A Prospective, Population-Based Study of the Epidemiology and Outcome of Out-of-Hospital Pediatric Cardiopulmonary Arrest

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ABSTRACT. ***Background.*** **This study reports the epidemiologic features, survival rates, and neurologic outcomes of the largest population-based series of pediatric out-of-hospital cardiopulmonary arrest patients with prospectively collected data.**

Methods. **Secondary analysis of data from a prospective, interventional trial of out-of-hospital pediatric airway management conducted from 1994 to 1997 (Gausche M, Lewis RJ, Stratton SJ, et al. *JAMA*. 2000;283:783-790). Consecutive out-of-hospital patients from 2 large urban counties in California <12 years old or 40 kg in bodyweight who were determined by paramedics to be pulseless and apneic were included. Main outcome measures included survival to hospital discharge, patient demographics, arrest etiology, arrest rhythm, event intervals, and neurologic outcomes.**

Results. **In 599 patients, 601 events were studied (54% were <1 year old, 58% were male). Return of spontaneous circulation was achieved in 29%; 25% were admitted to the hospital, and 8.6% (51) survived to hospital discharge. The most prevalent etiologies were sudden infant death syndrome and trauma; these resulted in relatively higher mortality. Respiratory etiologies and submersions followed; these resulted in relatively lower mortality. Twenty-six percent of the arrests were witnessed by citizens, and an additional 8% were witnessed by rescue personnel. Witnessed arrests had a higher survival rate (16%). Thirty-one percent of patients received bystander cardiopulmonary resuscitation, which was not demonstrated to result in improved survival rates. Arrest rhythms were asystole (67%), pulseless electrical activity (24%), and ventricular fibrillation (9%); children with the latter 2 rhythms had better survival rates. One third of the survivors (16 of 51) had good neurologic outcome, none of whom received >3 doses of epinephrine or were resuscitated for >31 minutes in the emergency department.**

Conclusions. **The 8.6% survival rate after out-of-hospital pediatric cardiopulmonary arrest is poor. Administration of >3 doses of epinephrine or prolonged resuscitation is futile.** ***Pediatrics*** **2004;114:157–164;** ***cardiopulmonary arrest, cardiopulmonary resuscitation, out-of-hospital, prehospital, pediatric.***

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ABBREVIATIONS. EMS, emergency medical services; BMV, bag-mask ventilation; CPR, cardiopulmonary resuscitation; ED, emergency department; ROSC, return of spontaneous circulation; PCPC, Pediatric Cerebral Performance Category; PEA, pulseless electrical activity; IQR, interquartile range; SIDS, sudden infant death syndrome; VF, ventricular fibrillation; VT, ventricular tachycardia.

Patient outcomes after pediatric cardiopulmonary arrest are dismal and have not improved over the last 3 decades.[1] Research to improve prevention and therapy and to optimize emergency medical services (EMS) protocols is needed to improve outcomes. Unfortunately, the current literature is limited mostly to small retrospective case series. Lack of uniformity in case definitions and outcomes reported has further inhibited data interpretation and meta-analyses. The pediatric Utstein style is a set of international guidelines for uniform reporting of pediatric advanced life support data that was published in 1995.[2] Recent studies have begun using these standardized definitions and reporting style.[3–5]

Even in studies in which data collection has been prospective, population based, and reported by using the Utstein criteria, data have been drawn primarily from EMS personnel written documentation. This study uses the pediatric Utstein style to record and report data and represents the largest prospective, population-based series of pediatric cardiopulmonary arrest patients to date. This study is unique in that additional data were gathered through direct telephone communication with EMS personnel after transfer of patient care to the receiving hospital, thus minimizing recall bias, missing data, and recording bias.

METHODS

This is a secondary analysis of data from an interventional, randomized, controlled trial of pediatric airway management conducted from March 15, 1994, to January 1, 1997, the methodology and primary results of which have been described elsewhere.[6,7] Briefly, the original study was a controlled, clinical trial of out-of-hospital airway management in children ≤12 years old or estimated to weigh <40 kg. Patients requiring airway management were assigned by calendar day to receive either bag-mask ventilation (BMV) (odd days; n = 410) or BMV followed by endotracheal intubation (even days; n = 420). This study showed that there was no significant difference in patient survival rates in the BMV group and the endotracheal intubation group for either the overall patient sample or the cardiopulmonary arrest subgroup.

Subjects

This study population consisted of consecutive patients ≤12 years old or ≤40 kg estimated body weight entered into the original interventional study who were noted to be in cardiac arrest, defined as inability by paramedics to palpate a central pulse, unresponsiveness, and apnea. Patients who were considered pulseless and/or given cardiopulmonary resuscitation (CPR) before EMS arrival but who had a pulse on EMS arrival were not included. Patients who became pulseless during evaluation and transport by paramedics were included.

Setting

Los Angeles and Orange Counties, California, are 2 contiguous metropolitan urban areas with an area of 4869 square miles and a population of >12 million persons,[8,9] ~25% of which are <13 years old. Both counties have a 2-tiered EMS response consisting of basic and advanced life support units. Los Angeles County patients were transported to the nearest emergency department (ED) approved for pediatric patients or to 1 of 13 trauma centers (if a trauma patient).[10] Orange County patients were transported to a designated receiving hospital for stabilization and later transferred to a pediatric tertiary care facility as needed.

Data Collection

A closed-response data-collection form was completed in the ED by the paramedic and emergency physician and mailed to study investigators. Paramedics paged a 24-hour on-call investigator immediately after transfer of patient care to the ED staff. The on-call investigator interviewed the paramedic by using a structured format and recorded information on the precipitating event; presenting and arrest rhythms; presence of witnesses and provision of bystander CPR; estimated down time before arrest; out-of-hospital interventions; and whether there was return of spontaneous circulation (ROSC).

Two research nurses retrospectively reviewed inpatient medical records, coroner reports, investigator report forms, and EMS report forms to obtain demographic information, process-of-care data (eg, elapsed times), and outcome data on all patients. For patients transferred from one acute care hospital to another, records at the second hospital were obtained, and the patient was followed until discharged from the hospital or a chronic care facility.

Case Ascertainment

During the original study, several safeguards were put in place to ensure that eligible patients were not missed.[7] These safeguards included regular review of all pediatric EMS calls, monthly evaluation of patient accrual rates, and a systematic review of cases for a 3-month period midway into the study period.[6] During this systematic review, investigators comprehensively surveyed all out-of-hospital care coordinators and reviewed all pediatric EMS records; only 1 possible missed subject was detected.

Outcomes

The primary study outcome, survival to discharge from an acute care hospital, and the secondary outcome, neurologic status using the Pediatric Cerebral Performance Category (PCPC)[11] at hospital discharge, were evaluated retrospectively as described.[6] The PCPC categorizes outcome as 1 (normal), 2 (mild disability), 3 (moderate disability), 4 (severe disability), 5 (coma/vegetative state), and 6 (death). We added category 7 (no change from previously abnormal neurologic status).

Definitions

Although data were collected prospectively, not all EMS event intervals as outlined by the Utstein style[2] were feasible to collect or collected accurately. We established definitions for important EMS event intervals (Table 1).

EMS personnel were defined as "those who responded in an official capacity as part of an organized specifically-trained response team" per the Utstein definitions.[2] Law enforcement personnel often arrived on the scene first; therefore, EMS personnel performing CPR included trained first responders, law enforcement officers on duty, EMS-basic providers, paramedics, nurses, and physicians. Bystander CPR included CPR performed by non-medically trained people as well as medically trained personnel who were bystanders and not part of an organized response team.

Although the Utstein style recommends broad categorization of arrest etiology as respiratory compromise, circulatory compromise, or cardiorespiratory failure, we wished to report more detailed data.[2] Etiology subgroup assignments were based on all the information available from EMS run forms, investigator forms, inpatient medical records, and coroner reports.

Age categories of neonate (0-28 days old), infant (30-364 days), toddler (1-4 years), and child (5-12 years) were used, consistent with the pediatric Utstein style.[2] Because of inclusion criteria that allowed for patients >12 years old to be enrolled if their estimated weight was <40 kg, 3 patients >12 years old were enrolled. We included these patients in the "child" category.

Arrest rhythm consisted of the rhythm noted by paramedics when the patient was found to be pulseless. Patients reported by paramedics to have organized electrical activity on the cardiac monitor yet to be without a palpable central pulse were defined as having an arrest rhythm of pulseless electrical activity (PEA).

TABLE 1. Definitions for EMS Event Intervals

EMS Event Interval	Decision Rule
Discovery interval	Estimated time last seen to time EMS notified (dispatch called)
Call-response interval	Time EMS unit notified (dispatch called) to time of BLS or ALS arrival at scene
Scene-interval	Time of BLS or ALS arrival at scene to time EMS unit left scene
Minutes to CPR	If the arrest is witnessed and with bystander CPR or the arrest occurs in the presence of EMS, then minutes to CPR = 0 If arrest is witnessed and without bystander CPR, minutes to CPR = time EMS unit notified (dispatch called) to time BLS or ALS arrived at scene If arrest is unwitnessed and without bystander CPR, minutes to CPR = estimated time last seen to arrival of BLS or ALS at scene If arrest is unwitnessed and with bystander CPR on discovery, minutes to CPR = time patient last seen to time EMS unit notified (dispatch called)
Start-stop CPR interval	If bystander CPR present, start-stop CPR interval = the time EMS unit notified (dispatch called) to time of ROSC or death If patient arrested in presence of EMS providers or there is no bystander CPR, start-stop CPR interval = time of EMS unit arrival to time of ROSC or death
Transport interval	Time EMS unit left scene to time of arrival in ED
Sustained ROSC	If known ROSC >20 min or ROSC in the field or in the ED that results in the patient being admitted to the hospital alive

BLS, indicates basic life support; ALS, advanced life support.

When the paramedic described only "full arrest" or "pulseless" without information on electrical rhythm, we considered arrest rhythm to be missing.

Institutional Review Board Approvals

The primary study was approved by all 115 institutional review boards or medical staff offices of participating hospitals. Patients were enrolled under a waiver of consent as described previously.[6,7]

Statistical Analysis

Data analysis was performed with Stata 6.0 software (Stata Corp, College Station, TX) and SAS 8.1 (SAS Institute Inc, Cary, NC) by K.D.Y. and C.D.M. Continuous variables are reported by median and interquartile range (IQR) and compared by using the Wilcoxon rank sum test. Categorical variables are expressed as proportions and compared with the χ^2 test.

RESULTS

There were 601 cardiopulmonary arrest events in 599 subjects from the 830 patients enrolled in the original interventional study. Arrests were distributed evenly over the days of the week and months of the year.

Status of survival to hospital discharge was known for 596 arrest events, and status of ROSC was known for 594. ROSC was never achieved in 71% (424 of 594); in 25% (148 of 594) of the events, patients were admitted to the hospital, and 8.6% (51 of 596) survived to hospital discharge (Fig 1). One child survived 2 arrest events, ie, there were 50 survivors of 51 arrest events.

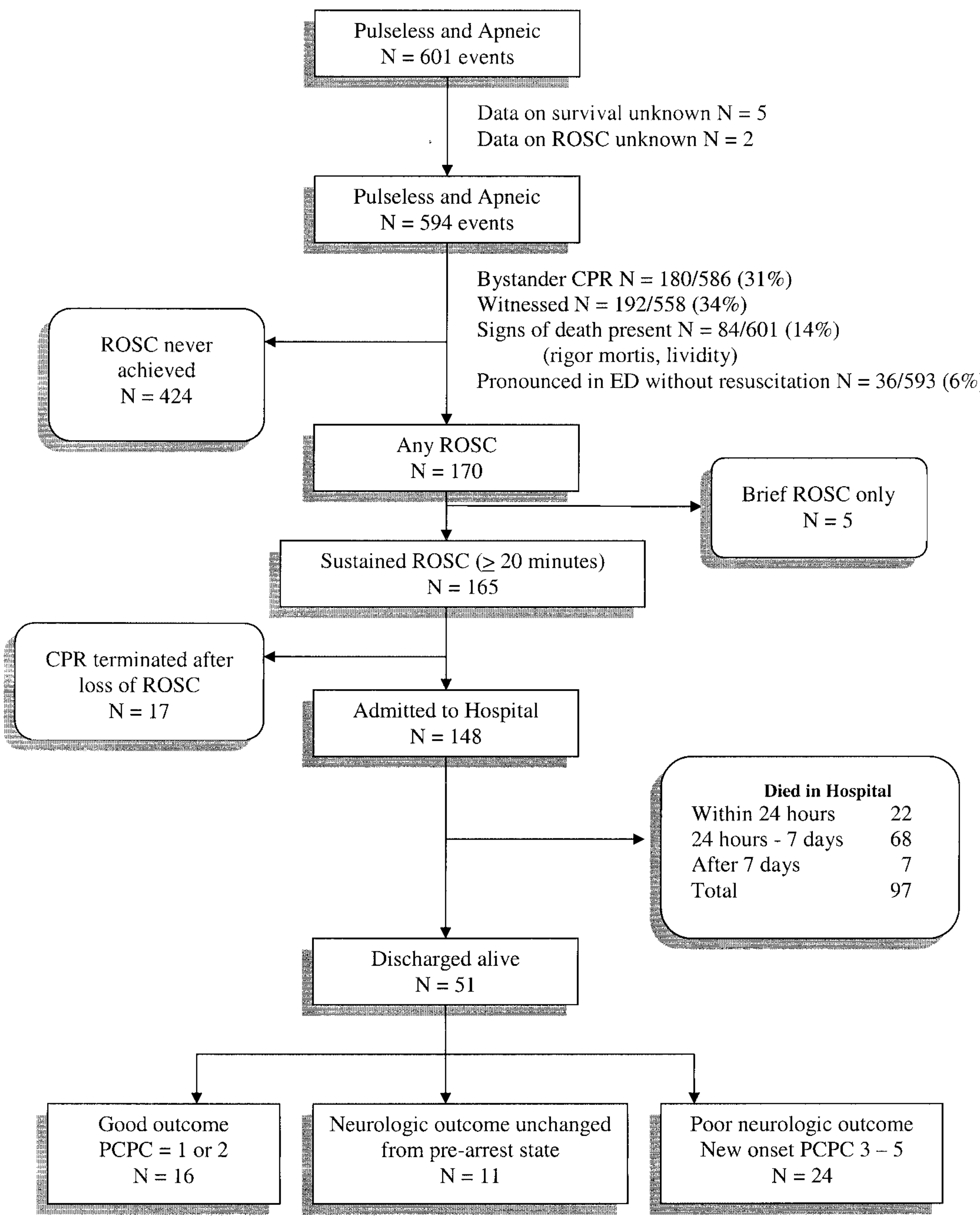

Fig. 1. Flow diagram of patient enrollment and outcomes. PCPC: 1 indicates no disability; 2, mild disability; 3, moderate disability; 4, severe disability; 5, coma or vegetative state.

Table 2 lists characteristics of the subjects. For each variable, there are different numbers of events with missing data; the table lists the number of events with complete information. Fifty-eight percent of the subjects were male ($P < .001$, relative to an expected proportion of 50%). African Americans made up 25% (104 of 410) of our Los Angeles County cardiopulmonary arrest population but account for only 12% of the overall population of children 0 to 14 years old during this time period as reported in census data.[12] Thus, although there were no significant differences in survival by gender or ethnicity, African American children in Los Angeles County had twice the risk of sustaining cardiopulmonary arrest compared with the total population. There was a trend toward a higher proportion of sudden infant death syndrome (SIDS) as the arrest etiology in the African American patients (29% vs 23%; $P = .08$).

Children <1 year old predominated (328 of 601, 54%). Ten percent of the population consisted of neonates (0-28 days old), and approximately half of these neonates were newly born. Newborns had a high survival rate of 36% (11 of 31). Survival for infants 29 to 364 days old was low (10 of 265, 4%), as was survival for children 5 to 12 years old (4 of 92, 4%).

Table 3 lists the primary arrest etiologies. Patients with traumatic arrests had relatively lower survival rates, whereas patients with a respiratory or submersion-associated etiology had better survival rates.

Data were available regarding the presence of a witness to the arrest for 561 subjects: 26% (147) of the arrests were witnessed by a citizen, and an additional 8% (45) of the arrests occurred in the presence of EMS personnel. Witnessed arrests had a significantly higher survival rate (31 of 192, 16%), compared with the overall survival rate of 8.6% ($P < .0001$). Bystander CPR was given in 181 of 590 (31%) of the cases in which data were recorded. There was no observed gain in survival with bystander CPR. Only 28% (41 of 147) of victims whose arrest was witnessed by a citizen received bystander CPR. For arrests witnessed by citizens, there was a trend toward higher survival for those who received bystander CPR (9 of 41, 22%), versus those who didn't (14 of 105, 13%) ($P = .2$).

Arrest rhythms could be determined for 548 subjects, with asystole accounting for 67%, followed by PEA in 24%, and ventricular fibrillation (VF) in 9%. There were no cases of ventricular tachycardia (VT). Only 3% of patients in asystole survived to hospital discharge, compared with 19% of those in PEA and 10% of those in VF ($P < .0001$). VF was more common in the following subgroups: children >5 years old (17 of 87, 20%), patients with an underlying cardiac etiology (10 of 47, 21%) or submersion etiology (10 of 72, 14%), and among those with witnessed arrests (22 of 165, 13%). Eighty-seven percent of SIDS patients (115 of 132) were in asystole, whereas 6% (8 of 132) were in VF.

Airway management was randomized as part of the original interventional study. Of the 51 survival

TABLE 2. Patient Characteristics

Patient Characteristic	Nonsurvivors ($n = 545$)	Survivors to Hospital Discharge ($n = 51$)	Total ($n = 601$)	P Value
Age category				<.0001
Neonate (0–28 days)	46/545 (8%)	13/51 (25%)	59/601 (10%)	
Newborn	20/545 (4%)	11/51 (22%)	31/601 (5%)	
Infant (29–364 days)	255/545 (47%)	10/51 (20%)	269/601 (45%)	
Toddler (1–4 years)	156/545 (29%)	24/51 (47%)	180/601 (30%)	
Child (5–12 years)	88/545 (16%)	4/51 (8%)	93/601 (15%)	
Gender				
Male	310/545 (57%)	34/51 (67%)	349/601 (58%)	.18
Ethnicity				.35
Hispanic	213/511 (42%)	24/47 (51%)	239/562 (43%)	
Non-Hispanic white	146/511 (29%)	11/47 (23%)	159/562 (28%)	
African American	102/511 (20%)	5/47 (11%)	107/562 (19%)	
Asian	38/511 (7%)	5/47 (11%)	43/562 (8%)	
Other	12/511 (2%)	2/47 (4%)	14/562 (2%)	
Los Angeles County	404/545 (74%)	38/51 (75%)	446/601 (74%)	.95
Arrest location				.0056
Home/residence	337/496 (68%)	23/43 (53%)	363/543 (67%)	
Water	60/496 (12%)	12/43 (28%)	73/543 (13%)	
Road/street	48/496 (10%)	2/43 (5%)	50/543 (9%)	
Vehicle	16/496 (3%)	5/43 (12%)	21/543 (4%)	
School/daycare	14/496 (3%)	1/43 (2%)	15/543 (3%)	
Public/recreation site	11/496 (2%)	0/43	11/543 (2%)	
Work	10/496 (2%)	0/43	10/543 (2%)	
Witnessed				
By any witness	161/509 (32%)	31/49 (63%)	192/561 (34%)	<.0001
By EMS	37/509 (7%)	8/49 (16%)	45/561 (8%)	.026
Bystander CPR	164/535 (31%)	16/51 (31%)	180/590 (31%)	.96
Arrest rhythm				<.0001
Asystole	352/504 (70%)	10/40 (25%)	365/548 (67%)	
PEA	107/504 (21%)	25/40 (62%)	133/548 (24%)	
VF	45/504 (9%)	5/40 (13%)	50/548 (9%)	

Note that the denominators reflect the total number of patients for that subcategory with available data. The denominators for survivors and nonsurvivors do not add up to the total, because there were 5 patients missing data with respect to survival.

TABLE 3. Etiologies of 601 Pediatric Out-of-Hospital Cardiac Arrests

Etiology	Etiology, *n*	Etiology, %	Survival Data Known, *n*	Survived, *n*	Survived, %	95% CI for % Survived
SIDS	136	23	136	0	0	0–3
Trauma	118	20	118	6	5	2–11
Pedestrian auto	48					
Abuse	25					
Asphyxiation	21					
Motor vehicle collision	10					
Penetrating	9					
Respiratory	96	16	95	20	21	13–31
Infectious	33					
Unspecified	19					
Reactive airways	14					
Foreign body aspiration	12					
Delivery of newborn	10					
Submersion	73	12	72	12	17	9–27
Pool	50					
Bathtub	12					
Jacuzzi/spa	4					
Lake/pond	4					
Bucket	1					
Washing machine	1					
Cardiac	48	8	48	4	8	2–20
Congenital	33					
Cardiomyopathy	6					
Myocarditis	3					
Dysrhythmia	2					
Congestive heart failure	2					
Central nervous system	35	6	35	1	3	0–15
Unspecified	22					
Infection	6					
Seizure	4					
Tumor	3					
Burn	6	1	6	0	0	0–46
Poisoning	6	1	6	1	17	0–64
Opiates	2					
Carbon Monoxide	1					
Iron	1					
Benzoates	1					
Unspecified	1					
Other	63	10	63	6	10	4–20
Prematurity	18					
Sepsis	14					
Congenital defects	11					
Dehydration	4					
Metabolic	4					
Neglect	4					
Unspecified	3					
Anaphylaxis	2					
Heat stroke	1					
Human immunodeficiency virus	1					
Malignancy	1					
Unknown	20	3	17	1	6	0–29

CI indicates confidence interval.

episodes, 27 patients were randomized to BMV, and 24 were randomized to endotracheal intubation (ETI); 39 actually received only BMV and 12 were intubated successfully. Of 16 survivors with good neurologic outcome (PCPC 1 or 2), 8 were randomized to each of the airway-management methods, but 12 received only BMV and 4 were intubated successfully.

One or more doses of epinephrine were given in 86% (510 of 596), with epinephrine given to 32% (192 of 596) out of hospital and 82% (489 of 596) in the ED. Survival was higher when fewer doses of epinephrine were needed, and in nearly half (25 of 51, 49%) of the survival events, no epinephrine was required. No survivor with a good neurologic outcome (PCPC score of 1 or 2) received >3 total doses of epinephrine.

Table 4 lists EMS event intervals as defined in Table 1. Differences between the median discovery interval and the median interval to receiving CPR between survivors and nonsurvivors were statistically significant. There were no significant differences in the other time intervals between survivors and nonsurvivors. The longest duration of CPR in a survivor was 56 minutes, in a survivor with good neurologic outcome, 42 minutes, and with out-of-hospital time subtracted (ie, duration of CPR in ED), 31 minutes.

Neurologic outcome data were available after all 51 survival to hospital discharge events. Sixteen sur-

TABLE 4. Event Intervals

Event Interval, min	Total		Total Nonsurvivors		Survivors	
	Median	(IQR)	Median	(IQR)	Median	(IQR)
Discovery interval	8	(0–60)	10	(0–60)	0	(0–4)
Call-response interval	5	(3–6)	5	(3–6)	4	(3–5)
Scene interval	9	(5–13)	9	(5–13)	10	(6–15)
Transport interval	5	(4–8)	5	(4–8)	5.5	(4–9)
Total EMS interval (response + scene + transport)	20	(16–26)	20	(15–26)	21	(16–29)
Start-stop CPR interval	36	(27–47)	36	(29–48)	16	(10–30)
Interval to CPR	10	(3–60)	13	(4–64)	3	(0–5)

Note that intervals are not generally independent: total EMS interval includes the call-response interval, scene interval, and transport interval; start-stop CPR interval may include the call-response interval, scene interval, and transport intervals; interval to CPR includes discovery interval and also includes the call-response interval in cases of CPR performed by EMS only.

vivors (31%) had good neurologic outcome (PCPC score of 1 or 2). In more than half of the survival events (27 of 51, 53%), subjects had a heart rate >60 beats per minute on arrival to the ED, and 20 of these 27 patients survived with good neurologic outcome. Table 2 shows characteristics of survivors.

DISCUSSION

A collective review of pediatric cardiopulmonary arrest epidemiology published in 1999 summarized data from 44 studies published between 1970 and February, 1997, which included a total of 2385 cardiac arrest patients.[1] Survival to hospital discharge rate for out-of-hospital arrests was 8.4%, and the demographic data were similar to our study. Because the collective review summarized studies with a wide variety of methodology, geographic locations, health care delivery settings, and case definitions and terminology used, the results could have been biased by some of the larger studies.[1] It is encouraging then to note that the data we report in this study are generally consistent with the findings in the collective review. It is now clear that the epidemiology of out-of-hospital pediatric cardiopulmonary arrest includes the predominance of males, infants, SIDS etiology, and a poor overall survival rate of ~9%. Survival is poor among trauma patients and better for those with a respiratory or submersion etiology. Survival is also improved in witnessed arrests and with PEA or VF arrest rhythm.

Many limitations exist in the current literature on pediatric cardiopulmonary arrest. Most studies are small and retrospective and are not population based. Case definitions and outcomes reported vary widely, making comparisons difficult. The 1995 pediatric Utstein style guidelines provided uniform case definitions and outcome measures and specified out-of-hospital variables to collect.[2] Several issues may contribute to reluctance to use the Utstein style.[13,14] The sheer number of time intervals and variables to collect may be logistically impractical. Some variables are not routinely or reliably collected by EMS personnel and would only be obtainable by use of a trained observer riding along with paramedic rescues. We chose to adopt the Utstein terminology but defined time intervals and other variables by using a practical set of definitions. Since 1995, 3 studies have reported pediatric cardiopulmonary arrest patients by using elements of the pediatric Utstein style.[3–5] Only 1 study was large, prospective, and population based.[5]

Sirbaugh et al[5] reported 300 cardiac arrest patients <18 years old in Houston, Texas. Demographics were similar to those found in the collective review and in our study. Although 60% of the arrests occurred at home with family members present, only 17% of them received bystander CPR. Initial recorded rhythm was asystole in 83%, PEA in 12%, and VF/VT in 4%. Both the rate of VF/VT and the survival to hospital discharge rate of 2% (6 of 300) were lower than those seen in the collective review[1] and in our study, as well as in other large population-based series.[15,16] All 6 survivors had out-of-hospital on-scene ROSC, and none required epinephrine. Five of the 6 had poor neurologic outcomes.

PEA was not documented in the majority of studies in the collective review[1] and was reported less commonly in the Sirbaugh et al study.[5] We found 24% of our subjects to be in PEA, and these children had significantly improved survival, a finding that has not been emphasized previously. We were able to identify PEA as the arrest rhythm in a higher proportion of children than other studies because of direct communication with paramedics immediately after the transfer of care to the ED. In many instances, PEA was not recorded on the out-of-hospital EMS forms used by paramedics, and this information would not have been available by using a study design involving review of EMS forms alone for rhythm determination.

Age, etiology, and arrest rhythm likely all interact in their effects on survival. SIDS is the predominant etiology of arrest for infants, and the arrest rhythm is usually asystole, also associated with poor survival. Early defibrillation of VF results in increased survival. The latest pediatric advanced life support guidelines recommend use of automatic external defibrillators for children ≥8 years old in certain subgroups at high risk for VF.[17] Our findings support higher rates of VF for children >5 years old, cardiac or submersion etiologies, and witnessed arrests.

Although bystander CPR resulted in improved survival in the collective review, there were no differences in survival in our study. The overall rate of bystander CPR of 31% was low, however, and many of those who received bystander CPR may have had a discovery interval too long to benefit. Our study did show a nonsignificant trend of higher survival for patients with witnessed arrests who received bystander CPR. Previous literature supports the efficacy of bystander CPR in adults[18] and in pediatric submersion injuries.[19] Bystander CPR may delay deterioration from high-survival rhythms (VF, PEA) to asystole[20] and enhance successful defibrillation.[21]

The question of when it is appropriate to end CPR efforts is an important one, balancing issues of resource utilization, family member emotions, and the controversy of producing additional survivors with poor neurologic outcomes.[22] Previous literature has suggested that >2 doses of epinephrine or CPR duration >30 minutes does not produce additional survivors.[1] Some of our survivors received up to 6 doses of epinephrine and CPR for >30 minutes in duration. However, these observations include out-of-hospital epinephrine doses and CPR time, whereas the studies cited in the collective review primarily referred to epinephrine and CPR given in the ED. No survivor in our study who received >3 doses of epinephrine total or who had CPR in the ED >31 minutes survived with good neurologic outcome.

Good neurologic outcome occurred in approximately one third of our survivors, with an additional one fourth unchanged from their previously abnormal neurologic status. Although efforts to improve out-of-hospital, ED, and inpatient therapies are needed, the best approach may be prevention. Etiologies amenable to preventive efforts such as SIDS, trauma and burns, submersion, poisoning, and foreign-body aspiration accounted for the majority of the arrests. African Americans are at high risk and may particularly benefit from preventive efforts aimed at lowering SIDS rates. Community outreach can improve the rates of bystander CPR,[23] potentially leading to improved survival and neurologic outcomes.

LIMITATIONS

This study is a secondary analysis, and because the original study was not specifically designed for our purposes, some of the patients have missing information. Still, the numbers of patients with complete information are much larger than any prior series. Some Utstein-recommended variables were not collected in the original data set, such as intermittent ROSC. Neurologic outcome was determined on a retrospective basis by chart review and only for the time of hospital discharge. Neurologic outcome at 6 months and 1 year is not available.

CONCLUSIONS

The survival rate of children after out-of-hospital pediatric cardiopulmonary arrest is low. Prolonged resuscitative efforts do not produce additional survivors with good neurologic outcomes. Although research to improve therapeutic measures is needed, prevention efforts and community outreach to improve the rate of bystander CPR may have a greater impact.

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GOOD NEWS

"A new state-by-state breakdown of teenage pregnancy and abortion rates in 2000 shows declines among all racial and ethnic groups and in every state, continuing a decade-long trend that researchers attribute to better contraception and less, or more cautious, sexual activity. Overall, the national teenage pregnancy rate declined by 2 percent from 1999 to 2000 and fell by 28 percent from its 1990 peak, according to data the Alan Guttmacher Institute compiled from the most recent figures available. The pregnancy rate among black teenagers dropped even more steeply, by 32 percent in the same period."

Bernstein N. *New York Times*. February 20, 2004

Submitted by Student

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A Prospective, Population-Based Study of the Epidemiology and Outcome of Out-of-Hospital Pediatric Cardiopulmonary Arrest

Kelly D. Young, Marianne Gausche-Hill, Christian D. McClung and Roger J. Lewis

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