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Original Research Article

Study the Role of Iron Deficiency Anaemia in Febrile Seizures at SKMCH, Muzaffarpur, Bihar

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Abstract

Background: According to the World Health Organization, between 500 million and 2 billion individuals worldwide are iron deficient. Iron deficiency is the most common haematological condition in children between the ages of 6 months and 5 years. This age range typically corresponds to the period of time when febrile seizures are most common. This study sought to ascertain the impact of iron deficient anaemia on febrile seizures.

Methods: In Department of Pediatrics at Sri Krishna Medical College and Hospital, Muzaffarpur, Bihar, carried out this cross-sectional observational study. 85 children between the ages of 6 months and 5 years who presented with simple and complex febrile seizures to the hospital emergency and pediatrics ward were included during the 12-month study period from November 2021 to October 2022.

Results: The median age in this study for the onset of febrile seizures is 21 months. The frequency of febrile seizures and the severity of anaemia are unrelated. Iron deficiency is indicated by low HB, low MCH, low MCV, high RDW, low serum iron, high TIBC, and low serum iron to TIBC ratio, among other parameters.

Conclusion: The current hospital-based observational analysis led us to the conclusion that children who experienced febrile seizures were more likely to develop iron deficiency anaemia. The results suggest that infants experiencing febrile seizures should undergo screening for iron deficiency anaemia (IDA). All of the tests used to evaluate iron deficiency anaemia (Sr Iron, TIBC) produced significantly lower results. This demonstrates that febrile seizures are more common in kids with low iron levels.

Keywords: Febrile Convulsions, Iron Deficiency Anemia.

Introduction

The leading cause of anaemia, which affects 500 million to 2 billion people worldwide, is iron deficiency anaemia, according to the World Health Organization [1]. Iron deficiency anaemia is the most common nutritional deficit and childhood hemological condition in developing countries, typically affecting children between the ages of 6 and 24 months. Iron deficiency affects over 50% of all anaemic infants and toddlers under the

age of 60 months. Several enzymes involved in neuro-chemical processes, such as the formation of myelin, the metabolism of brain energy, the production of some neurotransmitters, and the metabolism of some enzymes like mono-aminoxidase and aldehidoxidase, all require iron as a nutrient. Iron is also essential for the synthesis of haemoglobin.

Cytochrome C oxidase expression, a sign of brain metabolic activity, is lowered by iron deprivation. As a result, an infant or child's seizure threshold may shift as a result of iron deficiency anaemia. Neurological symptoms like inattentiveness, impaired memory, delayed motor development, and behavioural disruption are all known to be brought on by iron deficiency anaemia [2]. Studies show that warmth affects the effects of iron deficiency on the brain, increasing the possibility of febrile seizures in children with the disease, as well as their kind, duration, and recurrence risk [3].

So it's probable that in addition to febrile seizures, iron deficiency anaemia may also increase the risk of other neurological disorders including irritability, poor memory, etc. The observed prevalence of febrile seizures is between 2 and 4% in babies, and the recurrence rate is almost 50% in infants under 1 year old and 28% in those over 1 year old [4]. The majority of febrile seizure occurrences are reported to occur in children between the ages of 14 and 18 months, which is also the age range in which iron deficiency anaemia is most common (6 months to 24 months) [5].

"Seizures that occur between the age of 6 and 60 months with a temperature of 38 degree centigrade or higher, that are not the result of central nervous system infection or any metabolic imbalance, and that occur in the absence of a history of prior afebrile seizures," is how febrile seizures are defined [6]. The prognosis for febrile seizures is excellent. Epilepsy is fewer than 1% likely to occur. Because of aspiration and hypoxia brought on by extended episodes, there is an elevated risk of morbidity and fatality in febrile seizures [7].

Numerous studies have been conducted to better understand the relationship between febrile seizures and iron deficient anaemia. In order to get a firm conclusion regarding this matter, more research is required. Despite the fact that a number of research have found positive outcomes, many others have found no link between iron deficiency anaemia and febrile seizures.

This study objectives were to identify the severity of the association between febrile seizures and iron deficiency anaemia, the most common age at which febrile seizures occur, and the relationship's prevalence.

Material and Methods

85 children between the ages of 6 months and 5 years who presented with simple and complex febrile seizures to the emergency and pediatrics ward of Sri Krishna Medical College and Hospital, Muzaffarpur, Bihar, over the course of a 12-month period between November 2021 and October 2022 were the subjects of a hospital-based cross-sectional observational study. The percentage of febrile seizures that were iron-deficient was used to calculate the sample size.

When febrile seizures occur in children between the ages of 6 months and 5 years, they are taken to SKMCH where, depending on the severity of the condition, they may either get OPD or IPD treatment. To assist the patient feel better, immediate care was provided. The following phase involved asking parents for their children's permission to participate in the study.

Venous blood was extracted and transferred to the pathology department for examination after a thorough history was given, a physical examination was completed, and informed

consent had been obtained. Hemoglobin estimation (Hb), RBC count, peripheral smear, MCV, MCH, MCHC, Red cell distribution width (RDW), Senior iron, Total iron binding capacity (TIBC), and Senior Iron:TIBC ratio were the tests used to evaluate whether a person had an iron shortage.

The results of the investigation applied to the patient. Anaemia is characterised by haemoglobin levels that are lower than 11 g/dl. Microcytosis is the term used to describe MCV levels that are below the age-corrected normal ranges for erythrocytic volumes (MCV of 70 fl/mcl in children under 2 years, 73 fl/mcl in children between 2 and 4 years, and 75 fl/mcl in children between 5 and 7 years).

Children between the ages of 6 months and 5 years who present with febrile seizures associated with fever and who are neurologically healthy both before and after the seizure episode were included in this study. Whose age range was between 6 months and 5 years, as well as those with afebrile seizures, known cases of epilepsy, any indications of a CNS infection, any neurodevelopmental issues (such as cerebral palsy, premature birth, hemiplegia, or neurodegenerative disorders), previously identified cases of other hematologic issues (such as Thalassemia, sickle cell anaemia, or haemophilia), bleeding or coagulation disorders, haematological mal ignancy and who are on iron supplementation were excluded.

Results

Table 1 shows that sex distribution of the children. Male patient participation in the study is higher than female patient participation, which is just 28.2%, at 71.8%.

Table 1: Sex Distribution of children

Sex	No. of cases	Percentage
Female	24	28.2%
Male	61	71.8%
Total	85	100.0%

Table 2 shows that more children between the ages of 6 and 12 months (32.9%) were chosen for the study than between the other age groups of 13 to 18 months, 19 to 24 months, 25 to 30 months, and 30 to 60 months (8.2%, 20%, 12.9%, and 24.7%, respectively). The children that took part in the study are, on average, 21 months old.

Table 2: Age in months Distribution of children

Age in months	No. of cases	Percentage
6-12	28	32.9%
13-18	07	8.2%
19-24	17	20.0%
25-30	11	12.9%
30-60	22	24.7%
Total	85	100.0%

Mean±SD: 21.73±9.91

Table 3 demonstrates that 51.8% of patients had body temperatures below 100^0F, which is higher than the 18.8% of patients with body temperatures between 100 and 101^0 F and the 29.4% of patients with body temperatures over 101^0 F.

Table 3: Fever Distribution of children

Fever	No. of cases	Percentage
$<100^0$F	44	51.8%
$100\text{-}101^0$F	16	18.8%
$>101^0$F	25	29.4%
Total	85	100.0%

Mean±SD: 99.97±1.12

Table 4: Hemoglobin Distribution of children

Hemoglobin (g/dl)	No. of cases	Percentage
6-7	3	3.5%
7-8	3	3.5%
8-9	11	12.9%
9-10	21	24.7%
10-11	22	25.9%
>11	25	29.4%
Total	85	100.0%

Table 5: MCV/MCH and MCHC Distribution of children

	No. of cases	Percentage
MCV		
• <70	30	35.3%
• 70-80	53	62.3%
• >80	2	2.4%
MCH		
• <25	36	42.4%
• 25-30	47	55.3%
• >30	2	2.4%
MCHC		
• <30	21	24.7%
• 30-35	63	74.1%
• >35	1	1.2

Mean MCV is 71.98fl, Mean MCH is 24.6, Mean MCHC is 30.74, p value <0.001.

The distribution of children's haemoglobin is shown in Table 4. It demonstrates that <11 is regarded as anaemic, consisting of 70.6% of which 6-7gm%, 7-8gm%, 8-9gm%, 9-10gm%, and 10-11gm% include, respectively, 3.5, 3.5, 12.9, 24.7, and 25.9.

Patients with MCV <80fl made up 97.6% of all patients; those with MCV <70fl made up 35.3%; those with MCV between 70 and 80fl made up 62.3%; and those with MCV >80fl made up only 2.4.

The mean MCV was 71.98 fl, the MCH value among patients in the thesis was 42.4%, between <25 and 30 was 55.3%, and greater than 30 was 2.4%.

The mean MCH was 24.6; the mean MCHC was 30.74; the percentage of patients with MCHC values between <30 and >35 was 74.1%, 24.7%, and 1.2%, respectively.

Table 6: Serum iron Distribution of children

Serum Iron	No. of cases	Percentage
<50	20	23.5%
50-90	53	62.4%
>90	12	14.1%

p value<0.001

Serum ferritin levels were below 90 in 85.9% of patients, with levels between 50 and 90 in 62.4% and below 50 in 23% of patients. Just 14.1% of patients have a score of >90 or above. The serum ferritin level's p value is significant for this inquiry.

Table 7: Febrile seizures and its association with or without iron deficiency

	No. of cases	Percentage
Febrile seizure with iron deficiency	73	85.88
Febrile seizure without iron deficiency	12	14.12
Total	85	100.0%

p value<0.001

Table 8: TIBC Distribution among children

Serum Iron	No. of cases	Percentage
Raised	54	64.4%
Normal	31	35.6%
Total	85	100.0%

Patients with elevated TIBC made up 54 patients in this study, or 64.4%, whereas those with normal TIBC made up 35.6%. P Value for the TIBC value in this investigation is significant.

Table 9: Serum iron/TIBC Distribution among children

Serum Iron/TIBC	No. of cases	Percentage
<10	21	24.7%
10-20	57	67.1%
>20	07	8.2%

p value<0.001

According to Table 9, the Serum Iron/TIBC <20 accounts for roughly 91.8% of the total, with <10 accounting for 24.7% and 10–20 accounting for 67.1%. This study p value is significant.

Table 10: Peripheral smear Distribution of children

Peripheral smear	No. of cases	Percentage
Normocytic norm chromic	28	32.9%
Hypochromic microcytic	57	67.1%
Total	85	100.0%

A peripheral smear with a hypochromic microcytic count was present in 57 patients in this study, or about 67% of the total, and 28 patients, or roughly 33%. A student t test (two

tailed, independent) was used to gauge the study's significance.

Discussion

In the current study, there was a 2.5:1 male to female ratio in the group of those who experienced febrile seizures. Since a very long time, numerous researches have been carried out, and they have consistently demonstrated that boys have a higher frequency of febrile seizures. The ratios of boys to girls have varied between research, from 1.1:1 (Nelson and Ellenberg) to 2:1; (Hauser; Forsgren *et al*) [8,9] Our current research, however, contradicts the findings of other significant studies conducted by Verity *et al*. in 1985, who found that there is no sex difference in the frequency of febrile seizures. Only the black populace favours men, according to an NCPP survey (Nelson and Ellenberg). It is not yet known, however, if there is a biological explanation for the gender differences in febrile seizures or whether boys are simply more vulnerable since they live outdoors more frequently [10].

The typical age for febrile seizures, as noted by Alfredo Piscane *et al*., was about 15 months. In the current investigation, the mean age of occurrence of febrile seizures was approximately 21 months [11]. According to three distinct studies by Vasvani RK *et al*, Waruiru C *et al*, and Azhar S Daoud *et al* [12-14]. frequent febrile seizures peak at roughly 18 months. Ellenberg *et al*. found that 23.3 months was the average seizure age. The second year of life is generally considered to be the most common age at which the febrile seizure and the first febrile seizure occur.

Numerous studies, including those by Wallace *et al*., Al- Eissa *et al*., and Farwell *et al*., have demonstrated that, in addition to the mean age of febrile seizures, young age is a risk factor for complicated febrile seizures [15-17]. Young age at onset has also been connected to recurrence of febrile seizures. Uhari *et al*., whose analysis was not done in this study [18].

The axillary temperature taken at check-in and recorded per procedure before an antipyretic was prescribed. In the current experiment, the body's initial temperature was close to 100^0F. Berg *et al*. claimed in the literature that when peak temperature increased, the likelihood of recurrence reduced; however, the current study did not support this claim. There are two possible explanations: the first anti-pyretic use, which was not known at the time of the investigation, and the measurement of admission temperature rather than height of temperature, which was not covered by the investigation.

In the current study, there were 58 patients out of 85 who had no prior history of febrile seizures, or approximately 68% of the total patient population. In contrast, Wallace *et al* study found that 34 patients out of 72, or approximately 47% of the total patient population, had a prior history of febrile seizures.

Family history is not significant in the current study because more patients come from non-consanguineous unions. Studies by Khalid N. *et al*. and Azhar S. Daoud *et al*. found that cases had a higher likelihood than controls of having a family history of febrile seizures and epilepsy. This distinction, nevertheless, was not statistically significant. While Lewis *et al*. (11%) found a low family history link, separate research by Farwell *et al*. (29%) showed a substantial family history link. According to Millichap *et al* [19] children in families with febrile seizures frequently have both febrile and afebrile seizures.

In the current study, 81 patients roughly 94% of the population had a normal developmental history. This is close to studies by Ellenberg JH, which found 82% of patients to have a normal developmental history.

Conclusion

The results of numerous studies on the connection between iron deficiency anaemia and febrile seizures are inconsistent. To ascertain whether there is a connection between the two, this investigation was conducted.

The current hospital-based observational study has led us to the conclusion that febrile seizures affect males more commonly than females. The typical onset age of febrile seizures is 21 months. Iron deficiency anaemia was more prevalent in kids who had febrile seizures.

According to the research, anaemia caused by iron deficiency may raise the risk of febrile seizures. IDA screening should be considered when a kid experiences a febrile seizure. To ascertain whether iron deficiency anaemia existed, every investigation (Sr. Iron, TIBC) produced considerably lower findings. This demonstrates that febrile seizures are more common in kids with low iron levels.

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