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A PROSPECTIVE OBSERVATIONAL STUDY ON THE ASSESSMENT OF ANTIMICROBIALS IN LOWER RESPIRATORY TRACT INFECTIONS

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ABSTRACT

Background: Lower respiratory tract infection is a group of infections which affects the lungs and the lower airways which is mainly caused by pathogens like bacteria, fungi, and viruses. LRTI is mainly treated with antimicrobial agents which include a wide range of antibiotics, and antiviral drugs. **Methodology**: Our study was carried out as a prospective observational study assessed at Gleneagles Aware Global hospital, Hyderabad for a period of 6 months. **Results:** Within the study 165 individuals have been enlisted from which males were 62.45% and females were 37.57%. The most common diagnosed LRTI was Pneumonia i.e., 44.84%. There is no significant difference between smokers and non-smokers in severity of LRTI. In the analysis of ABG (arterial blood gases) 56.88% were found abnormal. Cefoperazone+sulbactam, doxycycline, azithromycin, piperacillin+tazobactam, ceftriaxone was widely used in LRTI therapy. **Conclusion:** From our analysis we conclude that the age group of 56-75 were more suffered with LRTI. There is no significant difference in the severity of LRTI between normal BMI and obese patients. Cefoperazone+sulbactam was the widely used antimicrobial agent. Combination of triple antimicrobial therapy (36.96%), dual antimicrobial therapy (35.75%) and single antimicrobial therapy (27.27%) is used for lower respiratory tract infections. The LHS was less (1-5 days) in people taking dual and triple antimicrobial agents compared to patients taking single antimicrobial agents.

KEYWORDS: Infection, LRTI, Antimicrobials, Oxygen therapy, Supportive care.

INTRODUCTION

Antimicrobial resistance is one of the greatest threats to global public health and the World Health Organisation warns against a return to a pre-antibiotic era.[1] Higher prevalence of resistance among human pathogens increases the risk of uncontainable infections, prolonged illness and hospital stay, increased mortality, and consequently increased health care costs.[2] Antibiotic use is the main driver of antibiotic resistance, why addressing the excessive and inappropriate use of antibiotics is essential.[3] In Denmark, general practice accounts for about 75% of the total human antibiotic consumption.[4] Acute lower respiratory tract infections (LRTIs) are among the most common infections managed in Danish general practice[5], with pneumonia being a common indication for antibiotic prescriptions.[6]

According to Danish and international recommendations, patients with suspected pneumonia should, in general, be treated with antibiotics.[5] Contrary, acute bronchitis is most often considered a viral infection and thus most patients will not benefit from antibiotic treatment.[5] However, it can be difficult to differentiate pneumonia from other LRTIs by means of symptoms and signs[7], and the point-of-care test (POCT) named C-reactive protein (CRP) has been used since 1999 in Danish general practice.[8] Evidence exists that CRP-testing can reduce antibiotic prescribing for acute respiratory tract infections[9] and many guidelines recommend CRP-testing in patients presenting with symptoms of an acute LRTI.[5,10] However, as CRP is a non-specific marker of inflammation, it is challenging to set a specific cut-off value for treatment with antibiotics. Also, imaging can be used as a supportive diagnostic tool for diagnosing pneumonia, with chest X-ray being the most commonly used. However, diagnostic imaging is far from always used in patients suspected for pneumonia due to low availability, high radiation dose, and high costs. In summary, a great deal of diagnostic uncertainty exists when dealing with patients with acute LRTIs in general practice and this may lead to too many people being diagnosed with pneumonia and thus resulting in inappropriate use of antibiotics.[11]

The main need for study is there are many antimicrobial drugs available. Increased number of medications and

treatment options may lead to irrational drug use and cause undesired therapeutic outcomes. So, only standard treatment needs to be followed by the prescriber. The irrational use or misuse of antimicrobial drugs may lead to: Development of drug resistance, Adverse drug reactions, Increase in health care expenses.

METHODOLOGY

Study Design: It is a prospective observational study.

Source of data collection

- Patient data organizing form
- Patient records and prescription
- Patient medical and medication history

Inclusion Criteria

- Both male and female
- Patients with and without comorbidities
- Age from above 15 years to 95 years

Exclusion Criteria

- Immunocompromised patients
- Age below 15 years
- Other respiratory infections than LRTI
- Stage V RF patients
- Final stage of liver disease
- Child pursy liver disease

Methods of data collection

- Patient data collection form
- Informed consent form

Study Procedure

- Literature review for the study
- Recruiting patients based on the eligibility criteria
- Collection of patient data and complete information
- Evaluation of drug use patterns of antimicrobials in LRTI
- Identification of ADRs, drug interactions, medication errors
- Data processing and analysis
- Result formatting and submission

Patient data collection form

A comprehensive participant form for collecting data was designed in accordance with study's specifications.

Duration of the study- 6 months.

Sample size: 100- 150.

Study Location: Gleneagles Aware Global Hospital, Hyderabad.

RESULTS

Table 1: Age-Wise Distribution.

AGE DISTRIBUTION	TOTAL NO. OF PATIENTS	PERCENTAGE
15-35	30	18.18%
36-55	49	29.69%
56-75	67	40.60%
76-95	19	11.51%

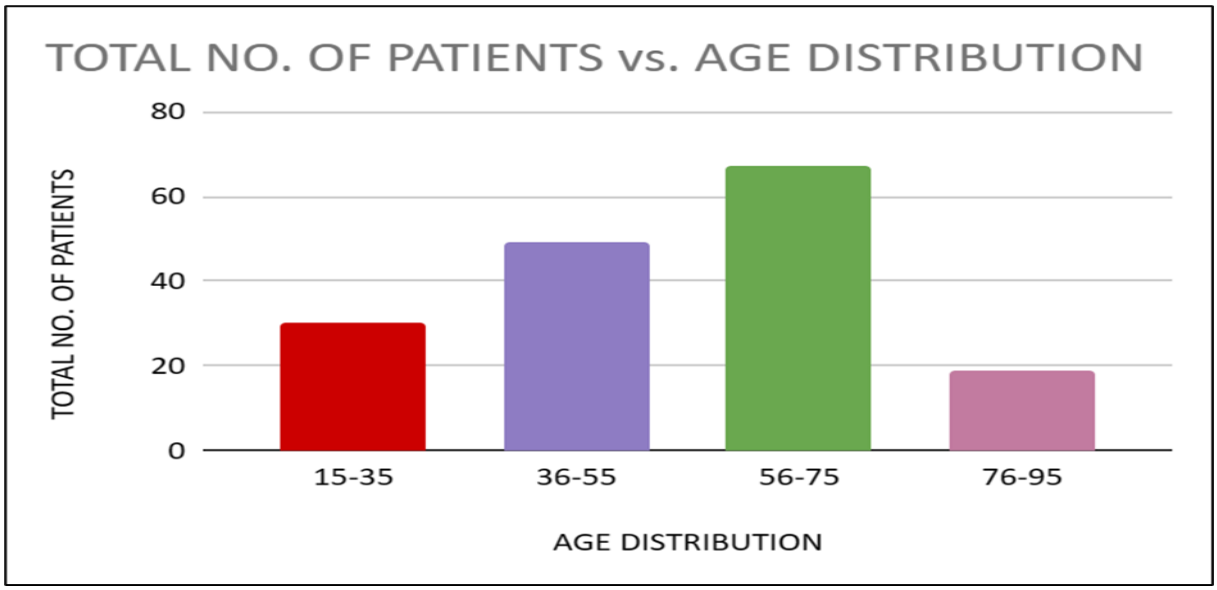

Figure 1: Age Wise Distribution.

In the study conducted among 165 patients, the age was categorized between 15-35 years (18.18%) 35-55 years (29.60%), 56-75 years (40.60%) and 76-95 years (11.51%).

Table 2: Gender-Wise Distribution.

GENDER DISTRIBUTION	TOTAL NO. OF PATIENTS	PERCENTAGE
MALE	103	62.45%
FEMALE	62	37.57%

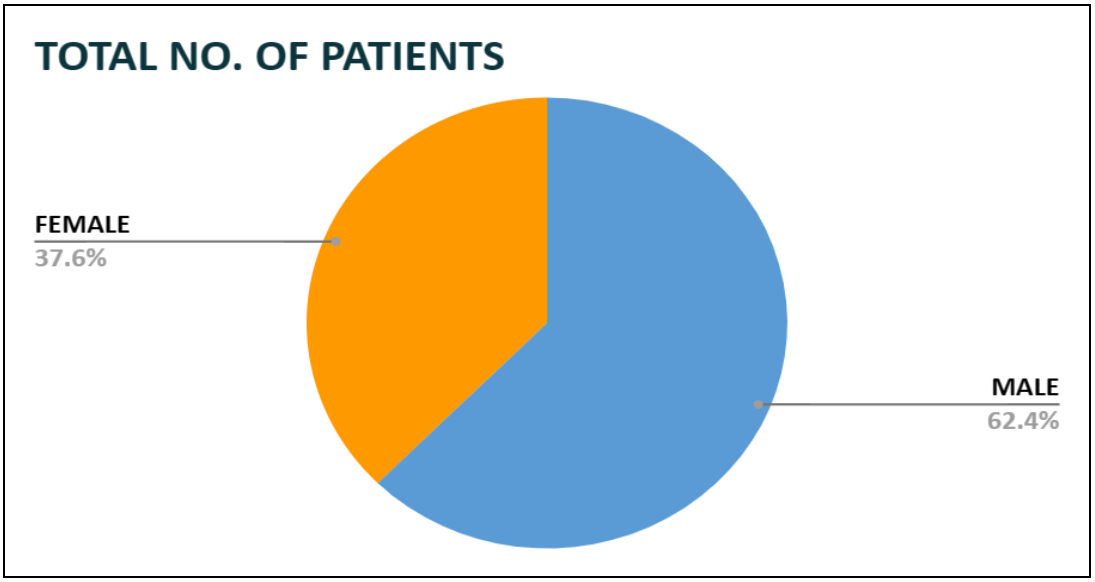

Figure 2: Gender Wise Distribution.

In this study, it was reported that 165 patients prescribed Antimicrobials in LRTI were male (62.45%) followed by female (37.57%).

Table 3: Gender Distribution Based On Age.

Age Distribution	Male	Female
15-35	21	9
36-55	28	21
56-75	39	28
76-95	15	4

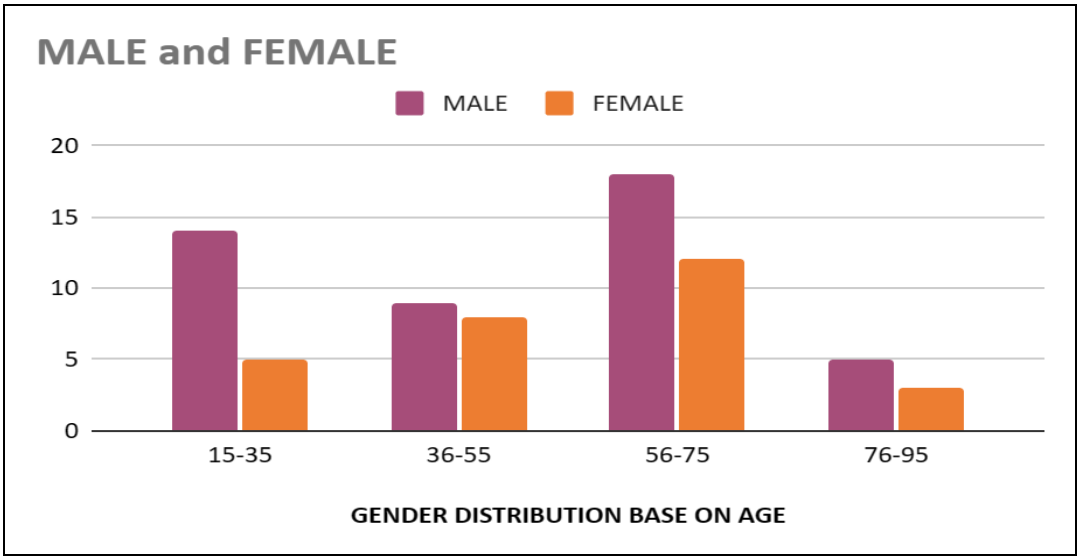

Figure 3: Gender Distribution Based On Age.

In this study it was observed that the patients age was sub classified based on the gender such as 15-35 years (Male-21, Female-9), 36-55 years (Male-28, Female-21), 56-75(Male-39, Female-28) and 76-95 years (Male-15, Female-4).

Table 4: Distribution Based On Bmi.

BMI DISTRIBUTION	TOTAL NO. OF PATIENTS	PERCENTAGE
UNDERWEIGHT (<18.5)	6	3.63%
NORMAL (18.5-24.9)	74	44.84%
OVERWEIGHT (25-29.9)	59	35.75%
OBESE (30-34.9)	17	10.30%
EXTREMELY OBESE (>35)	9	5.45%

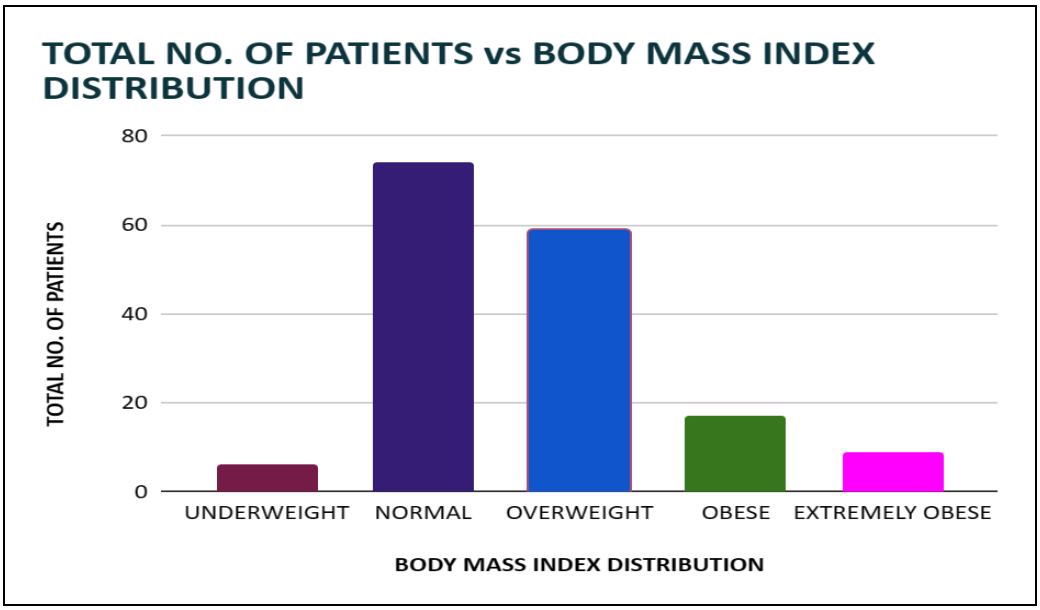

Figure 4: Body Mass Index Distribution.

In this study, among the 165 patients the BMIs were classified as Underweight (3.63%), Normal (44.84%), Overweight (35.75%), Obese (10.30%) and extremely obese (5.45%).

Table 5: Distribution Based on Smoking History.

DISTRIBUTION BASED ON SMOKING HISTORY	TOTAL NO. OF PATIENTS	PERCENTAGE
SMOKER	78	47.27%
NON-SMOKER	87	52.72%

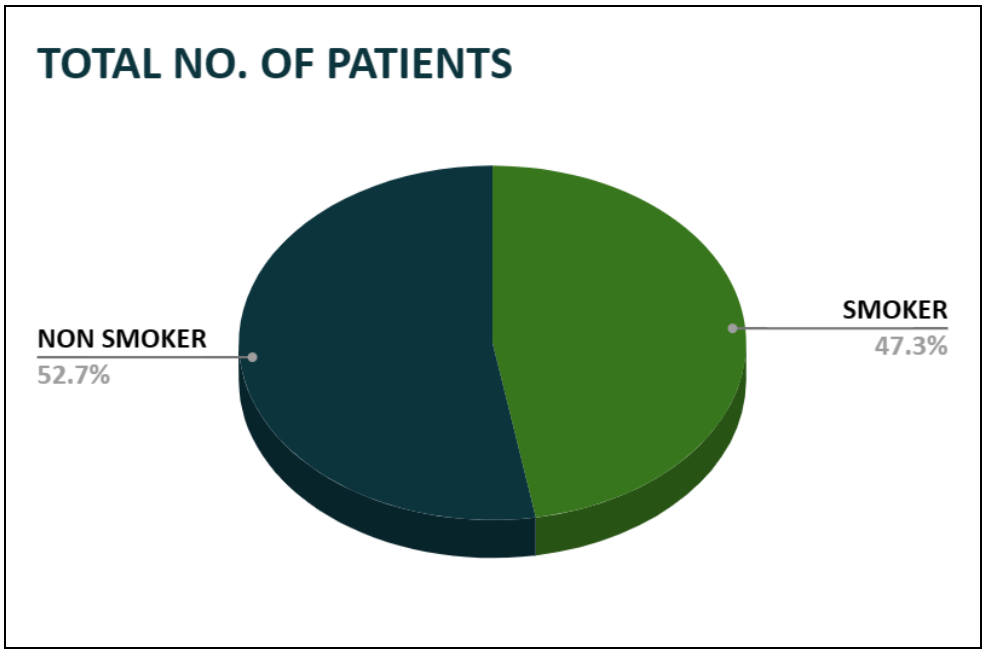

Figure 5: Distribution Based On Smoking History.

In this study, the Smoking history of 165 patients were classified as Non-smokers (52.72%) and smokers (47.27%).

Table 6: Distribution Based On Lhs.

Lhs	Total no. Of patients	Percentage
1-5 DAYS	126	76.36%
6-10 DAYS	34	20.60%
11-15 DAYS	4	2.42%
16-20 DAYS	1	0.60%

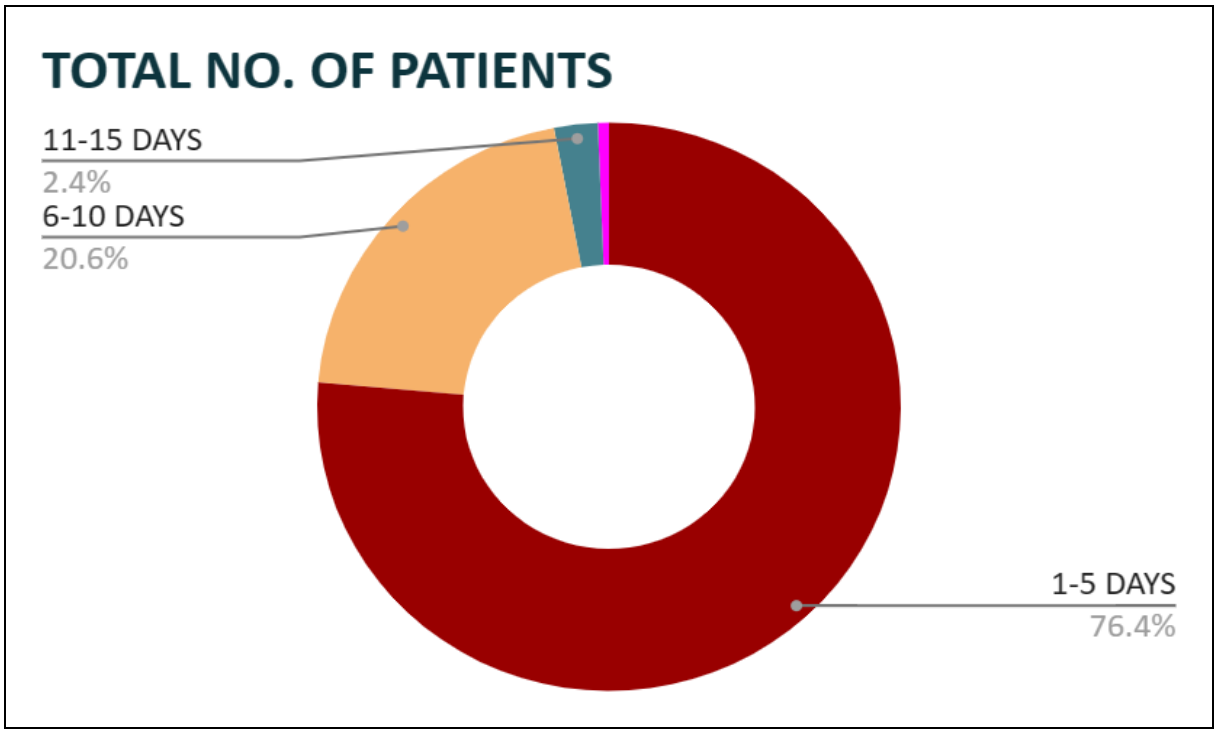

Figure 6: Distribution Based On Lhs.

In this study, the LHS among 165 participants was categorized into 1-5 Days (76.36%), 6-10 Days (20.60%), 11-15 Days (2.42%) and 16-20 Days (0.60%).

Table 7: Distribution of Patients Based on The Diagnosis.

DIAGNOSIS	TOTAL NO. OF PATIENTS	PERCENTAGE
PNEUMONIA	74	44.84%
COPD	25	15.15%
TUBERCULOSIS	19	11.51%
BRONCHIECTASIS	11	6.66%
RF	19	11.51%
INFLUENZA	7	4.24%
COVID-19	6	3.63%
RSV	2	1.21%
ARDS	2	1.21%

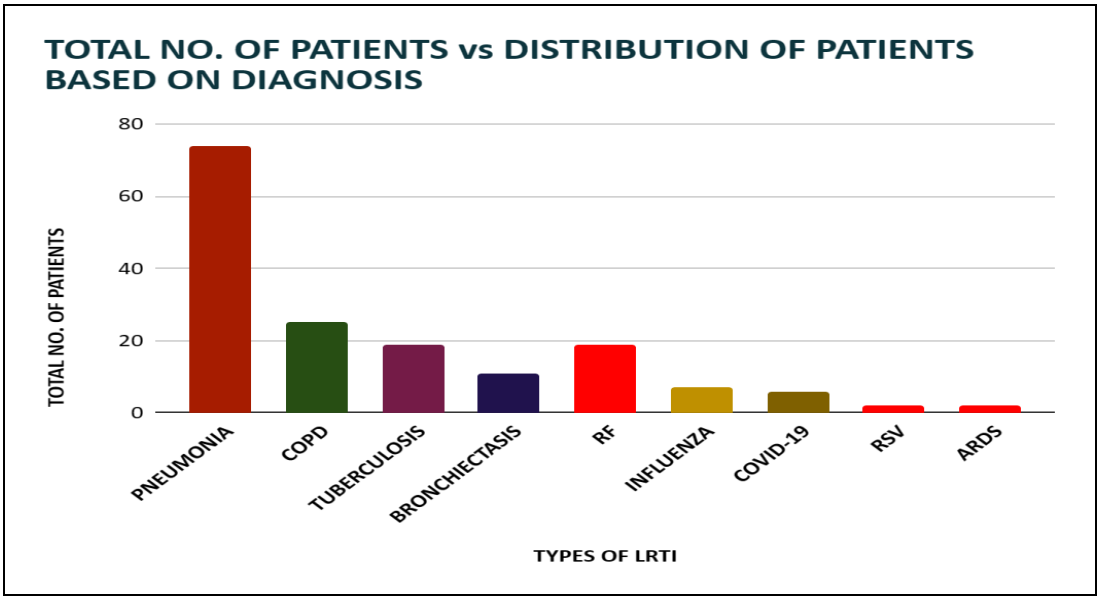

Figure 7: Distribution of Participants Based on The Diagnosis.

165 patients were categorized based on the particular diagnosed infections which are Pneumonia (44.84%), COPD (15.15%), Tuberculosis (11.51%), Bronchiectasis (6.66%), Respiratory failure (11.51%), Influenza (4.24%), RSV (1.21%) and ARDS (1.21%).

Table 8: Distribution of Patients Based on Type Of Pneumonia.

Types Of Pneumonia	Total No. Of Pneumonia Patients	Percentage
CAP	37	22.42%
HAP	25	15.15%
VAP	1	0.06%
VIRAL	11	6.66%

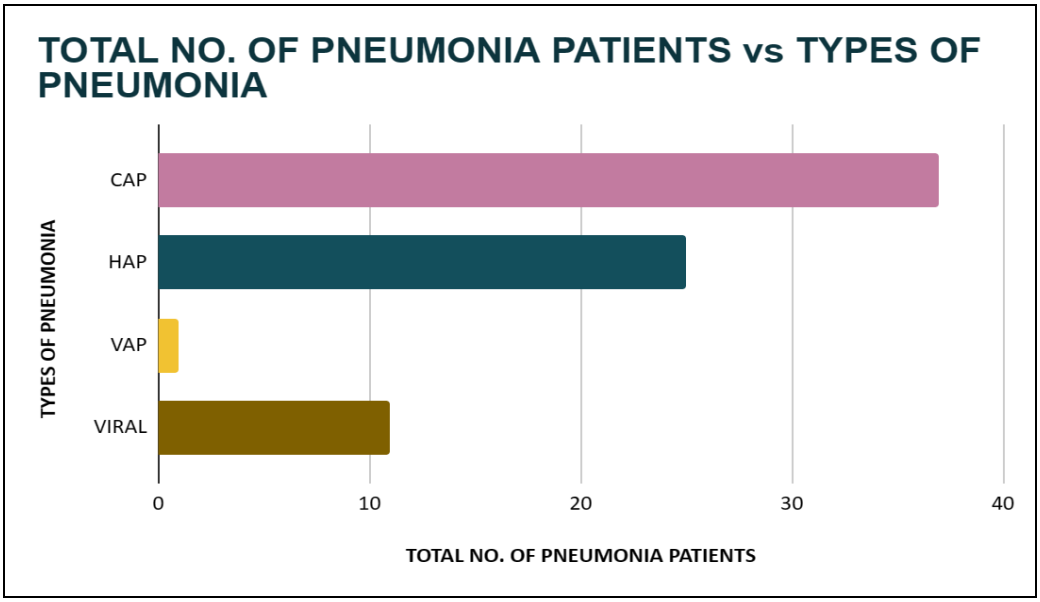

Figure 8: Distribution of Individuals Based on Type Of Pneumonia.

The patients classified based on the types of pneumonia were CAP (22.42%), HAP (15.15%), VAP (0.06%) and Viral (6.66%).

Table 9: Distribution of Pneumonia Patients Based on Smoking History.

Pneumonia Patients Based On Smoking History	Total No. Of Pneumonia Patients	Percentage
SMOKERS	28	37.83%
NON-SMOKERS	46	62.16%

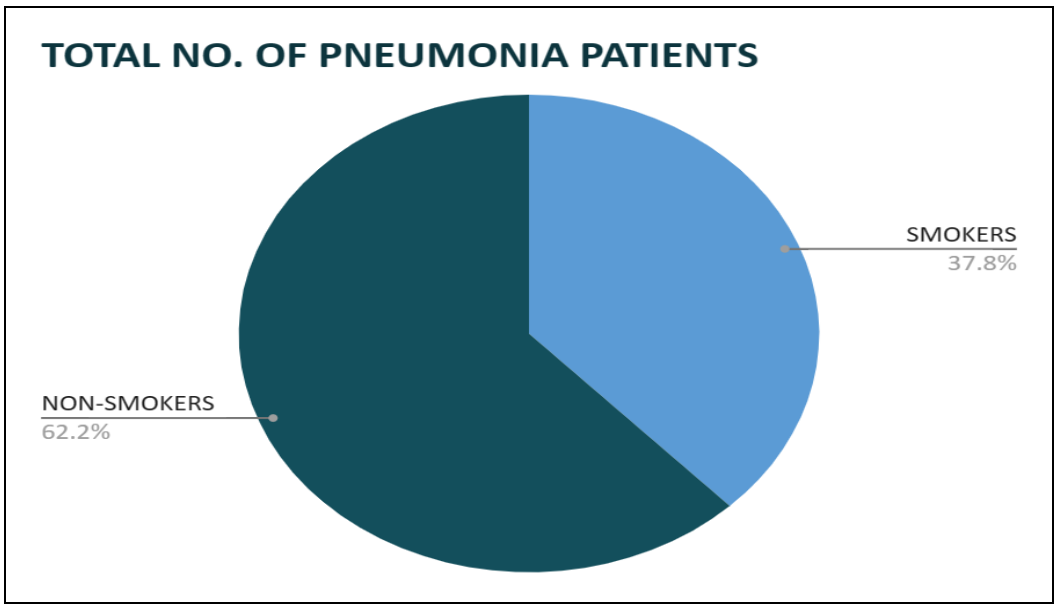

Figure 9: Distribution of Pneumonia Individuals Based on Smoking History.

The Pneumonia patients were classified as Smokers (37.8%) & Non-smokers (62.2%).

Table 10: Distribution Of Pneumonia Patients Based On Bmi.

Bmi	Total No. Of Pneumonia Patients	Percentage
NORMAL	49	66.21%
OBESE	25	33.78%

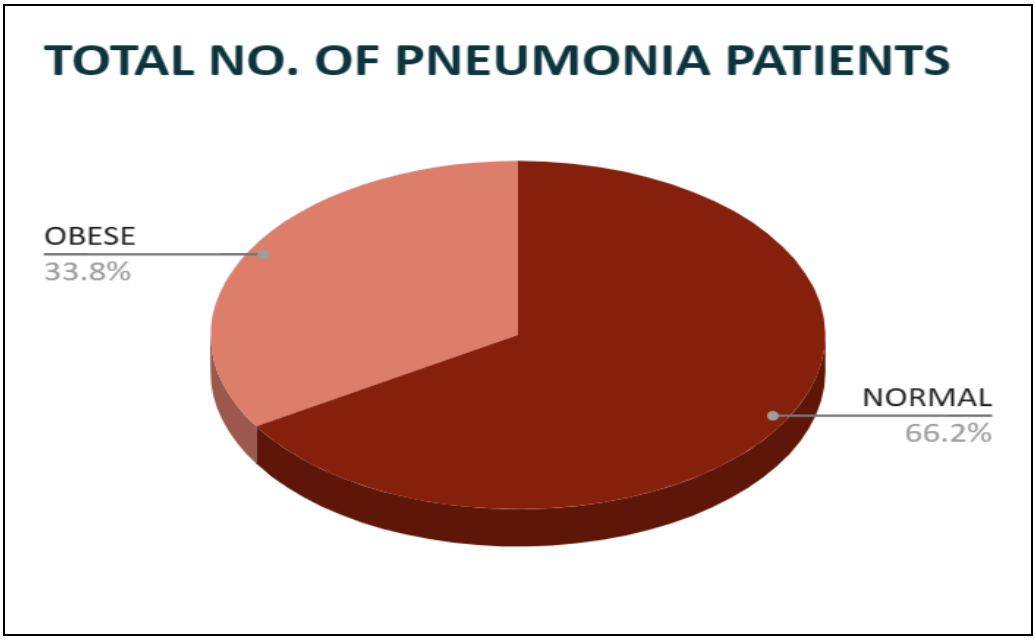

Figure 10: Distribution of Pneumonia Individuals Based on Bmi.

The Pneumonia diagnosed patients were classified on the bases of their BMIs which was Normal (66.2%) & Obese (33.8%).

Table 11: Distribution of Pneumonia Patients Based on Lhs.

LHS	TOTAL NO. OF PNEUMONIA PATIENTS	PERCENTAGE
1-5 DAYS	49	66.21%
6-10 DAYS	23	31.08%
11-15 DAYS	2	2.70%
16-20 DAYS	0	0%

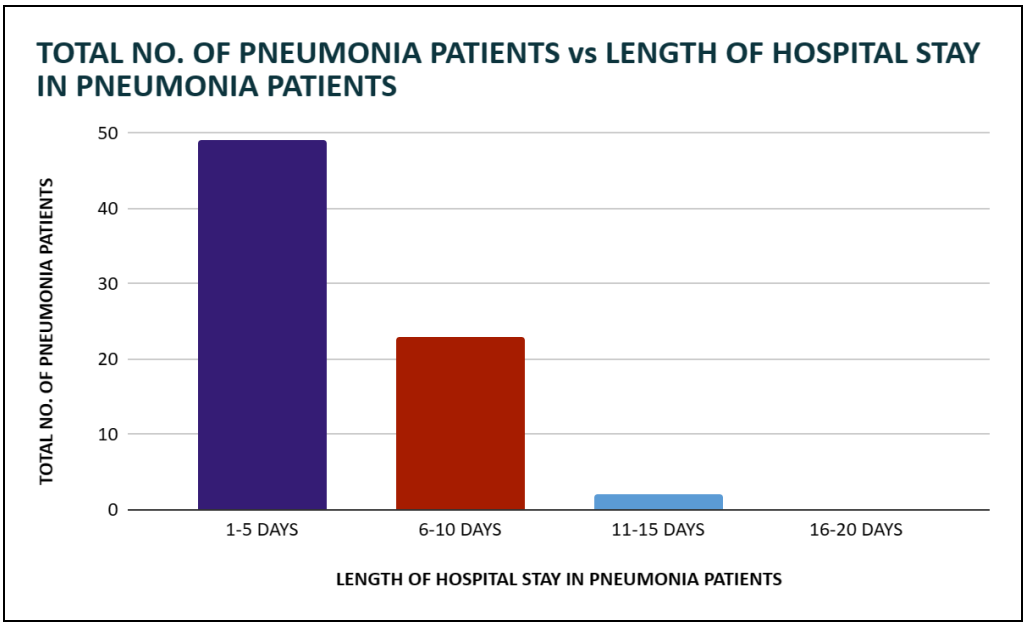

Figure 11: Distribution of Pneumonia Patients Based on Lhs.

In this study classification of Pneumonia diagnosed patients based on LHS were 1-5 Days (66.21%), 6-10 Days (31.08%), 11-15 Days (2.70%) & 16-20 Days (0%).

Table 12: Distribution of Lhs In Pneumonia Patients Based on Body Mass Index.

Lhs In Pneumonia Patients	Normal Weight Patients	Obese Patients
1-5 DAYS	35	6
6-10 DAYS	17	18
11-15 DAYS	1	1
16-20 DAYS	0	0

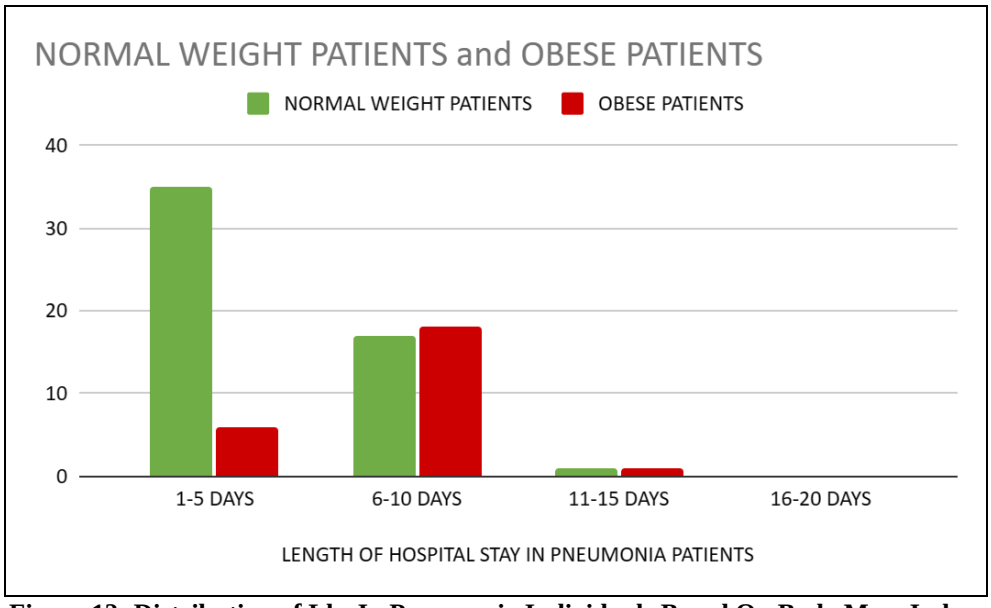

Figure 12: Distribution of Lhs In Pneumonia Individuals Based On Body Mass Index.

In this study, it was observed that the pneumonia patient's length of hospital stay based on body mass index was classified as.
1-5 days- (normal weight patients- 35 Obese patients- 6)
6-10 days- (normal weight patients- 17, Obese patients- 18)
11-15 days- (normal weight patients- 1, Obese patients- 1)
16-20 days- (normal weight patients -0, Obese patients- 0)

Table 13: Distribution of Length of Hospital Stay in Pneumonia Patients Based on Smoking History.

Length of Hospital Stay	Smokers	Non-Smokers
1-5 DAYS	18	31
6-10 DAYS	8	15
11-15 DAYS	2	-
16-20 DAYS	-	-

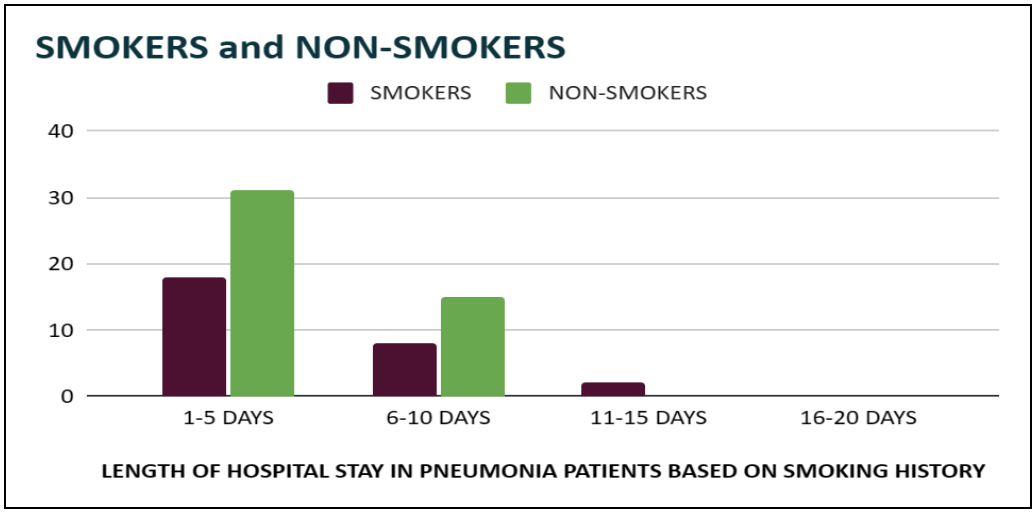

Figure 13: Distribution of Lhs In Pneumonia Individuals Based on Smoking History.

It was observed that the LHS of pneumonia patients based on smoking history was classified as:
1-5 days - (Smokers-18, Non-smokers-31)
6-10 days – (Smokers- 8, Non- smokers-15)
11-15 days- (Smokers-2, Non-smokers- 0)
16- 20 days- (Smokers- 0, Non-smokers- 0).

Table 14: Distribution of Patients Based on Culture Reports.

Culture Identification	Total No. Of Patients	Percentage
POSITIVE	51	30.90%
NEGATIVE	114	69.09%

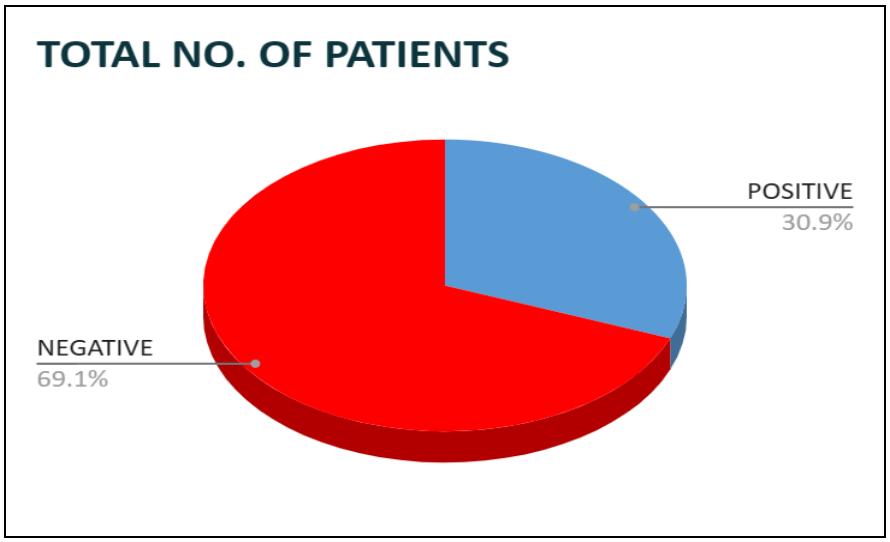

Figure 14: Distribution of Participants Based on Culture Reports.

The patients were classified based on culture reports among which are Positive (30.9%) and Negative (69.1%).

Table 15: Distribution of Patients Based on Abg Performed.

Abg Analysis	Total No. Of Patients	Percentage
PERFORMED	109	66.06%
NOT PERFORMED	56	33.93%

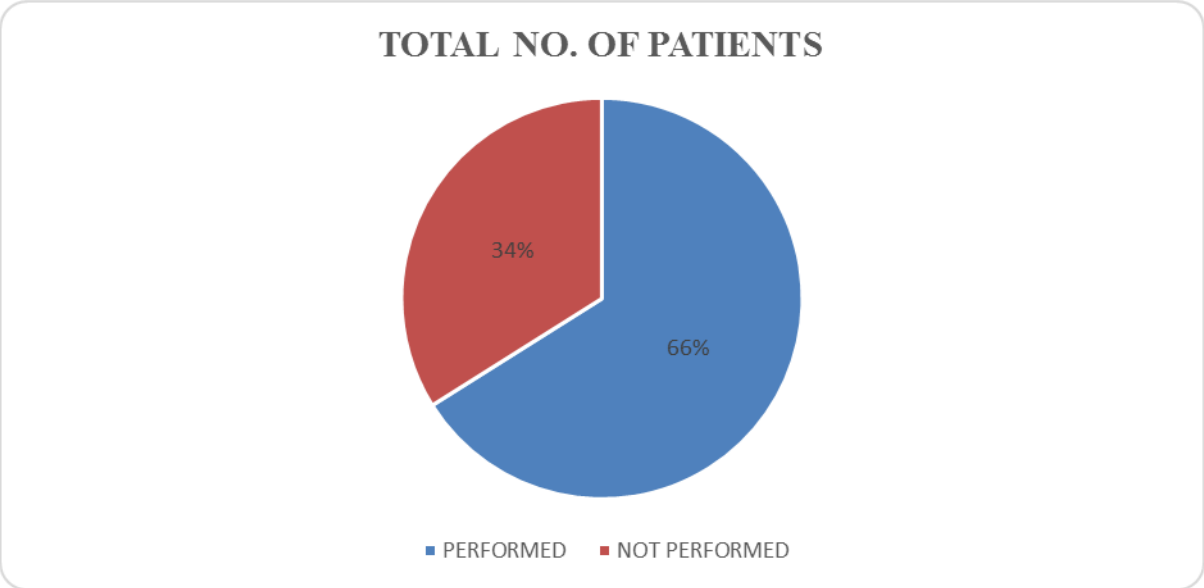

Figure 15: Distribution of Patients Based on Arterial Blood Gas Performed.

In this study it was observed that the patients were classified on the basis of Arterial blood gas among which are Performed (66.1%) and not performed (33.93%).

Table 16: Distribution of Patients Based on Arterial Blood Gas Reports.

Arterial Blood Gas Analysis	Total No. Of Patients	Percentage
NORMAL	47	43.11%
ABNORMAL	62	56.88%

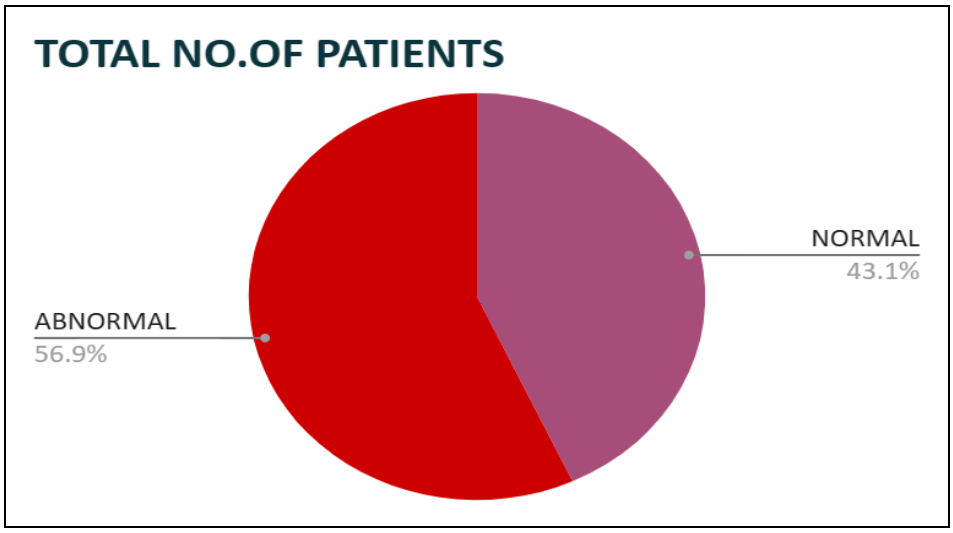

Figure 16: Distribution of Patients Based on Arterial Blood Gas Reports.

In this study it was observed that the patients performed with Arterial blood gas were reported as Normal (43.1%) & Abnormal (56.9%).

Table 17: distribution of patients based on abnormal arterial blood gas reports:

Abnormal abg levels	Total no. Of patients	Percentage
PNEUMONIA	43	69.35%
RESPIRATORY FAILURE	19	30.64%

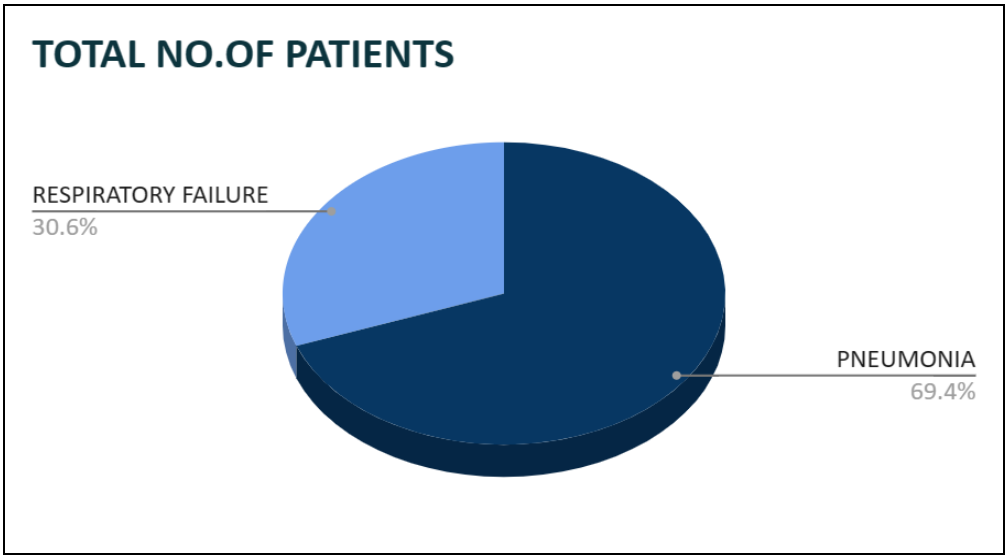

Figure 17: Distribution of Patients Based on Abnormal Arterial Blood Gas Reports.

In this study it was observed that the patients reported with abnormal levels of Arterial blood gas were categorized as Pneumonia patients (69.4%) & Respiratory failure patients (30.6%).

Table 18: Distribution Of Patients Based On Different Types Of Antimicrobial Agents Prescribed:

Antimicrobials Prescribed	Total No. Of Patients	Percentage
Cefoperazone-Sulbactam	56	33.93%
Piperacillin-Tazobactam	14	8.48%
Doxycycline	51	30.90%
Azithromycin	54	14.54%
Ceftriaxone	55	33.33%
Oseltamivir	35	21.21%

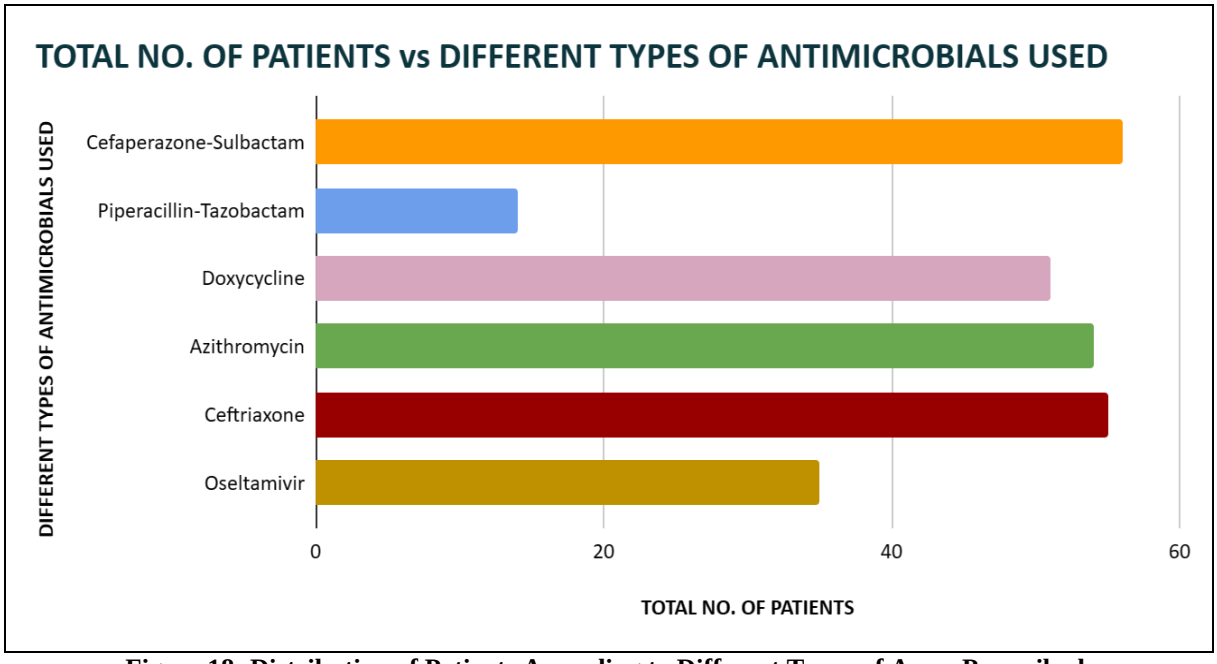

Figure 18: Distribution of Patients According to Different Types of Amas Prescribed.

Patients were prescribed with different type of Antimicrobials in which those were classified as Cefoperazone + Sulbactam (33.93%), Piperacillin+Tazobactam (8.48%), Doxycycline (30.90%), Azithromycin (14.54%), Ceftriaxone (33.33%) & Oseltamivir (21.21%).

Table 19: Distribution of Patients According to Number Of Antimicrobials Used.

Pt.S On Antimicrobials	Total No. Of Patients	Percentage
> 1 antimicrobial agents	119	72.12%
Only 1 antimicrobial agent	46	27.87%

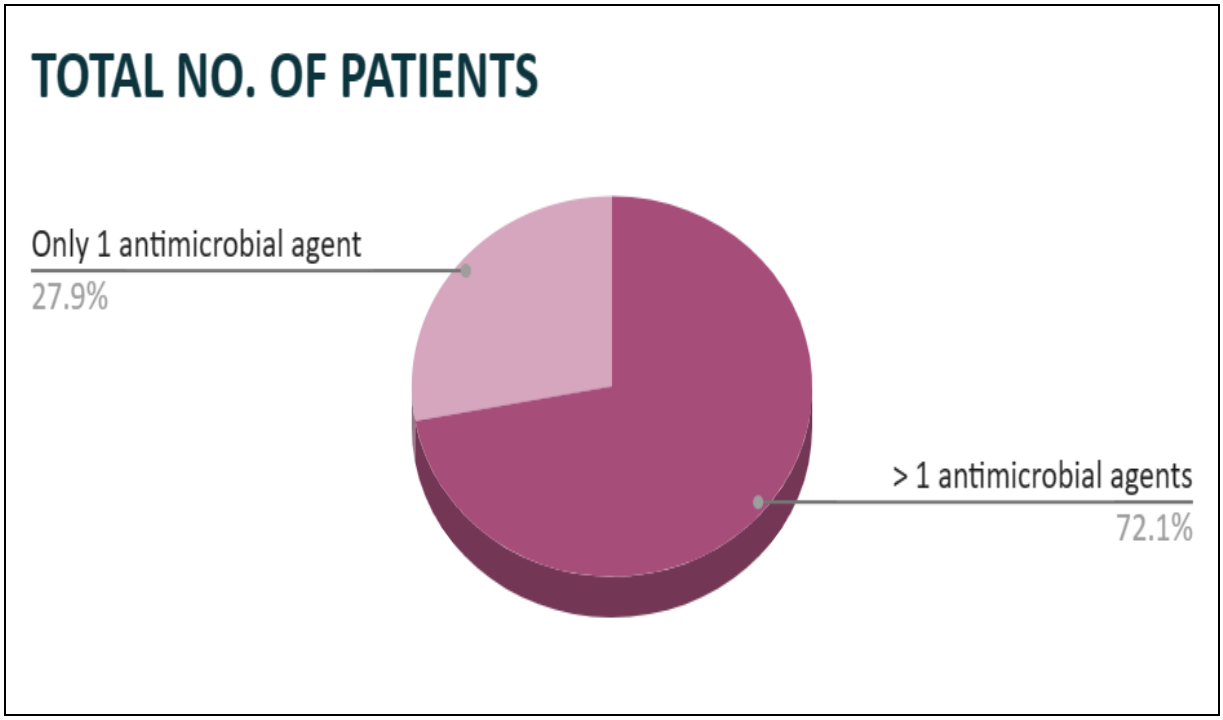

Figure 19: Distribution of Patients Based on No. of Antimicrobials Used.

In this study it was observed that the patients are categorized based on the use of Antimicrobials in which there are more than 1 Antimicrobial (72.1%) & only 1 antimicrobial (27.9%).

Table 20: Distribution of Patients Based on More Than One Antimicrobials Used In Specific Conditions:

> 1 Antimicrobials Used In Specific Conditions	Total No. Of Patients	Percentage
COPD	12	7.27%
PNEUMONIA	51	30.90%
TUBERCULOSIS	19	11.51%
BRONCHIECTASIS	8	4.84%
RF	16	9.69%
INFLUENZA	7	4.24%
COVID-19	6	3.63%

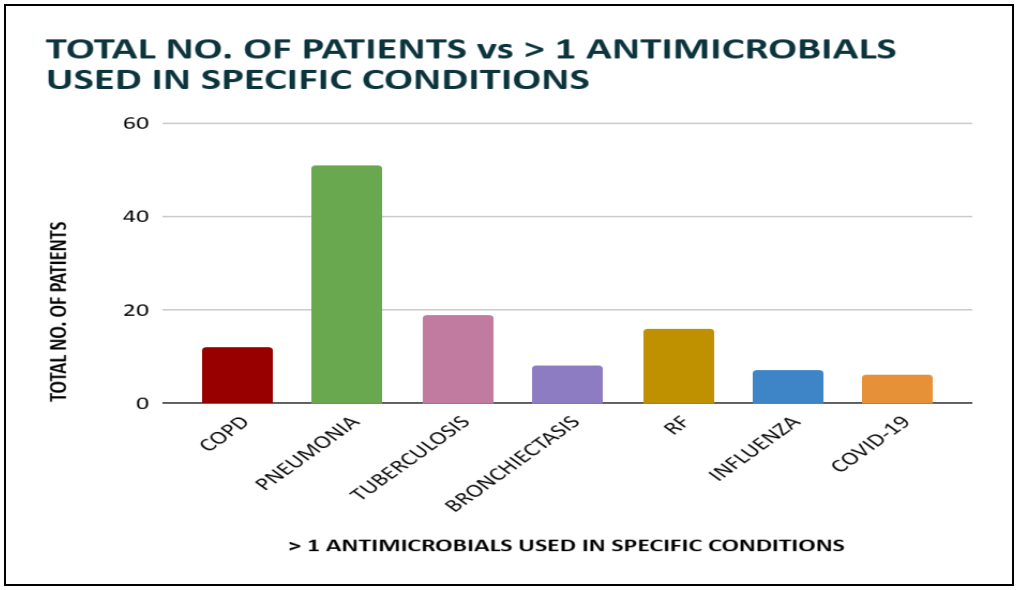

Figure 20: Distribution of Patients Based on More Than One Antimicrobials Used In Specific Conditions.

In this study it is observed that patients prescribed with more than one Antimicrobials are classified in few categories such as COPD (7.27%), Pneumonia (30.90%), Tuberculosis (11.5%), Bronchiectasis (4.84%), Respiratory failure (9.69%), Influenza (4.24%) & COVID-19 (3.63%).

Table 21: Distribution of Pts Based on Antimicrobials Prescribed In Combination.

Antimicrobials	Total No. Of Patients	Percentage
SINGLE DRUG	45	27.27%
DOUBLE DRUGS	59	35.75%
TRIPLE OR MORE DRUGS	61	36.96%

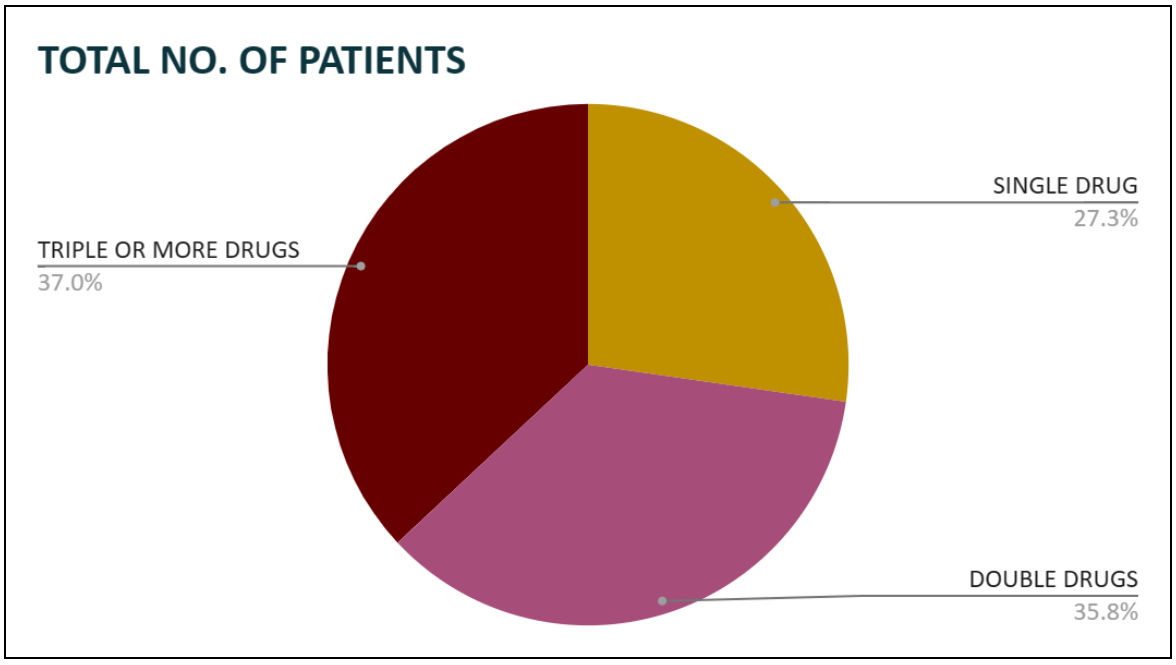

Figure 21: Distribution of Pts Based on Antimicrobials Prescribed in Combination.

In this study, it was observed that diagnosed patients prescribed with Antimicrobials in combinations were classified as Single drug (27.27%), Double drugs (35.75%) & Triple or more drugs (36.96%).

Table 22: Distribution of Length of Hospital Stay In Pneumonia Patients Based on Combination Drugs Usage.

LENGTH OF HOSPITAL STAY	SINGLE DRUG	DOUBLE DRUGS	TRIPLE OR MORE DRUGS
1-5 DAYS	4	12	23
6-10 DAYS	13	5	11
11-15 DAYS	1	2	2
16-20 DAYS	0	1	0

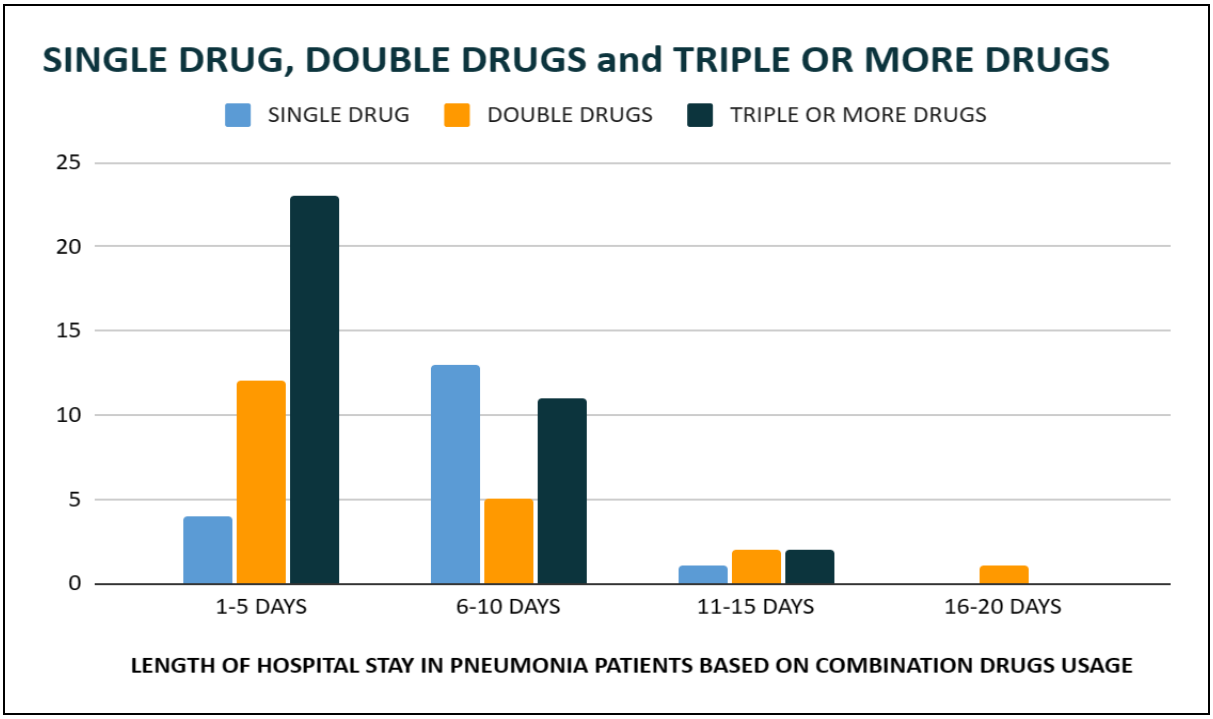

Figure 22: Distribution of Lhs In Pneumonia Patients According To Combination Antimicrobials Usage.

It was observed that the LHS in Pneumonia individuals based on combination antimicrobials usage:1-5 days- (single drug- 4, double drug- 12, triple drug- 23.
6-10 days- (single drug- 13, double drug- 5, triple drug- 11).
11-15 days- (single drug- 1, double drug- 2, triple drug- 2).
16-20 days- (single drug- 0, double drug-1, triple drug- 0).

DISCUSSION

- We have conducted a prospective observational study on the assessment of AMAs in lower respiratory tract infections.
- In our study 165 patients were enrolled, in which males were 103(62.45%) and 62 (37.57%) were females.
- Men are most affected with LRTI compared to females.
- The patients were categorized based on their age groups, in which the age group of 56-75 years, male patients (39 patients) suffered more from LRTI compared with the same age group of females (28 patients).
- 67 patients irrespective of gender from the age group of 56-75 years have suffered from LRTI.
- Age group of 76-95 years old male patients (15 patients) and female patients (4 patients) are less likely to be seen in our study.
- Based on the BMI patients were categorised into underweight, normal weight, overweight, obese and extremely obese. Among 165 patients, we observed that 74 patients were in normal weight (44.84%) followed by overweight (59 patients, 35.75%), obese (17 patients, 10.30%), extremely obese (9 patients, 5.45%) and underweight (6 patients, 3.63%).
- Based on history of smoking patients were categorised into smokers and non-smokers. In our study we have seen the majority of non-smokers 87 patients, (52.72%).
- The severity of the disease is much more in smokers when compared to non-smokers.
- For the majority of the patients, the LHS was 1-5 days in which 126 individuals were seen (76.36%).
- The common LRTI's seen in our study were Pneumonia, COPD, Tuberculosis, Bronchiectasis, and Respiratory failure. The LRTI seen in the majority of patients is Pneumonia: 74 patients (44.84%).
- In those Pneumonia patients, community acquired Pneumonia is mostly observed (37 patients, 22.42%).

- In our study non-smokers (46 patients, 62.16%) are affected more in number with Pneumonia than smokers (28 patients, 37.83%).
- Smokers and non-smokers did not significantly differ in their levels of pneumonia severity.
- We have observed that the patients diagnosed with Pneumonia majority fall under normal body mass index (49 patients, 66.21%).
- The LHS for most of the Pneumonia Pt's based on their body mass index was between 1-5 days.
- In Pneumonia patients, irrespective of smoking history there is no significant difference, in them the average was between 1-5 days.
- The culture test reports among 165 patients were found to be negative in most of the patient population (114 reports, 69.1%).
- Arterial blood gases (ABG) were performed in 109 patients (66.06%), In which the abnormal Arterial blood gas was found in 62 patients (56.88%).
- The main significance of performing ABG is, it shows the effectiveness of oxygen transfer from the lungs to the bloodstream.
- Among 62 patients, 43 were reported with abnormal levels of Arterial blood gas and were mostly diagnosed with Pneumonia (69.4%).
- The commonly used antimicrobial agents in the treatment of LRTI were cefoperazone+sulbactam, piperacillin+tazobactam, doxycycline, azithromycin, oseltamivir, and ceftriaxone.
- 56 patients who were diagnosed as lower respiratory tract infections were prescribed with Cefoperazone+Sulbactam (33.93%).
- In the majority of patients more than one antimicrobial is used (72.12%).
- Among all lower respiratory tract infections, more than one antimicrobial was mostly prescribed to Pneumonia patients (51 patients, 30.90%).
- The length of hospital stay in monotherapy antimicrobial agents is observed more in 6-10 days.
- In those people who used dual, triple antimicrobial therapy, the LHS was 1-5 days (47.29%) when compared to monotherapy (5.40%).
- In patients diagnosed with Pneumonia, a maximum number of patients were reported to be prescribed with triple or more antimicrobials (61 patients, 37.96%).
- The LHS of Pneumonia diagnosed patients given with combination drugs were mostly between 1-5 days.

CONCLUSION

A prospective observational study was conducted to assess the antimicrobials used in LRTI therapy.

The patients enrolled in the study were 165. Among these male patients were 103 and female patients were 62.

People belonging to the age group of 56-75 were to be more in number suffering from lower respiratory tract infections.

Among the people suffering from LRTI, Pneumonia was the LRTI seen in many people 44.84%.

LHS in many Pneumonia pt's is between 1-5 days (52.70%).

There is no remarkable difference in LHS in patients with history of smoking and without history of smoking.

There is no notable difference in LHS in patients with normal BMI and obese patients.

In many people with LRTI, cefoperazone+sulbactam was the widely used antimicrobial agent (33.93%).

A single antimicrobial agent was used in 27.27%.

Dual therapy was used in 35.75%.

Triple or more antimicrobial agents were used in 36.96%.

In these people who used dual, triple antimicrobial therapy the LHS was 1-5 days (47.29%) when compared to monotherapy (5.40%).

In our study it was observed that combination of triple antimicrobial therapy (Cefoperazone+sulbactam, azithromycin, doxycycline = 36.96%), dual antimicrobial therapy (Cefoperazone+sulbactam, doxycycline = 35.75%), and single antimicrobial therapy (27.27%) is used.

The LHS was less (1-5 days) in people taking dual and triple antimicrobial agents compared to patients taking single antimicrobial agent.

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