POSITION PAPER

NATIONAL ASSOCIATION OF EMS PHYSICIANS

TERMINATION OF RESUSCITATION IN THE PREHOSPITAL SETTING FOR ADULT PATIENTS SUFFERING NONTRAUMATIC CARDIAC ARREST

E. David Bailey, MD, Gerald C. Wydro, MD, David C. Cone, MD, for the National Association of EMS Physicians Standards and Clinical Practice Committee

ABSTRACT

The National Association of EMS Physicians (NAEMSP) supports out-of-hospital termination of resuscitation for adult, nontraumatic cardiac arrest patients who have not responded to full resuscitative efforts. The following factors should be considered in establishing termination of resuscitation protocols: 1) Termination of resuscitation may be considered for any adult patient who suffers sudden cardiac death that is likely to be medical. 2) Unwitnessed cardiac arrest with delayed initiation of cardiopulmonary resuscitation (CPR) beyond 6 minutes and delayed defibrillation beyond 8 minutes has a poor prognosis. 3) In the absence of "do not resuscitate" or advanced directives, a full resuscitative effort including CPR, definitive airway management, medication administration, defibrillation if necessary, and at least 20 minutes of treatment following Advanced Cardiac Life Support (ACLS) guidelines should be performed prior to declaring the patient dead. 4) A patient whose rhythm changes to, or remains in, ventricular fibrillation or ventricular tachycardia should have continued resuscitative efforts. Patients in asystole or pulseless electrical activity should be strongly considered for out-of-hospital termination of resuscitation. 5) Logistic factors should be considered, such as collapse in a public place, family wishes, and safety of the crew and public. 6) Online medical direction should be established prior to termination of resuscitation. The decision to terminate efforts should be a consensus between the on-scene paramedic and the online physician. 7) The on-scene providers and family should have access to resources, such as clergy, crisis workers, and social workers. 8) Quality review is necessary to ensure appropriate application of the termination protocol, law enforcement notification, medical examiner or coroner involvement, and family counseling. **Key words:** resuscitation termination; National Association of EMS Physicians; NAEMSP; out-of-hospital cardiac arrest; cardiac arrest.

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Dr. Bailey is in the Department of Emergency Medicine, Christiana Care Health System, Newark, Delaware. Dr. Wydro is in the Division of EMS, Department of Emergency Medicine, MCP–Hahnemann School of Medicine, Philadelphia, Pennsylvania. Dr. Cone is chief of the Division of EMS, Section of Emergency Medicine, Yale School of Medicine, New Haven, Connecticut.

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Address correspondence and reprint requests to: David C. Cone, MD, Chief, Division of EMS, Section of Emergency Medicine, Yale School of Medicine, Suite 260, 464 Congress Avenue, New Haven, CT 06519-1315. e-mail:<david.cone@yale.edu>.

Each year, approximately 400,000 persons suffer sudden cardiac death in the United States. The vast majority of sudden cardiac death occurs in the out-of-hospital setting.[1] Ventricular fibrillation (VF), a potentially reversible dysrhythmia, is the initial rhythm for most patients suffering sudden cardiac death.[2–4] If defibrillation does not occur quickly, however, this rhythm degenerates into asystole, a rhythm that is generally terminal. Emergency medical services (EMS) systems in the 1960s and 1970s found their origins in the concept that timely activation of EMS, rapid cardiopulmonary resuscitation (CPR), defibrillation, and Advanced Cardiac Life Support (ACLS) in the out-of-hospital setting offered patients suffering from out-of-hospital cardiac arrest the best chance of survival.[2–5] Since that time much effort has been expended to maximize the "chain of survival" in the out-of-hospital setting. In the past, when patients failed to respond to prehospital resuscitative efforts, the resuscitation was classically continued in a mobile advanced life support (ALS) unit, speeding to the hospital, for continued resuscitative efforts in the emergency department (ED). Pronouncement of death in the field was reserved for the patient with obvious signs of prolonged cardiac arrest such as rigor mortis and lividity.

In the late 1970s researchers began to report the futility of transporting certain patients suffering out-of-hospital cardiac arrest to the ED for continued resuscitative efforts. Since that time, a mounting body of literature, largely in the form of retrospective studies, has

shown that there is a subset of patients who do not benefit from continued resuscitative efforts. When we consider that continued resuscitation and rapid transport to the ED carry significant financial costs as well as possible hazards to the public and prehospital personnel (including blood-borne pathogen exposure, injuries associated with moving patients, and motor vehicle accidents while transporting to the hospital), the benefit associated with continued resuscitation becomes questionable.

Several EMS systems, following the early lead of the Seattle and Milwaukee systems, have developed protocols to allow for terminating resuscitative efforts in the field.[6] However, as Kellermann pointed out in a 1993 concept paper,[7] in contrast to the consensus that has developed regarding how to best treat out-of-hospital cardiac arrest, there is no consensus on how or when to terminate such treatment. While it seems reasonable to assume that these protocols grew out of the body of literature that suggests that certain factors such as cardiac rhythms, time intervals, and care given in the prehospital setting (e.g., bystander CPR) are predictive of outcome, we cannot be certain of this. It must also be recognized that termination of resuscitation in the prehospital setting goes beyond the science of resuscitation. Other considerations include the education of prehospital providers regarding the pathophysiology of cardiac arrest (including an understanding of the natural history of cardiac arrest, with attention to collapse-to-treatment intervals, and the poor prognosis that prolonged collapse-to-definitive care intervals portends for the patient), the families of the victims and their needs, and the needs of prehospital providers who are now responsible for grief counseling and family notification. Safety and logistic issues must also be taken into consideration, requiring a comprehensive multidisciplinary response to termination of resuscitative efforts in the field.

Literature Review

Research in field termination of resuscitation began in the late 1970s and early 1980s. Most studies were retrospective, observational studies designed to ascertain which factors associated with out-of-hospital resuscitation were associated with favorable or poor outcomes. Several EMS systems developed protocols to deal with resuscitations that were felt to be futile or likely to have a poor outcome. Prospective studies were developed in an attempt to validate termination protocols or to better study factors associated with a change in outcome from field resuscitation. The purpose of this section is to review the relevant literature, to provide a scientific framework upon which the field termination concept can be built.

One of the first papers on the topic of termination of resuscitation appeared in 1977, by Eliastam et al.[8] After examining 198 patients in cardiac arrest, the authors recommended not initiating or discontinuing efforts for patients with apnea and pulselessness known to have exceeded 10 minutes, no response to 30 minutes of ACLS, no ventricular electrocardiographic (ECG) activity after as little as 10 minutes of ACLS, and pre-existing terminal illnesses. It should be noted that the focus of this paper was patients brought to the ED in cardiac arrest—field termination of efforts is not addressed.

The same can be said for what appears to be the first organized review on this topic, by Smith and Bodai in 1985, covering a handful of studies (including Eliastam et al.'s) conducted between 1970 and 1983.[9] The authors reviewed the impact of cardiac rhythm, CPR duration, and witnessed arrest on resuscitation survival, and found that asystole and bradyarrhythmias were associated with a 0.3% chance of survival, while ventricular arrhythmias such as VF and ventricular tachycardia (VT) were associated with a 10% survival rate (though no uniform definition of "survival" was used). They also found that CPR duration of longer than 30 minutes was associated with a poor outcome, as was unwitnessed arrest. The authors concluded that asystolic rhythms, prolonged resuscitative efforts, and unwitnessed cardiac arrests were associated with a poor prognosis. Interestingly, an accompanying editorial by Eisenberg and Cummins[10] proposed field termination as the best way to avoid "needless and wasteful resuscitations in hospital EDs," despite having cautioned against the small but non-zero possibility of successful resuscitation even after prolonged efforts. They caution that guidelines for field termination must only be guidelines, and must be "tempered by the total clinical picture," with a joint decision by the paramedics on the scene and the physician providing direct medical oversight regarding termination of efforts for any individual patient. This editorial appears to be the first formal recommendation for field termination of resuscitative efforts for certain patients.

One important early paper that was not included in Smith and Bodai's review was presented in 1984 by Roth et al.[11] This paper, which examined 187 cardiac arrests, looked at issues such as ALS response interval, arrest witnessed by EMS personnel, and presence of bystander CPR—issues that have become increasingly recognized as important in the science of resuscitation. These authors found a 42.9% rate of survival to discharge in patients with bystander CPR, an ALS response of less than 4 minutes, and an initial rhythm of VF or VT. The authors confirm the "unfavorable prognosis" of non-VF/VT rhythms, and

speculate that patients with other, less favorable rhythms may come from a population with more advanced coronary artery disease and/or prior myocardial damage.

In 1986, Aprahamian et al. retrospectively evaluated 445 nontraumatic cardiac arrests[12] in a three-tiered system [first-responder emergency medical technician (EMT), basic life support (BLS) transport, and paramedic unit response]. Study parameters included patient age, sex, response time, witnessed arrest, bystander CPR, and initial rhythm. Out of 445 arrests, treatment was not initiated (at the discretion of the providers, with no protocols) for 126 patients, all of whom had an initial rhythm of asystole, downtimes of more than 15 minutes, unwitnessed cardiac arrest, and no bystander CPR initiated prior to EMS arrival. Of the 319 patients for whom resuscitation was initiated, 132 had resuscitation terminated in the field at 45 minutes for degeneration of their rhythm or no response to therapy. One hundred eighty-seven patients were transported to the ED for further resuscitative efforts. Of those patients, 42 were discharged from the hospital: 32 had an initial rhythm of VF/VT, seven presented in pulseless electrical activity (PEA), and three presented with asystole. For the 252 patients with asystole as their presenting rhythm, only five (1.9%) survived. The authors raise the question of whether all of the asystolic patients who survived were truly in asystole, or whether some may have been in a more viable rhythm misdiagnosed as asystole. They also found that unwitnessed arrests, lack of bystander CPR, and prolonged downtimes were all associated with very poor outcomes. A presenting rhythm of VF/VT was the most critical factor associated with survival to discharge in this study.

Dunn et al. in 1986 analyzed the outcome of patients suffering cardiac arrest due to VF in the inpatient setting.[13] There were 125 patients with 173 total cardiac arrests, with 53 patients surviving to discharge. Dunn et al. found that factors associated with survival were primary VF, time from onset to first shock of less than 5 minutes, fewer than five shocks to end the arrhythmia, and no previous antiarrhythmic therapy. Extrapolating these data to the prehospital setting is difficult since all of these arrests were witnessed with very short response times in the hospital, and the level of care is not necessarily comparable to that in the prehospital setting.

In 1988, Kellermann et al.[14] studied 240 refractory cardiac arrest patients in the out-of-hospital setting. Of those 240, 32 were resuscitated in the ED and only four (1.7%) survived to hospital discharge. Two patients were neurologically intact at discharge, and both had transient return of spontaneous circulation (ROSC) prior to ED arrival. The remaining two were discharged with severe neurologic deficits. Kellermann et al. concluded that failure to regain circulation in the field was strongly associated with a poor outcome.

In 1989, Bonnin and Swor reviewed 244 out-of-hospital nontraumatic cardiac arrests.[15] Twelve patients were excluded, for drug overdose (2 patients), family preference to terminate (7), and incomplete records (3). Fifty-one patients had ROSC in the field, and 181 arrived in the ED without pulses. Of those who regained spontaneous circulation in the field, 21 (41%) were discharged from the hospital. Of those without return of circulation in the field, only ten (6%) survived to admission, and only one patient was discharged neurologically intact. The discharged patient had an initial rhythm of PEA and had no definitive airway placed in the field. Based on the data, it was concluded that for those patients who received full ACLS measures and definitive airway management, field termination was appropriate if there was no ROSC in the field. An editorial[16] accompanying Bonnin and Swor's article made what appears to be the first evidence-based call for termination of resuscitation efforts in the field, and stresses the need for a comprehensive effort at the scene, including successful intubation and intravenous access, before termination of efforts is considered.

A study by Lewis et al.[17] in 1990 found similar results. Only 24 (11%) of 211 consecutive cardiac arrest patients who arrived at the ED without a pulse developed a pulse during ED efforts, 18 survived to admission, and only one of these patients, who sustained cardiac arrest during transport, survived to discharge.

A 1991 study by Gray et al.[18] examined 185 patients transported to the ED after failed resuscitative efforts in the field. Sixteen patients (9%) survived to hospital admission (with a shorter field effort being the only factor examined that was associated with improved survival), but none survived to discharge. Total costs of almost $181,000 were expended during the hospital care of these 16 patients, and the authors concluded that ED resuscitation for such patients is "not worthwhile," and consumes "precious institutional and economic resources without gain."

A larger study by Kellermann and colleagues published in *JAMA* in 1993 found similar results.[19] One thousand sixty-eight patients were included in the study. Return of spontaneous circulation was achieved in 310 of the 1,068 patients. Of those patients with ROSC, 82 (26.5%) were discharged from the hospital and 19% were neurologically intact. Three patients (0.4%) without ROSC in the field were discharged from the hospital, none of them neurologically intact. It was calculated that ROSC had a sensitivity of 96% and a negative predictive value of

99.6%. Return of spontaneous circulation was the only criterion confirmed to have a high degree of negative predictive value for outcome.

The same issue of *JAMA* also contained a prospective study by Bonnin and colleagues that evaluated which patients who failed to regain spontaneous circulation in the field survived to discharge.[20] The study had 1,322 patients enrolled: 952 patients did not regain pulses in the field, and only six (0.6%) of these (all with refractory VF) were discharged from the hospital. Another 370 patients regained pulses in the field, and 86 of these (23%) survived to hospital discharge. Most patients regaining pulses in the field did so within 20 minutes. Patients with refractory or recurrent VF and VT generally regained pulses within 20–39 minutes. The authors concluded that predictors of survival for unwitnessed, out-of-hospital cardiac arrest were full ACLS with definitive airway management, ROSC for 5 minutes with a heart rate of at least 60 beats/min, refractory VF or VT, and ROSC within 25 minutes (or 30 minutes with a rhythm of VF or VT).

An editorial by Gray[21] accompanied these two studies, and stressed problems with response intervals, fragmented "fiefdoms," and local politics in examining why most locales have poor resuscitation rates. Gray suggests that "transport and further hospital care to make up for any inadequacies in an emergency medical system is not only delusional but also dangerous and costly," and suggests that field termination protocols are necessary supplements to the chain of survival.

Schoenenberger et al. reviewed the case histories of 141 consecutive witnessed cardiac arrest patients brought to the ED with continued resuscitative efforts.[22] Of the 141 patients in the study, 91 died in the ED and 50 regained pulses. Thirty-two later died in the hospital and 18 (13%) survived to discharge, with 16 being neurologically intact. Factors associated with increased survival included short downtime, bystander CPR, and VF on arrival at the ED.

A European study by van der Hoeven et al.[23] examined 216 patients with failed field resuscitations brought to the ED without vital signs. Only six survived to discharge, and all six had an initial rhythm of VF and bystander CPR. Unfortunately, it is not specified whether any of these patients had even transient ROSC, nor whether they remained in VF until arrival at the hospital or had deteriorated to more terminal rhythms.

Stratton and Neimann recently reported a two-year prospective study to evaluate the impact of asystole and PEA on the overall survivorship of out-of-hospital cardiac arrest.[24] They examined 197 prehospital cardiac arrest patients: 138 had rhythms of asystole or PEA, and 30 had VF or VT as their initial rhythms. Ninety-four patients had witnessed cardiac arrests, and bystander CPR was provided in 77 cases. Of all patients, 15 survived to admission and ten (5%) survived to discharge. Nine of the ten patients had asystole or PEA as their initial rhythms, all of them had witnessed arrests, and five had bystander CPR. Critical factors in survival were the event's being witnessed and the presence of bystander CPR.

As a final clinical note, some research is available suggesting that end-tidal carbon dioxide (CO_2) levels of 10 mm Hg or less are associated with a poor outcome,[25] and at least one other paper has hinted at a role for digital capnometry in out-of-hospital cardiac arrest management.[26] While this technology may hold promise in the future, additional studies are needed before a recommendation can be made regarding the role of capnometry in termination of resuscitative efforts.

The scope of resuscitative research reaches beyond the realm of clinical factors indicating futility. In 1998, Hick and Mahoney prospectively evaluated unsuccessful prehospital resuscitations to determine which factors play a role in the decision to transport patients in continued arrest.[27] These factors included medical control preferences, scene safety factors, medical factors, social and family factors, and extreme obesity.

There are at least two studies to suggest that family acceptance of field death is generally good. The first, by Schmidt and Harrahill, retrospectively interviewed family members (94% spouses) of 31 patients who had been pronounced dead by EMS personnel.[28] While it is not clear from the article how many of these patients had had resuscitation attempted, none of the family members interviewed felt that the patient should have been transported to the hospital, and most found the EMS crews to be professional (81%) and supportive (74%).

A similar study by Delbridge et al.[29] found that family members of 24 of the 25 cardiac arrest patients whose resuscitation efforts had been terminated in the field were satisfied with the decision, and family members of 13 of the 14 patients who were transported to the ED for continued efforts indicated that they might have accepted field termination. It should be noted that an emergency physician was present in the field for each of these resuscitations, a resource that most EMS systems do not have available.

Finally, Faine et al. recently reported the implementation of a termination of resuscitation policy in the city of Chicago.[30] This policy applies only to adult, normothermic, nontraumatic arrest patients with an initial rhythm of asystole, and the article discusses the development and implementation of this policy; some outcome data are reported but are not the focus of the paper.

POSITION

The recommendations presented in this position are based on the (mostly retrospective) research present to date, and the system requirements necessary to best provide support for the patient, family, providers, the community. This position specifically does *not* address patients sustaining traumatic cardiac arrest; those with signs of obvious death such as rigor mortis, lividity, or decomposition (on whom resuscitation should clearly not be attempted); or pediatric patients (less than 18 years of age). While it may be appropriate to develop similar recommendations for pediatric patients, the literature is not as well developed and has not been reviewed here.

1. *Patient Population:* Termination of resuscitation may be considered for any patient who suffers sudden cardiac death that is likely to be medical. Patients who are likely suffering from hypothermia or cold water drowning should generally not be considered candidates for field termination of resuscitation.

2. *Collapse-to-treatment Interval:* Important intervals include the times from collapse to the times the patient is found, CPR is started, defibrillation is administered, and ACLS is initiated. Unwitnessed cardiac arrests with unknown downtimes, delayed initiation of CPR beyond 6 minutes, and delay to defibrillation of more than 8 minutes carry a poor prognosis. These intervals are often hard to define, and although they are associated with poor outcomes, should be used as considerations but not as criteria for termination of resuscitation.

3. *Treatment Requirements:* A full resuscitative effort is required prior to consideration for termination of resuscitation in the out-of-hospital setting. This includes definitive airway management, intravenous access, defibrillation/cardioversion if necessary, CPR, and 20 to 30 minutes of treatment following Advanced Cardiac Life Support guidelines and/or local protocols.

4. *Response to Therapy:* Patients without ROSC are candidates for termination of resuscitation. Those patients whose rhythm changes to, or remains in, VF or VT should have continued resuscitative efforts. Patients in asystole or PEA are considered to be in terminal rhythms, and termination of resuscitation should be considered.

5. *Logistic Factors:* Consideration should be given to family wishes. If the family wishes efforts be continued, or if the family's wishes remain unclear, particularly if there is a communication barrier, it may be preferable to continue resuscitative efforts. Other logistic factors may be considered, including collapse in a public place, weather, and safety of the crew and public.

6. *Education of EMS Personnel:* Emergency medical services providers should be educated regarding the ramifications of termination protocols. This includes education regarding the natural history and pathophysiology of cardiac arrest, and the inherently poor prognosis it carries.

7. *Medical Oversight:* All termination protocols need to be developed and implemented under the guidance of the system medical director, with input from physicians responsible for providing online direction. Online medical direction should be established prior to termination of resuscitation in the field. The final decision to terminate resuscitative efforts should be a consensus between the paramedic and online physician.

8. *Care of the Deceased:* After the decision to terminate resuscitative efforts has occurred, many important steps need to occur. These include notification of local law enforcement, involvement of the medical examiner or coroner, and completion of the patient call report and online direction documentation. Policies and protocols for termination of resuscitative efforts in the field should outline the steps that are needed based on local practices, and must be in place before programs terminating resuscitation in the field are implemented.

9. *Family Counseling and Support:* Policies and procedures for termination of resuscitative efforts in the field should include social, psychological, and grief counseling. Field providers and their supervisors need to be trained in grief counseling and providing support to family members of the deceased. The EMS system and family should have access to resources, such as clergy, crisis workers, social workers, and other necessary personnel.

10. *Support for EMS Personnel:* Emergency medical services personnel will be taking on the new role of grief counselor and may need support as well. An anonymous method of provider support should exist to provide personnel with a means to talk about the stress they may encounter in dealing with the termination of resuscitation in the out-of-hospital setting.

11. *Quality Assurance and Improvement:* Some form of quality review is necessary to ensure appropriate application of the termination protocol, as well as law enforcement notification, medical examiner or coroner involvement, and family counseling. Emergency medical services provider mental health should also be routinely evaluated to ensure adequate resources for providers.

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