Controversies in Post Resuscitation After Cardiac Arrest

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More News About Gainesville FL..
- 124,354 souls
- 2007 Best place to live and play in USA
  - 2009 UF ranked #1 party school
  - 2009 UF ranked #1 lowest number of hours that students study
- Local marijuana is called “Gainesville Green” and is the most potent strain growing in USA

No Conflicts of Interest
(Member: ACLS subcommittee AHA-ECC)

The “Bow Tie” Concept

Evidence Based Medicine

Van de Wouw JACC 1997;30(3):780

PubMed End of 2013
16,000 + manuscripts on CPR.

500 + manuscripts on post ROSC care

Human Randomized Controlled: 18, Human Clinical: 34
Meta Analysis/ Practice Guidelines/ Review/ Systematic Reviews: 200
Post Resuscitation Care

Epidemiology of CA

- 200,000 out of hospital: survival 8%  
  Merchant 2011 Nov;39(11): 2401-6
- Sudden Cardiac Death (Coronary) at least ½ but still not well defined  
  Kong JACC 2011 57(7) :794
- 200,000 in hospital: survival 22%

Cardiac Arrest and Post ROSC State

- Cardiac Arrest is an EVENT
  - Dysrhythmic
  - Asphyxial
- CPR is the Therapeutic Approach to Cardiac Arrest
  - Cardiovascular recovery
  - Brain recovery
- Post ROSC is a SYNDROME
  1. Systemic inflammatory response triggered by ischemia/reperfusion process
  2. Brain injury
  3. Myocardial Dysfunction
  4. “Other” MOSF from preexisting precipitating pathology

Post-ROSC Care: An Opportunity to Improve Outcome From Cardiac Arrest

- Cerebral Protection
  - Hypothermia and CMRO₂
  - CDO₂ (CBF)
  - O₂ / CO₂ and Cerebro-Cardio-Pulmonary-Interactions
  - ROSC Attack vs Head CT ROSC Attack
- Cardiovascular Support
  - PCI post-ROSC
  - Myocardial dysfunction
- Neurological prognostication
- Systems of Care for post ROSC patients
Cardiac Arrest in 3 Phases

Who is eligible? A Case for the “Non Shockable” Patient

1. A 60 y/old with hypoxicemic 15 minutes PEA arrest from treating the “6th” vital sign on a surgical floor. Resuscitated - transported in the ICU.
2. A 60 y old patient with STEMI, R Ventricular MI followed by asystole resolved after 20 minutes of CPR ACLS protocol

Both pts: 10 Min after ROSC occasionally move spontaneously and are only localizing to pain. No evidence of seizure.

Hypothermia and CMRO₂

Who is NOT going to survive..

Acta Anaesthesiologica Scandinavica 2013;57:784-792
Pulmonary Hypertension and Cardiac Arrest: Unlikely Long Term Survival

Hooper AmJRCM 2002;165:341-344

TH for PEA: Small Case Series..

Testori Resuscitation 2011; 82 (9): 1162

TH and Non Shockable OOH

All Comers

Soga T et al  Circulation Journal  2012

2,524 Perioperative CA in 234 Hospitals..

Ramachandran SK et al. Anesthesiology V119 (6) 2013

Can You Cool Here?

Polderman KH. Crit Care 2007

No Arguments. Move Quickly

• Persistent hypotension?
• Type of Rhythm
• Pregnancy?
• Severe pre-admission morbidity?
• Age?
• Active bleeding? Take care of it quickly, but use common sense for contraindications.
• Reverse your anesthetic to assess neurological status? Use Common Sense, probably no
• Cool ASAP but you have 4 hours time to get things organized by literature criteria (VF)
TH: How Soon and How Long?  
1,4,8 Hours Start and 24 vs 48 h Duration

Best Way to Cool?

Surface vs Endovascular  
162 Patients, 2003-8

Table 1. Factors that were found to affect survival with good neurologic function (modified Rankin score 0 or 1) in a multiple logistic regression.

<table>
<thead>
<tr>
<th>Factor</th>
<th>Adjusted Odds Ratio (95% Confidence Interval)</th>
<th>p</th>
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<tbody>
<tr>
<td>Initial shockable rhythm (yes)</td>
<td>4.57 (1.65, 12.08)</td>
<td>.001</td>
</tr>
<tr>
<td>Surviving (yes)</td>
<td>0.07 (0.02, 0.29)</td>
<td>.001</td>
</tr>
<tr>
<td>Age (per yr)</td>
<td>0.94 (0.89, 0.99)</td>
<td>.011</td>
</tr>
<tr>
<td>Insulin (yes)</td>
<td>0.19 (0.07, 0.55)</td>
<td>.001</td>
</tr>
<tr>
<td>Response time &lt;30 mins (median)</td>
<td>3.42 (1.37, 8.62)</td>
<td>.009</td>
</tr>
<tr>
<td>Shoorting (yes)</td>
<td>3.55 (1.23, 9.77)</td>
<td>.029</td>
</tr>
<tr>
<td>Pre-existing neurologic damage (yes)</td>
<td>0.53 (0.82, 3.06)</td>
<td>.337</td>
</tr>
<tr>
<td>Hypehermia method (surface cooling)</td>
<td>0.63 (0.31, 1.33)</td>
<td>.300</td>
</tr>
</tbody>
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TH:  
1. How soon?  
2. How long?  
1. ASAP: There is a Trauma, STEMI and Stroke alarm, there should be a ROSC alarm!  
2. No human data. Stay Tuned

An Automatic Cooling Device  
Probably Improves Outcome

Which Device it is Unclear

How Deep Should I Cool?

32 C By Evidence in Shockable Rhythm
COLD Team STAT to the ED. EMTs Delivered a Post ROSC V Fib Patient Ready for Hypothermia

The patient’s wife tells you he had sudden severe headache before “going down”

Post ROSC Head CT Scan?

CT pre TH and Prognostication

High sensitivity
Low Specificity
May Delay the TH Induction Process but Good Info to R/O Cerebral Pathology

- SAH and OOHCA 4-15%
- Usually PEA/ Asystole
- Unlikely survivable

In the ICU on Low dose Epinephrine (BPS 80 mmHg). Cardiac Echo Global LV Dysfunction EF 45%

Cerebral Blood Flow After Cardiac Arrest

What pressure Doc?
BP post ROSC
Retrospective, 2 hours after CA

Mullner M Stroke 1996;27:59

Autoregulation in Cardiac Arrest

Sundgreen C Stroke 2001;32:128-132

Pressure Cerebro-vascular
Reactivity Index and TCD

Lang EW J Neurol Neurosurg Psychiatry 2003;74:1053-1059
Howells T J Neurosurg 102(2):317-7

Blood Pressure Goal?
May be the highest the L Ventricle can
tolerate without the risk of more cerebral
edema or myocardial dysfunction

MAP 80 + mmHg
Norepi/Epi ± Dobutamine

O2 Sat is 90%!!!

Kilgannon J JAMA 2010;303(21) 2155-2171

O2 during CA vs post ROSC

Pitcher Resuscitation 83 (4) 417-422;2012
Spindelboeck Resuscitation 84(2013);770-775
What PaCO₂?

Normal Individuals

PaCO₂

Leave the CO₂ Alone..

To Cath or Not to Cath

STEMI and Cardiac Arrest

Post ROSC Head CT Scan?

STEMI and CA: A Review

Kern K. Cath and Cardiovascular Interv 75:616-624. 2010
STEMI and CA
The Real Controversy
Impact of Expected Increases Mortality of the Cath Lab on Hospital $S

**AHA Scientific Statement**
Impact of Percutaneous Coronary Intervention Performance Reporting on Cardiac Resuscitation Centers
A Scientific Statement From the American Heart Association
Carla N. Henning, MD, FACCS, AHCPC, Michael D. Gatzke, MD, Clift W. Colleen, MD, PhD, John W. Freeman, MD, and Michael B.炙, MD, Circulation 2013;128:762-773

**Poor Agreement Between Currently Used Estimates of “Good Outcome”**

- Monitoring injury
- Monitoring recovery
  - Neuro exam
  - Biomarkers
  - EEG
  - Neuroimaging
  - SSEP Cortical Response

**Neuro Exam + Severity Score 72 h post ROSC**
- No evidence of coma
- Coma w/ MOF
- Coma w/ multisystem failure

**Myoclonic Status post ROSC: No Survival**
**EEG**

Drs. Thomas Bleck and Paul Vespa
UCLA Neuromedical 2010

**EKG**

**CT GWR (Gray/White Ratio)**

**MRI**

(Cortical and Basal Findings)

- FOCAL 30% Survival
- DIFFUSE 7% survival

Post ROSC DWI MRI 72h and Outcome at 3 months:
Highly sensitive (98%) and poorly specific (46.2%)

NeuroCC. Gen D 2012 17(2) 240-4

**Beyond the EGG**

(SSEP N2) Median Nerve response

- Performed day 3-5 days of persistent coma, post hypothermia

Leitnner Neurology 2010;74:965-69

**Withdrawal of Care in Most of the Studies is Between 60 to 80%**

**ROSC**

48 Hours

**Day 3 and Beyond**

Awaken

**Neuro Exam**

Support

Withdrawal

**Brain Death**

**Persistent Vegetative State**

**Self-Fulfilling Prophecy**

(Pygmalion Effect)

Our actions (towards others)

Our beliefs (about ourselves)

Others actions (towards us)

Others beliefs (about us)
My Hospital is Better Than Yours!!

Resuscitation “Best Standards” + Hypothermia
Ullevan University Oslo

Post ROSC Resuscitation Center of Excellence Requirements:
• Strong EMS System / short transit time
• ROSC ALARM 24/7 therapeutic hypothermia
• STEMI/CA ROSC ALARM for PCI
• ICU best evidence based practice

Conclusions: Post-ROSC Care
• Cerebral Protection
  – Hypothermia and CMRO₂
  – CDO₂ (CBF)
  – O₂ / CO₂ and Cerebro-Cardio-Pulmonary Interactions
  – ROSC Attack vs Head CT ROSC Attack
  – Monitoring
• Cardiovascular Support
  – PCI post ROSC
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• Neurological prognostication
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For Those in Cardiac Arrest
The Future is Bright..

TERIMA KASIH!!