ROLE OF LATERAL DECUBITUS CHEST RADIOGRAPH IN DETECTING MILD PLEURAL EFFUSION AND ITS CORRELATION WITH THORACIC USG

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ABSTRACT

BACKGROUND

Abnormal accumulation of fluid in the pleural space is called pleural effusion. In this study, an attempt has been made to arrive at the diagnostic accuracy of lateral decubitus chest radiograph to detect mild pleural effusion with comparison to transthoracic ultrasonography keeping the spleen and liver as acoustic window.

MATERIALS AND METHODS

This study was carried out in the Department of Radio-diagnosis, North Bengal Medical College, Darjeeling, West Bengal, India. In this study, 50 male patients having mild pleural effusion detected by USG, have undergone lateral decubitus chest radiograph in a specially designed table.

RESULTS

In this study, detection rate of pleural effusion by lateral decubitus chest radiograph in comparison to USG is 72%.

CONCLUSION

Transthoracic USG being a low cost, radiation hazard free method is much more preferable to lateral decubitus chest radiography for diagnosing mild pleural effusion.

KEYWORDS

Mild Pleural effusion, 2D Ultrasonography, chest radiograph, Transthoracic, lateral decubitus view, fluid colour sign.

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BACKGROUND

Frequently small amount of pleural fluid (5-20ml.) can be detected in healthy person.[1] According to different workers the minimum quantity of pleural fluid detectable by different imaging methods varies but it is within a broad range irrespective of computed tomography, ultrasonography or chest radiography methods are used.[2,3,4] After the introduction of sonography, it is now possible to detect very small amount of fluid in pleural space.[3,4,5,6] Only there are few articles comparing the minimum thickness of pleural fluid detectable by sonography and chest radiograph. Also there is lack of consensus regarding the sonographic criteria defining mild pleural effusion.

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Erect Postero-Anterior (PA) Radiograph

For detection of pleural effusion in erect chest (PA) Radiograph approximately 175 to 500 ml. of fluid is required to be present in the pleural cavity.[7] So we cannot detect mild pleural effusion in erect PA Radiograph. Initially in erect position fluid accumulates between lung base and diaphragm, forming sub pulmonary pleural effusion provided there is no adhesions. Usually it is agreed that gravitational pull is the main factor for collection of fluid in that location but according to some authors elasticity of lung, basal atelectasis and surface tension are also very important factors.[8,9] Along with sub pulmonary fluid collection, fluid also accumulates in the costophrenic sulcus, visible initially as medial displacement of costophrenic angle followed by blunting of diaphragm-forming so called meniscus sign, a concave line obscuring the costophrenic angle and whole or part of diaphragm. Upper limit of the pleural effusion is horizontal and usually seen at the level of the apex of meniscus.[10] In the periphery of thorax fluid is tangential to the X-ray beam and the X-ray beam traverses greater depth in the periphery than at the center.[11] Earliest sign of pleural effusion in chest erect PA Radiograph is the small meniscus and or medial displacement of costophrenic angle. Approximately 200-300 ml. of fluid is expected to be aspirable in these patients, in addition there will probably be some residual fluid after thoracocentesis.

Erect Chest Lateral Views

In a study done by Collins et al[7] showed that as little as 25 ml of pleural.

Fluid can be detected on lateral erect chest radiograph. A small meniscus sign in the posterior costophrenic angle is a useful sign for detection of small pleural effusion on lateral views.

Lateral Decubitus Views (LDV)

Before the advent of sonography lateral decubitus chest radiograph were considered as very useful for diagnosis of small pleural effusion. Rigler[12] is the first to describe this position. But study of Rigler was on cadaver, so he did not use expiratory technique, nor did he perform radiograph with horizontal X-ray beam. The method of doing LDV with central beam parallel to the pleural fluid level was introduced by Hessen[13] and expiratory LDV was introduced by Muller and Lofstedt.[14] In cadaveric study it is found that as small as 5ml of fluid can be detected in this technique, but it is not so reliable due to inaccurate result of thoracocentesis. Mild pleural effusion in LDV is usually described as minimum of 3 mm. but not more than 15 mm of fluid layer thicknesses having horizontal upper border in the dependent lateral chest wall. Kocijancic et al.[15] found that LDV in expiration increases the sensitivity of this method. This technique is helpful to diagnose small pleural effusion and to recognize artifacts e.g. skin fold, bed sheets, sub-cutaneous fat.

Thoracic Ultrasonography

Now ultrasonography (USG) becomes an important modality of choice for detection of mild pleural effusion.[16,17,18,19] Sonographic criteria for detecting small pleural effusion is at least 3 mm fluid layer thickness in between parietal and visceral pleura and / or change in fluid layer thickness during inspiration and expiration as well as during change in patient's position. Sonographic measurements should be taken with transducer perpendicular to chest wall, because it is a real time method. In a comparative study between thoracic USG and expiratory LDV chest Radiography by Kocijancic et al.,[20] it is shown that both are useful for demonstrating mild pleural effusion, but fluid layer thickness is better assessed by USG. In this study the main sign for detecting mild pleural effusion were same - change in the fluid layer thickness during inspiration/expiration. 3-15 mm. fluid thickness was found in both modalities. A special method of USG examination called "elbow position" was introduced by them in which patient kept in lateral decubitus position for 5 minutes and then USG was done with the patient leaning on the elbow. By this technique small sub - pulmonary effusion can be detected better. The so called "Fluid Colour Sign" is helpful to differentiate pleural thickening & effusion in USG. During respiratory and cardiac movements there will be colour signal in case of pleural effusion which is absent in pleural thickening.

MATERIALS AND METHODS

Inclusion Criteria

- Patient having mild pleural effusion in our 2D USG study.
- Ambulatory male patients.
- Patient having no respiratory distress.
- Adult and cooperative patients.

Exclusion Criteria

- Moderate to severe pleural effusion.
- Patient having respiratory distress.
- Previous history of trauma.
- Patient suspected with empyema thoracis.
- Non-cooperative and restless patients.
- Obese and female patients.

The study included 50 male patients diagnosed to have mild pleural effusion by 2D USG machine referred to the department of Radio diagnosis, North Bengal Medical College & Hospital after considering the inclusion and exclusion criteria. Transthoracic USG done with 3-5 MHz linear and curvilinear transducer in HD-7 model, of M/S PHILIPS. In this study we included only patient with mild cases of pleural effusion. We considered mild pleural effusion as 5 mm or less perpendicular fluid thickness (pleuro- liver distance) 1 cm away from the angle of ultrasonography images.

Figure 1. Showing Pleuro-Liver Distance in USG THORAX

Figure 2. Showing Transducer Placement during Transthoracic USG

Figure 3. Showing Digital X-ray Machine with Chest Stand

Patient was examined in supine position with arms folded over the head. Transducer was placed in long axis over the lateral chest wall along the mid axillary line in full inspiration (Figure 2). The thickness of pleural fluid was measured in mm by USG digital caliper. Perpendicular distance between lateral chest wall and the liver measured at a distance of 1 cm away from the angle. Those patients having mild pleural effusion i.e. 5mm or less fluid thickness were subjected to lateral decubitus chest radiograph in our digital or conventional x-ray machine. Our DR- XRAY machine is AGFA made and conventional x-ray machine made by M/S SHIMADZU 800mA. Patients were counseled and explained the procedure and then placed in lateral decubitus position on a separate wooden table placed in front of the chest stand. The affected side was placed in dependent position and patient were kept for at least 5 minutes to allow the fluid to settle down. The arm was folded above the head, hip and knee were semi flexed and a radio lucent cushion was placed below the patient's body and cross –table X-ray with horizontal beam was done.

RESULTS

This study included 50 male patients of different age group (>20yrs).Of these 50 patients, 23 patients were in the group above 50 yrs.

Out of these 50 patients (n=50) diagnosed to have small pleural effusion by USG, 36 cases were detected by lateral decubitus chest radiograph. So in our study detection rate of pleural effusion by lateral decubitus chest radio graph in comparison to USG is 72%.

Age (yrs.)	No. of Patient (n=50)
20-30	5
30-40	9
40-50	13
>50	23

Table 1. Showing Distribution of Patients According to Age Group

Positive for Lateral Decubitus (n=14)	Negative for Lateral Decubitus (n=36)	t Test	p Value
39.7 ± 10.7	53.3 ± 13.8	3.31	.002

Table 2. Comparison of Mean Age of Patients According to Detection of Pleural Effusion in Lateral Decubitus Chest Radiography

Table shows that patients in whom lateral decubitus chest radiograph fails to detect pleural effusion have lower mean age than patients in whom fluid is not detected. The difference is statistically significant ($p<0.05$).

Age (Mean ± SD) of patient positive for USG: 49.3 ± 14.3 years.

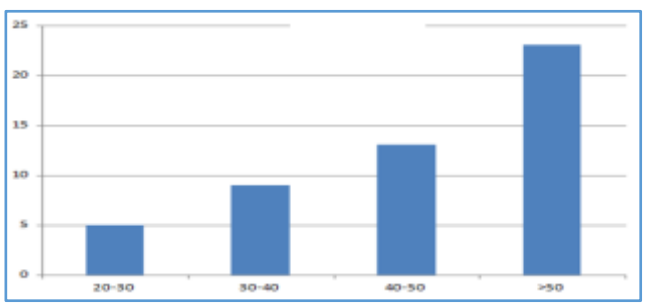

Figure 4. Showing Distribution of Cases According to Age Group

Modality	No. of +ve Cases
Ultrasonography	50
Lateral decubitus chest X-ray	36

Table 3. Showing Detection of Pleural Effusion by Both Modalities

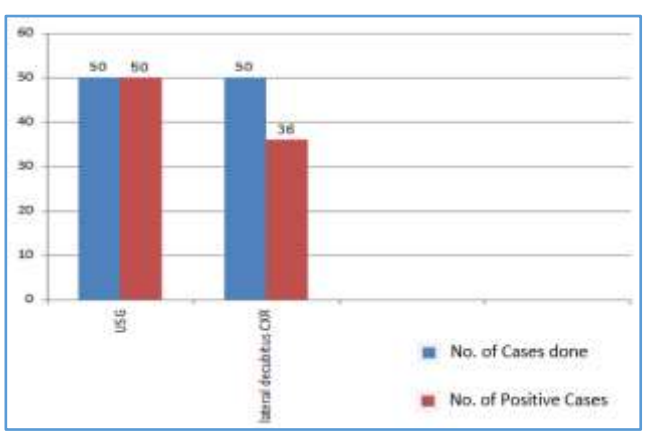

Figure 5. Showing Detection of Pleural Effusion in Both Modalities

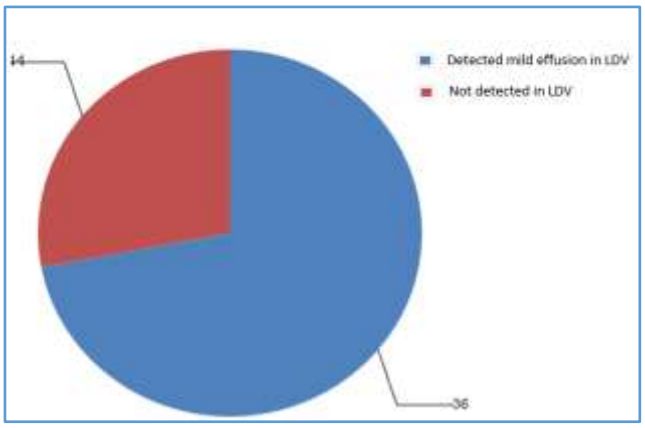

Figure 6. Pie Chart showing Detection Rate of Mild Pleural Effusion by Lateral Decubitus View (LDV)

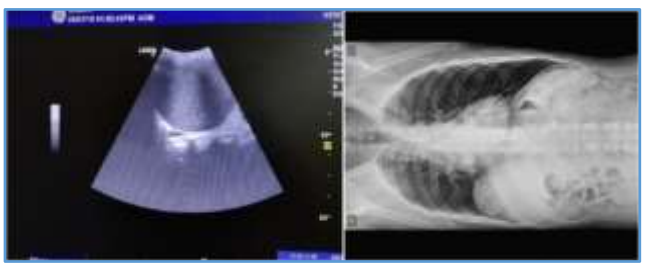

Figure 7. Showing Minimal Amount of Pleural Effusion in USG, but, No Effusion in LDV Chest Radiograph, in the Same Patient

Figure 8. Showing Minimal Amount of Pleural Effusion in USG, but, No Effusion was Found in LDV Chest Radiograph

Figure 9. Showing Mild Pleural Effusion in USG & LDV Chest Radiograph, in the Same Patient

DISCUSSION

The patients were referred to our department either for USG thorax due to clinical suspicion of pleural effusion or incidentally found pleural effusion during abdominal USG. Total no. of 50 male patients showing mild pleural effusion in USG were included in this study and all of them underwent lateral decubitus chest radiograph, Out 2400 of these 50 patients maximum patients were in the age group of >50 yrs. (46%).

Among the 50 patients, 36 patients showed pleural effusion by lateral decubitus chest radiograph. So in this study 72% patients were diagnosed as small pleural effusion by lateral decubitus chest radiograph in comparison to USG thorax.

Lateral decubitus radiograph was used for many years in the diagnosis of small pleural effusion. This position was first mentioned in the work of Rigler.[12] In last two decades USG of pleural space becomes a leading real time diagnostic modality of choice for demonstrating mild pleural effusion.

In a study done by N.Xirouchakiet al.[21] found that chest radiography has a diagnostic accuracy of 69% in comparison to USG. It correlates well with our study.

Study done by Kocijancicet al.[22] showed that for detection of physiologic pleural fluid in healthy individual thoracic Ultrasonography is far better than lateral decubitus expiratory chest radiograph. Out of 106 healthy volunteers fluid was visible in 28 patients in USG and lateral decubitus expiratory radiograph showed fluid in only one case, indicating that USG is much more superior to Radiograph. This is consistent with our findings.

In the work of Kocijancicet al.[23] on Chest sonography versus lateral decubitus radiography in the diagnosis of small pleural effusion concluded that Chest sonography has high degree of accuracy relative to that of lateral decubitus chest radiography. They found that compared with radiological examination chest sonography had positive predictive value of 92% in diagnosis of small pleural effusion. This approximates our study.

Kamila Sikora et al.[24] in a review article on ultrasound for the detection of pleural effusions and guidance of the thoracocentesis procedure found ultrasonography as a more accurate imaging tool than chest radiography for the diagnosis of pleural effusion. This corroborates our study.

CONCLUSION

Transthoracic USG is much more superior and preferrable to lateral decubitus chest radiography for detecting mild pleural effusion.

Sonography being low-cost, radiation-hazard-free, sensitive method, it should be the modality of choice for diagnosis of mild pleural effusion.

Thoracic USG has the added advantage of guiding thoracocentesis for aetiological diagnosis.

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