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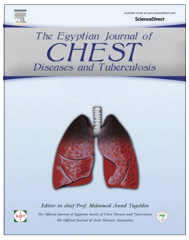

ORIGINAL ARTICLE

Pleural manometry in pleural effusion

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KEYWORDS

Pleural manometry;
Thoracentesis;
Pleural elastance;
Symptoms;
Lung entrapment

Abstract Pleural manometry is a valuable tool to determine lung expansibility and helps to avoid unsafe pressure changes during thoracentesis.

Study design: Cross-sectional descriptive study.

Aim of the work: To measure the pleural pressure during thoracocentesis in patients with pleural effusion and the value of their measurement in both diagnostic and therapeutic decisions.

Patients and methods: Forty-four patients with pleural effusion were included. Thoracocentesis was performed for all patients. End-expiratory pleural pressure values were recorded after the withdrawal of 5 ml of fluid (initial pleural pressure), after the removal of every 500 ml for the first liter then after the withdrawal of every 250 ml for the second liter, and every 100 ml thereafter until the procedure completed. The last recorded pressure was used as the closing pressure. Comparisons were done according to the etiology and character of the effusion (transudate or exudate). The pressure/volume curves were done and studied.

Results: Twenty out of 34 patients with exudative pleural effusion having a pleural space elastance >14.5 cm H_2O/L were identified. These patients had a diagnosis of malignant effusion either primary or secondary (14/20 patients), or inflammatory causes (6/20 patients). All the 10 patients with transudative effusion had an elastance <14.5 cm H_2O/L. The study revealed a statistically significant decrease in closing pressure in the symptomatic group when compared to non-symptomatic group (p value $= 0.022$), none of our patients (including symptomatic patients) had exceeded the proposed cutoff value for unsafe pleural pressures (-20 cm H_2O).

Conclusion: Pleural manometry is proved a useful tool to differentiate freely expandable lungs from lungs with entrapment. It is proved as a useful guide as to when to terminate thoracentesis in large volume thoracentesis.

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Introduction

Pleural effusion is diagnosed in approximately 1.5 million patients each year in the United States, making therapeutic thoracocentesis one of the most commonly performed medical procedures [1].

Measurement of pleural liquid and surface pressure in a normal pleural space is technically challenging because the normal pleural space is only approximately 20 μm thick, and the insertion of any device into the pleural space will create deformation that was not present before the insertion of the device [2].

Pleural manometry provides data to enhance our understanding of the underlying pleural pathophysiology when an effusion is present and aids the physician in both diagnostic and therapeutic decisions [3], and can help him to avoid unsafe pressure changes during thoracentesis and to avoid re-expansion pulmonary edema.

Clinically, obtaining information about the elastic characteristics of the pleural space is the objective of pleural space manometry [4].

Pleural elastance (PE) has been defined as the change observed in pleural pressure divided by the amount of fluid removed. A normal pleural elastance is estimated to be < 14.5 cm H_2O/L [5].

Aim of the work

The study was designed as a cross-sectional descriptive study aiming to measure the pleural pressure during thoracocentesis in patients with pleural effusion and the value of their measurement in both diagnostic and therapeutic decisions.

Patients and methods

The study was carried out at Kasr Al-Aini hospital, Chest Department. A total of 44 patients with pleural effusion were included into the study. The following were excluded from the study: patients with very small amounts of pleural effusion, patients on mechanical ventilation, patients using anticoagulant therapy, patients refusing to be subjected to thoracocentesis.

The patient was sitting with his arms on the back of the chair, causing the intercostal spaces to be extended and facilitates access. The skin was cleaned with betadine antiseptic solution. Pleural aspiration should take place in a clean area using full aseptic techniques. 5–10 cc Lidocaine 2% was given as local anesthetic in the site of puncture. 1 cc atropine was injected intramuscularly. Site of insertion:-into the lowest zone of the effusion determined either by auscultation or by sonographic guidance. At the upper border of the lower rib.

Thoracocentesis was performed for all patients with the use of wide bore catheter (16 guage) and IV sets.

As shown in Fig. 1, the measurement of pleural pressure was done by a simple water column manometer as that designed for measuring CVP. The water manometer consists of two lengths of intravenous tubing connected through a three way valve to a wide bore catheter inserted in the pleural space. The tubing from the thoracocentesis catheter to the measuring scale extends 40–50 cm below the level of the catheter insertion

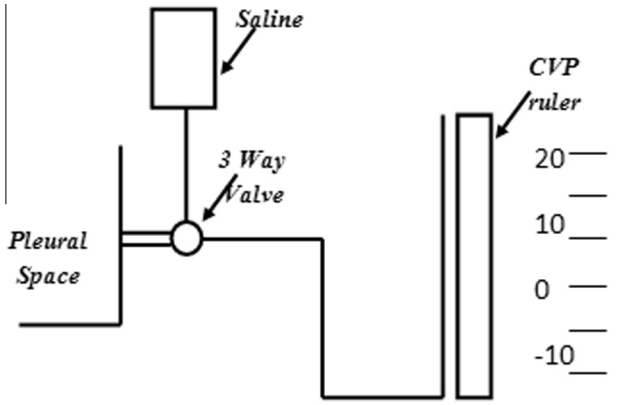

Figure 1 A schematic diagram illustrating the complete pleural manometer setup.

into the chest similar to a U-shaped water manometer .The system (IV tubing) is purged of air with normal saline. Zero value was set at the thoracic puncture level.

After pressure recording the water manometer described above was removed. The catheter was connected to a fluid drainage bag through IV tubing for drainage. End-expiratory pleural pressure values were recorded after the withdrawal of 5 ml of fluid (initial pleural pressure), after the removal of every 500 ml for the first liter then after the withdrawal of every 250 ml for the second liter, and every 100 ml thereafter until the procedure completed.

Thoracocentesis was discontinued when no more fluid could be obtained; the patient developed symptoms related to the removal of fluid (i.e., chest pain, cough or chest tightness), or pleural pressure become -20 cm H_2O or lower.

The last recorded pressure was used as the closing pressure.

Initial and further pleural pressures, volume of fluid removed were measured in all pleural effusion patients, and comparisons were done according to the etiology and character of the effusion (transudate or exudate).The pressure/volume curves were done and studied.

Statistical analysis

Gathered data were processed using SPSS version 15 (SPSS Inc., Chicago, IL, USA). Quantitative data were expressed as mean ± SD while qualitative data were expressed as numbers and percentages (%). Student *t* test was used to test significance of difference for quantitative variables and Chi Square was used to test significance of difference for qualitative variables. A probability value of p-value < 0.05 was considered statistically significant.

Results

In the current study, 44 patients with pleural effusion were enrolled. Mean age of the studied patients was 50.8 with range from 17 to 70 years old. More than half of the studied patients were females (52.3%). About 45.5% of the pleural effusion patients were smokers. The most common chronic medical conditions were hypertension and DM (13.6%). Regarding co morbidities 11.4% of the studied patients had history of