ORIGINAL ARTICLE

Frequency of acute bacterial meningitis in children with first episode of febrile seizures

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Abstract

Objective: To determine the frequency of acute bacterial meningitis in children with first episode of febrile seizures.

Methods: This cross-sectional study was conducted at the Polyclinic, Postgraduate Medical Institute, Islamabad, Pakistan, from December 2012 to August 2013, and comprised patients with first episode of fever and seizure. SPSS 10 was used for data analysis.

Results: Of the157 patients, 12(7.6%) were diagnosed to have acute bacterial meningitis with 5(41.6%) in the age group of 6-12 months, 4(33.3%) in 13-18 months and 3(25%) in the age group of 19-60 months.

Conclusion: Clinicians evaluating children after a febrile seizure should direct their attention toward identifying the cause of the child's fever.

Keywords: Febrile seizure, CSF, Lumbar puncture, Meningitis. (JPMA 67: 1054; 2017)

Introduction

Febrile seizure is the most commonly occurring childhood benign seizure. It is defined as a seizure that occurs in association with fever in children aged 6 months to 5 years, with no evidence of central nervous system (CNS) infection or other identifiable causes of seizure and no history of an afebrile seizure.[1] These seizures are mostly self-limiting with no long-term sequel.[2] Febrile seizures are classified as simple and complex. About 65-90% of febrile seizures are simple.[3] The incidence of febrile seizures in most parts of the world is 2-5% and about 1-6% of the patients develop epilepsy later in life, especially those with the history of complex febrile seizures.[4] If the family history of febrile seizure is present, this incidence increases to four times and 31% in first-degree relatives. This also shows there is some genetic aetiology behind these seizures, but little is known about it.[5] Other reasons why fever causes fits are increased electrical activity of heated neuron probably by altering the activity of ion channels; cytokines released during fever, specifically interleukin-1β, enhance the excitability of neurons; and alkalosis induced by hyperventilation during fever also increases neuronal excitability.[6] A recent study has shown that the incidence of febrile seizures, especially the complex variety, has increased over the last decade.[7] For simple febrile seizure, no treatment is required. But for complex febrile seizure lasting more than 5 minutes, acute abortive therapy should be initiated. Besides, parental counselling is another important aspect of management. There is no role of prophylactic medication; in fact, there is an increased risk of adverse effects in 30% patients.[8] No mortality or morbidity is associated with febrile seizure, even with prolonged febrile seizures no motor or cognitive deficit has been reported.[9] Febrile seizure is a diagnosis of exclusion. So, it is important to rule out all other causes of seizures. It is mandatory to look for signs of raised intracranial pressure i.e. bulging fontanel, papilloedema and signs of meningeal irritation to exclude meningitis.[10] As acute bacterial meningitis (ABM) is a life-threatening medical emergency, delay in onset of treatment may lead to long-term neurodevelopmental sequel. Clinical suspicion is supported by cerebrospinal fluid (CSF) analysis to rule out meningitis.

Studies are carried out worldwide regarding the necessity of lumbar puncture (LP) in children presenting with first episode of fever with fits. The American Academy of Paediatrics (AAP) has provided useful guidelines to rationalise the use of routine LP and neurodiagnostic tools for such children. According to AAP, LP in a child presenting with first simple febrile seizure should be performed in a sick-looking child with clinical sign and symptom of meningitis; in child aged 6-12 months with lack of immunisation, especially haemophilus (H.) influenzae type b(Hib) and streptococcus (S.) pneumoniae, or immunisation status unknown; and in child already treated with antibiotics. Laboratory or radiological investigations and electroencephalogram (EEG) is not required.[11] Studies are being conducted internationally to accept or refute the AAP guidelines, but unfortunately limited data is available regarding South

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Asian children.[12]

Lumbar puncture is an invasive procedure. On the one hand it is the only diagnostic test for meningitis, but on the other hand, it increases anxiety among parents who are already traumatised witnessing their child having seizures. The current study was planned to assess the necessity of LP in children presenting with their first febrile seizure, and to determine whether AAP guidelines were applicable in our country. Most of the patients who present to the emergency department with fever and fits are diagnosed as febrile seizures; they only need observation, effective management of high-grade fever by simple measures and parental counselling.

Patients and Methods

This cross-sectional study was carried out at the Paediatrics Emergency Department, Federal Government Polyclinic, Post-graduate Medical Institute, Islamabad, Pakistan, from December 2012 to August 2013, and comprised children with first episode of febrile seizures. Sample size was calculated using World Health Organisation's (WHO) calculator.[13] Confidence interval (CI) was kept at95%, anticipated population proportion7%[2] and absolute precision 4%. Non-probability convenient sampling technique was used. All the patients aged between 6 and60 months presenting with fever >100 degrees Fahrenheit with first episode of febrile seizure, and who arrived at emergency department within 12 hours of febrile seizure were included. Patients with history of peri-natal asphyxia, afebrile seizure, altered mental health or cerebral palsy, history of trauma, recent neurosurgical intervention or presence of shunt or who were on antibiotics for >48 hours were excluded.

Presenting complaints were noted for all patients and they were examined as per standard examination method. After taking informed consent from the parents, lumbar puncture was performed along with a random blood sugar to see how many children presenting with febrile fits have ABM. Cerebrospinal fluid was collected for cell counts with differentials, proteins, glucose and culture and sensitivity (C/S). CSF was analysed as per standard laboratory methods by a pathologist.

ABM was diagnosed in a child presenting with fever and seizure on the basis of CSF pleocytosis (white blood cell (WBC) count >5/ul), proteins more than 40 mg%, glucose < 2/3rd of blood sugar level or CSF C/S showing growth of a microbe.

Children diagnosed to have meningitis were admitted and treated accordingly, whereas children diagnosed to have febrile seizure were managed for fever with oral antipyretics and other medications according to the source of infection.

Permission was taken from the ethical committee before carrying out the study. SPSS 10 was used for data analysis. Mean and standard deviation were presented for quantitative data, such as age and temperature. Frequencies and percentages were presented for categorical data, such as gender and meningitis.

Results

Of the 18,243 patients who presented during the study period, 504(2.8%) had seizures. Of them, 157(31%) patients met the inclusion criteria. Of those included, 91(58%) were boys and 66(42%) were girls. The male-to-female ratio was 3:1. The mean age of patients was 18.54+14.7 months (range: 6-52 months). Among them, 12(7.6%) cases were diagnosed to have ABM. Other causes of fever were upper respiratory tract infection (URTI) 61(39%), urinary tract infection (UTI) 22(14%), pneumonia 3(2%), acute gastroenteritis 25(16%), acute suppurative otitis media 13(8.3%), malaria 12(7.6%), measles 8(5%) and chickenpox 1(0.6%) (Table-1).

Of those who had ABM, 5(41.6%) were in the age group of 6-12 months, 4(33.3%) in 13-18 months and 3(25%) in the

Table-1: Causes of febrile fits other than meningitis.

S. No	Causes of fever	No(percentage)
1	URTI	61(39)
2	UTI	22(14)
3	Pneumonia	3(2.1)
4	Acute Gastroenteritis	25(16)
5	Acute Suppurative Otitis Media	13(8.3)
6	Malaria	12(7.6)
7	Measles	8(5)
8	Chicken Pox	1(0.6)

URTI: Upper respiratory tract infection
UTI: Urinary tract infection.

Table-2: Sign and symptoms with and without meningitis.

S No.	Sign & Symptoms without Meningitis	Sign & Symptoms with Meningitis
1	Cough 61(39%)	Drowsy 4(2.5%)
2	Flu 38(24%)	Bulging fontanel 3(2%)
3	Diarrhoea 25(16%)	Neck stiffness 2(1.2%)
4	Vomiting 23(14.6%)	Vomiting 2(1.2%)
5	Dysuria 19(12%)	Reluctance to feed 1(0.6%)
6	Ear ache 11(7%)	
7	Rash 9(5.7%).	
8	Rigors & chills 4(2.5%)	
9	Ear discharge 3(0%)	

age group of 19-60 months. Moreover, 7(58.3%) meningitis cases were culture positive. In the age group of 6-12 months, 2(1.3%) cultures were positive for streptococcus pnemoniae, 1(0.6%) for H. influenza and there was no growth on 2(1.3%) samples of CSF. In the age group of 13-18 months, 2(1.3%) cultures were positive for streptococcus pnemoniae, 1 for H. influenza and no growth on 1(0.6%%) sample. Also, 2(1.3%) cultures were positive for S. pnemoniae in the age group of 19-60 months and no growth on remaining 1(0.6%) culture.

Among the children who presented with first episode of seizure with fever also had one of the following clinical features that helped us to make diagnosis i.e. cough 61(39%), flu 38(24%), diarrhoea 25(16%), vomiting 23(14.6%), dysuria 19(12%), ear ache 11(7%), rash 9(5.7%), rigors and chills 4(2.5%) and ear discharge 3(2%). The children who were diagnosed to have meningitis had following signs and symptoms i.e. drowsiness 4(2.5%), bulging fontanel 3(2%), neck stiffness 2(1.2%), vomiting 2(1.2%) and reluctance to feed 1(0.6%) (Table-2).

The children who experienced fever with seizures had a mean temperature of 101.69+1.7 degrees Fahrenheit (range: 100-105 degrees).

Discussion

Febrile seizures are the most frequent benign seizure disorder a paediatrician comes across in an emergency department. Our study was conducted to determine the necessity of lumbar puncture in all children (6-60 months) who presented to the paediatric emergency department in order to exclude acute bacterial meningitis. A study conducted in the United Kingdom (UK)[14] revealed significantly higher incidence of febrile seizures in South Asian children (especially those with Pakistani origin) as compared to non-South Asian children.

In our study, 12 (7.6%) patients were diagnosed to have acute bacterial meningitis. A study by Jai Krishin et al. found the incidence of ABM to be 4.8% in patients with febrile fits.[15] Although this study was also covering the same city, the incidence of bacterial meningitis was lower than our study probably because there were more younger patients in our study group, having poor immunity and good chances of getting bacterial infections. A study at Taif showed only 6(2%) patients had meningitis.[16] Another study performed in Nepal in 2008 revealed that out of total 175 patients, 17% were diagnosed to have ABM.[17] So, the incidence is different in different Asian countries.

The current study showed out of the 12 children having meningitis, 7(58%) were boys and 5(42%) were girls. This finding was consistent with another study carried out at in Iran where 19 children with febrile seizures had acute bacterial meningitis, out of which 11(58%) were boys and 8(42%) were girls.[18]

Moreover, for our personal interest we also noted the associated clinical features in such children along with fever and seizures. Most of these meningitis patients presented with at least one of the following features i.e. reluctance to feed, bulging fontanel, altered sensorium, vomiting and neck stiffness. However, in a study conducted in Iran,[19] only 12(4.7%) participants were diagnosed to have meningitis. Among these children with meningitis had at least one of the following signs and symptoms:bulging fontanel, nuchal rigidity, lethargy, irritability, headache, vomiting, drowsiness, toxicity, coma, complex seizures, age < 12 months and prior antibiotic use. They concluded that there is no need for routine lumbar puncture in all children who present with seizure and fever. However a lumbar puncture is mandatory in infants younger than 12 months or those who have received prior antibiotics.

The current study discovered that out of 12 children with ABM, 5(41.6%) were in the age group of 6-12 months, 4(33.3%) in 13-18 months and 3(25%) in the age group of 19-60 months. According to a study in Nepal,[20] on 110 hospitalised patients, 16(14.54%) were diagnosed to have meningitis, with 6(37.5%) in the age groups of 6-12 months and 13-18 months each, and 4(25%) in the age group of 19-60 months. In agreement with the current study, they concluded that lumbar puncture is a must to rule out meningitis in all children between the age of 6-18 months presenting with first episode of fever and seizure, even in the absence of signs of meningial irritation.

Our study also supports the AAP guidelines. But Kimia et al. conducted a large study on the age group of 6-18 months presenting with first episode of simple febrile fits and no case of meningitis was found in this age group.[12] They even recommended the AAP to revise their guidelines regarding performing lumbar puncture in this age group. There are other studies as well which support this conclusion. For instance, Teach and Geil[21] evaluated 243 children in the age group of 3-60 months and found that none of the patients had meningitis. Likewise, Hampers et al. got to the same conclusion.[22] A recent meta-analysis has even challenged the routine use of lumbar puncture not only for simple febrile seizure but also for complex febrile seizures in infants and even unimmunised children.[23] But these are the data from developed countries which might not be applicable to our side of world, the so-called developing countries,

probably because of difference in causative organism, socio-economic conditions and immunisation status.

Children aged >18 months clearly had signs and symptoms of acute bacterial meningitis in our study, which support going for lumbar puncture. But children aged <18 months in spite of having a higher incidence of ABM did not show clinical features that were sufficient alone to diagnose ABM. Most of the presenting features for meningitis, i.e. vomiting, reluctance to feed, irritability, altered sensorium, were also common with other ailments like upper respiratory tract infections, urinary tract infections, acute gastroenteritis, and acute suppurative otitis media, hence raising the need for lumbar puncture to diagnose meningitis.

These guidelines are not applicable to the patients with complex febrile seizures (prolonged, focal and/or recurrent) and neither to the children with previous neurologic insults, known central nervous system abnormalities or history of afebrile seizures.

Whenever it is decided to perform a lumbar puncture, blood culture should be sent to laboratory as it increases the possibility of detecting causative organism. It is recommended to get blood cultures of all suspected cases, especially when lumbar puncture is contraindicated. The yield of positive culture may vary with the causative organism. For meningococcal meningitis 40%, H.influenzae 50-90% and S. pneumoniae 75% of blood cultures are positive.[24] Serum glucose level should also be checked concurrently to determine if CSF glucose is less than 70% of serum glucose level, which is a characteristic of bacterial meningitis.

Pakistan is an underdeveloped country, where rate of immunisation is approximately 50%, and that also with limited data available. Therefore, immunisation status of most of the children is doubtful, making them at increased risk of ABM. Acute bacterial meningitis is a life-threatening condition and delay in diagnosis may have lifelong sequel. This further necessitates the need for lumbar puncture in children <18 months of age. On the other hand, children aged >18 months presenting with first episode of fever with seizure, who do not have signs and symptoms of meningitis should be observed in paediatric emergency department for at least 2 hours with effective management of high-grade fever and parental counselling. We recommend that meningitis should be considered in the differential diagnosis for any febrile child, and LP should be performed if the child appears ill or if there are clinical signs or symptoms of concern, as delay in diagnosis may lead to increase in morbidity and mortality due to ABM.

Also, LP should be performed in children aged <18 months who present with first episode of fever with seizure, especially if they are deficient in H. influenzae type b and S. pneumoniae immunisations or for whom immunisation status is unknown.

Further, children aged >18 months who present with first episode of fever with seizure but do not show clinical features of meningitis should be observed in paediatric emergency for 2 hours post-seizure, with effective management of high-grade fever and parental counselling.

Conclusion

Clinicians evaluating infants or young children after a simple febrile seizure should direct their attention towards identifying the cause of the child's fever. LP is an option in children who have been pre-treated with antibiotics.

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