Original research article

Estimation of Serum Sodium and Glucose Levels in Acute Febrile Convulsions

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Abstract

Background: Febrile seizures are a common occurrence in children below the age of 5 years. There is a possibility of recurrence in one-third of these cases. We in the current study tried to evaluate the serum sodium and glucose levels in cases with acute febrile convulsions admitted to our hospital.

Methods: This was a cross-sectional study was conducted in the Department of Pediatrics, cases admitted in Pediatrics wards, Bhaskar Medical College and General Hospital, Moinabad, Hyderabad, Telangana State. All cases with febrile seizures were admitted for the first time to our hospital. Febrile seizures (Febrile seizures are defined as a seizure occurring in association with a febrile illness, in the absence of CNS infection or any other defined cause of seizures).

Results: Out of n=100 cases studied the most common cause of febrile convulsions in cases of this study was upper respiratory infections in 89% of cases. The duration of convulsion revealed most of the convulsions were lasting for < 5 minutes in 68% of cases. Between 5 – 10 minutes in 28% of cases and > 10 minutes in 4% of cases and the cases were with hyponatremia. No family history of febrile convulsions was recorded in 77% of cases and positive family history of convulsion was found in 33% of cases. Blood glucose levels were found to be normal in 84% of cases and high glucose levels in 6% of cases.

Conclusions: The study finds that febrile convulsions are more common in males as compared to females. The serum sodium levels in 50% of cases were found to be lower and a greater number of males were with hyponatremia as compared to females. The severity of hyponatremia was also associated with a significantly increased duration of convulsions.

Keywords: Febrile Convulsions, Seizures, Hyponatremia, Blood Glucose Levels

Introduction

Febrile seizures are a common problem in our country, the incidence in India being 3-5 %. Because of its close association with epilepsy in the future, studies have attempted to identify the risk factor associated with them viz, family history of febrile seizures, epilepsy, perinatal factors, genetic factors, but risk factors remain largely unknown. [1, 2] Febrile seizures occur in children between 6 months to 5 years of age, at a time in their development when the seizure threshold is low. This is a time when young children are susceptible to frequent childhood infections such as upper respiratory infection, Otitis media, viral syndrome, and they respond with comparably higher temperatures. Preliminary studies in children appear to support the

hypothesis that the cytokine network is activated and may have a role in the pathogenesis of febrile seizures, but the precise clinical and pathological significance of these observations is not yet clear. [3] During routine electrolyte studies in patients with febrile convulsions, some researchers found the serum sodium level to be lower in children with recurrent convulsions. relative hyponatremia, sweating may predispose the febrile child to the occurrence of simple febrile seizure [4-7] Sodium ions play an important role in cell physiology, neuronal cell depolarization, production of electrical discharge and may affect the predisposition to seizures. Sodium is a dominant cation of the Extracellular Fluid [ECF] and it is the principal determinant of extracellular osmolality. Sodium is therefore necessary for the maintenance of intravascular volume. Therefore, the need to evaluate and correlate serum sodium levels in febrile seizures becomes significant. [8] Blood glucose levels should be determined in children with prolonged postictal obtundation or with poor oral intake (prolonged fasting). Studies have shown that hyperglycemia and an increase in the CSF glucose concentration are found in febrile convulsions. However, it is not just by a stress reaction, evoked by the seizure, as has been hypothesized earlier, but by the influence of increased body temperature as well. [4, 9] Hence there is a need to study the association between serum Sodium and glucose levels in febrile seizures among the children with febrile seizures admitted to our Hospital.

Material and Methods

This was a cross-sectional study was conducted in the Department of Pediatrics, cases admitted in Pediatrics wards, Bhaskar Medical College and General Hospital, Moinabad, Hyderabad, Telangana State. Institutional Ethical Committee Permission was obtained for the study. Written consent was obtained from the parents/guardians of the children included in the study.

Inclusion Criteria

1. Aged between 6 months to 5 years
2. With febrile seizures admitted for the first time to our hospital. Febrile seizures (Febrile seizures being defined as a seizure occurring in association with a febrile illness, in the absence of CNS infection or any other defined cause of seizures)
3. Male and Female cases

Exclusion criteria

1. Children with afebrile seizures.
2. CNS infections.
3. Developmental delay.
4. Persistent neurological deficit.
5. Children with gastroenteritis, pneumonia.
6. Children with a history suggestive of cystic fibrosis.
7. Children with Renal problems.

Based on the inclusion and exclusion criteria a total of n=100 cases were included in the study. A detailed history was obtained with regards to the Fever-type, duration, Convulsions- type, duration, the number of episodes of convulsion, prior hospitalization and medication, Co-morbid diseases, Past-history of convulsions, birth and developmental history, Family history. Laboratory investigations were carried out, at the time of catheter placement for seizures included CBC (Hb, DC, ESR), serum sodium, and serum glucose.

The patients were managed according to the standard protocols for the particular ailment and laboratory findings. Statistical analysis: Data was entered using Microsoft Excel 2010 version and analyzed using EPI INFO version 7. Data were summarized in percentages and proportions. Numerical data were presented in mean, standard deviation, and range.

Appropriate statistical tests ANOVA was applied wherever required with a significance level at 5% ($p<0.05$) considered statistically significant.

Results

In this study consecutive cases of febrile seizures were included out of n=100 cases 54% were male and 46% were females. The most common age group involving male cases was 3-5 years with n=28(51.85%) of all male cases in the study. Similarly, in females, the common age group involved was 3 – 4 years with n=16(34.78%) cases the detailed description is depicted in table 1.

Table 1: Age and sex-wise distribution of the study population

Age groups (years)	Male	Female	Total	Percentage
<1	2	0	02	2%
1-2	11	9	20	20%
2-3	13	11	24	24%
3-4	14	16	30	30%
4-5	14	10	24	24%
Total	54	46	100	100%

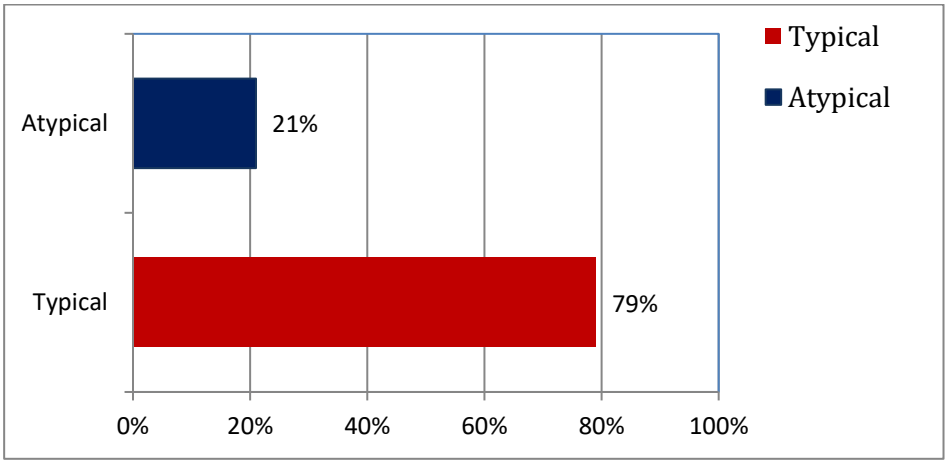
The most common cause of febrile convulsions in cases of this study was upper respiratory infections in 89% of cases. The associated symptoms of cough and cold were found in all the cases of URI. Ear discharges were found in 2 cases and loose stools were the symptom of diarrhea cases. The incidence of diarrhoeal diseases was more common in male cases and the incidence of viral fever was found to be more common in female cases. Acute Suppurative Otitis Media was the least common cause of febrile convulsions found in 2% cases given in table 2.

Table 2: Clinical Cause of febrile convulsion

Cause	Male	Female	Frequency	Percentage
Diarrhoeal diseases	03	02	05	5%
ASOM	01	01	02	2%
URI	49	40	89	89%
Viral fever	01	03	04	4%
Total	54	46	100	100%

The study of duration of convulsion revealed most of the convulsions were lasting for < 5 minutes in 68% of cases. Between 5 – 10 minutes in 28% of cases and > 10 minutes in 4% of cases and the cases were with hyponatremia. No family history of febrile convulsions was recorded in 77% of cases and positive family history of convulsion was found in 33% of cases. The type of convulsions has been depicted in Graph-1.

Graph 1: showing the type of convulsions recorded in cases of study



The estimation of blood sugar levels in the below 5 years range was done a level between 101 – 150 mg/dl is considered as normal range and the level below 100 mg/dl was considered as low blood sugar levels and >150 mg/dl was considered as increased levels. The serum sodium levels were 135 – 145 mEq/L were considered normal levels and values below 135 mEq/L were considered as low levels and > 145 mEq/L were considered as increased levels details are depicted in table 3.

Table 3: Blood sugar levels and serum sodium levels in the cases of study

	Male	Female	Percentage
Blood sugar levels			
High	4	2	6%
Low	2	8	10%
Normal	48	36	84%
Total	54	46	100%
Serum Sodium levels			
High	2	2	4
Low	38	12	50
Normal	14	32	46
Total	54	46	100

The mean age of presentation of febrile seizure was found to be 33.12 ± 15.1 months. The mean temperature at which the children had febrile convulsion was 101.41 ± 0.83° F. The mean hemoglobin levels of children were 10.7±0.92 gm/ dl. The mean TLC levels in the children were 11687±1923 cells/ cu.mm. The ANOVA analysis of serum sodium levels and sex found the p values were 0.04 which is considered significant. However, in a similar analysis of blood glucose and sex, the p values were 0.2 which was not significant.

Discussion

The mean age of the cases in the present study was 33.12±15.1 months. A study done by Al Eissa found the mean age of presentation was 15 months. [10] E Plochl et al., [11] in Germany observed febrile convulsion first appeared on average age of 22.9 months, and in children with recurrent febrile convulsions, it appeared early at an average of 18.2 months. Another

interesting fact they observed was children with a family history of febrile seizures earlier presentation of convulsions at 14.5 months. [11] In this study, 77% of cases were without a positive family history of convulsions therefore the age at first presentation on average is more as compared to the previous studies. The male to female ratio of the current study was 54:46 and similar predominance has been observed in the other similar studies. [12 - 14] It has been suggested that the male gender is more susceptible to infections and frequent illnesses and constitutes a risk factor for the recurrence of febrile convulsions. [13] The mean temperature at which the children had febrile convulsion was 101.41 ± 0.83° F. El Radhi et al., [15] In an interesting observation found that the mean temperatures were lower in cases where there was a high chance of recurrence of febrile convulsions. During most acute pyretic diseases water and electrolyte balance is disturbed especially the sodium values in children. [16, 17] It was also observed that sodium levels are lower in children with febrile convulsions as compared to the normal population [7, 17] Consistent with these findings of the previous study we in the current study found lower levels of serum sodium in 50% of cases of the study and greater number of males were found with a lower level of sodium and febrile convulsions. It has been stated that hyponatremia is due to higher levels of vasopressin released to affect thermoregulatory neurons through the anteroseptal region of the limbic system. [18] Sometimes children can present with higher levels of hyponatremia as compared to adults which may result in increased intracellular fluid passage brain edema and encephalopathy. There is also a decrease in levels of intracerebral arterial oxygen and decreased threshold for seizures along with decreased cerebral blood flow. [6, 19] The estimation of blood glucose levels revealed 84% of cases with normal blood sugar levels. It has been reported that there is stress-induced hyperglycemia is a temporary elevation in blood glucose due to elevated levels of cortisol, growth hormone, glucagon, and cytokines during stress. [20] It has also been reported that those who had seizures for the first time have severe and prolonged hyperglycemia episodes. This study didn't find significant elevation of blood glucose levels possibly since there was no poor feeding of the child during pyrexia due to irritability this may have dampened whatever the endogenous hyperglycemia might have occurred. The severity of hyperglycemia is also dependent to a large extent on the intensity of the stressor. Similar observations have been reported by IS Kara et al., [21] in their study of recurrent febrile convulsions.

Conclusion

The study finds that febrile convulsions are more common in males as compared to females. The serum sodium levels in 50% of cases were found to be lower and a greater number of males were with hyponatremia as compared to females. The severity of hyponatremia was also associated with a significantly increased duration of convulsions. However, there was no significant difference in serum glucose levels between male and female cases. Therefore, it is prudent to estimate the serum sodium and glucose levels in cases of febrile illness in children to assess the possibility of recurrence of seizures.

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