

Just In Time Learning – Hypothermia

This week we have seen some of the year’s lowest temperatures and significant snow accumulation. It is essential to recognize, assess and treat various cold emergencies as EMS clinicians.

Bottom Line Up Front:

- Rewarm the patient and remove wet clothing as soon as possible
- Handle hypothermic patients gently. The irritable myocardium is irritable and prone to VT or VF even with minor stimulation
- Consult early for hypothermic patients in cardiac arrest as medication and defibrillation intervals may change
- Hypothermia is a contraindication to the TOR protocol unless there are injuries obviously incompatible with life.

Deeper Dive into the Medicine:

Definition:

- Core Temperature <35°C (95°F)
- Unintentional hypothermia is associated with significant morbidity and mortality. Roughly 1500 persons die of accidental hypothermia in the US annually.
- Despite the high mortality associated with pre-hospital arrest, well-directed treatment can result in complete neurologic recovery in the hypothermic patient.
- 50% who die of hypothermia are >65 years old.
- Risk of cardiac arrest increased with temperature <32°C, as stable cardiac rhythms can quickly degenerate into unstable rhythms. Hypothermic patient without a pulse must be managed differently due to physiology changes that occur at low temperatures.
 - Defibrillation and many medications may be ineffective until the core temperature is above 30.0°C. If defibrillation is warranted but unsuccessful, active rewarming should be initiated while CPR is continued.

Classification	Temperature	Signs/Symptoms
I / Mild	32-35°C (90-95°F)	Shivering, awake

II / Moderate	28-32°C (82-90°F)	Shivering, depressed mental status
III / Severe	20-28°C (68-82°F)	Unconscious/severely depressed mental status, shivering ceases
IV / Profound	<20°C (68°F)	Unobtainable VS

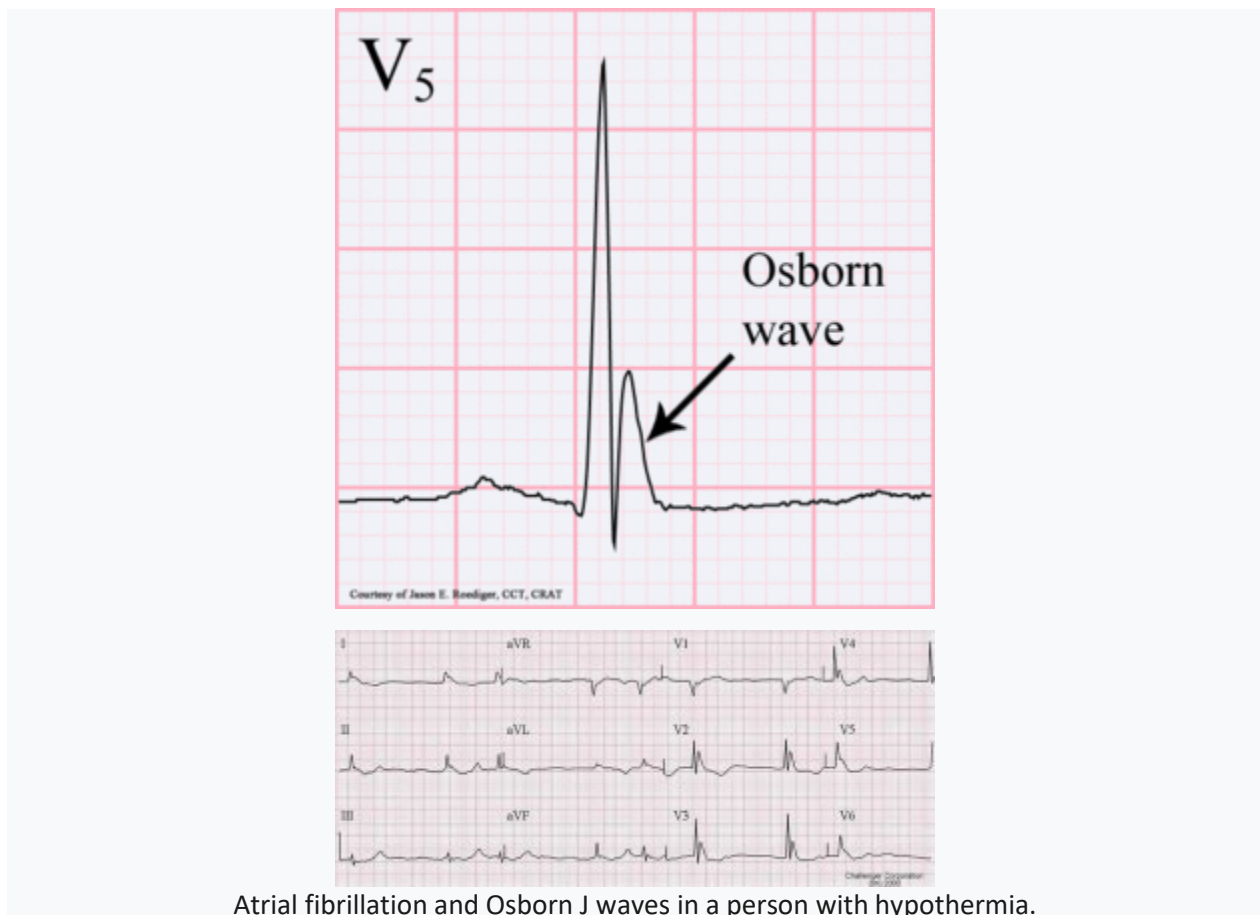
Associated Problems:

- Cold injuries
 - Frostbite: reddened, mottled, bluish or white-gray appearing skin in a cold-exposed area; pain in the area followed by numbness in later stages
 - Handel frost bitten areas gently and do not rub
 - Cover affected areas with lightweight gauze
- Cardiac dysfunction
 - Dysrhythmias
 - May occur spontaneously if temperature <30°C (86°F)
 - Afterdrop: Initial drop in temperature and BP as rewarming is started due to loss of vasoconstriction in cold peripheral tissues
- Coagulopathy
 - Decreased clotting function
 - Platelet function and inhibition of coagulation cascade
 - Part of the lethal triad of trauma
 - Thromboembolism
 - Secondary to hemoconcentration, increased blood viscosity, and poor circulation
 - Disseminated intravascular coagulation
- Ineffective Drugs
 - Protein binding increases as body temperature drops, and most drugs become ineffective
 - Pharmacologic manipulation of the pulse and blood pressure generally should be avoided (consider consult)
 - Oral meds poorly absorbed because of decreased gastrointestinal motility
 - Intramuscular route avoided due to poor absorption from vasoconstricted sites
- Other
 - Acid-base disorders

- Aspiration pneumonia
- Pancreatitis
- Rhabdomyolysis

Evaluation:

- Standard thermometers may be inaccurate
 - Some standard thermometers record only to 34°C
 - Core temps will be more accurate but difficult to obtain in the pre-hospital environment
- Check blood glucose as can be very high or low due to stress response
- ECG Findings:



- Typical sequence in severe hypothermia is sinus bradycardia → atrial fibrillation with slow ventricular response → ventricular fibrillation → asystole
- Other ECG findings:
 - Osborn (J) wave - Size of wave correlates with degree of hypothermia.
 - Muscle tremor artifact
 - T-wave inversions

- PR, QRS, QT prolongation
- ST segment elevation or depression
- AV block
- PVCs

General Management:

Basic Measures:

- Remove patient from the cold environment and remove wet clothing
- Handle patient gently
 - V-fib may be induced by rough handling of patient due to irritable myocardium
- Rewarming
 - Passively rewarm the patient by placing them in a warm environment
 - Cover the patient's body with a thermal blanket and use another blanket to cover the patient's head (except the face).
 - Blankets - If patient still shivering, capable of rewarming 0.5°C/hr
- Oxygen therapy
 - Provide warmed O₂ liberally (if available)
 - Hypothermia causes leftward shift of oxyhemoglobin dissociation curve
- IVF
 - Patients are also hypovolemic since hypothermia causes impaired renal concentrating ability, and in turn causing cold diuresis
 - Patients are prone to rhabdomyolysis and will need hydration
 - Intravascular volume is lost due to extravascular shift
- Pain Management
 - Treat pain appropriately utilizing the pain management protocol

Dysrhythmias:

- Rewarming is treatment of choice. Most dysrhythmias (e.g. sinus brady, a-fib/flutter) require no other therapy
- Activity of antiarrhythmics is unpredictable in hypothermia
- Hypothermic heart is relatively resistant to atropine, pacing, and cardioversion
- Ventricular tachycardia or Ventricular fibrillation are most common

- May be refractory to therapy until patient is rewarmed
- Attempt defibrillation
- Value of deferring repeat defibrillation until a target temperature is reached is uncertain, but it is reasonable to perform further defibrillation attempts concurrent with rewarming

Cardiac Arrest

- Attempt resuscitation of all hypothermic patients unless there are injuries incompatible with life
- Consult early for hypothermic cardiac arrests as defibrillation and drug intervals may change based on the degree of hypothermia

Termination of CPR

- Hypothermia is a contraindication to TOR in the field
 - Hypothermic patients in cardiac arrest may survive even after a prolonged down time.

Stay safe, take care of one another, and keep warm!