

## Research Article

# A Study of Community-Acquired Pneumonias in Elderly Individuals in Bijapur, India

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Community-acquired pneumonia (CAP) in elderly has different clinical presentation and higher mortality than CAP in other age group. Clinical presentation may vary from mere presence of fever to altered sensorium. The incomplete clinical picture of CAP in the elderly may be associated with a delay in establishing the diagnosis and, consequently, in starting adequate antibiotic therapy. Delay in diagnosis and treatment may contribute to the higher observed death rate in the elderly population with CAP. Hence the following study was undertaken to study the clinical, radiological, and bacteriological profile of community-acquired pneumonia in elderly. A total of 50 patients were studied. Age group varied from 66 years to 88 years. Presentation varied from typical symptoms to altered sensorium. Smoking and COPD were most common predisposing conditions. Most common organisms responsible were *Streptococcus pneumoniae*, *Klebsiella pneumoniae*, *Pseudomonas*, *H. influenzae*, and *Staphylococcus aureus*. Etiological agents could not be identified in many cases because of difficulty in collecting sputum in elderly patients, lower yield of culture, and various atypical and difficult to isolate causative organisms. Hence there is need for an empirical therapy covering both typical and atypical organisms. Better understanding of these aspects may help a long way in managing elderly patients with pneumonia.

## 1. Introduction

Pneumonia “the captain of men of death,” “The friend of the aged, allowing them a merciful relief from those cold gradations of decay, that make the last state of all so distressing” as described by William Osler, is one of the most common infectious disease encountered in the clinical practice [1].

Pneumonia is the sixth leading cause of death in the United States [2]. About 600,000 persons with pneumonia are hospitalized each year, and there are 64 million days of restricted activity due to this illness [3]. The reported incidence rates of radiologically confirmed community acquired pneumonia in different populations varied between 1.3 and 11.6 cases per 1000 inhabitant-year with highest rates in elderly adults that is 13–15 cases per 1000 inhabitant-year. In developed countries almost one half of total hospitalization

for pneumonia occur in patients over 65 years, and pneumonia is a leading cause of death in this age group [4].

Managing pneumonia in an elderly patient requires an appreciation of many aspects of geriatric medicine, including the demographics of our aging population [5]. The effect of pneumonia on the general health of an elderly person, and knowledge of how pneumonia in this population is different than in younger populations. As stated by Sir William Osler, “In old age, pneumonia may be latent, coming on without chill, the cough and expectoration are slight, the physical signs ill defined and changeable, and the constitutional symptoms out of all proportion.”

Most patients who require hospitalization for the treatment of community-acquired pneumonia (CAP) are elderly. The elderly have impaired function of many organs by virtue of the aging process and as a result of comorbidity [6]. There

are structural and functional alterations in old age which impair the host's defense against pulmonary infection [7, 8].

Elderly patients hospitalized because of CAP constitute a special population and since they commonly have underlying illnesses, prior neurologic disturbances, nutritional and immunologic deficits. CAP in this population has peculiar clinical characteristics. For instance, not all the signs and symptoms of pneumonia are present in all cases. The clinical presentation may consist only of an alteration of the patient's general condition, confusion, or decompensation of underlying disease. The incomplete clinical picture of CAP in the elderly may be associated with a delay in establishing the diagnosis and, consequently, in starting adequate antibiotic therapy. Delay in diagnosis and treatment may contribute to the higher observed death rate in the elderly population with CAP [9, 10]. Hence the following study was undertaken to study the clinical, radiological, and bacteriological profile of community-acquired pneumonia in elderly.

## 2. Material and Methods

The present study was conducted at Al-Ameen Medical College hospital and District hospital, Bijapur (affiliated to Al-Ameen Medical College) between December 2008 and June 2010. This study is a prospective study carried out on 50 cases of community-acquired pneumonia of patients aged >65 years. Prior to the study, the protocol was approved by the institutional ethical committee, and all patients gave their informed consent to participate.

**2.1. Inclusion Criteria.** They are following: (a) age >65 years, (b) clinical symptoms like fever, cough with or without expectoration, pleuritic chest pain, dyspnea, and altered sensorium and (c) clinical signs like tachypnea, reduced chest movements, dull percussion note, bronchial breath sounds, increased vocal fremitus, and vocal resonance and crepitations. (d) Radiological evidence of pneumonia without any clinical evidence of pneumonia will also be included.

**2.2. Exclusion Criteria.** (a) Hospital acquired pneumonia that is patient hospitalized in the previous 14 days. (b) HIV-positive status. (c) Tuberculosis. (d) Lung malignancies.

Patient demographic features were recorded according to a standard questionnaire. A detailed clinical history was taken. History for comorbid illness and habits like smoking and alcoholism were taken. Comorbid illnesses were defined as the presence of coexisting cardiac failure, ischemic heart disease, chronic lung disease (copd), chronic liver disease (cirrhosis of liver), chronic kidney disease (diabetic nephropathy), malignancies (multiple myeloma), neurological diseases (old h/o strokes) and diabetes mellitus. A detailed clinical examination was carried out including general physical examination, vital signs, and respiratory system examination, mainly for signs of consolidation and other systemic examination for the comorbid illness. Routine investigations like hemoglobin, total leucocytes count, differential count, ESR, random blood sugar, blood urea, serum creatinine, liver function tests, and serum electrolytes

TABLE 1: Age and sex distribution.

Age in years	No. of patients	Percentage
65–74	32	64%
75–84	14	28%
≥85	4	8%
Sex	No. of patients	Percentage
Male	35	70%
Female	15	30%

were sent. Radiological evaluation was done. Sputum was collected for gram stain and culture and sensitivity, before starting empirical antibiotic therapy. Antibiotic was subsequently changed if necessary based on clinical response and culture and sensitivity reports.

**2.3. Statistical Analysis.** The data was analyzed by Mean  $\pm$  SD (standard deviation), percentage, and Chi-square test ( $P$  value <0.05 was considered significant).

## 3. Results

The present study was conducted at Al-Ameen Medical College hospital and District hospital, Bijapur (affiliated to Al-Ameen Medical College) between December 2008 and June 2010. This study is a prospective study carried out on 50 cases of hospitalized community-acquired pneumonia patients aged >65 years. A detailed history was taken, clinical parameters on admission were noted, routine investigations, chest X-ray, and sputum examination were carried out on all patients. The results and observations of the study are as follows.

**3.1. Age Distribution.** In this study the age group of patients varied from 66 to 88 years. Mean age was  $72.22 \pm 6.14$  years. Majority of patients were in the age group 65–74 years. The detailed age distribution is shown in Table 1.

**3.2. Sex Distribution.** Out of 50 patients, 35 (70%) were males, and 15 (30%) were females. The detail of sex distribution is shown in Table 1.

**3.3. Predisposing Conditions.** Among the predisposing conditions, COPD was the most common, noted in 24 (48%) patient. Other predisposing conditions noted were diabetes mellitus in 14 (28%) patients, congestive cardiac failure in 8 (16%), neurologic diseases in 4 (8%) patients, renal diseases in 3 (6%) patients, chronic liver disease in 2 (4%) patients, and malignancy in 1 (2%) patients. Among habits, smoking was most common noted in 32 (74%) patients followed by alcoholism in 8 (16%) patients. This is depicted in Table 2.

**3.4. Symptomatology.** In this study patients presented with both typical and atypical symptoms. Among the typical respiratory symptoms, cough was present in 37 (74%) patients, expectoration in 32 (64%) patients, 23 had mucopurulent sputum, and 9 patients had mucoid sputum, fever in 28

TABLE 2: Predisposing conditions.

Predisposing conditions	No. of patients	Percentage
Smoking	32	74%
Alcoholism	8	6%
COPD	24	48%
Diabetes mellitus	14	24%
Congestive cardiac failure	8	16%
Neurologic diseases	4	8%
Renal diseases	3	6%
Chronic liver diseases	2	4%
Malignancy	1	2%

TABLE 3: Table showing symptomatology.

Presenting symptoms	No. of patients	Percentage
Cough	37	74%
Expectoration	32	64%
Fever	28	56%
Dyspnea	11	22%
Pleuritic chest pain	10	20%
Altered sensorium	8	16%
Gastrointestinal symptoms	4	8%

TABLE 4: General physical examination.

Signs	No. of patients	Percentage
Pallor	13	26%
Icterus	6	12%
Cyanosis	4	8%
Clubbing	2	4%
Pedal oedema	4	8%

(56%) patients, dyspnea in 11 (22%), and pleuritic chest pain in 10 (20%) patients. Among the atypical symptoms altered sensorium was present in 8 (16%) patients and gastrointestinal symptoms of anorexia, nausea, vomiting, or diarrhea in 4 (8%) patients. The details of symptomatology is shown in Table 3.

**3.5. Findings on General Physical Examination.** General physical examination of the patient showed pallor in 13 (26%) patients, icterus in 6 (12%) patients, cyanosis in 4 (8%) patients, clubbing in 2 (4%) and pedal oedema in 4 (8%) patients. This is shown in Table 4.

**3.6. Vital Signs.** In this study, raised temperature  $>38^{\circ}\text{C}$  was noted in 34 (68%) patients, in 18 patients it was  $38.9\text{c}$ – $39.9\text{c}$ , and 14 patients had  $39.9\text{c}$ – $40\text{c}$ , tachypnea defined by respiratory rate  $>24/\text{min}$  was noted in 42 (84%) patients (25 had respiratory rate of  $24$ – $26/\text{min}$  and 17 patients had respiratory rate of  $27$ – $30/\text{min}$ ), tachycardia defined as pulse rate  $>100/\text{min}$  was noted in 35 (70%) patients (28 patients had pulse rate in range of  $100$ – $120/\text{min}$  and 7 patients

TABLE 5: Vital signs.

Vital signs	Present study	Percentage
Temperature $>38\text{c}$	34	68%
Tachypnea $>24/\text{min}$	42	84%
Tachycardia $>100/\text{min}$	35	70%
Hypotension $<90\text{ mmHg}$	8	16%
Temperature $<35\text{c}$	1	2%

TABLE 6: Respiratory system examination findings.

Clinical signs	No. of patients	Percentage
Reduced chest movements	10	20%
Impaired note	14	28%
Bronchial breathing	12	24%
Increased VF and VR	10	20%
Crepitations	47	94%
Pleural rub	12	24%

had pulse rate of  $120$ – $130/\text{min}$ ), hypotension defined as systolic blood pressure  $<90\text{ mmHg}$  was noted in 8 (16%) patients (6 patients had SBP of  $60$ – $80\text{ mmHg}$  and SBP was not recordable in 2 patients) and hypothermia defined as temperature  $<35^{\circ}\text{C}$  was noted in 1 (2%) patients (34.6c). This is shown in Table 5.

**3.7. Findings on Respiratory System Examination.** In this study, crepitation was the most common respiratory system examination findings, which was noted in 47 (94%) patients. Other findings were reduced chest movements, impaired note on percussion, bronchial breathing, increased vocal fremitus and vocal resonance, and pleural rub. The details of these are shown in Table 6.

**3.8. Laboratory Characteristics.** Leucocytosis defined as total leucocyte count  $>11,000/\text{cum}$  was the most common, noted in 42 (84%) patients. Leucopenia defined as total leucocyte count  $<4,000/\text{cum}$  was noted in 4 (8%) patients. Anemia defined as Hb  $<11\text{ gm/dL}$  was noted in 16 (32%) patients. ESR  $>20\text{ mm}$  at 1 hour was noted in 38 (76%) patients. Blood urea  $>40\text{ mg/dL}$  was noted in 20 (40%) patients. Serum creatinine  $>1.4\text{ mg/dL}$  was noted in 8 (16%) patients. Raised serum bilirubin greater  $>1.2\text{ mg/dL}$  was noted in 6 (12%), and raised liver enzymes were noted in 8 (16%) patients. Hypoalbuminemia defined as serum albumin  $<3.5\text{ mg/dL}$  was noted in 14 (28%), patients. Hyponatremia defined by serum sodium  $<130\text{ meq/L}$  was noted in 14 (28%) and hypokalemia was noted in 2 (4%) patients. Details of these are shown in Table 7.

**3.8.1. Results of Sputum Gram Staining.** Adequate sputum sample showing bacteriological positivity could be obtained in only 26 (54%) patients. Of these, 16 (32%) were gram-positive cocci, 6 (12%) were gram-negative bacilli, and 4 (8%) were mixed. Details are shown in Table 8.

TABLE 7: Laboratory parameters.

Laboratory parameters	No. of patients	Percentage
Anemia <11 g/dL (13–15 g/dL)	16	32%
Leucocytosis >11,000/cumm (5000–10,000/cumm)	42	84%
Leucopenia <4,000/cumm	4	8%
Raised ESR >20 mm at 1 hr		
Age     20   55   90		
Men     12   14   19	38	76%
Women  18   21   23		
High RBS >200 mg/dL (90–130 mg/dL)	8	16%
Raised urea >40 mg/dL (20–40 mg/dL)	20	40%
Serum creatinine >1.4 mg/dL (0.6–1.5 mg/dL)	8	16%
Raised bilirubin >1.2 mg/dL (0.2–1 mg/dL)	6	12%
Raised liver enzymes		
SGPT-9-40 IU/L	8	16%
SGOT-10-35 IU/L		
Hypoalbuminemia (3.5–5.3 g/L)	14	28%
Hyponatremia (135–145 mEq/L)	8	16%
Hypokalemia (3.5–5.0 mEq/L)	2	4%

TABLE 8: Sputum gram staining.

Gram staining	No. of patients	Percentage
Gram-positive cocci	16	32%
Gram-negative bacilli	6	12%
Mixed	4	8%
Undetermined	24	48%

TABLE 9: Showing bacteria isolated on culture.

Bacteria isolated	No. of patients	Percentage
<i>Streptococcus pneumonia</i>	8	16%
<i>Klebsiella pneumonia</i>	3	6%
<i>Pseudomonas</i>	2	4%
<i>Hemophilus influenza</i>	2	4%
<i>Staphylococcus aureus</i>	1	2%
<i>Escherasia coli</i>	1	2%

TABLE 10: Radiological findings.

Radiological finding	No. of patients	Percentage
Lobar pneumonia	39	78%
Bronchopneumonia	9	18%
Interstitial pneumonia	2	4%
Pleural effusion	6	12%
Cavitation	2	4%

3.8.2. *Results of Sputum Culture.* In this study positive sputum culture was obtained in only 18 patients (32%). *Streptococcus pneumonia* was the most common organism isolated, obtained in 8 (16%) patients, followed by *Klebsiella*

*pneumonia* in 3 (6%) patients, *Pseudomonas* in 2 (4%), *Hemophilus influenza* in 2 (4%), *Staphylococcus aureus* in 1 (2%), and *E. coli* in 1 (2%) patients. A detail of this is shown in Table 9.

#### 4. Sputum Gram Staining and Culture Demonstrated Correlation in 18 of 26 Patients (with Both Gram Staining and Culture Positivity and 8 Patients Had Sterile Cultures)

4.1. *Radiological Findings.* In this study, lobar pneumonia was the most common radiological finding, which was noted in 39 (78%) patients of which 26 patients had mid to lower zone consolidation, 8 patients had whole lung consolidation, 2 patients had upper zone consolidation and 3 had bilateral pneumonia. Out of 39 patients with lobar pneumonia the distribution was 24 to the right lung, 12 to left lung and 3 bilateral. Bronchopneumonia was noted in 9 (18%) patients and interstitial pneumonia in 2 (4%) patients, pleural effusion in 6 (12%) patients and cavitation in 2 (4%) patients. This is shown in Table 10.

4.2. *Complications.* The most common complication noted was septic shock in 8 (16%) patients, followed by pleural effusion in 6 (12%) patients. The other complications noted were congestive cardiac failure, ARDS, lung abscess, and emphysema. Details of this are shown in Table 11.

4.3. *Mortality.* In this study, out of 50 patients, 42 (84%) patients improved and 8 (16%) patients had mortality. This is shown in Table 12.

TABLE 11: Complications.

Complications	No. of patients	Percentage
Septic shock	8	16%
Pleural effusion	6	12%
CCF	4	8%
ARDS	2	4%
Lung abscess	2	4%
Emphyema	2	4%

TABLE 12: Mortality.

Outcome	No. of patients	Percentage
Improved	42	84%
Died	8	16%

## 5. Analysis of Prognostic Factors of Community Acquired Pneumonia in Elderly

Analysis of clinical characters shows that age distribution above 65 years had no association with mortality. Among the clinical presentation altered sensorium had statistically highly significant association with increased mortality. Presence of associated diseases had statistically significant association with mortality. This is shown in Table 13.

Analysis of vital signs shows statistically significant association of temperature  $>38^{\circ}\text{C}$  and  $<35^{\circ}\text{C}$ , pulse rate  $>100/\text{min}$ , and systolic blood pressure  $<90\text{ mmHg}$  with mortality. This is shown in Table 14.

Analysis of laboratory parameters shows statistically significant association of total leucocyte count  $>11,000$  and  $<4000$  cells/cumm, raised urea and hyponatremia with mortality, whereas raised serum creatinine, and hypoalbuminemia did not show significant association. This is shown in Table 15.

Analysis of complications shows highly significant association of ARDS and septic shock with mortality. This is shown in Table 16.

## 6. Discussion

Community-acquired pneumonia (CAP) is a frequent cause of hospital admission and mortality in elderly patients worldwide. The clinical presentation, etiology, and outcome of community-acquired pneumonia in elderly differs from that of other population. In the present study, 50 patients of community-acquired pneumonia  $>65$  years of age were included. The results of study which has been presented in previously are discussed below.

**6.1. Age.** Pneumonia is common in the extremes of age. In this study, the age group of patients presenting with community-acquired pneumonia ranged from 66 to 88 years. Of these patients 32 (64%) were aged 65–74 years, 14 (28%) were aged 75–84 years, and 4 (8%) were aged  $\geq 85$  years. In a study conducted by Riquelme et al. 14,069 Medicare patients age  $>65$  years who required hospitalization for CAP were

studied. They noted that 30.3% were aged 65–74 years, 41.8% were aged 75–84 years, and 27.8% were aged  $>85$  years [11].

In another study by Torres et al., the mean age of elderly patients presenting with community-acquired pneumonia was  $78 \pm 8$  yr (mean  $\pm$  SD) [12]. These differences may be due to differences in the rate of hospitalization and access to health care of the elderly in the different populations studied.

The increased incidence of pneumonia in elderly patients is due to the defects in mechanical clearance of airways, loss of elastic recoil of lungs, decreased strength of respiratory muscle causing decreased effectiveness of coughing, age-related decline in mucociliary clearance, defects in humoral and cell-mediated immunity, and cumulative effects of comorbid chronic diseases and their treatments.

**6.2. Sex Distribution.** In this study males 35 (70%) were affected more than females 15 (30%). This sex distribution is similar to study conducted by Riquemele et al. where 67% were males and 33% were females, and this may be attributed to increased rates of alcoholism and smoking in males and also due to the increased association of comorbid conditions like COPD, congestive cardiac failure and others in males. This is shown in Table 17.

**6.3. Predisposing Conditions.** The presence of chronic comorbidity in most of the CAP patients in our study is compatible with the contention that an important risk factor for pneumonia in elderly people is the prevalence of other illnesses [13]. This is shown in Table 18.

Kobashi et al. studied 83 patients with elderly pneumonia, and thirty-eight patients (45%) had a history of respiratory disease, with chronic obstructive pulmonary disease (COPD) being most common (16 cases). Sixty-two patients (74%) had a history of nonrespiratory disease, most commonly cerebrovascular disease (16 patients). Fifty patients were current smoker (60%), and 15 drank alcohol (16%) regularly [14].

Smoking was the most important risk factor (72%) in our study. The increased risk of pneumonia in smokers is due to alteration in respiratory flora, mechanical clearance, and cellular defenses. Bacterial colonization of lower respiratory tract is more prevalent in smokers than nonsmokers, mucociliary clearance is defective in smokers, owing to a reduction in ciliary beat frequency and changes in volume and viscoelastic properties of respiratory secretions. In a population-based case-control study, Nuorti et al. found that cigarette smoking was the strongest independent risk factor for invasive pneumococcal disease [15].

Alcoholism is also a risk factor as it interferes with various respiratory tract defenses such as alterations in normal flora, increased risk of aspiration, impaired mechanical clearance and deficient humoral and cellular immunity.

In our study COPD was most common associated comorbid condition (48%). Increased incidence and mortality of pneumonia have been described in COPD patients. This is explained due to defective mucociliary clearance, mucous plugging, airway collapse, respiratory muscle fatigue, and the effect of medications used [16].

TABLE 13: Association of clinical characteristics with mortality.

Variables	Survivors ( <i>n</i> = 42)	Nonsurvivors ( <i>n</i> = 8)	Total ( <i>n</i> = 50)	$X^2$	<i>P</i> value	Inference*
Age in yrs						
65–75	28	4	32	3.763	>0.05	NA
75–85	12	2	14			
>85	2	2	4			
Fever	27	6	33	0.344	0.558	NA
Cough	33	4	37	2.851	0.091	NA
Expectoration	24	4	28	0.139	0.709	NA
Dyspnea	9	2	11	0.05	0.823	NA
Pleuritic chest pain	10	0	10	2.024	0.154	NA
Altered sensorium	6	6	12	13.581	0.000	HA
Gastrointestinal symptoms	3	2	5	2.381	>0.05	NA
Associated diseases	26	7	33	21.176	0.05	A
Smoking	25	7	32	2.283	0.131	NA

\*NA: not associated, A: associated, HA: highly associated.

TABLE 14: Association of vital signs with mortality.

Variables	Survivors ( <i>n</i> = 42)	Nonsurvivors ( <i>n</i> = 8)	Total ( <i>n</i> = 50)	$X^2$	<i>P</i> value	Inference*
Temperature						
35°C	0	1	1	6.725	0.05	A
35–38°C	16	1	17			
>38°C	26	6	32			
Respiratory rate >24/min	32	8	40	2.381	0.123	NA
Pulse rate >100/min	28	8	36	3.704	0.054	A
Systolic blood pressure <90 mmHg	1	7	8	36.226	0.000	HA

\*NA: not associated, A: associated, HA: highly associated.

TABLE 15: Association of laboratory data with mortality.

Variables	Survivors ( <i>n</i> = 42)	Nonsurvivors ( <i>n</i> = 8)	Total ( <i>n</i> = 50)	Chi-square	<i>P</i> value	Inference*
Total leucocyte count						
<4000/cumm	2	3	5	8.162	0.025	HA
4000– 11,000 cumm	5	1	6			
>11,000 cumm	35	4	39			
Blood urea >40 mmHg	27	8	35	4.082	0.043	A
Serum creatinine >1.4 g/dL	22	7	29	3.402	0.065	NA
Hypoalbuminemia	11	3	14	0.426	0.514	NA
Hyponatremia	3	5	8	15.322	0.000	HA

\*NA: not associated, A: associated, HA: highly associated.

TABLE 16: Association of complications with mortality.

Complications	Survivors ( <i>n</i> = 42)	Nonsurvivors ( <i>n</i> = 8)	Total ( <i>n</i> = 50)	Chi-square	<i>P</i> value	Inference*
ARDS	0	2	2			
Septic shock	2	6	8			
CCF	4	0	4	43.8	0.005	Highly significant
Emphyema	2	0	2			
Lung abscess	2	0	2			
Pleural effusion	6	0	6			

TABLE 17: Sex distribution in study conducted by us and Riquemele et al.

Sex	Our study	Riquemele et al.
Male	70%	67%
Female	30%	33%

TABLE 18: Predisposing factors seen in our study and another study conducted by Torres et al. is as follows.

Predisposing conditions	Our study	Torres et al.
Smoking	32 (74%)	62 (62%)
Alcoholism	8 (6%)	22 (22%)
COPD	24 (48%)	30 (30%)
Diabetes mellitus	14 (24%)	1 (17%)
Congestive cardiac failure	8 (16%)	28 (28%)
Neurologic diseases	4 (8%)	5 (5%)
Renal diseases	3 (6%)	4 (4%)
Chronic liver diseases	2 (4%)	4 (4%)
Malignancy	1 (2%)	5 (5%)

6.4. *Presenting Complaints.* Elderly patient may present with typical as well as atypical symptoms. Atypical symptoms are commonly described in elderly than in younger patients. The clinical presentation may consist of only an alteration of the patient's general condition, confusion, or decompensation of underlying disease. Clinical presentation according to our study as well as studies conducted by Torres et al. and Kobashi et al. is shown in Table 19.

In this study patients presented with atypical presentations like altered sensorium, nausea, vomiting, diarrhea, loss of appetite, and breathlessness in addition to typical symptoms of cough, expectoration, fever, and pleuritic chest pain. Cough was the most common respiratory symptom noted in 37 (74%) patients, which was productive in only 29 (58%) patients, due to decreased ability of elderly to bring out the sputum.

Harper and Newton found that the classical constellation of CAP in the elderly of cough, fever, and dyspnea was absent in 56% of patients [17]. Fever was the presenting feature in 32 (64%) patients in our study. The frequency of fever in elderly patients with CAP according to various studies ranges from 33% to 60%.

Altered sensorium was the presenting feature in 8 (16%) of patients in our study. Venkatesan and coworkers [18] and Harper and associates found a prevalence of 47% and 15%, respectively, of mental alteration in elderly patients with CAP at admission. A practical conclusion of clinical interest is that an effort has to be made to take chest radiographs, upon arrival at the hospital, of all elderly patients with delirium.

6.5. *General Physical Examination Findings.* In this study general physical examination of the patient showed pallor in 8 (16%) patients which may be secondary to infection, associated comorbid conditions, and malnutrition. Icterus was observed in 6 (12%) patients. Icterus is commonly described

TABLE 19: Clinical presentation according to our study as well as studies conducted by Torres et al. and Kobashi et al.

Presenting symptoms	Our study	Torres et al.	Kobashi et al.
Cough	37 (74%)	407 (81%)	52 (62%)
Expectoration	32 (64%)	331 (66%)	47 (56%)
Fever	28 (56%)	380 (76%)	47 (56%)
Dyspnea	11 (22%)	351 (70%)	16 (19%)
Pleuritic chest pain	10 (20%)	218 (43%)	12 (14%)
Altered sensorium	8 (16%)	130 (26%)	7 (8%)
Gastrointestinal symptoms	4 (8%)	36 (8%)	7 (8%)

in streptococcal pneumonia infections and also in others as part of multiorgan dysfunction and also due to underlying chronic liver disease in some patients. Central cyanosis observed in 4 (8%) patients. Central cyanosis is explained due to shunting of blood through consolidated lung. Vital signs noted in our study as well as in study conducted by Kobashi et al. is shown in Table 20.

In our study tachypnea was the most common sign 42 (84%) patients, followed by tachycardia 35 (70%) patients. Fever the most frequently noted symptom of infection occurs less frequently in elderly. In our study fever was noted in 34 (68%) of patients. Poor febrile response was correlated to decrease release of IL-1 in elderly patients [19]. Hypothermia is noted in 1 (2%) patient and is associated with poor prognosis. Septic shock secondary to pneumonia is commonly seen in elderly, and this may account for hypotension seen in 8 (16%) of patients.

6.6. *Findings of Respiratory System Examination.* Among the respiratory signs noted in our study crepitations was the most frequent finding noted in most of the patients 47 (94%). In a study by Zalcaín et al., crepitations were the most common respiratory finding noted in 79% of patients [20]. Other characteristics respiratory signs like bronchial breathing, increased vocal fremitus and vocal resonance, and impaired note on percussion were present in less than one third of the patients. This shows the paucity of characteristic clinical signs in elderly patients with pneumonia and the need to diagnose pneumonia in elderly patients with atypical presentations and minimal signs and symptoms.

6.7. *Laboratory Data.* Among the laboratory investigations in our study, leucocytosis was the most consistent finding noted in 42 (84%) patients where as leucopenia was seen in 4 (8%) patient and was associated with poor prognosis. In study by Torres et al., seventy-six (76%) patients had a leukocyte count >10.000/mm<sup>3</sup>. Elevated white blood cell counts in elderly people may be caused by the increased rate of pneumococcal infection in old age.

In our study raised blood urea was noted in 20 (40%) patients. Raised bilirubin in 6 (12%) and raised liver enzymes in 8 (16%) was noted. The hepatic impairment and the impaired renal function were more severe in the elderly age group compared to the younger groups in various studies.

TABLE 20: Vital signs noted in our study as well as in study conducted by Kobashi et al.

Vital signs	Present study	Kobashi et al.
Temperature >38 c	34 (68%)	47 (56%)
Tachypnea >24/min	42 (84%)	59 (70%)
Tachycardia >100/min	35 (70%)	58 (69%)
Hypotension <90 mmHg	8 (16%)	15 (18%)
Temperature <35 c	1 (2%)	1 (1%)

TABLE 21: Radiological findings in our study and study by Torres et al.

Radiological findings	Our study	Torres et al.
Lobar pneumonia	39 (78%)	367 (82%)
Bronchopneumonia	9 (18%)	62 (12%)
Interstitial pneumonia	2 (4%)	18 (4%)
Pleural effusion	6 (12%)	60 (11%)
Cavitation	2 (4%)	9 (2%)

This may suggest a more severe systemic infection in this age group [21].

Hyponatremia was seen in 8 (16%) of patients. Hyponatraemia due to inappropriate antidiuretic hormone (ADH) secretion may occur in any pneumonia and is notably more common in *Legionella* infection.

In our study, serum albumin level was low in 14 (28%) patients. Serum albumin level is commonly cited as a marker of nutritional status, and it has been correlated independently with a higher case-fatality rate among persons with CAP [22]. Although serum albumin level is an indicator of nutritional status, experimental and clinical data indicate that in inflammatory disorders the synthesis of acute-phase proteins occurs at the expense of albumin, and thus a low serum albumin level can be caused by both malnutrition and the acute inflammatory response.

In a study conducted by Kobashi et al., the main laboratory data at admission were as follows: the white blood cell count was above 10,000/cumm in 58%, the ESR was over 20 mm in one hour in 95%, the serum protein was under 6.5 g/dL in 30%, serum albumin was under 3.5 g/dL in 35%, and blood urea nitrogen (BUN) was over 20 mg/dL in 23%.

**6.8. Sputum Microscopy and Culture.** In this study bacteriological positivity on gram staining of sputum was seen in 26 (52%) of patients. Cultures were positive in only 18 (32%) patients. *Streptococcus pneumoniae* was the most common etiological agent isolated, 8 (16%) patients, followed by gram-negative bacilli like *Klebsiella pneumoniae* 3 (6%), *Pseudomonas aeruginosa* 2 (4%), *E. coli* 1 (2%), *Hemophilus influenzae* 2 (4%) and *Staphylococcus aureus* 1 (2%) patient. This is almost similar to study conducted by Torres et al., where Sputum analysis was performed in 403 (80%) cases and of these 186 (46%) were of good quality and 71 (38%) showed positive results, bacteriological diagnosis was achieved in 11 of 30 cases (37%), with 13 microorganisms (five *S. pneumoniae*, two *C. pneumoniae*, one *L. pneumophila*,

one *P. aeruginosa*, one *Klebsiella pneumoniae*, one *Escherichia coli*, one *Staphylococcus aureus*, one *Streptococcus viridians*).

Woodhead et al. reviewed 11 studies that reported on the etiology of pneumonia in the elderly and compared them to 3 studies of pneumonia in younger populations. The proportion of cases due to *H. influenzae*, *S. aureus*, and gram-negative bacilli was higher among the elderly, and the proportion due to *Legionella* and other atypical pathogens was higher among the younger patients [23].

Colonization of the oropharyngeal mucosa with aerobic gram negative Bacilli like *Escherichia coli*, *Klebsiella* species, *Proteus* species, *Enterobacter* species, and *Pseudomonas aeruginosa* increases with increasing age, predisposing to increased incidence of gram-negative bacilli in aged [24].

In various studies in Western counties undertaken to investigate the causes of community-acquired pneumonia in the elderly, the distribution of causative pathogens appeared to differ from that in younger adults, *S. pneumoniae*, was the most common causing about 50% of infections, respiratory viruses, *H. influenzae*, gram-negative bacilli, *C. pneumoniae* and *L. pneumophila* were others commonly noted [25].

The cause of CAP is often difficult to establish. The most effective methods are often invasive and cannot always be justified, and serological diagnosis is too late to be of any therapeutic use. Despite the progress made in the diagnosis of pneumonia, it takes a few days to identify the causative microorganism in the blood or sputum samples, and the etiology of half of all patients with CAP remains uncertain [26]. Physicians need reliable data on the relative prevalence of different etiological agents in the patients' area of residence, in addition to the clinical, laboratory, and radiological findings in order to initiate antibiotic treatment empirically. The relative frequency of etiological agents varies among different geographical areas [27].

**6.9. Radiological Presentation.** The radiological data in our study showed a predominance of lobar pneumonia in 39 (78%) patients followed by bronchopneumonia in 9 (18%) patients. Radiological data of our study compared with that due to Torres et al. is shown in Table 21.

Riquelme et al. found the chest-radiographic infiltrate pattern on admission as alveolar in 82% cases interstitial in 6% and mixed in 13% and unilateral in 71%.

**6.10. Complications.** Various complications noted in our study are pleural effusion 6 (12%), septic shock 8 (6%), ARDS 3 (6%), lung abscess 2 (4%), emphysema 2 (4%), and decompensation of heart failure 4 (8%) patients.

Zalacain et al. noted pleural effusion in 60 (12%), septic shock in 41 (8%), lung abscess in 2 (4%), and emphysema in 14 (3%) as common complications in their study.

**6.11. Mortality.** In this study, 8 (16%) patients had mortality. Mortality rates for elderly patients hospitalized with CAP in previous reports range from 6 to 40% [28]. Along with associated comorbidities and malnutrition, increased age itself is an independent risk factor for increased mortality for CAP in elderly. Kaplan et al. reported a mortality of 11% in elderly patients with community-acquired pneumonia [29].

**6.12. Prognostic Factors.** In our study, the following prognostic factors shown to have statistically significant association with mortality; altered sensorium, presence of associated diseases, temperature  $>38^{\circ}\text{C}$  or  $<35^{\circ}\text{C}$ , pulse rate  $>100/\text{min}$ , systolic blood pressure  $<90\text{ mmHg}$ , leucocytosis  $>11,000\text{ cells/cumm}$ , leucopenia  $<4000\text{ cells/cumm}$ , raised urea  $>40\text{ mg/dL}$ , hyponatremia, ARDS and septic shock.

Conte et al. developed a prognostic rule for elderly patients admitted with CAP. They found five predictors of bad prognosis as follows: presence of comorbidity, abnormal vital signs axillary temperature  $>38^{\circ}\text{C}$ , cardiac frequency  $>110\text{ beats/min}$  and systolic arterial pressure  $<90\text{ mmHg}$ , age  $>85\text{ yrs}$ , alteration in mental state, and plasma creatinine  $>1.5\text{ mg/dL}$  [30].

## 7. Conclusion

Community-acquired pneumonia in elderly patients is a common and serious problem encountered in clinical practice. Elderly patients with community-acquired pneumonia have different clinical presentation and higher mortality. Elderly patients may present with atypical symptoms like altered sensorium and gastrointestinal symptoms, other than the typical respiratory symptoms of pneumonia. They may not have all the classical signs of consolidation and may present with only few signs like tachypnea, tachycardia, and crepitations. The atypical presentations may lead to delay in diagnosis and initiation of treatment and may be responsible for higher observed mortality in elderly patients with pneumonia.

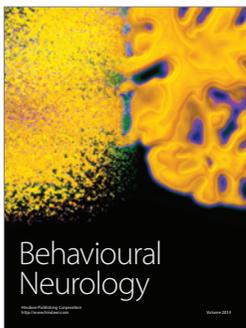
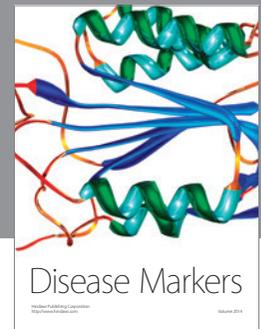
Etiological agents cannot be identified in many cases because of difficulty in collecting sputum in elderly patients, lower yield of culture, and various atypical and difficult to isolate causative organisms. Hence the need for an empirical therapy covering both typical and atypical organisms.

The following prognostic factors shown to have statistically significant association with mortality; altered sensorium, presence of associated diseases, temperature  $>38^{\circ}\text{C}$  or  $<35^{\circ}\text{C}$ , pulse rate  $>100/\text{min}$ , systolic blood pressure  $<90\text{ mmHg}$ , leucocytosis  $>11,000\text{ cells/cumm}$ , leucopenia  $<4000\text{ cells/cumm}$ , raised urea  $>40\text{ mg/dL}$ , hyponatremia, ARDS and septic shock. Prospective studies on larger number of patients are required to substantiate these findings.

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