Research Article

Laboratory and Radiological Imaging in Evaluating Cases with Pleural Effusion

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Abstract

Background: pleural effusion disease became widely distributed nowadays with multiple pathogenic mechanisms. **Aim of the work:** to assess the efficacy of radiological and laboratory investigations in pleural effusion. **Methods:** Seventy patients with pleural effusion subjected to full history taking, examination and Radiological investigations including chest X ray, CT and US and laboratory investigations. **Results:** diagnosis of pleural effusion require combined investigations. **Conclusions**: ultrasound is standard tool for diagnosing and evaluating the pleural effusion.

Keywords: pleural effusion, TUS, chest CT, pleural fluid analysis.

Introduction

A pleural effusion is an accumulation of fluid in the pleural space, due to imbalance between the formation and reabsorption of such fluid. A multiple causes of a pleural effusion, with different pathogenic mechanisms as elevated hydrostatic pressure gradient (transudation); increased extravasation of the pleural vessels (exudation); due to local inflammatory process; decrease in lymphatic drainage[(1)] .

Presence of a pleural effusion heralds an underlying disease process that may be pulmonary or non-pulmonary in origin and, furthermore, that may be acute or chronic. Although the etiologic spectrum of pleural effusion can be extensive, most pleural effusions are caused by congestive heart failure, pneumonia, malignancy, or pulmonary embolism[(2)].

Pleural effusions are generally classified as transudates or exudates, based on the mechanism of fluid formation and pleural fluid chemistry. Transudates result from an imbalance of oncotic and hydrostatic pressures, whereas exudates are the result of inflammatory processes of the pleura and/or decreased lymphatic drainage. In some cases, it is not rare for pleural fluid to exhibit mixed characteristics of transudate and exudate [(2)].

The initial diagnostic consideration is distinguishing transudates from exudates. Although a number of chemical tests have been proposed to differentiate pleural fluid transudates from exudates, the tests first proposed by Light et al have become the criterion standards. The fluid is considered an exudate if any of the following are found:

- Ratio of pleural fluid to serum protein greater than 0.5
- Ratio of pleural fluid to serum LDH greater than 0.6
- Pleural fluid LDH greater than two thirds of the upper limits of normal serum value

The fluid is considered a transudate if all of the above are absent [(3).]

Chest Radiograph:

It is the first imaging approach regarding a pleural effusion [(4).]

Ultrasound:

The use of ultrasonography (US) has become a standard technique worldwide in evaluating the pleural space [(4).]

Chest Computer Tomography:

Chest CT is often considered the gold standard which frequently used to investigate thoracic

pathologies because of its cross-sectional perspective and superior contrast resolution and as it is helping to differentiate pleural from parenchymal disease [5].

Patients and methods

The study was done on seventy patients with pleural effusion who attendant to chest department, Minia university hospital. The study protocol was approved by the hospital's research ethics broad. The patients divided into 2 groups first one diagnosed by ultrasound guided biopsy and the other diagnosed by Thoracoscopic pleural biosy. All patients were enrolled in the study after written informed consent.

All Patients were subjected to full history taking, examination and Radiological investigations including:

(1) Chest X-ray (postro-anterior).

(2) Recent Computed Tomography (CT) of the chest with contrast.

(3) Ultrasound with color Doppler: All cases were examined by curvilinear transducer (3.5 MHz) and linear array transducer (7.5 MHz). Screening of the patient's chest using the low frequency probe and pleural fluid analysis.

Results

Table (1): Comparative statistical analysis between mean of pleural fluid data of group I and group II

		Group I	Group II	P value
		N=45	N=25	
Site of effusion	RT LT	20(44.4%) 22(48.9%)	16(64%) 8(32%)	0.342
Pleural fluid color	Yellowish Hemorrhagic	31(68.9%) 14(31.1%)	12(48%) 13(52%)	0.085
Pleural fluid appearance	Clear Turbid	8(17.8%) 37(82.2%)	9(36%) 16(64%)	0.088
Pleural glucose	Mean ± SD	102.1±64.8	116.4±91.5	0.821
Total protein	Mean ± SD	4.6±0.7	4.7±0.8	0.722
LDH	Mean ± SD	596±459	660.2±710.8	0.624
Gram stain	+Ve -Ve	6(13.3%) 39(86.7%)	2(8%) 23(92%)	0.702
Culture and sensitivity	+Ve -Ve	6(13.3%) 39(86.7%)	2(8%) 23(92%)	0.702
Acid fast bacilli	+Ve -Ve	0(0%) 45(100%)	1(4%) 24(96%)	0.357
Cytological examination	Lymphocytes Neutrophilis	42(93.3%) 3(6.7%)	25(100%) 0(0%)	0.548
Malignant cells in fluid	-Ve +Ve	37(82.2%) 8(17.8%)	18(72%) 7(28%)	0.318

RT=right, LT=left, LDH=lactate dehydrogenase

Table (1): shows no statistical significance between both study groups in the comparative data in pleural fluid analysis.

Table (2): Comparative statistical analysis between Songraphic data of group I and group II:

US data		Group I N=45	Group II N=25	P value
Amount of effusion	Moderate Massive	29(64.4%) 10(22.2%)	8(32%) 17(68%)	<0.001*
Fluid echogenicity	Anechoic Complex non-septated Complex septated Ecchogenic	8(17.8%) 13(28.9%) 6(13.3%) 18(40%)	4(16%) 0(0%) 2(8%) 19(76%)	0.004*
Fluid septation	No Yes	21(46.7%) 24(53.3%)	21(84%) 4(16%)	0.002*
Diaphragmatic Pleura nodule	No Yes	22(48.9%) 23(51.1%)	7(28%) 18(72%)	0.089
Parietal pleura nodule	Dynamic collapse Static collapse	32(71.1%) 13(28.9%)	19(76%) 6(24%)	0.659
Lung		23(51.1%) 22(48.9%)	13(52%) 12(48%)	0.943
Pleural thickening	No Yes	0(0%) 45(100%)	3(12%) 22(88%)	0.042*
Pleural thickness	Mean ± SD	3.6±1.8	3.5±1.9	0.708
Sinusoid pattern	No Yes	19(42.2%) 26(57.8%)	6(24%) 19(76%)	0.127
Color Doppler	Yes	45(100%)	25(100%)	----

US=ultrasound

Table (2): shows the difference between both study groups in sonographic data which reveals statistical significance in increased amount (P value <0.001) and echogenicity (P value <0.004) with no septation (P value <0.002) in group II compared to group I and increased pleural thickness (P value <0.04) in group I compared to group II. There is no statistical significance in both groups in presence of diaphragmatic pleural nodule, lung abnormality and sinusoidal pattern.

Table (3): Comparative statistical analysis between final diagnosis which divided into malignant and non-malignant of group I and group II:

		Group I N=45	Group II N=25	P value
Final diagnosis	Malignant Non malignant	27(60%) 18(40%)	19(76%) 6(24%)	0.231

Table (3): shows that 60% of TUS guided biopsy group diagnosed as malignant compared to 76% of patient diagnosed by thoracoscopy with no statistical significance.

Discussion

Pleural fluid LDH levels greater than 1000 IU/L suggest empyema, malignant effusion, rheumatoid effusion, or pleural paragonimiasis. Pleural fluid LDH levels are also increased in effusions from Pneumocystis jiroveci (formerly, *P. carinii*) pneumonia. The diagnosis is suggested by a pleural fluid/serum LDH ratio of greater than 1, with a pleural fluid/serum protein ratio of less than 0.5[(6)].

If an exudate is suspected clinically or is confirmed by chemistry test results, send the pleural fluid for total and differential cell counts, Gram stain, culture, and cytology. Pleural fluid lymphocytosis, with lymphocyte values greater than 85% of the total nucleated cells, suggests TB, lymphoma, sarcoidosis, chronic rheumatoid pleurisy, yellow nail syndrome, and chylothorax. Pleural lymphocyte values of 50-70% of the nucleated cells suggest malignancy[6].

Bediwy et al.,[7] stated that in TUS diagnosed 83.3% of free pleural effusion lesions, 60% of encysted pleural effusion lesions with diagnosing all empyema lesions, but less sensitive in detecting pleural thickening and pleural nodules or masses**.**

Sikora et al.,[8] also reported that transthoracic US serves as a more accurate imaging tool than chest radiography in the diagnosis of pleural effusions and allows discrimination of pleural effusions from other lung pathology which may appear similar on a chest X-ray. Also US can allow diagnosis of complicated pleural effusions, such as empyema.

On the other hand, Bediwy et al.,[7] stated that in TUS was less sensitive than CT chest in detecting pleural thickening and pleural nodules or masses**.** Also Raj et al.,[9] who stated that CT chest allows detailed evaluation of the pleura and differentiation of benign from malignant pleural disease and also adequate enhancement of the pleura enables differentiation of the thickened pleura from adjacent effusion or aerated or collapsed lung.

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