

Trauma Anesthesia Guidelines at UCH

The University of Colorado Hospital (UCH) is a level I trauma center. Successfully managing the trauma patient requires a coordinated plan with the surgical and anesthesia teams, operating room nurses and technicians. Management of these patients is similar to managing other surgical patients with potential for large intraoperative blood loss, fluid shifts and coexisting diseases. In addition, these patients may have multiple acute injuries that require multiple surgical teams to coordinate care. Damage Control Resuscitation is a coordinated effort with Damage Control Surgery. For Level I/II trauma centers anesthesiology services must be available in-house 24 hours a day, available within 30 minutes for emergency operations and for managing airway problems. The attending anesthesiologist must be present for all operations. The following are guidelines for anesthesia management:

A. Preoperative Preparation

1. Trauma Room selection and setup is coordinated with the OR Charge Nurse. The anesthesia technicians (8-5912) will setup the equipment. Check the room at the beginning of each call shift.
 - a. Level One rapid infuser in room with disposables in place but not engaged or flushed with crystalloid.
 - b. Belmont rapid infuser available with disposables in place but not in room unless requested by the attending.
 - c. Central venous catheters in various large-bore types from 9-12F with multiple lumens (ie., MAC, Quad-lumen, Hemodialysis) and 7/9F triple lumen kits, along with a flushed transducer setup for CVP monitoring.
 - d. Arterial line transducer setup and flushed with normal saline and 20g arterial catheter kits available.
 - e. 5 F central venous catheter kit in room for surgical to place femoral arterial line if indicated.
 - f. Large bore intravenous catheters in 14/16g sizes available in addition to a Rapid Infusion Catheter (RIC).
 - g. Video laryngoscope with a variety of blades.
 - h. Ultrasound plugged in.
 - i. Basic airway management devices ready including laryngoscope and blades, oral and nasal airways, endotracheal tubes with stylet and intubating stylet.
 - j. Syringes for induction agents, muscle relaxants and emergency drugs: follow Joint Commission and Pharmacy regulations. Consider vasoactive infusions, call pharmacy early with requests and utilize the Pyxis Trauma kit.
 - k. Ensure trauma operating room is warmed.
2. The anesthesiology call resident (R1) or advanced practice provider (C1) will carry the Trauma Activation pager and respond to the ED for trauma activation during call hours after 1500 (see attachment for description of Trauma Alert and Trauma Activation criteria). If the R1 or C1 is unable to respond one of the anesthesiologists on call will respond. The Trauma Activation pager will be carried by the shift coordinator during daytime operations from 0700 to 1500.

Effective communication and handoff of patient care is encouraged between the ED, Trauma Surgery and Anesthesiology teams. The OR charge nurse (8-3512) will also coordinate with the anesthesiology charge.

3. Ensure type and cross is completed. The Massive Transfusion Policy is initiated if the patient likely will require 10U PRBCs in 12 hours, greater than 4u PRBCs in 4 hours or has hemodynamic instability (Blood Bank 8-4444). The MTP has been updated recently to include additional "Triggers for Initiating MTP" (see attached MTP Quick Guide). Use emergency release (uncrossmatched Type O) PRBCs if crossmatched PRBCs are not ready, then switch to crossmatched PRBCs if available and guided by UCH Blood Bank policy.
4. Anticipate the possibility of multiple injuries detected in the primary and secondary patient surveys. These may include unstable cervical spine, multiple skeletal fractures, pneumothorax or flail chest, cardiac contusion or tamponade, CNS trauma, major vascular damage and soft tissue organ damage causing massive hemorrhage. Communication with the surgical team is key to coordinating resuscitation efforts.
5. The Trauma kit is available in the center core Pyxis and contains TXA, epinephrine, norepinephrine and phenylephrine infusions along with albumin 5% 500 ml.

B. Intraoperative Management

1. Consider RSI with in-line stabilization of cervical spine for general anesthesia induction and intubation of trauma patient.
2. Standard ASA monitors in addition to arterial catheter. Monitor CVP if indicated.
3. Adequate intravenous access includes two large bore peripheral catheters obtained before central venous access (this is the usual scenario unless peripheral catheters are difficult to obtain). Then consider the need for a large-bore central venous catheter, such as a 9Fr catheter, for massive fluid and blood product administration. This may be done during initial resuscitation preoperatively.
4. REBOA or Resuscitative Endovascular Balloon Occlusion of the Aorta is indicated in trauma patients with trauma arrest, hemorrhagic shock from pelvic fracture or non-compressible abdominal hemorrhage. The trauma patient may arrive from the ED with a femoral arterial 7 Fr sheath and REBOA catheter in place or it may be placed in the operating room. Communicate with the Trauma Surgery team for using this to transduce arterial blood pressure, closely monitor aortic occlusion times, and coordinate balloon deflation during REBOA resuscitation. Please refer to the Department of Surgery TACS website for more details on the REBOA pathway: REBOA-algorithm.pdf.

5. If greater than 4 units over 4 hours or 10u PRBC in 12 hours is anticipated or other indications (see the attached MTP Quick Guide) initiate the Massive Transfusion Policy. Note that the MTP utilizes a 1:1:1 ratio of PRBCs:FFP:Plts. UCH utilizes apheresis platelets with one unit equaling 10u of regular platelets. So the MTP product ratio is 10:10:1 above with 1 unit of apheresis platelets for every 10u of PRBCs and FFP.
6. Per the UCH Massive Transfusion Policy, administration of additional FFP and platelets may be considered in the patient with continued, active bleeding (see MTP Quick Guide for additional details). Deactivate MTP when bleeding is controlled.
7. Operational Process for use of Whole Blood (November 2019)
 - a. Whole blood is stored in the ED blood refrigerator and will only be initiated on Trauma patients in the ED meeting criteria for the MTP.
 - i. After initiation in the ED, whole blood administration may be continued when transporting to the OR, STICU, IR, etc.
 - b. Blood component therapy (PRBCs/FFP/Plts) will remain available in the ED blood refrigerator for non-trauma MTP.
 - c. Maximum of 4 units O-positive Whole Blood will be administered to a single trauma patient.
 - d. Immediately upon activating an MTP, the ED will send staff to the blood bank to obtain a cooler of the second MTP pack of blood components.
 - i. Unused whole blood products will be immediately placed into the cooler to avoid wastage (max time 20 minutes).
 - ii. All unused blood products will be returned to the blood bank in the cooler.
8. Consider the use of other procoagulants and adjuncts such as TXA, rVIIa, Kcentra and cryoprecipitate based on comorbidities, INR and TEG results for continued, active bleeding (see below, the MTP Quick Guide and the UCH Trauma TEG Resuscitation guidelines).
9. Goals of management and resuscitation include SBP >90mmHg, Hgb between 7-10 depending on patient's coexisting diseases, normothermia with T 36-38C, INR <1.5 (TEG results best if available), base deficit < 6 and pH >7.2. Frequent use of TEG and ABGs are recommended to guide overall resuscitation, transfusion requirements and to correct coagulopathy.
10. Early and frequent correction of hypocalcemia is recommended with frequent ABG monitoring every 30-45 minutes.
11. Avoid the use of albumin in the setting of Traumatic Brain Injury (TBI).

12. Consider use of norepinephrine and/or vasopressin for hypotension refractory to fluid, blood product and acid/base optimization. Follow CVP, ABG-guided resuscitation and continue to consider other multiple injuries noted in A.4. above that may cause refractory hypotension.
13. Sodium bicarbonate boluses or infusion may be indicated for metabolic acidosis with a pH < 7.2 that is unresponsive to fluid and blood product administration. Consider this formula for bicarbonate replacement: $\text{HCO}_3 \text{ meq} = \text{BE}(\text{base excess}) \times \text{weight}(\text{kg}) \times 1.7$. Give half the deficit then follow treatment with arterial blood gas analysis.
14. Consider the use of TXA, recombinant factor VIIa or Kcentra in the massive trauma patient with certain precautions.
 - a. TXA should only be used within the first 3 hours after injury in adult patients with severe shock (SBP < 75 mmHg) with known predictors of or TEG confirmed hyperfibrinolysis. Give 1000mg of TXA IV over 10 minutes with another 1000mg IV over 8 hours.
 - b. Recombinant factor VIIa (100mcg/kg) is unlikely to be beneficial in the civilian trauma patient but may be considered if TXA is ineffective.
 - c. Use of Prothrombin Complex Concentrate (Kcentra) may provide a complete correction of factor deficiency coagulopathy as guided by INR values. It's use is strictly off-label for treatment of Trauma-induced coagulopathy and some studies suggest a higher incidence of thrombotic events when used for this indication. Dosage of Kcentra is recommended 25 U/kg IV (INR 2-<4), 35 U/kg (INR 4-6) and 50 U/kg (INR >6).

The use of these adjuvants will be the decision of the surgical and anesthesiology teams. These agents have not been proven to improve overall patient outcomes or to reduce the amount of blood product administration in all studies.

C. Postoperative management

1. Contact SICU resident and faculty to facilitate a seamless handoff of patient care from the operating room to the ICU. Prior to transfer to the SICU/BTU ensure that ETT, CVC and arterial catheters are secure especially if placed outside of the OR prior to emergency surgery.
2. Same management goals as intraoperative above for continued resuscitation and anticipation of return to the OR.
3. Consider multimodal analgesia for pain control in anticipation of extubation after patient is stabilized in the ICU.

References

1. Rotondo, MF (Chair, Committee on Trauma). (2012). *Advanced Trauma Life Support Student Course Manual* (9th Edition). Chicago, IL: American College of Surgeons.
2. Joint Trauma System. (2013). *Joint Theatre Trauma System Clinical Practice Guideline, Damage Control Resuscitation at Level IIb/III Treatment Facilities*. Ft Sam Houston, TX: United States Army Institute of Surgical Research.
3. University of Colorado Hospital. (2012). *University of Colorado Hospital Policy and Procedure- Massive Transfusion*. Aurora, Colorado.
4. American College of Surgeons Committee on Trauma. (2014). *Resources for Optimal Care of the Injured Patient* (6th Edition). Chicago, IL: American College of Surgeons.
5. White NJ. Mechanisms of trauma-induced coagulopathy. *Hematology*. 2013
6. Gonzalez E, et al. Trauma-induced coagulopathy: an institution's 35 year perspective on practice and research. *Scand J Surg*. 2014.
7. Holcomb JB, et. al. Transfusion of plasma, platelets, and red blood cells in a 1:1:1 vs. a 1:1:2 ratio and mortality of patients with severe trauma: the PROPPR randomized clinical trial. *JAMA*. 2015: 313(5).
8. Holcomb JB, et. al. The Prospective, Observational, Multicenter, Major Trauma Transfusion (PROMTT) study: Comparative effectiveness of a time-varying treatment with competing risks. *JAMA Surg*. 2013; 148(2): 127-136.
9. Spinella PC. The effect of recombinant activated factor VII on mortality in combat-related casualties with severe trauma and massive transfusion. *J Trauma*. 2008: 64(2).
10. The CRASH-2 Collaborators. Effects of tranexamic acid on death, vascular occlusive events, and blood transfusion in trauma patients with significant haemorrhage (CRASH-2): a randomized, placebo-controlled trial. *Lancet*. 2010; 376: 23-32.
11. Grottke O, et. al. Prothrombin Complex Concentrates in Trauma and Perioperative Bleeding. *Anesthesiology*, April 2015; 122(4).

Trauma Anesthesiology QI Team:

Erik Nelson, MD

Fareed Azam, MD

Melanie Donnelly, MD

Lauren Mclaughlin, DO

Laura Kirk, MD

Nicholas Schiavoni, MD

Brooke Calabrese, MD

Revised January 2020

Attachment- UCH MTP Quick Guide

** Procoagulants are an anesthesia department recommendation and are not a part of*

Triggers for Activation	Activating MTP	Cooler Contents	Lab Studies	Hemostasis	Post-MTP Care
<p>A. Any patient receiving <u>blood products to maintain SBP</u> while en route</p> <p>B. Any patient with an Assessment of Blood Consumption <u>(ABC) Score of 2 or greater</u></p> <p>1. SBP<90 (1 point)</p> <p>2. HR>120 (1 point)</p> <p>3. Positive Focused Assessment Sonography in Trauma (FAST Exam) (1 point)</p> <p>4. Penetrating torso injury (1 point)</p>	<p>A. <u>Designate a person</u> responsible for activating MTP</p> <p>1. Primary Team</p> <p>2. Intensivist Team</p> <p>3. ED, Anesthesia</p> <p>B. Activate MTP</p> <p>1. Call blood bank <u>(844444)</u></p> <p>2. Identify patient and MRN</p> <p>3. Initiate <u>Trauma Page</u> for MTP activation</p>	<p>A. Cooler #1</p> <ul style="list-style-type: none"> • 5u PRBCs • 5u FFP • 1u apheresis platelets <p>B. Cooler #2</p> <ul style="list-style-type: none"> • 5u PRBCs • 5u FFP <p>C. Alternate coolers, #1 and #2, until MTP deactivated</p> <p>D. <u>Ordering Dept</u> to pick up contents</p> <p>E. Blood products to be <u>transported w/patient</u></p>	<p>A. Baseline labs</p> <ul style="list-style-type: none"> • CBC, ABG, PT/PTTT EG, BMP, iCa, Lactate <p>B. Repeat labs Q4h OR after each cooler</p> <p>C. Obtain fibrinogen level after 10u PRBCs</p> <ul style="list-style-type: none"> • Give cryo 10u for fibrinogen <100 	<p>A. Bleeding Controlled → Deactivate MTP</p> <p>B. Bleeding uncontrolled → Continue MTP</p> <p>C. Continued ooze, consider</p> <p>1. FFP for INR>1.6</p> <p>2. Platelets for plt< 50K</p> <p>3*. <u>TXA</u> w/in 3h of injury + severe shock OR TEG confirmed hyper-fibrinolysis</p> <p>4*. <u>rFVIIa</u> (100mcg/kg) if TXA ineffective</p> <p>5*. <u>Kcentra</u> as guided by INR</p> <ul style="list-style-type: none"> • 25 U/kg (INR 2-4) • 35 U/kg (INR 4-6) • 50 U/kg (INR >6) 	<p>A. Deactivate MTP</p> <p>B. Return cooler with unused products to blood bank</p> <p>C. Draw labs (CBC, PT, Fibrinogen, BMP, iCa)</p> <ul style="list-style-type: none"> • QID for 24h • Then, BID for 24h

original UCH MTP Quick Guide

Attachment- TEG Interpretation

<u>TEG Value</u>	<u>Transfuse</u>
TEG-ACT>140	FFP
R Time >10	FFP
K time >3	Cryoprecipitate
α Angle <53	Cryoprecipitate +/- Platelets
MA <50	Platelets
LY30>3%	Tranexamic Acid

UCH Trauma Alert / Activation Criteria

TRAUMA ACTIVATION:	
1. Physiologic	
a. Airway: Unstable airway, intubated or assisted ventilation	✓
b. Confirmed hypotension	
i. ANY trauma with a confirmed Systolic Blood Pressure (SBP) \leq 90mmHg (or SBP considered hypotensive if $<$ 10 y/o)	
ii. Or SBP \leq 110 if \geq 65 years old	
c. Glasgow Coma Score (GCS) $<$ 9	
d. Transfer patients from other facilities receiving blood en route to maintain vital signs	
e. Deterioration of a previously stable patient	
2. Anatomic	
a. GSW injury to neck, chest, abdomen, or extremity proximal to elbow or knee	
b. Mass casualty incident (\geq 3 victims meeting alert criteria)	
c. Mechanically unstable pelvic injury (open or obvious by physical exam)	
d. Amputation or mangled extremity proximal to the ankle or wrist	
3. TACS staff, EM attending OR senior resident may upgrade patients with concerning findings or for need for additional resources at their discretion	

TRAUMA ALERT:	
1. Physiologic	
a. Heart rate \geq 120	✓
b. GCS \leq 13 and \geq 9	
2. Anatomic:	
a. Stab wound to neck torso or groin in absence of hypotension	
b. Open or depressed skull fracture, penetrating skull injury	
c. New focal neurologic deficit (i.e. paralysis, sensory deficit, suspected spinal cord injury)	
d. Pelvic fracture confirmed radiographically	
e. \geq 2 closed long bone fractures	
f. Open long bone fracture	
g. Partial, deep partial or full thickness ("2 nd or 3 rd degree") burn $>$ 10% BSA from the scene.	
h. Flail chest	
i. Positive FAST exam in the setting of trauma	
3. Mechanism / Patient Factors	
a. High energy electrical injury from the scene	
b. Age \geq 65 and significant mechanism, excluding ground level fall	
c. Anticoagulated patient with significant mechanism, excluding ground level fall (includes warfarin, new oral anticoagulants, & clopidogrel, but not ASA or NSAIDs alone)	
d. The Charge RN, TACS staff, or EM attending or senior resident discretion with high risk mechanism or patient considerations, for example:	
i. Mechanism: ejection; unrestrained rollover; death in same vehicle; extrication time $>$ 20 minutes; high speed auto-ped or auto-bicycle ($>$ 20 mph); MCC $>$ 20 mph and unhelmeted or separation; fall from height ($>$ 20 ft); ATV or equestrian ejection or rollover.	
ii. Patient factors: $>$ 20 weeks gestation, multiple medical co- morbidities	

All criteria should be associated with traumatic mechanism.

Page should be sent as early as possible and based on EMS report if criteria met.

UCHEALTH TRAUMA TEG RESUSCITATION

ABC Score Activate MTP if ≥ 2 of the following:

- Systolic BP ≤ 90
- HR ≥ 120 bpm
- Penetrating Torso Injury
- +FAST Exam

uhealth

Things to Remember:

- Airway
- Breathing
- Circulation
- Insert 5F micro-puncture femoral A-line in activations with hypotension, +ABC criteria, or high risk for hemorrhagic shock
- Labs
 - POC ABG/Lactate
 - POC INR
 - CMP
 - CBC
 - Plasma PT/INR, PTT
 - Type and screen (cross if MTP)
 - TEG

MTP ACTIVATION CARD

SEPTEMBER 2017

UCHEALTH TRAUMA TEG RESUSCITATION

Labs incl. TEG, POC ABG, POC INR, MTP Activated

2 grams CaCl_2 IV

Transfuse 5u PRBC, 5u FFP, 1u PLT

TEG Results

R Time
 >8 min

2u FFP

$<65^\circ$

2 FFP

Angle

$<55^\circ$

2 FFP + 2 Cryo

MA
 <55 mm

1u Plt

LY30 $\geq 5\%$

1 gram IV TXA

Recheck
TEG

