

# Prevalence of Streptococcus Pneumoniae in Community Acquired Pneumonia and their Antibiotic Susceptibility Pattern in a Tertiary Care Hospital, South India

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**Abstract:** *Introduction:* Pneumonia is an infection of pulmonary parenchyma, which results from the proliferation of microbial pathogen at the alveolar level and the host response to those pathogens. Aetiology of CAP is generally bacterial but the microbial pattern varies from place to place. The most common pathogen in any patient population is Streptococcus pneumoniae. A major consideration in the treatment of pneumococcal pneumonia is the increasing worldwide incidence of resistance to antibiotics. Sputum is often the most readily available clinical specimen and commonly used for diagnosis of CAP. *Aims and objectives:* 1. To know the prevalence of Stre.pneumoniae in community acquired pneumonia. 2. To know the susceptibility pattern of Stre. pneumoniae. *Materials and methods:* Retrospective analysis of Sputum samples received for culture and sensitivity from January 2016 to December 2016 were processed. After screening, 1098 sputum samples were processed. Smears were prepared from colonies of a haemolytic and stained with gram stain. The isolates were confirmed by optochin susceptibility and bile solubility test. 510 Streptococcus pneumoniae isolates were subjected for antibiotic susceptibility testing by Kirby – Bauer disc diffusion method. *Results:* Of 1098 processed sputum samples 863 samples showed culture positive (78.6%). Among culture positive samples 510 isolates were Streptococcus pneumoniae (59.1%). Of 510 Streptococcus pneumoniae isolates 71.8% were from OPD and 28.2% from IPD. Majority of the isolates were from 41- 60 years. Susceptibility to amoxicillin- clavulanic acid was 72.9% and piperacillin – tazobactam 81.3%. *Conclusions:* 1. Strep.pneumoniae accounts for 59.1% of community acquired pneumonia. 2. The most common age group affected with Strep.pneumoniae was 41-60 years. 3. More isolates were susceptible to amoxicillin- clavulanic acid and piperacillin – tazobactam.

**Keywords:** Community acquired pneumonia, Streptococcus pneumoniae, sputum

## 1. Introduction

Pneumonia is an infection of pulmonary parenchyma, which results from the proliferation of microbial pathogen at the alveolar level and the host response to those pathogens. [1] The infection can develop in persons living in community (community acquired pneumonia) or in already hospitalized (nosocomial pneumonia). [2] Even though there is extensive list of potential etiologic agents in community acquired pneumonia (CAP), most cases of CAP are caused by relatively few pathogens.[1] Etiology of CAP is generally bacterial but the microbial pattern varies from place to place and so does the antimicrobial sensitivity and emerging resistance pattern. [3] The most common pathogen in any patient population is Streptococcus pneumoniae. [2, 4] Streptococcus pneumoniae periodically colonizes the human nasopharynx in most persons. [5] Aspiration of nasopharyngeal secretions containing Strep.pneumoniae into respiratory tract is a common event and this may occur even in sleep. When the normal defenses are compromised by viral infection, anesthesia, chilling or other factors, Stre.

pneumoniae multiply, penetrate the bronchial mucosa and spread through lung along the peribronchial tissues and lymphatics which results in pneumonia. [6] Pneumonia represents a difficult challenge for the clinician, since the etiology cannot be determined by clinical presentation. A major consideration in the treatment of pneumococcal pneumonia is the increasing worldwide incidence of resistance to antibiotics. [5] Sputum is often the most readily available clinical specimen and commonly used for diagnosis of CAP. [7] Expecterated sputum is the most common lower respiratory tract specimen received by the microbiology laboratory. [8] Hence the present study was performed to know the prevalence of Stre. pneumoniae in community acquired pneumonia cases and their susceptibility pattern, which can further helps in the management of CAP by choosing empirical antibiotic.

## 2. Aims and Objectives

- 1) To know the prevalence of Stre. pneumoniae in community acquired pneumonia.

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- 2) To know the most common age group infected with *Streptococcus pneumoniae*.
- 3) To know the susceptibility pattern of *Streptococcus pneumoniae*.

Materials and methods: Retrospective analysis of data was done. Sputum samples received for culture and sensitivity from both outpatient and inpatient departments of pediatrics and general medicine from January 2016 to December 2016 were processed in bacteriology section, clinical microbiology lab, RIMS, Kadapa. All sputum samples were subjected to direct microscopy by doing Gram stain. Smears showing less than 10 epithelial cells per high power field were further subjected to culture by inoculating on MacConkey medium and blood agar and incubated aerobically at 37 ° C for 18- 24 hours. After screening 1098 sputum samples were processed. Smears were prepared from colonies of small dome shape and  $\alpha$  haemolytic and stained with gram stain. Gram positive flame shaped diplococci were considered as *Streptococcus pneumoniae* and the isolates were confirmed by optochin susceptibility and bile solubility test. [9] Like that 510 *Streptococcus pneumoniae* isolates were subjected for antibiotic susceptibility testing on blood agar by Kirby – Bauer disc diffusion method. All the procedures were performed by following standard operative procedures.

### 3. Results

Of 1098 processed sputum samples 863 samples showed culture positive (78.6%). Among culture positive samples 510 isolates were *Streptococcus pneumoniae* (59.1%) as shown in table 1. Out of 510 *Streptococcus pneumoniae* isolates 71.8% were from outpatient department and 28.2% from inpatient departments. Majority of the isolates were from 41- 60 years (41 – 50: 119, 51-60: 117). Isolates were more from males (OP - 75.9% & IP – 77.7%) than females as shown in table 2. Susceptibility to amoxicillin- clavulanic acid and piperacillin – tazobactam (81.3%) was more (72.9%). Susceptibility to levofloxacin was 59.4%. 41.5% and 41.3% of isolates were sensitive to ciprofloxacin and ceftriaxone respectively. Less percent of isolates were sensitive to penicillin (22.1%), erythromycin (23.5%), cefipime (26.2%), amoxicillin (13.1%) as shown in table 3.

### 4. Discussion

Community Acquired Pneumonia (CAP) is a frequently encountered lower respiratory tract parenchymal lung infection which continues to be a major health problem leading to significant morbidity and mortality worldwide.[4] Bacteriological profile in Community Acquired Pneumonia (CAP) is different in different countries and changes with time even within the same country. [10] The choice of empirical therapy for CAP has become complicated by the rapid development of drug resistance to commonly used antibiotics. The resistant strains of bacteria can quickly multiply and spread within the community. Specific microbiological investigations are essential for minimizing the consequent development of complications and for improving the outcomes.[11]

*Streptococcus pneumoniae* also called *Pneumococcus* is an ubiquitous human respiratory pathogen, well known for its

association with pneumonia, sinusitis, otitis and meningitis. Pneumonia is the most common important presentation of pneumococcal disease by virtue of its frequency accounting for 80- 90% of all pneumococcal diseases. [7] *Pneumococcal pneumonia* accounts for about 60% of all bacterial pneumonias. [12]

In the present study 59.1% of isolates from sputum samples of community acquired pneumonia were *Streptococcus pneumoniae*. Whereas the prevalence of the organism was 14 % in Okesola et al study [13], 34 % in Acharya et al study[3], 22.4% in Goyet et al study[14], 13.9% in Charles et al study[15] and 22% in Amisshah et al study[16] But it was 77.8% in Seify et al study.[17] This high percentage of *Streptococcus pneumoniae* isolates in our study might be due to reporting every pneumococcal isolate as pathogen as the organism can be one of the commensals in upper respiratory tract. Another reason might be majority of samples in our study were from outpatient department (71.8%) than inpatient department (28.2%). of the isolates were from 41- 60 years 46.3% (41 – 50: 23.3%, 51-60: 22.9%). Almost it was similar with studies by Giriraj et al [4], Acharya et al [3] and it was 30 – 49 years in Amisshah et al study [16], 26- 45 years in Regasa et al study. [18] In the present study *Streptococcus pneumoniae* isolates were more from male individuals (OP- 75.9% & IP – 77.7%) than females (OP- 24.15 & IP – 22.2%). Male predominance was also observed in studies by Regasa et al (55.9%) [18], Vijay et al (69.23%) [19], Giriraj et al (72%) [4] and Amisshah et al (62.2%)[16] This male predominance might be because of their exposure to polluted environment at work places, individual habits like smoking. Financial independence in male individuals is more than females, which might be one of the reasons to turn up hospitals whenever they are feeling ill which in turn lead to getting more samples from this gender.

The major consideration in treatment of pneumococcal pneumonia is the increasing worldwide incidence of resistance to antibiotics. Antibiotic therapy is generally started empirically when the patient is initially seen. The organism remained sensitive for penicillin for decades after introduction of the drug, but the resistance was detected in the late 1960s. [5] In the present study only 22.1% of isolates were sensitive to penicillin. It was also observed that there was no much variation between the isolates from OP and IP samples. Amoxicillin sensitivity was also less in both outpatient and inpatients with sensitivity of 10.1% and 20.8% respectively. A third generation cephalosporin, which is being commonly used in treating infections, ceftriaxone showed susceptibility of 59% from inpatients and 34.5% from outpatients. The overall susceptible isolates to ceftriaxone were 41.3%. Susceptibility to cefepime, a fourth generation cephalosporin, was still less (26.2%). In a study by Acharya et al susceptibility to ceftriaxone and cefepime were 18 % and 15% respectively [3] Resistance to  $\beta$  – lactam antibiotics was caused by altered penicillin binding proteins that possess lower affinity for  $\beta$  lactam antibiotics. [5]

Many of the penicillin resistant *Strep.pneumoniae* isolates are resistant to three or more antibiotic classes. [20] In contrast to penicillin resistance, resistance to macrolides is

increasing through several mechanisms like target site modification and efflux mechanism encoded by *mef* gene. [1] The present study showed 47.9% of pneumococcal isolates from IPD and 13.9% from OPD were susceptible to erythromycin. This might be due to increasing use of macrolides as an empirical antibiotic of choice in management of community acquired pneumonia. Anti pneumococcal quinolones have assumed great importance in therapy of community acquired pneumonia because it is possible with a single drug given once daily to cover respiratory pathogens and they penetrate well into respiratory secretions and highly bioavailable. [2] The present study showed susceptibility of 65.2%, 66.6% and 70.8% from IPD and 23.2%, 31.6% and 54.9% from OPD isolates to ofloxacin, ciprofloxacin and levofloxacin respectively. In a study by Acharya et al ciprofloxacin susceptible isolates were 49%. [3] The organism can acquire resistance to quinolones by changing one or more target sites (topoisomerases II and IV) by mutations in *gyr A* and *gyr C* genes respectively. [1]

Susceptibility to co-trimoxazole was high in inpatients (72.9%) than outpatients (26.5%) whereas it was only 18% in a study by Acharya et al. [3] To one of the most commonly used synergistic antibacterials, amoxicillin-clavulanic acid, 64.4% and 94.4% of pneumococcal isolates from OPD & IPD respectively were sensitive. To piperacillin-tazobactam it was 81.3%.

Our study observed that majority cases of community acquired pneumonia were treated on outpatient basis. The overall susceptibility to antibacterials that are commonly used was less with isolates of OPD cases than IPD cases. This might be because of many reasons. Some of them might be - partially treated cases with commonly available antibacterials were referred to tertiary hospital, issuing of antibacterials by unqualified practitioners and by pharmacies without clinician's prescription and not maintaining dosage schedule and compliance of antibiotics. The most important risk factor for antibiotic resistant pneumococcal infection is the use of a specific antibiotic within the previous 3 months. [1] The prevalence of pneumococcal infections can be decreased by smoking cessation, prevention of antibiotic overuse, influenza vaccination, and correction of underlying risk factors along with pneumococcal vaccination. [1, 5, 20] Immunity to *Strep.pneumoniae* is type specific. Two types of pneumococcal vaccines are available - 23 valent pneumococcal polysaccharide vaccine (PPV23) and 7 valent polysaccharide conjugate vaccine (PCV7). [20]

## 5. Conclusions

- 1) *Strep.pneumoniae* accounts for 59.1% of community acquired pneumonia.
- 2) Majority of cases were treated on outpatient basis.
- 3) *Strep.pneumoniae* isolates were more from male individuals.
- 4) The most common age group affected with *Strep.pneumoniae* was 41-60 years.
- 5) More isolates were susceptible to amoxicillin-clavulanic acid and piperacillin-tazobactam.

## 6. Limitations

- 1) Underlying risk factor(s) of patients is not known.
- 2) Previous antibiotic usage was not known.

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Conflicts of interest: nil

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**Table 1:** Showing percentage of culture positive and Strep.pneumoniae in total cases

Total Samples	Culture Positive	Strep.pneumoniae
1098	863(78.6%)	510(59.1%)

**TABLE –2** showing age wise distribution of Strep.pneumoniae isolates among OPD and IPD

AGE	O.P		I.P		TOTAL
	MALE	FEMALE	MALE	FEMALE	
11-20	11	06	03	01	21
21-30	14	16	15	08	53
31-40	24	12	11	11	58
41-50	58	19	37	05	119
51-60	72	20	21	04	117
61-70	73	06	21	03	103
>70	26	09	04	00	39
TOTAL	278 (75.9%)	88 (24.1%)	112 (77.7%)	32 (22.2%)	510
	366 (71.8%)		144 (28.2%)		510

**Table 3:** Antibiotic sensitivity pattern of Strep.pneumoniae isolates

	Pen	E	COT	OF	CIP	LE	CTR	CPM	AMX	AMC	AMP	PIT
O.P (366)	74 (20.2%)	51 (13.9%)	97 (26.5%)	85 (23.2%)	116 (31.6%)	201 (54.9%)	126 (34.5%)	70 (19.1%)	37 (10.1%)	236 (64.4%)	45 (12.2%)	283 (77.3%)
I.P (144)	39 (27%)	69 (47.9%)	105 (72.9%)	94 (65.2%)	96 (66.6%)	102 (70.8%)	85 (59.0%)	64 (44.4%)	30 (20.8%)	136 (94.4%)	65 (45.1%)	123 (85.4%)
Total (510)	113 (22.1%)	120 (23.5%)	202 (39.6%)	179 (35.0%)	226 (41.5%)	303 (59.4%)	211 (41.3%)	134 (26.2%)	67 (13.1%)	372 (72.9%)	110 (21.5%)	406 (81.3%)