Bleeding Control, Management, Replacement

UCLA Paramedic Transition Course 2013
Tony Melendez, RN BS, MICN EMS Educator

Wow…

- Loss of circulating blood volume from **hemorrhage** is the most common cause of shock in trauma patients

- As stated elsewhere today…
- Approx ½ of all trauma deaths occur from CNS injury
- **Approx 1/3 of all trauma deaths occur from exsanguinations**
- Significant drops in BP are generally not manifested until **up to 30%** of a patient's blood volume is lost!

Traumatic Bleeding

- As a result of hemorrhage in the body…
- The body responds with a compensatory stimulation of the sympathetic nervous system to maintain oxygen delivery to the tissues.
- You develop…
- Increased ventricular contractility…
- Leading to increased HR and SV…
- Increased RR…
- Vasoconstriction…

Traumatic Bleeding

- As the shock state progresses…
- Vital organ perfusion (heart & Brain) can only be maintained at the expense of non-vital organs.

- If shock not reversed…
- Progressive lactate production leads to worsening systemic metabolic acidosis…
- Which along with hypoxemia ….
- Ultimately leads to loss of peripheral vasoconstriction & cardiovascular collapse

Sympathetic VS. Parasympathetic Nervous System Action

- SNS (excitatory)
- Increased
  - cerebral perfusion
- Increased
  - heart rate
- Increased
  - blood flow to skeletal muscles
- Decreased digestion
- Pupils dilate
- Bronchial dilation

- PSNS (inhibitory)
- Decreased
  - cerebral perfusion
- Decreased
  - heart rate
- Decreased
  - blood flow to skeletal muscles
- Increased digestion
- Pupils constrict
- Bronchial constriction

Important signs of evolving hemorrhage

- Tachycardia
- Hypotension
- Cool extremities
- Weak peripheral pulses
- Prolonged Cap refill (> 2 secs)
- Narrowing pulse pressure (< 25 mmhg)
- AMS w/o head injury

- Traumatic shock from hemorrhage most commonly comes **from blunt intraabdominal injury**

What Blood loss looks like

Classes of Hemorrhage based on clinical presentation

- Class I: (up to 15%)
  - HR = normal or minimally elevated
  - BP = normal
  - Pulse pressure = normal
  - Respiratory rate = normal

- Pulse pressure = SBP – DBP
  - If your BP = 120/80….your PP = 40
  - If your BP = 70/40….your PP = 30

Pulse Pressure

- A pulse pressure is considered abnormally low if it is less than 25% of the systolic value.
- The most common cause of a low (narrow) pulse pressure is a drop in left ventricular stroke volume.
- In trauma …
- a low or narrow pulse pressure suggests **significant blood loss**
- (insufficient preload leading to reduced cardiac output).

Moderate Bleeding

Class II: (15 to 30%)

- Tachycardia (100 – 120/min)
- Tachypnea (20 -24/min)
- Decreased Pulse pressure
- **Minimal SBP drop if at all**
  - (primary HR compensation occurs)
- Skin signs evident
  - cool, clammy, delayed cap refill

Severe Bleeding…!

Class III: (30-40% loss)

- BP drops significantly
  - (any BP less than 90!)
  - (BP drops 20 -30% from initial measure!)
- Changes in Mental Status
  - Disorientation, Poor STM, can't focus attention
  - Agitation, Anxiety
- HR > 120/min
- Mod Tachypnea
- Delayed Cap refill

Critical Hemorrhage…!

Class IV: (> 40% loss)

- Significant BP loss
- + AMS
- Pulse Pressure narrows (< 25 mmhg)
- Cold, Pale skin with delayed cap refill
- No urine being produced
- Absent peripheral pulses

How Much Blood Do We Have…?

- Average Human blood volume = 70 – 90 ml/kg
- Therefore…
- If you weigh 180 lbs…
- You have 80ml x 81.8kg = **6.54 L**
- **(30% loss = 1.9L)**

- If you weigh 65 lbs (my 6 y/o)
- You have 90ml x 29.5kg = **2.65 L**
- **(30% loss = 750ml)**
- **Little over 3 cups to lose…**

Where do Trauma pts bleed…

Large scale bleeding occurs at 5 possible locations

1. Major external wounds
   - Thigh can hold one to two L of blood
2. Chest (thoracic cavity)
   - Cardiac Tamponade, Tension Pneumothorax
3. Abdomen (peritoneal cavity)
4. Retroperitoneum (from Pelvic Fx)
   - Pelvic cavity can hold **50%** blood volume
5. Scalp & Face wounds can bleed profusely & are overlooked, possibly under-appreciated

Control Bleeding…ACT!

- Direct Pressure
  with Bulky Padding and Elastic Bandage (wet better)
- Apply Cloth Circumferential Peritoneal Binder
- Tourniquets (“two-two-two”)
  - 2 “ proximal of amputated or mangled extremity
  - 2” is minimal for width of constricting band
  - 2 hours is the longest it should be in place (some literature says release after 45 min)
- Establish 2 large bore IV’s (#14, #16, #18)
- Infuse 0.9 NS or LR for 2L as fast as possible.
- Begin massive transfusion protocol for ongoing bleeding
  - PRBC, FFP, Platelets @ a ratio of …**1:1:1**
  - Avoids Hemo-dilution & Coagulopathy
  - Avoid Hypothermia during resuscitation

Fluid resuscitation controversy

- Debate continues over best fluid for resuscitation of hypovolemic shock
- LR or NS?
- Large volumes of 0.9NS can lead to
- Hyper-chloremic metabolic acidosis
- Large volumes of LR can lead to
- Metabolic Alkalosis
- Large volumes of isotonic crystalloids will lead hemo-dilution , coagulopathy and hypothermia
- My research found favor for 0.9NS for up to 50ml/kg then switch to LR for patients requiring additional IV fluids
    - ***www.Uptodate.com 2013:**
      Initial evaluation and management of of shock in Adult trauma

Endpoints for IV fluid bolus wide open

- Clear endpoints remain undefined.
- Always evaluate pt response to initial fluids and overall condition
- MAP = > 65 mmhg or
- A SBP = > 90 mmhg
- Is a reasonable goal with penetrating trauma
- For TBI …
- MAP > 105 or…
- SBP > 120 mmhg is reasonable

- The goals are..

1. Limit ongoing blood loss
2. Restore intravascular volume
3. Maintain adequate oxygen delivery

- Direct Pressure
- IV Fluids
- High flow O2

FAST SCAN

- Focused Assessment with Sonography for Trauma
- Is Ultrasound
- is an integral diagnostic tool used early on in ED trauma care.

- Looks for…
- Hemo-peritoneum (pericardial effusion)
- Intra-abdominal bleeding (peritoneal blood)

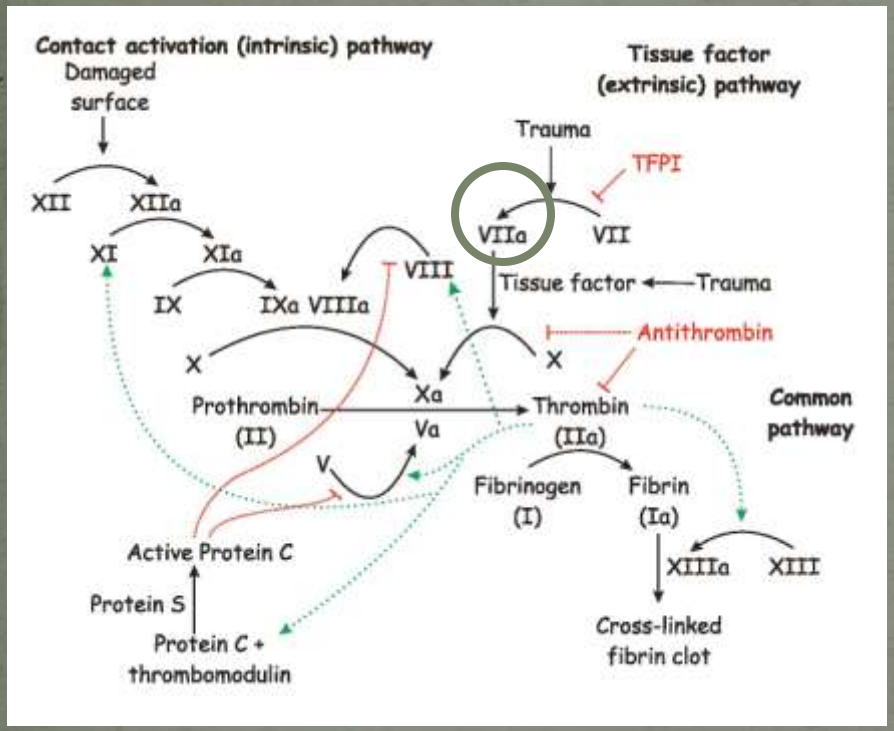
Hemostasis

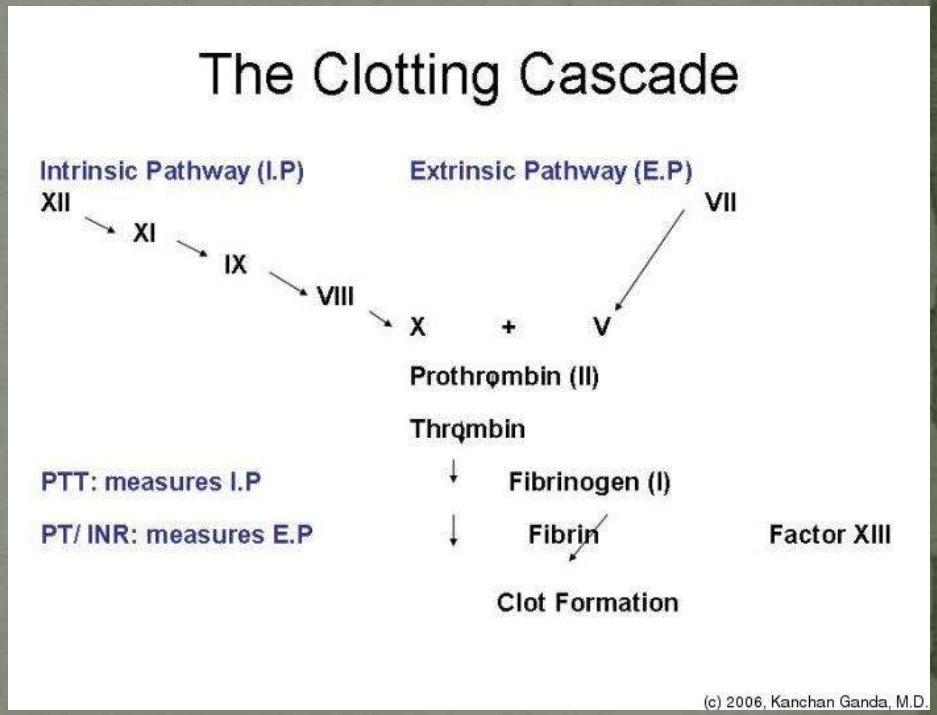
- The human clotting process is dynamic, highly interwoven array of multiple processes.
- Important point
- At any given moment the body, in effort to maintain homeostasis, is ready to drop the clot cascade into hemostasis and…
- At the same moment, is ready to mobilize anti-clot sequences to prohibit an unnecessary clot , say in the calf of coronary artery!

Blood Clotting made simple…?

Clotting process or …
Tampa Bay Offense..?

Roman numerals
indicate Protein mediators





Four Important Phases

I. Initiation and formation of platelet plug
   - (Platelet aggregation after activation)
II. Propagation of the clot by the coagulation cascade
III. Termination of clot by anti-thrombotic control mechanism
   - (anti-thrombin)
IV. Removal of the clot by fribinolysis*

When the process works correct…

- When the processes of clot formation and clot lysis are appropriately linked…
- A clot is laid down to initially stop bleeding…
- Followed later by clot lysis and tissue remodeling.

- Diminished clot generation (ASA, Coumadin)
- or enhanced clot lysis (Tpa)
- Can lead to abnormal bleeding…
- While excessive clot formation
- or reduced clot lysis
- can lead to excessive thrombosis (ACS, PE, DVT)

Novel hemostatic approaches

- Hemostatic agents
- Chitosan dressing
- Quickclot powder
- Fibrin sealant dressing
- All products used by military in combat
- Few controlled studies with civilians
- Unclear how to be used by civilian EMS

Tranexamic Acid

- Anti-fibrinolyic agent that may be of benefit in controlling bleeding following trauma
- Came out of CRASH-2 study
- Involved 274 hospitals in 40 countries, over 20,000 patients
- Overall mortality was lower
- Death from hemorrhage was lower
- No difference in complications were noted (PE, DVT)
- When given within 1-3 hours
- Increased mortality given after 3 hours
- A follow-up study confirmed benefit
- Limited study in USA
- Best place to administer may be the pre-hospital setting!

Blood Factor VIIa

- Off label use
  widespread in military for injured soldiers
  with severe hemorrhage

Questions….?