Original Article

Biochemical Parameters in Relation to Tuberculosis in Sudanese Patients

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ABSTRACT

Background: Malnutrition and wasting are associated with TB and HIV infection. Malnutrition and tuberculosis are both problems of considerable magnitude in most of the underdeveloped regions of the world. Nutritional status is significantly lower in patients with active tuberculosis compared with healthy controls. Both, protein-energy malnutrition and micronutrients deficiencies increase the risk of tuberculosis.

Objectives: To investigate the concentration of serum albumin, total protein, glutamate oxalo acetate transaminase (GOT), glutamate pyruvate transaminase (GPT) and zinc in Sudanese tuberculosis patients (TB), attending the Tropical Diseases Teaching Hospital, Khartoum State.

Materials and Methods: The study was performed on 60 tuberculosis patients, compared with 40 healthy individual age and sex matched used as control group .The study period was from April to August 2011. Serum albumin, total protein, GOT and GPT levels were determined by using clinical chemistry analyzer while zinc level was analyzed by atomic absorption spectro-photometers.

Results: Among TB patients the mean ±SD of plasma albumin, total protein, GOT, GPT and zinc respectively were 3.29±0.91, 7.55±1.59, 21.24±8.33, 9.12±6.34 and 0.47±0.17. The mean ±SD of plasma albumin, total protein, GOT, GPT and zinc for control group respectively were 4.19±0.93, 8.0±0.98, 26.0±9.08, 13.3±8.15, and 0.55±0.14. Statistically significant association was observed in all parameters between the patients and control group ($P<0.05$).

Conclusions: This study concluded that TB patients had significant decreased levels of all parameters; however albumin and GPT were more significant as compared to others.

Keywords: Tuberculosis, Total protein, Albumin, Liver enzymes, Zinc.

Approximately one third of the world population infected with mycobacterium tuberculosis and tuberculosis (TB) is one of the main causes of morbidity and mortality in developing countries[1]. Malnutrition and wasting are associated with TB and HIV infection. Co-infection with one may potentially exacerbate the wasting that occurs in the others[2]. Micro-nutrient deficiencies, such as zinc deficiency, lead to impaired immunity and thereby increase susceptibility to infections such as TB[3,4]. Zinc deficiency affects host defense by decreasing phogocytosis and reducing the number of circulating T cells5. Also zinc deficiency has been observed in HIV infection at various stages of the disease[6] and may be a co-factor for the progression of the disease[7]. Zinc in the body is involved in various activities, such as metabolic function, immunity and wound healing[8]. Albumin a major plasma protein of 69 KD has been reported low in TB[9]. If diagnosed and treated properly with anti-TB drugs, TB is a curable disease. These drugs can cause severe adverse reactions including hepatotoxicity, hepatic transaminase elevation, but symptomatic hepatotoxicity can be fatal without any intervention[10,11].Number

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of new TB cases during 2011 in Sudan were 2277 (=11% of new TB cases)[12].

Alanine Transaminase (ALT) also called Serum Glutamic Pyruvic Transaminase (SGPT) with a normal adult range of 7 - 56 IU/L rises dramatically in acute liver damage, such as viral hepatitis or paracetamol (acetaminophen) overdose. Aspartate transaminase (AST) also called Serum Glutamic Oxalocetic Transaminase (SGOT) is an enzyme associated with liver parenchymal cells found primarily in the liver, heart, kidney, pancreas and muscles. It is seen in tissue damage, especially the heart and liver. Normal Adult Range is 5 - 40 IU/L. The laboratory values are raised in acute liver damage. Elevated AST levels are not 'specific' for liver damage because it can also be used as a cardiac marker.

Malnutrition and tuberculosis are both problems of considerable magnitude in most of the underdeveloped regions of the world. These two problems tend to interact with each other. Tuberculosis mortality rates in different economic groups in a community tend to vary inversely with their economic levels. Similarly, nutritional status is significantly lower in patients with active tuberculosis compared with healthy controls.

Both, protein-energy malnutrition and micronutrients deficiencies increase the risk of tuberculosis. It has been found that malnourished tuberculosis patients have delayed recovery and higher mortality rates than well-nourished patients. Nutritional status of patients improves during tuberculosis chemotherapy. High prevalence of human immunodeficiency (HIV) infection in the underdeveloped countries further aggravates the problem of malnutrition and tuberculosis. Nutritional supplementation may represent a novel approach for fast recovery in tuberculosis patients. In addition, raising nutritional status of population may prove to be an effective measure to control tuberculosis in underdeveloped areas of world.

In vitro cellular killing by macrophages was found to be reduced during zinc deficiency and rapidly restored after zinc supplementation. Various studies on patients with tuberculosis had shown significantly lower plasma zinc level than those without tuberculosis, irrespective of their nutritional status[13,14].

MATERIALS AND METHODS:

Patients and controls: This prospective case-control study was performed on patients with a diagnosis of tuberculosis (TB) attending the Tropical Diseases Teaching Hospital, Omdurman, Khartoum State. A total of 60 repeated patients who developed clinical and/or laboratory evidence of TB from April to August 2011, were included and excluded patients with any other disease. These patients met the following diagnostic criteria for TB: serum albumin, total serum protein, GOT, GPT and zinc.

Sixty (60) patients diagnosed to have TB and treated with anti-TB drugs were selected and enrolled for this study. Forty (40), apparently healthy subjects were taken as controls for which observations were made during the same study period. The patients and controls were in the age group of 20-60 years. Written informed consent was obtained from all the subjects. Institutional Ethics Committee in Omdurman Islamic University approved the study protocol.

Study design: The type of TB, age, sex, ethnical groups, residues, occupations, history of jaundice was recorded. Method of establishing the diagnosis of TB was recorded: spectrum, x-ray and ESR. The details of anti-TB drugs (nature of drugs, dosages, duration of treatment and patient's observance) were noted. The nutritional status was estimated by calculating the body mass index BMI (kg/m^2). Patients with BMI range of 18.5 - 24.9 kg/m^2 were considered to have normal nutritional status.

Laboratory investigations including serum albumin, total serum protein, GOT, GPT and zinc were performed in all patients using standard laboratory procedures. 5 ml of blood sample were collected in plain vacationer tube from each individual of study population. The samples were centrifuged at 5000 rpm for 10 minutes and serum was obtained. Serum sample obtained was subjected to clinical

chemistry analyzer. Zinc was measured by atomic absorption spectrophotometric method.

Statistical analysis: Cases and controls were compared using the Student's t-test for continuous variables and the Chi-square test for dichotomous variables. Cornfield 95 per cent confidence limits were computed. Univariate logistic regression was performed on all clinical and baseline laboratory parameters to calculate odds ratio and then multivariate logistic regression was performed on all significant ($P<0.1$) parameters to calculate adjusted odds ratio. Serum albumin, total serum protein, GOT, GPT and zinc were converted into categorical variables while performing logistic regression. Statistical software package STATA 9.2 was used for data analysis.

RESULTS:

The various characteristics of the studied tuberculosis patients are presented in table (1). Table (2) shows the comparison between clinical and baseline laboratory parameters among the tuberculosis patients and the controls.

DISCUSSION:

The study population consisted of adult Sudanese with TB (aged 20-60 years) and a control group which comprised of healthy individuals matched for age and sex. The mean ages of both case and controls were compared. Predominantly those aged 21 to 60 years were mainly affected. This agrees with previous reports from developing countries where about 80% of affected individuals were age below 50 years[15-18], as compared with reports from developed countries where the majority of the infected population were more than 50 years of age. The finding of low serum proteins in our study population, which were predominantly in the low social class (table (1)), agree with the WHO declaration in 1982 that the prevalence of TB is inversely related to socioeconomic condition[19].

BMI was significantly lower in patients with TB compared with healthy group, which is in concurrence with a recent report from southern India[2]. The low BMI among patients with TB may be due to poor dietary intake, anorexia, impaired absorption of nutrients or increased catabolism[20]. The present observations are in concurrence with studies

Table (1): Characteristics of the studied tuberculosis patients (n=60)

Characteristics		N (%)
Ages (years)	<21	7(11.7)
	21-30	26(43.3)
	31-40	16(26.7)
	41-50	6(10.0)
	>50	5(8.3)
Sex	Males	40(66.7)
	Females	20(33.5)
Ethical groups	Nilo-Saharan	9(18.4)
	Afro-associated	26(53.1)
	Negros	14(28.6)
Residues	Rural	22(39.3)
	Urban	34(60.7)
Occupations	House wife	14(24.1)
	Free job	11(19.0)
	Student	11(19.0)
	Farmer	2(2.3)
	Worker	7(12.1)
	Police men	4(6.9)
	Driver	1(1.7)
	Teacher	1(1.7)
	Employee	1(1.7)
	No job	6(10.3)
Types of Tuberculoses	Pulmonary	52(86.7)
	Extra	8(13.3)
History of Jaundice	Yes	5(8.3)
	Not	55(91.7)
Spectrum	Yes	52(86.7)
	Not	8(13.3)
X-ray	Yes	51(85.0)
	Not	9(15.0)
ESR	Yes	26(43.3)
	Not	34(65.7)
Treatment	R+P+E	19(31.7)
	R	23(38.3)
	R+P	6(10.0)
	R+E	3(5.0)
	Not start	9(15.0)

Table (2): Comparison of clinical and baseline laboratory parameters between studied cases and controls (n=100)

Parameters (mean ± SD)	Cases (60)	Control (40)	P-value	Sig.
BMI (kg/m2)	20.24±3.05	22.48±3.80	0.000	Sig *
Serum Albumin	3.29±0.91	4.19±0.93	0.000	Sig *
Total Serum Protein	7.55±1.59	8.0±0.89	0.091	Sig
GOT	21.24±8.33	26.0±9.08	0.008	Sig
GPT	9.12±6.34	13.3±8.15	0.005	Sig *
Serum Zinc	0.47±0.17	0.55±0.14	0.012	Sig

Sig *(highly significant)

done in Indonesia[3]and Malawi[1]. Low BMI is a known risk factor for mortality[21].

Infection induces a reduction in plasma zinc and albumin levels in human beings as well as experimental animals. In this study plasma zinc and albumin levels were significantly reduced in patients with TB compared to healthy control. The possible causes for the low plasma zinc and albumin in TB patients were considered to be nutritional factors, enteropathy and acute phase reactant proteins[3,8]. The level of plasma zinc observed among TB patients was significantly lower than the controls, in agreement with a study in Indonesia[3]. Also, this was likely due to the redistribution of zinc from plasma to other tissues, or a reduction of the hepatic production of metabollothionin, a protein that transports zinc to the liver[22].

CONCLUSIONS:

This study concludes that, in the TB patients there is significant decrease of BMI, Albumin, total proteins, GOT, GPT and zinc. Among these albumin and GPT were strongly significant.

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