

Research Article

A study of pleural effusion with reference to different diagnostic modalities

Savita Jindal^{1*}, Pankaj Garg², Amit R. Dedun¹, Hemant Nayi¹, Divyashree J¹, Gaurav Sahu¹

¹Department of Pulmonary Medicine, B.J. Medical College, Ahmedabad, Gujarat, India

²Department of Medicine, GMERS Medical College, Gandhinagar, Gujarat, India

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*Correspondence:

Dr. Savita Jindal,

E-mail: drsavy05@gmail.com

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ABSTRACT

Background: Aim of current study was to determine the different etiologies of pleural effusion and efficacy of diagnostic methods.

Methods: 100 patients of pleural effusion of both sexes were taken randomly coming to our institution either indoor or OPD. Inclusion criteria: 100 patients of pleural effusion of any age and of either sex in whom thoracentesis can yield minimum amount of pleural fluid for diagnostic purposes. Exclusion criteria: Patients of pleural effusion in whom fluid could not be aspirated were excluded from the study.

Results: In this study 70% of the patients were male and 30% were female. Most of the patients were between 21-30 years of age. 92% of the pleural effusion was exudative and 8% was transudative. Tuberculosis is the most common (44%) cause of pleural effusion followed by malignancy (23%), 5% of the patients remains undiagnosed. Sensitivity, specificity, NPV, PPV of Light's criteria is 100% to differentiate between transudates and exudates. Among parameters of Light's criteria pleural LDH has highest specificity (100) and sensitivity (100) and NPV (80%). Sensitivity, specificity, NPV, PPV of ADA to differentiate between tuberculous and non tuberculous pleural effusion is 100%, 95%, 100%, 96.77% respectively. Pleural biopsy was positive in 80% of the tuberculous patients while in malignancy it was positive only in 20% of the patients.

Conclusions: Tuberculosis remains to be main cause of pleural effusion in India. Light's criteria is most specific & sensitive to diagnose between exudative & transudative pleural fluid. ADA is highly sensitive & specific to differentiate between tuberculous & nontuberculous pleural effusion. In centres where thorascopy is not available for undiagnostic cases of pleural effusion, pleural biopsy can be helpful in fair no. of cases for diagnosis.

Keywords: Pleural effusion (PE), Adenosine deaminase (ADA), Malignancy

INTRODUCTION

Someone has rightly said that pleural effusion is not a disease, but it is the sign of many diseases. It constitutes a major problem in all areas of clinical medicine. That is why examination of pleural fluid and pleura gives clue to the diagnosis of so many diseases. A patient with pleural effusion may present to chest physician or to general surgeon.¹ Collection of fluid has many etiological factors.

In India tuberculosis is the most common cause followed by malignancy.²⁻⁴ Pleural effusion often poses a diagnostic dilemma to the physician as differential diagnosis is wide. The major problem in clinical diagnosis of pleural effusion is not distinguishing transudates from exudates^{2,5} but is determining the cause of effusion, when it is an exudate. For this reason many laboratory correlations have been made with various diseases known to cause exudative effusion. Sometimes

diagnosis may be made easily but sometimes pleural effusion remain as undiagnosed.⁶⁻⁸ Light et al. has established a criteria demonstrating high degree of diagnostic accuracy for differentiating transudates and exudates.⁹

Adenosine deaminase (ADA) is an enzyme, as a marker of cellular immunity, its activity is found to be elevated in diseases, in which there is cell mediated immune response.¹⁰⁻¹²

METHODS

100 patients of pleural effusion of both sexes were taken randomly coming to our institution either indoor or OPD.

Inclusion criteria

100 patients of pleural effusion of any age and of either sex in whom thoracentesis can yield minimum amount of pleural fluid for diagnostic purposes.

Exclusion criteria

Patients of pleural effusion in whom fluid could not be aspirated were excluded from the study.

RESULTS

Table 1 shows (Total) mean age = 37.80 ± 15.47 mean age in TB = 32.18 ± 15.47 and in Malignancy = 53.63 ± 18.93. This table shows that most of the patients (41 %) were between the age group 21-30 years. 70% of the patients were male while 30% of the patients were female, shows male preponderance.

Table 1: Age and sex distribution.

Age group (years)	Males	Females	Total
11-20	03	01	04
21-30	28	13	41
31-40	09	05	14
41-50	10	05	15
51-60	16	05	21
More than 60	04	01	05
Total	70	30	100

Table 2 shows that maximum number of cases of pleural effusion were tuberculosis (44%), followed by malignancy (23%) and parapneumonic (13%). 5% of the cases of pleural effusion remain undiagnosed.

Table 3: Majority of patient had right sided effusion. 80% of patients in CCF had bilateral pleural effusion. 52.17% of the malignant pleural effusion has right sided pleural effusion. Right sided effusion is more in tuberculous and in malignancy. Majority (80%) of the patients of CCF had bilateral pleural effusion.

Table 2: Etiological diagnosis of pleural effusion.

Diagnosis	No. of cases		Total	Percentage (%)
	Male	Female		
TB	28	16	44	44
Malignancy	18	5	23	23
Parapneumonic	9	4	13	13
CCF	5	0	5	5
Cirrhosis of liver	1	0	1	1
Ruptured liver abscess	1	0	1	1
Hypoproteinaemia	0	1	1	1
Chylothorax	1	0	1	1
Constrictive pericarditis	1	0	1	1
Chronic pancreatitis	2	0	2	2
Collagen vascular diseases	0	2	2	2
Hydatid cyst rupture	1	0	1	1
Undiagnosed	3	2	5	5
Total	70	30	100	100

Table 3: Side of effusion.

Diagnosis	Right (%)	Left (%)	Bilateral (%)
TB (44)	24 (54.54)	18 (40.90)	2 (4.54)
Malignancy (23)	12 (52.17)	9 (39.13)	2 (8.69)
Parapneumonia (13)	10 (76.92)	3 (23.67)	0
CCF (5)	1 (20)	0	4 (80)
Cirrhosis of liver (1)	1 (100)	0	0
Ruptured liver abscess (1)	1 (100)	0	0
Hypoproteinaemia (1)	1 (100)	0	0
Chylothorax (1)	0	0	1 (100)
Constrictive pericarditis (1)	0	0	1 (100)
Chronic pancreatitis (2)	0	0	2 (100)
Collagen vascular disease (2)	1 (50)	1 (50)	0
Hydatid cyst rupture (1)	1 (100)	0	0
Undiagnosed (5)	2 (40)	3 (60)	0
Total (100)	56	34	10
Percentage	56	34	10

Table 4 shows that 92% of the patients of present study were having exudative pleural effusion and 8% of the patients had transudative pleural effusion.

Table 5 shows that tuberculous, malignant and parapneumonic pleural effusion had pleural fluid glucose level less than 60 mg/dL. All the tuberculous pleural effusion has ADA level more than 40 mg/dL. 93.3% of

the malignant pleural effusion and all other pleural effusion have ADA less than 40 mg/dL. Only 6.67% of the malignant pleural effusion has ADA level more than

40 mg/dL. 85% of the all patients have cholesterol level >60 mg/dL.

Table 4: Biochemical analysis of pleural fluid (Light's criteria).

Diagnosis	Pleural fluid Prt./S. prt. (100)(%)		Pleural fluid LDH (60X%)		Pleural fluid /S. LDH (60X%)	
	>0.5	<0.5	<200	>200	<0.6	>0.6
TB (44)	44	-	1 (3.34)	29 (96.67)	2	28
Malignancy (23)	22 (95.65)	1 (4.34)	0	15 (100)	0	15
Parapneumonia (13)	12 (92.30)	1 (7.69)	1 (20)	4 (80)	1	4
CCF (5)	0	5 (100)	5 (100)	-	5	0
Cirrhosis of liver (1)	0	1 (100)	1 (100)	-	1	0
Ruptured liver abscess (1)	1 (100)	-	-	-	-	-
Chylothorax (1)	1 (100)	-	-	1 (100)	-	1
Hypoproteinemia (1)	0	1 (100)	1 (100)	-	1	-
Constrictive pericarditis (1)	1 (100)	-	1 (100)	-	1	-
Chronic pancreatitis (2)	2 (100)	-	-	-	-	-
Collagen vascular disease (2)	2 (100)	-	-	-	-	-
Hydatid cyst ruptures (1)	1 (100)	-	0	1 (100)	-	1
Undiagnosed (5)	5 (100)	-	-	-	-	-
Total (100)	91	9	10	50	11	49
Percentage	91	9	16.66	83.34	18.33	81.67

Table 5: Other laboratory parameters.

Diagnosis	(100) Pleural fluid		PI. Fluid (ADA)(%)		(60) Pleural fluid	
	<60 mg/dL	> 60 mg/dL	<40	>40	<60	>60
TB (44)	43 (97.72)	1 (2.27)	0	30 (100)	0	30 (100)
Malignancy (23)	22 (95.65)	1 (4.34)	14 (13.3)	1 (6.67)	1 (13.3)	14 (93.3)
Parapneumonia (13)	13 (100)	0	2 (100)	-	0	5 (100)
CCF (5)	0	5 (100)	1 (100)	-	5 (100)	-
Cirrhosis of liver (1)	0	1 (100)	-	-	1 (100)	-
Ruptured liver abscess (1)	1 (100)	-	-	-	-	-
Chylothorax (1)	1 (100)	0	1 (100)	-	-	1 (100)
Hypoproteinemia (1)	0	1 (100)	-	-	1 (100)	-
Constrictive pericarditis (1)	0	1 (100)	1 (100)	-	1 (100)	-
Chronic pancreatitis (2)	0	2 (100)	-	-	-	-
Collagen vascular disease (2)	1 (50)	1 (50)	-	-	-	-
Hydatid cyst ruptures (1)	0	1 (100)	-	-	0	1 (100)
Undiagnosed (5)	0	5 (100)	-	-	-	-
Total (100)	86	14	19	31	9	51
Percentage	86	14	38	62	15	85

Table 6 shows that in transudates mean SD of ratio of pleural fluid to serum protein is less than 0.5 while in exudates it is >0.5. Mean value of other parameters of Lights criteria also fulfils the Lights criteria in transudates and exudates.

Table 7 shows that Light's criteria is most specific and sensitive indicator to distinguish between transudates and exudates. In Light's criteria pleural fluid/S. prt is most

sensitive (97.8%) while pleural fluid LDH as well as its ratio to S. LDH is most specific (100%).

Table 8 shows that ADA is the sensitive parameter to differentiate between tuberculous and non tuberculous pleural effusion.

Table 9 shows that in majority of the tuberculous pleural effusion (80%) pleural biopsy confirms the diagnosis

while in malignancy only few patients (20%) diagnosis is confirmed by biopsy. The reason may be that in

tuberculous whole pleural membrane is inflamed while in malignancy patchy inflammation is there.

Table 6: Mean value and standard deviation of different biological parameters in transudate, exudates, tuberculous and malignant pleural effusion.

Parameters	Transudates (Mean ± SD)	Exudates (Mean ± SD)	Tuberculous (Mean ± SD)	Malignant (Mean ± SD)
Pleural fluid Prt./S. prt.	0.32 ± 0.09 (8)	0.71 ± 0.14 (92)	0.715 ± 0.127 (44)	0.69 ± 0.127 (23)
Pleural fluid LDH	160.0 ± 23.523 (8)	376.34 ± 111.25 (52)	363.03 ± 103.17 (30)	421.6 ± 117.17 (15)
Pleural fluid LDH i.e. S. LDH	0.48 ± 0.077 (8)	0.87 ± 0.391 (52)	0.848 ± 0.34 (30)	0.99 ± 0.516 (15)
Pleural fluid Glu.	94 ± 19.8 (8)	36.46 ± 24.89 (92)	40.70 ± 25.80 (44)	36.56 ± 21.62 (23)
Pleural fluid ADA	23.5 ± 4.04 (2)	63.06 ± 31.51 (48)	84.16 ± 18.38 (30)	30.2 ± 7.26 (15)
Pleural fluid cho.	47.36 ± 10.96 (8)	112.54 ± 45.16 (52)	118.0 ± 19.45 (30)	88.26 ± 19.27 (15)

Table 7: Sensitivity, specificity, positive predictive value (PPV) and negative predictive value (NPV) of various laboratory parameters for transudate.

Parameters (cut off value)	Sensitivity (%)	Specificity (%)	PPV (%)	NPV (%)
Pleural fluid/ S. prt. (0.5)	97.8	87.5	98.9	77.77
Pleural fluid LDH (200)	96.15	100	100	80
Pleural fluid/ S. LDH (0.6)	94.23	100	100	72.72
Light's criteria	100	100	100	100

Table 8: Sensitivity, specificity, NPV, PPV of pleural fluid ADA.

Diagnosis	Sensitivity (%)	Specificity (%)	NPV (%)	PPV (%)
Tuberculous (40) pleural effusion	100	95	100	96.77
Non-tuberculous pleural effusion (30)	95	100	96.77	100

Table 9: Pleural biopsy.

Diagnosis	Positive for diagnosis (%)	Negative for diagnosis (%)
Tuberculous (20)	16 (80)	4 (20)
Malignancy (5)	1 (20)	4 (80)
Total (25)	17	10
Percentage	68	32

Pleural fluid for ZN stain was done in all pleural effusion, (it was positive in 2 (4.54%) patients out of 44 patients of tuberculous pleural effusion) the reason for this is that pleural effusion is the result of inflammation of pleura due to DTH (Delayed Type of Hypersensitivity). Pleural

fluid AFB (Acid Fast Bacilli) present only if the subpleural focus ruptures into pleural cavity.

In all suspected cases of parapneumonic pleural effusion gram stain for pleural fluid was done. Out of 13 parapneumonic patients 7 (53.64%) were positive for gram stain.

In all malignant pleural effusion cytology of the pleural fluid was carried out. (It was positive in 15 (65.21%) of the patients out of 23 patients.

DISCUSSION

In this study tuberculosis pleural effusion is 44% while it varies in different studies. Malignant pleural effusion is 23% which is comparable to Thiruvengadam (1962),¹³ Valdes (1991),¹⁴ Valdes (1996).¹⁰ Parapneumonic pleural effusion is 13% which is comparable to Hirsch (1979),⁸ Valdez (1991),¹⁴ Valdez (1996)¹⁰ J. E. Heffner (2002),¹⁵ J. E. Heffner (2003).¹⁶ CCF effusion is 5% which is comparable to Thiruvengadam (1962).¹³ In present study common age group among all patients is 21-30 years which is comparable to Irani et al. study.¹⁷ In present study mean age is 37.8 ± 15.47 which is comparable to N. K. Menon.¹⁸

In present study 92% of the patients had exudative pleural effusion which is comparable to S. Ramero¹⁹ and Valdes study²⁰ and 8% of the patients had transudative pleural effusion, in other studies percentage of transudate pleural effusion is very high. This may be due to high incidence of tuberculosis in India.

Sensitivity, specificity, PPV (Positive Predictive Value), NPV (Negative Predictive Value) of PF (Pleural Fluid)/S. Prt. (Serum Protein) in present study is 97.8%, 87.5%, 98.9%, 77.77% respectively which comparable to Light's study.⁹

PI/Fluid LDH (Lactate Dehydrogenase) sensitivity, specificity, PPV, NPV in present study is 96.15, 100, 100%, 80% respectively which comparable to Light's⁹ and John E. Heffner's²¹ study.

Mean SD (Standard Deviation) of ADA in tuberculous pleural effusion was 84.16 in present study, which is comparable to Piras MA et al.,¹² Gilhotra²² study, while in non-tuberculous it was 30.2 which is comparable to Gilhotra²² study

Sensitivity, NPV of ADA in present study was 100% which is same as that of B.R. Maldhure.⁴ Which shows ADA is a sensitive parameter to differentiate between tuberculous and non tuberculous pleural effusion.

In present study pleural biopsy is present in 68% of the patients which is comparable to Lloyd M.S. study.²³ In present study pleural fluid for AFB present in 4.54% which is same as that of Pranay Sinha study.²⁴ In this study pleural fluid cytology for malignant cell in malignancy was present in 65.21% of the malignant pleural effusion patients which was comparable to Salyer study.²⁵

Summary

100 cases of pleural effusion were studied by clinical, radiological and various laboratory methods. In this study 70% of the patients were male and 30% were female. Most of the patients were between 21-30 years of age. 92% of the pleural effusion was exudative and 8% was transudative. Tuberculosis is the most common (44%) cause of pleural effusion followed by malignancy (23%), 5% of the patients remains undiagnosed.

Right sided effusion was present in 56% patients while left sided in 34% and 10% of the patients had bilateral pleural effusion. 46% of the patients had yellowish colour fluid followed by 23% of the patients with haemorrhagic pleural effusion, followed by 13% purulent. Yellowish colour fluid was present in 84.09% of the tuberculous patients while common cause of haemorrhagic pleural fluid was malignancy (69.56%) only 1% of the patient with chylothorax was having milky white pleural effusion. 76.92% of the patients with parapneumonic pleural effusion had purulent pleural fluid. All the transudates pleural fluid had clear fluid.

Sensitivity, specificity, NPV, PPV of Light's criteria is 100% to differentiate between transudates and exudates. Among parameters of Light's criteria pleural LDH has highest specificity (100) and sensitivity (100) and NPV (80%).

Sensitivity, specificity, NPV, PPV of ADA to differentiate between tuberculous and non tuberculous pleural effusion is 100%, 95%, 100%, 96.77% respectively. Pleural biopsy was positive in 80% of the tuberculous patients while in malignancy it was positive

only in 20% of the patients. Pleural fluid for AFB was present in 4.54% of the tuberculous patients. 65.21% of the malignant pleural effusion, pleural fluid cytology for malignant cells was present.

CONCLUSION

In day to day practice we come across cases of pleural effusion, usually to diagnose pleural effusion not a difficult task but still some cases requires detailed examination but number of these cases are few. By doing specific tests like pleural biopsy, pleural fluid ADA we can significantly improve diagnostic yield as these tests are, easily approachable and non-invasive or minimally invasive and can significantly reduce hospitalization period. In centres where thoracoscopy is not available for undiagnostic cases of pleural effusion, pleural biopsy can be helpful in fair no. of cases for diagnosis.

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