
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

that cardiopulmonary resuscitation (CPR) was instituted, whether by a bystander or professional. Resuscitation time was defined as the duration of CPR until either return of spontaneous circulation or death was declared.

RESULTS

A total of 54 articles were retrieved for the initial review.^{2,3,6-57} Of these, 35 were eliminated for the reasons described previously,⁶⁻⁴⁰ leaving 19 articles with potentially useful information.^{2,3,41-57} An additional 23 articles were screened for the secondary review,⁵⁸⁻⁸¹ with 9 articles appropriate for inclusion.^{58,64-69,72,81} There were 2 sets of patients included in 2 manuscripts each, and data was used only once.^{53,72,74,80} There were 5 class II studies and 22 class III studies. From the 27 articles, there were 1114 patients who suffered an out-of-hospital traumatic cardiopulmonary arrest, with 60 surviving to hospital discharge (5.4%). Outcome data were available in 23 papers for 51 of these patients (Table 1): 29 suffered neurologic devastation and were either severely disabled or in a vegetative state,^{2,41,44-6,53,64,66,68} 3 patients had moderate disability,^{3,42,66} and 19 survived with a “good” or full neurologic recovery.^{3,42,66,68,69} A separate evidentiary table provides data for cases of out-of-hospital traumatic cardiopulmonary arrest in children for which outcome was not reported (Table 2).^{56,59,72,81}

A uniform system of describing disability was not used by all authors, although the most popular system was the pediatric cerebral performance category (PCPC) (Table 3).⁸² Thirty-six patients suffered an out-of-hospital traumatic cardiopulmonary arrest from penetrating injuries, and at least 9 of them had a resuscitative thoracotomy in an ED; all of these patients died regardless of whether thoracotomy was performed.^{3,50-52,68} Resuscitative thoracotomy was performed at the scene, in the ED, or in the operating room, for a total of 30 patients (combined blunt and penetrating trauma victims) who suffered an out-of-hospital traumatic cardiopulmonary arrest, and there were no survivors.^{3,50-52} A few published papers mentioned children who were declared dead in the field, implying that the state or country has a do-not-resuscitate protocol for a subset of arrest victims.^{3,47,48,78,79}

Cause of death, interval of arrest to CPR, and total resuscitation time for survivors were reported in a few papers. Specific anatomic causes of death were only rarely mentioned in

failure before harvesting.⁵⁸ However, it was noted by another group that it is ethically inappropriate to proceed with resuscitation solely to preserve organs, because the physician may be more committed to the potential well-being of an unknown recipient rather than the patient at hand or his or her family members. Traditionally, cadaveric organ transplantation operates under the “dead donor rule,” and organ recovery must not be

the direct cause of the donor’s death, a concept that is justified by the prohibition against the direct killing of innocent persons. Further, the added expense associated with organ preservation, until such time as decoupling has occurred and the family can be approached about donation, is generally the responsibility of the donor family. If the family decides to donate, future expenses will be born by the organ procurement organization

on behalf of the recipient.⁸³ If the family declines the opportunity to donate, this added expense and burden is not offset by a perceived benefit to the family.⁴⁴

DISCUSSION

unlikely to have been pulseless because of the difficulty of recognizing pulselessness in children.^{60,87}

ED crowding in the United States is an emerging threat to patient safety and public health, particularly in safety net hospitals.⁸⁸⁻⁹⁰ Although the effects of ED crowding on patient care and outcome are complex, transport of a nonviable patient from the field to the ED has the secondary effect of making the resources of the EMS personnel unavailable for those who might benefit from crucial immediate attention. A series of articles by Morrison et al validating the termination of resuscitation rule estimated that the frequency of out-of-hospital adult cardiac arrest transports to the ED could be reduced from 100% to 37.4% of calls, with no loss of viable patients, thus resulting in valuable resource and cost savings.⁹¹⁻⁹³ In addition to the cost concerns, the “lights and siren” run is associated with significant potential for injury to EMS personnel and the public.⁹⁴⁻⁹⁷ Finally, the costs of supplies (often including precious blood products) and the emotional toll on ED providers who would not otherwise be exposed to the death, including the risk of post-traumatic stress disorder, are all important considerations that should not be ignored when choosing whether to transport a patient who is already dead or who will inevitably die (unpublished survey data; in process to submit for publication).

It is for these reasons that there is increasing acceptance of termination of resuscitation for adults when there is no hope for a good outcome.^{1,91,92,98-102} Although the same justifications apply to children, especially in light of worse out-of-hospital resuscitation outcomes, children are routinely excluded from termination-of-resuscitation protocols, at least in the United States.¹

final outcome data are often lacking. One study used registry data that may repeat reports of some children previously mentioned in the other studies. There is now an effort to try to standardize data for out-of-hospital arrests that will be helpful going forward, but this information cannot be applied to this review.¹¹⁶ One of the more recent reviews that applied this template excluded trauma patients.⁷⁸ Some of the references in the discussion that detail out-of-hospital cardiac arrest transports to the ED in adults may not necessarily translate to children. The original Hopson study has been reconfirmed, and one of the

FUTURE POLICY AND PROTOCOL GUIDANCE

1. Termination-of-resuscitation protocols for children based on the evidence should be developed and implemented under the guidance of the EMS system or state EMS medical director. Online medical control may be needed to determine the appropriateness of termination of resuscitation in individual children.
2. Policies and procedures for termination-of-resuscitation protocols must include notification of the appropriate law enforcement agencies and notification of the medical examiner or coroner for final disposition of the body.
3. EMS providers should receive education regarding communication with families and assistance with how to direct families to community and grief resources. EMS providers should have immediate access to resources for their own debriefing and counseling. Families of the deceased should have immediate access to culturally and linguistically appropriate care, counseling, and resources, including access to clergy, social workers, and other counseling personnel.
4. EMS, medical control, and ED providers should have access to resources for their own debriefing and counseling after the death of a child.
5. Adherence to policies and protocols governing termination of resuscitation should be monitored through a quality review system.
6. A more formal study evaluating out-of-hospital traumatic cardiopulmonary arrest that includes long-term neurologic and functional outcome should be performed to clarify expectations for intact survival in children and legitimize the inclusion of children in termination-of-resuscitation protocols.
7. Research is vitally needed regarding the acceptance of termination-of-resuscitation protocols by families of children sustaining out-of-hospital traumatic cardiopulmonary arrest to determine the potential emotional effects of both termination of resuscitation and failure to initiate resuscitative efforts when futility of such efforts is apparent.
8. There is a need for more research/study of infants/children/adolescents from diverse racial, ethnic, cultural, and socioeconomic populations to determine whether disparities in resuscitative care or outcomes exist.
9. Engagement of, partnership with, and collaboration with local communities and advocacy groups, perhaps through a community-based participatory research concept, may prove helpful in developing protocols and providing community health education programs about this subject.

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