The Association between Iron Deficiency Anemia and Febrile Convulsion in Children

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Abstract

Objective: In this study our main goal is to evaluate the association between iron deficiency anemia and febrile convulsion in Children. Method: This prospective observational study was done in the tertiary medical college and hospital from September 2015 to September 2017. A total of 60 consecutive children who fulfilled the inclusion criteria were considered in this study. Result: During the study, grading of anemia was moderate to severe in majority of cases (60%). Most of the patients belong to <7 ng/ml group, 88%. Low serum ferritin has association with the occurrence of simple febrile Convulsion, also, febrile Convulsion was 6 times vulnerable to develop in moderate to severe anemia. Conclusion: From our study we can conclude that, IDA was associated with a moderate increased risk of FC in children, particularly in the areas with low and moderate prevalence of anemia. We also recommend that, in future studies, IDA and FC should be defined more precisely and the role of the important factors, such as socio-economic status and the serum levels of zinc, manganese, lead, etc., should be controlled to determine whether the association between IDA and FC is causal or not.

Keywords: Iron deficiency (IDA), anemia and febrile convulsion.

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INTRODUCTION

Febrile Convulsions (FC) refer to the convulsions that occur in children between the ages of 6 months and five years, with body temperature of 38°C or higher not resulting from Central Nervous System (CNS) infection or any metabolic imbalance without any prior afebrile seizures. This condition occurs in 2-5% of the children who are neurologically healthy [1]. The precise cause of FC is not known, but several genetic and environmental factors have been implicated [2].

Iron deficiency (IDA) is the most common nutritional deficiency in the world. Iron is an important micronutrient which is used by roughly all the cells in the human body. It is well understood that iron is a cofactor for several enzymes in the body and has a role in the neurotransmitters production and function, hormonal function and DNA duplication [3].

Iron deficiency stimulates the function of neurons and, consequently, increases the risk of convulsions [4, 5]. Similar conditions are observed in Attention Deficit Hyperactivity Disorder (ADHD) and Restless Leg Syndrome (RLS) [6]. Animal studies have shown the pathophysiology of this malfunction.

In this study our main goal is to evaluate the association between iron deficiency anemia and febrile convulsion in Children

OBJECTIVE

General Objective
- To evaluate the association between iron deficiency anemia and febrile convulsion in Children.

Specific Objectives
- To detect clinical characteristics of patients.
- To identify serum Ferritin level of the patients
**METHODOLOGY**

| Type of study | Prospective observational study. |
|---------------|----------------------------------|
| Place of study | Tertiary medical college and hospital. |
| Study period  | September 2015 to September 2017 |
| Study population | 60 consecutive children who fulfilled the inclusion criteria were considered in this study. |
| Sampling technique | Purposive |

**METHOD**

Samples with atypical febrile seizure, unconsciousness, electrolyte imbalance, having developmental anomaly, neurological deficit or with CNS manifestations were excluded from the study. Patient details such as age, gender, socioeconomic status was noted. A detailed history was taken regarding the duration and type of symptoms, systemic associations taken. Initial evaluation of the patients by history and clinical examination was performed and recorded in patients’ data collection sheet.

**STATISTICAL ANALYSIS**

Data were processed and analyzed using computer-based software SPSS (Statistical Package for Social Sciences) for windows version 22. Unpaired t-test was used to compare quantitative variables. Variables were expressed as range and mean ± SD. p value < 0.05 were taken significant. Students’ t test, Pearson’s correlation coefficient test, multivariate logistic regression analysis and Fisher’s exact test as applicable.

**RESULTS**

In Table-1 shows age distribution of the patients where most of the patients (51.7%) belongs to age group 13 months - 36 months then 40% belongs to 6 months - 12 months then 8.3% patients belongs to 37 months to 60 months.

The following table is given below in detail:

| Variable  | Distribution     | Percentage (%) |
|-----------|------------------|----------------|
| Age group | 6 months - 12 months | 40             |
|           | 13 months -36 months | 51.7          |
|           | 37 months -60 months | 8.3           |

In figure-1 shows gender distribution of the patients where male was 79% and female was 21%. Male patients were 58% higher than female. The following figure is given below in detail:
In Figure-2 shows residential area distribution of the patients where 80% patients belong to urban area the following figure is given below in detail:

![Figure-2: Residential area distribution of the patients](image)

In Table-2 shows clinical profile of the patients where grading of anemia was moderate to severe in majority of cases (60%). The following table is given below in detail:

| Clinical profile                  | %   |
|----------------------------------|-----|
| Family history of febrile seizure|     |
| Yes                              | 41.7|
| No                               | 5.3 |
| Anemia                           |     |
| Yes                              | 93.3|
| No                               | 6.7 |
| Severity of anemia               |     |
| Severe (3-6 gm/dl)               | 11.7|
| Moderate (6-9 gm/dl)             | 40.0|
| Mild (9-12 gm/dl)                | 48.3|
| Investigation                    |     |
| Hb (g/dl)                        | 10.3±8.7|
| MCV (fl)                         | 69.3±5.90|
| MCH (pg)                         | 23.7±2.65|
| MCHC (gm/dl)                     | 28.6±3.66|

In Figure-3 shows Serum Ferritin level of the patients where most of the patients belong to <7ng/ml, 88%. The following figure is given below in detail:

![Figure-3: Serum Ferritin level of the patients](image)

In Table-3 shows association of and anemia and serum ferritin between febrile Convulsion where low serum ferritin has association with the occurrence of simple febrile Convulsion, also, febrile Convulsion was 6 times vulnerable to develop in moderate to severe anemia. The following table is given below in detail:

| Clinical profile | Febrile Convulsion | 95% CI    |
|------------------|--------------------|-----------|
| **Anemia:**      |                    |           |
| Mild             | 41.7               | 5.3       |
| Moderate to severe | 2.47-14.85       |           |
| **Serum ferritin** |                  |           |
| <7ng/ml          | 93.3               | 6.7       |
| >7ng/ml          | 14.96-173.5        |           |
DISCUSSION

In our study the mean haemoglobin concentration of the cases were low. One study showed their cases group had anemia (defined by Hb less than 11gm/dl) but did not mention the severity of anemia [6]. Another study also showed similar result [7].

In the present study the mean MCH, MCHC, MCV and serum ferritin (ng/ml) were significantly less in patients which is supported by one report [8].

One study reported that, MCH was significantly low in case group. Also, several studies also noticed the mean Hb, HCT, MCH, serum iron level significantly lower in case group.

In this study majority cases had low serum ferritin level (<7 ng/ml) comprising 88%. One study mentioned that mean ferritin level was lower in children who had a convulsion with fever suggesting a possible risk factors in febrile convulsion. They have shown that the mean plasma ferritin level was significantly lower (p <0.0001) in the first febrile convulsion group compared to the control group [9].

In one study observed that only 22.5% child with febrile convulsion had iron deficiency anemia. Febrile convolution group had significantly high RBC indices (MCV, MCH, MCHC) [10].

In this current study we found low serum ferritin has association with the occurrence of simple febrile convulsion (CI 14.96-173.5). One report showed positive association of Iron Deficiency Anemia with febrile convulsion. In their study mean serum ferritin level incase 6.9 μg/L & in control 7.9 μg/L. children having febrile convulsion [11].

Another study reported that, the ferritin level is affected by the severity of fever and increases with fever [6]. Consequently, ferritin level could not be compared in Fc case and control group. Nonetheless, when groups with similar fever severity (temperature) were compared, ferritin level was found to be lower in the FC children compared with the healthy ones [7]. This is consistent with other findings from our meta-analysis [8, 9].

According to the one finding, 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 [10]. The role of iron has also been documented in the production of serotonin, dopamine, and Gamma-Butyric Acid (GABA).

CONCLUSION

From our study we can conclude that, IDA was associated with a moderate increased risk of FC in children, particularly in the areas with low and moderate prevalence of anemia. We also recommend that, in future studies, IDA and FC should be defined more precisely and the role of the important factors, such as socio-economic status and the serum levels of zinc, manganese, lead, etc., should be controlled to determine whether the association between IDA and FC is causal or not.

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