



Serum Sodium Levels Among Children With Simple Febrile Seizure And Afebrile Seizure In A Tertiary Care Hospital

¹Saishte Mahajan, ²Ravinder K. Gupta, ¹Abhai S Bhadwal, ³Vikas Sharma

¹Intern, ²Professor and Head, ³Senior Resident,

Department of Pediatrics, Acharya Shri Chander College of Medical Sciences (ASCOMS), Jammu, J & K

***Corresponding Author:**

Dr. Ravinder K. Gupta

Professor and Head, Department of Pediatrics, ASCOMS Hospital, Sidhra, Jammu, Jammu and Kashmir, 180017

Type of Publication: Original Research Paper

Conflicts of Interest: Nil

Abstract

Objective: To assess and compare the serum sodium concentration in children with Simple Febrile Seizures and Afebrile seizures.

Design: A case-control Study

Setting: Indoor and Outdoor wings of Department of Pediatrics, Acharya Shri Chander College of Medical Sciences (ASCOMS), Jammu (J&K)

Sample Size: 120 (60 each - Children having simple febrile seizures and afebrile seizures)

Material and Method: A total of 120 children were studied who were categorized into 2 groups of children with Simple Febrile Seizures and children having afebrile seizures. Serum sodium levels were measured in both the groups.

Results: Of the total 120 patients in our study, 74 (61.6%) were males and 46 (38.3%) were females. In patients with Simple febrile seizures, 35% had temperature in the range of 101.1-102°F. Simple febrile seizure lasted for 2-5 minutes in 32(53.3%) children. Approximately 11 (18.3%) patients in febrile group had positive family history. Serum sodium levels in 78.3% children with simple febrile seizures were in the range of 130-135mEq/L whereas in the afebrile group only 20 (33.3%) subjects were in this range.

Conclusion: Hyponatremia was significantly seen in children with simple febrile seizures

Keywords: Fever, seizure, hyponatremia

Introduction

Seizures are one of the most frequent problems encountered during the pediatric age group and are related to specific risk factors like positive family history, fever, infection etc. Seizure is a symptom that occurs suddenly and temporarily due to abnormal excessive or synchronous neuronal activity in the brain^[1,2].

Childhood seizures mostly comprise of febrile convulsions^[3,4]. About 2-5% of all children suffer from at least one febrile convulsion in early childhood and most of them being simple. The peak incidence of febrile seizures occurs in the 2nd year of

life and is more common in males^[5]. The SFS last for not more than 15 minutes and occur most commonly between 65-90%^[6].

As for now, pediatric age group is most vulnerable to neurological illness especially seizures and its risk is highest in the 2nd year of life. However, studies regarding etiology of febrile seizures have been extensively studied meanwhile that of afebrile seizures are limited in India as well as worldwide.

High grade fever is an important contributing factor in the development of electrolyte disturbance during the period of seizures^[7]. Various studies have indicated that variation in serum electrolytes will

increase the chances of development of seizure and its recurrence in children [5]. Sodium plays a vital role in the neurological cell depolarization and production of electrical discharge. It is suggested that decreased sodium levels increase the susceptibility of convulsions in febrile illness. Hyponatremia is more likely to be associated with complicated seizures. Serum sodium levels are lowest in children with recurrent seizures. Hyponatremia has also shown to reduce the threshold to convulsive stimuli in animals. [2,6]

The main objective of this work was undertaken to compare the serum sodium levels among children suffering from febrile and afebrile seizures as studies related to this are very limited in our setup. So, keeping the above situation in consideration, it is important to consider the needs of family as seizures are frightening and many parents who witness a first seizure fear initially that their child is dying [8].

Aim: Aim of the study was to compare the serum sodium concentration in children with Simple Febrile Seizures and Afebrile seizures.

Materials And Method

A case-control, prospective study was conducted in the outpatient and inpatient wings of Department of Pediatrics, ASCOMS and Hospital, for a period of 12 months (December 2020 to November 2021).

Children aged between 6 months to 6 years who presented with seizures (both Simple febrile seizure as well as afebrile seizures) in the OPD as well as admitted in the wards were enrolled for the study. The study was conducted after getting approval from the Institutional Independent Ethical Committee wide reference number ASCOMS/IEC/RP& T/2020/379 dated 25.07.2020. An informed consent was obtained from the parents of all children who enrolled for the study. The exclusion criteria

comprised of children with a history of previous afebrile seizure, i/v fluid therapy in the last 48 hours, failure to thrive, malabsorption, meningitis, encephalopathy, any previous known renal disease, developmental delay.

A total of 120 children who participated in the study were categorized into 2 groups. Group-A included children with Simple Febrile Seizures and Group-B was set as a control group with children having afebrile seizures.

Serum sodium levels were measured along with patient’s gender, age, history for seizure in 1st degree relations, temperature, duration of seizure and the most likely cause of fever. An appropriate statistical method will be applied. The data will be collected in the form of number and percentages and graded accordingly.

Results:

The study included 120 subjects in both the cases (Group A and Group B) which were analysed for further evaluation. Mean age of participants in Group A was 23.9 months whereas that of Group B was 35.25 months. A slight significant difference in age was seen in both groups. In this study, there was equal number of cases in both the group. 60 (50%) patients who were in Group A had Simple Febrile seizure and Group B which was the control group had 60 (50%) patients with afebrile seizure.

Of the total 120 patients in our study, 74 (61.6%) were males and 46 (38.3%) were females. Comparing between Group A and Group B revealed the percentage of males were almost same in both the groups whereas in Group A most of the children belonged in the age group of 12-24 months in comparison to Group B where most of the children were of age between 48-60 months.

Table 1:

n=Number of patients

	Group A		Group B	
Age months	Male n(%)	Female n(%)	Male n(%)	Female n(%)
6 -12	4 (10.5)	3(13.6)	3(8.3)	2(8.3)
12-24	16(42.1)	10(45.4)	10(27.7)	5(20.8)

24-36	14(36.8)	7(31.8)	6(16.6)	4(16.6)
36-48	3(7.8)	1(4.5)	6(16.6)	4(16.6)
48-60	1(2.8)	1(4.5)	11(30.5)	9(37.5)
Total	38	22	36	24

In Table 2, it can be observed that in Group A maximum percentage of patients (35%) had temperature in the range of 101.1-102°F. About 13(21.6%) subjects had temperature in the range of 100.1-101 °F and 12(20%) subjects had temperature in the range of 102.1-103 °F whereas in Group B all the patients were in the temperature range of 98-99 °F.

Table 2: Temperature, n=Number of patients

	Group A n(%)	Group B n(%)
Temperature in Fahrenheit		
98-99	Nil	60(100)
99.1 -100	8(13.3)	-
100.1-101	13(21.6)	-
101.1-102	21(35)	-
102.1-103	12(20)	-
103.1-104	6(10)	-
Total	60	60

It is observed in Table 3 that Simple febrile seizure lasted for 2-5 minutes in 32(53.3%) children and 5-10 minutes in 17(28.3%) children. None of the children in group A experienced the seizure for more than 15 minutes. In Group B with afebrile seizures, duration of seizure was 5-10 minutes in 21(35%) subjects, 10-15 minutes in 19(31.6%) subjects and more than 15 minutes in 2(3.3%) patients.

Table 3: Duration of seizure

	Group A n(%)	Group B n(%)	p-value
Duration in Minutes			
Less than 2	8(13.3)	7(11.6)	0.079
2-5	32(53.3)	11(18.3)	0.0001
5-10	17(28.3)	21(35)	0.4320
10-15	3(5)	19(31.6)	0.0188
More than 15	-	2(3.3)	0.1577

Total	60	60	
-------	----	----	--

Table 4 shows the difference between subjects in both the groups having a positive family history of seizures and subjects without any family history. Approximately 11 (18.3%) patients in Group A had positive family history whereas only 5 (8.3%) in Group B had a family history.

Table 4: Positive family history for febrile Seizure, n=Number of patients

	Group A n(%)	Group B n(%)	p-value
Positive family history	11(18.3)	5(8.3)	0.1082
No family history	49(81.6)	55(91.6)	0.1093

Among the 60 subjects who had simple febrile seizures, Upper Respiratory Infection and Gastroenteritis were the causes of fever in 20(33.3%) and 17(28.3%) patients respectively. Vaccination was the least common cause of fever with just 3(5%) subjects reporting fever due to it as depicted in table 5.

Table 5: Causes of fever , n=Number of patients

	Number	Percentage(%)
Upper respiratory infection	20	33.3
Acute otitis media	7	11.6
Gastroenteritis	17	28.3
Urinary Tract Infection	8	13.3
Vaccination	3	5
Fever without localized sign	5	8.3
Total	60	100

The mean sodium levels in subject with simple febrile seizures were 133.69 mEq/L while mean sodium levels in patient with afebrile seizures were 136.1 mEq/L.

In Group A, 47 (78.3%) children had a serum sodium level between the range of 130-135mEq/L whereas in Group B only 20 (33.3%) subjects were in this range. Most of the patients in Group B (66.6%) presented with serum sodium levels in the range of 136-140 mEq/L. None of the children had serum sodium levels >140 mEq/L in any group.

Table 6: Serum sodium concentrations at the time of presentation, n=Number of patients

	Group A	Group B	p-value
Sodium concentration mEq/L	n(%)	n(%)	
130 - 135	47(78.3)	20(33.3)	<0.0001
136 - 140	13(21.6)	40(66.6)	<0.0001
>140	-	-	-

Discussion:

It is well established that hyponatremia is a known factor to make patient vulnerable to seizures and high fever is an important cause of electrolyte imbalance especially in children. Though numbers of studies have unequivocally demonstrated that children suffering from simple seizure with fever have declined sodium levels, however there are less reports regarding evaluation of sodium levels in patients with afebrile seizures. Therefore, the present study was conducted in children suffering from seizures with and without fever to determine significance of sodium levels.

Our study has demonstrated that majority of patients were males (male:female ratio = 37:23). There are similar reports where children with seizures were predominantly males^[9,10]. In febrile group majority of seizures occurred between 101-104 °F (60%) and had duration 2-10 minutes. The present study demonstrates that serum hyponatremia was prevalent in majority of the children suffering from seizure with fever (78.3%) while only 33.3% of the children with seizure without fever had hyponatremia the results of which are comparable to the observations made by other authors^[11]. However, in contrast to our study, another study showed no significant difference in serum sodium levels in children with simple febrile seizures and the afebrile seizure group^[12].

Statistically, there was a significant difference between two groups and it is clearly highlighted that hyponatremia is an important associated factor especially in simple febrile seizure. Poor intake in these children with fever further contributes towards hyponatremia in addition to other number of factors which can influence electrolyte imbalance. Family history of febrile seizure as an important factor has been documented in some studies^[13, 14] but that was not observed in our study, which is consistent with results by Maia *et al*^[15].

The significant results of this study demonstrate that fever is an important cause of electrolyte imbalance. Sodium disorder can cause encephalopathy, irritability and may result in seizure. Alteration in the electrolyte gradient across neurological cellular membrane has both direct and indirect effect on neurological excitability and abnormal discharge can cause seizure^[16,17].

The result of given trial demonstrates the importance of evaluation of sodium levels in children with seizure with or without fever.

Conclusion:

Hyponatremia has been observed to be one of the major contributors to cause simple febrile seizures especially in pediatric set-up. Based on the findings in our study, we could cite a major difference in mean levels of sodium between both groups. Although serum sodium levels cannot always assist in prediction of simple febrile seizures but relative hyponatremia may predispose the child for recurrence of seizures. Hence, we could demonstrate a significant role of serum sodium in predicting the occurrence of seizure with or without fever.

Limitations:

The current trial suffers from few limitations as only children suffering from seizures with and without fever were evaluated and children with fever without seizure were not examined. Only sodium levels were evaluated, other electrolytes like calcium, magnesium and potassium were not established though their declined levels can not cause seizures. Moreover, the patients were not followed to the recovery.

References:

1. Gowda V, Kulhalli P Jr., Benakappa N Sr., Benakappa A. Etiological profile of afebrile seizures in infants in a tertiary care center from southern india. *J Pediatr Neurosci.* 2019; 14(2):82-85.
2. Hidayah N, Huldani, Fauziah, Risyad MN. Seizure due to electrolyte imbalance in pediatric. *Eur. J. Mol. Clin. Med.* 2020; 7(8):4664-68.
3. Suryawanshi M, Madavi D, Gandhi P. Association of febrile seizure with hyponatremia- a prospective study. *Glob. J. Res. Anal.* 2019; 8(9):13-14
4. Fallah R, Islami Z. Evaluation of serum sodium levels in simple, multiple and recurrent febrile convulsions. *Acta Med Iran* 2009; 47(3):225-27.
5. Penta VBT, Lakkappa L. Assessment of serum sodium levels among the febrile seizures children in a tertiary care hospital. *Indian J Child Health.* 2018; 5(11):670-73.
6. Duangpetsang J. Serum sodium levels predict the recurrence of febrile seizure within 24 hours. *J Health Sci Med Res* 2019; 37(4):227-80.

7. Kulandaivel M. Serum sodium levels and probability of recurrent febrile convulsions. *Int. J. Sci. Study* 2017; 5(2):5-8.
8. Michoulas A, Farrell K, Connolly M. Approach to a child with a first afebrile seizure. *B. C. Med. J.* 2011; 53:274-77.
9. Benny S. Role of serum sodium levels in recurrent episodes of febrile seizure. *Int J Contemp Pediatr* 2020; 7(7):1606-13.
10. Salehiomran M, Ebrahimzadeh H, Hajiahmadi M. The serum sodium levels and recurrence of simple febrile seizure during the first 24 hours in children. *Caspian J. Pediatr.* 2018; 4(1):278-81.
11. Heydarian F, Ashrafzadeh F, Kam S. Simple febrile seizure: the role of serum sodium levels in prediction of seizure recurrence during the first 24 hours. *Iran. J. Child Neurol.* 2009;31-34.
12. Swami G, Devpura K, Meena V, Dogra L. Serum sodium level in febrile seizure- does it predict seizure recurrence within 24 hours? *Int. J. Inf. Res. Rev.* 2017; 4(2):63-67
13. Winckler MI, Rotta NT. Clinical and electrophalographic follow-up after a first unprovoked seizure. *Pediatr Neurol* 2004; 30:201-06.
14. Monetti VC, Granieri E, Casetta I, Tola MR, Paolino E, Malagu S, et al. Risk factors for idiopathic generalized seizures: a population-based case control study in Capparo, Italy. *Epilepsia* 1995; 36:224-29.
15. Maia C, Moreira AR, Lopes T, Martins C. Risk of recurrence after a first unprovoked seizure in children. *J Pediatr* 2017; 93(3):281-86.
16. Nardone R, Brigo F, Trinka E. Acute symptomatic seizures caused by electrolyte disturbance. *J Clin Neurol.* 2016; 12(1):21-33.
17. Hossain MM, Saha NC. Clinical review of febrile seizure and updates. *Karnataka Paediatr J* 2021;36(1): 3-12.