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To study of serum magnesium, zinc level and albumin/globulin ratio in pulmonary tuberculosis patients and comparison with normal subjects

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Abstract
Tuberculosis remains the number one killer infectious disease affecting adults in the developing countries. The risk of developing active TB is greatest in patients with altered host cellular immunity, including extremes of age, malnutrition, cancer, immunosuppressive therapy, HIV infection, end-stage renal disease, and diabetes. Tuberculosis is considered as one of the most important infectious disease. It results in change in serum levels of many micronutrients in the immune system and metabolism. The aim of this study to estimate and compare serum Magnesium level, serum Zinc level and serum A/G ratio between pulmonary tuberculosis patients and normal subjects.

Keywords: Tuberculosis, Immunity, Magnesium, Zinc, Albumin, Globulin

Introduction

Tuberculosis (TB) is an airborne infectious disease caused by Mycobacterium tuberculosis and is a major cause of morbidity and mortality, particularly in developing countries[1].Most morbidity causing disease in the world and expected to continue in the same Position up to 2020. In 2001, the WHO estimated that 1.86 billions persons were infected with tuberculosis[2]. However, multidrug-resistant (MDR) and extensively drug-resistant TB, HIV-associated TB and weak health systems are major challenges. The World Health Organization is making an effort to dramatically reduce the burden of TB and to halve TB deaths and prevalence by 2015, through its Stop TB Strategy and supporting the Global Plan to Stop TB[3]. The risk of developing active TB is greatest in patients with altered host cellular immunity, including extremes of age, malnutrition, cancer, immunosuppressive therapy, HIV infection, end-stage renal disease, and diabetes.

According to Leo Galland, magnesium acts as a cofactor for immunoglobulin synthesis, immune cell adherence, antibody- dependent cytolysis, IgM lymphocyte binding, T helper B-cell adherence and additional responses [4]. Epidemiological studies have linked higher intakes of magnesium with lower incidences of respiratory problem.[5] Britton et al. demonstrated that a lower dietary magnesium intake was associated with impaired lung function, bronchial hyper-

reactivity and an increased risk of wheezing.[6]

Zn is an integral part of the structure and function of many biological enzymes and a regulator of ion transporters relevant to pulmonary function and disease in circulatory failures and other pulmonary disorders.[7] Zn is also known to exhibit powerful anti-oxidant activity in several organ systems including the lungs.[8]

Micronutrient deficiencies such as zinc deficiency lead to impaired immunity and thereby increase susceptibility to infections such as tuberculosis.[9] Zinc deficiency affect host defence by detraining phagocytosis and reducing the number of T cells. Several studies have demonstrated that the serum levels of zinc decrease significantly during active tuberculosis and increase following recovery after institution of anti-tuberculous therapy and improvement of the nutritional status .[10]

The study of serum protein profile in chronic diseases was undertaken primarily to identify factors of prognostic significance in patients with pulmonary tuberculosis. Weak associations, though statistically significant, were observed between the extent of tuberculous disease on admission and the concentrations of $\alpha_2$and gamma-globulins and the A/G and A/ α_2 ratios. It has been well established that in chronic infectious diseases like tuberculosis, the albumin content of serum proteins shows a decrease while the globulin content shows an increase leading to low albumin to globulin (A/G) and albumin to α_2-globulin (A/α_2) ratios.[11]

Materials and methods

All 100 subjects were randomly selected and aged between 30-70 year in Respiratory Medicine Department and T.B Clinic of PBM Hospital. Informed consent was obtained from each participant before their recruitment. The subjects were divided in to two groups one is 50 clinically diagnosed Pulmonary Tuberculosis patients will be represented as study group and 50 normal persons will be selected as control group. Patients on drugs containing zinc and magnesium in their constituents will be excluded from the study.

Collection of samples

5ml blood from antecubital vein has withdrawn in a perfectly clean dry syringe and was transferred to a clean dry vial slowly by the side of the vial after removing the needle to avoid haemolysis. The blood was allowed to clot at room temperature for 30 minutes and then transferred to a centrifuge tube. The serum was separated by centrifugation at 3000 rpm for 10 minutes.

Estimation of serum magnesium and zinc:

The serum magnesium and zinc were estimated by atomic absorption spectrophotometer (AA-7000) as described by Fernandez et al (1971),[12] in the department of Biochemistry, S.P. Medical College, Bikaner.

Estimation of albumin/globulin ratio[13]:

A) Estimation of serum protein: Mix the contents of the tubes thoroughly. Wait for 15 minutes and take the readings using a spectrophotometer at 540nm. Calculate the concentration in g/dL of total protein in the given serum.

B) Estimation of serum albumin: Mix all tubes by tapping them, one by one, against the palm. Let stand for 10 minutes at room temperature, take the reading in a spectrophotometer at 630nm. Calculate the concentration of serum albumin and determine the A/G ratio in patient's samples.

Results

The present study show the results in table no. 1 show the comparison of mean value of serum Zinc (µg%) level between control group (97.01±19.99) & study group (63.46± 9.539) and are highly significant ($p<0.0001$) and Comparison of Mean value of Serum Magnesium Concentration (mg%) in highly

significant (p <0.0001) in between two groups and in table no. 2 show the mean ± SD value of serum Albumin/Globulin ratio (1.790±0.2512) in control group & mean ± SD value in study group is (1.158±0.4871) and comparison between control & study group are highly significant (p <0.0001).

Discussion

The present study observed the comparison of mean value of serum Zinc (µg%) and serum magnesium level between control group and study groups and both are highly significant (p <0.0001). According to Rankovic and Drdevic[14] show that the zinc concentration in the effusion and serum are higher than 1.0 reliably indicates the presence of tuberculous pleurisy, signifying the diagnostic value of zinc in tuberculosis. Hassan Ghulam observed that estimation of serum zinc levels is an important tool in diagnosis and monitoring of response to treatment in pulmonary tuberculosis, and even a booster of the immunological mechanisms if instituted during the course of treatment[15]. According to Colonel Khursheed Muhammad Uttra et al show that the high percentage of zinc deficient patients of pulmonary tuberculosis promotes that estimation of serum zinc levels can be an important tool in treatment of pulmonary tuberculosis[16].This was likely due to the redistribution of zinc from plasma to other tissues, a reduction of the hepatic production of the zinc-carrier protein á -macroglobulin and a rise in the production of metallothionin, a protein that transports zinc to the liver.

Table 1: Comparison of Mean Serum Magnesium (mg%) and Mean Serum Zinc Concentration (µg%) in Pulmonary Tuberculosis Patients (Study Group) with Normal subjects (Control Group).

Blood Parameter	Normal subjects (Control Group)			Pulmonary Tuberculosis Patients (Study Group)			Significant
	Mean ± SD	Range	SE	Mean ± SD	Range	SE	P
Serum Mg (mg%)	2.063±0.3578	1.370-2.85	0.0506	1.3478±0.1707	1.060-1.660	0.02414	<0.0001
Serum Zn (µg%)	97.01±19.99	60.70-1.45	2.856	63.46±9.539	49.70-92.70	1.349	<0.0001

Table 2: Comparison of Mean Serum Albumin/Globulin Ratio in Pulmonary Tuberculosis Patients (Study Group) with Normal subjects (Control Group).

Values	Normal subjects (Control Group)	Pulmonary Tuberculosis Patients (Study Group)
Mean	1.790	1.158
Range	1.420-2.450	0.620-3.90
SD	0.2512	0.4871
SE	0.03588	0.06889
p	<0.0001	

The present study in Table no. 2 observed the mean ± SD value of serum Albumin/Globulin ratio is (1.790±0.2512) in control group & mean ± SD value in study group is (1.158±0.4871) and comparison are highly significant ($p < 0.0001$). The study of serum protein profile before and during treatment with short course regimens was undertaken primarily to identify factors of prognostic significance in patients with pulmonary tuberculosis. Weak associations, though statistically significant, were observed between the extent of tuberculous disease on admission and the concentrations of α2and g-globulins and the A/G and A/ α2 ratios. During treatment, the mean decrease in the concentration of α2 -globulin was more pronounced than that of the other globulins, and the increase in the A/ α2 ratio was substantially higher than that of the A/G ratio. Similar observations were made by Gilliland and others[11] who suggested that the A/ α2 ratio could be employed to assess the activity of the disease and to monitor the progress of the patient during chemotherapy.

Conclusion

Tuberculosis (TB) is an important global health problem which is declared as global emergency by world health organization (WHO) in 1993. The dietary deficiency of trace elements like Magnesium, zinc and Albumin/Globulin ratio have been associated with defective functioning of immune mechanisms in humans and hence these imbalance in these elements may be associated in the pathophysiology of infectious diseases like pulmonary tuberculosis.

The estimation of serum Magnesium, Zinc, Albumin/Globulin ratio can have an auxillary value in the early diagnosis and in monitoring the prognosis of subjects with pulmonary tuberculosis.

On the other hand we can only speculate as to whether the serum Magnesium, Zinc levels and Albumin/Globulin ratio could serve as a diagnostic tool and to assess the beneficial effects of anti tuberculous therapy, but further studies with larger group is necessary.

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