



Proportion of adults hospitalized with community-acquired pneumonia showing complete resolution of chest radiograph abnormalities at the end of 4 weeks

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Abstract

Aim: Chest radiography is a crucial step in confirming or excluding a clinical diagnosis of pneumonia. Our objective is to assess the proportion of community acquired pneumonia inpatients who show complete radiographic clearance at the end of 4 weeks and the association of this with factors like age, aetiology and extend of involvement.

Methods: This prospective study was conducted at Government Medical College, Thrissur on consecutive inpatients with community acquired pneumonia during study period of 1 year. Repeat chest x-rays were taken to assess resolution of initial findings at 4 weeks from disease onset.

Results: A total of 85 patients (54 males and 31 females) were included in this study. 22.35% showed complete radiographic clearance at discharge. The median time of discharge was 9 days. 74.12% (63 participants) showed complete clearance at the end of 4 weeks. 10.59% who had no clearance in their chest X-ray at the end of 4 weeks had an alternate diagnosis.

Conclusion: A period of 4-6 weeks can be considered as a safe observation time for the infiltrates to resolve in CAP. Chest X-rays taken before this period do not offer any additional benefit in the management unless the patient is deteriorating. In this study 74% had complete clearance and the remaining needed a further follow up. Asymptomatic patients showed resolution in a slow manner while symptomatic patients had an alternate diagnosis after follow up.

Keywords: Pneumonia, Chest X-Ray, Follow up

I. Introduction

An infection of the pulmonary parenchyma from the level of the respiratory bronchioles to the alveoli is referred to as pneumonia⁽¹⁾. Presence of new lung infiltrates on a chest radiograph along with any of the following symptoms like new or worsening cough, dyspnea, pleuritic chest pain, purulent sputum, disorientation, fever, hypoxemia,

rales, leukocytosis, or leucopenia can be used to diagnose pneumonia clinically⁽²⁾. Community-acquired pneumonia is the pneumonia acquired outside hospital. BTS guidelines recommend that all patients admitted to a hospital with suspected CAP should have a chest radiograph performed as soon as possible to confirm or refute their diagnosis⁽³⁾. Indian guidelines also recommend that wherever feasible, a chest radiograph should be obtained in all patients suspected of having CAP⁽⁴⁾.

Patients who are not improving clinically while receiving adequate care, as well as those patients who are exhibiting deteriorating symptoms or physical signs, or in whom an underlying malignancy is suspected, should have their chest radiographs repeated. However, it is now usual practice to repeat the chest radiograph both during follow-up appointments, which typically occur 4-6 weeks after hospital discharge. There is no solid recommendation regarding the usefulness of this procedure in patients who have otherwise healed adequately⁽⁴⁾. This study plans to assess the proportion of community acquired pneumonia inpatients who show complete radiographic clearance at the end of 4 weeks and the association of this with factors like age, aetiology, and extend of involvement. This study may throw light into usefulness of a follow up chest X-ray at 4 weeks and knowledge of the patterns of resolution and the factors affecting it. This study may also be useful in understanding how a follow-up chest radiography in the setting of pneumonia leads to diagnoses of malignant and non malignant diseases both when the radiological changes are persistent and when only partially resolved.

II. Materials and Methods

This prospective study was conducted in Department of pulmonology, Government medical college, Thrissur, Kerala. A total of 85 consecutive patients with community acquired pneumonia admitted at Government medical college Thrissur during study period of 1 year were included



Inclusion criteria: All consecutive patients admitted at government medical college Thrissur with diagnosis of community acquired pneumonia.

Exclusion criteria: Tuberculous pneumonia, patients below 16 years of age, Hospital acquired pneumonia, Aspiration pneumonia, SARS covid 19 pneumonia, Pregnancy.

Study Method: All consecutive patients admitted with a clinical diagnosis of community acquired pneumonia at government medical college Thrissur during the study period were selected. At hospital admission, demographic data, comorbidities noted, symptoms and clinical signs were evaluated. Patient comorbidities were noted. Routine laboratory tests, sputum gram stain, sputum culture, blood culture and a chest radiograph are obtained.

Radiographic evidence of pneumonia was defined as the presence of consolidation (a dense or fluffy opacity with or without air bronchograms), other infiltrate (linear and patchy alveolar or interstitial densities), or pleural effusion. The extend of initial radiographic involvement is noted. Antibiotic treatment given based on the ATS IDSA 2019 guidelines. Patients were discharged once they clinically improved. X-ray was repeated at discharge and findings documented. After discharge from the hospital, all patients are asked to return to the outpatient clinic for follow up at 4 weeks (from disease onset). Repeat chest x-rays are taken to look for resolution of initial findings. Patients with residual infiltrates, both symptomatic and asymptomatic were followed up with repeat chest x-ray after 14 days and further investigated to rule out alternate diagnosis.

Analysis: All data were entered into Microsoft excel and analysed using SPSS software. Fisher's exact test was used to study association between

categorical variables. Statistical significance was estimated with p value <0.05. Results are described in percentages, mean and standard deviation.

Ethical issues

Ethics committee number is IEC/GMCTSR/052/2021. The study was done to analyse the proportion of complete resolution of radiograph abnormality at the end of 4 weeks in CAP patients. This was a prospective study. Patient details were kept confidential throughout the study. There were no financial commitments for patients during any part of study. No harm was incurred to the patient due to this study.

III. Results

Of the 85 participants, 54(63.53%) patients were male and 31 (36.47%) were female. The male to female ratio was 1.74:1. Mean age of the study population was 58.76 ± 15.44 years (range = 15-87yrs). Highest number of patients (55.29%) were in the age group of 50-69 years. The least amount of patients was within the age group 10-29 years (5.88%).

Most common presenting symptom was cough (91.7%) followed by fever (72%). (table 1 supplementary data). 29.4% were current smokers. 31% were alcohol abusers. 41.18% patients were diabetic. 34% patients had h/o COPD and 10.59% patients had h/o pulmonary TB.

Most commonly isolated organism in sputum was klebsiella. (table 2 supplementary data)

Chest X-ray showed 40% had right sided pneumonia.(table 3 supplementary data) As illustrated in table 4, majority (58%) had single lobe involvement

Table 4 : Extend of involvement

Extend	Frequency	Percent
Single lobe involvement	49	58
Single side multilobar	13	15
Bilateral multilobar	15	18
Bronchopneumonia	8	9
	85	100

25% had parapneumonic effusion (table 5 supplementary data)

The median time of discharge was 9 days (minimum :4 days, maximum :14days).

As shown in table 5, 22.3% showed complete clearance at discharge itself.

Follow Up chest x-ray at DISCHARGE	Frequency	Percent
complete clearance	19	22.35



no clearance	23	27.06
partial clearance	43	50.59
Total	85	100

Table 6 :Follow up chest x-ray at discharge

Table 7 shows the follow up X-ray at 4 weeks from disease onset.
 74.12% (63 participants) showed complete clearance at the end of 4 weeks
 15.29% (13 participants) showed partial clearance.
 10.59% (9 participants) had no clearance in their chest X-ray at the end of 4 weeks

Follow Up Chest Radiograph at 4 Weeks	Frequency	Percent
complete clearance	63	74.12
no clearance	9	10.59
partial clearance	13	15.29
Total	85	100

Table 7:Follow up chest x-ray at 4 weeks

Out of the 13 patients who showed partial clearance 7 of them were asymptomatic and were kept under follow up. They were found to have clearance later (≥ 6 wks). 3 patients expired due to other comorbidities and complication and hence lost to follow up. 2 of them were symptomatic. Bronchoscopy showed MDR klebsiella. One patient was diagnosed with ILD.

	FREQUENCY	PERCENT
Asymptomatic	7	53.84%
Expired	3	23.07%
Symptomatic →MDR klebsiella in bronchial wash	2	15.38%
ILD	1	7.69

Table 8: Follow up of partial clearance group

10.59% (9 participants) had no clearance in their chest X-ray at the end of 4 weeks. All of them were symptomatic. 5 of them were diagnosed with adenocarcinoma, one each with BOOP,tuberculosis ,lymphoma.one patient expired during follow up.

	FREQUENCY	PERCENT
Adenocarcinoma	5	55.55%
BOOP	1	11.11%
Tuberculosis	1	11.11%
Lymphoma	1	11.11%
Expired	1	11.11%

Table 9:Follow up of no clearance group

There was no statistically significant difference in radiographic clearance among different age groups , aetiological agents isolated in sputum and extent of involvement. (table 10, 11, 12. supplementary data)



IV. Discussion

Radiographic changes resolve comparatively slowly and lags behind clinical recovery. In this study conducted among inpatients with community acquired pneumonia, 74.12% showed complete radiographic clearance at the end of 4 weeks. In a study by Mittl R et al complete resolution of chest radiographic changes occurred at 2 weeks in 51% of cases, in 64% by 4 weeks and 73% at 6 weeks after initial presentation.⁽⁵⁾

In our study a statistically significant association was not obtained between the radiographic clearance and patient factors like age, extent of involvement and aetiology. However few previous studies have found association with age and extent of involvement. In this study, multivariate analysis revealed that the only factors independently relating to clearance rate were age and multilobar involvement⁽⁵⁾. In the BTS multicentre CAP study age was also a major factor influencing rate of radiographic recovery⁽⁶⁾. In a research by El Solh AA et al, patients over the age of 70 demonstrated, 35%, 60%, and 84% radiographic clearance at 3, 6, and 12 weeks respectively.⁽⁷⁾

In several research, it was discovered that the aetiology of pneumonia affected the radiographic clearance. The isolation of aetiological agent from sputum was low in our study. It is challenging to isolate the aetiological agent from sputum or any other material in the current situation with early antibiotic initiation. In the famous CDC EPIC study, which subjected 2259 people hospitalised with CAP to meticulous microbiologic testing, no pathogen was found in 62% of patients.⁽⁸⁾

In this study of 85 participants, 10.51% who was initially diagnosed and treated as a case of community acquired pneumonia, had an alternate diagnosis at the end of follow up with half of them turning out to have an underlying malignancy. In a study of 236 adults presenting to their general practitioner with a clinical diagnosis of CAP, 10 were found to have underlying lung cancer on follow up investigations. An increased risk of lung cancer was seen in older smokers > 60 yrs age (6 of 36 i.e 17%), indicating that a chest radiograph was especially recommended for this subset of patients with CAP in the community⁽⁹⁾. In one study of 162 adults hospitalised with suspected CAP by Macfarlane JT et al the diagnosis was accepted in only 127, 10 (6%) of the 162 being found to have cancer⁽¹⁰⁾. Another study by Holmberg H et al on the value of convalescent chest radiography and follow-up in association of pneumonia and lung cancer it was found that 13 (1.3%) of 1011 patients

hospitalised with CAP to have an underlying lung cancer on investigation.⁽¹¹⁾

Limitations:

A potential limitation of this study was the absence of microbiologic diagnosis in majority of CAP patients. Cases of atypical pneumonias were not identified in this study. The rate of radiographic clearance in outpatients setting were not investigated.

V. Conclusion

Chest x-rays taken at discharge do not provide any additional benefit to the management or follow up. A period of 4-6 weeks can be considered as a safe observation time for the infiltrates to resolve. In this study 74% had complete clearance and the remaining needed a further follow up. Asymptomatic patients showed resolution in a slow manner while symptomatic patients had an alternate diagnosis after follow up. This leads to a conclusion that the likelihood that whether a patient will benefit from repeated radiographic examinations must be weighed against the clinical improvement of the patient and the pre test possibility of an alternate diagnosis or underlying malignancy. However considering high incidence of lung malignancy even patients with partial resolution of symptoms must be kept under follow up. From this study it is found that Follow-up chest radiography in the setting of patients initially treated as community acquired pneumonia leads to small but significant number of diagnoses of malignant and non malignant diseases both when the radiological changes are persistent and when only partially resolved.

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SUPPLEMENTARY DATA

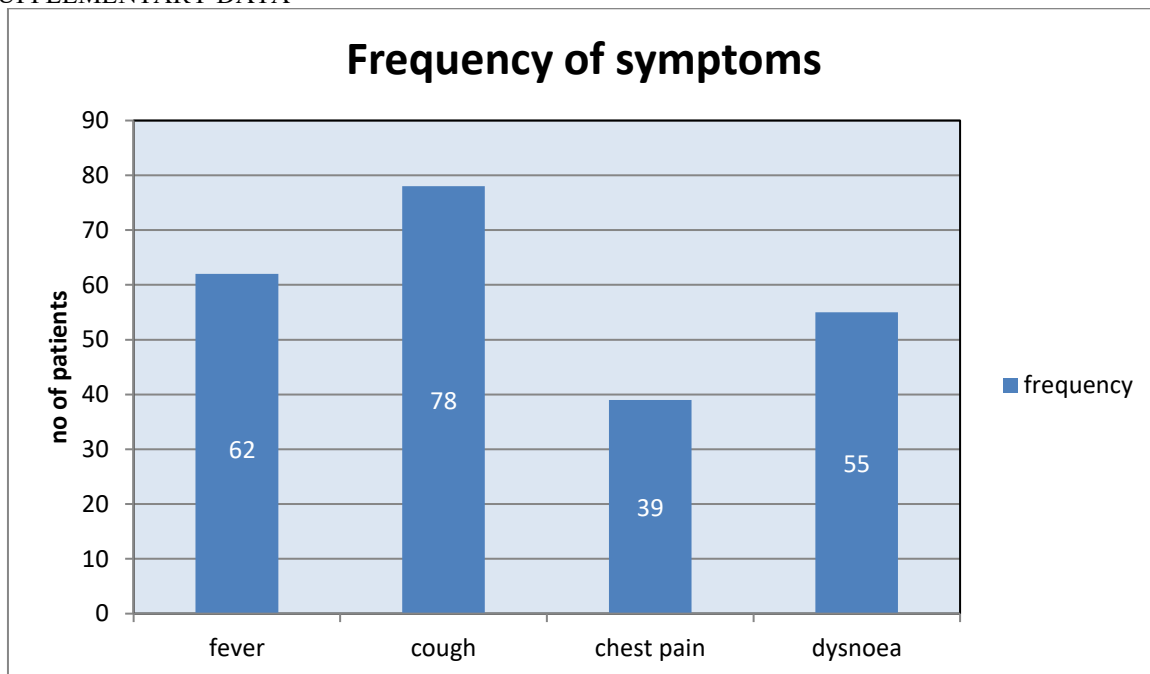


Table 1: Frequency of symptoms

Table 2: SPUTUM C/S

Sputum C/S	Frequency	Percent
Pseudomonas	5	5.88
Klebsiella	9	10.59
Acinetobacter	6	7.06
Others	3	3.53
Normal flora/inappropriate sample	62	72.94



Total	85	100
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Table 2: Sputum C/S

Others included citrobacter, staphylococcus ,mixed bacterial growth.
 Most commonly isolated was klebsiella

Side	Frequency	Percent
Right	34	40
Left	28	32
Bilateral	23	27
Total	85	100

Table 3: side of involvement

Effussion	Freq.	Percent
absent	63	75
present	21	25
Total	84	100

Table 4 : presence of effussion

.9 ASSOCIATION BETWEEN FOLLOW UP CHEST RADIOGRAPH AT 4 WEEKS AND AGE GROUP

Association between Follow up Chest Radiograph at 4 weeks and Age Group				
Age Group	Follow up Chest Radiograph at 4 weeks			Total
	Complete Clearance	No Clearance	Partial Clearance	
10-29	3 (60.00)	1 (20.00)	1 (20.00)	5 (100.00)
30-49	13 (76.47)	1 (5.88)	3(17.65)	17 (100.00)
50-69	36 (76.60)	6(12.77)	5(10.64)	47 (100.00)
>70	11 (68.75)	1 (6.25)	4 (25.00)	16 (100.00)
Total	63 (74.12)	9 (10.59)	13 (15.29)	85 (100.00)

Fisher's Exact P value = 0.650

There was no statistically significant difference in radiographic clearance among diffe Table 24

Table 10: ASSOCIATION BETWEEN FOLLOW UP CHEST RADIOGRAPH AT 4 WEEKS AND EXTEND OF INVOLVEMENT

Extend of involvement	Follow up Chest Radiograph at 4 weeks			Total
	Complete Clearance	No Clearance	Partial Clearance	
Single lobe involvement	37 (75.51)	4 (8.16)	8 (16.33)	49 (100.00)
Single sided Multilobar	10 (76.92)	1 (7.69)	2 (15.38)	13(100.00)
Bronchopneumonia	8 (100.00)	0 (0.00)	0 (0.00)	8 (100.00)
Bilateral multilobar involvement	8 (53.33)	4 (26.67)	3 (20.00)	15 (100.00)
Total	63 (74.12)	9 (10.59)	13 (15.29)	85 (100.00)

Fisher's Exact P value :0.320

Table 31



There was no statistically significant difference in the initial extent of involvement in chest x-ray of patients having complete and no/partial clearance

Table 11 : ASSOCIATION BETWEEN FOLLOW UP CHEST RADIOGRAPH AT 4 WEEKS AND SPUTUM C/S

Association between Follow up Chest Radiograph at 4 weeks and Sputum C/s				
Sputum C/S	Follow up Chest Radiograph at 4 weeks			Total
	Complete Clearance	No Clearance	Partial Clearance	
Pseudomonas	4 (80.00)	1 (20.00)	0 (0.00)	5 (100.00)
Klebsiella	4 (44.44)	0 (0.00)	5 (55.56)	9 (100.00)
Acinetobacter	5 (83.33)	0 (0.00)	1 (16.67)	6 (100.00)
Others	2 (66.67)	1 (33.33)	0 (0.00)	3 (100.00)
Inappropriate sample/ normal flora	48 (77.42)	7 (11.29)	7 (11.29)	62 (100.00)
Total	63 (74.12)	9 (10.59)	13 (15.29)	85 (100.00)

Fisher's Exact P value : 0.067

There was no statistically significant difference in the sputum culture reports of patients having clearance in their chest x-ray at the end of 4 weeks. *Table 32*