Apparent Life-Threatening Event: Multicenter Prospective Cohort Study to Develop a Clinical Decision Rule for Admission to the Hospital

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Study objective: We identify factors in emergency department (ED) patients presenting with apparent life-threatening events that distinguish those safe for discharge from those warranting hospitalization.

Methods: Data were prospectively collected on all subjects presenting to 4 EDs with apparent life-threatening events. Patients were observed for subsequent events or interventions, defined a priori, which would have mandated hospital admission (eg, hypoxia, apnea, bradycardia that is not self-resolving, or serious bacterial infection). For patients discharged from the ED, telephone follow-up was arranged. Classification and regression tree analysis was performed to delineate admission predictors.

Results: A total of 832 subjects were enrolled. The overall median age was 31.5 days (interquartile range 10 to 90 days); 427 (51.3%) were male patients, and 513 (61.7%) arrived by emergency medical services. One hundred ninety-one (23.0%) infants had a significant intervention warranting hospitalization. One hundred thirty-seven patients (16.5%) met predetermined criteria that would obviously mandate hospital admission (eg, persistent hypoxia requiring oxygen) by the end of their ED stay. In addition to these patients for whom it was obvious that admission would be necessary in the ED, classification and regression tree analysis (receiver operating curve=0.90) yielded 2 factors predictive of hospitalization: having a significant medical history and having greater than 1 apparent life-threatening event in 24 hours. The sensitivity was 89.0% (95% confidence interval 83.5% to 92.9%); specificity was 61.9% (95% confidence interval 58.0% to 65.7%).

Conclusion: We found 3 variables (obvious need for admission, significant medical history, >1 apparent life-threatening event in 24 hours) that identified most but not all infants with apparent life-threatening events necessitating admission. These variables require external validation and reliability assessment before clinical implementation. [Ann Emerg Med. 2013;61:379-387.]

Please see page 380 for the Editor's Capsule Summary of this article.

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INTRODUCTION

Background

The 1986 National Institutes of Health (NIH) Consensus Development Conference on Infantile Apnea and Home Monitoring defined an apparent life-threatening event as "an episode that is frightening to the observer and is characterized by some combination of apnea (central or occasionally obstructive), color change (usually cyanotic or pallid but occasionally erythematous or plethoric), marked change in muscle tone (usually marked limpness), choking or gagging."[1] The incidence of apparent life-threatening events is estimated to be between 0.46 and 10 per 1,000 live births, accounting for 0.8% to 1% of all emergency department (ED) visits of patients younger than 1 year and 2% of pediatric hospitalizations.[2-4] Most apparent life-threatening events occur in infants younger than 1 year, with a median age of 1 to 3 months, with prematurity being a risk factor.[3-5] The challenge with such events is that the diagnosis is based on presenting symptoms. The wide range in reported incidence reflects the numerous causes of apparent life-threatening events, which include both life-threatening and non–life-threatening disorders, such as gastroesophageal reflux, upper respiratory infections, anemia, apnea, meningitis, breath-holding spells, bronchiolitis, dehydration, dysrhythmias, abusive head injury, pneumonia, febrile seizures, unprovoked seizures, and sepsis. Furthermore, there are conflicting data about whether patients who present with apparent life-threatening events are at high risk for a recurrent event, apnea, subsequent death, or another serious disorder.[6-11]

Editor's Capsule Summary

What is already known on this topic

Most infants with apparent life-threatening events are admitted to the hospital despite few experiencing complications.

What question this study addressed

Do clinical factors predict when admission is warranted for apparent life-threatening events?

What this study adds to our knowledge

In this multicenter study of 832 infants with apparent life-threatening events, the presence of any of 3 factors (obvious reasons for admit, significant medical history, >1 apparent life-threatening event in 24 hours) identified most (89%) of the 191 infants who ultimately had justification for hospitalization.

How this is relevant to clinical practice

This clinical decision rule, if externally validated, would substantially reduce hospitalizations for apparent life-threatening events while inadvertently discharging 7% of infants who ideally should have been admitted.

Importance

More than 80% of patients with apparent life-threatening events appear to be in no acute distress in the ED,[12] and no specific diagnosis is found at ED evaluation in up to 30% of these patients.[3] Thus, which patients presenting with apparent life-threatening events require admission remains an unanswered question. A clinician's decision whether to admit for an apparent life-threatening event will depend on the history and physical examination, results of diagnostic testing performed in the ED, the clinician's level of suspicion for a serious underlying disease, and consideration of the caretaker's anxiety. The conservative approach mandates admission to a monitored bed, yet 3 recent studies have found that only 7% to 16% of infants admitted for apparent life-threatening events needed a significant intervention during hospitalization,[3,13,14] and this implies that many infants with apparent life-threatening events may be safely discharged from the ED, as long as the group more likely to need significant intervention can be identified. Previous studies have identified prematurity, age younger than 30 days, history of other illness, recurrent apparent life-threatening events, abnormal initial examination result, cyanosis as the color change, absence of history of choking, and absence of symptoms of upper respiratory infection as predictors of requiring intervention.[3,13-15] These studies, however, have limitations, including small cohort size and single-center nature.

Goals of This Investigation

The objective of this prospective multicenter study was to identify factors for ED patients presenting with apparent life-threatening events that distinguish those safe for discharge from those who warrant hospital admission.

MATERIALS AND METHODS

Study Design and Selection of Participants

The study was designed as a multicenter observational cohort trial in which data collection occurred during 28 months, from August 2009 to February 2012. Our study population included infants younger than 12 months, presenting at 4 study sites, meeting at least 2 of the 4 criteria of the NIH Consensus definition of apparent life-threatening events,[1] as adjudicated by the treating attending emergency physician. Eligibility for inclusion and exclusion, as well as the outcome variable of whether hospitalization was required, was determined by predefined criteria (Figure 1). Patient characteristics previously cited in the literature as potential risk factors of adverse outcomes in patients with apparent life-threatening events (Figure 2) were collected and analyzed. For the variable, "significant medical history," subjects were assessed for factors that could put them at risk for an adverse outcome from an apparent life-threatening event, including congenital heart disease, Down syndrome or other chromosomal anomalies, craniofacial disorders, chronic lung disease, previous intubations, hydrocephalus, seizure disorder, history of dysrhythmias, and neuromuscular disorders. Because we assessed prematurity separately, a history of prematurity by itself was not considered having a significant medical history. In the ED, the treating physician completed a data collection form documenting the patient characteristics described above (Figure E1, available online at http://www.annemergmed.com).

At the end of the ED stay, patients were classified as "obviously needing admission" if the child needed supplemental oxygen for non–self-resolving hypoxia, intubation, ventilation, cardiopulmonary resuscitation (CPR), intravenous antibiotics for a confirmed serious bacterial infection, or antiepileptic drugs (for status epilepticus); had hemodynamic instability warranting continuous intravenous fluids or vasopressors; or had a positive test result for respiratory syncytial virus or pertussis in the setting of an apparent life-threatening event.

Because our study was not an intervention study, diagnostic evaluations, as well as the decision to admit or discharge a patient, was at the discretion of the treating attending physician. Parents of patients discharged from the ED were called by telephone (telephone script is described in Figure E2, available online at http://www.annemergmed.com) to determine whether the infant developed a subsequent apparent life-threatening event, was hospitalized elsewhere, or received a diagnosis of a condition warranting hospitalization within 1 week of the ED visit. The duration of 1 week was chosen because the outcome of interest was the acute need for hospitalization. If the infant remained well for 1 week after the event, we thought it unlikely that hospitalization would have changed the course of events.