THE PREDICTIVE VALUE OF CARCINOEMBRYONIC ANTIGEN IN PATIENT WITH PLEURAL EFFUSION

Thesis
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The Master Degree Of Chest Diseases

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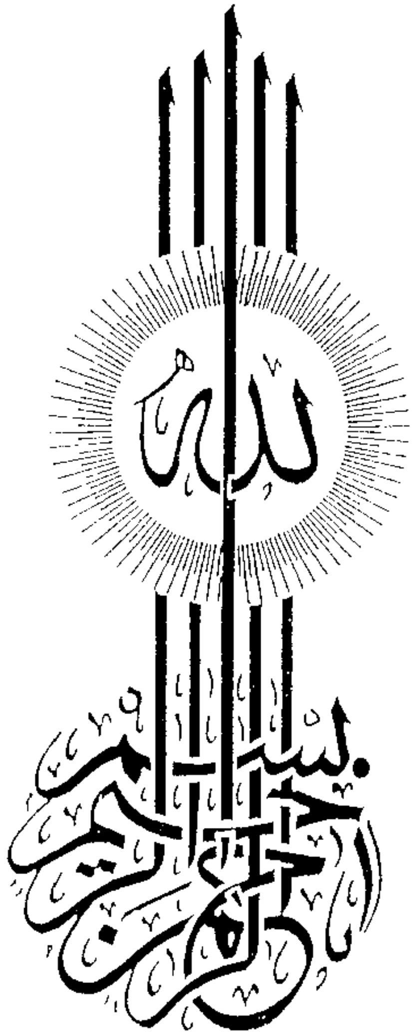
بسم الله الرحمن الرحيم

سبحانك لا علم لنا إلا ما علمتنا

إنك أنت العليم الحكيم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A C K N O W L E D G E M E N T

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C O N T E N T S

INTRODUCTION

AND

AIM OF WORK

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The aetiological diagnosis of pleural effusion is often a difficult problem .

Cytology alone can diagnose only about one half of malignant pleural effusion (Leuallen and Carr, 1978) . Various substances (enzymes , metals and specific protein) were measured in pleural effusion, but their discriminative value for separating malignant from non-malignant effusion was not proven (Vladutiu, 1977) .

In 1974, Cortes and co-workers reported pleural fluid carcinoembryonic antigen (CEA) levels $<$ 2.5 ng/ml in three patients with benign disease and $>$ 2.5 ng/ml in four of eight patients with malignant effusions . In 1975 , Lowenstein and associates and Basta et al. published preliminary results that showed higher levels of CEA activities in malignant than in benign effusions . These findings have since been confirmed by other laboratories (Nystrom et al., 1977 ; Booth et al., 1977) .

The present study was undertaken to determine whether CEA assay in serum and pleural fluids is useful in detecting malignancy .

REVIEW OF LITERATURE

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Morphology Of The Pleura

Each lung is invested by a serous membrane arranged in the form of closed invaginated sac termed the pleura. The visceral pleura covers the surface of the lung and lines the fissures between its lobes, while the parietal pleura lines the inner surface of the hemithorax and is subdivided into mediastinal pleura, diaphragmatic pleura and costal pleura (Warwich and Williams, 1973) .

Structure of the pleura :

The pleura consists of a thin superficial layer known as endopleura and a dense deeper layer known as the chief layer . The free surface of the pleura is smooth and moistened by a serous fluid . It is covered by a single layer of flattened cells which form a meso-tehlium and rest on basement membrane beneath which are network, of yellow elastic and white fibers, embedded in ground substance, containing also fibroblast,macrophages and other cell types which characterise loose connective tissues, blood vessels, lymphatics and nerves are distributed in the substance of the pleura. The mesothelial cells are important for the mobility of the pleural membranes .

They are 15 - 30 u wide and 6 - 7 u thick (Fraser and Pare, 1985) .

The electron microscope has shown that the surface of the mesothelial cells is not smooth, but bears microvilli varying in length up to 3 u . The member of microvilli varies from cell to cell but increased caudally . They are numerous in the visceral than the parietal pleura and sparse over the ribs (Wang, 1974) . They may have absorptive function, but may also increase surface mucopolysaccharide and so counteract frictional faces (Corrin, 1980) .

Blood supply :

The blood supply of the costal part of the parietal pleura is from the intercostal arteries, while the mediastinal and diaphragmatic parts are supplied from the pericardiophrenic branch of the internal mammary artery (Crofton and Douglas, 1981) , while the blood supply to the visceral is mainly from bronchial arteries . However, venous drainage of the visceral pleura is via the pulmonary veins (Agostoni , 1972) and that of the parietal pleura is via intercostal veins .

Lymphatic drainage :

The lymphatics of costal part of parietal pleura drain into glands along internal mammary artery (sternal glands) and to the intercostal glands near heads of 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 pericardiophrenic artery and drain into the posterior mediastinal glands (Simer, 1952) .

The lymphatic drainage of the visceral pleura is via small subpleural network of lymphatics within the interlobular connective tissue which communicate with deep lymphatic vessels within the lung (Simer, 1952) .

Nerve supply :

The visceral pleura is supplied by autonomic fibers only and is essentially devoid of pain fibers while the parietal pleura is richly supplied with sensory nerve fibers from the intercostal nerves . The sensory supply to the central portion of the diaphragmatic pleura is via phrenic nerve (Robert and Robert, 1974) .

Physiology Of The Pleural Space

The pleural space is lined by the parietal and visceral pleural membranes which are permeable to liquid and gas. In normal persons, this space contains a small amount of liquid but no gas (Black, 1972) . That fluid which is a lubricant one is secreted at the parietal pleural surface and reabsorbed at the surface of the visceral pleura (Hills, 1985) .

Figure (1) shows the mean pressure' in the parietal pleura capillaries, which is estimated tobe 30 cm H_2O. This force plus 8 cm H_2O pressure produced by the colloidal osmotic pressure of the pleural fluid plus - 5 cm H_2O produced by the elastic recoil of the lung, all produce a total pressure of 43 cm H_2O acting to force fluid into the pleural space . This force is opposed by a pressure of 34 cm H_2O generated by the colloidal osmotic pressure of plasma proteins, the difference (9 cm H_2O), is the force producing movement of fluid into the pleural space .

In the visceral pleura, the plasma colloidal osmotic pressure (34 cm H_2O) is opposed by pleural fluid colloidal osmotic pressure (8 cm H_2O) plus capillary hydrostatic

Fig.(1) Pressures involved in transudation and reabsorption of pleural fluid (Agostoni and Mead , 1964) .

	Parietal pleura		Visceral pleura	
	Factors causing pleural fluid formation	Factors causing pleural fluid absorption	Factors causing pleural fluid formation	Factors causing pleural fluid absorption
	* Capillary hydrostatic pressure = 30 cm H_2O	* Plasma colloidal osmotic pressure = 34 cm H_2O	* Capillary hydrostatic pressure = 11 cm H_2O	* Plasma colloidal pressure = 34 cm H_2O
	* Pleural fluid colloidal osmotic pressure = 8 cm H_2O		* Pleural fluid colloidal osmotic pressure = 8 cm H_2O	
	* Intrapleural pressure= -5 cm H_2O		* Intrapleura pressure= - 5 cm H_2O	
Total	43 cm H_2O	34 cm H_2O	24 cm H_2O	34 cm H_2O
Resultant	9 cm H_2O filtration into pleural cavity		10 cm H_2O absorption into visceral pleura	

pressure (11 cm H_2O) plus the intrapleural negative pressure (- 5 cm H_2O) . The resultant is (10 cm H_2O) causing pleural fluid absorption into the visceral pleura (Agostoni and Mead , 1964) .

At equilibrium, the flow of liquid through the two membranes must be equal (except for the drain through the lymphatics that under normal conditions, should be nearly negligible) . When a saline solution is introduced into the pleural space, the equilibrium is disturbed, the pressure of the pleural liquid rises and therefore the net driving pressure across the visceral pleura increases while that across the patietal pleura decreases . So, the outflow of liquid through the visceral pleura should become higher than the inflow through the parietal pleura. The volume of the liquid is then redcued until the deformation forces produced by the contact between the membranes lower the pressure of the pleural fluid to its original value, preventing further reduction of its volume and the equilibrium is thus established (Green and Pride, 1980).

Gas does not accumulate in the pleural space because of the low total gas pressure in venous blood . At sea level, the parietal pressure of the various gases in venous blood, P O_2 = 40 mmHg , P CO_2 = 46 mmHg, P H_2O = 46 mmHg and P N_2 = 573 mmHg . The total of these parietal pressures, 706 mmHg is 54 mmHg (73 cm H_2O) less than the atmospheric pressure .

The pressure in the pleural space at resting lung volume is approximately 5 cm H_2O less than atmospheric pressure . Therefore, there is a gradient of 68 cm H_2O favouring absorption of gas from the pleural space and the pleural space remains gas free (Black , 1972).

Characteristic features of normal pleural fluid :

Volume : The volume of liquid in single pleural space in man is about 2 ml (Agostoni, 1972) .

Physiological features :

The protein concentration of pleural fluid in man is 1.77 gm/ 100 ml (range 1.38 - 3.35) . The content of sodium, potassium and calcium are similar to those of interstitial liquid , whereas pH is 7.64 , and total CO_2 and bicarbonates are higher than in plasma . The relative viscosity of pleural liquid in man is 1.24 (Yamada , 1933) .