Infant Seizures Not So Infantile: First-Time Seizures in Children Under Six Months of Age Presenting to the ED

THUY T. BUI, MD, CARLOS A. DELGADO, MD, AND HAROLD K. SIMON, MD

Data regarding first-time seizures in children ≤6 months of age is limited. This retrospective study, therefore, reviews the presentation, management, and outcome of children ≤6 months of age presenting to a pediatric tertiary care facility with a first-time seizure. Charts for 31 patients were identified and reviewed. Nineteen patients (61%) received sepsis work-ups. Two of the 31 (7%) had infectious etiologies. One of these infants, a 3-month-old who presented with only a history of fever and eyes rolling back but otherwise appeared well on initial presentation, had pneumococcal meningitis. Neuroimaging studies were performed in 22 (71%) patients with 12 of 22 (54%) having abnormal findings. Electroencephalogram (EEGs) were performed on 22 patients (71%) with 11 (50%) showing seizure activity. Electrolytes were checked on 19 patients (61%) with 5 being clinically significant. Etiologies included idiopathic (32%), congenital anomalies (26%), inborn errors of metabolism (16%), electrolyte abnormalities (16%), infection (7%), and trauma (3%). In conclusion, unlike children >6 months of age in whom febrile seizures and idiopathic seizure disorders are most common, a large percentage of children ≤6 months of age presenting with first-time seizures have significant underlying pathology. This pathology often includes immediately life-threatening conditions in these children who may look deceptively well on initial evaluation. (Am J Emerg Med 2002;20:518-520. Copyright 2002, Elsevier Science (USA). All rights reserved.)

Seizures are the most common neurologic disorder of childhood and are a common reason for parents to seek care in the emergency department (ED) for their infants and children. Approximately 3% to 6% of children will experience at least 1 seizure before the age of 16.[1] Many of these seizures are the first manifestations of epilepsy. Most, however, will be simple febrile seizures, which are defined as seizures occurring in association with a febrile illness in which no evidence of intracranial infection or other identifiable cause is found. The exact etiology is unknown, but the entity is considered an age-related phenomenon that occurs in children 6 months to 6 years of age.[2]

Seizures in young infants are often atypical and may be difficult to recognize clinically because they often do not present as symmetric, generalized tonic-clonic convulsions. More commonly, seizures in this age range will present as a subtle finding or focal abnormality.[3] They can be difficult to distinguish from the normal spectrum of infant behaviors. Often, single episodes of staring, involuntary movements, or eye deviation will occur during the first few months of life. Frequent recurrences will prompt parents to seek medical care for evaluation of possible seizure activity.

Seizures, both febrile and nonfebrile, occur in children of all ages and often pose a challenge to the physician in terms of cause, management, and prognosis.[4] When making decisions regarding evaluation of an infant with a possible first-time seizure, an emergency physician must weigh resource use versus the likelihood that a test will show any significant abnormality.[5] In an infant less than 6 months of age in whom history and physical examination are not always reliable and in whom evidence-based medicine and research regarding management is limited, the value and necessity of a conservative management approach has not been evaluated.[6] Work-ups often include but are not limited to lumbar punctures, laboratory studies, neurodiagnostic imaging, metabolic assays, and electroencephalograms.[7,8]

Although much information exists with regard to febrile and idiopathic seizure disorders in children older than 6 months of age, very limited data can be found on the etiology, management, and outcome of seizures in children 6 months or younger. The objective of this study, therefore, is to retrospectively evaluate and review the presentation, management, and outcome of children 6 months of age or younger presenting to the hospital with first-time seizures.

MATERIALS AND METHODS

This is a retrospective chart review of children ≤6 months of age presenting with first-time seizures evaluated at a pediatric tertiary care facility over a 2-year period (1998-2000). The annual patient census of the ED at this facility during this period is over 34,000. Patients were identified based on a primary or a secondary ICD-9 code of seizure. Patients from outside facilities were excluded from the study if there was an inability to obtain all records from their initial evaluation.

Hospital charts, which include both ED and inpatient records, were reviewed for patient demographics, history of present illness including a description of the seizure and any history of fever, past medical/birth history including any previous history of seizures, any family history of seizures, medications, physical examination on presentation, any studies performed (complete blood count, lumbar puncture, urinalysis, blood/urine/cerebrospinal fluid cultures, chemistries, metabolic studies, neuroimaging studies, electroen-

From the Department of Pediatrics, Division of Emergency Medicine, Emory University/Children's Healthcare of Atlanta, Atlanta, GA.

Manuscript received November 20, 2001, accepted December 22, 2001.

Presented in part at the Pediatric Academic Societies' annual meeting in Baltimore, MD, in April 2001 and at the Society for Academic Emergency Medicine's annual meeting in Atlanta, GA, in May 2001.

Address reprint requests to Thuy T. Bui, MD, 1645 Tullie Circle, Atlanta, GA 30029. E-mail: Thuy.bui@oz.ped.emory.edu

Key Words: Infant, seizure, first time.

0735-6757/02/2006-0006$35.00/0
doi:10.1053/ajem.2002.34796

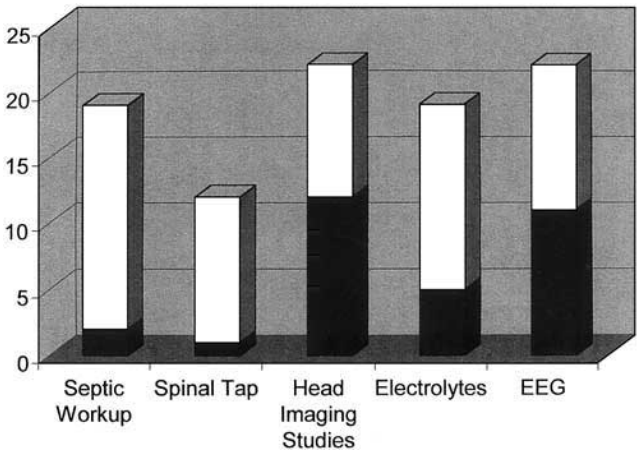

FIGURE 1. Results of studies obtained. Studies obtained are listed on the x-axis. Exact number of studies obtained is listed on the y-axis. Positive studies are those that yielded a significant finding. ■, positive; □, negative

cephalograms [EEG]), hospital course, management, and outcome. All information is reported using descriptive statistics.

RESULTS

Thirty-four patients less than 6 months of age were identified with first-time seizures. Thirty-one of 34 patients (91%) had records available and, therefore, were included in the study. Those excluded had work-ups performed at outside facilities. The mean age at presentation was 2.7 months (range, 12 days to 6 months). Sixty-one percent of the patients were boys. Fifty-five percent were Caucasian, 42% African American, and 3% Hispanic. Twenty-one (68%) of the seizure episodes were described as generalized tonic-clonic in nature. Ten (32%) were more subtle and focal in description (ie, staring, blinking, eyes rolling back, lip smacking). Only 3 (10%) of the children presented with either fever in the ED or a history of fever at home. Twenty-six patients (84%) were admitted to the hospital.

With regard to management, 19 of 31 (61%) received sepsis work-ups, which included a complete blood count, urinalysis, and blood and urine cultures. Of these 19, 63% had lumbar punctures performed. Two of the 31 (7%) had infectious etiologies including 1 who had toxoplasmosis and 1 who had pneumococcal meningitis and sepsis. Of a particular and concerning note, the patient with pneumococcal meningitis was a 3-month-old child who presented with only a history of fever and "eyes rolling back." The child was otherwise well and afebrile on initial presentation to the ED. The decision was made to admit the child for observation. On the night of admission, the child went into status epilepticus, was intubated, and transferred to the pediatric intensive care unit where a full sepsis evaluation was performed. The initial complete blood count revealed a normal white blood cell count of 8,000 cells/μL but a differential significant for 36% bands. The spinal fluid contained a white blood cell count of 560 cells/μL, a glucose level of 23 mg/dL, and a protein level of 242 mg/dL. The final cultures grew *Streptococcus pneumoniae* in both the blood and cerebrospinal fluid.

Imaging studies of the head were performed in 22 (71%) of the patients with 12 of 22 (54%) being positive. Positive findings included Aicardi Syndrome, Miller-Diecker Syndrome, Tuberous Sclerosis, an infarct, and a depressed skull fracture (this child presented with a seizure several days after being in a motor vehicle accident for which the parents did not initially seek medical attention).

Electrolytes were checked on 19 patients (61%) with 5 having significant findings. Two children were found to have hyponatremia (both secondary to improper dilution of formula with initial serum sodiums of 117 and 120 mmol/L), 2 were hypoglycemic (initial serum glucose levels of 21 and 47 mg/dL), and 1 was hypocalcemic (initial serum calcium level of 6.7 mg/dL).

EEGs were performed on 22 patients (71%) with 11 (50%) being positive for seizure activity. For a summary of results of studies obtained, refer to Fig 1.

Etiologies for the seizures included idiopathic (32%), congenital anomalies (26%), inborn errors of metabolism (16%), electrolyte abnormalities (16%), infection (7%), and trauma (3%; Fig 2).

DISCUSSION

The term seizure does not imply a diagnosis but rather indicates a clinical event that reflects a time-related dysfunction of the central nervous system and may signal a serious underlying abnormality.[4] In essence, it is merely a symptom of an underlying physiologic process that requires a more thorough investigation.[1] This principle is well shown by this retrospective chart review.

Of the 31 patients included in the study, 28 had extensive work-ups on initial presentation and 21 were found to have significant underlying pathology including sepsis, inborn errors of metabolism, electrolyte disturbances, and congenital anomalies and syndromes. None were diagnosed with epilepsy or simple febrile seizures, although 10 were discharged with a diagnosis of seizure with no underlying etiology found during hospitalization.

Very few of these patients were found to have infectious or traumatic etiologies—only 7% and 3%, respectively. A

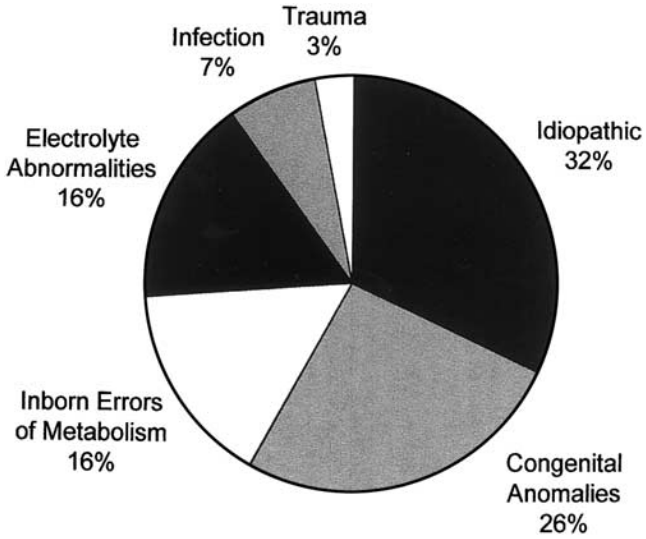

FIGURE 2. Breakdown of diagnoses by percentages.

larger percentage of these infants (42%) were found to have congenital abnormalities including syndromes, cranial malformations, and inborn errors of metabolism. In this study, obtaining neurodiagnostic imaging was found to be more beneficial for making the diagnosis than the more commonly performed sepsis work-ups.

In addition, as evidenced by the case of the child found to have pneumococcal meningitis and sepsis despite a benign history and normal examination on initial presentation, this study also reiterates the fact that the history and physical examination in a young infant is often an unreliable indicator of an underlying serious illness. As mentioned earlier, seizures in young infants are often subtle and difficult to distinguish from normal behavior. In this review, one third of the infants presented with a history of episodes that were not generalized tonic-clonic in activity.

There are several limitations to this study. First, patients were included in this review based on an ICD-9 code of seizure. Any patients who had seizures attributed to other causes (ie, acute life-threatening event, gastroesophageal reflux disease, infantile spasms) and were not coded as seizure would have been overlooked and not included in the study. This may account for the small sample size of this study. Also, not all patients in the study received a full work-up (laboratory evaluation, spinal tap, neurodiagnostic imaging, EEG, metabolic evaluation); therefore, some of the diagnoses might be underestimated. For example, several of the infants diagnosed with idiopathic seizures only received an EEG. A more complete work-up may reveal a different etiology. However, because of the retrospective nature of this study, these interventions could not be controlled. It is important to mention that the retrospective nature of this study may have helped avoid observation bias. The physicians making the diagnosis of seizure and ordering the studies did not know this study would be performed and, therefore, could not alter their routine practice or determination of seizure activity.

Despite the limitations of this study, it is difficult to ignore the findings. Because of the wide variation of diagnoses and the unreliability of history and physical examination, conservative management of first-time seizures in this young age group is strongly suggested. As is seen in this study, unlike children >6 months of age in whom febrile seizures and idiopathic seizure disorders are most common, a large percentage of children ≤ 6 months of age presenting with first-time seizures tended to have significant and, in many cases, chronic life-altering pathology. Although these children may often present with unclear histories and nonspecific physical findings, it is important to remember that they are also at risk for immediately life-threatening conditions as was evidenced by the well-appearing child with pneumococcal meningitis.

REFERENCES

1. Fleischer GR, Ludwig S, Henretig FM, et al (eds): Textbook of Pediatric Emergency Medicine. Philadelphia, PA, Lippincott Williams & Wilkins, 2000, pp 701-708, 1241-3

2. Bergman DA, Baltz RD, Cooley JR, et al: Practice parameter: The neurodiagnostic evaluation of the child with a first simple febrile seizure. Pediatrics 1996;97:769-72

3. Shuper A, Mimouni M: Problems of differentiation between epilepsy and non-epileptic paroxysmal events in the first year of life. Arch Dis Child 1995;73:342-4

4. Halsam R: Nonfebrile seizures. Pediatr Rev 1997;18:40-49

5. Scarfone RJ, Pond K, Thompson K, et al: Utility of laboratory testing for infants with seizures. Pediatr Emerg Care 2000;16: 309-12

6. Wolf SM, Ochoa JG, Conway EE: Seizure management in pediatric patients for the nineties. Pediatr Ann 1998;27:655-64

7. Green SM, Rothrock SG, Clem K: Can seizure be the sole manifestation of meningitis in children with fever? Pediatrics 1993; 91:527-34

8. Joffe A, McCormick M, DeAngelis C: Which children with febrile seizure need an LP? A decision analysis approach. Am J Dis Child 1983;137:1153-6