

Iron Deficiency among Patients with Febrile Seizures in Al Ramadi Maternity and Children Teaching Hospital, Western Iraq

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ABSTRACT

Background: Febrile seizures are the most predominant neurological disorders in children between 6 months-5 years, at the same time iron deficiency anaemia is one of nutritional insult that implicated as risk factor for occurrence of febrile seizures.

Objective: To estimate the role of iron deficiency as a risk factor for febrile seizures in children aged 6 months -5 years, western Iraq.

Patients and methods: A case control study has been conducted in AL Ramadi maternity and children teaching hospital during January to October of 2016. All children with history of febrile seizures aged 6 months-5 years were involved as cases group, others with febrile illness and no seizures were considered as control group. Data from 58 child of each group were collected. The data include age, sex, temperature, causes of febrile illness, Hb, haematocrit and s. ferritin levels. The data were subjected to statistical analysis run under IBM SPSS ver. 23.

Results: Means age \pm SD were 27.48 ± 14.83 and 23.24 ± 14.37 months in cases and control groups respectively with no significant difference between them. Most of the children (65.52%) of those with febrile seizures were less than 3 years old. Mean temperature of cases group (38.86°C) was found to be significantly greater than that of the control group (38.52°C) at $p\text{-value} < 0.01$. Mean Hb level, PCV%, s. ferritin level were significantly lower in cases group than in control group. Proportion of iron deficiency anaemia was significantly higher in febrile seizure group (65.52%) than in control group (31.03%) at $p\text{-value} < 0.01$.

Conclusion: Occurrence of IDA in cases group is found to be more than 2 times of that in the control group. Early detection and proper treatment of IDA can play a prominent role in limitation the prevalence of febrile seizures among children below 5 years.

Keywords: Febrile seizures; Iron deficiency anaemia; Respiratory tract infection

INTRODUCTION

Febrile seizures (FSs) are the most predominant neurological disorders in childhood with a multifactorial inheritance that occur in 2-5% of children in United States, 5-10% in India and up to 14% in Guam [1-3].

FSs described as a seizures that come in association with high grade fever of 38 centigrade or more without brain infection or electrolytes disturbances involving age groups ranged from 6 months-5 years with peak age of occurrence of 18-24 months [4,5].

Iron deficiency anaemia (IDA) is another well pronounced easily correctable nutritional problem that can affect the intellectual

development and occur predominately in a nearly similar age interval of FSs in young children 6 months-24 months [6,7]. In general, anaemia was noted in a proportion 46-66% of children younger than 4 years of in developing countries and approximately half of them were iron deficient [8]. Indeed, iron is one of the micronutrient that have an important role in neuronal development (neurogenesis), maturation of myelin, energy and neurotransmitters metabolism [9,10] as well as formation of haemoglobin.

Thus abnormal neurotransmitters functions as a sequence of iron deficiency, may in turn contribute to alteration of seizure threshold and initiation of febrile seizures in young children [7].

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So if we take into account the same age prevalence of IDA& FSs and the effect of iron deficiency on brain function, as well as the value of Hb in carrying O₂ to brain and since presence of fever can exaggerate the symptoms that result from effect of IDA on brain, so relation between FSs and IDA is probable .

Based on all the above considerations, and since no study was conducted in al Ramadi province western Iraq, about such problem, so our study was conducted to estimate the role of iron deficiency as a risk factor for febrile seizures among children from 6 months-5 years, western Iraq.

PATIENTS AND METHODS

A case control study has been conducted in AL Ramadi maternity and children teaching hospital, western Iraq during the period January to October of 2016. The study approved by the ethics committee of AL Anbar University, Medical College. All children who admitted with history of febrile seizure and their age ranged from 6 months-5 years were involved in the study as a febrile seizure group (FSG). The control group collected randomly from children between 6 months-5 years who they admitted for same hospital during study period with febrile illness & no seizures (non-seizure group, NFSG).

Detailed history and physical examination were done for them. Simple febrile seizure defined as single seizure that associated with peak of fever, last less than 15 minutes, once per day and generalized features, complex febrile seizures defined as seizure last more than 15 minutes, frequent per day or had focal features [11]. All patients with history of CNS infection and history of delayed developmental milestone were excluded. Information that collected from studied groups include

age, sex, degree of temperature at admission, causes of febrile illness (respiratory tract infection, gastroenteritis, otitis media, tonsillitis, others), nature of seizures, duration and frequency of seizure were all recorded for every patient. Five mls of blood was aspirated to assess Hb, hematocrit (PCV) and s. ferritin values in studied groups (ferritin Accu Bind, ELISA Microwells, USA).

IDA defined as Hb level less than 11 gm/dl. PCV less than 30%, vs. ferritin less than 12 ng/ml [6,12]. The data were statistically analysed using IBM SPSS vs. 23.0, p-value<0.05 was considered significant.

RESULTS

One hundred sixteen children aged 6 months-5 years were included in the study during the period mentioned previously. Patients were classified into two groups each of 58 patients. The cases group (FSG) involved 34 males and 24 females which indicates a male to female ration of 1.42:1, on the other hand, the control group (NFSG) consist of 36 males and 22 females with a male to female ratio of 1.64:1.

Regarding FSG, 48 (82.7%) of them had simple type febrile seizures, and the remaining cases had complex type (17.3%). Most of patients with febrile seizures 38 (65.52%) were below age of 3 years. Out of this group 22(37.93%) their age ranged from 12-24 months. Only four patients (6.9%) were found in the age group 6-12 months (Table 1).

The means age were 27.48 ± 14.83 and 23.24 ± 14.37 in FSG and NFSG respectively with no significant difference between them ($p=0.120$), (Table 2).

Table 1: Distribution of patients according to age, gender and case-control groups.

Age (Months)	FSG (n= 58)		NSG (n=58)	
	Gender		Gender	
	Males N (%)	Females N (%)	Males N (%)	Females N (%)
6<12	0 (0.0)	4 (16.67)	10 (27.78)	6 (27.27)
12<24	14 (41.18)	8 (33.33)	12 (33.33)	8 (36.36)
24<36	4 (11.76)	8 (33.33)	2 (5.56)	6 (27.27)
36<48	6 (17.65)	4 (16.67)	0 (0.0)	2 (9.09)
48 ≤ 60	10 (29.41)	0 (0.0)	12 (33.33)	0 (0.0)
Total	34 (100)	24 (100)	36 (100)	22 (100)

Table 2: Demographic characteristic and haematological findings of febrile seizure group and non-febrile seizure groups.

Variables		FSG (Cases)	NSG (Controls)	p-value
		(N=58)	(N=58)	
Age, months (mean ± SD)		27.48 ± 14.83	23.24 ± 14.37	0.12
Gender	Male N (%)	34 (59)	36 (62)	0.74
	Female N (%)	24 (41)	22 (38)	0.74
Temperature °C (mean ± SD)		38.86 ± 0.544	38.52 ± 0.580	0.001 *
Causes of febrile illness N (%)	Respiratory Tract Infection	30 (51.7)	10 (17.2)	0.0002*
	Gastroenteritis	20 (34.5)	38 (65.5)	0.011*
	Otitis media	4 (6.9)	4 (6.9)	1
	others	6 (10.3)	6 (10.3)	1
§ Hb g/dl (mean ± SD)		10.54 ± 0.83	11.16 ± 1.12	0.001*
§§ Pcv% (mean ± SD)		30.72 ± 1.58	34.50 ± 3.63	0.000*
s. ferritin ng/ml (mean ± SD)		20.97 ± 11.44	43.59 ± 26.15	0.000*
IDA N (%)		38 (65.52)	18 (31.03)	0.0003*

§ Hemoglobin, §§ Packed cell volume, * Significant difference

The Chi-square test revealed no significant association between gender and groups of the study (Chi-square=0.144, p-value=0.7). Percentages of gender groups were compared to each other in both groups and found to be not significantly different (Table 2). Mean temperature at admission was significantly higher in FSG than NFSG, (p=0.001).

Respiratory tract infection was significantly the most predominant cause of febrile illness in FSG 30 (51.7%) as compared to NFSG 10 (17.2%), whereas gastroenteritis was significantly lower in FSG 20 (34.5%) as compared to NSG 38 (65.5%) (Table 2).

Means Hb level, PCV% and s. ferritin levels were significantly lower in FSG than in NFSG, p values were all less than 0.05.

The proportion of IDA among FSG was significantly higher than that of NFSG, 38 (65.52%) vs. 18 (31.03%), p-value=0.0003.

DISCUSSION

Febrile seizures are the most common neurological disorder that occurs in children less than 5 years old without central nervous system infection or electrolyte disturbances.

In the current study FSs were pronounced predominately in children below age of 3 years (65.52%), mainly among 12-24 months age group which is in agreement with other studies [13,14].

The mean age of onset of FSs was 27.48 months which is nearly similar to others [4,5,15,16].

As described by other researchers [13,17] majority of patients with FSs had simple type of seizure (82.7%) and the remaining had complex type. The association between FSG, NFSG and gender groups was statistically insignificant which is comparable with results of other reports [18,19].

Moreover, Like other reports [15,20,21], this study revealed a significant high peak temperature at admission in FSG than NFSG. It was generally reported that fever is one the risk factors implicated in occurrence of FSs that may aggravate the worse effect of lack of iron on brain function which may precipitate seizure attack [17,22].

Regarding causes of febrile illness, respiratory tract infection was the predominant cause of febrile illness in FSG which is found to be significantly higher than that of the NFSG and that is in agreement with other studies [23-25].

On the other hand gastroenteritis was significantly lower in FSG than NFSG which supports the suggestion of its protective effect against FSs as reported by other studies [5,26].

Several previous publications from different countries worldwide clearly demonstrated the existence of association between IDA and FSs and they considered IDA as an important risk factor for occurrence of FSs [9,27,28].

This study carried out in the Western region of Iraq in order to cast light on some of the important concepts associated with main issue of the study. Accordingly, this study showed that there are statistically significant reduction in means Hb level, PCV%, s. ferritin level of (FSG) compared to (NFSG), in addition the proportion of IDA in FSG was more twice that in the NSG (Table 2). This results is in agreement with Daoud et al. report, from Jordan, [29] who study the association between IDA and s. ferritin, they thought that lack of iron could be possible cause of FSs. as they found a significant low mean s. ferritin levels and higher

percentage of cases with low serum ferritin $\leq 30 \mu\text{g/dl}$ among FSG than controls, $29 \pm 21 \text{ mcg/L}$ vs. $53.3 \pm 37.9 \text{ mcg/L}$, (p 0.000).

On other hand, Kumari et al. [30] used univariate and multivariate analysis for the data collected from the same purposes of this study, they observed a significant higher proportion of iron deficiency in FSG than controls, 63.6% vs.24.7%, p=0.001 which is complies with the results of the current study. The same conclusion reported by Momen et al. from Iran [18], whom they confirm the existence of positive relation between febrile seizure and IDA.

Habibian et al. [31] conducted a meta-analysis study and observed that IDA was moderately increased the chance of FSs in children especially in the regions of low or moderate percentage of IDA.

Moreover, similar significant association between IDA and FSs was pronounced by El-Shafie et al. [32], 2017 whom conducted a prospective case control study of 60 cases aged 6 months -5 years from Egyptian children, they found that 21 (52.5%) of cases had IDA compared to 4 (20%) of controls p<0.05.

However, other studies had proved otherwise and denied any association between IDA and FSs and thus did not agree with results of this study. Amirjalali et al. [33] Omen et al. [34] and Abaskhanian et al. [35] deduced a lack relationship between IDA and FSs.

Furthermore, Shinnar et al. [5] suggested that IDA was less common in febrile seizure patients than healthy children. Whereas Talebian, et al. [36] in a study involved 120 children aged less than 5 years, reported that IDA was more common in controls than FSG and concluded that IDA was not a risk factor but rather a protective factor against FSs.

Bidabadi et al. [15] in a case control study of 200 cases with febrile seizures and 200 controls aged 6 months-5 years, found that IDA was less frequent in patients with FSs than controls with no statistical difference between the two groups, but the protective effect of iron deficiency against FSs was not proved (odd ratio 1.175).

Indeed, these variations in results of these reports could be related to the variations in studies designs, different samples sizes and age groups involved, different measures used for diagnosis of IDA, nutritional status and prevalence of IDA among children involved in these studies from different regions. Unfortunately, no previous study was carried out in al Ramadi province, Western Iraq, regarding prevalence of IDA among children aged less than 5 years. Based on the results of this study, it can be concluded that IDA is about two times more predominant in FSs patients than in other patients with no FSs, and Iron deficiency is well recognized as a risk factor in children aged less than 5 year. In this context, early detection with proper correction of IDA will be effective in reducing rates of FSs among those children. Large sized prospective study is necessary to assess prevalence of IDA in children less than 5 years as well as to help evaluating nutritional problems that may contribute positively to the IDA.

CONCLUSION

According to sample size, males are more exposed to the risk of febrile seizure since the male to female ratio in the FSG was 1.42:1 and it was 1.64:1 in the control group. Febrile seizure does not occur on the basis of gender since no significant association found between gender groups and groups of study.

More than 65% of the patients in the FSG were below 3 years old. Patients' temperature at admission was found to be significantly higher in the FSG than in the NFSG.

The predominant cause of febrile illness in the FSG was the respiratory tract infection which accounted for a significantly higher percentage when compared to its counterpart in the NSG.

IDA proportion among patients in FSG was significantly higher when compared to that of the NSG.

Attention as well as rapid management for children admitted with respiratory tract infection very necessary to prevent worse deterioration as it may happen when such cases confront delayed medical procedures.

CONFLICT OF INTEREST

The author has no conflicts of interest relevant to this article.

REFERENCES

1. Abou-Khalil BW, Gallagher MJ, Macdonald RL. Epilepsies. In: Daroff RB, Jankovic J, Mazziotta JC, Pomeroy SL, eds. *Bradley's Neurology In Clinical Practice*. 7th edn. Philadelphia, PA: Elsevier; 2016; 101.
2. Shinnar S. Febrile Seizure. In: Swaiman KF, Ashwal S, Ferriero DM, eds. *Pediatric Neurology Principles & Practice*. 4th edn, Philadelphia: Lippincott Williams & Wilkins, 2006;1:1079-1089.
3. Paul SP, Blaikley S, Chinthapalli R. Clinical update: Febrile convulsion in childhood. *Community Pract*. 2012; 85(7):36-8.
4. Rosman NP. Evaluation of the child who convulses with fever. *Paediatr Drugs*. 2003; 5(7):457-61.
5. Shinnar S, Glauser TA. Febrile Seizures. *J Child Neurol*. 2002; 17:44-52.
6. World Health Organization. *Iron Deficiency Anemia Assessment, prevention and control. A guide for program Manager*. Geneva, 2001.
7. Beard JL. Iron deficiency alters brain development and functioning. *J Nutr*. 2003; 133(5):1468-72.
8. Stoltzfus R. Defining iron deficiency anemia in public health terms: A time for reflection. *J Nutr*. 2001; 131(2s-2):5655-75.
9. Sherjil A, Us Saeed Z, Shehzad S, Amjad R. Iron deficiency anemia—a risk factor for febrile seizures in children. *J Ayub Med Coll Abbottabad*. 2010; 22(3):71-3.
10. Rouault TA, Cooperman S. Brain iron metabolism. *Semin Pediatr Neurol*. 2006; 13(3):142-8.
11. Mikati MA. Febrile seizures. In: Stanton BF, Schor NF Behrman RE, Geme JWS. *Nelson Textbook of Pediatrics* 19th edn. Saunders Elsevier 2011.
12. Degrucc GC. *Clinical Hematology in Medical practice*, 5th. Victoria: Black well Science Ltd; 2004.
13. Aliabad GM, Khajeh A, Fayyazi A, Safdari L. Clinical, epidemiological and laboratory characteristics of patients with febrile convulsion. *J Compr Ped*. 2013; 3(4):134-7.
14. Shrestha D, Dhakal AK, Shakya H, Shakya A, Shah SC, Mehata S. Clinical characteristics of children with febrile seizure. *J Nepal Health Res Counc*. 2014; 12(28):162-6.
15. Bidabadi E, Mashouf M. Association between iron deficiency anemia and first febrile convulsion: A case control study. *Seizure*. 2009; 18(5):347-51.
16. Majumdar R, Haricharan KR, Venkatamurthy M. Iron deficiency as a risk factor for first febrile seizure. *J Evol Med Dent Sci*. 2013; 2(21):3834-3840.
17. Ghasemi, Valizadeh F, Taei N. Iron deficiency anemia in children with febrile seizure: A case-control study. *Iran J Child Neurol*. 2014; 8(2):38-44.
18. Momen AA, Nikfar R, Karimi B. Evaluation of Iron status in 9 month to 5 year old children with Febrile seizures: A Case-Control Study in the south west of Iran. *Iran J Child Neurol*. 2010; 4(2):45-50.
19. Modarisi M, Mahmoudian T, Yayhini O, Kelishadi R, Golestani H, Tavasoli A, et al. Is Iron insufficiency associated with Febrile seizure? Experience in an Iranian Hospital. *J Compr Ped*. 2012; 3(1):21-4.
20. Ala B, Nathalie G, Isabel F, et al. Genetic influence on the clinical characteristics and outcome of febrile seizures-A retrospective study. *Eur J Paediatr Neurol*. 2005; 9(5):339-345.
21. Derak hshanfar H, Abask hanian A, Ali mohammadi H, Modanlookordi M. Association between iron deficiency anemia and febrile seizure in children. *Med Glas (Zenicko)*. 2012; 9(2):239-42.
22. Glader B. Anemia of Inadequate production. In: Kliegman R, Behrman R, Jenson H, Stanton B (eds). *Nelson Textbook of Pediatrics*. 18th edn. Philadelphia, USA Saunders Elsevier 2007;2014-17.
23. Winkler AS, Tluway A, Schmutzhard E. Febrile seizures in rural Tanzania: hospital-based incidence and clinical characteristics. *J Trop Pediatr*. 2013; 59(4):298-304.
24. Shrestha SK. Role of CSF analysis for the first episode of febrile seizure among children between six months to five years ago. *J Nepal Pediatr*. 2010; 30(2):90-3.
25. Kaputu Kalala Malu C, Mafutu Musalu E, Dubru J M, Leroy P, Tomat A M, Misson JP. Epidemiology and characteristics of febrile seizures in children. *Rev Med Liege*. 2013; 68(4):180-5.
26. Lee EH, Chung S. A Comparative study of febrile and afebrile seizures associated with mild gastroenteritis. *Brain Dev*. 2013; 35(7):636-40.
27. Hartfield DS, Tan J, Yager JY, Rosychuk RJ, Spandy D, Haines C, et al. The association between iron deficiency and febrile seizures in childhood. *Clin Pediatr (Phila)*. 2009; 48(4):420-426.
28. Naveed-Ur-Rehman, Billo AG. Association between iron deficiency anemia and febrile seizures. *J Coll Phys Surg Pak*. 2005; 15(6):338-340.
29. Daoud AS, Batieha A, Abu-Ehteish F, Gharaibeh N, Ajlouni S, Hijazi S. Iron status: a possible risk factor for the first febrile seizure. *Epilepsia*. 2002; 43(7):740-3.
30. Kumari PL, Nair MK, Nair SM, Kailas L, Geetha S. Iron deficiency as a risk factor for simple febrile seizures –a case control study. *Indian Pediatr*. 2012; 49(1):17-9.
31. Habibian N, Alipour A, Rezaia Zaheh A. Association between Iron Deficiency Anemia and Febrile Convulsion In 3–60 months old children: A systemic Review and Meta-Analysis. *Iran J Med Sci*. 2014; 39(6):496-505.
32. El-Shafie AM, Abou El-Nour ESS, El-Hawy MA. Study of iron deficiency anemia in children with Febrile seizure. *Menoufia Med Journal*. 2017; 30(1):209-212.
33. Amirsalari S, Keihani Doust ZT, Ahmadi M, Sabouri A, Kavemanesh Z, Afsharpeyman S, et al. Relationship between iron deficiency anemia and febrile seizures. *Iran J Child Neurol*. 2010; 4(1):27-30.
34. Omen M, Hakim Zadeh M. Case-control study of the relationship between anemia and febrile convulsion in children between 9 months and 5 years of age. *Ahuaz J Uni Med Sci*. 2003; 1:50-4.
35. Abaskhanian A, Vahid shahi K, Parvinnejad N. The Association between iron deficiency and the first episode of febrile seizure. *J Bablo Univ Med Sci*. 2009; 11(3):32-36.
36. Talebian A, Momtaz manesh N. Febrile seizures and Anemia. *Iran J Child Neurol*. 2007; 2(1):31-3.