LOMA LINDA UNIVERSITY
MEDICAL CENTER

Clinical Guidelines
Massive Transfusion

Loma Linda University Medical Center

Background

Routine blood transfusion processes are insufficient to provide appropriate care for patients emergently needing large quantities of blood. This protocol is intended to act as a guideline for care of such patients and includes processes for blood delivery, managing coagulopathy and other effects of massive transfusion, and for transition or termination of the protocol. Variation from the protocol for good medical practice is anticipated.

Indications

The Massive Transfusion Protocol may be activated for patients requiring or who are anticipated to require massive transfusion, including trauma, surgery, obstetric complications, etc. Massive transfusion is intentionally not strictly defined - this protocol is intended for situations where rapid blood availability and transfusion is necessary or may be necessary to avoid morbidity and mortality.

Limitations

Blood provided under the massive transfusion protocols may be group O, may be uncross-matched, may not include type specific plasma, and is provided in fixed ratios that may be inappropriate for bleeding scenarios other than exsanguination. The blood bank will attempt to primarily utilize crossmatched RBCs and compatible plasma as soon as possible to avoid excessive depletion of trauma units. Reverting from fixed-ratio transfusions to test-guided product selection is anticipated to limit blood transfusion.

Activation

The massive transfusion protocol may be activated by any physician needing a mass transfusion pack for patient care; a verbal request to transfusion service staff may be made in person or by calling x45346. Since there is no LLEAP order for massive transfusion protocol packs, there is a release order that will need to be signed by a physician. The request may be conveyed by nursing or other personnel, who will need to provide the activating physician's name to the blood bank.

It can be difficult to decide whether to activate; suggestions may include persistent hemodynamic instability, active bleeding requiring operation, and urgent transfusion in response to trauma. The ABC score for trauma patients may be helpful in deciding whether to activate the massive transfusion protocol. The presences of two or more of the following predict a likely need for activation of the massive transfusion protocol:

- Penetrating Mechanism?
- ED Systolic BP $\leq$ 90 mmHg?
- ED HR $\geq$ 120?
- Positive Ultrasound FAST Exam?

If in doubt, it is better to activate the Massive Transfusion Protocol and not need it than to fail to activate it and delay successful resuscitation due to lack of blood products.

The transfusion service will require appropriate documentation of need for activation; in extremely urgent cases, this can be handled after the fact.

Availability and Content

Massive transfusion coolers are available 24/7 on 5-10 minutes notice. At LLUMC and LLUCH, enough blood is generally available to provide 2 coolers in the first 20 minutes; additional coolers may be delayed for thawing of plasma.

Initial cooler: In most level-A traumas, an initial cooler containing 4 units of pRBCs and 2 units thawed plasma is delivered to the trauma bay in anticipation of additional blood need.

Subsequent coolers: contain 6 units uncrossmatched pRBCs, 800-1000 mL of plasma, and 1 apheresis platelet (a "6 pack") to resemble as 1:1 ratio of RBCs to plasma. Every other cooler, starting with the 3rd, includes 1 pooled cryoprecipitate (a "5 pack").

Plasma will be group A plasma until the patient type is identified, at which time, the transfusion service may switch to group specific plasma.

RBCs will be group O. In male patients or elderly patients, Rh-positive units will be used. In female patients, or until male gender or advanced age are known, Rh-negative units will be used whenever possible.

The transfusion service will attempt to remain 1-2 coolers "ahead" on massive transfusions whenever possible to ensure blood availability for the current case and any simultaneous cases that arise.

Delivery

The transfusion service must be able to perform testing and to support multiple simultaneous blood users, including trauma, ED, OR, OB, and routine transfusion, so it is not staffed to routinely deliver blood products. As such, arranging for delivery of blood products is the responsibility of the team requesting massive transfusion.

Termination

When bleeding is adequately controlled, the massive transfusion protocol can be discontinued in favor of routine patient care.

Termination may also be considered when futile or in patients with extremely poor prognosis if exhaustion of the blood supply threatens the ability to care for other patients.

Due to the extraordinary level of effort required to support massive transfusions, it is very important to notify the transfusion service when massive transfusion is discontinued (including patient death).

When attending provider determines that the MTP is no longer indicated due to adequate control or futility, the attending or a representative will notify transfusion service of termination of the massive transfusion protocol.

Medical Recommendations by Setting

The available resources and expected monitoring may vary somewhat by setting; for example, the operating room will naturally have resources that may not be available in the radiology suite.

Trauma Bay

When feasible, a 1:1 transfusion of PRBC:plasma transfusion ratio should be targeted for initial resuscitation.

Initial laboratory coagulation testing should include INR, aPTT, Fibrinogen, CBC, and TEG if available, with iCa++ assessed on a blood gas. These should be repeated a hourly, or more often if coagulopathy is suspected.

Goals

The goals of MTP are to provide adequate blood volume and hemoglobin to maintain perfusion and oxygenation. Additional goals are to avoid or resolve metabolic acidosis, hypothermia, coagulopathy with the below targets. This will often require deviation from a fixed 1:1 ratio to achieve.

a. INR less than 1.8
b. Hgb greater than 7.0 gm/dL
c. Platelet count greater than 100,000
d. Fibrinogen greater than 100 mg/di
e. Prevent/resolve hypocalcemia
f. Address hyperkalemia
g. Target body temperature >= 26C or 97F

Other therapeutics

Consider antifibrinolytics (tranexamic acid or amicar) for massive bleeding with coagulopathy not corrected by blood product administration, or cases of confirmed or suspected fibrinolysis. If used, antifibrinolytics (tranexamic acid or amicar) should be limited to adult patients within 3 hours of injury, and no known contraindications to antifibrinolytics.

Consider prothrombin complex concentrates (PCC) for Warfarin reversal with major bleeding.

Factor VII (rVIIa) is not recommended due to thrombotic complications, except as a last resort in uncontrollable, life-threatening exsanguination.

Calcium in the form of calcium gluconate or calcium chloride should be considered whenever the ionized calcium (iCa++) appears to be low on blood gas or other testing.

Operating Room and Intensive Care Unit

1:1 transfusion ratios should be targeted for initial resuscitation, with a goal of transitioning from Massive Transfusion Protocol to specific component therapy as needed per coagulation testing and patient condition.

Other testing is as per trauma bay.

Angiography, elsewhere

The Massive Transfusion Protocol should be followed in angiography and elsewhere whenever possible. It is helpful to have a physician, focusing on resuscitation in addition to the team performing angiography or other studies or procedures.

The presence of a physician specifically skilled in supporting patients during angiography is highly encouraged, in addition to other service providers performing angiography.

Transition of Care

Blood normally should not be transferred with a patient across phases of care; however, during Massive Transfusion, patient acuity makes it unreasonable to return blood to the transfusion service. Unless they are returned to the transfusion service, coolers assigned to a specific patient should stay with that patient as they are moved into different locations (such as imaging, OR, etc.) Unused blood products will be returned to transfusion services as condition dictates.

The signoff to the new team should include that the massive transfusion protocol is active and, if known, when the next cooler will be available.

Mass Trauma, (Multiple Casualty)

In mass trauma situations, multiple patients may simultaneously need trauma blood. This may exceed the ability of the transfusion service to provide coolers for each patient. In these situations, the transfusion service may establish a depot for trauma blood in the Emergency Department and provide individual units of blood as needed on a case by case basis. We will attempt to utilize the 1:1 ratio until indications for specific component therapy are identified. Other aspects of the protocol, such as testing, will likely remain useful.

Quality Indicators and Monitoring

All massive transfusion protocol activations are retrospectively reviewed in the transfusion service to assess appropriate use of the protocol. This includes evaluation of indications for activation, and brief evaluation as to whether any transfusion reactions were noted, including significant coagulopathy, thrombosis, ARDS, etc. Additionally, pathology is notified for patient who received out of group plasma to monitor for hemolysis.

In cases where the utilization of the MTP leads to significant findings, (i.e. patient death occurs during massive transfusion protocol activation, reports of limited blood availability, delay in receiving the blood) or other quality questions will be reviewed at Trauma QI, Surgery M&M, or both.

The trauma service, with assistance as needed from the transfusion service, will review at least 20% of Massive Transfusion Protocol activations for trauma for the following performance indicators:

- Time from calling MTP to first infusion of blood products
- Whether RBC:plasma transfusion ratios remain in the range of 1:1 to 1.5:1.
- Wastage rates

APPROVERS: Medical Staff Executive Committee