STUDY OF ADENOSINE DEAMINASE ACTIVITY IN PULMONARY TUBERCULOSIS AND OTHER COMMON RESPIRATORY DISEASES

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ABSTRACT

Tuberculosis has, in a short span of time, become a major health problem in the third world or developing countries like India. In view of this, a retrospective study was conducted to study Adenosine deaminase activity in serum and pleural fluid in patients affected with Pulmonary Tuberculosis and other common non-tubercular chronic respiratory diseases. The study was carried out on 100 patients suffering from various pulmonary disorders, between January 2002 and August 2002. Thirty-five normal healthy individuals were included as control subjects. ADA estimation was done by sensitive colorimetric method. The study revealed that the serum ADA activity was higher in patients of tuberculous pulmonary and pleural diseases and non-tuberculous pulmonary diseases than in control subjects. The mean serum ADA activity in the patients' group was 35.5 ± 6.93 u/l as compared to 16.20 ± 2.85 u/l in control group, showing a highly significant ($P < 0.001$) difference. ADA activity was highest in tuberculous pleuropulmonary diseases. The pleural fluid ADA activity was higher in pyogenic pleural effusion than in tuberculous pleural effusion.

KEY WORDS

Adenosine deaminase, Tuberculosis, Pleural effusion

INTRODUCTION

Tuberculosis has emerged as one of the most lethal diseases man has ever faced. It has, in a short span of time, become a major health problem in the third world or developing countries. The severity of the diseases can be judged by the fact that it affects all ages, irrespective of the sex. No other disease has so much socio-economic health significance as tuberculosis in a country like India.

It has been estimated that nearly 500,000 people die of this disease every year. The no. of cases at any one point of time has been estimated to be at least 9-10 million, one-fourth of which i.e. 2-2.5 million are likely to be infectious.

An increase in serum ADA activity has been described in several diseases as Tuberculosis, Typhoid fever, Infectious mononucleosis and Brucellosis. In lieu of these facts, determination of ADA activity in cerebrospinal, pleural and peritoneal fluids has been reported to be a valuable adjunct in the diagnosis of tuberculous meningitis, pleuro-pulmonary diseases and ascites(1).

MATERIALS AND METHODS

Data Collection and Compilation:

The present study was carried out on 100 patients suffering from various pulmonary disorders. 35 healthy individuals were included as control subjects. A detailed clinical history was taken and a thorough physical examination was carried out in every subject. A set of investigations including sputum smear examination, pleural fluid examination, X-ray chest, Bronchoscopy and fine needle aspiration biopsy, was carried out on the study group. The patients in the study group were divided into five subgroups as given in table 1. ADA estimation was done by sensitive colorimetric method described by Guisti (2).

Principle

Adenosine deaminase catalyses deamination of adenosine leading to formation of inosine and ammonia. Ammonia (NH_3) forms an intensely blue indophenol with sodium hypochlorite and phenol in alkaline solution. Sodium nitroprusside ($\text{Na}_2(\text{Fe}(\text{CN})_5\text{NO})$) is the catalyst. The ammonia concentration thus released, deamination by ADA is directly proportional to the examination of indophenol. The reaction catalyzed by ADA is stopped at the end of incubation period by addition of phenol nitroprusside.

Locus of Study

The study was conducted in the Biochemistry and Pathology department of M.Y. Hospital and M.G.M. Medical College, Indore.

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Table 1 : Various study groups and the number of patients included in each group.

S.No	Study Group	No. of Patients
1.	Group I- Pulmonary tuberculosis A-sputum positive patients (AFB +ve)	53
	i) Moderately advanced	14
	ii) Far advanced	12
	B-sputum negative patients (AFB - ve)	
	i) Minimal	8
	ii) Moderately advanced	8
	iii) Far advanced	11
2.	Group II- Suppurative lung disease	16
	A-Lung abscess	7
	B-Bronchiectasis	9
3.	Group III- Malignancy of lung	8
4	Group IV- Empyema	9
5.	Group V- Tubercular pleural effusion	14
	Total	100
	Healthy controls	35

Table 2 : Serum and pleural fluid ADA levels in different groups of patients and healthy controls.

S.No.	Study Group	Serum ADA Activity Levels			Pleural Fluid ADA Activity Levels		
		Range (U/L)	Mean (U/L)	S.D.	Range (U/L)	Mean (U/L)	S.D.
1.	I Pulmonary Tuberculosis						
2.	I A (i) Moderately advanced	31.42-45.80	39.65	3.6887	-	-	-
3.	I A (ii) Far advanced	36.08-45.66	40.31	2.6668	-	-	-
4.	I B (i) Minimal	35.00-44.46	38.43	2.9920	-	-	-
5.	I B (ii) Moderately advanced	32.46-43.22	38.973	3.3517	-	-	-
6.	I B (iii) Far advanced	36.43-45.86	41.86	3.0296	-	-	-
7.	II A Lung Abscess	23.68-28.49	25.98	1.9227	-	-	-
8.	II B Bronchiectasis	24.82-29.40	26.47	1.4448	-	-	-
9.	III Malignancy Lung	22.42-26.94	24.90	1.4564	-	-	-
10.	IV Empyema	24.03-32.12	28.20	2.5700	90.48-114.56	104.81	8.4045
11.	V TB Pleural Effusion	37.28-43.28	40.19	1.5744	64.48-102.44	37.18	11.5749
12.	Healthy Controls	12.84-19.46	16.20	1.8573	-	-	-

Table 3 : Comparison of serum ADA activity level in cases of pulmonary tuberculosis and non-tubercular pulmonary disease

Groups	No. of Patients	Serum Adenosine Deaminase Activity Levels				
		Mean (U/L)	S.D.	Z	P	Significance
Tubercular (I)	53	39.97	2.24	25.24	<<0.001	Highly Significant
Non Tubercular (II) & (III)	24	25.80	1.67	-	-	-

RESULTS AND DISCUSSION

Control Group

Thirty five normal individuals aged 14 to 70 years [23 males (65.7 %) and 12 females (34.3 %)] were included as control. In this group the serum ADA activity level ranged from 12.84 to 19.46 u/l with a mean value of 16.2 ± 2.85 u/l. The mean value of serum ADA activity was 16.21 ± 2.03 u/l for males and 16.18 ± 1.63 u/l for females. These finding are similar to those reported by Jhamaria *et al*; 16.8 ± 10.2 u/l and 19.09 ± 2.99 u/l respectively for males and females (3).

Study Group

This group consisted of 100 patients; 71 males and 29 females. The mean serum ADA activity in this group was 35.5 ± 6.93 u/l as compared to 16.20 ± 2.85 u/l in control group, showing a highly significant ($P < 0.001$) difference. (Table 2).

The mean serum ADA activity level in sputum AFB +ve as well as AFB -ve cases was 39.95 ± 2.21 u/l and 39.72 ± 2.28 u/l respectively, showing no difference in these two groups (4). The mean serum ADA activity in pulmonary tuberculosis was 39.97 ± 2.24 u/l while the same in non tuberculous respiratory diseases, taken together, was 25.80 ± 1.41 u/l. Statistically comparing, these figures show significantly raised values in the former group ($P < 0.001$).

No significant difference was observed in mean serum ADA activity in different sex and age groups among these patients.

The enzyme ADA is predominantly a T lymphocyte enzyme and its plasma activity is high in diseases where cellular immunity is stimulated such as tuberculosis. ADA activity is raised in lymphocytic pleural effusion of tuberculous origin only. We do not know why enzyme activity is not increased in other lymphocytic effusions. Percentage of T lymphocyte subpopulation in tuberculous pleural fluid is higher than in peripheral blood. But this does not correlate

with the levels of ADA. This shows that the activity of the enzyme may be correlated more to the maturative stage of T cells than to its number (5).

The higher ADA activity in pleural fluid than in serum in patients with tuberculous pleurisy and emphysema indicated that cells within the pleural cavity in this disease are locally synthesizing ADA. It seems reasonable to regard the high ADA activity in tuberculous pleural as a reflection of local activation of T lymphocytes. The level of ADA activity in tuberculosis is higher than any other disease. ADA activity is low in non-tuberculous pleural effusion (excluding emphysema) and non-tuberculous pulmonary diseases. Its sensitivity and specificity are very high.

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