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Cerebrospinal Fluid Indices in Children with Febrile Convulsion

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Abstract

Background and Objective: Febrile convulsions (FC) are the most common seizure disorders in children. Lumbar puncture should be considered in any case with FC who is suspected to intracranial infections. This study determined white blood cell and polymorphonuclear cell counts, protein and glucose levels in cerebrospinal fluids (CFS) of children that were hospitalized with FC.

Methods: In this cross sectional study, lumbar puncture samples of children with FC admitted to the Neurology ward of Ali-Asghar Children's Hospital from 2010–2013 were evaluated. Recorded data included age, sex, type of seizure (simple, complex), frequent attack of FC, family history of FC or epilepsy and cerebrospinal indices (white blood cell, protein and glucose).

Results: In this study, 91 CSF specimens of patients with FC were evaluated. Mean (SD) age of cases was 17.66±10.81 months. Fifty seven (62.6%) of cases were male. Mean glucose and protein levels of CSF was 62.57±12.30 and 21.34±9.52 milligram per deciliter, respectively. Median of WBC and PMN count of CSF were 1 and 0 cell/mm^3, respectively. There was not significant relationship between patients' characteristics and CSF indices (P >0.05).

Conclusion: During FCs, glucose and protein levels of CSF are in normal limits. Minimally changes may occur in CSF cell counts.

Keywords: Febrile Convulsion, Cerebrospinal fluid (CFS), Children

Introduction

Febrile convulsions (FC) are the most frequent seizure disorders in children 6–60 months of age with peak incidence at 14-18 months. FC affects 2–5% of children and every physician may deal with this disorder in emergency centers (1). There is a definition of febrile convulsion by International League against Epilepsy (ILAE) that says "a seizure which is associated with a febrile illness in the absence of a CNS infection or an acute electrolyte imbalance in children who are older than 1 month of age, and did not have prior afebrile seizures" (2). Febrile convulsions are divided to two simple and complex forms. In simple FC, one generalized febrile seizure occurs during 24 hours and continues for a time lower than 15 minutes. Complex FC is ascribed to focal or prolonged (more than 15 minutes) or frequent (more than one seizure in 24 hours) febrile seizure (1). FC has a genetic background which determines individual susceptibility, regulation of immune response, neuronal excitability and interactions with exogenous agents such as viruses (3). In the first step of evaluation of children with FC, it is necessary to find the cause of the fever and exclude intracranial infections such as meningitis and encephalitis clinically and by lumbar puncture (4, 5). Other investigations including serum glucose or electrolytes, trace elements, electroencephalography and brain imaging may be considered by neurologist's decision making (6-9). However, one of the most important diagnostic

Table 1. CSF Indices in cases with simple and complex febrile seizure

Variable	Febrile Convulsion Types		P-value
	Simple	Complex	
	59 (65%)	32 (35%)	
WBC range			
0-4	55 (60%)	30 (32.8%)	
			0.64*
5-10	4(5%)	2 (2.2%)	
PMN range			
0	57 (62.8%)	31 (34%)	
			0.72*
1-3	2 (2.2%)	1 (1%)	
Mean Glucose levels	62.03±11.95	63.56±13.07	0.57*
Mean Protein Levels	21.49±9.91	21.06±8.81	0.84*

* Not significant

assessments is meticulous interpretation of cerebrospinal fluid (CSF) abnormalities that needs to know normal limits and its changes during seizures (10).

This study designed to determine CSF indices including white blood cell (WBC), polymorphonuclear (PMN) cell counts, and protein and glucose levels in CFSs of children with FC.

Methods

Our study is a cross-sectional study on children who were admitted with FC in Ali-Asghar Children's Hospital, a tertiary medical center in Tehran, Iran, from May 2010 to December 2013. Ethical committees of the Iran University of Medical Sciences approved the project. Ninety one cases 6-60 months with febrile seizure enrolled in the study. Cases with diagnosis of meningitis or encephalitis, and bloody CSF were excluded. Data including age, gender, type of convulsions (simple or complex), recurrent seizures (more than one attack of FC during the life), positive history of FC and epilepsy in first relatives and data about CSF indices including WBC counts, PMN counts, glucose and protein levels were recorded. Statistical analysis was performed using SPSS for windows (ver. 16). The student t-test was employed for comparing variables in two groups and a Pearson correlation for association between variables. P values of less than 0.05 were considered significant.

Results

In this cross sectional study, 91CFS specimens of patients with febrile convulsion were evaluated. Mean (SD) age of cases was 17.66±10.81 months. Sixty six (72.5%) of cases had age under 18 months. Fifty seven (62.6%) of cases were male. Thirty two (35.5%) cases had complex FC. Thirteen (14.3%) of children had history of previous FC. Twenty seven (30%) and 12 (13%) of patients had family history of FC and epilepsy in their first relatives, respectively. Median of WBC and PMN cell count of CSF was 1(between 0 and 10) and zero (between 0 and 3) cell/mm^3, respectively. Mean (SD) glucose and protein levels of CSF was 62.57±12.30 and 21.34±9.52 milligram per deciliter, respectively. About 7.2% cases had WBC count more than 5/mm^3 and 3.2% PMN cell count more than 3/mm^3 in CSF. Cerebrospinal fluid indices in cases with simple and complex febrile seizure are compared in Table1. There was not significant relationship between types of FC and other characteristic of the patients and CSF indices (P>0.05).

Discussion

According to American Academy of Pediatric Practice Parameters, lumbar puncture should be considered in children with first attack of FC specially in patients under 18 months of age for ruling out bacterial meningitis even in absence of meningeal signs. CSF analysis is the most important tool for detection of abnormalities of WBCs count, protein and glucose levels that suggests intracranial infections (5,13). Other than infections, CSF indices are affected by many factors including etiology, type and duration of seizures. In some previous studies, occurrence of CSF pleocytosis after seizure disorders is controversial and rate of elevation of white blood cells of CSF is 4-30%(14,15). Tumani et al evaluated CSF parameters of 309 patients with seizure disorders and found cell count elevation in only 6% of the cases. The normal value, maximal cell count and median cell count were less than 5/mm^3, 24/mm^3 and 1/mm^3, respectively (15). Although their cases were afebrile and older than our patients, their results showed that pleocytosis after seizure is not significant.

Rider et al had an evaluation about CSF parameters of 212 children with afebrile seizure, complex

FC and status epilepticus. Patients with complex FC had median WBC count of 1 cell/mm^3 and PMN cell count 0 cell/mm^3 and WBC count more than normal limits (<5 cell/mm^3) in 9.8% cases. Protein and glucose levels were in normal range that was similar to our study (10).

In study of Frank et al, from 200 children with febrile status epilepticus, 136 lumbar punctures were evaluated. WBC count of CSF was fewer than 3 WBC/mm^3 in 96.2% of the cases. Only one patient had 12 WBCs in CSF sample. Glucose and protein levels were in normal ranges. They suggested that CSF pleocytosis is not due to febrile seizures and if detected, other important causes must be investigated (16).

There were some limitations in our study such as small sample size and traumatic punctures that resulted in elimination of the CSF specimens.

Conclusion

Interpretation of CSF indices in FC cases should be done carefully and in combination with clinical assessment. CSF analysis of patients with simple or complex FC - in absence of meningitis- may detect minimally pleocytosis that is not significant.

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Conflicts of interest: None declared.

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