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PREVALENCE OF STREPTOCOCCUS PNEUMONIAE CAUSING COMMUNITY ACQUIRED PNEUMONIA AMONG ADULTS IN TERTIARY CARE CENTER: CLINICAL AND MICROBIOLOGICAL CHARACTERISTICS

Microbiology

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ABSTRACT

Community acquired pneumonia (CAP) in adult is still a common and serious illness in India. *Streptococcus pneumoniae* being the main pathogen responsible for this infection, the present study was conducted to know the prevalence of *S. pneumoniae* in adult CAP patients along with their clinical characteristics and antibiotic sensitivity pattern. **Material and Methods:** It is a hospital based cross sectional study from November 2019 to October 2021. Total 120 adult CAP patients were studied using patient's sputum and blood culture samples. *S. pneumoniae* isolates were identified by conventional method. Antibiogram of isolates were studied as per CLSI guidelines 2019 by Kirby Bauer's disk diffusion method and MIC of resistant isolates by E test. **Result:** 120 adult CAP patients consisting of 78 males and 42 females of age group 18 to 90 years were included. Common symptoms were fever (95.38%) and cough (90%). Prevalence of *S. pneumonia* in our study was (15.18%). Maximum isolates were obtained from sputum (18.96%) followed by blood culture (4.76%). Antibiogram showed maximum resistance to levofloxacin (41.66%) followed by penicillin (33.33%), cotrimoxazole (33.33%) and tetracycline (25%) by disk diffusion method. Penicillin resistant *S. pneumonia* isolates showed maximum resistance to amoxicillin-clavulunate (25%) followed by penicillin (16.66%), cefotaxime (8.33%) and cefepime (8.33%) by MIC E strip test. Levofloxacin, cotrimoxazole and tetracycline resistant *S. pneumoniae* isolates showed resistance in (33.33%), (25%), (25%) isolates respectively by MIC E strip test. Multidrug resistance was noticed in one (8.33%) strain. **Conclusion:** *S. pneumoniae* continue to be the cause of CAP in adult patients. Multidrug resistance in isolates necessitating the identification and antibiogram study of CAP isolates necessary before starting any antibiotic therapy.

KEYWORDS

CAP, *S. pneumoniae*, resistance, MIC

INTRODUCTION

Pneumonia is a disease known to humanity from antiquity.[1] It is classified as a pneumonia in a patient living at home (community-acquired pneumonia), in a patient already hospitalized for other than pneumonia (hospital-acquired pneumonia) or ventilator associated pneumonia.[2]

Community acquired pneumonia (CAP) ranks third as the most common cause of death worldwide.[3,4] It is prevalent in both developing and developed countries; however five times more common in developing countries.[4]

Streptococcus pneumoniae is the most common cause of CAP and is estimated to cause approximately 30% - 50% of CAP in adults.[5] The case fatality rate of invasive pneumococcal disease reach about 15–20% in adults and 30–40% in the elderly.[6]

In CAP, immediate initiation of effective antibiotic therapy is important for a favourable outcome and empirical choice of initial antibiotics is the mainstay of treatment.[7] However antimicrobial resistance of *S. pneumoniae* against the most commonly used drugs is increasing worldwide. It is resistant to one or more antibiotics in more than 30% of cases.[8,9]

Hence, this study is an attempt to find out the prevalence of *S. pneumoniae* in CAP and its resistance pattern to commonly used antibiotics.

MATERIAL AND METHODS

This study was conducted in the Department of Microbiology of a tertiary care Hospital in Central India from November-2019 to October-2021**.** Expectorated sputum and blood samples for blood culture from clinically and radiologically diagnosed cases of CAP were collected. Quality of sputum was assessed by Bartlett's grading.[10] Salivary samples were rejected and only score 1 and above were included in the study**.** Samples were inoculated on Columbia based Gentamicin Sheep Blood agar and Columbia based Chocolate agar (incubated at 37° C in a candle extension jar with 5% - 10% CO2). The samples were processed by standard microbiological techniques.[11] Identifcation was based on colony morphology, gram stain, catalase, optochin susceptibility, bile solubility and inulin fermentation test.[12]

Antibiotic sensitivity of *S. pneumoniae* was done by Kirby Bauer's disk diffusion method using Mueller Hinton Sheep Blood agar and results were interpreted in accordance with CLSI 2019 using the following antibiotic disks obtained from Hi-Media, Mumbai: oxacillin disk 1 µg (detection of penicillin resistance), erythromycin 15 µg, tetracycline 30 µg, levofloxacin 5 µg, cotrimoxazole 1.25/23.75 µg.[13] MIC of resistant isolates was performed using E test strips (Hi-media laboratories Pvt. Ltd. Mumbai).

RESULTS

A total 120 adult CAP patients consists of 78 (65%) males and 42 (35%) females of age group 18 to 90 years were included. Smoking and alcoholism were observed as the most frequent associated conditions. Common respiratory symptoms were fever (95.38%), cough (90%), expectoration (60%), breathlessness (52.5%) and chest pain (40.33%). (Fig 1)

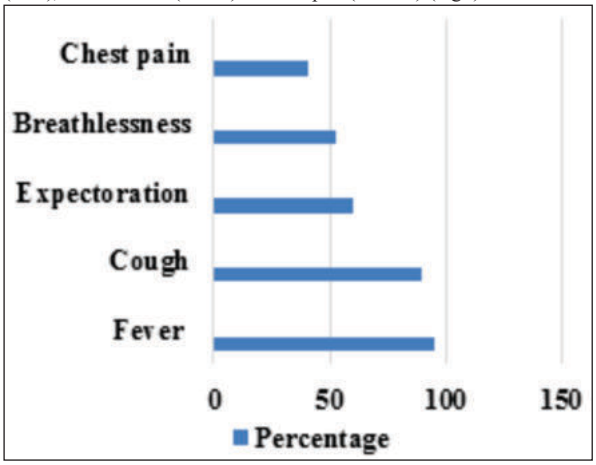

Figure 1: Symptom wise distribution in CAP pts

Sputum and blood culture showed bacterial isolation in 79 (65.83%) patients. The prevalence of *S. pneumoniae* in our study was 12/79 (15.18%) in CAP patients. Maximum *S. pneumoniae* isolates were from 61-75 years age group with male to female ratio was 3:1. Out of total pneumococcal isolates, 11/58 (18.96%) were obtained from sputum sample followed by blood culture 1/21 (4.76%).

Antibiogram of isolates showed 100% sensitivity to erythromycin and maximum resistance to levofloxacin (41.66%) followed by penicillin (33.33%), cotrimoxazole (33.33%) and tetracycline (25%) by Kirby Bauer's disk diffusion method. (Fig 2)

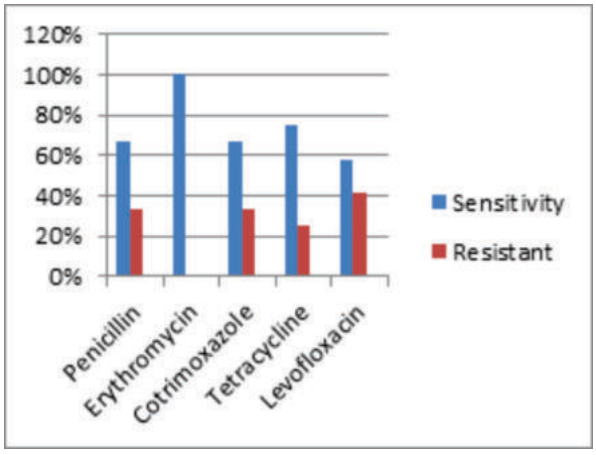

Figure 2: Antibiogram of *S. pneumoniae* by Kirby Bauer's Disk diffusion method

All the isolates which showed resistance to 1 or more antibiotics were tested for MIC by E strip method. As per CLSI 2019 guidelines penicillin, amoxicillin-clavulunate, cefotaxime and cefepime MICs should be determined for isolates with oxacillin zone diameters < 19 mm.

Penicillin resistant (33.33%) *S. pneumoniae* isolates showed (16.66%) intermediate and complete resistance by MIC E strip test. Maximum resistance shown to amoxicillin-clavulunate (25%) followed by cefotaxime (8.33%) and cefepime (8.33%) by MIC E strip test. (Table 1)

Table 1 :Antibiogram of β lactam antibiotics of *S. pneumoniae* resistant strains by MIC E strip test

Antibiotic	S (%)	I (%)	R (%)
Penicillin	00 (00)	2 (16.66)	2 (16.66)
Amoxicillin-clavulunate	00 (00)	1 (8.33)	3 (25)
Cefotaxime	2 (16.66)	1 (8.33)	1 (8.33)
Cefepime	2 (16.66)	1 (8.33)	1 (8.33)

S- sensitive, I- intermediate, R- resistant

Levofloxacin (41.66%), cotrimoxazole (33.33%) and tetracycline (25%) resistant *S. pneumoniae* isolates showed resistance in (33.33%), (25%) and (25%) isolates respectively by MIC E strip test (Table 2)

Table 2: Antibiogram of non β lactam antibiotics of *S.pneumoniae* resistant strains by MIC E test

`Antibiotic	S (%)	I (%)	R (%)
Cotrimoxazole	1 (8.33)	-	3 (25)
Tetracycline	0 (00)	-	3 (25)
Levofloxacin	1 (8.33)	-	4 (33.33)

S- sensitive, I- intermediate, R- resistant

Multidrug resistance was seen in one (8.33%) strain of *S. pneumoniae* showing resistance to levofloxacin, tetracycline and cotrimoxazole.

DISCUSSION

Pneumonia is the leading cause of mortality from infectious disease worldwide. It remains a serious illness despite the availability of potent antimicrobials and effective vaccines.[14] The present study was conducted among 120 cases with signs and symptoms suggestive of CAP.

Fever 115 (95.83%) was the commonest symptom followed by cough 108 (90.00%), expectoration 72 (60.00%), breathlessness 63 (52.50%) and pleuritic chest pain 49 (40.33%). Similar observation was seen in study by Sharma R et al[15] where fever (95.1%) was the most common symptom followed by cough (75.7%) and breathlessness (65%). In a study by A. Ayyappa et al[16] cough was the commonest symptom (100%) followed by fever (95%), expectoration (88%) and chest pain (75%).

Sputum 58 (48.33%) and blood culture 21 (17.50%) showed bacterial isolation in 79 (65.83%) patients which is in consistent with study by A. Ayyappa et al.[16] Lower culture positivity rate might be due to prior administration of antibiotics or the etiological agents might be atypical organisms or viruses.

The prevalence of *Streptococcus pneumoniae* was 12/79 (15.18%) in CAP patients. The prevalence rate in the present study is similar to Prasad P et al[17] and it is lower than Jain SK et al.[18] Low rates of *S. pneumoniae* may be due to the increased awareness of pneumococcal vaccines or being a tertiary care center patients usually come after taking antibiotics from outside.

Out of 12 pneumococcal isolates, 65% were males and the rest 35% were females. Male predominance with male to female ratio was 3:1 and from elder age group which is similar with the findings of study by Chawla K et al[19]. The high incidence in the elderly age group may be due to impairment of the immune system, age related decline in mechanical clearance of airways and loss of elastic recoil of lungs. Increased rates of smoking and alcoholism in males as well as association with co-morbid conditions like COPD were responsible for male predominance.

In the present study the maximum number of *S. pneumoniae* isolates were obtained from sputum sample 11/58 (18.96%) followed by blood which constituted 1/21 (4.76%) which is similar to C. Cilloniz et al.[20] The difference in sample wise distribution may be due to the sensitivity of conventional methods used for isolation.

Resistance to penicillin using oxacillin disk (33.3%) in present study by disk diffusion method is similar to SP McCurdy et al.[21] (28.2%) Very low resistance was reported by Chawla K et al[19] (14%). The difference in resistance to penicillin may be due to use of antibiotics policy and selective pressure of drugs.

Screening with oxacillin (1μg) disks cannot distinguish between intermediate resistance strains and borderline susceptible strains. Therefore MIC determination should be performed for strains showed resistance to oxacillin using the disk diffusion technique.[19]

In present study, MIC with penicillin E strips showed same percentage (16.33%) in intermediate resistance and complete resistance whereas other studies such as. Goyal R et al[22] and Chawla K et al[19] revealed 86.7% and 10% of intermediate resistance and 9% and 4% total resistance to penicillin respectively. The major reason for this is increased globalization causing geographic spread of drug-resistant clones with special capacity to spread and colonize facilitated by antibiotic pressure.

MIC of *S. pneumoniae* to amoxicillin-clavulunate by E strip test showed 25% resistance which is higher than Goyal R et al[22] (4%) and 8.33% resistance to cefotaxime which is similar to Vila – Corcoles A et al[23] (9.7%). No resistance was seen in Goyal R et al[22] and Chawla K et al.[19] MIC testing by E strip test showed 8.33% intermediate and complete resistance to cefepime. Other studies (Li Xin-Xin et al[24]) showed more intermediate resistance than complete resistance.

Resistance pattern to cotrimoxazole in the present study by disk diffusion method was (33.33%) and (25%) by E test which is similar to Chawla K et al.[19] Increase in cotrimoxazole resistance possibly due to the wider use of these antibiotics in the hospital as well as the community because of the dose convenience, cost-effectiveness and easy availability over the counter.

Tetracycline resistance by both the method was similar (25%) in the present study. Resistance to tetracycline in the present study was similar to Reinert R et al[25] and Chawla K et al.[19] This might be because of the frequent use of tetracycline to treat respiratory infections in patients, resulting in substantial resistance against it.

Present study showed (41.66%) resistance to levofloxacin by disk diffusion method whereas E strip testing showed (33.33%) resistance which is higher than other Indian studies. Chawla K et al[19] showed (14%) resistance to levofloxacin by both disk diffusion method and E strip test. The high fluoroquinolone resistance observed in this study may be due to overuse of quinolones. It limit the empirical use of fluoroquinolones in CAP in Indian settings.

Multi drug resistant (MDR) *S. pneumoniae,* defined as resistant to penicillin and two or more non β lactam agents (macrolides, cotrimoxazole or tetracycline). MDR was seen in one (8.33%) strain of *S. pneumoniae.* Other Indian studies (Goyal R et al[22], Chawla K et al[19]) also reported MDR in 4% and 50% respectively. The empirical treatment of pneumococcal infections often requires a combination of two or more antibiotics and for longer duration. These conditions inevitably lead to the initiation of high or multidrug resistance among patients with infections.

All the isolates (100%) were sensitive to erythromycin whch is similar to Goyal R et al.[22]

CONCLUSION

Present study observed the resistance of *S. pneumoniae to* penicillin and other antimicrobial agents which emphasizes the need of continuous local as well as global monitoring of the sensitivity pattern of this pathogen. To overcome the multidrug resistance *Streptococcus pneumoniae* infection, it is important to follow antibiotic policy strictly. It will help to reduce the indiscriminative use of antibiotics and control the spread of drug resistance among species.

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