**Original Research Article**

**International Journal of Medical and Health Research**
**ISSN: 2454-9142**
**Received: 21-03-2020; Accepted: 26-04-2020; Published: 28-04-2020**
**www.medicalsciencejournal.com**
**Volume 6; Issue 4; 2020; Page No. 39-42**

# Assessment of serum magnesium level and its correlation with febrile convulsion in children of north Bihar Region

**Dr. Kripa Nath Mishra[1], Dr. Pankaj Kumar[2*], Dr. Anil Kumar[3]**

[1] Professor & HOD, Department of Pediatrics, Darbhanga Medical College & Hospital, Laheriasarai, Darbhanga, Bihar, India
[2] Junior Resident, Department of Pediatrics, Darbhanga Medical College & Hospital, Laheriasarai, Darbhanga, Bihar, India
[3] Junior Resident, Department of Pediatrics, Darbhanga Medical College & Hospital, Laheriasarai, Darbhanga, Bihar, India
[*] Corresponding Author: Dr. Pankaj Kumar

**Abstract**

**Background:** Febrile seizure is defined as seizure that occurs between the age of six month to five year, with temperature of more than 38ºC (100.4ºF) or higher, that are not the result of CNS infection or any metabolic imbalance, and that occur in the absence of a history of prior afebrile seizures. Low level of magnesium in serum below baseline is characterized by hyper-excitability of central nervous system leading to convulsions. Alteration in blood level of sodium, potassium, calcium, and magnesium has been implicated in the pathogenesis of developing seizures. Normal level of this electrolyte is necessary for CNS function. Magnesium is essential for membrane stabilization and nerve conduction. Hypomagnesaemia is characterized by hyper-excitability of CNS leading to convulsions.

**Aim:** Assessment of serum magnesium level and its correlation with febrile convulsion in admitted children of hospital.

**Materials and Methods:** This study was conducted in Department of pediatrics, Darbhanga Medical College & hospital, Laheriasarai, Darbhanga, Bihar from November 2018 to October 2019. This study was Observational prospective study and total 130 children of febrile convulsion was selected.

**Results:** Out of 130 total cases, 113 (86.67%) were typical febrile convulsions and 17 (13.33%) were atypical febrile convulsions. Hypomagnesaemia was seen in 21 (16 %) children, out of these 10 (47.36%) cases were males and 11 (52.64%) cases were females. Out of 17 atypical febrile convulsions, only 2 cases were having hypomagnesaemia and 15 were having normal magnesium level.

**Conclusion:** From this study we conclude that there was some association between hypomagnesaemia and typical febrile convulsions. We got positive correlation between level of serum magnesium and febrile convulsions. However large clinical studies are required to establish the associations of hypomagnesaemia and febrile convulsions.

**Keywords:** febrile convulsion, serum magnesium level, hypomagnesaemia

## Introduction

Febrile seizure is defined as seizure that occurs between the age of six month to five year, with temperature of more than 38ºC (100.4ºF) or higher, that are not the result of CNS infection or any metabolic imbalance, and that occur in the absence of a history of prior afebrile seizures [1]. Approximately 30-40% of children with episode of febrile seizures will experience recurrence, therefore febrile seizure is an important illness to understand and prevent [2]. Involvement of several factors like genetic predisposition, change in the level of neurotransmitter and some trace elements in pathogenesis of febrile seizures but exact pathogenesis is not fully understood. Several studies demonstrated that the level of some trace elements play a vital role in causation of seizures [3]. Between 2% and 5% of neurologically healthy infants and children experience at least one, usually simple febrile s eizure. Simple febrile seizures do not have an increased risk of mortality even though they are concerning to the parents. Complex seizures may have an approximately 2-fold long term increase in mortality rates, as compared with the general population, over the subsequent 2 years, probably secondary to a coexisting pathology.

The genetic population to the incidence of febrile seizures is manifested by a positive family history for febrile seizures in many patients. In some families, the disorder is inherited as an autosomal dominant trait, and multiple single gene that cause the disorder have been identified in such families. However, in most cases of disorder appear to be polygenic, and many genes predisposing to it remain to be identified. Genes associated with febrile seizures include SCN1A, SCN1B, SCN9A, and CPA6. In term of other etiologies, a dysregulation between the pro-inflammatory IL-1β, IL-6, and IL-8 cytokines and anti-inflammatory ILR-1A cytokines has been associated with febrile status epilepticus. A decrease ILR-1A/IL-8 ratio (suggestive of an overall pro-inflammatory state) is predictive of hippocampal abnormalities on MRI done after febrile status epilepticus. The ILR-1A/IL-8 ratio may thus prove to be a potential biomarker for identifying febrile seizure patients who may be at higher risk for developing mesial temporal lobe epilepsy later in life. Almost any type of epilepsy can be preceded by febrile seizures. A few epilepsy syndromes typically start with febrile seizures; these are generalised epilepsy with febrile seizures plus (GEFS+), Severe myoclonic epilepsy of infancy (SMEI or Dravet syndrome), and, in many patients, temporal lobe epilepsy secondary to mesial temporal sclerosis. GEFS+ is an autosomal dominant syndrome with a

highly variable phenotype. Onset is usually in early childhood, and remission is usually in mid-childhood. It is characterised by multiple febrile seizures and by several subsequent types of afebrile generalised seizures, including generalised tonic clinic seizures, absence, myoclonic, atonic or myoclonic astatic seizures with variable degrees of severity. A focal febrile seizure plus epilepsy variant, in which the seizures are focal rather than generalised, has also been described.

Dravet syndrome is the most severe of the phenotypic spectrum of febrile seizure-associated epilepsies. It constitutes a distinct entity, the onset of which is in infancy. It is initially characterised by febrile and afebrile unilateral colonic seizures that recur every 1 or 2 month. These early seizures are typically induced by fever, but they differ from the usual febrile convulsions in that they are more prolonged, more frequent, and focal and recur in clusters. Seizures subsequently start to occur with lower fevers and then without fever. During the second year of life, myoclonus, atypical absences, and focal seizures occur frequently and developmental delay usually follows. This syndrome is usually caused by de novo mutation, although rarely it is inherited in an autosomal dominant manner or may be inherited from a nonaffected carrier parent. Mutation in the SCN1A gene are the most common cause of Dravet syndrome. The same gene is mutated in the GEFS+ spectrum; however, in Dravet syndrome the mutation lead to loss of function and thus to a more severe phenotype. There are several milder variants of Dravet syndrome that manifest some but not all of the above features and that are referred to as Dravet syndrome spectrum or SMEI-Borderland. Rarely the GABRG2, SCN1B, and SCN2A genes may cause Dravet syndrome; however, in 10-20% of the cases a specific gene mutation is not identified.

The majority of patients who had prolonged febrile seizures and encephalopathy after vaccination and who had been presumed to have suffered from vaccine encephalopathy (seizures and psychomotor regression occurring after vaccination and presumed to be caused by it) turn out to have Dravet syndrome mutation, indicating that their disease is caused by the mutation and not secondary to the vaccine. This has raised doubts about the very existence of the entity termed vaccine encephalopathy. Each child who presents with a febrile seizure requires a detailed history and a thorough general and neurological examination. A CT or MRI is not recommended in evaluating the child after a first simple febrile seizure. The workup of children with complex febrile seizures needs to be individualised. This can include an EEG and neuroimaging. If the child is presenting with the first simple febrile seizure and is otherwise neurologically healthy, an EEG need not be performed as part of the evaluation. Febrile seizures often occur in the context of otitis media, roseola and human herpesvirus (HHV 6) infections; and infections with norovirus, enteroviruses, shigella, or similar agents, making the evaluation more demanding. In patients with febrile status epilepticus, HHV-6B (more frequently) and HHV-7 infections accounts for 30% of the cases.

The decrease level of magnesium in serum below baseline is characterized by hyper-excitability of central nervous system leading to convulsions. Alteration in blood level of sodium, potassium, calcium, and magnesium has been implicated in the pathogenesis of developing seizures. Normal level of this electrolyte is necessary for CNS function. Magnesium is essential for membrane stabilization and nerve conduction. Hypomagnesaemia is characterized by hyper-excitability of CNS leading to convulsions. The normal level of plasma magnesium levels are 1.5 to 2.3 mg/dl. Infants have slightly higher plasma magnesium concentrations than older children adults. Only 1% of body magnesium is extracellular. Between 30% and 50% of dietary magnesium is absorbed. Good dietary sources include green vegetables, cereals, nuts, meats, and hard water. The small intestine is the major site of magnesium absorption, but the regulation of magnesium absorption is poorly understood. There is passive absorption, which permits high absorption in the presence of excessive intake. It probably occurs by paracellular mechanism. Most intracellular magnesium is bound to proteins; only approximately 25% is exchangeable. Because cells with higher metabolic rates have higher magnesium concentrations, most intracellular magnesium is present in muscle and liver.

Hypomagnesaemia is serum magnesium level is less than 1.5 mg/dl. Febrile convulsion is most common type of seizure in childhood.

Action of magnesium level in febrile seizure:- Glutamate is a major excitatory neurotransmitter in brain acting as an agonist at NMDA receptors. Extracellular Mg2+ normally blocks NMDA receptors. Hypomagnesaemia release of inhibition of voltage dependent gradient at NMDA receptors that leads massive depolarization of neuronal network and burst of action, after that this leads to glutamate mediated depolarization of the post synaptic membrane and enhancement of epileptiform electrical activity. Mg2+ also acts a voltage dependent calcium channel antagonist, thus hypomagnesaemia will leads to release of calcium ions, which causes nerve excitability [4]. Therefore, study is undertaken to find out the serum magnesium level and its correlation with febrile convulsions.

**Aim and objective**

To assess the serum magnesium level in children of febrile convulsion and its correlation.

**Materials and Methods**

This study was done in Department of pediatrics, Darbhanga Medical College & hospital, Laheriasarai, Darbhanga, Bihar, India from November 2018 to October 2019.This was an observational prospective study among the children coming to inpatient department.

A total of 130 children 6 month to 5 years of age presenting with fever and convulsions diagnosed as febrile convulsions were included and the serum magnesium levels were measured using catalyst method by synchron CXR systems. Informed consent was taken from parents of all the children. Detailed clinical history was taken along with through clinical examination. Approval of the Institutional ethical committee was taken prior to conduct of this study.

**Inclusion criteria**

Children age group between 6 months to 5 years, with normal neurological development with a diagnosis of febrile convulsions.

**Exclusion criteria**

Metabolic disorder, CNS infection (encephalitis, meningitis), Electrolytes imbalance due to gastrointestinal disease, Children on magnesium supplements.

**Statistical analysis**

All data was collected and entered in Microsoft Excel and analyzed using Statistical Package for social sciences (SPSS) version 17. Descriptive statistics was used primarily. Categorical data were expressed in proportions and percentages. Pie chart, Bar chart and Bivariate correlation was used.

**Results**

A total 130 children of Febrile convulsion children were taken for this study of which 70 were males and 60 were female coming to inpatient department of hospital from various districts of north Bihar. As per amongst 130 cases 34 were infants, 36 toddlers and 60 were in preschool age. Serum magnesium levels were normal in 109 and in only 21 cases showed hypomagnesaemia. In our study there was found some association between serum magnesium level and febrile convulsion children.

Hypomagnesaemia was seen in 9 infants as compare to toddlers and preschool aged where only 4 and 8 respectively had hypomagnesaemia [as per table-1]

Other biochemical abnormalities that were noted in these febrile convulsion's children where hypocalcemia (20), hypoglycemia (8) and hyponatremia (6).

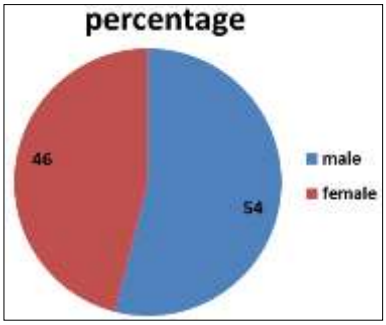


**Fig 1:** Case distribution of gender

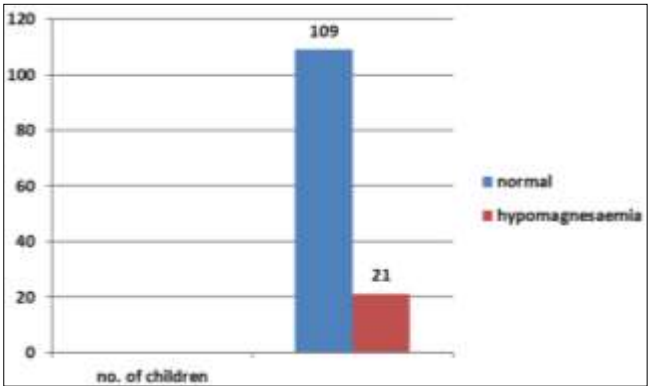


**Fig 2:** serum magnesium level

**Table 1:** Age wise distribution of serum magnesium level in febrile convulsion.

| Magnesium level | Infants (total 34) | Toddlers (total 36) | Preschool (total 60) |
|---|---|---|---|
| Decreased | 9 | 4 | 8 |
| Normal | 25 | 32 | 52 |

**Discussion**

Magnesium is the 4th most common cation in the body and the 3rd most common intracellular cation. It Is mainly found in bone, muscle and soft tissue [1]. Mg2+ is important for membrane stabilization and nerve conduction. The normal plasma magnesium concentration is 1.5-2.3mg/dl. Infant have slightly higher plasma concentration than older children and adults. Mg2+ is a chemical gate keeper, so calcium entry to nervous cell increase due to magnesium deficiency, and finally causes stimulation, spasm and convulsions. Hypomagnesaemia results in release of inhibition of voltage dependent gradient at NMDA receptor after that massive depolarization of neuronal network and burst of action takes place that leads to glutamate mediated depolarization of the post synaptic membrane and enhancement of epileptic form electrical activity. Magnesium also acts as a voltage dependent calcium channel antagonist, therefore hypomagnesaemia will leads to release of Ca2+ ions, which causes nerve excitability.

Mg2+ plays an important role in establishing the electrical potential across cell membrane as a result of its involvement in the Na+/K+ ATPase system which is responsible for maintaining sodium and potassium gradients across cell membrane. Recent evidence indicate that the deficiency of magnesium play a significant role in febrile convulsion [5, 6]. Mg+2 play an important role in establishing electric potential across cell membrane. It also affects calcium metabolism as the production of cyclic adenosine monophosphate (cAMP) is magnesium dependent, which in turn controls release of parathyroid hormone [5, 7]. Our study showed difference in magnesium level in between two groups which is similar to studies done by Prakash, Talebian and Sadinegad [8, 10]. However, studies done by Burhanoglu, Donalson, Rutter and Heipertz showed no difference in Magnesium level [11, 13]. A recent study done in 2013 in Ain Shams university and National research centre Egypt to asses blood levels of trace elements in familial febrile convulsion concluded that serum selenium and magnesium levels were significant low and regression model in their study showed that selenium and magnesium have protective effect in children with febrile convulsion [14].

**Conclusions**

Febrile convulsion is common type of convulsion in children. A positive correlation was found between levels of serum magnesium and febrile convulsion. Thus, children with low serum magnesium level are more prone to get febrile convulsions than children with normal magnesium levels. Statically significant association was found with hypomagnesaemia and typical febrile convulsions. Therefore, more studies at larger level required to establish a strong co-relation between the two.

**References**

1. Nelson's Text Book of Pediatrics, 21st edition:3092.
2. Leung A, Rob Edition, 2: son L, Febrile seizures, J pediatric health care. 2007: 2(4):250-5
3. Lihan A, Kali S, Var A, Akyol. Serum and hair trace elements levels in patients with epilepsy and healthy subjects: does the antiepileptic therapy affect the element concentration of hair. Eur J neural. 1999; 6:705-9.
4. Van Paerschan W, Bodian C, marker H, Metabolic abnormalities and new onset seizure in human immunodeficiency virus-seropositive patients Epilepsia. 1995; 36:146-150.
5. Benga I, Baltescu V, Tilinca R, *et al*. Plasma and cerebrospinal fluid concentrations of magnesium in

epileptic children. J Neuro Sci. 1985; 67(1):29-34.
6. Suter C, Klingman W, Neurological, manifestations of magnesium depletion states. Neurology (Minneapp).1955; 5:691-9
7. Chhaparwal BC, Kohli G, Potywali JN, *et al*. Magnesium level in serum and in CSF in febrile convulsions in infants and children. Indian j Paediatrics. 1971; 38(5):241-15.
8. Prakash Mishra O, Singhal D, Upadhyay RS, *et al*.cerebro fluid zinc,magnesium,copper and gamma aminobutyric acid level in febrileseizures. J Pediatr Neurol. 2007; 5(1)39-44.
9. Talebian A, Vakili Z, Talar SA, *et al*. Assessment of relation between serum zinc and magnesium levels in children with febrile convulsions. Iranian J Pathol. 2009; 4(4):157-60.
10. Sadi nejad M, Mohsenzadeh A, Varkoohi A, *et al*. Assesing serum magnesium level in 9 months till 5years old children with febrile convulsion in spring 1383 J Iranian Children Dis. 2002; 13:00-00.
11. Donaldson D, Trotman HH, Barton M, *et al*. Routine laboratory investigations in infants and children presenting with fever and seizures at the university hospital of west indies. West Indian Med J. 2008; 57(4):369-372.
12. Rutter N, Smales OR, Calcium, magnesium and glucose level in blood and CSF of children with febrile convulsions. Arch Dis Child. 1976; 51(2):141-3.
13. Heipertz R, Eichoff K, Karstens KH. Cerebrospinal fluid concentration of magnesium and inorganic phosphate in epilepsy. J Neuro Sci. 1979: 41(1):55-60.
14. Macdonian Journal of Medical Science 2014; 7(1):68-73. Assessment of the level of GABA and some trace elements in blood in children who suffer from familial convulsion osama *et al*.