

STUDY OF COMMUNITY-ACQUIRED BACTERIAL PNEUMONIAS PRESENTING TO TERTIARY CARE CENTRE

Ramakrishna Rachakonda¹, Revathi Mogilappa²

¹Professor, Department of Pulmonology, Katuri Medical College, Guntur, Andhra Pradesh.

²Senior Resident, Department of Pulmonology, SVRR Hospital, Tirupati, Andhra Pradesh.

ABSTRACT

BACKGROUND

Patients attending the Pulmonology OPD with symptoms of cough with expectoration of more than 10 days with pulmonary shadows suggestive of pneumonia were included in our study. Patients' positive for AFB in the sputum and symptoms suggestive of tuberculosis were excluded.

MATERIALS AND METHODS

156 patients diagnosed to have pneumonia were included in the study. Patients having a history of cough with expectoration and fever for 10 days or more were subjected to clinical, radiological and sputum examination. Patients in whom tuberculosis was excluded by clinical, radiological and sputum examination and having associated shadows in the chest x-ray above 20 years of age were taken into the study and subjected to thorough clinical examination, haematological and biochemical examination. Sputum was sent for Gram stain and culture and sensitivity. Sensitivity pattern of the organisms isolated were studied.

RESULTS

85% of patients belong to 40 years and above age group. 73.12% of these patients are males and rest are females. 54% of the patients presented as bronchopneumonia by Radiology. Bilateral lesions present in 55% of patients followed by right-sided lesions in 26% and left-sided lesions in 19%. Cough, expectoration, fever and chest pain were the common symptoms and nearly all the patients had symptoms. Increased white cell count at the time of admission correlated with increased duration of hospital stay and is statistically significant (the p-value is <0.00001). Active and passive smoking is associated with pneumonia and the value is statistically significant (p<0.00001). Presence of comorbidities is associated with increased hospital stay and the value is statistically significant (p<0.00001). Individual comorbidities are not associated with increased prevalence of pneumonia. Presence of comorbidities compared to absence of comorbidities showed a statistically significant correlation (p value <0.00001). 48% of the patients were diagnosed as having gram-positive cocci and nearly 15% gram-negative bacilli. 5.12% had mixed organisms and 28% had normal Gram stain study. 3.20% patients had fungal elements in Gram stain study. 127 out of 156 patients were positive for bacterial pathogens by culture. Commonest organism isolated was Streptococcus pneumonia in 32.69% followed by Staph aureus in 18.59%, Klebsiella in 8.97%, Pseudomonas in 5.76%, Haemophilus influenza in 4.48%, mixed pathogens in 8.97% and Citrobacter in 1.92%. No organism was isolated by culture in 18.58%. Streptococcus pneumonia and Haemophilus influenzae organisms isolated in these patients were sensitive to routine drugs in all these patients. Nearly, 10% of Staphylococci, 7% of Klebsiella and 22% Pseudomonas organisms are found resistant to the routine drugs. Tazobactam-Piperacillin resistance was seen in both Klebsiella and Pseudomonas species and both were sensitive to meropenem.

CONCLUSION

Community acquired pneumonia occurs in the older age group among the adult population. Smoking has a significant correlation with development of pneumonia. Predominant number of patients are male. Bilateral and bronchopneumonia pattern is the commonest presentation. Comorbidities and initial white blood cell concentration enhance the duration of hospital stay and the values are statistically significant. Commonest organism isolated is Streptococcus pneumonia followed by Staphylococcus aureus, Klebsiella, Haemophilus and Pseudomonas. Staphylococci, Klebsiella and Pseudomonas species showed resistance. Tazobactam + Piperacillin resistance is seen among Klebsiella and Pseudomonas species isolated in our centre.

KEYWORDS

Pneumonia, Diabetes Mellitus, COPD, Smoking History, Comorbidities, Bacilli, Cocci.

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Corresponding Author:

Dr. Ramakrishna Rachakonda,

Sanjeevani Hospital, A1, Ramkuteer Majestic, 3/13,

Brodipet, Guntur - 522002, Andhra Pradesh.

E-mail: ramakrishna45@yahoo.co.in

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BACKGROUND

Pneumonia is an acute inflammation of the pulmonary parenchyma that can be caused by various infective and non-infective causes presenting with physical and radiological features compatible with pulmonary consolidation of a part or parts of one or both lungs. Despite being the cause of significant morbidity and mortality, pneumonia is often misdiagnosed, mistreated and underestimated. Pneumonia is a common cause of infection-

related mortality and is one of the most important challenges in clinical medicine. Inappropriate or delayed treatment of pulmonary infection contributes to poor clinical outcomes, avoidable drug exposures and emergence of antimicrobial resistance. Pneumonia is one of the leading causes of death and morbidity both in developing and developed countries and is the commonest cause (10%) of hospitalisation in adults and children.

Aims and Objectives of the Study

1. To assess the clinical and radiological patterns of pneumonias.
2. To study the risk factors and their outcome.
3. To assess the spectrum of organisms.
4. To study the comorbidities.
5. To study the duration of hospital stay.
6. To study the influence of smoking on the development of pneumonia.

Objective of the Study- The present study is undertaken to study-

1. The age distribution.
2. Sex distribution.
3. To correlate smoking history with development of pneumonia.
4. To study the comorbidities associated with pneumonia and correlating the presence of comorbidities and duration of hospital stay.
5. To correlate initial white blood cell count with duration of hospital stay.
6. To analyse the organism isolated by sputum culture and their sensitivity pattern.

MATERIALS AND METHODS

156 patients having a history of cough with expectoration of more than 10 days attending our tertiary care centre with chest radiological shadows suggestive of pneumonia.

Inclusion Criteria

All patients 20 years or more in age presenting with cough with expectoration and fever of more than 10 days with pulmonary shadows in x-ray suggestive of bacterial pneumonia.

Exclusion Criteria

1. Patients with symptoms and radiological shadows suggestive of tuberculosis, but sputum negative for AFB.
2. Patients with history of tuberculosis.
3. Patients with positive sputum for AFB.
4. Moribund patients.
5. Uncooperative patients.

We analysed the history of the 156 patients thus selected studied the chest x-rays and subjected them to routine biochemical and haematological examination. Sputum was sent for Gram stain and culture and sensitivity. We correlated initial white blood count and comorbidities with duration of hospital stay. We studied the resistance

pattern of different bacterial pathogens identified by sputum culture.

RESULTS

85% of patients belonged to 40 years and above age group and 60% of the patients belonged to 60 years and above age group. 73.12% of these patients are males and rest are females. 54% of the patients presented as bronchopneumonia by Radiology. Bilateral lesions present in 55% of patients followed by right-sided lesions in 26% and left-sided lesions in 19%. Cough, expectoration, fever and chest pain were the common symptoms and nearly all the patients had symptoms.

Leucocyte count was correlated with duration of hospital stay. Leucocyte count was divided into three groups 4,000-11,000; 11,000 to 15,000; and above 15,000/cu. mm group. Hospital stay was divided into 5-9 days, 9-15 days and more than 15 days. Increased white cell count at the time of admission correlated with increased duration of hospital stay and is statistically significant (p-value <0.0001).

Gram stain is an important mode of investigation. 48% of the patients were diagnosed as having gram-positive cocci and nearly 15% gram-negative bacilli. 5.12% had mixed organisms and 28% had normal Gram stain study. 3.20% patients had fungal elements in Gram stain study.

127 out of 156 patients were positive for bacterial pathogens by culture. Commonest organism isolated was Streptococcus pneumonia in 32.69% followed by Staphylococcus aureus in 18.59%, Klebsiella in 8.97%, Pseudomonas in 5.76%, Haemophilus influenzae in 4.48%, mixed pathogens in 8.97% and Citrobacter in 1.92%. No organism was isolated by culture in 18.58%.

Sensitivity pattern- Streptococcus pneumonia and Haemophilus influenzae organisms isolated in these patients were sensitive to routine drugs in all these patients. Nearly, 10% of Staphylococci, 7% of Klebsiella and 22% Pseudomonas organisms are found resistant to the routine drugs. Tazobactam-Piperacillin resistance was seen in both Klebsiella and Pseudomonas species and both were sensitive to meropenem.

Smoking pattern- 110 out of 115 (95.65%) male patients are smokers. Only 5 patients (4.35% of male) are non-smokers. Non-smoking form of tobacco was seen in 28.69% of male patients.

Age Group	Number of Patients	Percentage
20-29 years	4	2.56%
30-39 years	19	12.17%
40-49 years	39	25.0%
50-59 years	52	33.33%
60 and above	42	26.92%
Total	156	

Table 1. Age Distribution

Majority of our patients belong to 40 years and above age group and 60% of the patients belonged to 60 years and above age group.

Sl. No	Sex	Number of Patients	Percentage
1.	Male	115	73.12%
2.	Female	41	26.88%
	Total	156	

Table 2. Sex Distribution

There are more number of male patients than female.

Sl. No.	Radiological Presentation	Number of Patients	Percentage
1.	Lobar pneumonia	29	18.59%
2.	Bronchopneumonia	84	53.84%
3.	Segmental pneumonia	22	14.10%
4.	Subsegmental pneumonia	21	13.46%

Table 3. Radiological Presentation

Bronchopneumonia pattern was seen in more than 50% of our patients followed by lobar pneumonia, segmental pneumonia and subsegmental pneumonia.

Sl. No.	Side of the Lesion	Number of Patients	Percentage
1.	Right side only	41	26.28%
2.	Left side only	29	18.59%
3.	Bilateral	86	55.13%

Table 4. Side of the Lesion

Bilateral lesions were seen in a majority followed by right-sided lesions and left-sided lesions.

Symptoms	20-29 years	30-39 years	40-49 years	50-59 years	>60 years	Total
Cough	4	19	36	52	42	153 (98.07%)
Expectoration	4	17	35	47	37	140 (89.74%)
Fever	4	19	35	41	39	138 (88.46%)
Chest pain	2	9	19	14	13	57 (36.54%)
Haemoptysis or haemorrhagic sputum	1	2	9	6	4	22 (14.10%)
Breathlessness	4	15	37	52	42	150 (96.15%)

Table 5. Symptomatology Correlated with Age Group

Cough with expectoration, breathlessness and fever occurred in almost all the age groups of patients. Chest pain and haemoptysis were less frequent.

Leucocyte Count	Number of Patients	Duration of Hospital Stay		
		5-9 days	9-15 days	>15 days
4,000-11,000/cu. mm	101 (65%)	76	23	2
11,000-15,000/cu. mm	25	9	5	11
>15,000/cu. mm	30	13	4	13

Table 6. Leucocyte Count and Hospital Stay

Calculating the Chi-square test correlating the initial white cell count and number of day's hospital stay- The Chi-square statistic is 45.2451. The p-value is <0.00001. The result is significant at p <0.05. Thus, initial leucocyte count correlated with the duration of hospital stay.

Gram Stain Status	No. of Patients	% of Total
Gram-positive cocci	76	48.71%
Gram-negative bacilli	23	14.74%
Mixed organisms	8	5.12%
Normal study	44	28.20%
Fungal elements	5	3.20%
Total	156	

Table 7. Sputum Gram Stain Culture Report of this Study

Sputum Gram stain was positive in nearly 72% patients and normal in 28% indicating the significance of Gram stain examination of sputum.

Organism Isolated	No. of Cases	Percentage
Streptococcus pneumoniae	51	32.69%
Staphylococcus aureus	29	18.59%
Klebsiella pneumoniae	14	8.97%
Haemophilus influenzae	7	4.48%
Pseudomonas aeruginosa	9	5.76%
No organism	29	18.58%
Citrobacter	3	1.92%
Mixed pathogens	14	8.97%

Table 8. Culture and Sensitivity

Culture study of sputum revealed the organism in 81.42%. No organism was isolated in 18.58%.

Total number of patients positive for bacteria pathogens by culture 127/156 (81.41%).

Organism Isolated	Number of Cases	Sensitive to Drugs	Resistant to Drugs	Percent Sensitive
Streptococcus pneumoniae	51	51	None	100%
Staphylococcus	29	26	3	89.65%
Klebsiella pneumoniae	14	13	1	92.86%
Haemophilus influenzae	7	7	0	100%
Pseudomonas aeruginosa	9	7	2	77.77%
Citrobacter	3	3	0	100%
Mixed pathogens	14	14	0	100%

Table 9. Resistance Patterns of the Organisms Isolated

100% sensitivity to drugs was seen in *Streptococcus pneumonia*, *Haemophilus influenza*, *Citrobacter* and when mixed pathogens were isolated. *Staphylococcus aureus*, *Klebsiella pneumoniae* and *Pseudomonas aeruginosa* organisms showed resistance.

Type of Smoking	Male	Percentage of Total	Female	Number	Percentage	P value
Cigarette	49	31.41%	0	0		
Beedi	29	18.59%	0	0		
Combined	31	19.87%	0	0		<0.05
Passive	0	0	19	12.18%		
Non-smoking form of tobacco	33	21.15%	6	3.84%		
Non-smokers	5	3.20	16	10.25%		

Table 10. Smoking History and Type of Smoking among Patients of Pneumonia N=156

Taking into consideration and calculating the association of smoking active or passive with development of pneumonia in males and females. The Chi-square statistics is 31.7607. The p value is <0.00001. The result is significant at p value of <0.05.

Among female pneumonia patients, 46.34% were passive smokers. 14.63% were exposed to non-smoking form of tobacco. 4.34% of male patients and 39.02% of female patients are non-smokers. History of active or passive smoking is associated with development of pneumonia compared to non-smokers and the values are statistically significant (p value <0.00001).

Comorbidity	No. of Patients	Percentage
Diabetes mellitus	28	17.94%
COPD	58	37.18%
Chronic renal impairment	4	2.56%
Post-trauma	2	1.28%
IHD/HTN	9	5.77%
None	51	32.69%

Table 11. Pneumonia and Comorbidities- Total Number of Patients 101

Comorbidities- 101 out of 156 patients had associated comorbidities (64.74%). The comorbidities include diabetes mellitus (17.94%), COPD (37.18%), IHD/HTN (5.77%), chronic renal impairment (2.56%) and post-trauma or CVA aspiration (1.28%).

COPD is the commonest comorbidity followed by diabetes mellitus. Patients with comorbidities have increased prevalence of pneumonia compared to those patients without comorbidities and the values are statistically significant. Taking into consideration presence of comorbidities and lack of comorbidities in patients of pneumonia. Chi-square values- The Chi-square statistic is 28.2448. P value is <0.00001. The result is significant at p value of <0.05.

Comorbidity	No. of Patients	5-9 Days	10-15 Days	>15 Days
DM	28	8	19	1
COPD	58	22	30	6
CRF	4	0	04	0
Post-trauma aspiration	2	2	0	0
IHD/HTN	9	6	3	
None	51	42	8	1

Table 12. Comorbidity and Duration of Hospital Stay

Presence of comorbidities increased the incidence of pneumonia and increased hospital stay.

Taking into consideration, individual comorbidities and calculating the correlation of duration of hospital stay with individual comorbidities like diabetes mellitus, COPD, chronic renal failure, post-trauma or post-CVA aspiration, the Chi-square statistic is 11.8613 and the p-value is 0.157499. The result is not statistically significant.

Taking into consideration, presence of comorbidities and lack of comorbidities in patients of pneumonia; Chi-square values- The Chi-square statistic is 28.2448. P value is <0.00001. The result is significant at p value of <0.05.

We correlated comorbidities and duration of hospital stay. Majority of patients who had no comorbidities were discharged in 5-9 days (82.35%). 73.26% of patients with comorbidities had a hospital stay of more than 10 days. Individual comorbidities did not contribute to increased hospital stay. When duration of hospital stay is correlated to the presence or absence of comorbidities, there is a statistically significant correlation between presence of comorbidities and increased duration of hospital stay (p-value <0.00001).

DISCUSSION

Pneumonia is an important clinical problem in medical practice. Pneumonia occurs predominantly in older age group in the adult population. 85% of patients belonged to 40 years and above age group and 60% of the patients belonged to 60 years and above age group. Its incidence raises sharply with increase in age. Caroline L. Trotter et al found an increasing incidence of pneumonia not explicable by age or comorbidities.¹ Mean age of the patients in the Seema Jain Study was 57 years and in our study also majority of patients belonged to 50 years and above age group.² Pneumonia is associated with considerable morbidity and mortality. CAP incidence is high in winter and smoking and alcoholism are associated with increased incidence of pneumonia.³ In our study, 96% of males and 60% of females were either smokers, passive smokers or taking non-smoking forms of tobacco though we did not correlate quantity of tobacco smoked and severity of pneumonia.

A Spanish study revealed pneumonia prevalence increased with age and more frequency was seen in men compared to women. They found metabolic disease, cardiovascular disease and diabetes mellitus were common

comorbidities.⁴ In our study, diabetes mellitus and COPD were frequent comorbidities.

J. Almirall et al Spanish study showed the commonest organism isolated by sputum, urine and blood culture was *Streptococcus pneumoniae* and it was similar in our studies.⁵ In the M. Nawal Lutfiyya study, majority of the patients on CAP were symptomatic and so in our study and basing on the symptomatology and associated parameters, severity of pneumonia is decided basing on PSI and necessary treatment instituted.⁶ Angel Vila-Corcoles et al study found that CAP was most common in immunocompromised hosts and those on corticosteroid therapy and chronic lung disease. Commonest organism isolated was *Streptococcus pneumoniae* (49%) followed by *Pseudomonas*, *Chlamydia pneumoniae* and *H. influenzae* and increased risk of CAP was found among patients with previous hospitalisation for CAP in the previous two years and chronic lung disease.⁷ In a Vietnamese study by Kensuke Takahashi, commonest organism was *Haemophilus influenzae* (28%) followed by *Streptococcus pneumoniae* (23%) by study among their cases of CAP.⁸

Elena Parina et al insisted on empirical therapy of CAP and stated that individualised antibiotic therapy is needed and early shift to oral antibiotic is needed.⁹ Vladimir Kaplan et al stated that the mortality, duration of hospital stay and treatment cost increased with increased age and comorbidities¹⁰ and this observation is similar to our study. Despite statistically significant associations of some pre-analytic factors and biomarker levels, a clinically relevant influence was not found on the severity and outcome of pneumonia in Alexander Kutz study.¹¹ In our study, increased initial white cell count was associated with increased duration of hospital stay. Comorbidities like COPD and diabetes mellitus increased hospital stay and increased costs. Richard R Watkins et al had *Streptococcus pneumoniae* as a common bacterial pathogen among hospital admitted patients followed by gram-negative bacilli and *Staphylococcus aureus* and *H. influenzae*. Their study revealed viral pathogens and *Legionella*, *Mycoplasma* and *Chlamydia* as other causes.¹²

In Kerttula study, evidence for a specific aetiology was obtained in 79 patients (49.4%). The pneumococcus was the most common aetiological agent identified in 25.6% of cases. Other bacteria, *Haemophilus influenzae*, *Branhamella catarrhalis*, *Neisseria meningitidis* and *Chlamydia* spp. were demonstrated in 23.5%, *Mycoplasma pneumoniae* in 1.2% and viruses in 7.4% patients. In 58% of those with viral pneumonia, there was evidence of mixed infection with bacteria by serological and culture tests.¹³ In the Oberoy study from Mumbai sputum culture, BACTEC blood culture and urine culture for pneumococcal antigen were done. The organisms isolated included *S. pneumoniae*, *C. pneumoniae*, *H. influenzae*, *M. catarrhalis*, *M. pneumoniae*, *L. pneumophila*, *P. aeruginosa*, *Staphylococcus* and *S. typhi*.¹⁴ Ajit Wig et al study from India stated that pneumonia is associated with considerable mortality and the severity should be assessed by assessment scores like CURB-65 scores and early intervention can reduce the mortality.¹⁵

Mosavir Ansarie Pakistani study showed similar bacterial pathogens in their study, but stated that serological investigations can diagnose *Mycoplasma* and *Chlamydia* in mild-to-moderate CAP.¹⁶ Maqsood Ahmed Khan presentation insisted on observation of standard guidelines in the management of CAP in adults and children.¹⁷

CONCLUSION

Among the adult population, pneumonia occurs in older age group possibly because of increased smoking and comorbidities require early and accurate diagnosis and institution of standardised treatment. Smoking increases the incidence of pneumonia in susceptible population. Increased white cell count at the time of diagnosis increases the duration of hospital stay and the costs thereon. Presence of comorbidities can increase the duration of hospital stay. Commonest organism isolated in CAP in our setting is *Streptococcus pneumoniae* followed by *Staphylococcus aureus*, *Klebsiella pneumoniae*, *Haemophilus influenzae* and *Pseudomonas*. *Staphylococcus*, *Klebsiella* and *Pseudomonas* species are associated with resistant strains. Resistance to Tazobactam+ Piperacillin is seen in both *Klebsiella* and *Pseudomonas* pathogens in our settings. However, both the organisms showed sensitivity to meropenem.

Abbreviations- DM- Diabetes mellitus; COPD- Chronic obstructive pulmonary disease; CRF- Chronic renal failure; CAP- Community-acquired pneumonia; CVA- Cerebrovascular accident; PSI- Pneumonia severity index.

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