



ISSN: 0976-3031

Available Online at <http://www.recentscientific.com>

International Journal of Recent Scientific Research
Vol. 7, Issue, 8, pp. 12832-12835, August, 2016

**International Journal of
Recent Scientific
Research**

Research Article

A COMPARATIVE STUDY AND EVALUATION OF INCREASED DIAGNOSTIC PLEURAL FLUID ASPIRATION WITH ULTRASONOGRAPHY THAN CHEST X- RAY

Maneesha Jelia¹, Babu Lal Bansiwala², Anil Saxena³, Suman Khangarot⁴ and Rajendra Takhar⁵

¹Department of Physiology, Govt. Medical College, Kota, Rajasthan, India

^{2,3,4,5}Department of Respiratory Medicine, Government Medical College, Kota, Rajasthan, India

ARTICLE INFO

Article History:

Received 05th May, 2016

Received in revised form 08th June, 2016

Accepted 10th July, 2016

Published online 28th August, 2016

Key Words:

Pleural effusion, thoracocentesis, x-ray, ultrasonography

ABSTRACT

Pleural effusion is excess fluid that accumulates between the two pleural layers, the fluid-filled space that surrounds the lungs. Excessive amounts of such fluid can impair breathing by limiting the expansion of the lungs during ventilation. Four types of fluids can accumulate in the pleural space:- 1.Serous fluid (hydrothorax)2. Blood (haemothorax) 3.Chyle (chylothorax)4.Pus (pyothorax or empyema)¹

Pleural effusion is usually diagnosed on the basis of medical history and physical examination, and confirmed by chest x-ray and ultrasonography. This is an open label, comparative, analytical, interventional and prospective study was carried out on patients with signs and symptoms suggestive of pleural effusion, admitted in Dept. of Respiratory medicine, New Medical College and Hospital Kota, during a period of one year Oct. 2013 to Sept. 2014. The aim of our study to compare and evaluate the increased diagnostic pleural fluid aspiration with ultrasonography than chest radiography. We observed that on radiological examination 65% cases show evidence of pleural effusion while USG could diagnose 100% cases of effusion. In the 1st group (< 100 ml fluid) USG increases the average amount of pleural fluid aspiration to 70ml approx. Number of cases of therapeutic aspiration also increased in the 1st group by USG as compared to 5 cases by chest x-ray. In the 2nd group (101–200 ml fluid) of study cases, fluid aspiration increased by 3.2 times and number of cases also increased to 18 by USG. In the 3rd group (> 200 ml) fluid aspiration increased by 2.45 times, and all the remaining failed cases of chest x-ray were aspirated under USG guidance. The number of patients for successful therapeutic thoracocentesis also increased by chest Ultrasonography.

Copyright © Maneesha Jelia *et al.*, 2016, this is an open-access article distributed under the terms of the Creative Commons Attribution License, which permits unrestricted use, distribution and reproduction in any medium, provided the original work is properly cited.

INTRODUCTION

Pleural effusion is excess fluid that accumulates between the two pleural layers, the fluid-filled space that surrounds the lungs. Excessive amounts of such fluid can impair breathing by limiting the expansion of the lungs during ventilation. Four types of fluids can accumulate in the pleural space:- 1.Serous fluid(hydrothorax) 2.Blood (haemothorax) 3.Chyle (chylothorax) 4.Pus (pyothorax or empyema)

Pleural effusion is usually diagnosed on the basis of medical history and physical examination, and confirmed by chest x-ray and ultrasonography. Once accumulated fluid is more than 300 ml, there are usually detectable clinical signs in the patient, such as decreased movement of the chest on the affected side, stony dullness to percussion over the fluid, diminished breath

sounds on the affected side, decreased vocal resonance and fremitus (though this is an inconsistent and unreliable sign), and pleural friction rub. Above the effusion, where the lung is compressed, there may be bronchial breathing and egophony.¹

As the pleural fluid aspiration results is affected by technique used, so this study was planned to compare these results and for better produce outcome.

Radiological Examination

Chest x-rays are the most commonly used examination to assess for the presence of a pleural effusion, however, it should be noted that on a routine erect chest x-ray as much as 250 to 500ml of fluid is required before it becomes evident. A lateral decubitus film is most sensitive, able to identify even a small

*Corresponding author: Maneesha Jelia

Department of Physiology, Govt. Medical College, Kota, Rajasthan, India

amount of fluid. At the other extreme, supine films can mask large quantities of fluid.²

Principle of Ultrasonography³

Very high frequency sound (>30,000Hz) is directed into the body from a transducer placed in contact with the skin. Transducer contains piezoelectric crystals. To make good acoustic contact, the skin is smeared with a jelly. Fluid is a good conductor of sound and ultrasound is hence useful in diagnosing cysts and fluid filled structures, which produce large echos from their walls, but no echoes from the fluid contained within them.

Fuid Quantification by Ultrasonography⁴

The fluid volume can be calculated by measuring the maximum perpendicular distance between the surface and the chest wall. The scan is performed with the patient in the supine position, at maximum inspiration. The measurement is made right above the diaphragm. A 20mm extension corresponds to an average volume of 380 ml (± 130 ml). A 40 mm extension corresponds to an average volume of 1,000 ml (± 330 ml).

Thoracocentesis⁵

Once a pleural effusion is diagnosed, the cause must be determined. Pleural fluid is drawn out of the pleural space in a process called thoracocentesis. A needle is inserted through the back of the chest wall in the sixth, seventh, or eighth intercostal space on the midaxillary line, into the pleural space.

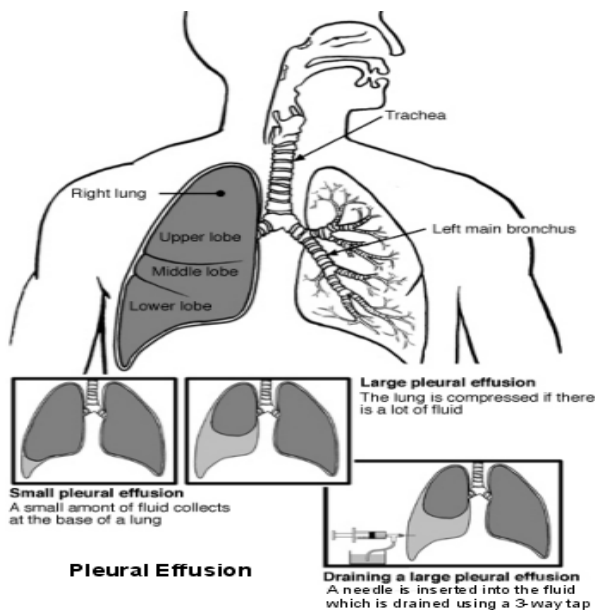


Fig Diagram showing pleural effusion and thoracocentesis procedure

MATERIAL AND METHODS

The source of data

This is an open label, comparative, analytical, Interventional and prospective study was carried out on patients with signs and symptoms suggestive of pleural effusion, admitted in Dept. of Respiratory medicine, New Medical College and Hospital Kota, during a period of one year Oct. 2013 to Sept. 2014.

Method of Collection of data

This study was done in 100 cases of pleural effusion. The diagnosis was established by a detailed history, clinical examination followed by chest X- ray & chest ultrasonography.

Inclusion criteria

1. Age more than 18 years presenting with clinical features of pleural effusion.
2. Patients who had given valid consent.

Exclusion Criteria

1. Patients who had not given valid consent.
2. Hemodynamically unstable patients.

Ethical consideration: The study was approved by ethics committee of the Government Medical College, kota. The approval number is F3() /Acad/Ethicl comm./MCK/2014/1087

RESULTS

Table 1 Side of Pleural Effusion By Chest Radiography V/S Ultrasonography

S.N	Effusion Side	Chest X-Ray	Ultrasonography	Extra cases detected by USG
1	Right hemithorax	47	65	18
2	Left hemithorax	14	22	8
3	Bilateral	2	9	7
Total effusion cases		63	96	33

On using Chest radiography we could diagnose fluid in 63 cases, including 47 on right side, 14 left side & 2 in bilateral sides, out of 100 study cases. While Ultrasonography detected fluid in all 96 (100%) cases, including 65 right, 22 left and 9 bilateral sides out of 100 study cases.

Table 2 Therapeutic Thoracocentesis by Using Chest X-Ray

Groups	Expected amount of fluid by Chest X-Ray in groups (ml)	Total Effusion Cases diagnosed by Clinical & chest radiography (100%)	Successful Aspiration of fluid in diagnosed Cases (%)	Average Amount of aspirated fluid approx. (ml)	Number of cases with Failed aspiration (%)
1 st	<100 ml	13	5 (38.55%)	10	8(61.5%)
2 nd	101-200 ml	20	9 (45%)	50	11(55%)
3 rd	>200 ml	30	20 (66.67%)	110	10(33.33%)
Total effusion cases		63	34 (53.96%)	-	29 (46.04%)

The table shows by clinical and radiological method, successful therapeutic thoracocentesis done in 34 patients out of 63 pleural effusion cases (i.e 54% success) diagnosed by chest x-ray.

In the 1st group of patients, we successfully aspirated in 5 patients out of 13 patients. (We expected minimal pleural fluid < 100ml by chest x-ray). Only diagnostic fluid average 10 ml could be aspirated in the 1st group cases.

Successful thoracocentesis in 20 out of 30 patients done in the 3rd group patients. The average amount of 110 ml fluid was aspirated. (With expected fluid >200ml)

Shows superiority of USG in diagnosing 100% pleural effusion Cases.

In the 1st group USG increases the average amount of pleural fluid aspiration to 70ml approx. This shows 7 times increased fluid aspiration by USG than CXR. Also number of cases also increased to 34 by USG compared to 5 cases by CXR.

We categorized all patients into three groups according to expected amount of pleural fluid in the space (1) Less than 100 ml (2) 101 to 200 ml (3) more than 200 ml.

Table 3Therapeutic Thoracocentesis By Usg

Group	Expected amount of pleural fluid (ml)	Total no. of cases (100%)	Therapeutic Aspiration by USG done in. (including failed cases of CXR)	Successful aspiration by USG	Average Amount of aspirated fluid approx. (ml)	Fluid Aspiration benefit by USG than CXR
1 st	<100 ml	39	34 (8)	34	70	7 Times
2 nd	101-200 ml	27	18 (11)	18	160	3.2 Times
3 rd	>200 ml	30	10 (10)	10	270	2.45 Times
4 th	No Fluid	04				
Total study cases		100	62 (29)	62	-	-

In the 2nd group study cases, fluid aspiration increased by 3.2 times and number of cases also increased, 18 by USG compared to 9 cases by chest x-ray.

In the 3rd group fluid aspiration increased by 2.45 times, and all the remaining failed cases of chest x-ray were aspirated under USG guidance.

Table 4 Comparison of Therapeutic Thoracocentesis By Chest X-Ray And Ultrasonography

Group	Effusion groups	Total study cases	Aspiration done in cases by Chest x-ray guidance	Aspiration done in cases by USG guidance
1 st	≤ 100 ml	39	5	34
2 nd	101-200ml	27	9	18
3 rd	≥ 200 ml	30	20	10
4 th	No fluid	4	-	-
Total cases		100	34	62

USG is superior in fluid aspiration in all groups, the in 1st group, 34 cases of aspiration done by USG guidance as compared to 5 cases by chest x-ray.

In the 2nd group cases increased to 18 by USG compared to 9 by chest x-ray.

In the 3rd group fluid aspiration was done in 20 cases by chest x-ray, where fluid was easy to aspirate while the remaining failed 10 cases of chest x-ray because of septations or loculation, were aspirated under USG guidance.

The number of patients also increased by USG guidance in all groups.

USG superior in diagnosing thickened pleura in 4 cases (100%) with no fluid.

DISCUSSION

In our study, we were able to diagnose pleural effusion in 63 patients. Out of these cases; 47 (75%) cases had effusion in right sided, 14 (22%) had left sided while 2 (4%) had bilateral effusion. The majority of cases had minimal effusion occupying less than 1/3rd of hemi thorax. While USG diagnosed 96 cases of pleural effusion; 65 (68%) cases had right sided pleural effusion, 22 (23%) had left sided effusion and 9 (10%) were bilateral effusion. TB pleural effusion is typically unilateral, small to moderate in size as concluded by *Valdes L. et al(1998)*.⁶ Similar results found by *Race et al (1957)*;⁷ that in their study of 402 patients with CHF, 88% had bilateral, 8% right sided and 4% left sided effusion respectively. *Leuallan and Carr et al (1958)*⁸ on a study of 436 patients had described that right sided pleural effusion more common than left sided.

We observed that Successful therapeutic thoracocentesis done in 34 patients out of 63 patients (i.e54% successful) by clinicoradiological method.

It was difficult to aspirate fluid with minimal pleural effusion in radiologically diagnosed cases because of blind procedure and fear of complication like pneumothorax.

We also consider the rule, aspiration done only when the thickness of fluid on lateral decubitus x-ray view was more than 10mm as suggested concluded by *Light RW et al in (1995)*⁹ & *Colice GL et al in (2000)*¹⁰.

Average amount of fluid aspirated in 20 out of 30 cases, in the 3rd group with approximately 110ml of pleural fluid. Although in these patients fluid was expected more than 200ml and quantification done by chest radiography method (PA view) with blunting of the lateral costophrenic angle and also clinical examination. *Blackmore et al (1996)*¹¹, demonstrated pleural fluid volume estimation,

The present study also showed superiority of USG in diagnosing 100% pleural effusion cases.

In the 1st group USG increases the average amount of pleural fluid aspiration to 70ml approx. This shows 7 times increased fluid aspiration amount by USG than chest x-ray. In the 2nd group study cases, fluid aspiration increased by 3.2 times and number of cases also increased. In the 3rd group fluid aspiration increased by 2.45 times, and all the remaining failed cases of chest x-ray were aspirated under USG guidance. The number of patients also increased by chest Ultrasonography. USG superior in diagnosing thickened pleura in 4 cases (100%).

Quantification of Pleural fluid volume estimation helped by *Eibenberger et al(1994)* and *Adilson Cunha Ferreira*^{4,12} in a study on 51 patients undergoes lateral decubitus chest x-ray and chest USG while supine, the results were analysed as fluid thickness among these two groups and expected amount of fluid in the space. Also 30 mm thickness on lateral decubitus chest x-ray corresponds to 1000ml fluid while 40mm fluid thickness for USG. Thus, estimation of fluid help in fluid aspiration under guidance. Similar observations made by *Balik M, et al (2006)*¹³ also helped in evaluating the amount of fluid in the pleural space.

USG is superior in fluid aspiration in all groups of cases, in the 1st group, 34cases of therapeutic aspiration done by USG guidance as compared to 5 cases by chest x-ray. In the 2nd group study cases, aspiration done in 18 by USG compared to 9 by chest x-ray. In the 3rd group fluid aspiration was done in 20 cases by chest x-ray, because fluid is easy to aspirated.

Remaining failed cases of chest x-ray because of septations or loculation, were aspirated under USG guidance.

Our study concluded that

On radiological examination 65% cases show evidence of pleural effusion while USG could diagnose 100% cases of effusion.

Our study showed that clinicoradiological method diagnosed effusion in 63 cases, but site localization for was successful in 45 (75%) cases and therapeutic thoracocentesis was done in 34(55%) cases only. While USG successfully diagnosed & therapeutic thoracocentesis done in all the remaining cases (100%) of pleural effusion in the study cases.

We concluded that superiority of USG in diagnosing 100% pleural effusion Cases. In the 1st group (< 100 ml fluid) USG increases the average amount of pleural fluid aspiration to 70ml approx. Number of cases of therapeutic aspiration also increased in the 1st group by USG as compared to 5 cases by chest x-ray.

In the 2nd group (101–200 ml fluid) of study cases, fluid aspiration increased by 3.2 times and number of cases also increased to 18 by USG. In the 3rd group (> 200 ml) fluid aspiration increased by 2.45 times, and all the remaining failed cases of chest x-ray were aspirated under USG guidance.

The number of patients for successful therapeutic thoracocentesis also increased by chest Ultrasonography. USG superior in diagnosing thickened pleura in 4 cases (100%) with no fluid.

References

1. Wong, CL, Holroyd-Leduc, J, Straus, SE (Jan 2009); "Does this patient have a pleural effusion?". JAMA 301 (3): 309-17.

2. Gerald de Lacey, Simon Morley (2012) - The Chest X Ray a Survival Guide Reprint, 2008 First Edition.
3. Carol M .Rumach, Stephanic R. Wilson *et al* (2011)- Diagnostic Ultrasound 4TH Edition
4. Adilson Cunha Ferreira *et al* 2006; the role of ultrasound in assessment of pleural effusion.
5. Bartter T, Santarelli R, Akers SM, Pratter MR. The evaluation of pleural effusion. Chest 1994; 106: 1209-14.
6. Valdes L, San Jose E, Alvarez D, *et al*. Tuberculous pleurisy; a study of 254 patients *aech intern med* 1998.
7. Race GA, scheifley CH, EWdwards JE. *et al* hydrothorax in congestive heart failure. *Am J med.* 1957; 22; 83-89.
8. Leuallan and Carr DT *et al* 1958: Pleural effusion –A statistical study of 436 patients. *New Engl J Med* 1955.252:79.
9. Light R.W (1995); Pleural diseases 3 rd ed. Willams and Wilkins Baltimore MD
10. Colice GL, Curtis A, Deslauriers J, *et al*. Medical and surgical treatment of parapneumonic effusions: an evidence-based guideline. Chest. 2000; 118(4):1158–1171.] .
11. Blackmore, Black WC, Dallas RV, *et, al* (1996);- Pleural fluid volume estimation; a chest radiograph prediction rule.
12. Adilson Cunha Ferreira^I; Francisco Mauad Filho^I; Tatiana Braga^{II}; Glenda Downing Fanstone^{III}; Ivan Charbel Bumlai Chodraui^{IV}; Nilton Onari^V (2006); ultrasonographic application in the quantification of pleural effusion.
13. Balik m plasil p waidauf p *et al* (2006) - ultrasound estimation of volume of pleural fluid in mechanically ventilated patients.

How to cite this article:

Maneesha Jelia *et al.* 2016, A Comparative Study And Evaluation of Increased Diagnostic Pleural Fluid Aspiration With Ultrasonography than Chest X- Ray. *Int J Recent Sci Res.* 7(8), pp. 12832-12835.