Original Article

Serum Magnesium Profile in different grades of malnutrition

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Abstract

Background: Magnesium is the second most common intracellular cation in the body and plays an essential role in numerous biochemical reactions in vivo. Although magnesium supplementation is a time- honured pillar of management of PEM, the data on serum magnesium profile in PEM are conflicting and meagre. This study aims at evaluation of magnesium status in different grades of PEM.

Objective: For better management of PEM patients, to evaluate the role of magnesium in pathophysiology of PEM.

Methodology: A prospective comparative study was conducted in Dhaka. Shishu Hospital nutritional rehabilitation unit. Serum magnesium level was estimated of a total no. of 183 children, suffering from PEM.

Result: Serum magnesium level of well-nourished, mildly malnourished and moderately malnourished children were 1.99 meq/L, 2.14 meq/L and 2.14 meq/L respectively. Serum magnesium level of marasmus, kwashiorkor and marasmic kwashiorkor were 2.03 meq/L, 1.95 meq/L and 1.84 meq/L respectively.

Conclusion: Children suffering from oedematous malnutrition had lower serum magnesium status compared to non-oedematous malnutrition whereas magnesium status of non-oedematous malnutrition were comparable to the control group.

Key words: Protein-Energy malnutrition, serum magnesium profile.

Introduction

Malnutrition, the silent emergency, is a crucial problem worldwide. Directly or indirectly, it is the main determinant of physical well-being of man, U-5 children of development countries are the most effected by the havoc of malnutrition.[1] The role of magnesium in pathogenesis and management of malnutrition is underscored. Magnesium is the second most common intracellular cation in the body (next only to potasssium) and plays an essential role in numerous biochemical reaction in vivo.[2] It is involved in many enzymatic steps including synthesis of fatty acids and proteins, the glycolytic pathway, the formation of cAMP etc..[3] Magnesium depletion in PEM may remain asymptomatic or may produce symptoms such as tremors, athetiod movements, abdominal distension, seizure, psychomotor change etc..[4] Deficiency of magnesium is known to compromise primary and secondary immune responses.[5] Recently it has been demonstrated that hypomagnesemia may increase tissue susceptibility to lipid peroxidation, a process known to cause cellular injury which is main factor in pathogenesis of PEM.[6] Although magnesium supplementation is a timehonored pillar of management of children with PEM, the data on serum magnesium levels in malnourished children are conflicting and meagre. Moreover such data in Bangladeshi children of different grades of malnutrition is not available. This study is aimed at evaluation of magnesium status of Bangladeshi children suffering from different grades of malnutrition.

Patients and methods

This is a prospective comparative study conducted between 1st July 1997 to 31st December 1998 in Dhaka Shishu Hospital. About 1000 children are admitted every month in the hospital of which 50 are admitted in nutrition unit. Cases were selected randomly from among the hospitalized children aged 6-60 months who had been suffering from PEM. Controls were selected randomly from among the hospitalized children aged 6-60 months who were well-nourished. Children who received magnesium supplementation before or after admission to the hospital were excluded from this study.

Result

Serum magnesium level was estimated of a total of 183 children and the values obtained were analyzed against

a number of variables to explore perturbation of serum magnesium level influenced by different epidemiological, clinical and biochemical conditions of PEM children.

First the patients were classified into six groups according to anthropometry and clinical criteria, as shown in Table-I.

Table-I: Classification of study population.

Group	Wt. for age	Oedema	Clinical classification
A	>90% OF NCHS mean	(-)	Well nourished (control)
B	75%-90% of NCHS mean	(-)	Mild malnutrition
C	60-74% of NCHS mean	(-)	Moderate malnutrition
D	<60% of NCHS mean	(-)	Marasmus
E	60-80% of NCHS mean	(+)	Kwashiorkor
F	<60% of NCHS mean	(+)	Marasmic Kawshiorkor

Number of children in each group with corresponding values of serum magnesium is depicted in Table-II.

Table-II: Serum magnesium profile in different groups of study population.

Group	No. of Children	S.magnesium in meq/L (mean)	Standard deviation
A	33	1.989	0.141
B	30	2.138	0.352
C	32	2.140	0.306
D	30	2.031	0.377
E	28	1.950	0.250
F	30	1.843	0.303
Tatal	**183**	**2.0015**	**0.285**

Serum magnesium in different groups of patients were compared to the control. Children with mild malnutrition had significantly higher magnesium than the control ($P < O.05$). Children with kwashiorkor and marasmic kwashiorkor had lower level of serum magnesium than the control but the difference in these groups are statistically not significant ($P> 0.05$).

Discussion

In one study by P.N. Singla *et al* serum magnesium level was significantly low in children with moderate and severe malnutrition and even nearly half of the marasmic children had serum magnesium level in the hvpomagnesemic range (<1.25 meq/L).[7] In our study no value was in hypomagnesemic range. R.D montgomery in his study on 27 infants aged 9 to 24 months suffering from kwashiorkor or the closely related clinical syndromes of PEM commonly observed in Jamaica (Jellife DB et al) found that blood levels of magnesium were normal despite evidence of magnesium depletion on muscle biopsy and urinalysis of these patients. They postulated that these techniques are better indices of body magnesium depletion than the blood level.[8] Geaffry C Linder et al studied magnesium balance in 13 male children aged 1-2 years with acute kwashiorkor and postulated that body's magnesium store is considerably depleted in these patients.[9] Joan L Caddel et al evaluated 28 patients of severe malnutrition and found abnormally low plasma or serum magnesium values in 24 of them (85.7%), the mean value was 1.29meq/L (0.43 standard deviation) and in 19 patients plasma values were less than 1.4 meq/L,the accepted lower limit of normal.[10] PJ Pretorius et al discovered in his magnesium balance study that there was low excretion of magnesium in the urine but magnesium content of serum and RBS was almost invariably within the normal range and did not differ significantly from the values obtained in control subjects. They used magnesium balance study by calculating the difference between intake and fecal urinary excretion.[11] They showed that whereas normal subjects promptly excrted in urine the equivalent of nearly 90% of an intravenous dose of magnesium, patients who were depleted of magnesium retained the equivalent of 40% or more of the dose .This time honored test "The Thoren's test" or "The loading test" is highly preferred by the investigators to asses body's magnesium status.[12] According to NK Mittal et al, rectal mucosa is a relatively rapidly turning over tissue, is a portion of the target organ (gut mucosa) primarily affected in diarrhea and is easy to sample. Therefore it can be a preferable site to evaluate serial change in magnesium status in acute and chronic diarrhea so frequently co-exist with PEM.[13] Magnesium content of biopsied muscle was used for analysis by RD Montgomery. Serum magnesium analysis by colorometric dye complexion method as was used in our study, is suitable particularly in pediatric testing because only very small volume of blood (1ml) is required.[14] P N singla et al opined that serum magnesium estimation could be a good practice because of its simplicity. Magnesium content of mononuclear blood cells (WBC) may provide a better index for magnesium status than serum concentration.[15] Atomic energy spectrophotometry test remains the most accurate method for magnesium determination. R A Reinhart stated that assessment of total body magnesium status is better because only a very small portion (about 1%) of body's magnesium content is present in the serum.[16]

Conclusion

This study established serum magnesium profile in different PEM syndromes in Bangladesh. Children suffering from oedematous malnutrition had lower magnesium status compared to non-oedernatous malnutrition. Magnesium status of non-oedematous malnutrition syndromes were comparable to the control group. Magnesium supplementation is practiced in management of PEM. Although serum magnesium estimation is an easy technique, atomic energy spectrophotometry, magnesium balance studies and magnesium loading test (Thoren's Test) are better indices of body's magnesium status.

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