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Haematology

Evaluate the Effectiveness of Serum Magnesium Level in Patients with Newly Diagnosed Acute Leukemia

Dr. Md. Abdul Kader Zilani[1*], Dr. Jannatul Ferdous[2], Dr. Mohammad Nurul Islam Khan[3], Dr. Masuda Begum[4], Dr. Sushanta Kumar Barman[5], Dr. Showrab Biswas[6]

[1]Assistant Professor, Department of Haematology, Rangpur Medical College, Rangpur, Bangladesh
[2]Assistant Registrar, Department of Anaesthesiology, Rangpur Medical College Hospital, Rangpur, Bangladesh
[3]Assistant Registrar, Department of Medicine, Rangpur Medical College Hospital, Rangpur, Bangladesh
[4]Professor, Department of Haematology, BSMMU, Dhaka, Bangladesh
[5]Registrar, Department of Medicine, Rangpur Medical College Hospital, Rangpur, Bangladesh
[6]Registrar, Department of Haematology, Chottogram Medical College Hospital, Chottogram, Bangladesh

Abstract	Original Research Article

Background: Acute leukaemia is a clonal malignant disorder affecting all age groups. It is characterized by the accumulation of immature blast cells in the bone marrow. This results in bone marrow failure, reflected by peripheral blood cytopenias and circulating blast cells. In most cases the etiology is not obvious, but internal and external factors associated with damage to DNA can predispose to acute leukaemia. ***Objective:*** In this study our main goal is to evaluate the effectiveness of serum magnesium level in patients with newly diagnosed acute leukemia. ***Method:*** This Observational cross-sectional study was done at Department of Haematology, BSMMU, Dhaka from September 2016 to August 2017. During the study period of total 85 patients were enrolled for the study. ***Results:*** Most of the patient's age was found 36.17(±19.15) years, majority age group was found 10-40 years of age which was (62.4%). Regarding gender 55% were found male and 45% were found female and educational status 45(54.12%) were primary level, 21(24.71%) were SSC, 5(5.88%) were HSC and 07(8.24%). Majority (60%) of the patients were found married. Majority 59% of the patients came from poor class socioeconomic status followed by 40% were came from middle class socioeconomic status. Regarding occupational status 33(38.82%) were house wife, 10(11.76%) were day laborer, 12(14.12%) were farmer and 19(22.35%) was student. Regarding acute leukemia majority 60(70.6%) were found AML and 25(29.4%) ALL. ***Conclusion:*** From our result we can conclude that, significantly lower serum magnesium level was found in newly diagnosed acute leukemia patients. Among them significantly lower in ALL patients than AML patients. Half of the acute leukemia patients were found hypomagnesaemia.
Keywords: Acute leukemia, hypocalcemia, serum magnesium, hypomagnesaemia.

INTRODUCTION

Hematological malignancies (HM) comprise approximately 6.5% of all cancer incidences worldwide in 2012 [1]. WHO predicts that the number of blood-related cancer cases would increase about 48% in less developed countries by 2030 as compared to 2012[1]. Leukemia is a cancer of the bone marrow and blood, characterized by the uncontrolled growth of specific types of white blood cells. While leukemia occurs about 10 times more often in adults than in children [2]. Acute leukaemia is a clonal malignant disorder affecting all age groups. It is characterised by the accumulation of immature blast cells in the bone marrow. This results in bone marrow failure, reflected by peripheral blood cytopenias and circulating blast cells. In most cases the etiology is not obvious, but internal and external factors

associated with damage to DNA can predispose to acute leukaemia[3]. Trace elements at optimum levels are required for numerous metabolic and physiological processes in the human body. Zinc (Zn), Copper (Cu) and Manganese (Mn) are important cofactors for several enzymes that play a role in maintaining DNA integrity [4]. In addition, they are involved in membrane transport, nerve conduction and muscle contraction and also in the function of subcellular systems such as mitochondria. Cu, Zn, Mn and selenium also act as antioxidants [5]. Therefore, imbalances in the optimum levels of these trace elements may adversely affect biological processes and are associated with many fatal diseases, such as cancer. There are several reports on serum trace element levels in malignant diseases including leukemia and lymphomas [6].

Hypomagnesemia is a relatively common electrolyte abnormality in leukemic patients. It has been reported that low serum magnesium levels may be detected in as many as 30% of AL patients [7]. Several studies have shown an increase cancer rate in regions with low magnesium levels in soil & drinking water. Magnesium is actually the key to the body's proper assimilation and use of calcium as well as other important nutrients. Patients with hypomagnesaemia consume too much calcium without sufficient magnesium the excess calcium is not utilized correctly & may actually become toxic, causing painful conditions in the body. Hypocalcemia is a prominent manifestation of magnesium deficiency in humans [8].

METHODOLOGY

Type of study	Observational cross-sectional study
Place of study	Department of Haematology, BSMMU, Dhaka
Study period	September 2016 to August 2017
Study population	All newly diagnosed acute leukemia patients attending department of Haematology
Sampling technique	Purposive

METHOD

SELECTION CRITERIA
Inclusion Criteria
- All patients with newly diagnosis of acute leukemia.
- The diagnosis confirmed by bone marrow study and/or immunophenotyping.
- Giving informed written consent to participate.

Exclusion Criteria
- Patients already received chemotherapy.
- Patients already received any mineral supplementation.
- Moribund patients.
- Patient refuses to participate.
- Subject with diabetes mellitus
- Subject with diuretic therapy

Data Collection procedure
A pre-designed structured data collection sheet was used. For each and every subject separate data collection sheet was prepared. After selection of study subjects data was collected by details history taking and clinical examination. Written consent was taken from those who was agree to participate in the study. The patients were chosen according to purposive sampling as diagnosed case of acute leukemia attending department of Haematology. The diagnosis was confirmed by bone marrow study. All patients' data including demographical, clinical and laboratory data was collected to evaluate basic hemogram and trace elements status specially magnesium

Statistical Analysis
All data were processed by utilizing SPSS program (Version 23.0) and expressed as frequencies or percentages as well as mean (SD/SEM) as applicable. Unpaired t-test was used for continuous variables. Pearson's correlation coefficients were used between serum magnesium level with other sodium, potassium, chloride, calcium and albumin. The level of significance was determined as <0.05. p value <0.05 was declared as statistically significant.

RESULT

Age distribution of the study population
Table 1 showed mean age was found $36.17(\pm19.15)$ years, majority age group was found 10-40 years of age which was (62.4%).

Table-I: Age distribution of the study population (n=85)

Age in years	Number	Percentage
10-20 years	27	31.8
21-30 years	13	15.3
31-40 years	13	15.3
41-50 years	15	17.6
51-60 years	06	07.1
> 60 years	11	12.9
Total	85	100.0
Mean ±SD	36.17(±19.15)	Range (10-78)

OBJECTIVES
General objective
To determine the status of serum magnesium level in patients with newly diagnosed acute leukemia.

Specific objectives
- To measure magnesium level in study subjects.
- To correlate magnesium level with sodium, potassium, chloride
- To correlate magnesium level with calcium and albumin.

Sex distribution of the study population

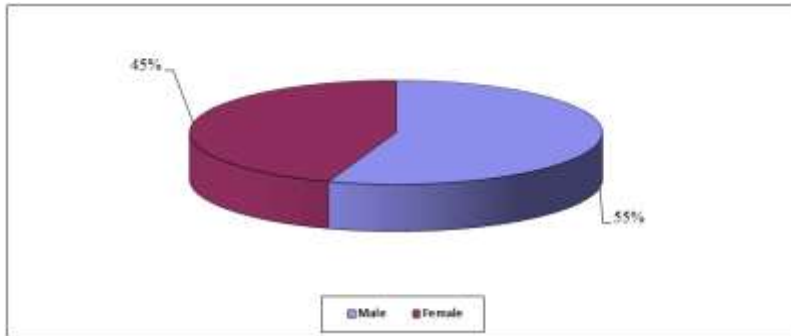Regarding gender 55% were found male and 45% were found female.

Fig-3: Sex distribution of the study population (n=85)

Educational status of the study population

Figure 1 showed regarding educational status 45(54.12%) were primary level, 21(24.71%) were SSC, 5(5.88%) were HSC and 07(8.24%).
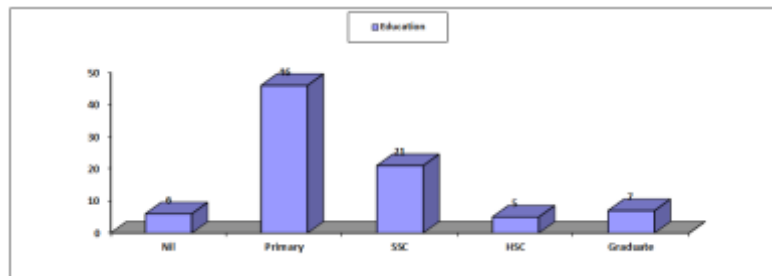

Fig-1: Distribution of educational status of the study population (n=85)

Marital status of the study population

Figure 2 showed majority (60%) of the patients were found married

Fig-2: Marital status of the study population (n=85)

Socio-economic status of the study population

Figure 3 showed majority 59% of the patients came from poor class socioeconomic status followed by 40% were came from middle class socioeconomic status.
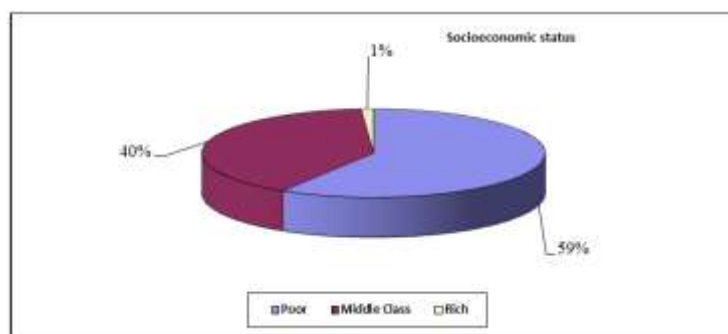

Fig-3: Socio-economic status of the study population (n=85)

Occupational status of the study population

Regarding occupational status 33(38.82%) were house wife, 10(11.76%) were day laborer, 12(14.12%) were farmer and 19(22.35%) was student.
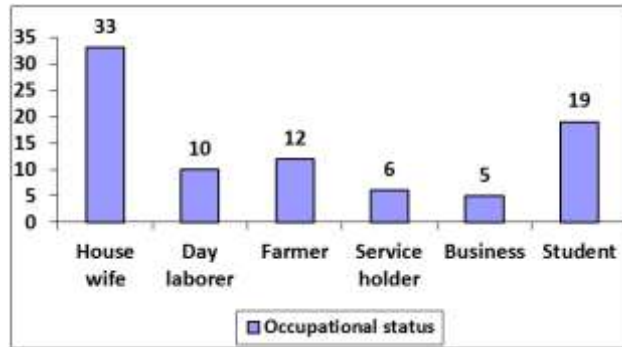
Fig-4: Occupational status of the study population (n=85)

Nutritional status of the study population

Table II showed regarding nutritional status 25(29.4%) was well nourished, 50(58.8%) was moderately nourished and 10(11.8%) was malnourished.

Table-II: Nutritional status of the study population (n=85)

	Number	Percentage
Well nourished	25	29.4
Moderately nourished	50	58.8
Malnourished	10	11.8
Total	85	100.0

Life style of the study population

Table III showed most (96.5%) of the life style was found active.

Table-III: Life style of the study population (n=85)

	Number of patients	Percentage
Moderately sedentary	03	03.5
Active	82	96.5
Total	85	100.0

Distribution of acute leukemia of the study population

Regarding acute leukemia majority 60(70.6%) were found AML and 25(29.4%) ALL

Table-IV: Distribution of acute leukemia of the study population (n=85)

Acute leukemia	Number	Percentage
ALL	25	29.4
AML	60	70.6
Total	85	100.0

Distribution of serum magnesium level of the study population

Regarding serum magnesium level majority 44(51.8%) was found hypomagnesaemia followed by 38(44.7%) were normal magnesium and 03(3.5%) were hypermagnesaemia

Table-V: Distribution of serum magnesium level of the study population (n=85)

Serum magnesium	Normal	Percentage
Hypomagnesaemia	44	51.8
Normal	38	44.7
Hypermagnesaemia	3	3.5
Total	85	100.0

DISCUSSION

In present study observed that the mean age was found 36.17(±19.15) years, majority age group was found 10-40 years of age which was (62.4%). Similar observation was found in Demir *et al.* study they showed that the average age of patients was 38.08±11.22 years (range 24-56)[9]. In study of Merza *et al.* also observed similar observation [10].

In present study regarding gender 55% were found male and 45% were found female. In study of Demir et al. observed that out of 42 cases 14(33.3%) of them were females and the other 28(66.7%) person were males [9]. In study of Merza *et al.* observed acute leukemia group composed of 42-person (AML: 38; ALL: 4), 14(33.3%) of them were females and the other 28(66.7%) person were males [10].

In present study investigation of the population, it was reported that mean serum sodium was 136.00±4.54 mmol/L, serum potassium was 3.77±0.49 mmol/L, serum chloride was 101.85±11.05 mmol/L, serum magnesium was 1.80±0.54 mg/dL, serum albumin was 34.56±6.47 g/L, serum calcium was 8.16±1.14 mg/dL, serum creatinine was 0.78±0.18 mg/dl, RBS was 5.98±1.22 mmol/l, Hb% was 8.75±1.97 gm/dl, ESR was 73.93±34.24 mm/1st hour, platelets count was 77.86±87.28 ×10^9/L, TWBC was 50.07±70.17 ×10^9/L and blast was 62.38±22.53%. In study of Demir *et al.* observed that the mean serum creatinine was found 0.85±0.32 mg/dL, Hb% was 8.93±0.91 gm/dl, plateletes count 36.4±11.7 ×10^9/L, mean WBC 51.5±35.1×10^9/L.

In present study observed that regarding acute leukemia majority 60(70.6%) were found AML and 25(29.4%) ALL. Similar observation was found Demir et al. they showed Acute leukemia group composed of 42 person (AML: 38(90.5%; ALL: 4(9.5%).

In present study observed that the mean serum magnesium was found 1.56±0.60 mg/dl in ALL patients and 1.89±0.49 mg/dl in AML patients which was significantly lower in ALL patient than AML patients (p =0.009). Mean serum Sodium, Potassium and Chloride were not significantly associated with ALL and AML patients. Merza *et al.* study observed that the mean concentration of serum magnesium (S.Mg) (mg/dl) in All 1.623(±0.453) (mg/dl), AML were 1.737 (±0.385) (mg/dl). Milionis *et al.* study reported that there were no significant differences in the incidence of serum Sodium, Potassium and Chloride between patients with AML and ALL, which was more frequently observed in AML patients [13].

In present study regarding serum magnesium level majority 44(51.8%) was found hypomagnesaemia followed by 38(44.7%) were normal magnesium and 03(3.5%) were hypermagnesaemia. In study of Demir *et al.* observed that the serum levels of Mg were significantly lower in with acute leukemia patients than in the controls (p<0.001) [9]. The decreased S[Mg] in ALL patients (65.7%) can be explained in accordance with the findings of Sahin *et al.* and Orhun *et al.* [11]. Moreover, Guo *et al.* reported that hypomagnesemia was a result of movement of extracellular Mg into the skeleton through bone formation after initiation of treatment for ALL [12].

The normal S [Mg] indicated by (38.2%) of total patients is in accordance with the observation made by Sahin *et al.* [11]. Other workers had also reported similar findings on the normal and decreased S[Mg] in patients with malignant disorders Atkinson *et al.* and Milionis *et al.* showed a controversial results that may have been related to the fact that S[Mg] are not always stable and may be affected by variable factors [13]. Thus, measurement of hair [Mg] seems to be a better indicator in the detection of its chronic deficiency as recorded by Sahin *et al.* and Donma *et al.* [11]. The increased S[Mg] represented as 3.6% in ALL are cases of hypermagnesemia. Conditions that interfere with the glomerular filtration (e.g. renal glomerular dysfunction) result in the retention of Mg and hence elevation of serum level [14]. Further work on the measurement of urine [Mg] would be valuable in distinguishing renal losses of Mg from other causes of hypomagnesemia.

CONCLUSION

Significantly lower serum magnesium level was found in newly diagnosed acute leukemia patients. Among them significantly lower in ALL patients than AML patients. Half of the acute leukemia patients were found hypomagnesaemia.

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