INTERNAL ONLY

CLINICAL BUSINESS RULES

Prince of Wales Hospital and Community Health Services

NAME OF DOCUMENT	**Massive Transfusion Protocol (MTP)**
TYPE OF DOCUMENT	**Business Rules**
MANUAL	**Clinical Business Rule**
DATE OF PUBLICATION	**January 2012**
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LEVEL OF EVIDENCE	**Refer to Section 3**
REVIEW DATE	
FORMER REFERENCE(S)	**Clinical Procedures Manual Section 4F.2 Massive Transfusion Protocol January 2007**
EXECUTIVE SPONSOR or EXECUTIVE CLINICAL SPONSOR	**Director of Clinical and Medical Services Director of Nursing**
AUTHOR	**Senior Haematologist Randwick Campus Transfusion Committee**
KEY TERMS	**Major bleeding episodes Massive Transfusion**
SUMMARY	**Describes the process for the management of blood transfusion requirements in major bleeding episodes occurring in adult patients at the POWH. It aims to assist the interactions of the treating clinicians and the Blood Bank. Note: RHW have a detailed description of the MTP and a policy for the management of Post Partum Haemorrhage.**

COMPLIANCE WITH THIS DOCUMENT IS MANDATORY

Feedback about this document can be sent to powhpolicy@sesiahs.health.nsw.gov.au

Clinical Business Rules Manual
Massive Transfusion Protocol

1. PURPOSE & SCOPE

To streamline the management of blood transfusion requirements in major bleeding episodes occurring in adult patients at the POWH, assisting the interactions of the treating clinicians and the Blood Bank. It should be noted that any instance of massive transfusion may have unique clinical features and the Protocol may need to be tailored to the individual patient circumstances.

2. RESPONSIBILITIES

Consultant in charge of the case (e.g. anaesthetist, intensivist, emergency physician, trauma team leader)
Blood Bank Technician on Duty
Haematology Registrar/Consultant on-call
After Hours Nursing Nurse Manager
Advanced Practice Nurse
After Hours Clinical Support Nurse

3. REFERENCES

3.1 External References

1. American Association of Blood Banks second edition: Transfusion in Trauma and Massive Transfusion
2. Australian Red Cross Blood Service Massive Transfusion. Available at http://www.transfusion.com.au/disease_therapeutics/transfusion
3. Hirschberg A, Dugas M, Banez EI, Scott BG, Wall MJ, Mattox KL.Minimising Dilutional coagulopathy in Exsanguinating Haemorrhage: A Computer Simulation. J Trauma-Injury Infection and Critical Care. 2003; 54(3):454-463
4. St George Hospital Clinical Policies and Procedures Manual Section 7.8 Guidelines for Massive Blood Transfusion
5. National Blood Authority Australia. Patient Blood Management Guidelines: Module 1 – Critical bleeding/Massive Transfusion. March 2011. Available at www.nba.gov.au
6. CRASH-2 trial collaborators. Effects of tranexamic acid on death, vascular occlusive events, and blood transfusion in trauma patients with significant haemorrhage (CRASH-2): a randomised, placebo-controlled trial. The Lancet. 2010; 376(9734): 23-32.

3.2 Internal References

POWH Blood Bank Procedures Manual
POWH Clinical Business Rules: Blood Component Management and Administration
POWH Clinical Business Rules: Recombinant Factor VIIa (Novoseven RT®) for Life-threatening Bleeding
Royal Hospital for Women Clinical Policies, Procedures and Guidelines Manual: Massive Transfusion in Obstetrics and Gynaecology
Royal Hospital for Women Clinical Policies, Procedures and Guidelines Manual: Post-partum Haemorrhage – prevention and management

4. DEFINITIONS

1 pooled bag of platelets = 4 units of platelets
PRBC = packed red blood cells
FFP = fresh frozen plasma
Adult blood volume = ~ 70mL/kg

5. PROCEDURE

5.1 PRINCIPLES OF MASSIVE TRANSFUSION

5.1.1 Criteria for Identifying Patients at Risk of Massive Haemorrhage (any)

- Patients likely to need replacement of their entire blood volume in 24 hours
- Patients who have at least one (1) of severe thoracic, abdominal or pelvic injury
- Patients who are receiving or have received > 3000mL (40mL/kg) crystalloid/colloid and 4 units of blood and have ongoing fluid resuscitation needs.

5.1.2 Damage Control During Resuscitation

- Early consultant input to arrest haemorrhage and minimize macrovascular bleeding
- Minimize macrovascular bleeding
- Minimize microvascular bleeding and coagulopathy – aggressive fluid resuscitation; use active warming measures (i.e. thermal control devices) to try and avoid hypothermia and acidosis

5.1.3 Activation of the Massive Transfusion Protocol (MTP)

- Consultant in charge of the case (e.g. anaesthetist, intensivist, emergency physician, trauma team leader) notifies Blood Bank directly (ext 29145) once patient is identified to be at risk by fulfilling criteria in 5.1.1 above inclusively.
- Blood Bank scientists may also identify a patient and ask if the team wish to activate the MTP
- Blood component therapy, after the initial four (4) units of packed cells, is then administered according to the MTP, provided the initial haematological and coagulation screens are within normal limits.
- Haematological and coagulation monitoring is performed according to MTP, and guides ongoing component therapy.
- Component therapy administration may be altered by the consultant in charge particularly in the event of abnormal initial haematological and coagulation values, clinical conditions (e.g. liver failure) suggesting coagulopathic risk or the patient having received blood components prior to arrival at POWH
- The decision to cease the MTP is that of the consultant in charge and must be communicated directly to Blood Bank.

5.1.4 Principles of Coagulopathy Management in Massive Transfusion

- Coagulation factors are often at inadequate levels in patients suffering non-compressible or microvascular bleeds, despite normal APTT and PT. These measurements are often underestimated in the presence of coexistent hypothermia. Once APTT and PT are abnormal, there is probably close to only 30 – 40% of coagulation factor present. It is therefore prudent to be aggressive with FFP early – rather than waiting for an abnormal result as a trigger to replace coagulation factors.
- The endpoint of the coagulation cascades is fibrinogen being converted to fibrin. Coagulopathy will not tend to correct, even with adequate factor replacement, unless fibrinogen is adequately present. Cryoprecipitate is the appropriate choice for hypofibrinogenaemia.
- Platelets tend to approach inadequate levels only after transfusion of 8 – 10 units packed red blood cells (PRBCs). Despite adequate levels, platelet function is affected by hypothermia and acidosis. Damage control resuscitation minimizing hypothermia and acidosis is therefore critical to survival.

5.2 MASSIVE TRANSFUSION PROTOCOL (MTP)

(also see **Appendix 1** for Massive Transfusion Protocol Flowchart)

5.2.1 Consultant in Charge

- Ensure adherence to 'damage control' guidelines.
- Activate MTP by direct communication with Blood Bank technician/scientist (ext number 29145).
- Ensure haematological and biochemical monitoring of replacement therapy and resuscitative efforts occurs approximately every 60 minutes during resuscitation.
- Assume responsibility for the order, rate and recording of component therapy replacement, guided by clinical impression and resuscitative end points.
- Cease the MTP by direct communication with on duty Blood Bank technician.

5.2.2 Blood Bank/Haematology Role (see also separate blood bank protocol)

- Supply initial 4 units PRBC
- Once supplied immediately enquire of requesting Medical Officer as to the need for MTP activation. If MTP activated, record activating Medical Officer's name, notify on call Haematologist/registrar, and dispense blood components as per MTP pack.
- Ensure emergent grouping and cross match of recipient's blood.
- Ensure adequate thawing of frozen product. Note: FFP takes 30 minutes to thaw
- Ensure emergent processing of haematological and coagulation parameters initially and during resuscitation by notifying specimen reception and main lab of the MTP.
- Advise consultant in charge of variances from haematological end points.

5.2.3 Massive Transfusion Protocol Pack (MTP pack)

- 4 units PRBC, 4 units FFP, 1 pooled bag of platelets
- NOTE: Australian Red Cross Blood Service may experience platelet shortage – every effort will be made to supply patients on the MTP protocol
- Alternating with
- 4 units PRBC, 4 units FFP, 6 units Cryoprecipitate.

- Suggest additional:
  - Platelets – if platelets < 50 X 10^9/L *or* < 100 X 10^9/L with head injury.
  - Cryoprecipitate – if fibrinogen < 1.0 g/L
  - FFP – if PT, APTT prolonged and provided fibrinogen > 1.0 g/L
  - PRBC – if Hb< 80 g/L
  - Calcium chloride – if ionised calcium < 2.0 mmol/L

5.2.4 Haematological / biochemical monitoring

- FBC, EUC, LFT, ionised calcium, PT/APTT, Fibrinogen, ABG, Group/crossmatch initially.
- FBC, EUC, PT/APTT, fibrinogen, arterial venous blood gases (A/VBG) every 60 mins during resuscitation. Ionised calcium measurements may also be required

5.2.5 Resuscitative End points for Massive Haemorrhage

- INR < 1.5; PT less than 16 seconds; APTT less than 42 seconds.
- Fibrinogen greater than 1.0g/L
- Platelets greater than 50 x 10^9/L
- PH 7.35 - 7.45
- Core Temperature greater than 35.5°C
- Base Deficit less than -3
- Poor prognostic values = Temp < 34°C, Base Deficit > -6, PH < 7.1, lactate > 4mmol/L, ionised calcium <1.1 mmol/L.

5.2.6 Recombinant activated factor (rFVIIa)

- Consider in life-threatening bleeding but note that this is 'off label' use. There has been no randomised trial demonstrating a survival advantage of rFVIIa use in life-threatening bleeding.
- rFVIIa is most efficacious when every effort has been made to correct surgical bleeding, hypothermia and acidosis. In particular, patient pH should be > 7.2 for procoagulant effect
- Authorisation required by consultant haematologist on call
- Dose: 90 microg/kg, rounded to the nearest whole vial to minimize wastage, given as an intravenous bolus. A second dose may be required 2 hours after the first.
- **Recombinant rFVIIa is kept in Blood Bank (see also Prince of Wales Hospital**

Clinical Business Rule: Recombinant Factor VIIa (Novoseven RT®) for Life-threatening Bleeding)

5.2.7 Tranexamic acid

- A randomised controlled trial of trauma patients who received tranexamic acid demonstrated improved survival both from all-cause mortality and death from bleeding[6].
- In trauma patients with significant haemorrhage, consider intravenous (IV) tranexamic acid:

  Tranexamic Acid1g IV loading dose over 10 minutes followed by tranexamic acid 1g IV infusion over 8 hours
- Availability: ampoules containing 1g/10mL in **pharmacy and After Hours Drug Room (AHDR)**. Contact either the Advanced Practice Nurse (pager # 45387), After Hours Clinical Nurse Educator (#44193) or After Hours Nurse Manager (pager # 44194) for access to the AHDR.

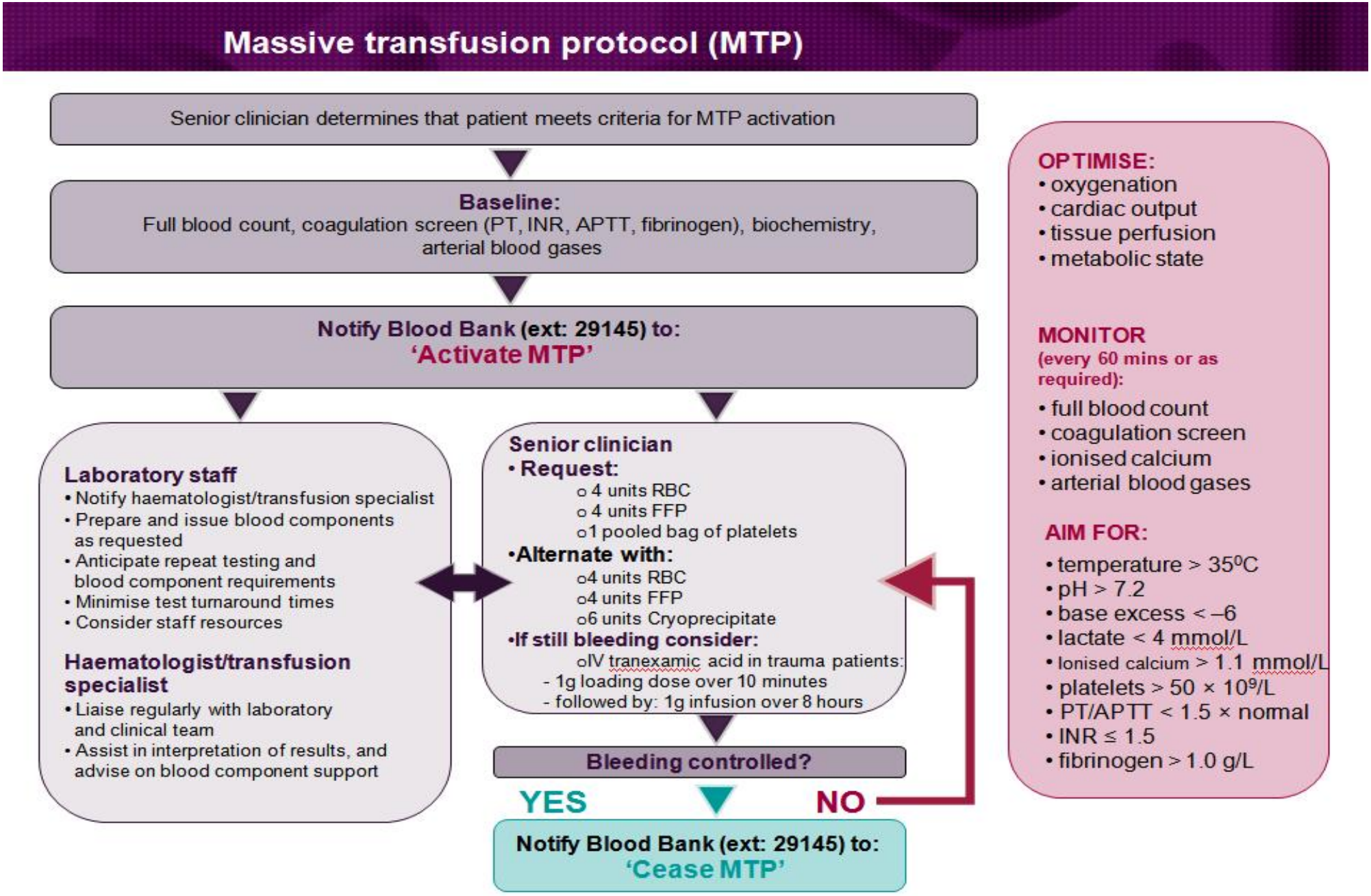
6. DOCUMENTATION

Recombinant VIIa registry for off-label use (POWH contributes to a National and International registry)
Blood Bank log of MTP activation and Randwick Transfusion Committee review

7. REVISION & APPROVAL HISTORY

Date	Revision No.	Author and Approval
2006	Drafts	Dr Susan MacCallum & Randwick Campus Transfusion Committee.
January 2007	0	Written by Dr Susan MacCallum & Randwick Campus Transfusion Committee. Approved by POWH Policy & Procedure Committee.
October 2011	1	Dr Susan MacCallum & Randwick Campus Transfusion Committee.
December 2011	1	Updated. Changes to Sections 5.2.3, 5.2.6 and 5.2.7 Approved by POW/SSEH Policy and Procedure Review Committee for distribution. Approved by POW Drug & Therapeutics Committee.

Appendix 1


Massive transfusion protocol (MTP)
Senior clinician determines that patient meets criteria for MTP activation
Baseline:
Full blood count, coagulation screen (PT, INR, APTT, fibrinogen), biochemistry, arterial blood gases
Notify Blood Bank (ext: 29145) to:
'Activate MTP'
Laboratory staff
• Notify haematologist/transfusion specialist
• Prepare and issue blood components as requested
• Anticipate repeat testing and blood component requirements
• Minimise test turnaround times
• Consider staff resources
Haematologist/transfusion specialist
• Liaise regularly with laboratory and clinical team
• Assist in interpretation of results, and advise on blood component support
Senior clinician
• Request:
o 4 units RBC
o 4 units FFP
o1 pooled bag of platelets
•Alternate with:
o4 units RBC
o4 units FFP
o6 units Cryoprecipitate
•If still bleeding consider:
oIV tranexamic acid in trauma patients:
- 1g loading dose over 10 minutes
- followed by: 1g infusion over 8 hours
Bleeding controlled?
YES
NO
Notify Blood Bank (ext: 29145) to:
'Cease MTP'
OPTIMISE:
• oxygenation
• cardiac output
• tissue perfusion
• metabolic state
MONITOR
(every 60 mins or as required):
• full blood count
• coagulation screen
• ionised calcium
• arterial blood gases
AIM FOR:
• temperature > 35⁰C
• pH > 7.2
• base excess < –6
• lactate < 4 mmol/L
• Ionised calcium > 1.1 mmol/L
• platelets > 50 × 10⁹/L
• PT/APTT < 1.5 × normal
• INR ≤ 1.5
• fibrinogen > 1.0 g/L