

## COMPARISON BETWEEN THE EFFECT OF CEFTRIAXONE AND AZITHROMYCIN IN THE MANAGEMENT OF COMMUNITY ACQUIRED PNEUMONIA PATIENTS IN HOSPITAL SETTING

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### Abstract

**Introduction:** pneumonia can be defined as symptoms that incorporate acute lower respiratory tract (LRT) infection, comprising of cough and a minimum of one more LRT symptom, in parallel to any other 'systemic symptom and new focal signs on chest examination. Annually, there were approximately 151.8 million cases about a decade ago and among them 8.7% (13.1 million) required hospitalization. India ranks in top five countries on basis of CAP load with more than 23% worldwide cases.

**Materials and Methods:** the design of this study is a Retrospective Cohort. A total of 123 patients ranging from 3 years old to 17 years old with a average of 9.90 years old, with bacterial pneumonia were included in the study. The diagnostic criteria of Infectious Disease Society of America and the British Thoracic Society were used in this study to determine the diagnosis and conclusion of the study. Out of 123 patients, 65 patients (Group 1) were given azithromycin at the initial dosage of 10 mg/kg followed by 5 mg/kg for 2 to 5 days while 58 patients (Group 2) were given ceftriaxone at the single intramuscular dose of 50 mg/kg. The clinical criteria and Likelihood criteria was determined before and after the treatment in both the groups to compare the efficiency of the two drugs. The adverse effects of the two drugs were also considered.

**Result:** the clinical criteria and Likelihood Ratio was determined before starting the treatment. On Day 5<sup>th</sup>, after completion of the treatment in both the groups, all the patients were again re-assessed. Group 1 showed more improvement as compared to group 2 patients as the fever in group 1 patients came down to 2.43% from 52.84% of the total number of patients. A high respiratory rate was found in 2.43% of 123 patients in the case of group 1 as compared to 4.06% of 123 patients in the case of group 2. Group 1 patients showed adverse effects like diarrhea, itching and nausea while group 2 patients showed tarry stool, sore throat and weakness as adverse effects. 12.19% of the total patients showed adverse effects from group 1 while 35.77% of the total patients showed adverse effects from group 2.

**Conclusion:** the study concludes that although both of the drugs used are effective in managing CAP. Azithromycin regimen has a significantly beneficial as compared to a single intramuscular dose of ceftriaxone.

**Keywords:** pneumonia, CAP, azithromycin, ceftriaxone, antibiotic

### Introduction

Community acquired pneumonia (CAP) can be explained as acute infection of the pulmonary parenchyma; with the chest radiograph exhibiting presence of an acute infiltrate or auscultatory decrees eloquent with pneumonia, the patient in this case must not be hospitalized or have had stayed in any medical care center for at least a fortnight before the first symptoms begin to appear [1]. According to the British Thoracic Society in absence of an X-ray, pneumonia can be defined as symptoms that incorporate acute lower respiratory tract (LRT) infection, comprising of cough and a minimum of one more LRT symptom, in parallel to any other 'systemic symptom and new focal signs on chest examination'[2]. The human population that forms most susceptible category constitute of two 5's age group: below 5 years of age and above 65 years; rate of mortality being much high in latter group [3]. The age category least affected is 18-24 years. The patients who pave their way to hospital due CAP display approximate mortality rate of 14% [4]. CAP the respiratory system related disease though a common household name is very

deadly with high global rates both in terms of morbidity and mortality [5, 6]. According to a general estimation its yearly incidence may fluctuate amid 5 to 11/1000 people, getting higher when the population is mature [7]. Extensive variations can be seen in mortality rates of CAP - being less than 5% in outdoor patients; becoming 10% in hospitalized ones and surpassing 30% in Intensive Care Unit (ICU) cases [8]. People suffering from various life-style or other diseases like diabetes, kidney malfunction, chronic obstructive pulmonary disease (COPD), heart and liver diseases, malignancy, etc. are more fragile to CAP and face enhanced chances of mortality [7]. A wide array of etiologic agents including 'bacteria, fungi, viruses, and protozoa' cook CAP in the host. Like in US earlier *Pneumococcus* was most common but has diminished now [9] and dipped down to only 10%-15% of inpatient cases sufferers [10, 11] suggesting that this vision should be broadened now on account of risks to the ill thus pacifying stern illness [12].

*Epidemiology*

Causative agents of CAP may be of typical or atypical type. Main players of former class comprise of ‘*Streptococcus pneumoniae*, *Haemophilus influenzae*’, and (sometimes even) ‘*Staphylococcus aureus*’ and few Gram-negative rods like *Klebsiella pneumoniae* and *Pseudomonas aeruginosa* [13,14,15, 16]. Latter class of “atypical” disease inducers incorporate ‘*Mycoplasma pneumoniae*, *Chlamydia pneumoniae* (mostly in outpatients), and *Legionella* spp. (mostly in inpatients)’, others in the backseat are *Chlamydia* Spp. and *C burnetii*. Among them only *L. pneumophila* enjoys a confirmed, notorious identity while others lay in sleep mode due to lack of identification and detection techniques and remain less frequently reported [17]. Other viruses that invade the respiratory tract like ‘influenza viruses, adenoviruses, and respiratory syncytial viruses’ also few others like parainfluenza virus, coronavirus etc [18,19, 20, 21, 22-25, 26]. Despite of this comprehensive list, still in 40-60% cases, cause of CAP remains mysterious and unidentified and yet in other 2-5% cases, more than one pathogen is detected [26].

Indian studies on CAP incidences have been very limited, as sample sizes are often scanty and bacterial culture is still the most prevalent test. Researches from various parts of India have reported *Pneumococcus* spp. [12] and Gram-negative bacilli [27] as causative agents of CAP. Young population (<50 years) devoid of any comorbid conditions or irregularity of vital signs, showed *Mycoplasma* spp as main causative agent while this position was taken over by *S pneumoniae* in older patients or ones suffering from previous underlying diseases [28]. Lifestyle hazard of cigarette smoking was the lone, dominant peril responsible for invasive pneumococcal disease in immunocompetent, non-elderly adults [29].

#### Epidemiology in India

Since many moons, India and other developing countries are facing CAP caused mortality of toddlers who are under-five years of age. According to a study new yearly cases were 151.8 million (about) about a decade ago and among them 8.7% (13.1 million) required hospitalization [30]. India ranks in top five countries on basis of CAP load with more than 23% worldwide cases [31]. An annual study (35) was conducted in 2016 in 4 districts of two most populous states of India (UP- Etawah and Lucknow and Bihar- Patna and Darbhanga ), n=5172 (CAP hospitalized cases), surprisingly showed only 28.7% (1485/5172) females, unfortunately revealing yet again the gloomy picture of gender and health-care bias still prevailing in India [32, 33, 34]. The study also stated that its only 4% of total CAP cases that seek their way to hospitalization, thus there must be mountainous concentration of unreported deaths (due to lack of admission in to any kind of hospital). These both incidences were found worth mentioning as they may lead to better and deeper insight of future learning

about CAP cases particularly in India (which must have been suppressed and blanketed due to above causes) [35].

#### Clinical features

The widely accepted clinical symptoms in a study [35] in unanimity with WHO are - severe pneumonia with CAP is delineated by alarming signs of- incapability to drink, relentless puking, paroxysms and seizures, lassitude or blackout, stridor in a calm child or grave malnutrition. Toddlers displaying fast breathing were categorized under pneumonia (included both presence and absence of chest in-drawing); and those with pneumonia along with other peril signals were called as “severe pneumonia” [36]. The minimum breathing threshold taken here [41] was: for <2 months age, 60 or more breaths per minute (bpm), 50 or more bpm for 2-11 months and 40 or more bpm for 12-59 months of age. States under the study did had immunization in 2016 only for measles and HiB (*Haemophilus influenzae type B*) and in accordance with universal immunization schedule [37, 38] and not for *Streptococcus pneumoniae*. And that too was quite overwhelming being HiB vaccine coverage in UP was 70%-79% and even better in Bihar >90% [39]. But they are equally notorious states in regards to maternal and child health care [40]. Arrays of disparity deviation in CAP cases were noted in districts under study, one plausible reason for this in Bihar could be inferior healthcare infrastructure there and variations incare-seeking available to CAP patients. A customary practice in Indian rural areas, is prevalence of habit of approaching various untrained and unprofessional health providers in situations of illness or while suffering from any disease. These include ‘pharmacists or medical store keepers, faith healers and traditional healers’ and it causes delay in proper treatment and ineffective and indecorous dosing [41, 42, 43]. Self-medication with drugs available over the counter is yet another evil that defaces the line of treatment.

An annual study [44] was conducted in 2009 in Lourdes Hospital, Ernakulam (750 bedded multispecialty referral hospital serving both city and town dwellers). It included all patients, both out-door and admitted on account of CAP) but was devoid of any control group. Results revealed presence of *S. pneumoniae* as the commonest pathogen and up to 25% cases could not be related to any causative pathogen. These results validated previous cross-border [45] and domestic studies [46]. The study also reported about 50% normal flora in CAP [44].

Another study [47] conducted in 2015 in JSS Medical College Hospital, Mysuru reported that only in 34% patients etiological organisms could be identified; most frequently encountered were- *Klebsiella pneumoniae* (8/34) and influenza virus (H1N1) (8/34). ICU samples proved better with higher isolation rates and null case of MRSA crossed the path.

A biennial (2013-15) study was undertaken in Sher-i-Kashmir Institute of Medical Sciences (SKIMS), Kashmir [48] which is a prominent center providing both tertiary care and referral facility and constitutes of about 700 beds. Study subjects were adults of 18 and above years and sample size was n=225, having clinical symptoms of CAP. CAP criteria taken care of here was acute illness accompanied with at least one of these forthcoming signs- fever, onset of a new cough (included both sputum production and absence of it), pain in chest area (pleuritic), 'dyspnea, or altered breath sound on auscultation', also a chest radiograph that exhibited a recently new pulmonary infiltrate (showing signs of acute pneumonia sprouting in maximum 2 days of hospital-stay) [5, 6]. Results revealed presence of 'Streptococcus pneumoniae, Legionella, and influenza' as most frequent agents of CAP [48]. The precise role of viruses in CAP is not yet well established e.g. 'pathogens, co-pathogens, triggers or all-in-one'. About 1/3 CAP cases report that the disease causing reason is a kind of respiratory virus [49, 50, 51] still their precise work mechanism remains in haze that whether they are actual pathogens, co-pathogens, triggers or play-all- role at a time. This study [52] established that confirmation of virus in nasopharyngeal swabs is sufficient to explain CAP pathogenesis.

#### *Drug treatment of CAP*

Knowing the exact cause is vital while deploying any treatment as if it is due to atypical pathogens the course takes a totally different path because these are mostly resistant to all beta-lactams thus their eradication will need either of these- macrolide, a fluoroquinolone, or a tetracycline [48]. Earlier also there have been reported about ~10%–15% of cases where CAP is caused by a combination of typical and atypical pathogens [53, 54].

Results from a hospital based study unveiled that in their setting *S. pneumoniae* common and both linezolid or amikacin came out to be most effective; it was based on culture and sensitivity tests and the study suggested that this test should be taken before deciding the antibiotic-profile to be prescribed. It also advocated Mono-therapy (for both typical and atypical CAP causative agents) over double-drug therapy as the former is equally competent and budget-friendly [44]. Another already mentioned study [47] exhibited absolute resistance of *P. aeruginosa* to 'levofloxacin and azithromycin (both 100%), amikacin (60%), and piperacillin-tazobactam (80%)'. Here many causative agents of CAP showcased sensitivity to carbapenems (61.7%) and amikacin (35.2%); similar results were obtained by two different studies- the one in Mangalore showed sensitivity to Ciprofloxacin (49%) [55] and one from Kerala showed amikacin (44.84%) sensitivity [56].

#### **Literature Review**

A randomized trial was carried out in Qaem Hospital, Alborz city (n=150, study period Dec. 2016 - June 2017). A two groups of CAP patients were formed in two treatment groups. First group got allocated the oral Levofloxacin (LVF) (TAVANEX), 750 mg, to be given one time each day for 5 days. Second group was subjected to 'parenteral Ceftriaxone 1gr BD plus oral Azithromycin (250 mg, once daily) for seven to ten days (standard regimen)'. Results revealed that oral LVF monotherapy was equally effective as blend of Ceftriaxone (CTX) & Azithromycin (AZH) in CAP induced hospitalized population. Findings from the study revealed that both treatment groups did not deviate much on parameters of 'body temperature, WBC count, respiratory sounds and admission duration'. Though, rare cases of skin rash, stomach upset or peculiarities of central nervous system were reported. There was a clean slate also with regards to hospital transience, clinical worsening and antibiotic acceleration while hospital admission in both groups [57]. A secondary, biennial study at Persahabatan Hospital in Jakarta with n= 100 patients (64 on intravenous CTX and oral AZH and 36 on LVF only) showed high variations in cost where the; median cost of combo-drug profile was less its direct total medical cost was high. It was discovered that LVF was more cost-effective and decreased the hospital stay of the patient in comparison to combo-therapy while considering CAP patients [58].

A recent US study tried to compare incidences (from Saint Vincent Healthcare) of medicine-failure amid the CTX used singularly (84 patients) and blend of CTX with AZH (159 patients) in CAP caused inpatients and unearthed that  $\beta$ -lactam (CTX) monotherapy was equally effectual as it along with AZH for empiric medication in cases of CAP [59].

A comparative systematic review of 7 studies (that happened between 2002 and 2014) compared AZH, and clarithromycin (CLY) {along with use of beta-lactams (BLm)} where AZH 500 mg daily was injected IV and CLY was given either by mouth or in form of IV injection (its dosage varied from 300-1000 mg/day). The most common pathogen detected was *Streptococcus pneumoniae* in macrolide groups, (it appeared in '130 and 80 isolates in the CLY-based and AZH-based groups, respectively'). Here used macrolide combo constituted of either a 'penicillin-lactamase inhibitor or a cephalosporin-based BLm, (where CTX was preferred most). Results revealed that BLm- AZH receivers had a slighter longer in-stay at health care center; although both Macrolides and AZH were found to be having reasonably safe pharmacokinetic effect [60]. An interesting secondary-type study on two different dosages of Ceftriaxone was carried to discover the better option among the two while considering them as treatment for CAP. In all 24 studies were included where half were based on 1 g daily dose and resistant half had based on 2 g/day dose of Ceftriaxone.

Results revealed that lower dose was equally effective in treatment and that higher concentration of medicine (i.e. 2 g daily here) did not showed up any overwhelming result in improvement of clinical outcomes in CAP patients [61]. A five-yearly study that included retrospective analysis taking data from 4 diverse hospitals got conducted between 2008 -2013. The final number of subjects that got a place here was 20,600 patients and were subdivided into group 1 with 11,201 patients (55.84%) obtaining dual-drug therapy of ceftriaxone with azithromycin, and resistant 8,859 (44.16%) got fluoroquinolone drugs. Results unveiled that mortality rate in patients receiving fluoroquinolones was low-slung than those getting double-medicines [62]. An extensive study that covered a time-frame of almost 40 years (search was completed through PubMed from 1980–2019) intended to find out the length of time for which AZH (either alone; to be given for 5 days or along with any other antibiotic; to be given for 3 days) should be provided to CAP patients. Otherwise standard CAP treatment suggests 1500 mg administration of AZH to be equally divided in 5 even doses. This study though displayed that same dose when divided into a 3-days course was as effectual as the 5 day treatment and runs parallel to longer medicine receiving time in outdoor patients receiving clarithromycin or amoxicillin/clavulanate. This can be attributed to long half-life of AZH that shortens the treatment course, and also because level of this medicine remains appreciably maintained in the blood stream. But it does not recommend 3-day treatment for patients who needed a hospital stay, despite of low risk of cardiac death which is no-more greater than with other antibiotics [63].

## Materials and Methods

The design of this study is a Retrospective Cohort. A total of 123 patients ranging from 3 years old to 17 years old with a average of 9.90 years old, with bacterial pneumonia were included in the study. The diagnostic criteria used in this study were largely productive cough and fever. Bloody sputum, anorexia, chest pain, shortness of breath, tactile fremitus, and crackles are some of the other symptoms. According to the Infectious Disease Society of America and the British Thoracic Society [64-67], confirming criteria included X-Ray imaging with visible infiltration. Patients who stopped taking their medication in the middle of the study were not included. The study looked at admitted patients who were in the hospital between February and October of 2021.

Out of 123 patients, 65 patients (Group 1) were given azithromycin at the initial dosage of 10 mg/kg followed by 5 mg/kg for 2 to 5 days while 58 patients (Group 2) were given ceftriaxone at the single intramuscular dose of 50 mg/kg. The assessment of clinical outcome was done on the 5th day. The clinical assessment was based on various aspects, namely, the disappearance of the clinical features, resolution of imaging features and appearance of adverse effects of the drug treatment.

A clinician can use clinical features of pneumonia patients to predict the likelihood of the diagnosis but cannot infer the diagnosis. Therefore, along with the clinical features, imaging study is essential [68]. The following criteria were used for predicting the likelihood of the diagnosis. The following tables (Table 1 and Table 2) represent the scores for diagnosing Community Acquired Pneumonia (CAP) and hence the likelihood ratio [69].

**Table 1: The clinical criteria on which the diagnosis of pneumonia is based on**

Criteria	Score
Presence of Rhinorrhea	-2
Presence of Sore throat	-1
Presence of Night sweats	1
Myalgia	1
Whole day Sputum secretion	1
Respiratory rate > 25 breaths/min	2
Temperature $\geq 37.8^{\circ}\text{C}$ ( $100^{\circ}\text{F}$ )	2

**Table 2: The total points and corresponding Likelihood Ratio, indicating the probability of pneumonia**

Total points	Likelihood ratio
$\geq 3$	LR+ = 14.0
$\geq 1$	LR+ = 5.0
$\geq -1$	LR+ = 1.5
< -1	LR- = 0.2

After confirmation of the diagnosis, the patients were admitted to the hospital, given that, Total Score  $\geq 1$ . The drug treatment was applied as mentioned before and the pharmacological effects and adverse effects were observed.

## Result

This study considered 123 patients in total. Out of 123 patients, there are 68 males (55.28%) and 55 females (44.71%) in the study. There are two groups in this study. Group 1 patients received azithromycin at the mentioned dosage while Group 2 patients received ceftriaxone at the mentioned dosage. On the 5th day of the hospital admission, the patients were re-assessed including clinical aspects and imaging status. Along with the clinical picture, the chest X-Ray showed typical infiltration in all the patients of both groups.

The study found that all the patients in Group 1 and Group 2 had fever with a temperature of more than 37.8°C. The

study found that 47.96% of the total patients and 43.90% of the total patients had a respiratory rate of more than 25 breaths/minute in Group 1 and Group 2 respectively. In group 1, 25.20%, 45.52% and 34.14% of the total patients had night sweats, myalgia and sputum secretion, respectively. Similarly, in group 2, clinical features like night sweats, myalgia and sputum secretion accounted for 21.95%, 39.83%, 36.58% of the total patients, respectively. The complete assessments before the hospital admission and after the treatment are given below in Table 3 and Table 4 which are showing the number of patients (from each group) in each criterion and likelihood ratio, respectively.

**Table 3: Diagnostic criteria of Bacterial Pneumonia and number of patients positive for each criterion from each group (Before Treatment)**

Criteria	Group 1 (n=65)	% of total number of patients	Group 2 (n=58)	% of total number of patients
Presence of Rhinorrhea	0	0	0	0
Presence of Sore throat	0	0	2	1.62
Presence of Night sweats	31	25.20	27	21.95
Myalgia	56	45.52	49	39.83
Whole day Sputum secretion	42	34.14	45	36.58
Respiratory rate > 25 breaths/min	59	47.96	54	43.90
Temperature $\geq$ 37.8°C (100°F)	65	52.84	58	47.15

**Table 4: Correlation of the above score with Likelihood Ratio (LR) in each of the group (Before Treatment)**

Total points	Likelihood ratio	Group 1 (n=65)	% of total number of patients	Group 2 (n=58)	% of total number of patients
$\geq$ 3	LR+ = 14.0	52	42.27	51	41.46
$\geq$ 1	LR+ = 5.0	13	10.56	07	5.69
$\geq$ -1	LR+ = 1.5	0	0	0	0
< -1	LR- = 0.2	0	0	0	0

After completion of the drug schedule in both the groups, on the 5th day, all the patients were again re-assessed. Every patient showed negative imaging status, that is, chest infiltration was negative. In both groups, the resolution occurred significantly. After treatment completion, there was a significant improvement in both groups. But group 1 showed more improvement as compared to group 2 patients as the fever in group 1 patients came down to 2.43% from 52.84% of the total number of patients. A high respiratory

rate was found in 2.43% of 123 patients in the case of group 1 as compared to 4.06% of 123 patients in the case of group 2. Even the Likelihood Ratio (LR) has come down in both the groups after the treatment. Table 5 and Table 6 below shows after the treatment, the number of patients from each group who have clinical features and the number of patients from each group who have a Likelihood Ratio of 5 and more, respectively.

**Table 5: Diagnostic criteria of Bacterial Pneumonia and number of patients positive for each criterion from each group (After Treatment)**

Criteria	Group 1 (n=65)	% of total number of patients	Group 2 (n=58)	% of total number of patients
Presence of Rhinorrhea	0		0	
Presence of Sore throat	0		0	
Presence of Night sweats	0		0	
Myalgia	12	9.75	13	10.56
Whole day Sputum secretion	9	7.31	11	8.94
Respiratory rate > 25 breaths/min	3	2.43	5	4.06
Temperature $\geq$ 37.8°C (100°F)	3	2.43	8	6.50

**Table 6: Correlation of the above score with Likelihood Ratio (LR) in each of the group (After Treatment)**

Total points	Likelihood ratio	Group 1 (n=65)	% of total number of patients	Group 2 (n=58)	% of total number of patients
$\geq 3$	LR+ = 14.0	4	3.252	9	7.31
$\geq 1$	LR+ = 5.0	23	18.69	28	22.76
$\geq -1$	LR+ = 1.5	0	0	0	0
< -1	LR- = 0.2	0	0	0	0

The adverse effects were also determined in each group of patients. Although in this study, the adverse effects did not significantly observed, there are fewer adverse effects reported from both the groups. Table 7 shows the adverse effects the patients had after receiving Azithromycin and its respective number of patients for each adverse effect. Table 8 shows the adverse effects the patients had after receiving Ceftriaxone and its respective number of patients for each adverse effect. Group 1 patients showed adverse effects like diarrhea, itching and nausea while group 2 patients showed tarry stool, sore throat and weakness as adverse effects. 12.19% of the total patients showed adverse effects from group 1 while 35.77% of the total patients showed adverse effects from group 2. The summary of the adverse effects are shown in the table below (Table 7 and Table 8).

**Table 7: The adverse effects of the patients who received azithromycin and their corresponding percentages**

Adverse Effect	Group 1 (n=65)	% of total number of patients
Diarrhea	12	9.75
Itching	2	1.62
Nausea	1	0.81

**Table 8: The adverse effects of the patients who received ceftriaxone and their corresponding percentages**

Adverse Effect	Group 2	% of total number of patients
	(n=58)	
Tarry stool	15	12.19
Sore throat	11	8.94
Weakness	18	14.63

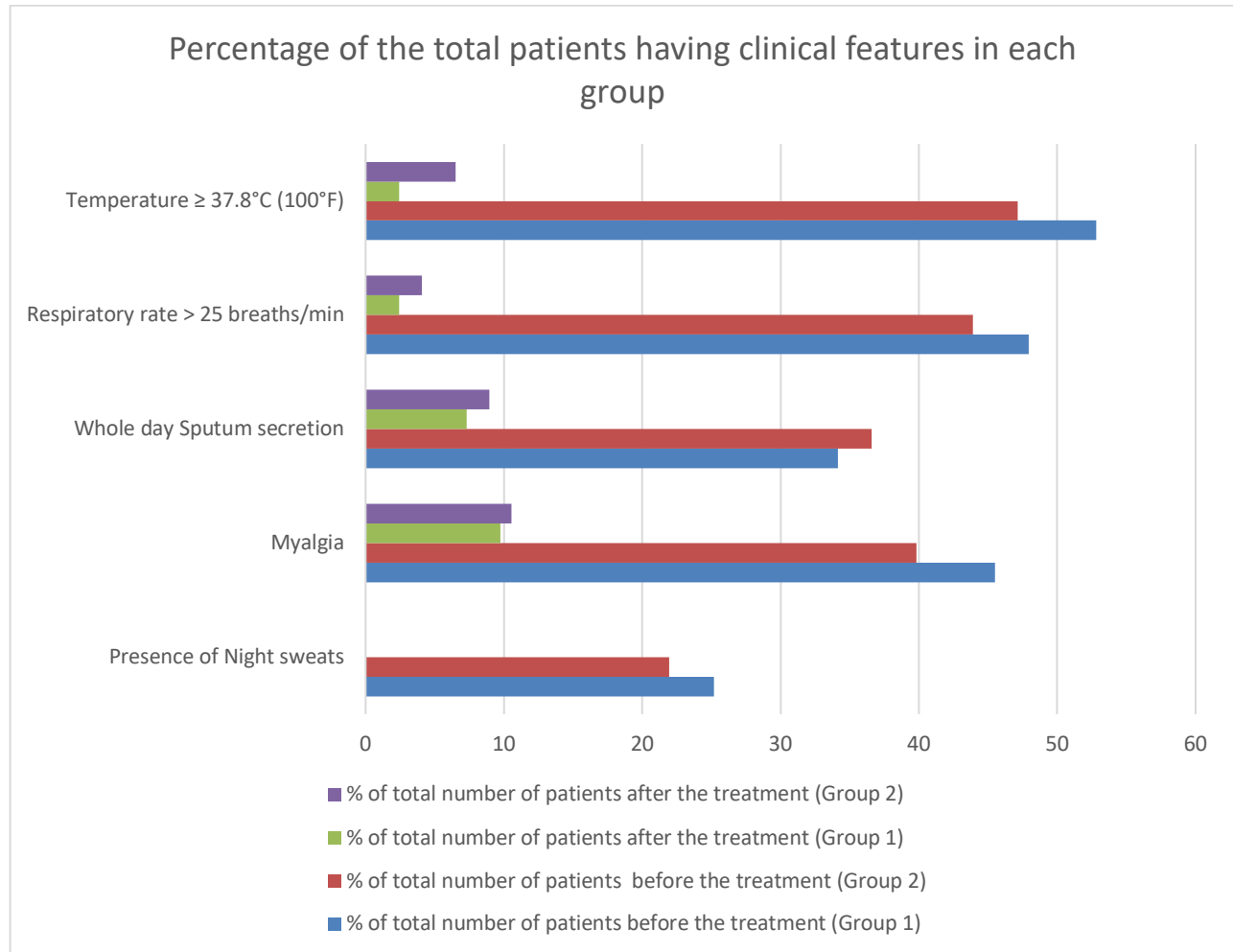
## Discussion

The study found that the patients who had azithromycin (group 1) have benefitted more as compared to the patients who had ceftriaxone (group 2) in terms of resolution and adverse effects. However, both the groups have benefitted and lung infiltration resolved after the treatment as evidenced from imaging results. This shows that both drugs are effective in treating bacterial pneumonia. However, the comparison of clinical features and adverse effects between the two groups have clearly shown that azithromycin is

more beneficial as compared to the ceftriaxone regimen. The following table (Table 9) shows the percentage of the total number of patients having each of the clinical features before and after the treatment from each group. In the table below it can be observed that in group 1, the drop in percentage of patients with Temperature  $\geq 37.8^{\circ}\text{C}$  is more significant than group 2. For other clinical criteria, the drop in the percentage of the total number of patients in group 1 is more than in group 2.

**Table 9: The percentage of patients having clinical features in group 1 and group 2 before and after the treatment**

Criteria	% of total number of patients before the treatment (Group 1)	% of total number of patients before the treatment (Group 2)	% of total number of patients after the treatment (Group 1)	% of total number of patients after the treatment (Group 2)
Presence of Night sweats	25.2	21.95	0	0
Myalgia	45.52	39.83	9.75	10.56
Whole day Sputum secretion	34.14	36.58	7.31	8.94
Respiratory rate > 25 breaths/min	47.96	43.9	2.43	4.06
Temperature $\geq 37.8^{\circ}\text{C}$ (100°F)	52.84	47.15	2.43	6.5

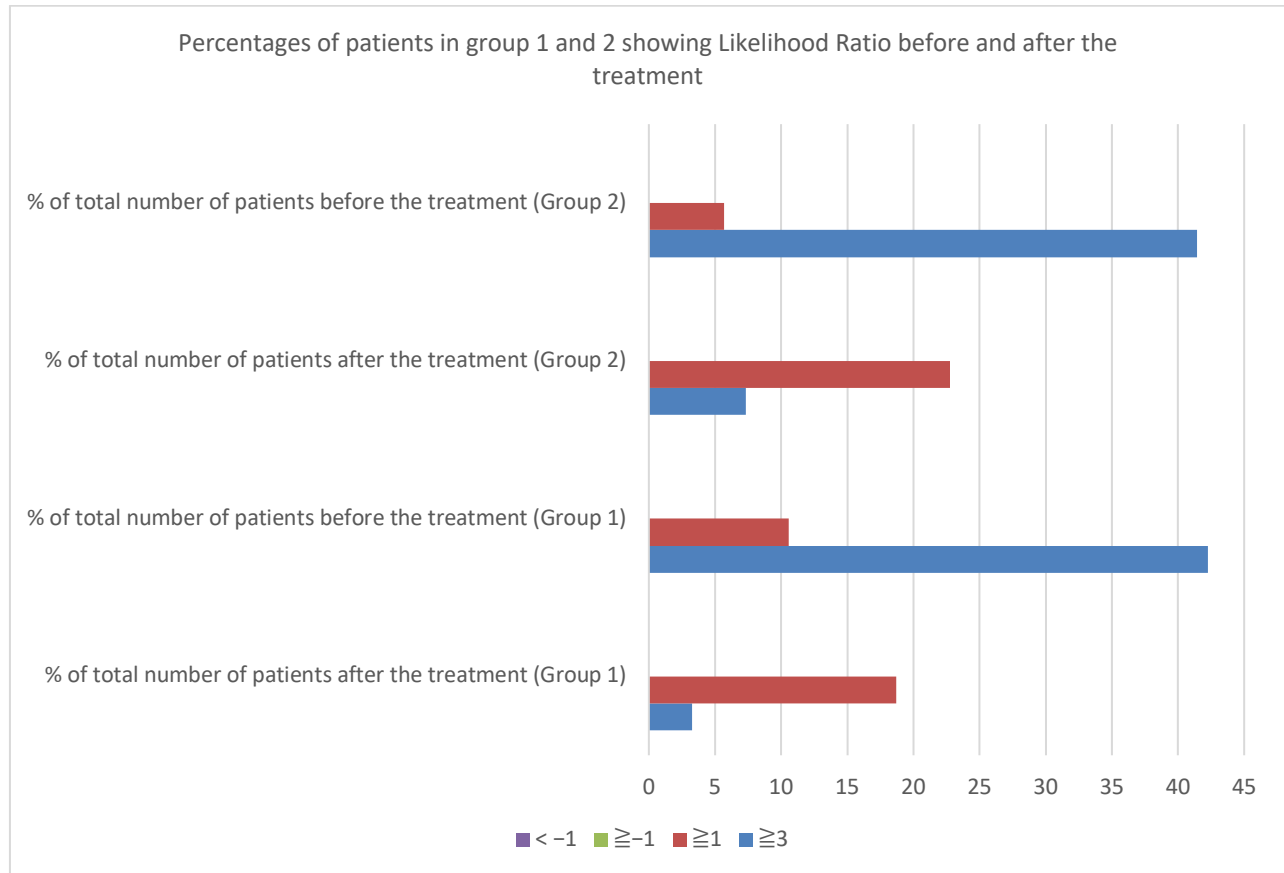


**Figure 1: Percentage of the total patients having clinical features in each group and showing the comparison between the two groups**

Table 10 and Figure 2 shows that there is significant decrease in Likelihood Ratio (LR) among the group 1 patients while the group 2 patients' reduction in LR is less significant as compared to group 1 patients. This result was obtained on the 5<sup>th</sup> day of their treatment and so, none of the patients showed complete resolution from pneumonia. Table 10 also evidently presents that azithromycin regimen has positive pharmacological effect on the patients faster than ceftriaxone.

**Table 10: The percentage of patients with corresponding Likelihood Ratio (LR) before and after the treatment in group 1 and group 2**

Total points	Likelihood ratio	% of total number of patients before the treatment (Group 1)	% of total number of patients after the treatment (Group 1)	% of total number of patients before the treatment (Group 2)	% of total number of patients after the treatment (Group 2)
$\geq 3$	LR+ = 14.0	42.27	3.252	41.46	7.31
$\geq 1$	LR+ = 5.0	10.56	18.69	5.69	22.76
$\geq -1$	LR+ = 1.5	0	0	0	0
$< -1$	LR- = 0.2	0	0	0	0



**Figure 2: Percentages of patients in group 1 and 2 showing Likelihood Ratio before and after the treatment**

Therefore, all the schematic representations above clearly show that group 1 patients have a slightly beneficial effect as compared to the patients of group 2.

Again, 12.19% of the total patients from group 1 had adverse effects while 35.77% of the total patients from group 2 had adverse effects. Therefore, the patients who were given azithromycin had much lesser adverse effects as compared to the patients who received ceftriaxone.

The findings above evidently support regimen of azithromycin (initial dosage of 10 mg/kg followed by 5 mg/kg for 2 to 5 days) against ceftriaxone (single intramuscular dose of 50 mg/kg) in managing Community Acquired Pneumonia (CAP).

### Conclusion

The study concludes that although both of the drugs (azithromycin and ceftriaxone) are effective in managing CAP, still azithromycin has a significant positive pharmacological effect as compared to a single intramuscular dose of ceftriaxone. This can also be attributed to keeping the least possible adverse effects. The study also suggests conducting more studies comparing the

efficient pharmacological effect of various drugs in managing CAP.

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