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Ch. Praveen Kumar
Assistant Professor, Department of Respiratory Medicine, Chalmeda Anandarao Medical College, Karimnagar, Telangana, India

Dr. Baburao Eruku
Assistant Professor, Department of Respiratory Medicine, Mamata Medical College, Khammam, Telangana, India

Corresponding Author:
Dr. Baburao Eruku
Assistant Professor, Department of Respiratory Medicine, Mamata Medical College, Khammam, Telangana, India

Pleural space infection bacteriology and clinical, laboratory, and physical outcomes

Ch. Praveen Kumar and Dr. Baburao Eruku

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Abstract
Introduction and Objectives: Even with the development of powerful medicines, bacterial pneumonia remains a leading cause of death and disability. The goal of this article is to discuss the bacteriology of pleural space infection and to identify the parameters that would predict infection outcome in different types of parapneumonic effusion.
Materials and Methods: Observational study of patients diagnosed with simple, difficult, or complex parapneumonic effusion who were admitted at the Department of Respiratory Medicine, Mamata Medical College, Khammam, Telangana, India, between March 2019 to September 2019. Gram staining and culture growth of pleural fluid was examined to characterised the bacteria that cause pleural space infection. Multiple logistic regressions were used to statistically analyse the data and draw comparisons between the two outcomes.
Results: Multiple logistic regression models and a univariate model were utilised. Comparable gram-positive and gram-negative bacterial growth was seen in this study of pleural space infections. pH, loculation, positive stain, culture, fever, and serum albumin were all statistically significant in independent analyses. Tube thoracostomy success or failure was significantly predicted by PH, loculation, and serum albumin in a multivariate analysis.
Conclusion: Predictive indicators for the prognosis of difficult and complex parapneumonic effusion included pleural fluid pH, loculation, and serum albumin in a multivariate analysis. They may be put to use in sending patients on to more permanent care.

Keywords: Pleural space, bacteriology and clinical, laboratory, physical outcomes

Introduction
In the western world, the frequency of pleural infection might reach up to 80,000 cases each year. This condition presents a clinical challenge. Mortality and morbidity are very high; roughly twenty percent of people diagnosed with empyema pass away, and approximately twenty percent of patients need surgery to recover within a year after contracting the illness [1, 2]. Even with the development of medicines that are very efficient, bacterial pneumonia continues to be a leading cause of illness and death among the general population. Individuals who had pleural effusions were shown to have a likelihood of treatment failure that was 2.7 times higher than that of patients who did not have pleural effusions in one research that included 1,424 patients hospitalized with community-acquired pneumonia [3-5]. According to the findings of another study, the relative risk of mortality in patients with community-acquired pneumonia was found to be 7.0 times higher for patients with bilateral pleural effusions and 3.4 times higher for patients with unilateral pleural effusion of moderate or greater size when compared with other patients with community-acquired pneumonia alone [6, 7]. Both of these numbers were higher than the risk of mortality in patients with community-acquired pneumonia alone. The majority of pleural effusions that are linked with pneumonia resolve without any special treatment focused targeting the pleural fluid. However, around 10% of patients need operational intervention in order to cure their condition. Some of the morbidity that is associated with parapneumonic effusions is attributable to the fact that appropriate treatment for these effusions was not started in a timely manner [8-10].
Antibiotics tailored to the patient's culture and sensitivity level are all that are required to treat a straightforward parapneumonic effusion. When dealing with a complex case of parapneumonic effusion or empyema, medical intervention in the form of thoracentesis, tube

thoracostomy, thoracoscopic intervention, or surgery may be required [11-13]. It was hypothesised that there could be clinical, laboratory, and biochemical prognostic factors that determine the outcome of parapneumonic effusion, and that these factors, if identified at the optimal period, would result in a reduction in the morbidity and mortality associated with parapneumonic effusion. This was one of the hypotheses that were tested. The purpose of this research was to determine the existence of such factors [14-16].

Materials and Methods

Observational study of patients diagnosed with simple, difficult, or complex parapneumonic effusion who were admitted at the Department of Respiratory Medicine, Mamata Medical College, Khammam, Telangana, India, between March 2019 to September 2019. Gram staining and culture growth of pleural fluid was examined to characterise the bacteria that cause pleural space infection. Multiple logistic regressions were used to statistically analyse the data and draw comparisons between the two outcomes.

Inclusion criteria

1. All parapneumonic effusion patients admitted to the facility who are older than fifteen years.
2. Diagnosis of simple parapneumonic effusion in all cases
3. Every Complex Parapneumonic Effusion
4. The whole spectrum of parapneumonic effusion.

Exclusion criteria

1. All patients having effusion from iatrogenic or other reasons, such as trauma, were excluded.
2. Exclusion of paediatric parapneumonic effusion
3. Tubercular pleural effusion has been ruled out

Statistical analysis

Determinants (clinical, laboratory, and physical) of outcome in pleural space infection, particularly severe and complex parapneumonic effusion, were identified, and the bacteriology of the pleural infection was characterised. The outcomes were classified as either successful or unsuccessful. Means were compared using the t test and chi-square test for students with varying degrees of autonomy. Logistic regression analysis, in particular binary logistic regression, forward analysis, and backward conditional regression, are useful for identifying independent predictors of dichotomous dependent variables by removing potentially confusing factors. The numbers were calculated using SPSS version 17.

Results

In this study, we aimed to characterised the bacterial aetiology of pleural infection and identify clinical, laboratory, and physical predictors of prognosis in pleural space infection, with a focus on difficult and complex parapneumonic effusion. Success or failure was used as the outcome.

Tables 1: Age wise distribution

Outcome	Sex	Mean	N
Failure	Male	46.21	65
	Female	47.32	35
	Total	45.12	100
success	Male	46.29	40
	Female	47.32	60
	Total	46.58	100
Total	Male	46.21	80
	Female	46.31	20
	Total	45.14	100

Average patient ages by gender and result for different types of parapneumonic effusion, broken down by successful and unsuccessful treatment.

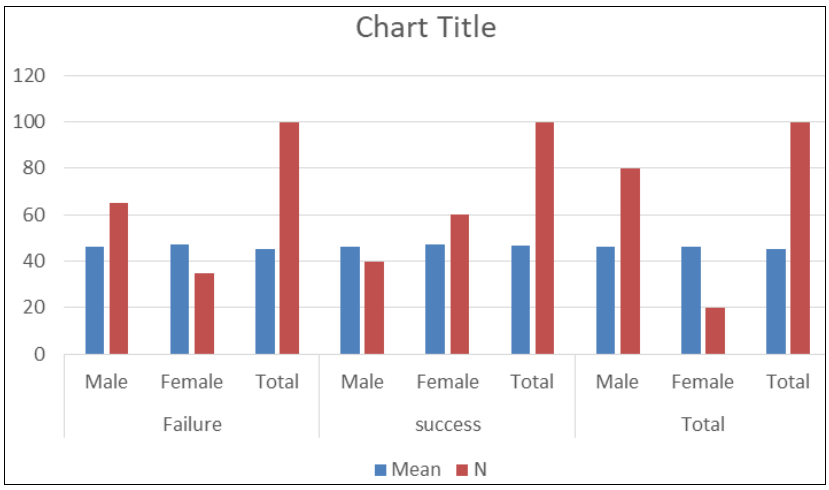

Fig 1: Age wise distribution

Table 2: Mean hydrogen ion conc. male and female patients with successful and unsuccessful

Outcome	Sex	Mean	N
Failure	Male	6.123	65
	Female	5.312	35
	Total	6.457	100
Success	Male	6.241	60
	Female	6.247	40
	Total	6.892	100

Total	Male	7.147	72
	Female	7.258	28
	Total	7.368	100

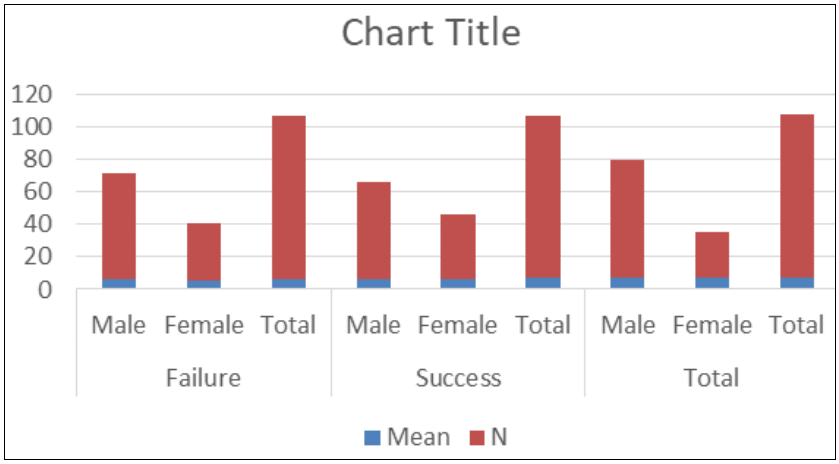

Fig 2: Mean hydrogen ion conc. male and female patients with successful and unsuccessful

Table 3: The average number of white blood cells in pleural fluid, between males and females

Outcome	Sex	Mean	N
Failure	Male	12868.01	65
	Female	9933.14	35
	Total	11982.14	100
Success	Male	6776.78	60
	Female	5665.56	40
	Total	6476.14	100
Total	Male	10179.98	72
	Female	7598.85	28
	Total	9510.78	100

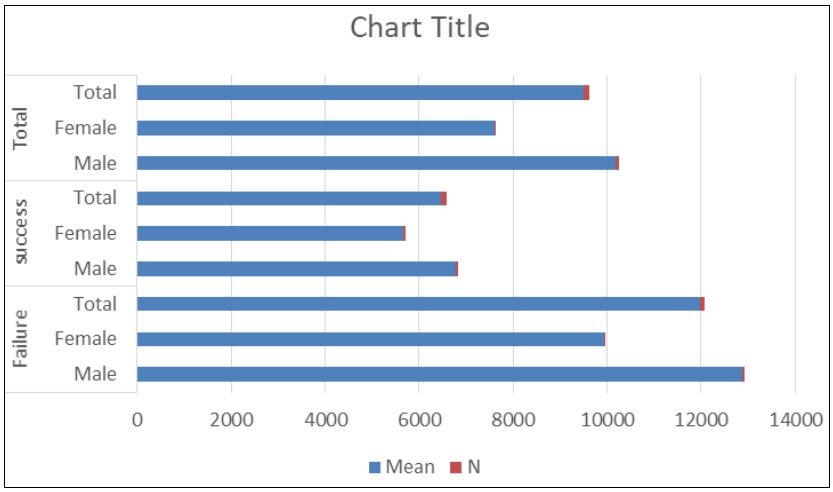

Fig 3: Average number of white blood cells in pleural fluid, between males, females

Table 4: Male and female patients' median serum albumin conc. shown in a cross table

Outcome	Sex	Mean	N
Failure	Male	3.2754	65
	Female	3.4455	35
	Total	3.1478	100
Success	Male	2.3587	40
	Female	2.6589	60
	Total	2.4789	100
Total	Male	3.8952	80
	Female	3.7894	20
	Total	3.5789	100

Table 5: The heat of victory and defeat, put to the test

Fever			
	Observed N	**Expected N**	**Residual**
No fever	25	68.1	-18.4
Present	75	65.7	16.7
Total	100		

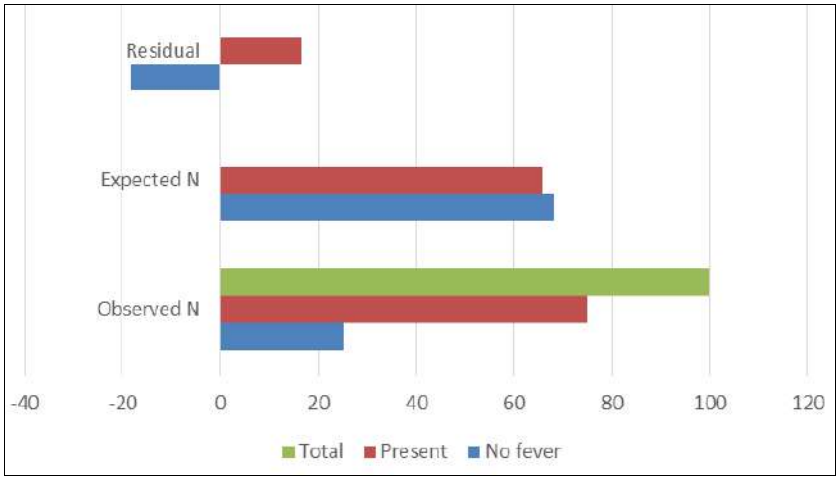

Fig 4: The heat of victory and defeat, put to the test

Discussion

Traditional tube thoracostomy drainage has a 32%-71% success rate. The 41% success rate we found is consistent with what has been seen in previous trials. Empyema has been linked to a high death rate. There was a 31% mortality rate overall, and 40 of those deaths were attributable to empyemas specifically in the current investigation. Important aspects to consider while deciding on a pleural drainage technique include the severity of the infection, the kind of pleural fluid present, the presence or absence of loculations, and the patient's general health. According to Moran's review, these four elements also affect tube thoracostomy drainage success [17-19].

According to Le Mense *et al*., there was no difference between multiloculated and uniloculated empyemas, parapneumonic and non parapneumonic empyemas, and culture proven and biochemically proved empyemas with regard to operation success or length of hospital stay. Since all of their patients initially presented with loculated pleural fluid, their success rate for tube thoracostomy drainage was low at 11%. In contrast, more than half of patients in one group of 26 who had thoracoscopy for chronic empyema of at least 3 weeks' duration were still in the fibrino purulent stage of their illness. We found that a success rate of 86.7% could be achieved while doing tube thoracostomy without loculation. Surgery should be considered for patients who continue to show indications of sepsis and who have a pleural accumulation after drainage and antibiotic treatment [20-23]. If sepsis doesn't improve within seven to ten days, it's recommended that you see a surgeon for a second opinion. In all nonresponsive instances, consultation with a thoracic surgeon should be explored [24-26].

If a pleural infection is treated quickly, the prognosis for the patient's long-term survival is excellent. Within the first four hundred days after drainage, there was a 14% mortality rate among 85 patients who were monitored for up to four years. The empyema-related sepsis did not directly cause death, but rather a concomitant disease [27]. There are no features in the patient's clinical presentation, imaging, or pleural fluid that reliably predict the patient's prognosis. Even though there have been no links shown between hypoalbuminemia, loculated fluid, or anaerobic infections and poor result in recent investigations, these factors have been linked to poor outcomes in the past. Some individuals (up to 13%) may have persistent pleural thickening as a long-term complication of pleural empyema [28, 29]. Though severe functional impairment due to pleural fibrosis is uncommon, it may occur. Patients with fibrothorax may sometimes find relief from their symptoms after undergoing surgical decortication. Empyema necessitans is another uncommon consequence. The visceral pleural rind is generally readily extricated from the lung if decortications is completed within 2 weeks after pleural infection, which is another benefit of early thoracotomy [30]. As a result, situations that are deemed hopeless should be referred early so that they may have surgery. Using a logistic regression model, we found that factors such a decrease in PH, loculation, and serum albumin may accurately predict failure.

Conclusion

In conclusion, factors including pH, pleural loculation, and serum albumin may be used to forecast the development of a pleural space infection, even in cases with convoluted and complex parapneumonic effusion. By identifying at-risk patients and referring them for definitive care at an earlier stage, such predictors may help minimise the morbidity and mortality associated with complex parapneumonic effusion. Our study's bacteriology of pleural space infection is consistent with other studies' bacteriology, with gram-positive and gram-negative organisms appearing equally.

Conflict of Interest

None

Funding Support

Nil

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