Original Article

Study of Clinical, Radiological, and Bacteriological Profile of Community-Acquired Pneumonia in Hospitalized Patients of Gajra Raja Medical College, Gwalior, Central India

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Abstract

Background: The true incidence of pneumonia acquired in the community is unknown, but this is a common clinical problem worldwide especially in developing countries and remains a leading cause of death in India.

Aims and Objectives: The aim and objective of the study were to check clinical, radiological, and bacteriological profile of patients of community-acquired pneumonia (CAP).

Materials and Methods: The present study was undertaken in Department of Medicine Gajra Raja Medical College & Associated J.A Group of Hospital, Gwalior, Madhya Pradesh. For the study, 120 indoor patients of >15 years of age group were selected from Medicine Department, diagnosed as CAP. The study conducted from September 2011 to October 2012. In all studied patient's chest-X-rays, routine laboratory test, sputum, and blood culture were done.

Results: Despite the use of standard protocols, microbiological diagnosis of CAP was confirmed only in 55 (45.5%) of patients by sputum and blood culture. Sputum was the most common etiological source of organism isolation (44) followed by blood (11), *Streptococcus pneumoniae* was the commonest pathogen 20 (36.4%). Followed by *Klebsiella pneumoniae* 16 (29.%), *Staphylococcus aureus* 11 (20%) and other Gram-negatives bacilli* 8 (14.5%.) *(*Haemophilus influenzae* 5.5%, *Pseudomonas* 1.8%, *Acinetobacter* 1.8%, *Enterobacter* 1.8%, *Escherichia coli* 1.8%, *Citrobacter* 1.8%). CAP was found predominantly in males (67.5%) and elderly age group (68.3%). Maximum number of patients presented with cough (92.5%), fever (90%), dyspnea (59.2%), expectoration (55%), pleuritic chest pain (14.2%), most common predisposing factors associated with CAP in the following chronological order-smoking (40.8%) > chronic obstructive airway disease (35.8%) > cardiovascular disease (16.7%) > alcoholism (12.5%) > diabetes mellitus (6.7%) > neurological disorders (2.5%). Lobar pneumonia especially right lower lobe consolidation was the most common radiological finding observed in 48.3% patients, followed by left lower lobe infiltration ($P < 0.0001$).

Conclusion: *S. pneumoniae* was the most common pathogen, but the emergence of the higher incidence of Gram-negative organism specially *K. pneumoniae* has occurred in our geographical area (India). Age, smoking, and underlying co-morbid conditions especially chronic obstructive pulmonary disease were significantly associated with the development of CAP ($P < 0.01$). Radiographic changes usually cannot be used to distinguish bacterial from the nonbacterial pneumonia.

Keywords: Bacteriology, Blood culture, Chronic obstructive pulmonary disease, Community-acquired pneumonia, Radiology smoking, Sputum culture

INTRODUCTION

Pneumonia is a disease known to mankind from antiquity. Pneumonia defines as, "This is an acute inflammation of the pulmonary parenchyma that can be caused by various infective and noninfective origin."[1]

Despite the availability of potent antibiotics, community-

acquired pneumonia (CAP) remains common and serious illness with significant morbidity and mortality, both in developing and developed countries. In the United State, pneumonia is the sixth leading cause of death.[2-4] Estimates of the incidence of CAP range from 4 to 5 million cases per annually, which is about 20% of these require hospitalization. But the problem is much greater in developing countries where the pneumonia is the most common cause of hospital attendance in adults.[5] Though definite statistics are lacking, pneumonia remains a leading cause of death in India.[6] The mortality rate of the pneumonia patient in outpatient setting is low, in the range of 1-5%, but among patient who require admission to Intensive Care Unit is approaches 25%.[7-10] With the beginning of the antibiotic era, the mortality rate leveled off and remained fairly constant. This mortality rate is heavily weighted against elderly. This prediction of pneumonia for elderly is not new and led William Osler in 1898 to describe as "pneumonia is a special enemy of old age." The cause of CAP is often difficult to establish. Despite the progress made in the diagnosis of pneumonia, it takes a few days to identify the causative micro-organism in the blood or sputum samples and the etiology of half of all patients with CAP remains uncertain.[3] In order to reach logical therapeutic decisions physicians need reliable data on the relative prevalence of different etiology agent in the patients "area of residence," in addition to the clinical, laboratory, and radiological finding.[7] Because the relative frequency of etiological agents varies among different geographical areas.

There are various studies conducted to describe its clinical, bacteriological, and radiological features in different population group, whether these inferences hold good for our population is a pertinent question. In view of this, we need to study CAP in our setting, and by the mode of this study we will help in early detection of disease, and clinical, bacteriological, and radiological profile of pneumonia acquired in the community admitted in our geographical area.

MATERIALS AND METHODS

This prospective study was carried out in the Department of Medicine, J.A. Group of Hospital, Gajra Raja Medical College, Gwalior, Madhya Pradesh.

Source of Data

For the study admitted patient, above 15 years of age group were selected from Medicine Department, diagnosed as CAP. The study conducted during a time period of 1 year from September 2011 to October 2012.

Sample Size

120 indoor patients of CAP were included in the study after informed consent.

Inclusion Criteria

New and progressive pulmonary infiltrates on chest radiograph with at least two of following four:

1. Fever (temperature >37.8°C)
2. Production of purulent sputum
3. Cough (H/O <4 weeks)
4. Leukocytosis (white blood cell count >10,000/cumm).

Exclusion Criteria

1. Patient with hospitalized pneumonia
2. Patient with aspiration pneumonia
3. Patient with pulmonary infarction, pulmonary tuberculosis, immune-compromised.

All included patient were subjected for a detailed history and clinical examination. Standard protocol was used for collection of sample, in all the patients' chest-skiagram posterior-anterior view, routine laboratory test, sputum, and blood culture were done. All efforts were made to obtain sputum within 24 h of admission. In patients who could not expectorate sputum spontaneously, sputum was induced by nebulization with 3% hypertonic saline. And after collection of sputum, it was immediately sent to micro-biology department for culture on blood agar and MacConkeys agar media. Two blood culture samples were also obtained from each patient from different sites of body 30 min apart and inoculated on appropriate agar medias at 37°C for 48-72 h.

Statistical Analysis

Significance was evaluated by Student's *t*-test and Chi-square test and $P < 0.05$ was considered as significant. The statistical software namely SPSS 11.0 and Systal 8.0 (IBM, Ibs chicago)were used for the analysis of the data.

RESULTS

The study group consisted of 120 patients, among whom 81 (67.5%) were males, and 39 (32.5%) were females. Age of patients ranges from 15 to 85, with the mean age 52.36 ± 16.77 years. Most patient 82 (68.3%) of CAP were elderly belong to >50 years age group (Table 1).

Cough was the most common symptom present in (92.5%) patients, followed by fever (90%), dyspnea (59.2%), expectoration (55%), and chest pain (14.2%). Chest pain was more common in younger than elderly age group patients (Table 2).

In study, chronic obstructive airway disease was the most common (35.8%), predisposing conditions. Other were cardiovascular disorders (16.7%), congestive cardiac failure (16%), diabetes mellitus (DM) (6.7%), neurological conditions (5.8%), and chronic liver disease (2.5%).

Among habits, smoking was the most commonly noted in (40.8%) patient, followed by alcoholism in (12.5%) patients. Maximum smokers and drinkers were elderly belong to > 50 years age group (Table 3).

Lower lobe of the right lung was most commonly involved in CAP ($P < 0.0001$). 19.8% chest skiagram showed bilateral involvement of lungs. We did not found any correlation between involvement of particular lung field and causative micro-organism (Tables 4 and 5).

The overall establishment of etiological diagnosis was possible only in 55 (45.8%) cases of CAP. Rates of isolation of organisms were by sputum culture 44 (36.7%), and by blood culture 11 (9.1%). The most common organism isolated was *Streptococcus pneumonia* 20 (36.4%) followed by *Klebsiella pneumonia* 16 (29%), *Staphylococcus aureus* 11 (20%), *Haemophilus influenzae* and other Gram-negative bacilli constitutes about 8 (14.5%) (Tables 6 and 7).

DISCUSSION

Age/Sex Incidence

In the study, 120 patients were observed, and majority of patients 81 (67.5%) were males in comparison to the female population which were 39 (32.5%). The male to female ratio is 2:1. Mean age of patients was 52.36 ± 16.77 years. 82 (68.3%) belong to > 50 years of age group. It is well-documented that pneumonia incidence rises sharply with extremes of age.[11,12]

This could be attributed to the well-established fact that majority of predisposing risk factors like cigarette smoking,

Table 1: Pattern of age and gender distribution of patients in CAP

Age in years	Male		Female		Total	
	Number	Percentage	Number	Percentage	Number	Percentage
≤20	0	0.0	4	10.3	4	3.3
20-29	4	4.9	5	12.7	9	7.5
30-39	8	9.9	6	15.4	14	11.7
40-49	7	8.7	4	10.3	11	9.2
50-59	21	25.9	10	25.6	31	25.8
60-69	23	28.4	4	10.3	27	22.5
>70	18	22.2	6	15.4	24	20
Total	81	67.5	39	32.5	120	100
Mean±SD	55.72±14.70		45.38±18.74		52±17	

SD: Standard deviation, CAP: Community-acquired pneumonia

Table 2: Pattern of clinical features in patients with CAP

Clinical features	Age group <50 year (*n*=38)		Age group >50 year (*n*=82)		Total (*n*=120)		*P* value	Inference*
	Number of patients	%	Number of patients	%	Number of patients	%		
Cough	35	92.7	76	92.1	111	92.5	0.92	NA
Fever	34	89.5	74	90.2	108	90	0.92	NA
Dyspnea	17	44.7	51	62.2	71	59.2	0.29	NA
Expectoration	21	55.3	45	54.9	66	55	0.91	NA
Pleuritic chest pain	10	26.3	7	8.5	17	14.2	0.01	HA
Nausea/vomiting	2	5.3	7	8.5	09	7.5	0.60	NA
Altered mental status	0	0.0	4	4.9	04	3.3	0.08	A

*NA: Not associated, HA: Highly associated, A: Associated, CAP: Community-acquired pneumonia

Table 3: Correlation of predisposing risk factors in patient with CAP

Risk factors	Age group <50 year (*n*=38)		Age group >50 year (*n*=82)		Total (*n*=120)		*P* value	Inference*
	Number of patients	%	Number of patients	%	Number of patients	%		
Smoking	03	7.9	46	56.1	49	40.8	<0.0001	HA
COAD	03	7.9	40	48.8	43	35.8	<0.0001	HA
Cardiovascular disorders	06	15.8	14	17.1	20	16.7	0.84	NA
Alcoholism	02	5.3	13	15.9	15	12.5	0.03	A
DM	0	0.0	08	9.8	08	6.7	0.007	HA
Liver disease	0	0.0	03	3.6	03	2.5	0.1	NA
CVA	01	2.6	02	2.4	03	2.5	0.71	SA

*NA: Not associated, HA: Highly associated, A: Associated, CAP: Community-acquired pneumonia, COAD: Chronic obstructive airway disease, CVA: Cerebrovascular accident, DM: Diabetes mellitus

Table 4: Chest X-ray findings in patients with CAP

Radiological finding	Number of patients	Percentage
Lobar pneumonia	96	80
Bronchopneumonia	20	16.7
Interstitial pneumonia	4	3.3
Pleural effusion	8	6.7

CAP: Community-acquired pneumonia

Table 5: Chest X-ray pattern of patients with CAP

Chest X-ray report	Number of patients	Percentage
Right upper lobe	9	7.8
Right middle lobe	7	5.8
Right lower lobe	58	48.3
Left upper lobe	4	3.3
Left middle lobe	8	6.7
Left lower lobe	19	15.8
Multiple lobar involvement	15	12.5

CAP: Community-acquired pneumonia

alcoholism, chronic obstructive pulmonary disease (COPD), coronary artery disease, etc., more common in middle-aged and elderly predominantly in males. This is in accordance to the earlier studies like Liberman *et al.*,[13] Shah *et al.*,[14] Bansal *et al.*[15]

Presenting Complaints

The majority of patients were presented with cough 92.5% (n = 111), fever 90% (n = 108), dyspnea 59.2% (n = 71) and followed by expectoration, chest pain, gestrointestinal symptoms, and altered mental status in 55%,14.2%, 10.9%, and 3.3%, respectively. This fact supported by some Indian and the Western studies.[7,14,15]

Predisposing Factors

The most common identified risk factor were smoking (40.8%), COPD (35.8%), cardiovascular diseases (16.7%), followed by alcoholism (12.5%) and DM (6.7%) ($P < 0.05$), all of the above-mentioned predisposing factors altering the local and systemic respiratory defense mechanisms, predisposing to lung infection that has been well-documented. Although it is not different from identified risk factors from India and the West.[2,14-16]

Investigations

In a study, the microbial diagnosis of CAP was confirmed only in 45.8% patients. This could be due to the limited use of laboratory tests. In a study, we only used sputum and blood culture as diagnostic tools to identify the culprit organism causes pneumonia.

44 (36.7%) isolated by sputum, and 11 (9.2%) by blood culture. But this is another fact that even with the use of extensive laboratory testing and various invasive procedures, etiological confirmation could be achieved only in 45-70% patients.[3,13] The most common isolated pathogen was *S.*

Table 6: Pattern of micro-organism isolation from sputum culture in patients with CAP

Micro-organism from sputum culture	Number of isolated organisms	Percentage
S. pneumoniae	16	36.4
K. pneumoniae	14	31.8
S. aureus	09	20.4
H. influenzae	02	4.5
Pseudomonas	01	2.3
Acinetobacter	01	2.3
E. coli	01	2.3
Total	44	36.7

S. pneumoniae: Streptococcus pneumoniae, K. pneumoniae: Klebsiella pneumoniae, S. aureus: Staphylococcus aureus, H. influenzae: Haemophilus influenzae, E. coli: Escherichia coli, CAP: Community-acquired pneumonia

Table 7: Pattern of micro-organism isolation from blood culture in patients with CAP

Organism from blood culture	Number of isolated organisms	Percentage
S. pneumoniae	04	36.4
K. pneumoniae	02	18.2
S. aureus	02	18.2
H. influenzae	01	9.1
Enterobacter	01	9.1
Citrobacter	01	9.1
Total	11	9.2

S. pneumoniae: Streptococcus pneumoniae, K. pneumoniae: Klebsiella pneumoniae, S. aureus: Staphylococcus aureus, H. influenzae: Haemophilus influenzae, CAP: Community-acquired pneumonia

pneumoniae accounting for 36.4%. Next common was *K. pneumoniae* which accounts for 29.1% this followed by *S. aureus*, and other Gram-negative bacilli 20%, 14.5%, respectively (Gram-negative bacilli includes *H. influenzae*, *Pseudomonas, Acinetobacter*, *Escherichia coli*, *Enterobacter, Citrobacter* accounting 5.5%, 1.8%, 1.8%, 1.8%, 1.8%, 1.8%, respectively). As per some Indian studies, over last three decades have reported higher incidence of Gram-negative organisms among culture positive pneumonia.[17-20] We also obtained more number of Gram-negative organism by culture compared with some earlier western studies.[21] The radiological data in our study showed a predominance of lobar pneumonia in 96 (80%) patients followed by bronchopneumonia in 20 (16.7%) and interstitial pneumonia in 4 (3.3%) patients. Radiological data ($P < 0.0001$) of our study emphasized by similar studies done by Torres *et al.*[22] Bansal *et al.*[15] Chest film showing infiltrates is necessary to establish the diagnosis of pneumonia. But radiographic changes usually cannot be used to distinguish bacterial from the nonbacterial pneumonia.

CONCLUSIONS

The study was undertaken in Department of Medicine Gajra Raja Medical College & Associated J.A. Group of Hospital, Gwalior, Madhya Pradesh with the objective

to know the prevalence of etiological microorganism of CAP, clinical presentation of patients, and correlation between involvement of particular lung field with causative micro-organism. And the study concluded: *S. pneumoniae* was the most common pathogen incriminated in CAP, but the emergence of the higher incidence of Gram-negative organism especially *K. pneumoniae* has occurred in our geographical area. Typical symptoms (cough, expectoration, dyspnea) were common in both young and elder age group patients, but atypical symptoms e.g. altered mental status was commonly found in the elder population. A practical conclusion of clinical interest is that an effort has to be made to take chest radiographs, to exclude the possibility of pneumonia in elderly patients presented in hospital with delirium. Chest film showing infiltrates is necessary to establish the diagnosis of pneumonia. But radiographic changes usually cannot be used to distinguish bacterial from the nonbacterial pneumonia.

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