Original Research Paper

Volume - 12 | Issue - 01 | January - 2022 | PRINT ISSN No. 2249 - 555X | DOI : 10.36106/ijar

Respiratory Medicine

TO STUDY PROFILE OF PATIENTS WITH PLEURAL EFFUSION AT TERTIARY CARE CENTRE.

Dr. Abhijeet M. Yadav	Junior Resident Department of Respiratory Medicine, L.T.M.G.H. Sion, Mumbai, Maharashtra, India
Dr. Jairaj P. Nair	Associate professor, Dept. of Respiratory Medicine, L.T.M.G.H. Sion, Mumbai, Maharashtra, India
Dr. Nilkanth T. Awad	Professor and HOD, Dept. of Respiratory Medicine, L.T.M.G.H. Sion, Mumbai, Maharashtra, India
Dr. Sunil Dighe	Junior Resident Department of Respiratory Medicine, L.T.M.G.H. Sion, Mumbai, Maharashtra, India

KEYWORDS :

INTRODUCTION

Pleural effusion is the condition characterized by an abnormal collection of fluid in pleural space resulting from excess fluid production or decreased absorption(1–3). It is due to pleural fluid accumulation inside pleural space. The major mechanism include: increased interstitial fluid in the lungs secondary to increased pulmonary capillary pressure (i.e., heart failure) or permeability (i.e., pneumonia); decreased intrapleural pressure (i.e., atelectasis); decreased plasma oncotic pressure (i.e., hypoalbuminemia); increased pleural membrane permeability and obstructed lymphatic flow (e.g., pleural malignancy or infection); diaphragmatic defects (i.e., hepatic hydrothorax); and thoracic duct rupture (i.e., chylothorax)(4).

Likewise, many different diseases may cause pleural effusion, the most common causes in adults are pneumonia, tuberculosis, malignancy, heart failure, and pulmonary embolism, whereas pneumonia is the leading etiology in children(5–9).

Pleural effusion is a common manifestation of variety of diseases so it can represent as a vast variety of differentials. So, for exact etiological diagnosis of pleural effusion requires a systematic & structured approach.(1,4,8,10–12) The approach should allow minimal invasive procedure & minimal consumption of time. For this thoracocentesis & proper pleural fluid analysis is mandatory(1,5,10,13–15). Pleural effusion is a common chest problem, yet 20% of the case remains undiagnosed despite good history, thorough clinical, radiological, full examination of aspirated fluid and pleural biopsy. It is estimated that its prevalence is approximately 400 cases/100000 of pleural effusion (PE) is common in clinical practice. For appropriate diagnosis of pleural effusion stepwise approach is required which include proper clinical history & physical examination, radiological confirmation with chest x-ray, ultrasound chest, CT thorax wherever applicable. Role of thoracocentesis is equally important in reaching up to exact diagnosis(4,10,11). Pleural fluid analysis in the form cellular picture, biochemical investigations, microbiological investigations, cytology should be required for exact diagnosis so, to know the role of each investigation & its appropriate usefulness is mandatory(1,10,16).

Although the evaluation of patients with pleural effusion is necessary to determine whether the effusion is a transudate or an exudate? An exudative effusion is diagnosed if the patient meets lights criteria(10,15,17). The serum to pleural fluid protein or albumin gradients may help better categorize the occasional transudate misidentified as an exudate by these criteria. If the patient has a transudative effusion, therapy should be directed toward the underlying heart failure or cirrhosis. If the patient has an exudative effusion, attempts should be made to define the etiology. Pneumonia, cancer, tuberculosis, and pulmonary embolism account for most exudative effusions. Many pleural fluid tests are useful in the differential diagnosis of exudative effusions. Other tests helpful for diagnosis include helical computed tomography and thoracoscopy(5,18).

The study was conducted on patients with pleural effusion to reach exact diagnosis by using various diagnostic approaches.

AIMS & OBJECTIVES

To study the patients presenting with pleural effusion and identify the etiology with the help of clinical, radiological, biochemical, histopathological examination.

MATERIALS & METHODS

The study was conducted in department of respiratory medicine at Lokmanya Tilak Municipal Medical College, Sion, Mumbai in the year 2016-18. It was a hospital based prospective observational study and included 161 cases of pleural effusion admitted in the Department of respiratory medicine. A structured interview was carried out in all cases of pleural effusion and diagnostic thoracocentesis was carried out in those satisfying the inclusion criteria. Lights criteria was applied and the patients were classified into transudative and exudative and further investigations were carried out appropriately. All individuals above 12 years of age with a diagnosis of pleural effusion who were willing to participate in the study after obtaining a written informed consent were included in the study.

Inclusion Criteria: All the patients presenting with pleural effusion above 12 years of age.

Exclusion Criteria: Patient below 12 years of age, Patients with deranged hematological parameters.

RESULTS:

From the data obtained, it was found that male preponderance seen in our study with116(72%) were males and 45(28%) were females. The mean age (in years) of patients was 37.60± 16.56. Majority of the patients that were affected within 50 years of age. Maximum i.e., 41 (25.5%) of the patients were in 21–30-year age group & Patients in between 31 to 40 yrs. of age were 32 (19.9%).

Total 161 patients were included in the study out of which most common presenting symptom overall was dyspnea seen in 135(83.9%) & chest pain in 134(83.8%) of patients, followed by fever in 126 (78.3%) of patients & cough in 122 (75.8%) of patients. loss of weight & loss of appetite presents in significant number of patients i.e., 126(78.3%). The duration of symptoms lasts more than 3 weeks in more than 50% study population. The percentage of distribution of the symptoms shown in **Table 1**.

Table 1: Distribution Of Symptoms In Study Population

Name of Symptoms	Number of patients	Percentage
Fever	126	78.3%
Cough	122	75.8%
Chest pain	134	83.8%
Dyspnea	135	83.9%
Hemoptysis	8	5%
Loss of weight & loss of appetite	126	78.3%
Wheezing	7	4.3%
Past history of tuberculosis	51	31.7%
History of smoking	41	25.5%

According to chest x ray findings majority of the patients i.e., 98 (60.9%) had right sided pleural effusion while 57 (35.4%) patients present left sided pleural effusion. From the data it was found that only 8 (5%) patients shown bilateral pleural effusion.

USG chest suggestive of 110(68.3%) patients had free pleural effusion while 51(31.7%) had loculated pleural effusion. Whereas on HRCT 34 (21.1%) had parenchymal involvement.

From lab investigation data it was revealed that Mean hemoglobin, total leukocyte count, platelet count, in all the patients were 11.51,9167 & 307593 respectively. While Random blood sugar, total protein & albumin were 116,6.63 & 3.31 respectively.

Data regarding pleural fluid analysis shown that Data regarding pleural fluid analysis shown that common pleural fluid appearance in tubercular group was clear that is 75.2% followed by turbid in 23.4% of the patients.90% of malignant pleural effusion showed Hemorrhagic pleural fluid. In case of infectious group other than tuberculosis 60% of patients showed turbid appearance.

Most common range of pleural fluid pH in tuberculous group was in between 7.1 to 7.5 in which number of patients were 48.9%. In malignant group most common range of PH is between 6.6 to 7 & 7.1 to 7.5 which was 40%. In infectious group other than tuberculosis most common PH range is 7.1 to 7.5 which is 50%.

In tuberculous group 70.9% of patients showing pleural fluid proteins between 4 to 6 grams. In malignant group 50% of the patients having range between 4 to 6 grams. In infectious group other than tuberculosis 50% shows pleural fluid proteins below 4 gram & 50% shows in between 4 to 6 grams.

55.3% of patients in tubercular group shows pleural fluid albumin in between 2 to 3 grams & 40% of the patients shows albumin level more than 3 grams. In malignant group 90% of the patients showed pleural fluid albumin level between 2 to 3 grams. In infectious group other than tuberculosis 40% of patients showing1 to 2 grams of albumin & 40% showing between 2-3 grams. Most of the patients in our study had pleural fluid glucose level in between 60 to 150 mg/dl i.e., 53.9% in tubercular group & 50% in malignant group, contrary to this 70% of the patients in infectious group other than tuberculosis had pleural fluid glucose less than 20.

Maximum number of patients had pleural fluid cholesterol in the range between 50 to 100 mg/dl. Number of patients in this range in tuberculous, malignancy & in infectious group other than tuberculosis were 58.2% ,60% & 50% respectively.

Pleural fluid LDH in the range between 501 to 5000IU/L, seen in 96(68.08%) in tubercular group, 6 (60%) in malignant group, 4 (40%) in infectious group other than tuberculosis group respectively. Other than that, in infectious group other than tuberculosis 4(40%) of the patients also had pleural fluid LDH in between 5001to 10000IU/L. While 77.7% of the patients in tubercular group had ADA level more than 40 U/L &. In malignant group 80% of patients had ADA less than 40 U/L. In infectious group other than tuberculosis 60% patients had ADA more than 70 U/L.

Pleural fluid CBNAAT is positive in 16.8% of the patients out of which 6.2% showing MTB detected low,3.1% Showing MTB detected medium,3.7% showing MTB detected very low, 0.6% showing MTB detected high while 3.1% patients showing MTB detected low with rifampicin resistance. The detailed pleural fluid analysis of study population shown in **Table 2**

Table 2: Pleural Fluid Analysis

Parameter	Frequency	Percentage
1. Appearance of pleural fluid		
Greenish	1	0.6%
Hemorrhagic	10	6.2%
Clear straw colored	111	68.9%
Turbid	39	24.2%
Total	161	100.0%
2. pH OF PLEURAL FLUID –		
<=6.5	12	7.5%
6.6-7	46	28.6%
7.1-7.5	78	48.4%
7.5-8	25	15.5%
Total	161	100.0%
3. Total cell counts of pleural fluid		
<100	14	8.7%
101-1000	95	59.0%
>1000	52	32.3%
Total	161	100.0%
4. Pleural fluid polymorphs Percentage		
<50 %	110	68.3%
>50%	51	31.7%
>50%	51	31.7%
Total	161	100.0%
5. Pleural fluid lymphocytes Percentage		
<50 %	59	36.6%
>50%	102	63.4%
Total	161	100.0%
6. Pleural fluid proteins		
<4.0 gm	31	19.3%
4.1-6.0gm	110	68.3%
>6.0 gm	20	12.4%
>6.0 gm	20	12.4%
>6.0 gm	20	12.4%
Total	161	100.0%
7. Pleural fluid Albumin		
<1 gm	4	2.5%
1-2 gm	24	14.9%
2-3 gm	91	56.5%
>3 gm	42	26.1%
Total	161	100.0%
8. Pleural fluid glucose		
<20	44	27.3%
21-60	27	16.3%
61-150	84	52.1%
150	6	3.7%
Total	161	100.0%
9. Pleural fluid Lactate Dehydrogenase		
100-500	2	1.2%
501-5000	19	11.8%
5001-10000	106	65.8%
>10000	20	12.4%
Total	161	100.0%
10. Pleural fluid cholesterol		
<50	23	14.3%
51-100	93	57.8%
>100	45	28.0%
Total	161	100.0%
11. Pleural fluid Amylase		
<50	103	64.0%
51-100	51	31.7%
>100	7	4.3%
Total	161	100.0%
12. Pleural fluid Adenosine Deaminase ADA(U/L)		
<40	36	22.4%
41-70	51	31.7%
>70	74	46.0%
Total	161	100.0%

Diagnosis was made on the basis of clinical, radiological, hematological parameters (total number of cells, polymorphs, lymphocytes), pleural fluid analysis (pH, pleural fluid ADA, LDH, glucose) microbiological confirmation (cytology, AFB smear, Gene Xpert, LJ culture, Bacterial culture). The details findings of pleural fluid cytology were shown in **Table 3**.

Table 3: Pleural Fluid Cytology

Parameter	Frequency	Percentage
Malignant Cells		
Yes	7	4.3%
No	154	67.1%
Total	161	100.0%
AFB Smear		
AFB Seen	3	1.9%
AFB Not Seen	158	98.1%
Total	161	100.0%

Pleural Fluid LJ Culture		
No Growth	158	98.1%
Growth Seen	3	1.9%
Total	161	100.0%
Pleural Fluid MGIT Culture		
Growth Seen	6	3.72%
No Growth	49	30.43%
Not Available	106	65.8%
Total	161	100%
Pleural Fluid Bacterial Culture		
Acinetobacter	2	1.2%
MRSA	3	1.9%
Pseudomonas	2	1.2%
Streptococcus	6	3.7%
No Growth	3	1.9%
Total	16	9.93%

Out of 161 patients 4.3% of patient's pleural fluid positive for malignant cells. While Pleural fluid AFB smear positive in only 1.9% of the patients. Pleural fluid LJ culture showing growth in 1.9% of the patients and 3.72 % of patients among 161 showed growths on MGIT culture. Out of 7 bacterial empyema 5 were showing growth positive for some bacteria. Most common organism in bacterial empyema was streptococcus. Pleural fluid CBNAAT is positive in 16.8% of the patients out of which 6.2% showing MTB detected low,3.1% Showing MTB detected medium,3.7% showing MTB detected very low,0.6% showing MTB detected high while 3.1% patients showing MTB detected low with rifampicin resistance.

All the above parameters will reflect into the exact etiology of the pleural effusion. So, it can broadly divide into three categories as shown in **Table 4**. Out of 161 patients in our study, 141 were tuberculous pleural effusion, 10 patients had malignant pleural effusions, 10 had infective causes other than tuberculosis.

Table 4: Etiology Of Pleural Effusion

ETIOLOGY	NUMBER OF PATIENTS	Percentage
Tuberculosis	141	87.6%
Malignancy	10	6.2%
Infective (Non-TB)	10	6.2%

In tuberculous group & malignancy group most of the pleural effusion were right sided 61% & 80% respectively, 4.3% of the tubercular pleural effusion also showing bilateral pleural effusion. It was shown in **Table 5**.

Table 5: C- X-ray Findings

CX RAY	Tuberculous	Malignancy	Infective other than TB	Total
Right	86(61%)	8(80%)	4 (40%)40%	98(60.9%)
Left	51(36.2)	2(20%)	4(40%)	57(35.4%)
Bilateral	6(4.3%)	0(0%)	2(20%)	8(5%)

On USG chest 66.3% of pleural effusion were free while 33.3% were loculated in tubercular group. While in malignant group 100% were free effusion. In infectious group other than tuberculosis 60% were free effusion.

On HRCT 14.9% of tubercular pleural effusion shows parenchymal involvement. In case of malignancy that was 90%. while in infectious group other than tuberculosis 40% patients showing parenchymal involvement. It has shown in **Table 6**.

Table 6 Usg & Hrct Findings

USG		Tuberculous	Malignancy	Infective other than TB	Total
Free fluid	N	94	10	6	110
	%	66.7%	100.0%	60.0%	68.3%
Loculate	N	47	0	4	51
	%	33.3%	0.0%	40.0%	31.7%
HRCT					
Parenchymal	N	21	9	4	34
	%	14.9%	90.0%	40.0%	21.1%

DISCUSSION

In this study, total of 161 patients were included. The mean age (in years) of the patients was 36.35± 16.05. Maximum number of patient's i.e., 41 (25.5%) were in the age group of 21-30 years. The maximum number of patients with pleural effusion belonged to the age group 21-30 years.There was a male preponderance found in our study showing 116(72%) patients were males and 45(28%) were females.

Most of the patients in our study presented with chest pain [134(83.8%)] & dyspnea [135(83.9%)] as a chief complaint. The next common symptoms were fever 126 (78.3%) and cough 122 (75.8%).

Majority of the patients in our study, had right sided pleural effusion [98 (60.9%)] & on chest ultrasound free effusion was more than loculated 110(68.3) & 51(31.7%) respectively. While HRCT chest showed 21.1% patients had parenchymal involvement.

In our study based on etiology, pleural effusion was broadly classified into 3 major groups-

Diagnostic criteria used in our study.

1. Tubercular pleural effusion
2. Malignancy
3. For empyema & parapneumonic effusion

Out of 161 patients included in our study, the most common etiology of pleural effusion was tuberculous i.e., 141(87.6%), second was malignancy 10(6.2%) patients & third was infective other than tuberculosis 10(6.2%). (7 were bacterial empyema, one was transudative pleural effusion due to dengue fever & 2 were Streptococcus pneumonic pleural effusion). In our study tuberculous effusion was most common etiology showing a greater number of cases whereas malignant effusion still second most common cause but number of cases in this group were less as compare to this study. This may be due to epidemiological situation of TB in India. Median Duration of symptoms in our study in tubercular, malignancy & infective other than tuberculosis group was 30, 60, & 8.5 days respectively. On pleural fluid examination tubercular pleural effusion & malignant pleural effusion were lymphocytic predominant showed 65.2% & 90% of patients more than 50% of lymphocytes respectively. Mean pleural fluid lymphocyte in tubercular & malignancy group is 57.65% & 75%. Whereas in infectious group other than tuberculosis predominant cells were polymorphs in 90% of the cases. Most common age group affected in tubercular pleural effusion is 21 to 40 yrs. i.e., 66(46.8. %) with mean age of 36.35 +/-16.05 years. Right sided tubercular pleural effusion was commonly seen in 61% of the patients while 4.3% of the patients also showed bilateral pleural effusion. Most common presenting symptom in tubercular group was chest pain & dyspnea which was 83.6%, followed by fever 80.9%. Most common appearance of pleural fluid in tubercular group was clear straw colored i.e., 75.2%. Mean pleural fluid pH in Tubercular group was 7.36, with common range in between 7.1 to 7.5. A pleural fluid pH less than 7.30 was associated with the conditions like malignancy & tuberculosis. The mean pH value found in our study was higher than this study in malignancy & TB group.

In our study, in tuberculous & malignant group around 60% of the patients showed pleural fluid total cells in the range of 100 to 1000 /cumm, while 60% of the patients in infectious other than tuberculosis group showed total cells more than 1000/cumm. Overall mean pleural fluid total cells in all the three groups were 974.65. Tubercular & malignant group showed lymphocytic predominant cellular picture, while infectious other than tuberculosis group was predominantly polymorphic cellular picture.

In our study tubercular, malignancy & infectious other than TB groups showed median values for pleural fluid total cells/cumm were 576, 398 & 1325 respectively. For lymphocytes in % they were 70,80,12.50 respectively & for polymorphs in % 20,20,87.50 respectively. our study in tuberculous pleural effusion showed 83.7% of patients had pleural fluid protein more than 4 gm% with mean value of 5.06. While 58.2% of patients had pleural fluid glucose more than 60 mg%. with mean of 66.66. In tubercular group mean pleural fluid cholesterol & LDH were 90.70 & 3326 respectively. In tubercular group, 83% of the patients had ADA activity more than 40 U/L, while mean pleural fluid ADA was 92.74 in our study. Pleural fluid CBNAAT was positive in TB group among 19.14% of the patients, while overall 16.8% of the patients in our study showed positive result for CBNAAT. Out of which 6.2% showing MTB detected low, 3.1% Showing MTB detected medium, 3.7% showing MTB detected very low,0.6% showing MTB detected high, while 3.1% patients showing MTB detected low with rifampicin resistance.

In our study most common age group in case of malignant pleural effusion was 61 to 70 years where number of cases were 40% with mean age in years was 53.30 +/- 13.33. In patients having malignant pleural effusion most common symptom was dyspnea present in 10(100%) of patient, followed by cough & loss of weight & loss of appetite 8(80%) ,5(50%) of patients gave history of smoking. Patients with malignant effusion had dyspnea as a common symptom (51%) which is consistent with our study. Total 90% of malignant pleural effusion showed hemorrhagic pleural fluid in our study. Pleural fluid appearance was more commonly found to be hemorrhagic (50.56%). Mean values for pleural fluid glucose in malignancy group was 59.60 in our study. In study carried by Anurag Agrawal etal153. Most malignant effusions have a high lymphocyte count and glucose < 60 mg/dl. Median value of pleural fluid ADA in malignancy group was 21.80 U/L. In this study, the median ADA value in malignant pleural effusion was 24.12 U/L which was consistent with our study. Out of 10 malignant pleural effusion in our study, 5 (50%) were adenocarcinoma, one (10%) was squamous cell carcinoma & one (10%) was synovial cell sarcoma. In our study out of 161 patients 4.3% of patient's pleural fluid positive for malignant cells. Out of 10 malignant patients 7 (70%) were positive for malignant cells.

In our study in a group infectious other than tuberculosis most common age group affected was 31 to 40 years with mean age was 39.60 in years & most common presenting symptom was chest pain in 100%, followed by fever & dyspnea in 80% of the patients. Mean pleural fluid PH & glucose in infectious group other than tuberculosis is 7.20. & 32.20 respectively in our study with 70% of patients in infectious group other than tuberculosis had pleural fluid glucose less than 20. In infectious group other than tuberculosis 4 (40%) of the patients had having pleural fluid LDH in between 501 to 5000 & 4(40%) had in between 5001to 10000. Mean pleural fluid LDH in infectious group other than tuberculosis is 7919. Bacterial culture was positive in 70% of the patients in infectious group other than tuberculosis. In bacterial empyema 71% of patients showed growth. Out of 7 bacterial empyema 3 were showing positive growth for streptococci, one was showing growth of pseudomonas, one showing Acinetobacter, two patients showing no growth on culture.

Out of Syn pneumonic pleural effusion 1 showing growth of streptococcus while other showing growth of pseudomonas ,1 dengue pleural effusion showing no growth.

Other tubercular pleural effusion also showed growth in bacterial culture 3 of them showing MRSA,2 of them showing streptococci,1 was showing growth of Acinetobacter probably due to longer hospital stay in these patients.

CONCLUSION

Tuberculosis was found to be the leading cause of pleural effusion followed by bacterial empyema and malignancy. In this study, cellular picture (Lymphocyte predominance), biochemical tests (High ADA level), along with appropriate clinical features are the mainstay in the diagnosis of tubercular pleural effusion. Although Microbiological analysis in the form of Gene x pert, LJ medium helps in confirming the etiological diagnosis and MDR status, their sensitivity is less in confirming the diagnosis of tuberculosis. Hence circumstantial evidence in form of clinical features and biochemical analysis is important in the diagnosis. On the other hand, the diagnostic utility of microbiological assessment in empyema was high. streptococcus was the most common pathogen isolated. Pleural fluid cytology yield is high in diagnosis of malignant pleural effusion, HRCT helps in identifying underlying parenchymal involvement also low ADA levels are encountered in malignancy.

REFERENCES

1. Saguil A, Wyrick K, Hallgren J. Diagnostic approach to pleural effusion. Am Fam Physician. 2014;90(2):99–104.
2. Dhital K, Bhandari R, Kharel P, Giri KP. Clinical profile of patients with pleural effusion admitted to KMCTH. 2010;(February).
3. Medford A, Maskell N. Pleural effusion. Postgrad Med J. 2005;81(961):702–10.
4. Porcel JM, Light RW. Diagnostic approach to pleural effusion in adults. Am Fam Physician. 2006;73(7):1211–20.
5. Vorster MJ, Allwood BW, Diacon AH, Koegelenberg CFN. Tuberculous pleural effusions: Advances and controversies. J Thorac Dis. 2015;7(6):981–91.
6. Kalaajieh WK. Etiology of exudative pleural effusions in adults in North Lebanon. Can Respir J. 2001;8(2):93–7.
7. NUBIOLA P. The clinical problem. Tokoginecol Pract. 1961;20(25):536–44.
8. Lei X, Wang J, Yang Z. Diagnostic Accuracy of Pleural Effusion Mononuclear Cells/Leukocyte Ratio in Tuberculous Pleurisy. Front Med. 2021;8(March):1–7.
9. View of A clinicopathological study of pleural effusion with special reference to malignant aetiology in a tertiary care hospital in West Bengal.pdf.
10. Light RW. Diagnostic principles in pleural disease. Eur Respir J. 1997;10(2):476–81.
11. Maldonado F, Lentz RJ, Light RW. Diagnostic approach to pleural diseases: New tricks for an old trade. F1000Research. 2017;6:1–6.
12. Dalil Roofchayee N, Marjani M, Dezfuli NK, Tabarsi P, Moniri A, Varahram M, et al. Potential diagnostic value of pleural fluid cytokines levels for tuberculous pleural effusion. Sci Rep [Internet]. 2021;11(1):1–8. Available from: https://doi.org/10.1038/s41598-020-79685-1
13. Ali MS, Light RW, Maldonado F. Pleuroscopy or video-assisted thoracoscopic surgery for exudative pleural effusion: A comparative overview. J Thorac Dis. 2019;11(7):3207–16.
14. Shiroshita A, Nozaki S, Tanaka Y, Luo Y, Kataoka Y. Thoracic ultrasound for malignant pleural effusion: a systematic review and meta-analysis. ERJ Open Res. 2020;6(4):00464–2020.
15. Light RW. Parapneumonic effusions and empyema. Proc Am Thorac Soc. 2006;3(1):75–80.
16. R R, P VKK. Study of 200 Cases of Pleural Fluid. J Evid Based Med Healthc. 2016;3(76):4114–8.
17. Light RW. Tuberculous pleural effusion. Turk Toraks Derg. 2015;16(1):1–9.
18. Yang W, Zhang B, Zhang ZM. Infectious pleural effusion status and treatment progress. J Thorac Dis. 2017;9(11):4690–9.