



RESEARCH ARTICLE

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**BACTERIOLOGY OF PLEURAL FLUID INFECTIONS AT A
TERTIARY CARE HOSPITAL.**

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Abstract: Bacterial infections are one of the most common causes for exudative pleural effusion. Pleural effusions associated with pneumonias cause more morbidity and mortality than pleural effusion alone. Retrospective analysis of 472 pleural fluid samples received during the period of January 2010 to December 2011 was done. Organisms and their antibiogram patterns were determined. Among 472 samples 312(66.1%) were culture positive. Organisms isolated were *Klebsiella pneumoniae* (30%), *Pseudomonas aeruginosa* (23%), NFGNB (17%), *E.coli* (15%), *Citrobacter* (10%), *Staphylococcus aureus* (5%). *K.pneumoniae* were sensitive to piperacillin tazobactam (92%) and imipenem (80%), resistant to cefotaxime (90%). *Pseudomonas* was sensitive to piperacillin tazobactam (73.8%) and amikacin (72%). Bacteriology of pleural infection is changing, Gram negative bacteria from the pleural infections appear to be increasing. The majority of the pleural fluid isolates were hospital pathogens showing high level of resistance to most of the antibiotics. Piperacillin Tazobactam and imipenem were most effective for gram negative isolates.

Keywords: Empyema, Pleural effusion, Bacterial infection, *Klebsiella pneumoniae*

INTRODUCTION

Bacterial infection of the pleura was first described in ancient Greece by Hippocrates.¹ Pleural infection continues to cause significant morbidity and mortality despite the improvement of antimicrobial therapy and the existence of multiple options for drainage of the infected pleural space.² Empyema and complicated Para pneumonic effusion are the two main clinical syndromes associated with thoracic bacterial infections. The bacteriology of thoracic empyema has been changing since the introduction of antibiotics. Before the antibiotic era, *Streptococcus pneumoniae* or β -hemolytic streptococci were isolated in most empyema fluid, and *Staphylococcus aureus* was the most common pathogen of thoracic empyema between 1955 and 1965. In the early 1970s, anaerobic bacteria were isolated most frequently.³ Several studies have found that the majority of culture positive effusions are due to aerobic microorganisms, while up to 15% are caused exclusively by anaerobic bacteria and the remainder are due to multiple microorganisms. Analysis of pleural fluid obtained via thoracentesis is a valuable procedure in determining the cause of pleural effusions. It is generally

recommended that microbiologic cultures and smears be performed on pleural fluid obtained by thoracentesis. Gram stain and culture has for decades been the “gold standard” for the detection of microorganisms in pleural fluid samples. Peripheral blood culture can increase the identification rate of the causative organism, while sputum cultures are positive less often than pleural fluid cultures⁴. A variety of other techniques, such as countercurrent immunoelectrophoresis, direct gas-liquid chromatography, immunochromatographic membrane test and flow-cytometry, have not been demonstrated to be superior, because their usefulness is limited to certain bacterial groups.⁵ Currently use of nucleic amplification tests appears to be the method with the highest sensitivity (up to 75%) in the identification of bacteria in pleural fluid.⁶ It should be emphasized, however, that pleural fluid culture is the only method that provides the sensitivity profile of the isolated microorganism to various antibiotics. This retrospective study was designed to investigate the bacterial isolates of acute thoracic empyema in a tertiary care hospital over a 2-year period.

MATERIALS AND METHODS

A retrospective analysis of 472 clinically suspected cases of pleural effusion admitted in Intensive Respiratory Care Unit during a period of 2 years from January 2010 to December 2011 are included in the study. We excluded cases of tuberculosis pleuritis. Out of the 472 cases, 312 patients were males and 160 were females (male: female ratio of 1.87: 1). Infected pleural effusion was identified, if they met the following criteria: (1) The thoracocentesis received thick purulent-appearing pleural fluid: and (2) Microscopic examination of pleural effusions revealed a WBC count of < 15,000/ μ l, with neutrophils predominance, and the microorganisms were identified by microscopic examination or were isolated by cultures.⁷ All the patients underwent diagnostic thoracocentesis under aseptic precautions. The specimens were examined by Gram's staining and were cultured for aerobic growth on blood agar, and MacConkey agar. Following isolation of organisms, conventional identification was carried out by subjecting to biochemical tests and antimicrobial susceptibility test by standard Kirby- Bauer disc diffusion method.⁸

RESULTS AND DISCUSSION

Among 472 samples 312 (66.1%) were culture positive. Male patients predominated with a male/female ratio of about 2:1. Most predominant were aerobic gram negative organisms which were responsible for over 90% of isolates. In the aerobic gram negative group *K.pneumoniae* and *Pseudomonas aeruginosa* were the most frequent isolates. Organisms isolated (Table-1) were *K.pneumoniae* 92 (30%), *Pseudomonas aeruginosa* 73(23%), NFGNB 54 (17%), *E.coli* 48 (15%), *Citrobacter* 30 (10%), *Staphylococcus aureus* 15 (5%). *K.pneumoniae* were sensitive to piperacillin tazobactam (92%) and imipenem (80%) but highly resistant to cefotaxime (90%). Most of the *Pseudomonas* were sensitive to piperacillin tazobactam (73.8%) and amikacin (72%) and resistant to cefotaxime (86.8%) and netilmicin (85%). NFGNB were sensitive to cefoperazone (92%) and piperacillin tazobactam (76.9%), resistant to ampicillin (87.5%) and cefotaxime (81.5%). *Citrobacter* were uniformly sensitive to imipenem and piperacillin tazobactam. *E.coli* were sensitive to imipenem (92.3%) and piperacillin tazobactam (80%), and

highly resistant to ampicillin (100%) and cefotaxime (100%).

Discussion:

In this retrospective study we found that aerobic gram negative organisms were the predominant pathogens in acute thoracic empyema and *K.pneumoniae* was the most frequently isolated pathogen. Studies have demonstrated that the bacteriology of pleural infection in adults has been changing over the past decades. *Streptococcus pneumoniae* (60-70%) and *Streptococcus hemolyticus* were the bacteria most commonly isolated from infected pleural fluids before the advent of antibiotics. Between 1955 and 1965, *Staphylococcus aureus* became the most common isolate, to be overtaken by the anaerobic organisms in the early 1970s. In the past twenty years, aerobic organisms have again become the predominant isolates.⁹ Patients with acute thoracic empyema caused by gram negative bacteria had a significantly higher mortality rate than those with empyema caused by other isolates. The highest mortality rate in the aerobic Gram negative group might have been correlated with the patient's underlying condition, which impairs the immune status and alters the colonized strains of bacteria. The mortality rate of patients with *klebsiella*

empyema was also significantly higher than that of those with non- *klebsiella* empyema. *Klebsiella pneumoniae* has also been reported earlier as the predominant isolate in other studies.^{10,11} The markedly high rate of Gram-negative bacterial infection in the pleural cavity might be associated with the high incidence of underlying disease (66%). The most common underlying factor observed in this study was COPD, which was observed in other studies also.^{12,13}

In summary pleural infection remains a major healthcare problem and bacteriology of empyema is complex and is changing. Gram negative bacteria from the pleural infections appear to be increasing, the clinicians need to know the local prevalence of microbes and their antibiotic sensitivity pattern. Patients with gram negative infections in the pleural cavity require more aggressive treatment due to their higher mortality rate. In this study the majority of the pleural fluid isolates were hospital pathogens showing high level of resistance to most of the antibiotics. Piperacillin Tazobactam and imipenem were most effective for gram negative isolates. We believe these findings are valuable for wide clinical application in critical care medicine.

Table 1

Bacteriology of pleural fluid infection from 312 culture positive patients

organism	Isolates .No (%)
<i>K.pneumoniae</i>	92 (30%)
<i>Pseudomonas aeruginosa</i>	73 (23%)
NFGNB	54 (17%)
<i>E.coli</i>	48 (15%)
Citrobacter	30 (10%)
<i>Staphylococcus aureus</i>	15 (5%)

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