Original Research Article

Clinico Etiological and Radiological Profile of Patients with Non Resolving Pneumonia

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Abstract

Introduction: Community acquired pneumonia is one of the commonest respiratory illnesses seen globally. However in some patients the radiological infiltrates fail to resolve by 50% at 2 weeks or complete resolution by 4 weeks despite 10 days of minimum standard antibiotic therapy. Factors like inadequate antibiotic therapy, impaired host defence mechanisms, antibiotic resistance, extremely virulent organisms, nonbacterial aetiologies, endo-bronchial lesionsetc are associated with slow resolution of pneumonia.

Methods: This is a prospective hospital-based study conducted in the department of Pulmonary Medicine Gauhati Medical College and Hospital for a duration of 12 months from March 2023 to February 2024 among 49 patients. Detailed history and physical examination was taken. Routine blood investigation, sputum analysis, chest X ray and CT thorax was done. Bronchoscopy for lavage, TBLB, TBNA, endobronchial biopsy and CT guided biopsy was done wherever indicated. Additional investigations included ANCA profile, Hypersensitivity pneumonitis panel and Serum/ BAL for galactomannan.

Results: Mean age of the population was 47.83 years +/- 14.11 years with a slight male preponderance of 1.2:1. Majority of the cases (28.6%) belonged to the age group of 40-49 years. The most common symptom was cough. Smoking and diabetes was found to be the most common comorbidity. TBNA was done in 6.1%, endobronchial biopsy in 18.4% and CT guided biopsy 18.4 % of cases. Majority 32.7% are diagnosed with NSCLC followed by 22.4% with pulmonary tuberculosis, 8.2% with bacterial pneumonia, 8.2% with aspergilloma, 6.1% with bronchiectasis, 4.1% with organizing pneumonia, 4.1% with lung abscess, 4.1% with vasculitis, 2% with Progressive Massive Fibrosis, 2% with hypersensitivity pneumonitis and 2% with pleural effusion.

Conclusion: From this study the most common etiology of non-resolving pneumonia was found to be lung malignancy (non-small cell lung cancer) followed by tuberculosis. Bronchoalveolar lavage was found have higher yield in comparison to sputum analysis for infective causes. Bronchoscopy and CT thorax also aided in guided biopsy.

Keywords: TBLB: Transbronchial Lung Biopsy, TBNA: Transbronchial Needle Aspiration, CT: Computed tomography, ANCA: Anti- Neutrophil Cytoplasmic Antibody, NSCLC: Non-Small Cell Lung Cancer.

Introduction

Community acquired pneumonia (CAP) is one of the commonest respiratory diseases prevalent worldwide. Globally, its incidence is 1 - 25 per thousand population per year. [1] Most patients can be treated as outpatients; however, the death rate of the hospitalised patients ranges from 5% to 10%, among which those requiring intensive care can be as high as 29%. [2]

Pulmonologists often come across with patients of slowly resolving or non-resolving pulmonary infiltrates in radiological studies who are on antibiotics and which is responsible for eight percent of bronchoscopies performed. [3] The term non resolving or slow-resolving pneumonia is used to refer to patients who present with persistence of pulmonary infiltrates for more than 30 days after initial pneumonia-like symptoms.

Most of these patients usually suffer from diseases other than community acquired pneumonia after careful evaluation. [4] It is responsible for nearly fifteen percentage of admissions. [5]There can be many factors associated with slow resolution or non-resolution of pneumonia including inadequate antibiotic therapy, impaired host defence mechanisms, antibiotic resistance, extremely virulent organisms, nonbacterial aetiologies and endo-bronchial lesions including neoplasms.

Overall mortality rates of non-resolving pneumonia are as high as 34% in patients hospitalised with CAP. [6]

In spite of the high incidence of non-resolving pneumonia, it is seen that there are very less studies in literature addressing this issue. Meagre knowledge on the possible clinical course and outcomes of community-acquired pneumonia or nosocomial pneumonia is a common dilemma for pulmonologists. The appropriateness in selecting patients for further evaluation is also challenging. So, a better understanding is crucial for efficient management of such patients.

Aims and Objectives

Primary Objective: To study the clinical, etiological and radiological profile of patients with non-resolving pneumonia in a tertiary care hospital.

Secondary Objectives:

To study

- The various infectious aetiologies of non-resolving pneumonia
- Non-infectious aetiologies of non-resolving pneumonia
- Co-morbidities associated with non-resolving pneumonia
- Utility of sputum vs bronchoalveolar lavage in diagnosing tuberculosis in non-resolving pneumonia.
- The diagnostic yield of bronchoscopy in non-resolving pneumonia.
- The diagnostic yield of CT guided biopsy in the diagnosis of non-resolving pneumonia

Materials and Method

This is a hospital-based observational study conducted in the Department of Pulmonary Medicine, Gauhati Medical College and Hospital, from March 2023 to February 2024 (12 months). Patients admitted with pneumonia were screened, and those meeting the case definition of non-resolving pneumonia were enrolled after informed consent.

Non resolving pneumonia is defined as – "A clinical condition wherein there is radiological infiltrates (focal or diffuse, unilateral or bilateral, parenchymal or interstitial) which begin with clinical association of acute pulmonary infection and with a minimum 10 days of standard antimicrobial therapy, patients either fail to improve or worsen, or radiological opacities fail to resolve by 50% at 2 weeks or less than complete clearing at 4 weeks." [7,8]

During the study period, 1180 patients were admitted with a provisional diagnosis of pneumonia; 49 (4.1%) met the criteria for non-resolving pneumonia and were enrolled through purposive sampling. Smoking history was quantified using the smoking index: <200 (light), 200–400 (moderate) and >400 (heavy). Comorbidities recorded included diabetes, CKD/AKI, cancer, cardiac diseases (CHF, CAD), and hypertension.

All the patients underwent routine investigations including CBC, RFT, LFT, ESR, CRP, serum electrolytes, and chest X-ray (PA view). HRCT and/or CECT chest was performed as indicated. Patients requiring fibreoptic bronchoscopy (FOB) underwent pre-evaluation (ECG, 2D echo wherever needed). FOB was performed using an Olympus fibreoptic bronchoscope, following the British Thoracic Society guidelines. Additional tests such as CT-guided biopsy, ANCA, hypersensitivity pneumonitis profile, and BAL/sputum for galactomannan were carried out when indicated.

Statistical Analysis: The data was analysed using the SPSS software

Results

Age Distribution: The study population ranged from 19 to 90 years. Mean age ± SD was 47.83 years +/- 14.11 years. Out of the 49 cases, majority i.e. 14 (28.6%) belonged to the age group of 40-49 years and 1 (2%) was in the age group of 90-99 years.
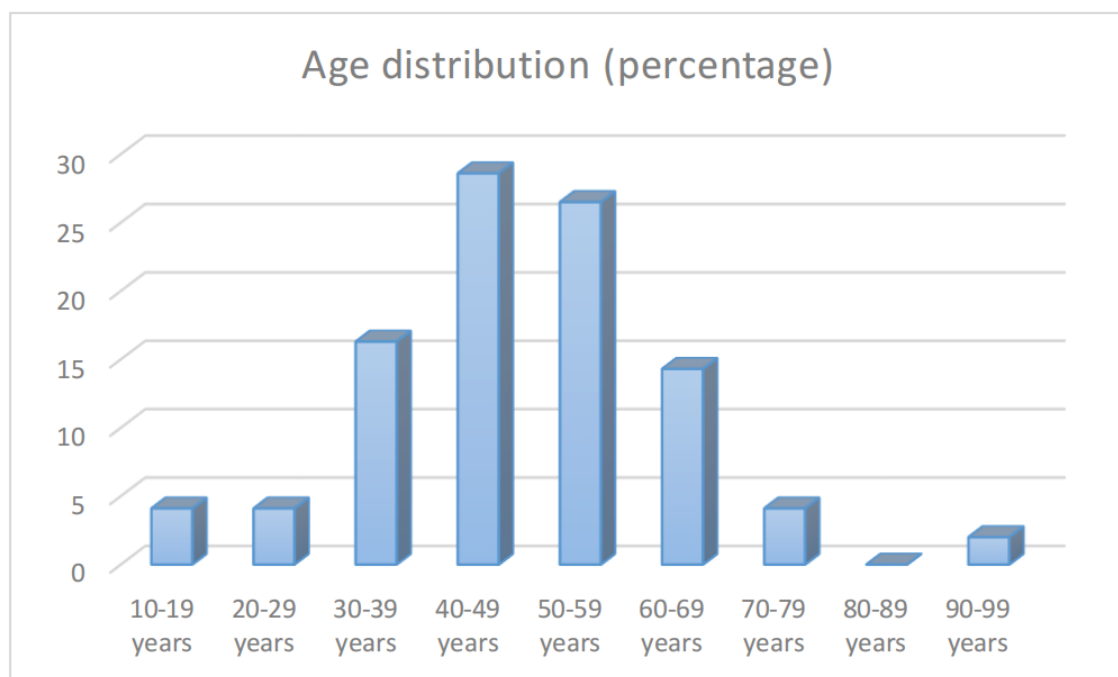
Figure 1: Age distribution (%)

2. Sex Distribution: Our study had a male preponderance with male to female ratio being 1.2:1.

3. Distribution Of Presenting Symptoms: Out of the 49 patients, all (100%) of them presented with cough which was followed by shortness of breath in 41 (83.7%) patients. Other presenting symptoms included fever in 27 (55.1%) cases, haemoptysis in 26 (53.1%) cases and chest pain in 11 cases (22.4%) respectively.

4. Duration of Presenting Symptoms: Duration of presenting symptoms ranged from 1-5 months with Median +/- SD duration being 2 months +/- 1.11. Out of the 49 patients, majority that is 15 (30.6%) were symptomatic for 2 months. Eleven (22.4%) cases were symptomatic for 1 month, 5 (10.2%) were symptomatic for 1.5 months, 15 (30.6%) patients were symptomatic for 2 months, 1 (2%) patient was symptomatic for 2.5 months, 9 (18.4%) patients were symptomatic for 3 months, 6 (12.2%) patients were symptomatic for 4 months, and 2 (4.1%) patients were symptomatic for 5 months.

5. Addictions: In our study, among the 49 patients, 19 (38.8%) were smoker and 9 (18.4%) were alcoholic. Six (12.25%) patients gave history of both smoking and alcohol abuse. Thirty (61.2%) patients did not give any history of addiction.

6. Comorbidities: Out of the 49 patients, 28 (57.1%) presented with comorbidities which included diabetes mellitus in 14 (28.6%) patients, systemic hypertension in 8 (16.3%), hypothyroidism in 5 (10.2%) patients and COPD in 14 (28.6%) patients. It was also found that 9

patients had multiple comorbidities among which 3 (33.3%) patients presented with Diabetes and Hypertension, 2 (22.2%) patients presented with Diabetes, Hypertension and COPD, 2 (22.2%) patients presented with Diabetes, Hypertension and Hypothyroidism, 1 (11.1%) patient presented with Diabetes and Hypothyroidism and 1(11.1%) patient presented with Hypothyroidism and COPD.

9. History of Prior Respiratory Illness: In our study eight (16.3%) patients had prior history of respiratory illness.

10. Chest x ray Findings: Among the 49 patients enrolled in our study, Chest X ray had inhomogeneous opacities in 40 (81.7%) patients, cavitary lesions in 5 (10.2%) patients, and consolidation in 3 (6.1%) patients and reticular opacities in 1 (2%) patients.

11. Computed Tomography (Ct) Findings: Among the 49 cases enrolled in our study, the CT thorax findings were as follows: lung abscess in 2 (4.1%) patients, bronchiectasis in 3 (6.1%) patients, cavitary lesions in 4 (8.2%) patients, consolidation in 20 (40.8%) patients, pleural effusion in 1 (2%) patient, ground glass opacities (GGO) in 1 (2%) patient, mass lesion in 14 (28.6%) patients, nodules in 3 (6.1%) patients, and Progressive Massive Fibrosis in 1 (2%) patient.

12. Sputum Analysis: In our study 1 (2%) patient was positive for sputum AFB and sputum for CBNAAT which was sensitive to Rifampicin in 1 (2%) patient. Gram Staining revealed that 6 (12%) patients with Gram negative and 8 (16.3) patients with gram positive bacteria.

13. Sputum Culture and Sensitivity: In our study it was found that. Thirty five patients (71.5%) did not have any growth in the sputum culture, 8 (16.4%) had growth of non-pathogenic organism, 3 (6.1%) had growth of Pseudomonas aeruginosa, 2 (4%) had growth of Klebsiella pneumoniae and 1 (2%) patient had growth of gram negative bacilli, which was not identified.

14. BAL Analysis: Out of 49 patients, 10 (20%) patients were positive for AFB smear and 12 (24.5%) patients had CNBAAT positivity in BAL fluid analysis. Among 12 patients, who were CBNAAT positive, 8 (66.8%) patients were sensitive, 2 (16.6%) were resistant and 2 (16.6%) patients had indeterminate sensitivity to rifampicin. Ten (20.4%) patients showed gram positivity and 8 (16.3%) patients showed gram negativity in BAL fluid analysis.

15. BAL Fluid Culture And Sensitivity: Out of the 49 patients, thirty (61.3%) patients did not have any growth in the BAL fluid, 8 (16.3%) had growth of non-pathogenic organism, 5 (10.2%) had growth of pseudomonas aeruginosa, 4 (8.2%) had growth of Klebsiella pneumoniae, 1 (2%) had growth of Escherichia coli. BAL fluid culture was not done in 1 (2%) patient.

16. Bronchoalveolar Lavage (BAL) Cytology- among 49 patients, BAL for malignant cytology was positive in 1 (2%) patient, negative in 45 (91.8%) patients and inconclusive in 1 (2%) patient. BAL cytology was not done in 2 (4.2%) patients.

17. TRANS BRONCHIAL NEEDLE ASPIRATION FINDINGS: Among the 49 patients TBNA was done in 3 (6.1%) patients. 2 (4%) patients had malignant cells and 1 (2%) patient had epithelioid granuloma in the aspirate.

18. Endobronchial Biopsy: Among 49 patients, Endobronchial biopsy was done in 9 (18.4%) patients and was not done in 40 (81.6%) patients. Out of the 9 patients, who underwent endobronchial biopsy, the histopathology report of 8 (89%) patients were suggestive of NSCLC while in 1 (11%) patient it was negative for malignancy

19. Computed Tomography Guided Biopsy and Findings: In our study, CT guided biopsy was done in 9 patients. Six (67%) patients had a histopathological diagnosis of NSCLC, 1 (11%) patient was diagnosed with organizing pneumonia, 1 (11%) patient had non caseating granuloma and 1 (11%) had inflammation as findings.

20. Additional Investigations: In our study other investigations to find out the etiology included BAL/ serum for galactomannan which was positive in 4 (8.1%) patients, ANCA profile was positive in 2 (4.1%) patients and Hypersensitivity pneumonitis panel was positive in 1 patient (2%)

21. Final Diagnosis: Out of the 49 patients in our study, the final diagnoses were, 16 (32.7%) patients were diagnosed to have non-small cell lung cancer (NSCLC), 4 (8.2%) patients had bacterial pneumonia, 3 (6.1%) patients had bronchiectasis, 4 (8.2%) patients had aspergilloma, 11 (22.4%) patients had pulmonary tuberculosis, 1 (2%) patient had hypersensitivity pneumonitis, 2 (4.1%) patients had organizing pneumonia, 1 (2%) patient had progressive massive fibrosis, 2 (4.1%) patients had lung abscess, 2 (4.1%) patients had vasculitis and 1 (2%) patient had pleural effusion. Out of 11 cases of pulmonary tuberculosis, 9 cases were sensitive to first line anti tubercular drugs, whereas, 2 patients had multidrug resistant tuberculosis.

Discussion

Age Distribution: The study included patients from 19 to 90 years of age with mean age of 47.83 +/- 14.11 years. Majority belonged to the age group of 30-39 years (28.6%) followed by 26.5% in the age group of 50-59 years.

In a similar study by B Jayaprakash, et al [9] and Chaudhuri, et al [10] 84.6% and 81% patients were found to be above the age of 40 years respectively.

Hence it can be concluded that age is an important risk factor for Non resolution or slow resolution of pneumonia with increase in incidence mostly seen in older age group.

Sex Distribution: The present study showed a slight male preponderance with a male: female ratio being 1.2:1 with a similar presentation seen in the study by Jose Wellington Alves Dos Santos et al [11] where the incidence of 'non-resolving pneumonia' was found to be more common in males (56%) in comparison to females (44%).

Presenting Symptoms: Cough was found to be the most common presenting symptom in our study as all the patients enrolled presented with cough. It is followed by shortness of breath in 83.7% patients. Other presenting symptoms includes fever in 55.1%, hemoptysis in 53.1% and chest pain in 22.4% respectively. A similar study conducted by Jose Wellington Alves Dos Santos et al [11] the most common symptoms was cough and fever which was found in all cases. It was followed by shortness of breath seen 69% of the cases.

Another similar study by Rao GS, et al [12]also highlighted that cough was the most common presenting symptom which was seen in all the patients which was followed by dyspnoea in 70%.

Duration of Presenting Symptoms: The duration of presenting symptoms in our study ranges from 1-5 months with median +/- SD duration of

symptoms being 2 +/- 1.11 months. Majority of the patients that is 30.6% were symptomatic for 2 months, 22.4% patients were symptomatic for 1 month, 10.2% were symptomatic for 1.5 months, 2% were symptomatic for 2.5 months, 18.4% were symptomatic for 3 months, 12.2% were symptomatic for 4 months, and 4.1% patients were symptomatic for 5 months.

In a study conducted by Fein AM et al. [13] among 41 patients with non-resolving pneumonia, it was observed that the duration of symptoms like cough and fever often extended beyond the typical time frame expected for pneumonia. This study highlighted the median duration of symptoms before resolution to be 29 days.

According to a study by Jayaprakash et al [9]it was found that majority of the patients

that is 70% presented with symptoms extending beyond 4 weeks.

Addictions: In our study, 38.8% are smoker and 18.4% are alcoholic and 12.2% patients are both smoker and alcoholic.

In a study by Jain, et al [14],38.4% of patients gave a history of smoking which strongly correlates to our study.

Comorbidities: The prevalence of comorbidities in our study is 57.1%, while 42.9% patients do not have any comorbidities. 28.6% patients have diabetes mellitus, 16.3% patients have systemic hypertension, 10.2% patients had hypothyroidism and 28.6% patients have COPD. Our study also depicted the presence of multiple comorbidities among 9 patients. It was found that 3 (33.3%) patients presented with both Diabetes and Hypertension, 2 (22.2%) patients presented with Diabetes, Hypertension and COPD, 2 (22.2%) patients presented with Diabetes, Hypertension and Hypothyroidism, 1 (11.1%) patient presented with Diabetes and Hypothyroidism and 1(11.1%) patient presented with Hypothyroidism and COPD.

In a study by B. Jayaprakash et al [9]Diabetes mellitus was the most common comorbidity with an incidence of 45.7%, followed by COPD in 35.7%, hypertension in 21.4% and CAD in 18.6% of patients. A study by Shorr AF et al [15]found that comorbidities such as diabetes mellitus, cardiac disease and chronic lung disease were common in HCAP patients and contributed to poorer outcomes. The results obtained from this study suggested that 30% of the subjects had heart disease (including systemic hypertension), 25% had diabetes, 30% had COPD, which is almost similar to the findings in our study.

In a study by Kaplan et al [16]on pneumonia with particular emphasis on elderly it was found that about 22% of the enrolled patients has 2

comorbidities and about 8.5% of the patients has more than 3 comorbidities. It also laid importance on the poor prognosis due to presence of multiple comorbidities.

Previous History of Respiratory Illness: Among the 49 patients in our study, 16.3% subjects has a past history of respiratory illness. In a study by Torres et al [17]. Past history of respiratory illness was associated with increased risk of pneumonia. Patients who already had chronic respiratory diseases such as COPD, or asthma, had two to four times increased incidence of pneumonia.

Role of Chest X-ray: Among 49 patients in our study, Chest x ray findings are suggestive of inhomogeneous opacities in 40 (81.7%) patients, cavitary lesions in 5 (10.2%) patients, consolidation with air bronchogram in 3 (6.1%) patients and reticular opacities in 1 (2%) patients.

In a study by Jain et al [14]the most common chest x ray finding was Consolidation seen in 60%, consolidation along with cavity in.7%, cavity with air fluid level in 6.15% Although chest x ray is one of the initial radiological diagnostic modalities, it is highly nonspecific in most cases and requires expertise in interpretation. However it is helpful in disease identification, monitoring and follow up of cases of non-resolving pneumonia.

Role of Computed Tomography of Thorax: Among the 49 cases, consolidation is the commonest finding observed in 20 (40.8%) subjects. Other findings of CT thorax are as follows: lung abscess in 2 (4.1%) patients, bronchiectasis in 3(6.1%) patients, cavitary lesions in 4 (8.2%) patients, , pleural effusion in 1 (2%) patient, ground glass opacities (GGO) in 1 (2%) patient, mass lesion in 14 (28.6%) patients, nodules in 3 (6.1%) patients and PMF in 1 (2%) patient.

According to a study by Tanaka N et al [18]HRCT findings were suggestive of air space consolidation was found in 72.2%, centrilobular nodules in 64.3% and ground-glass opacities in 57.1% patients. In another study by Choudhury et al [10], similar to our study the most common finding in CT thorax was consolidation seen in 85% of patients while the remaining 15% of patients presented with cavity and consolidation.

CT thorax is undoubtedly a more sensitive and specific modality of radiological diagnosis. It helps in ruling out other causes which may present as non-specific infiltrates in chest x ray as seen in our study as well as correlated in the literatures mentioned above.

Role of Sputum Analysis In Non-Resolving Pneumonia: Among the 49 patients enrolled in the present study, sputum acid fast bacilli was seen in 1 patient and sputum CBNAAT is positive in 1 (2%)

patient. Seventy one percentage of patients did not have any growth in the sputum culture, 16.4% had growth of non-pathogenic organism, 6.1% had growth of pseudomonas aeruginosa, 4% had growth of klebsiella pneumoniae and 2% patient had growth of gram negative bacilli, which was not identified.

In a study by Ewig S et al [19]only 36% (42 patients) produced sputum. Among the 42 patients, 23 samples were considered to be microscopically valid. Gram stain was positive in 5 patients and negative in 1 sample. Mycobacterial tuberculosis was not identified in this study.

The quality of sputum is an important parameter for determining the yield of an organism. In our study most patients had poor sputum sample hence the diagnostic yield was low. Therefore, bronchoalveolar lavage was performed in the remaining 48 patients.

Role of Bronchoalveolar Lavage in Diagnosis of Non Resolving Pneumonia: Bronchoalveolar Lavage is done in the remaining 48 patients who presented with non-productive cough and whose sputum samples were unsatisfactory.

It is found that 10 (20%) patients had a positive AFB staining in BAL fluid and 12 (24.5%) patients had CNBAAT positivity in BAL fluid analysis. Among the 12 patients, who are CBNAAT positive, 8 (66.8%) patients are sensitive, 2 (16.6%) are resistant and 2 (16.6%) patients have intermediate sensitivity to rifampicin.

Hence BAL fluid analysis also helps in identifying patients with TB including MDR. Lavage for culture and sensitivity is also performed in the 48 patients. It is found that 30 (61.3%) patients did not show any growth in the BAL fluid, 8 (16.3%) have growth of non-pathogenic organism, 5 (10.2%) have growth of pseudomonas aeruginosa, 4 (8.2%) have growth of Klebsiella pneumoniae, 1 (2%) have growth of Escherichia coli. BAL fluid culture is not done in 1 (2%) patient. Among 49 patients, BAL cytology is positive for malignancy in 1 (2%) patient, negative in 45 (91.8%) patients, inconclusive in 1 (2%) patient and not done in 2 (4.2%) patients.

According to a study by Chaudhuri, et al [10]bronchoscopy and lavage was found to be positive in 85.7%% of patients and inconclusive in 14.3%. Bronchoscopic findings were as follows pneumonia of bacterial origin in 53.3%, Bronchogenic carcinoma 26.67%, Tuberculosis in 16.67% and Wegener's granulomatosis in 1.67%. out of the 56 patients that underwent bronchoscopy, gram-negative bacilli was the most common organisms seen in 30 out of 32 cases of bacterial pneumonia (93.75%); S. aureus accounted for 2 cases that is 6.25%. Klebsiella (13 patients) and

Pseudomonas aeruginosa (11 patients) were the most common among gram-negative organisms. E. coli and Acinetobacter were isolated among 3 cases.

According to a study by Jain et al [14] it was found that bronchoscopy and lavage was useful in identify the etiological agents. BAL AFB was positive in 8 patients and BAL AFB culture in 5 patients. Other findings identified were as follows Pneumococcus in 25%, Pseudomonas in 16.6%, Klebsiella in 16.6%, Legionella in 16.6%, Acinetobacter in 8.3%, and Staphylococcus in 8.3% and Candida in 4.1%.

Hence it can be concluded that Bronchoalveolar lavage is more sensitive then sputum analysis to identify aetiologic agent as seen from our study and related literatures depicted above. It is more advantageous in cases with non-productive or poor quality of sputum production.

Role of Endo Bronchial Biopsy and Trans Bronchial Needle Aspiration in Diagnosing Non Resolving Pneumonia: In our study, TBNA was performed in 3 patients, diagnosing malignancy in 2 and granuloma in 1. Endobronchial biopsy was done in 9 patients, of which 8 were diagnosed with NSCLC. Similar findings were reported by Chaudhuri et al.[10], where 26.7% of cases were bronchogenic carcinoma, with squamous cell carcinoma more often detected by endobronchial biopsy and adenocarcinoma by CT-guided biopsy. Jain et al.[14] also demonstrated the diagnostic value of endobronchial and transbronchial biopsies, identifying squamous cell carcinoma, adenocarcinoma, small cell carcinoma, and pulmonary tuberculosis.

Role of Computed Tomography of Thorax and Ct Guided Biopsy: CT is one of the most useful diagnostic tools employed in this study. Consolidation is the most common CT finding seen in 40.8% of patients in this study. Other The findings includes: abscess in 4.1% patients, bronchiectasis in 6.1% patients, cavitary lesions in 8.2% patients, pleural effusion in 2% patients, ground glass opacities (GGO) in 2% patients, mass lesion in 28.6% patients, multiple nodules in 6.1% patients, and PMF in 2% patients. CT also aids in guided biopsy of 9 patients. Six (67%) patients have a histopathological diagnosis of NSCLC, 1(11%) patients is diagnosed to be organizing pneumonia, 1(11%) patient as non caseating granuloma and 1(11%) patient have inflammation as findings.

In a study by Chaudhuri et al [10] out of the 10 cases diagnosed with squamous cell carcinoma, only 3 cases were diagnosed with CT guided biopsy. While all the 5 cases of Adenocarcinoma

were diagnosed by CT guided biopsy on account of being peripheral in location.

According to a study by Jain et al [14] out of the 15 cases of Bronchogenic carcinoma, CT guided biopsy findings were as follows- 3 cases were diagnosed with Squamous cell carcinoma, 3 cases as Adenocarcinoma, 1 case as Large Cell Lung Cancer and 4 cases were identified with pulmonary TB

Hence it can be concluded that Computed tomography of Thorax is one of the most useful diagnostic modalities as depicted by our study as well as by similar literatures as mentioned above. CT also aided in guided biopsy of the leisons and thereby in proper diagnosis.

Additional Investigations: Additional investigations in our study includes Bronchoalveolar lavage or serum for galactomannan which is positive in 4 (8.1%) patients, ANCA profile is positive in 2 (4.1%) patients and Hypersensitivity pneumonitis panel is positive in 1 patient (2%).

In a study by Jose Wellington Alves Dos Santos et al [11] out of the total 180 cases, 8 patients had non-infectious aetiologies. Among these 8 patients, 1 patient was diagnosed with Hypersensitivity pneumonitis, Wegener's Granulomatosis and acute leukaemia each. In a study by Jain et al [14]the incidence of Wegener's granulomatosis was found to be 1.5% patients. All these studies depicts the importance of additional investigations in patients who do not respond to standard antimicrobial therapy as shown in our study.

Final Diagnosis: In this study, among 49 patients, majority of patients (32.7%) patients were diagnosed to have non-small cell lung cancer (NSCLC), 22.4% patients had pulmonary tuberculosis, 8.2% patients had bacterial pneumonia, 8.2% patients had aspergilloma, 6.1% patients had bronchiectasis, 4.1% patients had organizing pneumonia, 4.1% patients had lung abscess, 4.1% patients had vasculitis, 2% patients had Progressive Massive fibrosis, 2% patients had hypersensitivity pneumonitis and 2% patients had pleural effusion. Out of 11 cases of pulmonary tuberculosis, 9 cases were sensitive to first line anti tubercular drugs, whereas, 2 patients had multidrug resistant tuberculosis. However, in 2 patients no cause could be identified and they responded after a course of injectable antibiotics at hospital.

In a study by Chaudhuri et al [10] the final diagnosis obtained were as follows: bacterial pneumonia in 53.33% patients, bronchogenic carcinoma in 26.67% cases, and tuberculosis in 16.67% cases, Wegener's granulomatosis in 1.67% patients, and undiagnosed in 1.67% patients.

In another study by Jain et al. [14] the final aetiologies identified were bacterial pneumonia in 37% patients, pulmonary tuberculosis in 29.2% patients, bronchogenic carcinoma in 23% patients, endobronchial impacted foreign body in 3% patients, segmental bronchus stenosis in 1.5% patients, endobronchial clots of blood in 1.5% patients, granulomatosis with polyangiitis in 1.5% patients. However in 3% of patients the cause remained undiagnosed.

In our study it was seen that the majority of the patients were finally diagnosed with lung cancer. In the past few years, incidences of cancer in the North Eastern part of the country has been found to be highest [20]. The primary risk factor identified was Tobacco. IARC also established a causal association between exposure to second-hand smoke and lung cancer risk.

As the patient profile of 'Gauhati Medical College and Hospital' comprises that of the entire North Eastern region, this disparity in the final diagnosis was hence seen. Other causes like pulmonary tuberculosis and bacterial pneumonia and the non-infectious rare causes like organising pneumonia and vasculitis showed similar incidences with literature as discussed above.

Summary

The sample size of our study was 49. Our study showed a slight male preponderance with male to female ratio being 1.2:1. The study population belonged to the age group of 19 to 90 years and mean age was 47.83 years +/- 14.11 years. Majority of the cases 14(28.6%) belonged to the age group of 40- 49 years followed by 13 (26.5%) in the age group of 50-59 years. All the cases (100%) presented with cough which was the main presenting symptom which was followed by shortness of breath in 41 (83.7%) patients, fever in 27 patients (55.1%), haemoptysis in 26 patients (53.1%) and chest pain in 11 patients (22.4%). The symptom duration in our study ranged from 1-5 months with median +/- SD duration being 2 months +/- 1.11 days. Nineteen cases (38.8%) were smoker, 9 (18.4%) were alcoholic and 6 (12.25%) cases were both smoker and alcoholic. In our study 28 (57.1%) presented with co morbidities with diabetes mellitus 14 (28.6%) and COPD 14 (28.6%) being the most common co morbidities. Multiple comorbidities was seen in 9 patients. Eight (16.3%) cases presented with past history of respiratory illness.

Chest X ray findings included inhomogeneous opacities in majority that is 40 (81.7%) of patients followed by cavitary lesions in 5 (10.2%), consolidation with air bronchogram in 3 (6.1%) and reticular opacities in 1 (2%) patients.

CT thorax was suggestive of consolidation in majority that is 20 (40.8%) cases, followed by mass lesion in 14 (28.6%) cases, cavitary lesions in 4 (8.2%) cases, bronchiectasis and multiple nodules in 3(6.1%) cases each, lung abscess in 2 (4.1%) cases, pleural effusion in 1 (2%) case, ground glass opacities (GGO) in 1 (2%) case and PMF in 1 (2%) case. Sputum for acid fast bacilli was positive in 1(2%) case and sputum CBNAAT was positive in 1 (2%) case.

Sputum culture and sensitivity showed that 8 (16.4%) cases had growth of non-pathogenic organism, 3 (6.1%) had growth of pseudomonas aeruginosa, 2 (4%) had growth of klebsiella pneumoniae and 1 (2%) patient had growth of gram negative bacilli, which was not identified. However it did not show any growth in 35 (71.5%) cases in our study. Bronchoalveolar Lavage was performed in 48 cases. Among them 10 (20%) cases were positive for AFB and 12 (24.5%) cases showed CNBAAT positivity. Among the 12 cases with CBNAAT positivity, 8 (66.8%) cases were sensitive, 2 (16.6%) were resistant and 2 (16.6%) patients had indeterminate sensitivity to rifampicin. TBNA was done in 3 (6.1%) cases among which 2 (66.7%) cases had malignant cells positive and 1 (33.3%) case showed epithelioid granuloma in the aspirate.

Endobronchial biopsy was performed in 9 (18.4%) cases, among which in 8 (89%) cases histopathological examination was suggestive of NSCLC. CT guided biopsy was performed in 9 cases among which 6 (67%) cases were diagnosed with NSCLC, 1(11%) with organizing pneumonia, 1 (11%) with non-caseating granulomas and 1 (11%) was suggestive of inflammation. The final diagnosis was suggestive that majority 16 (32.7%) were diagnosed with non-small cell lung cancer (NSCLC), 11 (22.4%) cases with pulmonary tuberculosis, 4 (8.2%) cases with bacterial pneumonia, 4 (8.2%) cases with aspergilloma, 3 (6.1%) cases with bronchiectasis, 2 (4.1%) cases with organizing pneumonia, 2 (4.1%) cases with lung abscess, 2 (4.1%) cases with vasculitis, 1 (2%) case with Progressive Massive Fibrosis, 1 (2%) cases with hypersensitivity pneumonitis and 1 (2%) case with pleural effusion.

Conclusion

In conclusion, our study provides a comprehensive analysis of the clinical, etiological and radiological profile of patients with non-resolving pneumonia, based on the data collected from 49 patients from the Department of Pulmonary Medicine, Gauhati Medical College and Hospital. The findings underscore the diverse range of aetiologies associated with non-resolving pneumonia, with non-small cell lung cancer (NSCLC) and pulmonary tuberculosis emerging as the most common diagnoses as depicted from our study. Our study also highlights the importance of thorough diagnostic evaluation, including imaging, Bronchoscopy, microbiological and serological testing, to accurately identify the underlying causes of non-resolving pneumonia. Our study also emphasised the importance of non-infectious causes of slow or non-resolution of radiological infiltrates such as Vasculitis, organising pneumonia, Hypersensitivity pneumonitis and Progressive Massive Fibrosis. These results can help guide clinicians in tailoring management strategies for slowly resolving or non-resolving pneumonia, thereby improving patient outcomes.

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