

Acute Meningitis among Infants and Toddlers with Febrile Seizures: Time for a Reappraisal of the Value of a Lumbar Puncture

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ABSTRACT: **Background:** Since clinical signs of meningeal irritation in infants may be absent or misleading, the American Academy of Pediatrics in 1996 recommended that a lumbar puncture be performed in young children following a febrile seizure. Recent evidence supports a conservative approach in children who do not look ill at the time of the physician's assessment. Moreover, seizures as the presenting or sole symptom of bacterial meningitis are very rare.

Objectives: To assess physicians' compliance with the Academy's recommendations and to determine the incidence of meningitis among febrile seizure patients, including those who did not undergo the puncture.

Methods: We conducted a retrospective analysis of the number of punctures obtained in febrile seizure patients aged 6–24 months, focusing on the clinician's indications for performing the procedure and on the clinical course of children who did not undergo the puncture.

Results: Among 278 patients (84% simple febrile seizure), 52 (18.7%) underwent the procedure. It was performed in 38% of 45 complex febrile seizure cases and in 48% of 91 infants younger than 12 months of age. Aseptic meningitis occurred in two infants, both with post-ictal apathy. Bacterial meningitis was not found and in none of the patients who did not undergo the puncture was meningitis later diagnosed.

Conclusions: Compliance with the Academy's recommendations was low, as emergency room physicians based their decision whether to obtain a lumbar puncture solely on clinical grounds. No case of bacterial meningitis was detected among 278 young children with a febrile seizure, including those who did not undergo the puncture.

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to predict the development of epilepsy or to carry a higher risk of a serious acute neurological disease. Despite the excellent prognosis and the low risk for further epilepsy, simple febrile seizures have traditionally been considered a potential presenting symptom of acute meningitis [2,3]. Thus, lumbar puncture is frequently performed in young infants following a febrile seizure, as ruling out meningeal infection in infants based solely on clinical assessment may be misleading [3-5]. As recently as 1996, the American Academy of Pediatrics Subcommittee on febrile seizures recommended obtaining an LP in every child under 12 months of age presenting with a first simple febrile seizure [3].

This axiom was recently questioned as clinical practice shows that simple febrile seizures are rarely a presenting symptom of meningitis, let alone the only symptom of the disease [4,5]. Even complex febrile seizures without other signs and symptoms of acute neurological involvement have also been shown to carry a low risk of acute bacterial meningitis [6-8]. In reality, only about 50% of infants and children with a first simple febrile seizure undergo an LP. This fact suggests that emergency room physicians frequently decide whether to perform the test solely on clinical grounds [9].

The aim of our study was to assess physicians' compliance with the AAP 1996 recommendations in a medical center outside the U.S. and Canada, in a country with a high infant vaccination rate.

PATIENTS AND METHODS

We conducted a retrospective analysis of all consecutive cases of febrile seizures in patients aged 6–24 months between January 2007 and December 2009. Data gathered included demographic information, characteristics of the seizure, the etiology (if established) of the febrile illness, and whether a lumbar puncture was obtained. Of note, in our institution the decision not to perform the procedure is always made by an attending physician experienced in emergency pediatric care.

LP = lumbar puncture

AAP = American Academy of Pediatrics

Febrile seizures are a frequent reason for referral to the emergency department and represent the most common seizure type in infants and young children [1]. These seizures are classified as simple or complex, the latter considered more likely

Patients with preexisting epilepsy or other central nervous system diseases were excluded from the analysis. Special attention was given to the presence or absence of clinical signs or symptoms suggestive of meningitis and whether patients who did not undergo the procedure were later diagnosed with acute meningitis. This study was approved by the Meir Medical Center Institutional Review Board.

RESULTS

Altogether, 278 charts of infants and young children were evaluated. Ninety-one were aged ≤ 1 year. In 92%, the seizure was their first febrile seizure event. A family history of febrile seizures was reported for 40% of patients. Of the 278 patients, 233 (84%) sustained a simple febrile seizure. An LP was obtained in 52 of the 278 cases, representing only 18.7% of the patients. The procedure was done in 38% of 45 cases with complex febrile seizures. As expected, the procedure was performed in a higher percentage (48%) of the 91 infants younger than 12 months of age. Nevertheless, more than half of the younger group did not undergo a lumbar puncture.

Meningitis (aseptic) was detected in two children: one with a simple febrile event and one with a complex seizure. Both were apathetic in the emergency room. In another three patients with complex febrile seizures a bloody tap was obtained and systemic antibiotic therapy was instituted until sterile cerebrospinal fluid cultures were reported. No cases of bacterial meningitis were found. Meningitis, either bacterial or aseptic, was not ultimately diagnosed in any patient who did not undergo a lumbar puncture despite having a febrile seizure.

Apathy/lethargy was the main indication for an LP: six of seven patients with apathy underwent the procedure, including the two aseptic meningitis cases.

Regarding the etiology of the febrile illness leading to the seizure, in a third of the cases a viral disease was diagnosed, namely upper respiratory infection, skin rash, conjunctivitis and pharyngitis/laryngitis. However, the most common condition associated with the febrile seizure was acute otitis media (50% of cases). Acute gastroenteritis was detected in 11.5% (only 3 of these 32 patients had clinical dysentery). The proportion of cases with prolonged seizures was higher among children with acute gastroenteritis (3 of 7) compared to those with other etiologies (4 of 271) ($P = 0.27$). Low serum sodium levels were detected in 49% of cases. When correlating complex febrile seizures with low serum sodium levels, a borderline statistical significance ($P = 0.51$) was detected.

DISCUSSION

Emergency room physicians often face the dilemma whether to obtain an LP in an alert, non-ill looking infant after a simple febrile seizure. The fear of missing bacterial meningitis

and the accepted view that clinical signs of the disease may be absent or non-specific at this age have led to the common practice of performing the puncture in many of these infants irrespective of their clinical status after the febrile seizure. As mentioned, the 1996 AAP Subcommittee recommended obtaining an LP in every child under 12 months old presenting with a first simple febrile seizure [3]. Since then, evidence has accumulated suggesting that seizures as the presenting or only symptom of bacterial meningitis in young children are a rare occurrence [4-7].

The controversy about performing an LP after a febrile seizure has been extensive: some experts believe that it should be obtained in every infant while others base their decision on clinical criteria [10-12]. Changes in the epidemiology of bacterial meningitis following the introduction of effective vaccines probably played a role as well [13]. In fact, the main question asked is whether isolated seizures can be the presenting manifestation or the only feature of bacterial meningitis. Recently, an extensive literature review of published studies on the clinical features suggestive of meningitis in children showed that seizures were predictive of meningitis only if they occurred outside of the febrile seizure range [14]. Conversely, a study from India [15] found a relatively high incidence of bacterial meningitis among patients with complex febrile seizures (4.81%). However, simple febrile seizures were rarely associated with meningitis (0.86% of cases). It is noteworthy that of the 497 children aged 6–18 months evaluated in that study, only 199 (40%) underwent an LP [15]. The authors did not specify whether meningitis was ultimately diagnosed among infants who did not undergo the procedure immediately after the seizure. Seizures lasting more than 30 minutes, post-ictal drowsiness, and neurological deficits were predictive of meningitis. Although we did not detect a single case of bacterial meningitis, the only two cases with aseptic meningitis exhibited clinical signs suggestive of an ongoing acute CNS process, namely apathy. Therefore, a decision to obtain an LP was made on clinical grounds. Despite the small number of lumbar punctures obtained in our patients (52 cases out of 278), no cases of meningitis were diagnosed among patients who did not undergo the procedure. Since our hospital is the only referral center in this region, we are confident that patients with bacterial meningitis who did not undergo an LP would have been referred back to our emergency room.

A review of the recent literature outside of North America on the role and need for an LP in infants with febrile seizures reveals conflicting findings and recommendations: Ghotbi and Shiva [15] performed the procedure in all 254 patients aged 6 months to 5 years and diagnosed bacterial meningitis in 4.7%. Besides obvious signs of CNS involvement or previous antibiotic treatment, patient age < 12 months

CNS = central nervous system

was significantly associated with bacterial meningitis [16]. Conversely, a larger series of 377 children from Papua, New Guinea detected no cases of bacterial meningitis in cases with a single febrile seizure and a normal neurologic status on admission [17]. Lumbar puncture was obtained in 74% of single-seizure cases. Another series of 106 cases also supports the argument that the risk of bacterial meningitis following a single simple febrile seizure is extremely low in a neurologically normal infant older than 7 months [18].

After the 1996 AAP recommendations, a report from a large U.S. patient series covering the years 1995 and 2006 revealed that an LP was performed in 38% of cases of first simple febrile seizure in patients aged 6–18 months. Rates of LP decreased significantly over time. No patient had bacterial meningitis. Moreover, none of the 704 patients returned to the hospital with a diagnosis of bacterial meningitis [4]. Another series reported 50% compliance with the AAP guidelines [9]. Regarding complex febrile seizures, the attitude of emergency room pediatricians seems to be similar: a survey of 353 pediatricians showed that only 34% would obtain a lumbar puncture [8].

The recently described association between seizures and acute viral gastroenteritis is worth mentioning. Most published series report on afebrile infants and children who experience seizures during the acute illness. Hence, febrile seizure patients with gastroenteritis were usually excluded. We recently showed that the presence or absence of fever in patients with gastroenteritis-related seizures does not influence seizure characteristics. Therefore, to avoid unnecessary diagnostic procedures, the presence of gastroenteritis should be considered as the probable cause of the fever in these infants [19].

Our study findings add to the growing evidence supporting the fact that in a neurologically normal young child after a simple febrile seizure there is probably no need to obtain a lumbar puncture. We also found that complex febrile seizures were not predictive of bacterial meningitis. However, in cases with abnormal post-ictal findings, particularly apathy, obtaining the puncture is probably justified, as the two cases of aseptic meningitis belonged in this subgroup of patients.

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