

# **DAMAGE CONTROL HEMATOLOGY: *UTILIZATION OF A TRAUMA EXSANGUINATION PROTOCOL***

## **INTRODUCTION**

Massive blood transfusion (MBT) is most commonly defined as complete replacement of a patient's blood volume within a 24-hour period. Despite significant complications and logistical problems associated with MBT, results of many studies have demonstrated significant survival rates that justify its use in trauma. In the absence of a pre-defined massive transfusion protocol, access to the appropriate blood products (and adequate volume of these products) may be significantly delayed. Without prompt replacement of these blood products, the resultant coagulopathy may become overwhelming and, not infrequently, lethal. Rapid intervention with appropriate clotting factors and platelets has been shown to actually decrease the overall utilization of blood products. In fact, the implementation of an organized policy to address exsanguinating hemorrhage in the trauma population has proven of benefit to both patient outcomes as well as blood product utilization. Cinat and colleagues demonstrated an increase in survival (from 16% to 45%) in patients with “exsanguinating hemorrhage” following the implementation of such a protocol at their institution.

## **PURPOSE**

To define the process by which large amounts of pre-defined blood products may be accessed in an expeditious manner in patients with life-threatening injuries and massive blood loss. This protocol will standardize the type and manner of blood product request, as well as the rapid acquisition and delivery of these products to the trauma team.

## **INTERVENTION**

To describe the process to expeditiously access large quantities of blood products for those trauma patients with injuries that result in rapid and massive blood loss. The purpose of this policy is to standardize the type and manner of blood product request and acquisition in certain clinical situations and to formalize the related system responses.

### **I. PROCEDURE**

**Initiation:** The attending trauma surgeon will determine which patients (based on physiology or injury complex) warrant blood bank response beyond routine. The policy will be activated if the patient has on-going life threatening bleeding or CNS bleeding as well as the presence of one or more of the following criteria: Blood loss exceeding 1 BV, known hereditary or acquired hemostatic disorder of either plasma coagulation or platelet defects (platelet inhibitors). The attending will notify Blood Bank and activate the “Trauma Exsanguination Policy”.

**Notifications:** The attending must supply the Blood Bank Technician with the following information: attending trauma surgeon name, patient sex and approximate age, Medical Record #, Stat Name, and the location (must include OR room #) where blood is to be delivered.

Blood Bank will call OR to inform them that initial response products are en route and ascertain whether protocol should continue or cease. If they are told to continue, the next round of products will be prepared.

**Initial Blood Bank Response/Delivery:** Upon receipt of call from attending, the Blood Bank will prepare and dispense the following blood products as part of the initial response: (10) units non-irradiated PRBC's (uncross-matched), (2) units single donor platelets, and (4) units of plasma. Cryoprecipitate may be requested for patients with reduced fibrinogen In addition, upon initiation of the protocol, 4 units of FFP will be thawed in anticipation of further transfusion in this same patient.

## **II. FOLLOW-UP**

**Follow-up Blood Bank Response:** Following the initial release of products, the following products will be delivered as they are prepared: (6) units PRBC's, (2) Units Platelets and (4) units thawed plasma. This cycle of dispensing follow-up products will continue until terminated by the attending trauma surgeon in the OR.

Blood Bank will contact OR room to notify them next round products are en route and get decision on whether or not to continue protocol.

For each response Blood Bank will notify OR when products are en route and ascertain whether or not protocol will continue.

**Factor VIIa:** On rare occasions, it may be appropriate to infuse recombinant factor VIIa for ongoing non-surgical bleeding refractory to conventional therapy. This should be limited to:

- a. Transfusion of > 10 units PRBCS with ongoing requirement (equivalent to loss of more than 1.5 blood volumes) with ongoing requirement
- b. No evidence of “surgical” bleeding
- c. Marginal response to at least two rounds of hemostatic blood components (e.g. 2 platelet transfusions, 3 U FFP, etc.)

In addition, patients receiving factor VIIa should *ideally* have:

- a. Platelet count maintained > 100k
- b. INR < 1.5
- c. Fibrinogen > 100

\*As this is an off-label use, a modified-dose of 30 mcg/kg will be used for the initial administration. Attending physicians should note that the risk for thrombosis is increased with patients with mechanical heart valves, active DIC, cardiac support devices. If deemed necessary, a second dose of factor VIIa will be given at 90 ug/kg. The additional dose will be infused once in two hours if bleeding persists. This additional dose must be approved by physicians in the blood bank. The drug may be ordered

verbally in the trauma bay or operating room, but must be entered as an order once the patient is admitted to a bed.

**Unused Products:** It will be the responsibility of the Trauma Surgeon initiating the protocol to assure that products that are not transfused get returned to Blood Bank via OR staff.

### **III. QUALITY REVIEW:**

Trauma Exsanguination Protocol initiation will be a Quality Performance Indicator. All cases for which the Trauma Exsanguination policy is initiated will be reviewed as part of the Blood Utilization Committee QI/PI program.

## **BIBLIOGRAPHY**

1. Crosson, J.T. Massive transfusion. *Clin Lab Med* 16 (1996), pp. 873–882.
2. Hiippala S. Replacement of massive blood loss. *Vox Sang* 74 (1998), 399–407.
3. Spence R.K., Jeter E.K. Transfusion in surgery and trauma. In: P.D. Mintz, Editor, *Transfusion therapy: clinical principles and practice*, AABB Press, Bethesda, MD (1999), 171–197.

4. Phillips, T.F., Soulier G, Wilson R.F. Outcome of massive transfusion exceeding two blood volumes in trauma-emergency surgery. *J Trauma* 27 (1987), 903–910.
5. Cossgrif N., Moore, E.E., Sauaia A, Kenny-Moynihan J, Burch J.M., Galloway B. Predicting life-threatening coagulopathy in the massively transfused patient: hypothermia and acidoses revisited. *J Trauma* 42 (1997), pp. 857–862.
6. Valeri C.R., Feingold H., Cassidy G., Ragno G., Khuri S., Altschule M. Hypothermia-induced reversible platelet dysfunction. *Ann Surg* 205 (1987), 175–181.
7. British Committee for Standards in Haematology, Working Party of the Blood Transfusion Task Force, Guidelines for the use of fresh frozen plasma. *Transfus Med* 2 (1992), 57–63.
8. Fresh-Frozen Plasma, Cryoprecipitate, and Platelets Administration Practice Guidelines Development Task Force of the College of American Pathologists (CAP), Practice parameter for the use of fresh-frozen plasma, cryoprecipitate, and platelets. *JAMA* 271 (1994), 777–781.
9. American Society of Anesthesiologists Task force on Blood Component Therapy, Practice guidelines for blood component therapy. *Anesthesiol* 84 (1996), 732–747.
10. Medical Directors Advisory Committee, National Blood Transfusion Council, Guideline for the use of fresh-frozen plasma. *SAMJ* 88 (1998), 1344–1347.
11. Miller R.D., Robbins T.O., Tong M.J., Barton S.L. Coagulation defects associated with massive blood transfusion. *Ann Surg* 174 (1971), 794–801.

12. Counts R.B., Haisch C., Simon T.L., Maxwell N.G., Heimbach D.M., Carrico C.J. Hemostasis in massively transfused trauma patients. *Ann Surg* 190 (1979), 91–99.
13. Reed R.L., Heimbach D.M., Counts R.B., Ciavarella D., Baron L., Carrico C.J. *et al.*, Prophylactic platelet administration during massive transfusion. *Ann Surg* 203 (1986), 40–48.
14. Ciavarella D., Reed R.L., Counts R.B., Baron L., Pavlin E., Heimbach D.M. *et al.*, Clotting factor levels and the risk of microvascular bleeding in the massively transfused patient. *Br J Haematol* 67 (1987), pp. 365–368.
15. Murray D.J., Olson J., Strauss R., Tinker J.H. Coagulation changes during packed red cell replacement of major blood loss. *Anesthesiol* 69 (1988), 839–845.
16. Hiippala S.T., Myllylä G.J., Vahtera E.M. Hemostatic factors and replacement of major blood loss with plasma-poor red cell concentrates. *Anesth Analg* 81 (1995), 360–365.
17. Faringer P.D., Mullins R.J., Johnson R.L., Trunkey D.D. Blood component supplementation during massive transfusion of AS-1 red cells in trauma patients. *J Trauma* 34 (1993), 481–487.
18. Hirshberg A., Banez E.I., Bradford S.G., Wall M.J., Mattox K.L. Minimizing Dilutional Coagulopathy in Exsanguinating Hemorrhage: A Computer Simulation. *J Trauma* 54(3):454-463, March 2003.
19. Wilson R.F., Mammen E., Walt A.J. Eight years of experience with massive blood transfusions. *J Trauma* 1971;11:275-285.

- 20.** Kivioja A., Myllynen P., Rokkanen P. Survival after massive transfusions exceeding four blood volumes in patients with blunt injuries. *Am Surg* 1991;57:398-401
- 21.** Velmahos G.C., Chan L., Chan M. Is there a limit to massive blood transfusion after severe trauma? *Arch Surg* 1998;133:947-952.
- 22.** Rotondo M.E., Schwab C.W., McGonigal M. Damage control: an approach for improved survival in exsanguinating penetrating abdominal injury. *J Trauma* 1993;35:375-383.