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Research Article

Risk Factors for Simple Febrile Convulsions: A Case Control Study

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ABSTRACT

Simple febrile convulsion is most common disease of nervous system in children with known and unknown risk factors for their occurrence.

Methodology: In this case control study, conducted at a tertiary care hospital, risk factors for simple febrile convulsions were assessed in the age group of 6-60 months. Children satisfying the selection criteria were divided into cases (with simple febrile convulsions) and controls (fever without convulsion) by their cause of hospitalization. Results were interpreted using chi-square test and descriptive statistics.

Results: In our study we found that, younger age, thrombocytopenia, short duration of fever, family history of febrile seizures, caesarean section as a mode of delivery were significant risk factors in our study.

Conclusion: Counseling of parents regarding control of underlying fever may reduce the occurrence of simple febrile convulsions.

Keywords: Simple febrile seizures; Risk factors; Age; Pre-counselling knowledge

INTRODUCTION

Febrile seizures are one of the most common disorders of childhood with a prevalence of 2% to 5% of all children. Simple febrile seizures are defined as generalized seizures that occur between 6 to 60 months of age with a temperature of 38 degrees or higher which are not due to the result of central nervous system infection or any metabolic imbalance and which are brief, lasting for less than 15 minutes and occur once within 24 hour period in the absence of history of prior afebrile seizures [1]. The cause of simple febrile convulsions remains largely unknown, however many genetic and environmental factors may play an important role in their occurrence. Febrile seizures occur more frequently in boys than in girls and are strongly age dependent. Maternal complications during pregnancy have adverse fetal outcome and may be associated with increased risk of febrile seizures, like maternal smoking.

However in some studies it has been shown that birth order, mode of delivery, perinatal asphyxia are not related with increased risk of febrile convulsions [2].Similarly the risk of febrile seizure is associated with many other risk factors like family history, iron deficiency anemia. Children with simple febrile seizures have a high rate of recurrence, which varies with age. Febrile convulsions have a benign course and the risk of developing epilepsy later in life is slight, 2.4%[3].The neurodevelopmental outcome of the child is unhampered. Hence, it is essential to allay the anxiety of parents regarding febrile convulsions and to clarify the distinction between a child having febrile convulsion and a child having epilepsy. Hence counseling forms an integral part of any treatment protocol. The present study aims to assess the risk factors leading to simple febrile convulsions in children and to evaluate the clinical and laboratory profile among children with febrile seizures in comparison with children having fever but without seizures and also to assess the pre-counselling knowledge of the parents regarding febrile seizures.

METHODOLOGY

This prospective, qualitative case control study was carried out in a tertiary care hospital in pune from Jan 2013 till Dec 2014.Institutional Ethics Committee clearance was obtained before commencement of data collection. Written informed consent was obtained from all the parents at the time of recruitment in the study after explanation of the nature and purpose of the study.60 children with clinical diagnosis of simple

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febrile seizure were considered as study group while 60 others were selected as control group from the in-patient units.

Inclusion criteria were

Cases A. Children in the age group of 6months to 60 months (5 yrs) presenting with generalized tonic-clinic seizure of duration not exceeding 15 minutes along with fever, with no recurrence of the seizure within 24 hours. B. No clinical evidence of underlying cause for seizure e.g. Intracranial infection, metabolic disorder, congenital anomalies and without any post-ictal neurological deficit and absence of prior history of afebrile seizure. Control group: A. A child in the age group 6-60 months having fever without an attack of convulsions.

Case B. No clinical evidence of intra-cranial infection/ metabolic disorder/congenital CNS abnormality. Children with intra cranial infection/known neurologic/metabolic disorder/congenital anomalies of CNS, age less than 6 months and more than 60 months, presenting with seizures without fever, chronic seizure disorder/epilepsy presenting with seizures during fever, complex febrile seizures were excluded from the study.

Oral temperature was recorded with clinical thermometer with all aseptic precautions during the course of hospitalization. The temperature closest to the time of seizure was that recorded either closest to the time of seizure at home or at the emergency department. Smoking during pregnancy was defined as either no smoking [never smoked at all or quit smoking before pregnancy] or smoking [continued smoking during pregnancy] or passive smoking [daily exposure to smoke either in work place or at home during pregnancy]. Detailed history and clinical examination of the participating child was done to assess the parameters. Any associated infection was evaluated through relevant laboratory tests. Ante natal records and previous medical records of the child related to birth history, type of delivery, any previous admissions, if available, were evaluated.

Personalized counselling of every parent of the participating child was done and information regarding simple febrile convulsions and simple techniques to control fever and convulsions were taught to every parent. A specially designed pro-forma was used to document background demographic information of the patients along with Illness and treatment information centred around pyrexia and seizures. For the purpose of conducting an exploratory interview a semi-structured interview format using appropriate probes was designed. Stratified analysis of the study and the control group data has been presented in results. Frequency distribution analysis of the categories along with relevant comparative analysis was carried out using standard statistical SPSS software.

RESULTS

We found that proportion of younger boys (6months to 3yrs) is higher in the study group at 97.1% in comparison to the control group at 62.5% ($p<0.001$). In terms of gender, there was no statistically significant difference between the two groups in the proportion of boys and girls. Higher percentage of pre-term births were reported in the study group (13.3%) compared to the control group (10%),but the difference was not statistically significant. Considering birth weight as a risk factor, the proportion of VLBW and LBW children put together was definitely higher in the study group (33%) than the controls (25%),but this did not reach the level of statistical significance laboratory profile (Tables 1-5).

Table 1: Hemoglobin.

Age	Study group	Control group	Total
6-23 months < 10.5 gm/dl	16(50%)	16(53.3%)	32(51.6%)
6-23 months ≥ 10.5 gm/dl	16(50%)	14(46.7%)	30(48.4%)
Total	32 (100%)	30 (100%)	62 (100%)
≥ 24 months <11.5	17(60.7%)	19(63.3%)	36(62.1%)
≥ 24 months ≥ 11.5	11(39.3%)	11(36.7%)	22(37.9%)
Total	28 (100%)	30 (100%)	58(100%)
p = 0.793& 0.837 Not significant			

Table 2: MCV.

Age	Study	Controls	Total
6-23 months <72fL	13(40.6%)	15(50%)	28(45.2%)
6-23 months ≥ 72fL	19(59.4%)	15(50%)	34(54.8%)
Total	32(100%)	30(100%)	62(100%)
≥ 24 months <76fL	13(46.4%)	18(60%)	31(53.4%)
≥ 24 months ≥ 76fL	15(53.6%)	12(40.0%)	27(46.6%)
Total	28(100%)	30(100%)	58(100%)
p=0.459& 0.300 Not significant			

Table 3: Peripheral blood smear.

Microcytic, hypochromic RBCs	Study group	Control group	Total
No	28 (47.7%)	27 (45.0%)	55 (45.8%)
Yes	32 (53.3%)	33 (55.0%)	65 (54, 2%)

Total	60 (100%)	60 (100%)	120 100%)
Pvalue=0.5			

Table 4: Platelet count.

Platelet count	Study group	Control group	Total
Thrombocytopenia	2 (3.3%)	12 (20.0%)	14 (11.7%)
Thrombocytosis	2 (3.3%)	2 (3.3%)	4 (3.3%)
Normal range	56 (93.3%)	46 (76.7%)	102 (85.0%)
Total	60 (100%)	60 (100%)	120 (100%)
x^2=8.123, dF=2 p value=0.017			

Table 5: Total leucocyte count.

TLC	Study group	Control group	Total
Leucopenia	3 (5.0%)	5 (8.3%)	8 (6.7%)
Leucocytosis	16 (26.7%)	27 (45.0%)	43 (35.8%)
Normal range	41 (68.3%)	28 (46.7%)	69 (57.5%)
Total	60 (100%)	60 (100%)	120 (100%)
x2= 5.763, df=2, p value =0.056			

Hemoglobin, MCV, PBS, total leucocyte count and platelet count distribution in both study and control groups has been shown in the (Tables 1-4).

Two out of three children in the study group had upper or lower respiratory infection (66.7%). Gastrointestinal infection was documented in 8.3%.No source of infection could be identified clinically in 23.3% in the study group. Even in the control group of medically ill children other than febrile convulsions, respiratory infections topped the list of frequency(58.3%), followed by gastrointestinal infection in 13.3%. Dengue was diagnosed in 10% and no source could be found in 3.3%. The other lesser percentage of infections included, urinary tract infection (3.33%), cellulitis (3.33%), eye infection (1.7%), ear (3.33%), measles (1.7%) and viral arthritis (1.7%). Profile of Pyrexia: (Tables 6-8).

Table 6: Duration of fever.

Duration of Fever	Study group	Control group	Total
≤ 24 hrs	37 (61.7%)	5 (8.3%)	42 (35.0%)
25-72 hrs	17 (28.3%)	30 (50.0%)	47 (39.2%)
>72 hrs	6 (10.0%)	25 (41.7%)	31 (25.8%)
Total	60 (100%)	60 (100%)	120 (100%)
x^2=39.622,df=2, p value =.000			

Table 7: Severity of fever

Severity of fever	Study group	Control group	Total
≤380c	22 (36.7%)	16 (26.7%)	38 (31.7%)
>380c	38 (63.3%)	44 (73.3%)	82 (68.3%)
Total	60 (100%)	60 (100%)	120 (100%)
Pvalue=0.163			

Table 8: Interval between fever spike and convulsion.

Interval	Male	Female	Total
<30 mins	19 (55.9%)	12 (46.2%)	31(51.7%)
=>30-60 mins	9 (26.5%)	10 (38.5%)	19 (31.7%)
>1-5 hrs	4 (11.8%)	4 (15.4%)	8 (13.3%)
>5 hrs	2 (5.9%)	0(0%)	2 (3.3%)
Total	34 (56.7%)	26 (43.3%)	60 (100%)

61.7% children with febrile seizure in the study group reported for hospitalization within 24 hrs of total duration of fever. Only 10% children had fever for more than 3 days before coming to the hospital. (Table 10) In the absence of an alarming symptom like seizure, 91.7% of children with pyrexia and other medical illnesses as documented in the control group were brought to the hospital following fever that lasted for more than 24 hours. The mean duration of fever in the control group was 2.5 times more than that of the study group. (Mean duration of fever for study and control group being 42.63 and 103.6 hours respectively) (Table10) ($p<0.05$). About 2 in 3 children in the study group were recorded to have fever more than 380Celsius (63.3%). More number of children in the non-seizure group (73.3%) had similar degree of fever. There was no significant difference in the severity of fever and occurrence of seizure. More than half the children (51.7%) had developed convulsion within less than 30 mins since the peak of fever spike. Overall, four out of five (83.33%) children had a convulsion within an hour of the spike of fever. Overall, 91.7% of the children in the study group had received some treatment before reaching the hospital like antipyretics and some non-pharmacological treatment such as tepid sponging. 8.3% children were untreated. 95% of the children in the control group on the other hand had received some treatment and only 5% were untreated. Maternal profile of risk factors [Tables 9-12].

Table 9: Smoking as a risk factor.

Smoking	Cases	Controls	Total
Active	0	1(1.7%)	1(0.8%)
No smoking	48(80%)	49(81.7%)	97(80.8%)
Passive	12(20%)	10(16.7%)	22(18.3%)
Total	**60**	**60**	**120**
P value-0.551			

Table 10: PIH as a risk factor.

PIH	Cases	Controls	Total

Yes	4(6.7%)	6(10%)	10(8.3%)
No	56(93.3%)	54(90%)	110(91.7%)
Total	**60**	**60**	**120**
Pvalue-0.372			

Table 11: Type of delivery

Type of delivery	Study group	Control group	Total
Caesarean	11 (18.3%)	9 (15.0%)	20 (16.7%)
vaginal	49 (81.7%)	51 (85.0%)	100 (83.3%)
Total	60 (100%)	60 (100%)	120 (100%)

Table 12: Genetic disposition for febrile seizure

Genetic disposition	Study group	Control group	Total
Febrile seizure in 10 relatives	8 (13.3%)	2 (3.3%)	10 (8.3%)
Febile seizure in 20relatives	7 (11.7%)	0 (0%)	7 (5.8%)
No febrile seizures in relatives	45 (75.0%)	58 (96.7%)	103 (85.8%)
Total	60 (100%)	60 (100%)	120 (100%)
Note: **x^2= 12.241, df=2, p value=0.002**			

DISCUSSION

It is generally believed that febrile seizure is an age-dependent response of the immature brain to fever. This postulation is supported by the fact that most (80-85%) febrile seizures occur between 6 months and 3 years of age, with the peak incidence at 18 months. Found that febrile seizures most commonly occur within first 2 years of life [4]. In the present study, it has been observed that overall younger children who are in the age group of 6 months to 3 years in the study group (88.3%) have outnumbered those in control group (68.4%) ($p<0.05$).The mean age in our study is 23 months which was quite similar to findings of miller. Simple febrile convulsions occur more frequently in males, with a male to female ratio ranging from 1.1:1 to 4:1 [5].

Among the peri-natal risk factors, low birth weight and very low birth weight was documented in about one in 3 children in the febrile seizure group compared to one in four in the control group. The mean birth weight for the seizure group was 2.47 kg compared to 2.6 kg in the controls. Low birth weight is an indicator of adverse foetal environment and hence can associate with increased risk of febrile convulsions. We found that Caesarean section to be a significant risk factor for simple febrile seizures. In some studies it has been shown that mode of delivery is not related with increased risk of febrile convulsions [6]. We did not find any association between birth weights, prematurity, maternal smoking and simple febrile seizures, contrary to the findings among the most researched risk factors with laboratory evidence is iron deficiency anaemia. In our study, Iron deficiency anaemia was slightly more in children without febrile seizures, but without statistical significance. Higher proportion of girls (61%) had low haemoglobin levels compared to boys in the study group indicating compromised nutritional status of female children in our country. In this study, only routine baseline haematological investigations available in the hospital were done. Ferritin levels were not done as a result. Most studies in the literature have studied a complete laboratory evidence of Iron deficiency anaemia including ferritin levels.

A study has shown that iron deficiency is a significant risk factor for simple febrile seizure. However produced contradictory results in his study in March 2005.

Among the other parameters that may be confounding factors, documentation of systemic infections brought out significant percentages of controls with a variety of sources of infections that included viral as well as bacterial infections. In keeping with this, the control group showed higher proportion of leukocytosis and leucopenia compared to the seizure group. There was also a significant observable thrombocytopenia that corresponded with dengue infection in about 10% of control group.

80% of febrile seizures occur during the first day of fever even before the parent is aware of fever. Convulsions occur during the first few hours of febrile illness [7]. There have been debates regarding the most important factor in causing convulsions, whether it is the severity of fever or rapid increase in temperature.

In the present study, about one in three children in the study group had mild (<380C) pyrexia. It appears that the threshold of neuronal excitability may be low in these cases. Other than the severity of fever, duration of fever is an equally important parameter. 61.7% children in the febrile seizure group were brought to the hospital within 24 hrs of total duration of fever. In the absence of an alarming symptom of seizure, the control group children were brought to the hospital after about 2.5 times longer than mean duration of fever.($p<0.05$)

The most striking finding has been the interval between spike of fever and convulsion. More than half the children (51.7%) had developed convulsion within less than 30 mins since the peak of fever. Overall, four out of five (83.3%) children had a convulsion within an hour of the spike of fever.

Among the various sources of infections in the population suffering from febrile convulsions, respiratory infections followed by gastrointestinal are the most prevalent categories. In the present study similar findings have been recorded. Two thirds of the febrile seizure group had respiratory infections and 8.3 % had gastro-intestinal infections. Noticed 86% children with URTI and 8% children with acute gastroenteritis [8].

In the present study, in our cultural context, smoking and maternal alcoholism is less prevalent; hence there might have been no significant correlation between smoking and occurrence of febrile convulsions. However exposure to passive smoking was observed in 20% of the study population in this study.

Genetic disposition is among the other significant risk factors. In the present study, about 25% of the study group children had genetic vulnerability for febrile seizure by way of presence of febrile seizure illness in first and second degree relatives compared to 13% in the controls ($p<0.05$). The genes associated with febrile convulsions can be transmitted through both parents. The affection of first degree relatives is important in assessment of the recurrent risk for febrile convulsions as compared to second and third degree family members [9-19].

In spite of various studies looking at individual risk factors implicated in febrile convulsions, it is now being recognized that none of the risk factors alone identify children at high risk or low risk of recurrent seizures. The risk is better predicted by a combination of risk factors which act in a cumulative way and can identify groups of various risk categories. Towards this end, it is important to analyse the association of various risk factors and the extent to which the variance in the findings can be attributed to their inter-relationship.

The results of this qualitative analysis have thrown mixed findings. One hundred percent parents expressed fears and apprehensions and 80% feared that the condition is life threatening. The remainder of the cohort expressed fears based on hearsay and culturally shared notions.

CONCLUSION

Younger age, short duration of fever, family history of febrile seizures are significant risk factors in occurrence of febrile seizures. Most of the seizures occur within 1 hour of peak of fever episode hence interventions in controlling fever as soon as fever spike occurs may reduce occurrence of convulsions, however further studies are required to study the impact of corrective measures.

Existing level of medical literacy revealed information that has lessons for the treating doctors. There was a high level of ignorance about the course and outcome as well as treatment options among the parents. The present study is unique in this aspect in having documented the parent's perceptions and anticipations. This data calls for attention of pediatricians to corrective steps and possibility of development of protocols for sensitization and education of parents which in turn may have mitigating effect on the negative consequences.

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