

ORIGINAL RESEARCH

Estimation of serum magnesium in pulmonary tuberculosis and its associate with duration of illness

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ABSTRACT

Background- Tuberculosis has been a major health problem in developing countries including India. Magnesium is an essential cation and has an important role in the physiological functions of the body. **Method-** In the present study magnesium estimation was done with spectrophotometer in patients of the pulmonary tuberculosis, of varying duration of illness. **Result-** serum magnesium was done in 40 patients of varying duration of illness and it was found that, level of serum magnesium was inversely proportion to the duration of the illness. **Conclusion-** serum magnesium value was lower than normal in all patients of tuberculosis of varying duration.

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**INTRODUCTION
TUBERCULOSIS**

Over the years, tuberculosis has been one of the oldest human diseases, which has led to suffering and death in several cases. Along with the therapeutic, prognostic, and diagnostic impact, the economic and social impact of this disease has been huge.

The annual risk of pulmonary infection in India is nearly 1 – 2.5% as against 0.1-0.01% in the industrialized countries. However, the annual rate of decline of pulmonary infection in India is approximately 3%, as against > 10% in the industrialized countries.

Since, the Robert Koch's discovery of cases with tuberculosis in 1882, the microscopic detection of the bacilli in the clinical specimens has remained the backbone in the diagnosis of tuberculosis in the developing countries. However, in the human immunodeficiency virus era, the microscopic diagnosis is expected to have a few drawbacks. As a low clinical sensitivity of the technique in HIV – associated TB and lack of access to the quality microscopy services in HIV endemic areas. Recently, various technologies are being developed and introduced for the rapid as well as improved diagnosis of tuberculosis. This would comprise of growth based detection, advancements in microscopy, and

subsequent strain characterization, such as antigen detection, molecular detection, the drug susceptibility testing, coupled with the latest described Y-release essays.

Since, tuberculosis leads to widespread tissue damage, hence, other tests are expected to be an option for the indirect assessment for the disease activity of the pulmonary tuberculosis.

MAGNESIUM

The 4th most abundant and important cation. Magnesium is present as an intracellular cation in the living cells as well in the tissues.

The other important sources include the cereals, green vegetables, potatoes, dairy products (such as cheese), almonds, and beans.

The total magnesium present in the body is nearly 2400 Meq. nearly 2/3 of it is in the bones, which is present in the extracellular fluid and the rest in the soft tissues. Additionally, over 1.5 to 1.8 meq/L is expected to be maintained in the plasma. Further, nearly 15% of the magnesium content in the body is exchangeable with the tissues, however, there are variations. Muscles consist of approximately 20% of the exchangeable magnesium, whereas, it is just the reverse in the case of hypothyroidism. Magnesium found in blood is partly bounded to the proteins.

During the physiological pH conditions, nearly 1/3rd content is that of protein, and the remaining 2/3rd is the ionic concentration of the magnesium, which is 50% . (1)

ABSORPTION

The average daily intake of magnesium in humans is approximately 250-230 mg, which is majorly obtained from green vegetables, wherein Mg is found in the porphyrin group of chlorophyll. Nearly 1/3rd of the dietary magnesium is absorbed and the remaining is excreted in feces. Within half an hour, absorption takes place in a small bowl, beginning within an hour after ingestion and continues for over 2 to 8 hrs at a steady rate. By this time of the process, around 80% of the absorption is expected to have taken place.

Absorption gets doubled when the magnesium requirement is doubled and vice-versa. Increase in the absorption occurs due to the calcium deficient diets, whereas, decrease in the absorption takes place due to the extra amount of calcium present. A common transport mechanism is suggested for the intestinal tract for both Magnesium as well as Calcium. The intestinal mucosal state and mobility affects the absorption. In the Small bowel, the absorption is expected to decrease in the damaged mucosal state. The parathyroid hormone, which increases the absorption level, however, the phosphates, phytates, and the acids decreases the absorption. Magnesium is lost from the body in the form of sweat, and feces (nearly 60 to 80% of Mg is lost in the form of feces). Some amount of magnesium is lost in the form of sweat daily.

In the case of normal healthy adult diet, 3 to 17 meg of Magnesium is excreted daily. Increase in the diet, increases the calcium produced, and the rise in excretion of Magnesium parathyroid hormone reduces the excretion. Aldosterone, GH, and ADH help increase the excretion. There are nearly 80% higher excretion rate in the case of hyperthyroidism. Increased excretion results in the chronic alcoholic with the delirium tremens.

Magnesium is included as an activator and cofactor for spectrum of the enzymatic action. This is very important for the carboxylation and glycolytic enzymes.

Magnesium exerts effect on the neuro-muscular region. The low levels are expected to produce hypomagnesaemia which is nearly 20%, whereas, the higher levels deprives of no conduction at neuromuscular junction. The magnesium is present in the parts such as, in the dental enamel, and bones. The hypomagnesaemia has been reported in the cases such as adrenocortical insufficiency, uncontrolled diabetes mellitus, advanced and acute renal failure, and hypothyroidism. The low level of magnesium is seen in the Kwashiorkor prolonged gastric emptying time (such as portal cirrhosis, hyperthyroidism, delirium tremens, primary aldosteronism, renal diseases) and malabsorption.

In men, the magnesium deficiency rarely occurs.

In the animals, Cattle grazing in the fields fertilized with the nitrates are expected to occur on account of its high content in the diet. The absorption of Magnesium is impaired by the formation of the insoluble Ammonium Magnesium Phosphates. (2 & 3)

In the case of humans, the experimentally induced Magnesium depletion was reported in two patients and both patients were fed with Magnesium deficient synthetic diets, one for 414 days and the other for 274 days. In both the cases, the magnesium fell slowly over few months. In the human beings the clinical Hypomagnesaemia were seen in the cases of gross tremors, abnormal EMG, hyporeflexia, and positive chopstick sign. The convulsion occurred in both the cases of hypomagnesaemia and despite adequate therapy developed hypokalemia and hypocalcaemia.

Therefore the purpose of their study is to detect serum management levels in pulmonary tuberculosis patient of varying illness duration.

Management deficiency has been shown to correlate with a number of chronic cardiovascular disease, including hypertension, diabetes mellitus & hyperlipidemia (1-2). Nearly 50 medications have been implicated as including hypomagnesaemia (4-5).

AIMS & OBJECTIVES

- To study the levels of serum magnesium in cases of pulmonary tuberculosis and to find out the correlation with the pulmonary tuberculosis of varying duration.

MATERIALS & METHODS

This is a case-control study. Present study was conducted in 40 subjects attending medical OPD, admitted in the S.N.M.M.C.H, Dhanbad over period of may 2023 to April 2024 and normal individuals served as a control.

SELECTION OF PATIENTS

Inclusion criteria: All the patients with radiological evidence, symptoms, & sputum examination positive for AFB with ZN method were included.

Exclusion Criteria: Any chronic debilitating condition, malabsorption, alcoholism, pancreatitis, patient, on diuretics & other medications, affecting serum magnesium levels adversely, were excluded from the study.

A detailed history was taken and through examination was done in every case. The diagnosis of tuberculosis was confirmed by sputum examination for AFB by ZN staining. Cases were divided with duration of the disease as category 1, duration < 1 months, category 2, between 1 month to 3 months and category 3, more than 3 months duration of the illness.

SERUM MANAGEMENT ESTIMATION

Was done by spectrophotometer each blood sample centrifused at 5000 rpm for 20 minutes the supernatant of blood serum was used for the analysis

of magnesium. Statistical analysis was carried out version 20. with Satisfical package for social sciences SPSS

OBSERVATIONS

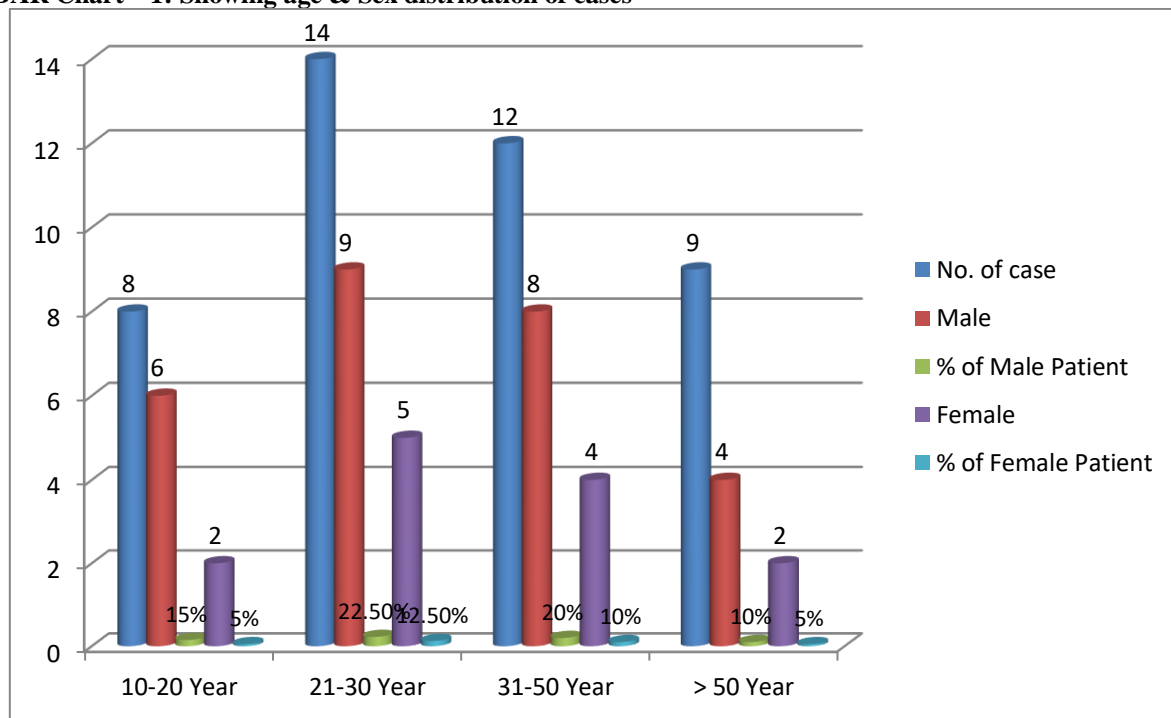
Table-1 Serum Magnesium levels in Patients & Control

Variable Mean ± SD	Control	T.B. Patient
Magnesium in mg/dl	2.10-2.70 mg/dl	1.05-2.60 m

Table 2: Age & Sex wise distribution of the cases

Age	No. of Case	Male	Female
10-20 Year	8	6 (15%)	2 (5%)
21-30 Year	14	9 (22.5%)	5 (12.5%)
31-50 Year	12	8 (20%)	4 (10%)
> 50 Year	9	4 (10%)	2 (5%)

BAR Chart – 1: Showing age & Sex distribution of cases



Therefore the purpose of their study is to detect serum management levels in pulmonary tuberculosis patient of varying illness duration.

Table 3: Duration of illness wise distribution of cases

Category	Duration	No. of case
Category – 1	1 Month Duration	12 (30%)
Category – 2	1 to 3 Months Duration	21 (52.5%)
Category – 3	3 Months Duration	7 (17.5%)

Table 4: Average and mean level of serum magnesium with duration of illness

Category	Average	Mean Serum magnesium
Category – 1	1.92-2.60 mg/dl	2.12 mg/dl
Category – 2	1.30-1.40	1.35 mg/dl
Category – 3	1.09-1.21	1.12 mg/dl

Bar Chart-2: Showing serum magnesium level with duration of illness

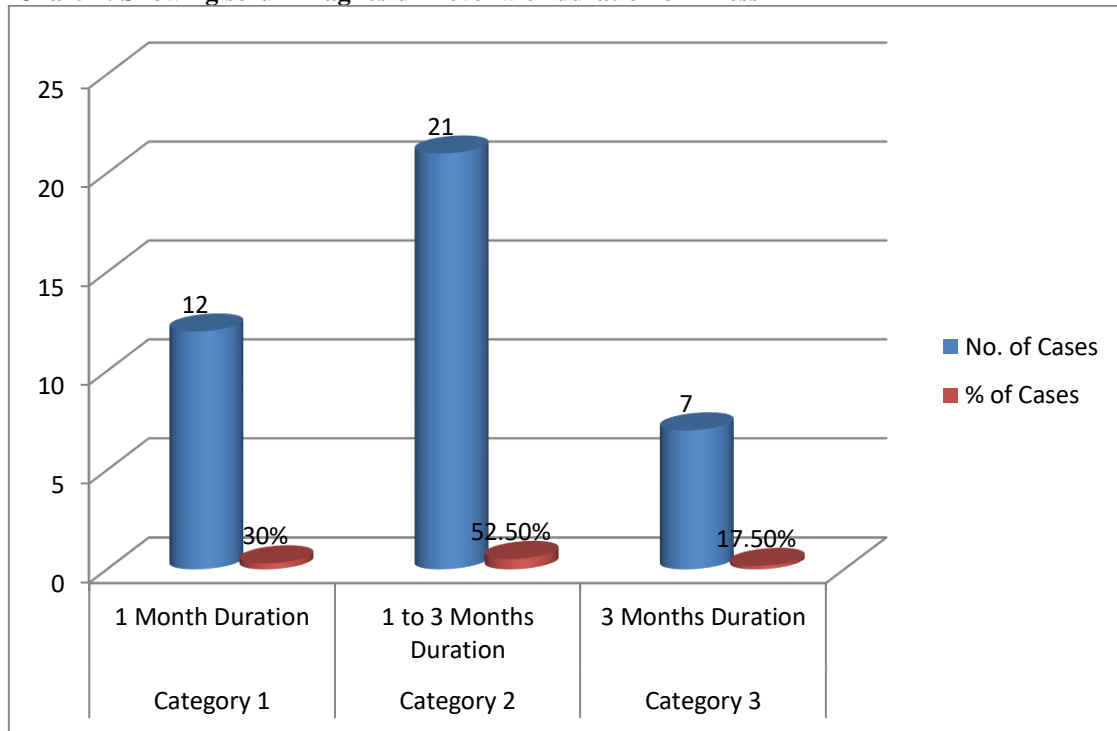
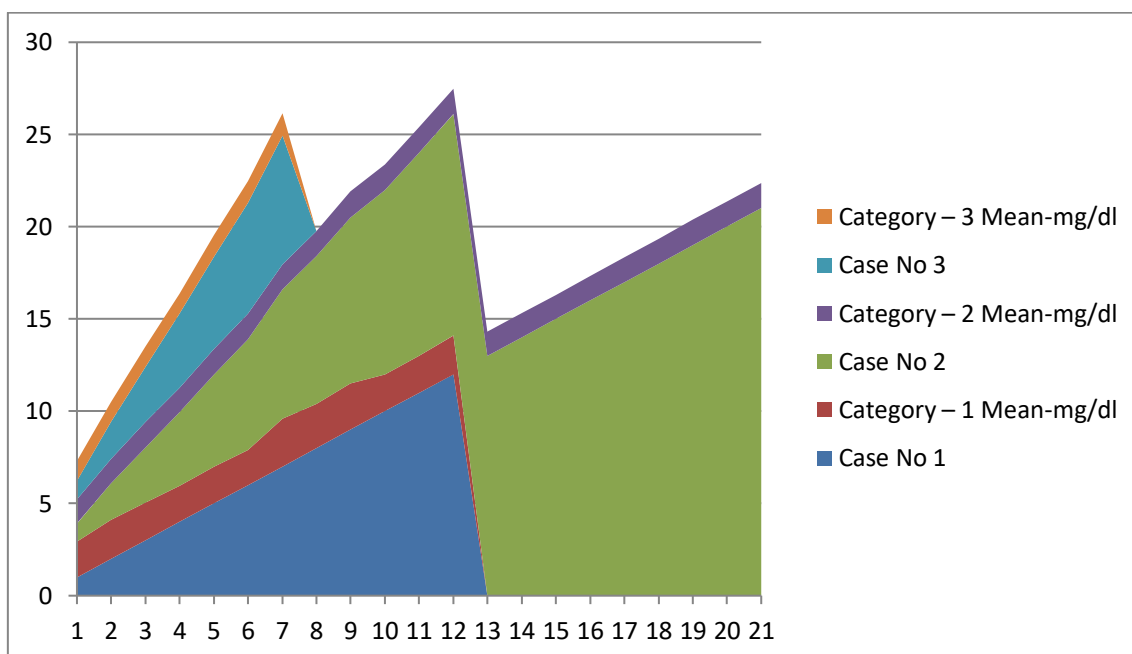
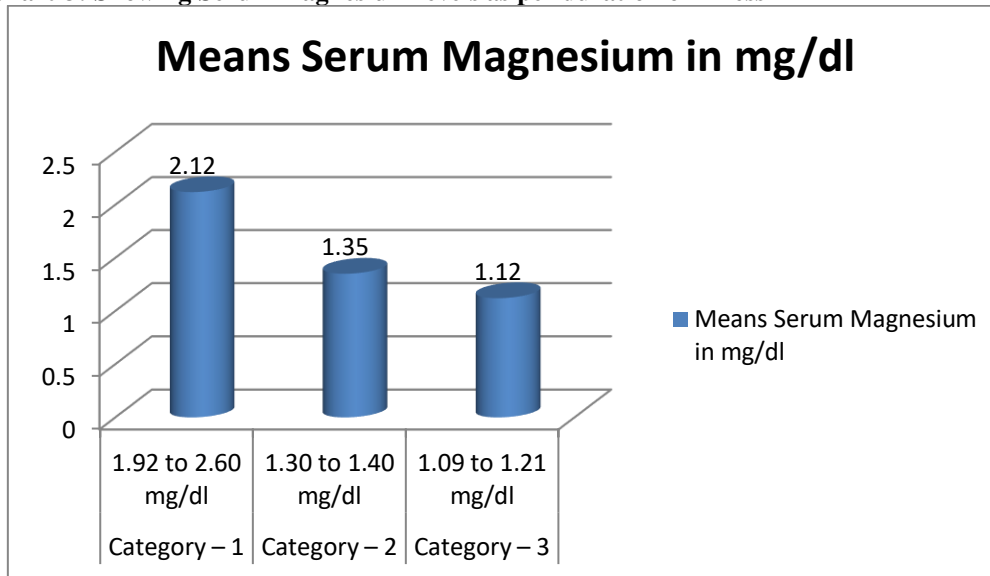


Table 5: Serum Magnesium Levels in all the cases of pulmonary tuberculosis with different duration of illness

Case No	Category – 1 Mean-mg/dl	Case No	Category – 2 Mean-mg/dl	Case No	Category – 3 Mean-mg/dl
1	1.92	1	1.3	1	1.08
2	2.1	2	1.32	2	1.07
3	2.05	3	1.36	3	1.09
4	1.94	4	1.33	4	1.11
5	1.99	5	1.39	5	1.16
6	1.9	6	1.38	6	1.2
7	2.6	7	1.35	7	1.19
8	2.4	8	1.38		
9	2.5	9	1.4		
10	1.98	10	1.4		
11	2	11	1.37		
12	2.1	12	1.38		
		13	1.32		
		14	1.31		
		15	1.3		
		16	1.33		
		17	1.35		
		18	1.34		
		19	1.38		
		20	1.35		
		21	1.38		

Colum Chart-3: Showing Serum magnesium levels as per duration of illness



Out of 40 cases studied the maximum no. of cases 14 (35%) were in the age group of 21 to 30 years followed next by age group between 31 – 50 years where we found 12 cases (30%) in the age group of >50 years we had only 6 cases (15%) in sex wise distribution of the cases. Maximum no. of cases were in the age group of 21-30 years while in the age group of 10 – 20 &> 50 years age group only 2 cases in each group was found.

We analyzed the values of serum management according to duration of the disease and it was observed that in category – 1 patient serum magnesium level was almost in the normal i.e. between 1.92 to 2.6 mg% with a mean value of 2.12 mg% while in category 2, patients serum magnesium levels was modestly decreased with a range of 1.30 – 1.4 mg/dl. And a mean value of 1.3 mg/dl suggesting

duration of illness bears, an inverse relation with the level serum magnesium. In category 3 patient serum magnesium level was markedly decreased (from 1.09 to 1.21 mg/dl) with a mean value of 1.12 mg/dl attributed probably to more pulmonary tissue destruction poor nutritional status, owing to prolonged duration of illness without treatment.

DISCUSSTION

It is reported that serum magnesium levels in patients with pulmonary tuberculosis is very much revealing. Hypomagnesaemia has been reported in uncontrolled diabetes, renal failure, Hepatitis, cirrhosis of Liver & ischemic heart disease, Magnesium is an essential mineral and controls many physiological functions of the body. (4 & 5)

Magnesium is essential for various enzyme systems as a cofactor that is responsible for cellular metabolism. The activating effect of magnesium extends to glucose utilization, Fat, protein, nucleic acid & co-enzyme synthesis & muscle Contraction. The lowered values of serum magnesium could be due to tissue destruction. due to disease process and a reduced intake of serum magnesium as a result of diminished appetite. These finding were consistent with that of jain et al 1976 ,Narang et al, 1984, Agrwal&Srivastava 1986. **(6, 7 & 8)**

Serum Magnesium estimation appears as a better marker than ionized magnesium because it is easily available & inexpensive.

Baquri at studied the level of serum Magnesium in pulmonary tuberculosis with different stages and found the inverse relation with the severity of the disease and level of the serum magnesium. **(9)**

Study done by Menon et al also showed that serum magnesium levels were significantly lower as compared to normal control. **(10)**

Podelensa had studied serum magnesium in pulmonary tuberculosis but could not find any significant change but he found low levels of serum magnesium in patients of pneumonia and he concluded in his study that it is an important marker to differentiate between pulmonary tuberculosis & pneumonia.**(11)**

Hence we can say that serum magnesium may indicate severity of the disease in the pulmonary tuberculosis.

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