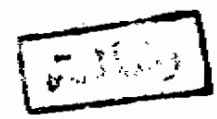
THE USE OF ADENOSINE DEAMINASE IN THE DIAGNOSIS OF TUBERCULOUS PLEURAL EFFUSION

THESIS

Submitted in Partial Fulfilment of
Master Degree of Chest Diseases

Presented by

OMAR ABDEL RHMAN MOSTAFA



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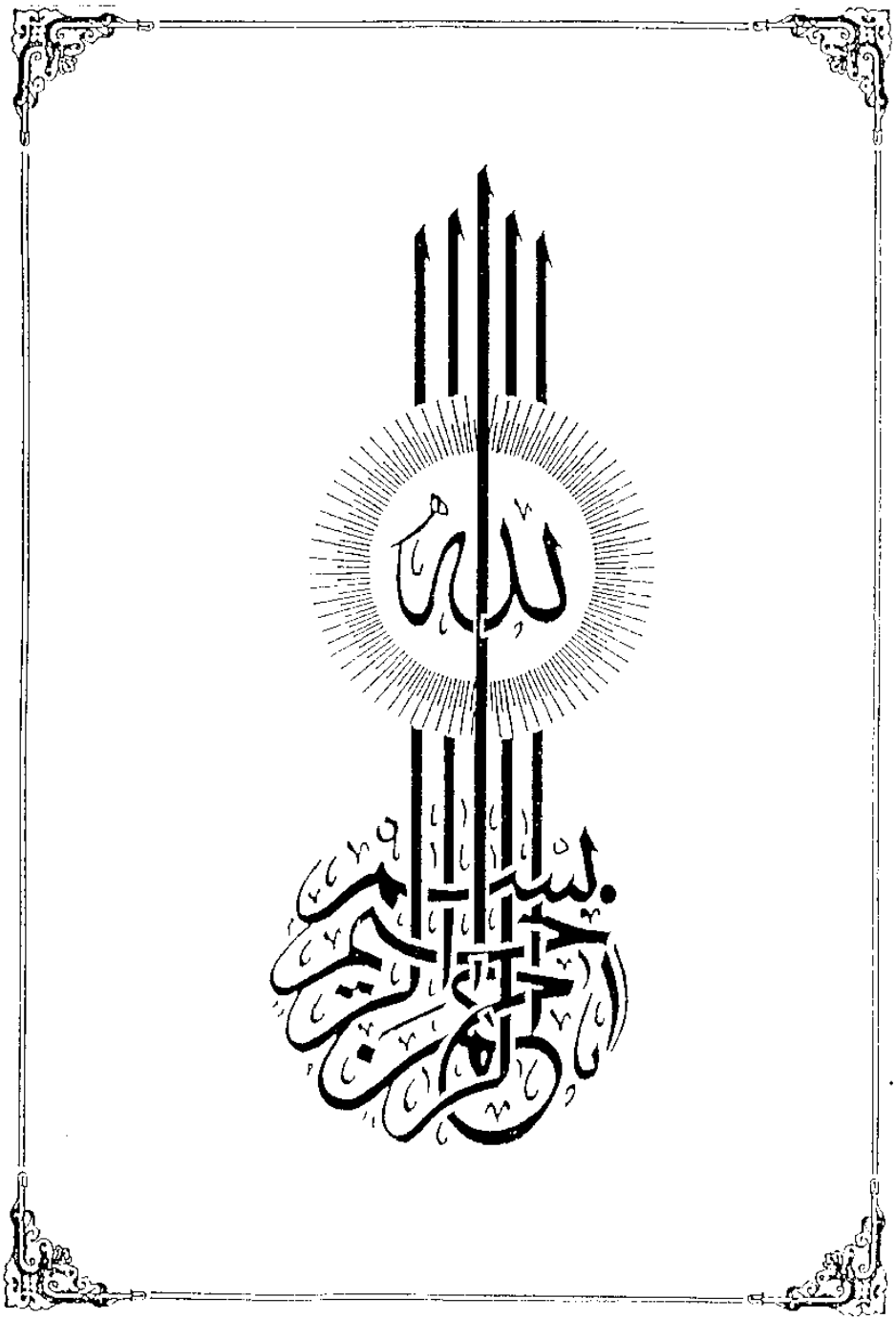

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INTRODUCTION

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AIM OF THE WORK

Introduction

Adenosine deaminase is an enzyme involved in catabolism of purine bases, capable of catalyzing the deamination of adenosine forming inosine in the process. (Fox and Kelley, 1978) (46).

Its main physiologic activity is related to lymphocytic proliferation and differentiation. The enzyme activity increases substantially during mitogenic and antigenic responses of lymphocytes and conversely, lymphocyte blastogenesis is inhibited by inhibitors of adenosine deaminase (Shore et al., 1981)(134). (Hovi et al., 1976)(67).

Adenosine deaminase activity is higher in T-cells than in B-cells. As a marker of cellular immunity its plasma activity is found to be elevated in these diseases in which there is a cell-mediated immune response. Tuberculosis is one of these diseases in which there is a cell-mediated immune response.

Tuberculous pleural effusion is a common clinical finding and its detection and differentiation from other causes of pleural effusion is sometimes difficult.

Recent investigations have demonstrated that adenosine deaminase activity is elevated in the pleural fluid of patients with tuberculous pleural effusion and may be used as a diagnostic test in the differential diagnosis of pleural effusion due to tuberculosis from other types of pleural effusion (Ocana et al., 1983)(102).

Aim of the Work

To evaluate the usefulness of adenosine deaminase activity in the diagnosis of tuberculous pleural effusion.

REVIEW OF LITERATURE

THE PLEURA

Pleura is a serous membrane of mesodermal origin (Crofton and Douglase, 1981) (28).

Development

As the lungs grow laterally from the mediastinum during foetal development they grow into a part of coelomic cavity. This cavity is lined with undifferentiated mesenchyme. As the lungs extend into the cavity they are invested with the mesenchymal lining which becomes the visceral and parietal layers of the pleura (Hinshaw and Marrey, 1980) (63).

Anatomy

The serous membrane covering the lung parenchyma is called the visceral pleura. The remainder of the lining of the pleural cavity is designated the parietal pleura. The parietal pleura includes the diaphragmatic pleura, the mediastinal pleura and the costal pleura which cover the diaphragm, mediastinum, and thoracic skeletone respectively (Light, 1983) (85).

Histology

The parietal pleura is lined on the free surface by a single layer of mesothelial cells lying on a connective tissue layer of collagen and elastic fibers. In the connective tissue layer, blood capillaries, lymphatic channels and pain fibers are present. (Barrett, 1970)(11).

The outer portion of the visceral pleura is a single layer of mesothelial cells which is a few micron thick and has a maximum diameter of about 30 μm. Between these large cells are clefts, some of which are filled with lymphocytes. Below the surface mesothelium is a delicate layer of connective tissue, the endopleura, which contains more fibrocytes and histiocytes. Beneath the endopleura is the chief or middle layer of the visceral pleura that is composed of collagen and elastic fibers. Beneath the chief layer is the subpleural interstitial tissue (the vascular layer of the pleura) that contains the major blood and lymphatic vessels (Robert and James, 1980) (119).

Blood Supply

Branches of the bronchial artery which reach the pleura in the interlobular septa provide the main blood supply of the visceral pleura, but a few branches of the pulmonary artery supply the deepest part of the visceral pleura (Crofton and Douglas; 1981) (28).

The blood supply of the costal part of the parietal pleura is from the intercostal arteries. The mediastinal and diaphragmatic pleura is supplied by the pericardiacophrenic branch of the internal mammary artery (Crofton and Douglas; 1981) (28).

The venous drainage of the visceral pleura is via the the pulmonary veins.

The parietal pleura is drained by the intercostal veins, although its mediastinal portion, also drains into the bronchial veins (Robert and Robert, 1983)(120).

The Pleural Lymphatic

The lymphatic drainage of the visceral pleura is via the subpleural network of lymphatics which drain into the hilar glands (Barrett; 1970)(11).

The lymphatics of the costal part of the parietal pleura drains into the sternal glands and to the internal intercostal glands near the heads of the ribs.

The lymphatics of the diaphragmatic part drain into the sternal, anterior and posterior mediastinal lymph glands.

The lymphatics from the mediastinal part accompany the pericardiacophrenic artery and drain into the posterior mediastinal glands (Crofton and Douglase; 1981)(28).

The Nerve Supply

The visceral pleura is supplied by autonomic fibers only and is essentially devoid of pain fibers, while the parietal pleura is supplied with sensory nerve fibers from the intercostal nerves. The sensory supply of the central portion of the diaphragmatic pleura is via phrenic nerve (Barrett; 1970)(11).

The Pleural Space

The pleural space is a potential cavity located between the two opposing layers of pleura. (Ganong; 1983)(48).

In health, this space is gas-free and contains only a few milliliter of serous fluid with a protein concentration under 2 g/dl. (Agostoni; 1972)(4).

Physiology of the Pleural Space

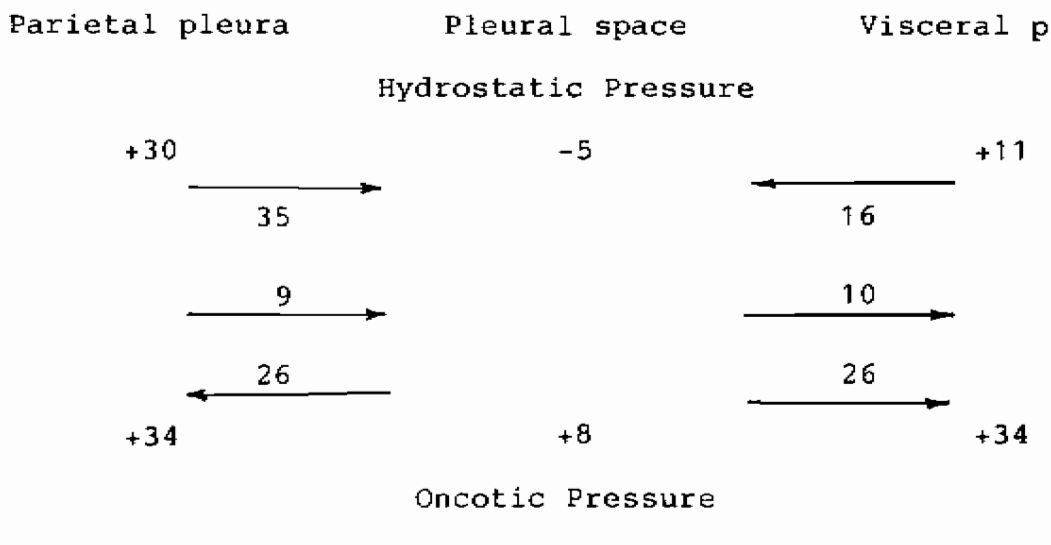
The passage of protein-free liquid through the pleural membranes is dependent upon the hydrostatic and oncotic pressures across them (Agostoni et al.; 1957)(3).

When the capillaries in the parietal pleura are considered, it can be seen that the net hydrostatic pressure favoring the movement of fluid from these capillaries to the pleural space is the systemic capillary pressure (30 cmH_2O) minus the negative pleural pressure (-5 cmH_2O) or 35 cmH_2O. Opposing this is the oncotic pressure in the blood (34 cmH_2O) minus the oncotic pressure in the pleural fluid (8 cmH_2O) or 26 cmH_2O. The resulting net pressure difference of 9 cmH_2O (35-26) favors movement of fluid from the parietal pleura into the pleural space. (Light; 1983)(85).

The only difference between the visceral and the parietal pleura in the scheme outlined in the figure is that the capillaries of the visceral pleura have the pressures of the pulmonary rather than the systemic circulation. Therefore,

the hydrostatic pressure in these capillaries is much lower. The net force across the visceral pleura is 10 cmH_2O favoring the absorption of pleural fluid.

Normally, the pleural space is maintained nearly fluid-free because even though the net pressure differences for the parietal and visceral pleura are comparable, the capacity of the visceral pleura to exchange fluid is greater than that of the parietal pleura.



Diagrammatic representation of the pressures involved in the formation and absorption of pleural fluid.

There are normally small amounts of protein (1.5 g/dl) in the pleural fluid (Agostoni, et al.; 1957)(3).

This protein slowly leaks from the pleural capillaries into the pleural space. If protein were allowed to accumulate in the pleural space, the oncotic pressure of the pleural fluid would increase, and eventually pleural fluid formation

would exceed pleural fluid absorption and a pleural effusion would develop.

However, protein is continuously removed from the pleural space via the pleural lymphatics.