Paroxysmal Events in Infants: Persistent Eye Closure Makes Seizures Unlikely

Christian M. Korff, MD, and Douglas R. Nordli, Jr, MD

ABSTRACT. **Objective.** Paroxysmal events are frequent in infancy. A precise diagnosis is often difficult to assign despite adequate history and physical examination. Certain clinical signs may help to suggest the diagnosis, thereby avoiding unnecessary and costly investigations. The aim of this study was to determine the frequency of eye opening during infantile seizures and evaluate the potential usefulness of this simple observation in the differential diagnosis of acute events in infants.

**Methods.** We performed a retrospective video electroencephalogram review of the seizures recorded in infants at our Epilepsy Center, paying specific attention to eye opening.

**Results.** Ninety-one seizures in 69 infants were included. Eyes were open in 85 (93.4%) cases.

**Conclusions.** Infants whose eyes are closed throughout the paroxysmal event are most likely not having seizures. *Pediatrics* 2005;116:e485–e486. URL: www.pediatrics.org/cgi/doi/10.1542/peds.2005-0632; paroxysmal events, infants, eyes, seizures.

**ABBREVIATIONS.** EEG, electroencephalogram; ALTE, apparent life threatening event.

Infants (children aged 1–24 months) can have a variety of peculiar paroxysmal events.1,2 Most confusing can be the infant who suddenly has altered behavior or a dramatic fluctuation in the level of alertness for no clear reason. A variety of causes are often suspected, including syncope and epilepsy. Although it is clear that an accurate differential diagnosis depends on careful attention to the history, some simple features may be of use. During a recent presentation at the daily pediatric intake rounds, a resident observed that an infant's eyes were closed throughout the paroxysmal event. This struck us as unusual for an ictal event, so we carefully examined our experience with video electroencephalogram (EEG) recordings of infants with seizures to determine how often eyes were closed throughout recorded events.

**METHODS**

The database of the Epilepsy Center at Children's Memorial Hospital (Chicago, IL) includes patients who are aged 1 day to 18 years and present with a great diversity of indications, ranging from new-onset paroxysmal spells to intractable epileptic seizures. Twenty-three gold electrodes are used for all recordings, including 3 references and the ground, and placed according to the rules of the 10–20 international system. All recordings are interpreted by a pediatric epileptologist at Children’s Memorial Hospital.

The seizures and the epilepsy syndromes were classified according to the International League Against Epilepsy recommendations,3,4 as described in Table 1. To increase the accuracy of the classification, we created a subcategory of partial seizures (2.4) for which it was impossible to determine alteration of consciousness or secondary generalization and further specified the event type by adding its predominant clinical manifestation.

From a total of 2112 patients monitored in our video EEG laboratory from May 2000 through January 2005, 109 distinct seizures in 77 infants were analyzed. When several seizures were recorded during the same EEG, only 1 seizure type per EEG was considered (eg, if 100 spasms and 50 clonic seizures were noted during the same recording, then only 1 of each was considered; if spasms or clonic seizures were recorded during another EEG, then 1 event per seizure type was considered as well). The entire video file was reviewed throughout the ictus. Nonepileptic events were not analyzed for comparison in this study. Eighteen events in 8 patients were excluded either because no video file was available or because the video recording was not sufficiently reliable to determine whether the eyes were open or not. We retrospectively analyzed the clinical manifestations of the remaining 91 seizures in 69 infants, paying special attention to the opening of the eyes. Eye opening was considered present when the patient’s eyes were open at any time for any duration during the event.

**RESULTS**

Table 2 summarizes the main characteristics of the 91 seizures. In 85 (93.4%) cases, eyes were open at some point during the ictus. Eyes were closed throughout the event in 6 (6.6%) patients only (Table 3): in 2 cases, the infants presented with asymmetric spasms and partial seizures in the context of severe neonatal asphyxia in one and group B streptococcus meningocencephalitis in the other; they both had been

<table>
<thead>
<tr>
<th>TABLE 1.</th>
<th>Adapted ILAE Classification of Seizures</th>
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<tr>
<td>1. Generalized seizures</td>
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<tr>
<td>1.1 Absence</td>
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<tr>
<td>1.2 Myoclonic</td>
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<tr>
<td>1.3 Clonic</td>
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<tr>
<td>1.4 Tonic</td>
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<tr>
<td>1.5 Tonic-clonic</td>
<td></td>
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<tr>
<td>1.6 Atonic</td>
<td></td>
</tr>
<tr>
<td>2. Partial seizures</td>
<td></td>
</tr>
<tr>
<td>2.1 Simple</td>
<td></td>
</tr>
<tr>
<td>2.2 Complex</td>
<td></td>
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<tr>
<td>2.3 Secondary generalization</td>
<td></td>
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<tr>
<td>2.4 Uncertain whether simple or complex</td>
<td></td>
</tr>
<tr>
<td>3. Unclassified</td>
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</table>

ILAE indicates International League Against Epilepsy.
pretreated with sedative medication and were in the ICU. Two patients had spasms while asleep; 1 received a diagnosis of early infantile epileptic encephalopathy, and the other received a diagnosis of West syndrome. One patient was drowsy and had spasms in the context of symptomatic generalized epilepsy not otherwise specified. The last patient had several myoclonic seizures that could be observed while awake or asleep; his eyes were kept closed in some of them. He received a diagnosis of symptomatic generalized epilepsy not otherwise specified.

Sixty-five (71.4%) events started while children were awake; 25 (27.5%) had onset during sleep. In 1 patient, we could not determine whether the infant was awake or not.

**DISCUSSION**

The differential diagnosis of paroxysmal episodes in children includes a large number of causes, such as gastroesophageal reflux disease, chronic gastric volvulus, breath-holding spells, syncope, and seizures.1,2,5,6 Some of these manifest as apparent life-threatening events (ALTE), which often lead to extensive and costly investigations. It has been estimated that a careful history and examination would point to the underlying cause in 50% of ALTEs, therefore leaving a significant number of episodes undiagnosed.6 These results not only underline the usefulness of a very basic medical work-up but also highlight the necessity to find additional descriptive features in such situations. Specific signs may help to exclude certain conditions, thereby avoiding unnecessary and often expensive investigations.

A recent systematic review of the medical literature from 1966 to 2002 revealed that seizures were among the most common diagnoses made in children who presented with ALTEs, accounting for 11% of all cases. According to the authors, this review confirmed the usefulness of investigations for seizures in ALTEs.6

One simple observation may aid in the identification of nonepileptic sudden paroxysmal events in infants. We found that eyes were open in all infantile seizures except 6. Two had been treated with sedative medication, 2 were asleep, and 1 was drowsy at onset. Only 1 patient was fully awake during some of his recorded seizures. It is interesting that eye opening was also observed in the great majority of patients who had seizure erupting from sleep. Infants whose eyes are closed throughout the paroxysmal event, therefore, most likely are not having seizures.

Our results may have been influenced by a referral bias: all of these patients were referred to a tertiary center for care, so the proportion of infants with intractable seizures and encephalopathies might be expected to be higher than in the general population. We have found, however, that infants with intractable seizures and diffuse encephalopathies often present with subtle ictal features, so we suspect that our referral bias would have made detection of eye opening harder than in the general population. Electrographic seizures without clinical accompaniment, commonly seen in neonates, were very rare in our infants. The few infants whose eyes remained closed during seizures had other acute or chronic severe neurologic conditions, such as ischemic insults, infections, or epileptic syndromes, that clearly pointed to seizures.

Thus, when confronted with an infant with sudden paroxysmal events of unclear cause, it is useful to inquire whether eyes were open or closed throughout the event. Infants with persistent eye closure are highly unlikely to be experiencing epileptic seizures.

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**REFERENCES**

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