

# New Assessment, Treatment, and Evacuation Guidelines for Hypothermia & Drowning



By: Nadia Kimmel RN, WEMT

# PRESENTATION OBJECTIVES

- Small group scenario -rafting accident
- Review 4 stages of cold water immersion
- Updates on assessment, treatment & prevention guidelines for drowning & hypothermia
- Standards of care
- Question period



# SCENARIO

## RAFTING ACCIDENT

- High water multi-day, overnight trip (4 boat trip)
- Class III-IV section of river
- Air temp = 65°F & water temp = 45°F
- 1st boat flips at the beginning of a long rapid
- 2 clients and 1 guide are in the water
- 2<sup>nd</sup> boat is just entering the rapid

Below the rapid:

- Client # 1 - Pulled back into the boat
- Client #2 - Unresponsive floating downstream



# SCENARIO

## PRIMARY ASSESSMENT

Patient #1 - Age: 34

- Pulled into a boat
- Responsive
- Skin color - WNL
- Shivering
- A&Ox4
- Breathing rapidly
- Mildly coughing
- No injuries found

Patient #2 - Age: 57

- Pulled into a boat
- Unresponsive
- Cyanotic
- Rapid carotid pulse
- Agonal breathing
- Foam emanating from mouth
- No injuries found



# SCENARIO

## TREATMENT - PATIENT #1

- Remove wet clothes
- Hypowrap ~30 min (shivering stops & warms up)
- Warm fluids & food
- Reassess for injuries once warm
- Focused spine assessment (if suspected MOI for a spine injury)
- If coughing stops and breathing returns to normal, monitor for S/Sx of flash pulmonary edema for the next 6 hours.



# SCENARIO

## TREATMENT - PATIENT #2

- Call for an evacuation
- Open airway - Give 5 rescue breaths
- Rescue breathing rate - 1 breath every 6 seconds
- Assess for a pulse every 2 minutes
- Breathe through the foam
- Clear airway via log roll when water or vomit emanates from the mouth
- Remove wet clothes and place in hypowrap
- If no pulse, start CPR (30 compressions : 2 breaths)
- Compression-only CPR is not appropriate



# SCENARIO

## DROWNING - DEFINITION

### The World Health Organization's New Definition

- Drowning is the process of experiencing respiratory impairment due to submersion or immersion in liquid
- Near drowning
  - Delayed, secondary, or parking lot drowning
  - Flush drowning
- Drowning related
  - Wet drowning
  - Nonfatal drowning without complications
  - Dry drowning
    - Nonfatal drowning with complications
- Fatal drowning

*Patient # 1*

*Patient # 2*



# COLD WATER IMMERSION

## PATHOPHYSIOLOGY OF DROWNING



Cerebral Hypoxia (Low O<sub>2</sub>) → Death of brain tissue



Surfactant washout (pulmonary edema → Foam  
Decreased compliance (stiff lungs) and continued  
poor gas exchange Brain & organ failure



Hypoxemia, hyperventilation, hypothermia - leads  
to cardiac dysrhythmias Cardiac arrest



# COLD WATER IMMERSION

## 4 PHASES OF COLD WATER IMMERSION

Definition of cold water that can induce cold water shock varies with experts. Water temperature of ( $\leq 59^{\circ}\text{F}/15^{\circ}\text{C}$ ) is common in the literature.

1. Cold Water Shock
2. Cold Incapacitation
3. Hypothermia
4. Circum-Rescue Collapse



# DROWNING

## 1. COLD WATER SHOCK

### COLD SHOCK RESPONSE (0-2 min.)



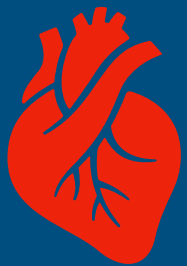
Gasp Reflex → Inhale water = Drown



Hyperventilation

→ Faint = Drown

→ Breath/Timing = Drown



↑ Cardiac Work

→ Cardiac Arrest

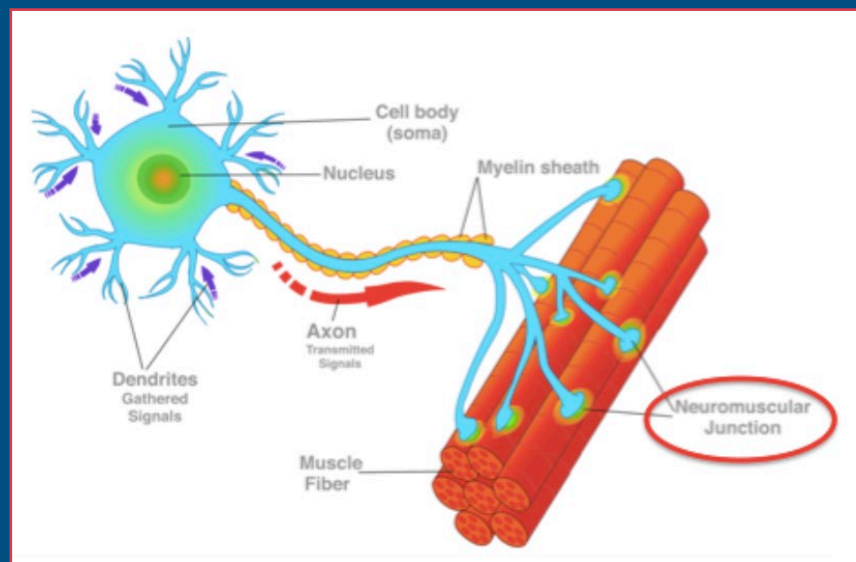
*If existing heart condition*

# DROWNING

## 2. COLD WATER INCAPACITATION

LOSS OF MEANINGFUL MOVEMENT (2-15 min.)

Cooling of nerves & muscle fibers



- Swim Failure
- Can't hold on
- Can't perform survival tasks

If you are unable to get out of cold water w/n 2-15 minutes, you may not be able to get out under your own power.

# DROWNING

## 3. HYPOTHERMIA

BODY COOLING ( >30 min. - 1 hour)



Cooling to unconsciousness:

- If head goes under = Drown
- If head is above water = Cooling to cardiac arrest

# DROWNING

## 4. CIRCUM-RESCUE COLLAPSE

A physical phenomenon that occurs before, during or shortly after a rescue from cold environments

Sudden drop in BP caused from:

- Vertical hoist rescue from cold water or a crevasse

*Get person supine right away and in a hypowrap*

- Imminent rescue - stress hormones no longer released

*Patient needs to keep fighting for their lives*



# DROWNING

# COLD WATER IMMERSION

## **1 - 10 - 1 Principle**

Refers to the first 3 phases  
of cold water immersion

Adapted from Cold Water Boot Camp - Dr. Gordon Giesbrecht



# DROWNING COLD WATER IMMERSION

## **1 Minute - 10 Minutes - 1 Hour**

If you fall into cold water you have:

- 1 minute to get control of your breathing
- 10 minutes of meaningful movement
- 1 hour before you become unconscious due to hypothermia





# DROWNING

## NEW RESEARCH - WEM JOURNAL 2019

### Wilderness Medical Society Clinical Practice Guidelines for the Treatment and Prevention of Drowning: 2019 Update

Andrew C. Schmidt, DO, MPH<sup>1</sup>; Justin R. Sempsrott, MD<sup>2</sup>; Seth C. Hawkins, MD<sup>3</sup>; Ali S. Arastu, MD<sup>4</sup>; Tracy A. Cushing, MD, MPH<sup>5</sup>; Paul S. Auerbach, MD, MS<sup>6</sup>

- Global definition
- Cerebral hypoxia main cause of mortality
- Rescue breathing is imperative
- Consider circum-rescue collapse
- Guidelines to ceasing a rescue and resuscitative efforts





# DROWNING

## WHAT TO EXPECT - DROWNING VICTIM

### Unresponsive Drowning Patient

- Eyes open or closed
- Ineffective breathing (agonal, gasping, or snoring)
- No Breathing
- Foam emanating from the airway
- Vomiting (water/fluid/mucous/stomach contents)
- Posturing (decorticate-like, rigid limbs, seizure-like)

**RESCUE BREATHS!**



# DROWNING

## Tx - RESPONSIVE DROWNING VICTIM

- Individuals that are asymptomatic, or presenting with a mild cough may stay in the field and be monitored for worsening S/Sx
- If evacuation of a mildly symptomatic individual has begun and the patient becomes asymptomatic for 4 to 6 hours, canceling further evacuation and continuing previous activity may be considered

### Flash Pulmonary Edema

#### S/Sx

- Severe coughing
- Tightness in the chest/wheezing
- Rales
- Frothy sputum
- Foamy material in the airway
- Diminishing LOR
- Low BP (no bilateral radial pulses)

#### Tx

- **High flow oxygen if available**
- **Position of comfort**
- **Manage airway**
- **Rescue breathe**
- **Evacuate immediately**

# DROWNING

## GRADE & MORTALITY RATE

**Table 1**

Out-of-hospital management and classification of drowning patients

<i>Grade</i>	<i>Pulmonary exam</i>	<i>Cardiac exam</i>	<i>Mortality (%)</i>
0	Normal auscultation, without cough	Radial pulses	0
1	Normal auscultation, with cough	Radial pulses	0
2	Rales, small foam in airway	Radial pulses	0.6
3	Acute pulmonary edema	Radial pulses	5
4	Acute pulmonary edema	Hypotension	19
5	Respiratory arrest	Hypotension	44
6	Cardiopulmonary arrest		93

Adapted from Semprcott et al.<sup>25</sup>



# DROWNING

## CEASING RESUSCITATIVE EFFORTS

Based on resources, consider ceasing resuscitative efforts after 30 minutes of continuous CPR with a:

- Normothermic patient
- Hypothermic patient with a known submersion time of more than 30 minutes in water temperature greater than 43 °F (6° C)
- Hypothermic patient with a known submersion time of more than 90 minutes in water temperature less than 43 °F (6° C)



# DROWNING

## NEW RESEARCH - WEM JOURNAL 2020

WILDERNESS & ENVIRONMENTAL MEDICINE 2020; 31(1): 11–5

### Flush Drowning as a Cause of Whitewater Deaths

David J. Farstad, MD; J. Matthew Luttrell, MD

*Division of Emergency Medicine, UC Health North Medical Center of the Rockies, Loveland, CO*

*“An obscure term frequently associated with high-volume rivers, continuous rapids, cold water, and a lack of prolonged underwater entrapment” (Farstad et al.)*

- American Whitewater Association Accident Database 1950–2018
- Flush drowning fatalities
- 61% Rocky Mountain verses 15% Southeast regions
- Authors suggest that cold water immersion ( $\leq 50^{\circ}\text{F}/10^{\circ}\text{C}$ ) is a contributing factor
- Authors also suggest that age may also play a role since the mean age of the victims is 51



# DROWNING PROTECTIVE EQUIPMENT

Research suggests:

Insulative clothing (e.g., neoprene, wetsuit, drysuit, cap), can help mitigate drownings associated with cold water immersion ( $\leq 50^{\circ}\text{F}/10^{\circ}\text{C}$ ) by helping individuals:

- Take control of their breathing
- Minimize water inhalation
- Decrease the workload of the heart
- Allow muscle and nerve fibers function for longer periods of time to swim to safety, hold on, and perform survival tasks



# RISK MANAGEMENT

1. Is the risk of an adverse event in water temperatures below ( $\leq 59^{\circ}\text{F}/15^{\circ}\text{C}$ ) degrees Fahrenheit reasonably foreseeable

- Increased risk of drowning?
- increased risk of inability to participate in rescue?

2. Was the foreseeable risk appropriately mitigated within industry standards (Did you satisfy your duty of care)?

- AWA code of safety (item 5.2)
- Industry Standards: What would the reasonably prudent professional outfitter do?
- Testimony of industry experts





# HYPOTHERMIA

## DEFINITION & TYPES

Involuntary drop of core body temperature below 95°F (35°C)



### Two Types

#### 1. Primary Hypothermia

*In response to cold environmental exposure*

#### 2. Secondary Hypothermia

- **Acute illness** (e.g., CVA, diabetic emergency)
- **Trauma** (e.g., burns, hemorrhage, spinal cord injury, shock)
- *Impaired behavioral response (e.g., drug abuse disorder, psychiatric condition)*
- *Can occur in a warm environment*





# HYPOTHERMIA

## NEW RESEARCH - WEM JOURNAL 2019

WILDERNESS MEDICAL SOCIETY CLINICAL PRACTICE GUIDELINES

### Wilderness Medical Society Clinical Practice Guidelines for the Out-of-Hospital Evaluation and Treatment of Accidental Hypothermia: 2019 Update

- Cold Card: Tool to identify, assess, and treat stages of hypothermia
- Cold Stress: A precursor to hypothermia
- After Drop and Circum-Rescue **Collapse**: Care during rescue

#### Primary Use:

- Stop and fix “E” life threat: Using all 3 essential elements of a hypowrap
- Body position during rescue
- External heat source placement update



# HYPOTHERMIA

## DMM ASSESSMENT CHART - 2020

### Assessing Hypothermia in a Patient

1. Assess **Consciousness** (conscious or unresponsive)
2. Assess **Movement** (normal, impaired, or no movement)
3. Assess **Shivering** (mild, uncontrollable, or decreasing)
4. Assess **LOR** (A&Ox4, decreasing, "U" on AVPU)

#### COLD STRESSED

#### MILD

#### MODERATE

#### SEVERE

CONSCIOUS	CONSCIOUS	CONSCIOUS	If cold & unresponsive assume <b>SEVERE HYPOTHERMIA</b>
MOVEMENT NORMAL	IMPAIRED	MOVEMENT	
SHIVERING	SHIVERING	UNCONTROLLABLE SHIVERING → NONE	
LOR = A&Ox4	LOR = A&Ox4	↓ LOR	

1. Reduce heat loss
2. Provide high-calorie food or drink
3. Move around/exercise to warm up

1. Handle gently
2. Have patient sit or lie down in hypowrap for at least 30 min.
4. Heat sources - chest, back, armpits
5. Give high-calorie food/drink
6. Monitor for 'afterdrop' if patient recovers
7. Evacuate if no improvement

1. No standing/walking
2. Handle gently
3. Keep horizontal in hypowrap
4. Heat sources - chest, back, armpits
5. No food or drink
6. Evacuate carefully to hospital with ECLS capability

1. Check carotid pulse for 60 sec.
  - IF no pulse, start CPR
  - IF pulse but no breathing, rescue breathe: (1 breath every 5-6 sec.)
2. Treat like Moderate Hypothermia
3. Evacuate carefully ASAP to hospital with ECLS capability



# HYPOTHERMIA WEM COLD CARD

- You must have these 4 elements for a successful hypo (burrito) wrap
- If using an external heat source it should be placed to the torso with a barrier in between.
- **No** more groin or neck area placement
- Active shivering + hypowrap = normothermic results and ability to eventually self-rescue

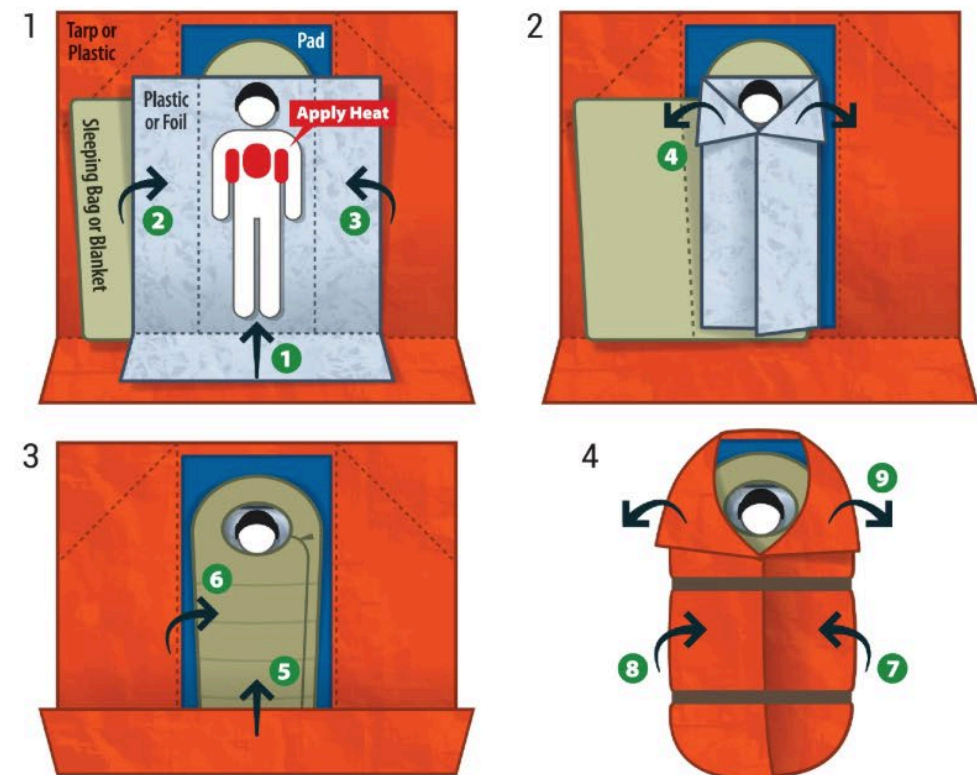
## CARE FOR COLD PATIENT

### SUGGESTED SUPPLIES FOR SEARCH/RESPONSE TEAMS IN COLD ENVIRONMENTS:

- |   |  |
|---|--|
| 1 - Tarp or plastic sheet for vapour barrier outside sleeping bag | 1 - Plastic or foil sheet (2 x 3 m) for vapour barrier placed inside sleeping bag  |
| 1 - Insulated ground pad  | 1 - Source of heat <b>for each team member</b> (e.g., chemical heating pads, or warm water in a bottle or hydration bladder), or <b>each team</b> (e.g., charcoal heater, chemical / electrical heating blanket, or military style Hypothermia Prevention and Management Kit [HPMK]) |
| 1 - Hooded sleeping bag (or equivalent)                           |  |

### INSTRUCTIONS FOR HYPOTHERMIA WRAP "The Burrito"

1. Dry or damp clothing: *Leave clothing on*  
**IF** Shelter / Transport is **less than** 30 minutes away, **THEN Wrap immediately**
2. Very wet clothing: **IF** Shelter / Transport is **more than** 30 minutes away, **THEN Protect patient from environment, remove wet clothing and wrap**
3. Avoid burns: follow product instructions; place thin material between heat and skin; check hourly for excess redness



Copyright © 2018. Baby It's Cold Outside. All rights reserved. [BICOrescue.com](http://BICOrescue.com)

Sources: [BICOrescue.com](http://BICOrescue.com); Zafren, Giesbrecht, Danzl et al. Wilderness Environ Med. 2014; 25:S66-85.

# HYPOOTHERMIA

## NEW RESEARCH - RESUSCITATION JOURNAL - 2021

### **Clinical staging of accidental hypothermia: The Revised Swiss System Recommendation of the International Commission for Mountain Emergency Medicine (ICAR MedCom)**

*Martin E. Musi<sup>a,b,\*</sup>, Alison Sheets<sup>a,b,c</sup>, Ken Zafren<sup>b,d,e</sup>, Hermann Brugger<sup>b,f,g</sup>,  
Peter Paal<sup>b,h</sup>, Natalie Hölzl<sup>b,i</sup>, Mathieu Pasquier<sup>b,j</sup>*

- Field friendly system when an accurate core temperature is not available and without accompanying trauma or other medical conditions that may affect LOR

### **Primary Use:**

- Identify risk of cardiac arrest from primary hypothermia
- Using LOR using “AVPU” as the sole indicator





# HYPOTHERMIA

## SWISS MODEL - STAGING HYPOTHERMIA

	Stage 1	Stage 2	Stage 3	Stage 4
Clinical findings <sup>a</sup>	“Alert” from AVPU	“Verbal” from AVPU	“Painful” or “Unconscious” from AVPU AND Vital signs present	“Unconscious” from AVPU AND No detectable vital signs <sup>b</sup>
Risk of cardiac arrest <sup>c</sup>	Low	Moderate	High	Hypothermic cardiac arrest



“Although shivering is not used as a stage-defining sign, its presence usually means that core temperature is above 95°F (35°C), a temperature at which hypothermic cardiac arrest is unlikely to occur.” (Musi, et al. 2021)



# HYPOTHERMIA

## OVERLAY OF BOTH MODELS

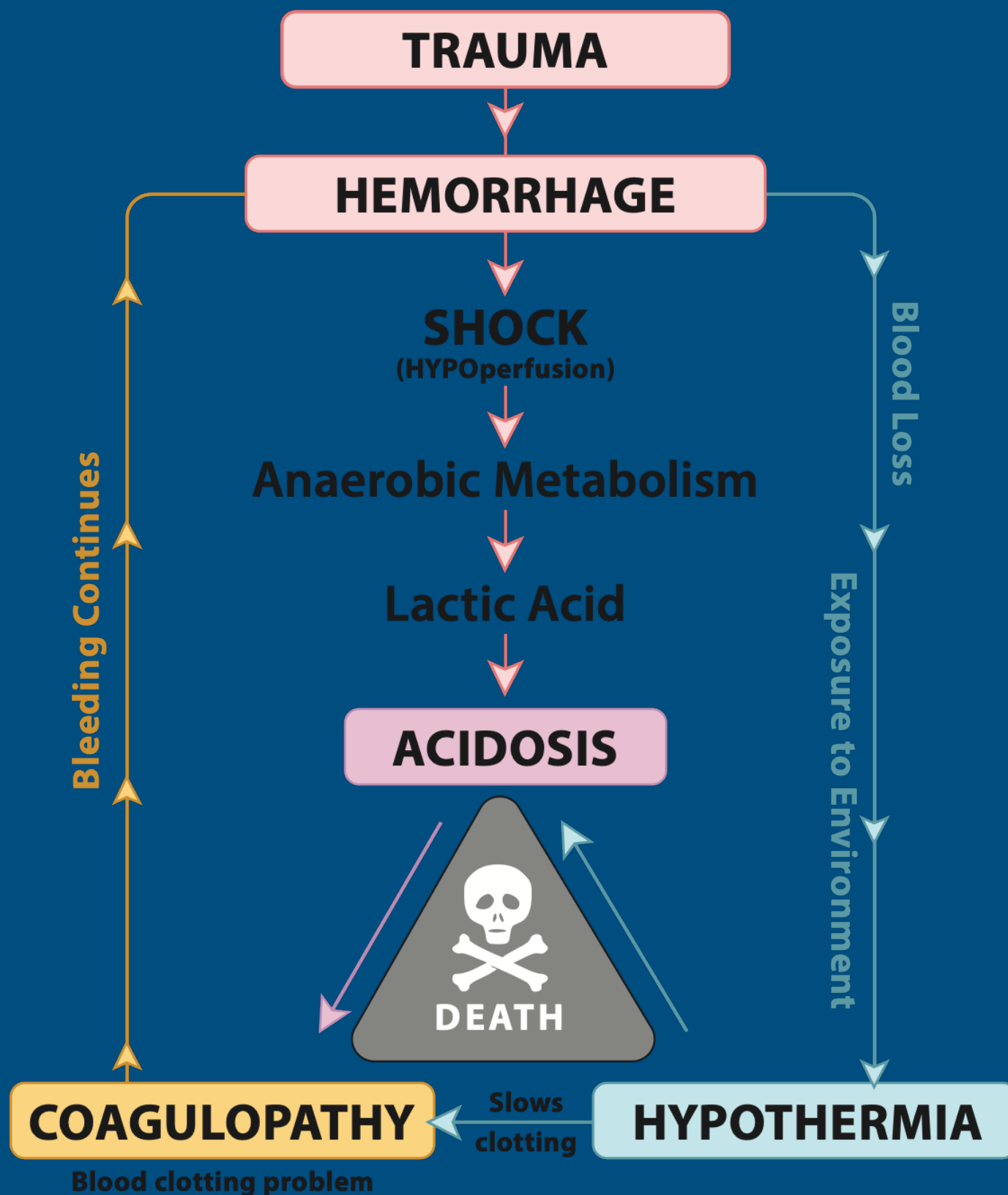
WEM MODEL →

SWISS MODEL



	MILD	MODERATE	SEVERE
	CONSCIOUS	CONSCIOUS	If cold & unresponsive assume <b>SEVERE HYPOTHERMIA</b>
	IMPAIRED MOVEMENT		
	SHIVERING	UNCONTROLLABLE SHIVERING → NONE	
	LOR = A&Ox4	↓ LOR	
LOR → AVPU	Stage 1 A	Stage 2 V	Stage 3 P or U
Presence of HR & RR	✓	✓	✓
Risk of Cardiac Arrest	Low	Mod	High
			Cardiac Arrest

# LETHAL TRIAD OF TRAUMA



Primary Assessment

“C” - Circulation  
Stop the bleeding

“E” - Expose  
Find the bleeding

“E” - Environment  
Hypowrap

⚠ Transport Decision  
Evacuate

Secondary hypothermia





**Thank You!**

