

# Clinical Pearls from the Preventable Mortality Review Committee

Q3 2022

## Pelvic Bleeding

Pelvic bleeding is a potentially lethal condition, and it rarely occurs without pelvic fractures that can be diagnosed on pelvic x-ray during the initial trauma survey. An abdominal binder will stop most venous bleeding, but control of arterial pelvic bleeding, diagnosed by CT scan with contrast, frequently requires methods not available in an emergency department or in smaller hospitals. These methods include:

1. Angiographic embolization: requires interventional radiology, and delays increase mortality; this is the only definitive treatment that does not require subsequent interventions.
2. Preperitoneal pelvic packing: requires operating room and limiting laparotomy to just below the umbilicus: associated with surgical site infection but possible in most hospitals with an OR and general surgeons.
3. Bilateral temporary internal iliac ligation: requires laparotomy; now recommend temporary ligation with vessel loops or Rummel Tourniquet and readdressing at OR takeback. Possible in most hospitals with an OR and general surgeons.
4. REBOA (REsuscitative Balloon Occclusion of the Aorta): requires vascular access skills and is only a temporizing procedure because it stops blood flow below the balloon; associated with vascular complications, including leg loss.

Rapid diagnosis, damage control resuscitation, prevention of hypothermia, acidosis, and coagulopathy, and rapid transfer to a Trauma Center with these capabilities is essential to save lives.

1. Costantini TW, et al. Pelvic fracture pattern predicts the need for hemorrhage control intervention—results of an AAST multi-institutional study. *Journal of Trauma and Acute Care Surgery*. 2017 Jun 1;82(6):1030-8.
2. Matsushima K, et al. Effect of door-to-angioembolization time on mortality in pelvic fracture: every hour of delay counts. *Journal of Trauma and Acute Care Surgery*. 2018 May 1;84(5):685-92.
3. Burlew CC, et al. Preperitoneal pelvic packing reduces mortality in patients with life-threatening hemorrhage due to unstable pelvic fractures. *The journal of trauma and acute care surgery*. 2017 Feb;82(2):233.
4. Mikdad S, et al. Pre-peritoneal pelvic packing for early hemorrhage control reduces mortality compared to resuscitative endovascular balloon occlusion of the aorta in severe blunt pelvic trauma patients: a nationwide analysis. *Injury*. 2020 Aug 1;51(8):1834-9.
5. DuBose J, et al. Bilateral internal iliac artery ligation as a damage control approach in massive retroperitoneal bleeding after pelvic fracture. *Journal of Trauma and Acute Care Surgery*. 2010 Dec 1;69(6):1507-14.
6. Asmar S, et al. Resuscitative endovascular balloon occlusion of the aorta vs. pre-peritoneal packing in patients with pelvic fracture. *Journal of the American College of Surgeons*. 2021 Jan 1;232(1):17-26.

# Confirming Death on Hospital Arrival

Recommend Performing the following before Confirming Death on Hospital Arrival

1. Confirm airway with direct (or video) laryngoscopy (because Continuous End Tidal Waveform capnography will not be accurate during cardiac arrest)
2. Treat potential tension pneumothorax (PTX): bilateral chest tubes, finger thoracostomy, or needle decompression in the 4-5th axillary intercostal space
3. Ultrasound of the heart shows no pericardial fluid and asystole (if tamponade is present, resuscitative thoracotomy should be considered)

Resuscitative thoracotomy should be considered **futile** when ANY of the following are true:

- a) prehospital CPR exceeds 10 minutes after blunt trauma without a response
- b) prehospital CPR exceeds 15 minutes after penetrating trauma without a response
- c) asystole is the presenting rhythm, and there is no pericardial tamponade
- d) blunt trauma with NONE of the following:
  - pupillary response,
  - spontaneous ventilation,
  - presence of a carotid pulse,
  - measurable or palpable blood pressure,
  - extremity movement, or
  - cardiac electrical activity

1. Kotwal RS, et al. Eliminating preventable death on the battlefield. Archives of surgery. 2011 Dec 1;146(12):1350-8.

2. McPherson JJ, Feigin DS, Bellamy RF. Prevalence of tension pneumothorax in fatally wounded combat casualties. Journal of Trauma and Acute Care Surgery. 2006 Mar 1;60(3):573-8.

3. Inaba K, et al. Optimal positioning for emergent needle thoracostomy: a cadaver-based study. Journal of Trauma and Acute Care Surgery. 2011 Nov 1;71(5):1099-103.

4. Seamon MJ, et al. An evidence-based approach to patient selection for emergency department thoracotomy: a practice management guideline from the Eastern Association for the Surgery of Trauma. Journal of Trauma and Acute Care Surgery. 2015 Jul 1;79(1):159-73.

5. Inaba K, et al. FAST ultrasound examination as a predictor of outcomes after resuscitative thoracotomy: a prospective evaluation. Annals of surgery. 2015 Sep 1;262(3):512-8.

6. Moore EE, et al. Defining the limits of resuscitative emergency department thoracotomy: a contemporary Western Trauma Association perspective. Journal of Trauma and Acute Care Surgery. 2011 Feb 1;70(2):334-9.

## Confirming Intubation

Confirmation of proper endotracheal tube placement should be completed in all patients at the time of initial intubation in the hospital and out-of-hospital settings. Physical examination methods such as auscultating the chest and epigastrium, visualization of thoracic movement, and fogging in the tube are not sufficiently reliable to confirm endotracheal tube placement. Similarly, pulse oximetry and chest radiography are unreliable as sole techniques for determining endotracheal tube location. During intubation, direct visualization of the endotracheal tube passing through the vocal cords into the trachea, especially with a video-laryngoscope, constitutes firm evidence of correct tube placement, but additional techniques should be used as objective findings to confirm proper endotracheal tube position.<sup>(1)</sup>

Continuous End Tidal Waveform capnography is the most reliable method for confirming the initial and ongoing placement and function of an advanced airway and is considered the standard of care for in-hospital advanced airway management. Given the availability of waveform capnography, unrecognized misplacement of an advanced airway should never occur. Although colorimetric devices and capnometry can confirm initial advanced airway placement, they are less sensitive and specific in low-flow states such as cardiac arrest.<sup>(2)</sup>

Continuous and non-waveform capnography may be less accurate for patients in cardiac arrest and those with markedly decreased perfusion. If capnography is inconclusive, other confirmation methods, such as an esophageal detector device, ultrasound, or bronchoscopy, should be used.<sup>(1)</sup> Esophageal detector devices have been shown to have false positives in several situations and should not be used as the sole confirmatory method. Re-visualization via direct or video-laryngoscopy may be required if the above methods are unavailable.

1. Ward MA. The American College of Emergency Physicians Policy Statement on Sepsis-based Fluid Resuscitation Thirsts for Supporting Evidence and Balance. *Annals of Emergency Medicine*. 2022 Mar 1;79(3):318-9.  
2. Davis DP, Bosson N, Guyette FX, Wolfe A, Bobrow BJ, Olvera D, Walker RG, Levy M. Optimizing Physiology During Prehospital Airway Management: An NAEMSP Position Statement and Resource Document. *Prehospital Emergency Care*. 2022 Jan 4;26(sup1):72-9.

# Damage Control Resuscitation Principles

Stop exsanguinating bleeding ASAP

Primary survey is now XABCDE (X = exsanguinating hemorrhage; coming to ATLS)

For abdominal bleeding this likely requires the operating room

Prevent hypothermia: Temp goal >36 C. or > 98.6 F.

Permissive hypotension: SBP <85mmHg until major bleeding is stopped

For treating bleeding: Whole Blood > platelets/plasma > RBC > Plasmalyte/Normosol > normal saline

Give calcium with massive transfusion: 1 gm at the start and with each round of MTP

Crystalloid & vasopressors are bad for bleeding patients.

If must use: Vasopressin > Vasopressors (eg, norepinephrine, phenylephrine, etc.)

Vasopressin 4 units IV to start > 0.04 units / minute infusion is standard dose

1. Holcomb JB, et al. Damage control resuscitation: directly addressing the early coagulopathy of trauma. *Journal of Trauma and Acute Care Surgery*. 2007 Feb 1;62(2):307-10.
2. Oyeniyi BT, et al. Trends in 1029 trauma deaths at a level 1 trauma center: impact of a bleeding control bundle of care. *Injury*. 2017 Jan 1;48(1):5-12.
3. Ferrada P, et al. Circulation first—the time has come to question the sequencing of care in the ABCs of trauma; an American Association for the Surgery of Trauma multicenter trial. *World Journal of Emergency Surgery*. 2018 Dec;13:1-6.
4. Martin RS, et al. Injury-associated hypothermia: an analysis of the 2004 National Trauma Data Bank. *Shock*. 2005 Aug 1;24(2):114-8.
5. Bickell WH, et al. Immediate versus delayed fluid resuscitation for hypotensive patients with penetrating torso injuries. *New England Journal of Medicine*. 1994 Oct 27;331(17):1105-9.
6. Hazelton JP, et al. Use of cold-stored whole blood is associated with improved mortality in hemostatic resuscitation of major bleeding: a multicenter study. *Annals of surgery*. 2022 Oct 1;276(4):579-88.
7. Guyette FX, et al. Prehospital blood product and crystalloid resuscitation in the severely injured patient: a secondary analysis of the prehospital air medical plasma trial. *Annals of surgery*. 2021 Feb 1;273(2):358-64.
8. Moore HB, et al. Forgot calcium? Admission ionized-calcium in two civilian randomized controlled trials of pre-hospital plasma for traumatic hemorrhagic shock. *The journal of trauma and acute care surgery*. 2020 May;88(5):588.
9. Cotton BA, et al. The cellular, metabolic, and systemic consequences of aggressive fluid resuscitation strategies. *Shock*. 2006 Aug 1;26(2):115-21.
10. Sims CA, et al. Effect of low-dose supplementation of arginine vasopressin on need for blood product transfusions in patients with trauma and hemorrhagic shock: a randomized clinical trial. *JAMA surgery*. 2019 Nov 1;154(11):994-1003.

These guidelines were prepared by the ADH (trauma medical consultant) and members of the Arkansas State Preventable Mortality Committee. They are intended to serve as guidelines based on a review of the current medical literature. They are not intended to be used as strict policies or protocols. Their use is at the discretion of the managing physician.



Arkansas Trauma System