# Massive Transfusion Protocol in Trauma - St George Hospital (SGH)

| Cross references | SGSHHHS CLIN016 Warfarin Reversal  
|                  | SGSHHHS CLIN148 Blood and Blood Component Administration Guidelines  
|                  | SGSHHHS CLIN147 Blood Components – Storage of Outside of Blood Bank  
|                  | SGSHHHS CLIN217 Massive Transfusion Protocol at SGH (excluding trauma)  

## Trauma Clinical Business Rules SGH
*Protocol for Early Notification of Trauma Surgeon, Anaesthetist, Operating Theatre*

## Haematology Clinical Business Rules SGH
*Recombinant Factor VIIa for Life Threatening Bleeding*

## External Sources
- Australia and New Zealand Blood Transfusion Society (ANZBTS) Guidelines  
- ANZBTS (2007) *Guidelines for pre-transfusion testing*. 5th ed. page 13, 2.5 Critical bleeding/Massive Transfusion; Sydney  
- American Association of Blood Banks 2nd Ed: *Transfusion in Trauma and Massive Transfusion*  
- Australian National Health and Medical Research Council (2001) Clinical Practice Guidelines  
  *Use of Blood Components* Section 3.6 Acutely Haemorrhaging Patients.

## 1. What it is
A guideline that specifies the scope and limitations for the administration of massive blood transfusion in the context of a bleeding trauma patient

## 2. Employees it applies to
Clinicians, Nurses, Scientists and Laboratory Staff caring for bleeding trauma patients

## 3. When to use it
The protocol MUST be activated upon arrival of patients with certain injury patterns or considered for activation once it is noted that a patient has received or is going to receive more than 4 units of packed red blood cells in a 24 hr period

## 4. Why the rule is necessary
Early and appropriate blood product replacement is associated with less blood product usage and better patient outcomes

## 5. Who is responsible
Director of Trauma and Director of Emergency, St George Hospital (SGH)
Massive Transfusion Protocol In Trauma Clinical Pathway

1. Patients with these injuries are likely to benefit from early 1:1:1 replacement of factors with immediate activation of MTP.
2. Identify patients that arrive with iatrogenic or therapeutic coagulopathy and confirmed or suspicion of significant bleeding.
3. Consider rapid reversal of coagulopathy by utilizing ‘prothrombinex’ and/or thawed Group AB FFP before Xmatch FFP available.
4. A subgroup of severely injured patients have been shown to have better outcome if Tranexamic acid is used. Refer to Consultant Medical Staff.
5. Patients insidiously receiving blood products, are often dilutionally, consumptively and hypothermically coagulopathic and benefit from MTP if appropriately selected.
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1. Criteria for Identifying Patients for the MTP

1.1 Patients who have replaced or are likely to replace their entire blood volume (10 or more units of packed red cells in a 70kg adult) in under 24hrs.
1.2 Patients with severe thoracic, abdominal or pelvic injury.
1.3 Patients who have received a combined total > 2000mls resuscitation fluid (crystalloid/colloid/PRBCs) or 4 units of blood and have ongoing fluid resuscitation needs.

2. Damage Control during Resuscitation

2.1 Early senior medical input is required to arrest haemorrhage for patients suffering blunt torso trauma and evolving haemorrhagic shock or any penetrating neck or torso trauma (refer to per ‘Early Notification Protocol’). This is to enable early operative intervention or radiological embolization if deemed necessary. Early notifications are as follows:
   - Anaesthetics
   - Trauma Surgeon
   - Interventional Radiologist
   - Blood Bank
2.2 Minimize macrovascular bleeding - Direct pressure control of external bleeding points, haemostatic sutures over bleeding lacerations, fracture reduction to anatomical position (including temporary pelvic fracture stabilization).
2.3 Minimize microvascular bleeding and coagulopathy - appropriate initial fluid volume resuscitation targeting BP > 80mmHg or > 90mmHg (if associated head injury) whilst determining site/s of bleeding, active fluid (‘Ranger’) and patient (‘Bair Hugger’) warming, and avoidance of hypothermia and acidosis.
   Blood products to be transfused should be warmed using a blood warmer.

3. Activation of the MTP

3.1 The MTP Coordinator (Trauma Team Leader, Surgeon, Anaesthetist or Intensivist) notifies Blood Bank directly (ext 33433 and ext 33434) or page 464 after hours once patient is identified to be at risk.
3.2 Blood component therapy is then administered according to the MTP.
3.3 Haematological and coagulation monitoring is performed (FBC, PT, APTT, fibrinogen) according to MTP protocol (see section 8), to guide ongoing component therapy.
3.4 Component therapy administration may be altered by the MTP Coordinator in the event of prehospital product administration, abnormal initial haematological and coagulation values or clinical conditions suggesting coagulopathic risk (e.g. liver failure etc).
3.5 The decision to cease the MTP is made by the MTP Coordinator and must be communicated directly to Blood Bank.
4. Principles of Coagulopathy during Massive Transfusion

4.1 It is prudent to be aggressive with FFP early rather than to wait for an abnormal result as a trigger to replace coagulation factors. Recent evidence suggests that severely injured trauma patients suffer acute traumatic coagulopathy before arrival, and this may be aggravated by large volume crystalloid infusion. Coagulation factors are often at inadequate levels in patients suffering non-compressible or microvascular bleeds, despite normal APTT and PTT. These measurements are also underestimated in the presence of coexistent hypothermia. Once the APTT, PTT are abnormal, coagulation factor levels may be only 30 – 40% of normal levels.

4.2 Hypofibrinogenaemia may occur at an early stage, especially if normovolaemia has been maintained by massive red cell transfusion prior to initiation of the MTP. Further, low-grade Disseminated Intravascular Coagulopathy (DIC) may occur in many massive transfusion settings. The endpoint of the coagulation cascade is the conversion of fibrinogen to fibrin. Even with adequate factor replacement, haemostasis will be impaired unless sufficient fibrinogen is present. Cryoprecipitate is given to raise fibrinogen levels. FFP also contains some fibrinogen.

4.3 Significant thrombocytopenia is usually a late occurrence. Platelets fall to <50x109/L from normal levels after approximately two exchanges of blood volume, unless there is significant DIC or other causes of platelet consumption. Despite adequate levels, platelet function is affected by hypothermia and acidosis. Damage control resuscitation to minimize hypothermia and acidosis is therefore critical to platelet function and overall haemorrhage control.

5. MTP Coordinator Responsibilities

5.1 Ensure patient fulfils criteria for activation of MTP.
5.2 Ensure adherence to ‘damage control’ guidelines (see Section 2).
5.3 Activate MTP by direct communication with blood bank technologist (ext 33433 and ext 33434 or page 464 after hours).
5.4 Enlist consultation/advice of on call Blood Bank Haematologist, if required.
5.5 Ensure haematological (FBC), coagulation (PT, APTT, fibrinogen, D-dimer) and biochemical monitoring of replacement therapy approximately every 60 minutes during resuscitation (according to section 8). Assume responsibility for the order, rate and recording of component therapy replacement, guided by clinical impression and resuscitative end points (see Section 9).
5.6 Expedite the transport of patient blood samples to the laboratory in order to shorten the turnaround time for results.
5.7 Consider the use of Recombinant Factor VIIa (rFVIIa) in the event of life threatening bleeding and failed conventional support, in the absence of surgical causes of bleeding. Usage should be in accordance with the St George Hospital Guidelines for the use of rFVIIa, particularly with regard to the correction of hypothermia, acidosis, thrombocytopenia, and coagulation parameters prior to the use of rFVIIa. The correction of hypofibrinogenaemia using cryoprecipitate is often overlooked.
5.8 Consider use of Tranexamic acid (see section 8).
5.9 Consider Group AB FFP and/or Prothrombinex early in patients with known Warfarin use, ‘Point of Care’ (POC) INR > 2 or those who have received 4 or more packed red blood cells pre-hospital.
5.10 Cease the MTP by direct communication with on duty blood bank technician.
6. Blood Bank/Haematology Responsibilities

6.1 If a patient has replaced his or her entire blood volume (approximately 10 units of red cells in a 70kg adult) in less than 24hr, ask the Medical Officer (MO) whether they wish to activate the MTP.

6.2 If MTP is activated:
   a) Note the MO name and contact details,
   b) Suggest involvement of on call Blood Bank Haematologist
   c) Dispense blood components as per one MTP pack.
   d) Inform Haematology laboratory (cell analyser and haemostasis sections) of patient’s details and MO contact details

6.3 If MTP not initially activated but more red cells (>4 units) are requested within 24hrs, ask the MO if they wish to activate the MTP or to consult the Blood Bank Haematologist.

6.4 The Haematology laboratory shall prioritise and expedite testing and phoning of laboratory results for all samples from patients in the MTP.

7. MTP Pack

7.1. The MTP Pack comprises:
   - 4 units packed red cells
   - 4 units FFP
   - 1 adult pooled pack of platelets
   - 5 packs of cryoprecipitate

After the MTP pack has been issued, additional blood products should be ordered based on the results of the latest FBC and coagulation screening tests. If no results are available, the Coordinator may request a second MTP pack.

7.2. Suggest additional
   - Platelets – if platelets < 50x10^9/l (or < 100x10^9/l with head injury)
   - Cryoprecipitate – if fibrinogen < 1.0g/l
   - FFP – if INR, APTT prolonged (>1.5X normal)
   - Red cells – if Hb < 80g/l
   - CaCl2 – if ionized Ca++ < 1.1mmol/l

8. Tranexamic Acid Use

If a trauma victim is within 3 hours of injury AND is anticipated to need significant blood transfusion as evidenced by:

1) haemorrhagic shock
2) signs of ongoing bleeding (systolic BP <90 mmHg and/or HR >110)
3) penetrating torso trauma or
4) one or more major amputations

TXA should be administered thus:

   - 1 gram of TXA in 100 mL of Normal Saline solution (if has not been given prior to SGH arrival)
   - Begin second infusion of 1 gram of TXA in 500 mL of Normal Saline over 8 hours after other fluid resuscitation.

Questions

1. When should the MTP be activated?
   A: When a patient has severe chest and/or abdominal and/or pelvic injury. Also if a patient requires more than 4 units of packed red blood cells over 24 hours
2. What is the role of ‘Prothrombinex’ and Group AB FFP?
   A: These should be considered in time critical bleeding trauma patients with suspected or known coagulopathy, without needing to know the patient’s blood group or having a crossmatch.

3. When should Tranexamic Acid (TXA) be used?
   A: This should be considered in patients with life threatening bleeding, presenting within 3 hours of injury

**Keywords**: Massive, transfusion, blood

I, Martin Mackertich, Director of Clinical Services of St George Hospital attest that this business rule is not in contravention of any legislation, industrial award or policy directive.

**Revision and approval history**

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