

## **An assessment of the necessity of lumbar puncture in children with seizure and fever**

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### **Abstract**

**Objective:** It is frequently thought that lumbar puncture (LP), is a mandatory procedure in all children who have fever and a seizure; because a convulsion may be the sole clinical manifestations of bacterial meningitis.

To assess whether meningitis could be recognized using readily available clinical information.

**Methods:** This study was done during a 4 yr period from 2002-2006. A total of 254 previously healthy children aged 6 months to 5 years, were brought consecutively to the paediatric department of a teaching university hospital after their first fever-associated-seizure; lumbar puncture (LP) was performed in all cases. Children with seizure and fever and meningitis served as cases and those with fever and seizure, but no meningitis, served as control.

Factors compared in the two groups were: age, lethargy, irritability, vomiting, nuchal rigidity, bulging fontanel, headache, drowsiness, toxicity, coma, complex seizure, and prior antibiotic use.

**Results:** Twelve, (4.7 %), cases were diagnosed as meningitis. Risk factors significantly associated with meningitis were: age <12 months, lethargy, irritability, vomiting, nuchal rigidity, bulging fontanel, headache, drowsiness, toxicity, coma, complex seizure, and prior antibiotic use, ( $p < 0.05$ ). All children with meningitis had at least one of the risk factors mentioned above.

**Conclusion:** Our results indicate that based on available clinical data, meningitis can be ruled out in children presenting with seizure and fever; thus there is no need for routine lumbar puncture in all children who present with fever and seizure. However a lumbar puncture is mandatory in infants younger than 12 months or who have received prior antibiotics (JPMA 59:292; 2009).

### **Introduction**

Seizure and fever are common findings among 2-5% children aged 4 months to 5 years and has been reported in 25-30 % of children with bacterial meningitis.<sup>1-5</sup> One of the most important clinical decision to make is whether a lumbar puncture, (LP) is necessary to rule out pyogenic

necessity of doing LP in children with seizure and fever without signs of meningitis, and recommend that LP should only be done on children selected on the basis of history and clinical manifestations suggestive of meningitis.<sup>3,8,9</sup> The incidence of bacterial meningitis as a cause of febrile seizures has decreased over the past 20 years and is now between 0.23% and 2%; recent retrospective studies have found that

**Table 1: Characteristics of seizure in children with fever and seizure with and without meningitis.**

	Number with meningitis N=12	Number without meningitis N=242	P value	Odds Ratio	95 % confidence intervals
Seizure >24 hr of onset of fever	9	15	<0.0001	45.4	11.11-185.5
Repeated seizures (>1 episode)	6	53	0.0354	3.566	1.1-11.5
Prolonged seizure (>15 min)	3	24	0.1228	3.028	.0766-11.955

meningitis or encephalitis.<sup>6,7</sup> Several researchers are of the opinion that meningitis may be present in children presenting with seizure and fever in the absence of typical clinical manifestations; these investigators recommend a lumbar puncture in all children with seizure and fever except in those cases where the possibility of CNS infection seems truly remote.<sup>6-8</sup>

On the other hand, doing lumbar puncture (LP), has its hazards, i.e. in children with bacteraemia, it could end in meningitis.<sup>3,5</sup> Other investigators, have questioned the

children with bacterial meningitis almost always demonstrate meningeal signs, focal neurologic findings, or signs of extreme illness.<sup>10</sup> The risk of pyogenic meningitis in children with simple febrile seizures equals the risk of meningitis (<1.3%) in a febrile child without seizure.<sup>11</sup>

The object of this study was to see if we could differentiate children with meningitis, merely by relying on the history and physical examination alone.

### **Methods**

This study was done during a 4 year period from

2002-2006, on children aged 6 months to 5 years, who have been hospitalized in the paediatric ward at Taleghani Teaching Hospital associated with Shaheed Beheshti University of Medical Sciences. In these children, a complete history was taken upon hospitalization, and then, a physical examination

**Table 2: Findings and clinical signs in children with and without meningitis.**

	Children with meningitis N=12	Children without meningitis N=242	P value
Age <1 year	7	52	0.0078
Oral antibiotic prior to admission	7	27	<0.0002
Lethargy	5	13	<0.0006
Irritability	7	34	<0.0008
Vomiting	8	0	<0.0001
Nuchal rigidity	4	0	<0.0001
Bulging fontanel	1	0	<0.047
Headache	2	1	<0.006
Toxicity	4	8	<0.0012
Drowsiness	3	0	<0.0001
Coma	1	0	<0.047

was performed by the resident in charge, paying special attention to the signs of meningitis, i.e. lethargy, nuchal rigidity, bulging fontanel, drowsiness, or coma. The data was documented, and transferred to EXCEL software.

Laboratory tests including CBC, electrolytes, urinalysis, urine culture, faecal tests and culture, and lumbar puncture were done. Also CSF tests for sugar, protein, WBC, and CSF culture were carried out in all patients. The child was considered as a case of meningitis if: WBC >10/cu mm, Gram stain positive for bacteria, and/or a positive CSF culture. Also, the CSF in cases with meningitis had a sugar level <40mg/dL and or protein >80mg/dL.

Children with seizure and fever and meningitis, served as cases, and those with fever and seizure, but no meningitis were categorized as controls. Variables considered for comparison in the two groups were: age, lethargy, irritability, vomiting, nuchal rigidity, bulging fontanel, headache, drowsiness, toxicity, coma, complex seizure, i.e. repeated seizure, seizure lasting for longer than 15 minutes, and prior antibiotic use.

All data was analyzed using Fisher exact test, p value and odds ratio. Using Woolf approximation, a 95 % confidence interval was obtained.

## Results

Two-hundred and fifty-four children between the ages of 6 to 60 months presenting with a first seizure with fever were included.

There were 137 boys (the ratio of boys to girls = 1.2: 1). Average age was 19.3 months. In 12 cases, meningitis was

diagnosed, 5 were bacterial and the rest were viral meningitis or encephalitis. Among those who had meningitis seven had received antibiotic as outpatients prior to hospitalization, in two of them the only clinical finding was fever.

Table 1 shows the characteristics of the children with and without meningitis.

Fifty-nine cases were under 1 year of age. There was a significant difference in the incidence of meningitis in children under and over 12 months of age, i.e. 11% vs. 2.56%, respectively, (p= 0.0078).

Three cases, (25 %), of those with, and 27 cases, (9.9 %), without meningitis, had seizure lasting longer than 15 minutes, which statistically was not meaningful. Six cases, (50 %), with meningitis, and 53 cases, (21 %), without meningitis, had more than one seizure, which was statistically significant, (Table 2).

Seven cases, (58 %), with, and, 27 cases, (11 %), without meningitis, had received antibiotics as outpatients prior to admission, this was statistically meaningful, (Table 2). Table 2 shows clinical findings and their statistical analysis of the children with and without meningitis.

The etiology of fever in children in our study is as follows: URI in 110 cases, gastroenteritis in 73 cases, URI and otitis media in 35 cases, meningitis in 12 cases, five of which were bacterial. UTI in 10 cases, gastroenteritis and URI in 7 cases, roseola in 4 cases, infectious mononucleosis in 2 cases, and streptococcal pharyngitis in 1 case.

## Discussion

Meningitis was diagnosed in 4.7 % of the children in our study. These numbers compare well with previous studies performed by Akpede<sup>5</sup> in which 4.2% of 522 children between ages of 1-6 months presenting with fever and seizure were diagnosed as meningitis and Al-Essai<sup>12</sup> who reported 3.5% of their patients as having meningitis; however Carrol et al<sup>3</sup> are of the opinion that the risk of bacterial meningitis is extremely small (less than one in two hundred), even in children under 1 year of age who are hospitalized with a febrile convulsion. In contrast Offringa's study on 309 children with fever and seizure reports a higher incidence, (7%), of meningitis in their patients.<sup>9</sup> These figures are in stark contrast to those quoted by Teach and colleagues who claim that in a study done on 243 children admitted due to seizure and fever, without any clinical signs of meningitis, none of them had meningitis.<sup>13</sup>

Other studies that show the incidence of bacterial meningitis in children who presented to the emergency room because of their first febrile seizure but with no clinical signs of meningitis are as follows: Dawson and Capaldi,<sup>14</sup> (100 patients, 0 meningitis); Anderson et al,<sup>15</sup> (100 patients, 0

meningitis); Von Stuijvenberg,<sup>16</sup> (203 cases, 0 meningitis); Kinsella et al,<sup>17</sup> (47 patients, 0 meningitis).

However there have been reports of missing meningitis in children with febrile seizures, notably a case report of a 12-month old infant with acute bacterial meningitis with a simple febrile seizure with no other signs.<sup>10</sup> According to other reports, the frequency of bacterial meningitis in a child with seizures and fever is low, but nevertheless significant, with studies showing up to 7% of children having bacterial meningitis; most children with meningitis who present with fever and seizures have an altered conscious state, signs of increased intracranial pressure, or signs of meningism, but it should be remembered that meningeal signs can be absent in infants and young children with meningitis.<sup>18</sup>

In our patients the following risk factors were associated with meningitis: age under 1 year, repeated seizures, onset of seizure 24 hours after the onset of fever, seizures lasting longer than 15 minutes, drowsiness, nuchal rigidity, irritability of unknown origin, lethargy, vomiting, bulging fontanel, headache, and finally, the use of antibiotics prior to the onset of seizure. A previous survey reported the discriminating signs between children with and without meningitis as: petechiae, nuchal rigidity, coma, continuous drowsiness, ongoing seizure in the emergency room, paresis, and paralysis. Children whose seizures showed no complex features and whose febrile illness revealed no suspicious features did not have meningitis. The results of these investigators showed that based on clinical data, meningitis can be ruled out in children presenting with seizure and fever so there is no need for a routine LP<sup>8</sup> In Akpede's<sup>5</sup> study six children who had bacterial meningitis, had none of the classic signs of meningitis, but had other indications for an LP, including: age < 6 months, focal or repeated seizures, absence of seizure in the familial history, coma, and presence of a source of infection outside the CNS. These researchers believed the decision to do an LP, will depend on such factors as age, and complex seizures with fever. In Lorber's<sup>19</sup> study clinical signs observed to be predictive of meningitis were: prolonged illness, photophobia, nuchal rigidity, Kerning's sign, continuation of fever without any specific cause, and deterioration of patient's condition in hospital.

In two of our patients classical signs of meningitis were absent; however one of these patients was only eight months of age and the other, who was 23 months old, had experienced prolonged seizure lasting >15 minutes and both these infants had received oral antibiotics prior to the onset of seizure. Our observations were similar to those found in Al-Essai's<sup>12</sup> study, where factors as age less than 18 months, fever lasting more than 48 hours, questionable signs of meningitis, and complex seizures, were quoted as being

important in deciding to do an LP.

According to Carrol and Brookfield,<sup>3</sup> routine lumbar puncture procedure following a febrile convulsion in infancy is unjustified and potentially hazardous. Taking into consideration the above argument their practice following a febrile convulsion in infancy follows a "less is more" rule. Infants are assessed by a middle grade paediatrician shortly after admission and those without meningeal signs (irritability, lethargy, or bulging fontanel) who have recovered from their seizure are reviewed after four hours. If no deterioration has occurred and the child appears well, lumbar puncture is considered unnecessary.<sup>3</sup> Offringa and colleagues<sup>20</sup> who investigated 344 children with first experience of fever and seizure, in a prospective study concluded that doing LP, on patients with major clinical signs of meningitis, will mean that, only 16 children out of 304 (5%), would undergo a lumbar puncture, and, no cases of meningitis will be ignored. Moreover, only 2% of children will undergo an unnecessary lumbar puncture.

Similar to some other studies, almost all our patients with meningitis had signs of meningeal irritation viz. irritability or/and nuchal rigidity.<sup>3,8,18,19</sup> Another finding that was noticed in our study was the development of complex febrile seizures in most of the children with meningitis, a risk factor that has been quoted by some other authors as well.<sup>5,8,12</sup>

Approximately one-third of our patients presented with altered consciousness, a finding that has been reported previously.<sup>8,18</sup> An additional risk factor in our patients was prior use of antibiotics; about 58% of meningitis cases in our study had used oral antibiotics before hospitalization as compared to 11% without meningitis.

Our results are consistent with the reports from researchers in the field who are of the opinion that the risk of meningitis is negligible in children with a simple febrile seizure in the absence of risk factors such as age younger than 18 months, prior use of antibiotics or signs of meningeal irritation.<sup>3-8,12-17</sup>

## Conclusion

Our findings suggested that in children presenting with seizure and fever, spinal tap should be reserved for cases with clinical manifestations of meningitis, or the presence of risk factors such as age <12 months, repeated seizures and/or prior use of antibiotics. In addition, a delayed convulsion i.e. more than 24 hours after the onset of fever constitutes an independent risk factor for meningitis.

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