# TRAUMATIC SHOCK





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# An introduction to traumatic shock!!

- Carries a 30% to 40% mortality rate
- Responsible for 50% of traumatic death in first 24 hours.
- Principals of fluid resuscitation in traumatic shock:
- 1-Restore intravascular volume
- 2-Prevent or correct coagulopathy

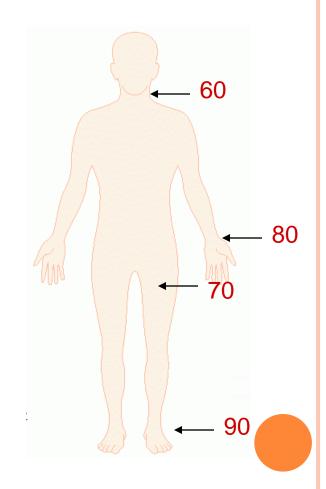
#### Clinical features

- Depends on
- 1. The cause, rate, volume and duration of volume loss or bleeding
- 2. The effect of current medications
- 3. Patient's baseline physiologic status

Classification of hemorrhage severity as a percentage of blood volume loss based on vital signs in NOT accurate and SHOULD NOT be used to guide ED resuscitation!!!!

## SHOCK

- Do you remember how to quickly estimate blood pressure by pulse?
- If you palpate a pulse, you know SBP is at least this number



## Hypovolemic Shock

#### **Empirical Criteria for Diagnosis of Circulatory Shock\***

- Ill appearance or altered mental status
- Heart rate >100 beats/min
- Respiratory rate >20 breaths/min or PaCO2 <32 mm Hg
- Arterial base deficit <-4 mEq/L or lactate >4 mM/L
- Urine output <0.5 mL/kg/hr
- Arterial hypotension >30 continuous minutes duration

\*Regardless of cause, Four criteria(majority) should be met



#### TABLE 3-1 SIGNS AND SYMPTOMS OF HEMORRHAGE BY CLASS

CLASS I	CLASS II (MILD)	CLASS III (MODERATE)	CLASS IV (SEVERE)
<15%	15–30%	31–40%	>40%
$\leftrightarrow$	↔/↑	1	1/11
$\leftrightarrow$	$\leftrightarrow$	↔/↓	1
$\leftrightarrow$	1	1	1
$\leftrightarrow$	$\leftrightarrow$	↔/↑	1
$\leftrightarrow$	$\leftrightarrow$	1	11
$\leftrightarrow$	$\leftrightarrow$	1	1
0 to -2 mEq/L	-2 to -6 mEq/L	-6 to -10 mEq/L	-10 mEq/L or less
Monitor	Possible	Yes	Massive Transfusion Protocol
	<15%	<15% ←	CLASS I       CLASS II (MILD)       (MODERATE)         4 5%       15-30%       31-40%         4  ←       ←       ←         4  ←       ←       ←         4  ←       ←       ←         4  ←       ←       ←         4  ←       ←       ←         5  ←       0       to -6         4  ←       to -10       mEq/L

<sup>&</sup>lt;sup>a</sup> Base excess is the quantity of base (HCO $_3$ -, in mEq/L) that is above or below the normal range in the body. A negative number is called a base deficit and indicates metabolic acidosis.

# Diagnosis

- Vital signs offer little value
- Oxygen debt develops in tissues when oxygen delivery does not meet the metabolic demands
- Oxygen debt is the only physiologic measure that has clearly been linked to mortality and morbidity
- Lactate and base deficit are using as resuscitation monitors in shock

# **Treatment:**

- Begins in prehospital!!!
- Restore intravenous volume
- Maintain oxygen-carrying capacity
- Limit ongoing blood loss
- Prevent coagulopathy

# A,B then C!

- Achieve SpO2> 94%
- Hemostatic hypotensive rescucitation
- BP goals: SBP: 90 mmHg
- SHOULD NOT be used in patients with myocardial disease, cerebral ischemia or traumatic brain injury

# Magical fluids!!!!

- Isotonic crystalloids: normal saline, lactated ringer
- Large volume infusion can cause neutrophil activation
- Lactated ringer can increase cytokine release or cause lactic acidosis
- Normal saline can cause hyperchloremic acidosis or intracellular K depletion
- Colloid solutions: have no proven consistent benefit!

# INFUSION RATES



$\underline{\text{Access}}$	Gravity	<u>Pressure</u>
18 g peripheral IV	50 mL/min	150 mL/min
16 g peripheral IV	100 mL/min	225 mL/min
14 g peripheral IV	150 mL/min	275 mL/min
8.5 Fr CV Line	200 mL/min	450 mL/min

## **ISOTONIC FLUIDS:**

TABLE 13-3 Isotonic Fluid Composition*							
Fluid	Na+ (mmol/L)	K+ (mmol/L)	Ca <sup>++</sup> (mmol/L)	Mg <sup>++</sup> (mmol/L)	CL <sup>-</sup> (mmol/L)	Buffer (mmol/L)	Osmolarity (mOsm/L)
Normal saline	154	0	0	0	154	None	308
Ringer's lactate	130	4	1.4	0	109	28 lactate	273
Ringer's acetate	130	5	1	1	112	27 acetate	276
Hartmann's	131	5	2	0	111	29 lactate	278
Plasma-Lyte A®	140	5	0	1.5	98	27 acetate 23 gluconate	294

### Transfusion In Traumatic Shock

- Using only PRBC may not restore tissue oxygen
- FFP can be kept in 1-6 C for up to 5 days
- Universal donor for FFP is AB+

#### Predictors for massive transfusion need:

- 1. Penetrating mechanism
- Positive FAST examination
- 3. SBP<90
- 4. PR>120

 High plasma to PRBC ratio resuscitation offer a better survival benefit

Best ratio for PRBC:FFP:Plt is 1:1:1

• Tranexamic acid has a survival benefit if started in first 3 hours of injury: 1 gram in 10 min then 1 gram in 8 hours infusion.

 Most massive transfusion protocols include calcium administration and monitoring ionized calcium.

#### **MASSIVE TRANSFUSION:**

#### Massive Transfusion Protocol (MTP) - ADULT

#### Appropriate initial interventions:

- . Intravenous access 2 large bore IVs and Central Venous Cath
- Labs: T&S, CBC, Plts, INR, PT, PTT, Fibrinogen, Electrolytes. BUN/Creatinine, ionized calcium
- . Continual monitoring: VS, U/O, Acid-base status
- Aggressive re-warming
- Prevent/Reverse acidosis
- Correct hypocalcemia: CaGluconate or CaCl
- Target goal ionized calcium 1.2–1.3
- If use CaCl 1 gm, give slowly IV
- Repeat lab testing to evaluate coagulopathy
- · Stop crystalloid avoid dilutional coagulopathy

#### Other considerations:

- · Cell salvage: Anes Tech via front desk
- . Heparin reversal: Protamine 1 mg IV/100 U heparin
- Warfarin reversal: Vitamin K 10 mg IV: consider prothromin CC
- Chronic Renal Failure or VW Disease: DDAVP
  - 0.3 microgram/kg IV x 1 dose
- · Consider antifibrinolytics:
  - · Tranexamic acid 10 mg/kg IV
  - . Amicar 5 gm IV bolus then 1 gm/hr IV infusion

#### Additional help

Anesthesia: Page

#### General Guidelines for Lab-based Blood Component Replacement in Adults:

Product	Threshold	Dose
RBCs	No threshold	MD discretion
FFP	INR >1.5	4 units FFP
Platelets	<100,000	One 5-pack Plts
Cryoprecipitate	Fibrinogen <100	Two 5-packs cryoprecipitate

#### Identify and Manage Bleeding

(Surgery, Angiographic, Embolization, Endoscopy)

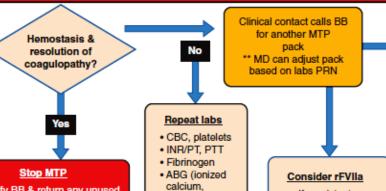
Adult: 4U RBCs in <4 hours and ongoing bleeding

#### Clinical Team Activates MTP & Designates Clinical Contact

Clinical Contact Phones Blood Bank (BB) and:

- Provides name of clinical contact person to BB
- · Provides MR#, sex, name, location of patient
- Records name of BB contact, calls if location/contact information changes
- · Sends person to pick up the cooler
- Ensures that MTP protocol electronic order is entered

### BB prepares MTP pack; transfuse as 1:1:1 ratio MTP pack: 6U RBCs; 4U FFP; one (1) 5-pack platelets



potassium,

hematocrit)

lactate.

- Notify BB & return any unused blood ASAP
- Resume standard orders
   D/C MTP electronic order

- If persistent coagulopathy
- 90 micrograms/kg

FIGURE 13-4. Massive transfusion protocol (MTP) from the University of Michigan's Level I Trauma Center. ABG = arterial blood gas; D/C = discontinue; DDAVP = desmopressin; FFP = fresh frozen plasma; MD = physician; Plts = platelets; PT = prothrombin time; RBCs = red blood cells; T&S = type and screen; U/O = urine output; VS = vital signs; VW = von Willebrand's.



