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

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ABBREVIATIONS: EMS, emergency medical services; ED, emergency department; CPR, cardiopulmonary resuscitation; PCPC, pediatric cerebral performance category; ROSC, return of spontaneous circulation.

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ABSTRACT

This multiorganizational literature review was undertaken to provide an evidence base for determining whether or not recommendations for out-of-hospital termination of resuscitation could be made for children who are victims of traumatic cardiopulmonary arrest. Although there is increasing acceptance of out-of-hospital termination of resuscitation for adult traumatic cardiopulmonary arrest when there is no expectation of a good outcome, children are routinely excluded from state termination-of-resuscitation protocols. The decision to withhold resuscitative efforts in a child under specific circumstances (decapitation or dependent lividity, rigor mortis, etc) is reasonable. If there is any doubt as to the circumstances or timing of the traumatic cardiopulmonary arrest, under the current status of limiting termination of resuscitation in the field to persons older than 18 years in most states, resuscitation should be initiated and continued until arrival to the appropriate facility. If the patient has arrested, resuscitation has already exceeded 30 minutes, and the nearest facility is more than 30 minutes away, involvement of parents and family of these children in the decision-making process with assistance and guidance from medical professionals should be considered as part of an emphasis on family-centered care, because the evidence suggests that either death or a poor outcome is inevitable.

INTRODUCTION

In 2003, the National Association of EMS Physicians and the Committee on Trauma of the American College of Surgeons published guidelines for out-of-hospital withholding or termination of resuscitation for adult victims of traumatic cardiopulmonary arrest who met specific criteria.[1] Clinical criteria included absent pulse, unorganized electrocardiogram rhythm, fixed pupils (all at the scene), and cardiopulmonary resuscitation greater than 15 minutes. The recommendations did not extend to the pediatric population. Although many of the studies on which the recommendations were based included children, the vast majority of the involved subjects were adults. Studies published to that time that addressed the pediatric population in particular[2,3] and evaluated survival and functional outcome of pediatric blunt trauma victims with either full traumatic cardiopulmonary arrest or severe hypotension suggested that the prognosis for pediatric traumatic cardiopulmonary arrest victims is similar to that for adults. Given the emotional demands of withholding resuscitation from a child in the field, it was believed by both the leadership in pediatric trauma care and emergency medical services (EMS) that additional studies were warranted before including children in any

termination-of-resuscitation protocol. This literature review in pediatrics was undertaken to provide an evidence base for determining whether recommendations for out-of-hospital termination of resuscitation could be made. The project aims were to: (1) identify whether specific criteria exist that would support out-of-hospital withholding or termination of resuscitation for traumatic cardiopulmonary arrest victims; and (2) identify a specific time frame for any subset of pediatric trauma patients beyond which further resuscitative efforts are futile.

MATERIALS AND METHODS

Organizational participants included the Committee on Trauma, Subcommittee on Emergency Services–Prehospital, and Pediatric Surgical Specialty Group of the American College of Surgeons; Committee on Pediatric Emergency Medicine of the American Academy of Pediatrics; National Association of EMS Physicians; and Pediatric Committee of the American College of Emergency Physicians. The initial review was completed in September 2008, and additional literature through 2011 was added to provide currency to the review. General guidelines for evaluation included:

1. Distinguish between blunt and penetrating trauma victims.
2. Define "pediatric patient" as 18 years of age or younger.
3. Determine location of arrest (out-of-hospital or emergency department [ED]).

Specific characteristics of the arrest were determined, if possible, as follows:

1. Distinguish between respiratory and cardiopulmonary arrest (from any cause).
2. Determine duration of witnessed arrest.
3. Determine duration of resuscitation to successful return of spontaneous circulation.
4. Determine outcome of children who had successful return of spontaneous circulation: did they survive to reach the hospital, survive to hospital discharge, and have long-term neurologic function?
5. Determine duration of resuscitation efforts in nonsurvivors.
6. Determine effects of epinephrine administration.
7. Determine outcome of thoracotomy when used.
8. Exclude special circumstances: drowning (warm or cold water), hypothermia, burns, electrocution (lightning, electric fence).
9. Determine any caveats with regard to survival to be an organ donor.

Methodology for the evidence evaluation was based on the 2000 Eastern Association for the Surgery of Trauma guideline "Utilizing Evidence-Based Outcome Measures to Develop Practice Management Guidelines: A Primer."[4] Class I evidence is derived from prospective, randomized, controlled trials; class II evidence represents clinical studies in which data were collected prospectively or retrospective analyses that were based on clearly reliable data; and class III evidence is based on retrospectively collected data. A validity scale for class I was detailed by Jadad et al in 1996.[5] Recommendations were classified as level 1, 2, or 3 according to the following definitions:

Level 1: The recommendation is convincingly justifiable based on the available scientific information alone. This recommendation is usually based on class I data; however, strong class II evidence may form the basis for a level 1 recommendation, especially if the issue does not lend itself to testing in a randomized format. Conversely, low quality or contradictory class I data may not be able to support a level 1 recommendation.

Level 2: The recommendation is reasonably justifiable by available scientific evidence and strongly supported by expert opinion. This recommendation is usually supported by class II data or a preponderance of class III evidence.

Level 3: The recommendation is supported by available data but adequate scientific evidence is lacking. This recommendation is generally supported by class III data. This type of recommendation is useful for educational purposes and in guiding future clinical research.

Each article was assigned at least 2 reviewers. The assignments were known only to the project director. All articles were also reviewed by the project director, and evidence class was reconciled as needed.

LITERATURE REVIEW

MedLine and PubMed were searched for the initial review through Ovid from 1980 to 2006. Subsequently, the review was updated with literature as recent as 2011. Search terms included traumatic cardiopulmonary arrest, blunt trauma, cardiorespiratory arrest, resuscitative thoracotomy, out-of-hospital cardiac arrest, out-of-hospital termination of resuscitation, cardiopulmonary resuscitation, emergency medical services, advanced life support, basic life support, outcome, survival, children, and adolescent. Article bibliographies were hand-searched for additional references. New citations were added and assigned as appropriate. Abstracts were included only if a companion manuscript was identified. Editorials, letters to the editor, and studies that included only adults were eliminated. Published papers that included only victims of drowning were ultimately eliminated after review, because the special circumstance of hypothermia and/or cold water drowning may alter resuscitation. Studies that included both adults and children were used if the children were evaluated separately or if data relevant only to children could be abstracted from the text. Studies that mixed traumatic arrests and arrests from other causes were used only if the trauma cohort was described independently. Only trauma patients who suffered a cardiopulmonary arrest rather than isolated respiratory arrest were included. Individual patients were included for review only if they could be tracked through the published paper such that some outcome (ie, at least survival to hospital discharge) could be determined. The arrest interval or time to resuscitation was defined, in a witnessed arrest, as the time between the occurrence of arrest and the time