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Clinical, Microbiological and radiological study of community acquired Pneumonia

Dr.Kaliparambil Sugathan Roshni[1]; Dr.P.C.Mishra[2]; Dr.S.C.Mohapatra[3]; Dr.A.Swetha[4]; Dr.S.Prasanna Kumar[5], Dr.Sushanth Vemuganti[6].

[1]*Dr. Kaliparambil Sugathan Roshni, Junior Resident, General Medicine, Maharaja's Institute of Medical Sciences, Nellimarla, Vizianagaram Dist, AP, India.*
[2]*Dr. P.C.Mishra, M.D., General Medicine, Professor, Maharaja's Institute of Medical Sciences, Nellimarla, Vizianagaram Dist,AP, India.*
[3]*Dr. S.C.Mohapatra, M.D., General Medicine, Professor & HOD, Maharaja's Institute of Medical Sciences, Nellimarla, Vizianagaram Dist, AP, India.*
[4]*Dr. A.Swetha, General Medicine, Maharaja's Institute of Medical Sciences, Nellimarla, Vizianagaram Dist, AP, India.*
[5]*Dr. S. Prasanna Kumar, Junior Resident, General Medicine, Maharaja's Institute of Medical Sciences, Nellimarla, Vizianagaram Dist, AP, India.*
[6]*Dr. Sushanth Vemuganti, Junior Resident, General Medicine, Maharaja's Institute of Medical Sciences, Nellimarla, Vizianagaram Dist,AP, India.*

Abstract:
Background*: The true incidence of pneumonia acquired in the community is unknown, but this is a common clinical problem worldwide especially in developing countries and remains a leading cause of death in India.*
Aims and Objectives*: The aim and objective of the study were to check clinical, radiological, and bacteriological profile of patients of community-acquired pneumonia (CAP).*
Materials and Methods*: The present study was undertaken in Department of Medicine General Medicine Department, Maharaja's Institute of Medical Sciences, Nellimarla, Vizianagaram, Vizianagaram Dist, India from October 2014 to September 2016.. For the study, 60 indoor patients of >15 years of age group were selected from Medicine Department, diagnosed as CAP. In all studied patient's chest-X-rays, routine laboratory test, sputum, and blood culture were done.*
Results*: Despite the use of standard protocols, microbiological diagnosis of CAP was confirmed only in 28 (45.5%) of patients by sputum and blood culture. Sputum was the most common etiological source of organism isolation (22) followed by blood (6), Streptococcus pneumoniae was the commonest pathogen 10 (36.4%). Followed by Klebsiella pneumoniae 8 (29.%), Staphylococcus aureus 6 (20%) and other Gram-negatives bacilli* 8 (14.5%.) *(Haemophilus influenzae 5.5%, Pseudomonas 1.8%, Acinetobacter 1.8%, Enterobacter 1.8%, Escherichia coli 1.8%, Citrobacter 1.8%). CAP was found predominantly in males (67.5%) and elderly age group (68.3%). Maximum number of patients presented with cough (92.5%), fever (90%), dyspnea (59.2%), expectoration (55%), pleuritic chest pain (14.2%), most common predisposing factors associated with CAP in the following chronological order-smoking (40.8%) > chronic obstructive airway disease (35.8%) > cardiovascular disease (16.7%) > alcoholism (12.5%) > diabetes mellitus (6.7%) > neurological disorders (2.5%). Lobar pneumonia especially right lower lobe consolidation was the most common radiological finding observed in 48.3% patients, followed by left lower lobe infiltration (P < 0.0001).*
Conclusion: *S. pneumoniae was the most common pathogen, but the emergence of the higher incidence of Gram-negative organism specially K. pneumoniae has occurred in our geographical area (India). Age, smoking, and underlying co-morbid conditions especially chronic obstructive pulmonary disease were significantly associated with the development of CAP (P < 0.01). Radiographic changes usually cannot be used to distinguish bacterial from the nonbacterial pneumonia.*

Keywords: *Bacteriology, Blood culture, Chronic obstructive pulmonary disease, Community-acquired pneumonia, Radiology smoking, Sputum culture*

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I. Introduction

Pneumonia is a disease known to mankind from antiquity.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].

Community acquired pneumonia (CAP)is an acute illness acquired in the community with symptoms suggestive of Lower Respiratory Tract Infection (LRTI) together with presence of a chest radiograph of intra pulmonary shadowing which is likely to be new and has no clear alternative cause.[1,2]

Community acquired pneumonia is a common disorder with an incidence of about 20% to 30% in developing countries compared to an incidence of 3% to 4 % in developed countries.[6,43,44]The aetiology of CAP remains uncertain in many patients. Even with the use of extensive laboratory testing and invasive procedures, etiological confirmation being achieved in no more than 45% to 70% of patients.[51,52] Streptococcus pneumonia is the most commonly isolated pathogen responsible for 35% to 60% of cases.[53,54]The bacteriological profile of community-acquired pneumonia is different in different countries and changing with time within the same country, probably due to frequent use of antibiotics, changes in environmental pollution, increased awareness of the disease and changes in life expectancy.

Prognostic scoring systems for CAP have been developed to address these issues. The two prominent tools for this purpose are the pneumonia severity index (PSI) and the BTS rule, which has recently been modified to the CURB-65 rule.[22, 23]

Treatment of CAP continues to be a challenge even in 21st century. Recommendations for CAP therapy are different, depending on whether patients require hospitalization or are treated as outpatients[24]. Other issues for treatment recommendations include the emergence of antibiotic resistance among Streptococcus pneumonia and mono versus combination antibiotic therapy.

II. Aims And Objectives

- To study the clinical presentation of Community Acquired Pneumonia (CAP) in Maharaja Institute of Medical Sciences; Vizianagaram; Andhra Pradesh.
- To study the risk factors associated with CAP.
- To assess the spectrum of organisms responsible for CAP.
- To study the complications.
- To study the response to treatment and duration of hospital stay.

III. Materials And Methods

Total of 50 patients of age group >15 years, diagnosed as Community Acquired Pneumonia (CAP) and admit in to ICU and Medical wards, Maharajah's Institute of Medical Sciences, Nellimarla, Vizianagaram from October 2014 to September 2016.

3.1Inclusion criteria

Patients with new or progressive pulmonary infiltrates on chest radiograph together with at least two of the following:

- Fever, Cough, Production of sputum or
- Leucocytosis ≥ 11,000/ mm^3.

3.2 Exclusion criteria

- Patients with radiographic or laboratory evidence suggestive of tuberculosis, acquired immunodeficiency syndrome (AIDS), leukaemia and those with chest infiltrates due to other causes such as congestive heart failure, pulmonary infarction or obstructive pneumonia due to lung cancer, and patients receiving immunosuppressive treatment were excluded from the study.

III.3 Method of the study:

In all the patients, detail history was taken and clinical examination was done. All of them were subjected to undergo chest radiograph, complete haemogram, renal and liver function tests, fasting blood sugar and serum electrolytes estimation were done. All efforts were made to obtain sputum at the time of initial clinical evaluation or within 24 hours of admission. In patients who could not expectorate sputum spontaneously, sputum was induced by nebulisation with 3% hypertonic saline. Sputum originating from lower respiratory tract containing > 25 polymorphonuclear leucocytes and < 10 epithelial cells per low power field (total magnification x 100) was subjected to Gram's staining.

Sputum was also subjected to bacterial culture on blood agar and MacConkeys agar media. Two blood culture samples were also obtained from each patient at the time of initial visit from different vene-puncture sites and were cultured on blood agar and MacConkey's agar media.All patients were hospitalized and one full course of antibiotics treatment according to sensitivity given.

III.4 Investigations used:

- Sputum - Direct smear by Gram and Ziehl - Neelsen stains, Culture and antimicrobial sensitivity testing.
- Blood culture - Frequently positive in pneumococcal pneumonia
- Chest X-Ray - P/A view

A high neutrophil leukocytosis favors a diagnosis of bacterial (particularly pneumococcal) pneumonia; patients with pneumonia caused by atypical agents tend to have a marginally raised or normal white cell count. A marked leucopenia indicates either a viral aetiology or overwhelming bacterial infections.

IV. Observation And Results

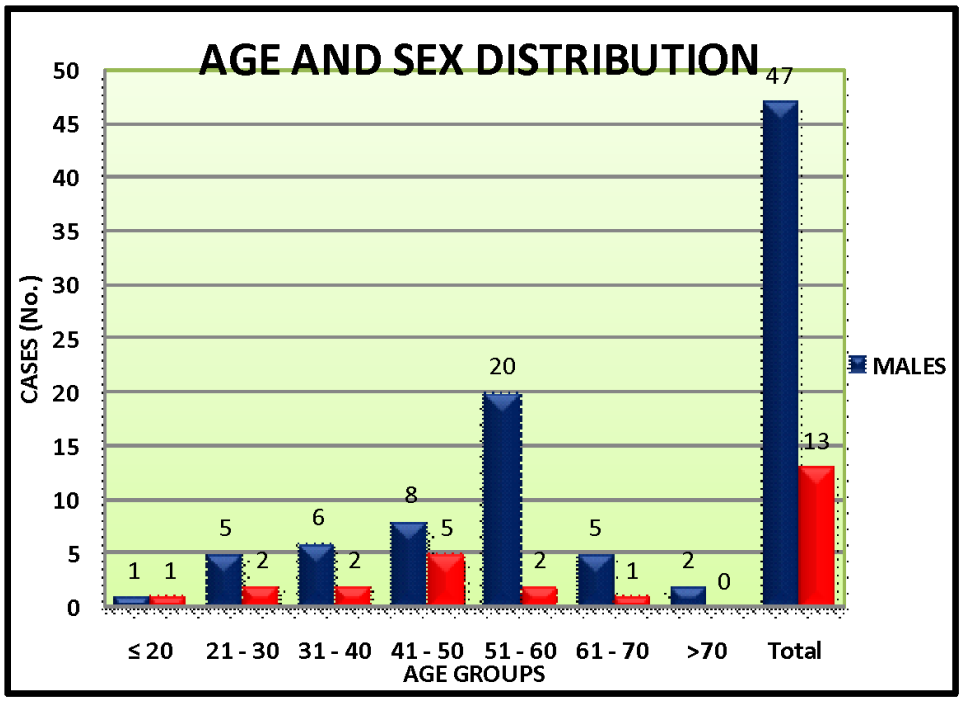
Total 50 patients of age group >15 years, diagnosed as Community Acquired Pneumonia (CAP) and admit in to ICU and Medical wards, Maharajah's Institute of Medical Sciences, Nellimarla, Vizianagaram

Table 1 Age Distribution of Patients

AGE (YEARS)	MALES		FEMALES		TOTAL	
	NO.	%	NO.	%	NO.	%
<20	1	1.66	-	-	1	1.66
21-30	5	8.33	3	2	8	13.33
31-40	6	10	2	3.33	8	13.33
41-50	8	13.33	5	8.33	13	21.66
51-60	20	33.3	2	3.33	22	36.66
61-70	5	8.33	1	1.66	6	10
>70	2	3.33	-	-	2	3.33
TOTAL	47	78.33	13	21.66	60	100

Table -2 : sex distribution

	Mean (yrs)	Standard deviation (yrs)	Range (yrs)
Male	49.77	13.66	19 –80
Female	42.85	12.88	24 – 66
Total	48.27	13.69	19 – 80



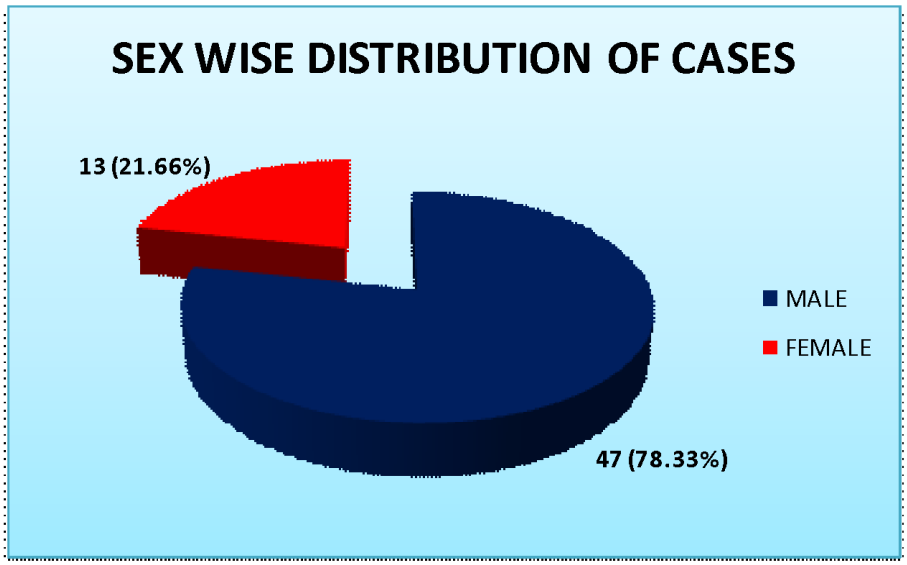


Table 3 : : Distribution in Rural and Urban Areas

SL. NO.	URBAN/RURAL	NO. OF CASES	PERCENTAGE
1	RURAL	41	68.33%
2	URBAN	19	31.66%
TOTAL		60	100%

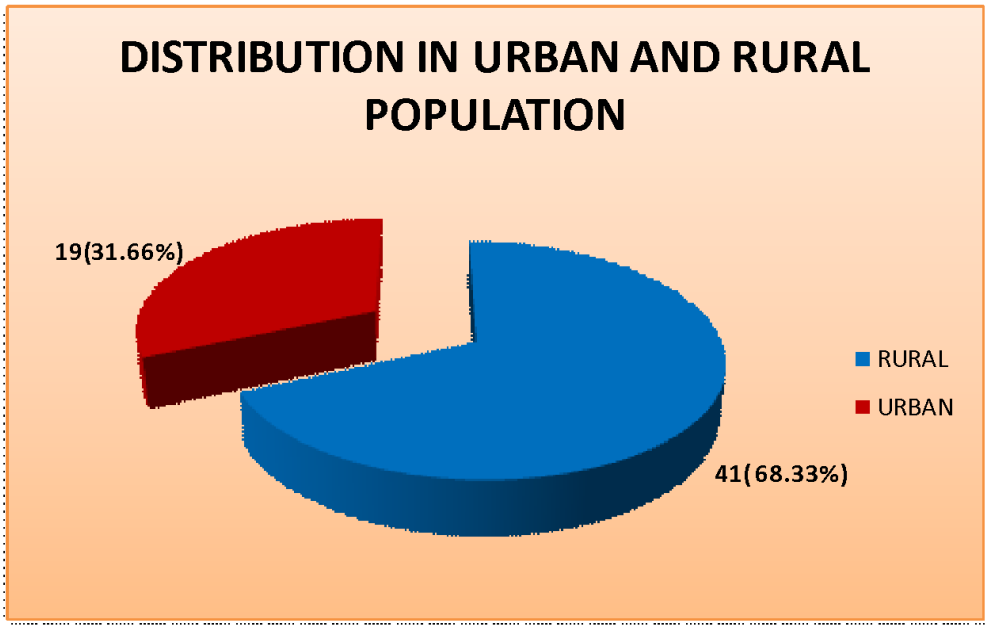


Table 4 Duration of Hospital Stay

Duration (Days)	Number	%
5-10	50	83.33%
11-15	7	11.66%
16-21	3	5%
Total	60	100%

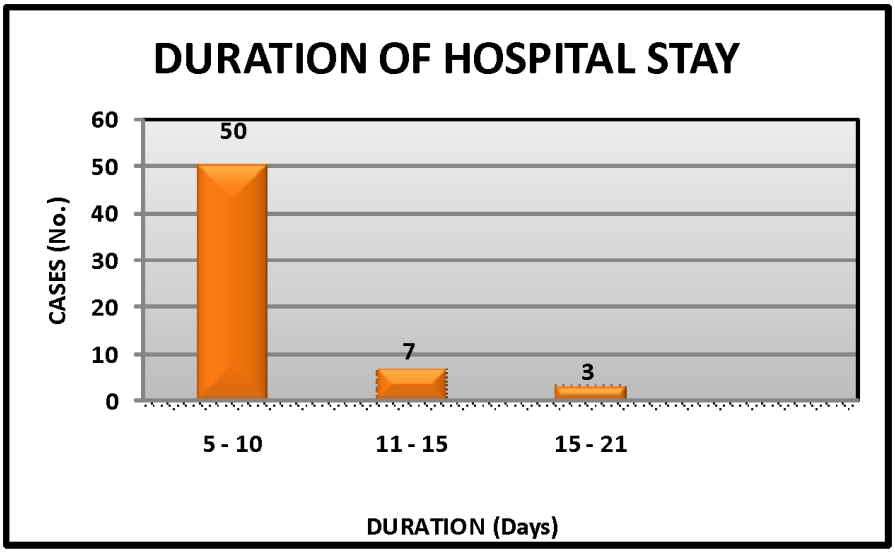


Table -5: Predisposing Factors
Signs Distribution of Patients

Signs	Number	%
HYPERTENSION	4	6.66%
DIABETES	6	10%
COPD	11	18.33%
SMOKING	22	36.66%
ALCOHOLISM	13	21.66%

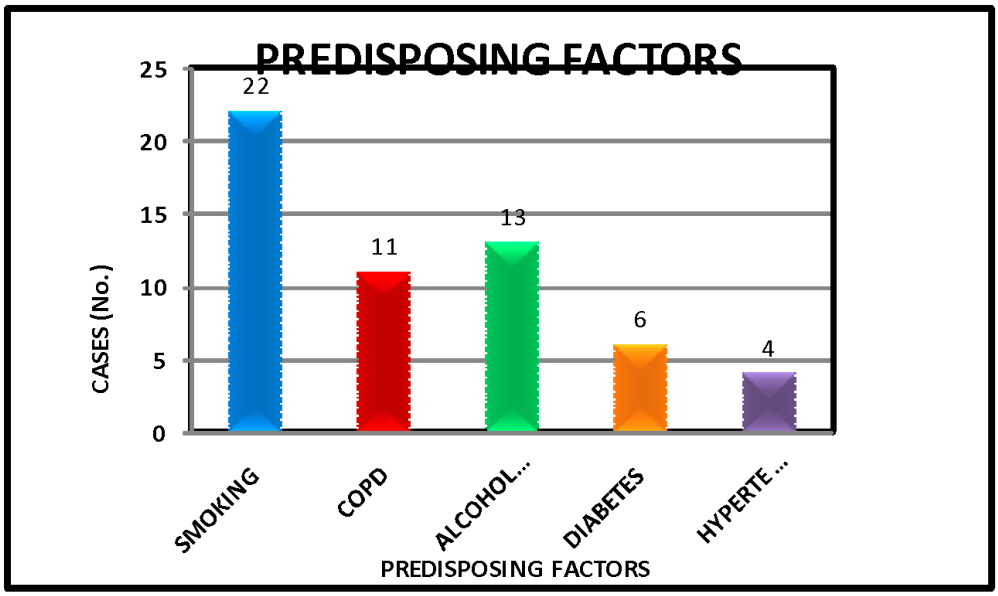


Table 6 : Presenting Symptoms

Signs	Number	%
FEVER	60	100%
COUGH	60	100%
EXPECTORATION	52	86.66%
DYSPNOEA	49	81.66%
CHEST PAIN	38	63.33%

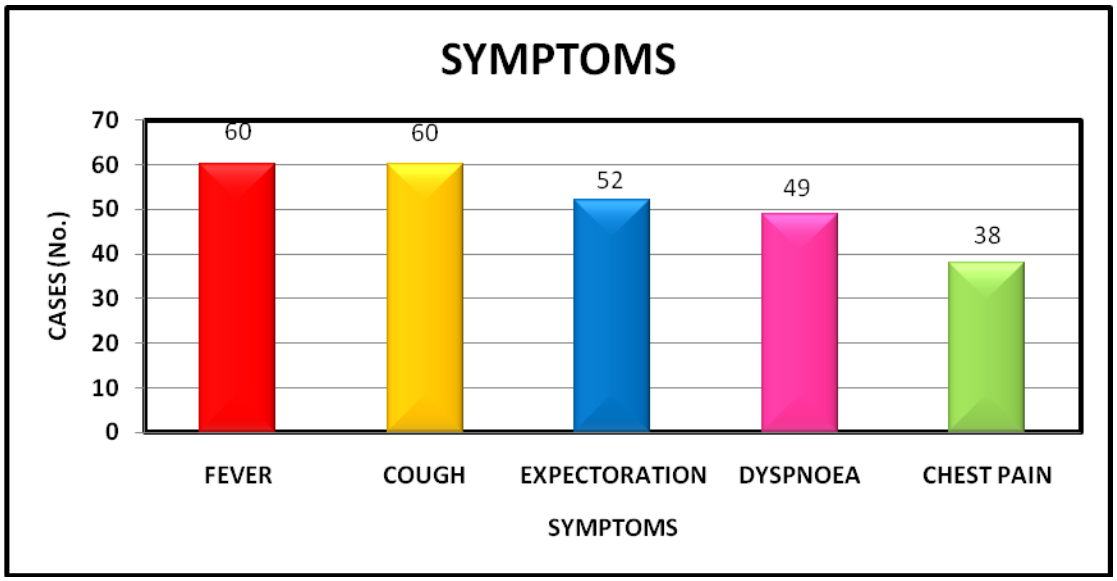


Table -7 : General Examination

Signs	Number	%
PALLOR	14	23.33%
ICTERUS	2	3.33%
CLUBBING	4	6.66%
CYANOSIS	5	8.33%
PEDAL EDEMA	1	1.66%

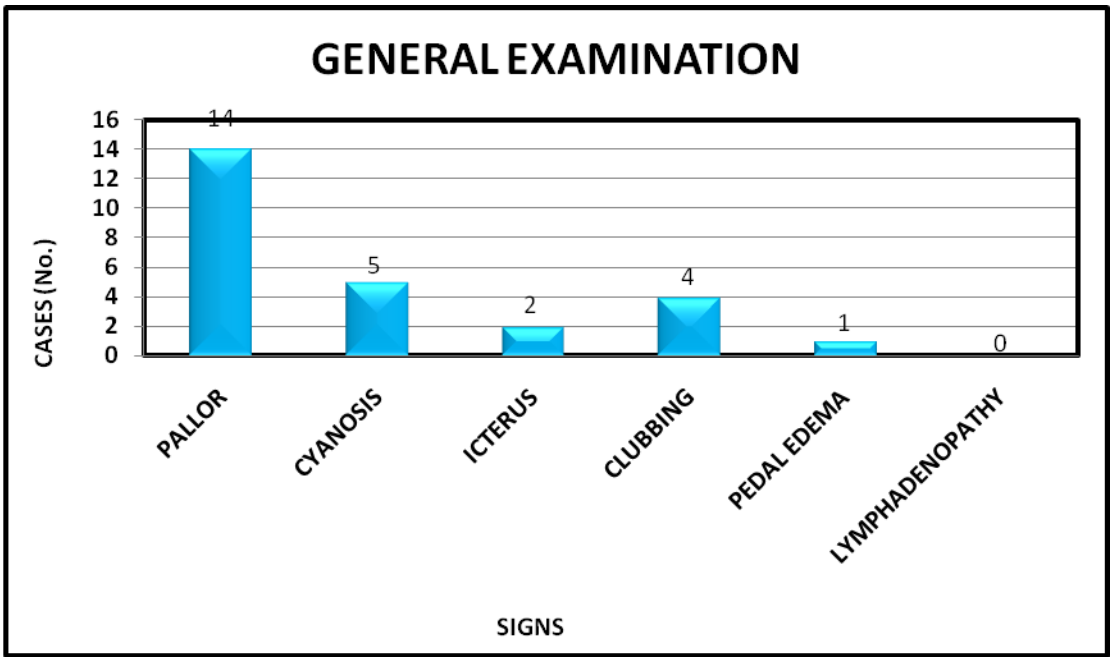


Table-8 : Systemic Examination

FEATURE	NO. OF CASES	PERCENTAGE
INCREASED VOCAL FREMITUS & VOCALRESONANCE	50	83.33%
BRONCHIAL BREATHING	53	88.33%
WHISPERED PECTORILOQUY	34	56.66%
CREPITATIONS	41	68.33%

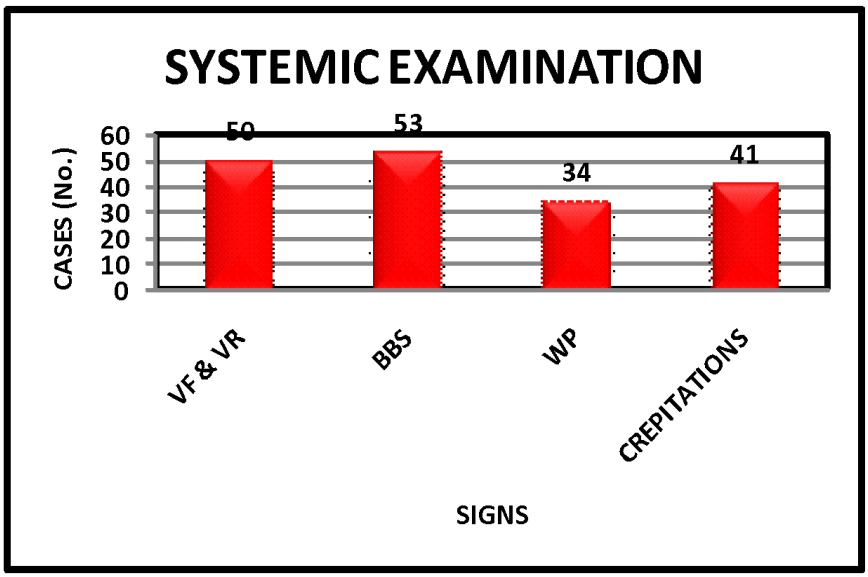


Table – 9 **Sputum Staining**

STAINING	NO. OF CASES	PERCENTAGE%
GRAM POSITIVE	30	50
GRAM NEGATIVE	14	23.33
MIXED	1	1.66
NO ORGANISM	15	25

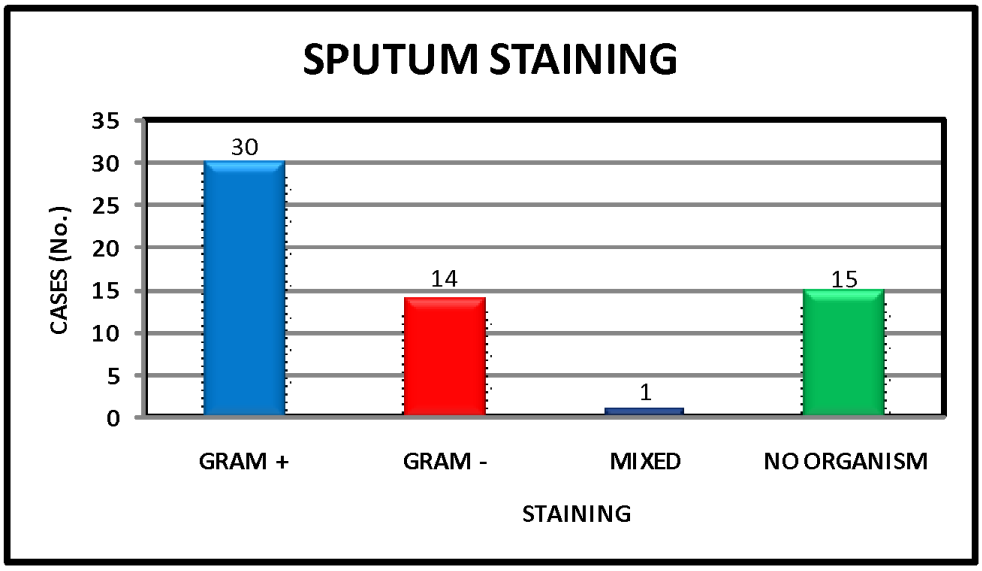


Table 10 :Sputum Culture

SL. NO.	ORGANISM	NO. OF CASES	PERCENTAGE
1	Streptococcus pneumoniae	21	35%
2	Staphylococcus aureus	9	15%
3	Klebsiella pneumoniae	7	11.66%
4	Pseudomonas aeruginosa	5	8.33%
5	E. Coli	2	3.33%
6	Mixed	1	1.66%
7	No organism	15	25%
TOTAL		60	100

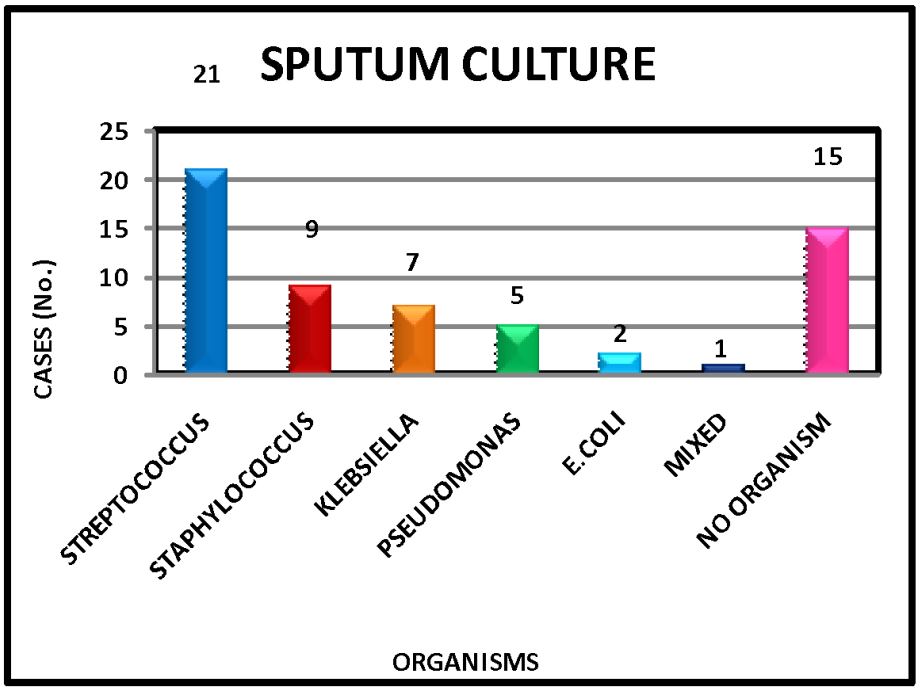


Table 11: Anatomical Localisation

S.No.	MODE OF LOCALIZATION	No. OF CASES	PERCENTAGE
1.	Unilateral involvement	55	91.66%
	• Right lung	38	63.33%
	• Left lung	17	28.33%
2.	Bilateral involvement	5	8.33%
3.	Right upper lobe	2	3.33%
4.	Right middle lobe	11	18.33%
5.	Right lower lobe	22	36.66%
6.	Left upper lobe	3	5%
7.	Left lower lobe	14	23.33%
8.	More than one lobe	8	13.33%

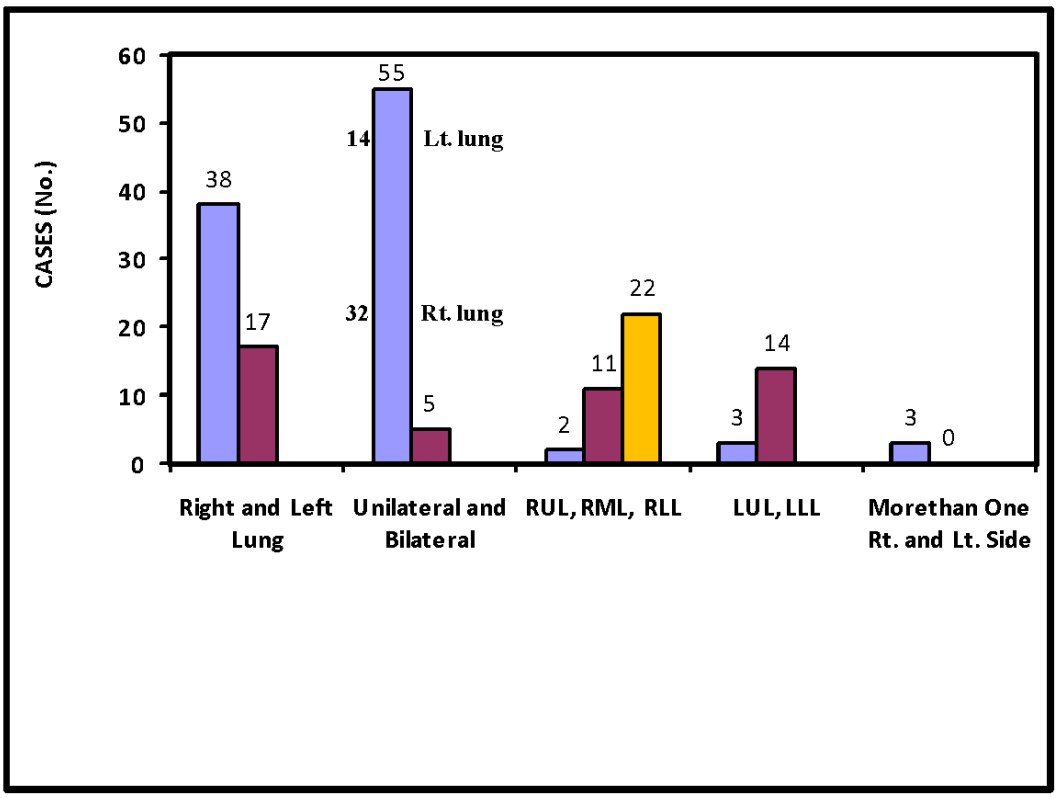


Table12: Complications

SL. NO.	COMPLICATION	NO. OF CASES	PERCENTAGE
1	Pleural Effusion	2	3.33%
2	Empyema	-	-
3	Lung abscess	2	3.33%
4	Circulatory failure	6	10%
5	Jaundice	2	3.33%
6	Acute renal failure	2	3.33%

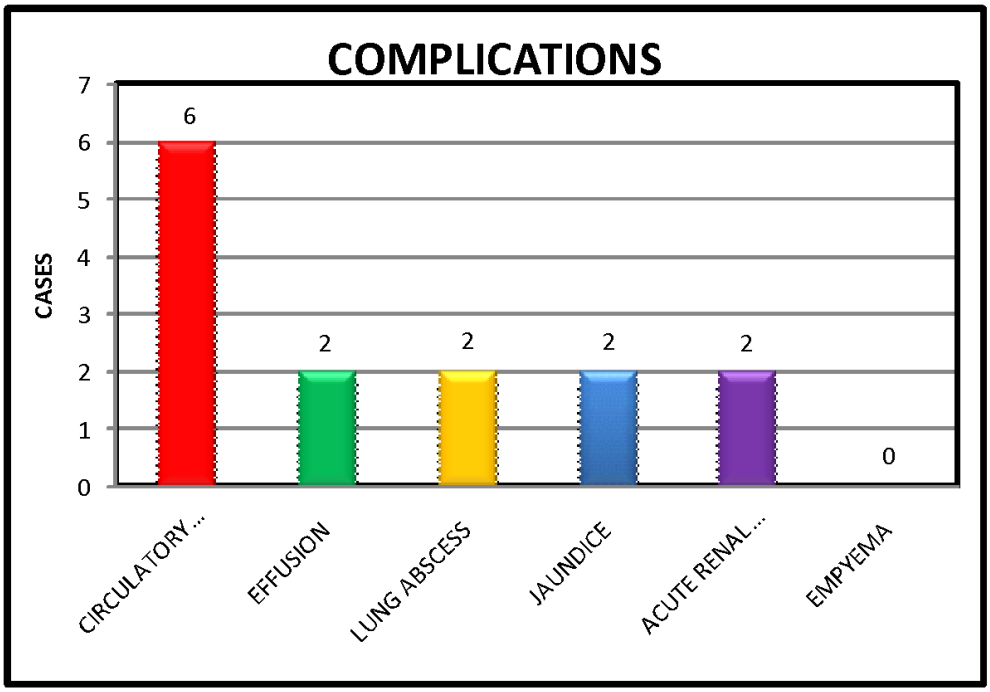
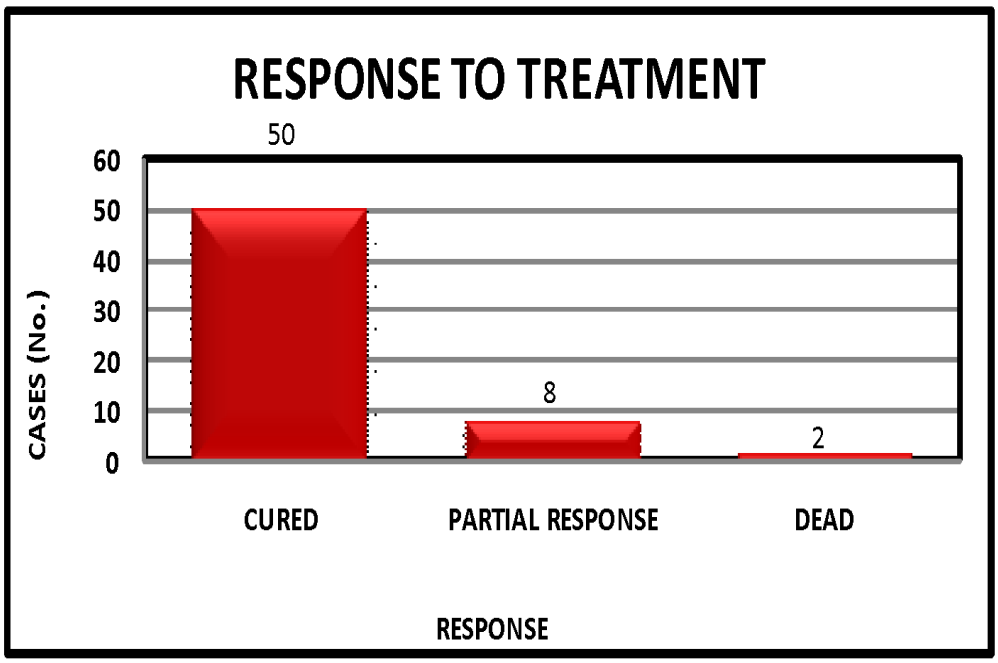
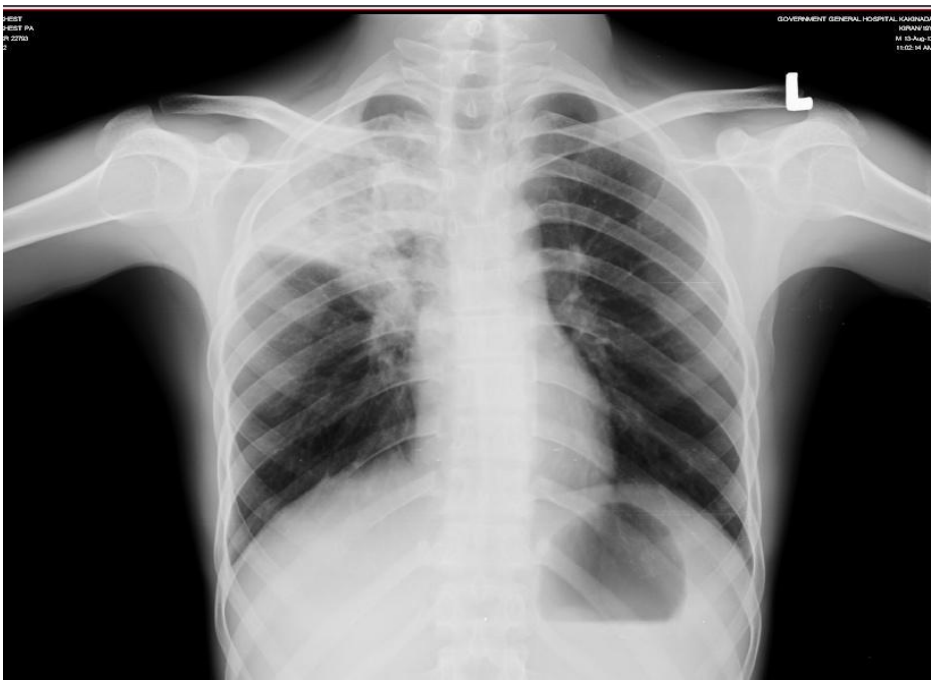


Table 13: Response to Treatment

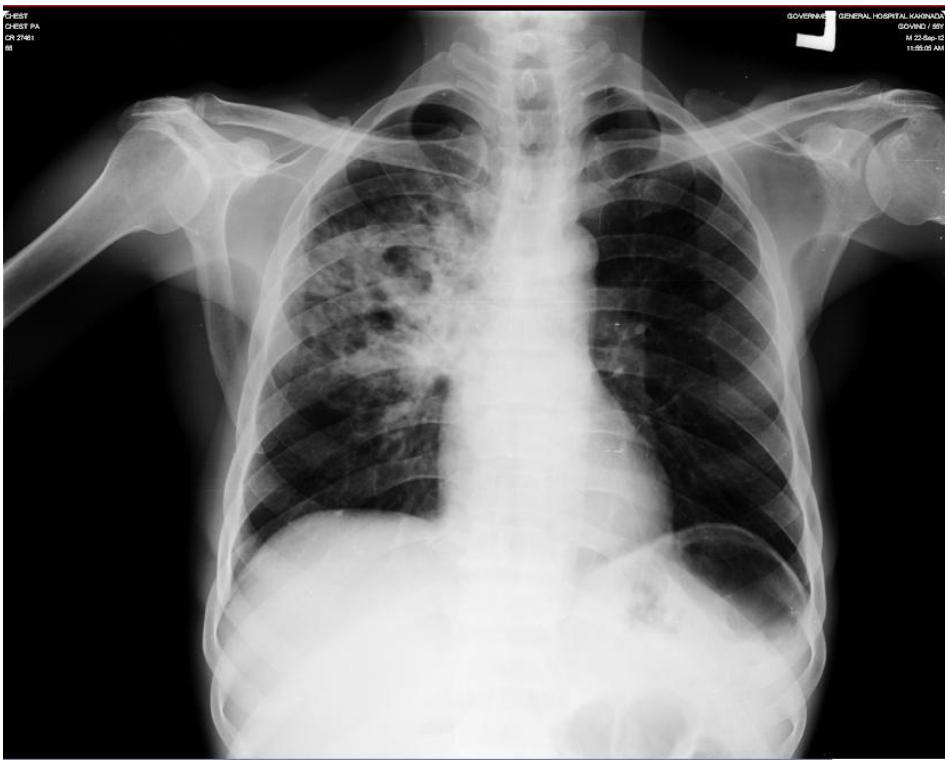
SL. NO.	RESPONSE	NO. OF CASES	PERCENTAGE
1	CURED	50	83.33
2	PARTIAL RESPONSE	8	13.33
3	DEAD	2	3.33
TOTAL		60	100



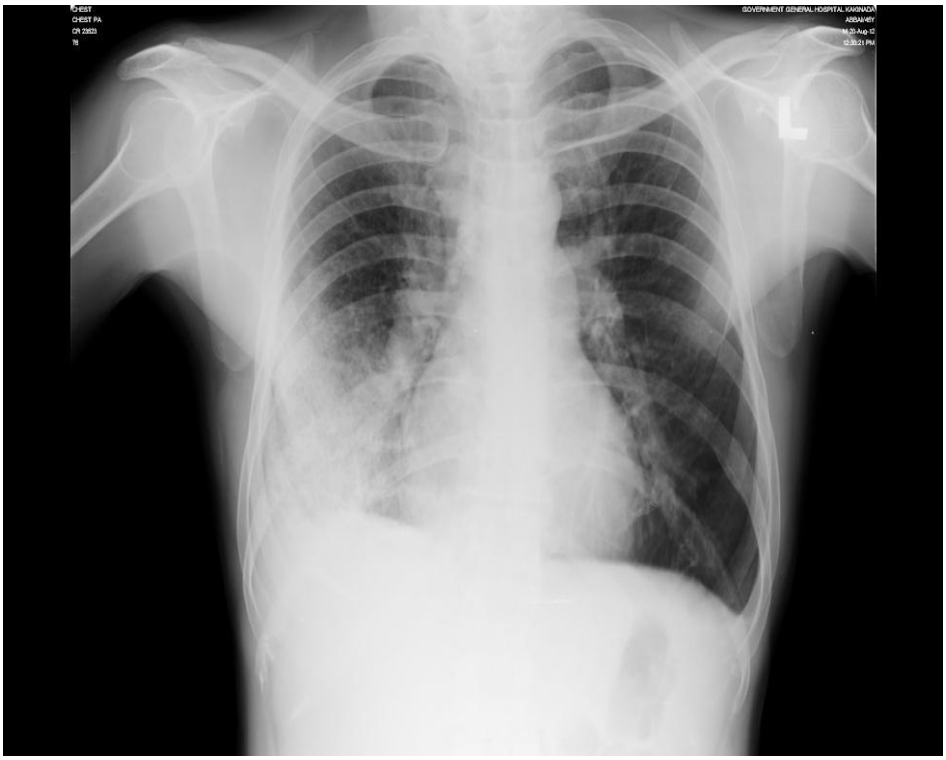
CHEST RADIOGRAPHS



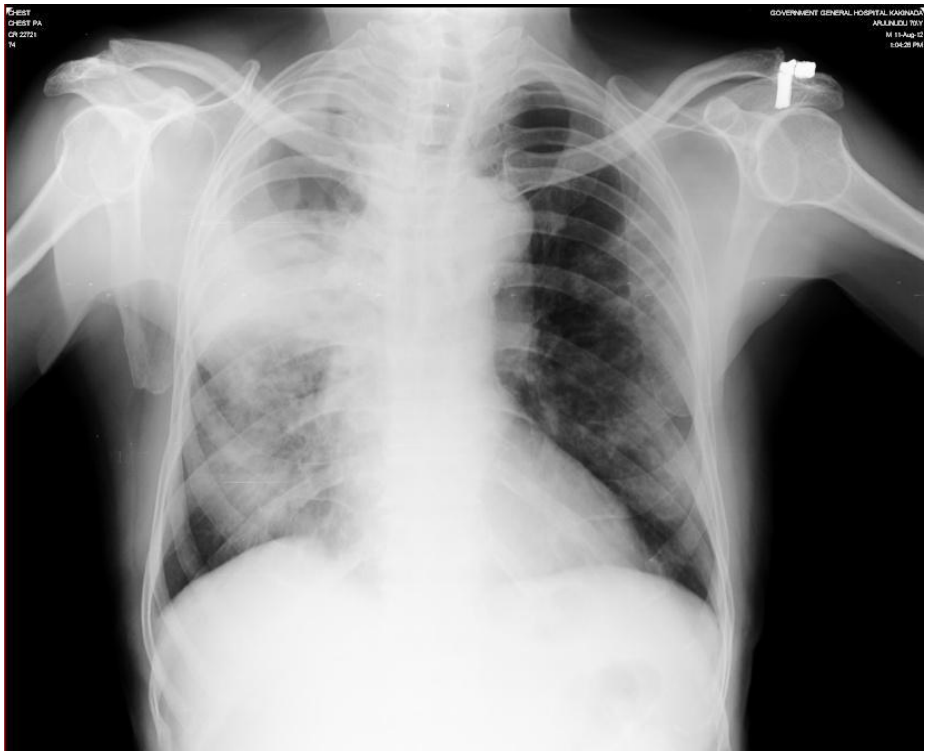
X ray chest PA view showing consolidation Rt. Upper zone



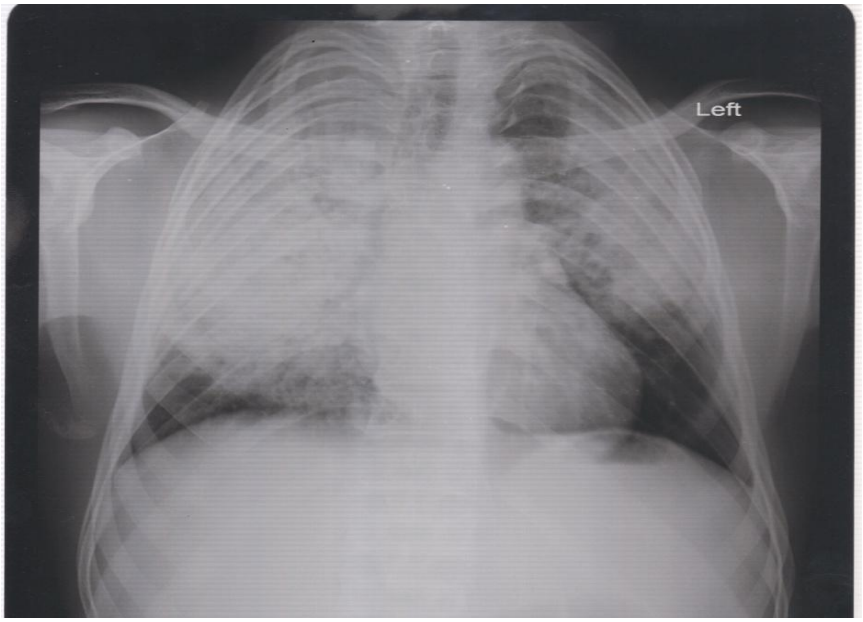
X ray chest PA view showing pneumonia Rt. Middle zone



X ray chest PA view showing Rt. Lower zone consolidation



X ray chest PA view showing consolidation Rt. middle and lower zones



Chest X ray PA view showing bilateral pneumonic consolidation

V. Discussion

Community Acquired Pneumonia (CAP)is a common medical problem in tropical countries like India. This prospective study of Community Acquired Pneumonia consisted of 60 patients admitted in Maharaja Institute of Medical Sciences, Nellimarla, Vizianagaram district; AP. All cases met inclusion and exclusion criteria.

There are many studies done in different parts of the world on community acquired pneumonia. Few of the important studies are quoted for comparison and discussion.

5.1. AGE:

It is well documented that pneumonia is commonly occurring disease in the community & its incidence rises sharply with extremes of age.[17, 25]

The present study included patients of CAP with age ranging from 19- 80 years with mean age of 48.27± 13.69 years which is similar to the studies done by Shrestha R et al[68] (51.3 yrs), BansalS et al[53] (52.7 ± 18.1 yrs) and Shah et al[63] (53.68 ± 14.74 yrs). The mean age of presentation in males is 49.77 ± 13.66 yrs whereas in females it is 42.85 ± 12.88 yrs. This is comparable to the study done by Shah et al[55] (60.8 ± 13.6 yrs in males and 48.3 ± 17 yrs in females).

In this study, majority of patients with CAP were middle aged and elderly (71% are more than 50 years of age). Similar age distribution was also observed by Deyetal[7]and Shah et al[63]in their study of CAP with 59%and 67% of patients respectively in the age group of > 50 years.

5.2. SEX INCIDENCE:

In this study of 60 patients of CAP, it was observed that majority of patients are males (78.33%) compared to the females (21.66%) with a male to female ratio of 3.6: 1. Similar male preponderance of CAP was also observed by various studies like Joshua et al[22],Shah et al[63], Aroma oberoi et al [60] and Shrestha R et al[68].

This could be attributed to the well-established fact that cigarette smoking and alcoholism, as well as underlying lung disease e.g. COPD predispose to pneumonia and are more common in males. In this study group majority of male patients are exposed to one or more of the above mentioned predisposing factors.

5.3. URBAN AND RURAL POPULATION:

In this study, 68.33% of the patients of CAP are from rural area and majority was daily wage workers and manual laborers belonging to low socio-economic status. Remaining 31.66% of patients belong to urban population.

The increased frequency of lung infection in rural population may be attributed to malnutrition, poverty, overcrowding and low socio-economic status.

5.4. DURATION OF HOSPITAL STAY:

In our study, most of the patients (83.33 %) required hospitalization for less than 10 days, 11.66 % required stay between 11-15 days and only 5% for more than 15 days with the mean duration of 7.74days. This is in par with the study conducted by BansalS et al[53] (9.11 days) and Shrestha et al[68](8 days). The contribution of pneumonia by virtue of man hours among workers is significant. Most of the patients with longer duration of hospital stay have developed either pulmonary complications or systemic complications.

5.5. PREDISPOSING FACTORS:

In the analysis of various predisposing factors in the cases taken up for this study, smoking proved to be a significant predisposing factor for CAP accounting for 36.66% of cases. This correlates very well with the Bochud study[42], which mentioned the incidence of smoking as 35.3% among its cohorts. Incidence of other predisposing factors of CAP in present study like alcoholism (21.66%), COPD (18.33%) and Diabetes (10%)is comparable with Bochud study[42]which observed alcoholism in 12.9%, COPD in 6.5% and diabetes in 2.9% of CAP patients. Other studies by Aroma oberoi et al [60]and Shah et al[63]also observed smoking as the most common risk factor for CAP (26.6% and 65% respectively).

Table14 showing comparison of predisposing factors in various studies

Factor	Bochud et al[42] 2001	Aroma oberoi et al[60] 2006	Shah et al[63] 2010	Present study
Smoking	35.3%	26.6%	65%	36.66%
COPD	6.5%	14%	57%	18.33%
Alcoholism	12.9%	23%	1%	21.66%
Diabetes	2.9%	13.7%	13%	10%

Smoking is a well-known and important risk factor for CAP through alterations in mechanisms of the host defence system[64]. Almirallet al[65]reported that even in persons without COPD, the proportion of CAP cases attributable in the population to ever having consumed any type of tobacco was 23% (95% confidence intervals 3.3 to 42.7%).Alterations in the immune system and inflammatory mechanisms in smokers are well known. Tobacco smoking is the most important risk factor for the development of COPD[66]and these patients were known to be at a higher risk of pneumonia and other respiratory infections. Both smoking and COPD are predisposing risk factors for CAP[67]. These patients have altered mucocilliary mechanisms in the lower respiratory tract and stasis of secretions in lung parenchyma, which predispose to pneumonia. COPD patients who are on regular inhaled corticosteroids are also susceptible to respiratory infections.

Diabetes is also one of the risk factors for community acquired pneumonia. Diabetes is a predisposing factor for various infections in the body by altering immune and inflammatory mechanisms. In the present study 10% of the patients have diabetes mellitus as predisposing factor for CAP.

5.6. PRESENTING COMPLAINTS:

Fever and cough (100% each) are the most common presenting symptoms of CAP in the present study. Other presenting symptoms include expectoration (86.66%), breathlessness (81.66%) and chest pain (63.33%). Similar incidence of presenting symptoms of CAP was also observed in other studies done by Mac Farieneet al[30], Joshua. P. et al[22], Bansal et al[53]and Shah et al[63].

Table 15 showing Comparison of Presenting Symptoms in various studies

Symptoms	Mac Fariene Study[30] 1982	Joshua P et al[22] 2003	Bansal et al[53] 2004	Shah et al[63] 2010	Present study
Fever	86%	88%	90%	95%	100%
Cough	92%	92%	97%	99%	100%
Expectoration	54%	65%	87%	65%	86.66%
Dyspnoea	67%	71%	48%	-	81.66%
Chest pain	62%	-	34%	75%	63.33%

5.7. GENERAL PHYSICAL EXAMINATION:

In this study, pallor is the most common general examination finding observed (23.33%) followed by cyanosis (8.33%), icterus (3.33%), clubbing (6.66%) and pedal edema (1.66%).Pedal edema observed in one

patient who developed acute kidney injury. These findings are comparable to Bansalet al[53] study with pallor (11%), icterus(3%) and cyanosis(27%) among its cohorts.

Our results are also comparable to the study done by Abdullah et al[69] in elderly population which demonstrated pallor (26%), icterus(12%), cyanosis(8%), clubbing(4%) and pedal edema(8%) in its cohorts.

Anaemia seen in 23.33% of cases of CAP in our study may be an indicator of extent of malnutrition and the resultant impaired immunity in the community.

5.8. VITAL SIGNS:

In this study, examination of vital data revealed that 86.66% had tachypnea (respiratory rate > 24/min), 78.33% had tachycardia (pulse rate > 100/min), 10% had hypotension (SBP < 90 mmHg) and all the cases had elevated body temperature (> 38^0 C).

These findings are comparable to those obtained by Abdullah et al[69] in their study of elderly population which demonstrated elevated temperature in 68%, tachypnea in 84%, tachycardia in 70% and hypotension in 16%. Several other comparable studies include those done by Bansal et al[53] which showed tachypnea in 24%, hypotension in 13% and Shah et al[63]which showed tachycardia in 92% among their patients.

The above mentioned vital signs, tachycardia, tachypnoea and high-grade fever associated with chills and rigors are well known to occur in patients with acute lung infections. Thus, meticulous recording of the respiratory rate and blood pressure at the time of initial evaluation and careful monitoring thereafter will be helpful in reducing the mortality in patients with CAP.

5.9. S**YSTEMIC EXAMINATION:**

In this study of CAP, the examination of respiratory system revealed various features of pneumonia like bronchial breath sounds in 88.33%, increased VF and VR in 83.33% and inspiratory crackles in 68.33% of patients. These physical signs in case of pneumonia are well documented to occur frequently as evident from other studies.

Similarly study done by Bansal et al[53] observed an incidence of bronchial breath sounds and crepitations in 47% and 98% of their subjects respectively. However, study done by Abdullah et al[69] observed crepitations as the common respiratory finding in 94% of their elderly subjects of CAP. The clinical findings in our study are comparable to the study done by Speteri et al as shown below.

Table 16 showing comparison of respiratory signs in various studies

Signs	Speteri et al[70] 1988	Bansal et al[53] 2003	Present study
BRONCHIAL BREATH SOUNDS	72%	47%	88.33%
INCREASED VOCAL FREMITUS	85%	-	83.33%
VOCAL RESONANCE	85%	-	83.33%
WHISPERED PECTORILOQUY	85%	-	56.66%
CREPITATIONS	72%	98%	68.33%

5.10. INVESTIGATIONS:

A. **Hematological Tests**

In our study of CAP, hematological investigations revealed polymorphonuclea rleukocytosis (leukocyte count >11,000 cells/mm^3) in 70%, raised ESR(>20mm at 1 hour) in 73.33% and anemia(Hb< 11gm/dL)in 41.66% of the patients in the study group.

Joshua et al[22] also observed similar incidence of leukocytosis in 58% of the cases while Shah et al reported an incidence of 43% in their study of CAP which are comparable to the present study.

Abdullah et al[69] reported leukocytosis in 84%, anemia in 32%, raised ESR in 76% of his elderly subjects. A high leukocyte count (>15000 cells/mm^3) strongly indicates a bacterial cause.

B. **Sputum Staining**

In the present study of CAP, staining of sputum revealed Gram positive organisms in majority of cases (50%) compared to Gram-negative organisms (23.33%) and mixed etiology (1.66%). Similar observations were made by Larry G. Reimer et al[16] in their study which found Gram positivity in 76%, Gram negativity in 14% while mixed etiology in 10% of the cases.

In our study, in about 25% of cases no organism could be seen on Gram staining and culture was negative in these cases. Probably the pathogens were atypical bacteria, fungi etc. in these cases.

In a similar study done on adult population by Abdullah et al[69], it was found that sputum shows Gram positivity in 32%, Gram negativity in 12%, mixed staining in 8% and no organism in 48% of the cases. This study is comparable to our present study.

So Gram's staining is a useful tool in predicting the probable organism before culture reports are available and these can be made use of, in initiating appropriate empirical therapy.

C. Sputum Culture

In the present study, sputum culture revealed *Streptococcus pneumoniae* as the most common pathogen in CAP accounting for 35%. Next common are *Staphylococcus aureus* (15%) and *Klebsiella* (11.66%) followed by *Pseudomonas* (8.33%) and *E.coli* (3.33%). No organisms were grown in 25% of the cultures.

These observations are similar to that of study done by Larry G. Reimer et al[16] and Sanraj K. Basi et al[20]as depicted below.

Sputum Culture	Larry G. Reimer[16] 1998	Sanraj K. Basi[20] 2004	Present study
Streptococcus	15-76%	73%	35%
Staphylococcus	3-14%	32%	15%
Klebsiella	3-14%	-	11.66%
Pseudomonas	-	8%	8.33%
E-Coli	6-20%	4%	3.33%
Mixed	-	3%	1.66%

Streptococcus pneumonia is the most common organism identified in our study. Studies from USA and UK have reported isolation rates for streptococcus ranging from 39% to 75% [31,74,75,76].

Our study had reported that *Stapylococcus aureus* to be the second most common isolate in 15% of the cultures. This is in par with the results obtained by Sanraj K Basi et al[20] (32%), Larry G Reimer[16] (3-14%), Bansal et al[53](17%). But studies during the last three decades from India have reported a higher prevalence of Gram negative organisms among culture positive pneumonias[54, 56, 61].

Most of the patients from whom Gram negative bacteria was isolated were over 50 years of age, smokers or alcoholics or had COPD. It has been reported that old age, smoking, alcoholism and COPD impair pulmonary defenses predispose to CAP caused by Gram negative bacteria**.**

The overall identification of bacterial pathogens was 75%, which is comparable to that of Shimla[53] (75.6%), Chandigarh[60] (47.7), or other parts of the world like UK[71](62%), Singapore[72](68%), and Philippines[73](56%). Our study is in par with many other studies in different regions of India and the world.

5.11. LOCALIZATION BASED ON CHEST X-RAY:

Our study based on chest X-ray PA view showed pneumonia to be more common on the right side (63.33%) with predominant involvement of right lower lobe in 36.66% of cases. Left side was involved in 28.33% while bilateral pneumonia was noticed in 8.33% of cases. Most commonly involved lobe is right lower lobe (36.66%) followed by left lower lobe (23.33%), right middle lobe (18.33%), left upper lobe (5%) and right upper lobe (3.33%) in decreasing order. Multilobar involvement is observed in 13.33% of cases.

Our study is comparable to the study done by Bansal et al[53] which demonstrated right lower lobe infiltration to be the most common (48.6%)followed by left lower lobe (21%), multilobar involvement (15.7%), right upper lobe (8.5%).

Major involvement of right lower lobe is attributed to the anatomical position of the right main bronchus, which is short, more or less vertical facilitating aspiration in to the basal bronchial segments.

5.12. ANALYSIS OF MAJOR COMPLICATIONS:

Our study showed lung complications in 6.66% of patients with CAP. Among them, 3.33% had lung abscess and 3.33% had pleural effusion. None of the patients developed empyema in our study group.

Systemic complication in the form of circulatory failure was noticed in 10% of cases, probably a result of delayed presentation to the hospital and extensive lung involvement with delayed antibiotic therapy. These patients developed sepsis and septic shock. They were treated with vasopressors and higher antibiotics.

Acute renal failure occurred in 3.33% of patients in the study group. Both these patients developed ARF because of late presentation and as they belong to elderly age group and have developed bilateral pneumonia. Both of them recovered from acute kidney injury with effective antibiotic therapy without any requirement for dialysis.

These figures are comparable to those obtained by Bansal et al[53] who observed circulatory failure in about 5% of their patients. Our results are also comparable to the study done by Abdullah et al[69] which reported shock(16%), effusion(12%) and lung abscess(4%) among elderly subjects.

5.13. RESPONSE TO TREATMENT:

In the present study 83.33% of cases showed good clinical response while partial response was observed in 13.33% of cases. Only 2 patients with circulatory failure expired while on treatment with a mortality rate of 3.33%. Both of them belong to elderly age group and they have predisposing factors like COPD and smoking. The organisms isolated in both of them are staphylococcus aureus and pseudomonas aureginosa. Good clinical response to treatment emphasizes the curable nature of CAP.

In the study by Bochudet al[42], 45% were cured, while 38% had minimal residual lesion and no improvement or worsening was reported in 5% of cases.

Mortality due to CAP in various hospital based studies has been variable. While the British Thoracic Society multi-centric study recorded a low mortality of 5.7%[77] which is on par with our study (3.33%), higher mortality (ranging from 21% to 25%) has been reported in other studies[78, 79]. However, in another Indian study a significantly higher mortality was noticed in patients aged 50 years or above and in those with underlying co-morbid conditions[56]. According to the study conducted by British Thoracic Society and the Public Health Laboratory Services[80], patients had a 21 fold increased risk of mortality if they had respiratory rate 30 breaths per minute or more and diastolic blood pressure less than or equal to 60 mm of Hg.

This emphasizes the need for further investigations in patients who had bad prognostic factors at the time of admission so as to establish the etiology, start early treatment and thereby reducing mortality.

Our observations will also be useful to monitor the trends of CAP in the population of the region and will help the physicians to start rational empirical treatment for patients with CAP.

VI. Conclusion

In essence, CAP is a common malady affecting elderly, rural, males with history of smoking, COPD and alcoholism. It commonly presents with all the classical symptoms and signs of pneumonic consolidation. Cases presenting with peripheral circulatory failure have a higher mortality.

Majority of the pneumonias are caused by *Streptococcus and Staphylococcus* in our study. Clinical and radiological response to a combination of Betalactam and macrolides or fluroquinolones was excellent, requiring less than a 10 days stay as an inpatient. Finally, cessation of smoking and alcoholism, early detection of cases with appropriate empirical treatment pending laboratory reports for as little as a week will go a long way in curing this condition.

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