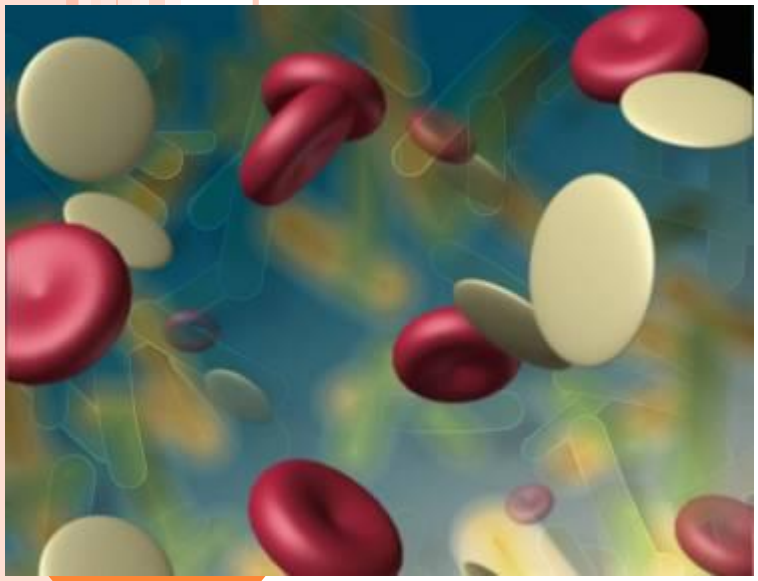
Traumatic Shock



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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

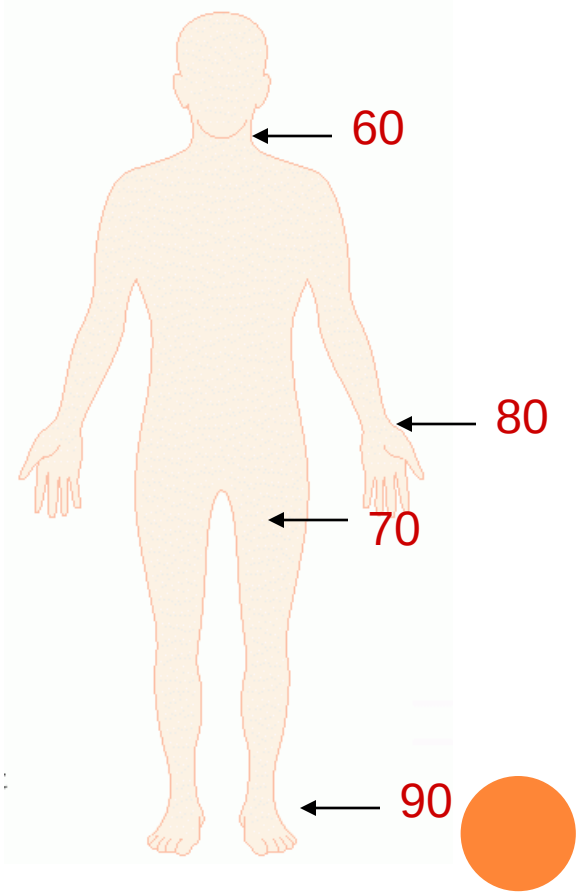
- Depends on

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

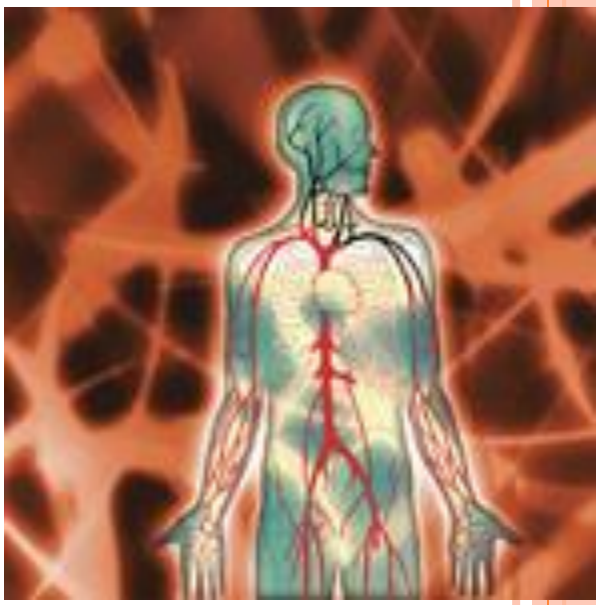


TABLE 3-1 SIGNS AND SYMPTOMS OF HEMORRHAGE BY CLASS

PARAMETER	CLASS I	CLASS II (MILD)	CLASS III (MODERATE)	CLASS IV (SEVERE)
Approximate blood loss	<15%	15–30%	31–40%	>40%
Heart rate	↔	↔/↑	↑	↑/↑↑
Blood pressure	↔	↔	↔/↓	↓
Pulse pressure	↔	↓	↓	↓
Respiratory rate	↔	↔	↔/↑	↑
Urine output	↔	↔	↓	↓↓
Glasgow Coma Scale score	↔	↔	↓	↓
Base deficit[a]	0 to –2 mEq/L	–2 to –6 mEq/L	–6 to –10 mEq/L	–10 mEq/L or less
Need for blood products	Monitor	Possible	Yes	Massive Transfusion Protocol

[a] 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

Access	Gravity	Pressure
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^{++} (mmol/L)	Mg^{++} (mmol/L)	CL^- (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
2. 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:

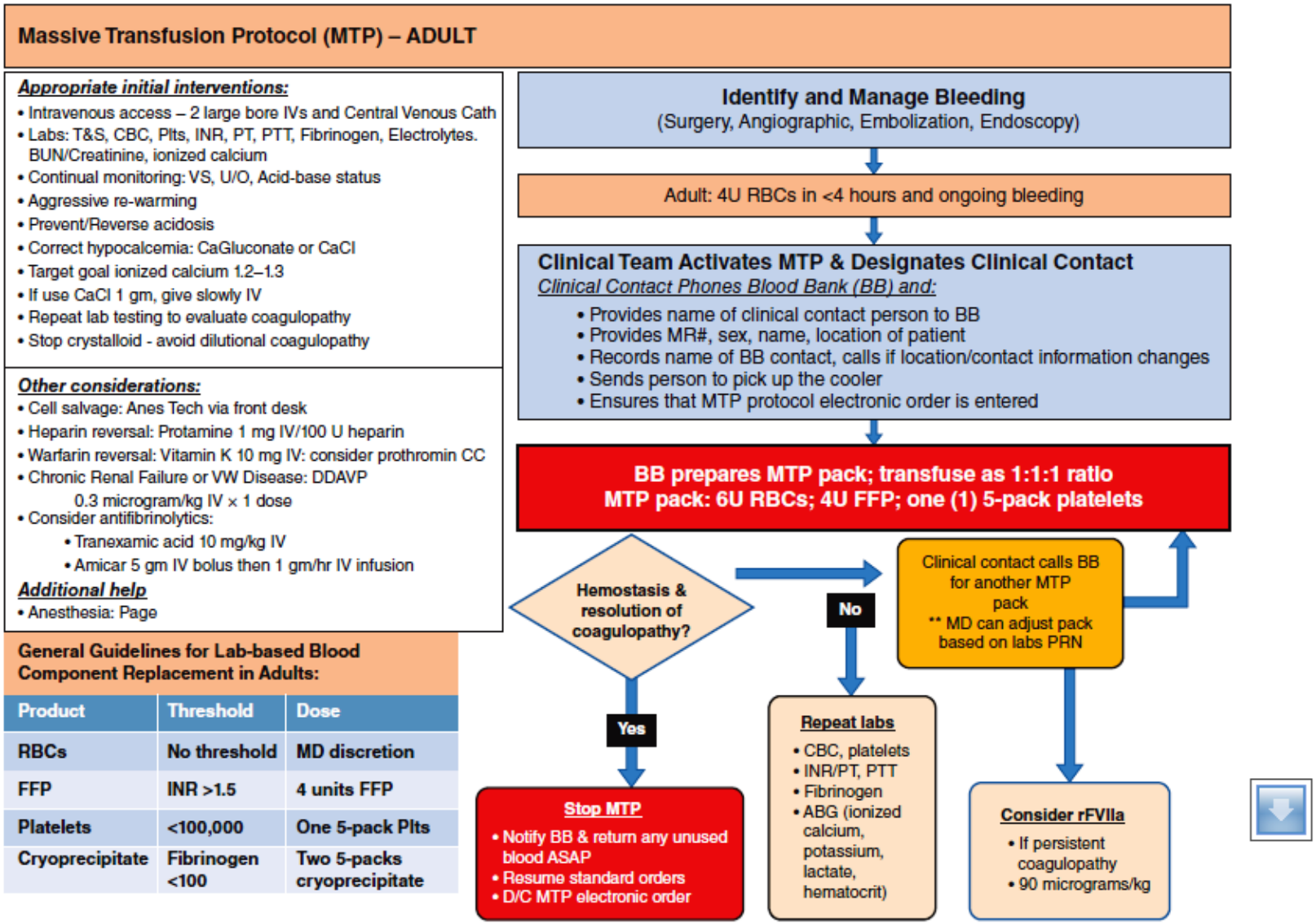


FIGURE 13-4. Massive transfusion protocol (MTP) from the University of Michigan's Level I Trauma Center. ABG = arterial blood gas; D/C = discontinue; DDAVP = desmopressin; FFP = fresh frozen plasma; MD = physician; Plts = platelets; PT = prothrombin time; RBCs = red blood cells; T&S = type and screen;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


THANK YOU FOR YOUR ATTENTION
Any Questions?