

GUIDANCE DOCUMENT FOR MASSIVE HEMORRHAGE MANAGEMENT IN ADULTS





## 1.0 Definitions & Acronyms

- **1.1 Massive Hemorrhage Event (MHE)**: Transfusion of a volume of blood components equivalent to a patient's estimated total blood volume within a 24 hour period. This approximates 10 units or more packed red blood cells in adults. Other definitions include 50% loss of total blood volume within 3 hours; blood loss at a rate greater than 150 mL/minute; or blood loss requiring four units of RBCs in a four hour time period.
- **1.2** Massive Hemorrhage Protocol (MHP): A protocol developed to ensure rapid recognition, response, and intervention to care for those patients experiencing a massive hemorrhage event. A Massive Hemorrhage Protocol is activated when the health care provider anticipates the hemorrhage event will require massive transfusion support.

## 2.0 General Information

Hemorrhage accounts for approximately 50% of deaths within 24 hours of a traumatic injury and up to 80% of intraoperative trauma-related deaths. The majority of significant hemorrhage cases are trauma, surgical, and obstetrical.

Class	Blood Loss (% Total Blood volume)	Heart Rate	Blood Pressure	Tissue Perfusion	Other Clinical Signs	Fluid Therapy
I	<15	Normal or Increased	Normal	Normal	None	None
II	15-30	Increased	Normal or decreased	Decreased	Anxiety	Crystalloid/Colloid Blood
III	30-40	Increased	Decreased	Decreased	Oliguria Confusion	Crystalloid/Colloid Blood
IV	>40	Increased	Decreased	Decreased	Lethargy Coma	Crystalloid/Colloid Blood

Hemorrhage is classified into four groups:

Transfusion Therapy: Clinical Principles and Practice, 2<sup>rd</sup> Edition, Mintz





Hemostasis is the primary goal during a massive hemorrhage event; minimize blood loss, and minimize the need for transfusion of blood components and blood products. Any attempts to elevate blood pressure prior to obtaining some degree of hemostasis may increase the rate of bleeding.

The "lethal" triad for patients experiencing traumatic hemorrhage is a result of the effects of coagulopathy, hypothermia, and acidosis. The correction of coagulopathy has received more attention as it further complicates massive transfusion. Coagulopathy occurs shortly after injury; even before the patient is admitted and resuscitation and treatment begins.

Reports indicate that trauma induced coagulopathy occurs in approximately 25% of patients independent of acidosis and hypothermia. The increased severity of the injury or the higher the injury-severity score, the higher the incidence of coagulopathy. Patient groups with a pre-disposition to coagulopathy should be recognized as early as possible. Examples include patients with chronic renal failure, hereditary bleeding disorders, or patients on antiplatelet or anticoagulant medications.

Hypothermia increases the risk of multiple organ failure and coagulopathy. Hypothermia may be prevented by using patient warming devices, blood warmers and by pre-warming resuscitation fluids.

Acidosis may occur due to poor oxygen delivery and may be worsened by hypothermia.

Calcium replacement is very important to maintain hemostasis. Citrate toxicity must be monitored regularly by testing ionized calcium levels. Citrate is metabolized to bicarbonate which can lead to metabolic alkalosis. Citrate in blood products binds calcium and magnesium; over time the body's ability to metabolize citrate can be affected.

## Summary of treatment priorities:

- Maintain tissue perfusion and oxygenation by restoring circulating volume.
- Achieve hemostasis by correction of coagulopathy via surgical or other interventions including use of blood component therapy.
- Prevent hypothermia, hypovolemic shock and multiple organ failure.
- Mitigate citrate toxicity and metabolic alkalosis.





Communication and organization are key components to improve the success of a massive hemorrhage event. When a Massive Hemorrhage Protocol is executed effectively, the result is early RBC transfusion and decreased time to initial transfusion of plasma and platelets.

Initial replacement is based on a 1:1:1 ratio of RBC: FP: Platelets. After one blood volume has been replaced, RBC: FP should be transfused on a 1:1 ratio.

There has been much discussion regarding transfusion ratios as it relates to morbidity and mortality. This guidance document and the associated guidelines will be subject to review on an ongoing basis as new evidence may support changing ratios.

When Massive Hemorrhage Protocols are in place, many retrospective studies have actually shown an overall decrease in the use of blood components. Contributing factors include: ensuring appropriate component ratios, adequate blood availability, and rapid delivery to the recipient through standardization of care and clear communication.

Some recent treatment protocols utilize transfusion packages; 6 RBCs, 1500 mL FP and if necessary 1 adult dose of platelets, administered when a massive hemorrhage event is identified. This option may work well in large centres, but could lead to inventory problems and product wastage in smaller facilities.

More recently, most countries have been supporting patient blood management programs which focus on improving client outcomes and minimizing unnecessary exposure to blood components. The three goals are: optimize blood volume and red cell mass, minimize blood loss, and optimize the patient's tolerance to anemia.

Another concept which has been proposed since the mid 2000s is 'damage control' resuscitation which involves rapid surgical control of bleeding; early and increased use of the 1:1:1 ratio for transfusion of blood components; limited crystalloid use; prevention and treatment of hypothermia, hypocalcaemia, and acidosis; and strategies to treat hypotension.

Point of care hematology and coagulation testing may also be beneficial, if available, as individualized treatment is based on laboratory results. It is important to identify when hemostasis has been achieved and to re-evaluate the plan of care to minimize the risks associated with giving further transfusions of blood components; the risks may outweigh the benefits of further transfusions. Unnecessary exposure to blood components may increase adverse transfusion events as well as acute respiratory distress syndrome, sepsis, and multiple organ dysfunction.





The Canadian National Advisory Committee on Blood and Blood Products (NAC) supports a 'three strategy approach' to transfusion support in trauma patients at risk for massive hemorrhage. The strategy includes:

- 1. Early administration of tranexamic acid, preferably within the first 3 hours after injury.
- 2. Immediate administration of a 'foundation ratio' of blood components if critical bleeding is present. A foundation ratio is a pre-set standardized ratio as outlined in facility policy.
- 3. Assessment and further transfusions as supported by the patient's clinical status and laboratory tests results.

Alternative treatments such as heparin reversal, warfarin reversal, anti-fibrinolytics and DDAVP should be considered where appropriate.

\*Note: Despite instituting Massive Hemorrhage Protocols, it is very important to use the specialized assessment skills of the team and to view each patient as unique. Massive Hemorrhage Protocols should be used as a tool to provide guidelines for treatment and should not be a replacement for thorough patient assessment. Alternate therapies may be required during the resuscitation process.





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