Original article

Diagnostic Accuracy of Complicated Pleural Effusion Score to differentiation between Tuberculous Pleural Effusion and Complicated Parapneumonic Effusions

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ABSTRACT

Background: In tuberculosis-endemic areas, the complicated pleural effusion score aids in distinguishing between CTPE and CPPE, which present with similar symptoms. The aim of this study was to assess the diagnostic accuracy of the complicated pleural effusion score to distinguish between CTPE from CPPE

Patients and methods: This was a cross-sectional study conducted at the Institute of Tuberculosis and Chest Medicine (outdoor and indoor locations), Mayo Hospital Lahore. The study included 70 patients aged 18–80 years with patients with clinical suspicion of complicated Parapneumonic pleural effusion and Tuberculous Pleural effusion were included in current study complicated parapneumonic or tuberculous pleural effusion. Exclusions were empyema, suspected/confirmed pleural malignancy, bleeding diathesis, and pregnancy. After taking informed written consent, I/V line was passed and diagnostic pleural tap was done under Ultrasound guidance with 50cc Disposable syringe under aseptic measures and pleural fluid was sent for complete analysis including PH, Glucose, Total leukocyte count with differential cell count and ADA levels estimation. After that, COMPLES score was calculated. Patients with a COMPLE score <12 were presumptively diagnosed with tuberculous pleural effusion, while those with a score ≥12 were presumptively diagnosed with parapneumonic pleural effusion. Both groups then underwent closed pleural biopsy with Abram's needle after two days and 5-6 biopsy samples were taken and sent for histopathology, bacterial culture and sensitivity and Mycobaterium culture.

Results: Mean COMPLES score was 12.05±4.91. As per cut point of COMPLES score 36 (51.4%) patients had been diagnosed with tuberculous pleural effusion and 34 (48.6%) had been diagnosed with parapneumonic pleural effusion. Sensitivity and specificity of COMPLES score was 100% and 81.82%. While the respective values for positive and negative prediction accuracy were 76.74% and 100%. The diagnostic accuracy of COMPLES score was 88.57% respectively.

Conclusion: The COMPLES score proved highly effective in differentiating tuberculous pleural effusion from complicated parapneumonic effusions. A score ≥12 identified tuberculous pleural effusion with 100% sensitivity and 81.82% specificity. The positive predictive value was 76.74%, the negative predictive value was 100%, and the overall diagnostic accuracy was 88.57%.

Keywords:

Diagnostic, Precise, Difficult, Pleural effusion, Complicated Parapneumonic effusions

INTRODUCTION

Pleural effusion is the accumulation of transudative or exudative fluid in the pleural cavity, caused by infections, malignancies, or chronic heart, liver, and kidney diseases.[1] Pleural infection is a clinical problem with high mortality of up to 20%.[2] The diagnosis of cause of pleural effusion is difficult, even though the patients often complain of typical symptoms indicative of pleural diseases, for instance, pleuritic chest pain, cough and shortness of breath.[3]

Diagnosing tuberculous pleural effusion is challenging due to its paucibacillary nature. It is a common form of extrapulmonary TB requiring differentiation from other exudative pleural effusions.[4,5]

The presence of pleural effusion can be confirmed by radiological studies including simple chest radiography, ultrasonography, or computed tomography of Chest.[6] However, identifying the cause of pleural effusion by pleural fluid analysis is essential before starting proper treatment.[7] Pleural fluid analysis involves biochemistry, histology, culture and sensitivity and adenosine deaminase (ADA) levels.The differential diagnosis of cases with pleural fluid showing lymphocytic predominance in histology and high ADA levels is problematic.[5,8]

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Tuberculous pleural effusion (TPE) is characterized by lymphocytic predominance and high adenosine deaminase (ADA) levels.[9] However, TPEs sometimes may present withnon-lymphocytic predominance; whereas, parapneumonic effusion (PPE) often exceeds the cutoff value of ADA for TPE. Recently developed Complicated Pleural Effusion Score (COMPLES) was based on the combination of pleural fluid adenosine deaminase (ADA) levels, the percentage of mononuclear cells (MNC%), pH of pleural fluid, and age of patient.[10]

The current study is designed to evaluate the diagnostic accuracy of Complicated Pleural Effusion Score (COMPLES) to differentiate Tuberculous Pleural Effusion from Complicated Parapneumonic Effusion in our local population. As patients with these conditions usually present with similar symptoms, thus it is important to do detailed workup to differentiate both the conditions from each other in order to initiate appropriate treatment.

PATIENTS AND METHODS

A Cross sectional study was conducted at the Department of Pulmonology, Mayo Hospital Lahore both indoor and outdoor. Non probability consecutive sampling was used to enroll patients. Sample size of 81 patients was calculated by using 95% confidence level, 10% absolute precision with expected sensitivity COMPLES as 97%, expected specificity as 92% and expected prevalence as 64%.[10]

Patients of either gender, aged between 18-80 years and patients with clinical suspicion of complicated Parapneumonic pleural effusion and Tuberculous Pleural effusion were included in current study. All the cases with diagnosis of empyema (macroscopic pus), suspected or Confirmed Pleural Malignancy, bleeding diathesis on History and pregnant women were excluded from the study. A total of 70 cases meeting the inclusion criteria were included, all presenting with clinical and laboratory diagnoses of tuberculous pleural effusion (TPE) and parapneumonic pleural effusion (PPE). TPE and PPE. The study was carried out after taking permission from IRB. After taking informed written consent, I/V line was passed and diagnostic pleural tap was done under Ultrasound guidance with 50cc Disposable syringe under aseptic measures and pleural fluid was sent for complete analysis including PH, Glucose, Total leucocyte count with differential cell count and ADA levels estimation. Then patients were diagnosed on the basis of COMPLES score ≥12 COMPLES score less than 12 considered as without disease. Both group of patients were then undergo closed pleural biopsy with Abram's needle after two days and 5-6 biopsy samples will be taken and were sent for histopathology, Bacterial culture and sensitivity and Mycobaterium culture.

All data was entered and analyzed using SPSS version 26. Quantitative variation like ADA and PH etc. was presented as Mean ± S.D. Qualitative variable like gender& ethnicity were presented as frequency and percentages. The sensitivity and specificity of diagnosing tuberculous pleural effusion and complicated parapneumonic effusion were evaluated using closed pleural biopsy with an Abram's pleural biopsy needle as the gold standard. P-value <0.05 was taken as significant.

RESULTS

The average patient age in this study was 55.92±9.45 years. Patients' ages ranged from 36 to 78, respectively. There were 54 (77.1%) males and 16 (22.9%) females among the patients Mean COMPLES score was 12.05±4.91. Minimum and maximum score was 4 and 19. As per cut point of COMPLES score 36(51.4%) patients had score <12 and 34(48.6%) had score ≥12 (Table 1).

As per histopathology findings 26(37.1%) patients had Granulomatous inflammation and 44(62.9%) were diagnosed with necro-inflammatory tissue. Table-2

Diagnostic accuracy of COMPLES score showed that patients who were diagnosed with Granulomatous inflammation all of these patients COMPLES score was >12 while patients who were diagnosed with necro-inflammatory tissue among them 8(18.2%) patients COMPLES score was ≥12 and 36(81.8%) had COMPLES score <12. Sensitivity and specificity of COMPLES score was 100% and 81.82%. The percentages for the positive as well as negative predictive values were, however, respectively, 76.74 and 100. Diagnostic accuracy of COMPLES score was 88.57% respectively (Table 3).

Table-1: Complicated pleural effusion score

	Frequency	Percent
<12 (CPPE)	36	51.4%
≥12 (CTPE)	34	48.6%
Total	70	100%

Table-2: Histopathology findings

	Frequency	Percent
Granulomatous inflammation	26	37.1%
Necro inflammatory tissue	44	62.9%
Total	70	100%

Table-3: Diagnostic accuracy of Complicated Pleural Effusion Score (COMPLES)

Diagnostic Test (COMPLES score)	Granulomatous Inflammation (Granuloma)	Necro-inflammatory tissue (CPPE)	TP	TN	FP	FN
>12 (CTPE)	26 (100%)	8 (18.2%)	26	0	8	0
<12 (CPPE)	0 (0%)	36 (81.8%)	0	36	0	0
Total	26	44	26	36	8	0
Diagnostic accuracy	**Value**	**CI-95%**				
Sensitivity	100%	(87.13-100)				
Specificity	81.82%	(68.04-90.49)				
PPV	76.74%	(60-87.56)				
NPV	100%	(90.36-100)				

CTPE: Complicated Tuberculous Pleural Effusion
CPPE: Complicated Parapneumonic Pleural Effusion

DISCUSSION

In this study, we employed the COMPLE score to distinguish among complicated tuberculous pleural effusion with complicated parapneumonic effusions, with histopathological findings serving as the gold standard. Results showed good sensitivity and specificity for differentiating CTPE and CPPE. COMPLE's sensitivity and specificity in this investigation were 100% and 81.82 percent, respectively. While positive and negative predictive value for COMPLE score was 76.74% and 100% respectively. Overall diagnostic accuracy of COMPLE score was 88.57% which is excellent and further this score can be adopted in our clinical practice to differentiate CTPE and CPPE. Very limited data is available on diagnostic accuracy of COMPLE score. This study in our local settings is the first of its kind in which diagnostic ability of this score was assessed.

Luis Corral-Gudino in his study used COMPLES score for differentiating between CTPE and complicated Parapneumonic Effusions. In his results he reported that prevalence of complicated Tuberculous pleural effusion and complicated Parapneumonic pleural effusion was 25% and 63.8% respectively. It further reported that at cut off value ≥ 12, COMPLES had 97 % sensitivity, 92 % specificity along with area under curve as 94.7% for identifying Complicated Tuberculous pleural effusion versus complex Parapneumonic pleural effusion.[10] TBE and CPPE are both common throughout the world, and using standard pleural fluid (Pf) criteria, it can be challenging to differentiate between them clinically, radio logically, or biochemically (e.g. Pf pH, glucose and ADA). Even while Pf pH in CPPE and TBE is often lower, overlaps do occasionally occur.[11,12]

In the literature, both ADA (adenosine deaminase) and T-SPOT have been reported to demonstrate strong diagnostic performance in detecting tuberculosis pleural effusion (TBPE). ADA's diagnostic accuracy exceeds 90%, showing a low rate of false negatives and false positives. Similarly, T-SPOT has proven to be a valuable diagnostic tool, with a sensitivity of 93.7% and a specificity of 77.4%.[13,14] These findings are consistent with previous research, where ADA has consistently demonstrated high sensitivity and specificity, reaffirming its role as a key diagnostic marker for TBPE.

A pleural effusion diagnosis needs a mix of clinical, radiographic, and laboratory studies. The significance of fluid biochemical markers or their integration with other approaches, in differentiating TPE from parapneumonic effusions in CPE sufferers has not been thoroughly explored.[15] ADA levels demonstrate strong diagnostic value for pleural effusion, particularly in identifying conditions like tuberculous pleural effusion (TPE). However, its specificity is limited, as elevated ADA levels can also be found in conditions like bacterial empyema and complicated parapneumonic pleural effusion (CPPE). Despite this, in high burden settings, the presence of lymphocytic-predominant effusion and elevated ADA is often considered a strong indicator of TPE. The combination of ADA elevation and lymphocyte predominance, which are relatively easy to assess, supports the initiation of treatment in patients with a high pre-test probability of tuberculosis.

Keeping in mind the above discussion a question comes in mind that what makes COMPLES so unique and important to be used in our clinical practice for differentiating CTPE and CPPE. Pleural effusion is known to exacerbate a wide range of illnesses and has over 60 alternative diagnoses.[18]A thorough investigation of pleural fluid is essential to discover the underlying reason. The commonly accepted clinical recommendations for the work-up of pleural effusions include pleural fluid pH and glucose concentrations.[19]

Literature have shown a potential link between pleural fluid pH and glucose, but it's unclear if both tests are necessary. No research has determined whether they provide redundant or independent information, or if the connection depends on the underlying disease. Deirdre B. Fitzgerald's study found glucose alone identified 91.7% of infection-related

effusions, while pH alone recognized 95.0%. He concluded that pH and glucose have a non-linear relationship, with one unable to predict the other. High concordance suggests that either test is usually sufficient.[20]

Closed pleural biopsy with Abram's needle is invasive and takes time for diagnosis, but the COMPLES score offers a quick, reliable alternative for differentiating CTPE from CPPE, allowing early treatment. ADA, while lacking specificity in empyemas and CPPE, remains useful in non-complicated TPE (NCTPE), which typically presents as lymphocytic exudates. Biochemical markers and their combination with other parameters for distinguishing TPE from parapneumonic effusions require further study.[21]

CONCLUSION

The COMPLES score proved highly effective in differentiating tuberculous pleural effusion from complicated parapneumonic effusions. A score ≥12 identified tuberculous pleural effusion with 100% sensitivity and 81.82% specificity. The positive predictive value was 76.74%, the negative predictive value was 100%, and the overall diagnostic accuracy was 88.57%.Keeping in mind these findings COMPLE score can be adopted in our clinical practice to differentiate CTPE with CPPE.

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