

## ORIGINAL ARTICLE

# To determine the bacteriological profile of pneumonia patients in tertiary care hospital

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### ABSTRACT:

**Aim:** To determine the bacteriological profile of pneumonia patients in tertiary care hospital. **Methods:** This study was carried out in the Department of Microbiology. Clinically diagnosed cases of pneumonia (symptomatic), patients who developed symptoms of pneumonia after 48 hours of admission to the hospital and patients who developed symptoms 48 hours after being administered on the ventilator. 100 patients were included in this study. **Results:** Staphylococcus aureus (8%), Coagulase negative Staphylococcus(8%) and Pneumococci(2%) were the common Gram positive bacteria isolated. Among the Gram negative bacteria, the commonest organism isolated was Klebsiella species (35%) followed by Pseudomonas species (25%), Acinetobacter (10%), E.coli (10%) and Providencia spp (2%). Methicillin resistance was seen in all 8 cases of Saphylococcus aureus isolates (100%) and in 8 case of CONS (8%). (82%), Norfloxacin, Levofloxacin and Meropenam (72% each). E.coli was sensitive to Amikacin (88%), Aztreonam (77%), Nitrofurantoin, Netilmicin and Meropenam (66% each). **Conclusion:** According to this study, most of the organisms are resistant to 3rd generation Cephalosporins. Further studies should closely examine the administration of initial therapy in pneumonia patients.

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### INTRODUCTION

Respiratory tract infections are the most frequent of all the infections and accounts for the number of work days lost in the general population. Among them, pneumonia is the commonest disease with a high prevalence in the community and a cause of significant mortality and morbidity.<sup>1</sup> Pneumonia is broadly defined as any infection of lung parenchyma. Pneumonia is clinically divided into community acquired pneumonia (CAP) and nosocomial pneumonia. Infectious diseases Society of America defines CAP as “an acute infection of the pulmonary parenchyma that is associated with at least some symptoms of acute infection, accompanied by the presence of an acute infiltrate on a chest radiogram or auscultatory findings consistent with pneumonia in a patient not hospitalized or residing in a long-term care facility for more than 14 days before onset of symptoms.”<sup>1,2</sup>

Lower respiratory tract infections (LRTI) are the most common bacterial infections among patients in neurological intensive care units, resulting in high overall mortality, which may range from 22% to 71%.<sup>3</sup> There is a dire need of epidemiological studies for ventilated patients, to know the local microbial flora and their antibiotic profiles for rational use of antibiotics. Hence, this study was undertaken to determine the prevalence of pathogenic bacteria in respiratory secretions of ventilated patients and their antibiotic susceptibility patterns.<sup>4</sup>

### MATERIAL AND METHODS

This study was carried out in the Department of Microbiology, after taking the approval of the protocol review committee and institutional ethics committee. 100 patients were included in this study.

### INCLUSION CRITERIA

Clinically diagnosed cases of pneumonia (symptomatic), patients who developed symptoms of pneumonia after 48 hours of admission to the hospital and patients who developed symptoms 48 hours after being administered on the ventilator.

### EXCLUSION CRITERIA

Patients already on antibiotic treatment, patients with other lower respiratory infections like Bronchitis, Bronchiectasis, emphysema, hydropneumothorax, and patients clinically diagnosed with active Tuberculosis, HIV.

### METHODOLOGY

#### SAMPLE COLLECTION

**Sputum:** Thick mucopurulent sputum collected in sterile screw capped container. Strict instructions about rinsing mouth with water and to expectorate after deep cough directly into sterile container were given to the patient.

**Induced sputum collection:** was done in pediatric patients (who cannot bring out sputum) using 3%-5% hypertonic saline in nebulizer.<sup>5,6</sup>

**Endotracheal tube tip/ endotracheal aspiration:** collected in mechanically ventilated patients

following standard guidelines. In case of Endotracheal tube aspiration, colony count of 105cfu/ml was taken as diagnostic culture threshold. Induced sputum, endotracheal aspiration and endotracheal tube tip collection processes were done by a well-trained, skilled person following standard procedures (under the supervision of a pediatrician in required cases).

All samples collected were processed in Microbiology laboratory within 2 hours. Samples containing more of saliva according to lab findings were rejected. All samples were subjected to Gram staining and culture. Gram staining- to look for the presence of pus cells, epithelial cells and bacteria. The presence of <10 squamous cells and >25 PMN per low field, or 10 leucocytes for every squamous epithelial cell is indicative of high quality of expectorated sputum samples in adults. Hence, sputum samples showing less than above mentioned cell count were not included for culture as it is suggestive of oropharyngeal contamination. Every sample was inoculated onto Blood agar, Chocolate agar and Mac Conkey agar plates and incubated aerobically at 37°C for 18-24 hours. Chocolate agar plate was incubated in candle jar at 37°C for obtaining good growth of pneumococci if any. Growth obtained was identified based on colony morphology and standard biochemical reactions.<sup>7</sup> Antibiotic susceptibility patterns to various antibiotics was studied by Kirby-Bauer disc diffusion method on Muller Hinton Agar using Mc Farland's 0.5 turbidity standard for the inoculum.<sup>8</sup> Antibiotic discs tested for Gram negative bacilli (Enterobacteriaceae) were: Amikacin, Ceftriaxone, Ciprofloxacin, Gentamicin, Imipenam, Meropenam, Cefipime, Netilmicin, Ofloxacin, Cotrimoxazole, Piperacillin+Tazobactam, Ceftazidime, Ceftazidime+Clavulanic acid, Cefotaxime, Cefotaxime+Clavulanic acid, Aztreonam. Antibiotic discs tested for non enterobacteriaceae were: Amikacin, Ceftriaxone, Ciprofloxacin, Gentamicin, Imipenam, Meropenam, Cefipime, Netilmicin, Ofloxacin, Cotrimoxazole, Piperacillin+Tazobactam, Ceftazidime, Ceftazidime+Clavulanic acid, Cefotaxime, Cefotaxime+Clavulanic acid, Aztreonam. Antibiotic discs tested for Gram positive cocci were: Ampicillin, Amoxicillin+Clavulanic acid, Amikacin, Cefoxitin, Ceftriaxone, Ciprofloxacin, Erythromycin, Gentamicin, Tetracycline, Linezolid, Cotrimoxazole. Methicillin resistance for Staphylococcus aureus was detected using Cifoxitin (30µg) disc. ESBL production among Gram negative bacteria was confirmed using the cephalosporin and cephalosporin/ clavulanic acid (cefotaxime and cefotaxime plus clavulanic acid, ceftazidime and ceftazidime plus clavulanic acid) combination disc test following clinical laboratory standard institute (CLSI) guidelines.<sup>8</sup>

Imipenam, Meropenam, Cefipime, Netilmicin, Levofloxacin, Norfloxacin, Nitrofurantoin, Cotrimoxazole, Piperacillin+Tazobactam, Tetracycline, Ceftazidime, Ceftazidime+Clavulanic acid, Cefotaxime, Cefotaxime+Clavulanic acid, Aztreonam. Antibiotic discs tested for non enterobacteriaceae were: Amikacin, Ceftriaxone, Ciprofloxacin, Gentamicin, Imipenam, Meropenam, Cefipime, Netilmicin, Ofloxacin, Cotrimoxazole, Piperacillin+Tazobactam, Ceftazidime, Ceftazidime+Clavulanic acid, Cefotaxime, Cefotaxime+Clavulanic acid, Aztreonam. Antibiotic discs tested for Gram positive cocci were: Ampicillin, Amoxicillin+Clavulanic acid, Amikacin, Cefoxitin, Ceftriaxone, Ciprofloxacin, Erythromycin, Gentamicin, Tetracycline, Linezolid, Cotrimoxazole. Methicillin resistance for Staphylococcus aureus was detected using Cifoxitin (30µg) disc. ESBL production among Gram negative bacteria was confirmed using the cephalosporin and cephalosporin/ clavulanic acid (cefotaxime and cefotaxime plus clavulanic acid, ceftazidime and ceftazidime plus clavulanic acid) combination disc test following clinical laboratory standard institute (CLSI) guidelines.<sup>8</sup>

**RESULTS**

Out of the total 100 patients meeting all the inclusion criteria enrolled for the study, 70(70%) were male and 30(30%) were female. All age groups were considered for the study but most of them 30(30%) were between 60-69 years (Table 1). Most of the samples collected were sputum (77%) and 7(7%) were Endotracheal tube tips.

**Table 1: Age distribution**

Age	Number	%
Below 10	7	7
10-20	4	4
20-30	5	5
30-40	9	9
40-50	8	8
50-60	11	11
60-70	30	30
Above 70	26	26
Total	100	100

In the commensals isolated, the most common were alpha-hemolytic streptococci. Out of 100 samples which yielded causative agents, 83 yielded single isolate and 17 yielded double isolates. Amongst the bacteria isolated, 77(77%) were Gram positive and 23(23%) were Gram negative. (Table 2)

**Table 2: Culture results**

Culture	No. of cases	%
Pathogenic growth	77	77
Commensals	23	23

Staphylococcus aureus (8%), Coagulase negative Staphylococcus(8%) and Pneumococci(2%) were the common Gram positive bacteria isolated. Among the Gram negative bacteria, the commonest organism isolated was Klebsiella species (35%) followed by Pseudomonas species (25%), Acinetobacter (10%), E.coli (10%) and Providencia spp (2%). (Table 3). Methicillin resistance was seen in all 8 cases of Saphylococcus aureus isolates (100%) and in 8 case of CONS (8%).

**Table 3: Gram positive and Gram negative Bacteria isolated**

	Organism	Frequency	Percent
Gram Positive (N=28)	Pneumococci	2	2
	Staph aureus	8	8
	Staph CONS	8	8
	Acinetobacter	10	10
Gram Negative (N=72)	E.coli	10	10
	Klebsiella spp	35	35
	Providencia spp	2	2
	Pseudomonas	25	25

**Table 4: ESBL producers in Gram negative bacteria**

Bacteria	Producer	Non- producer	Total
Acinetobacter	1	9	9
E.coli	1	8	9
Klebsiella spp	2	28	31
Providencia spp	1	0	1
Total	5	45	50

(82%), Norfloxacin, Levofloxacin and Meropenam (72% each). E.coli was sensitive to Amikacin (88%), Aztreonam (77%), Nitrofurantoin, Netilmicin and Meropenam (66% each).

**Table 5: Associated co-morbid conditions**

Co-morbid conditions	No of cases	%
Diabetes Melitus	34	34
Hypertension	30	30
Ischemic heart disease	8	8
Scoliosis	8	8
Asthama	4	4
Epilepsy	8	8
Idiopathic Thrombocytic Purpura	8	8

Acinetobacter was sensitive to Aztreonam (88%), Meropenam, Imipenam, Netilmicin and Ofloxacin (55% each). 85(85%) Pseudomonas isolates were sensitive to Amikacin, Netilmicin and Imipenam followed by Gentamicin (80%) and Meropenam (80%). Providencia spp was sensitive to Amikacin, Ceftriaxone, Ciprofloxacin, Gentamicin, Imipenam, Cefipime, Netilmicin, Levofloxacin, Nitrofurantoin, Cotrimoxazole and Tetracycline.

Among the Gram positive bacteria, Staphylococcus aureus was sensitive to Amikacin (100%), Gentamicin (100%) and Linezolid (100%) Coagulase negative Staphylococcus was most sensitive to Amikacin, Cefotaxime, Gentamicin, Linezolid and Tetracyclin (3% each). Pneumococci was sensitive to Optochin, Tetracyclin, Linezolid, Amikacin, Gentamicin (100% each). Out of all the cases taken for the study, few patients had other co-morbid conditions like Diabetes, Hypertension, Bronchial asthma, Epilepsy, etc.

## DISCUSSION

Health care associated infections (HCAI) continue to be a major cause of morbidity and device associated infections contributes a maximum towards Healthcare Associated Infections. The mechanically ventilated and tracheostomized patients are colonized with bacteria of either endogenous or exogenous origin which might end up in Ventilator Associated

Tracheobronchitis or Ventilator Associated Pneumonia.<sup>3</sup> Bypassing of the upper respiratory tract and imperfect functioning of mucociliary escalator (due to insertion of tube in trachea) impair the immune system. Besides, leakage of secretion around the tube and opening of the binding site for gram negative bacteria may have cause high rate of colonization.<sup>4</sup>

Gram negative bacilli (72%) outnumbered the Gram positive cocci (28%) in the bacteriological profile which was similar to the results obtained in a South Indian study in which commonest organism isolated was Klebsiella(48.2%), Pseudomonas(15.3%), E.coli(8.4%), Acinetobacter(7.7%).<sup>9</sup> Causal role of CONS in pneumonia is not well established. Out of the 8 cases from whom CONS was isolated in our study, one patient was diabetic and another was a neonate. These cases were considered due to lowered immunity. Whereas causal role could not be explained in the other cases.

Methicillin resistance was seen in all 8 isolates of Staphylococcus aureus and showed sensitivity to Amikacin, Gentamicin and Linezolid in contrast to a study done by author in which all 93 MRSA isolates were sensitive to Linezolid, Vaccomycin and Teicoplanin.<sup>10</sup>

Many Klebsiella spp were sensitive to Aztreonam, Gentamicin, Meropenam, Norfloxacin which is in

contrast to the others studies in which all *Klebsiella* isolates were sensitive to Imipenam (100%).<sup>10</sup>

*Pneumococci* was isolated in only 2 sample which is in complete contrast to the study done by Sandeep Kumar Jain et al. in which *Streptococcus pneumoniae* was the commonest pathogen.<sup>11</sup>

In the present study, ESBL production was seen in 5 isolates and 45 isolates were non-producers of ESBL which is comparatively lower than the study done by Maninder Kaur and Aruna Aggarwal in which 45%(299) of the isolates were found to be ESBL producers.<sup>12</sup> This implies that the organism is suggestive of multidrug resistance.

## CONCLUSION

According to this study, most of the organisms are resistant to 3rd generation Cephalosporins. Further studies should closely examine the administration of initial therapy in pneumonia patients.

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