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Original Research Article

Prevalence and Antimicrobial Susceptibility Pattern of Streptococcus Pneumoniae Isolated From Respiratory Samples in a South Indian Tertiary Care Hospital

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ABSTRACT

Objective: Streptococcus pneumniae is the most common cause of community acquired pneumonia and RTI affecting mostly the extremes of age groups. Globally, an estimated 1.6 million people including 1 million children less than 5 years old die of invasive pneumonia disease annually .The present study was conducted to find out the prevalence and antimicrobial susceptibility pattern of respiratory isolates of Streptococcus pneumoniae at our hospital.

Materials And Methods: Patients having symptoms of respiratory tract infections , whose respiratory samples (sputum/ throat swab/ bronchial washing) were sent for culture and sensitivity prior to starting of any antibiotics, during the period from June 2012 to June 2013 were included in the study . Informed consent was taken from the patient and ethical clearance was obtained from the institute. Streptococcus pneumoniae was identified by standard laboratory procedure as per CLSI guideline. Antimicrobial susceptibility testing was done by Kirby-Bauer disk diffusion method in Blood Agar media.

Results : Out of 300 respiratory samples ,108 Streptococcus pneumoniae were isolated among which 72 (66.67%) were males and 36 (33.33 %) were females .The IPD (90 / 83.33%) contributed more than OPD patients (18 / 16.67%) .Overall male to female ratio was 2 : 1 . The age incidence of (1-10) years , (11- 40) years , (41 – 60) years and > 60 years age groups were 30 (27.78 %) , 12 (11.11 %) , 26 (24.07 %) and 40 (37.04 %) respectively. Positive samples were received mostly from the TBCD department (54 / 50.00 %) followed by Paediatrics (30 / 27.78 %) , General Medicine (15 / 13.88 %) , Surgery (6 / 5.56 %) and lowest from CTVS department (3 / 2.78 %). Vancomycin and Imipenem were the most active antibiotics with 100 % susceptibility rates. The next best were Amoxyclav, Erythromycin, Levofloxacin, Ceftazidime and Cefepime.

Conclusions: Pneumococcal infection easily spreads among community and indiscriminate use of antibiotics contributes to their resistance. Area-wise studies on antimicrobial susceptibility profiles are essential to guide policy on the appropriate use of antibiotics to reduce the morbidity and mortality and also to control the emergence of antimicrobial resistance.

Keywords: Streptococcus pneumoniae, RTI, susceptibility, antimicrobial resistance.

INTRODUCTION

Streptococcus pneumoniae is one of the most common bacteria causing pneumonia, both lobar and broncho-pneumonia and also acute tracheobronchitis, empyema, acute exacerbation of chronic bronchitis. [1] It is also the most common cause of community acquired pneumonia. [2]

The source of human infection is the respiratory tract of carriers and less often, of patients. They occur in the throat of approximately half the population sampled at any time. They are transmitted by fingers or by inhalation of contaminated droplets .Dissemination is facilitated by crowding and disease results only when host resistance is lowered by contributory factors like respiratory viral infection, pulmonary congestion, stress, malnutrition, immune deficiency, alcoholism, splenectomy and sickle cell disease. [1]

The uniqueness of the organism is that it has a polysaccharide capsule which is the key to the virulence of this organism. [3] In addition to the respiratory tract infection it may also cause invasive pneumococcal disease. Invasive pneumococcal disease is defined as isolation of Streptococcus pneumoniae from a normal sterile site which most frequently affects children less than 2 years and adult at least 65 years old and immune-compromised individuals. [4]

Globally, an estimated 1.6 million people including 1 million children less than 5 years old die of invasive pneumonia disease annually. [5]

Following the initial detection of penicillin resistant Streptococcus pneumoniae in a few geographic regions like India, South Africa, Australia and Spain, in the 1970s, resistance to penicillin and other antibiotics has spread worldwide. [6]

Area-wise studies on antimicrobial susceptibility profiles are essential to guide policy on the appropriate use of antibiotics. The present study was conducted to find out the prevalence and antimicrobial susceptibility pattern of Streptococcus pneumoniae isolates obtained from respiratory samples at our hospital. The information would be useful in establishing empiric therapy guidelines and to contribute data to larger more extensive surveillance programs.

MATERIALS & METHODS

The present study was conducted in the department of Microbiology, GSL Medical College & General Hospital, Rajahmundry, Andhra Pradesh, India. Patients having symptoms of respiratory tract infections diagnosed provisionally in different IPDs and OPDs, whose respiratory samples (sputum / throat swab / bronchial washings) were sent for culture and sensitivity prior to starting of any antibiotics, during the period from June 2012 to June 2013 were included in the study . Informed consent was taken from the patient and ethical clearance was obtained from the institute.

300 respiratory samples received during that period were inoculated in Blood agar, MacConkey's agar and Nutrient agar media and routine standard operative procedures are followed in the laboratory in isolating and identifying the organisms. Streptococcus pneumoniae was identified by typical colony appearance, Gram stain morphology showing typical lanceolate shaped Gram positive diplococci, presence of capsule in India Ink preparation, and confirmed by Inulin fermentation, Bile solubility and Optochin sensitivity tests.

Antimicrobial susceptibility testing was done by Kirby-Bauer disk diffusion method in Blood Agar media and results are interpreted according to the Clinical and Laboratory Standards Institute (CLSI) guidelines. [7,8] Anti-pneumococcal

antibiotics like penicillin G (10 units) , amoxyclav (20/10 mcg) , piperacillin (100 mcg) , ceftriaxone (30 mcg) , cefotaxime (30 mcg) , ceftazidime (30 mcg) , cefepime (30 mcg) ,imipenem (10 mcg) , aztreonam (30 mcg) , oxacillin (1 mcg) , vancomycin (30 mcg) , ciprofloxacin (5 mcg) , levofloxacin (5 mcg) , erythromycin (15 mcg) , co-trimoxazole (1.25/23.75 mcg) gentamycin (10 mcg) , amikacin (30 mcg) and clindamycin (2 mcg) [8] were tested (HIMEDIA, MUMBAI, INDIA) .

Statistical Methods: The data obtained in this study was summarized by counts & percentages. Antibiotic Susceptibility rates were presented with the respective 95% confidence interval values.

RESULTS

Out of a total 300 sputum samples and broncho-alveolar lavage received in our central laboratory during the period from June 2012 – June 2013, 108 Streptococcus pneumoniae were isolated among which 72 (66.67%) were from male patient and 36 (33.33 %) were from females .The majority were obtained from In Patient dept. (90 / 83.33%) and less number of isolates were from OPD patients (18/ 16.67%). Among the 90 IPD isolates 57 (63.33%) were from male and 33 (36.67%) were from female whereas among 18 OPD patients 15 (83.33%) were males and 3 (16.67%) were female (Table – 1). Overall male to female ratio was 2:1.

Table – 1 : Sex-wise distribution of streptococcus pneumoniae isolates of respiratory samples in IPD and OPD patients.

Sex Distribution (n = 108)	IPD (n = 90)	OPD (n = 18)
Male = 72 (66.67%)	57 (63.33 %)	15 (83.33%)
Female = 36 (33.33%)	33 (36.67 %)	3 (16.67%)
Total 108 (100%)	90 (100%)	18 (100%)

The age incidence among 1-10 years age group was 30 (27.78 %) [male – 22 , female – 8] , among 11- 40 years age group , 12 (11.11 %) [male – 10 , female – 2] , in 41– 60 years it was 26 (24.07 %) [male – 15 , female – 11] and in > 60 years age group it was 40 (37.04 %) [male – 26 , female – 14] (Table – 2)

Table – 2 : Age wise distribution of Strepococcus pneumoniae isolates.

Age groups	Male	Female
(1-10) Years [n = 30] (27.78 %)	22 (73.33 %)	8 (26.67 %)
(11 – 40) Years [n = 12] (11.11 %)	10(83.33 %)	2 (16.67 %)
(41 – 60) Years [n = 26] (24.07 %)	15(57.69 %)	11(42.31 %)
> 60 Years [n = 40] (37.04 %)	26(65.00%)	14(35.00 %)

Most of the streptococcus pneumoniae isolates were from respiratory samples received from the TBCD department (54 / 50.00 %) followed by Paediatrics (30 / 27.78 %) , General Medicine (15 / 13.88 %) , Surgery (6 / 5.56 %) and lowest from CTVS department (3 / 2.78 %) (Table – 3).

Table-3: Department wise distribution of Str. pneumoniae isolated from sputum sample.

Name of the Department (s)	No(s) (%) of Streptococcus pneumoniae
TBCD	54 (50.00 %)
Paediatrics	30 (27.78 %)
General Medicine	15 (13.88 %)
General Surgery	6 (5.56 %)
CTVS	3 (2.78 %)

The results of antimicrobial susceptibility of streptococcus pneumoniae isolates to various antibiotics tested in this study are shown in Table – 4 & Figure - 1 . 95 % confidence interval data is also presented. Vancomycin and Imipenem were the most active antibiotics with 100 % susceptibility rates. The next best were Amoxyclav, Erythromycin, Levofloxacin, Ceftazidime and Cefepime. Significant resistant were observed in common antibiotics like Co-trimoxazole 81 (75.00%) , Aztreonam 82 (75.93%) , Amikacin 74 (68.51%) and Oxacillin 60 (55.56%) .

Table – 4 : Antimicrobial susceptibility of Streptococcus pneumoniae isolates (n = 108) to various antibiotics.

Antimicrobial agents	Sensitive		Resistant	
	Number (%)	95% Confidence Interval	Number (%)	95% Confidence Interval
Penicillin G	75 (69.44)	60.21 – 77.34	33 (30.56)	22.66 – 39.79
Amoxyclav	93 (86.11)	78.34 – 91.40	15 (13.89)	08.60 - 21.66
Piperacillin	81 (75.00)	66.07 – 82.21	27 (25.00)	17.79 – 33.93
Oxacillin	48 (44.44)	35.42 – 53.85	60 (55.56)	46.15 – 64.58
Vancomycin	108 (100)	96.57 – 1.00	00 (00.0)	00.00 – 03.43
Clindamycin	72 (66.66)	57.34 – 74.85	36 (33.34)	25.15 – 42.66
Erythromycin	90 (83.33)	75.19 – 89.19	18 (16.67)	10.81 – 24.81
Gentamicin	70 (64.81)	55.44 – 73.17	30 (35.19)	26.83 – 44.56
Amikacin	34 (31.48)	23.49 – 40.75	74 (68.51)	59.25 – 76.51
Co-trimoxazole	27 (25.00)	17.79 – 33.93	81 (75.00)	66.07 – 82.21
Ciprofloxacin	78 (72.22)	63.12 – 79.79	30 (27.78)	20.21 – 36.88
Levofloxacin	93 (86.11)	78.34 – 91.40	15 (13.89)	08.60 – 21.66
Imipenem	108 (100)	96.57 – 1.00	0 (00.00)	00.00 – 03.43
Aztreonam	26 (24.07)	16.99 – 32.94	82 (75.93)	67.06 – 83.01
Cefotaxime	81 (75.00)	66.07 – 82.21	27 (25.00)	17.79 – 33.93
Ceftriaxone	76 (70.37)	61.18 – 78.16	32 (29.63)	21.84 – 38.82
Ceftazidime	96 (88.88)	81.58 – 93.53	12 (11.12)	06.47 – 18.42
Cefepime	92 (85.19)	77.28 – 90.67	16 (14.81)	09.33 – 22.72

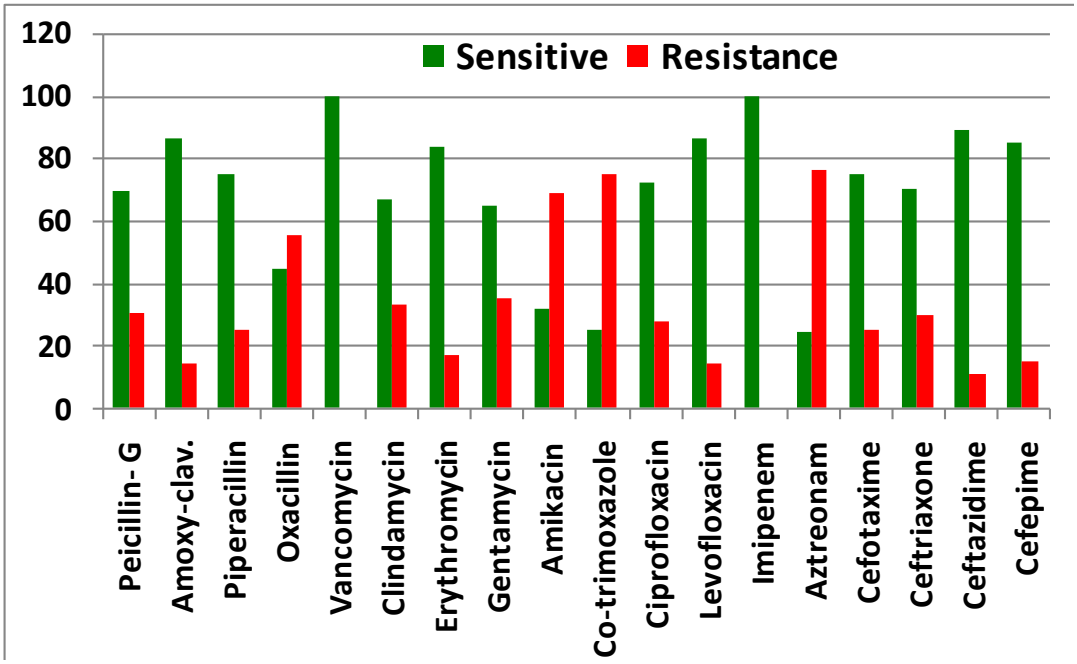

Figure – 1: Antibiotic sensitivity pattern of Streptococcus pneumonia.

DISCUSSION

The present study reveals the prevalence of Streptococcus pneumoniae more in extremes of age groups as seen in 1-10 years age group, it is 27.78%, diminishing to 11.11 % in 11- 40 years age group , again increasing to 24.07 % in 41 – 60 years age group and finally increased much more to 37.04 % in more than 60 years age group ; which corroborates with the same trend reported long back in 1995 of high incidence of pneumonia in children and adults in different parts of the world. [9] It may be due to decreased immunity in the extremes of age groups.

The male to female ratio was 2:1 which closely corroborates with the ratio of

2.8 : 1 by the study of Kiran Chawla et. al. [10]

The highest antibiotic susceptibility was seen with Vancomycin and Imipenem of 100 % each followed by ceftazidime (88.88 %) , Amoxyclav and Levofloxacin of 86.11% each , Cefepime (85.19 %) and Erythromycin (83.33 %) ; moderate sensitivity was seen with Piperacillin (75%) ,Cefotaxim (75 %) ,Ciprofloxacin (72.22 %) , Penicillin – G (69.44 %). The high resistance patterns were seen with Aztreonam (75.93 %) followed by Amikacin (68.51 %) , co-trimoxazole (55.56%) , Clindamycin (33.39 %), Gentamycin (35.19 %).

Possibly the indiscriminate use of common antibiotics have contributed to the higher resistance pattern as seen with Amikacin , Gentamycin , Co-trimoxazole and. decreasing sensitivity pattern as seen with commonly used drugs like Penicillin-G , Cefotaxim , Ciprofloxacin , Piperacillin . However chance of genetic mutation contributing to the resistance is also there . All these observations are in tandem with various other studies by Lalitha MK et.al. , Goyal R. et. al. , and Kanungo R. et. al. done in different parts of North and South India. [11-13]

CONCLUSION

Incidence of respiratory tract infection caused by Streptococcus pneumoniae is increasing worldwide affecting the Children and aged adult population which may lead to inavasive pneumococcal infection by dissemination to other organs of the body if not treated in time. The inadvertent and indiscriminate use of antibiotics has lead to the emergence of resistance among commonly used antibiotics ; so judicious use of sensitive antibiotics like Erythromycin, Amoxyclav , Levofloxacin , Ciprofloxacin etc. should be done and in non responsive cases only highly sensitive drugs like Vancomycin , Imipenem , Ceftazidime , Cefepime etc. Should be used.

Our study aims to guide clinicians on appropriate use of antibiotics. This not only reduces the morbidity and mortality in the patients infected with Streptococcus pneumoniae but also controls the emergence and spread of resistance among this pathogens. Regular monitoring of the use of antibiotics helps in preserving the effectiveness of antibiotics.

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