#### MY PATIENT WAS RESUSCITATED, NOW WHAT?



#### HealthTrust Resuscitation Webinar Series

Continuing Nursing and Allied Health Education Provider:



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Funding provided by:



#### Nicole Kupchik MN, RN, CCNS, CCRN, PCCN-CMC

- Clinical Nurse Specialist
- Former Code Blue Committee Co-Chair
- Currently consultant
- Staff Nurse

#### National resuscitation presentations:

- American Heart Association (AHA)
- Emergency Cardiovascular Care Updates (ECCU)
- Society of Critical Care Medicine (SCCM)
- National Teaching Institute (NTI)
- Emergency Nurses Association (ENA)



#### MY PATIENT WAS RESUSCITATED, NOW WHAT?



#### HealthTrust Resuscitation Webinar Series

#### **4-Part Resuscitation Webinar Series**

September 28<sup>th</sup> – What's New with the ACLS & BLS Guidelines?

December 20<sup>th</sup> – High Quality CPR & Why It Matters!

February 1<sup>st</sup> – Capnography: It's about more than ventilation!

March 1<sup>st</sup> – My Patient was Resuscitated, Now What?

# Objectives

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



### Trends in Resuscitation



#### Adult Immediate Post-Cardiac Arrest Care Algorithm – 2015 Update



# **Overall ROSC Goals**

- Does the patient need to go to the cath lab?
  - Assess the 12 Lead ECG
- Hemodynamic goals
  - Avoid hypotension
  - Monitor Capnography post arrest!
- Avoid post arrest Hypoxemia or Hyperoxemia
- Targeted Temperature Management

# Hemodynamic goals?

#### $\square$ SBP < 90 mmHg associated with worse outcomes

- Trzeciak et al (2009), Crit Care Med
- Bray et al (2014) Resuscitation
- Kilganon et al (2008) Resuscitation
- MAP > 100 mmHg during 2 hrs after ROSC associated with better neurologic recovery
  - Mullner et al (1996) Stroke
- Study with "bundle" of care including MAP > 80 mmHg associated with higher survival & neuro outcomes
  - Gaieski et al (2009) Resuscitation

# 2015 AHA Guideline Update

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

Identify optimal MAP for the patient

# Oxygenation

Hypoxia:  $PaO_2 < 60$ P/ F ratio < 300

Hyperoxia:  $PaO_2 > 300$  or

#### 2015 ACLS Update:

- 100% FiO<sub>2</sub> until ROSC
- Avoid hypoxia or hyperoxia



Kilgannon et al (2010) JAMA

# 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 O<sub>2</sub> sat can be measured

■ Maintain O<sub>2</sub> sat ≥94%
 ■ Class IIa, LOE C-LD

### What about the brain?

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#### MILD THERAPEUTIC HYPOTHERMIA TO IMPROVE THE NEUROLOGIC OUTCOME AFTER CARDIAC ARREST

THE HYPOTHERMIA AFTER CARDIAC ARREST STUDY GROUP\*

INDUCED HYPOTHERMIA AFTER OUT-OF-HOSPITAL CARDIAC ARREST

#### TREATMENT OF COMATOSE SURVIVORS OF OUT-OF-HOSPITAL CARDIAC ARREST WITH INDUCED HYPOTHERMIA

STEPHEN A. BERNARD, M.B., B.S., TIMOTHY W. GRAY, M.B., B.S., MICHAEL D. BUIST, M.B., B.S., BRUCE M. JONES, M.B., B.S., WILLIAM SILVESTER, M.B., B.S., GEOFF GUTTERIDGE, M.B., B.S., AND KAREN SMITH, B.SC.



Median initiation of cooling = 105 min. Median time to goal temp = 8 hours



The NEW ENGLAND JOURNAL of MEDICINE Active surface cooling protocol to induce mild therapeutic hypothermia after out-of-hospital cardiac arrest: A retrospective before-and-after comparison in a single hospital\*

Creighton W. Don, MD, PhD; W. T. Longstreth Jr, MD; Charles Maynard, PhD; Michele Olsufka, RN; Graham Nichol, MD; Todd Ray, RN; Nicole Kupchik, RN; Steven Deem, MD; Michael K. Copass, MD; Leonard A. Cobb, MD; Francis Kim, MD

491 patients from January 1, 2001 – December 31, 2004



Critical Care Medicine, 2009

### Why cool? To minimize reperfusion injury!

- Depleted stores of O<sub>2</sub> & glucose
- Intraœllular calcium influx
- Formation of O<sub>2</sub> free radicals
- Release of glutamate
- Intraœllular acidosis
- Disruption in blood brain barrier
- Mitochondrial injury
- Apoptosis



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



#### Hypoxic-Ischemic Brain Injury 36 hours later



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

# Who should be cooled?

Out-of-Hospital
Ventricular Fibrillation
Ventricular Tachycardia

#### What about:

- Asystole?
- DEA?
- In-Hospital arrests?
- Drowning?
- □ Bectrocution?
- Asphyxiation?



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

- A. Bradycardia
- **B** Diuresis
- c. Decreased cardiac output
- D. Hypokalemia
- E Decreased medication dearance
- F. Hyperglyœmia
- All of the above

# Shivering Management

- Should have a protocol for it!
- Skin counter-warming
- Magnesium
- Buspirone
- Acetaminophen
   (consider IV dosing)

- Propofol
- Dexmedetomidine (Preœdex)

Neuromuscular blockade + sedative

Step		Intervention	Dose
0	Baseline	Acetaminophen	650–1000 mg Q 4–6 h
		Buspirone	30 mg Q 8 h
		Magnesium sulfate	0.5–1 mg/h IV Goal (3–4 mg/dl)
		Skin counterwarming	43°C/MAX Temp
1	Mild sedation	Dexmedetomidine	0.2-1.5 mcg/kg/h
		or	Fentanyl starting dose 25 mcg/h
		Opioid	Meperidine 50-100 mg IM or IV
2	Moderate sedation	Dexmedetomidine and Opioid	Doses as above
3	Deep sedation	Propofol	50-75 mcg/kg/min
4	Neuromuscular blockade	Vecuronium	0.1 mg/kg IV

Columbia University shivering protocol

# Should we be infusing iced saline post ROSC to "kick start" cooling?

#### A. Yes, it works!!!

- No, the evidence doesn't support it
- c. Only if you have it available



- □ 2 L- 4°C lœd 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

#### Table 1. Baseline Characteristics of Randomized Eligible Patients (n=1359)<sup>a</sup>

	With Ventricu	lar Fibrillation	Without Ventricular Fibrillation		
	Intervention (n = 292)	Control (n = 291)	Intervention (n = 396)	Control (n = 380)	
Age, y	62.1 (14.2)	62.1 (15.6)	68.3 (16.3)	67.5 (16.5)	
Men, No. (%)	227 (78)	217 (75)	216 (55)	205 (54)	
Witnessed cardiac arrest, No. (%)	208 (71)	215 (74)	212 (54)	196 (52)	
CPR before EMS arrival, No. (%)	199 (68)	186 (64)	196 (50)	200 (53)	
Time from call to randomization, min	(n = 288) 32.9 (10.6)	(n = 286) 32.5 (9.5)	(n = 389) 34.4 (10.6)	(n = 373) 35.2 (12.6)	
Time from call to first responder ar- rival_min	(n = 290) 5.3 (2.0)	(n = 291) 5.2 (2.1)	(n = 395) 5.4 (2.1)	(n = 379) 5.2 (2.1)	
Sustained ROSC, No. (%)	273 (94)	274 (94)	354 (89)	343 (90)	
Time from call to sustained ROSC, min	(n = 142) 25 (14)	(n = 146) 24 (13)	(n = 178) 28 (14)	(n = 159) 27 (14)	
Time to first shock, min <sup>b</sup>	(n = 175) 9.4 (3.3)	(n = 179) 9.2 (2.5)	NA	NA	
Heart rate at randomization, beats/min	(n = 284) 109 (28)	(n = 285) 113 (28)	(n = 389) 110 (30)	(n = 370) 106 (31)	
Systolic blood pressure at randomiza- tion, mm Hg	(n = 271) 140 (37)	(n = 275) 144 (39)	(n = 374) 130 (43)	(n = 354) 131 (41)	

#### Kim et al, JAMA 2013 - Outcomes

#### Table 2. Status at Time of Discharge

	With Ventricular Fibrillation (n = 583)		Without Ventricular Fibrillation (n = 776)			
	No. (%) [95% Cl]			No. (%) [95% CI]		
	Intervention (n = 292)	Control (n = 291)	P Value	Intervention (n = 396)	Control (n = 380)	P Value
Vital status						
Dead	109 (37.3) [32 0-43 0]	104 (35.7) [30 5-41 4]		320 (80.8) [76.6-84.4]	318 (83.7) [79.6-87.1]	20
Alive	183 (62.7) [57.0-68.0]	187 (64.3) [58.6-69.5]		76 (19.2) [15.6-23.4]	62 (16.3) [12.9-20.4]	.30
Neurological status at discharge			_			
Full recovery	125 (42.8) [37.3-48.5]	145 (49.8) [40.7-52.1]		36 (9.1) [6.6-12.3]	34 (8.9) [6.5-12.2]	
Mildly impaired	43 (14.7) [11.1-19.2]	35 (12.0) [8.8-16.3]		21 (5.3) [3.5-8.0]	17 (4.5) [2.8-7.0]	
Severely impaired	6 (2.1) [0.9-4.4]	8 (2.7) [1.4-5.3]		5 (1.3) [0.5-2.9]	2 (0.5) [0.1-1.9]	74
Disabled (severity unknown)	2 (0.7) [0.2-2.5]	0		0	0	./4
Comatose	4 (1.4) [0.5-3.5]	7 (2.4) [1.2-4.9]		12 (3.0) [1.7-5.2]	7 (1.8) [0.9-3.8]	
Alive (status unknown)	3 (1.0) [0.4-3.0]	2 (0.7) [0.2-2.5]		2 (0.5) [0.1-1.8]	2 (0.5) [0.1-1.9]	

# Kim et al (2013) JAMA

#### Figure 2. The Proportion of Comatose Patients Achieving Either Death Without Awakening or Awakening as a Function of Days After Cardiac Arrest for Enrolled Patients





- 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 prehospital iced-saline

Re-arrest 26% (treatment group) vs. 21% (p = 0.008)

### **Post-Arrest Optimal Temperature?**

# 33°Cvs. 36°C



### Which temperature goal is preferred?

- A. Hypothermia ranging from 32 34° C
- в. 36° С
- c. Normothermia
- ⊿. 32 36 ° C
  - E Controlling temperature hasn't been shown to be beneficial

### **Characteristics**

~ 80% VFIB
 Received BLS within 1 min

#### First monitored rhythm - no. (%) †

Shockable rhythm

Characteristics of the cardiac arrest		
Location of cardiac arrest — no. (%)†		
Place of residence	245 (52)	255 (55)
Public place	197 (42)	188 (40)
Other	31 (7)	22 (5)
Bystander witnessed cardiac arrest — no. (%)	420 (89)	418 (90)
Bystander performed CPR — no. (%)	344 (73)	339 (73)
First monitored rhythm — no. (%)†		
Shockable rhythm	375 (79)	377 (81)
Ventricular fibrillation	349 (74)	356 (77)
	375 (79)	377 (81)
Asystole	59 (12)	54 (12)
Pulseless electrical activity	37 (8)	28 (6)
Unknown first rhythm, not responsive to shock or	not shocked 2 (<0.5)	6 (1)
Time from cardiac arrest to event — min‡		
Start of basic life support		
Median	1	1

0-2

10

6-13

25

18-40

9

5-13

25

16-40

Interquartile range

Interquartile range

Interquartile range

Median

Median

Start of advanced life support

Return of spontaneous circulation

### Results (at 180 days):

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

Table 2. Outcomes.				
Outcome	33°C Group	36°C Group	Hazard Ratio or Risk Ratio (95% CI)*	P Value
	no./tota	l no. (%)		
Primary outcome: deaths at end of trial	235/473 (50)	225/466 (48)	1.06 (0.89–1.28)	0.51
Secondary outcomes				
Neurologic function at follow-up†				
CPC of 3–5	251/469 (54)	242/464 (52)	1.02 (0.88-1.16)	0.78
Modified Rankin scale score of 4–6	245/469 (52)	239/464 (52)	1.01 (0.89–1.14)	0.87
Deaths at 180 days	226/473 (48)	220/466 (47)	1.01 (0.87–1.15)	0.92

#### 2015 Targeted Temperature Management Levels of Evidence – ILCOR/AHA

Recommendation	Class	LOE
Recommend against routine pre-hospital cooling of patients with ROSC with rapid infusion of cold IV fluids – No Harm		A
Comatose adult patients with ROSC after CA should have Targeted Temperature Management. For Vfib/pVT OHCA: For non Vfib/pVT (PEA & Asystole) & IHCA:		B-R C-EO
Maintain temperature 32 - 36° C	I	CB-R
TTM for a minimum of 24 hours after achieving ROSC	lla	C-EO
It may be reasonable to actively prevent fever in comatose patients after TTM	IIb	

Neumar et al (2015). Circulation;132[suppl 2]:S315-S367

#### Physiologic parameters 32 – 34° vs. 36°C

Physiologic parameter	<b>32 -</b> 34° C	36° C
Bradycardia	Yes, but not harmful	Not as much
Shivering	Yes, threshold less once at goal temperature	Yes!!!
<b>Bectrolyte shifts</b>	Yes, especially potassium & magnesium	Not as much
Drug dearance	Prolonged	Not as much
Cold induced diuresis	Yes	Not as much

# Clinical assessment:

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



# Re-warming

- Important to re-warm slowly
  - Vasodilation, hypotension if too quick
- Minimum 8 12 hours
  - ~0.15 0.25° C per hour
- □ If re-warm too quickly, can possibly negate benefits
  - Poor neuro outcomes in TBI/ Stroke\*
- Rebound hyperthermia

### **Re-warming**

The NEW ENGLAND JOURNAL of MEDICINE



# In conclusion,

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

#### **Questions?**

#### Following the Q & A session, the webinar will adjourn, and you will be directed to the Pfiedler Enterprises website to complete a course evaluation and will receive a printable certificate.

# Thank you for attending this continuing education presentation.