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ORIGINAL ARTICLE **OPEN ACCESS**

A Prospective Study on Prescribing Pattern of Antibiotics in Community Acquired Pneumonia at Tertiary Care Hospital

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ABSTRACT
Community acquired pneumonia (CAP) is a syndrome in which acute infection of the lungs develops in persons who have not been hospitalized recently and have not had regular exposure to health care system. It is commonly effecting people of all ages and symptoms occur as a result of oxygen absorbing areas of lungs (alveoli) filling with inflammatory fluid. Antibiotics plays a major role in the treatment of CAP. To assess the prescribing of antibiotics for 150 patients with community acquired pneumonia. This is a prospective observational study. The study was conducted in the Department of Respiratory, Gandhi Hospital, Secunderabad, Telangana for a period of 6 months. A total of 150 patients who met the study criteria were included in the study. The required data is collected from patient medication charts, patient case sheets, doctor notes, nurse notes, the collected data was analysed statistically. Out of 150 patients screened; the mean age of the patients was found to be 49.4 (20-80 years) and 91 were males and 59 were females. Out of 150 patients, 58 patients were presented with no comorbid conditions. According to study, beta-lactam antibiotics constituted more than 95% of prescriptions as first-line antibiotics and the macrolides as the second line choice of drugs in the empirical treatment of CAP patients. This study demonstrates that beta-lactam antibiotics was the most frequently prescribed antibiotics (more than 95%) as the first line antibiotic for the empirical treatment of CAP followed by macrolides. Among the beta lactams, the use of cephalosporins is 1.9 times higher than penicillins. Our study also demonstrates that there exits variability in the prescribing pattern of antibiotics in spite of advances of knowledge in management of CAP.
Keywords: *Community acquired pneumonia, macrolides, beta-lactam antibiotics, combination therapy.*

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INTRODUCTION

Pneumonia is a common infection affecting the air sacs in one or two lungs that occurs most commonly because of an infection. In pneumonia, air sacs got filled with inflammatory fluid or pus. Community acquired pneumonia (CAP) is the most common respiratory infections diagnosed by clinicians and is the leading cause of death in India. CAP affects people of all ages and its symptoms develops because of alveoli which is oxygen absorbing areas was filled with an inflammatory fluid. This inhibits function of lungs and causing dyspnoea, fever, chest pain and cough. It is one of the significant causes of mortality and morbidity especially seen in the elderly.

Epidemiology

CAP is one the sixth leading causes of death. Epidemiological studies have described that incidence of CAP varies widely with age, region and season. The incidence of CAP increases with increasing age. The incidence of CAP was approximately 5.1 to 6.1 cases per 1000 persons per year in United States. More cases occurring during the months of winter. Studies have also shown that;

- More than three million cases of CAP are reported per year.
- 5,00,000 hospitalizations per year.
- 45,000 deaths per year.

Antibiotics play a crucial role in the therapy of Community Acquired Pneumonia (CAP). The beta-lactam antibiotics had been historically considered as first line treatment for CAP however there is an increase in resistance rates and is now a major concern facing by many of the physicians. Selection of antibiotics for the empirical treatment of Community Acquired Pneumonia are based on selection of agents which are effective against the major bacterial causes of CAP. There is a decrease in mortality with combination therapy.

To assess the prescription pattern of antibiotics for the patients with community-acquired pneumonia attending tertiary care hospital.

Objectives:

- ✓ To evaluate the pattern and frequency of antibiotics which were prescribed to inpatients diagnosed with CAP.
- ✓ To assess whether initial empirical treatment with certain antibiotics (monotherapy) and (combination) antibiotic treatment of CAP is based on selecting agents effective against the major treatable bacterial causes of CAP.
- ✓ To assess whether therapy is associated with length of hospital stay of the patients.
- ✓ To evaluate the most frequently prescribed antibiotics for the inpatients and outpatients and at the time of discharge (monotherapy, combination therapy) diagnosed with CAP.
- ✓ To assess whether comorbid condition like DM (Diabetes Mellitus), HTN (Hypertension) respiratory diseases of CAP patient influence the selection of antibiotics for therapy.
- ✓ To evaluate the antibiotics prescribing pattern in the mild and moderate CAP patients.
- ✓ To identify which spectrum of antibiotics mostly prescribed for the CAP patients (Inpatients, at the time of discharge outpatients).
- ✓ To evaluate whether the antibiotics have been changed/added during the course of illness/due to worsening of conditions/after receiving sputum reports/if the patient doesn't respond well to that antibiotic.
- ✓ To assess associated antiviral/antifungal agent used along with antibiotic for the CAP patients.
- ✓ To evaluate which antibiotic therapy is most frequently prescribed (monotherapy or combination) at the time of discharge.

Need of the study

Antibiotics are the mainstay for treatment of CAP. The choice of antibiotic therapy can also impact the clinical outcomes of the disease, such as length of hospitality, need for ventilation, mortality rate. As antibiotic resistance one of the major public health concerns and significant challenge in the management of infectious diseases. So, studying prescribing pattern of antibiotics in CAP help to identify inappropriate use of antibiotics and also develop strategies to prevent the development of antibiotic resistance. Therefore; there is a need for studying the prescribing pattern of antibiotics for the treatment of CAP so that we can develop an effective antibiotic regimen for cap treatment &improve patient outcomes.

MATERIAL AND METHODS

Study protocol: It is a prospective observational study to be performed for a duration of six months; after the institutional ethical committee approved it (IEC) [IRB-AGI/2022-2023 Proposal No. 02]. Patients who meet the study criteria are included in the study. Patients case reports, lab investigation reports &medical records were used to gather the necessary information. Following the receipt of informed consent from patients and their informants. The data obtained shall be analyzed to know the prescribing pattern of antibiotics in the treatment of CAP.

Study design: It was a prospective observational study.

Study site: The study was conducted at Gandhi Hospital, Secunderabad, Telangana, India.

Study population: 150 Members included in the study.

Study criteria:

Inclusion criteria:

- CAP inpatients with confirmed diagnosis were included.
- Male &female patients of age groups (20-80) years.
- Patient with mild-moderate CAP.
- Both typical & atypical CAP patients.

Exclusion criteria:

- Pediatrics & age above 80 years.
- Unconscious patients and psychiatric patients.
- Patients with severe CAP.
- Cases with incomplete information of unknown cases of patient condition.
- Outpatients are excluded.

Sources of data: Patients cases sheets, medication charts, doctor notes, nurse notes.

RESULTS

We gathered 150 patients of with CAP from a tertiary care hospital over the period of 6 months based on inclusion and exclusion criteria. There were 91 males (60.6%) and 59 (39.3%) females among 150 CAP patients as shown in below Figure 1.

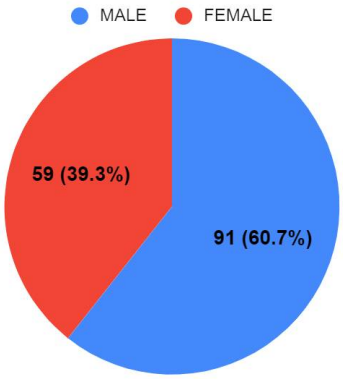

Figure 1: Distribution of study population based on gender

Among of 150 CAP patients, patients of age groups 20 to 80 were selected. There were 31 patients aged from 21 to30, 19 patients aged 31 to 40, 26 patients aged 41 to 50, 30 patients aged 51 to 60, 27 patients aged 61 to 70, 17 patients aged 71 to 80 as shown in below Figure 2. The mean age of patients was found to be 49.4.

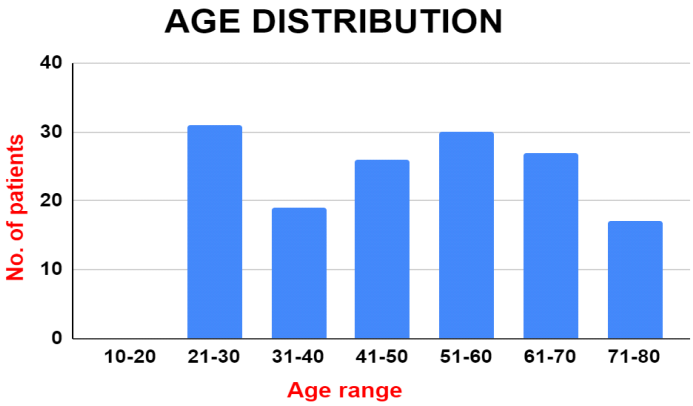

Figure 2: Distribution of study population based on age

Out of total 150 patients, 58 patients (38.6%) presented with no comorbid conditions. 92 (61.3%) had comorbid condition. Out of 92 patients, 54 patients (58.6%) had hypertension, 41 patients (44.56%) had diabetes mellitus and 41 patients (44.56%) had respiratory diseases like old PTB (pulmonary tuberculosis), asthma, ILD (interstitial lung disease).

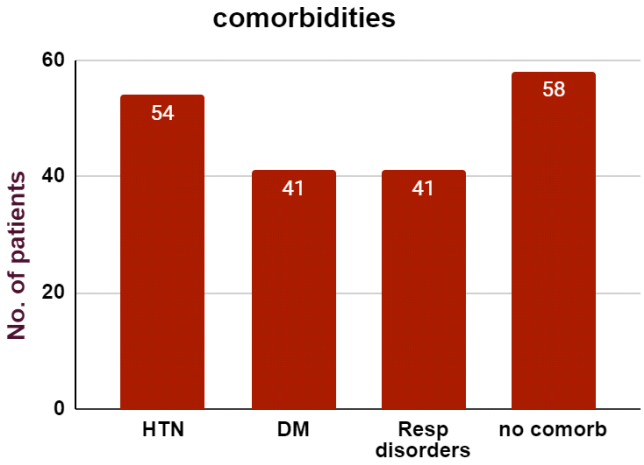

Figure 3: Comorbid condition of patients with CAP

The below Figure 4 shows the severity of CAP. Most of the patients got admitted with moderate CAP were 97 patients (64.6%) and patients with mild CAP were 53 patients (35.3%).

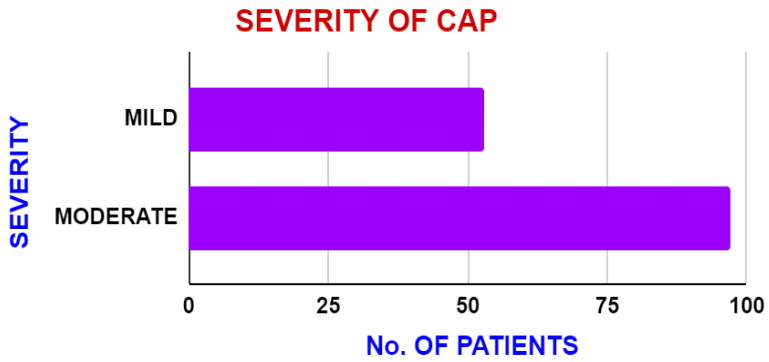

Figure 4: Distribution of study population based on severity of CAP

The Figure 5 shows the percentage of patients prescribed with single antibiotic (monotherapy), two, three antibiotics (combination therapy). Majority of patients prescribed with combination therapy that is two antibiotics for 129 patients (86%) followed 20 patients (13.3%) with single antibiotic and one patient with three antibiotics.

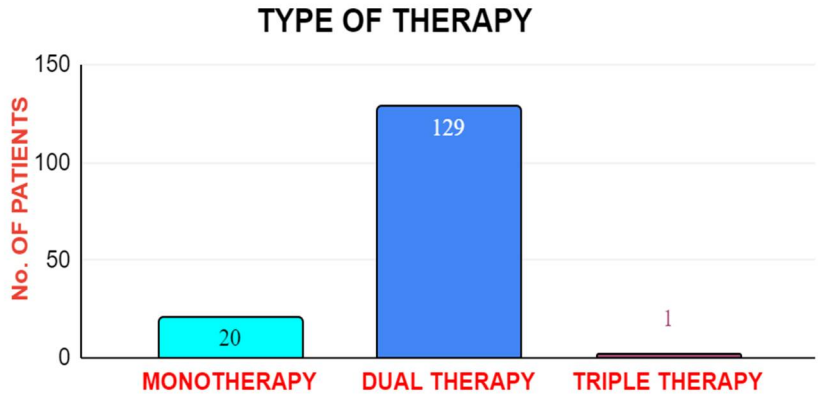

Figure 5: Shows the number of the patients prescribed with single, dual and triple antibiotics

Figure 6 shows the first line antibiotics prescribed for empirical treatment of patients with CAP. Initial empirical antibiotics prescribed were beta-lactam antibiotics. Among them cefoperazone + sulbactam prescribed for 55 patients (36.6%), piperacillin + tazobactam prescribed for 42 patients (28%), ceftriaxone prescribed for patients (18.6%) followed by amoxicillin + clavulanic acid for 20 patients (19.3%) followed by meropenem for 5 patients (3.33%).

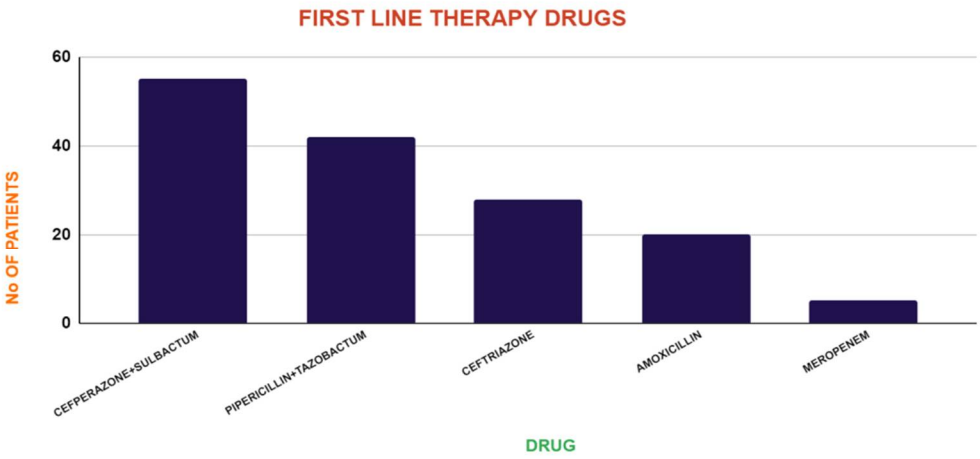

Figure 6: Shows the first line antibiotics prescribed for CAP patients

Figure 7 shows the add on drugs in dual therapy used for CAP patients. Patients with CAP were prescribed with macrolides as add on drugs in dual therapy and along with first line therapy (beta-lactam antibiotic) for effective treatment. Macrolides prescribed were tablet azithromycin for 48 patients, inj. clarithromycin prescribed for 80 patients. Most commonly prescribed macrolide was clarithromycin.

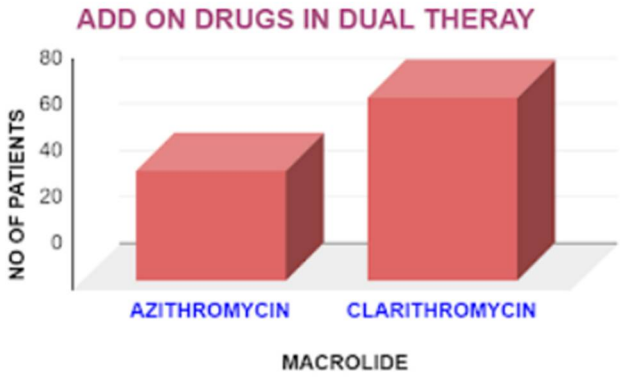

Figure 7: Add on antibiotics for dual therapy used for treatment of CAP

Below Figure 8 shows the most frequently prescribed combination therapy that is 2,3 antibiotics for patients with CAP. As mention earlier, macrolide was the second line therapy prescribed along with beta-lactam antibiotic. Most commonly prescribed antibiotics combination was cefoperazone + macrolide for 55 patients (42.6%) followed by piperacillin + macrolide for 32 patients (24.8%) followed ceftriaxone + macrolide for 22 patients (17.05%) followed by amoxicillin + macrolide for 15 patients (11.6%) followed by meropenem + macrolide for 5 patients (3%). One patient prescribed with three antibiotics of combination (clindamycin + piperacillin + macrolide) and 129 patients with two antibiotics as mentioned above.

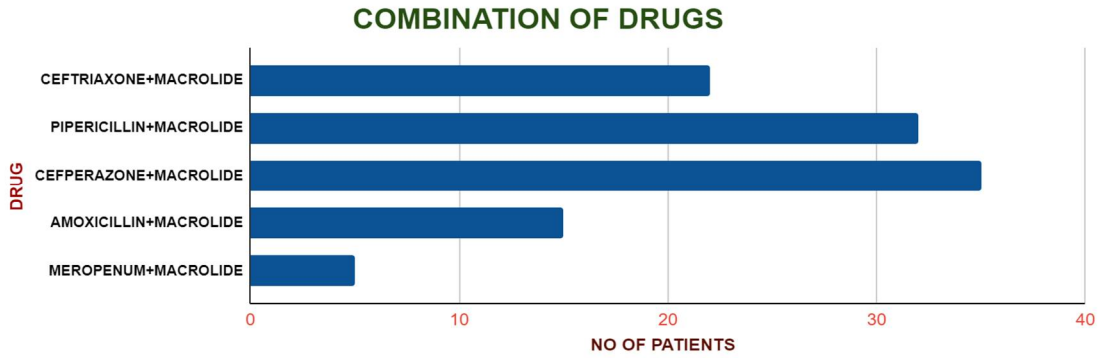

Figure 8: shows the combination therapy used in CAP patients

Below Figure 9 shows the most frequently used monotherapy that is single antibiotic for treatment of CAP. Ceftriaxone was most frequently used monotherapy for 13 patients (65%), piperacillin + tazobactam for four patients (20%), cefoperazone + sulbactam for 4 patients (10%), amoxicillin clavulanic acid for one patient (5%) out of 20 patients who received monotherapy.

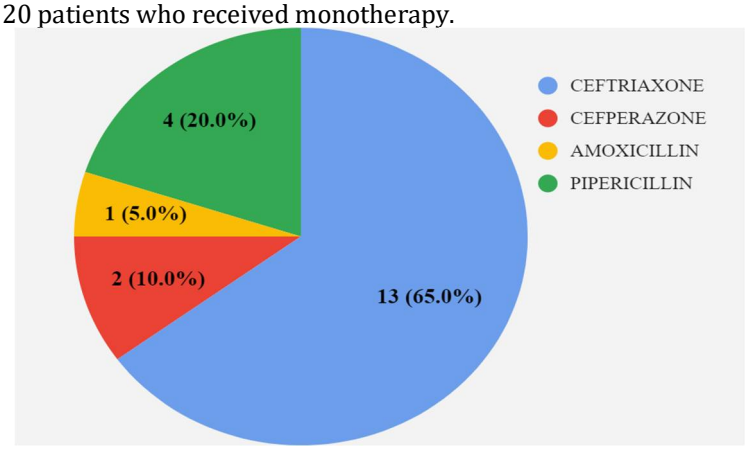

Figure 9: Monotherapy used for CAP patients

Below Figure 10 shows the associated antiviral or antifungal agent prescribed along with the antibiotic. Most of the patients presented with viral pneumonia (40 patients) compare fungal pneumonia (10 patients). So, antivirals are prescribed more than antifungals.

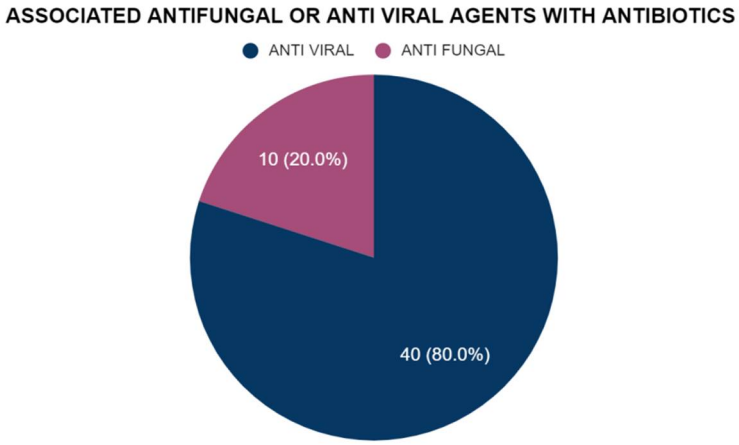

Figure 10: Associated antiviral and anti-fungal agents with antibiotics

Below pie chart shows the comparison between penicillins and cephalosporins as they are most commonly prescribed among beta lactams antibiotics.

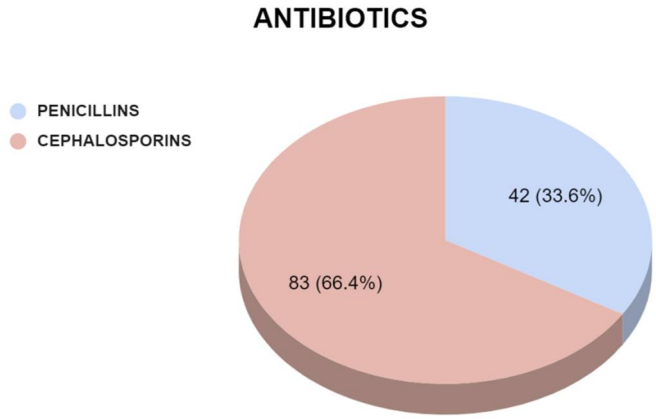

Figure 11: Comparison between the use of cephalosporins and penicillins

Below table shows the change in antibiotics during hospital stay after receiving the sputum reports. Out of 150 patients, sputum culture reports were found for 58patients. Out of 58 patients, 26 (44.8%) tested positive and 32 (55.17%) tested negative. From 26 sputum culture positive patients

- 15 Patients: *Klebsiella* isolated in sputum,
- 10 Patients: *Streptococcus pneumoniae* isolated in sputum,
- 1 Patient: *Pseudomonas aeruginosa.*

Here, only four patients were resistant to initial empirical antibiotics and those patients switched to other antibiotics to attain sensitivity for that microorganism. Out of 15 patients who tested *Klebsiella* positive, ceftriaxone injection prescribed as initial empirical antibiotic for 3 patients, after receiving the sputum reports there was no change in that antibiotic as it found to be sensitive to *Klebsiella*. Same happened with the inj. cefoperazone + sulbactam which was prescribed for 2 patients. But in case of piperacillin + tazobactam which was prescribed for 4 patients out of 15, 2 patients found to be sensitive for *Klebsiella* and 2 patients found to be resistant to *Klebsiella*, so switched to cefoperazone + sulbactam to attain sensitivity. Out of 10 *Streptococcus pneumoniae* positive patients, injection ceftriaxone prescribed for 1 patient, injection piperacillin + tazobactam for 6 patients, injection amoxicillin + clavulanic acid for 1 patient have been prescribed and all those antibiotics were found to be sensitive to *Streptococcus pneumonia,* but 2 patients who prescribed with cefoperazone + sulbactam were found to be resistant so switched to injection amoxicillin + clavulanic acid to attain the sensitivity.

One patient with *Pseudomonas aeruginosa* positive prescribed with injection cefoperazone + sulbactam was found to be sensitive to that organism.

Below Table 1 shows the prescribing pattern of antibiotics (monotherapy) in CAP patients at the time of discharge.

Table 1: Most commonly prescribed single antibiotic was cefpodoxime + sulbactam followed by amoxicillin + clavulanic acid

S. No.	Antibiotics	Class	No. of patients
1	Tab. Amoxicillin + clavulanic acid	Penicillin + beta-lactamase inhibitors	46
2	Cefpodoxime proxetil	Cephalosporin	53
3	Cefpodoxime + clavulanate	Cephalosporin + beta-lactamase inhibitors	18
4	Tab. Azithromycin	Macrolide	3
5	Tab. Cefixime	Cephalosporin	2
6	Tab. Levofloxacin	Fluroquinolones	1
7	Tab. Laropenem	Carbapenems	2

Table 2 shows the prescribing pattern of antibiotics (combination therapy) in CAP patients at the time of discharge.

Table 2: Amoxicillin and azithromycin, cefixime and azithromycin were most commonly prescribed combination antibiotics

S. No.	Antibiotics	No. of patients
1	Amoxicillin + azithromycin	2
2	Cefixime + azithromycin	2
3	Cefpodoxime + cotrimoxazole	1

DISCUSSION

An observational prospective study was conducted to determine the prescribing pattern of antibiotics in community acquired pneumonia patients. The study population consists of 130 patients who have diagnosed with CAP. The median age of the patients was 49.4 . There were 91 males and 59 females among 150 CAP patients. Men were mostly affected with CAP and the age group of 21 to 30 and 51 to 60 were mostly affected with CAP. The majority of the patients (92) were presented with comorbid conditions which include DM, HTN and respiratory diseases like old PTB, asthma, ILD. Majority of the patients admitted with moderate CAP (97 patients). We assessed the severity of CAP based on the age, CURB score, comorbid conditions, SpO2. We considered chest X-ray as the gold standard imaging test and also, we diagnosed CAP patients with sputum culture test to identify the type of organism being involved and to prescribe the respective antibiotic. Most of the patients whose sputum culture positive for *Klebsiella* treated with 3rd generation cephalosporins and positive for streptococcus pneumonia treated with penicillin. As antibiotics considered as the mainstay for the treatment of CAP. Majority of the patients prescribed with Broad spectrum antibiotics. None of them prescribed with narrow spectrum antibiotics. As most of the patients got admitted with moderate CAP 97 patients (64.6%), combination therapy was mostly prescribed

for the moderate patients. In combination therapy two antimicrobials prescribed for 86% (patients) and followed by 1 patient with three antibiotics. Single antibiotic prescribed for only 20 patients with mild CAP. Chi square test was performed to find the relation between comorbidities and the type of therapy used. The calculated chi square was 18.9 and 'p' value was 0.00004. Patients with comorbidities were found to be higher chances of receiving combination therapy than patients with no comorbidities ($p<0.05$). In monotherapy ceftriaxone was most frequently prescribed antibiotic (65%). In combination therapy cefoperazone + sulbactam and macrolide was most frequently prescribed (42.6%). Patients having multiple comorbidities prescribed with powerful piperacillin + tazobactam antibiotic for the effective treatment. In the patients with CAP; the use of cephalosporins is 1.9 times more than penicillin's. Along with antibiotics, other medications like oseltamivir for viral pneumonia, posaconazole, fluconazole for fungal pneumonia prescribed. Supportive treatment along with antibiotics include oxygen inhalation ,nebulizer (duolin+ budesonide) for improving SpO2 levels and for the treatment of cough syrup ambroxol and Tab. NAC were most commonly prescribed.

Changes in antimicrobial therapy during hospital stay

Out of 150 patients; the antibiotic regimen was changed in 35 patients during hospital stay. This therapy was changed based on sputum reports, worsening of the clinical conditions; when patient does not respond well to that prescribed antibiotic.

Outcomes and hospital stay of the patients

Mean duration of hospital stay for mild CAP was 9 to 11 days and for moderate CAP patients was 12 to 15 days. Out of 150 patients; majority of the patients i.e., 146 patients (97%) were successfully treated and got discharged. Only 4 patients (2%) treatment was found to be unsuccessful (i.e., non-resolving symptoms) seen, as these patients presented with moderate pneumonia, multiple comorbid conditions, severe symptoms, they did not respond well to the antibiotics prescribed by the physician during hospital stay.

CONCLUSION

Our study summarized into following findings:

- ✓ Majority of the patients got admitted with moderate CAP (64.6%) than mild CAP (35.36%).
- ✓ Beta-lactam antibiotics were most commonly prescribed antibiotics (>90%) than macrolide as initial empirical treatment and at the time of discharge.
- ✓ Among beta-lactam antibiotics, the use of third generation cephalosporins which include ceftriaxone, cefoperazone + sulbactam is 1.9 times higher than penicillin's.
- ✓ Patients with comorbid conditions were found to be higher chances of receiving combination therapy than patients with no comorbidities ($p<0.05$).
- ✓ Antimicrobial therapy was influenced by the comorbid conditions and severity of CAP.

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