

Joint Trauma System



Anesthesia for Trauma Patients

Part of the Joint Trauma System (JTS) Clinical Practice Guideline (CPG) Training Series



Purpose



This CPG provides a method of anesthesia that incorporates the induction and maintenance of anesthesia into an ongoing resuscitation during surgery for a trauma patient in extremis.

This presentation is based on the [JTS Anesthesia for Trauma Patients CPG, 05 Apr 2021 \(ID: 40\)](#). It is a high-level review. Please refer to the complete CPG for detailed instructions. Information contained in this presentation is only a guideline and not a substitute for clinical judgment.

Agenda



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2. Summary
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Updates: Jul 2021



- Use Whole Blood (WB) if available. FDA-approved cold stored WB is preferred over fresh WB (non-FDA approved).
- Initiate infusion of 1 gm Tranexamic Acid (TXA) over 8 hours if TXA 1 gm administered pre-operatively.
- Carefully follow calcium concentration during massive transfusion. Consider giving empiric calcium chloride if hypotensive.
- Stronger evidence exists for use of vasopressin in hemorrhagic shock. Consider vasopressin bolus of 2-4 units followed by a vasopressin infusion (0.04 U/min) in cases of refractory shock.

Summary



- Be prepared. Adjust induction and maintenance of anesthesia in critically ill and hemodynamically unstable patients.
- Anesthesia providers are integral to the operative resuscitation and after-care of trauma patients.

Pre-Induction

- Avoid Hypothermia.
 - ❑ Warm OR to greater than 30°C.
 - ❑ Warmed intravenous (IV) line and rapid infuser with warming capability.
 - ❑ Forced air warmer.
- Prepare for massive transfusion with establishment of massive transfusion protocol and communication with blood bank.
- Have anesthesia present in the trauma bay to assist when needed and provide smooth transition to OR.



Anesthesia providing assistance in trauma bay with airway and oxygenation with eventual intubation.

Induction of Anesthesia (1)



- Ongoing volume resuscitation critical to avoid disastrous induction in an exsanguinating patient.
- Verify functioning vascular access and placement of monitoring devices prior to induction.
 - Do not delay induction for placement of central access or invasive monitoring.
- Pre-oxygenation with four full vital capacity breaths ideal prior to rapid sequence induction.
 - May not be possible in obtunded patient and may have to rely on apneic oxygenation.

Induction of Anesthesia (2)

- Adjust induction dosages of sedative hypnotics to balance induction with hemodynamic changes.
 - ❑ Ketamine (1 mg/kg) will not decrease systemic vascular resistance to the same extent as other sedative hypnotics.
 - ❑ Propofol can decrease systemic vascular resistance significantly; reduce doses (0.5-1 mg/kg) in hypotensive patients.
- Succinylcholine or Rocuronium used most common neuromuscular relaxation medications for rapid sequence induction.
 - ❑ Sufficient relaxation in 45 seconds with succinylcholine at 1 mg/kg.
 - ❑ Sufficient relaxation in 60 seconds with rocuronium at 1-1.2 mg/kg.

Induction of Anesthesia (3)

- Prompt endotracheal intubation following induction mitigates risk of aspiration.
- Rapid sequence induction (RSI) with direct laryngoscopy is a safe and effective method to secure an airway.
- Prudent to minimize manipulation of the cervical spine to the extent possible.



Securing endotracheal tube after intubation with ongoing surgical procedures

Induction of Anesthesia (4)

- Be prudent with a limited number of immediately available airway adjuncts nearby. Laryngoscopist must be familiar with adjuncts.
 - ❑ Gum elastic bougie and video laryngoscopy are common adjuncts.
 - ❑ Surgical airway equipment should always be available.
- After intubation, verify end tidal carbon dioxide and communicate with surgeon.
 - ❑ Placement of orogastric tube soon after intubation may decrease risk of aspiration.

Maintenance of Anesthesia

- Maintenance of anesthesia can be accomplished via inhalational volatile agent or total intravenous anesthetic (TIVA).
 - ❑ Carefully titrate to hemodynamic profile while maintaining adequate sedation/hypnosis/analgesia.
 - ❑ Awareness and pain response can be mitigating during TIVA by using both a sedative hypnotic and analgesic.
- Maintain adequate IV access and obtain arterial line if indicated.

Maintenance of Anesthesia

- Obtain baseline set of labs to include coagulation studies and base excess.
- Guide maintenance of anesthesia and resuscitation to a mean arterial pressure goal, generally MAP > 55 mm Hg.
 - Maintain systolic blood pressure > 90 mm Hg in patients with documented or suspect TBI.



TBI patient undergoing operation

Resuscitation

- Resuscitation guided by the *Damage Control Resuscitation CPG*
 - Ratios of FFP: PRBC approaching 1:1 have been demonstrated to confer a survival benefit in trauma patients.
 - Communicate progress of resuscitation with surgical team.
- Tranexamic acid dose of 2 g over 10 minutes within 3 hours of injury has demonstrated a survival benefit.
 - If Initial dose of 1 gm administered follow by an infusion of 1 gm over 8 hours.

Resuscitation

- Vasopressors may be required in trauma, but are associated with higher mortality.
 - ❑ Vasopressin bolus 2-4 units followed by 0.04 U/min can be given in concert with aggressive blood product administration in refractory hypotension.
 - ❑ Hydrocortisone dose of 100 mg can improve vasopressor responsiveness in critically ill trauma patients.
- Timely administration of antibiotics can decrease post-operative infections and is part of anesthetic resuscitation.
 - ❑ See *JTS Infection Prevention CPG* for optimal antibiotics for given scenarios.



Ongoing resuscitation with blood products by anesthesia provider

Post-operative/Emergence

- Low lung volume ventilation, 6 mL/kg, can decrease mortality in patients with acute respiratory distress syndrome (ARDS).
 - ❑ Can improve outcomes in patients who have not developed ARDS.
 - ❑ Consider using low lung volume ventilation in OR.
- Communicate with next role of care to maintain continuity.
 - ❑ Provide a detailed written report/anesthetic record including the operative resuscitation.
 - ❑ Be immediately available in the post-operative period to answer any questions and clarify issues.

PI Monitoring



■ Population of Interest

1. All trauma patients who undergo surgery within 24 hours of arrival to first surgical role of care (includes all surgeries performed within 24 hours of arrival to first surgical role of care).
2. Patients who receive endotracheal tube/cricothyroidomy/tracheostomy before the initial surgery AND undergo surgical procedure at Role 2 or Role 3.

■ Intent (Expected Outcomes)

1. Anesthesia care is documented on an anesthetic record and uploaded to Theater Medical Data Store.
2. Trauma patients in the OR maintain a body temperature $> 36^{\circ}\text{C}$ during surgery.
3. Anesthesia following trauma will be induced and maintained with less than 20% drop in initial blood pressure.
4. Patients undergoing massive transfusion will receive blood products in 1:1:1:1 ratio (plasma:platelets:RBC:CRYO).
5. Calcium chloride or calcium gluconate is administered to patients who have received: one unit and after every 4 units of red blood product transfused.
6. Antibiotics are administered to all patients prior to initiation of surgery incision.

■ Data Source

- Patient Record
- Department of Defense Trauma Registry

■ Performance/Adherence Metrics

1. Number and percentage of patients in the population of interest who have anesthesia record received.
2. Number and percentage of trauma patients who maintained a body temperature $> 36^{\circ}\text{C}$ during surgery (as recorded on anesthesia record).
3. Number and percentage of patients who do not drop systolic blood pressure more than 20 mmHg during the first 15 min after induction of anesthesia.
4. Number and percentage of patients undergoing massive transfusion (>10 u RBC + whole blood with 24 hours after injury) who received blood products in an FFP:RBC ratio between 0.5:1 to 1:1.5 while in the operating room (as recorded on anesthesia record).
5. Number and percentage of patients undergoing massive transfusion (>10 u RBC + whole blood with 24 hours after injury) who receive platelet or whole blood transfusion while in the operating room (as recorded on anesthesia record).
6. Number and percentage of patients who received more than 1 units of blood products transfused who also received calcium chloride or calcium gluconate (as recorded on anesthesia record).
7. Number and percentage of patients who received antibiotic before surgery or documented no antibiotic indicated.

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Appendices



- **Appendix A:** Trauma Anesthesia Checklist
- **Appendix B:** Additional Information Regarding Off-Label Uses in CPGs

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