Flexible Medical Thoracoscopy In The Management of Malignant pleural Effusion

Thesis

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LIST OF ABBREVIATIONS

ABGs	Arterial blood gases
ACCP	American College of Chest Physicians
AFB	Acid-Fast bacilli
ATS	American Thoracic Society
CO_2	Carbon dioxide
COPD	Chronic obstructive pulmonary disease
CT	Computerized tomography
H&E	Hematoxylin and Eosin
HF	High Frequency
IM	Intramuscularly
INF -γ	Interferon-γ
LDH	Lactate dehydrogenase
MPF	Malignant pleural fluid
MPM	Malignant pleural mesothelioma
Nd:YAG	Neodymium: Yttrium Aluminum Garnet
PPD	Purified protein derivative
RICU	Respiratory intensive care unit
SpO_2	Pulse Oxygen saturation
VATS	Video-Assisted Thoracoscopic Surgery
VCR	Videocassette recorder

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Introduction :

Pleural effusion is a disease characterized by accumulation of fluid in the pleural cavity.

Classically, pleural effusions have been divided into transudates and exudates. A transudative effusion develops when the systemic factors influencing the formation or absorption of pleural fluid are altered so that pleural fluid accumulates.

In contrast, the exudative pleural effusion develops when the pleural surfaces or the capillaries in the location where the pleural fluid originates are altered such that fluid accumulates .

The correct diagnosis relies mainly on obtaining samples (fluid , or pleural tissue) from the pleura and subjecting it to a series of laboratory ,cytological , and pathological procedures before the diagnosis is reached . Tissue samples are obtained either by thoracocentesis and pleural fluid examination **(Collins & Sahn , 1987)** or by thoracoscope which has an excellent diagnostic yield for malignant pleural effusions and it can also establish the diagnosis of tuberculous pleurisy. **(Menzies & Charbonneau , 1991) .**

Thoracoscopy is based in the development of the artificial pneumothorax , of endoscopes and of pleural drainage . It was a combination of this three essentials that led to the success of the technique **(Brandt et al , 1985)** .

It was invented by a physician in Stockholm in the beginning of the 20th century called Hans Christian Jacobaeus when tuberculosis was a major threat to the European community. It was initially used to sever adhesions that held the lung from collapsing, in the course of inducing an Iatrogenic pnumothorax , the basis for collapse therapy . In addition to the diagnostic potential, Jacobaeus hoped by means of thoracoscopy to achieve prognostic information **(Bainbridge , 1993)** .

Medical thoracoscopy is performed by pulmonologists in an endoscopy suite or operating room depending on the local availability of the appropriate facility, local anesthesia , conscious sedation, and requirement of one or two ports of entry using simple non – disposable instrumentation. It provides also an effective method for performing pleurodesis **(Mathur & Loddenkemper , 1995**) . Malignant disease is the most frequent diagnosis in patients with difficult to diagnose pleural effusions in whom a definitive diagnosis is ultimately made. About 90 – 95 % of malignant effusions are exudates. Lung and breast cancers are the most common cause of malignant effusions. About 90 % of malignant effusions are moderate to large (> 500 ml) . Lymphocytes represent more than 50 % of the cells in malignant effusion in more than half the cases **(Sahn , 1985) .**

Aim of the work :

To study the value of medical thoracoscopy in management of malignant pleural effusions.

ANATOMY OF THE PLEURA

The visceral pleura envelopes the entire surface of the lungs: the parietal pleura covers the inner surface of chest wall, mediastinum and diaphragm; the visceral pleura invests the lungs everywhere except at the hilum, where the bronchi, pulmonary vessels and nerves enterThe lung substance. (Von Hayek, 1960).

Below the margin of visceral and parietal pleura at the hilum, pleural reflections from the dorsal and ventral surface of the lungs usually extend to the diaphragm as a double layer of the mesothelial tissue, the pulmonary . ligament.

The normal parietal and visceral pleural linings are smooth, glistening, semitransparent membranes. Beneath the single layer of mesothelium that covers the surface is a band of connective tissue containing abundant collagen and elastin: mesothelial cells vary considerably in size and shape, from flat to columnar. Numerous mitochondria, rough endoplasmic reticulum and golgi apparatus are prominent features of cuboidal and columnar cells suggesting that they are both active in the transport of substances across the pleural surfaces and in ensuring the structure and function of the pleural space (Wang, 1985).

Microvilli emeshed in a matrix of glycoproteins, project from the mesothelial cells, thereby serving as a

lubricant and as a device to increase the pleural surface area available for fluid transport (Wang, 1985).

Although the parietal & visceral membranes are similar in external appearance, important anatomic differences are found beneath the surface: beneath the parietal surface the arrangement of the connective tissue layer is straight forward; in contrast, the submesothelial connective tissue layer of visceral pleura gives rise to septa that permeate the lungs creating subdivisions that enhance gas exchange while lending support to the pulmonary parenchyma (Kinasewitz, 1998).

Pain fibers are present in the connective tissue layer of the parietal pleural but not the visceral pleural. These fibers have different origins , depending on the part of the thorax that they innervate ; the costal pleura and the peripheral rim of diaphragrnatic pleura are innervated by the intercostal nerves ; painful stimuli in these regions are sensed in the adjacent chest wall . The central parts of the diaphragm are innervated by the phrenic; stimuli in these areas elicit pain in the ipsi lateral shoulder (Kinasewitz , 1998).

The visceral and parietal pleura also differ with respect to blood supply; the parietal pleural is supplied by branches of the systemic arteries , the supply depending on location: the costal, diaphragmatic and mediastinal aspects receive blood predominantly from systemic arteries in their respective viscinities ; branches from these arteries subdivide to from a capillary network beneath the mesothelium of the costal and mediastinal pleura . (Kinasewitz, 1998)

In contrast, the blood supply of the visceral pleura has a dual origin and is more variable: depending on the species, the blood supply from either the pulmonary or bronchial circulation may predominate. In humans and in other species in which the visceral pleura is thick, the principal blood supply of the visceral pleura is from the bronchial circulation. Irrespective of whether they originate from the bronchial or pulmonary arterial system, the capillaries of the visceral pleura drain into the pulmonary veins. (Kinasewitz. 1998).

The lymphatic drainage of the two surfaces differs considerably. The parietal lymphatic route is the main system by which lymph leaves the pleural space. Its mesothelial surface is permeated by pores (stomas) that connect via lacunae to a lymphatic network in the adjacent submesothelial layer (Wang, 1985).

The lymphatics in different nodes; from the costal surface to the parasternal and paravertebral nodes; from the mediastinal surface to the tracheobronchial nodes. In the contrast to the parietal pleura, the visceral pleura is devoid of lacunae and stomas and the underlying lymphatic vessels appear to drain the pulmonary parenchyma rather than the pleural space. (Wang, 1985).

Embryology of the pleura

Introduction:

The coelomic cavity in the embryo is a U- shaped system with the thick bend cephaled. The cephaled portion becomes the pericardium and communicates bilaterally with pleural canals which in turn communicates with peritoneal canals. With development, the coelomic cavity becomes divided into the pericardium, the pleural cavitiy and the peritoneal cavity . These newly formed-pleural cavities are firmly lined by a layer of mesothelial cells (Arey, 1965).

The primordial brachial buds and the trachea lie in a median mass of mesenchyme cranial and dorsal to the peritoneal cavity, this mass of mesenchymal tissue is the further mediastinum and it separates the two pleural cavities. As the growing primordial lung buds bulge into the right and the left pleural cavities, they carry with them a covering of the lining mesothelium which becomes the visceral pleura. As the separate lobes evolve, they retain their mesothelial covering, which becomes the visceral pleura in the fissures and the lining mesothelium of the pleural cavity becomes the parietal pleura (Krahl, 1964).

A thin double fold of pleura below the hilum and extending almost to the diaphragm is called (the pulmonary ligament).

Physiology of the pleura

Formation of pleural fluid:

Normally, the composition of the thin layer of fluid between the parietal and visceral pleura is that of an ultrafiltrate of plasma (Table 1). The two linings act like semipermeable membranes, so the concentrations of small molecules, such as glucose, are similar in pleural fluid and plasma, whereas the concentrations of macromolecules (e.g. albumin) are considerably lower in pleural fluid than in plasma.(Kinasewitz, 1998).

Volume	0.1 –0.2 ml/kg
Cells / mm3	1000 – 5000
%Mesothelial cells	3 – 70%
%Monocytes	30 –50%
%Lymphocytes	2 –30 %
%Granulocytes	10%
Protein	1 – 2 mg/dl
%Albumin	50 – 70 % of plasma level
Glucose	~ plasma level
LDH	< 50% plasma level
PH	≥ plasma

Table 1 : Normal composition of pleural fluid

Although the volume of fluid normally present in the pleural space is small (of the order of 5- 15 ml), the rate of turnover of pleural fluid in humans is rapid and may exceed 1 liter per day. Because the rates of fluid entry and efflux are about equal, the volume of pleural fluid remains virtually constant.