Top 10 EMS Articles of 2012

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Disclosures

- Bigham:
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- Millin:
  - No disclosures
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- Rittenberger:
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Objectives

- Review top 10 EMS related articles of 2012
- Describe strengths and pitfalls of research articles
- Describe how each article can be incorporated into daily practice
- Have fun in the process

Methods

- Journal search
  - All titles in the following journals were searched…
    - Blair – Pediatric Emerg Care, Air Medical, Lancet, Resuscitation
    - Jon – PDM, NEJM, Circulation, Academic EM,
    - Michael – PEC, Annals of EM, JTrauma, JAMA
  - Abstracts & full articles chosen by each of the three reviewers to generate a list of 10 articles from their journal set
  - All three then chose the final 10 from the set of 30 by consensus (Rochambeau)
  - Final set represents the opinion of these 3
  - Other articles not presented that may equally of value
  - Attempted to find balance in types of articles ????

Categories

- Airway – 1 article
- Cardiac Arrest – 5 articles
- Pediatrics – 1 article
- Neurology – 1 article
- Pain management – 1 article
- Trauma – 1 article

Airway

Endotracheal intubation versus supraglotic airway insertion in out-of-hospital cardiac arrest

Henry E. Wang
Daniel Szydlo
John A. Stouffer
Steve Lin
Jestin N. Carlson
Christian Vaillancourt
Gena Sears
Richard P. Verbeek
Raymond Fowler
Ahamed H. Idris
Karl Koenig
James Christenson
Anushirvan Minokadeh
Joseph Brandt
Thomas Rea
The ROC Investigators

Resuscitation. 2012; 83: 1061-66

ETI vs SGA - Methods

- 10,500 patients
- Retrospective observational study
- Prospective ROC Epistry patients
  - Included: >17y non-trauma OHCA
    EMS Witnessed arrests
  - Excluded: no attempt or no success at AWM
- Multiple logistic regression
  - If both SGA and ETI, sensitivity analysis performed

ETI vs SGA - Results

- ETI in 81%; Survival 4.7%
- SGA 19%; Survival 3.9%
- For survival to discharge: OR 1.40 (1.04-1.89)
- For 24 hour survival/ROSC: OR 1.75 (1.5-2.0)
- SGA and ETI: sensitivity analysis favored ETI
- 63% King LT
- 21% Combitube
- 17% LMA

ETI vs SGA – So What?

- Historically – ETI controversial, data muddy
- Scientifically – SGA physiologically harmful?
  - Segal – reduction in swine cerebral blood flow
  - 15-50% decrease in flow due to carotid obstruction by balloons
  - Darren Braude- does not affect carotid
- Pragmatically – ROC has really good intubators
  - Experience & exposure predict success and outcome
- Is an RCT between ETI and SGA needed?

Pros/Cons

- Pro
  - Large prospectively obtained data set
  - Survival to hospital discharge with satisfactory functional status
  - Addressed the not intubated/not SGA group (AKA one shock wonders)
- Con
  - Excluded patients that were not successfully managed
  - Excluded patients with no attempt
  - Pts with placement of SGA then ETI – what's that about???
  - Included witnessed arrest – confounds dataset
  - Paramedic discretion

Cardiac Arrest

Association of Neighborhood Characteristics with Bystander-Initiated CPR

Comilla Sasson, MD
David J. Magid, MD
Paul Chan, MD
Elisabeth D. Root, PhD
Bryan F. McNally, MD, MPH
Arthur L. Kellerman, MD, MPH
Jason S. Haukoos, MD
CARES Surveillance Group

NEJM. 2012; 367: 1067-15.

SES & BSCPR- Methods

- 14,000 patients from CARES
- Looked at the neighborhood level
  - Census tract data
  - Race
  - Income
- >80% white or black, or integrated
- < or > $40,000 median household income
- Sensitivity analysis for other thresholds

SES & BSCPR- Methods

- Unit of measure = patient:
  - Sex, age, race, (un)witnessed, public/private,
- Unit of measure = neighbourhood

	High Income	Low Income
White	A	B
Black	C	D
Integrated	E	F

- Primary outcome: Bystander CPR (YES or NO)

SES & BSCPR - Results

- 29% received BSCPR
- 8% Survived, 4.1% CPC 1
- BS CPR improved all outcomes… (duh!)

- Odds of receiving BSCPR
  - Male > Female
  - White > Black (or other race)
  - Witnessed > Unwitnessed
  - Public > Private

SES & BSCPR- Results

- Unit of measure = neighbourhood

	High Income OR (p)	Low Income OR (p)
White	Ref 1.0	0.65 (<0.001)
Black	0.77 (<0.001)	0.49 (<0.001)
Integrated	1.03 (0.90)	0.62 (<0.001)

- Poor, Black 50% less likely than Rich, White
- Rich, Black 23% less likely than Rich, White

BSCPR & SES – So What?

- BSCPR rates are low
- BSCPR rates are variable among sites
- Within rates, disparity exists
- Similar findings across other US and Canadian sites
- What are the other SES factors in “neighbourhood”?
- Target various groups as part of public health policy?
- If BSCPR has SES variability, what else does?

Pros/Cons

- Pro
  - Large data base
  - Medical anthropology
  - What else is affected by differences in neighborhoods
- Con
  - ?? Hispanic population
  - Only 28.6% get bystander CPR

Wide variability in drug use in out-of-hospital cardiac arrest: A report from the resuscitation outcomes consortium☆

Benedict M. Glover[a], Siobhan P. Brown[b], Laurie Morrison[a], Daniel Davis[c], Peter J. Kudenchuk[b], Lois Van Ottingham[b], Christian Vaillancourt[d], Sheldon Cheskes[a], Dianne L. Atkins[e,f], Paul Dorian[a,*], the Resuscitation Outcomes Consortium Investigators

Resuscitation 83 (2012) 1324–1330

- 2010 AHA Guidelines downplay role of IV medications during ACLS
- **Question**: What is the variation in IV medication administration among ROC sites?

Methods

- Review of all ROC treated OHCA between 12/2005 and 6/2007
- Recorded administration of: amiodarone, lidocaine, epinephrine, vasopressin, atropine, and sodium bicarbonate
- Multivariable regression to assess association between drug use and outcome

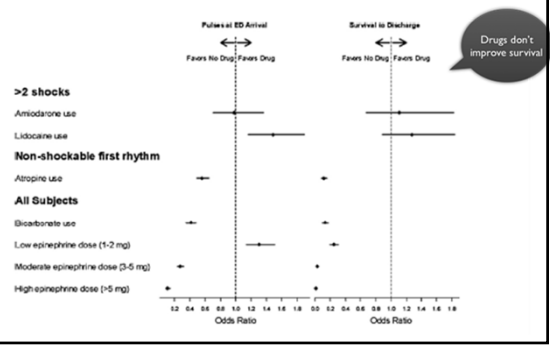
Results

- 16,221 OHCA among 74 EMS agencies
- 83% received at least one drug
- Anti-arrhythmics:
  - 96% of agencies use lidocaine
  - 55% use amiodarone
- Vasopressors:
  - 80% use epinephrine,
  - Vasopressin in 3%
- Atropine: 71%
- Sodium bicarbonate: 19%

Results

- Range in Use of the Drugs in OHCA
  - Amiodarone (0.1%-25%)
  - Lidocaine (0.2%-34%)
  - Epinephrine (57%-98%)
  - Atropine (27%-91%)
  - Bicarbonate (0.3%-71%)

Drug Use and Outcomes



So What?

- Wide variation in drugs administered
- "If you have seen one EMS agency…"
- Maybe we only need the IV for cold saline

Pros/Cons

- Pro
  - Shows that all these drugs we carry for cardiac arrest are worthless – yeah we can finally save some money
  - The answer to drug shortages
- Con
  - Still using 2000 guidelines
  - Giving drugs that should not have been given
  - All survival data is retrospective
  - Post arrest care- no TH, no care bundle
  - No fluid bolus studied

Prehospital Epinephrine Use and Survival Among Patients With Out-of-Hospital Cardiac Arrest

Akihito Hagihara, DMSc, MPH
Manabu Hasegawa, MD
Takeru Abe, MA
Takashi Nagata, MD
Yoshifumi Wakata, MD
Shogo Miyazaki, PhD

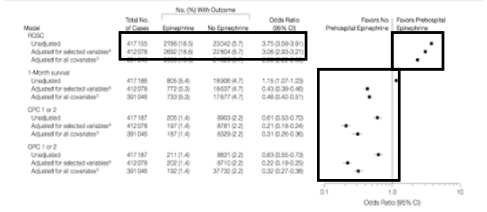
JAMA. 2012; 307 (11): 1161-68

Methods

- Purpose
  - Association between epinephrine use before hospital arrival and short and long term mortality in cardiac arrest
- Methods
  - Observational study using national registry data
  - Non randomized
  - Patients resuscitated with epi vs. those without epi
  - Epi pts matched to non-epi pts using propensity score
  - Regression analysis
  - Outcomes – ROSC, 1 yr survival, survival neuro intact

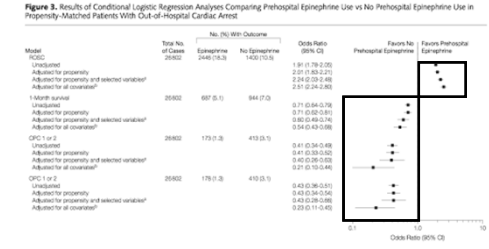
Results

Figure 2. Results of Unconditional Logistic Regression Analyses Comparing Prehospital Epinephrine Use vs No Prehospital Epinephrine Use in Patients With Out-of-Hospital Cardiac Arrest



Results

Figure 3. Results of Conditional Logistic Regression Analyses Comparing Prehospital Epinephrine Use vs No Prehospital Epinephrine Use in Propensity-Matched Patients With Out-of-Hospital Cardiac Arrest



So What??

- Epi
  - Beneficial for ROSC
  - Not beneficial for neurologically intact survival

Pros/Cons

- Pro
  - Don't have to use epi
  - Large dataset
  - Propensity analysis to match study groups
- Con
  - Not randomly assigned
  - No post resuscitative care
  - Still need an RCT to answer this question

Use of beta-blockers for the treatment of cardiac arrest due to ventricular fibrillation/pulseless ventricular tachycardia: A systematic review

Felipe Carvalho de Oliveira[a,b], Gilson Soares Feitosa-Filho[a,b,*], Luiz Eduardo Fonteles Ritt[b,c]

[a] Escola Bahiana de Medicina e Saúde Pública, Rua Frei Henrique, nº 68, Nazaré, CEP: 40050-420, Salvador, BA, Brazil
[b] Hospital Santa Izabel – Santa Casa de Misericórdia da Bahia, Hospital Santa Izabel, Praça Almeida Couto, S/N, Nazaré, 40050-410 Salvador, BA, Brazil
[c] São Paulo Federal University, Cardiology Department, Rua Napoleão de Barros, 715, CEP: 04024-002, Vila Clementino, São Paulo, SP, Brazil

Resuscitation 83 (2012) 674–683

- Epinephrine vasoconstricts through α-2 receptors
- Epinephrine also affects β-adrenoreceptors
  - Increase myocardial oxygen consumption
  - Hyperphosphorlylation of Ryanodine Receptor 2 (excessive Ca influx from sarcoplasmic reticulum to cytoplasm→ augments electrical instability)
- Epinephrine produces left-right shunt and alveolar dead space ventilation→ worsens ischemia

Background

- Various β-blockers have distinct pharmacological properties
  - Propanolol: nonspecific, lipophilic, half-life 3-4h
  - Esmolol: β1 specific, low lipophilicity, half-life 9min
  - Atenolol: β1 specific, lipophilic, half-life 6-9h
- **Question**: Any evidence β-blockers may help mitigate epinephrine's deleterious effects in pulseless VF/VT?

Methods

- MEDLINE review through February 2011
- MESH terms: "tachycardia, ventricular" OR "ventricular fibrillation" OR "resuscitation" AND "adrenergic beta-agonists"
- Keyword search: "beta-blocker," "beta-adrenergic blockade," "resuscitation," "Cardiopulmonary Resuscitation," and "cardiac arrest"
- Only reviewed studies with βblockade during CPR or immediately before VF induction

Results

- 12 animal studies
- 10 case reports
- 2 clinical trials

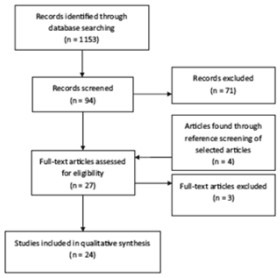


Fig. 1. Database research process and article selection.

Results

- Summary of Dog, Pig, Rat models
  - Decreases shocks necessary for defibrillation
  - Lowers myocardial oxygen requirements
  - Improves postresuscitation myocardial function
  - Reduces recurrences of arrhythmias
  - Prolongs survival

Results- Human Model

- Nademanee K, Circulation 2000.
- β-blockade in reverting shock-refractory VF
- 49 patients with ***electrical storm*** **(**20 VF/VT episodes per day or 4 VF/VT episodes per hour after MI) (72h-3mo)
- Groups: 1- ACLS therapy (N=22); 2- Adrenergic blockade (N=27)
- Adrenergic blockade: Left stellate ganglion block (N=6); Esmolol (N=7); Propanolol (N=14)

Results

- βblockade group: decreased VF from 20/day to 2.6± 1.7/day
- ACLS group: 91% continued to have VF episodes
- 1 year follow-up: βblockade group 18/27 (67%) survived, 1/22 (5%) in ACLS group

Results

- Miwa Y, Circ J 2010
- 42 consecutive electrical storm patients
- All received Landiolol (β1 blocker) between 2.5 and 80 ug/kg/min
- Did not control the arrhythmia in 9 patients (all died)
- Arrhythmia controlled but died later from MOF (N=8)
- Survival to discharge (N=25)

So What?

- Biologic plausibility and provoking
- Jim Menegazzi has been using this for a decade
- Is this why we saw an effect for amiodarone?

Pros/Cons

- Pro
  - Isn't this cool
  - Two human cohorts
  - Time for human trial
- Con
  - Low level of evidence
  - Soon Beta Blockers will also be in short supply

Impact of Changes in Resuscitation Practice on Survival and Neurological Outcome After Out-of-Hospital Cardiac Arrest Resulting From Nonshockable Arrhythmias

Peter J. Kudenchuk, MD; Jeffrey D. Redshaw, BS; Benjamin A. Stubbs, MPH; Carol E. Fahrenbruch, MSPH; Florence Dumas, MD; Randi Phelps, BS; Jennifer Blackwood; Thomas D. Rea, MD, MPH; Mickey S. Eisenberg, MD, PhD

(*Circulation*. 2012;125:1787-1794.)

- **Hypothesis:** Protocols prioritizing chest compressions improve outcome in nonshockable rhythms
- Review of OHCA between 1/1/2000 and 3/31/2010
- Control period: 1/1/2000 and 12/31/2004
- Intervention period 1/1/2005 and 3/31/2010

Results

- Reviewed 3134 in control period and 3579 in intervention period
- More bystander CPR in intervention period (57% vs. 48%)
- 1 year survival 2.7% in control period and 4.9% in intervention period (p=0.001)

Results

Table 4. Adjusted Odds Ratios for Study Outcomes Associated With the Intervention Compared With the Control Protocol Period Stratified According to Presenting Arrest Rhythm and Cause of the Cardiac Arrest

Outcomes	Control Period, 2000–2004	Intervention Period, 2005–2010	Adjusted* OR (95% CI)	*P* for Interaction	Control Period, 2000–2004	Intervention Period, 2005–2010	Adjusted* OR (95% CI)
	Presenting Arrest Rhythm						
	PEA				Asystole		
n	627	760			1147	1426	
ROSC at hospital arrival, n (%)	292 (46.6)	430 (56.6)	1.47 (1.18–1.83)	0.93	179 (15.6)	312 (21.9)	1.51 (1.23–1.86)
Survival to discharge, n (%)	68 (10.9)	119 (15.7)	1.48 (1.07–2.06)	0.73	14 (1.2)	30 (2.1)	1.69 (0.89–3.21)
CPC 1–2 at discharge, n (%)	54 (8.7)	97 (12.8)	1.50 (1.04–2.14)	0.61	6 (0.5)	15 (1.1)	2.01 (0.77–5.22)
Survival to 1 mo, n (%)	62 (9.9)	111 (14.6)	1.51 (1.07–2.11)	0.75	11 (1.0)	24 (1.7)	1.68 (0.81–3.47)
Survival to 1 y, n (%)	39 (6.2)	87 (11.5)	1.90 (1.27–2.85)	0.78	9 (0.8)	19 (1.3)	1.61 (0.72–3.60)
	Cause of Arrest						
	Cardiac				Noncardiac		
n	1054	1175			720	1011	
ROSC at hospital arrival, n (%)	236 (22.4)	359 (30.6)	1.69 (1.38–2.08)	0.06	235 (32.6)	383 (37.9)	1.33 (1.07–1.66)
Survival to discharge, n (%)	25 (2.4)	61 (5.2)	2.54 (1.56–4.14)	0.01	57 (7.9)	88 (8.7)	1.13 (0.78–1.63)
CPC 1–2 at discharge, n (%)	17 (1.6)	46 (3.9)	2.91 (1.62–5.20)	0.01	43 (6.0)	66 (6.5)	1.10 (0.72–1.68)
Survival to 1 mo, n (%)	21 (2.0)	53 (4.5)	2.63 (1.54–4.45)	0.01	52 (7.2)	82 (8.1)	1.15 (0.78–1.68)
Survival to 1 y, n (%)	13 (1.2)	37 (3.2)	2.89 (1.50–5.56)	0.11	35 (4.9)	69 (6.8)	1.49 (0.97–2.31)

OR indicates odds ratio; CI, confidence interval; PEA, pulseless electrical activity; ROSC, return of spontaneous circulation; and CPC, Cerebral Performance Category.
*Adjusted for age, sex, location of arrest, provision of bystander cardiopulmonary resuscitation, emergency medical service response interval (minutes from call receipt at the dispatch center to the earliest emergency medical service arrival on scene), cause of arrest, witnessed arrest, and initial rhythm.

What Changed?

- Better performance of CPR
- Less time analyzing rhythm

Table 5. Comparison of Cardiopulmonary Resuscitation Characteristics According to Protocol Period During the Initial 5 Minutes of Resuscitation

	Control Period, 2000–2004 (n=25)*	Intervention Period, 2005–2010 (n=25)*	P
Total chest compressions, mean (SD), n	259 (101)	360 (87)	<0.001
Compression ratio, mean (SD)†	53.7 (16.1)	66.8 (12.7)	0.008
Rhythm analyses, mean (SD), n	2.9 (0.8)	2.4 (0.7)	0.01
Total time spent in rhythm analysis, mean (SD), s	69 (26)	44 (10)	<0.001

*Matched pairs based on sex, age, initial cardiac arrest rhythm, and emergency medical service agency providing care.
†Proportion of resuscitation time without spontaneous circulation during which chest compressions were administered.

So What?

- Doing CPR correctly improves outcomes in non-VF OCHA
- Asystole is hard to fix

Pros/Cons

- Pro
  - Shows that there is value to changes we are making
- Con
  - Seattle
  - TOR has value in an EMS system
  - Observational
  - Study confounded by bystander CPR higher percentage in the intervention group

Pediatrics

Potential Adverse Effects of Spinal Immobilization in Children

Julie C. Leonard, MD, MPH
Jingnan Mao, MS
David M. Jaffe, MD

PEC. 2012; 16: 513-18.

Methods

- Purpose
  - Describe potential adverse effects on spinal immobilization in a pediatric population
- Methods
  - Prospective cohort study
  - < 18 yrs old
  - Met the ACS-COT criteria for requiring spinal immobilization
  - Spine immobilization – cervical collar +/- rigid spine board
  - Outcome – level of pain; rate of cervical imaging

Results

- 461 pts screened for eligibility
- 285 eligible for study
  - 173 spine immobilized
  - 112 non-spine immobilized, but meeting ACS-COT criteria
  - 1 pt in spine-immobilized group with cervical spine injury
  - 1/(173+112) = 1/ 285 = 0.35%

Results

TABLE 1. Characteristics of Children with and without Spinal Immobilization

Characteristic	Spine-Immobilized Prior to Evaluation ($n = 173$)	Not Spine-Immobilized but Met ACS Guidelines for Spinal Immobilization ($n = 112$)
Age—median (range), years*	11.3 (0.02–17.9)	7.6 (0.03–18.5)
Gender—male, % (95% CI)	49.1 (41.4–56.8)	58.9 (49.2–68.1)
Mechanism of injury, % (95% CI)		
Motor vehicle collision*	48.6 (40.9–56.3)	34.8 (26.1–44.4)
Fall*	20.8 (15.0–27.6)	42.0 (32.7–51.2)
Other	30.6 (23.9–38.0)	23.2 (15.8–32.1)
EMS arrival, % (95% CI)*	94.5 (90.0–97.5)	34.7 (24.0–46.5)
Glasgow Coma Scale score—median (range)	15 (12–15)	15 (13–15)
Pediatric Trauma Score—median (range)	11 (6–12)	11 (7–12)

*$p < 0.05$.
ACS = American College of Surgeons; CI = confidence interval; EMS = emergency medical services.

Results

TABLE 2. Effects of Spinal Immobilization in Children

	Spine-Immobilized Prior to Evaluation ($n = 173$)	Not Spine-Immobilized but Met ACS Guidelines for Spinal Immobilization ($n = 112$)	Odds Ratio/ Hazard Ratio (95% CI)
Pain score—median (range)	3 (0–4)	2 (0–4)	2.2 (1.4–3.4)†
Cervical spine imaging, % (95% CI)‡	56.6 (49.0–64.2)	13.4 (7.6–21.1)	8.2 (4.5–15.4)§
ED length of stay—median (range), hours	2.8 (0.3–15.1)	2.8 (0.3–10.8)	0.96 (0.76–1.2)
ED disposition, % (95% CI)			
Home	58.4 (50.7–65.8)	85.7 (77.8–91.6)	*Reference*
Floor or transfer	31.8 (24.9–39.3)	11.6 (6.3–19.0)	4.0 (2.1–7.8)§
ICU or OR	9.8 (5.8–15.3)	2.7 (0.6–7.6)	5.3 (1.5–19.0)*

*$p < 0.05$.
†Adjusted for Glasgow Coma Scale (GCS) score.
§$p < 0.0001$.
ACS = American College of Surgeons; CI = confidence interval; ED = emergency department; ICU = intensive care unit; OR = odds ratio.

So What?

- Pediatric patients meeting ACS-COT criteria for spine immoblization that were immobilized vs. those that were not immobilized….
  - Had similar levels of consciousness
  - Had high pain scores
  - Had higher rates of cervical spine imaging

Pros/Cons

- Pro
  - Adding to the evidence
  - Radiology data is an important addition to the literature
  - Identification of cultural issues in medicine
- Con
  - Chicken and egg question
  - Cervical collar and/or backboard
  - Does too much radiology really matter compared to a broken bone in the spinal column
  - Risk-benefit of Pain&Radiation vs. quadraplegia?

Neurology

Intramuscular versus Intravenous Therapy for Prehospital Status Epilepticus

Robert Silbergleit, MD
Valerie Durkalski, PhD
Daniel Lowenstein, MD
Robin Conwit, MD
Arthur Pancioli, MD
Yuko Palesch, PhD
William Barson, MD
For the NETT Investigators

NEJM. 2012; 366 (7): 591-600

Methods

- Purpose
  - Compare IV vs. IM dosing route for treatment of seizures with benzodiazepine
- Methods
  - Double-blind, randomized
  - Non-inferiority trial
  - > 40 kg
    - 10 mg IM midazolam vs. 4 mg IV lorazepam
  - 13 – 40 kg
    - 5 mg IM midazolam vs. 2 mg IV lorazepam
  - Outcome – termination of seizures prior to arrival

Results

Table 2. Primary and Secondary Outcomes.*

Outcome	Intention-to-Treat Analysis† (N = 893)		Per-Protocol Analysis‡ (N = 732)	
	IM Midazolam (N = 448)	IV Lorazepam (N = 445)	IM Midazolam (N = 362)	IV Lorazepam (N = 370)
Primary outcome				
Seizures terminated, no rescue therapy given				
No. of subjects	329	282	271	238
% of subjects (95% CI)§	73.4 (69.3–77.3)	63.4 (58.9–67.9)	74.9 (70.4–79.3)	64.3 (59.4–69.2)
Treatment failed — no. of subjects (%)	119 (26.6)	163 (36.6)	91 (25.1)	132 (35.7)
Seizures not terminated, no rescue therapy given	50 (11.2)	64 (14.4)	42 (11.6)	51 (13.8)
Seizures not terminated, rescue therapy given	22 (4.9)	42 (9.4)	14 (3.9)	38 (10.3)
Seizures terminated, rescue therapy given	47 (10.5)	57 (12.8)	35 (9.7)	43 (11.6)
Secondary outcomes				
Endotracheal intubation within 30 min after ED arrival				
No. of subjects — %	63 (14.1)	64 (14.4)	53 (14.6)	53 (14.3)
Relative risk (95% CI)	0.98 (0.70–1.34)		1.02 (0.71–1.45)	
Hospitalization				
No. of subjects — %	258 (57.6)	292 (65.6)	210 (58.0)	250 (67.6)
Relative risk (95% CI)	0.88 (0.79–0.98)		0.86 (0.77–0.96)	
ICU admission				
No. of subjects — %	128 (28.6)	161 (36.2)	102 (28.2)	138 (37.3)
Relative risk (95% CI)	0.79 (0.65–0.95)		0.76 (0.61–0.93)	
Recurrent seizure within 12 hr after ED arrival				
No. of subjects — %	51 (11.4)	47 (10.6)	37 (10.2)	39 (10.5)
Relative risk (95% CI)	1.08 (0.74–1.56)		0.97 (0.63–1.48)	
Hypotension				
No. of subjects — %	12 (2.7)	13 (2.9)	5 (1.4)	9 (2.4)
Relative risk (95% CI)	0.92 (0.42–1.98)		0.57 (0.19–1.67)	

Results

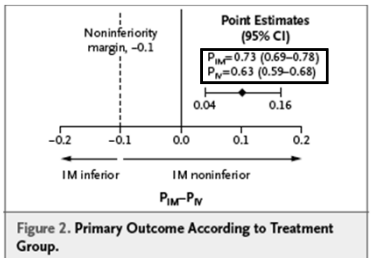


Figure 2. **Primary Outcome According to Treatment Group.**

Results

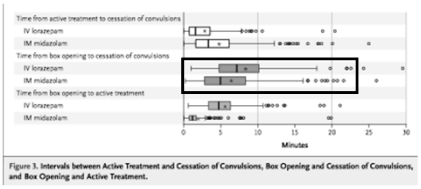


Figure 3. **Intervals between Active Treatment and Cessation of Convulsions, Box Opening and Cessation of Convulsions, and Box Opening and Active Treatment.**

So What?

- IM midazolam is at least as safe, if not more effective than IV lorazepam in terminating prehospital seizures
- Adverse event rates similar in two groups

Pros/Con

- Pro
  - Exception from informed consent study
  - A competitor for ROC, neuro style!
  - Non inferiority trial
  - Midazolam lasts, no refrigeration like lorazepam
- Con
  - Non inferiority trial
  - Result due to drug OR dose OR route

Morphine and Ketamine Is Superior to Morphine Alone for Out-of-Hospital Trauma Analgesia: A Randomized Controlled Trial

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Ann Emerg Med. 2012; 59: 497-503

Methods

- Purpose
  - Compare IV ketamine vs. IV morphine in the treatment of out-of-hospital pain
- Methods
  - Prospective, randomized, controlled, open-label study
  - Verbal pain score > 5 after treatment with 5 mg IV morphine
  - Ketamine 10 or 20 mg IV bolus vs.
  - Morphine 5 mg IV q 5 min
  - Pain score – baseline & hospital arrival
  - Outcome – change in verbal pain score 0 to 10

Results

- 135 pts enrolled
  - Morphine only group – 65
  - Ketamine after morphine – 70

Table 1. Demographic data and injury characteristics of patients.

Characteristics	Ketamine Group (n=70)	Morphine-Only Group (n=65)
Male, No. (%)	45 (64)	38 (58)
Age, y		
Median (IQR)	41 (26–56)	45 (31–66)
Minimum, maximum	18, 90	18, 96
Case nature, No. (%)		
Extremity fracture	26 (37)	29 (45)
Soft tissue injury	17 (24)	15 (23)
Fracture, other	14 (20)	13 (20)
Dislocation	11 (16)	7 (11)
Burn	2 (3)	1 (1)
Injury Severity Score		
Median (IQR)	4 (1–9)	4 (4–4)
Minimum, maximum	0, 13	0, 22
Initial pain score		
Median (IQR)	7.5 (6–9)	7 (6–8)
Minimum, maximum	3, 10	6, 10
Number of patients to whom methoxyflurane was administered, mL, frequency (%)	48 (68.6)	40 (61.5)
Dose of methoxyflurane administered, mL		
Median (IQR)	3 (3–3)	3 (3–3)
Minimum, maximum	0, 6	0, 6
Dose of trial drug administered after randomization, mg	Ketamine	Morphine
Median (IQR)	35 (20–50)	15 (10–15)
Minimum, maximum	10, 120	2.5, 60
Out-of-hospital time, min		
Median (IQR)	49.5 (34–65)	45 (36–60)
Minimum, maximum	20, 103	18, 123

IQR, interquartile range.

Results

- Numeric pain scale
  - Morphine group
    - - 3.2 (95% CI -3.7 – -2.7)
  - Ketamine group
    - -5.6 (95% CI -6.2 – -5.0)

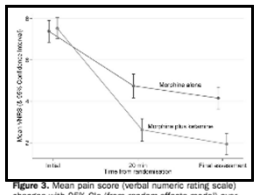

Figure 3. Mean pain score (verbal numeric rating scale) changes with 95% CIs (from random-effects model) over time by study group.

So What?

- The addition of ketamine to morphine is more effective at the treatment of out-of-hospital pain than the use of morphine alone

Pros/Cons

- Pros
  - Numeric pain rating scale
  - Well known drug that we're bringing into EMS world
  - Well done trial
- Cons
  - Use of methoxyflurane
  - Why morphine, fentanyl is better
  - Limited to less sick trauma

HEMS

Association Between Helicopter vs Ground Emergency Medical Services and Survival for Adults With Major Trauma

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Ground vs Air- Methods

- Retrospective cohort study
- 223 000 patients from National Trauma Data Bank
  - 2007, 2008, 2009
  - >15y
  - ISS >15
  - Blunt or Pen transported to L1 or L2 Trauma Centre
  - ICD 9 codes 800-959
  - Excluded DOA

Ground vs Air- Methods

- Missing data:
  - >20% - exclude
  - 38% of NTDB had >40% of values missing
  - Missing data imputed
- Logistic regression
  - Control of variance for clustering by trauma centre
  - Propensity scoring used to make data robust
    - Creates matched patient cohort
    - closest thing to an RCT with this type of data

Ground vs Air- Results

- Heli patients sicker
  - Worse HR, SBP, GCS Motor <0.001
- Heli patients survive more
  - OR 1.31 (1.27-1.38)
  - ARR of death 2.9% (1.5-4.3%)
  - NNT=65-69
  - $325,000 per life (QoL, etc not included)
- Heli patients are healthier on discharge
  - 48% require no services vs 57% <0.001

Ground vs Air- So What?

- Is this because of TIME?
- Is this because of CREW?
- Is this because of TRAUMA CENTRE?
- Need PREHOSPITAL criteria to make PREHOSPITAL decisions.

Pro/Con

- Pros
  - Methologically sound
  - Propensity score accounts for large numbers of missing data points in the NTDB
  - There is value to the HEMS program in my state
- Cons
  - Statistical: Inpute (make up) data
  - Admin dataset: bigger pile of data≠ better data

Thank You!