

Bacterial Isolates from the Sputum of Patients with Pneumonia Not Responding To Initial Antimicrobial Therapy.

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Abstract:

Background: Patients with community-acquired pneumonia (CAP) those admitted in a hospital but do not respond to initial antimicrobial therapy becomes the challenging approach to the attending physician. The knowledge of the likely pathogens and their sensitivity pattern helps the clinicians to better manage these cases.

Aims and Objectives: To study the spectrum of the bacterial isolates and to determine the antimicrobial sensitivity pattern obtained from the sputum of patients suffering from pneumonia not responding to initial antimicrobial therapy.

Materials and Methods: A retrospective study of 87 patients who were admitted in the medical wards of a tertiary care teaching hospital in India with the diagnosis of CAP and were not responding to initial antimicrobial therapy. The patient-related data were obtained from the case records and entered on a pre-designed proforma. This included demographic characteristics and reports of relevant clinical tests. The Sputum culture and sensitivity results were also noted on the proforma.

Results: A total of 98 bacterial isolates were obtained from 87 sputum sample. The most prevalent bacterial isolates included *Pseudomonas aeruginosa* (n = 31, 31.6%), *Klebsiella pneumoniae* (23, 23.4%), *Staphylococcus aureus* (15, 15.3%) and *Acinetobacter* species (11, 11.2%). Most bacterial isolates tested showed 100% sensitivity to meropenem except *Acinetobacter* species (25%). Conclusion: *P. aeruginosa* and *K. pneumoniae* were the most common bacterial pathogens isolated from the Sputum. The isolates tested showed 100% sensitivity to meropenem except *Acinetobacter* species. All the methicillin-resistant *S. aureus* isolates displayed sensitivity to vancomycin, linezolid and teicoplanin.

Keywords: Antimicrobial sensitivity, bacterial isolates, Sputum, pneumonia, Community-acquired pneumonia (CAP).

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I. Introduction

Pneumonia causes more deaths worldwide than any other infectious disease [1]. Although pneumonia can mostly be cured with antimicrobials, patients can die if prompt, appropriate, and adequate therapy is not initiated.

The distribution of bacterial isolates and their antibiotic sensitivity patterns in patients suffering from community-acquired pneumonia (CAP), healthcare-associated pneumonia or hospital-acquired pneumonia (HAP) have been reported in the literature.[1] Clinicians are faced with scenarios where patients initially diagnosed with CAP are admitted in the hospital for treatment but do not respond to initial empirical antibiotic therapy[2]. The possible reasons for this lack of response could be inappropriate choice of antibiotics, acquisition of drug-resistant pathogens from the community or development of superimposed infection due to hospital-acquired pathogens.[2]. This situation is further complicated if either the sputum culture report is inconclusive or the patient does not respond to the antibiotics to which the organisms were reported to be sensitive according to the sputum sensitivity report. This information can help the physicians in understanding the bacterial pathogens.

Each healthcare facility will have a different antibiotic sensitivity pattern among the various isolates. This study provides data from our tertiary care hospital. So, the present aims to study the spectrum of bacterial isolates obtained from the sputum samples of CAP patients who did not respond to initial empirical antimicrobial therapy and to study the sensitivity pattern of these bacterial isolates.

II. Materials And Methods

This study was conducted in the Department of microbiology and Departments of TB and Chest, Maharani Laxmi Bai Medical College, Jhansi. The hospital provides health care services to the surrounding urban, semiurban and rural areas, such cases were screened for inclusion in the study. CAP was defined as per the following criteria: (a) symptoms such as cough with or without expectoration, shortness of breath or pleuritic chest pain for less than 1 week, (b) one or more systemic features (temperature $>37^{\circ}\text{C}$, chills and rigors and/or severe malaise), (c) new focal signs on chest examination (bronchial breath sounds and/or crackles) and (d) new chest X-ray opacity for which there was no other explanation.[1] Diagnosed cases of CAP having received at least 3 days of antibiotic therapy in the ward without any improvement in clinical condition (i.e. persistence or worsening of initial symptoms and signs as described above), and with the availability of a Sputum bacterial culture and sensitivity report, were included in the study. Patients with history suggestive of healthcare-associated pneumonia or HAP prior to admission at our center, admission in an Intensive Care Unit, human immunodeficiency virus infection or patients on immunosuppressive drugs were excluded from the analysis. Using these criteria, 42 patients were excluded from the study.

The data of 87 patients who met the study criteria were noted on a pre-designed proforma and were finally used for the analysis. All the samples were cultured on McConkey agar, Blood agar and chocolate agar. Plates were incubated at 37°C overnight. The growth on the Petridishes was observed and bacterial isolates were identified according to standard protocol. Antibiotic Sensitivity was performed using the Kirby-Bauer disk-diffusion method .[3] The antibiotics tested were aztreonam, colistin, cefoperazone-sulbactam, cefpirome, cefepime, imipenem, meropenem, piperacillin-tazobactam, vancomycin, teicoplanin and linezolid.

III. Result And Discussion

The patients those were subjected to the sputum culture reports were inconclusive and the patients were not responding to empirical antibiotic therapy. All the cases were being managed in the wards. The procedure was performed after Day 3 of starting empirical antibiotics (range 4-6 days). Serology for human immunodeficiency virus, hepatitis B virus and hepatitis C virus was negative for all subjects. The co-morbidities seen in the study population were diabetes mellitus 15(17.2%)patients, hypertension 14(16%)patients, bronchial asthma 11 (12.6%) patients, chronic obstructive pulmonary disease 3 (3.4%) patients, dyslipidemia 2 (2.3%) patients and heart disease 2 (2.3%) patients. The chest radiographs of the subjects showed features suggestive of consolidation on the right side (37%), left side (41%) and bilateral involvement (9%).

A total of 98 bacterial isolates were obtained from the Sputum of 87 subjects. The spectrum of bacterial isolates obtained from the Sputum is shown in Table 1. Pseudomonas aeruginosa was the most common isolate obtained. Five (33%) of the 15 isolates of Staphylococcus aureus obtained from the Sputum were methicillin-resistant Staphylococcus aureus (MRSA).

The empirical antibiotics received by the subjects prior to flexible included ceftriaxone or cefotaxime [79 (91%) patients], azithromycin [51 (59%) patients], levofloxacin or moxifloxacin [11 (13%) patients] and aminoglycoside [21 (24%) patients]. Antimicrobial resistance among Gram positive and Gram negative organisms in isolates from spuum are shown in Tables 2 and 3 respectively. It was observed that Staphylococcus and Streptococcus isolates showed a high degree of resistance to macroclides. However, all isolates of Staphylococcus were sensitive to second-line antibiotics such as linezolid, etc., All isolates of Streptococcus were sensitive to ciprofloxacin. Most of the Gram negative isolates displayed a high percentage of resistance to beta lactam antibiotics. However, all except Acinetobacter were sensitive to meropenem.

Table1: Spectrum of bacterial isolates from Sputum sample.

Isolates	No of isolates (%)
Pseudomonas aeruginosa	31 (31.6)
Klebsiella pneumoniae	23 (23.4)
Staphylococcus aureus	15 (15.3)
Acinetobacter species	11 (11.2)
Streptococcus species	05 (5.1)
E. coli	10 (10.2)
Citrobacter species	03 (3.0)
Total	98 (100)

Table2: Antimicrobial sensitivity pattern of gram positive isolates from Sputum.

Antimicrobial agent	Staphylococcus	Streptococcus
Ampicillin	7.7 (1/13)	ND
Amoxycillin/clavulanate	76.9 (10/13)	ND
Oxacillin	66.7 (8/12)	75 (3/4)
Cefazolin	100 (1/10)	ND
Cefotaxime	ND	50 (1/2)
Ciprofloxacin	33.3 (4/12)	100 (5/5)

Erythromycin	23.1 (3/13)	40 (2/5)
Gentamicin	76.9 (10/13)	100 (1/1)
Amikacin	71.4 (5/7)	ND
Tetracyclin	84.6 (11/13)	60 (3/5)
TMP-SMX	92.3(12/13)	40 (2/5)
Rifampicin	50 (2/4)	ND
Chloramphenicol	100 (5/5)	100 (4/4)
Linezolid	100 (5/5)	ND
Vancomycin	100 (5/5)	ND
Teicoplanin	100 (5/5)	ND
ND: Not done, TMP-SMX: Trimethoprim-sulfamethoxazole		

Table 3: Antimicrobial sensitivity pattern of gram negative isolates from sputum.

Antibiotics	Pseudomonas	Klebsiella	Acinetobacter	Enterobacter	E. coli
Ampicillin	ND	0 (0/17)	0 (0/10)	0 (0/3)	0 (0/5)
Amoxicillin/clavulanate	ND	21.1 (4/19)	18.2 (2/11)	0 (0/4)	0 (0/5)
Cefazolin	ND	27.8 (5/18)	10 (1/10)	0 (0/4)	0 (0/5)
Ceftazidime	87.9 (29/33)	0 (0/1)	ND	0 (0/1)	ND
Cefotaxime	ND	26.3 (5/19)	9.1 (1/11)	0 (0/4)	20 (1/5)
Cefuroxime	ND	29.4 (5/17)	10 (1/10)	0 (0/4)	20 (1/5)
Cefepime	40 (2/5)	15.4 (2/13)	12..5 (1/8)	0 (0/3)	40 (2/5)
Cefoperazone/sulbactam	60 (3/5)	85.7 (12/14)	25 (2/8)	66.7 (2/3)	80 (4/5)
Cefpirome	ND	ND	0 (0/1)	50 (1/2)	ND
Erythromycin	ND	47.4 (9/19)	ND	ND	ND
Ciprofloxacin	94.1 (32/34)	36.8 (7/19)	18.2 (2/11)	33.3 (1/3)	25 (1/4)
Gentamicin	91.4 (32/35)	ND	17.3 (3/11)	25 (1/4)	40 (2/5)
Amikacin	91.4 (32/35)	94.7 (18/19)	17.3 (3/11)	25 (1/4)	100 (5/5)
Netilmicin	91.2 (31/34)	88.9 (16/18)	80 (8/10)	33.3 (1/3)	100 (5/5)
Tobramycin	93.9 (31/33)	ND	0 (0/1)	ND	ND
TMP-SMX	ND	29.4 (5/17)	45.5 (5/11)	33.3 (1/3)	25 (1/4)
Aztreonam	25 (1/4)	0 (0/13)	0 (0/9)	0 (1/4)	20 (1/5)
Meropenem	100 (5/5)	100 (14/14)	25 (2/8)	100 (2/2)	100 (5/5)
Piperacillin/tazobactam	83.3 (5/6)	57.1 (8/14)	25 (2/8)	50 (2/4)	80 (4/5)
ND: Not done, TMP-SMX: Trimethoprim-sulfamethoxazole					

IV. Conclusion

Patients admitted in wards with pneumonia but not responding to initial antimicrobial regimen may predominantly harbor drug-resistant Gram negative organisms. Meropenem can be effective if the isolates do not display sensitivity to other commonly used antimicrobials. *P. aeruginosa* and *K. pneumoniae* were the most common bacterial pathogens isolated from the Sputum. The isolates tested showed 100% sensitivity to meropenem except *Acinetobacter* species. All the methicillin-resistant *S. aureus* isolates displayed sensitivity to vancomycin, linezolid and teicoplanin. The limitation of this study was that the relative contribution of community- acquired and hospital-acquired pathogens to the overall spectrum of bacterial isolates could not be differentiated. However, it is well established that Gram negative pathogens and *S. aureus* are frequently associated with HAP.

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