POST-CARDIAC ARREST CARE: WHAT’S THE EVIDENCE?

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Objectives

- Discuss the 2015 AHA Guideline Updates for Post-Arrest Care
- Discuss oxygenation & hemodynamic targets
- Discuss the literature supporting Targeted Temperature Management post Cardiac Arrest

Trends in Resuscitation

- Pre-hospital phase
- Early defibrillation
- Quality CPR
- Post arrest: Supportive care
Overall ROSC Goals

- Does the patient need to go to the cath lab?
- Hemodynamic goals
  - Avoid hypotension
  - Monitor Capnography post arrest!
- Avoid post arrest Hypoxemia
- Targeted Temperature Management

Hemodynamic goals?

- SBP < 90 mmHg associated with worse outcomes
  - Trzeciak et al (2009), Crit Care Med
  - Bray et al (2014) Resuscitation

- MAP > 100 mmHg during 2 hrs after ROSC associated with better neurologic recovery

- Study with “bundle” of care including MAP > 80 mmHg associated with higher survival & neuro outcomes
2015 AHA Guideline Update

- Avoid & immediately correct SBP < 90 mmHg, MAP < 65 mmHg
  - Class IIb, LOE C-LD

- Identify optimal MAP for the patient

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Oxygenation

Hypoxia:
- PaO₂ < 60
- P/F Ratio < 300

Hyperoxia:
- PaO₂ > 300 or

2015 ACLS Draft Rec:
- 100% FiO₂ until ROSC
- Avoid hypoxia or hyperoxia

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2015 AHA Guideline Update

- To avoid hypoxia in adults with ROSC after CA, it is reasonable to use the highest available concentration of oxygen until the O₂ sat can be measured

- Maintain O₂ sat ≥ 94%
  - Class Ila, LOE C-LD
A New Treatment Option?

The New England Journal of Medicine

Vol. 350, No. 21, Nov. 21, 2002

Therapeutic Hypothermia to Improve the Neurologic Outcome After Cardiac Arrest

Treatment of Comatose Survivors of Out-of-Hospital Cardiac Arrest With Induced Hypothermia

Patients & Methods: From January 1, 2001, to December 31, 2004, 491 patients with out-of-hospital cardiac arrest who were successfully resuscitated were enrolled in the study. Patients received either therapeutic hypothermia or the standard of care. Median time from cardiac arrest to initiation of hypothermia was 105 minutes, and median time to achieve the target temperature was 8 hours.

Outcomes: Among 491 patients, 255 were in the hypothermia group and 236 were in the standard of care group. Median time to achievement of the target temperature in the hypothermia group was 8 hours, compared with 24 hours in the standard of care group. Mortality was significantly lower in the hypothermia group (18.4%) than in the standard of care group (29.3%). Neurologic outcome was significantly better in the hypothermia group (23% with good neurological outcome) than in the standard of care group (10% with good neurological outcome).

Critical Care Medicine, 2009
Why cool?
To minimize reperfusion injury!

- Depleted stores of $O_2$ & glucose
- Intracellular calcium influx
- Formation of $O_2$ free radicals
- Release of glutamate
- Intracellular acidosis
- Disruption in blood brain barrier
- Mitochondrial injury
- Apoptosis

Polderman, KH Crit Care Med (2009); 37:S186-202

CT scan (ED)
30 y.o. s/p asystolic arrest

Note: Loss of distinction between gray & white matter in the cerebral hemispheres

Used with permission of Dr. W. Longstreth, Harborview Medical Center

Hypoxic-Ischemic Brain Injury 36 hours later
Who should be cooled?

- Out-of-Hospital
- Ventricular Fibrillation
- Ventricular Tachycardia

What about:
- Asystole?
- PEA?
- In-Hospital arrests?
- Drowning?
- Electrocution?
- Asphyxiation?

Common side effects of mild hypothermia (32 - 34°C) include(s):

- Bradycardia
- Diuresis
- Decreased cardiac output
- Hypokalemia
- Decreased medication clearance
- Hyperglycemia
- All of the above

Hypothesis

If hospital cooling improves survival and outcomes, would initiating cooling pre-hospital make a bigger impact?
Pre-Hospital Iced Saline

- 2 L - 4°C Iced Saline
- Nearly all VFIB cases were admitted to the hospital and received cooling (despite randomization group)
- Decreased temperature by 1.2°C
- Decreased time to goal temperature by ~1 hour

Kim et al, JAMA (2013)

Kim et al, JAMA 2013 - Outcomes
Kim et al (2013) JAMA

Results

- Pre-Hospital cooling (via iced saline) made no difference in mortality or neurologic outcomes
- Increased diuretic use & higher incidence of pulmonary edema on initial chest x-ray with pre-hospital iced-saline
- Re-arrest 26% (treatment group) vs. 21% (p = 0.008)

Post-Arrest Optimal Temperature?

33°C vs. 36°C
Characteristics

- ~ 80% VFIB
- Received BLS within 1 min

Results (at 180 days):

- RCT 950 patients – Temp 33°C vs. 36°C
- 36 Hospitals – 10 countries
- Catheter 24%, surface cooling 76%

Clinical assessment:

- Does mild hypothermia (32 - 34°C) reduce mortality & improve neurologic outcomes post cardiac arrest?
  - YES!!!

- Does 36°C have the same benefit?
  - YES!!

- Does "normothermia" have the same benefit?
  - We don’t know!!

- Is fever bad post-cardiac arrest?
  - Very Likely!!
2015 AHA Guideline Update:

- Recommend against routine pre-hospital cooling of patients with ROSC with rapid infusion of cold IV fluids
  - Class III, LOE A
- Comatose adult patients with ROSC after CA should have Targeted Temperature Management.
  - Class I, LOE B-R for Vfib/pVT OHCA
  - Class I, LOE C-EO for non Vfib/pVT & IHCA

2015 AHA Guideline Update

- Maintain temperature 32 - 36˚C
  - Class I, LOE B-R
- TTM for a minimum of 24 hours after achieving ROSC
  - Class IIa, LOE C-EO
- It may be reasonable to actively prevent fever in comatose patients after TTM
  - Class IIb, LOE C-LD

Re-warming

- Important to re-warm slowly
  - Vasodilation, hypotension if too quick
- Minimum 8-12 hours
  - ~0.25˚C per hour
- If re-warm too quickly, can possibly negate benefits
  - Poor neuro outcomes in TBI/Stroke*
  - Rebound hyperthermia

Re-warming

In conclusion,

- Resuscitation involves a system of care, all being inter-dependent on improving outcomes
- Oxygen should be normalized
- Hemodynamic goals should be clearly identified & individualized for the patient
- Temperature should be managed to 32 - 36°C for 24 hours in patients resuscitated cardiac arrest