



EVALUATION OF PLEURAL & LUNG DISEASES BY ULTRASONOGRAPHY  
ORIGINAL RESEARCH ARTICLE

Dr. PoonamOhri<sup>1</sup>, Dr. RameshChander<sup>2\*</sup>, Dr. SanjeevKumar Kohli<sup>3</sup> and Dr. N.S. Neki<sup>4</sup>

Assistant Professor, Department of Radio diagnosis, Govt. Medical College, Amritsar

Professor & Head, Department of Radio diagnosis, Govt. Medical College, Amritsar

Senior Resident Department of Pathology, Govt. Medical College, Amritsar

Professor & Head, Department of Medicine, Govt. Medical College, Amritsar

ARTICLE INFO

Article History:

Received 12<sup>th</sup> November, 2017

Received in revised form 11<sup>th</sup>  
December, 2017

Accepted 23<sup>rd</sup> January, 2018

Published online 28<sup>th</sup> February, 2018

Key words:

Pleural effusion, lung diseases,  
Ultrasound (US)

ABSTRACT

**Abstract:** Pleural effusion & lung diseases are common problems affecting all age groups which require early diagnosis and treatment. Ultrasound has high accuracy in the diagnosis of pleural & peripheral lung diseases and has high efficacy in tapping pleural effusion & in differentiating solid from cystic lung masses.

**Aim:** To evaluate the precise location, extent of pleural & lung diseases and compare the efficacy & sensitivity of ultrasound with that of plain skiagrams.

**Materials & Methods:** Hundred patients admitted or attending out-patient department of Guru Nanak Dev Hospital & Chest and TB Hospital attached to Govt. Medical College, Amritsar of all ages and having pleural based opacities on plain skiagram were selected for the study. All the patients selected for the study were examined first radiographically. Standard PA and lateral skiagrams wherever required were taken. After this, the patients were examined by ultrasound and areas to be examined were selected on the basis of information available from skiagrams. Patients were examined in sitting and lying down position. The nature of lesion was evaluated and the skin to target depth was measured. The side for needle puncture was marked on the skin where required. Ultrasound findings, the probable diagnosis and the position in which site for puncture has been marked were recorded on the file. Image was recorded on single sided film using multi-format camera.

**Results :** Overall accuracy of plain X-ray in case of pleural effusion was 71.8% and in case of other lung disease was 80.9% whereas in case of ultrasound was 96.9% and 95.2% respectively Difference in accuracy of plain X-Ray and ultra sound alone is significant.

**Conclusion:** Sonography is the best modality for very ill patients as it causes minimum discomfort & can be used at bed side. Best results can be obtained by combining it with conventional x-rays.

Copyright © 2018 Dr.PoonamOhri et al. This is an open access article distributed under 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 a common medical problem; the presence of pleural effusion may be primary manifestation or a secondary complication of many disorders. As the differential diagnosis is wide, a systematic approach to investigation is necessary<sup>1</sup>. Imaging of the pleura can be challenging and it plays an important role in the diagnosis and subsequent management of patients with pleural disease. The presence of a pleural abnormality is usually suggested following a routine chest radiography (CXR); however, it often fails in determining the presence of loculations or septations within the effusion or in the detection of pleural thickening and fibrosis<sup>2</sup>. Sonography has a very high accuracy in the diagnosis of pleural and peripheral lung diseases. It has a much higher sensitivity than

conventional radiology in the diagnosis of pleural effusion and its effect on underlying lung. It can easily differentiate solid from cystic lesion. It has a high efficacy in differentiating tappable and non-tappable pleural effusions. It is ideal for site selection on skin to target measurements. Whenever needle puncture is to be undertaken, sonography is the best modality for very ill patients and it causes minimum discomfort and can be used at bed side.

As an imaging modality, transthoracic ultrasound (TUS) has many advantages, the most significant being its immediate application at the point of care and its ability to augment the clinical assessment of the respiratory system. It is relatively cheap, utilizes no radiation and has a short examination time<sup>3</sup>.

\*Corresponding author: Dr. RameshChander

Professor & Head, Dept. of Radiodiagnosis, Govt. Medical College, Amritsar, INDIA

Email: [chanderramesh2010@gmail.com](mailto:chanderramesh2010@gmail.com)

UltraSound (US) allows an easy differentiation of pleural locular fluid and thickened pleura. It is efficient in pinpointing thoracocentesis, even in small fluid collections<sup>4</sup>.

TUS is an extremely helpful guide for biopsies of the pleura<sup>5</sup>. Focal pleural abnormalities can be identified with US, and biopsies can be aimed at areas of interest. Recent studies have proposed that image-guidance may significantly increase the yield while decreasing the risk for complications<sup>6</sup>. Sonography is very helpful for determining the nature of pleural opacity, identifying minimal and loculated effusion and guiding thoracocentesis. Sonography is particularly useful when interpretation of chest radiograph is difficult. When there is question of whether fluid is sub pulmonic or sub phrenic, the patient is bed ridden, unconscious or unable to sit in upright position. Sonography can also identify the largest and most accessible area of fluid accumulation for thoracocentesis<sup>7</sup>.

The first step in the evaluation of patients with suspected pleural effusion is to confirm the diagnosis especially in the case of a white hemithorax on chest x-rays. Ultrasound is a useful method for these purposes because it allows the distinction between effusion and lung consolidations<sup>8</sup> and has a higher accuracy in detecting pleural effusion in comparison with bedside chest x-rays (93% vs 47%)<sup>9</sup>. In fact, chest x-rays can detect the presence of pleural effusion in patients in the orthostatic position only if the volume of the effusion is at least 200ml,<sup>10</sup> and the sensitivity of this method decreases in the supine position, whereas ultrasound can detect effusions as small as 20ml.<sup>11</sup>

**Aims & objectives**

1. To evaluate the precise location & extent of pleural & lung disease.
2. To compare the efficacy of ultra sound with that of plain X-Ray in diagnosing pleural & lung disease.
3. To evaluate the role of ultrasound & determine its sensitivity in evaluation, identification & characterization of various pleural & lung diseases & compare them statistically.

**MATERIALS & METHODS**

Hundred patients admitted or attending out-patient department of Guru Nanak Dev Hospital & Chest and TB Hospital attached to Govt. Medical College, Amritsar of all ages and having pleural based opacities on plain skiagram were selected for the study. All the patients selected for the study were examined first radiographically. Standard PA and lateral skiagram wherever required were taken. Lateral decubitus view and fluoroscopy was done wherever required. Various biochemical and histopathological tests were done wherever required. After this, the patients were examined by ultrasound and areas to be examined were selected on the basis of information available from skiagrams.

Patients were examined in sitting and lying down position. The liver and spleen were used as a tissue texture reference for solid and fluid containing regions respectively. The nature of lesion was evaluated and the skin to target depth was measured. The side for needle puncture was marked on the skin where required.

Sonographic findings, the probable diagnosis and the position in which site for puncture has been marked were recorded on the file. Image was recorded on single sided film using multi-format camera.

**RESULTS**

Of the 100 patients of age from 2 to 80 years, 72 were male and 28 females. Most of patients had illness of less than 6 months duration; 72% patients presented with fever and 68% with pain chest. Other symptom in the order of frequency were cough with expectoration (62%), dyspnoea (40%), dry cough (14%) and weight loss (10%)

**Table 1** Showing comparison of sonography and conventional radiology in 72 cases having pleural effusion

	Ultrasound	Radiology
Fluid suspected	69	53
False Positive	3	-
Indeterminate	-	19
Accuracy average (1%)	96.9	71.8

Table 1 shows results of ultrasonic and radiological examination in cases with pleural effusion in 72 cases. Result of ultrasound proved to be better as compared to radiology.

**Table 2** Showing comparison of Ultrasound with radiology in 21 pathologies other than pleural effusion

Pathologies	Final diagnosis	Ultrasound		Radiology	
		No.	% age	No.	% age
Parenchymal tumour	5	5	100	5	100
Hydatid cyst	2	2	100	2	100
Sub-diaphragmatic pathology	3	3	100	1	33.3
Consolidation	4	4	100	4	100
Pleural Thickening/fibrosis	4	4	100	4	100
Lung abscess	1	-	-	-	-
Pleural tumour	1	1	100	-	-
Pericardial effusion	1	1	100	1	100
Total	21	20	95.2	17	80.9

Result of ultrasound was better as compared to radiology. Sonography could make the correct diagnosis in 20 while radiology diagnosed 17 cases correctly. Sonography made one wrong diagnosis. This was wrongly diagnosed as loculated pleural effusion and was finally proved to be lung abscess.

Conventional radiology could not diagnose 2 cases having subdiaphragmatic pathologies as these were obscured by the associated ipsi lateral pleural effusion. One case of pleural tumour was wrongly diagnosed as encysted effusion and one case of lung abscess proved later on to be a case of consolidation.

**Table 3** Distribution of cases according to types of pleural and pulmonary lesions detected by means of ultrasound versus chest radiography

	US (%)	CXR (%)
Total number of pleural effusions detected	84 (100)	80 (95.2)
Encysted effusion	17 (20.23)	4 (4.8)
Hydropneumothorax	3 (3.6)	3 (3.6)
Pleural thickening	26 (31.0)	0 (0.0)
Pleural mass and/or nodules	6 (7.14)	0 (0.0)
Consolidation	20 (23.8)	6 (7.1)
Pulmonary nodules	0 (0.0)	4 (4.8)
Pulmonary mass	4 (4.8)	6 (7.1)

**DISCUSSION**

The purpose of undertaking the present study was to evaluate the role of sonography in detection and characterization of the lesions which were pleural and peripheral lung based and could be studied by ultrasound as there is no normal lung

intervening between the chest wall and the lesion. Routinely conventional radiology is the method of investigation in the pleural and peripheral lung based lesions. However, many times when the whole of the hemithorax is opaque or the fluid is encysted it is not possible with the conventional radiology to make a confident diagnosis. In these circumstances sonography can be very helpful.

Gryminski *et al*<sup>12</sup> in a study of 116 patients compared ultrasonography with radiology and detected 93% of effusion by ultrasound. In another study of 41 patients, pleural effusion was diagnosed in 93% by ultrasonography. In our study of 100 cases ultrasound could diagnose effusion in 96.9% cases. Emphasizing the superiority of sonography over radiology, Doust *et al*<sup>13</sup> also observed an accurate sonodiagnosis in 25 out of 27 cases of pleural effusion. Similar results are reported by others<sup>14-15</sup>. Sonography showed doubtful results in 13% cases. The possible cause postulated by them were obscuring of pleural fluid by reverberation from ribs and organization of pleural fluid. In the present study, we observed one false positive case diagnosed on sonography as having pleural effusion, while it turned out to be lung abscess. Ultrasonic examination is simple and can be performed at bed side. The results of examination are known immediately to the examiner and they are easy to interpret. Like radiology, the ultrasonic examination is a non invasive technique, more comfortable for a sick patient<sup>16</sup>. It is generally accepted that the ultrasonic intensity used for diagnostic purpose is entirely harmless to the patient.

US is a useful tool for physicians managing pleural diseases. It permits imaging of pleural effusion and other pleural based pathologies. It can be used to clarify the nature of pleural densities, pleural effusions, and pleural thickening. In the present study US demonstrated significant detection of pleural effusion in 100% of cases, which is greater than that for CXR at 92.2%. Similar results were reported by Zanobetti *et al*<sup>17</sup>. Who studied the possibility of replacing standard chest radiography with chest US for the evaluation of acute dyspnea; US detected 87 cases, whereas CXR detected 76 cases. Kalokairinou-Motogna *et al*<sup>18</sup>. also reported that US showed significantly greater detection of pleural effusion compared with radiography. Bediwy *et al*<sup>19</sup> reported that US had detected 70% of cases with pleural thickening, whereas CXR had detected only 10%. Another study by Helala *et al*<sup>20</sup>. reported that US had better accuracy compared with CXR in detecting pleural thickening.

## SUMMARY & CONCLUSION

The present study comprising of 100 patients was undertaken to evaluate the role of sonography in diagnosis of pleural and peripheral lung based lesions.

**From the observation made in the study following conclusions were drawn**

- Sonography has very high accuracy in diagnosis of pleural & peripheral lung lesions.
- It can easily differentiate solid from cystic lesions.
- It has much higher sensitivity than conventional radiology in the diagnosis of pleural effusion & in differentiating tappable from non tappable effusion.
- It is ideal for site selection wherever needle puncture is to be done.

- Ultrasound is noninvasive & reliable technique. No ionizing radiations are involved in the procedure.
- It has higher sensitivity in diagnosing lesions abutting chest wall other than pleural effusion as compared to conventional radiology.
- Sonography is best suited for very ill patients and can be done at bed side.
- Best results can be obtained by using sonography & conventional radiology as complimentary techniques.

## References

1. Parmasivam E, Bodenham A. Pleural fluid collections in critically care. *Respirology* 2007; 7:10-15.
2. Xirouchaki N, Magkanas E, Vaporidi K, Kondili E, Platakis M, Patrianakos A, *et al*. Lung ultrasound in critically ill patients: comparison with bed side chest radiography. *Intensive care med* 2011; 37:1488-1493.
3. Volpicelli G, Elbarbary M, Blaivas M, Lichtenstein DA, Mathis G, Kirkpatrick AW, *et al*. International evidence-based recommendations for point-of-care lung ultrasound. *Intensive care Med* 2012, 38:577-591.
4. Mayo PH, Doelken P. Pleural ultrasonography *Clin Chest Med* 2006; 27:215-217.
5. Diacon AH, Brutsche MH, Soler M. Accuracy of pleural puncture sites: a prospective comparison of clinical examination with controversy: closed needle pleural biopsy or thoroscopy-which first? *Respirology* 2011; 16:738-746.
6. Metintas m, Ak G, Dundar E, Yildirim H, Ozkan R, Kurt E, *et al*. Medical thoracoscopy vs CT Scan-guided Abrams pleural needle biopsy for diagnosis of patients with pleural effusions, a randomized, controlled trial, *chest* 2010, 137:1362-1368.
7. Yang PC. Ultra sound guided transthoracic biopsy of chest RCNA 2000, 38(2):323-324
8. D. Lichtenstein, O. Peyrouset Is lung ultrasound superior to CT? The example of CT occult necrotizing pneumonia *Intensive Care Med.*, 2006, 32 : 334-335
9. C.I. Henschke, D.F. Yankelevitz, A. Wand, *et al*. Accuracy and efficacy of chest radiography in the intensive care unit *Radiol. Clin. North Am.*, 1996, 34: 21-31
10. K.A. Hendrikse, J.W.C. Gratama, W.T. Hove, *et al*. Low value of routine chest radiographs in a mixed medical-surgical ICU chest, 2007, 132 : 823-828
11. M.S. Lauer Elements of danger-the case of Medical Imaging *N. Engl. J. Med.* 2009, 361: 841-843
12. Gryminski J, Krakowka P and Lypacewicz G. The diagnosis of pleural effusion by ultrasonic and radiologic techniques. *Chest* 1976; 70:33-37
13. Doust BD, Baum JK, Maklad NF, Doust VL, Ultrasonic evaluation of pleural opacities. *Radiology* 1975; 114:135-140.
14. Mathur RB, Sharma VK, Jain NK Verma A, Grag VK and Deopura K. Ultrasonic evaluation of pleural opacities. *Indian J Chest Dis Allied Sci* 1994; 36 (1): 21-25
15. Narang P and Bhargava SK. Ultrasonic features of tuberculosis pleural effusion. *Ind J Radiol Imag* 1993;2: 217-220.
16. Yu CJ, Yang PC, Chang DB and Luh KT. Diagnostic and therapeutic use of chest sonography: value in critically ill patients. *AJR* 1992; 159:695-701

17. Zanobetti M, Claudio P, Riccardo P, Can chest ultrasonography replace standard radiography for evaluation of acute dyspnea in the ED? *Egypt J Chest Dis Tuberc* 2011; 139:1140-1147.
18. Kalokairinou-Motogna M, Maratou K, PalanidI, Soldatos T, Antipa E, Tsikkini A, *et al.* Application of color Doppler ultrasound in the study of small pleural effusion. *Med Ultrason* 2010;12:12-16
19. BediwyAS, Badway ME, Salama AA, Zayed HA. The use of multi detector computed tomography and ultrasonography for evaluation of pleural lessions, *Egypt J Chest Dis Tuberc* 2014;64:161-168.
20. HelalaL A, Madkour A, Osman NM, Heita WM, Hakim I. Role of ultrasound in diagnosis and treatment of pleural diseases in respiratory intensive care unit. *Egypt J Bronchol* 2015;9:79-79.

**How to cite this article:**

Dr.PoonamOhri *et al* (2018) 'Evaluation of pleural & lung diseases by ultrasonography Original research article', *International Journal of Current Medical and Pharmaceutical Research*, 4(2), pp. 2996-2999.

\*\*\*\*\*