

Original Research Article

Comparative study of serum ferritin level in simple and complex febrile seizures in Government Tirunelveli Medical College

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Abstract

Background: Febrile seizures are one of the common reasons for emergency room visits in pediatric population affecting up to one in twenty children in various parts of the world. Though febrile seizures are commonly benign it is a source of major family distress and anxiety.

Aim of the study: To compare serum ferritin level in simple and complex febrile seizures among children.

Materials and methods: This case-control study was conducted at the Department of Pediatrics, Tirunelveli Medical College Hospital, Tirunelveli, from 2017-2018. All cases of febrile seizures which include both simple febrile and complex febrile seizures between the age group of 6 and 60 months were studied. Serum ferritin was estimated by the Ferritin-Turbilatex, by LAB KIT, CHEMEX, S.A. semi auto analyzer.

Results: The mean average serum ferritin level in simple febrile seizures was 22.76. The mean average serum ferritin level in complex febrile seizures was 24.72. Hence, it was statistically significant that low serum ferritin is present in those with simple febrile seizures.

Conclusion: Iron deficiency anemia was more frequent among children with febrile seizures than those with febrile illness alone. The result suggests that Iron deficiency anemia may be a risk factor for febrile seizures. Thus screening for IDA should be considered in children with febrile seizures. Fever can worsen the negative effect of iron deficiency anemia on the brain and a seizure can occur as a consequence. This suggests that iron-deficient children are more prone to febrile seizures.

Key words

Simple Seizures, Complex Febrile Seizures, Serum Ferritin Level, Iron Deficiency Anemia.

Introduction

Febrile seizures are seizures that occur between the age of 6 and 60 months with a temperature of 38°C (100.4°F) 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 [1]. A simple febrile seizure is a primary generalized, usually tonic-clonic attack associated with fever, lasting for a maximum of 15 min, and not recurrent within a 24-hr period [2]. A complex febrile seizure is more prolonged (>15 min), is focal, and/or reoccurs within 24 hours. Febrile status epilepticus is a febrile seizure lasting longer than 30 min [3]. Some use the term simple febrile seizure plus for those with recurrent febrile seizures within 24 hours. Most patients with simple febrile seizures have a very short postictal state and usually, return to their baseline normal behavior and consciousness within minutes of the seizure [4]. Iron plays a critical role in the metabolism of several neurotransmitters, and in low iron status, aldehyde oxidases and monoamine are reduced [5]. In addition, the expression of cytochrome C oxidase, a marker of neuronal metabolic activity, is decreased in iron deficiency. In developing countries, iron deficiency is one of the most prevalent nutritional problems [6] especially among infants aged between 6 and 24 months. In developing countries, 46–66% of all children under 4 years of age are anemic, with half of the prevalence attributed to iron deficiency anemia [6]. Many studies have clearly demonstrated the effect of iron on development, cognition, behavior, and neurophysiology, and especially on brain metabolism, neurotransmitter function, and myelination [7]. Iron-deficiency anemia is common during the second and third years of life and has been variably associated with developmental and behavioral impairments; hence it can influence motor and cognitive skills. Because iron is important for the function of various enzymes and neurotransmitters in the

central nervous system, low serum levels of ferritin may reduce the seizure threshold [8].

Materials and methods

This case-control study was conducted at the Department of Pediatrics, Tirunelveli Medical College Hospital, Tirunelveli, from 2017-2018. All cases of febrile seizures which include both simple febrile and complex febrile seizures between the age group of 6 and 60 months were studied. The control group includes the children in the same age group with fever but without seizures. After informed consent, a detailed history was taken, and the physical examination was done, then the venous blood sample was collected. Serum ferritin was estimated by the Ferritin-Turbilatex, blanket, CHEMEX, S.A semi autoanalyzer.

Inclusion criteria: Age between 6 months to 60 months, presenting with febrile seizures including both simple and complex febrile seizures, febrile seizures including both 1st episode and recurrent episodes.

Exclusion criteria: Any chronic systemic illness (Cardiac, Renal, Metabolic, Malignancy, Rheumatological) Neurodevelopmental delay, Previous afebrile seizures, Acute CNS infection, Children on iron therapy.

Statistical analysis: The data were analyzed and interpreted according to the type of variables. The continuous variables were analyzed in terms of mean and interpreted by student's t-test. The discontinuous variables were described in terms of percentages and interpreted by χ^2 (Chi-square) test.

Results

In our study we had taken 75 children with febrile seizures as cases and another 75 children without febrile seizures as controls. Among 75 children with febrile seizures, maximum cases

fall on the age group of 13-24 months (53%) followed by the age group of 25-36 months (21%), 6-12 months (18%) as per **Table - 1**.

Among 75 children presenting with febrile seizures, 52 children were presented with simple febrile seizures (69.3%) and 23 children were presenting with complex febrile seizures (**Graph - 1**).

The mean average serum ferritin level in simple febrile seizures was 22.76. The mean average serum ferritin level in complex febrile seizures was 24.72. Hence, it was statistically significant that low serum ferritin is presenting in those with simple febrile seizures (**Graph - 2**).

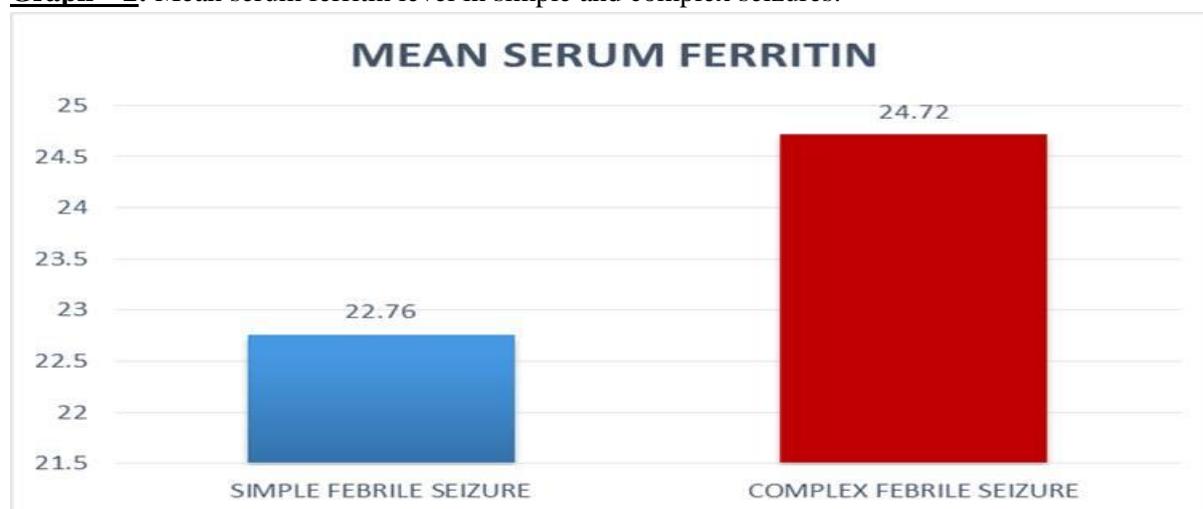
Table – 1: Age distribution.

Age (in months)	Febrile seizure	
	Present(n=75)	Absent(n=75)
6 TO 12	14	15
13 TO 24	40	43
25 TO 36	16	14
37 TO 48	5	3

Graph – 1: Types of seizures in study population.



Graph – 2: Mean serum ferritin level in simple and complex seizures.



Discussion

Seizures are the most common pediatric neurology problem that occurs in 4–10% of children in the first 6 years of their life and febrile seizures (FS) are the most common type of childhood seizures that occur in 2–5% of neurologically healthy children. Iron deficiency is the most common micronutrient deficiency that affects at least one-third of the world's population [9]. Anemia is the most common clinical manifestation of iron deficiency, but other organs and systems may also be affected. Cognitive dysfunction, psychomotor retardation, behavioral problems, pica, breath holding spells, restless leg syndrome, and thrombosis could be associated with iron deficiency [10]. The effect of iron deficiency in a 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, gamma - aminobutyric acid (GABA), and serotonin may be responsible for these symptoms [11]. The Maximum number of febrile seizures was in the age group of 13-24 months of age. Mean age of presentation of febrile seizures is 21.4 +/- 9.7 months. There was slightly higher male preponderance in cases with febrile seizures. Simple febrile seizures were more common than complex febrile seizures. The family history of febrile seizures and epilepsy were slightly higher in febrile seizures cases comparing to the controls. Average mean serum ferritin level was 23.37 pg/dl. In controls, the average mean serum ferritin is 27.68 pg/dl. The mean average serum ferritin level in simple febrile seizures was 22.76 pg/dl. The mean average serum ferritin level in complex febrile seizures was 24.72 pg/dl. Average mean serum ferritin was lower in febrile seizures cases than controls and average mean serum ferritin in simple febrile seizures was lower in simple febrile seizures than complex febrile seizures. Both were statistically significant. In children with first seizure, hemoglobin levels, serum iron

levels, and serum ferritin levels were lower than in the control group and iron deficiency (48% in FS, 44% in afebrile seizure, and 28% in control group) and iron deficiency anemia (26% in afebrile seizure, 22% in FS, and 10% in healthy children) were more frequent in children with seizures [12]. Sherjil A, et al. indicated that in Isfahan, Iran, the mean Hb, HCT, ferritin, iron, and MCH were lower in FS children than in febrile children without a seizure [13]. Naveed-ur-Rehman, et al. indicated that in Shiraz, Iran, iron deficiency (56.6% vs. 24.8%) was more frequent in children with FS and in the FS group; Hb levels were lower than in febrile children without seizure [14]. Hartfield DS, et al. indicated that in India, in FS children, iron deficiency was more frequent than in febrile children without a seizure. In another Indian study, the mean of serum ferritin levels was significantly lower in FS children than in children with febrile illness but without convulsion [15].

Conclusion

Iron deficiency anemia was more frequent among children with febrile seizures than those with febrile illness alone. The result suggests that Iron deficiency anemia may be a risk factor for febrile seizures. Thus screening for IDA should be considered in children with febrile seizures. Fever can worsen the negative effect of iron deficiency anemia on the brain and a seizure can occur as a consequence. This suggests that iron-deficient children are more prone to febrile seizures.

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