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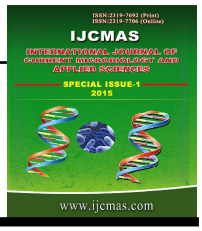

Original Research Article

Microbiological Prevalence in Empyema Thoracis in a Tertiary Care Centre in North India

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Keywords

Empyema, Etiology, Diagnosis, Empirical therapy

A B S T R A C T

Empyema is a common and at times life threatening infection of pleural cavity. It most commonly involves the younger and immunocompromised patients. The microbiological profile of organisms causing empema is always evolving, hence it needs constant surveillance to decide upon the antibiotic regimen and also the treatment protocol. Aim of the study is to evaluate the prevalence of different microbiological agents in patients of Empyema thoracis. All patients of Empyema thoracis who presented to our centre from September 2012 to August 2014 were included in the study. In addition to demographic data other information like past history of Tuberculosis and contact with case of pulmonary tuberculosis was also taken. All patients included in the study underwent chest X ray, complete blood counts, pleural aspirate was send for Gram staining, AFB staining, culture and sensitivity and ADA, cytology and biochemistry; other investigations like sputum for AFB, Mantoux Test, USG thorax was also done. Hundred and twenty three patients were included in study ranging from 3months to 40 years age group. In 45(36.58%) cases gram positive aerobes were cultured, in 17(13.82%) cases gram negative organisms were cultured, 8(6.5%) patients were diagnosed with tubercular pyothorax while in 43(34.95%) patients no organism could be cultured. Among gram positive organisms *Streptococcus* species (*S. pyogenes, S. milleri, S. pnuemoniae*) were the most frequent isolated organisms, and was isolated in 29(23.57%) of total cases. *Staphylococcus aureus* was isolated in 16 (13.1%) patients. Among Gram negative organisms *E. coli, Klebsiella* and *Pseudomonas aeruginosa* were most commonly isolated. *E. coli* was seen in 9(7.3%), *Klebsiella and pseudomonas* were found in 4 cases each (3.3%). Empyema thoracis is a life threatening disease if not treated properly. Since gram positive aerobes are the most common cause so patients can be given empirical therapy targeting these while investigations for other etiologies should be continued. A high number of patients did not show any growth which could be because of anaerobic organisms and hence an anaerobic coverage is also needed to provide comprehensive empirical therapy against the organisms causing empyema.

Introduction

The term 'empyema' is derived from the Greek words pyon, meaning pus and empyein, meaning pus-producing. Thus by definition the presence of pus in the pleural space is consistent with the diagnosis of empyema. Hippocrates in 500BC described pleural infection for the first time. Open thoracic drainage was the only treatment modality described till 19th century, when closed chest tube drainage was first described but not adopted (Meyer, 1989). The open surgical drainage was associated with a high mortality rate probably due to respiratory failure because of large open pneumothorax (Peters, 1989).

The introduction of antibiotics has reduced the incidence of empyema and its bacteriology has also changed. 60–70% of cases were caused by *Streptococcus pneumoniae*, in pre-antibiotic era which now accounts for about 10% of culture positive cases (Heffner, 1996). The prevalence of *Staphylococcus aureus* rose and the development of staphylococcal resistance in the 1950s increased complications and mortality (Bartlett, 1993; Stiles et al, 1970). More recently, the reported prevalence of anaerobic infections (Wallenhaupt, 1991) and Gram negative organisms (Alfageme and MuÃ,1993; Wallenhaupt, 1991) has also risen.

The microbe-specific factors favoring development of empyema as a complication of pneumonia have special clinical relevance. In overtly healthy adults, the bacteria most commonly causing pleural empyema are *S. aureus, S. pneumoniae* and *Streptococcus pyogenes* (Smith *et al.,* 1991; Welch *et al.,* 1961). Parapneumonic pleural effusions occur in 40% of patients with pneumococcal pneumonia but, empyema occurs in <5% of pneumococcal pneumonia patients (Smith *et al.,* 1991). Group A streptococcal pneumonia occurs much less frequently than pneumococcal pneumonia but is associated with a higher frequency of large pleural effusions that progress rapidly to produce empyema and sepsis. It is well appreciated that Klebsiella pneumonia and empyema may occur in alcoholic males. The fetid mouth and a predisposition to aspiration are clearly the forerunners of the fetid lung, lung abscesses, and/or anaerobic empyema. Such infections are usually polymicrobial and linked to pyorrhea or gingivitis and altered consciousness.

The main aim of this study is to evaluate the prevalence of different microbiological agents in patients of Empyema thoracis.

Materials and Methods

This is a prospective study conducted in Jawaharlal Nehru Medical College, AMU, Aligarh during the period from September 2012 to August 2014.All patients of Empyema thoracis who presented to our centre from September 2012 to August 2014 were included in the study.

The demographic data of all patients was recorded which includes name, age, sex, occupation, socioeconomic status, address. Duration of present illness and any history of treatment for this illness prior to presenting to the hospital were also recorded.

Their past history was recorded which includes any history of anti tubercular treatment in the past, history of contact with a case of tuberculosis. History of any other chronic illness was also recorded. All patients were investigated for complete blood counts, general blood picture, ESR, renal functions, serum electrolytes, blood glucose.

Their Pleural Fluid aspirate was sent for Gram's staining, acid fast bacilli staining, adenosine deaminase, culture and sensitivity. The patients who were suspected of having Tubercular disease also underwent Mantoux test.

All patients underwent a chest radiograph PA view at presentation which was followed by another radiograph 24 hours after ICTD insertion. Thereafter repeat radiographs were done after every 72–96 hrs until lung was completely expanded or till decision of surgical intervention was taken.

All patients underwent an ultrasound thorax 24 hours after ICTD insertion to assess pleural thickening and septations.

Their daily vitals were recorded which includes pulse rate, blood pressure, respiratory rate, oxygen saturation on room air, temperature in degree Celsius.

After sending cultures, all patients were started on empirical intravenous antibiotics against Gram positive, Gram negative and anaerobic organisms at first which was later switched over to antibiotics according to the sensitivity.

Further course of treatment was guided by improvement in their vital parameters, radiological and clinical situation of lung expansion.

Depending on lung expansion, if lung expanded completely within a period of 6 weeks of illness, their ICTD was removed and a chest radiograph was done 24 hours after tube removal. If lung was expanded in that radiograph patients were discharged. But if there was no evidence of lung expansion in a period of 6 weeks of illness patients were taken up for decortication.

Or if patient had uncontrolled sepsis, which was judged by continuing high grade fever, failure of normalization of total leukocyte counts, continuing respiratory distress, until a period of 2 weeks of hospitalization, patient was taken up for decortication.

After surgery, all patients underwent a chest radiograph 24 hours later. Radiographs were repeated every 72–96 hours until lung is expanded and ICTD was taken out. Time taken for complete lung expansion post-surgery and ICTD removal post-surgery were recorded. If there was incomplete lung expansion even 2 weeks after surgery, patient were discharged with ICTD in situ, if patient's vital parameters were stable. These patients were followed up in out-patients department.

All patients were followed up after 15 days, 1 month and 3 months in out-patients department.

Inclusion criteria:

All patients of empyema thoracis of age 1 year to 60 years were included.

Exclusion criteria

- Any patient of less than 1 year of age
- Any patient more than 60 years of age
- All patients with ruptured liver abscess

Observation: Out of 123 patients, in 45cases i.e. 36.58% Gram positive aerobes were cultured. In 17 cases i.e. 13.82% Gram negative organisms were cultured. 8 cases i.e. 6.5% patients were diagnosed with tubercular pyothorax while in 43 cases i.e. 34.95% disease could not be attributed to any organism (table 1).

Among Gram positive organisms, *Streptococcus* species which included *S. pyogenes, S. milleri* and *S. pnuemoniae,* were isolated in 29 (23.57%) of total cases. *Staphylococcus aureus* was isolated in 16 cases i.e. 13.1% patients (diaGram 1).

Among Gram negative organisms *E. coli, Klebsiella, Pseudomonas aeruginosa* were isolated. *E. coli* was seen in 9 cases i.e. 7.3%, *Klebsiella and Pseudomonas* were found in 4 cases each i.e. 3.3% (diagram 2).

In 51 patients i.e. 41.46% no organism was cultured. These patients also included those who were diagnosed to be case of tubercular pyothorax. Diagnosis of Tubercular pyothorax was made on the basis of Past history of Anti Tubercular Treatment, History of Contact, Pleural Fluid ADA, Pleural Fluid AFB staining, Montoux Test.

There were 43 patients i.e. (34.95%) whose microbiological etiology could not be reached. Among these 43 patients, there were 35 patients who presented to our center after 21 days. Out of these 35 patients microbiological diagnosis of only 31 patients could be made (Table 2).

On applying Fisher test to this data, p value was found to be less than 0.0001 which is very significant statistically. Hence it can be stated that there are less chances of making a microbiological diagnosis of patients who presented late to the hospital.

Empyema thoracis is a suppurative inflammatory process of the pleural cavity and has been recognized for over two millennia since the time of Hippocrates. The disease is mainly seen in younger age group with maximum incidence in less than 14 years age group.

In the present study, approximately 60% cases were in age group of less than or equal to 14 years of age. According to this data empyema thoracis is seen more commonly in young children and teenage population. Ghosh *et al.* (1990), Asindi *et al.* (1992) and Satish *et al.* (2003) also found the incidence to be highest in the same age group, with maximum incidence in less than 5 years age group. In a study done between 1995 and 2003 by Finley *et al.* (2008) found an increase in pleural infection Incidence Rate Ratio (IRR) of 2.2 in patients aged <19 years and 1.23 in patients of age >19 years.

In the present study male to female ratio was 3.1:1. Tan *et al.* (2000) showed 58% of patients to be males. Eastham *et al.* (2004) had a ratio of 2:1 among male and female patients. Rodriguez and Catalan (2006) found males to outnumber females by 2:1. Satish *et al.* (2003) reported equal incidences in males and females.

In the present study Gram positive species were the most commonly isolated organisms. Among Gram positive organisms *Streptococcus* species (*S. pyogenes, S. milleri, S. pnuemoniae*) were the most frequently isolated organisms (23.57%) followed by *Staphylococcus aureus* (13.1%). Among Gram negatives *E. coli, Klebsiella pneumonia* and *Pseudomonas aeruginosa* were most commonly isolated. *E. coli* was seen in 9 (7.3%) cases, *Klebsiella* and *Pseudomonas* were found in 4 cases each (3.3%). According to the British Thoracic Society Pleural Disease guidelines 2010 (Davies, 2010) the most common organism responsible for disease is *Streptococcus* species (52%) followed by anaerobes (20%). *Staph. aureus* was seen in 11% cases and Gram negative organisms were seen in 9% cases.

Table.1 Microbes causing Empyema

ETIOLOGIES

ORGANISM	*n(%)*
GRAM POSITIVES	
Streptococcus spp.	*29(23.57%)*
Strept. pyogenes	*13(10.57%)*
Strept. pneumoniae	*11(8.94%)*
Strept. Milleri	*5(4.01%)*
Staphylococcus aureus	16(13.1%)
GRAM NEGATIVE	
E.coli	*9(7.3%)*
Klebsiella	*4(3.3%)*
Pseudomonas aeruginosa	*4(3.3%)*
Tubercular	8(6.5%)
No Growth	43(34.95%)

Table.2 Duration of symptoms

Duration of symptoms	Diagnosed	Could not be diagnosed
<21 days	76	12
>21 days	4	31
Total	**80**	**43**

Diagram.1 Types of Gram Positive organisms cultured

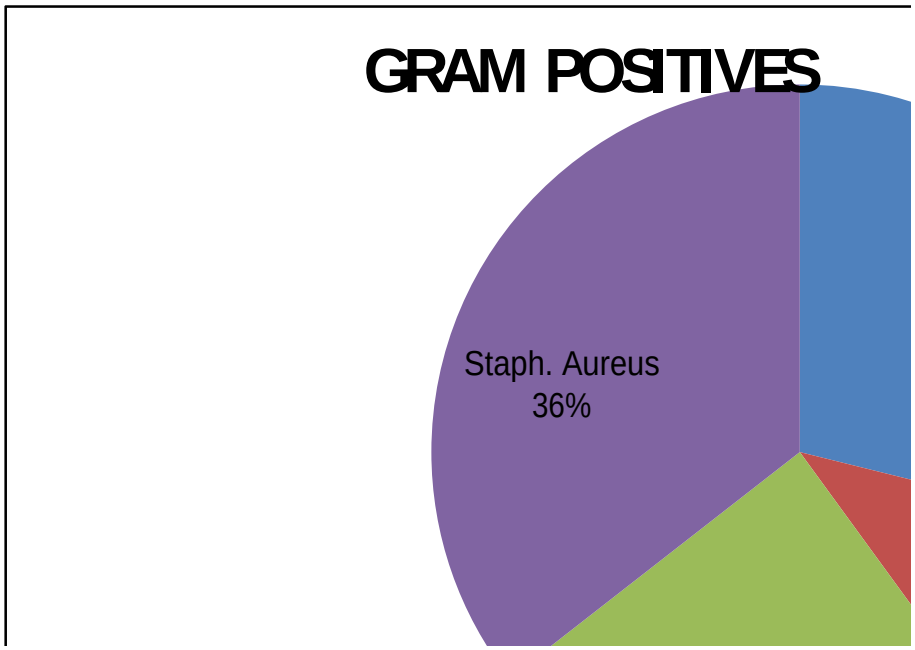
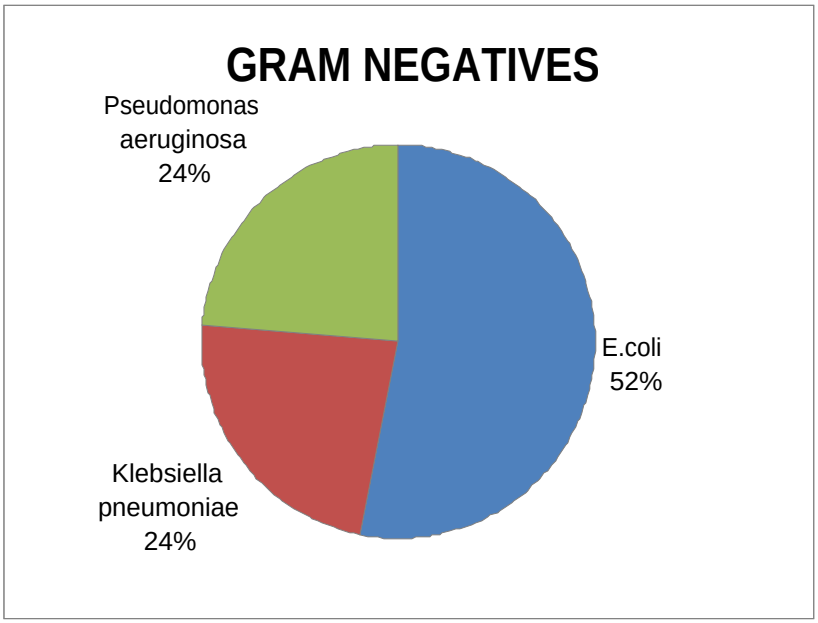


Diagram.2 Types of Gram Negative organisms cultured



It has now been observed that incidence of anaerobic infection is on the rise and is reported to be 12–34% in some studies (Bartlett, 1993). Anaerobes may be the only organisms isolated in about 14% culture-positive cases (Bartlett, 1993).

Infections with anaerobes usually have an insidous onset with low grade fever, greater weight loss and tend to occur more commonly in patients with aspiration pneumonia and those with poor dental hygiene (Bartlett *et al.*, 1974).

Mavroudis *et al.* (1981) also found *Streptococcus* to be the most common organism (31%) followed by *Staphylococcus* (21%) and Bacteroides (15%). Hughes and Van Scoy (1991) found that post pneumonic pyothorax was usually polymicrobial with multiple species of both aerobic and anaerobic organisms while pyothorax that occured after thoracic surgery was monomicrobial with *Staph. aureus* and aerobic Gram negative bacilli being the most common organisms.

Ours' being a tertiary care center patients usually presented late, after taking treatment from outside, which may be one of the causes of higher number of culture-negative cases. Since there was no facility of anaerobic cultures so we could not diagnose cases due to anaerobic organisms, which may be other reason of higher number of culture-negative cases. In the present study there was low incidence of tubercular pyothorax as compared to other studies, which may be due to the reason that more advanced tests like PCR, Quantiferon TB gold test were not employed.

Empyema thoracis is a common and life threatening disease if not treated properly. Since Gram positive aerobes are the most common cause so patients can be given empirical therapy targeting these while investigations for other etiologies should be continued. A high number of patients did not show any growth which could be because of anaerobic organisms.

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