

Pediatric Non-Traumatic Out-of-Hospital Cardiac Arrest: Should We Hit the Brakes?

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- No relevant disclosures to report



Objectives

- Review the epidemiology of pediatric out-of-hospital cardiac arrest
- Identify factors associated with improved survival from pediatric cardiac arrest
- Discuss the pros and cons of termination of resuscitation efforts on scene for pediatric out-of-hospital cardiac arrest
- Discuss efforts EMS providers can take to engage and support families following pediatric out-of-hospital cardiac arrest

Why Not Talk About Traumatic Pediatric OHCA?

- Outcome is dismal
- 4-5% survival, essentially all neurologically devastated
- National guidelines exist

POLICY STATEMENT

Withholding or Termination of Resuscitation in Pediatric Out-of-Hospital Traumatic Cardiopulmonary Arrest

What if we could save 1000 more children suffering non-traumatic OHCA each year than we do now?



Epidemiology of Non-traumatic Pediatric OHCA

- >5000 children per year (Topjian and Berg, 2012)
- Survival rate: 5-10% (8% Jayaram 2015, 6.7-10.2% Fink 2016)
- ~70-80% associated with respiratory failure
- No improvement over last decade (Jayaram, 2015)



EMS and CPR

- We do it best!
- “Resuscitologists”
- We do high quality CPR (... better than in-hospital CPR!)



Epidemiology of Non-traumatic Adult OHCA

- Increased survival over last decade
 - Overall: Increased from 7.6% to now 10-18% (Yamaguchi 2017)
 - Witnessed VF/VT: 14% to 31% (Yamaguchi 2017)
- What has the literature teased out
 - Early defibrillation
 - Minimize interruptions
 - Full chest recoil
 - Optimal chest compression rates and depth
 - Choreographed “pit crew” CPR
 - Variability of CPR en route (and DANGEROUS!)
 - BVM over advanced airway?
 - Mechanical CPR... ?
 - National guidelines for TOR in adults

Kids Are Not Just Little Adults... Or Are They?

- Special focus:
 - Make airway management a priority
 - Watch drug dosing safety
 - Family-centered care
- Same Principles:
 - Assess
 - Monitor
 - Effective Interventions
 - Quality improvement
 - Evidence base

No increase in survival from non-traumatic pediatric OHCA in the last decade. Survival remains low, 5-10%.

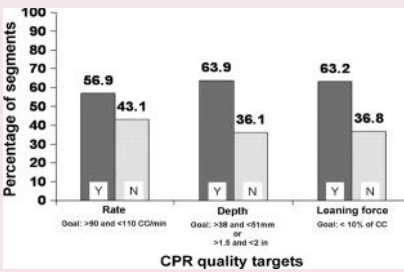
Why Aren't Kids More Resilient?

1. Are children less likely to survive cardiac arrest due to inherent factors?
2. Is the physiology of pediatric cardiac arrest such that once they fall of the cliff there is no turning back?
3. Is the science of pediatric resuscitation lagging behind that of adult medicine?

What Can We Glean from Pediatric In-Hospital Cardiac Arrest Literature?

- Improved survival in last decade
 - 10% 1980s
 - 27% 2005 (Nadkarni)
 - 43% 2009 (Girotra)
- Why?
 - Rapid response teams
 - Early interventions
 - High quality CPR

What Can We Glean from Pediatric In-Hospital Cardiac Arrest Literature?



2013:
 AHA compliant depth 26.2%;
 AHA compliant rate 83.7%;
 Systolic and Diastolic BP threshold(80/30) attained in ~60% of compressions

Sutton, Pediatrics 2009
 Sutton, Resuscitation 2013

What Can We Glean from Pediatric In-Hospital Cardiac Arrest Literature?

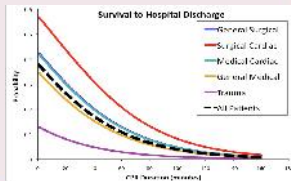
- New Findings
 - Early epinephrine administration, <5min associated with increased survival 33% vs 21% (Andersen, JAMA 2015)
 - Longer epinephrine intervals may be better (Hoyme, Resuscitation 2017)
 - - 5-8min OR 1.99, 8-10min OR 2.67
 - Intubation associated with decreased survival 36% vs 41% (Andersen, JAMA 2016)

Can we identify children who are likely to benefit from prolonged resuscitation?

Duration of CPR – When is it Futile?

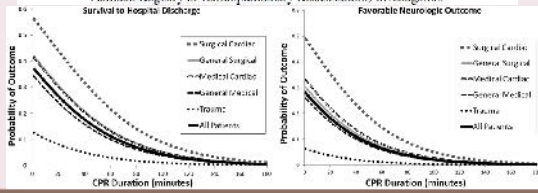
Duration of Cardiopulmonary Resuscitation and Illness Category Impact Survival and Neurologic Outcomes for In-hospital Pediatric Cardiac Arrests
 Ferris I. Maros, R. Scott Watson, Yunay M. Nadirani, Han-Hui Hwang, Robert A. Berg, Peter A. Mosay, Christopher L. Carroll, Richard J. Devane, Amy Pratsigourd, Lisa Weissfeld and Philip C. Spinella
 for the American Heart Association's Get With The Guidelines Resuscitation (Formerly the National Registry of Cardiopulmonary Resuscitation) Investigators

- Median duration of CPR:
 - Survivors 10min
 - Non-survivors 25min
- Adjusted probability of survival:
 - CPR 15min 29%
 - CPR 35min 19%



Duration of CPR – When is it Futile?

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The State of Pediatric OHCA

- 1mo survival with CPC 1-2 of transported pediatric OHCA without ROSC is extremely low: 1%
- Increased chance of survival if:
 - Witnessed arrest (aOR 3.22)
 - VF/VT (aOR 16)
 - PEA (aOR 5.2)

Goto et al, 2015

The State of Pediatric OHCA?

- Pediatric advanced airway management infrequent, lower success rates if <1yr (Hansen 2015)
- BVM seems better than ETI/SGA (OR 0.39 and 0.32) (Hansen 2017)
- Longer scene time (10-35min) associated with increased survival 10.2% vs 5.3% (Tijssen, 2016)
- Pit crew approach to pediatric OHCA associated with higher survival (17%) (Friesen, 2018)

Paramedics' Perspective on Pediatric OHCA

- Experience with pediatric OHCA:
 - 33% performed CPR on >20 children
 - 72% on >5 children
 - 7% had experience with pediatric TOR
- Beliefs regarding pediatric outcome:
 - 81% - pediatric patients had same or better chance of survival
 - 56% - felt uncomfortable with pediatric TOR despite worse prognosis



	Pediatric TOR
State	31.9%
EMS Agencies	30.4%

Fallat, Childress Grant

Hall, et al. Resuscitation. 2004; 60: 175-187

Pros and Cons of Pediatric TOR

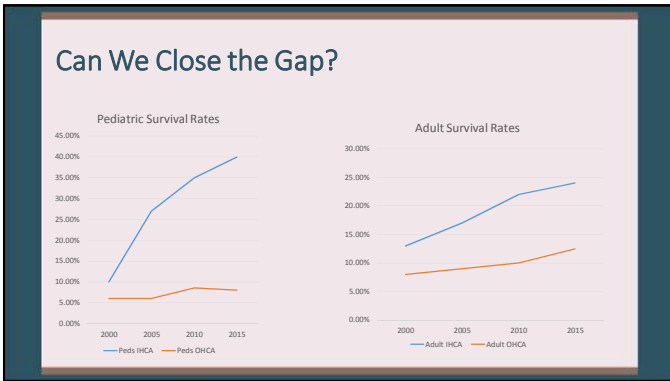
- | Pros | Cons |
|--|--|
| <ul style="list-style-type: none"> ▶ Survival is dismal, resuscitation futile ▶ Does not give false hope ▶ Assists with coroner's investigation ▶ Limits financial burden ▶ Resource and cost savings | <ul style="list-style-type: none"> ▶ Devastated family members ▶ Provider training ▶ Concern for legal liability ▶ Limited personnel to provide support ▶ Organ procurement |

Compassionate Options for Pediatric EMS (COPE)

1. Equips EMS providers with the knowledge and skills to help families cope with pediatric OHCA and death
 2. Educate EMS providers in how to provide "self help" to prevent secondary trauma
- Improved communication skills and self-insight



<https://apps.doornsa.com/COPEWeb>
 Email: aaron.calhoun@louisville.edu



- ### A New Vision for Management of Pediatric OHCA
- Support dispatcher-assisted bystander CPR for children and CPR training for the public
 - Providing high-quality CPR on scene immediately to children suffering non-traumatic cardiac arrest (QI essential)
 - Consider a pit-crew approach to pediatric resuscitation
 - Discourage a “scoop and run” approach for non-traumatic OHCA
 - Include children in TOR protocols
 - Foster family-centered care and EMS provider training in communicating a child’s death



State of Pediatric OHCA: unanswered Questions

- What are the right CPR quality and hemodynamic targets for children?
- What is the role of CPR quality feedback devices to optimize chest compression performance in children?
- How does end-tidal CO₂ monitoring compare to invasive hemodynamic monitoring?
