## Massive Transfusion Protocol (MTP)

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<th>TRIM Document No</th>
<th>SD16/10485</th>
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<tr>
<td>Policy Reference</td>
<td>SLHD_PC2016_016</td>
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<tr>
<td>Related MOH Policy</td>
<td>Blood - Management of Fresh Blood Components (PD2012_016)</td>
</tr>
<tr>
<td>Keywords</td>
<td>Blood; Transfusion; Massive transfusion; MTP; critical bleeding, RBC; platelets; cryoprecipitate; fresh; frozen; plasma; trauma; patient; Blood; Management; PBM</td>
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<tr>
<td>Applies to</td>
<td>All SLHD workers and all SLHD services and facilities providing care to adult patients</td>
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<tr>
<td>Clinical Stream(s)</td>
<td>Aged Chronic Care, Rehabilitation, General Medicine, General Practice, Endocrinology and Andrology, Cancer Services, Cardiovascular Services, Respiratory &amp; Critical Care Services, Gastroenterology and Liver Services, Laboratory Services, Medical Imaging Services, Mental Health Services, Neurosciences, Bone and Joint, Plastics and Trauma Surgical Services, Women's Health, Neonatology</td>
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<tr>
<td>Tier 2 Sign-off</td>
<td>Katherine Moore, Director Clinical Governance and Risk, 29 September 2016</td>
</tr>
<tr>
<td>Date approved by SLHD Policy Committee</td>
<td>Out of session – 18 November 2016</td>
</tr>
<tr>
<td>Author</td>
<td>Janet Varnam, Haemovigilance CNC, SLHD</td>
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<tr>
<td>Status</td>
<td>Active</td>
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<tr>
<td>Review Date</td>
<td>25 November 2021</td>
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<td>Risk Rating</td>
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Massive Transfusion Protocol (MTP)

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SLHD Massive Transfusion Protocol (MTP)

1. Introduction
The Massive Transfusion Protocol (MTP) applies to patients with:

- Actual or anticipated transfusion of 4 units of Red Blood Cells (RBC) in less than 4 hrs, + haemodynamically unstable, +/- anticipated ongoing bleeding
- Severe thoracic, abdominal, pelvic or multiple long bone trauma
- Major obstetric, gastrointestinal or surgical bleeding

2. The Aims / Expected Outcome of this Policy/Procedure/Guideline

- All patients requiring massive transfusion will be managed in accordance with current evidence based practice and the National Patient Blood Management Guideline
- Wastage of blood products associated with Massive Transfusion will be minimised.

3. Risk Statement
SLHD Enterprise Risk Management System (ERMS) Risk # 158 – Maintain a comprehensive Haemovigilance program:

- Clinical risk to patients related to the management of critical bleeding and massive transfusion
- Corporate risk associated with increased length of hospital stay and exposure to complaints, legal action, and/or blood product wastage

4. Scope
This document addresses the management of adult patients with critical bleeding who require massive transfusion.

It applies to medical officers, nurses, student nurses, midwives, student midwives, allied health, laboratory and support staff across all SLHD sites.

5. Resources
- Managed within existing resources

6. Implementation
- Distribute policy to all General Managers
- Targeted distribution to
  - Trauma services
  - SLHD blood banks
  - Haematology departments
  - Anaesthetic departments
  - Intensive care services
  - Obstetric services

7. Key Performance Indicators and Service Measures
- Number of adverse outcomes or incidents notified on the Incident Information Management System (IIIMS)
- Product wastage associated with MTP activation

Compliance with this Procedure is Mandatory
8. Definitions

<table>
<thead>
<tr>
<th>Term</th>
<th>Definition</th>
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<tbody>
<tr>
<td>Dilutional coagulopathy</td>
<td>A coagulopathy resulting from depletion of clotting factors which develops during massive transfusion</td>
</tr>
<tr>
<td>Thromboelastography</td>
<td>A point of care test which measures the efficiency of blood coagulation through assessing platelet function, clot strength and fibrinolysis.</td>
</tr>
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</table>

There are no universally accepted definitions of critical bleeding or massive transfusion. For the purpose of this procedure, the definitions suggested within the Patient Blood Management Guidelines have been adopted:

<table>
<thead>
<tr>
<th>Term</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>Critical bleeding</td>
<td>Major haemorrhage that is life threatening and likely to result in the need for massive transfusion</td>
</tr>
<tr>
<td>Massive transfusion</td>
<td>In adults, a transfusion of half of one blood volume in 4 hours, or more than one blood volume in 24 hours (adult blood volume is approximately 70mL/kg).</td>
</tr>
</tbody>
</table>

In patients with critical bleeding requiring massive transfusion, the use of Red Blood Cells (RBC) and other blood products may be life-saving. However, transfusion of increased volumes of RBC and other blood components may be independently associated with increased mortality and Acute Respiratory Distress Syndrome (ARDS).

9. Procedures

Coagulopathy develops rapidly during massive transfusion. Major trauma and hypothermia are also risk factors for coagulopathy. In major trauma, coagulopathy begins prior to arrival in hospital. The purpose of this protocol is to:

- Ensure clotting factors are transfused early during massive transfusion to avoid dilutional coagulopathy
- Ensure the treating team receives blood products rapidly without being required to order individual products.

9.1 Criteria for activation of MTP

The MTP should be activated for patients with any of the following:

- Actual or anticipated transfusion of 4 units of Red Blood Cells (RBC) in less than 4 hrs, + haemodynamically unstable, +/- anticipated ongoing bleeding
- Severe thoracic, abdominal, pelvic or multiple long bone trauma
- Major obstetric, gastrointestinal or surgical bleeding

Note: The MTP must be activated for all patients with known RBC antibodies when activation criteria have been met.

9.2 Method of activation

The Massive Transfusion Protocol may be activated by:

- A senior clinician contacting Blood Bank to activate
• A 5th unit of Red Blood Cells being ordered within a 4 hour period. In this case, Blood Bank will contact the medical team to determine whether the protocol should be activated for ongoing bleeding
• Royal Prince Alfred Hospital Trauma Code Crimson – Trauma Service Trauma Code Crimson Protocol RPAH PD2013_019 (RPAH only) results in automatic activation

The MTP will generally NOT be activated for Liver Transplants, Cardiac surgery and some other surgical procedures where transfusion requirements are determined utilising thromboelastography (TEG) point of care testing.

9.3 Patient management

Multidisciplinary approach involving clinical care team, include anaesthetist, surgeons, emergency/trauma staff, haematology team and Blood Bank.

Note: Please see also Appendix 1: MTP Flowchart

Haemorrhage control: early consultant input to control bleeding:
  o Identify cause
  o Initial measures: compression, tourniquet, packing
  o Surgical assessment: early surgery or angiography to stop bleeding
• Tolerate permissive hypotension (BP 80–100 mmHg systolic) until active bleeding controlled. A higher target BP is appropriate in head injury and pregnancy. See also 9.3.3 Special Clinical Situations.
• Avoid excessive crystalloid
• Prevent or correct hypothermia: Active patient warming and fluid warming are essential. Monitor core temperature - either rectal or nasopharyngeal.
• Prevent or correct hypocalcaemia: check Ca++ regularly and replace as required.
• Haematological Tests immediately then every 30 – 60 mins: FBC, Coag Screen, Fibrinogen, Biochemistry.
  o Send specimens at regular intervals but do not delay transfusion of blood products while waiting for results.
  o Inform laboratory that urgent coagulation testing is required with results rung through to the point of care.
• Arterial blood gas analysis including Ca++ immediately then every 30 – 60 mins.
• Consider cell-saver if personnel and equipment available. Note: in Rh (D) negative maternity patients receiving salvaged blood where the cord blood group is Rh (D) positive, a dose of Rh (D) immunoglobulin is required, with additional doses based on the result of assessment of fetomaternal haemorrhage test.
• For patients who had received more than 10 units of red blood cells, treatment for acute respiratory distress syndrome (ARDS) should be considered due to infusing large amount of volume.
• Ongoing patient management should be discussed between clinical team, haematology registrar and Blood Bank, especially in situations where multiple MTP needs to be coordinated or when inventory supply is low.

9.3.1 Resuscitative Aims for Massive Haemorrhage:

Note: Do not use haemoglobin alone as a transfusion trigger. Haemoglobin results should be interpreted in the context of haemodynamic status, organ perfusion and tissue oxygenation.

Aim for:
  1. INR < 1.5; PT less than 16 seconds; aPTT less than 42 seconds.
  2. Fibrinogen greater than 1.0 g/L or greater than 2.0 g/L for obstetric patients
  3. Platelets greater than 50 × 10^9/L
4. pH 7.35 - 7.45
5. Core Temperature greater than 35.5 degrees centigrade
6. Base Excess greater than -3.0

**Poor prognostic values:** SBP < 70 mmHg, Temp < 34°C, Base Excess < -6, pH < 7.1.

9.3.2 **Specific surgical considerations**

If significant ongoing bleeding despite patient management to achieve resuscitative aims for massive haemorrhage, consider damage control surgery or angiography.

9.3.3 **Special Clinical Situations**

<table>
<thead>
<tr>
<th>Warfarin</th>
<th>Add Vitamin K, prothrombinex/FFP</th>
</tr>
</thead>
<tbody>
<tr>
<td>Obstetric haemorrhage</td>
<td>Early DIC is often present; consider cryoprecipitate</td>
</tr>
<tr>
<td></td>
<td>In maternity patients, major blood loss can develop rapidly around the time of giving birth in the absence of haemodynamic compromise; hence, close monitoring of all women, and early recognition and rapid response, are critical.</td>
</tr>
<tr>
<td></td>
<td>Activate MTPs early</td>
</tr>
<tr>
<td>Head injury</td>
<td>Aim for a platelet count of greater than 100 × 10^9/L</td>
</tr>
<tr>
<td></td>
<td>Permissive hypotension contraindicated</td>
</tr>
</tbody>
</table>

9.4 **Blood Product Shipment Details:**

- Blood bank do not thaw frozen products in advance, and will only start thawing at the time of MTP activation. Blood Bank will continue to thaw FFP as per the defined shipments until a notification to cease MTP has been received.
- **First shipment:** 4 units of Red Blood Cells will arrive initially followed by 2 units FFP as part of the first shipment unless indicated otherwise.
  - Every shipment contains 4 units Red Cells and 4 units FFP with either 1 bag of pooled platelets or 10 units of standard (whole blood) cryoprecipitate (TCH) or 5 units of double pack (apheresis) cryoprecipitate (RPAH and CRGH), alternating between the pooled platelets and the cryoprecipitate each shipment.
- **Second shipment and alternate shipments thereafter:** 4 units Red Cells and 4 units FFP plus 1 Pooled Platelets (Note: 1 pooled platelets = 4 of the old units)
- **Third shipment and alternate shipments thereafter:** 4 units Red Cells and 4 units FFP plus 10 units standard (whole blood) Cryoprecipitate (Note: 10 units of standard (whole blood) cryoprecipitate = 4-5g dose fibrinogen) or 5 units of double pack (apheresis) cryoprecipitate (5 units of double pack (apheresis) cryoprecipitate contains 4-5g of fibrinogen.)

Shipments will continue as per sequence therefore Blood Bank **must** be informed when MTP has stopped.

**Important:** Although the first shipment will routinely contain only 2 units of FFP, clinicians are able to contact blood bank to request that the additional two units are thawed at the time of protocol activation.

**Note:** If uncrossmatched group O Rh (D) Negative RBCs are transfused prior to crossmatching, Blood Bank will also supply non group-specific fresh frozen plasma (Group-A).

Additional products may be ordered based on results of testing or clinical impression.
Suggested targets are:

- Further platelets if platelet count ≤ 50 \times 10^9/L (≤100 \times 10^9/L in head injury)
- Further FFP if INR > 1.5
- Further cryoprecipitate if fibrinogen ≤ 1.0 g/L or ≤ 2.0 g/L for maternity patients

9.4.1 **Blood Product Dosage:**

- Platelet count < 50 \times 10^9/L: give 1 pooled platelets
- INR > 1.5: give FFP 15ml/kg
- Fibrinogen < 1.0g/L or < 2.0 g/L for maternity patients: give standard (whole blood) cryoprecipitate 8-10 units/ 4-5 units of double pack (apheresis) cryoprecipitate.

9.5 Adjunct Medications

9.5.1 **Tranexamic Acid**

**Indications**

- Trauma patients requiring blood transfusion provided dose can be administered within 3 hours of the injury.
- Any other massive transfusion at discretion of treating team.
- Consider tranexamic acid for maternity patients within 3 hours of the onset of haemorrhage

**Dosage**

- 1 g infused over 10 minutes followed by 1 g over 8 hours.

9.5.2 **FACTOR VIII**

- Consider use in consultation with haematologist after attempting to correct fibrinogen, pH, temperature and platelet count

9.6 Protocol Discontinuation

Blood bank **must** be instructed to discontinue the MTP as soon as massive transfusion is no longer required to minimise product wastage. Notify Blood Bank when:

- Bleeding is controlled and massive transfusion is no longer required,
- Further resuscitation is deemed futile and transfusion ceased
- If the patient is being transferred to another facility.

10. **Guidelines**

    *The SLHD Patient Blood Management & Transfusion Committee has determined that the following Guideline should be adopted for use and application within SLHD services and facilities. SLHD is not responsible for updating the content of this Guideline.*

    - National Patient Blood Management Guideline

    *SLHD bears no responsibility for the accuracy, legality or content of the external site or for that of subsequent links. Contact the external site for answers to questions regarding its content.*

11. **Endorsements**

SLHD Patient Blood Management & Transfusion Committee, 28th April 2016

Compliance with this Procedure is Mandatory
12. Consultation

- General Managers of SLHD facilities
- Trauma services
- SLHD blood banks
- Haematology departments
- Anaesthetic departments
- Intensive care services
- Obstetric services

13. Links and tools


14. References


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, CRASH-2 Collaborators, Lancet 2010


Appendix 1 – Flowchart Massive Transfusion Procedure

**Medical Team attending bleeding patient**

**ACTIVATION**
Any one of:
- Trauma with life-threatening haemorrhage.
- Major obstetric, gastrointestinal or surgical bleeding.
- Actual or expected ongoing fluid resuscitation after 4 units RBC in ≤ 4 hours.

**NOTIFY BLOOD BANK**
“Activate MTP”

**TESTING**
- FBC, Coag Screen including Fibrinogen, Biochemistry
- Arterial Blood Gasses, including ionised Ca++
  Immediately, then
  Every 30 – 60 minutes

**BLOOD PRODUCTS**
- RBCs will be issued in sets of 4 units with clotting factors and/or platelets according to blood bank protocol.
- Additional platelets and factors may be ordered based on test results or clinical impression.

**ADJUNCT MEDICATIONS**
- Tranexamic Acid indicated in:
  - Trauma patients requiring blood transfusion within 3 hours of injury
  - Any other massive transfusion at discretion of treating team.
  - Consider for maternity patients within 3 hours of the onset of haemorrhage
  - Dose: 1g over 10 mins then 1g over 8 hours.
- rFVIIa
  - Not routinely indicated
  - Consider use in consultation with haematologist after attempting to correct fibrinogen, pH, temperature and platelet count.

**General Management**
- Aim for:
  - Temperature > 35°C
  - pH > 7.2
  - Ionised Ca++ > 1.1 mmol/L
  - Platelets > 50 x 10⁹/L
  - Fibrinogen > 1.0 g/L or > 2.0 g/L in maternity patients
  - INR ≤ 1.5
- Management of bleeding:
  - Identify cause
  - Compression, tourniquet, packing
  - Early intervention:
    - Surgery
    - Angiographic embolization
  - Consider damage-control surgery
  - Consider cell-salvage

**Cessation of Massive Transfusion**
- Notify blood bank immediately once massive transfusion no longer required.

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**Haematologist**

**Communicate with Clinical Team**
- Information required:
  - Age
  - Weight
  - Estimated blood loss
  - Injuries
  - Abnormal bleeding
  - Hypothermia
  - Initial trauma blood results
    (Haematologist chases results if not yet available)
- Advise on administration of additional factors and/or platelets. Indication for rFVIIa as necessary. To request for patient status when inventory is low

**Communicate with Laboratory**
- Liaises regularly with Blood Bank to ensure adequate and timely availability of blood products e.g.: pre-emptive thawing of FFP/Cryo.
- Liaises with laboratory to obtain blood test results and assists in interpretation of results to advise on blood component support.

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**Appendix 1 – Flowchart Massive Transfusion Procedure**

**Medcical Team attending bleeding patient**

- Activates MTP

**NOTIFY BLOOD BANK**

**TESTING**
- FBC, Coag Screen including Fibrinogen, Biochemistry
- Arterial Blood Gasses, including ionised Ca++
  Immediately, then
  Every 30 – 60 minutes

**BLOOD PRODUCTS**
- RBCs will be issued in sets of 4 units with clotting factors and/or platelets according to blood bank protocol.
- Additional platelets and factors may be ordered based on test results or clinical impression.

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  - Trauma patients requiring blood transfusion within 3 hours of injury
  - Any other massive transfusion at discretion of treating team.
  - Consider for maternity patients within 3 hours of the onset of haemorrhage
  - Dose: 1g over 10 mins then 1g over 8 hours.
- rFVIIa
  - Not routinely indicated
  - Consider use in consultation with haematologist after attempting to correct fibrinogen, pH, temperature and platelet count.

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- Aim for:
  - Temperature > 35°C
  - pH > 7.2
  - Ionised Ca++ > 1.1 mmol/L
  - Platelets > 50 x 10⁹/L
  - Fibrinogen > 1.0 g/L or > 2.0 g/L in maternity patients
  - INR ≤ 1.5
- Management of bleeding:
  - Identify cause
  - Compression, tourniquet, packing
  - Early intervention:
    - Surgery
    - Angiographic embolization
  - Consider damage-control surgery
  - Consider cell-salvage

**Cessation of Massive Transfusion**
- Notify blood bank immediately once massive transfusion no longer required.
Massive Transfusion Protocol Unit Tally
For Haematologist or Haematology Registrar

Patient Name: 
MRN: Blood Group:
Cord blood group (if relevant):
Name of Medical Officer requesting MTP:
Date & Time Started: __/__/____ am/pm

<table>
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<tr>
<th>Red Cells</th>
<th>FFP</th>
<th>Platelets</th>
<th>Cryo (S/A)*</th>
<th>Coags</th>
<th>Advice given</th>
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<tbody>
<tr>
<td>N°</td>
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Other products

<table>
<thead>
<tr>
<th>Prothrombinex</th>
<th>Recombinant FVIIa</th>
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<tr>
<td>Time</td>
<td>Time</td>
</tr>
<tr>
<td>Time</td>
<td>Time</td>
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* S: Standard (whole blood) cryo; A: Double pack (apheresis) cryo