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Original Research Article

Iron Deficiency Anemia as Risk Factor for the First Episode of Febrile Seizure

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Abstract

Aim: This study was aimed at evaluating the association between iron deficiency anemia and febrile seizures.

Methods: The study conducted was a prospective hospital-based investigation, involving a sample of 50 patients who exhibited typical febrile convulsions within the age range of 1 to 5 years, as defined by the AAP clinical practice recommendations. A control group consisting of 50 children, matched in terms of age and sex, was chosen from a population of children admitted with febrile illness but without experiencing a seizure.

Results: The case group had 86% (n=43) children with Hb levels ≤ 11 gm/dl, while the control group had 24% (n=12). Statistically substantial difference (p-value < 0.01). Anemia was more common in patients than controls (p=0.012). Significant decreases in hemoglobin and MCV were seen in cases compared to controls (p < 0.04). A substantial increase in RDW values was seen in cases compared to the control group (p < 0.04). The mean MCH levels of the two groups were not significantly different (p >0.04). The patients had significantly lower serum ferritin and iron levels than controls (p < 0.01). The TIBC value is significantly higher in cases compared to the control group (p < 0.01).

Conclusion: The data show that many febrile seizure children have iron-deficiency anemia and low blood iron. This suggests that low serum iron and anemia can exacerbate febrile seizures in children.

Keywords: Febrile Convulsions, Iron-Deficiency Anemia, Children.

Introduction

The most frequent childhood seizure is febrile seizure (FS), which affects 2–5% of neurologically healthy children. In 6-60-month-old children without previous afebrile seizures, FS is a seizure accompanied with a febrile illness without CNS infections or severe electrolyte abnormalities. [1] There are simple and sophisticated FS kinds. Seizures lasting more than 15 minutes and reoccurring within 24 hours are complex FS. At least one third of the world's population suffers from iron insufficiency, a common micronutrient shortage. [2] Iron deficiency usually causes anemia, although other organs and systems may be impacted. Iron deficiency may cause cognitive dysfunction, psychomotor retardation, behavioral abnormalities, pica, breath-holding spells, RLS, and thrombosis. [3,4] Effect of iron deficiency in the developing brain and mechanisms such as altered development of hippocampus neurons, impairment of energy metabolism, delayed maturation of myelin, slowed visual and auditory evoked potentials and alterations in synaptic neurotransmitter systems including norepinephrine, dopamine, glutamate, γ- aminobutyric acid, and serotonin may be responsible for these symptoms. [5,6] However, fever may worsen brain damage from iron shortage. [7]

Given the age prevalence of IDA and FS, which play the same role as iron in neurotransmitter synthesis (such as GABA dopamine and serotonin), [8] and certain enzymes, such as monoaminoxidase, the role of hemoglobin in carrying oxygen to the brain, and fever, that worsen symptoms induced by anemia, a relationship between IDA and FS is probable.

Most iron deficiency symptoms are anemia, however other organs and systems may be impacted. Iron deficiencies can cause cognitive dysfunction, psychomotor retardation, behavioral abnormalities, pica, breath-holding spells, RLS, and thrombosis. [9,10] Symptoms of iron deficiency in the developing brain may result in altered hippocampus development, energy metabolism, myelin maturation, visual and auditory evoked potentials, and synaptic neurotransmitter systems (e.g., norepinephrine, dopamine, glutamate, γ-aminobutyric acid, and serotonin).

[11] Fever can worsen brain damage from iron shortage. [12] A number of research have found inconsistent results on the link between IDA and FS.

The aim of this case-control study was to evaluate the relation of Iron Deficiency Anemia with the first episode of Febrile Seizure.

Materials and Methods

This study was conducted in Department of Pediatrics, Lord Buddha Koshi Medical College and Hospital, Saharsa, Bihar, India for one year and involved 50 patients who had typical febrile convulsions between the ages of 1 and 5 years, as defined by the AAP clinical practice guidelines. An age and sex-matched control group (n=50) was chosen from children admitted with febrile illness but without a seizure.

Hematological examinations include Haemoglobin, MCV, MCH, RDW, Serum Ferritin, Serum Iron, TIBC and Peripheral blood smear. In the process of anthropometric data collection, weight is measured using an electronic weighing scale, while length and height are measured using an infantometer and stadiometer, respectively. Head circumference was assessed using a plastic tape measure through the cross-tape method. Protein-energy malnutrition was graded based on IAP weight for age classification.

Inclusion Criteria

- Age between 1 year to 5 years
- The temperature of 38 degree Celsius (100.4 o F) or higher
- Not the result of central nervous system infection or any Metabolic imbalance.
- Occur in the absence of a history of prior afebrile seizure.
- Primarily generalized, usually tonic-clonic.
- Lasting for a maximum of 15 min.
- Not recurrent within a 24 hrs period.

Exclusion Criteria

- Children with neurological infection
- Children with developmental delay
- Children on iron therapy
- Children with previous febrile/afebrile seizure

Statistical Methods: Statistical analysis was done using appropriate statistical software.

Results

Table 1: Distribution of cases according to hemoglobin levels

Haemoglobin Level(gm/dl)	Cases	Controls
No anemia (≥11gm/dl)	6 (12)	37 (74)
Anemia		
Mild anemia (10-10.9gm/dl)	12 (24%)	5 (10%)
Moderate anemia (7-7.9gm/dl)	30 (60%)	5 (10%)
Severe anemia (<7gm/dl)	2 (4%)	3 (6%)

Table 1 shows that 86% (n=43) children had Hb <11 gm/dl from the case group as compared to 24% (n=12) in control group with significant p-value (p <0.01). The proportion of cases with anemia was significantly higher as compared to that of controls (p=0.012).

Table 2: Hematological parameters

Parameters	Cases		Controls		P-Value
	Mean	SD	Mean	SD	
Hb(gm/dl)	9.10	1.65	10.06	1.66	<0.01
MCV(fl)	67.89	15.32	17.65	9.96	<0.04
MCH(pg)	21.98	5.11	24.80	5.77	0.063
RDW	17.99	6.78	16.19	2.34	<0.04

Table 2 shows, mean hemoglobin level and MCV in cases were significantly lower as compared to that in controls (p <0.04). RDW value is significantly higher in cases as compared to control (p <0.04). No significant difference between the two groups was observed with respect to mean MCH levels (p >0.04).

Table 3: Mean level of iron metabolic markers in cases and controls

Iron metabolic markers	Case (Mean)	Control (Mean)
Serum ferritin	44.89	60.9
Iron	52.34	64.55
TIBC	389.67	331.33

Serum ferritin and serum iron levels in cases were significantly lower as compared to that in controls (p <0.01). TIBC value is significantly higher in cases as compared to control (p <0.01).

Discussion

Febrile seizures are the prevailing form of seizures, manifesting in approximately 3 to 4% of pediatric patients. [13] Due to their potential link to epilepsy in the future, several studies have sought to identify

the risk factors associated with them, such as a family history of febrile seizures, epilepsy, perinatal factors, and temperature peak. Pisacane et al. [14] have documented a correlation between low iron levels and febrile seizures, while Kobrinsky et al. have found that iron deficiency increases the susceptibility to seizures. [15] Due to its crucial role in the functioning of neurotransmitters and different enzymes, a decrease in serum ferritin levels has the potential to reduce seizure threshold. [16] Severe fever can exacerbate the adverse impact of low serum ferritin levels on the brain and induce seizures. [14]

The current study observed a predominance of male participants in both categories. The examination of sex indicates that the case group consisted of 68% males and 32% females. In their study, Leela Kumari et al [17] also documented a 53% representation of male children. The characteristics examined in this study included temperature, weight (Kg), height (Cm), and nutritional status. The mean temperature was observed to differ between the cases and control groups, but this difference did not reach statistical significance (p-value = 0.412). According to the research conducted by Modaresi M et al [18], Vaswani et al [19], and Daoud et al [20], it was found that while there was a higher occurrence of high temperature in the case group, this difference did not reach statistical significance. There was a higher prevalence of anemia observed in the patients in comparison to the control group. There was a statistically significant difference observed ($p<0.01$).

Previous studies conducted by Derakhshanfar et al. [21] and Modaresi M et al. [18] have also documented a statistically significant distinction when compared to the control group. The iron status components, including Hb, MCV, MCH, RDW, serum iron, ferritin, and TIBC, were assessed in both cases and controls. The current study revealed a significant decrease in mean ferritin and serum iron levels in the FS group compared to the control group ($p < 0.01$). In a study conducted by Daoud et al. [20], it was observed that the average ferritin level in individuals experiencing their initial febrile seizure was notably lower compared to a control group. Pisacane et al [14] investigated the levels of serum iron among controls and patients with FS, and they reported that iron deficiency anemia is substantially more frequent among the cases than among the controls.

Conclusion

The findings imply that many febrile seizure children have iron deficiency anemia and low serum iron. Iron deficiency anemia and febrile seizures were previously studied without conclusive findings. This study provided new data. Still, the preference bias and ambiguous social status are unusual in our investigation. Children with febrile seizures had greater IDA than those with febrile illness alone. IDA may increase FFS risk, according to the study. IDA monitoring is recommended for FFS kids.

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