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ORIGINAL ARTICLE

BACTERIAL SPECTRUM AND PATTERN OF ANTIMICROBIAL SENSITIVITY AMONG OUTPATIENTS WITH PNEUMONIA IN A TERTIARY CARE HOSPITAL

Sushma Sawaraj[1], Dinesh Kansal[2], Praveen Kumar Sharma[3], Kamlesh Thakur[4], Rekha Bansal[5] Gaurav Sharma[6]

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ABSTRACT: OBJECTIVES: To outline the spectrum of bacteria causing pneumonia and the pattern of antimicrobial sensitivity in outpatients with pneumonia in a tertiary care hospital in Himachal Pradesh. **METHODS:** Sputum of 108 immuno competent pneumonia patients attending outpatient departments of Medicine and Pulmonary medicine of Dr. R. P. Government Medical College, Kangra at Tanda was sent for Gram staining and culture and sensitivity testing. **RESULTS:** Commensals were detected in most of the cases (32, 29.6%) followed by Staphylococcus aureus in 17(15.7%) and Streptococcus pneumoniae in 16(14.8%). This was followed by three Gram negative organisms namely E Coli (11, 10.2%), Pseudomonas (10, 9.2%) and Klebsiella (8, 7.2%). No growth was obtained in 7(6.5%) and other organisms were isolated in 7(6.5%) specimens. Staphylococcus aureus was sensitive to vancomycin, clindamycin, cefoxitin, azithromycin and cotrimoxazole. Streptococcus pneumoniae was found to be sensitive to vancomycin, clindamycin, gentamicin, azithromycin, penicillin, cotrimoxazole, amoxicillin+clavulanic acid. Klebsiella was found to be sensitive to imipenem, azithromycin, ciprofloxacin, gentamicin and amoxicillin+clavulanic acid. E coli was sensitive to imipenem, gentamicin and amoxicillin+clavulanic acid. Pseudomonas aeruginosa was found to be sensitive to gentamicin, ceftazidime, imipenem, ticarcillin and piperacillin. **CONCLUSION:** Staphylococcus aureus and Streptococcus pneumoniae are the commonest organism causing pneumonia. Streptococcus pneumoniae is resistant to many antibiotics. Azithromycin can be the first line therapy for pneumonia.

KEYWORDS: Bacterial Spectrum, Pneumonia, Staphylococcus aureus, Streptococcus pneumoniae, Azithromycin.
MESHTERMS: Bacterial Spectrum, Pneumonia, Staphylococcus aureus, Streptococcus pneumoniae, Azithromycin.

INTRODUCTION: Community acquired Pneumonia (CAP) can be defined either on clinical or radiographical findings. Clinically it is defined as a symptoms of acute lower respiratory tract illness for less than 1 week; and(b) at least one systemic feature(temperature >37.7 deg C, chills, and rigors, and/ or severe malaise; and (c) new focal chest signs on examination; with (d) no other explanation for the illness. Radiographic shadowing above symptoms and signs when no other explanation exists is the radiographical definition of CAP. It is a significant public health problem resulting in profound morbidity and mortality. The number of deaths due to lower respiratory tract infections in India was 35.1/100,000 in 2008, accounting for 20% of the mortality due to infectious diseases. Both bacteria and viruses are responsible etiological agents, with viruses accounting for 10-36% of the cases.

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Although Streptococcus pneumoniae is the most common bacteria, but the proportion varies according to different studies. The susceptibility of these organisms also varies from region to region. The present study was undertaken to know the bacteria causing CAP in our population along with antimicrobial sensitivity patterns as no such data exists in our population till date. The results of the study should help us in choosing appropriate antibacterial agents for CAP in our patients.[1, 2]

OBJECTIVES: To outline the spectrum of bacteria causing pneumonia and the pattern of antimicrobial sensitivity in outpatients with pneumonia in a tertiary care hospital in Himachal Pradesh.

MATERIALS AND METHODS:

Study Design: Cross-sectional study.

Study Setting: The study was conducted in the departments of Pharmacology, Microbiology, and Pulmonary Medicine of Dr. R P Government Medical College and Hospital Kangra at Tanda for a duration of one year, from 1st February 2013 to 31st January 2014.

Study participants: 108 patients clinically diagnosed as having CAP and fulfilling the inclusion and exclusion criterion participated in the study.

INCLUSION CRITERIA: All Clinically diagnosed cases of CAP belonging any age and of either gender attending the outpatient department of Pulmonary Medicine and Medicine.

EXCLUSION CRITERIA:

1. Known Immuno compromised patients.
2. If consolidation is tuberculous in a suspected case of Pneumonia.
3. Patients not willing to participate in the study.
4. Those already on antibacterial therapy.

Ethical clearance: The study was approved by Protocol Review Board and Institutional Ethical Committee of Dr. RPGMC Kangra at Tanda. The information collected and individual identity was kept strictly confidential.

Consent: The written informed consent was obtained from all the patients/ guardian (In case of a minor).

Sample Collection for Culture and Sensitivity: Specimen**:** Protected Specimen Brushing (PSB) or Sputum.

PSB sample was collected from tracheobronchial tree where ever patient gave consent otherwise sputum samples were collected.

Sample transportation: Samples were transported immediately to the Department of Microbiology, Dr. R.P. Govt. Medical. College and Hospital Kangra at Tanda.

Processing of Samples: Out of the two specimens collected, Gram staining was done from one by modified Hucker's method and other was used for culture.

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Identification of Organisms: The isolates obtained on culture were studied and identified by the standard bacteriological techniques based on colony characters and biochemical tests. [3]

Colony Characteristics: the colonies of each organism isolated were studied in respect of size, shape, colour, surface, elevation, opacity, edges, margins and effect of media, pigment production, odour, emulsifiability and consistency.

Biochemical Reactions: Various biochemical tests were performed for Identification Gram positive bacteria: were identified by Catalase, Coagulase, Bile solubility, CAMP (Christie, Atkins and Munch Peterson) and Hippurate hydrolysis test. Gram negative bacteria: were identified by Catalase, Oxidase, Motility, IMViC reaction, O-F test, Carbohydrate fermentation test, Amino acid decarboxylation tests.

The Antibiotic susceptibility Test (AST): AST for antibacterial was performed for all pathogenic isolates by modified Kirby-Bauer disk diffusion method on Mueller – Hinton agar plates [4]

Quality Control: E.coli ATCC 25922; Staph aureus ATCC 25923, Pseudomonas aeruginosa ATCC 27853 were used as standard strains for quality control as per Clinical and laboratory standards institute guidelines.[5]

RESULTS: Among 108 patients of Pneumonia, commensals of throat were isolated in 40(38%) of specimens and pathogenic bacteria were isolated in 68(62%) of specimens. Out of 68 sputum specimens in Pneumonia, where pathogenic bacterial isolates were found, Staphylococcus aureus was isolated in 17(25%), Streptococcus pneumoniae in 16(24%), E.coli in 11(16%), Pseudomonas aeruginosa in 10(15%), Klebsiella spp in 8(12%), NFGO in 3(4%) Citrobacter spp in 2(3%), and Acinetobacter spp in 1(1%). (Fig. 1)

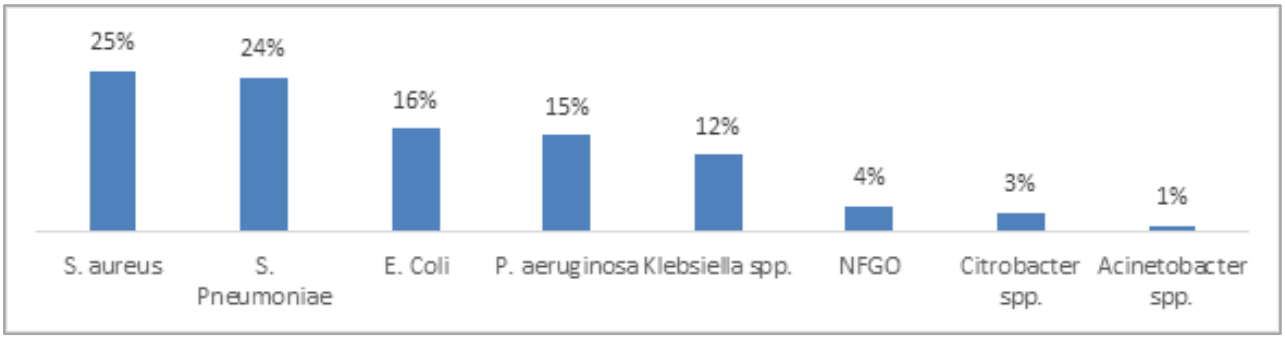

Fig. 1: Microbiological profile of pathogenic bacteria

Staphylococcus aureus in Pneumonia patients was sensitive to vancomycin in 17(100%), clindamycin in 16(94.2%), cefoxitin in 14(82.3%), azithromycin in 12(70.6%), gentamicin in 10(58.8%) and cotrimoxazole in 10(58.8%), penicillin 3(17.6%), amoxy+clav 3(17.6%), ofloxacin 1(5.9%) and ciprofloxacin 1(5.9%) of the specimens. Streptococcus pneumoniae was found to be sensitive to vancomycin in 16(100%), and clindamycin in 12(75%), azithromycin in 9(56.2%), ceftriaxone in 9(56.2%), cotrimoxazole in 7(43.7%), and amoxy+clav in 7(43.7%), ofloxacin in

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6(37.5%), gentamicin in 5(31.3%) and penicillin in 3(18.7%) of the specimens. (Fig 2). Pseudomonas aeruginosa was sensitive to gentamicin in 10(100%), ceftazidime in 9(90%), imipenem 5(50%), ticarcillin 3(30%), piperacillin 3 (30%), cotrimoxazole 3 (30%), cefepime 2(20%), ciprofloxacin 1(10%), cefixime 1(10%) and cefoxitin 1(10%). E. coli in pneumonia patients was sensitive to imipenem (81.8%), gentamicin 8(72.7%), amoxycillin+clavulanate 4(36.4%), ciprofloxacin 3(27.3%), cefixime 2(18.2%), cotrimoxazole 2(18.2%), cefalotin 1(9.1%) and norfloxacin 1(9.1%). Klebsiella spp. was sensitive to imipenem in 8(100%), azithromycin in 6(75%), ciprofloxacin in 6(75%) gentamicin in 4(50%), amoxy+ clav in 3 54(37.5%) cefixime in 2(25%), cotrimoxazole in 2(25%), cephalothin in 1(12.5%) of the specimens.

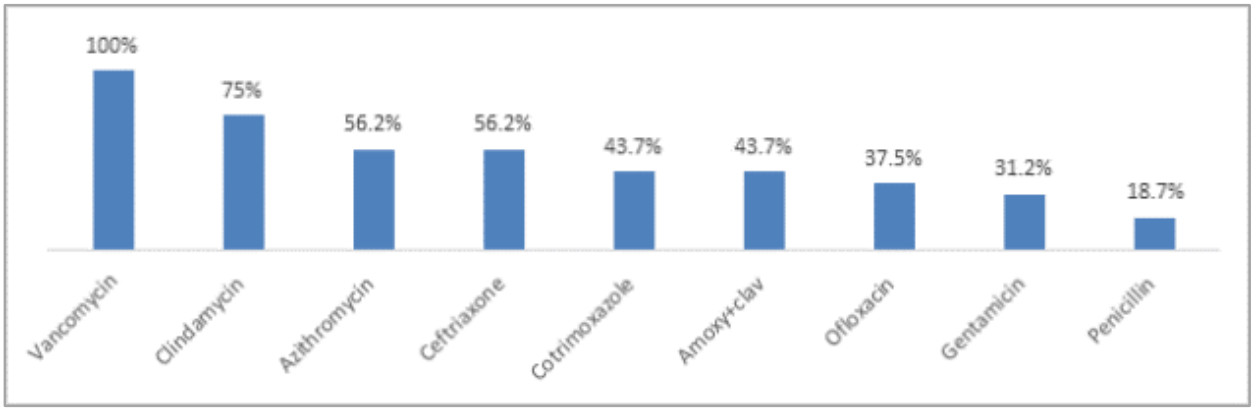

Fig. 2: Sensitivity profile of Streptococcus pneumoniae isolated from sputum

DISCUSSION: In the present study the rate of isolation of organisms from sputum was 63% while in the study by Oberoi et al rate of isolation from sputum culture and blood culture was 32% and 22% respectively. The reason for higher sputum positivity in our study may be better technique for sputum expectoration and rapid transportation of the specimen to the laboratory. In the present study, commensals of throat were isolated in 40(38%) of specimens, and pathogenic bacteria were isolated in 68(62%) of specimens while Shah et al in their study found that in 71(71%) cases no etiological cause was obtained. Bansal et al also found that out of the 70 patients, 53(75.6%) had an identifiable etiology with 12 of these had evidence of a mixed infection. No organisms could be isolated in 17(24.4%) patients. [6, 7, 8]

We found that Gram positive and negative organisms causing pneumonia were almost same i.e. Gram negative 35(51%) and Gram positive 33(49%) while Shah et al found that Gram negative organisms were the commonest cause (19, 65.5%), followed by gram positive (10, 34.5%) in their study.[8]

In the present study, Staphylococcus aureus was isolated in 17(25%), Streptococcus pneumoniae in 16(24%), E.coli in 11(16%), Pseudomonas aeruginosa in 10(15%), Klebsiella spp. in 8(12%), NFGO in 3(4%) Citrobacter spp in 2(3%), and Acinetobacter spp in 1(1%). This is in contrast to study by Oberoi et al according to which Streptococcus pneumoniae (22, 32.8%) was the commonest organism isolated followed by Pseudomonas aeruginosa (21, 30.9%), E.coli (8, 11.7%), Klebsiella spp (7, 10.2%). In addition, they also isolated Acinetobacter, Candida albicans, Aspergillus fumigatus and Staphylococcus aureus in a less number of cases. (9, 13.1%) Shah et al found that

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Pseudomonas aeruginosa was the commonest pathogen (10, 34.5%), followed by Staphylococcus aureus (7, 24.1%), Escherichia coli (6, 20.7%), Klebsiella spp. (3, 10.3%), Streptococcus pyogenes (1, 3.5%), Streptococcus pneumoniae (1, 3.5%) and Acinetobacter spp. (1, 3.5%). Other than the fact that they isolated Pseudomonas aerugenosa as the commonest organism, rest of the culture results were similar to the present study. Bansal et al found that, the most frequent pathogen was Streptococcus pneumoniae (19, 35.8%) followed by Klebsiella pneumoniae (12, 22%), Staphylococcus aureus (9, 17%), Mycoplasma pneumoniae (8, 15%), Escherichia coli (6, 11%), β-hemolytic streptococci (4, 7.5%) and other Gram-negative bacilli (5, 9%).[6, 7, 8]

Staphylococcus aureus in Pneumonia patients was sensitive to vancomycin in 17(100%), clindamycin in 16(94.2%), cefoxitin in 14(82.3%), azithromycin in 12(70.6%), gentamicin in 10, (58.8%) and cotrimoxazole in 10(58.8%). Streptococcus pneumoniae was found to be sensitive to vancomycin in 16, (100%) and clindamycin in 12(75%), azithromycin in 9 (56.2%), ceftriaxone in 9 (56.2%), cotrimoxazole in 7(43.7%), and amoxy+clav in 7(43.7%). E. coli in pneumonia patients was sensitive to imipenem (9, 81.8%), gentamicin (8, 72.7%), amoxycillin+clavulanate (4, 36.4%). (Fig 26) Pseudomonas aeruginosa was sensitive to gentamicin in 10(100%), ceftazidime in 9(90%), imipenem (5, 50%). Klebsiella spp. was sensitive to imipenem in 8(100%), azithromycin in 6(75%), ciprofloxacin in 6(75%) gentamicin in 4(50%). Therefore in the present study, organisms were highly susceptible to vancomycin, clindamycin, cefoxitin, azithromycin, gentamicin and cotrimoxazole, however resistance to penicillin, amoxycillin+clavulanate and fluoroquinolones was also noted in many cases. In the study by Oberoi et al the antibiotics which showed best sensitivity were third generation cephalosporins, fluoroquinolones and aminoglycosides. This is because of the higher incidence of gram negative pneumonia. The largest experience to date for treatment of Pseudomonas aeruginosa pneumonia have been with combination of a broad spectrum beta lactam antibiotic with an aminoglycoside such as gentamicin. The study revealed that CAP can be caused by different bacteriological agents with preponderance of gram negative over gram positive organisms in isolation from the blood but from sputum culture, higher number of Streptococcus pneumoniae were isolated. If the antibiotics according to the sensitivity pattern are administered to to these patients at an early stage of the disease, morbidity and mortality can be minimized. Iannini et al 2007 in a retrospective multicenter study 87 of 122 patients showed low level macrolide (Erythromycin) resistance, similar to our study.[6, 9]

In the present study we noted that Streptococcus pneumoniae was resistant to fluoroquinolones (Ofloxacin) in 62.5% cases. Chen et al against the back ground that Fluoroquinolones are now recommended for the treatment of respiratory tract infections due to Streptococcus pneumoniae, particularly when the isolates are resistant to beta lactam antibiotics, performed susceptibility testing. They concluded that the prevalence of pneumococci with reduced susceptibility to fluoroquinolones is increasing in Canada, probably as a result of selective pressure from the increased use of fluoroquinolones. Since, we also found increasing resistance to fluoroquinolones, the cause may be selective pressure due to overuse of these drugs in our area, particularly due to governmental supply of these drugs which are given to patients routinely for various infections including parenteral formulations. Weiss et al conducted a study over the course of a 20-month period, in a hospital respiratory ward in which ciprofloxacin was often used as empirical antimicrobial therapy for lower respiratory tract infections (LRTIs) and demonstrated the ability of S. pneumoniae to acquire multiple mutations that result in increasing levels of resistance to the

fluoroquinolones and to be transmitted from person to person. Shefet et al in a Cochrane meta-analysis of 24 trials including 5015 randomized patients found no benefit of atypical cover (Fluoroquinolone monotherapy versus nonatypical monotherapy). Liu et al in a prospective study of 610 patients found that susceptibility of Streptococcus pneumoniae to Penicillin and azithromycin was 77.8% and 20.6% respectively, while we found sensitivity rate to penicillin and azithromycin as 18.7% and 56.2% respectively which was opposite to the findings of Liu et al. [10, 11, 12, 13]

CONCLUSIONS:

- Staphylococcus aureus and Streptococcus pneumoniae are commonest organisms causing pneumonia.
- Streptococcus pneumoniae isolated from the sputum of pneumonia cases has shown resistance drugs like penicillin, amoxicillin/clavulanic and fluoroquinolones.
- It was found to be sensitive to clindamycin, macrolides (Azithromycin), third generation cephalosporins (Ceftriaxone) and cotrimoxazole.
- For presumptive treatment the first line may be a macrolide (Azithromycin) as it has shown activity against both gram negative and gram positive and combination therapy if required may be ceftriaxone plus azithromycin in such cases.

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AUTHORS:

1. Sushma Sawaraj
2. Dinesh Kansal
3. Praveen Kumar Sharma
4. Kamlesh Thakur
5. Rekha Bansal
6. Gaurav Sharma

PARTICULARS OF CONTRIBUTORS:

1. Resident, Department of Pharmacology, Dr. RPGMC, Kangra, H.P.
2. Professor & HOD, Department of Pharmacology, Dr. RPGMC, Kangra, H.P.
3. Associate Professor, Department of Pharmacology, Dr. RPGMC, Kangra, H.P.
4. Professor & HOD, Department of Microbiology, Dr. RPGMC, Kangra, H.P.
5. Assistant Professor, Department of Pulmonary Medicine, Dr. RPGMC, Kangra, H.P.
6. Assistant Professor, Department of Ophthalmology, Dr. RPGMC, Kangra, H.P.

NAME ADDRESS EMAIL ID OF THE CORRESPONDING AUTHOR:

Dr. Sushma Sawaraj,
Resident, Department of Pharmacology,
Dr. RPGMC, Kangra, H.P.
E-mail: sushmaswaraj07@gmail.com

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