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Bacteriological Profile and Antibiotic Sensitivity Pattern of Micro Organisms from Community Acquired Pneumonia.

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ABSTRACT

Community acquired pneumonia (CAP) is a public health problem. The aim of the study was to determine the etiological agents of the CAP and the antibiotic sensitivity pattern of the isolates in Bangalore. Hundred prospective patients with CAP were included in the study. Blood culture was done in all the cases and sputum culture was done in 66% of cases. Out of 100 patients, the etiology was established in 39% of cases from sputum and blood culture. Rate of isolation of organisms from sputum and blood culture was 54.5% (of 66 samples) and 4% (of 100 samples) respectively. The predominant organism from sputum culture was *Klebsiella spp* followed by *Streptococcus pneumoniae*, *Pseudomonas spp* and others. The predominant organism from blood culture was *Staphylococcus aureus* followed by *Klebsiella spp*. The isolates showed best sensitivity for third generation cephalosporins, fluoroquinolones and aminoglycosides. CAP incidence increases with increasing age and with risk factors like smoking, COPD and diabetes mellitus. Most common organism isolated were *Klebsiella spp* followed by *Streptococcus pneumoniae*, *Pseudomonas spp* and others, with best sensitivity for third generation cephalosporins, fluoroquinolones and aminoglycosides.

Keywords: Community acquired pneumonia, chronic obstructive pulmonary disease, etiology, risk factors, smoking.

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INTRODUCTION

Community acquired pneumonia (CAP) is a common infectious disease in adults all over the world and has a significant morbidity and mortality of 10% and 25 % respectively [1]. The incidence of CAP worldwide in adults is between 1.6 & 13.4 cases per 1000 inhabitants per year [2]. Pneumonia results in more than 5,00,000 hospital admissions annually in adults and ranks as the sixth leading cause of death in the United States [3]. About 13%-22% of patients with CAP require admission to the intensive care unit [4]. The problem is much greater in the developing countries where pneumonia is the most common cause of hospital admission in adults. Though definite statistics are lacking, pneumonia remains a leading cause of death in India [3].

Pneumonia is a microbial infection involving the terminal airways and alveoli of the lung [5]. Older patients have an increased incidence of pneumonia and increased mortality compared to younger populations [6]. The aging population, the increased prevalence of co-morbid illnesses like HIV infection and increasing microbial resistance have all probably contributed to the persistence of the high mortality rate, despite advances in medical care [7]. The bacteriological profile of CAP is different in different countries and is changing with time with in the same country, probably due to frequent use of antibiotics, changes in environmental pollution, increased awareness of the disease and changes in life expectancy [8].

Pneumonia management remains challenging because of several constantly changing factors, including an expanding spectrum of pathogens, changing antibiotic resistance patterns, the availability of newer antimicrobial agents and increasing emphasis on cost effectiveness and outpatient management [9]. Management of pneumonia remains empiric and challenging at the time of initiation of antibiotics, because the precise etiology is usually unknown. Despite progress in diagnostic tools and laboratory tests, it takes at least few days to identify the causative microorganisms in blood or sputum samples, and the etiology of CAP remains unknown in 30-60% of cases [5, 10]. The present study was undertaken to determine the etiology and antibiotic sensitivity pattern of CAP.

MATERIALS AND METHODS

The study was a prospective study carried out on 100 cases of community acquired pneumonia of patients aged >18 years. The protocol was approved by ethical committee of the Institute and informed consent was taken from all participate. CAP was defined as new pulmonary infiltration on chest roentgenogram on admission with at least one of major criteria or two of the minor criteria. Major criteria were cough, sputum production, or fever >37.8^{o}C. Minor criteria were pleuritic chest pain, dyspnea, altered mental status, pulmonary consolidation by examination, WBC count >11,000/mm^{3}. Patients in whom chest roentgenogram abnormalities were attributed to congestive heart failure, tuberculosis, pulmonary embolism or chronic underlying lung disease and patients on immunosuppressive therapy or AIDS were excluded from the study.

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Investigations:

1. Complete hemogram, fasting blood sugars and chest x-ray P/A view was done in all patients.
2. Early morning deeply coughed out sputum sample was collected. All the sputum samples were subjected to Grams staining. Samples containing more than 25 polymorph nuclear cells and less than 10 epithelial cells were also subjected to bacterial culture on sheep blood agar, chocolate agar and MacConkey's agar media and incubated at 37°C for 24-48hrs. The growth was subjected to Grams staining and biochemical tests for identification. The isolate was identified and antibiotic susceptibility tests were performed according to Kirby Bauer disc diffusion method.
3. Two samples for blood culture was drawn from two different sites within a gap of 30 minutes and inoculated into Brain heart infusion broth and incubated at 37°C for 7 days. Subculture was done on alternate days on MacConkey's agar, sheep blood agar and chocolate agar and incubated at 37°C for 24-48hrs. If there was any growth, it was identified and antibiotic susceptibility tests were performed according to Kirby Bauer disc diffusion method.

RESULTS

The mean age of patients was 53.36±17.42 years (range 18-90 years). There were 73 males and 27 females. Male to female ratio was 2.7:1. The maximum number of cases of CAP was in the more than 50 years of age group (60%). Most common presenting symptoms were cough (99%), sputum production (77%), fever (75%) and other symptoms were difficulty in breathing (45%) and chest pain (37%). The most common risk factors identified were smoking (45%) followed by COPD (26%) and diabetes mellitus (8%).

Sputum sample was obtained in 66 patients. Sputum culture was positive in 36 (54.5%) of the 66 samples subjected to culture, 2 patients had evidence of more one pathogen. Blood culture was performed in all 100 patients but 4 cultures yielded positive results (*Staphylococcus aureus* in three and *Klebsiella spp* in one patient).

Out of the 100 patients studied, etiological diagnosis was possible in 39 cases of CAP. The most common organism isolated was *Klebsiella spp* followed by *Streptococcus pneumoniae*, *Pseudomonas spp* and others. [Table-1] & [Table-2]. The isolates showed best sensitivity for third generation cephalosporins, fluoroquinolones and aminoglycosides. [Table-3]

Table-1: Distribution of organisms isolated from sputum culture.

Organisms	Number	Percentage
Klebsiella spp	17	44.7
Streptococcus pneumoniae	10	26.3
Pseudomonas spp	5	13.2
E.coli	3	7.9
Staphylococcus aureus	1	2.6
NFGNB	1	2.6
Citrobacter spp	1	2.6

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Table-2: Distribution of organisms isolated from blood culture

Organisms	Number	Percentage
Klebsiella spp	1	1.0
Staphylococcus aureus	3	3.0

Table-3: Sensitivity pattern of organisms isolated.

ANTIBIOTICS	SENSITIVITY(n=42)	
	Number	%
1.Amikacin	25	59.5
2.Amoxycillin	16	38.1
3.Ampicillin	9	21.4
4.Cefotaxime	31	73.8
5.Cefepime	35	83.3
6.Ciprofloxacin	32	76.2
7.Cefuroxime	18	42.9
8.Cotrimoxazole	29	69.1
9.Gentamicin	37	88.1
10.Imipenem	25	59.5
11.Levofloxacin	30	71.4
12.Piperacillin+Tazobactum	29	69.1
13.Clindamycin	12	28.6
14.Cloxacillin	10	23.8
15.Erythromycin	9	21.4
16.Linezolid	13	30.9
17.Tetracycline	14	33.3

DISCUSSION

The incidence of CAP was highest (60%) in the cohort of patients more than 50 years of age. Patients in the older age groups are more susceptible to gram negative pneumonia because of the effect of aging on immunity and pulmonary defenses, underlying chronic diseases, silent aspiration, increased exposure to antibiotics and institutional care [5]. The present study comprised of 73 males and 27 females. Earlier studies have shown that CAP is more common in males [11,12]. Our study demonstrated the same. The male

preponderance could be due to the fact that they are more exposed to risk factors like smoking, COPD, alcoholism etc.

Smoking was the most important risk factor (43%) in our study. The increased risk of pneumonia in smokers is due to alteration in respiratory flora, mechanical clearance and cellular defenses. Bacterial colonization of lower respiratory tract is more prevalent in smokers than nonsmokers and mucociliary clearance is more defective, owing to a reduction in ciliary beat frequency and changes in volume and viscoelastic properties of respiratory secretions [13]. Oxidative stress and alterations in responsiveness of inflammatory cells are associated with the physical and chemical properties of tobacco smoke [14,15]. Tobacco smoking is the most important risk factor for the development of COPD and it is recognized as a risk factor for other respiratory infections. Recent data suggest that patients who have COPD and CAP are morbid and have a high mortality rate than patients who do not have COPD. [16] Increased incidence and mortality of pneumonia in COPD patients is explained due to defective mucociliary clearance, mucous plugging, airway collapse, respiratory muscle fatigue and the effect of medications used [13]. The risk factors found in our study is not different from other Indian studies [17,18].

The microbial diagnosis of CAP was confirmed in 39% of patients with standard sputum and blood cultures. The low rate of isolation could be due to non-availability of sputum in all cases (34%), prior antibiotic administration, and lack of availability of serological methods for the detection of *Mycoplasma*, *Chlamydia*, *Legionella* and viruses.

The rate of isolation of organism from sputum culture and blood culture was 54.5% and 4% respectively. Many Indian studies showed positive sputum culture in 25-70%. [8,18,19] Decreased sputum positivity is due to prior use of antibiotics, inappropriate sputum production and non-productive cough. Blood culture positivity of 4% observed in our study is much lower than observed by others 5-33% [5, 8, 20]. The low blood culture isolation is explained by prior use of antibiotics and delay in taking the initial blood culture. Specimens containing low blood volumes, low bacterial concentrations or more fastidious organisms may not reach sufficient growth thresholds for detection by some manual or automated methods within the 5-7days of incubation period [21].

In the present study the most common organism isolated was *Klebsiella spp* followed by *Streptococcus pneumoniae* and *Pseudomonas spp*. Indian studies over the last three decades have reported higher incidence of gram negative organisms among culture positive pneumonia [8,18,19]. While few studies from India, U.S. and UK also reported that *Streptococcus pneumoniae* as the common isolated pathogen in 20-35% of cases [5,13,17,22-24]. It has been reported that old age, smoking and COPD impair pulmonary defenses and predispose to CAP caused by gram negative bacteria [8].

Two pathogens were isolated in 3 cases of our study. Polymicrobial etiology has been reported as a common phenomenon in lower respiratory tract infections [25,26]. The injury to ciliary motility of epithelial cells by one infectious agent may establish the conditions for other infectious agents to infiltrate the lower respiratory tract [27]. The present study shows that third generation cephalosporins, fluoroquinolones and aminoglycoside antibiotics have best sensitivity. The sensitivity pattern is similar to the study done by Aroma Oberoi et al

[17]. This is because of the higher incidence of CAP due to gram negative organisms. If the antibiotic is administered to the patients at an early stage of the disease, morbidity and mortality due to CAP can be minimized [17].

Limitations of this study was, lack of availability of facilities for detection of atypical and viral pathogens. Atypical pathogens have been reported in several studies on CAP accounting for 10-15% of the causes of pneumonia [23,28].

The present study was undertaken for the first time in our hospital to know the common causative agents and their antibiogram, so that they can start the empirical therapy as early as possible till the sensitivity report is ready.

CONCLUSION

CAP is the one of the common infection of the respiratory tract. It occurs in all age groups, but the incidence is more with advancing age and associated risk factors like smoking, COPD and diabetes. Identification of the specific pathogen in acute bacterial pneumonia is necessary for rational and appropriate antibiotic therapy. Etiological agents cannot be identified in many cases because of prior use of antibiotics, inappropriate sputum production and non-productive cough. Undiagnosed cases of CAP can be diagnosed by applying serological methods if available, so that appropriate treatment can be given to reduce the morbidity and mortality in these patients. Empirical treatment has to be started for all the cases of CAP, till the culture report arrives. The empirical therapy should be based on the presumptive etiologic diagnosis developed from all available epidemiologic, clinical and laboratory data. Once the culture report is available, the treatment should be based on the drug to which the organism is most susceptible.

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