

## **JTTS CLINICAL PRACTICE GUIDELINES FOR DAMAGE CONTROL RESUSCITATION AT LEVEL IIb AND III**

### **Introduction:**

The leading cause of potentially preventable death on the battlefield is noncompressible hemorrhage. Following Tactical Combat Casualty Care (TCCC) guidelines, tourniquets and hemostatic dressings are being used by medics to treat compressible hemorrhage, thus truncal bleeding is the unmet problem. At the FST and CSH level many physicians use the standard ATLS guidelines, starting resuscitation with crystalloid, then moving to PRBC and only after liters of these fluids adding plasma.

For the severely injured a new method of resuscitation utilizes objective criteria outlined below to initiate rFVIIa, thawed plasma and RBC use in the ED, within minutes of arrival. Crystalloid infusion is extremely limited. rFVIIa has recently shown improved hemostasis (decreasing blood loss by 23%) in combat casualties. Likewise increased use of plasma has recently been shown to improve mortality rates in combat casualties. These products are very safe in trauma patients and are currently in widespread use, both in military and civilian trauma patients. Conversely, excessive crystalloid has resulted in a greater incidence of abdominal compartment syndrome (16% vs 8%), multiple organ failure (22% vs 9%) and death (27% vs 11%) in a large series of civilian trauma patients. Administration of rFVIIa, PRBC, thawed plasma, platelets and cryoprecipitate and fresh whole blood at the FST and CSH, within the confines of the tactical situation, may decrease hemorrhagic morbidity and mortality of casualties with truncal hemorrhage.

**ED/EMT Resuscitation:** rFVIIa and plasma and PRBC (1:1 ratio) are indicated for any one of the following findings:

1. Truncal/axillary/neck or groin bleeding not controlled with tourniquets, hemcon dressings or quickclot
2. Large soft tissue injuries not controlled with tourniquets, hemcon dressings or quickclot.
3. A proximal amputation or mangled extremity
4. > 1000 cc blood out of a chest tube, or > 200 cc/hr for 4 consecutive hours
5. Physical exam findings:
  - a. decreased mental status from injury and shock
  - b. severe head injury
  - c. clinically coagulopathic
6. Objective physical exam or Laboratory findings
  - a. an  $\text{INR} \geq 1.5$
  - b. a base deficit  $\geq 6$
  - c. a  $\text{Hgb} \leq 12$
  - d. hypothermic from blood loss ( $T < 96^{\circ}\text{F}$ )
  - e. hypotensive from blood loss ( $\text{SBP} < 90 \text{ mmHg}$ ) or a weak/absent radial pulse)
7. Need for fresh whole blood transfusion
  - a. Bilateral proximal amputations
  - b. Large hemoperitoneum and significant shock

**Casualties with any one of these parameters have > 25% mortality and should be given rFVIIa and RBC:thawed plasma in a 1:1 ratio as soon as possible.**

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### **OR resuscitation:**

Most of the seriously injured casualties that receive hemostatic resuscitation in the ED will require the massive transfusion protocol, outlined in another CPG. In general this calls for coolers of products from the blood bank containing 6 units of PRBC, 6 units of plasma, 6 units of platelets and 10 packs of cryoprecipitate. Again crystalloid resuscitation is minimized, and rFVIIa is given when the INR is  $> 1.0$ . THAM is administered to keep the pH  $> 7.2$  and  $\text{Ca}^{++}$  is given after every 4 units of PRBC, and/or to keep ionized  $\text{Ca}^{++} > 1.0$  (on the ISTAT). The goal of OR resuscitation is to normalize all laboratory parameters, patient temperature, INR and base deficit. The operating room must be kept as warm as possible, usually 108°F. Major resuscitations in the OR (20-40 units) frequently only receive 3-4000 cc of crystalloid.

### **ICU resuscitation:**

Patients treated in the above fashion frequently arrive in the ICU warm (98), a base deficit of -3 and an INR of 1. This is after receiving an average of 17 PRBC, 13 plasma, 20 cryoprecipitate, 18 platelets, 7.2 mg rFVIIa and 4 liters crystalloid. Occasionally the patients require ongoing plasma and rFVIIa resuscitation, for an elevated INR and volume deficit. These patients are put on 50 cc/hr of crystalloid and because they are much less edematous than after traditional resuscitation regimens are able to extubate within 10 hours on average.

#### Dose of rFVIIa:

1. The usual trauma dose is 100 mcg/kg rFVIIa IV push
  - a. this dose can be safely repeated as many as 3-4 times in 20 minute intervals or greater

#### Route:

1. rFVIIa can be given through an IV or an intraosseous line.

#### Contraindications:

1. patient with active cardiac disease

#### Storage of rFVIIa

1. Keep rVIIa refrigerated at 2-8 degrees C°/36-46 degrees F° prior to reconstitution with sterile H<sub>2</sub>O
2. May store rFVIIa for up to 3 hours at room temperature (15-30 degrees C°/59-86 degrees F°) after reconstitution. If not maintained at these temperatures, the rVIIa is rendered inactive.

Plasma: (see separate guidance on use of plasma from Joint Theater Blood Program USCENCOM/CCSG)

**Thawed plasma not used under the precise conditions listed here may cause serious harm to the patient (infection or transfusion reactions); thus, it should be administered only by those trained to do so.**

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Infuse 250 cc plasma IV or IO after the rFVIIa; this can be by drip or by IV/IO push. No more than two units of un-typed plasma should be administered under these conditions; thus, immediately send blood to lab for typing, as all subsequent transfusions should be done with type-specific plasma where possible.

Storage of Thawed Plasma (see separate guidance on use of plasma from Joint Theater Blood Program USCENTCOM/CCSG)

**Plasma not stored under the precise conditions listed here may cause serious harm to the patient (infection or transfusion reactions) and should be properly discarded immediately.**

1. FFP can stay thawed (Thawed Plasma) for up to 5 days but it must be relabeled as “Thawed Plasma” complete with a new expiration annotated and stored at 1-6 C.
2. Thawed plasma for emergency use should be type AB or A; **DO NOT** allow more than 2 emergency plasma units to be administered until an ABO forward type or complete ABO type has been performed.
3. Administer plasma through standard blood administration set.
4. Use the HemaCool<sup>®</sup> Mobile Blood Storage Refrigerator / Freezer<sup>^</sup> or other refrigeration device to safely store these products (see further information as noted<sup>^</sup> below)

<sup>^</sup>HemaCool<sup>®</sup> Mobile Blood Storage Refrigerator / Freezer Model: HMC-MIL-1  
NSN: 4110-01-506-0895

Helmer Rapid Plasma Thawer has a 4 plasma unit model (DH4) and an 8 plasma unit model (DH8). NSN for the DH4 is 6640-01-510-3136. There is no NSN currently for the 8-unit model

### References:

TAB XX TO APPENDIX 3 TO ANNEX Q TO MNC-I OPERATIONS ORDER 05-03  
GUIDELINES FOR THE USE OF RECOMBINANT FVIIA AND PLASMA IN  
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