Purpose

Hemorrhage is the most common cause of death in the first hour of arrival to a trauma facility[1]. The utilization of massive hemorrhage protocols improves appropriate blood use, mobilizes necessary teams in a more organized fashion, and facilitates standardized communication between the various teams involved[2].

These protocols, combined with educational programs (on the protocol and simulations), improve patient outcomes in hemorrhage associated with trauma. They also assist in judicious use of blood components and products, which is particularly helpful in locations with limited blood supply or intermittent blood shortages.

Summary of recommendations

PREHOSPITAL

1. Communicate with a trauma center and arrange transportation as early as possible after EHS recognition of a massive hemorrhage situation.
2. Pre-register patients to streamline the laboratory identification process.
3. Use ATLS approach with initial stabilizing measures such as compression, staples, tourniquets and pelvic binders.
4. Give 2 g TXA as early as possible in a massive hemorrhage.
5. Regularly assess temperature and keep patient above 36 degrees Celsius.
6. Prehospital transfusion can include pRBC and other therapies to improve coagulopathy, such as plasma and clotting factor concentrates.

IN HOSPITAL

7. Assign team designations prior to patient arrival, including a team leader, trauma surgeon, anesthesiologist, nurses, laboratory personnel and a dedicated blood runner.
8. Prime rapid transfusion devices prior to patient arrival.
9. Emergency blood products should be hanging and ready to infuse.
10. Use an ATLS approach with primary, secondary survey, c-spine precautions, and SAMPLE history for the initial assessment.
11. Predict massive hemorrhage with ABC and shock index scores.
12. Communicate a hospital wide notification of massive hemorrhage for mobilization of resources.

IN HOSPITAL *(continued)*

13. Achieve early large bore IV access (18g or larger) and arterial line monitoring.
14. First pRBC should be given within 10 minutes of arrival.
15. Send group and screen early so that crossmatched blood can be given within 1 hour.
16. Laboratories should have a pre-set 'massive hemorrhage protocol' panel including CBC, INR, PTT, Fibrinogen, calcium, electrolytes, lactate, base deficit and ABG, and repeat this at least every hour during active resuscitation.
17. ROTEM or TEG may be used as a point of care device to guide resuscitation.
18. 2:1 or 1:1 (pRBC: plasma) should be used until lab results can guide resuscitation (including transfusion of platelets based on thrombocytopenia).
19. Plasma should be given with 30 minutes of initiation of the protocol.
20. Blood and vasopressor treatment should take priority over crystalloid resuscitation. Limit crystalloids to 1L if possible.
21. Early fibrinogen administration should be considered in severe trauma patients.
22. Transfusion targets include a Hb of >70–90, INR <1.8, Platelets >50, Fibrinogen >1.5.
23. Complications to be monitored for during transfusion include hemolysis, TRALI, TACO, alloimmunization, hypothermia, acidosis, hyperkalemia and hypocalcemia.

FURTHER MANAGEMENT IN HOSPITAL

24. A key early decision point includes whether the patient needs surgical intervention or angioembolization for hemostasis.
25. Investigations that may aid decision making include a FAST scan and whole body CT.
26. Involving hematopathology can be important with reversal of anticoagulants. PCC/Vitamin K can be used for warfarin, and TXA/PCC can be used for anti-Xa DOACs if no specific reversal agents available.
27. Appropriate termination of massive hemorrhage protocol including informing the blood bank can prevent wastage of blood products.
28. Patients will need ICU or alternate higher level of care, and due to elevated thromboembolic risk will require chemical DVT prophylaxis when feasible.