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Study of serum magnesium levels and its correlation with febrile convulsions in children aged 6 months to 5 years of age at KVG Medical College and Hospital, Sullia

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Abstract
Objective: To determine the association between serum magnesium levels and febrile seizures and to compare the serum magnesium level in simple febrile seizures & complex febrile seizures.
Design: Observational Prospective study
Setting: tertiary care hospital
Participants: A Observational Prospective study was undertaken in children with febrile seizure attending Out-patient and In-patient Department of paediatrics in K.V.G. Medical College, Sullia. During the period 1st December 2019 to 30th November 2020.
Results: Total No. Cases studied: 80 over a period of one year from Dec 2019 to Nov 2020. Out of 80 cases, 45 (55%) were males and females 35 (45%). Amongst 80 cases 21 were infants, 22 toddlers and 37 were in preschool age. serum magnesium levels were normal in 68 (84%) and in only 12 (16%) cases showed hypomagnesemia.
Conclusions: No association was found with Gender, Age, and Temperature of the patient and subtype of febrile convulsions. Statistically significant association was found with hypomagnesemia and 'Typical Febrile Convulsions'. No such association was found with Atypical Febrile Convulsions. Therapeutic value of administration of Magnesium in children with Febrile convulsions associated with hypomagnesemia to be established. This requires further interventional studies. Larger clinical studies are required to establish the association of hypomagnesemia and febrile convulsions. Further studies are suggested to determine the effect of Magnesium administration for the prevention of febrile convulsions.

Keywords: febrile seizure, hypomagnesemia

Introduction

Febrile convulsions (FCs) are the most common type of seizure and occur in 2-4% of all children[1]. Factors like genetics, neurotransmitters level changes and a few of trace elements have been introduced as possible causes [2-4]; however, the main cause is unknown yet.

Febrile seizures: are convulsions that occur from 6 months to 60 months of age associated with temperature of ≥38 ˚C, that are not due to CNS infection or any metabolic imbalance and that occur in the absence of a history of prior afebrile seizures.

Simple febrile seizures: Primary generalized convulsions, usually tonic-clonic in nature associated with fever, lasting for maximum of 15 minutes, and do not recur within a 24 hours.

Complex Febrile Seizures: Prolonged seizures lasting>15 minutes / Focal and/or Recur within 24 hours.

Alterations in the blood levels of sodium (Na+), potassium (K+), calcium (Ca+) and magnesium (Mg+) have been implicated in the pathogenesis for developing seizures. Normal level of these electrolytes is necessary for maintaining central nervous system function. Changes in cell membrane ion gradient can lead to direct and indirect impact on nervous discharges and thus facilitating convulsion like activities [5]. Magnesium is a chemical gate-keeper, so calcium entry to nervous cell increases due to magnesium deficiency, and finally causes over stimulation, spasm and convulsion [6].

Various studies have shown the correlation between Magnesium, Zinc and Copper levels in serum and cerebrospinal fluid (CSF) and occurrence of Febrile Convulsions. Hypomagnesaemia is characterized by Hyper excitability of the central nervous system leading to convulsions. Hence the study is undertaken to find out the Serum Magnesium levels and its correlation with febrile convulsions

Materials and Methods

A total of 80 children 6 months to 5 years of age admitted with history of fever and convulsions diagnosed as Febrile Convulsions were included in the study 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 thorough Clinical examination. Complete Blood Counts, Serum Magnesium levels, Serum Electrolytes, Blood Glucose and Serum Calcium levels were done. CT scan brain was done

wherever required in patients admitted to the wards or attending the outpatient of Department of Pediatrics at K.V.G. Medical College, Sullia during the period 1st December 2019 to 30th November 2020.

Inclusion Criteria

Children from 6 months to 5years of age with normal Neurological development with a diagnosis of Febrile Convulsions and Children with febrile convulsion admitted for the first time to our hospital.

Exclusion Criteria

- Seizures due to CNS infections and metabolic causes
- Children with History of Neonatal seizures.
- Children on magnesium supplements and/or received magnesium recently.
- Children admitted with febrile convulsions but who were already evaluated during previous admission in our institution were excluded from the study

Results

Total No. Cases studied: 80 over a period of one year from Dec 2019 to Nov 2020. Out of 80 cases, 45 (55%) were males and females 35 (45%). Amongst 80 cases 21 were infants, 22 toddlers and 37 were in preschool age. serum magnesium levels were normal in 68 (84%) and in only 12 (16%) cases showed hypomagnesemia.

Temperature was <100 ˚F in 6 cases, between 100 ˚F – 102 ˚F in 70 cases and in 4 cases it was >103 ˚F which was statistically not significant p-value 0.4919.

Out of 12 hypomagnesemia cases, males were 5 (42%) and females were 7 (58%) with insignificant p value 0.2090.

Out of 69 cases of typical febrile seizure, 11 cases (16%) had hypomagnesemia which was statistically significant with p value 0.014. Out of 11 cases of focal seizure, 1 had hypomagnesemia.

Table 1

Mg Levels	Infants (21)	Toddlers (22)	Preschool (37)
Normal	16	19	33
Decreased	5	3	4

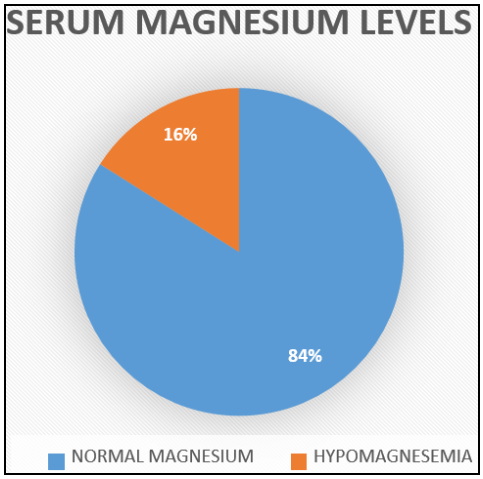

Fig 1

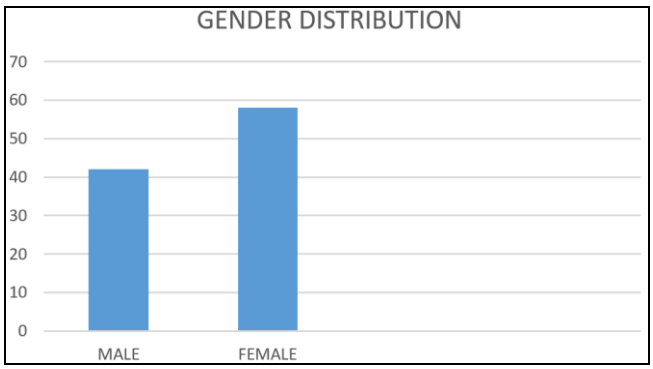

Fig 2

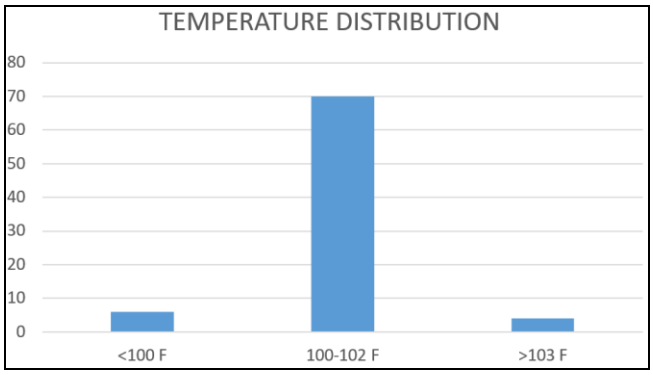

Fig 3

Discussion

Magnesium (Mg) is the fourth most common cation in the body and third most common intracellular cation. It is mainly found in muscle, other soft tissues, bone and erythrocyte [7]

It is also involved in neuronal function and it inhibits the facilitatory effects of calcium on synaptic transmission and also exerts a voltage dependent blockage of N-methyl-D-aspartate (NMDA) receptor channel [8].

It has been suggested that low serum Mg has occasionally been associated with significant effects on the central nervous system especially in causing seizures. It is suggested that an alterations in Mg concentrations in plasma and intracellular matrix gives rise to a functional impairment of the cell membranes, which might trigger seizures. Recent evidences indicate that the deficiency of Mg can play a significant role in febrile convulsions [9, 10]

Majority (99%) of magnesium is intracellular, the normal serum magnesium concentration is 0.7–1.15 mmol/l (1.7-2.8 mg/dl) [8]. Amongst 12 cases of hypomagnesium, 4 (33.33%) cases had serum magnesium levels between 1.4-1.5 mg/dl, 7 cases (58.33%) had serum magnesium levels between 1.3-1.4 and 1 case (8.3%) had s.mg levels below 1.3 mg/dl.

Our study had more female children with hypomagnesemia 7 (58%) than males 5 (42%) in contrast to other studies which showed male predominance, Baluram and Sherlin [11]and Mishra, Om Prakash, *et al* [12]. Other study like Ali Abbaskhan Iyan, *et al* [13]. also showed significant negative correlation between hypomagnesemia and severity of fever like in our study.

In our study there is positive correlation between hypomagnesemia and typical febrile seizure with p value of

0.0124 unlike in other studies like Ahmed Talebian, *et al* [14]. In our study the mean value for magnesium in normomagnesemia cases was 2.25+0.23 with P value calculated as 0.01224 which was significant and in hypomagnesemic cases it was 1.38+1.2 with p value 0.083793 which was not significant. Many other studies like Koshrashoni, *et al* [15]. also had no significant correlation between serum magnesium levels and febrile convulsion. Unlike in B.C. Chaparwal, *et al* . study [16] showed significant decrease in serum magnesium levels in febrile convulsions although total no of cases study was less.

Conclusions

No association was found with Temperature, Gender & Age and of the patient and subtype of febrile convulsions. Statistically significant association was found with hypomagnesemia and 'Typical Febrile Convulsions'. No such association was found with Atypical Febrile Convulsions. The value of administration of Magnesium in children with Febrile convulsions associated with hypomagnesemia to be established therapeutically. This requires further interventional studies to establish the same. Larger clinical studies are required to establish the association of hypomagnesemia and febrile convulsions. Further studies are suggested to determine the effect of Magnesium administration for the prevention of febrile convulsions.

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