecipitate 10 ml/kg	1.		
	2.		
	3.		
	4.		
	5.		
	6.		
	7.		
	8.		
	9.		
	10.		
Warmed Fresh Frozen Plasma 10 ml/kg	1.		
	2.		
	3.		
	4.		
	5.		
	6.		
	7.		
	8.		
	9.		
	10.		

Paediatric Massive Haemorrhage Protocol

Paediatric Code Red check list

Action point		Completed?	Time
Warmed platelets 10 ml/kg	1.		
	2.		
	3.		
	4.		
	5.		
	1.		
	2.		
	3.		
	4.		
	5.		
	1.		
	2.		
	3.		
	4.		
	5.		
	1.		
	2.		
	3.		
	4.		
	5.		
	1.		
	2.		
	3.		
	4.		
	5.		

Paediatric Massive Haemorrhage Protocol

Appendix 1. Patient groups requiring irradiated or CMV negative blood products

The following groups of patients should receive irradiated red cells and platelets:

- All patients with Hodgkins lymphoma
- All patients treated with regimes including the following drugs: purine analogues (fludarabine, cladribine, deoxycoformycin, clofarabine, nelarabine, bendamustine), ATG, alemtuzumab (Campath)
- All recipients of allogeneic or autologous bone marrow or peripheral blood stem cell transplant
- All donors of bone marrow (BM) or peripheral blood stem cells (PBSC) from 7 days before harvest and during harvest
- All patients undergoing BM or PBSC harvest for later autologous transplant-from 7 days before harvest and during harvest
- All cases where there may be a shared haplotype between donor and recipient
- Neonates who have previously received blood products in utero (required until 6 months after expected date of delivery)
- Children with severe T lymphocyte immunodeficiency syndromes (eg. SCID, CID, 22q11, Wiskott Aldrich syndrome)

The following patients should receive CMV negative blood products:

- Neonates
- Intra-uterine transfusions
- Planned transfusions during pregnancy
- Patients who are CMV negative or CMV status unknown who have received or may receive BMT/PBSCT in the future