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STUDY OF CLINICAL AND BACTERIOLOGICAL PROFILE OF COMMUNITY ACQUIRED PNEUMONIA IN A TERTIARY CARE HOSPITAL

Microbiology

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ABSTRACT

Community Acquired Pneumonia (CAP) is a lower respiratory tract parenchymal lung infection which continues to be a major health problem.1 CAP remains a common and serious illness despite the availability of potent new antimicrobials and effective vaccines.2 The problem is much greater in developing countries where pneumonia is the most common cause of hospital attendance in adults.3 Despite advances in management of CAP, mortality ranges from 6-15%.4 Initial management of CAP is empirical and dependent on the clear understanding of likely pathogens.5 In clinical practice, etiological agent is identified in <30% of cases. The present study was carried out to ascertain the bacterial profile of community acquired pneumonia. A detailed clinical history along with gram staining and culture was carried out on sputum samples from 100 patients above 18 years of age with signs and symptoms of LRTI. All isolates were subjected to antimicrobial susceptibility testing by Kirby- Bauer Disc Diffusion method on Mueller-Hinton agar. Klebsiella pneumonia was the most common organism isolated (22.7%) followed by Methicillin resistant Staphylococcus aureus and Escherichia coli in 13.6% each.

KEYWORDS

Community acquired pneumonia, clinical history, sputum culture, Antimicrobial susceptibility testing

INTRODUCTION

CAP is common in India, affecting 2,50,000 adults per year of whom 80,000 require hospitalization.[2] The overall rate of CAP in adults is 5-12 cases per 1000 population and the incidence markedly with age.[6] Despite advancement in management of CAP, mortality ranges from 6-15% .[4] Mortality is highest in CAP patients who require hospitalization, with a 30-day mortality up to 23%.[7] Identifying the cause remains a challenge. Due to lacunae in knowledge and lack in facilities pneumonia is misdiagnosed and mistreated. Another reason for poor outcome is the failure to assess the severity of the disease. Initial antimicrobial management of CAP is empirical and dependent on the clear understanding of the likely pathogens.[5] In clinical practice, the etiological agent is identified in <30% of all cases. Hence, this study is an attempt to find out the clinical and bacteriological profile of community acquired pneumonia.

MATERIAL AND METHODS

Study Design: The study was an observational study carried out in the Department of Microbiology in collaboration with the Medicine department at a tertiary care hospital in Western Maharashtra. Ethical clearance was taken, and the duration of the study was from January 2018 to December 2018.

Study Population: 100 clinically diagnosed patients of CAP

Inclusion Criteria: All adults (>18 yrs) with

- Signs and symptoms with LRTI (cough with or without expectoration, dyspnea, pleuritic chest pain, crackles on auscultation)
- New focal chest signs on physical examination
- At least one systemic feature (sweating, fever, shivering, aches or pains)
- No other explanation of the illness

Exclusion Criteria:

- Patients with immunosuppression
- An emerging alternative diagnosis during follow-up
- Pneumonia secondary to tuberculosis
- History of hospitalization within the previous 10 days
- Ventilator-associated pneumonia

Study Procedure:

- Detailed history along with general physical examination findings, clinical findings and radiological findings of all patients were collected.
- Sputum sample was collected in a sterile wide mouth container.
- Gram stain was performed on the sample. Those with >25 neutrophils and <10 epithelial cells per 10x low power field were taken as infectious samples and processed further, else were reported as salivary samples and repeat sample was advised. Gram stain was reported for pus cells and organisms seen.
- Sample was plated on two Blood agar (BA), one MacConkey agar and one Chocolate agar (CA). One BA and MacConkey were incubated at 37^0C in aerobic conditions. The other BA and CA plate was placed in candle jar and incubated at 37^0C in carbon dioxide jar.
- Antimicrobial susceptibility was performed for all the isolates using Kirby-Bauer disc diffusion method and using appropriate antimicrobials. Interpretation was done according to CLSI guidelines.

Statistical Analysis: All data was entered using the SPSS statistical software package, Version 23.0.0.0 (IBM Corporation). Continuous variables were expressed as mean ± standard deviation. Pearson chi-square test was done for categorical variables. Pearson correlation test was done to find a correlation. A 2-sided P value of <0.05 was considered statistically significant.

RESULTS

- Of the 100 patients included in the study, 63% were male and rest 37% were female. The age group of the patients varied from 18 to 80 years with a mean age of 52.13±16 yrs. Associated co-morbidities like COPD, diabetes mellitus, congestive cardiac failure, smoking and alcoholism were observed in most of the patients of which 68% of the patients were smokers.
- Patients presented with both typical and atypical symptoms. Typical respiratory symptoms were cough, fever, expectoration, pleuritic chest pain. Atypical symptoms were altered sensorium and gastrointestinal complaints. 94% of the patients presented with fever and 89% complained of cough.
- Most patients had fewer signs on general physical examination, 26% had pallor and 13% had pedal edema.
- Common clinical signs noted on examination were hyperthermia in 86%, tachypnoea in 48%. 895 of patients had crepitations on respiratory examination.
- Leukocytosis was the most common laboratory finding noted in 83% of patients.
- Lobar pneumonia was the most common radiological presentation seen in 77% of patients.
- Sputum gram positivity was obtained in 59% of the cases, of these most common was gram negative bacilli seen in 25%, followed by gram positive bacilli seen in 22% of the cases as depicted in Fig

- Bacterial isolation by sputum culture was possible in 41% patients (Fig. 2). As depicted in Table 1, Klebsiella pneumoniae was the most common, isolated in 22.7% patients. Other organisms isolated were Escherichia coli (13.6%), Methicillin resistant Staphylococcus aureus (13.6%), Streptococcus pneumoniae

(11.4%), Pseudomonas species (11.4%), Citrobacter species (9%), Enterobacter species (6.8%), Acinetobacter species (6.8%) and Streptococcus pyogenes in 4.5%. Antimicrobials effective against Streptococcus pneumoniae were third-generation cephalosporins, Linezolid and Levofloxacin. The antimicrobials effective against Methicillin resistant Staphylococcus aureus were Teicoplanin, Linezolid, Vancomycin and Levofloxacin. Refer Table 2.

FIG.1 SPUTUM GRAM STAIN

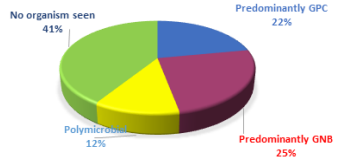

FIG.2 SPUTUM CULTURE

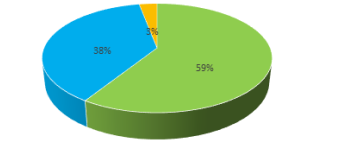

Table 1: Distribution of organisms isolated on sputum culture (n = 44)

Bacteria isolated	No. of isolates	Percentage
Klebsiella pneumoniae	10	22.7%
Escherichia coli	6	13.6%
Methicillin Resistant Staphylococcus aureus	6	13.6%
Streptococcus pneumoniae	5	11.4%
Pseudomonas spp	5	11.4%
Citrobacter spp	4	9.0%
Enterobacter spp	3	6.8%
Acinetobacter spp	3	6.8%
Streptococcus pyogenes	2	4.5%

Table 2: Antimicrobial sensitivity pattern for gram positive isolates

Antimicrobial	MRSA (n=6)	Streptococcus pneumoniae (n=5)	Streptococcus pyogenes (n=2)	Overall Sensitivity (n=13)
	S	S	S	
Penicillin	0%	1 (20%)	1 (50%)	2 (15.38%)
Erythromycin	4 (66.7%)	1 (20%)	1 (50%)	6 (46.15%)
Clindamycin	3 (50%)	0%	1 (50%)	4 (30.76%)
Gentamicin	3 (50%)	3 (60%)	1 (50%)	7 (53.85%)
Tetracycline	4 (66.7%)	2 (40%)	1(50%)	7 (53.85%)
Ciprofloxacin	2 (33.3%)	0%	0%	2 (15.3%)
Co-trimoxazole	4 (66.7%)	2 (40%)	0%	6 (46.15%)
Teicoplanin	6 (100%)	5 (100%)	2 (100%)	13 (100%)
Linezolid	6 (100%)	5 (100%)	2 (100%)	13 (100%)
Vancomycin	6 (100%)	-	-	-
Levofloxacin	5 (83.3%)	4 (80%)	2 (100%)	11 (84.61%)

- Antimicrobials effective against gram negative bacteria were Piperacillin-Tazobactam, Cefoperazone-Sulbactam, Levofloxacin. Amikacin and Meropenem. Refer Table 3.

Table 3 : Antimicrobial sensitivity pattern for gram negative isolates

Antimicrobial	Klebsiella pneumoniae (n=10)	E coli (n=6)	Pseudomonas spp (n=5)	Citrobacter spp (n=4)	Enterobacter spp (n=3)	Acinetobacter spp(n=3)	Overall Sensitivity
	S	S	S	S	S	S	
Amikacin	7 (70%)	5(83.3 %)	4 (80%)	3 (75%)	3 (100%)	0%	70.9 %
Ciprofloxacin	6 (60%)	3 (50%)	3 (60%)	2 (50%)	1(33.3 %)	0%	48.4 %
Cefotaxime	5 (50%)	2(33.3 %)	-	1 (25%)	0%	0%	30.8 %
Ceftazidime	-	-	5(100 %)	-	-	-	
Gentamicin	7 (70%)	3 (50%)	4 (80%)	2 (50%)	3 (100%)	0%	61.3 %
Co-trimoxazole	4 (40%)	1 (16.7%)	-	2 (50%)	3 (100%)	0%	38.5 %
Tetracycline	7 (70%)	2 (33.3%)	-	2 (50%)	2(66.7 %)	0%	50%
Meropenem	8 (80%)	5 (83.3%)	5(100 %)	4(100 %)	3 (100%)	2(66. 7%)	87.1 %
Piperacilin Tazobactam	8 (80%)	4 (66.7%)	5(100 %)	2 (50%)	3 (100%)	0%	70.1 %
Cefepime	7 (70%)	4(66.7 %)	3 (60%)	2 (50%)	2(66.7 %)	0%	58%
Cefoperazone Sulbactam	9 (90%)	5 (83.3%)	-	3 (75%)	2(66.7 %)	0%	73.1 %
Levofloxacin	10 (100%)	4(66.7 %)	-	4(100 %)	3 (100%)	2(66. 7%)	88.4 6%

- Pseudomonas species were most sensitive to Ceftazidime, Meropenem and Piperacillin-Tazobactam.
- The average length of stay in the hospital was 8.9 days ± 6.2 days.
- The overall mortality rate was 2%.
- The prognostic factors shown to have statistically significant association with culture positivity were expectoration, pleuritic chest pain, temperature >38^{0}C, tachypnoea (RR>24/min), tachycardia (pulse rate >100/min), crepitations, leukocytosis (WBC >11,000/cumm), raised liver enzymes (ALT >55 IU/l) and hyponatremia (serum sodium <130mEq/l).

DISCUSSION

Community acquired pneumonia is a lower respiratory tract parenchymal infection that continues to be a major health problem.[1] It is one of the most common causes of morbidity and mortality worldwide and remans a serious illness despite the availability of potent antimicrobials and effective vaccines.[2,8]

Initial management of Cap is empirical and dependent on the clear understanding of the likely pathogens.[5] This study was carried out to serve this purpose. A total of 100 clinically suspected community acquired pneumonia patients were included in the study.

In the present study, age group of patients ranged from 18 to 80 years, predominant age group being 56-80 years (53%). Significant statistical association was found. The mean age was 52.13 years with a standard deviation of 16.79 yrs which is very similar to other studies where the mean age was 51.3 years [9] and another where mean age was 53.68 years with a standard deviation of 14.74 years.[10] The increased rate of pneumonia in elderly is due to age related decline in mechanical clearance of airways, loss of elastic recoil of lungs, decreased strength in respiratory muscles leading to deceased effectiveness in coughing and cumulative effects of chronic comorbid conditions and their treatments.

In the present study there was a preponderance of males (63%) which was also found to be statistically significant and comparable with other studies.[11,12,13] This may be attributed to increased rates of smoking and alcoholism in males and also due to increasing association with co morbid conditions like COPD in men.

Presence of co-morbidities was observed as an important risk factor in our study, with smoking (68%) being most significant followed by COPD in 32%, alcoholism in 27% and diabetes mellitus in 21%. These findings were comparable with other studies conducted.[14,15] Increased risk of pneumonia in smokers is due to alteration in respiratory flora, mechanical clearance and cellular defects. Bacterial colonization of lower respiratory tract is more common in smokers as their mucociliary clearance is defective owing to ciliary beat frequency reduction and changes in volume and viscoelastic property of respiratory secretions.

In present study, patients presented with both typical and atypical symptoms. Fever was present in 94%, followed by cough in 89% of cases. Expectoration (42%) and pleuritic chest pain (34%) were found to be statistically significant which was comparable with other studies.[16] None of the findings of general examination held any statistical significance. Tachycardia, tachypnoea and high-grade fever were statistically significant and are well known to occur in patients

with acute lung infections. Therefore, meticulous recordings of respiratory rate and blood pressure during initial evaluation and careful monitoring thereafter will prove to be helpful in reducing mortality in patients with CAP.[17]

In the present study, the examination of respiratory system revealed various features of pneumonia like crepitations in 89% which was statistically significant. Though well documented, there is paucity of appearance of clinical signs in patients of pneumonia in making their diagnosis solely on basis of clinical signs tricky. Among laboratory investigations conducted in our study, leukocytosis was most consistently noted in 83% of patients, anemia was noted in 52%.

Radiological data gathered from this study, showed a predominance of lobar pneumonia (77%) of which pneumonia was more common on the right side (64%) with predominant involvement of the right lower lobe in 37% of cases. Major involvement of the right lobe is attributed to the anatomical position of the right main bronchus which is short and more or less vertical hence it facilitates aspiration into the basal bronchial segments. Bronchopneumonia was noted in 18% and interstitial pneumonia was seen in 5% cases. These findings are comparable with other studies conducted.[12,13]

Gram staining is a useful tool in predicting the probable organism before the culture reports are available. Appropriate sputum samples showing presence of bacteria on microscopy could be obtained in 59% cases, details in Fig.1. Colonization of oropharyngeal mucosa with gram negative bacilli increases with age, predisposing to their increased incidence in present study.

Findings of sputum culture depicted in Fig.2. Indian studies over the last three decades have reported a higher prevalence of gram-negative organisms among culture positive pneumonias.[18-20] In study conducted by Saurabh Kose et al. (Nagpur 2018)[21], on 174 CAP patients, the most frequent pathogen isolated was Klebsiella pneumoniae (46.22%). The role of gram negative bacteria(GNB) in CAP is elevated over the past few decades probably due to increase in the number of old CAP patients who are usually harboring colonizers of GNB, in addition to reported high severity of illness caused by GNB that usually require hospitalization.[22] Low rates of Streptococcus pneumoniae may be a true reduction due to increased awareness of pneumococcal vaccines or due to lower sensitivity of the used conventional methods.[23] The antimicrobial susceptibility findings of present study are comparable with those obtained by Prashasti et al. (Mangalore, 2017)[24]

CONCLUSION

CAP is a major health problem and is an important cause of morbidity and mortality worldwide despite the availability of potent new antimicrobials and effective vaccines. Initial antimicrobial management of CAP is empirical and dependent on clear understanding of prognostic factors and likely pathogens. Timely treatment will help in improving patient outcome.

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