

Diagnostic Value of Lumbar Puncture in Afebrile Infants with Suspected New-Onset Seizures

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No established guidelines address the need for lumbar puncture in fever-free infants younger than 6 months of age with a first seizure. We analyzed cerebrospinal fluid results in infants and found that lumbar puncture adds little diagnostic value to the evaluation of young, well-appearing infants presenting with possible new-onset seizures. (*J Pediatr* 2008;153:140-2)

Lumbar puncture (LP) is frequently performed in children in the presence of fever and seizures to rule out intracranial infection. The American Academy of Neurology Practice Parameter (February 2000) concluded that there was no evidence regarding the yield of routine LP after the first non-febrile seizure.¹ However, they still recommended LP in “the very young child (<6 months)” or in any child who appeared to have encephalopathy or exhibited meningismus. When infants are evaluated, it can be challenging to discern whether an unusual paroxysmal event represents an epileptic seizure or a more benign condition such as gastroesophageal reflux, breath-holding spells, or sleep myoclonus. We studied the diagnostic utility of LP in fever-free infants, 1 to 6 months of age, who had possible new-onset seizures and further focused our analysis on patients with a discharge diagnosis of epileptic seizure.

METHODS

Patients aged 1 to 6 months were identified from a prospective database that records all children evaluated by our in-house neurologists for possible first-time seizures. A total of 1093 patients were evaluated during the period of enrollment (October 2000 to February 2006). These patients underwent standardized evaluation that includes history and physical examination (including neurologic assessment), basic chemistry laboratory studies, head computed tomography, electroencephalography, and admission to the hospital for 24 hours of monitoring. LP is performed only on those patients for whom the evaluating physician deems it necessary.

Abnormal cerebrospinal fluid (CSF) findings were defined conservatively on the basis of previously published reference values.^{2,3} Abnormal CSF results were defined on the basis of the number of white blood cells ($>6/\text{mm}^3$), protein elevation (>50 mg/dL), or the presence of a positive bacterial culture or herpes simplex virus (HSV) polymerase chain reaction (PCR) study result. Bacterial cultures were sent on all the CSF samples, but HSV PCR and results were available only on a subset of patients.

At the time of discharge infants were assigned a diagnosis of seizure or nonepileptic event. This represented the neurologist’s final clinical impression, on the basis of presenting history, physical examination, diagnostic studies, and inpatient observation.

RESULTS

One hundred forty-one fever-free infants aged 1 to 6 months were evaluated for spells concerning for possible new-onset seizures. At the time of initial evaluation, 76 (54%) infants underwent LP. Clinicians were more likely to recommend LP in younger infants (Table I). No other clinical factor such as number or duration of spells or even abnormal features on physical examination such as focal abnormality or encephalopathy consistently influenced the decision to perform LP.

Among the 76 infants who underwent LP, 17 (22%) had CSF findings outside age-defined norms (Table II). CSF abnormalities consisted of elevated white blood cell count or increased protein. No infant with abnormal CSF, including 3 with abnormal

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CSF	Cerebrospinal fluid	LP	Lumbar puncture
HSV	Herpes simplex virus	PCR	Polymerase chain reaction

Table I. CSF results and final diagnosis of infants with possible new-onset seizures

Age in months	No. of patients	Patients with LP	Patients with LP and seizure diagnosis	Patients with LP and seizure diagnosis and abnormal CSF	Patients with LP and nonepileptic spell	Patients with LP and nonepileptic spell and abnormal CSF
1-2	37	26 (70%)	12 (46%)	3 (25%)	14 (54%)	5 (36%)
2-3	28	14 (50%)	12 (86%)	1 (8%)	2 (14%)	1 (50%)
3-4	28	18 (64%)	15 (83%)	3 (20%)	3 (17%)	2 (67%)
4-5	33	13 (39%)	12 (92%)	2 (17%)	1 (8%)	0 (0%)
5-6	15	5 (33%)	5 (100%)	0 (0%)	0 (0%)	0 (0%)
Total	141	76 (54%)	56 (74%)	9 (16%)	20 (26%)	8 (40%)

Table II. Age and physical examination of infants with abnormal CSF findings

Age (mos)	Physical examination	LP results				
		Glucose* (mg/dL)	Protein* (mg/dL)	WBCs cells/mm ³ (% neutrophils)	RBCs (cells/ μ L)	PCR
1	Normal	48	58	7 (0%)	32	HSV-
1.2	Normal	45	93	14 (4%)	3700	HSV-
1.3	Normal	47	69	2 (4%)	550	N/A
1.5	Umbilical hernia, hydrocele; normal neurologic examination	56	67	20 (7%)	1400	HSV-
1.5	"Jitteriness"	46	80	8 (0%)	0	HSV-
1.5	Normal	57	86	9 (6%)	900	N/A
1.7	Febrile earlier, normal examination	77	49	17 (53%)	3650	HSV-
2	Tachypnea, rhinorrhea, febrile earlier; normal neurologic examination	72	92	101 (2%)	105	HSV-
2	Normal	51	43	7 (0%)	100	N/A
3	Normal	53	52	2 (0%)	20	N/A
3	Mild axial hypotonia	49	84	8 (N/A)	0	HSV-
3.5	Normal	59	53	22 (0%)	18	N/A
3.5	Rhythmic movements of left arm, sedated on mental status examination†	62	59	35 (37%)	2550	HSV-
3	Normal	53	38	18 (29%)	303	HSV-
4	Hypertonic, brisk reflexes, decreased responsiveness	47	74	2 (2%)	12	N/A
4.4	Rhinorrhea, bronchi; normal neurologic examination	53	51	25 (80%)	15,800	N/A
5	Normal	68	50	15 (76%)	1925	N/A

WBC, White blood cells; RBC, red blood cells; N/A, study not performed.

*Normal ranges used: cells 0-6 WBCs/mm³, glucose 40-80 mg/dL, protein 5-50 mg/dL.

†Abnormal neurologic examination result.

neurologic examination results, had a confirmatory bacterial culture or PCR result to suggest bacterial meningitis or HSV encephalitis. Enteroviral PCR studies were not performed on the patients with abnormal CSF. Therefore, these patients received antibiotics for a 48- to 72-hour "rule-out" period.

Among the 65 infants who did not undergo LP, 8 had abnormalities on neurologic examination, including hemiparesis, hypotonia, encephalopathy, and overt seizure activity. All of these infants had an obvious cause for their suspected seizures such as intracranial hemorrhage related to nonaccidental trauma, established metabolic or genetic syndromes, or toxic exposures.

The frequency of abnormal CSF findings declined with increasing age of the infant. At the time of discharge, 53% of patients who had abnormal CSF were believed to have a

seizure, whereas the remaining 47% were believed to have a non-seizure event. There was no relationship between presence of CSF abnormalities and final diagnosis of seizure (Table I). Thus the abnormal CSF was not specific for either infection or seizures.

DISCUSSION

Most clinicians who encounter a well-appearing child or infant older than 6 months of age, with a normal neurologic examination, do not perform LP as part of the initial evaluation for possible seizures. In younger infants, however, there is no consistent clinical practice, which in part reflects the equivocal clinical guidelines regarding this population.

Our data suggest that clinicians are influenced by a patient's young age alone to perform LP, presumably to avoid

missing a treatable CNS infection. However, we found that none of the patients with abnormal CSF had confirmed bacterial meningitis or HSV encephalitis or other diagnosis requiring immediate and specific management. Furthermore, there was no relationship between abnormal CSF and the final diagnosis of seizure versus non-seizure. Thus obtaining abnormal CSF did not identify intracranial infection or contribute to final impression of a seizure disorder.

Mild CSF pleocytosis or hyperproteinemia may be the result of the convulsion itself³⁻⁶ or could be caused by other conditions such as tumor, demyelinating disease, metabolic disorder, other systemic illness, or a traumatic tap. Many of these other diagnoses do require prompt and specific management but would not be established on the basis of CSF abnormalities alone.

Limitations of our study include its small size: only 76 patients of the 141 (1-6 months old) underwent LP. Not all CSF samples were tested for HSV or enteroviral infection.

LP in a young infant is an invasive procedure that requires some skill and experience. It is often followed by intravenous antibiotics and monitoring for at least 48 hours, which are nontrivial burdens for a family with a young child. In young infants with spells suspicious for new-onset afebrile

seizures, the likelihood of intracranial infection is low. Even in fever-free infants with abnormal examinations, this series did not find that the LP added useful information. Cautious observation for 24 hours is perhaps a more prudent approach, especially in well-appearing infants. In young fever-free children who had possible new-onset seizures without accompanying encephalopathy, meningismus or focal neurologic signs, we found no evidence to indicate that LP provided information that guided management.

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