MASSIVE TRANSFUSION PROTOCOL (MTP) - CHW

PROCEDURE ©

DOCUMENT SUMMARY/KEY POINTS

- Massive transfusion is defined as the replacement (or the anticipation of replacement) of >1 blood volumes within the first 24 hours of resuscitation.
- This procedure may be activated by any medical or nurse clinician when massive blood loss in a child is occurring or anticipated. The on call Haematologist will be involved to aid clinicians in management.
- There is mandatory minimum data set required by Blood Bank on activation
- Blood bank will dispense both red cell and plasma products in a 1:1 ratio.
- Frequent monitoring of venous blood gas, electrolytes and calcium as indicated.

Administration of all blood products *must comply* with the CHW **Transfusion of Blood and Blood Components policy**:
http://chw.schn.health.nsw.gov.au/o/documents/policies/policies/2007-8092.pdf

Approved by:	SCHN Policy, Procedure and Guideline Committee	
Date effective:	1st May 2014	**Review Period:** 3 years
Team Leader:	Department Head	**Area/Dept:** Haematology

Date of Publishing: 3 March 2017 11:28 AM Date of Printing:

CHANGE SUMMARY

- Due for mandatory review.
- Addition of the intravenous tranexamic acid section.
- Addition of a flowchart

READ ACKNOWLEDGEMENT

- Appropriate staff working in acute care areas and Haematology staff are to read and acknowledge they understand the contents of this document.

TABLE OF CONTENTS

Purpose

This document describes the **activation and deactivation procedure** to provide blood components to patients requiring massive blood transfusion in a timely manner[1].

Definition

Massive transfusion is defined as the replacement (or anticipation of replacement) of one or more blood volumes within the first 24 hours of resuscitation[2].

Criteria for activating Massive Transfusion Protocol (MTP)

To activate the MTP, the following criteria applies:

- Any child requiring more than 20mL/kg of packed red blood cells (PRBC) in 2 hours and/or anticipated ongoing blood loss;

OR

- Any child requiring more than 40mL/kg of PRBC in a 24 hour period with ongoing blood loss;

OR

- "Code Crimson" for trauma with acute life threatening haemorrhage is activated (see CHW Procedure: Trauma: Code Crimson).

OR Blood Bank may activate protocol if:

i. > 2 units of PRBC issued within 1 hour for child < 5 years old, **OR**
ii. > 4 units PRBC issued within 1 hour for child ≥ 5 years old, **OR**
iii. The Blood Bank technician anticipates likelihood of additional component needs. In this situation, the Blood Bank technician contacts the Haematologist to activate the protocol, **OR**
iv. "Code Crimson" is activated.

Note: An exception to the above criteria is planned cardiac bypass surgery. If blood loss or usage is greater than anticipated, the MTP may be initiated at the discretion of the surgeon or anaesthetist.

Activation and Notification

The following persons may activate the massive transfusion protocol (MTP):

- Any medical or nurse clinician involved in the treatment of a child requiring a massive transfusion.
- Blood Bank technician/Haematologist if the above criteria is met.

The massive transfusion protocol is activated by notifying the Blood Bank technician on-call (ext. 52284 or pager 6832). The Blood Bank technician will then notify the on-call Haematologist, who will liaise with the clinical team.

Details required by Blood Bank

When providing (verbal) information to Blood Bank, the following details are required:

- **Name and contact (phone/pager) of contact person**.
  (It is best to identify one person who will co-ordinate with Blood Bank[2]. e.g. anaesthetist in Operating Suite, surgeon or emergency physician in the Emergency Department.)
- **Name and medical record number of patient**.
- **Weight of patient**.
- **Location of patient and phone number of location**.
  Note: *Clinical team must notify Blood Bank if the patient location changes.*
- **Initial blood results**
  e.g. full blood count (FBC), coagulation screen (coags), venous blood gas (VBG), cross match.
- **Urgency of need for blood products**
  e.g. immediate or over next 30 minutes[2]. This will help determine what products will be despatched. Refer to Time for Blood Product Availability table.

Use of intravenous tranexamic acid (Cyclokapron) in trauma

The use of intravenous tranexamic acid in trauma has been established for adult patients (CRASH-2 trial) and administration is likely to be beneficial in children as well:

- Tranexamic acid at a dose of 15 mg/kg (dose range 10-20 mg/kg; max 1g) by slow intravenous infusion over 10-15 minutes; ideally within the first 3 hours of trauma]
- Follow up doses can be given at the decision of the treating team and can be as IV boluses or continuous infusion

Precautions:

- Avoid rapid infusion or push injection as it may cause hypotension.
- Tranexamic acid should be used with caution in patients with haematuria, renal haemorrhage and bleeding into other bodies cavities (e.g. pleural space, joints) as inhibition of fibrinolysis may result in retention of blood clots in those spaces.
- Dose/interval adjustments for subsequent doses are required in renal impairment
- Do not use in conjunction with factor IX complex concentrates

Massive Transfusion Pack

Immediate Dispatch

The following "pack" will be despatched immediately upon activation of the MTP[3] according to patient weight:

Weight of Child			
< 15kg	**15 – 30kg**	**30 – 50kg**	**> 50kg**
1 unit PRBC[+] 1 unit FFP* 1 unit pooled platelets	2 unit PRBC 2 unit FFP 1 unit pooled platelets	3 unit PRBC 3 unit FFP 1 unit pooled platelets	4 unit PRBC 4 unit FFP 1 unit pooled platelets
Specimen tubes for sample collection from patient after administration of products will be sent with each pack. Pathology form (tests pre-printed) included.			

[+] PRBC = Packed Red Blood Cells
* FFP = fresh frozen plasma

Second Dispatch

Upon request for a second lot of blood products, the following will be issued according to weight:

Weight of Child			
< 15kg	**15 – 30kg**	**30 – 50kg**	**> 50kg**
1 unit PRBC 1 unit FFP 2 units cryoprecipitate	2 unit PRBC 2 unit FFP 3 units cryoprecipitate	3 unit PRBC 3 unit FFP 5 units cryoprecipitate	4 unit PRBC 4 unit FFP 8 units cryoprecipitate
Specimen tubes for sample collection from patient after administration of products will be sent with each pack. Pathology form (tests pre-printed) included.			

By this stage, the on-call Haematologist will be involved, and will direct further products in consultation with the clinical team. The principles of further replacement will be:

- 1:1 ratio of PRBC to FFP[3 - 10],
- Alternating platelets and cryoprecipitate, but adjusted according to laboratory results[2].
- Factor concentrates such as activated factor VII ("Novoseven") or prothrombin complex concentrates ("Prothrombinex") may be indicated, and this will be the decision of the on-call Haematologist in consultation with the clinical team[2, 11-13].

Note: Administration of all blood products *must comply* with the CHW Transfusion of Blood and Blood Components policy.

Responsibilities

The following points outline the responsibilities throughout the activation of the massive transfusion protocol (MTP) for Blood Bank and the clinical service/team involved.

Blood Bank Service

- Prioritise testing and product distribution to patient.
- Despatch massive transfusion package to the appropriate location.
- Maintain communication with clinical team and ensure continuous availability of products. Commence thawing of next batch of frozen products immediately upon despatch of previous pack.
- Communicates/notifies on-call Haematologist.

Clinical Service

- Ensure availability of runner to transport products rapidly to patient location.
- Informs Blood Bank if patient location changes as soon as possible.
- Deactivates MTP by notifying Blood Bank.

Time for Blood Product Availability

Product	Time Until Despatch From Blood Bank
O negative PRBC	Immediate
ABO specific PRBC (uncrossmatched)	5 – 10 minutes
Crossmatched PRBC	40 minutes
Frozen products (FFP, cryoprecipitate)	20 – 30 minutes

Laboratory Criteria – target values

As a general guideline in massive transfusion, the following target values are reasonable to aim for:

Test	Target value
Haemoglobin (Hb)	> 70 g/L
Platelets	> 50 x 10^9/L (or > 100 x 10^9/L if neurological injury)[2, 3, 5]
Activated partial thromboplastin time (APTT)	< 40 seconds[3]
Prothrombin time (PT)	< 20 seconds
Fibrinogen	> 1 g/L[2, 5]
Acidosis and hypothermia should also be vigorously corrected, as these exacerbate coagulopathy[2, 3, 11, 14] (refer to Ongoing Clinical and Laboratory Assessment).	

Ongoing Clinical and Laboratory Assessment

The following points need to be actioned/considered:

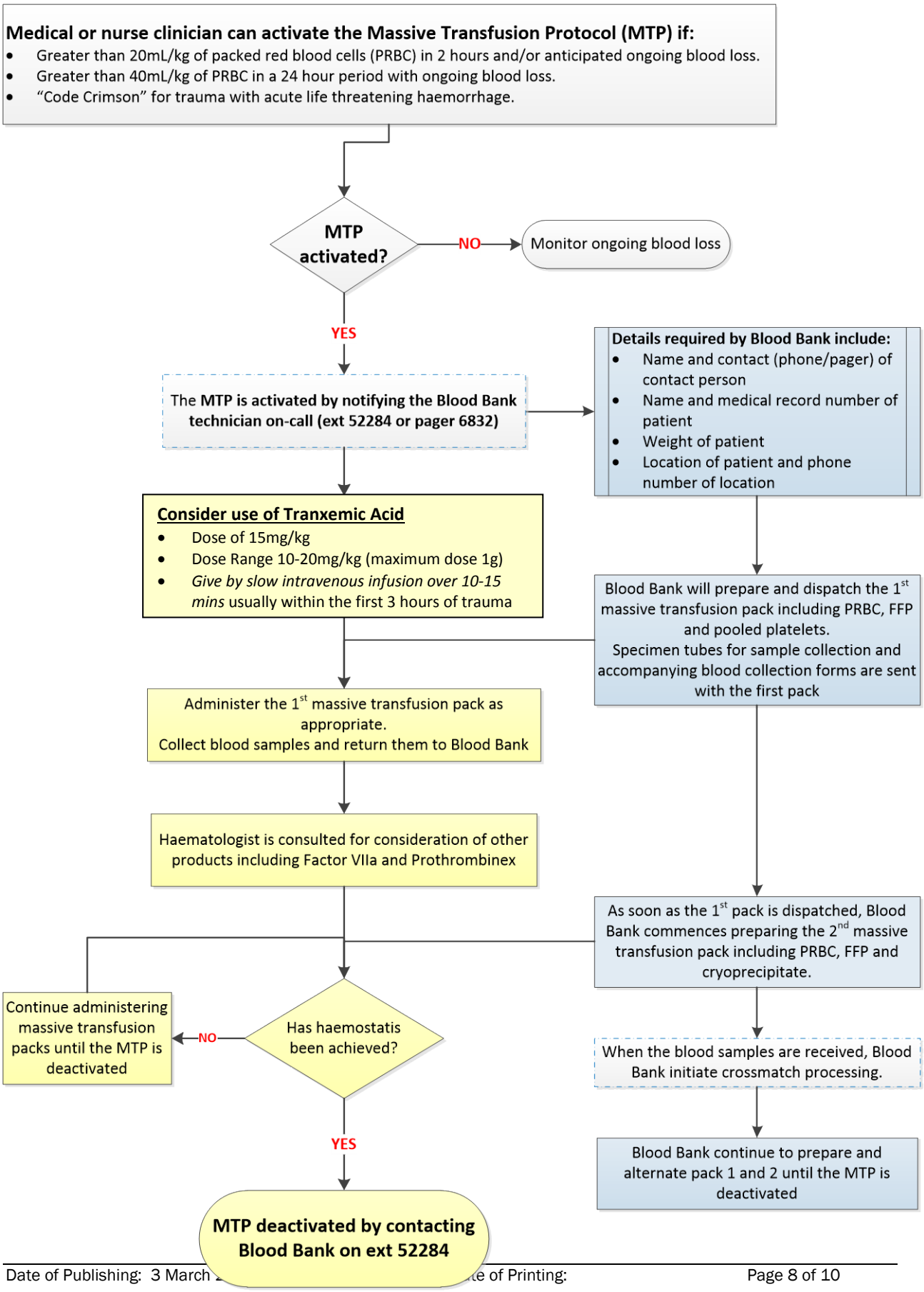
- Strict compliance with identification, documentation and product administration is mandatory as per CHW Transfusion of Blood and Blood Components policy.
- Laboratory tests **after administration of each "pack"** (FBC, coags).
- Additional crossmatch samples may be required. Clinical team will be notified by Blood Bank technician.
- Frequent monitoring of venous blood gas, electrolytes and calcium as indicated.
- Consider using a blood warmer.
- Consider use of cell saver (available in Operating Suite) to scavenge blood or to wash blood products and also rapid transfuser in children >30kgs. Inform theatre floor manager as early as possible if you require cell saver as cardiac technicians need to be called in to set this up. Give about 30 minutes for this to happen.

Deactivation of MTP

When deactivating the MTP the following will occur:

- The clinician in charge of the patient (or delegate) will notify Blood Bank of decreasing needs for products or termination of the massive transfusion protocol.
- Blood Bank technician will notify on-call Haematologist.

Massive Transfusion Protocol Flowchart



Abbreviations

MTP	Massive Transfusion Protocol
PRBC	Packed red blood cells
FBC	Full blood count
Coags	Coagulation Screen
VBG	Venous blood gas
APTT	Activated partial thromboplastin time
PT	Prothrombin time
FFP	Fresh frozen Plasma

References

1. Cotton BA, Au BK, Nunez TC, Gunter OL, Robertson AM, Young PP: Predefined massive transfusion protocols are associated with a reduction in organ failure and post injury complications. *J Trauma* 2009: 66(1): 41-49.
2. Stainsby D, MacLennan S, Thomas D, Isaac J, Hamilton PJ. Guidelines on the management of massive blood loss. *Br J Haematol* 2006: 135; 634-641.
3. Malone DL, Hess JR, Fingerhut A. Massive transfusion practices around the globe and a suggestion for a common massive transfusion protocol. *J Trauma* 2005: 60(6): S91-96.
4. Fraga GP, Bansal V, Coimbra R. Transfusion of blood products in trauma: an update. *J Emerg Med* 2009; April 1 (epub ahead of print).
5. Perkins JG, Cap AP, Weiss BM, Reid TJ, Bolan CE. Massive transfusion and nonsurgical hemostatic agents. *Crit Care Med* 2008; 36(7): S325-339.
6. Gonzalez EA, Moore FA, Holcomb JB, Miller CC, Kozar RA, Todd SR, Cocanour CS, Balldin BC, McKinley BA. Fresh frozen plasma should be given earlier to patients requiring massive transfusion. *J Trauma* 2007; 62:112-119.
7. Holcomb JB, Wade CE, Michalek JE, Chisholm GB, Zarzabel LA, Schreiber MA, Gonzalez EA, Pomper GJ, Perkins JG, Spinella PC, Williams KL, Park MS. Increased plasma and platelet to red blood cell ratios improves outcome in 466 massively transfused civilian trauma patients. *Ann Surg* 2008; 248:447-458.
8. Gunter OL, Au BK, Isbell JM, Mowery NT, Young PP, Cotton BA. Optimizing outcomes in damage control resuscitation: identifying blood product ratios associated with improved survival. *J Trauma* 2008; 65(3): 527-534.
9. Borman MA, Spinella PC, Perkins JG, Grathwohl KW, Repine T, Beekley AC, Sebesta J, Jenkins D, Wade CE, Holcomb JB. The ratio of blood products transfused affects mortality in patients receiving massive transfusions at a combat support hospital. *J Trauma* 2007; 63(4): 805-813.
10. Barret JP, Desai MH, Herndon DN. Massive transfusion of reconstituted whole blood is well tolerated in pediatric burn surgery. *J Trauma* 1999; 47(3):526-528.
11. Hess JR, Zimrin AB. Massive blood transfusion for trauma. *Curr Opin Hematol* 2005; 12:488-492.
12. Dutton RP, McCunn M, Hyder M, D'Angelo M, O'Connor J, Hess JR, Scalea TM. Factor VIIa for correction of traumatic coagulopathy. *J Trauma* 2004; 57(4):709-719.
13. Uhrig L, Blanot S, Baugnon T, Orliaguet G, Carli PA, Meyer PG. Use of recombinant activated factor VII in intractable bleeding during pediatric neurosurgical proceduters. *Pediatr Crit Care Med* 2007; 8(6): 576-579.
14. Barcelona SL, Thompson AA, Cote CJ. Intraoperative pediatric blood transfusion therapy: a review of common issues. Part I: hematologic and physiologic differences from adults; metabolic and infectious risks. *Pediatric Anesthesia* 2005; 15:716-726.