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Original Article

Serum magnesium level in patients with liver cirrhosis

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ABSTRACT

Aim: The present study was done to detect magnesium levels in serum in liver disorder like cirrhosis of liver and to compare them with the serum magnesium levels of controls. Methods: The subject group included 50 diagnostic cases of alcohol induced liver cirrhosis (group I) and 50 normal control group (group II). Serum magnesium levels were measured by spectrophotometer at 530 nm. (Wavelength range: 500-550 nm) in both the selected groups. Results: The study showed that serum magnesium levels were decreased in all cases of liver cirrhosis. The results were correlated with normal healthy control group from the levels of serum magnesium. Serum magnesium levels in groups I were found to be significantly lowered ($p < .0001$) than in group II. Conclusions: The decrease levels of serum magnesium in patients with liver cirrhosis indicates, that magnesium estimation in serum can serve as a valuable sensitive indicator of liver disorder, like liver cirrhosis.

1. Introduction

Liver Cirrhosis is most commonly caused by alcoholism and hepatitis B or C but has many other possible causes. Epidemiology of liver cirrhosis varies between gender, ethnic groups and geographical distribution [1]. Magnesium is an essential component of human body and other mammals, whose role in liver cirrhosis and its complications is still a matter of research. There are contrary reports about their serum concentrations in patients with liver cirrhosis. Magnesium is associated with more than 300 enzymatic reactions involving energy metabolism and protein and nucleic acid synthesis [2, 3]. It is also involved in immunoglobulin synthesis, immune cell adherence, antibody- dependent cytolysis, IgM lymphocyte binding, T helper B-cell adherence and additional responses [4]. Only 0.3% of total body magnesium exists in serum [5, 6]. Next to potassium it is the most abundant cation in the body [7]. Magnesium deficiency in various disorders likes' pulmonary tuberculosis [8], malabsorption syndromes [9], chronic alcoholism [10], bronchial asthma [11], epilepsy [12] prolonged gastric suction [13] and ischemic heart diseases [14], have been reported. The early signs of magnesium deficiency include vague symptoms such as loss of appetite, stomachache, and diarrhea. Longer-term deficiency symptoms may manifest as confusion, apathy, depression, irritability, arrhythmia, weakness, poor coordination, nausea, vomiting, electromyographic changes, muscle and nerve irritability, and tremors[15].The discovery of magnesium dates back to the year 1808 when it was first identified by Sir Humphrey Davy [16]. Its importance in rhythmical contractions of the muscle was demonstrated by J. Loeb in 1900 [17]. Willstatter in 1930 showed that magnesium occupied a central position in chlorophyll molecule[18].

Magnesium has many novel uses for common health conditions. As an antacid, magnesium salts react with gastric acid to form magnesium chloride, thereby neutralizing hydrochloric acid. As a laxative, magnesium acts osmotically in the intestine and colon as well as triggering the release of gastrin and cholecystokinin, stimulating gastric motility. The inhibitory effect of magnesium on pre-term labour contractions (tocolysis) is attributed to antagonism of calcium mediated uterine contractions, while the anticonvulsant actions of magnesium in eclampsia may be due to inhibition of neuromuscular transmission, and a resulting depressant effect on smooth muscle contraction [19].

The present study intended to determine the serum magnesium level in patients of liver cirrhosis and also to compare this finding with previous results.

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In spite of all these knowledge regarding importance of magnesium in human body, very little is known about magnesium metabolism in diseased states, in comparison to the extensive studies of calcium, sodium and potassium. The data that are available from such studies are not conclusive to draw definite relation between serum magnesium with liver cirrhosis. Hence, the purpose of this study was to detect serum magnesium values in liver cirrhosis patients and compare it with healthy subjects, and assessing the difference between them.

2. Materials and Methods

The study was carried out in the department of Biochemistry, Rohilkhand Medical College and Hospital, Bareilly. Total hundred subjects were selected and divided into two different groups. Group I included fifty diagnosed patients with liver cirrhosis. They were recruited for the study after taking their due written consent. The diagnosis of liver cirrhosis was established by detailed history of all such patients, positive findings on clinical examination, relevant biochemical tests and histopathological examination of the liver tissues. The subjects were in the age group of 31 to 62 years and all are male patients. Group II included fifty healthy control subjects. The age limits of this group were 31 to 62 years. The control subject includes 41 males and 9 females. Hypertension, chronic diarrhea, alcoholism, use of diuretics, reduced renal function and past history of severe liver disorders were exclusion criteria.

The fasting blood was collected from the cubital vein with all aseptic precautions in glass tubes free from electrolytes. Serum was separated and serum magnesium was measured by spectrophotometer at 530 nm. (Wavelength range: 500-550 nm) using Calmagite method [20].

The principle of the method depends on the formation of colored complex between magnesium ions and calmagite in alkaline medium. EGTA (ethylene glycol tetraacetic acid) reduces calcium interference, KCN (Potassium Cyanide) reduces interference of heavy metals and surfactant reduces interference of proteins and lipemia.

The procedure includes the incubation of only 10 µl of serum with 1000 µl of the reagent for five minutes at room temperature and the color intensity reflects the magnesium concentration in the serum.
Serum magnesium levels were calculated according to the following formula:

$$\frac{\text{Absorbance of Sample}}{\text{Absorbance of Standard}} \times 2 = \text{Magnesium MEq/L}$$

Reference Values:

Serum / Plasma

Males / Females 1.4 - 1.9 meq/L or 0.7 - 0.94 mmol/L

Statistical analysis was carried out using student t-test by EXCEL program (Microsoft Inc. USA). The difference is considered significant when $p < 0.05$.

3. Results

In our study total 100 participants, 50 diagnosed patients with liver cirrhosis (Group I) and 50 healthy control group (Group II). The age and sex distributions of Group I and Group II are shown in table 1.

Table-2 describes the serum magnesium levels significantly decrease in liver cirrhosis patients with the advancement in age. As seen from the table-3; mean concentration of serum magnesium in 50 diagnosed patients with liver cirrhosis was1.23 ± 0.098 meq/L, which is in hypomagnesemic range (below 1.40 meq/L). While in controls, mean concentration of serum magnesium was 1.55 ± 0.169 meq/L (p value < .0001).

Table -1: Age and sex distributions of Group I (liver cirrhosis) and Group II (healthy control group)

Group I (liver cirrhosis) n=50					Group II (Control subjects) n=50			
Age in years	No of cases	%	Male	Female	No of cases	%	Male	Female
31-38	07	14	07	00	07	14	05	02
39-46	16	32	16	00	16	32	12	04
47-54	18	36	18	00	18	36	16	02
55-62	09	18	09	00	09	18	08	01

Table-2: Serum magnesium levels in Group I (liver cirrhosis) and Group II (healthy control group) as per the age distribution.

Age in years	Percentage of cases	Serum Magnesium mean±SD, (meq/L)		p value
		Group I	Group II	
31-38	14	1.37 ± 0.025	1.70 ± 0.217	0.005
39-46	32	1.26 ± 0.077	1.62 ± 0.164	<.0001
47-54	36	1.21 ± 0.070	1.52 ± 0.104	<.0001
55-62	18	1.11 ± 0.048	1.40 ± 0.079	<.0001

Table-3: Showing serum magnesium levels (meq/L) in Group I (liver cirrhosis) and Group II (healthy control group).

Groups	Range	Mean	(±) SD	p value
Liver cirrhosis (Group-I)	1.05—1.35	1.23	0.098	
Control (Group-II)	1.30—1.90	1.55	0.169	<.0001

Group I versus group II p<0.0001 (HS)
HS- Highly Significant.

4.Discussion

In our study group-I (Liver Cirrhosis), 18 (36%) cases were in the age group of 47—54 years, 16 (32%) cases were in the age group of 39—46 years, 9 (18%) cases were in the age group of 55—62 years and 7 (14 %) in the age group of 31—38 years. Liver Cirhosis in this study group is found to be more common in male and mostly affects the middle age group (47-54 years) (Table-1).Our observation also reveals that the levels of serum magnesium are lower with advancement in age as in cases of liver cirrhosis (Table-2).

The result obtained from table-3 indicates that serum magnesium level markedly decreased in cases (liver cirrhosis) as compared to healthy controls ($p< .0001$). This finding is in conformity with the values reported by Wallach et al [21] , who reported the serum magnesium concentration significantly decrease in patients with liver cirrhosis in comparison to the control groups. Decrease serum levels of magnesium in Miller's research [22] as well as in research of Sullivan et al [23] were also found in cirrhotic patients. The research of Rocchi [24] and Suzuki [25] also confirmed the same. Kalbfleisch et al [26], who explained low serum magnesium level in liver cirrhosis is due to decreased nutritional intake of the metal and increased excretion of magnesium due to indirect effect of alcohol on renal tubules.

The other factors that might cause hypomagnesaemia in patients with liver cirrhosis include (1) poor absorption of magnesium in distal jejunum, (2) administration of magnesiuric diuretics (furosemide) and (3) decreased plasma level of albumin. (Kalbfleisch et al, 1963, Koivisto et al, 2002) [26, 27].

Our patients suffered from liver cirrhosis which is a chronic liver disease. The possible factors participating in the development of hypomagnesemia in our patients might be decreased nutritional intake of the metal and increased excretion of magnesium due to indirect effect of alcohol on renal tubules.

5. Conclusion

Serum magnesium levels were decreased in patients with liver cirrhosis as compared to normal controls. Therefore a routine biochemical assessment of magnesium status in patients with liver cirrhosis is an important step in the management protocol and to reduce progression of the disease.

6. References

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