e-ISSN: 0975-5160, p-ISSN: 2820-2651

Available online on www.ijtpr.com

International Journal of Toxicological and Pharmacological Research 2023; 13 (4); 214-220

Original Research Article

A Hospital-Based Observational Study to Evaluate the Relationship between Febrile Convulsions and Iron Deficiency Anemia

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Received: 19-01-2023 / Revised: 20-02-2023 / Accepted: 30-03-2023

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Conflict of interest: Nil

Abstract

Background: 2-5% of newborns and kids with normal neurological development have febrile seizures. After a single incidence, febrile seizures recur 30% of the time, twice as often after two or more episodes, and even more often in infants. In India, the frequency of febrile convulsions is 10–17%, which is greater than the incidence in affluent nations (2 to 7%).

Aims and Objectives: This research sought to determine if iron deficiency (ID) was a risk element for febrile convulsions and whether ID anemia was related to febrile seizures.

Materials and Methods: In a tertiary care facility in northeastern India, this observational case-control research was carried out and patients with febrile illnesses were chosen as controls (Group C) from comparable age groups and all patients with febrile seizures had been selected as cases (Group S). Children in both groups had their body temperatures recorded. CBC, TIBC, and serum iron blood tests were carried out.

Results: The mean ages in groups S and C in the current research were 2.33 years & 2.204 years, respectively. In group S, the mean haemoglobin levels were 8.25±1.0 g/dL, but in group C, they were 9.86±1.49 g/dL, which was significant statistically (p=0.003). Group S had considerably lower serum ferritin levels than the other group. MCV, MCH, and MCHC averages for group S were significantly lower than those for the control group. The current research additionally suggests a connection between febrile seizures and ID.

Conclusion: The current study demonstrated that haemoglobin, serum iron levels, serum ferritin, and MCV were substantially reduced in children with febrile convulsions, indicating that a low iron value plays a significant impact in febrile seizure children. Therefore, ID is indicative of febrile convulsions.

Keywords: TIBC; Iron deficiency anemia; MCV; Febrile seizure; Serum ferritin.

Introduction

To be considered febrile seizures, a child must be between the ages of 6 months and 5 years old, have a fever of 38°C (100.4°F) or higher, not have a CNS infection, metabolic disorders or history of afebrile seizures, and be experiencing a febrile illness. [1] An estimated 10-17% of children in India suffer from febrile

seizures each year, far higher than the global average of 2%-7%. [2]

Iron deficiency (ID) is still the most common micronutrient deficiency, affecting more than 20% of pregnant women as well as 23% of children bellow 5 years of age. This is despite a worldwide campaign by the WHO to increase understanding of and an aptitude in iron supplementation. Because receiving iron supplements subsequently in life cannot reverse the learning disabilities, behavioural issues, and mental illnesses linked to the early life ID, its impact on growing children is extremely damaging. [3,4]

ID may change a child's seizure threshold since it slows down the metabolism of specific neurotransmitters, including enzyme monoamine oxidase. [5,6] Additionally, ID anaemia causes a reduction in the production of cytochrome C oxidase, a measure of brain metabolic activity.[7] Given the prevalence of ID and febrile seizures in young children, it was hypothesised that there could be some connection among these two clinical disorders. A large number of the researches determined that ID is prevalent among febrile seizure individuals, [8,9] a few research studies found that the level of iron has no impact in febrile seizures, [10] and a handful of studies found that ID raises the seizure threshold, thereby protecting children from seizures. These studies sought to determine some correlation between them. [11]

So it's plausible that ID anemia might put people at a higher risk for febrile seizures as well as other neurological problems like irritability and poor memory. Between 2% and 4% of babies get febrile seizures; recurrence rates are around 50% in infants younger than 1 year old and 28% in infants older than 1 year old. [12] Children aged 14–18 months had the highest documented incidence of febrile seizures, which coincides with the age range (6–24 months) in which ID anaemia is most prevalent. [13,14] We designed this study to investigate the role of ID as an indication of risk for febrile seizures among children in light of the high frequency of ID in children under the age of five in our nation and contradicting findings from prior studies.

Aims and Objectives

This study sought to determine whether anemia caused by iron deficiency posed a risk for febrile convulsions and whether there was a connection between the two. Therefore, the results of the current study may contribute to a decrease in or prevent the febrile seizures in the general population.

Materials and Methods

The 60 children (6 months to 5 years old) who presented to the pediatric ER of a tertiary care facility in northeastern India with the initial occurrence of febrile seizure were the participants of this hospital-based observational case-control research. The Ethical Committee approved the study, and the parents gave their full, written consent after receiving information about it.

Inclusion criteria: Twelve patients who had febrile seizures within the ages of 6 months to 5 years who had a past history of high-grade fever, defined as a temperature over 100°F, were chosen as cases (Group S). In contrast, 48 individuals who had a history of fever but no prior history of seizures was chosen as research controls (Group C).

Exclusion criteria: The research excluded individuals with a history of seizures and suspected CNS infections as well as those who had had DPT vaccinations within 48 hours. In every instance, parents were prompted to sign the permission form after being informed of the study's objectives and voluntary nature. Parents were invited to complete an interview questionnaire about their children that included details such as the children's age, gender, and family history of seizures, occupation, and socioeconomic position. Children in both groups had their body temperatures taken and recorded. CBC, serum iron, and TIBC blood tests were carried out.

Statistical Analysis

Before entering the data into an Excel spreadsheet, it was first coded. The analysis was performed in SPSS for Windows, version 20 (IBM SPSS Statistics Inc., Chicago, Illinois, USA). Statistics such as the Chi-square test and more basic descriptive statistics like percentage, frequency, standard deviation, and mean were employed to examine the data. The analysis of variance test and the student t-test were employed to compare quantitative factors. A P value of <0.05 was **considered statistically significant.**

Results

48 children made up the control group (Group C) and 12 children with febrile seizure made up the case group (Group S) in this study. [Table 1]

Table 1: Comparison of demographic and clinical features between groups

Personal information		Group S (Mean±SD)	Group C (Mean±SD)	p-value
Age (years)*		2.331±1.531	2.201±1.061	0.731 **(NS)**
Gender	Male	04	30	0.061 **(NS)**
	Female	08	18	
PICA	Yes	07	20	0.161 **(NS)**
	No	08	28	
Pallor	Yes	12	06	0.011 **(S)**
	No	0	42	
Peripheral smear	Hypochromic Microcytic	08	21	0.151 **(NS)**
	Normochromic Normocytic	04	27	

*Mean±SD, NS- Not Significant, S- Significant

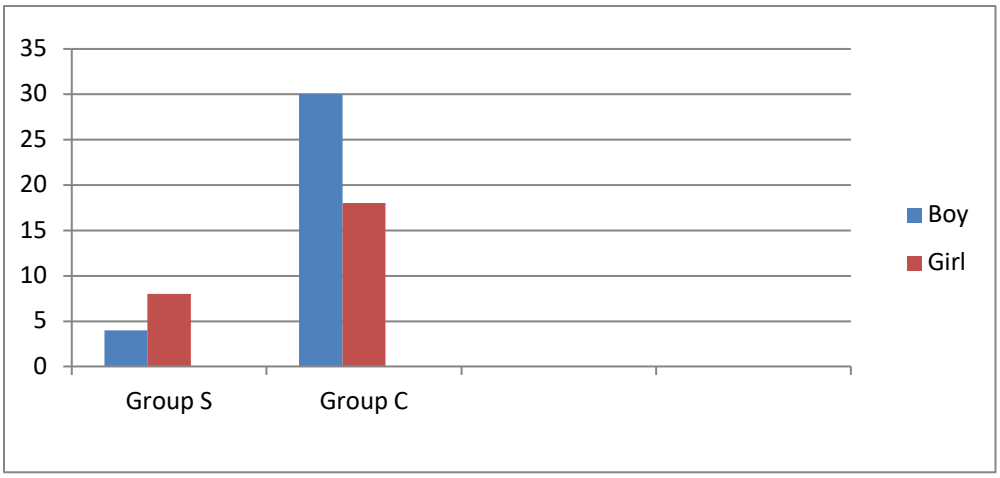
We found no statistically significant difference in the frequency of instances between the two groups for TIBC (P=0.221), however there was a statistical difference in the mean value of Hb, ferritin levels in the blood, and serum transferrin (P<0.05). [Table 2]

Table 2: Different indicators of Iron Deficiency anemia in children under study

Iron deficiency anemia	Group S (Mean±SD)	Group C (Mean±SD)	p-value
Hb	8.249±1.152	9.859±1.489	0.003 **(S)**
S. Iron levels	100.401±26.059	120.292±44.472	0.011 **(S)**
TIBC	349.551±51.019	333.282±37.929	0.221**(NS)**
S. Transferrin	231.979±14.622	274.431±47.219	0.001 **(S)**
MCV	70.381±5.059	80.762±7.401	0.001 **(S)**
MCH	19.522±0.969	21.439±2.441	0.011 **(S)**
MCHC	32.901±1.272	33.201±1.189	0.441**(NS)**
S. Ferritin	100.229±35.441	154.831±51.279	0.001 **(S)**

NS- Not Significant, S- Significant

According to the current study, in both groups incidences of febrile seizures were greater in females (66.7%) than in males children (33.3%). [Graph 1]



Graph 1: Comparison of febrile seizure between case and control group

Discussion

The current study indicated that the peak incidence of febrile seizures occurred between the ages of one and three (66.7%), with a mean age of 2.33 years. Previous studies have found the same thing. The Nelson paediatrics textbook states that the most common presenting age is between 14 and 18 months. [15] Aicardi's criteria for febrile convulsions in epilepsy indicate that the peak age for FS occurrence is between 14 and 18 months. [16] According to Berg *et al*.'s [17] study, peak prevalence is shown between 18 and 24 months of age.

The current study demonstrates that when the male to female ratio is 2:1, somewhat more girls (66.7% on average) experience febrile convulsions than boys (33.3% on average). The number of males to girls has ranged from 1.11 to 2.05 in a number of studies. [16-21] In contrast to previous large-scale investigations by Verity *et al* [21] in 1985, we found no variations by gender in the occurrence of febrile seizures in our study population.

Four (33.3%) and eight (66.7%) patients in the current investigation showed normocytic normochromic and hypochromic microcytic peripheral smears, respectively. In the research by Nigade and Khambalkar, 56 individuals had normocytic normochromic peripheral smears, while 114 patients had hypochromic microcytic smears. [19]

While previous research by Daoud *et al* [20] in Jordan found mean ferritin levels of 29.5 ng/ml and by Derakhshanfar *et al* [23] in Iran noticed greater concentrations in individuals with FS in comparison with controls, the mean serum ferritin concentration for group S in the present study was 100.23, a value that was significantly lower than group C (154.83).

However, it was determined by Bidabadi and Mashouf 22 and Yousefichaijan *et al* [11] that the case group's mean serum ferritin value was greater than that of the control group. It is possibly because ID anaemia is more common in our nation and Indian children have lower mean serum ferritin levels than children in Western countries. This conclusion is in line with research by Vaswani *et al* 8, Pisacane *et al* [24], and Hartfield *et al* [25] among others.

Children with febrile convulsions were more likely to have low haemoglobin, mean corpuscular volume, and serum ferritin levels, according to our study, which found a statistically significant disparity between the two groups. Serum ferritin concentrations were found to be low in a sizable percentage of infants with febrile convulsions, according to research by Daoud *et al*.[20]

According to the findings of Shaikh *et al* [26], Kamalammal and Balaji, [27] the case group's mean MCV, MCH, and MCHC were lower than those of the control group.

Fallah *et al* [28] from Iran found that the case group's mean HB was significantly lower (11.46±1.18 gm/dL) than the control group's (11.9±0.89 g/dL).

According to the findings of the present investigation, the mean serum ferritin levels for group S were 100.229±35.441 g/dl and those for group C were 154.831±51.279 g/dl. This suggests that serum ferritin levels were significantly reduced in the case group compared to the control group. As a consequence, the link between ID and febrile convulsions was highlighted. These findings concurred with those of Daoud *et al* [20], Rehman *et al* [29], and Pisacane *et al* [24]. The current study indicates that ID is one of probable risk factors for febrile convulsions. The neurological consequences of ID may be restricted to breath-holding spells, febrile convulsions, developmental problems, the risk of paediatric stroke, and breath-holding episodes. Comparable to a study conducted by Voorhess ML *et al* [30], the current investigation yields comparable results.

Limitations of the study: The study only involved a single geographic area, and its sample size was limited.

Conclusion

The results of the current study demonstrate that children with febrile seizures have poor iron status, as seen by the considerably decreased haemoglobin, MCV, ferritin level in the blood, and serum iron levels in these children. Thus, ID is a predictor of febrile convulsions. As a result, assessing serum ferritin is the most accurate way to determine the overall amount of iron stored in the body as well as a precise, sensitive, and reliable test for identifying iron deficiency in the initial phases of the disease itself. Therefore, it is advised that children who experience their first febrile convulsion themselves get a comprehensive blood count as well as ID screening using serum iron tests. To find out the frequency of future febrile seizures following the therapy for ID, a follow-up research of patients found to be iron deficient at the precise moment of a first febrile seizure would be extremely intriguing.

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