

## Trauma Patient Stability

EMS providers in the field and physicians in the ED are faced with rapidly assigning some degree of stability to the patients they treat. **What exactly are the shades of stability, and what considerations are there for each degree?**

In my mind, there are three levels of "stability":

- **Unstable** - this one is easy to figure out. The patient has obvious physiologic compromise, which may be objective (low blood pressure, low GCS or poor neuro exam, etc) or subjective (just plain looks bad).
  - **EMS:** These patients need transport to an appropriate level trauma center (I or II) immediately. If they need airway control or IV access that can't be obtained in the field, stop at the nearest Level III or IV for assist, then continue on your way FAST.
  - **ED:** These patient must be a trauma activation. If not activated as your top-tier trauma, activate or upgrade now! These patients must be seen by a trauma surgeon immediately, and can only go to the OR. No diagnostics

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### TRAUMA CALENDAR OF EVENTS

#### WESTERN TRAUMA ASSOCIATION ANNUAL MEETING

LOCATION: TELLURIDE, COLORADO

DATE: MARCH 1-6, 2015

#### TRAUMA, CRITICAL CARE & ACUTE CARE SURGERY 2015

LOCATION: CAESAR'S PALACE, LAS VEGAS, NEVADA

DATE: MARCH 23-25, 2015

outside the resuscitation room are allowed unless they can be converted into one of the two stability levels below.

- **Stable** - this one is usually easy to figure out, too. These patients look good, have good vitals, and a low to moderate energy mechanism for their trauma. Look out for those few patients that may be hiding something like moderate bleeding into some body cavity.
  - **EMS:** Follow your usual transport protocols to select the closest, appropriate hospital.
  - **ED:** Follow your standard protocols for trauma activation if needed. Transport for standard imaging is fine.
- **Metastable** - this is a term I invented. It describes patients who have evidence of ongoing volume loss that can be controlled with infusion of crystalloid and/or blood products. It is possible to maintain a certainly level of stability using higher than normal volume infusions. This allows physicians to consider diagnostics or interventions outside of an OR.

- **EMS:** Ensure adequate IV access and give fluids and/or blood per your local protocols. Transport to a Level I or II trauma center as quickly as possible.
- **ED:** Activate or upgrade to your highest level of trauma activation. The trauma surgeon needs to be present to help direct diagnostics or interventions. These patients may go to CT, IR or other appropriate areas with nurse and physician accompaniment to diagnose and possibly treat bleeding. If the patient changes to unstable at any point, they must immediately be taken to the OR.

## Does Initial Hematocrit Predict Shock?

### Everything you know is **WRONG!**

The classic textbook teaching is that **trauma patients bleed whole blood**. And that if you measure the hematocrit (or hemoglobin) on arrival, it will approximate their baseline value because not enough time has passed for equilibration and hemodilution. As I've said before, **you've got to be willing to question dogma!**

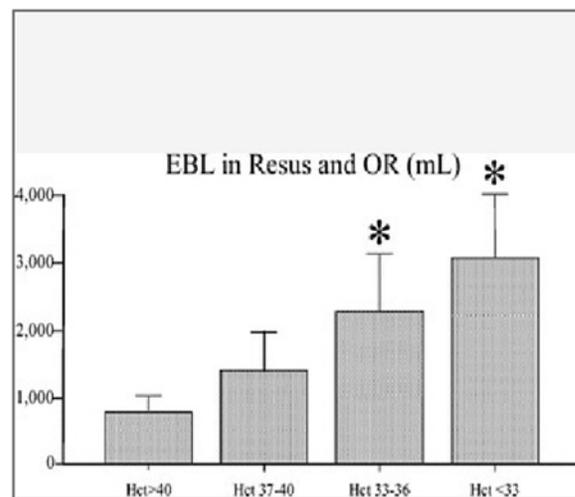
The trauma group at Ryder in Miami took a good look at this assumption. They drew initial labs on all patients requiring emergency surgery within 4 hours of presentation to the trauma center. They also estimated blood loss in the resuscitation room and OR and compared it to the initial hematocrit. And they compared the hematocrit to the amount of crystalloid and blood transfused in those areas.

Refer to the diagram in the next column.

Patients with lower initial hematocrits had significantly higher blood loss and fluid and blood replacement during the initial treatment period. Some of this effect may be due to the fact that blood loss was underestimated, or that prehospital IV fluids diluted the patient's blood counts. However, this study appears sound and should prompt us to question the "facts" we hear every day.

**Bottom line: Starling was right! Fluid shifts occur rapidly, and initial hematocrit or hemoglobin may very well reflect the volume status of patients who are bleeding rapidly. If the blood counts you obtain in the resuscitation room come back low, believe it! You must presume your patient is bleeding to death until proven otherwise.**

Reference: *Initial hematocrit in trauma: A paradigm shift? J Trauma 72(1):54-60, 2012.*



## Not All Plasma Is Created Equal

Trauma patients who either have, or are at risk for coagulopathy, routinely have plasma administered. This provides coagulation factors to make up for lower levels in the injured patient and promotes the ability to clot. All hospitals with a blood bank have fresh frozen plasma (FFP) on hand, and busier ones may have thawed plasma (TP) available so that the patient does not have to wait the 45 minutes or so that it takes to thaw FFP.

But does freshly thawed FFP behave like thawed plasma that's been sitting around for a while? The University of Texas - Houston trauma group presented some work that looked at this issue at the AAST conference last September. They looked at differences between freshly thawed FFP and plasma that had been thawed for 5 days. They examined the plasma's ability to generate thrombin, the kinetics of clot formation along with the clot's strength and stability, and clotting factor assays.

They found that the older thawed plasma showed decreased clotting potential, as well as diminished amounts of coag factors, especially V, VIII, von

Willebrand factor and Protein S. The clotting response (measured by TEG) was slower and took longer to develop the maximum amount of clot.

**Bottom Line: Older thawed plasma does not function the same as freshly thawed FFP in the lab. We don't know if this difference has clinical significance in the coagulopathic trauma patient. However, it seems prudent to ask for the freshest bags of thawed plasma during massive transfusion in hospitals that use it.**

*Reference: Multiple levels of degradation diminish stored plasma's hemostatic potential. Holcomb et al. Oral presentation #10, 69th Annual Meeting of the AAST, September 22, 2010.*

## Can I Take A Hypotensive Patient To CT?

Hypotension and CT scanners don't play together well. For years I've cautioned against this, having seen a number of patients crash and burn in this area early in my career. But it's a common error, and may jeopardize your patient's safety. A paper that is now in press looked at this practice in a trauma hospital in Taiwan.

Patients who had blunt abdominal trauma were retrospectively reviewed. Those who remained hypotensive (SBP<90) after 2L of crystalloid were scrutinized. The CT scanner was described as being located in the same area as the ED resuscitation rooms. Furthermore, several physicians and nurses were present during scans, and a full selection of resuscitation equipment was available in the scan area.

Here are the factoids:

- 909 patients were entered into the study
- Only 91 patients remained hypotensive after initial resuscitation, and only 58 of these were scanned before definitive management
- As expected, patients who were hypotensive after initial resuscitation had more serious injuries (ISS 22 vs 12), required more blood transfusions (938 vs 202 cc), and had a higher mortality (10% vs 1%).

- There were no significant differences in comparing hypotensive patients who went to CT scan vs those who did not if they underwent some sort of hemostatic procedure (laparotomy, angioembolization)
- In the hypotensive patients, **time to OR** in the CT scan group was **58 minutes vs 62 minutes for those who skipped the scan.**
- In the same patients, **time to angio** in the CT scan group was **147 minutes vs 140 minutes without a scan first.**

The authors conclude that "hypotension does not always make performing a CT scan unfeasible." (weak!)

**Read this paper closely and don't get fooled!** It is very retrospective and very small. And if you look at the times carefully, you will see some funny business. How can time to OR or angio be virtually identical regardless of whether CT is used? Is it the world's closest, fastest scanner? Probably not.

The authors showed that hypotensive patients have a ten-fold increase in mortality. They also recognized that definitive control of hemorrhage is the key to saving the patients. Unfortunately, there are factors in this retrospective study, such as various biases and some undocumented factors that make their two patient groups look artificially alike. This gives the appearance that the CT scan makes no difference.

In reality, the fact that there is no difference in times ensures that there is no clinical difference in outcome. To really answer this question, this kind of study must be done prospectively, and must have an adequate population size.

**Bottom line: Don't even consider going to CT with hypotensive patients. Even if you have the fastest, closest scanner in the world. Shock time still kills, and most CT scan rooms are very poor resuscitation rooms. If your patient is unstable in the ED, do your ABCs, get a quick exam, then transport to the area where you can get control of the bleeding. This will nearly always be your OR.**

*Reference: Hypotension does not always make computed tomography scans unfeasible in the management of blunt trauma patients. Injury 46(1):29-34, 2015.*

# Pelvic Fractures: OR vs Angio In The Unstable Patient

One of the cardinal rules of trauma care is that **hemodynamically unstable patients can only go to the operating room from the ED.** No trips to CT, xray, etc. Trauma professionals occasionally try to make exceptions to the rule, but it usually doesn't work out.

Well, what about the patient with severe pelvic fractures who is or becomes unstable? Pelvic fracture bleeding is not always easy or even possible to control in the OR, and angiography offers a way to identify and stop the bleeding, right?

The trauma group at Ryder in Miami did a lengthy (13 year) retrospective review of their experience with these patients. They looked at every patient who underwent angiography, then identified the subset that went to the OR followed by angiography. There were 134 angio patients and 49 OR to angio patients on whom they based their analysis. Obviously, there is plenty of opportunity for bias in this study, and many of the study patients identified had to be excluded due to incomplete records.

Patients who went to the OR first tended to have similar injury severity but were sicker than the angio alone group. Crystalloid and blood resuscitation volumes were significantly higher in the OR group as well. Most of these patients underwent a laparotomy, and 64% had active intra-abdominal bleeding. None died in OR, and most were left with a damage control abdominal closure.

In the angio group, there were really 2 subsets: angio alone, and angio followed by OR. Mortality in the angio alone group was similar to the OR-angio group. But deaths skyrocketed in those who went from angio to OR (67% vs 20%). This is likely due to them failing angiographic management of bleeding. Three patients died in the angio suite.

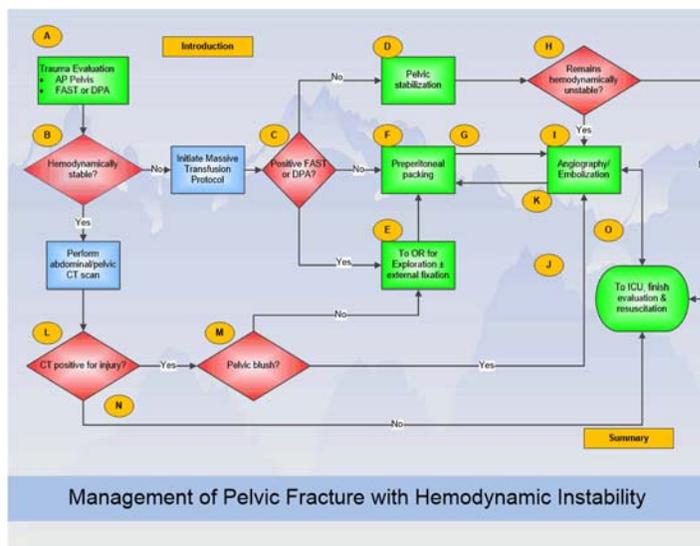
**Bottom line: There's a lot of data in this paper, and some of the results can be explained by selection bias. However, they appear to support algorithms released by EAST and the WTA (see diagram above). In general, a trauma patient with severe pelvic fractures and hemodynamic instability needs to go to OR to identify and treat any source of intra-abdominal bleeding. If pelvic bleeding remains a problem, preperitoneal packing may be considered, followed by a trip to angio at that point. The rule that unstable patients should only go to OR (or an ambulance bound for a trauma center if there is no OR) still holds!**

**And soon, as hybrid ORs become more commonplace, we won't even have to make this decision. Trauma, orthopedic, and vascular teams can all work at the same time in the same place!**

### References:

*Operating room or angiography suite for hemodynamically unstable pelvic fractures? J Trauma 72(2):364-372, 2012.*

<http://www.westerntrauma.org/algorithms/PelvicFractureNotes/References.html>



			
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