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Title

Deriving a Rule for Termination of Resuscitation in Pediatric Out-of-Hospital Cardiac Arrest

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INTRODUCTION

- Pediatric out-of-hospital cardiac arrest (OHCA) is an uncommon and stressful situation for providers
- Despite advanced life support interventions and optimal resuscitation techniques, pediatric OHCA carries a low survival rate of 11.3%
- Accepted criteria exist for adult patients, but not children
- There is a need to develop criteria to guide termination of resuscitation in cases when continued care would be futile

OBJECTIVES

- To derive a clinical decision rule for termination of resuscitation in non-traumatic OHCA in pediatric patients based on medical futility (less than 1% of survival)
- Determine sensitivity, specificity, positive predictive value (PPV), and negative predictive value (NPV) of the derived rule
- Survival to hospital discharge was the primary outcome of interest



(Sacramento KCRA 3)

CITATIONS

1. Harris MI, Crowe RP, Anders J, D'Acunto S, Adalgais KM, Fische J. Applying a set of termination of resuscitation criteria to paediatric out-of-hospital cardiac arrest. Resuscitation. 2021 Dec;169:175-181. doi: 10.1016/j.resuscitation.2021.09.015. Epub 2021 Sep 20. PMID: 34555488.

METHODS

- Derivation was performed using a retrospective observational cohort study design using the Cardiac Arrest Registry to Improve Survival (CARES) dataset over the past 9 years (2013-2021)
- Inclusion criteria: All cardiac arrest patients under 18 years old
- Exclusion criteria: Death due to trauma, signs of obvious death determined by responding EMS (rigor mortis, lividity, etc.), DNR status, arrest within a medical setting, no available outcome data
- Analysis was performed on n = 17918 out of the original 18069 patients
- Data was split into a training set (2013-2019) and a test set (2020-2021)
- Using the training set, a LASSO logistic regression was used to select the best predictors of survival

DERIVED CRITERIA

<input type="checkbox"/> Unwitnessed arrest
<input type="checkbox"/> No AED applied prior to EMS arrival
<input type="checkbox"/> Initial rhythm of asystole
<input type="checkbox"/> No CPR performed by bystander
<input type="checkbox"/> No sustained ROSC

Table 1. Criteria for termination of resuscitation derived from the training set. All five of the criteria must be met to predict non-survival.

RESULTS

- Derived criteria were applied to the training set and then the test set to ensure consistency of predicted outcomes

	Training set		Test set	
	Predicted survival	Predicted non-survival	Predicted Survival	Predicted non-survival
Survived	1283	5	644	2
Did not survive	9822	836	4816	510

Table 2. Results of applying the derived rule to the dataset.

	Training set	Test set
PPV	99.41%	99.61%
NPV	11.55%	11.79%

Table 3. PPV and NPV of the applied termination of resuscitation rule.



A UC Davis ambulance with child-friendly design and updated medical features to safely transport pediatric patients (University of California, Davis)

ETHICAL CONSIDERATIONS AND LIMITATIONS

- Medical futility is generally recognized as a PPV > 99%, or in other words, < 1% of patients meeting these criteria will survive
- Transport of a pediatric patient in the face of medical futility may lead to increased suffering for the family, cost, and use of public health resources
- Although the derived criteria meet that requirement, they cannot address the considerations of safety and emotions for first responders and patient's families and the decision to terminate resuscitation must be made contextually with consideration of these factors
- Pediatric termination of resuscitation protocols are currently used in several EMS jurisdictions within the United States¹

CONCLUSIONS

- These criteria provide a quick and simple way to determine medical futility of an out-of-hospital non-traumatic pediatric cardiac arrest and may provide guidance for developing EMS protocols
- In developing protocols for pediatric termination of resuscitation one must consider the support, understanding, and unique needs of the community and first responders in question