ORIGINAL ARTICLE

Frequency of Microorganisms in patients of Empyema Thoracis, Developing as a Complication of Community Acquired Pneumonia

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ABSTRACT

Aim: To determine the frequency of various microorganisms in patients of empyema thoracis developing as a complication of bacterial pneumonia.

Methods: This descriptive cross sectional study was conducted at department of Pulmonology, Bahawal Victoria Hospital, Bahawalpur from July 14, 2010 to January 13, 2011. In this study, 102 patients with empyema thoracis were included.

Results: Out of 102 patients, growth was seen among 79 (77.5%) patients. Out of those 79 patients, the following were results: streptococcus milleri in 26 (32.9%) patients, Klebsiella pneumoniae in 19 (24.1%) patients and bacterioides in 12 (15.1%) patients.

Conclusion: Streptococcus milleri is the most common causative microorganism detected in patients with empyema throacis.

Keywords: Empyema thoracis; community acquired pneumonia; microorganisms

INTRODUCTION

Community-acquired pneumonia (CAP) is a common and serious illness with high morbidity and mortality, as approximately 20% of episodes requiring hospitalization[1]. In a review article, mortality rates from CAP were reported as 5.1% for patients treated either as out-patients or in hospital and 36.5% for those admitted to intensive care units[2].

Pneumonia can result in complicated parapneumonic effusion (CPE) and/or empyema thoracis (ET) in 44 to 57% of all pneumonia cases[3,4].

Empyema thoracis is the collection of pus in the pleural cavity. [5] It was first described in the 5th century B.C. by Hippocrates in his aphorisms: "pleuritis that does not clear up in fourteen days results in empyema". Hippocrates proposed drainage as a treatment for it and for hundreds of years empyema was treated using open drainage[6].

Empyema thoracis arises as a complication of pneumonia in most of the cases (incidence of empyema is 7.2% after bacterial pneumonia) and is associated with a significant mortality rate of 11-50%[7,8]. Etiology of approximately 70% of all cases is bacterial[7]. Other causes include iatrogenic, traumatic, and malignancies[8].

Empyema thoracis presents commonly with fever (73%), cough (65%) and chest pain (60%)[8]. Many risk factors have been defined for empyema thoracis which include extremes of age, pneumonia requiring hospitalization, and co-morbid diseases, such as bronchiectasis, alcoholism, diabetes, immunocompromised states, and chronic obstructive pulmonary disease in addition to patients of post

transplant therapy.[9] The symptoms of empyema thoracis can be either acute or chronic depending upon??? . Weight loss and anemia are common with anaerobic infections. In patients with pneumonia, the clinical picture, such as the degree of leukocytosis or the incidence of chest pain, is very similar whether or not they have a parapneumonic effusion[10].

Knowledge of the exact bacteriology is very important in treatment of the empyema[11-13]. In literature, many studies have been carried out to detect the causative infecting organisms in empyema. In a study by Ahmed RA, Streptococcus milleri (50% of all the isolates) emerged as the most common organism. [11] Tareen S, et al, reported gram negative enteric rods (91%) as the most common agents followed by Strept. pyogenes (5.4%) being the only other organism isolated from two samples[12]. The results of study by Tsang KY, the bacteriology are as follow; Streptococcus milleri (19%), Bacteroides (14%), Klebsiella pneumoniae (12%), Peptostreptococcus (7%), Streptococcus Pnemoniae (3.5%), E.Coli (7%), Staph aureus (7%)and Pseudomonas(3.5%) were the most common organisms[13].

Antibiotics are started according to isolation of microorganism; drainage is mandatory which are most frequently achieved with tube thoracostomy[11]. The use of fibrinolytics remains controversial. Early thoracoscopy is an alternative to thrombolytics. Open surgical intervention is sometimes required to control pleural sepsis or to restore chest mechanics[11].

As the empyema throacis is associated with adverse outcomes so the early and best possible

treatment of the disease is very important. Initially, we give the empirical antibiotic therapy while waiting for culture and sensitivity report. Therefore the knowledge of various causative microorganisms of the disease is very important to offer the best possible empirical antibiotic treatment to the patients. Various studies have been done to know the exact causative organisms of empyema thoracis[13].

Various authors have reported different causative organisms in their studies but no single microorganism could be found as the most common cause of the disease in different population. This has made it difficult to establish a single standard disease in different population. This has made it difficult to establish a single standard empirical antibiotic regimen.

In my study, I observed the frequency of various organisms involved in causing the empyema thoracis in complicated bacterial pneumonia in our community so that we may be able to establish a standard empirical antibiotic therapy in our population. This would help us to do the early and more effective management of the disease so that hospital stay of patients might be reduced and the risk of morbidity and mortality might reduce.

MATERIAL AND METHODS

This descriptive cross sectional study was conducted at department of Pulmonology, Bahawal Victoria Hospital, Bahawalpur from July 14, 2010 to January 13, 2011. In this study, 102 patients with empyema thoracis fulfilling the inclusion and exclusion criteria were included. Study was started after the approval from ethical committee of our institution. Patients of both sexes having age >15 years, admitted in Pulmonology Department with history of high grade fever, cough and chest pain, having radioopaque opacity obliterating the costophrenic angle on X-ray Chest, PA view and pus on aspiration of pleural fluid and patients with good nutritional status assessed by Body Mass Index (BMI) ranging from 18 – 24 kg/m^2 were included in this study.

Patients taking antibiotics from last two weeks, patients who had any other associated medical disorder like diabetes mellitus, hepatic or renal insufficiency, connective tissue disease, lymphoma and HIV/ AIDS, Patients who had structural lung damage like interstitial lung disease, bronchiectasis, COPD, bronchial asthma, pulmonary tuberculosis and malignant chest disease, Patients who had history of smoking, alcoholism, steroid intake or immunosuppressive drugs, Patients with BMI < 18 kg/m^2 and > 24 kg/m^2 were excluded from the study.

Needle aspiration of pleural fluid was done with 20 cc sterile disposable syringe by researcher himself. Specimen was sent for culture on disc for routine bacterial culture media mentioned in operational definition to the hospital laboratory. Reports were collected after 3 days and the detected microorganisms on the culture report was documented by the pathologist. A separate proforma was used for every patient to record the particulars and the documented report of culture. All the collected data was entered in SPSS version 16 and analyzed. Mean and standard deviation was calculated for numerical data and qualitative data was presented as frequencies. .

RESULTS

All the data of 102 patients were entered in SPSS version 16 and analyzed. The mean age of the patients was 33.32 ±13.62 years [range 18 - 67 years]. There were 25 (24.5%) patients of age range of 15 - 20 years, 31 (30.4%) patients of age range of 21- 30 years, 19 (18.6%) patients of age range of 31-40 years, 17 (16.7 %) patients of age range of 41 - 50 years, 5 (4.9%) patients of age range of 51-60 years, 5 (4.9%) patients of age range > 61 years as shown in Table 1. Figure shows that there were 54 (52.9%) male patient swhile 48 (47.1%) patients were female. Patients were also distributed according to growth pattern. In 79 (77.5%) patients, growth was detected on culture and sensitivity and in 23 (22.5%) patients no growth was found.

Out of the 79 patients in whom microorganism was detected, Streptococcus milleri were found in 26 (33%) patients, bacterioides in 12 (15.1%) patiens, Klebsiella pneumoniae in 19 (24.1%) patients, peptostreptococci in 7 (8.9%) patients, Streptococcus pneumoniae in 4 (5.1%) patients, E. Coli in 5 (6.3%) patients, staphylococcus aures in 2 (2.5%) patients and pseudomonas in 4 (5.1%) patients.

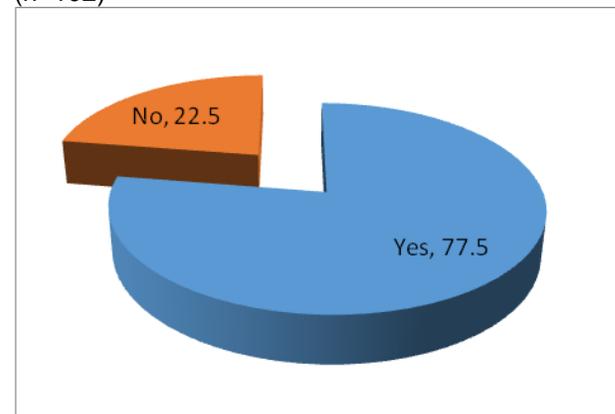Fig. 1: Distribution of patients by detection of Growth (n=102)

Table : Distribution of patients by age (n=102)

Age (Years)	n	%age
15 – 20	25	24.5
21 – 30	31	30.4
31 – 40	19	18.6
41 – 50	17	16.7
51 - 60	5	4.9
> 61	5	4.9
Mean ± SD	33.32 ± 13.62	
	18 - 67	

Table : Distribution of patients by Microorganisms (n=79)

Microorganism	n	%age
Streptococcus milleri	26	33
Bacterioides	12	15.1
Klebsiella pneumoniae	19	24.1
Peptostreptococci	7	8.9
Streptococcus pneumonia	4	5.1
E. coli	5	6.3
Staphylococcus aures	2	2.5
Pseudomonas aeruginosa	4	5.1

DISCUSSION

In this series, we studied a total 102 patients with empyema thoracis and microbiology was done in every case to document the most common pathogens in the pus of empyema thoracis. This is one of the largest studies conducted in Pakistan which included 102 patients. The results of the study showed that among those patients, streptococcus milleri was the most common organism (found in 32.9% patients,), followed by Klebsiella pneumoniae (24.1%), and Bacteroides (15.1%) Peptostrepto-coccus in (8.9%), E. Coli (6.3%), Psudomonas (5.1%), Streptococcus pnemoniae (5.1%), and staph aures (2.5%) patients.

In our local settings, the studies on this topic are very few. In a study by Tareen, et al., a total 42 patients with empyema thoracis were included. Among those, 81% patients were male and 19% were female. Mean age of subjects was 43 years. They concluded that gram negative enteric rods (91%) as the most common agents followed by Strept. pyogenes (5.4%) being the only other organism isolated from the samples of two patients.[12]

In another study by Tsang et al., 63 patients with diagnosis of empyema thoracis were studied. The mean age of the patients was 64 years and a male-to-female ratio of 45:18. The pleural fluid culture positivity rate was 68%; Streptococcus milleri (19%), Bacteroides (14%), Klebsiella pneumoniae (12%), Peptostreptococcus (7%), Streptococcus Pnemoniae (3.5%), E.Coli (7%), Staph aureus (7%)and Pseudomonas(3.5%) were the most common organisms. Like our study, streptococcus milleri was the most common organism. However, this was followed by Klebsiella pneumoniae (24.1%) in our study while, bateroided (15.1%) in their study. Similarly, staph aures was the least commonly detected organism in both of the studies.[13]

In a study by Chen et al., a total of 163 microorganisms were isolated from the pleural fluid of 139 patients. These patients were classified according to the following types of isolates: aerobic or facultative Gram-positive (n = 47); aerobic Gram-negative (n = 59); anaerobic (n = 14); and mixed (n = 19). The most predominant aerobic or facultative bacteria were Klebsiella pneumoniae (24.4%), Streptococcus constellatus (10.0%), Streptococcus intermedius (8.6%), and S aureus (5.7%). The predominant anaerobes were Fusobacterium species (8.6%) and Peptostreptococcus species (7.9%). The isolates from the 139 culture-positive patients were categorized into the following four groups: aerobic and facultative Gram-positive (n = 47); aerobic Gram-negative (n = 59); anaerobic (n = 14); and mixed (n = 19). In the aerobic and facultative Gram-positive group, viridans streptococci and S. aureus were the predominant pathogens. In the aerobic Gram-negative group, K. pneumoniae and Escherichia coli were the most frequent isolates. In the anaerobic group, Peptostreptococcus species and Fusobacterium nucleatum were predominant as single pathogens. In the group of patients with more than one pathogen isolated, Peptostreptococcus species, S constellatus, Eikenella corrodens, Prevotella species, and Fusobacterium species were the major isolated organisms. The differences among isolated organisms in these four groups were not related to age or gender but were related to underlying condition. Patients in the aerobic Gram-negative bacilli group had the highest incidence of underlying disease (84%; p = 0.006). The results of this study are comparable to that of ours, with a little difference that Klebsilla was the most common organism their study while this was second moost common in ours study.[14]

In a study by Lin et al., the most common pathogens in the medical ward were Streptococcus spp. (26%), Klebsiella pneumoniae (17%), S. aureus (14%), and Pseudomonas spp. (12%). Otherwise, in the MICU patients, the most common pathogens in the MICU were K. pneumoniae (24%), S. aureus (22%), Pseudomonas spp. (13%), and Streptococcus spp. (12%). When compared to our study, the results were quite comparable. In our study, the most common organism was streptococcus milleri followed by Klebsiella, while in their study, both of these organisms were the most common i.e. streptococcus in medical ward and klebsiella in MICU.[15]

The above discussion shows that the frequency of causative organisms varies greatly among different authors. This can be due to difference in age of the patients and culture kits available at the diagnostic center. There is also another observation that, streptococcus pneumoniae has become a less common aetiological agent for empyema thoracis and other Gram-positive, Gram-negative, and anaerobic organisms are more commonly isolated now. Such a change in pattern may be attributed to the worldwide accessibility of patients to broad-spectrum antibiotics.

CONCLUSION

Streptococcus milleri is the most common microorganism detected in cases of empyema thoracis, developing as a complication of bacterial pneumonia. The other causative organisms are Klebsiella pneumoniae and bacteroides. Unlike other cases of pneumonia, staphylococcus aures is least common organism.

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