

# Key EMS Articles Eagles 2010

**Corey M. Slovis, M.D.**  
*Dept. of Emergency Medicine, Vanderbilt University  
 Metro Nashville Fire Department  
 and International Airport  
 Nashville, TN*

Circulation 2009;120:1241-1247

### Resuscitation Science

#### Chest Compression Fraction Determines Survival in Patients With Out-of-Hospital Ventricular Fibrillation

Jim Christenson, MD; Douglas Andrusick, MSc; Siobhan Everson-Stewart, MS; Peter Kadanechuk, MD; David Hostler, PhD; Judy Powell, BSN; Clifton W. Callaway, MD, PhD; Dan Bishop; Christian Vaillancourt, MD, MSc; Dan Davis, MD; Tom P. Aufderheide, MD; Ahmed Idnis, MD; John A. Stouffer; Ian Stiell, MD, MSc; Robert Berg, MD; and the Resuscitation Outcomes Consortium Investigators

- 506 VF/VT patients from ROC
- 51% got bystander CPR
- 23% survival

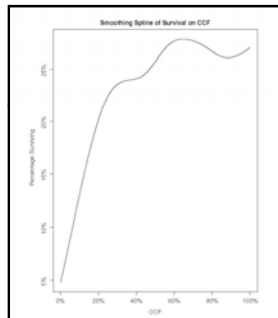
Does the chest compression fraction (% time pumping vs. interruptions) significantly influence survival?

### Resuscitation Science

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Increasing Chest Compression Fraction in VF/VT Arrests is an Independent Prediction of Hospital Discharge

JAMA 2008;299:1158-1165

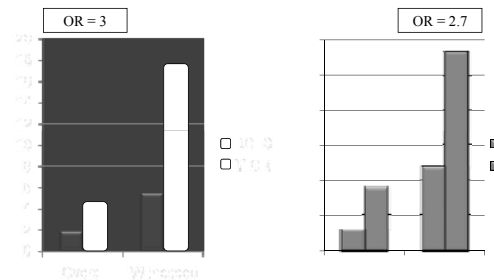
#### Minimally Interrupted Cardiac Resuscitation by Emergency Medical Services for Out-of-Hospital Cardiac Arrest

Bradley J. Bales, MD; Lani L. Clark, BS; Gordon K. Fink, MD; **Context:** Out-of-hospital cardiac arrest is a major public health problem. **Objective:** To investigate whether the survival of patients with out-of-hospital cardiac arrest could improve with minimally interrupted cardiac resuscitation (MIRCA).

- Evaluated Compression Only CPR
- 886 patients, 62 Fire Depts, Phoenix and Tucson
- 200 uninterrupted chest compressions over 2 min
- No active ventilation: O<sub>2</sub> mask affixed only
- 1 mg epinephrine each 200 compressions cycles

JAMA 2008;299:1158-1165

### Results



*AnnEmergMed 2009;54:656-662*

**Passive Oxygen Insufflation Is Superior to Bag-Valve-Mask Ventilation for Witnessed Ventricular Fibrillation Out-of-Hospital Cardiac Arrest**

Bentley J. Botrow, MD  
Gordon A. Ewy, MD  
Lari Clark, BS  
Vishal Chikara, MPH  
Robert A. Berg, MD  
Arthur B. Sanders, MD

From the Arizona Department of Health Services Bureau of Emergency Medical Services and Trauma Systems, Phoenix, AZ (Botrow, Clark, Chikara); Department of Emergency Medicine, Maricopa Medical Center, Phoenix, AZ (Botrow); the University of Arizona School of Health Care (Botrow, Ewy, Clark, Sanders, Hwang, Kanti); the Departments of Medicine (Ewy), and Emergency Medicine (Botrow, Sanders), University of Arizona College of Medicine, Tucson, AZ; and Critical Care Medicine, Children's Hospital of Philadelphia, Philadelphia, PA (Berg); Department of Emergency Medicine, Maricopa Clinic, Jacksonville, FL (Sanderowicz).

- Retrospective Study from 2005-2008
- Evaluated 2 types of MICR
- 1019 patients studied

Is just a 100% O<sub>2</sub> by face mask better, worse or equal to 8 breaths/min?

Passive Oxygen Insufflation Is Superior to Bag-Valve-Mask Ventilation for Witnessed Ventricular Fibrillation Out-of-Hospital Cardiac Arrest

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*AnnEmergMed 2009;54:656-662*

### Minimally Interrupted Cardiac Resuscitation

- 200 compressions then shock
- 3 cycles over six minutes
- Compared two methods of ventilation
- Face mask vs. 8 bag breaths/min
- Not ETT for at least 6 min of MICR

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*AnnEmergMed 2009;54:656-662*

Category	Active (%)	Passive (%)
1	9.5%	10%
2	10%	25.8%
3	25.8%	20.2%
4	20.2%	3.7%
5	3.7%	3.7%

OR = 2.5

*Circulation 2009;119:2597-2605*

**Improved Patient Survival Using a Modified Resuscitation Protocol for Out-of-Hospital Cardiac Arrest**

Alex G. Garza, MD, MPH; Matthew C. Grattan, MD; Joseph A. Salomone, MD; Daniel Lindholm, EMT-P, MICT; James McElroy, EMT-P, MICT; Rex Archer, MD, MPH

Background—Cardiac arrest continues to have poor survival in the United States. Recent studies have questioned current

- Does modifying the 2005 AHA ACLS guidelines improve survival?
- A retrospective study of VF 3 yrs before and 1 yr after implementing modified BCLS protocols
- Study performed in Kansas City
- Evaluated Vfib and pulseless V Tach

*Circulation 2009;119:2597-2605*

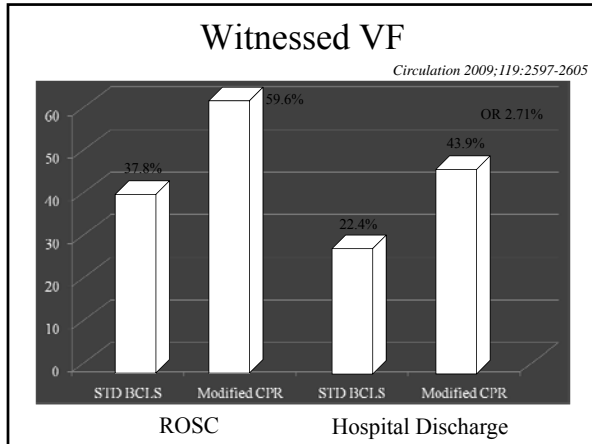
### Modified BCLS Protocol

- Compressions ↑ to 50:2 Ventilations
- 100% O<sub>2</sub> non rebreather mask on patients
- Ventilation done “gently”
- Shock Q 200 compressions/Q 2 min
- No intubation until 3 cycles (600 compressions)

*Circulation 2009;119:2597-2605*

### Modified BCLS Protocol

- Intubations limited to 3 total attempts
- Only 10 seconds allowed per attempt
- Defibrillation at 120, 160, 200 joules
- Maximized Hands on Time  
Minimized Hands Off Time



*Circulation 2009;119:2597-2605*

#### Improved Patient Survival Using a Modified Resuscitation Protocol for Out-of-Hospital Cardiac Arrest

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*Background*—Cardiac arrest continues to have poor survival in the United States. Recent studies have questioned current

**89% of Hospital Survivors of Modified CPR had Good Neurological Outcomes.**

*Circulation 2009;119:2597-2605*

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*Background*—Cardiac arrest continues to have poor survival in the United States. Recent studies have questioned current

**Endotracheal Intubation was associated with an increase in mortality.**

### CPR Take Home Points

**Maximize Hands on Time!**

**Minimize Interruptions...  
Even to intubate!**

*N Engl J Med 2004;351:647-56*

ORIGINAL ARTICLE

#### Advanced Cardiac Life Support in Out-of-Hospital Cardiac Arrest

Neil C. Smith, M.D.; George A. Wells, Ph.D.; Stuart Fink, A.C.C.P., M.P.H.; Daniel W. Spahr, M.D.; Lisa P. Neelke, M.P.H.; Victoria De Maio, M.D.; Graham Wilson, M.D., M.P.H.; Giovanni Casanovi, B.S.; James Bradburn, B.Sc.; Doug Murray, M.D.; Leonard Lurie, M.D.; B. N. K. M.P.H.; Tom Callaway, M.D.; Eugene Sweeney, M.D.; and Robert Stone, M.D., for the Ontario Prehospital Advanced Life Support Study Group

- Before and After Study of ACLS
- 17 cities, 5638 patients
- BCLS included rapid defibrillations

- No difference in survival to discharge  
5.0% vs. 5.1% survival
- ACLS did NOT improve outcomes

*Ann Emerg Med 2007;50:635-642*

EMERGENCY MEDICAL SERVICES/ORIGINAL RESEARCH

#### Survival Outcomes With the Introduction of Intravenous Epinephrine in the Management of Out-of-Hospital Cardiac Arrest

Marcus Eng Hock Ong, MBBS, MPH; Eng Hwa Tan, MBBS, MSc; Faith Susan Peng Ng, MApp Stat; Anshika Panichkulchai, BS; Susan Han Lim, MBBS, FRCS Ed

From the Department of Emergency Medicine, Singapore General Hospital (MH-Ong, SH Lim, Yip, Venkataswami); the Medical Department, Singapore Civil Defence Force (Tan); the Clinical Trials and Epidemiology Research Unit (FSP Ng, Panichkulchai); the Emergency Medicine Department, National University Hospital (Manning); the Department of Emergency Medicine, Alexandra Hospital (PN-Ong); the Department of Emergency Medicine, Chang Gung Hospital (SH Lim); the Children's Emergency, KK Women's and Children's Hospital (Sheng); and the Department of Cardiology, Tan Tock Seng Hospital (SH Lim, Sweeney, Yip, Venkataswami).

- Evaluated Epinephrine's effects on survival from cardiac arrest
- Before and after implementation study of 1,296 pts in Singapore

EMERGENCY MEDICAL SERVICES/ORIGINAL RESEARCH

**Survival Outcomes With the Introduction of Intravenous Epinephrine in the Management of Out-of-Hospital Cardiac Arrest**

*Ann Emerg Med* 2007;50:635-642

- No differences found if Arrest Witnessed
- No difference found if Bystander CPR
- No difference found if Response time < 8 min (though no Epi 0.8% vs. 2.1% with Epi)
- Subgroup analysis did show trend favoring Epi if:
  - Ventricular Fibrillation
  - Shorter Response Times (< 8 min)

JAMA 2009;302:2222-2229

**Intravenous Drug Administration During Out-of-Hospital Cardiac Arrest A Randomized Trial**

Thomas M. Obermeyer, MD  
Kjell Swale, MD, PhD  
Catherine Brackley, MS  
Jon Thurman  
Peter A. Stone, MD, PhD  
Lars Wik, MD, PhD

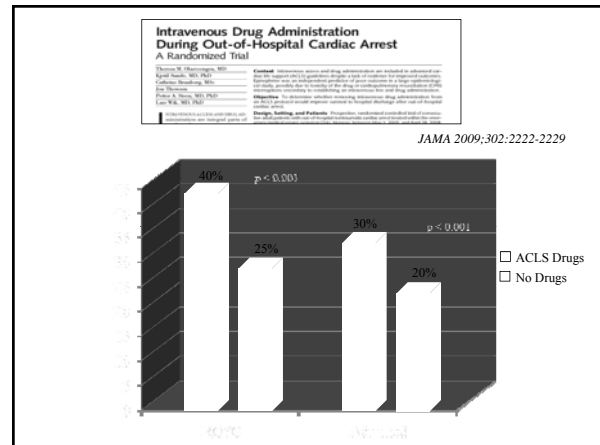
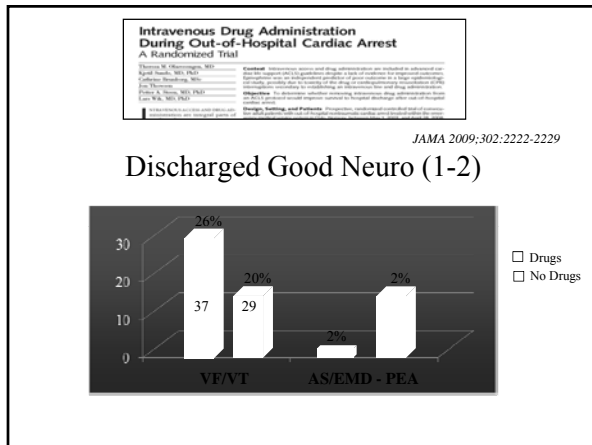
**Context:** Intravenous access and drug administration are included in advanced cardiac life support (ACLS) guidelines despite a lack of evidence for improved outcomes. Epinephrine was an independent predictor of poor outcome in a large epidemiological study, possibly due to toxicity of the drug or cardiopulmonary resuscitation (CPR) interruptions secondary to establishing an intravenous line and drug administration.

**Objective:** To determine whether removing intravenous drug administration from an ACLS protocol would improve survival to hospital discharge after out-of-hospital cardiac arrest.

**Design, Setting, and Patients:** Prospective, randomized controlled trial of emergency medical services (EMS) and out-of-hospital cardiac arrest conducted within the scope of a multicenter emergency medical services research network.

- Prospective Randomized Trial
- “ACLS” with and without IV Meds
- 418 pts ACLS Meds vs. 433 pts no Meds
- 33–34% had VF/VT

How effective is epinephrine, atropine, amiodorone or any other ACLS medication?



**Intravenous Drug Administration During Out-of-Hospital Cardiac Arrest A Randomized Trial**

JAMA 2009;302:2222-2229

- Bystander CPR doubled survival
- Survival decreased by 17% / min of prolonged response time

**ACLS Drugs**

We need to rethink all the time, money and training that goes into performing multistep multi-arm ACLS Algorithms.

# Trauma Care

ARTICLE IN PRESS  
EMERGENCY MEDICAL SERVICES/ORIGINAL RESEARCH

**Emergency Medical Services Intervals and Survival in Trauma: Assessment of the "Golden Hour" in a North American Prospective Cohort**

Craig D. Newgard, MD, MPH      From the Center for Policy and Research in Emergency Medicine, Department of Emergency Medicine, Oregon Health & Science University, Portland, OR (Newgard); the Department of Biostatistics (Schmickler), Batesville, Indiana, Department of Surgery (Dugan), and University of Washington Clinical Trial Center, University of Washington Harborview Center for Posthospital Emergency Care (Wich), and St. Louis, MO (Stuckert, Egan);  
Robert H. Schmickler, MS  
Justin R. Hodge, MD, MS, MBA  
John P. Stuckert, BSJAT

*AnnEmergMed:In Press*

- 3656 trauma patients; 806 died
- 146 EMS Agencies
- 51 Level I and II Trauma Centers

Do critically ill trauma patients benefit from "scoop and run" rapid transport?

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*AnnEmergMed:In Press*

## Patient Acuity

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- BP  $\leq$  90 mm Hg
- GCS  $\leq$  12
- RR  $<$  10 or  $>$  29
- Required Advanced Airway Intervention

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*AnnEmergMed:In Press*

No EMS time variable made any difference in trauma survival.

No effect:

- Activation Time
- Response Time
- On-Scene Time
- Transport Time

# ACS

## TIME is muscle... but

How important is it to save minutes if your D<sub>2</sub>B will beat the 90 minute goal?

*BMJ 2009;338:b1807*

**BMJ** **RESEARCH**

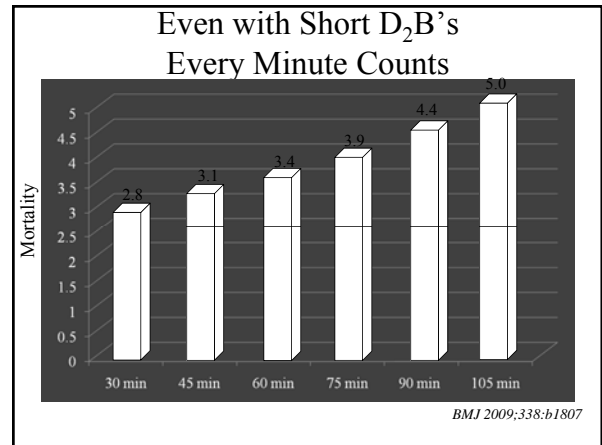
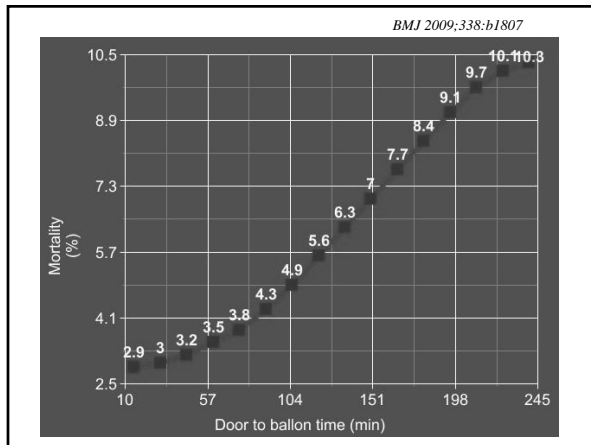
Association of door-to-balloon time and mortality in patients admitted to hospital with ST elevation myocardial infarction: national cohort study

- 43,801 STEMI PCI pts
- Median D<sub>2</sub>B of 83 min (IQR 6-109 min)
- Evaluated D<sub>2</sub>B time vs. mortality
- 2005-2006, 600 US centers

*BMJ 2009;338:b1807*

Association of door-to-balloon time and mortality in patients admitted to hospital with ST elevation myocardial infarction: national cohort study

- Consecutive patients
- No transfers
- No pre PCI lytics
- Analysis repeated excluding pts in shock
- Analysis repeated using only D<sub>2</sub>B < 6 hrs



*BMJ 2009;338:b1807*

Association of door-to-balloon time and mortality in patients admitted to hospital with ST elevation myocardial infarction: national cohort study

Time is Muscle

*BMJ 2009;338:b1807*

Association of door-to-balloon time and mortality in patients admitted to hospital with ST elevation myocardial infarction: national cohort study

The key take home point to this article is that every minute makes a difference.

Wasting time on scene for a good history, not pre-activating PCI Team, waiting to get extra test, or in the lab costs lives.

If D<sub>2</sub>B times need to be maximally shortened should paramedics read and activate the cath lab and cardiac cath team?

*Prehosp Emerg Care 2009;13:207-214*

**CAN PARAMEDICS READ ST-SEGMENT ELEVATION MYOCARDIAL INFARCTION ON PREHOSPITAL 12-LEAD ELECTROCARDIOGRAMS?**

Ketan Trivedi, MD, Jeremiah D. Schuur, MD, MHS, David C. Cone, MD

ABSTRACT

Introduction. Activation of the cardiac catheterization laboratory prior to patient arrival at the hospital, based on a prehospital 12-lead electrocardiogram (ECG), reduces door-to-balloon time by 10-25 minutes for patients with ST-segment elevation myocardial infarction (STEMI). Catheterization laboratory activation occurred in 8.1% (54/120) of cases. Of the STEMI cases, 96.1% were correctly read as STEMI, and 91.0% had the catheterization laboratory appropriately activated. Of the non-STEMI cases, 14.9% were incorrectly read as STEMI, and 12.0% had the catheterization laboratory activated.

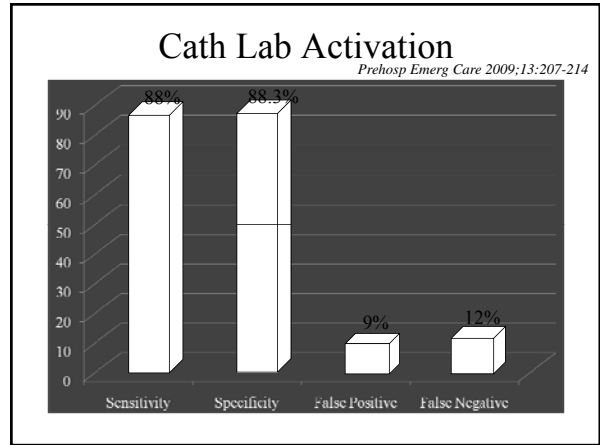
- Can Paramedics Accurately Read ECGs well enough to activate PCI Center’s Lab without MD involvement?
- Are Paramedics Sensitive Enough? (recognize STEMI’s)
- Are Paramedics Specific Enough? (not over call STEMI’s)

*Prehosp Emerg Care 2009;13:207-214*

**CAN PARAMEDICS READ ST-SEGMENT ELEVATION MYOCARDIAL INFARCTION ON PREHOSPITAL 12-LEAD ELECTROCARDIOGRAMS?**

Ketan Trivedi, MD, Jeremiah D. Schuur, MD, MHS, David C. Cone, MD

“Paramedics in an urban/suburban EMS system can diagnose STEMI and identify appropriate cardiac catheterization laboratory activations with a high degree of accuracy, and an acceptable false positive rate...”



*Prehosp Emerg Care 2009;13:207-214*

**CAN PARAMEDICS READ ST-SEGMENT ELEVATION MYOCARDIAL INFARCTION ON PREHOSPITAL 12-LEAD ELECTROCARDIOGRAMS?**

Ketan Trivedi, MD, Jeremiah D. Schuur, MD, MHS, David C. Cone, MD

- Paramedics without MD assistance miss more than 1 in 10 STEMI’s (12%).
- Paramedics without MD assistance incorrectly activate the lab about 1 out of every 10 activations (9%).

**Paramedics and STEMI Alerts**

**Take Home Points**

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ED MD overreads prior to EMS Arrival  
Improve Sensitivity and Specificity –  
have them send ECG if they can.

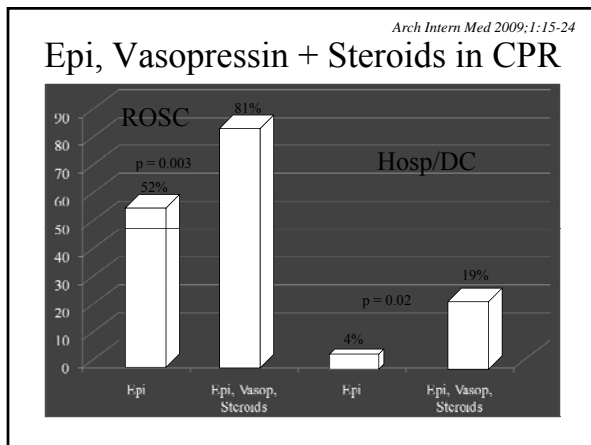
# Cardiac Arrest And Resuscitation

*Arch Intern Med 2009;1:15-24*

**Vasopressin, Epinephrine, and Corticosteroids  
for In-Hospital Cardiac Arrest**

Spyros D. Mentzelopoulos, MD, PhD; Spyros G. Zakynthinos, MD, PhD; Maria Tzoufi, MD, PhD; Nikos Katsios, MD; Andronika Papaspyllanou, MD; Sotiria Ghisioti, MD; Anastasios Stathopoulos, MD; Andromiki Kollintza, PhD; Elisavet Stamataki, MD, PhD; Charis Roussos, MD, PhD

- Epi vs. Epi + Vasopressin + Steroids
- 100 in-hospital refractory arrests
- Asystole, EMD-PEA and VF pts



- ### Comments
- 
- Small inpatient study with 3 subgroups
  - Single non-US Hospital
  - Functional status not well discussed
  - Steroids seemed helpful if pt in shock
  - 60% AS, 25% PEA, only 15% VF

### ACLS Drugs Take Home Point

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The role and dose of pressors  
(and perhaps steroids) in CPR  
still is not yet clearly defined.

## CPR Survival and Transportation

*Ann Emerg Med 2009;54:239-247*

EMERGENCY MEDICAL SERVICES/ORIGINAL RESEARCH

**Validation of 3 Termination of Resuscitation Criteria for Good Neurologic Survival After Out-of-Hospital Cardiac Arrest**

Michael L. Rhaug, BA From the University of Colorado Denver School of Medicine, Aurora, CO (Rhaug); Ryan, Haisinski; Richard L. Byrne, MD, MSc the Department of Emergency Medicine, Denver Health Medical Center, Denver, CO (Byrne); Jason S. Haukoos, MD, MSc and the Department of Epidemiology, Colorado School of Public Health, Aurora, CO (Haukoos); For the Colorado Cardiac Arrest

- 715 non traumatic arrests
- Evaluated 3 different criteria
- All 3 good, BLS best for predicting good survival vs. poor survival or death

**BLS TOR**  
Cardiac Arrest

↓

Not Witnessed by EMS Personnel  
and  
No Defibrillation Attempted Prior to Transport  
and  
No ROSC Prior to Transport

Yes | No

↓ | ↓

Terminate Resuscitation | Transport to Hospital

If implemented about 1/3 of patients would not be transported.

Ann Emerg Med 2009;54:239-247

**Take Home about TOR**  
**5 Rules Sometimes Worse Than 3**

Resuscitation 2009;80:324-328

- Unwitnessed Arrest by EMS
- No ROC Pre-Transport
- Non-Shockable Rhythm

**Therapeutic Hypothermia**

**Post Arrest**

**Evidence Based Recommendations for Therapeutic Hypothermia in STEMI**

A combination of mild hypothermia with 1<sup>o</sup> PCI “should be strongly considered as standard therapy in patients after out-of-hospital cardiac arrest due to STEMI.” Crit Care Med 2008;36:1780-1786

“...the available clinical evidence does not support therapeutic hypothermia as standard therapy for acute myocardial infarct [post arrest].” Crit Care Med 2009;37:S234-237

**Therapeutic Hypothermia (TH) s/p Arrest**  
**Take Home Points**

- Smaller studies continue to appear showing the benefits of post arrest
- TH use is rapidly expanding
- No large U.S. trial has yet been published

**Therapeutic Hypothermia  
Take Home Points**

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**The Jury is Still Out**

**EMS Airways**

*Prehosp Emerg Care 2009;13:304-310*

FOCUS ON AIRWAY MANAGEMENT

A PROSPECTIVE MULTICENTER EVALUATION OF PREHOSPITAL AIRWAY  
MANAGEMENT PERFORMANCE IN A LARGE METROPOLITAN REGION  
Denver Metro Airway Study Group\*

- 1,200 Denver paramedics
- 34 EMS transporting agencies
- 58% Fire based, 30% Private, 12% Single Agency
- All followed same airway protocols
- 81% Medial; 3% < 13 years old

*Prehosp Emerg Care 2009;13:304-310*

A PROSPECTIVE MULTICENTER EVALUATION OF PREHOSPITAL AIRWAY  
MANAGEMENT PERFORMANCE IN A LARGE METROPOLITAN REGION  
Denver Metro Airway Study Group\*

- 825 attempted intubations and transported
- 74.8% successful ETT (617/825)
- 20.6% failed ETT
- 5.2 % malpositioned tubes  
(1/2) in esophagus)

**Misplaced ETT Observations**

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*Prehosp Emerg Care 2009;13:304-310*

- More common if nasal (8.6% vs. 3.4%)
- Only 77.3% of pts had ETCO<sub>2</sub> performed
- Almost double rate of malposition if no ETCO<sub>2</sub> done  
(7.4% vs. 4%)
- Peds failures much more than Adults  
(13% vs. 4%)

**Tasers 2009**

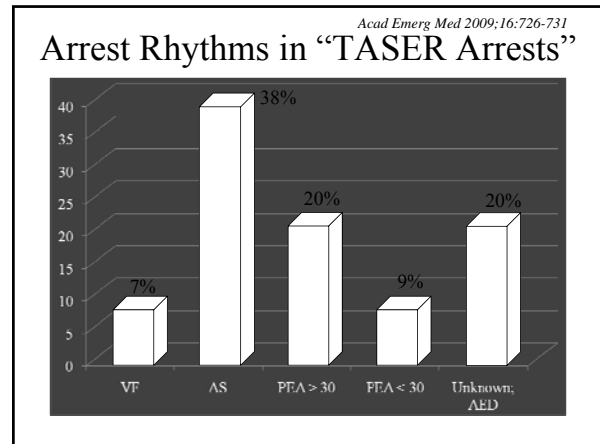
*Acad Emerg Med 2009;16:726-731*

**Presenting Rhythm in Sudden Deaths Temporally Proximate to Discharge of TASER Conducted Electrical Weapons**

Charles D. Sverdlow, MD, Michael C. Fishbein, MD, Linda Chaman, MPH, Dhananjaya R. Lakireddy, MD, and Patrick Tchou, MD

**Abstract**  
Objectives: Sudden deaths proximate to use of conducted electrical weapons (CEWs) have been attributed to cardiac electrical stimulation. The rhythm in death caused by rapid cardiac electrical stimulation.

- Retrospective study of 56 “TASER Arrests”
- All patients were monitored at time of arrest or had monitoring within minutes.
- < 3 min in 62%; < 5 min in 77%



## TASER Arrests Take Home Points

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The etiology of these arrests are still not completely understood however:

**TASERS rarely cause VF Arrests!**

*Acad Emerg Med 2009;16:726-731*

**Physiologic Effects of the TASER After Exercise**

Gary M. Vilke, MD, Christian M. Sloane, MD, Amanda Suffecool, Fred W. Kolkhorst, PhD, Tom S. Neuman, MD, Edward M. Castillo, PhD, MPH, and Theodore C. Chan, MD

**Abstract**  
Objectives: Incidents of sudden death following TASER exposure are poorly studied, and substantive

- 25 police officers brought to 85% of max HR
- TASERed: ECG, BP, HR, PH, lactate, monitored
- **TASERS had no significant ECG or physiologic effects**

## Summary and Take Home Points

- 1) Time is Muscle
  - STEMI = Scoop and Run (almost)
- 2) Paramedics are not going to be as accurate on STEMI ECG reads as MDs
  - Consider more MD involvement pre-activation
- 3) If you don't do a lot of airways, you shouldn't intubate

4) BCLS and ACLS is still a work in progress

- Push more, minimize interruptions
- Who needs oxygen anymore?*

5) Tasers are safe in normal people