CODEN [USA]: IAJPBB ISSN: 2349-7750

INDO AMERICAN JOURNAL OF
PHARMACEUTICAL SCIENCES

http://doi.org/10.5281/zenodo.2589174

Available online at: http://www.iajps.com ***Research Article***

OCCURRENCE OF BACTERIAL PNEUMONIA COMPLICATIONS DUE TO MULTIPLE MICROORGANISMS AMONG ET (EMPYEMA THORACIC) PATIENTS

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Article Received: December 2018 **Accepted:** February 2019 **Published:** March 2019

Abstract:

Background and Objective: *The Bacteria of pneumonia can also lead to Empyema Thoracic (ET) which can be lethal in causing morbidity and mortality. If we analyze the authors work, they describe different contributing organisms activating the empyema thoracic in the patients. This research was held in a local setup to determine the frequency of major contributing organism. The research objective was the assessment of several microorganisms present in patients of empyema thoracic growing in the result of complications occurring due to bacterial pneumonia.*

Methods: *Our descriptive cross-sectional research was carried out at Mayo Hospital, Lahore (February 2017 to July 2017) on a total of 102 empyema thoracic patients. Aspirate from pleural cavity sent for reports at culture and sensitivity. The culture and sensitivity reports showed the main outcome variable was the frequency of microorganism explain in tables as a frequency distribution.*

Results: *The study included 102 patients in which male and female were respectively 54 (52.9%) and 48 (47.1%). Mean ages were (33.32 ± 13.62) years, range (18 – 67) years. A number of patients with age, gender distribution, growth determination and micro-organisms distribution were also stratified in this research.*

Conclusion: *It is an established fact that the most causative microorganism identified in the patients with empyema thoracic was Streptococcus milleri.*

Keywords: *Empyema thoracic, bacterial pneumonia, microorganisms*

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Please cite this article in press wajeeha Aiman et al., ***Occurrence Of Bacterial Pneumonia Complications Due To Multiple Microorganisms Among Et (Empyema Thoracic) Patients.,*** *Indo Am. J. P. Sci, 2019; 06(03).*

INTRODUCTION:

Pneumonia is a common and lethal condition of illness almost (20%) of the patient's results in hospitalization. The patients get pneumonia mostly from (CAP) Community-acquired pneumonia and results in morbidity and mortality the higher rate observed in the patients admitted in hospitals [1]. Its reviewed in an article that the patients who visit hospitals for treatment of CAP have the mortality rate (5.1%), and the rate of mortality in patients admitted in ICU (Intensive Care Unit) is (36.5%) [2].

Para pneumonia effusion complication (CPE) and Empyema thoracic (ET) also happen in the result of pneumonia in patients 44% to 57% of all pneumonia cases [3, 4]. If the presence of pus detected in the pleural cavity then this condition known as empyema thoracic [5]. Hippocrates described it in his aphorisms in the period 5th century B.C. "pleuritis that does not clear up in fourteen days results in empyema". Hippocrates suggested the treatment by the method of drainage, and after hundreds of years, the open drainage treatment is still used [6].

The frequency of empyema after bacterial pneumonia is (7.2%) the complication of empyema thoracic rises in most of the cases of pneumonia linked with a significant mortality rate of (11% to 50%) [7, 8]. Aetiology of approximately 70 % of all cases is bacterial [7]. Traumatic, malignancies and iatrogenic are the causes [8]. Frequencies of (ET) Empyema thoracic presents commonly with temperature (73%), cough (65%) and chest pain (60%) [8]. Variable risk factors also defined for empyema thoracic including comorbid diseases (such as bronchiectasis, alcoholism, diabetes and chronic obstructive pulmonary disease), age factor and severity of pneumonia in which patient needs hospitalization. Symptoms of empyema thoracic can be either critical or enduring [9]. Common symptoms are weight loss and anaemia with anaerobic infections. The degree of leukocytosis or the occurrence of chest pain in patients with pneumonia is much related according to the clinical picture, whether the patients have the parapneumonic effusion or not [10].

The exact identification of the bacteria is very important in the treatment of the (ET) empyema thoracic [11, 13]. Many studies were done on a level of literature to identify the reason infecting the organisms in (ET) empyema. Ahmed RA held research in which he showed that almost half (50%) of the isolates of Streptococcus milleri occurred as the most common organism [11]. According to the Tareen S, et al research, the most common agent reported was gram-negative enteric rods (91%) the same study followed by Strept. Pyogenes presence in (5.4%) patients only other organism isolated from two different samples [12]. Tsang KY did another study on same cause according to his reports; the following is the bacteriology;

Bacteroides (14%), Streptococcus milleri (19%), Klebsiella pneumonia (12%), Pepto streptococcus (7%), Streptococcus Pneumonia (3.5%), E. Coli (7%), Staph aureus (7%) and Pseudomonas (3.5%) were the most common organisms [13].

According to the isolation of microorganism antibiotic recommended, treatment with the method of drainage is required mostly done with the help of tube thoracotomy [11]. Still, treatment using the fibrinolytic is debatable. Thoracoscopy is an alternate version of old thrombolytic. To control the pleural sepsis or to restore the chest structure open surgical intervention is sometimes required [11]. Due to (ET) empyema thoracic dreadful outcomes, it is very necessary to start the treatment on early stages. Our procedure was to give the patients the empirical antibiotics while waiting for the culture and sensitivity report. For the best productive results of empirical antibiotic treatment, it is highly recommended to identify the kinds of microorganisms causing the disease in patients. Many studies were done for the cause of identifying the exact causative organisms of (ET) empyema thoracic [13]. Different studies done by different authors for the same purpose of identifying the causative microorganism but the conclusion they reported could not lead us to the most common single causative organism in different patients, making it more difficult to report a single standard treatment of empirical antibiotics for different patients of different countries.

We observed different organism's frequencies in our studies activating (ET) empyema thoracic in complicated bacterial pneumonia in our society, for more effective empirical antibiotics treatment in our patients the early detection of the causative organism in patients in necessary to overcome the disease more efficiently and to reduce the rate of morbidity and mortality.

Bacterial pneumonia:

The patients with fever level of (101 F°) and complaints about the chest pain and radio-opaque opacity on X-ray chest, PA view confirms, then the patient was linked to bacterial pneumonia.

Empyema Thoracic:

It was assigned to the patients presenting with a history of high-grade fever (101 oF), cough and chest pain having radio-opaque opacity obliterating the costophrenic angle on X-ray chest PA view and pus on needle aspiration of pleural fluid.

The patient with the history of fever level (101 F°), coughing and chest pain having radio-opaque opacity obliterating the costophrenic angle on X-ray chest PA view and pus found on needle aspiration of pleural fluid, then the patient was linked to (ET) Empyema Thoracic.

Detection of microorganisms:

For a collection of pus from the pleural cavity of a patient with empyema thoracic a 20 CC sterile syringe is required. The sample extracted from the patient was then sent to the hospital's laboratory where they can detect different causative microorganism are made the growth pattern on the disk of routine bacterial culture media are also recorded which are blood agar for streptococcus milleri, blood agar for Bacteroides, CLED (Cysteine lactose electrolyte deficient) agar, blood agar for Klebsiella, blood agar for peptostreptococcus, chocolate agar for streptococcus pneumonia, MacConkey and 'CLED agar' for E-coli, blood agar for Staphylococcus auras, blood agar MacConkey and CLED agar for Pseudomonas.

The microorganisms labelled as positive on culture if the growth pattern of the causative microorganisms identified on the particular media.

MATERIAL AND METHODS:

Our descriptive cross-sectional research was carried out at Mayo Hospital, Lahore (February 2017 to July 2017) on a total of 102 empyema thoracic patients. We included the patients of both genders, age (above 15 years), high-grade fever history, chest pain, cough, abnormal chest PA view, pleural fluid pus, good nutritional status and BMI (18 – 24) kg/m^2. Whereas, we did not include any patient with antibiotic intake history, history of hepatic, renal, diabetic, connective tissue, HIV, AIDS and lymphoma disease, lung damage (interstitial lung disease, COPD, bronchiectasis, pulmonary tuberculosis, bronchial asthma and malignant chest disease), alcoholism, smoking, intake of steroid and BMI (< 18 kg/m^2 & > 24 kg/m^2).

The study started after getting the approval from the ethical committee of our institution, after which filtering the patient's inclusion and exclusion by the above-mentioned criteria, we included 102 patients with a written agreement as an acknowledgement from the hospitalized patients. Needle goal of pleural liquid was finished with 20 cc, sterile disposable syringe by specialist himself. Sample than sent for examination of culture on disc for routine bacterial culture media shown in operational definition to the laboratory of the hospital. Reports were gathered following 3 days and the distinguished microorganisms on the way of life report were recorded by the advisor pathologist (who has over multiyear post cooperation involvement in the field of Pathology) duly stamped. A different proforma utilized for each patient to record the points of interest and the archived report of culture. For the analysis of data, SPSS software used to get the statistical information by putting the information in it. The qualitative variables like sex and microorganisms on culture and sensitivity (Streptococcus pneumonia, Staphylococcus aureus, E. Coli, Streptococcus milleri, Bacteroides, Klebsiella pneumonia, Pepto streptococcus and Pseudomonas) presented as a frequency distribution. Quantitative data like age (in years) and nutritional status (BMI) were presented as means and standard deviations. The main outcome variable was the frequency of microorganisms which were presented as frequency distribution tables. Patient's age, sex and nutritional status (BMI) kept in mind and their effects on the causative microorganisms of empyema thoracic noted to minimize the confounding factors.

RESULTS:

The study included 102 patients in which male and female were respectively 54 (52.9%) and 48 (47.1%). Mean ages were (33.32 ± 13.62) years, range (18 – 67) years. Detailed outcomes about the number of patients with age, gender distribution, growth determination and micro-organisms distribution were also stratified in this research (Table – I to Table – IV).

Table – I: Age Distribution (102)

Age	Number	Percentage
15 to 20 Years	25	24.5
21 to 30 Years	31	30.4
31 to 40 Years	19	18.6
41 to 50 Years	17	16.7
51 to 60 Years	5	4.9
≥ 61 Years	5	4.9
Mean ± SD	33.32 ± 13.62	
Range	18 – 67	

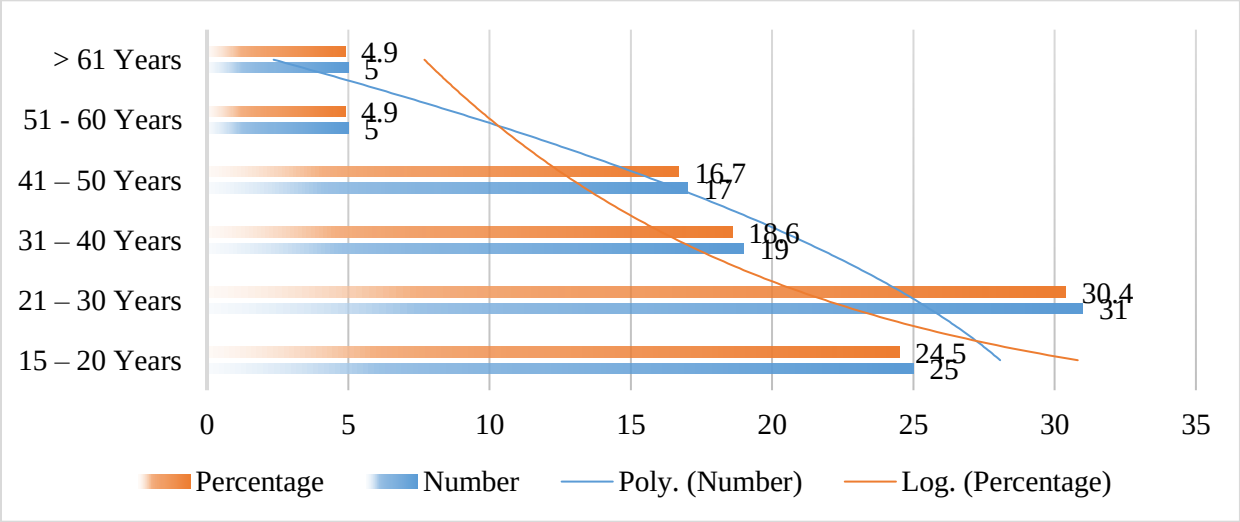


Table – II: Gender Distribution (102)

Gender	Number	Percentage
Male	54	52.9
Female	48	47.1

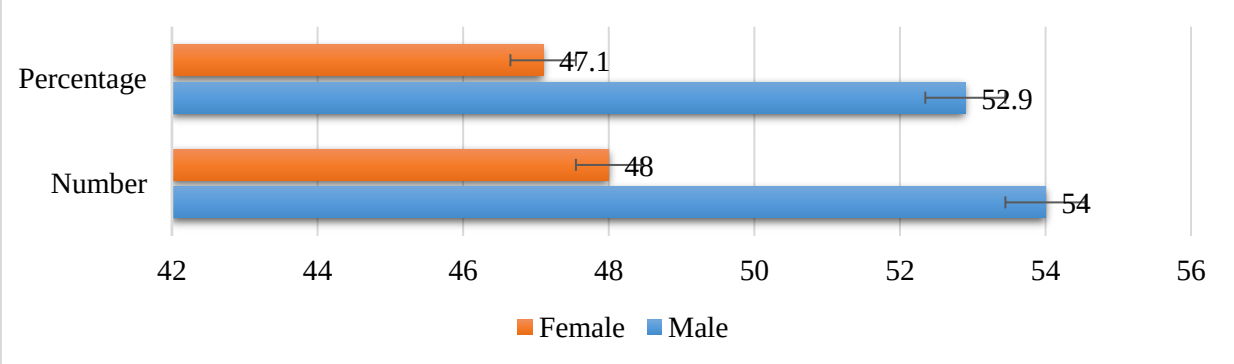


Table – III: Growth Detection (102)

Growth Detection	Number	Percentage
Yes	79	77.5
No	23	22.5

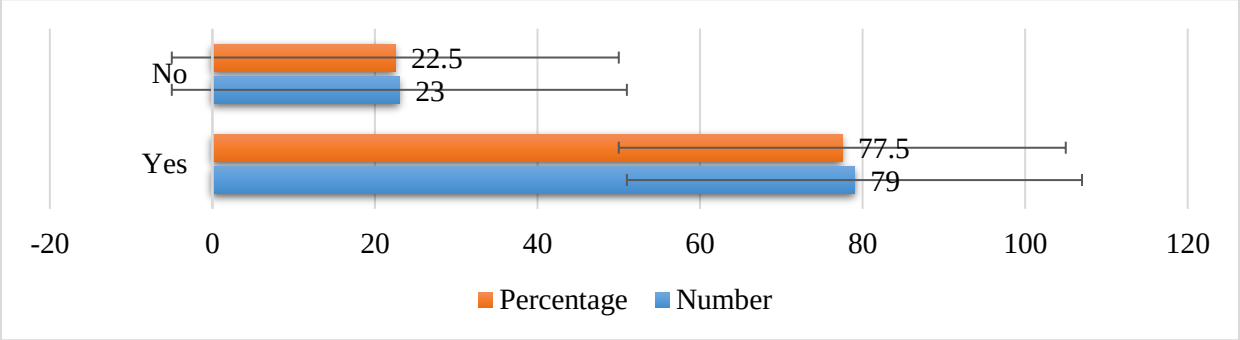
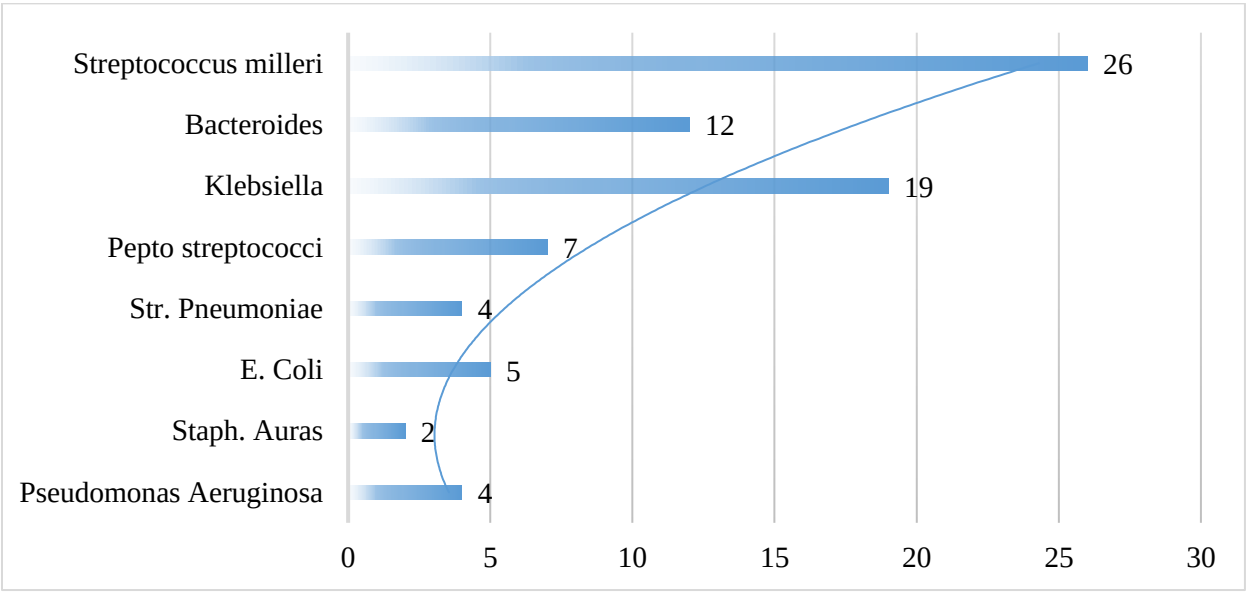


Table – IV: Micro-Organisms Distribution (102)

Micro-Organisms	Number of Patients
Pseudomonas aeruginosa	4
Staph. Auras	2
E. Coli	5
Str. Pneumonia	4
Pepto streptococci	7
Klebsiella	19
Bacteroides	12
Streptococcus milleri	26



DISCUSSION:

To find the most common pathogens in the pus of (ET) empyema thoracic we done complete microbiology to manuscript the information from our 102 patients with empyema thoracic. We found streptococcus as the most common causative organism present in (32.9%) of the patients, the same result also is seen in (24.1%) patients in which presence of Klebsiella pneumonia found, there were (15.1%) patients with Bacteroides in their systems. Now those organisms which are found on a low number of patients are also documented like the presence of Pepto streptococcus found in (8.9%) of the patients, patients with E. Coli are (6.3%), patients with Pseudomonas are (5.1%), patients with Streptococcus pneumonia are (5.1%) and staph aureus found in (2.5%) patients.

On research, it appeared that only a few studies were done on this topic yet. The same study by Tareen S, et al in which he included 42 patients of empyema thoracic among them 81% were men and 19% were women, the mean SD age of patients was 43 years. In his study, they concluded that (91%) gram-negative enteric rods as the most common agents shadowed by Strept. Pyogenes (5.4%) being the only other organism isolated from the samples of two patients [12].

Tsang KY, et al, included 63 in which 45 were men and 18 were women and their mean age was 64 years and were patients of empyema thoracic he studied them for the same reason. The culture report of the pleural fluid was 68% positive; in which the presence of Streptococcus milleri was (19%), Bacteroides (14%), presence of Klebsiella pneumonia (12%), patients having Pepto streptococcus (7%), patients having Streptococcus Pneumonia (3.5%), patients having E. Coli (7%), patients having Staph aureus (7%) and Pseudomonas in (3.5%) patients were the most common organisms. We have done our study on a very large scale and found Streptococcus milleri as the most common organism. However, this was followed by Klebsiella pneumonia (24.1%) in our study while, Bacteroides (15.1%) in their study. Similarly, staph aureus was the least commonly detected organism in both of the studies [13].

Another study by Chen K, et al, in which 139 patients were included and then 163 microorganisms were isolated from their pleural fluid, the patients then grouped by the name of isolates extracted from their fluid-like aerobic Gram-positive (n = 47), aerobic Gram-negative (n = 59), anaerobic (n = 14) and mixed (n = 19). According to his study, the most chronic aerobic bacteria were Klebsiella pneumonia (24.4%) appeared in patients, then streptococcus constellates found in (10.0%) patients, then streptococcus intermedius found in (8.6%) patients and Sauers in (5.7%) patients. Two species Fusobacterium and Pepto streptococcus also found which were predominant anaerobes in 8.6% and 7.9% of the patients respectively. Culture positive patients which were total 139 than categorized into four groups such as patients with aerobic Gram-positive (n = 47), patients with aerobic Gram-negative (n = 59), patients with anaerobic (n = 14) and patients with multiple isolates (n = 19). In the first category aerobic and facultative Gram-positive group 47 patients, the most predominant pathogens were viridians Streptococcus streptococci and S. aureus. The 59 patients of second category aerobic Gram-negative, the predominant pathogens were aerobic Gram-negative group and K. pneumonia and Escherichia coli. In the 14 patients of third category anaerobic group, the predominant as a single isolate were Pepto streptococcus species and Fusobacterium nucleate. In the 14 patients of category four with multiple isolates of pathogens, the main species were Pepto streptococcus, S constellatus, Eikenella corrodens, Prevotella and Fusobacterium were the main isolated organisms. Age and gender not related to these four groups whereas they related to the following condition. Most cases of Patients with pneumonia found in the first group of aerobic Gram-negative bacilli (84%; p = 0.006). This study's result is similar to our study the only difference found that Klebsiella was the most common organism in his study and second in our study [14].

In a study by Lin Y, et al, the most common pathogens in the medical ward were Streptococcus spp. (26%), Klebsiella pneumonia (17%), S. aureus (14%), and Pseudomonas spp. (12%). Otherwise, in the MICU patients, the most common pathogens in the MICU were K. pneumonia (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 the difference in age of the patients and culture kits available at the diagnostic centre. There is also another observation that streptococcus pneumonia has become a less common etiologic agent for empyema thoracic and other Gram-positive, Gram-negative, and anaerobic organisms are more commonly isolated now. Such a change in pattern may attribute to the worldwide accessibility of patients to broad-spectrum antibiotics.

CONCLUSION:

Our results show that the most common causative organism was Streptococcus milleri identified in

empyema thoracic patients. We also found some other organisms like Klebsiella pneumonia and Bacteroides, the least organism found is Staphylococcus aureus, for the better treatment of antibiotics according to the causative organism the culture and sensitivity must be done in all patients of empyema.

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