Updates in Shock Management in Trauma

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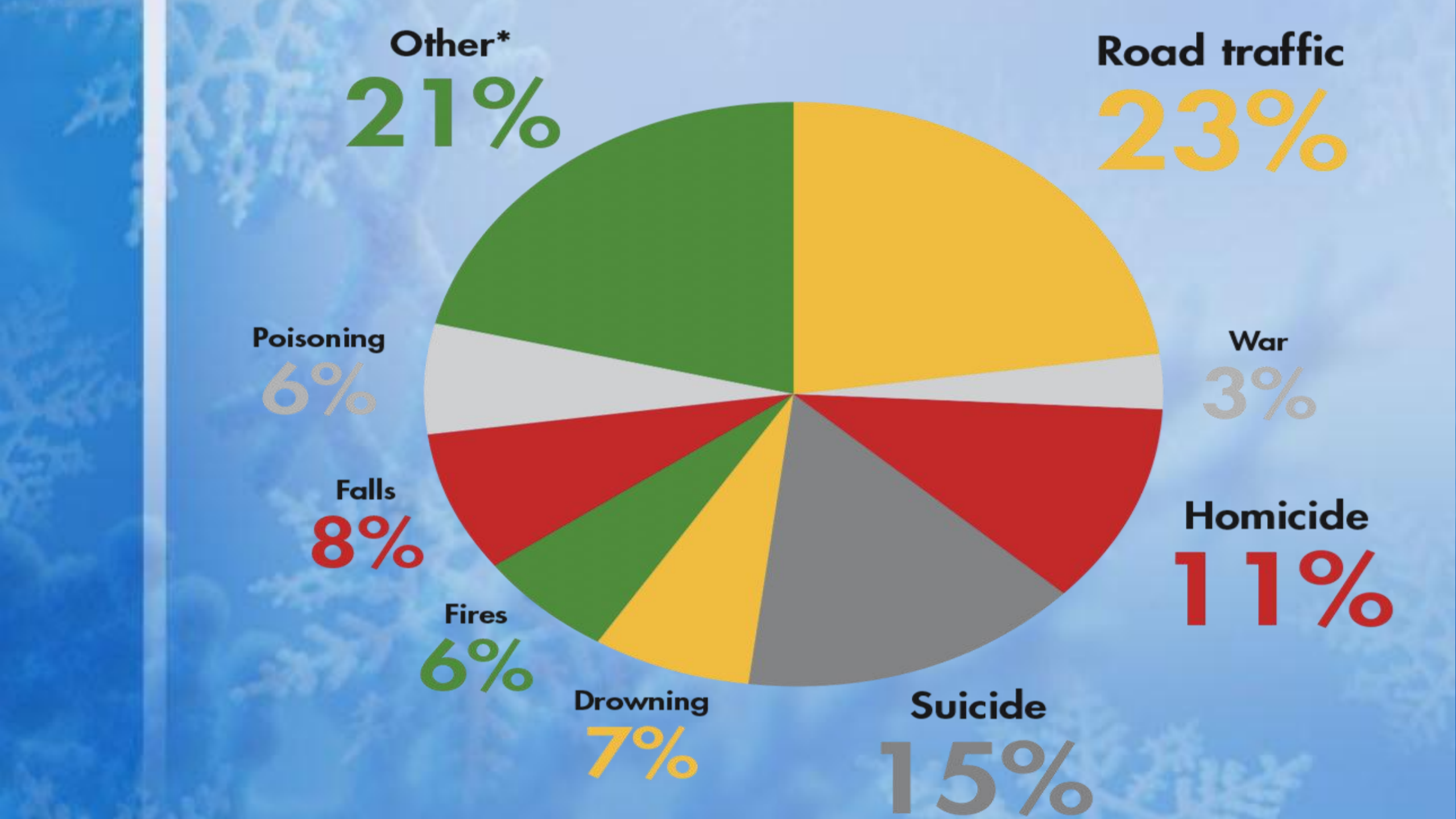
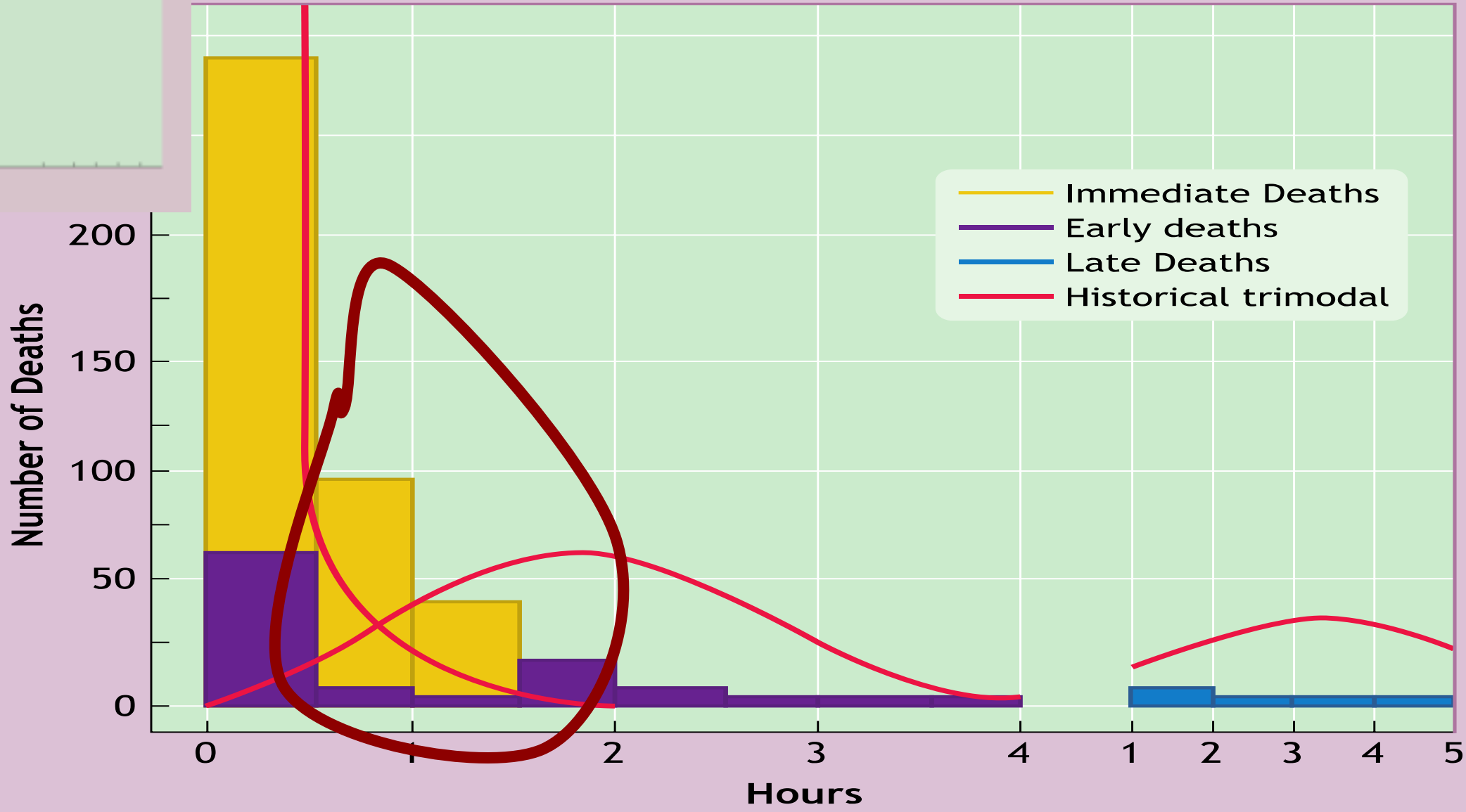
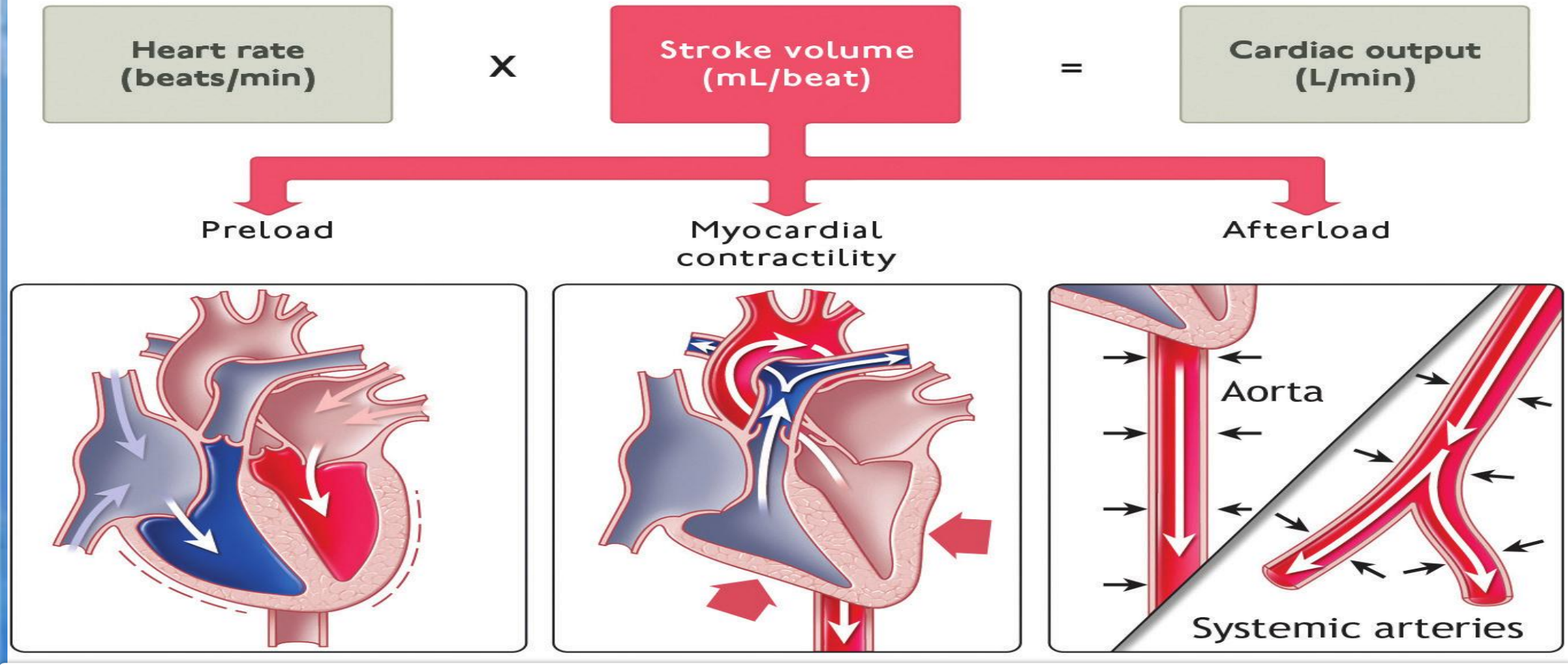

Other*
21%
Road traffic
23%
Poisoning
6%
War
3%
Falls
8%
Homicide
11%
Fires
6%
Drowning
7%
Suicide
15%

Timing Distribution of Trauma Deaths Compared With the Historical Trimodal Distribution



The definition of shock



- An abnormality of the circulatory system that results in inadequate organ perfusion and tissue oxygenation

SHOCK

In initial management

The first step:

› Is to recognize presence of shock.

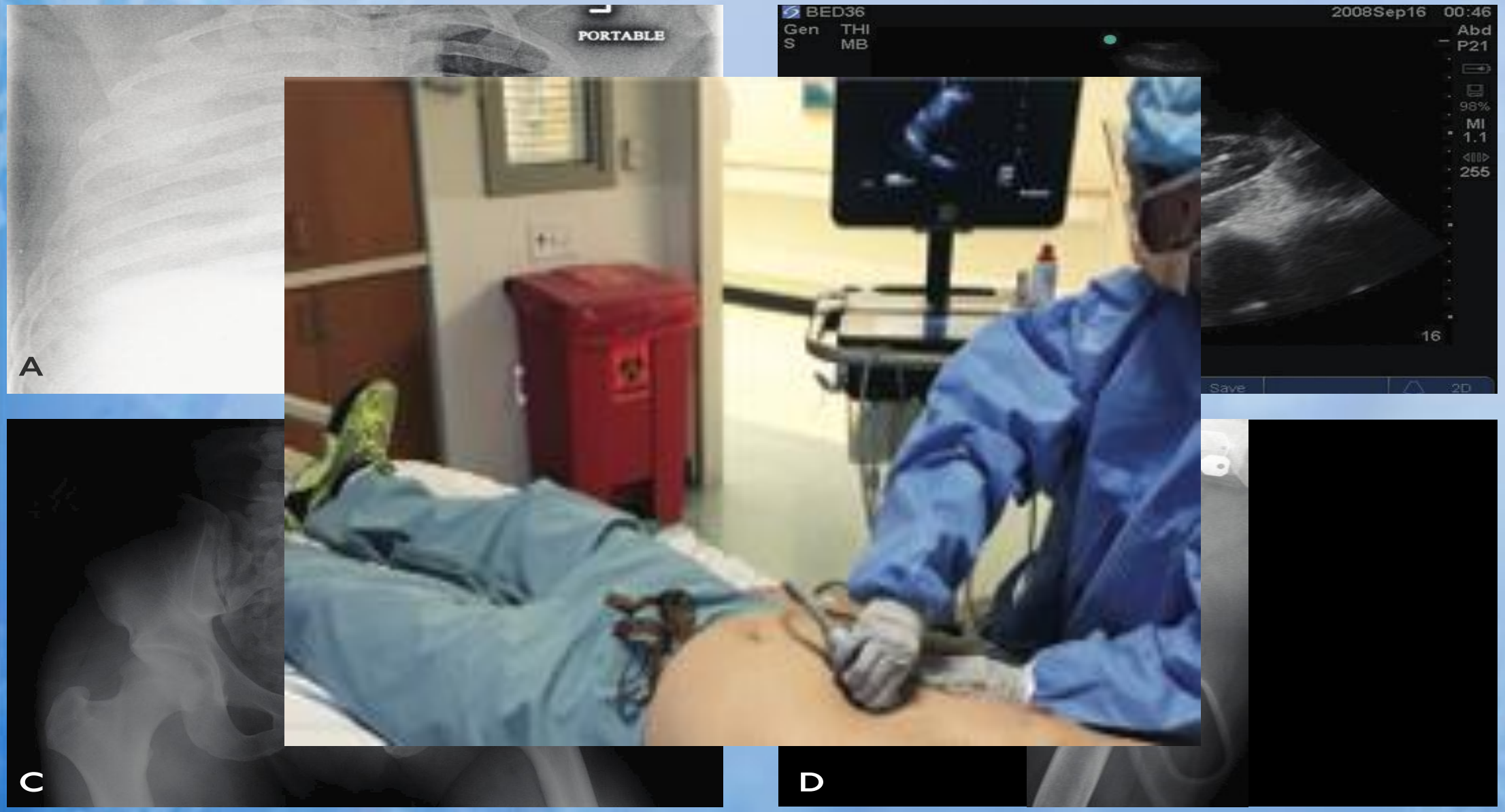
The second step:

› Identify the probable cause and adjust treatment accordingly.

› **The primary and secondary surveys, usually provides sufficient information to determine the causes.**

Diagnosis of shock can be missed when only a single parameter is used.

- Heart rate,
- Blood pressure,
- Skin perfusion,
- Mental status
- Arterial blood gas measurements of pH, pO_2, PCO_2,
- Oxygen saturation,
- Base deficit,
- End-tidal CO_2,
- Serum lactate



Sources of potential blood loss must be quickly assessed by physical examination and appropriate adjunctive studies.

Hemorrhage is the most common cause of shock in trauma patients.

- Soft tissue injury, even without severe hemorrhage, can result in shifts of fluid to the extracellular compartment.
- The response to blood loss must be considered in the context of these fluid shifts.

The priority of initial management

- The diagnosis and treatment must occur almost simultaneously.

- **S**topping the hemorrhage,
- **R**eplace the volume loss

(1 L for adults and 20 mL/kg for ped pts)

Identify evidence of adequate end-organ perfusion and tissue oxygenation

Organ dysfunction	↓ Perfusion	↓↓ Perfusion	↓↓↓ Perfusion
CNS	—	Restless, apathetic, anxious	Agitated/confused, coma
Respiration	—	↑ Ventilation	↑↑ Ventilation
Metabolism	—	Compensated metabolic acidemia	Uncompensated metabolic acidemia
Gut	—	↑ Motility	Ileus
Kidney	**Decreased urine volume** **Increased specific gravity**	Oliguria < 0.5 mL/kg/hr	Oliguria/anuria
Skin	Delayed capillary refill	Cold extremities	Mottled, cyanotic, cold extremities
CVS	Increase heart rate	**2* increase HR**	**2* increase HR**

Achieving a normal BP is not a substitute for definitive control of bleeding.

TABLE 3-2 RESPONSES TO INITIAL FLUID RESUSCITATION[a]

	RAPID RESPONSE	TRANSIENT RESPONSE	MINIMAL OR NO RESPONSE
Vital signs	Return to normal	Transient improvement, recurrence of decreased blood pressure and increased heart rate	Remain abnormal
Estimated blood loss	Minimal (<15 %)	Moderate and ongoing (15%–40%)	Severe (>40%)
Need for blood	Low	Moderate to high	Immediate
Blood preparation	Type and crossmatch	Type-specific	Emergency blood release
Need for operative intervention	Possibly	Likely	Highly likely
Early presence of surgeon	Yes	Yes	Yes

[a] Isotonic crystalloid solution, up to 1000 mL in adults; 20 mL/kg in children

DAMAGE CONTROL RESUSCITATION

Damage Control Resuscitation

- Permissive Hypotension
- Hemostatic Resuscitation
- Damage Control Surgery

Balancing the goal of organ perfusion and tissue oxygenation

- Controlled resuscitation,
- Balanced resuscitation,
- Hypotensive resuscitation,
- Permissive hypotension

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.

Data from: Mutschler A, Nienaber U, Brockamp T, et al. A critical reappraisal of the ATLS classification of hypovolaemic shock: does it really reflect clinical reality? *Resuscitation* 2013,84:309–313.

- Permissive Hypotension
- Hypovolemic Fluid Resuscitation
- Hypotensive Resuscitation

Fluid Restrictive Did Better

<u>If you got fluids:</u>

- SBP higher on ED arrival
- Same for OR arrival
- Hct lower on ED & OR arrival

- Survival: 62% vs 70%
- Complications: 30% vs 23%

Why are fluids bad?

- ✓Increase venous pressures ⇨ clot dislodges
- ✓Dilutes clotting factors
- ✓Cause hypothermia
- ✓Volume overload ⇨ ARDS, compartment syndrome, edema

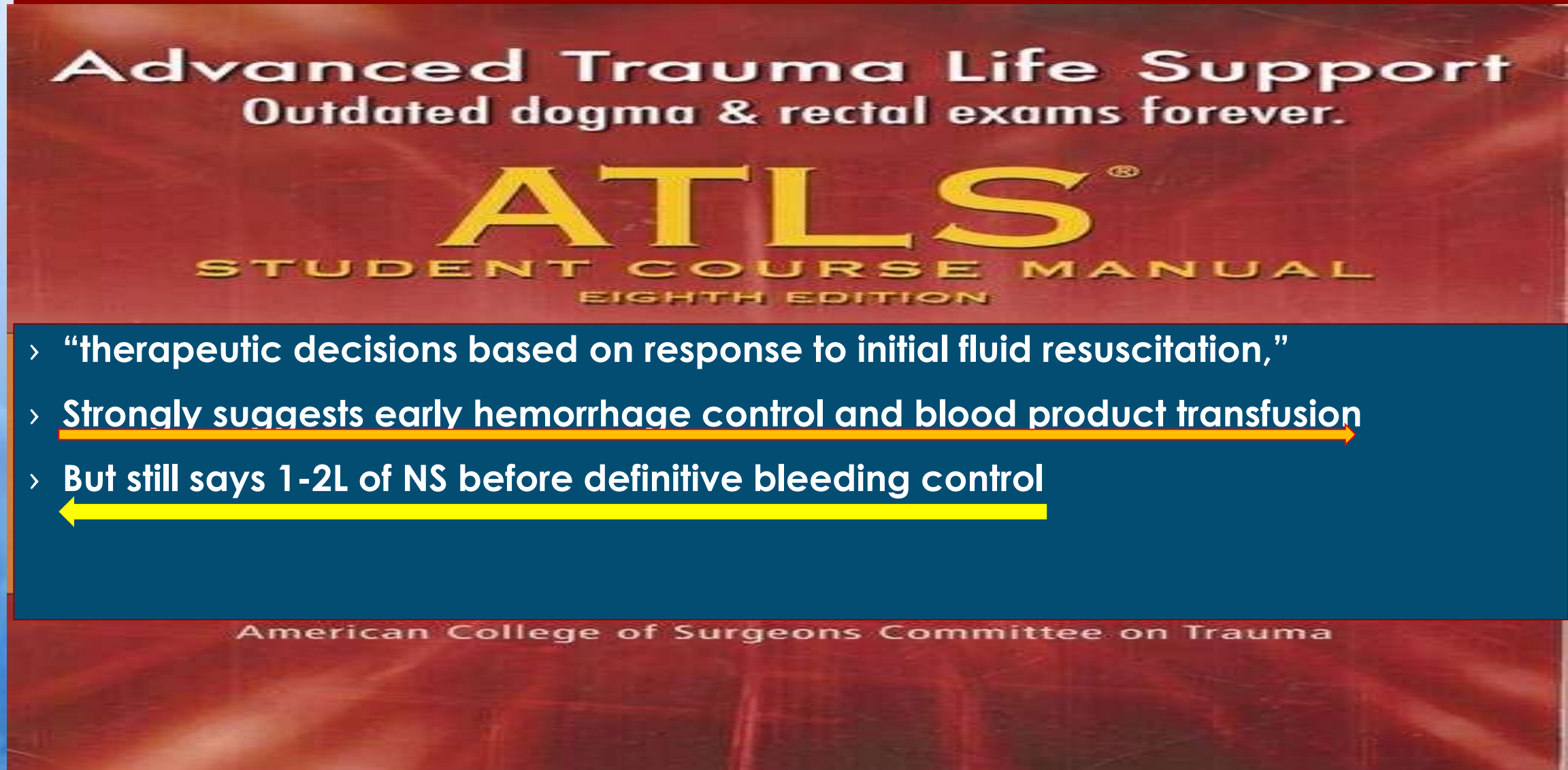
Hypotension is not the goal

Current Recommendations

- Permissive Hypotension is endorsed by US military (goal SBP 70)
- Vague elsewhere: Goal MAP 40-50, SBP of 80
- A **COMPROMISE** between maintaining perfusion & avoiding negative effects of IVF boluses

Kudo, J Int Care, 2017
Kwan, Cochrane Review, 2014

a more "balanced" approach toward crystalloid infusion



- "therapeutic decisions based on response to initial fluid resuscitation,"
- Strongly suggests early hemorrhage control and blood product transfusion
- But still says 1-2L of NS before definitive bleeding control

#2: Hemostatic Resuscitation

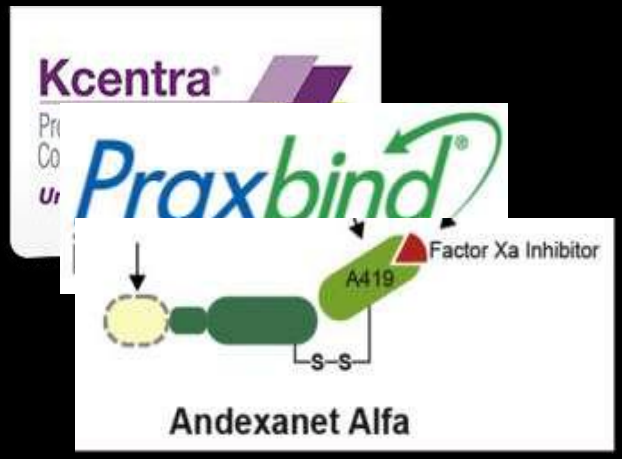
- The main purpose of blood transfusion is to restore the oxygen-carrying capacity of the intravascular volume.

1: Give Blood Early

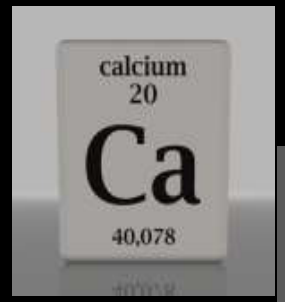
2: Resemble Whole Blood

3: Anticipate & Prevent Coagulopathy

4: Reverse Known Coagulopathy



5: Treat Complications



TRALI & TACO


MASSIVE TRANSFUSION
ABC
SI

ABC >2

- Penetrating Mechanism
- ED SBP < 90 mmHg
- ED HR > 120
- Positive FAST

SI >1

$$\frac{\text{HEART RATE}}{\text{SBP}}$$

HR 80, SBP 120
80/120 = 0.66

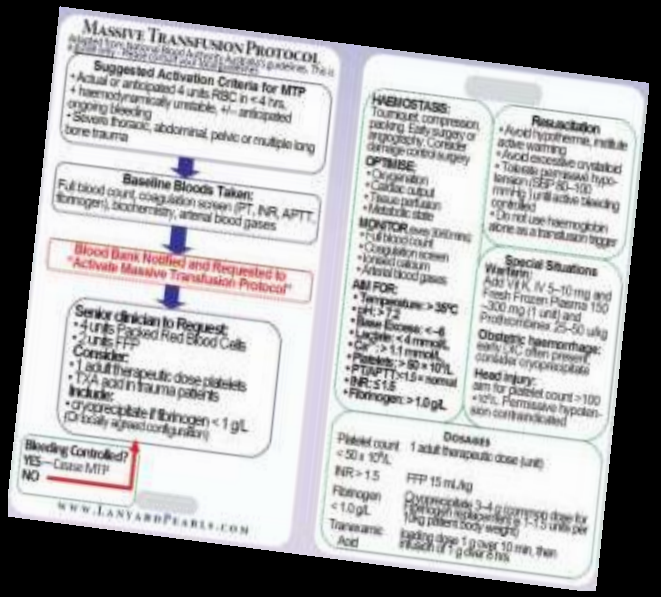
HR 100, SBP 100
100/100 = 1.0

HR 120, SBP 80
120/80 = 1.5

Schroll, *Injury* 2017

Do you have an MTP?

What is it?



MASSIVE TRANSFUSION PROTOCOL

Suggested Activation Criteria for MTP
- Actual or anticipated 4 units RBC in < 4 hrs.
- + haemodynamically unstable, +/- anticipated ongoing bleeding
- Severe thoracic, abdominal, pelvic or multiple long bone trauma

Baseline Bloods Taken:
Full blood count, coagulation screen (PT, INR, APTT, fibrinogen), biochemistry, arterial blood gases

Blood Bank Notified and Requested to "Activate Massive Transfusion Protocol"

Senior clinician to Request:
- 4 units Packed Red Blood Cells
- 2 units FFP

Consider:
- 1 adult therapeutic dose platelets
- TXA acid in trauma patients

Include:
- cryoprecipitate if fibrinogen < 1 g/L
(Clinically aligned contiguration)

Bleeding Controlled?
YES—Cease MTP
NO

HAEMOSTASIS:
Tourniquet, compression, packing. Early surgery or angiography. Consider damage control surgery

OPTIMISE:
- Oxygenation
- Cardiac output
- Tissue perfusion
- Metabolic state

MONITOR every 30-60 mins:
- Full blood count
- Coagulation screen
- Ionised calcium
- Arterial blood gases

AIM FOR:
- Temperature: > 35°C
- pH: > 7.2
- Base Excess: < –6
- Lactate: < 4 mmol/L
- Ca^{2+}: > 1.1 mmol/L
- Platelets: > 50 × 10^9/L
- PT/APTT: < 1.5 × normal
- INR: ≤ 1.5
- Fibrinogen: > 1.0 g/L

Resuscitation
- Avoid hypothermia, institute active warming
- Avoid excessive crystaloid
- Tolerate permissive hypotension (SBP 80–100 mmHg) until active bleeding controlled
- Do not use haemoglobin alone as a transfusion trigger

Special Situations
Warfarin:
Add Vit K IV 5–10 mg and Fresh Frozen Plasma 150–300 mg (1 unit) and Prothrombinex 25–50 u/kg

Obstetric haemorrhage:
early LSC often present, consider cryoprecipitate

Head injury:
aim for platelet count >100 ×10^9/L. Permissive hypotension contraindicated

DOSAGES

	1 adult therapeutic dose (unit)
Platelet count < 50 × 10^9/L	
INR > 1.5	FFP 15 mL/kg
Fibrinogen < 1.0 g/L	Cryoprecipitate 3–4 g (commercial dose for fibrinogen replacement is 1–1.5 units per 10kg patient body weight)
Tranexamic Acid	Loading dose 1 g over 10 min, then infusion of 1 g over 8 hrs.

www.LanyardPearls.com

Why 1:1:1?

PROMMTT

PROspective Observational Multicenter Massive Transfusion sTudy

Observational, Multicenter → Higher Plasma & Platelet ratios improved mortality

PROPPR

Pragmatic, Randomized Optimal Platelet and Plasma Ratios

RCT, Multicenter → RBC:FFP:Platelets 1:1:1 vs 1:1:2

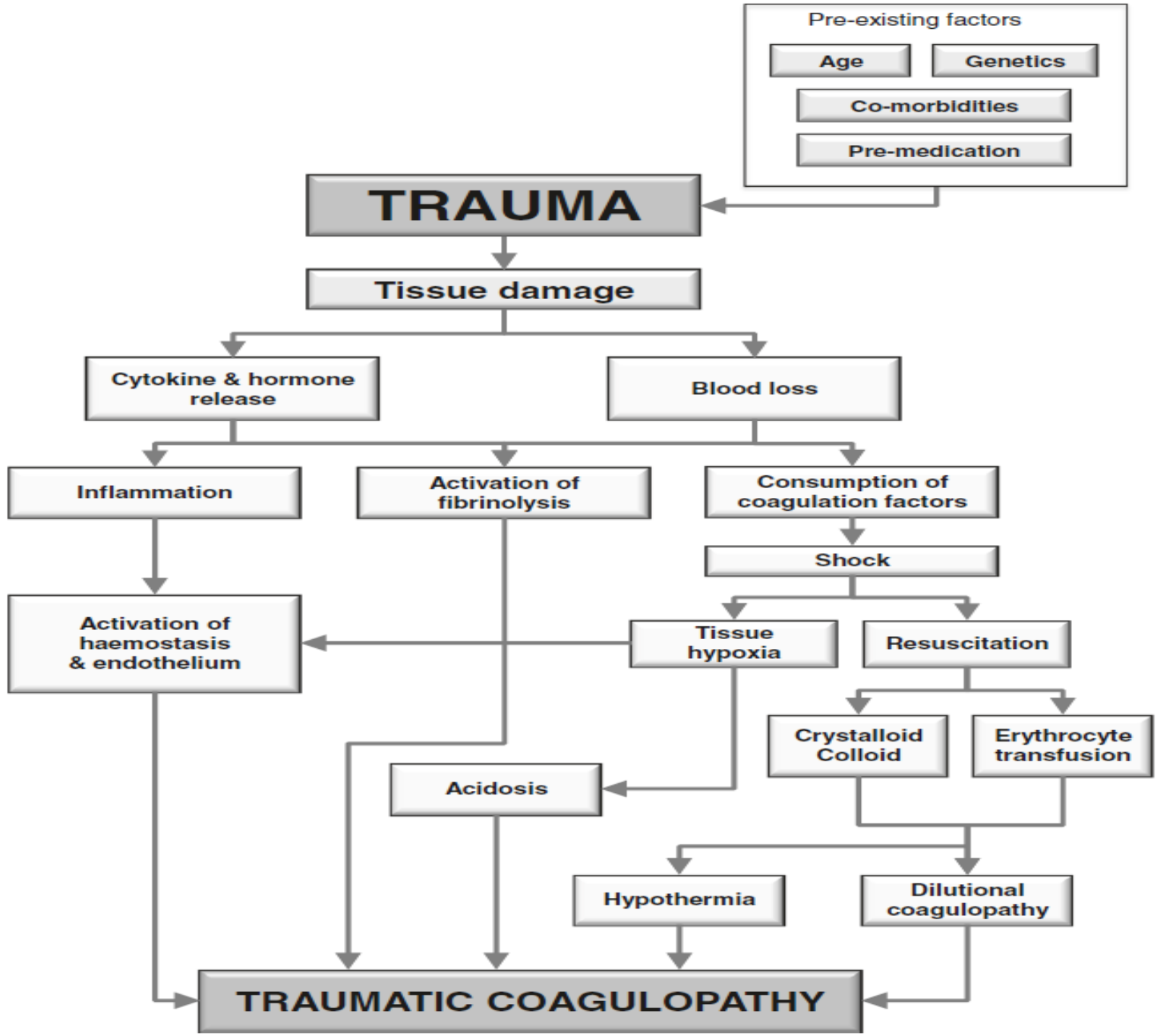
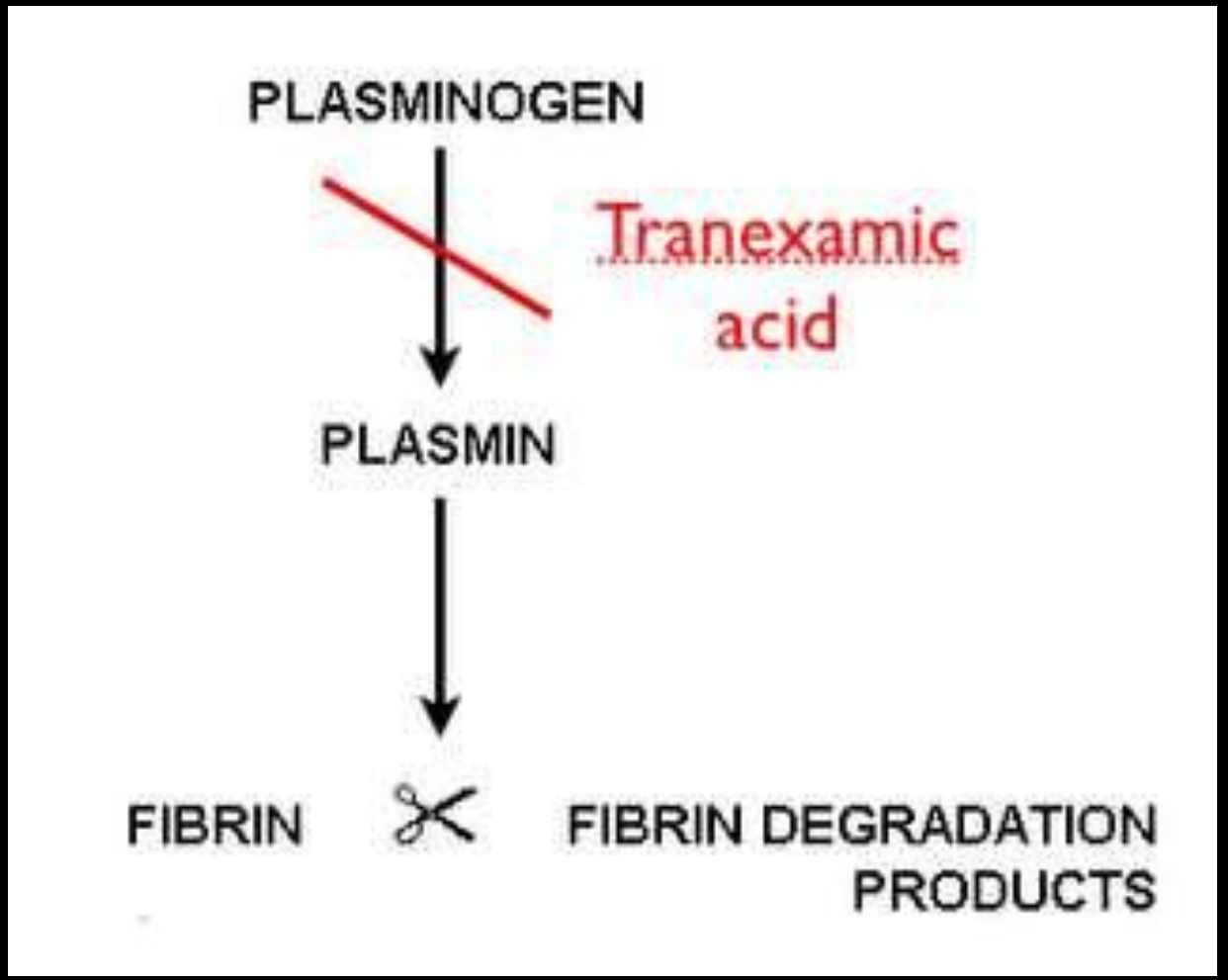


Fig. 1 Schematic drawing of the factors, both pre-existing and trauma-related, that contribute to traumatic coagulopathy. Adapted from [18, 19, 34]

Step 3: Anticipate & Prevent Coagulopathy



Up to 30% of severely injured on admission,

The Evidence

CRASH-2: RCT, TXA vs placebo

MATTERs: retrospective observational, TXA v none

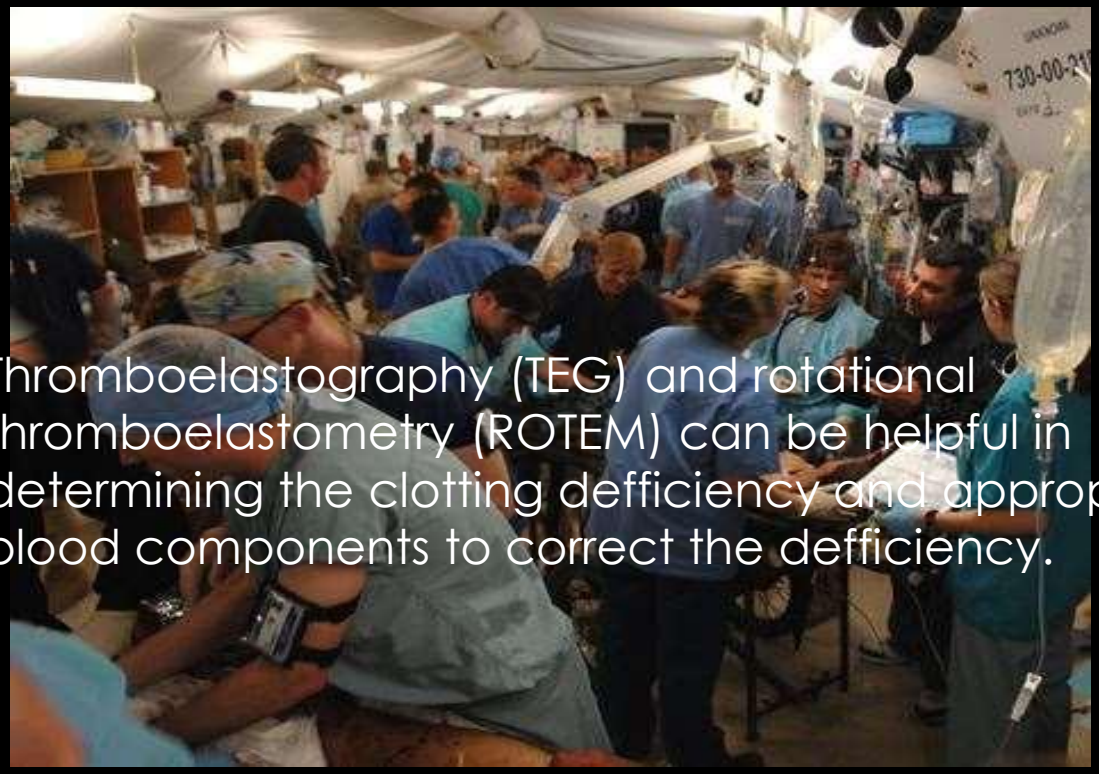
MATTERS2: retrospective observational, added cryo

Dose: TXA loading dose 1 gram/10 min then infusion 1 gram/8 hours

2013 Survey: 49% of Trauma Centers Use TXA with MTP

Thromboelastography (TEG) and Rotational thromboelastometry (ROTEM)

Say Yes to the TEG?



Thromboelastography (TEG) and rotational thromboelastometry (ROTEM) can be helpful in determining the clotting defficiency and appropriate blood components to correct the defficiency.

Step 4: Reverse Known Coagulopathy

Coumadin:

→ kCentra

NOACs:

- Direct thrombin inhibitor (Dabigatran/Pradaxa)→Praxbind
- Factor Xa inhibitors (Rivaroxaban/Xaralto, Apixiban/Eliquis)→Andexanet alfa

Post-tPa:

→cryo & platelets or RiaSTAP (fibrinogen) ***Aspirin:***

→Platelets or DDAVP

Step 5: Avoid Complications

- TACO (transfusion associated circulatory overload)
- TRALI (Transfusion-related acute lung **injury**)
- Hypocalcemia (Usually not necessary, When necessary, use ionized ca)
- Hypothermia
- Over-transfusion
- The Regular Stuff

(Cross-Matching, Allergies, Infection)

In Summary

Damage Control Resuscitation→less fluids, more factors, maybe TEG

1. Permissive Hypotension

2. Hemostatic Resuscitation

- Early blood
- 1:1:1
- Anticipate & Treat Coagulopathy
- Reverse Known Coagulopathy
- Awareness of Complications

3. Damage Control Surgery


SAY NOTHING
THEY'LL BLAME THE DOG
failepicfail.com