

## A prospective study on clinical and radiological resolution of community acquired pneumonia

Yogesh B Kamshette<sup>1\*</sup>, Satish Mudbi<sup>2</sup>, Nagabhushan B<sup>3</sup>

<sup>1</sup>Associate Professor, Department of Pulmonary Medicine, Bidar Institute of Medical Sciences, Bidar, Karnataka, India

<sup>2</sup>Senior Resident, Department of Pulmonary Medicine, Bidar Institute of Medical Sciences, Bidar, Karnataka, India

<sup>3</sup>Assistant Professor, Department of Pulmonary Medicine, Sridevi Medical College, Tumkur, Karnataka, India

Received: 28-11-2021 / Revised: 19-12-2021 / Accepted: 01-01-2022

### Abstract

**Introduction:** Pneumonia is a disease known to humanity from antiquity. Pneumonia is an acute inflammation of the pulmonary parenchyma that can be caused by various infective and noninfective origins, presenting with physical and radiological features compatible with the pulmonary consolidation of a part or parts of one or both lungs (Seaton, Seaton, Leitch, & Crofton, 2000). Pneumonia signifies a pulmonary inflammatory process. The most significant and striking feature of which is consolidation (Kasper et al., 2005). **Materials and Methods:** A prospective observational clinical study was conducted in BRIMS, Bidar a tertiary care setting during the period from January 2020 to December 2020 (1 year). All patients diagnosed as community-acquired pneumonia as per IDSA criteria were included. Treatment was started as per ATS guidelines. All patients were started on empirical antibiotic regimen as per the guidelines. No change in antibiotics were made on the basis of sputum reports unless they fail to show symptomatic improvement within 72 hours. Those with hospital acquired pneumonia or pulmonary tuberculosis were excluded. During the baseline visit, detailed history obtained and a careful clinical examination done. **Results:** A total number of 118 patients were enrolled in the study out of which six patients were lost to followup and two were excluded as their sputum AFB smear result was positive. Remaining 102 patients completed the study. Out of the total 102 patients, 41% were above the age of 60 years and 31% were between 46 to 60 years. The mean age of the study population was 53.49 + 15.35. Majority of the patients were (90%) males. Fever and cough were present in all the patients at the time of presentation. Dyspnoea was the next common symptom present in 73% of the patients. Pleuritic chest pain was present in 67% and wheezing in 7% of patients. **Conclusion:** Clinical resolution of community-acquired pneumonia occurred in 73% of patients within a period of two weeks. Radiological resolution occurred in 43% at the end of four weeks and 78% at the end of eight weeks. For those patients in whom clinical resolution has occurred, a delay in radiological resolution beyond a period of four weeks has not much clinical significance as the radiological resolution will follow eventually. Advanced age, female sex, prolonged duration of symptoms prior to diagnosis, multilobar involvement and co-existing diseases are associated with delay in resolution of community-acquired pneumonia.

**Key Words:** Pneumonia, Dyspnoea, chest pain, pulmonary tuberculosis.

This is an Open Access article that uses a funding model which does not charge readers or their institutions for access and distributed under the terms of the Creative Commons Attribution License (<http://creativecommons.org/licenses/by/4.0>) and the Budapest Open Access Initiative (<http://www.budapestopenaccessinitiative.org/read>), which permit unrestricted use, distribution, and reproduction in any medium, provided original work is properly credited.

### Introduction

Pneumonia is a disease known to humanity from antiquity. Pneumonia is an acute inflammation of the pulmonary parenchyma that can be caused by various infective and noninfective origins, presenting with physical and radiological features compatible with the pulmonary consolidation of a part or parts of one or both lungs (Seaton, Seaton, Leitch, & Crofton, 2000)[1]. Pneumonia signifies a pulmonary inflammatory process. The most significant and striking feature of which is consolidation (Kasper et al., 2005)[2].

Community acquired pneumonia is an acute illness acquired in the community with symptoms suggestive of LRTI. Together with the presence of a chest radiograph of intra-pulmonary shadowing which is likely to be new and has no clear alternative cause (Seaton, Seaton, Leitch, & Crofton, 2000). Pneumonia is one of the leading causes of death and morbidity, both in developing and developed countries and is the commonest cause (10%) of hospitalization in adult and children (Hall et al., 2001)[3].

Plain chest radiography is used in clinical practice, to confirm the diagnosis of CAP, to characterize the extent and severity of disease, and to search for complications.

It also serves as a tool to monitor the response to therapy and for detection of possible alternative or additional diagnosis. Despite exhaustive literature on CAP, the published data on the rate of resolution of symptoms in patients with pneumonia are limited and there is a paucity of studies assessing rates of clinical and radiological resolution[4]. A proper understanding of the expected duration for clinical as well as radiological resolution of CAP will guide physicians for the timely intervention and judicious utilisation of further diagnostic studies in managing patients with delayed resolution[5]. This study was conducted with an objective to assess the duration for clinical and radiological resolution of community-acquired pneumonia and to identify the factors leading on to delay in resolution.

### Materials and methods

#### Study design

A prospective observational clinical study

#### Study location

Department of Pulmonary Medicine, Bidar Institute of Medical Sciences, Bidar.

#### Study duration

January 2020 to December 2020 (1 year) in BRIMS, Bidar. A prospective observational clinical study was conducted in BRIMS, Bidar a tertiary care setting during the period from January 2020 to

\*Correspondence

**Dr. Yogesh B Kamshette**

Associate Professor, Department of Pulmonary Medicine, Bidar Institute of Medical Sciences, Bidar, Karnataka, India

E-mail: [drkamshette@gmail.com](mailto:drkamshette@gmail.com)

December 2020 (1 year). All patients diagnosed as community-acquired pneumonia as per IDSA criteria were included. Treatment was started as per ATS guidelines. All patients were started on empirical antibiotic regimen as per the guidelines. No change in antibiotics were made on the basis of sputum reports unless they fail to show symptomatic improvement within 72 hours. Those with hospital acquired pneumonia or pulmonary tuberculosis were excluded. During the baseline visit, detailed history obtained and a careful clinical examination done. The presence and severity of pneumonia related symptoms like cough, sputum, fever, pleuritic chest pain and shortness of breath were recorded using questionnaire at the time of initial presentation and again during followup visits on 3rd, 7th and 14th day of treatment. Scores were assigned for each symptom and the individual symptom scores at each time point were tabulated. Chest x-rays were taken at baseline visit and on days 7, 14, and 28. The site, extent and radiological pattern of opacities recorded. Two pulmonologists blinded to the patient's clinical status independently evaluated all the chest radiographs in sequence. The

pattern and extent of opacities in the followup x-rays were compared with the baseline film and rate of clearance recorded as percentage (i.e. no clearance or static; worsening; < 0.05 was considered as significant. Measurement of inter observer agreement on radiological clearance was done using kappa statistics.

### Results

A total number of 118 patients were enrolled in the study out of which six patients were lost to followup and two were excluded as their sputum AFB smear result was positive. Remaining 102 patients completed the study. Out of the total 102 patients, 41% were above the age of 60 years and 31% were between 46 to 60 years. The mean age of the study population was 53.49 + 15.35. Majority of the patients were (90%) males. Fever and cough were present in all the patients at the time of presentation. Dyspnoea was the next common symptom present in 73% of the patients. Pleuritic chest pain was present in 67% and wheezing in 7% of patients.

**Table 1: Age distribution**

| S.No | Age group | N   | Percentage |
|------|-----------|-----|------------|
| 1    | 18-30     | 8   | 8%         |
| 2    | 31-45     | 20  | 20%        |
| 3    | 46-60     | 32  | 31%        |
| 4    | 61-75     | 42  | 42%        |
| 5    | Total     | 102 | 100        |

**Table 2: Symptoms**

| S.No | Symptoms   | N (%)     |
|------|------------|-----------|
| 1    | Fever      | 102 (100) |
| 2    | Cough      | 102 (100) |
| 3    | Dyspnoea   | 74 (74)   |
| 4    | Chest pain | 68 (68)   |
| 5    | Wheezing   | 14 (14)   |

**Table 3: Symptom duration prior to diagnosis**

| Duration of symptoms | <10 days | 10-20 days | >20 days | Total |
|----------------------|----------|------------|----------|-------|
| Number               | 60       | 34         | 8        | 102   |
| Percentage           | 60%      | 34%        | 8%       | 100%  |

**Table 4: Comorbidities**

| Co-morbid Condition | N (%)   |
|---------------------|---------|
| Diabetes mellitus   | 51(51)  |
| Hypertension        | 20 (20) |
| COPD                | 24 (24) |
| Smoking             | 54 (54) |
| Alcoholism          | 20 (20) |

**Table 5: Radiological pattern**

| Radiological pattern | Consolidation | Acinar Infiltrate | Interstitial infiltrate | Mixed | Total |
|----------------------|---------------|-------------------|-------------------------|-------|-------|
| Number               | 70            | 20                | 4                       | 6     | 101   |
| Percentage           | 70            | 20                | 4                       | 6     | 100   |

**Table 6: Radiological resolution**

| Rate of clearance | <25 clearance | 25-50% clearance | 50-75% clearance | >75% clearance | Total      |
|-------------------|---------------|------------------|------------------|----------------|------------|
| Day 7             | 55 (55%)      | 33 (33%)         | 12 (12%)         | 0 (0)          | 101 (100%) |
| Day 14            | 14 (14%)      | 32 (32%)         | 52 (52%)         | 4 (4%)         | 101 (100%) |
| Day 28            | 4 (4%)        | 18 (18%)         | 36 (36%)         | 44 (44%)       | 101 (100%) |

**Table 7: Radiological extent vs resolution**

|            | <50 clearance | 50-75% clearance | >75 clearance |
|------------|---------------|------------------|---------------|
| Unilobar   | 18 (22%)      | 28 (33%)         | 38 (45%)      |
| Multilobar | 8 (44%)       | 8 (44%)          | 2 (12%)       |

**Table 8: factors associated with delayed resolution**

| Factor  | P value |
|---------|---------|
| Age >50 | <0.01   |

|                               |       |
|-------------------------------|-------|
| Duration of symptoms >20 days | <0.01 |
| Female sex                    | 0.045 |
| Smoking                       | 0.027 |
| Alcoholism                    | <0.01 |
| COPD                          | 0.05  |
| Multilobar disease            | <0.01 |

### Discussion

Majority of the patients in the present study were males. Various other studies also have reported a higher incidence of community-acquired pneumonia in males than females[6].

The predominant age group affected was those above 60 yrs. reflecting the fact that advanced age is a risk factor for development of CAP. This may be due to alterations in host defence mechanisms ranging from mechanical changes such as loss of lung elasticity or impaired cough reflex to immunological senescence in elderly patients, so that they have weaker immune responses and higher chance of oropharyngeal colonization[7].

The most common symptoms in the patients at the time of presentation were fever and cough. Jennifer et al in a prospective study also had reported fever and cough as the commonest symptoms in patients with CAP. The mean symptom score showed a consistent reduction during treatment and complete clinical resolution occurred in majority of patients by two weeks even though radiological resolution was lagging. Consolidation was the predominant radiological pattern which was found in 70% of the patients[8].

At the end of first week, 14% of the patients showed worsening of radiological shadows and 40% remained static. It is reported that chest radiographic improvement typically lags behind clinical improvement and the radiological abnormalities may even get worse initially following treatment. Within the first few days, persistence or even progression of infiltrates on chest radiographs is not unusual.

In the present study, the resolution of CAP was significantly delayed in those patients above the age of 60 years. Israel et al reported that patients aged 50 and older showed delayed resolution two to four times as often as young patients. Several studies have demonstrated that age itself is an independent factor for delayed resolution[9].

In patients with CAP, clinical response to therapy is the most important determinant for further invasive diagnostic studies. Resolution of symptoms suggests favourable response to therapy even when radiographic abnormalities fail to clear. Interventions or invasive diagnostic techniques can be deferred until a reasonable observation period of at least eight weeks in patients who are clinically stable or improving, even though the radiological clearance is delayed[10].

### Conclusion

Clinical resolution of community-acquired pneumonia occurred in 73% of patients within a period of two weeks. Radiological resolution occurred in 43% at the end of four weeks and 78% at the end of eight

weeks. For those patients in whom clinical resolution has occurred, a delay in radiological resolution beyond a period of four weeks has not much clinical significance as the radiological resolution will follow eventually. Advanced age, female sex, prolonged duration of symptoms prior to diagnosis, multilobar involvement and co-existing diseases are associated with delay in resolution of community-acquired pneumonia.

### References

1. El-Solh AA, Aquilina AT, Gunen H, et al. Radiographic resolution of community-acquired bacterial pneumonia in the elderly. *J Am Geriatr Soc* 2004;52(2):224-229.
2. Bruns AH, Oosterheert JJ, Prokop M, et al. Patterns of resolution of chest radiograph abnormalities in adults hospitalized with severe community-acquired pneumonia. *Clin Infect Dis* 2007;45(8):983-991.
3. Kuru T, Lynch JP. Nonresolving or slowly resolving pneumonia. *Clin Chest Med* 1999;20(3):623-651.
4. Brandenburgh JA, Marrie TJ, Coley CM, et al. Clinical presentation, processes and outcomes of care for patients with pneumococcal pneumonia. *J Gen Intern Med* 2000;15(9):638-646.
5. Almirall J, Gonzalez CA, Balanzu X, et al. Proportion tobacco smoking. 1999;116(2):375-379.
6. Laborin LR. Smoking and chronic obstructive pulmonary disease (COPD). Parallel epidemics of 21st century. *International Journal of Environmental Research and Public Health* 2009;6(1):209-224.
7. Brody JS, Spira A. State of the art. Chronic obstructive pulmonary disease, inflammation, and lung cancer. *Proc Am Thorac Soc* 2006;3(6):535-537.
8. Saetta M. Airway inflammation in chronic obstructive pulmonary disease. *Am J Respir Crit Care Med* 1999;160(5 Pt 2):S17-S20.
9. Mannino DM, Davis KJ, Kiri VA. Chronic obstructive pulmonary disease and hospitalizations for pneumonia in a US cohort. *Respir Med* 2007;101(10):1403-1410.
10. Peleg AY, Weerathna T, McCarthy JS, et al. Common infections in diabetes: pathogenesis, management and relationship to glycaemic control. *Diabetes Metab Res Rev* 2007;23(1):3-13.

**Conflict of Interest: Nil Source of support: Nil**