

# Febrile Seizures in Children and its Association with Bacterial Infection - A Hospital based Study

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## ABSTRACT

**Introduction:** Simple febrile seizures are the most common convulsive disorder of childhood. As bacterial infection and febrile seizures are common during early childhood, it was postulated that some association may exist between these two clinical conditions. So this research was undertaken to study the association of bacterial infection with febrile seizures in children.

**Material and Methods:** 100 children between 6 months to 05 years of age admitted with febrile seizures were included in this study. Patients were divided into three age groups: age group 6 months to 1 years, age group more than 1 to 2 years and age group more than 2 years to 5 years. Variables including age, sex, type of seizure, associated symptoms, family history of seizure or epilepsy, past history of seizures, laboratory test including blood and urine cultures were recorded.

**Results:** Total 15% had positive blood culture. *Streptococcus pneumoniae* was the most common organism in blood culture. Total 7% had positive Urine culture. *E coli* was found to be common organism in urine culture.

**Conclusion:** Even though viruses form major precipitating agents for febrile convulsions, bacterial infection should be ruled out in all children presenting with febrile seizures.

**Keywords:** Febrile Seizures, Bacterial Infection

## INTRODUCTION

Simple febrile seizures are the most common convulsive disorder of childhood and a frequent cause of visits to the emergency department (ED).<sup>1</sup> Febrile seizures (FS) are typically divided into two types, "simple" and "complex". A simple FS comprises of generalised tonic-clonic activity without focal features, of less than 15 minutes duration, without a recurrence in the subsequent 24 hours and resolving spontaneously.<sup>2,3,4,6</sup>

The incidence in the world varies between 5–10% (India), 8.8% (Japan), and 14% (Guam).<sup>5</sup> Between 9% and 35% of all first FS are complex.<sup>5,7,8</sup>

Febrile seizures occur when a susceptible child of a critical age has fever. The fever is typically higher than in control children with a similar illness, although the seizure does not always occur at the same time as the peak temperature or necessarily at the onset of fever.<sup>5</sup> Any viral or bacterial illness may provoke FS, and this is also (rarely) true for immunisation.<sup>9,10</sup>

In addition pyrexia may follow an afebrile tonic-clonic seizure, although this will rarely exceed 38°C. Ear, throat, lower respiratory, urinary tract, and a CNS infection should be considered as possible sources of any febrile illness. Routine blood tests are not recommended unless where

clinically indicated.<sup>11,12</sup> Interestingly, the risk of bacteraemia would appear to be the same in children with fever with or without simple febrile seizures.<sup>13</sup> Each child must therefore be evaluated individually and carefully.

So this research was undertaken to study the association of bacterial infection with febrile seizures in children.

## MATERIAL AND METHODS

The study was done on 100 consecutive cases of simple febrile seizures admitted to paediatric ward of a tertiary care hospital in southern India to study epidemiological and precipitating factors of febrile seizures and to study incidence of bacterial infection in case of febrile seizure in children between the age group of 6 month to 5 years. Ethical clearance was taken from the hospital ethical committee.

Patients were divided into three age groups: age group 6 months to 1 years, more than 1 to 2 years and more than 2 to 5 years. Variables including age, sex, associated symptoms, laboratory test including blood and urine cultures were recorded. Culture samples were collected before starting antibiotics.

The following definitions, terms and diagnostic criteria were used in accordance with specifications given in standard text books.

1. A simple febrile seizure is a primary generalized, usually tonic-clonic, attack associated with fever, lasting for a maximum of 15 min, and not recurrent within a 24-hour period. A complex febrile seizure is more prolonged (>15 min), is focal, and/or recurs within 24 hr. Febrile status epilepticus is a febrile seizure lasting >30 min.<sup>2</sup>
2. Fever: Measurements of axillary temperature more than 37.0° C or 99° F
3. Bacteraemia was defined as a blood culture obtained from a patient at initial presentation that was positive for pathogenic bacteria.
4. UTI - Growth of single urinary pathogen at a concentration of 10<sup>5</sup> CFU/ml

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**Clinical History**

- Patients Name, Age, Sex.
- History of fever.
- History of precipitating factors (like cough, cold rash, loose stools, vomiting, irritability, ear discharged etc).

**Clinical Examination**

A detailed general and systemic examination will be done in all cases to find out the foci of infection.

**Laboratory Investigations**

Necessary investigations were done by obtaining informed consent from the patient's parents.

- Blood culture and sensitivity.
- Urine culture and sensitivity
- Stool routine, culture and sensitivity.

**Inclusion criteria**

a) Children between 6 month to 5 years who presented with febrile seizures.

**Exclusion criteria**

- Who have history of Afebrile Seizures.
- Those who have received antibiotics prior to hospitalisation.

Age group	No. of cases (n=100)	Percentage (%)
6 Months – 1 Year	35	35
>1 Year – 2 Years	34	34
>2 Years - 5 Years	31	31

**Table-1:** Prevalence of febrile seizures in different age groups

Symptoms	6 months to 1 year (n=35)	>1 to 2 years (n=34)	>2 to 5 years (n=31)	Percentage (%)
Fever	35	34	31	100
Cough	16	17	18	51
Cold	16	7	9	32
Vomiting	12	9	5	26
Rash	14	5	12	31
Irritability	12	4	4	20
Ear discharge	1	5	1	7
Loose motion	12	9	6	27

**Table-2:** Febrile seizures – precipitating factors

Blood Culture	6 months to 1 year (n=35)	>1 to 2 years (n=34)	>2 to 5 years (n=31)	Percentage (%)
No Growth	31	29	25	85
Growth present	4	5	6	15

**Table-3:** Blood culture in febrile seizures

Organism	6 month to 1 year (n=35)	>1 to 2 years (n=34)	>2 to 5 years (n=31)	Percentage (%)
No.growth	31	29	25	85
Streptococcus pneumonia	2	2	2	6
Staphylococcus aureus	2	0	2	4
Enterobacteriaceae	1	2	2	5

**Table-4:** Type of Organisms in Blood culture of febrile seizures children

Urine Culture	6mths to 1 year(n=35)	>1 to 2 years(n=34)	>2 to 5 years(n=31)	Percentage(%)
No Growth	33	31	29	93
Growth	2	3	2	7

**Table-5:** Urine culture in febrile seizure children

- Children less than 6 month and more than 5 years of age.
- Those who have signs and symptoms of meningitis (e.g., neck stiffness, Kernig sign, Brudzinski sign), or history or examination suggests the presence of meningitis or intracranial infection.

**STATISTICAL ANALYSIS**

Following statistical methods were employed in the present study.

- Chi – square test
- Anova test
- Student t-Test
- All the statistical calculations were done through SPSS (statistical Presentation System Software).

**RESULTS**

**Prevalence of seizures in different age groups:** Occurrence of seizures was highest (35%) in the age group between 6 month to 1 year, followed by 34% in age group of more than 1 year to 2 year and 31% in age group of more than 2 year to 5 year.(Table 1)

**Febrile seizures- precipitating factors:** Fever was the predominant symptom (100%) followed by cough (51%), cold (32%), rash (31%), loose stools (27%) and vomiting (26%). In majority of cases, the precipitating factor found to be Upper respiratory tract infection (51%) followed by Viral exanthematous fever (31%) and acute gastroenteritis (27%). (Table. 2)

Urine culture growth	6mths to 1 year(n=35)	>1 to 2 years(n=34)	>2 to 5 years(n=31)	Percentage(%)
No growth	33	31	29	93
E.Coli	3	2	2	7

Table-6: Organisms isolated in Urine culture

Stool culture	6mths to 1 year(n=35)	>1 to 2 years(n=34)	>2 to 5 years(n=31)	Percentage(%)
No growth	35	33	30	98
Growth (E.Coli.)	0	1	1	2

Table-7: Stool culture in Febrile seizure children

The statistical test used was ANOVA test to find the strength between the variables. The *P* Value for fever-0.936, cough-0.357, cold-0.953, vomiting-0.218, irritability-0.223, ear discharge- 0.096, loose motion-0.199. These are insignificant and shows that there exists no correlation between the age and precipitating factors in present study.

**Blood culture in febrile seizures:** Out of 100 consecutive cases admitted to the hospital with convulsions, total 15 (15%) had positive blood culture. According to age (11.42%) in age group of 6mths to 1 year, (14.70%) in age group of more than 1 year to 2 year and (19.35%) in age group of more than 2 year to 5 years shown growth in their blood culture.(Table 3)

The statistical test used was ANOVA test to find the strength between the variables. The *P* Value was 0.695. It is insignificant and shows that there exists no correlation between the age and Blood Culture in the present study.

**Organisms isolated in blood culture:** Out of 100 consecutive cases admitted to the hospital with febrile convulsions, total (15%) had positive blood culture. Common organisms isolated were Streptococcus Pneumonia, Staphylococcus Aureus and Enterobacteriaceae. (Table 4)

**Urine Culture in febrile seizures:** Out of 100 consecutive cases admitted to the hospital with convulsions, total 7 (7%) had positive Urine culture. According to age 2/35(5.71%) in age group of 6mths to 1 year, 3/34(8.82%) in age group of more than 1 year to 2 year and 2/31(6.45%) in age group of more than 2 year to 5 years shown growth in their Urine culture.(Table 5)

The statistical test used was ANOVA test to find the strength between the variables. The *P* Value was 0.855.It is insignificant and shows that there exists no correlation between the age and Urine Culture in the present study.

**Organisms isolated in Urine culture:** Out of 100 consecutive cases admitted to the hospital with convulsions, total (7%) had positive Urine culture. Of positive Urine culture all cases grew E.Coli.(Table 6)

**Stool analysis and stool culture:** Of 100 cases 27 cases present with loose motions. Stool analysis and Stool culture was ordered for these cases. 5 (5%) of cases showed more than 10 pus cell per high power field. Of these cases 2 cases grew E.coli in their culture (*P*-0.780). (Table 7)

## DISCUSSION

**Prevalence of seizures in particular age groups:** In our study we recorded the highest incidence of febrile seizures in the age group of 6 month to 1 year (35%), followed by (34%) in the age group of 1year to 2 years.

In study done in 2013 by Winkler AS, et al<sup>14</sup> reported a total of 197 children with febrile seizures; the peak age of first febrile seizure was 2 years and one of five children experienced repeated episodes. In study conducted in 2012 by Shi XL, et al<sup>15</sup> showed the prevalence of Febrile seizure was 3.67% (235/6406) and most children (75.7%) experienced their first onset of febrile seizures at 6 month to 3 years of age (median:16 months). In study done in 2002 by Samir s.shah;Elizabeth<sup>16</sup> shown that the mean age was 15.9 ± 4.7 months (median, 16.0 months; range, 2-24 months). Most patients were older than 12 months (76.0%), and only 8 (2.1%) were younger than 6 months.

**Precipitating factors:** Febrile convulsions can be associated with various other symptoms depending on the aetiology. In the present study of the total 100 cases, All patients presented with fever (100%).Other symptoms associated with fever include cough (51%) and cold (32%), loose stools (27%), irritability (20%),vomiting (26%) and ear discharge (7%). In majority of cases, the precipitating factor found to be Upper respiratory tract infection (51%) followed by Viral exanthematous fever (31%) and acute gastroenteritis (27%). The *P* Value for fever-0.936, cough-0.357, cold-0.953, vomiting-0.218, irritability-0.223, ear discharge-0.096, loose motion-0.199. These are insignificant and shows that there exists no correlation between the age and precipitating factors in present study.

Febrile seizures are due to febrile illnesses from common infections such as tonsillitis, upper respiratory infections, and otitis media.<sup>17</sup> In our study, most cases of febrile seizures were associated with symptoms of upper respiratory tract infection or acute gastroenteritis.

In study conducted by Kaputa Kalala Malu C et al<sup>18</sup> shown that upper respiratory tract infection and otorhinolaryngologic viral infection were the most implicated occurring in 69.5% of patient. In study conducted in 2013 by Kang B, Kim DH et al<sup>19</sup> reported 17/755 case (2.2%) had febrile seizures who had Mild Rotavirus enteritis.

In another study done by Samir S Shah, Elizabeth R Alpern<sup>16</sup> showed that (64.1%) Otitis media, (23.2%) Upper Respiratory Tract Infection, (6.2%) Pneumonia and (2.5%)

gastroenteritis are implicated.

In study done by Dr Amarendra et al<sup>17</sup>, they reported common presentation for febrile convulsion were upper respiratory tract infection(86%) followed by acute gastroenteritis(8%). In our study we found that (45%) with Cough, (30%) Cold, (29%) Rash, (28%) loose motions,(25%) vomiting, (15%) irritability and (7%) with Ear Discharge.

**Incidence of occult bacteremia in case of Febrile convulsions:** In present study blood and urine were sent in all cases of which (15%) had positive blood culture and (7%) had positive urine culture. Blood culture grew *Streptococcus pneumoniae* in 6 cases, *Staphylococcus aureus* in 4 cases, and *Enterobacteriaceae* in 5 cases respectively. The *P* Value was 0.695.

In study done by Teran CG of the 219 patients included in the study, 135 (61.4%) cases had the aetiology of the FS diagnosed. Upper respiratory tract infection, otitis media, urinary infection, and pneumonia were the most common diagnoses attributed to the fever. Only 1 blood culture was positive for *Salmonella*.<sup>21</sup>

In study done by Richard Idro et al in 2008<sup>22</sup>, studied two hundred and forty eight children out of 4,602 (5.4%) had positive blood cultures. *Streptococcus pneumoniae* was the commonest cause of bacteraemia in both groups of children but was more common among patients with seizures, (10/23 [43.5%] vs 31/225 [13.8%], *p* < 0.001).

In study done by Teach SJ, Geil PA<sup>23</sup> and Trainor JL, Hampers LC-Acad<sup>24</sup> reported positive blood culture with *Streptococcus Pneumoniae* in 3% and 1.3% of study group, 1% and 6% had urinary tract infection respectively. Of 100 cases studied, total (7%) had positive Urine culture. Of culture positive cases all grew *E.Coli* bacteria. The *P* Value was 0.855. It is insignificant and shows that there exists no correlation between the age and Urine Culture.

Khan WA, Dhar U et al<sup>25</sup> found out in their study that 23/41 with documented febrile seizures had >50 leukocytes/HPF (*p*>2) and 13 cases had *Shigella dysenteriae* type 1, 26 cases had *Shigella flexneri* and 2 cases had other shigella species in their stool cultures(*p*-0.015).

## CONCLUSION

Febrile seizures are the most common seizures seen in children between 6 months to 5 years of age. Most common age group remain between 6 months to 2 years. Most common precipitating cause for fever in febrile seizures are Upper respiratory tract infection, Acute gastroenteritis, and Urinary tract infections. 15% cases were positive for blood culture, common bacteria being *streptococcus pneumoniae* and *staphylococcus aureus* while 7% were positive for urine culture, *E.coli* being common pathogen. Even though viruses form major precipitating agents for febrile convulsions, bacterial infection should be ruled out in all children presenting with febrile seizures.

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