Massive Transfusion Protocol (MTP)

POLICY STATEMENT

This protocol aims to standardize the transfusion of large volumes of blood products in patients sustaining significant hemorrhage.

REASON FOR POLICY

The purpose of the Massive Transfusion Protocol is to attempt to find a “middle-of-the-road” protocol that would be applicable to both trauma and non-trauma patients throughout the Georgia Regents Health System.

ENTITIES AFFECTED BY THIS POLICY

Georgia Regents Health System

WHO SHOULD READ THIS POLICY

All licensed nursing personnel, physicians, physician assistants, nurse practitioners, pathology staff, and any individual utilizing or ordering blood products.

DEFINITIONS

MTP: Massive Transfusion Protocol
MRN: Medical Record Number
RBC: Red Blood Cells
FFP: Fresh Frozen Plasma
PLT: Platelets

I. Framework of the Massive Transfusion Protocol

A. Early recognition of patients at risk for massive bleeding, and subsequent triggering of the MTP;
B. Immediate administration of a “foundation ratio” of blood products – the rationale behind this foundation ratio will be detailed below – with rapid transport of the indicated blood components from the blood bank to the bedside;

C. Goal-directed adjustments to the foundation ratio based on both clinical course and the results of laboratory tests, both traditional tests (haemoglobin/haematocrit, platelet count, prothrombin time/International Normalized Ratio, partial thromboplastin time, fibrinogen level) and less commonly utilized tests (thrombo-elastography).

II. Protocol

A. Responsible physician (attending physician or designee, typically senior resident) identifies that a patient is at risk for massive hemorrhage

B. Early administration of tranexamic acid in all trauma patients per existing protocol (consider administration of tranexamic acid in other patient populations)

C. Clinical personnel call the blood bank (extension 1-2731) with patient/trauma name, MRN, gender, and location, and name/pager of responsible physician (senior resident, primary attending)

D. Collect a properly labeled Fenwal Typenex armband for Type, Antibody Screen and Crossmatch, as well as a CBC, PT/INR, PTT, and fibrinogen

E. Send pre-transfusion sample (crossmatch) to blood bank by an individual designated to transport the sample to blood bank and to transport components to the patient’s bedside (e.g. medical student, clerical staff). At the blood bank, this individual should leave a contact number with the blood bank personnel.

F. Designated transport individual will complete the Blood Release Form MC 445/80-0760 with the patient/trauma name, MRN, location and indicate 4 uncrossmatched RBC’s. The blood bank will also be given paper order/request for further blood components.

G. Blood bank personnel will release 4 uncrossmatched type O RBC’s (Rh negative if patient is female) prior to receipt of pre-transfusion sample.
H. Designated transport individual takes blood components to patient’s bedside where transfusion is initiated via wide-bore tubing with fluid warming apparatus – no further non-protocol blood components should be ordered at this stage; transport personnel remain available to return to blood bank with paper orders.

I. After the 4 uncrossmatched RBC’s are released from the Blood Bank, 2 units fresh frozen plasma will be prepared; when ready, the designated transport individual will be contacted to pick-up the components and transport them to the patient’s bedside.

J. On completion of administration of the initial components, CBC, PT/INR, PTT, fibrinogen, chemistries including Ca2+, and TEG samples are sent – the results of these samples are used to guide further transfusion with platelets and cryoprecipitate, as well as to evaluate for hyperkalaemia and hypocalcaemia.

K. Once the of Type and Antibody Screen is completed, the Blood Bank will contact the responsible physician:
   1. if the patient’s clinical condition has stabilized, the massive transfusion is curtailed;
   2. otherwise, the blood bank will prepare 4 units type-specific (or cross-matched if available) RBC’s and 2 units FFP. If platelet and/or cryoprecipitate are needed, the responsible physician should inform the Blood Bank as to what is needed and how much.

L. The Blood Bank will call the designated transport individual informing them that the components are ready. The individual will transport the components to the bedside; again, further requests/administration of blood products is not possible until this second set of components have been transfused.

M. The cycle of preparation-administration continues, at a ratio of 4 units of RBC to 2 units FFP (4:2) plus additional blood products as indicated, until curtailed by the responsible physician.

Note: From the perspective of the blood bank, the goal is to be continually preparing RBC and FFP for administration without waiting for specific requests until the massive transfusion is curtailed by the responsible physician. Ideally, the next set of components should be ready for transfusion as the previous set is completing transfusion.
III. **Rationale:**

N. Use of tranexamic acid
   1. The CRASH-2 trial (and subsequent studies) demonstrated that early (within 8 hours of injury) administration of TXA to trauma patients with, or at risk of, significant bleeding resulted in a minor but significant decrease in all-cause mortality as well as a decrease in the risk of death due to bleeding. Although the effect was minor, the low cost of this drug and its low side-effect profile make TXA a potentially valuable adjunct.

O. Formula-driven transfusion and the optimal FFP:RBC ratio
   1. Blood component therapy was introduced in the 1970s to decrease the risk of infectious disease transmission associated with whole blood as well as to maximize the utility of each donated unit of blood. Blood component transfusions have traditionally been based on the results of laboratory studies, but this reactive strategy may not be appropriate when confronted with a rapidly exsanguinating patient. Transfusion pathways providing blood products preemptively, in a ratio of 1 unit RBC:1 unit of plasma:1 unit platelets were adopted in the military setting, but in the civilian setting the optimum ratio is unknown – several studies suggest that the optimal ratio is somewhere between 1.5-2.5 units RBC:1 unit FFP. The ratio of RBC:FFP in the proposed MTP, 2:1, is clinically acceptable and minimizes patient exposure to the deleterious effects of excessive plasma.

P. Platelets
   1. Only a minority of trauma patients will present with a platelet count of less than 100,000/µL, and clinically significant thrombocytopenia is unlikely to develop until one complete blood volume has been replaced. There is no specific evidence that pre-emptive platelet transfusion is useful. In addition, there is no evidence that platelet administration improves outcomes in patients who have taken antiplatelet agents. Given this lack of evidence, the proposed MTP does not include platelets in its foundation ratio, and limits platelet transfusion to those patients with laboratory evidence of thrombocytopenia.
Q. Fibrinogen
1. Fibrinogen levels may decrease significantly in consumption coagulopathy, disseminated intravascular coagulation, and hyperfibrinolysis – these conditions may be present in the massively bleeding patient. FFP contains physiologic levels of fibrinogen, while cryoprecipitate has a higher concentration. There is no evidence to support the use of one source of fibrinogen rather than the other, hence the proposed MTP does not include the preemptive or unguided administration of cryoprecipitate.

R. Laboratory tests
1. The traditional markers of coagulation – PT/INR and PTT – are limited in that they test only the initiation of coagulation, and represent only the first 4% of thrombin production. Thromboelastography (TEG) is a relatively rapid test – available at GRU Medical Center – that evaluates the entire coagulation system. Use of TEG is proposed in this MTP to potentially limit the administration of fibrinogen, cryoprecipitate, plasma, and platelets to those patients who have documented, demonstrable defects in their coagulation ability – i.e. a patient with a mildly elevated PT/INR but a normal TEG should not receive plasma.
2. Furthermore, use of TEG allows early recognition of hyperfibrinolysis. Further, the inclusion of specific laboratory tests at a specific point in the MTP should aid in curtailing the arbitrary ordering of sometimes inappropriate laboratory tests.

S. Release of components, use of designated transport individual, acceptance of paper orders
1. Retrospective analysis of a number of trials examining the utility of massive transfusion policies suggests that the time to administration of the first unit of blood is an important prognostic factor, with shorter times tending to result in improved survival. The aggressive, early use of a predesignated complement of blood components has also been to shown to decrease overall blood product usage in multiple studies. The GRU Medical Center blood bank already has a system in place to release uncross-matched units of RBC – the proposed MTP emphasizes and simplifies the early use of both RBC and FFP, as well as limits the ability of clinicians to order inappropriate ratios or amounts of blood components.
2. The presence of paper order requests is for clinician convenience – it allows the ordering of blood components without having to leave the patient’s bedside and log on to a computer.
IV. Notes

A. Release of the initial uncrossmatched RBC’s is not dependent on receipt of the pre-transfusion sample, and no computer order is required.

B. Clinicians should be aware that no further RBC/FFP will be released until the entire first set of components has been administered – i.e. the initial transfusion is always 4 units PRBC and 2 units FFP. Clinicians should therefore refrain from contacting the Blood Bank to request non-protocol (i.e. “blind”) components.

C. Only the responsible physician can order further “blind” RBC or FFP, and only if the patient remains haemodynamically unstable; the paper request can be honoured by the blood bank if time constraints prevent the use of the computer ordering system. Given that the goals of the Massive Transfusion Protocol include reduction of blood product wastage and standardization of transfusion practices, “blind” transfusion should be discouraged unless a specific clinical indication exists e.g. warfarin overdose requiring significant FFP administration.

D. Requests for additional FFP outside of the 2:1 ratio can only be made by the responsible physician, and only on the basis of definitive laboratory results, until the massive transfusion has been terminated; at that stage, the patient reverts to the standard transfusion ordering system.

E. Given the low likelihood of initiating the Massive Transfusion Protocol on a day-to-day basis, it is accepted that FFP will not be immediately available. FFP should be available within 20 minutes of initiation of the Massive Transfusion Protocol.

F. Laboratory tests should only be ordered when all of the components received have been administered, as opposed to during component transfusion.

G. Clinicians should understand that blood bank staffing is limited at times, and this may have an impact on the turnaround time for blood components.

H. Activation of the Massive Transfusion Protocol will trigger a review of the clinical situation by members of the Blood Transfusion Committee within 24-48 hours; the purpose of the review is to:
   1. Encourage and confirm appropriate activation
   2. Obtain clinician feedback to identify points or policies in the implementation which may require improvement
RELATED DOCUMENTS, FORMS, AND TOOLS

Afshari A et al. Thromboelastography (TEG) or thromboelastometry (ROTEM) to monitor haemotherapy versus usual care in patients with massive transfusion. *Cochrane Database Systemic Reviews* 2011; 3


Bhangu A Nepogodiev D, Doughty H, and Bowley DM. Meta-analysis of plasma to red blood cell ratios and mortality in massive blood transfusions for trauma. *Injury* 2012


Callum JL and Rizoli S. Plasma transfusion for patients with severe haemorrhage: what is the evidence? *Transfusion* 2012; 52:305-37S

CRASH-2 Trial collaborators. Effects of tranexamic acid on death, vascular occlusive events, and blood transfusion in trauma patients with significant haemorrhage: a randomized, placebo-controlled trial. *Lancet* 2010; 376:23-32


Enticott JC et al. A review on decision support for massive transfusion: understanding human factors to support the implementation of complex interventions in trauma. *Transfusion* 2012; 52:2692-2705


Kauver DS Lefering R Wade CE. Impact of haemorrhage on trauma outcome: An overview of epidemiology, clinical presentations, and therapeutic considerations. *Journal of Trauma* 2006; 60(6 supplement):S3-11


Sarani B et al. Transfusion of fresh frozen plasma in critically ill surgical patients is associated with an increased risk of infection. *Critical Care Medicine* 2008; 36: 1114-8


**AUTHORIZING SIGNATURE**

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