Original Research Article

Association of iron deficiency anaemia with febrile seizure in children

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Abstract

Background: Previous studies reported that iron deficiency could be a risk factor for Febrile Convulsion (FS) because both conditions are common in children of the same age. However, few studies described iron deficiency anaemia (IDA) to be less frequent in children with FS. Controversy exists regarding the association between IDA and FS during childhood. **Aim:** To evaluate the association of iron deficiency anaemia with febrile seizure in children. **Material and Methods:** A total of 40 children of age 6-60 months with FS were evaluated for iron deficiency anaemia by complete blood count, serum iron, sr. ferritin and TIBC levels. **Results:** Out of 40 cases, 26(65%) children had low serum iron concentration and 14 (35%) had normal serum iron concentration ($p>0.05$), the serum ferritin level was normal in 35 (87.5%) children and low in 5 (12.5%) ($p<0.05$), TIBC levels were high in 34 (85%) and normal in 6 (15%) children ($p<0.05$). Thus, 28 (70%) of the children were diagnosed of having iron deficiency anemia. **Conclusion:** Iron deficiency was the commonest association for the occurrence of febrile seizure. Accordingly, children with FS are suggested to be monitored for diagnosis and treatment of IDA.

Key Word: Febrile seizures, hemoglobin, serum iron, ferritin, association

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INTRODUCTION

Febrile seizure (FS) is the most common convulsive disorder in childrenaged 6 to 60 months with a prevalence of 2-5% in the children who are neurologically healthy.[1] It refers to the convulsions in children with body temperature of 38.5ºC or higher by rectal measurement not resulting from Central Nervous System (CNS) infection or any metabolic imbalance without any prior afebrile seizures. The exact cause of FC is not known, but several genetic and environmental factors have been implicated.[2] Due to the presence of iron in the hemoglobin structure, it plays a crucial role in the transport of oxygen to different tissues such as the brain. Iron deficiency reduces the metabolism of some neurotransmitters[1,3,4] Previous studies reported that iron deficiency could be a risk factor for FS because both conditions are common in children of the same age.[5-7]However, few studies described iron deficiency anaemia to be less frequent in children with FS.[8]In view of the conflicting reports and prevalence of these clinical entities, the present study was conducted to evaluate the association of iron deficiency anaemia with febrile seizure in children.

MATERIAL AND METHODS

The present study included 40 children with febrile seizures attending outpatient Department of paediatric, paediatric wards and paediatric intensive care unit of a tertiary care hospital.

Inclusion criteria

- Children with febrile seizure
- Children age between 6 and 60 months

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- No identifiable cause of seizure
- No afebrile seizure in the past

Exclusion criteria

- Children age <6 months and >60 months
- Children on iron therapy
- Children received blood transfusion before
- Children with meningitis, encephalitis, neurological deficiencies

After enrolling the patients in the study after informed written consent from parents, personal information about the children, including birth history, anthropometry measurementsfamily history of seizure, past history of FSand history of taking iron supplementswere collected from parents through an interviewed questionnaire The body temperature was measured and recorded by rectal method. Fever was graded as mild=99-100.9°F; moderate=101-103°F and severe=>103°F. After systemic and neurological examination, 5 ml of blood was collected and sent to pathology and biochemistry department for estimation of CBC, serum Iron, and TIBC tests. Equipments used were Sysmax KX-21 Haematology Counter and Access II Immunoassay Analyser (Beckman Coulter).Iron deficiency anaemia was defined as hemoglobin level below 11 gm/dL, Serum ferritin level below 12 ng/mL, Mean Corpuscular Volume (MCV) below 65 fL and TIBC >430 mcg/dL.

Statistical analysis

The collected data were analyzed using descriptive statistics, including frequency, percentage, mean and standard deviation, as well as analytical statistics, such as Chi-square (for comparison of qualitative variables) and the analysis of variance test and t-test (for comparison of quantitative variables).

RESULTS

In present study, majority i.e., 31(77.5%) of the children were in the age group of 1-5 years and 26 (65%) were males and 14 (35%) were females with male to female ratio being 1.8:1. Most of the children i.e., 35 (87.5%) had their first episode of febrile seizure. No one had significant family history of FS or epilepsy or anaemia. All children studied had normal birth history i.e., there was no history of low birth weight, asphyxia and NICU admission. There was no history of delayed motor and mental milestones. Most of the children were categorized as normal 31(77.5%), 08 (20%) were wasted and one (2.5%) were in undernourished according to WHO classification (Table 1). In present study, 32 (80%) children had moderate grade of fever. Mild grade fever was seen in 5 (12.5%) children and severe grade fever was seen in 3 (7.5%) children. On physical examination, all children had pallor with hepatosplenomegaly in 7 (17.5%) children. Neurological examination was normal in all the children.

Table 1: Characteristics of the studied population (n=40)

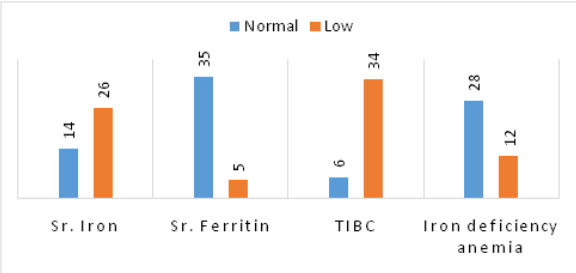
Patient characteristics	No. of cases	Percentage
Age group (years)		
<1	09	22.5%
1-5	31	77.5%
>5	00	00%
Sex		
Male	26	65%
Female	14	35%
Past history of FS		
Recurrent	05	12.5%
First episode	35	87.5%
Anthropometry		
Normal	31	77.5%
Wasting	08	20%
Wasting/stunting	01	2.5%

Out of the 40 children, 34 (85%) had low hemoglobin. The proportion of cases with low hemoglobin was significantly more than the proportion of cases with normal hemoglobin ($p<0.05$). 24 (60%) of the children had low MCV, 28 (70%) had low MCH and MCHC and 31 (77.5%) had high red cell distribution width (RDW) (Table 2).

Table 2: Laboratory examination in studied population

Investigation	No. of cases	Percentage	*p*-value
Hemoglobin			
Normal	06	15%	<0.05 (Significant)
Low	34	85%	
MCV			
Normal	16	40%	>0.05
Low	24	60%	(Not significant)
MCH and MCHC			
Normal	12	30%	<0.05 (Significant)
Low	28	70%	
RDW			
Normal	09	22.5%	<0.05 (Significant)
Low	31	77.5%	

In our study of 40 children, 26 (65%) of children had low serum iron concentration and 14 (35%) had normal serum iron concentration (p>0.05), the serum ferritin level was normal in 35 (87.5%) children and low in 5 (12.5%) (p<0.05), TIBC levels were high in 34 (85%) and normal in 6 (15%) children (p<0.05). Thus, out of 40 children, 28 (70%) of the children were diagnosed of having iron deficiency anemia and 12 (30%) children without iron deficiency anemia (Graph 1).



Graph 1: Distribution of serum iron levels

DISCUSSION

Iron is an essential element in the metabolism and functioning of enzymes required in neurochemical reactions. Iron deficiency leads to dysfunction of myelination as well as tyrosine and tryptophan hydroxylase synthesis, which are necessary for neurotransmitter production as well as the release of neurotransmitters from vesicles.[9,10] Fever can worsen the effects of anemia or iron deficiency on the brain, and therefore cause convulsions. In addition, anemia can be associated with the degree of febrile disease, and patients with more severe symptoms may be affected by convulsions.[11]Clinically neurological symptoms like poor attention span, learning deficits, poor memory, delayed motor development and behavioral changes caused by iron deficiency are well known.[12] Majority i.e., 31 (77.5%) of the children were in the age group of 1-5 years in present study, thus, IDA was a risk factor for occurrence of febrile seizure more in the age group of 1-5 years. In a study by Ur-Rahman and Billoo70% of the children of both IDA and FS were in the age group of 1-5 years.[13]Auvichayapat P *et al* reported 60.34% of the children of both IDA and FS were in the age group of 1-3 years.[14] In our study, male predominance was seen with male to female ratio being 1.8:1.In a study by Vaswani *et al* male to female ratio in association with FS and IDA as 2:1.[15]Kobrinsky NL *et al*also reported male predominance in their study.[16] In our study, out of 40 children, 28 (70%) of the children were diagnosed of having iron deficiency anemia. In accordance with our findings, a study by Pisacane *et al* reported that anemia in their case group (30%) was higher than in hospital control group (14%) and healthy group (12%).[11]A study by Ur-Rahman and Billoo on 30 children with febrile convulsion and 30 children with other febrile diseases indicated that IDA in their case group was significantly more common than in control group.[13]Vaswani et al, also found 68% of FS cases were iron-deficient compared to 30% of controls.[15]In a study by Ghasemi F *et al*, the incidence of IDA in the febrile convulsion group was significantly higher than in the other two control groups.[17] To summarize, serum iron was low in maximum number of cases which is the specific confirmatory for diagnosing IDA, because serum ferritin is the acute phase reactant and elevated in many other conditions, and hence not specific. TIBC was another parameter in serum iron studies which were high in maximum number of cases.

CONCLUSION

In conclusion, iron deficiency was the commonest association for the occurrence of febrile seizure. Majority of the children having febrile seizure suffer from iron-deficiency anemia and low serum iron. Thus, iron deficiency can be added to the list of risk factors for febrile convulsions. Accordingly, children with FS are suggested to be monitored for diagnosis and treatment of IDA.

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