Title
Neonatal seizures and infantile spasms

Permalink
https://escholarship.org/uc/item/1jd3f41k

ISBN
9780323034326

Author
Baram, TZ

Publication Date
2006-12-01

DOI
10.1016/B9780323034326.50009X

License
CC BY 4.0

Peer reviewed
Seizures

Neonatal Seizures and Infantile Spasms
Tallie Z. Baram, M.D., Ph.D.

Neonatal Seizures

Most seizures in a newborn are symptomatic—they are caused by acute or remote insults to the developing brain. Some of these may be eliminated or reversed; others may require concurrent treatment. Therefore, a diagnostic evaluation should precede or coincide with therapeutic intervention (see later). A second unique feature of many neonatal seizures is their unusual or subtle nature compared with seizures later in life. In addition to tonic, clonic, focal, or apparent generalized motor seizures, neonatal seizures may consist of fragmented, nonrhythmic movements, eye blinking, single-extremity posture, or electroencephalographic seizures without overt motor manifestations. Thus, the clinician should have a high level of suspicion for seizures in an ill neonate. Tachycardia or bradycardia, unexplained oxygen desaturation, or abnormal mental status may signify ongoing seizures. Finally, the outcome of neonatal seizures is best predicted by their cause. For example, hypocalcemia-induced seizures in an otherwise normal full-term infant typically remit, with good outcome. In contrast, seizures following severe hypoxia/ischemia, severe neonatal infection, or congenital brain malformation may respond to treatment, but the infant’s prognosis would be guarded.

TREATMENT (Figure 1)

There is no “absolute best” drug. Phenobarbital is recommended here because it is both rapid and long acting and has no “ceiling”; repeated boluses can be used in severe cases as monotherapy with high likelihood of success. Ignore serum levels; in any event, they are not steady-state. Use remission as your guideline. With phenobarbital monotherapy, respiratory depression is uncommon. If you add benzodiazepines, be prepared to intubate. If the seizures or the cause are focal, phenytoin may be considered. Here, if a dose of phenytoin, 20 mg/kg, with serum levels greater than 20 μg/mL is ineffective, then further doses are unlikely to be helpful.

Infantile Spasms

Infantile spasms (West’s syndrome) are a severe, relatively common (~1:2400 births), and often missed diagnosis. It is important to recognize infantile spasms because they respond poorly to conventional anticonvulsants, but remit in most infants when treated with high-dose adrenocorticotropic hormone (ACTH) (see later) (Figure 2). A broad consensus suggests that cognitive outcome is better in infants with infantile spasms who are treated successfully.

Infantile spasms are considered a form of myoclonic seizures that occur in clusters. They are prevalent in 3- to 12-month-old infants and are associated with a highly abnormal (interictal), chaotic electroencephalogram (EEG) (hypsarrhythmia). This pathognomonic EEG pattern is most commonly observed during sleep. The seizures may be flexor, extensor, or mixed, subtle, or massive, and “flattening” of the EEG during a spasm is typical. Most infantile spasms are symptomatic, resulting from a large variety of insults or genetic causes. A variant associated with tuberous sclerosis may be particularly responsive to vigabatrin (100 to 150 mg/kg/day). This medication is available outside the United States, and the side effects of visual-restrictive retinal changes should be considered.

In some cases the causes of infantile spasms may be treatable, with seizure remittance. Mostly, treatment of the spasms with a goal of eliminating them and normalizing the EEG is required. Early, successful therapy seems to improve cognitive outcome. The latter is grim in symptomatic cases but excellent in remitting idiopathic cases.

The most efficacious treatment is high-dose ACTH, with greater than 85% success. A 2-week treatment with this potent hormone results in unpleasant but rarely dangerous side effects such as acne, hypertension, voracious appetite, and irritability. Long-lasting treatment may lead to immunosuppression or gastric bleeding. Because efficacy is a function of the dose, and
side effects are a function of the duration of treatment, it is best to initiate ACTH treatment at the high dosage and limit duration to 2 weeks, with a 2-week taper. Complete dramatic remission of the spasms typically occurs during the first week. Note that twice-daily dosing at the high (ActharGel, 150 U/m² of body surface area) is required. Occasional “bad” batches of the hormone have been described.

In infants with a strong focal element of the spasms, particularly with focal lesion (e.g., tuber) and focal EEG, surgical therapy should be considered. A trial of ACTH may still be indicated and may convert apparent infantile spasms to focal seizures.

Other therapies may be successful at a much lower rate. Consider pyridoxine (to exclude pyridoxine-dependent seizures, or as therapy), 100-150 mg/day; valproate; topiramate; and the ketogenic diet.

If seizures remit and recur, verify that these are indeed infantile spasms rather than a new seizure type with focal EEG. A second course of ACTH may be effective for infantile spasm recurrence. New seizure types, instigated by the original disorder, may respond to appropriate anticonvulsant therapy.

### TABLE 1 Risk of Experiencing a Febrile Seizure

<table>
<thead>
<tr>
<th>Factor</th>
<th>Risk of Febrile Seizure (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>General population</td>
<td>2</td>
</tr>
<tr>
<td>Child in daycare</td>
<td>7</td>
</tr>
<tr>
<td>Slow development</td>
<td>10</td>
</tr>
<tr>
<td>Prolonged nursery stay (&gt;28 days)</td>
<td>12</td>
</tr>
<tr>
<td>Febrile seizure in first-degree relative (mother, father, sibling)</td>
<td>10</td>
</tr>
<tr>
<td>Febrile seizure in two first-degree relatives</td>
<td>33</td>
</tr>
<tr>
<td>Any two risk factors</td>
<td>28</td>
</tr>
</tbody>
</table>


### What Is the Chance That My Child Will Have Febrile Seizures?

Families with a history of febrile seizures may ask this question, particularly when there are siblings with febrile seizures. Febrile seizures are more common in some families, and 10% to 20% of siblings of children with febrile seizures will also experience them. Certain other children may have an increased risk, as high as 25% if the child had a prolonged nursery stay, slow development, or daycare attendance. These factors suggest susceptibility to febrile seizures in a child who may have experienced some subtle neurologic changes and who is exposed on a more consistent basis to a wide range of infections in the daycare setting. When two or more of these factors exist, it may be appropriate at one of the early well-child visits to discuss management of fever and what to do if a febrile seizure occurs (Table 1).

### What Should We Do If Our Child Has a Febrile Seizure?

Most febrile seizures are brief and do not need medical intervention. If, however, the seizure has persisted longer than 5 minutes, Emergency Medical Services (i.e., “911”) should be called. Less than 5% of febrile seizures occur as status epilepticus, and it is likely that the seizure will end before medications can be given. The usual intervention is either lorazepam, 0.1 mg/kg intravenously (IV), up to 4 mg, or diazepam, 0.3 mg/kg IV given slowly at less than 1 mg/kg/min. Health care providers in emergency settings should recall that diazepam could be given rectally.a In essence, care during a febrile seizure should be the same as for any other generalized convulsion.

When the seizure is over and the child has returned to baseline (often sleepiness if the seizure has occurred at night), a decision must be made concerning the

---

*aDiastat, 0.5 mg/kg rectally for children 2 to 5 years, 0.3 mg/kg rectally for children 5 to 11 years, 0.2 mg/kg rectally for children older than 11 years, all rounded to the nearest syringe size; one dose may be repeated after 30 minutes, if necessary.
Current Therapy in Neurologic Disease 7th Edition

Richard T. Johnson, M.D., F.R.C.P.
Distinguished Service Professor of Neurology, Microbiology, and Neuroscience
The Johns Hopkins University School of Medicine and Bloomberg School of Public Health, Baltimore, Maryland

John W. Griffin, M.D.
Professor and Director of Neurology, Professor of Neurosciences
The Johns Hopkins University School of Medicine, Baltimore, Maryland

Justin C. McArthur, M.B.B.S., M.P.H.
Professor of Neurology, Pathology, and Epidemiology
The Johns Hopkins University School of Medicine, Baltimore, Maryland

MOSBY
ELSEVIER
Notice

Knowledge and best practice in this field are constantly changing. As new research and experience broaden our knowledge, changes in practice, treatment and drug therapy may become necessary or appropriate. Readers are advised to check the most current information provided (i) on procedures featured or (ii) by the manufacturer of each product to be administered, to verify the recommended dose or formula, the method and duration of administration, and contraindications. It is the responsibility of the practitioner, relying on their own experience and knowledge of the patient, to make diagnoses, to determine dosages and the best treatment for each individual patient, and to take all appropriate safety precautions. To the fullest extent of the law, neither the Publisher nor the Editors assume any liability for any injury and/or damage to persons or property arising out of or related to any use of the material contained in this book.

The Publisher

Contributors

Neha P. Amin, B.S., B.A.S.
Medical Student, University of Pennsylvania School of Medicine, Philadelphia, Pennsylvania
Optic Neuritis

Charles F. Argoft, Ph.D.
Assistant Professor of Neurology, New York University School of Medicine; Director, Cohn Pain Management Center, North Shore University Hospital, Bethpage, New York
Chronic Pain Management: General Principles

Allen J. Askamit, Jr., M.D.
Associate Professor of Neurology, Mayo College of Medicine; Consultant, Department of Neurology, Mayo Clinic, Rochester, Minnesota
Acute Bacterial Meningitis

Alan Y. Avidan, M.D., M.P.H.
Assistant Professor of Neurology, University of Michigan Medical School; Director, Sleep Disorders Clinic, University of Michigan Health System, Ann Arbor, Michigan
Parasomnias

Laura J. Balcer, M.D., M.S.C.E.
Associate Professor of Neurology and Ophthalmology, University of Pennsylvania School of Medicine, Philadelphia, Pennsylvania
Optic Neuritis

Talie Z. Baram, M.D., Ph.D.
Professor of Pediatrics, Anatomy/Neurobiology, and Neurology and Danette Shepard Professor of Neurological Sciences, Department of Pediatrics, University of California, Irvine, School of Medicine, Irvine, California
Neonatal Seizures and Infantile Spasms

Allan J. Belzberg, M.D.
Associate Professor of Neurosurgery, Johns Hopkins University School of Medicine; Attending Neurosurgeon, Johns Hopkins Hospital, Baltimore, Maryland
Peripheral Nerve Injury

Sara E. Benjamin, M.D.
Chief Resident, Department of Neurology, George Washington University School of Medicine and Health Sciences, Washington, DC
Wernicke Disease and Korsakoff Psychosis

Anish Bhardwaj, M.D., F.A.H.A., F.C.C.M.
Associate Professor of Neurology, Neurological Surgery, and Anesthesiology Critical Care Medicine; Director, Neuroscience Critical Care Fellowship Program; Vice Chairman, Department of Neurology, Johns Hopkins University School of Medicine; Co-Director, Neurosciences Critical Care Division; Attending Physician, Johns Hopkins Hospital and Bayview Medical Center, Baltimore, Maryland
The Unconscious Patient

Kevin M. Biglan, M.D., M.P.H.
Assistant Professor of Neurology, University of Rochester School of Medicine and Dentistry, Rochester, New York
Huntington's Disease

Tom J. Blanchard, M.R.C.P., D.T.M.&H., Ph.D.
Senior Lecturer in Tropical Medicine, Clinical Research Group, Liverpool School of Tropical Medicine, Liverpool, United Kingdom
Cerebral Malaria

John B. Bodensteiner, M.D.
Professor of Clinical Pediatrics and Neurology, Department of Pediatrics, University of Arizona College of Medicine; Chief, Pediatric Neurology, St. Joseph's Hospital and Children's Health Center, and Barrow Neurological Institute, Phoenix, Arizona
Tuberous Sclerosis Complex

Devin L. Brown, M.D.
Assistant Professor of Neurology, University of Michigan Medical School; Staff Neurologist, Stroke Program, University of Michigan Health System, Ann Arbor, Michigan
Embol of Cardiac Origin

John C. M. Brust, M.D.
Professor of Clinical Neurology, Columbia University College of Physicians and Surgeons; Director, Department of Neurology, Harlem Hospital Center, New York, New York
Alcohol Intoxication and Withdrawal

Arthur L. Burnett, M.D.
Professor of Urology, Johns Hopkins University School of Medicine; Active Staff, Johns Hopkins Hospital, Baltimore, Maryland
Urinary and Sexual Dysfunction in Multiple Sclerosis and Myelitis

Anthony S. Burns, M.D.
Assistant Professor of Rehabilitation Medicine, Jefferson Medical College of Thomas Jefferson University; Assistant Director, Regional Spinal Cord Injury Center of the Delaware Valley, Thomas Jefferson University Hospital, Philadelphia, Pennsylvania
Acute Spinal Cord Injury