Cruise the EMS Literature and Avoid Prehospital Errors: Don’t Bury Your Mistakes!

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Deputy Medical Director, Baltimore City Fire Department
Objectives

• Discuss the importance of literature review and identify EMS peer reviewed resources
• Examine the latest trends in prehospital airway management
• Describe important outcomes related to prehospital 12 lead electrocardiography
• Understand other topics of interest discussed in the 2014 EMS / resuscitation literature
Know Where to Get Your Literary Fix!
Peer Reviewed Resources
Access

- Medical director
- Librarian
- Online forums (vetted peer review sites)
- Instructor
- www.pubmed.com
- www.emedicine.com
Drop that tube and slap on the pap!
Prehospital Noninvasive Ventilation for Acute Respiratory Failure: Systematic Review, Network Meta-analysis, and Individual Patient Data Meta-analysis

Steve Goodacre, PhD, John W. Stevens, PhD, Abdullah Pandor, MSc, Edith Poku, MBChB, Shijie Ren, PhD, Anna Cantrell, MA, Vincent Bounes, PhD, Arantxa Mas, MD, Didier Payen, PhD, David Petrie, MD, Markus Soeren Roessler, PhD, Gunther Weitz, MD, Laurent Ducros, MD, and Patrick Plaisance, PhD
Methods

• Eight randomized trials
• CPAP and BiPAP
• Focused exclusively on pre-hospital
• Effect on mortality
• Effect on intubation rate
CPAP was more effective than the usual prehospital care in terms of mortality.
Intubation rate: CPAP vs Standard Care

When compared to usual care, prehospital CPAP decreases intubation rates.
Take Home: NIV

- Role of BiPAP unclear
- CPAP reduces mortality
- CPAP benefits in undifferentiated resp distress
Sound Familiar?

PREHOSPITAL EMERGENCY CARE 2013;17:261–273

PREHOSPITAL CONTINUOUS POSITIVE AIRWAY PRESSURE FOR ACUTE RESPIRATORY FAILURE: A SYSTEMATIC REVIEW AND META-ANALYSIS

Teresa A. Williams, PhD, MHLthSci (Res), PG Dip Clin Epi, BN, ICU Cert, RN, Judith Finn, PhD, MEdSt, GradDipPH, BSc, DipAppSc, RN, RM, ICCert, FRCNA, Gavin D. Perkins, PhD, MBBS, Ian G. Jacobs, BAppSc, DipEd, PhD, RN, FRCNA, FACAP, FERC

- Meta analysis
- 1002 patients
- 471 receiving CPAP
- Majority of patients with pulmonary edema
Prehospital CPAP

Effect of CPAP on risk of intubation
Prehospital CPAP

Effect of continuous positive airway pressure on mortality
Discussion and Take Home

• CPAP early
• CPAP aggressively
• CPAP for all causes of respiratory failure
• Reduction in mortality
• Reduction in intubation
Don’t forget the monitor!
Why do the 12 lead?

ORIGINAL CONTRIBUTIONS

Effect of Prehospital Cardiac Catheterization Lab Activation on Door-to-Balloon Time, Mortality, and False-Positive Activation

Benjamin T. Squire, MPH, Joshua H. Tamayo-Sarver, PhD, Paula Rashi, RN, William Koenig, MD, James T. Niemann, MD

Prehospital Emergency Care 2014;18:1–8
The Scope of the Problem

- 500,000 STEMI patients per year!
- 60% transported by EMS
- PCI is definitive treatment
- Time critical intervention
Study Setting: Data Collection

- Los Angeles County EMS database
- 9.8 million residents
- 549,732 EMS responses
- 3052 patients from 05/2008 → 08/2009
- Activation based upon:

***ACUTE MI SUSPECTED***
RESULTS

• Mean D2B 13 mins less
• EMS 8% more likely to meet D2B
• Mortality higher in EMS group

FIGURE 2. Distribution of door to balloon times by mode of activation.
EMS vs ED Activations

DTB %

DTB Time

ED
EMS
Overall

0 20 40 60 80 100
Areas of Concern

• High percentage (33%) of false positives
• No prehospital ECG transmission
• Implemented following study’s conclusion
Missing the Mark

Statewide EMS database
2,639 STEMI patients
Results

- 12.1% had NO chest pain
- 87% of CP patients had prehospital ECG
- 72.3% of patients without CP had prehosp ECG
- Longer FMC to device times
Who presented atypically?

- Elderly
- Female
- Diabetic

Good thing I’m male with retrosternal crushing chest discomfort.
Why Waste the Time?

- Better door to balloon times
- Better patient outcomes
- Faster delivery to definitive care
- Potential for decreased infarct size
Don’t Arrest Patient Progress!
Its All About the Epi!

Effects of prehospital adrenaline administration on out-of-hospital cardiac arrest outcomes: a systematic review and meta-analysis

Pongsakorn Atikawanparit¹,², Sasivimol Rattanasiri¹*, Mark McEvoy³, Colin A Graham⁴, Yuwares Sittichanbuncha² and Ammarin Thakkinstian¹
Prehospital Epinephrine

- 15 studies
- Meta analysis
Outcomes of Interest

- Increased prehospital ROSC
- Decreased survival to discharge
- No differences in hospital admission
Discussion and Take Home

• Benefits of routine epi unclear
• No reduction in mortality
• Some studies suggest benefit with early admin
Clinical paper

Airway management and out-of-hospital cardiac arrest outcome in the CARES registry

Jason McMullan a,*, Ryan Gerecht a, Jordan Bonomo a, Rachel Robb b, Bryan McNally b, John Donnelly c, Henry E. Wang c, On behalf of the CARES Surveillance Group

a Department of Emergency Medicine, University of Cincinnati, United States
b Department of Emergency Medicine, Emory University, United States
c Department of Emergency Medicine, University of Alabama School of Medicine, United States
CARES and Cardiac Arrest

- Voluntary, nationwide registry
- 10,691 cases of OHCA
- 5591 received ETI
- 3110 received SGA
- 1929 received no advanced airway
- Adults > 18
### Table 3


<table>
<thead>
<tr>
<th>Outcome</th>
<th>No advanced airway (n = 1929)</th>
<th>Supraglottic airway (n = 3110)</th>
<th>Endotracheal intubation (n = 5591)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Field termination of resuscitation (%)</td>
<td>33.8</td>
<td>34.6</td>
<td>22.3</td>
</tr>
<tr>
<td>Sustained ROSC (%)</td>
<td>36.5</td>
<td>25.5</td>
<td>33.8</td>
</tr>
<tr>
<td>Survival to hospital admission (%)</td>
<td>33.4</td>
<td>21.4</td>
<td>26.6</td>
</tr>
<tr>
<td>Survival to hospital discharge (%)</td>
<td>21.9</td>
<td>6.7</td>
<td>8.3</td>
</tr>
<tr>
<td>Survival to hospital discharge with good neurologic outcome (%)</td>
<td>18.6</td>
<td>5.2</td>
<td>5.4</td>
</tr>
</tbody>
</table>

![Graph showing outcomes](https://via.placeholder.com/150)

- **Survival + good neuro %**
- **Survival to discharge %**
- **Survival to Admit %**
- **Sustained ROSC**
- **Field TOR**

Legend:
- **ETI**
- **SGA**
- **Basic Airway**
Take Home Points

• No imperative for SGA
• Unclear benefit for ETI
• Survival differences between SGA and ETI limited to patients with a shockable rhythm
• Survival highest with NO advanced airway
Just Chill Out Already!
Hypothermia in 2014

• Widespread implementation
• Ice packs
• Saline
• EMS and in-hospital uses
• Positive outcomes
Chilling Questions

• Is there an imperative for EMS to cool?
• What is the best method for cooling?
• Any negative effects?
Original Investigation

Effect of Prehospital Induction of Mild Hypothermia on Survival and Neurological Status Among Adults With Cardiac Arrest: A Randomized Clinical Trial

Francis Kim, MD; Graham Nichol, MD, MPH; Charles Maynard, PhD; Al Hallstrom, PhD; Peter J. Kudenchuk, MD; Thomas Rea, MD, MPH; Michael K. Copass, MD; David Carlbom, MD; Steven Deem, MD; W. T. Longstreth Jr, MD; Michele Olsufka, RN; Leonard A. Cobb, MD

- King County, WA
- 1359 EMS cardiac arrest patients randomized
- December 2007-2012
- Nearly all VF patients received in hospital cooling irrespective of randomization
Hypothermia Outcomes

• Survival to discharge
• Neurological status at discharge
• **NOT ROSC!**

![Image of ice packs on a head](image)

*Figure 6. Ice packs to the head.*
VF Arrest + Cooling

- 62.7% survived to discharge
- 42.8% full neurological recovery
- 15% with mild impairment
- 2.1% with severe impairment
Prehospital cooling:
- increased incidence of re-arrest
- Increased incidence of pulmonary edema
- No improvement in neurologic status (VF and non VF)
Considerations and Limitations

• High performing EMS system
• Unusually high survival rates
• Unclear if intervention caused outcomes
• Effect of cooled, rapid infusion of IV saline unclear
  → acidosis
  → reperfusion injury
Targeted Temperature Management at 33°C versus 36°C after Cardiac Arrest
Study Design

- 950 unconscious survivors of OOHCA
- Assigned to TTM at 33 or 36 degrees C
- All cause mortality
- Neurologic function
- 36 ICUs in Europe and Australia
### Outcomes

**Table 2. Outcomes.**

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

• No differences in survival
• No differences in neurological outcome
• No support for lower target
So... How Low Do We Go?

→ No clear imperative for EMS to cool
→ No clear endorsement of best method for cooling
→ Cooling SHOULD begin in-hospital
→ Transport directed to centers capable of cooling / post arrest care
Come on Facebook...

Just forty more "likes" and I can save that little girl's life.
Got dilaudid?
Prehospital pain management 2014
An Evidence-based Guideline for Prehospital Analgesia in Trauma

Marianne Gausche-Hill, MD, Kathleen M. Brown, MD, Zoë J. Oliver, MD, CCFP (EM), Comilla Sasson, MD, MS, Peter S. Dayan, MD, MSc, Nicholas M. Eschmann, EMT-P, MS (Epidemiology), Tasmeen S. Weik, DrPh, MPH, Benjamin J. Lawner, DO, EMT-P, FAAEM, Ritu Sahni, MD, MPH, Yngve Falck-Ytter, Joseph L. Wright, MD, MPH, Knox Todd, MD, MPH, Eddy S. Lang, MDCM, CCFP (EM)

Prehospital Emergency Care 2014
EMS physicians
Pain medicine specialists
EMS providers
Pediatric emergency medicine physicians
Evidence based guideline review
Adverse Effects and Relative Contraindications

Sedation
Hypotension
SPO$_2$ < 90%
Allergy
Condition preventing administration (blocked nose, no IV)

(Weak recommendation, very low quality evidence)
INTERNATIONAL EMS

A COMPARISON OF KETAMINE AND MORPHINE ANALGESIA IN PREHOSPITAL
TRAUMA CARE: A CLUSTER RANDOMIZED CLINICAL TRIAL IN RURAL QUANG
TRI PROVINCE, VIETNAM

Kim Phung Tran, MD, PhD, Quynh Nguyen, MD, MPH, Xuan Nhuan Truong, MD, Viet Le,
MSci, Van Phu Le, MD, Nam Mai, MD, MPH, Hans Husum, MD, PhD, Ole Kristian Losvik, MD

PREHOSPITAL EMERGENCY CARE 2014;18:257–264
Why is Pain Control Important?

**BACKGROUND**

Efficient pain relief is crucial when providing primary life support to trauma victims. Acute pain makes breathing efforts inefficient, thereby adversely affecting oxygenation. Persistent pain and anxiety also cause the postinjury release of chemical triggers, which can induce postinjury stress responses. If uncontrolled, the postinjury stress response is a major risk factor for postinjury organ failure and trauma-related death.\(^1,2\)
Study Background

- Trauma patients in Vietnam
- Prospective trial of ketamine vs morphine
- Clinical endpoints
- Vomiting, salivation
- Blood pressure change
- Pain reduction
320 patients were assessed for eligibility

Ineligible (n=8)
- Age < 30 months (n=1)
- Deep unconscious (n=7)

312 patients underwent randomization

170 were treated with ketamine analgesia
- Prehospital time > 48h (n=1)

169 patients were analyzed in the ketamine group
- 28 with head injury
- 32 were hypotensive

142 were treated with morphine analgesia
- Prehospital time > 48h (n=2)
- ISS = 75 (n=1)

139 patients were analyzed in the morphine group
- 28 with head injury
- 20 were hypotensive
Design Limitations

Intervention

Before conducting the study, all participating doctors underwent 1 week of training in advanced trauma life support by the authors (NQ, TXN, LVP). The training included the effects and side effects of ketamine and the measurement of pain. Ketamine was administered as slow intermittent intravenous injections of doses of 0.2–0.3 mg/kg. Atropine and diazepam were not part of the treatment protocol. Morphine was administered in one single intramuscular dose of 10 mg for adult patients and 5 mg for child casualties, in accordance with the national guidelines.
Special-K

- Improved analgesia
- Less hypotension
- Less N/V (27 in Morphine group, 8 in Ketamine)
- No respiratory depression
- Increased agitation
Transexamic Acid
Figure 1. Acute Coagulopathy of Trauma Shock (Reprinted with permission)
Prehospital Use of Tranexamic Acid for Hemorrhagic Shock in Primary and Secondary Air Medical Evacuation

Erik Nelson Vu, CCP, MD, FRCPC, DAvMed, Rob S. Schlamp, CCP, Robert T. Wand, CCP, Geoff A. Kleine-Deters, CCP, RN, Mark P. Vu, MD, FRCPC, and John M. Tallon, MD, MSc, FRCPC

- Integration of TXA into protocol
- Early use for massive hemorrhage
- 13 instances of TXA
- Progressive flight protocols:
  → 24 hour medical oversight
  → Permissive hypotension
Inclusion for TXA

- Age > 16
- Major trauma (a-priori or by mechanism)
- HR > 100 bpm
- SBP < 90 mm Hg
Outcomes

• “No complications”
• Integrated into existing protocols
• 1g loading dose administered
• Average time to TXA: 32 minutes
What About Clinical Outcomes?

Tranexamic acid in the prehospital setting: Israel Defense Forces’ initial experience

Ari M. Lipsky a,1, Amir Abramovich a,1, Roy Nadler a, Uri Feinstein a, Gadi Shaked b, Yitshak Kreiss c, Elon Glassberg a,∗

a Trauma & Combat Medicine Branch, Medical Corps, Israel Defense Forces, Israel
b Department of Surgery, Soroka Medical Center, Beer-Sheba, Israel
c Surgeon General’s Headquarters, Medical Corps, Israel Defense Forces, Israel
Study Background

• December 2011- February 2013
• All IDF patients receiving TXA
• Administered in accordance with IDF protocol

1. Any penetrating injury to the torso, including the neck, axillae, groin, and buttocks.
2. Blunt or penetrating injury accompanied by signs of shock. Shock was defined as the presence of any of the following: systolic blood pressure (SBP) <90 mmHg, heart rate (HR) >100 beats per minute on repeated measurement, delayed capillary refill (>2 s), or altered level of consciousness in a casualty
Results

- 40 verified reports of TXA
- Penetrating trauma in 22 (55%) of cases
- Blunt trauma in 18 (45%) of cases
- 10 casualties received morphine
- 8/22 casualties transported by HEMS received PRBC
- 33 patients received TXA within an hour
Results

- No delays resulting from TXA
- Mortality benefit conferred at 24-48 hours
- Successful integration into existing protocol
- Liberal use observed, deviation from protocol
- Endorsement of TXA for civilian use
TXA Crashes the Party

In a large, placebo controlled trial, “CRASH-2”, the early use of TXA was associated with:

- Reduced need for blood transfusions
- Improved mortality
- Cost effectiveness
- No increase in thromboembolic events
Thank You!

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