THE RELATIONSHIP BETWEEN IRON DEFICIENCY ANEMIA AND THE INCIDENCE OF FEBRILE CONVULSIONS

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ABSTRACT

OBJECTIVES

To determine the role of iron deficiency anemia in patients with febrile convulsions in the 06 to 60 months in a tertiary care hospital.

METHODOLOGY

This cross-sectional study was undertaken at Ayub Teaching Hospital, Abbottabad, from January 2020 to February 2022. Patients with typical and atypical febrile seizures were recruited for the study, while patients with neurodegenerative diseases, meningoencephalitis, epilepsy, trauma, nephritic syndrome, and hypertensive seizures were excluded from the study. Iron deficiency was identified concerning a complete blood count. The data were analyzed in SPSS version 21, and the significance value was kept at < 0.005.

RESULTS

In the present study, 102 patients were enrolled. The mean age of the sample was 15 months, with an age range of 6-54 months. The male-to-female ratio was 2:1. The mean haemoglobin (HB) of the sample observed was 9.9±1.9, mean corpuscular volume (MCV) 73±13, red cell distribution width (RDW) 16±7.9 white cell count (WBC) 12.9±7.1 and platelets of 312±180. The use of cow milk in febrile seizures was 41%, and only 33% of parents were unaware of proper milk dilution.

CONCLUSION

We concluded that patients with atypical febrile seizures and those with seizures more than once have a significantly higher degree of iron deficiency anemia than those with typical febrile seizures. Moreover, the group with prolonged seizures has severe anemia compared to the group with brief seizures.

KEYWORDS: *Febrile Convulsions, Seizures, Iron Deficiency Anemia*

INTRODUCTION

Iron is one of the essential micronutrients in the human body. Besides being part of hemoglobin and cytochrome, iron strongly impacts the developing central nervous system.[1] Iron is also important in the nervous system for synthesizing neurotransmitters like gamma-aminobutyric acid (GABA), serotonin, dopamine, glutamate, and monoamines. Iron also plays a key role in the myelination of neurons, particularly in the parahippocampal area. According to statistics from the WHO, more than 1.6 billion people are affected by iron deficiency, making iron the most common micronutrient deficiency globally.[2] The major group prone to iron deficiency is children, particularly the preschool group, which is of major concern because of the role of iron in the devolving central nervous system. When iron stores decrease in the body, synaptic activity in the synaptic junction gets altered. There is an imbalance between excitation and inhibition of synaptic activity. The physiological manifestation in response to this imbalance is seizureogenic activity in the brain.[3] Seizures are the most common neurological symptom in children. Among seizures, febrile seizures are most common in childhood and can be further divided into simple, complex, and febrile status epileptics. The estimated global index of febrile seizures is 4.8 per 1000 people per year.[4] Chickenpox, influenza, middle ear infections, and upper and lower airway infections are common infections linked with febrile seizures.[5] Iron deficiency in febrile seizures can be predicted easily from a complete blood count and can be treated early with iron supplements. An iron supplement later in life isn't a remedy for seizures, breath-holding spells, or various psychological disorders. Along with iron deficiency, anemia and zinc deficiency may be risk factors for febrile seizures, according to certain research.[6,7] So, the current study will determine the risk factors, the severity of seizures concerning anaemia, and the peak age group of febrile seizures in children. In this way, the study updates the existing data and provides reliable facts to the treating physician about the importance of anemia in children. Moreover, nutritionists and healthcare authorities can utilize the data to promote nutrition, fortification of dietary items, and long-term health programs for child growth and mental development.

METHODOLOGY

An observational cross-sectional study was conducted in Ayub Teaching Hospital, Abbottabad, from January 2020 to February 2022. The institutional ethical committee approved the study with approval code ref.No.RC-2022/EA-01/058. A non-probability purposive sampling technique was applied for sample collection. The source of data collection was a written questionnaire, which included a patient profile, risk factors for iron deficiency, typical and atypical presentations of febrile seizures, and complete blood findings. Iron deficiency anemia is defined according to WHO classification: hemoglobin less than 11 g/dl, mean corpuscular volume (MCV) less than 72 femtoliter, mean corpuscular hemoglobin less than 25 picograms, mean corpuscular hemoglobin concentration (MCHC) less than 30 g/dl, and red cell distribution width greater than 15%.[8] Confounding variables like the history of bleeding, blood loss, chronic diarrhea, and family history of bleeding diathesis were added to determine the cause of anemia. Full, informed consent from parents was also obtained before filling out each questionnaire. Patients presented with typical and atypical febrile fits are included in the study, while patients presented with seizures secondary to CNS infection, a neurodegenerative disorder, febrile and a febrile status epilepticus, and any previous hypoxic insult to the brain are excluded from the sample. According to the American Academy of Pediatrics, febrile convulsions are convulsions that are associated with a fever of above 38°C (100.4 °F) and occur above six months and below five years of age in the absence of any organic central nervous lesion-including infection and metabolic disturbances-and any prior afebrile convulsions.[9] The qualitative data were presented in frequency and percentages, while the quantitative data were presented in terms of mean and standard deviation. The analysis of variance, Student T-test, and chi-square test were used to determine the statistical significance of variables. A p-value less than 0.05 was considered significant. The data was analyzed using SPSS version 21.

RESULTS

In the current study, 102 (n=102) individuals meeting the inclusive criteria were recruited. The mean age of the sample was 15 months ± 14, with an age range of 6–54 months. Seventy patients were male, with a male-to-female ratio of 2:1. The use of cow milk in febrile seizures was 41%, and only 33% of parents were unaware of proper milk dilution. The mean HB of the sample observed was 9.9±1.9, MCV 73±13, RDW 16±7.9 WBC count 12.9±7.1 and platelets of 312±180. The details of age in subgroups with blood parameters are shown in Table 1.

Table 1: Comparison of Age Group Versus Blood Parameters

Variables	Age (Months)	Mean with S.D	Homogeneity of Variance Significance	ANOVA Significance
RBC's Count	6-12	3.8±0.7	0.017	0.010
	13-24	4.5±0.5		
	25-48	4.1±0.4		
	49-60	4.6±0.09		
Hemoglobin	6-12	9.8±1.9	0.15	0.008
	13-24	8.8±2.4		
	13-24	10.7±1.7		
	49-60	12.3±0.17		
Mean Corpuscular Volume	6-12	73.7±14	0.93	0.14
	13-24	64.7±10		
	13-24	77.2±11		
	49-60	79.5±7.5		
Red cell distribution width[4]	6-12	16±8.9	0.7	0.53
	13-24	14±2.8		
	13-24	16±4.4		
	49-60	11±4.0		
WBC's Count	6-12	12.5±12.5	0.00	0.17
	13-24	13.9±13.9		
	13-24	12.5±12.5		
	49-60	20.5±20.5		
Platelets	6-12	302±170[1]	0.00	0.19
	13-24	439±43		
	13-24	311±225		
	49-60	248±276		

Eighty-four patients (82%) presented with typical generalized febrile seizures, out of which 80 experienced fever spikes before the onset of seizures. The duration of seizures was significantly lower in patients with generalized seizures (p=0.00) than in patients with localized seizures, as shown in Table 2. A history of febrile convulsions is present in 20 individuals (19.6%); 22 patients (21.6%) had a family history of febrile convulsions, and 18 (17.6%) had a family history of epilepsy. Patients with severe anemia had significantly longer durations of seizures, as illustrated in Figs. 1 and 2.

Table 2: Showing Characteristic of Patients with Febrile Seizures

Variables			F(%)	Numbers(n=102)
Birth History	Term		92	94
	preterm		7.8	08
Birth Weight	Low birth weight		25	26
	Normal weight		75	76
Blood Loss	Oral		02	02
	Nasal		3.9	04
	No loss		94	96
Dilution of Milk	Yes (41%)	Proper	66.6	28
		Improper	33.3	14
	No (58%)		58.8	60
Diarrhea History	>2weeks		9.8	10
	<2weeks		56.9	58

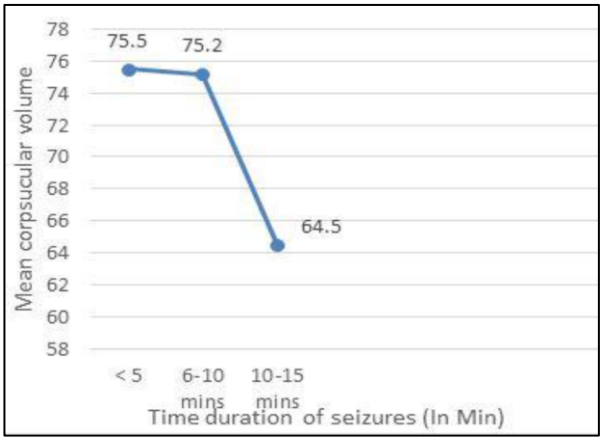

Figure 1: Correlation of Mean Corpuscular Volume Verses Duration of Seizures

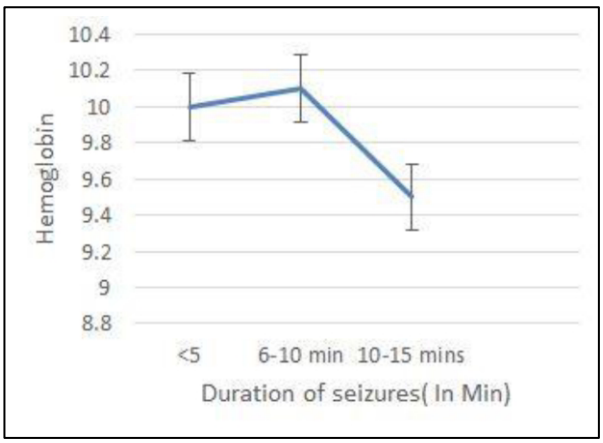

Figure 2: Correlation of Hemoglobin versus Duration of Seizures

DISCUSSION

The present study revealed that males were more prone to convulsions than females, which is also proven by Karimi et al. and Ahmed BW et al. Most of our patients (80%) fall in the age group of 6–24 months. While Ahmad et al. also reported the same findings, a study done in Iraq reported the 30- to 60-month age group as the predominant age group for febrile seizures.[10,11] Iron was an important remedy for this age group. It helps transport oxygen to the brain by synthesizing neurotransmitters in different brain areas. Besides this, it is also associated with various neurological disorders like breath-holding spells, attention deficit hyperreactivity (ADHD), and restless leg syndrome, particularly in the first two years of life.[10] We recorded a mean HB of 9.9 g/dl, an MCV of 73 fl, and an elevated RDW (16%). These hematological indices suggested that the patient who presented with febrile fits had microcytic anemia, which is also evident from studies done in Iraq, India, Jordan, Nepal, and Pakistan.[11,13,14,15,16] A study conducted in India and Nepal reported a higher degree of mean HB than our study sample; the reason could be a higher degree of cow milk usage in our population and improper milk dilution.[12,17] It was also observed that patients with severe microcytic anemia have significantly longer durations of seizures. 19% of individuals had a history of febrile seizures, and 17% had a family history of febrile convulsions in siblings.[18] These findings are similar to those reported by Aslan M et al. The frequency of generalized seizures was also close to that observed by Aslan M et al. We also found that birth weight has no association with febrile seizures, Chaudhary BR et al. also found no significant association between the case and control groups.[12] We observed that 40% of patients with febrile convulsions use cow milk as a primary feeding source, which could be the reason for microcytic anemia, as 72% of our sample population is younger than one year.

LIMITATIONS

The study was conducted in a single tertiary care hospital, which may limit the generalizability of the findings to other settings or populations. The cross-sectional design of the study does not allow for the establishment of a cause-and-effect relationship between iron deficiency anemia and febrile convulsions. The exclusion of certain conditions, such as neurodegenerative diseases and epilepsy, may have introduced selection bias and affected the overall representation of patients with febrile convulsions.

CONCLUSIONS

We concluded that patients with atypical febrile seizures and patients with seizures more than once significantly had a higher degree of iron deficiency anemia than patients with typical febrile seizures. Moreover, seizures are particularly prolonged in patients with the severe microcytic anemia. The majority of patients do not know the proper dilution of milk. Preterm, post-term, birth weight, weaning, and chronic diarrhea are independent risk factors for febrile seizures. Males are more prone to seizures as compared to females.

CONFLICT OF INTEREST: None

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