

ORIGINAL RESEARCH

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

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Received: 17 September, 2023

Accepted: 19 October, 2023

ABSTRACT

Background: Pneumonia, a disease that has afflicted humanity since ancient times, is characterized by the acute inflammation of the pulmonary parenchyma. This inflammation can stem from a variety of infective and noninfective causes, and it typically manifests with clinical and radiological characteristics indicative of the consolidation of one or more segments of either or both lungs. Pneumonia essentially represents a pulmonary inflammatory process, with consolidation being the most pronounced and noteworthy hallmark of this condition. In essence, consolidation is a key feature of pneumonia, symbolizing the affected and inflamed areas of the lung tissue. **Methods:** A prospective observational clinical study was carried out at a tertiary care facility over the course of one year. The study encompassed all patients who received a diagnosis of community-acquired pneumonia, in accordance with the criteria established by the Infectious Diseases Society of America (IDSA). Treatment for these patients adhered to the guidelines set forth by the American Thoracic Society (ATS). Specifically, all patients were initiated on an empirical antibiotic regimen in line with the ATS recommendations. **Results:** In this study, a total of 236 patients were initially enrolled. However, 12 patients were lost to follow-up, and 4 were excluded due to a positive sputum AFB smear result. Consequently, 204 patients successfully completed the study. Among this group, 41% were aged 60 years and above, while 31% fell within the age range of 46 to 60 years. The mean age of the entire study population was 53.49 years, with a standard deviation of 15.35. The study primarily consisted of male patients, making up the majority at 90% of the total participants. As for clinical symptoms observed at the time of presentation, fever and cough were universally present in all patients. Dyspnoea was the next most common symptom, affecting 73% of the patients. Pleuritic chest pain was reported by 67% of the participants, while wheezing was noted in 7% of the cases. These findings provide a comprehensive overview of the demographic and clinical characteristics of the patient population under study. **Conclusion:** In this study, the clinical resolution of community-acquired pneumonia was observed in 73% of patients within a two-week timeframe. Several factors were found to be associated with a delay in the resolution of community-acquired pneumonia. These included advanced age, female gender, a prolonged duration of symptoms prior to diagnosis, involvement of multiple lung lobes, and the presence of co-existing medical conditions. These findings shed light on the various factors that can influence the pace of recovery in patients with community-acquired pneumonia, highlighting the importance of considering these variables in the clinical management of the condition.

Keywords: Pneumonia, Dyspnoea, chest pain, pulmonary tuberculosis

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INTRODUCTION

Pneumonia is a disease with a long history of affliction upon humanity. It is characterized by the acute inflammation of the pulmonary parenchyma, stemming from various infective and noninfective origins. Pneumonia typically presents with clinical and radiological features that are consistent with the consolidation of one or more sections of either or both lungs, as described by Seaton, Seaton, Leitch, & Crofton in 2000¹. The hallmark of pneumonia is the

inflammatory consolidation within the lung tissue, a significant and striking feature, as emphasized by Kasper et al. in 2005. Community-acquired pneumonia, on the other hand, refers to an acute illness that individuals contract within the community. It is marked by symptoms suggestive of Lower Respiratory Tract Infection (LRTI) and is often accompanied by a chest radiograph showing new intra-pulmonary shadowing, for which there is no clear alternative cause². This definition, as per Seaton,

Seaton, Leitch, & Crofton in 2000, helps to distinguish community-acquired pneumonia from other respiratory conditions. Pneumonia is a substantial global health concern, contributing significantly to mortality and morbidity in both developed and developing countries. It is a leading cause of hospitalization, accounting for approximately 10% of admissions among both adults and children, as noted by Hall et al. in 2001. The impact of pneumonia on healthcare systems and public health underscores the importance of ongoing research and effective management strategies for this condition³. Plain chest radiography plays a pivotal role in clinical practice, particularly in the context of Community-Acquired Pneumonia (CAP). Its utility extends to confirming the diagnosis of CAP, a fundamental step in the treatment process. By visualizing infiltrates and opacities in the lung tissue, chest radiography provides the necessary confirmation for healthcare professionals to initiate the appropriate treatment regimen.

Beyond diagnosis, chest radiography is instrumental in characterizing the extent and severity of the disease. It enables clinicians to assess the affected areas of the lungs and determine the degree of involvement, which, in turn, guides treatment decisions. This assessment is crucial for deciding whether hospitalization is required and tailoring treatment strategies to the patient's specific condition. Moreover, chest radiography serves as a vigilant tool in the search for potential complications associated with pneumonia. From pleural effusion to abscess formation, these complications can significantly impact patient outcomes. The timely identification of such issues is essential for prompt intervention and comprehensive care. In essence, plain chest radiography is an indispensable asset in the clinical management of CAP⁴. It not only validates the diagnosis but also empowers healthcare providers to gauge the severity of the disease, identify potential complications, and make informed treatment decisions, all of which collectively contribute to effective and personalized patient care. Additionally, plain chest radiography serves as a valuable tool for monitoring the response to therapy in patients with Community-Acquired Pneumonia (CAP) and for the detection of potential alternative or additional diagnoses. While there is a wealth of literature available on CAP, there is a notable scarcity of published data regarding the rates of symptom resolution and limited research on the rates of clinical and radiological resolution following treatment.

Understanding the expected duration for both clinical and radiological resolution of CAP is crucial, as it guides healthcare professionals in making timely interventions and judiciously utilizing further diagnostic studies when managing patients with delayed resolution.

The primary objective of this study was to assess the time required for clinical and radiological resolution

of community-acquired pneumonia and to identify the various factors contributing to delays in the resolution process⁵. This research aims to enhance our comprehension of the course of CAP, offering valuable insights that can inform more effective and efficient patient management and care.

MATERIALS AND METHODS

In this clinical study, all patients diagnosed with community-acquired pneumonia based on the criteria established by the Infectious Diseases Society of America (IDSA) were included. Treatment was initiated following the guidelines provided by the American Thoracic Society (ATS)⁶. Specifically, all patients were prescribed an empirical antibiotic regimen as recommended by the ATS guidelines. These antibiotics were not altered based on sputum reports unless the patients failed to exhibit symptomatic improvement within a 72-hour window. Patients with hospital-acquired pneumonia or pulmonary tuberculosis were excluded from the study to ensure a focus on community-acquired pneumonia cases.

During the baseline visit, a comprehensive patient history was obtained, and a thorough clinical examination was conducted. The presence and severity of pneumonia-related symptoms, including cough, sputum production, fever, pleuritic chest pain, and shortness of breath, were meticulously recorded using a standardized questionnaire both at the initial presentation and during follow-up visits on the 3rd, 7th, and 14th days of treatment⁷. Scores were assigned to each symptom, and individual symptom scores at each time point were documented. To assess the progress and response to treatment, chest X-rays were performed at various time points, including the baseline visit and on days 7, 14, and 28. These radiographs were used to evaluate the site, extent, and radiological pattern of opacities. The interpretation of the chest radiographs was conducted independently by two pulmonologists who were blinded to the patient's clinical status. Their evaluations were performed in a sequential manner to ensure an objective assessment of the radiological findings.

RESULTS

In this study, a total of 236 patients were initially enrolled. However, six patients were lost to follow-up, and two were excluded due to positive sputum AFB smear results. As a result, 204 patients successfully completed the study. Among this group, 41% of the patients were aged 60 years or older, while 31% fell within the age range of 46 to 60 years. The mean age of the entire study population was 53.49 years, with a standard deviation of 15.35. The majority of the patients, constituting 90% of the total participants, were male. At the time of their initial presentation, all patients exhibited fever and cough, which were universal symptoms. Dyspnoea was the next most common symptom, affecting 73% of the patients.

Pleuritic chest pain was reported by 67% of the participants, while wheezing was noted in 7% of the cases. These findings provide a comprehensive overview of the demographic and clinical characteristics of the patient population under study.

Table 1: Age distribution

S. No	Age group	N
1	18-30	16
2	31-45	40
3	46-60	64
4	61-75	84
5	Total	204

Table 2: Symptoms

S. No	Symptoms	N (%)
1	Fever	204 (100)
2	Cough	204 (100)
3	Dyspnoea	148 (74)
4	Chest pain	126 (68)
5	Wheezing	28 (14)

Table 3: Comorbidities

Co-morbid Condition	N (%)
Diabetes mellitus	102(51)
Hypertension	40 (20)
COPD	48 (24)
Smoking	108 (54)
Alcoholism	40 (20)

Table 4: Radiological extent vs resolution

	<50 clearance	50-75% clearance	>75 clearance
Unilobar	36 (22%)	56 (33%)	76 (45%)
Multilobar	16 (44%)	16 (44%)	4 (12%)

DISCUSSION

The observation that the majority of patients in the present study were males aligns with findings from various other studies that have reported a higher incidence of community-acquired pneumonia in males as compared to females⁸. This gender-based difference in the prevalence of pneumonia has been a recurring trend noted in epidemiological data. While the precise reasons for this gender disparity may vary, it highlights the importance of considering gender-related factors in the understanding and management of community-acquired pneumonia. Such insights can inform public health strategies and clinical approaches to effectively address this condition in both male and female populations. The study's observation that the predominant age group affected by community-acquired pneumonia (CAP) was individuals aged 60 years and above reflects the well-established fact that advanced age is a significant risk factor for the development of CAP. This phenomenon can be attributed to a range of age-related alterations in host defense mechanisms.

Advanced age often brings about physiological changes that impact the respiratory system. These changes may include the loss of lung elasticity, which can reduce the effectiveness of the cough reflex and overall lung function. Additionally, immunological senescence, or the natural aging of the immune system, can lead to weaker immune responses in elderly patients⁹. As a result, they may have a higher susceptibility to oropharyngeal colonization by pathogens, increasing their risk of developing CAP. Understanding these age-related factors is crucial for healthcare providers to tailor their approach to pneumonia prevention and management in elderly populations. It underscores the importance of vaccination, respiratory hygiene, and early intervention in this at-risk group to reduce the burden of CAP in older individuals. The study found that the most common symptoms among patients at the time of presentation were fever and cough. This observation aligns with the findings of Jennifer et al., who, in a prospective study, also reported fever and cough as the most common symptoms in patients with Community-Acquired Pneumonia (CAP).

Furthermore, the study's data showed a consistent reduction in the mean symptom score during the course of treatment. Notably, a majority of patients achieved complete clinical resolution within two weeks, even though radiological resolution lagged behind. The predominant radiological pattern observed in the patients was consolidation, which was present in 70% of cases. These findings emphasize the importance of monitoring clinical symptoms and their resolution during the treatment of CAP and highlight the distinct pattern of consolidation in radiological assessments, a key feature of the condition. The study observed that at the end of the first week, 14% of the patients exhibited worsening of radiological shadows, while 40% remained unchanged. This observation is consistent with the well-documented phenomenon that chest radiographic improvement often lags behind clinical improvement in cases of pneumonia. In fact, it is not uncommon for radiological abnormalities to initially worsen or persist within the first few days following treatment. This delay in radiological resolution is a known aspect of the healing process in pneumonia cases.

Furthermore, the study found that the resolution of Community-Acquired Pneumonia (CAP) was significantly delayed in patients aged 60 years and above. This observation is in line with the findings of Israel et al., who reported that patients aged 50 and older experienced delayed resolution two to four times more frequently than younger patients. Multiple studies have provided evidence that age itself is an independent factor contributing to delayed resolution in cases of pneumonia. These insights underscore the importance of considering age as a critical variable in the management and prognosis of CAP, particularly in older patient populations. In patients diagnosed with Community-Acquired Pneumonia (CAP), the clinical

response to therapy holds paramount importance as a determinant for the need for further invasive diagnostic studies¹⁰. A favorable response to treatment is primarily indicated by the resolution of symptoms. Importantly, clinical improvement is a significant marker of progress even in cases where radiographic abnormalities do not clear promptly.

As a result, interventions or invasive diagnostic procedures can be deferred in patients who are clinically stable or showing improvement. This deferral is possible when there is a reasonable observation period, typically extending up to at least eight weeks, allowing for clinical stability or progress, even if radiological clearance is delayed. This approach emphasizes the significance of monitoring the patient's overall condition and clinical symptoms as a guide for the timing and necessity of invasive diagnostic procedures, contributing to more patient-centered and prudent healthcare decisions.

CONCLUSION

The study findings reveal the temporal dynamics of resolution in cases of Community-Acquired Pneumonia (CAP). Clinical resolution was achieved in 73% of patients within the relatively short span of two weeks. In contrast, radiological resolution was observed in 43% of cases at the end of four weeks, with a substantial increase to 78% by the end of eight weeks. This indicates that radiological improvements lag behind clinical recovery. Importantly, for patients in whom clinical resolution has occurred, any delay in achieving radiological resolution beyond a four-week period is deemed to have limited clinical significance. It is anticipated that radiological improvements will eventually align with the clinical recovery already achieved. Certain factors are associated with delays in the resolution of CAP. These include advanced age, female gender, a prolonged duration of symptoms before diagnosis, the involvement of multiple lung lobes, and the presence of co-existing medical

conditions. These variables underscore the importance of considering individual patient characteristics and risk factors in the management and prognostication of CAP, contributing to more personalized and effective healthcare approaches for this condition.

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