

# Advanced Cardiovascular Life Support

Role of Hypothermia

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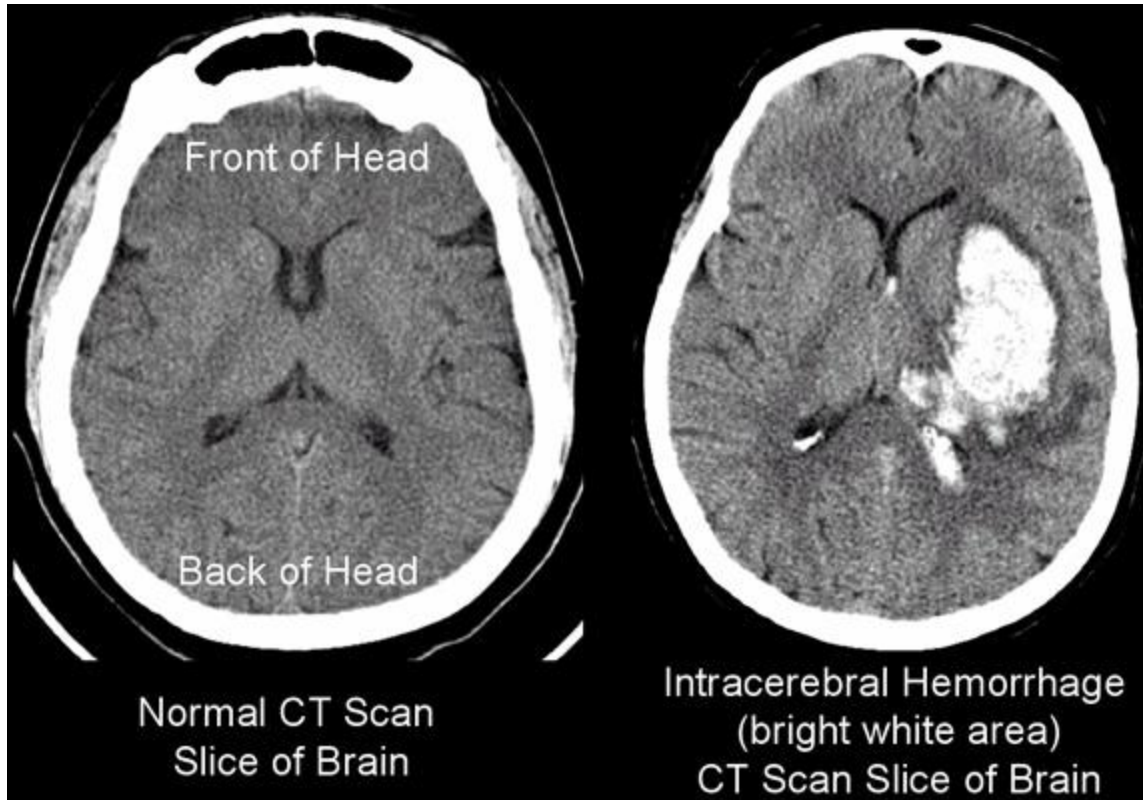
I have no financial disclosures.

Why do Hypothermia?

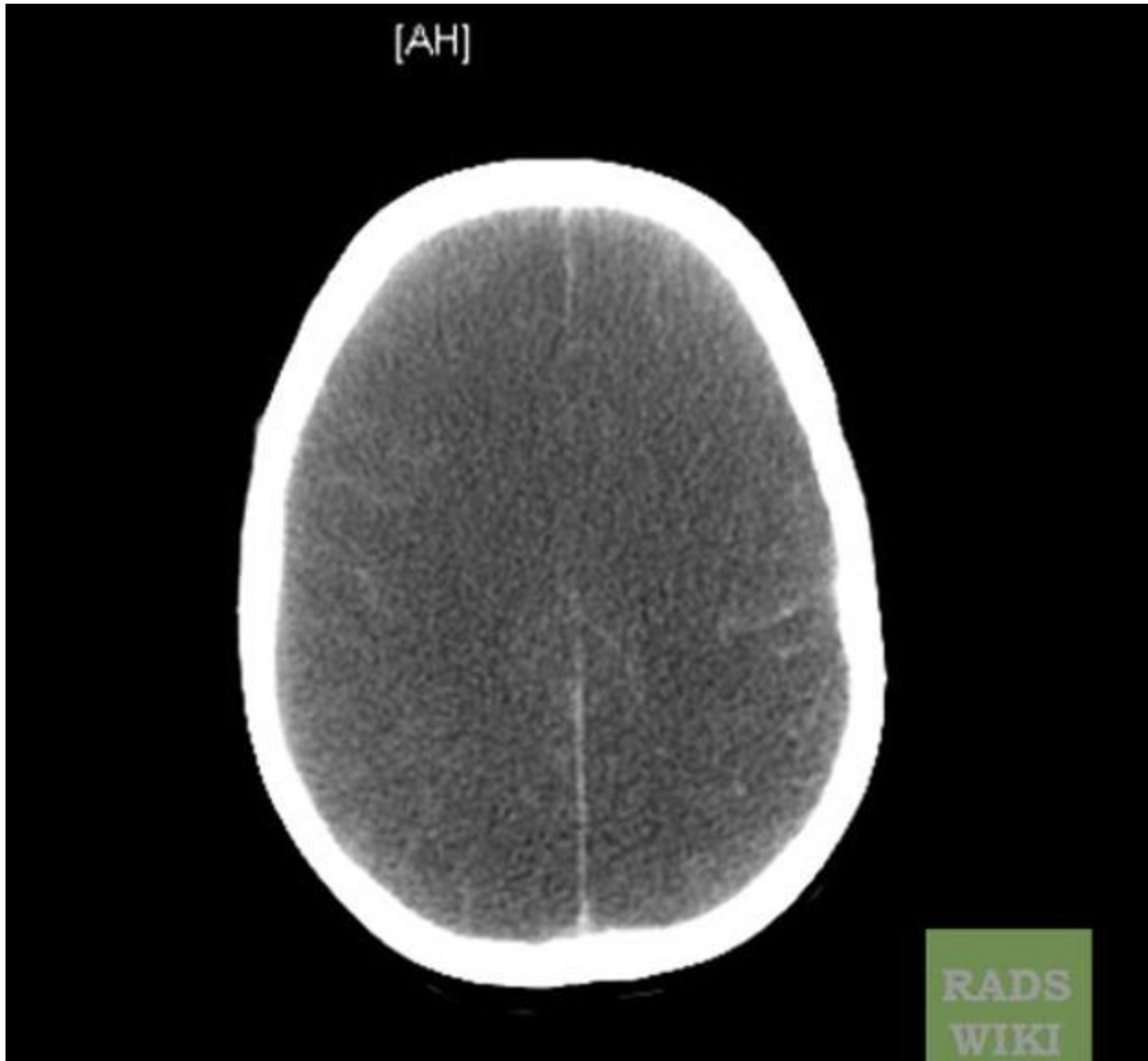
**Save the brain!!!!!!**

# CPR successful with ROSC in 30-70%

- Greater than 65 % die a neurological death from anoxic brain injury
- Less than 6-10 % survive out of hospital cardiac arrest



# Severe Anoxic Brain Injury





# Mechanism of Neuroprotection

- For every 1 degree drop in C metabolism slows by 5-7 percent reducing oxygen need for ATP production and ion transport
- More recent data shows hypothermia itself stabilizes cell membrane reducing influx of ions from oxygen deprivation and reduces cell death
- Reduces oxidative stress during reperfusion reducing cell death and injury

# The Proof

- Europe, Holtzer, Michael. “Mild Hypothermia to Improve Neurological Outcome after Cardiac Arrest” NEJM (2002) Vol 346, No 8
- Australia, Bernard, Stephen et al. “Treatment of Comatose Survivors of Out of Hospital Cardiac Arrest with Induced Hypothermia” NEJM (2002) Vol 346, No8

- European study ROSC 22 min normothermia vs ROSC 21 min hypothermia, 24hrs 32-34 degrees C., results showed 55% favorable neurologic outcomes vs 39% favorable neurologic outcome in normothermia
- Australians similar with 49% favorable neurologic outcome hypothermia vs 26% in normothermia group

# Effects of Hypothermia

- Increases risk of ventricular arrhythmia, bradycardia, prolonged PR/QRS/QT and myocardial depression
- Decreases metabolic rate however shivering will increase metabolic rate, CO<sub>2</sub> production and O<sub>2</sub> consumption
- Hyperglycemia due to insulin resistance
- Ileus, increase risk of stress ulcer, no feeding 48hrs
- Platelet dysfunction and clotting factor dysfunction increase risk of bleeding
- Impairs leukocyte function increase risk of infection
- Cold diuresis and shift K/MG intracellularly induction and extracellular rewarming

# Contraindications

- DNR
- Awake responding GCS>9
- Minimal premorbid cognitive status
- Baseline terminal or end stage disease
- Trauma
- Uncontrolled bleeding
- Greater than six hours since ROSC
- Sepsis
- Age less than 18 and pregnancy



# Four phases of Therapeutic Hypothermia

- Induction with goal to reach 33 degrees in four hours
- Maintenance
- Rewarming starts 24 hrs after cooling started and we rewarm at .33 degrees C per hour. Should never exceed greater than .5 degrees C per hour
- Controlled Normothermia

# Cooling Methods

- Surface mechanism are ice packs/  
cooling pads/blankets
- Internal or intravascular methods are cold  
saline at 4 degrees or endovascular  
catheters





- External Cooling pads applied to torso and thighs cool at a rate of .5 to 1 degree C per hour.



- Intravascular device available for induction and maintenance of hypothermia not shown to be superior and more invasive

# Goal is 33 degrees C in 4 hours

- Infusion of 30cc/kg of 4 degree C isotonic saline with pressure bag reduces core temp by  $> 2$  degree/hr comparable to endovascular catheters
- Ice packs to axillae, groin, and neck initially until surface cooling pads placed.
- Surface cooling pads thermostatically controlled
- Intravascular cooling devices available no documented superiority

# Shivering/Sedation

- Buspirone/Acetaminophen
- Meperidine suppress shivering but proconvulsant primary metabolite and we do not use
- Propofol if no hypotension 10-50 mcg/kg/min and Midazolam if hypotensive
- Frequently need neuromuscular blocking Vecuronium (Norcuron) and Cisatracurium (Nimbex) if renal or hepatic dysfunction

# Respiratory Considerations

- Avoid hyperventilation PaCO<sub>2</sub> no lower than 40mmHg which prevents cerebral vasoconstriction
- Maintain O<sub>2</sub> Sats 94 avoiding prolonged hyperoxia which has been associated with worse outcomes

# Hemodynamic Considerations

- Maintaining end organ perfusion requires adequate MAP. MAP above 70 associated with better neurologic outcomes
- Volume resuscitate to CVP 8-12 with saline (4 degree C) up to 30cc/kg
- If MAP less than 70 after volume resuscitation initiate Norepinephrine
- Dopamine associate with more arrhythmias

# Antiarrhythmic Drugs?

- No data to support prophylactic use of antiarrhythmic drugs after ROSC even if used during resuscitation

# Key Points

- Determine and treat cause of arrest
- Protocol driven to standardize care
- Fluid resuscitation with cold IVF
- MAP > 70
- Use of automated devices for induction, maintenance, and rewarming
- Avoid hyperoxia
- Avoid hyperventilation
- Team approach with ER/Critical Care/Cardiology