

Massive Transfusion Protocol

Pearls

- The development and implementation of massive transfusion protocols have been associated with a reduction in mortality and overall blood product use.
- Each facility should develop and use a massive transfusion protocol.
- Utilize prediction tools for massive transfusion in adult trauma patients in an effort to avoid unnecessary exposure to blood products.
- Transfuse universal RBC and plasma in a ratio between 1:1 and 1:2 (plasma to RBC).
- A blood warmer should be used whenever more than three units are transfused. Hypothermia should be either avoided or minimized.

Hemorrhage is the most common cause of death in the first hour of arrival to a trauma center. Over 80% of deaths in the operating room (OR) and about 50% of deaths in the first 24 hours of injury are due to exsanguination and coagulopathy. Predicting the need for massive transfusion (> 10 units red blood cells [RBC] in 24 hours) is difficult. And, because they are unplanned and require rapid processing, effective coordination between various hospital personnel is required. The development and implementation of massive transfusion protocols (MTPs) have been associated with a reduction in mortality and overall blood product use in trauma centers.

According to the American College of Surgeons (ACS) Trauma Quality Improvement Program (2014), **MTP should be developed by a multi-disciplinary team and address** the following:

- Triggers for initiating massive transfusion in trauma
- Resuscitation in the trauma bay, including:
 - MTP product availability
 - MTP product delivery
 - MTP blood product transfusion
- Continuing MTP in the OR, angiography suite, and intensive care unit
- Transfusion service processes for delivery of blood products
- Transfusion targets
- The use of adjuncts for massive transfusion patients
- Termination of the MTP
- Performance improvement monitoring

The ACS Trauma Quality Improvement Program (2014) also recommends that **criteria to trigger the activation of an MTP** should include one or more of the following:

- ABC score of 2 or more
- Persistent hemodynamic instability
- Active bleeding requiring operation or angioembolization
- Blood transfusion in the trauma bay

While mortality is improved with rapid activation of a MTP, complications are increased if patients have unnecessary exposure to blood products. Prediction tools for massive transfusion in adult trauma patients have been developed for both military and civilian trauma patients with injuries from penetrating or blunt trauma, with specificities ranging between 80-90%.

One well-validated scoring system is the Assessment of Blood Consumption (ABC) Score for Massive Transfusion*.

	No	Yes
Penetrating torso injury	0	1
SBP \leq 90 in ED	0	1
Pulse $>$ 120 in ED	0	1
Positive FAST	0	1

ABC Score	Interpretation
0-1	Not likely to require massive transfusion
2-4	Like to require massive transfusion

*A score of 2 or more warrants MTP activation.

The ABC score overestimates the need for transfusion, with a positive predictive value of 50-55%, meaning that 45-50% patients in whom MTP is activated will not need a massive transfusion. However, the ABC score is excellent at identifying who will NOT need massive transfusion, with a negative predictive value of less than 5%, meaning it identifies more than 95% of all patients who will need a massive transfusion. Other prediction scores have been developed and all include the presence of severe tissue injury and hemorrhagic shock as important risk factors.

If **MTP triggers are met**, the ACS Trauma Quality Improvement Program (2014) recommends the following:

- Begin universal blood product infusion rather than crystalloid or colloid solutions
- Transfuse universal RBC and plasma in a ratio between 1:1 and 1:2 (plasma to RBC)
- Transfuse one single donor apheresis or random donor platelet pool for each six units of RBC
- Blood products should be automatically sent by the transfusion service in established ratios
- Subsequent coolers should be delivered at 15-minute intervals until the MTP has been terminated
- The goal is to keep at least one MTP cooler ahead for the duration of the MTP activation

Preventing hypothermia is important. A blood warmer should be used whenever more than 3 units are transfused. Hypothermia should be either avoided or minimized. Rapid transfusion of multiple units of chilled blood may reduce the core temperature abruptly and can lead to cardiac arrhythmias. Six units of RBCs at 4°C will reduce the body temperature of a 70 kg adult by 1°C. This heat loss can be additive with the evaporative heat loss associated with an open abdomen or other body cavity, which, by itself, can lead to a 1°C decrease in core temperature in 40 minutes. Thus, 10 units of cold blood products and an hour of surgery can lead to a 3°C drop in core temperature and hypothermic coagulopathy.

References

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