EM CASES SUMMARY

Episode 118 Trauma – 1st and Last 15 Minutes Part 1

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Prepare the team, your gear and yourself for trauma resuscitation

Preparing the team for trauma

Prepare your team in the few minutes prior to the patient arriving in your ED based on the little information you have garnered from the EMS call, so that this complex logistical co-ordination can occur as an efficient flow [1].
Team-Based Preparation: 4 Discussion Points

1. What do we know? The stem that you receive from the EMS call
2. What do we expect to see/What are the possibilities? Run through the most likely immediate life-threatening issues/injuries
3. What do we do? And discuss contingencies if those actions fail. What is your response if the initial plan fails or does not produce expected results?
4. Role assignment. Assign logistical tasks to team members.

Preparing the gear for trauma resuscitation

Ensure that your ED has a well thought out trauma cart that clearly contains the gear that you may require, including a pelvic binder, thoracostomy kit, cricothyrotomy kit etc. When assigning roles, assign gear preparation with each role.

Preparing yourself for trauma resuscitation

Mental preparation, including visualization of complex tasks, deep breathing exercises, and positive self-talk to help focus.

Consider calling for help early (anesthesia, surgery, orthopaedics, paediatrics etc) if you work in a center that does not have a dedicated trauma team. Tie up loose ends with other patients in your ED if time permits before the trauma patient arrives, so that after you're done managing the trauma patient, your ED is not a disaster zone.

Resequencing the trauma resuscitation

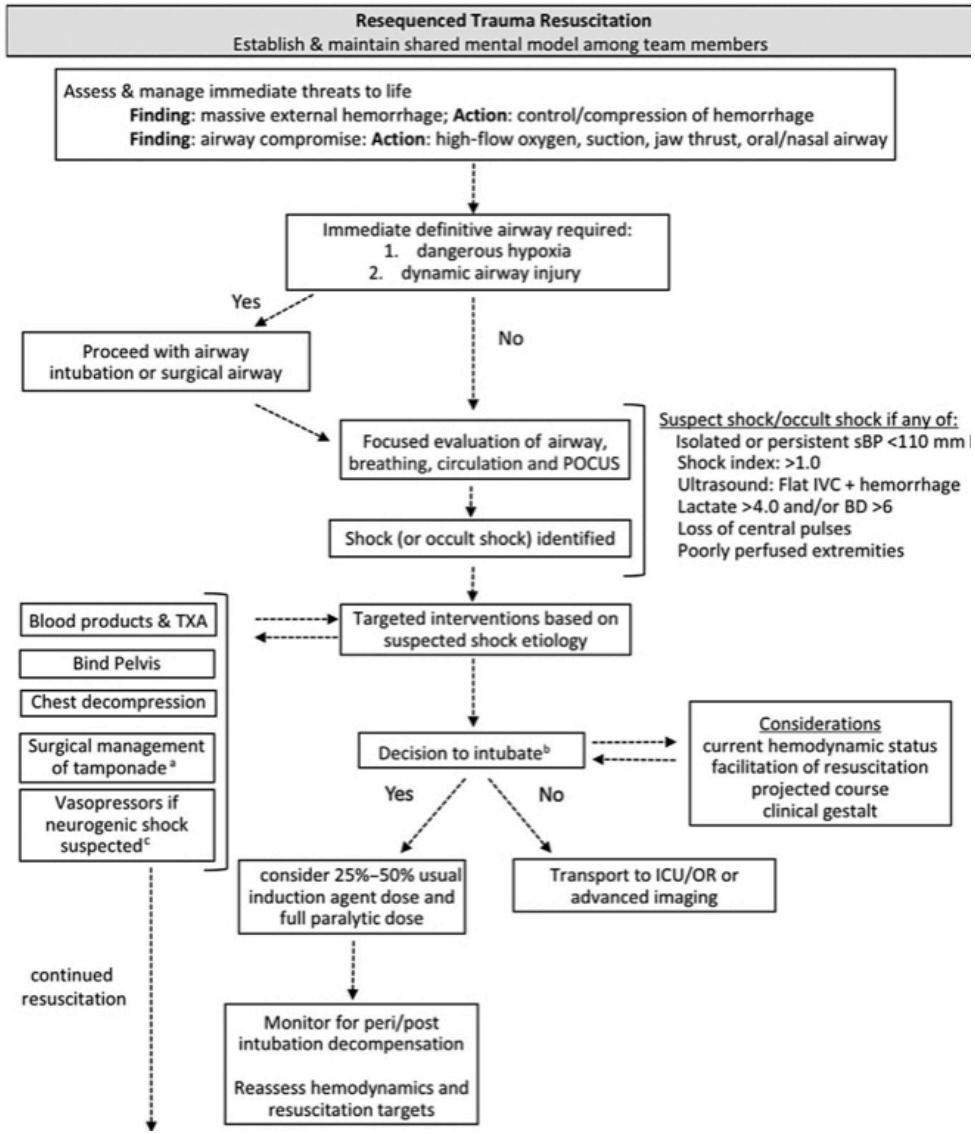
Intubation causes an increase in intrathoracic pressure, resulting in a decrease in right atrial pressure which negatively impacts both hemorrhagic and obstructive shock. Pre-intubation hypotension is a significant risk factor for postintubation cardiac arrest. Hence, the adage "resuscitate before you intubate" in volume depleted patients, and procedures to relieve obstructive shock such as bilateral finger thoracostomies and thoracotomy, should be considered prior to endotracheal intubation.

Focus on physiologic priorities rather than always "ABC". Tailor your approach to the most severe life-threatening injuries first. Vocalize your assessment and plan.

Two categories of immediate life-threats in trauma:

1. Massive external hemorrhage
2. Critical airway compromise a) *critical/refractory hypoxia* (<90% oxygen saturation despite maximal noninvasive ventilation) b) *dynamic airway* (anticipate evolving disruption of airway, head/neck injuries that are expected to worsen over the next few minutes)

Once these two immediate life threats have been ruled out or managed, resuscitation should focus on hemodynamic optimization *before* definitive airway management.



Occult shock in trauma resuscitation

The early identification of occult shock is important because under-recognition is associated with worse patient outcomes.
How to assess for occult shock in the first 15 minutes of trauma resuscitation

1. Calculate the *Shock index* (HR/SBP) [10] and/or *delta Shock Index*; if shock index > 1 or delta Shock Index ≥ 0.1, assume occult shock
2. Assess *the lowest* BP measured and trend of BP over time; if isolated or persistent SBP <110, assume occult shock [7]
3. FAST positive with flat IVC
4. Feel for the presence of peripheral pulses and look for signs of poorly perfused extremities
5. Altered LOA in the absence of severe head injury

Shock index >1 or Delta Shock Index ≥0.1 is a sign of occult shock and is predictive of post-intubation hypotension, transfusion requirements, injury severity and mortality

A single drop in BP in the field or in the ED is predictive of need for surgical intervention and mortality. An isolated decrease in SBP <105 mmHg is associated with a 12-fold increase in the need for immediate therapeutic intervention [6].

Pearl: When receiving handover from EMS ask not only the most recent BP but the *lowest* BP recorded.

Shock index is predictably *unreliable* in the following circumstances

1. Altered physiologic compensation (e.g. older patients [9]) – consider *delta shock index
2. Presence of underlying medical conditions (eg.. undertreated hypertension)
3. Medication-related disturbances (e.g. B-blockers)

*Delta shock index ≥0.1 predicts increased transfusion requirements and mortality and may be a more useful prognostication tool than shock index, especially in older patients and those with a history of untreated hypertension.

Pitfall: Prehospital hypotension that normalizes without intervention that is ignored. A single prehospital drop in BP may be a clue to impending catastrophic shock.

Early actions to consider in the first 15 minutes of trauma resuscitation

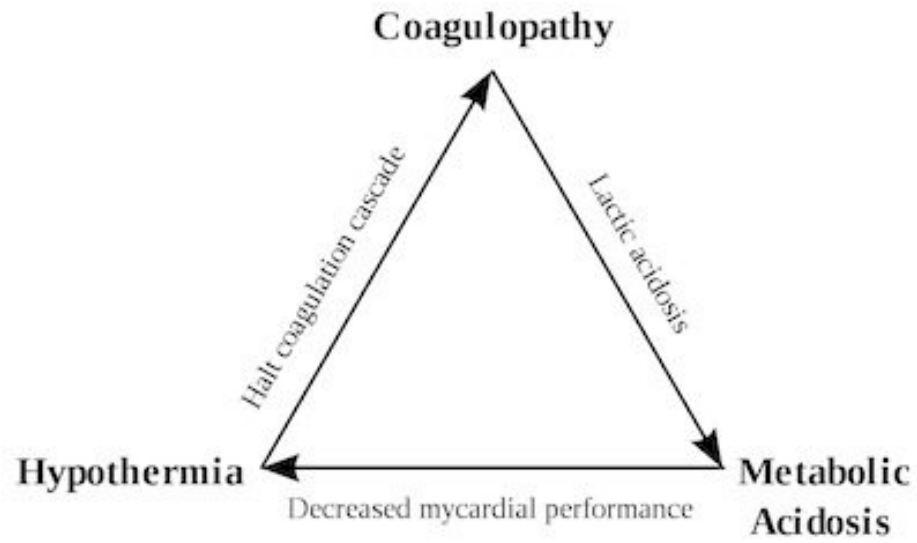
1. Direct pressure/tourniquet on wounds/splint obvious fractures
2. Bilateral finger thoracostomies
3. Pelvic binder application
4. IV tranexamic acid
5. Blood products/massive transfusion protocol
6. Call to trauma center - request transfer/retrieval as soon as the need for higher level of trauma care is presumed
7. Vasopressors only if neurogenic/spinal shock suspected

Vascular access in the first 15 minutes of trauma resuscitation

Two short large bore peripheral IVs are recommended for initial vascular access in the trauma patient.
If a peripheral IV cannot be rapidly obtained a humerus IO with pressure bag has adequate infusion rates but should be used only as a bridge to venous access and should be checked frequently for flow.
A central line is not mandatory if two well running peripheral lines are established but should be considered for patients requiring long transport times or when REBOA is being planned.

Volume resuscitation, volume challenge, controlled resuscitation and early resuscitation targets

Consider the following before volume resuscitation. *The patient that is bleeding may not appear to be in shock, and the patient who is in shock may not be actively bleeding*. Your job is to not only identify shock/occult shock but to identify active bleeding, obstructive and spinal shock.
Large volumes of crystalloid contribute to the trauma "triangle of death" (metabolic acidosis, hypothermia and coagulation derangements).



Consider a *volume challenge* to assess for active occult hemorrhage. 250mL of crystalloid under pressure followed by assessment of signs of perfusion. If a patient transiently responds to 250mL of crystalloid, you may assume active occult hemorrhage. If there is no response consider other causes of shock (obstructive, spinal). If you suspect active occult hemorrhage based on severe mechanism (e.g. fall from 7 stories), clinical assessment and/or volume challenge, start blood products ASAP.

Controlled resuscitation (previously termed "permissive hypotension")[13]. While there are fairly well studied resuscitation targets in the first few *hours* of trauma resuscitation (urine output, lactate clearance, base deficit etc), there is little to guide us in the first 15 minutes of trauma resuscitation. If there is a delay to starting blood transfusion in a patient presumed to have hemorrhagic shock, consider only small boluses of crystalloid (i.e. 250mL), just enough to maintain adequate tissue perfusion (peripheral pulses present in blunt trauma or central pulses in penetrating injury) and maintain a SBP ≥ 70. For most trauma patients consider targeting this SBP throughout your resuscitation. This approach has been termed "*Controlled Resuscitation*" and is recommended by our experts a reasonable early resuscitation target. One prospective RCT showed a NNT

of 11 for inhospital mortality [13]. Keep in mind the elderly patient, the patient with uncontrolled hypertension at baseline, the patient with a major head injury and the patient with spinal shock, may require adjustment in their BP target.

Indications for massive transfusion and resuscitation intensity in trauma resuscitation

Formula to assess which patients need massive transfusion protocol (MTP)

Clinical judgment + Mechanism of injury + Pitfall conditions

It is important to identify early on if your patient requires MTP and the logistics of how to administer it.

Step 1: If the patient is in an obvious shock state, *or* shock index is >1 [11], *or* delta shock index is ≥0.1 [16], *or* has an **ABC score** ≥ 2* [14], activate the MTP.

Step 2: If none of these are present, consider the *resuscitation intensity* [19,20]: patients who require 4 units of any combination of crystalloids or blood products to maintain adequate perfusion are considered to have high resuscitation intensity which predicts higher mortality, and should be considered for a MTP.

***ABC score** [14]
1 point for each of: penetrating injury, positive FAST, SBP ≤90, HR ≥120.
A score of ≥2 indicates requirement for activation of MTP

Pitfall conditions - consider a lower threshold for activating MTP

- Anticoagulation - patients taking anticoagulants are not well represented in MTP studies; have a lower threshold for calling for blood
- Elderly
- Medications such as B-blockers

How to give MTP

Give the MTP in balanced blood products 1:1:1 [18]. Although the ratio of red cells to FFP to platelets is meant to be 1:1:1 over the first 24hrs, that does not mean the patient requires FFP and platelets immediately in the ED. Rather, give 4 units of red cells up front as they can usually be delivered faster that FFP and platelets.

Take Home Points for Trauma - The First and Last 15 Minutes Part 1

- Prepare your team, your gear and yourself prior to patient arrival with 4 discussion points, assigning specific gear preparation to specific team members and mental preparation
- Resequence the trauma resuscitation by managing massive external hemorrhage and active/dynamic airway first, then concentrating on hemodynamic optimization before definitive airway management in those patients without active/dynamic airways
- Identify occult shock using shock index >1, delta shock index ≥0.1, the lowest BP recorded, FAST/IVC, a fluid challenge and clinical exam
- Consider the patient's age, blood pressure medications and baseline blood pressure in assessing for occult shock, interpreting the shock index and in deciding to activate massive transfusion protocol
- Early actions to consider include control of massive external hemorrhage, bilateral finger thoracostomies, pelvic binder, tranexamic acid, activation of massive transfusion protocol and call for help

- Two large bore IVs are the preferred initial access in most trauma patients
- Avoid transferring a patient long distances with IO access only
- Large volumes of crystalloid may lead to the "triangle of death"; your goal should be no crystalloid
- Controlled resuscitation to a target SBP of ≥70 is reasonable in most young, otherwise healthy trauma patients presumed to be in hemorrhagic shock
- Use clinical judgement, mechanism of injury, pitfall conditions, shock index and resuscitation intensity to help in decisions to activate massive transfusion protocol

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