Lipid Profile in Tuberculous Patients: A Preliminary Report

Mohamed M. Metwally[1] and Hesham Abdel Raheem[2]

[1]Chest Diseases Department and [2]Clinical Pathology Department, Assiut University Hospital, Assiut, Egypt

Abstract: Background: Serum cholesterol in pulmonary TB patients is lower than healthy controls, but this is not clear if it is a risk factor or a consequence of the disease itself. **Study Objectives:** To detect any differences in lipid profile between Egyptian TB patients and controls and to test whether this difference changes after treatment or not aiming to prove if the difference is a risk factor for tuberculosis or a consequence of the disease itself. **Patients and Methods:** For new TB patients, we did a fasting serum lipid profile of serum cholesterol (SC), triglycerides (TG), low density lipoproteins (LDL) and high density lipoproteins (HDL). All patients received the same four antiTB drugs for 8 weeks then a follow up lipid profile was done. Samples for lipid profile from healthy controls were also taken. **Results:** We recruited 30 new TB patients, 14 women and 16 men with a mean age (±SD) of 33.4 ±13.25 years. There were 16 pulmonary TB and 14 other forms as pleural (5), TB lymphadenitis (5), TB peritonitis (4) plus 15 controls. Regarding the whole studied group, only serum triglyceride was significantly lower before treatment than control group ($P<0.01$) while both serum cholesterol and HDL showed a significant increase after treatment than before it ($P<0.01$ for both). Regarding pulmonary tuberculosis patients, both serum cholesterol and triglycerides were significantly lower on diagnosis than healthy controls ($P<0.05$ for both) and only serum cholesterol increased significantly after treatment than before it ($P<0.01$). **Conclusions and recommendations:** Hypocholesterolemia in Egyptian patients with pulmonary TB is present at the time of diagnosis. However, it proved to be a consequence of the disease rather than a risk factor as serum cholesterol significantly increased in both pulmonary TB and in the whole group after treatment.

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1. Introduction

Pulmonary tuberculosis is one of the oldest diseases, afflicting the human race since ancient times. A milestone in therapy was the discovery of drugs with antimycobacterial activity, beginning in 1944 with Streptomycin. With the currently available drugs, about 90% of pulmonary tuberculosis cases can be cured[1]. However, the success of the treatment depends on the use of appropriate antituberculous drugs, the adherence of the patient to treatment, the sensitivity of mycobacteria to drugs, and the control of associated diseases[2]. An additional factor that could negatively affect the efficacy of the antitubercular treatment is a deficiency in cellular immunity, which in turn can be influenced by nutritional status[3].

Guzman *et al.*[4] and ***Pérez-Guzmán***[5], found that most patients with pulmonary tuberculosis had low total serum cholesterol levels, and that values of about 90 mg/dL were strongly associated with mortality in those patients with miliary disease. Although very scantily investigated, these associations have been already mentioned by others. For example, ***Taylor*** and ***Bamgboye***[6] ***and Padmapriyadarsini***[7], found low cholesterol levels in Nigerian tuberculous patients.

Cholesterol constitutes up to 30% of the total lipid content in the cell membrane, and participates in the fluidity of this structure[8].***Thomas***[9] consequently, cholesterol is involved in the activity of membrane-bound enzymes and membrane functions such as phagocytosis and cell growth. In this context, ***Drabowsky*** *et al.* [10] demonstrated that cholesterol content in the cell membrane of human lymphocytes is important for their cytotoxic function. Moreover, in a work published by ***Gatfield*** and ***Pieters***[11] a clear derangement of the ability of the macrophage to phagocytose mycobacteria was observed when they were depleted of cholesterol. All of these findings are important in patients with pulmonary tuberculosis, inasmuch as activated lymphocyte subsets, such as CD4, CD8, and T cells, recruit macrophages and release molecules, such as interferon and tumor necrosis factor that render them more efficient in killing mycobacteria. In addition, cytotoxic lymphocytes (either CD4 or CD8) undergo phagocytosis of macrophages that have already internalized mycobacteria[12].

However, taking into account the above-mentioned clinical observations and in vitro studies, it was evident for us that in the case of pulmonary tuberculosis, a low-cholesterol level might have a detrimental effect. Unfortunately, this kind of studies cannot unveil whether hypocholesterolemia in tuberculosis is a consequence of the disease or a contributory factor. In a recent randomized clinical

trial in pulmonary tuberculous patients (new cases) hospitalized during the intensive phase of the four-drug antitubercular treatment, ***Guzman*** *et al.,* 2005 demonstrated that a cholesterol-rich diet notably accelerated the bacteriological sterilization of sputum[13].

Aim of the work:

To detect any differences in lipid profile between Egyptian TB patients and controls and to test whether this difference changes after treatment or not aiming to prove if the difference is a risk factor for tuberculosis or a consequence of the disease itself.

2. Patients and Methods

This study was conducted in Chest diseases department, Assiut University from May 2006 to November 2006. We recruited patients with newly diagnosed Tuberculosis of any type (never treated, newly diagnosed patients with bacteriologic confirmation of the disease) and excluded those with a history of diabetes mellitus.

For every patient who accepted entry to the study, we did a 12- hours fasting blood sample from a peripheral vein for serum cholesterol, triglycerides, low density lipoproteins, high density lipoproteins and fasting blood sugar (Hitachi 912 autoanalyzer, Roche Boehringer, Mannheim, Germany).

Diabetic patients were excluded from the study. All patients received the same four drugs antituberculous treatment during the intensive phase of 8 weeks on outpatient bases. They received a short-course regimen with four antituberculous drugs, which were administered daily at standard doses (Isoniazid, Rifampicin, Pyrazinamide, and Ethambutol, according to body weight), under the directly observed therapy strategy, as proposed by the World Health Organization.[14] Drugs were administered in the morning, approximately 30 to 60 min before breakfast. After 8 weeks, another follow up blood sample was taken under the same conditions. Blood samples from healthy controls were also taken.

Statistical Analysis:

Differences between the control group and the experimental groups were assessed by using the independent sample t-test while differences before and after treatment in the same patient was done by using paired sample t-test. Statistical analysis was performed using a statistical software package (SPSS version 10 for windows). Statistical significance was set at $p<0.05$ (two-tailed test). Data in the text and figures are expressed as frequencies or as the mean ± SD.

3. Results

We recruited 30 new TB patients, 14 women and 16 men with a mean age ± SD of 33.4 ± 13.25 years. There were 16 pulmonary TB and 14 other forms as pleural (5), TB lymphadenitis (5), TB peritonitis (4) (**Figure 1**) plus 15 controls.

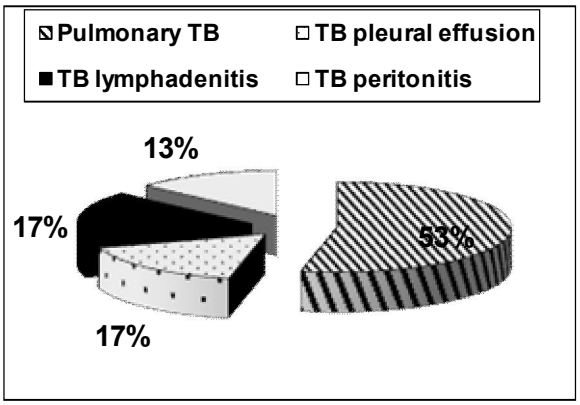

Figure 1. Percentage distribution of different recruited tuberculous cases

The mean ± SD in mg/dl of different serum lipid parameters for control group as well as the test group (before and after anti TB treatment) are shown in ***table 1***.

Table 1. Serum lipid profile in control and the whole test group before and after anti tuberculous treatment

Group Item	Control (I)	Whole Test Group		Significance	
		Before II	After III	I vs II	II vs III
Cholesterol…	144±34.6	135.8±30.8	155.7±28.4	NS	**S**
Triglycerides…	113.6±39.8	80.1 ± 23.5	76 ± 20	**S**	NS
HDL…	39.2±3.9	42.6 ± 15.1	58.3 ± 16.6	NS	**S**
LDL…	82±30.7	77.16±24.9	82 ± 23.6	NS	NS

S= Significant NS= Non-significant

Regarding the whole studied group, only serum triglyceride was significantly lower before treatment than control group ($P<0.01$) while both serum cholesterol and HDL showed a significant increase

after treatment than before it (P<0.01 for both). On evaluating the subgroup of pulmonary tuberculosis patients alone, we found that both serum cholesterol and triglycerides were significantly lower on diagnosis than healthy controls (P<0.05 for both) and only serum cholesterol increased significantly after treatment than before it (P<0.01) as shown in ***table 2***.

Table 2. Serum lipid profile in control and the pulmonary TB group before and after anti tuberculous treatment

Group Item	Control I	Pulmonary TB Group		Significance	
		Before II	After III	I vs II	II vs III
Cholesterol	144±34.6	120±26	148.6±30	**S**	**S**
Triglycerides	113.6±39.8	78 ±20.8	80.8±23	**S**	NS
HDL	39.2±3.9	37.7±16	53±16.5	NS	NS
LDL	82±30.7	66.9±18.8	79±28.6	NS	NS

S= Significant NS= Non-significant

4. Discussion

It is estimated that about one third of the world's population is infected with Mycobacterium tuberculosis[15], yet only a small proportion of these individuals (~10% of those not receiving preventive therapy) will develop active tuberculosis. Therefore, it is evident that some specific conditions predispose these individuals to develop the disease. In this sense, several studies have confirmed that patients with pulmonary tuberculosis often have low cholesterol levels[4,6]. This comes in agreement with the results of our study that showed a significantly lower level of serum cholesterol and triglycerides in pulmonary TB patients than controls. However, on evaluating the whole group with different TB presentations, there were only lower serum triglycerides than controls. To our knowledge, this is the first report that discusses lipid profile in tuberculosis in general so, there were no available results of previous researches to compare with. On trying to address the question of hypocholesterolemia if being a risk factor as suggested by ***Guzman*** *et al.*[16] or a consequence of the disease itself, we did a follow up serum cholesterol after stabilization of the disease. We hypothesized that if hypocholesterolemia is corrected after disease stability, then the patient would have normal serum cholesterol before being diseased and consequently, hypocholesterolemia would be considered as consequence of the disease rather that a risk factor as risk factors should be present before the disease and continue to be present after treating the disease. In this context, we found that serum cholesterol increased significantly after treatment in pulmonary TB as well as whole TB groups to a comparable level to that of healthy controls with no statistic significance (data not shown in tables). In this same line of thoughts, we may find that hypocholesterolemia is a common feature shared by several conditions traditionally considered as risk factors for developing tuberculosis, such as malnutrition[17], aging, gastrectomy,[18] intravenous drug use, leukemias and other cancers and chronic renal failure[19]. On the contrary, patients with diabetes mellitus, a disease considered as an important risk factor for tuberculosis, there is usually associated hypercholesterolemia.

In conclusion, according to our results, we found that patients with pulmonary tuberculosis have hypocholesterolemia that proved to be a consequence of the disease itself rather than a risk factor. This hypocholesterolemia proved to be correctable to normal levels with regular intake of anti TB treatment and normal diet. Further research is needed with larger number of patients and longer follow up periods in order to provide additional support to this assertion.

Corresponding author
Hesham Abdel Raheem[2]
Clinical Pathology Department, Assiut University Hospital, Assiut, Egypt

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