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Bacterial Profile and Antibiotic Susceptibility Pattern of Lower Respiratory Tract Infections in a Tertiary Care Hospital

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Abstract: ***Sputum samples are often sent to the Microbiology laboratory for the diagnosis of lower respiratory tract infections (LRTIs). LRTIs account for a major burden of disease in all age groups especially in infants and elderly. Knowledge of pathogens causing these infections and their sensitivity patterns can be helpful in selection of appropriate antimicrobial therapy. Aim: To know the spectrum of bacteria isolated from sputum samples and to determine the antimicrobial susceptibility pattern of the isolates. Material and Methods: This study was conducted from February 2018 to January 2019 in the Department of Microbiology at RIMS, Ranchi. The sputum samples received were processed to isolate and identify bacterial pathogens as per standard bacteriological techniques. Antibiotic susceptibility testing was done by Kirby-Bauer disc diffusion method. Result : Out of 268 samples processed 130 (48.51%) were culture positive. Klebsiella pneumoniae 42/130 (32.31%) was the most common organism isolated followed by Staphylococcus aureus 34 /130 (26.15%) and Pseudomonas aeruginosa 24/130 (18.46%). Sensitivity of Klebsiella pneumoniae and Pseudomonas aeruginosa was good to imipenem and piperacillin-tazobactum. Staphylococcus aureus isolates showed high susceptibility to vancomycin and linezolid. Conclusion: Changing antimicrobial resistance poses a challenge in treating LRTIs. Hence periodical monitoring of respiratory pathogens and their antimicrobial susceptibility is needed to assess the trends in etiological and sensitivity patterns for effective management of these infections.***

Keywords: sputum, respiratory pathogens, antibiogram

1. Introduction

The infections of trachea, bronchi, bronchioles and the lungs are called lower respiratory tract infections (LRTIs) which include bronchitis, bronchiolitis, pneumonia, lung abscess and exacerbations of chronic lung disease [1]. LRTIs are one of the most common infectious diseases of humans accounting for 4.4% of all hospital admissions and 3-5% of deaths in adults [2], [3].

Expectorated sputum is a useful sample for the diagnosis of LRTIs which can be obtained easily and non-invasively from patients [4].The choice of antibiotics and management of these infections is greatly influenced by the etiologies of respiratory infections. A rising trend in the antimicrobial resistance among the respiratory pathogens has been observed which poses a challenge in antimicrobial therapy [5]. Therefore there is a need to monitor the bacteriological profile and review their antibiotic sensitivity pattern for proper treatment by rational drug therapy thereby preventing morbidity and mortality associated with these infections.

2. Aims and Objectives

To identify the bacterial pathogens in sputum samples of patients with lower respiratory tract infections and to determine their antimicrobial susceptibility pattern.

3. Material and Methods

A cross-sectional study was conducted in the Department of Microbiology at RIMS Ranchi, which is a tertiary care centre for a period of one year from February 2018 to January 2019. During this time period sputum samples (n=268) were obtained from patients attending OPDs and admitted in various wards and ICUs of the hospital clinically suspected of LRTIs. Deeply coughed out or induced sputum was collected but spontaneous early morning sputum was preferred [6]. Data collection included age, sex, department and a brief history of illness of the patients.

Sample processing was done as per standard bacteriological techniques like macroscopic examination and direct microscopy which gave information about the quality of the specimen [7]. Samples were inoculated on nutrient agar, 5% sheep blood agar, MacConkey agar and chocolate agar and were incubated at 37°C for 24 to 48 hours. The isolated bacteria were identified using standard microbiological methods which included colony morphology, Gram's staining and biochemical tests.

The antimicrobial susceptibility testing was done on Mueller-Hinton agar by Kirby-Bauer disk diffusion method and interpreted as per Clinical and Laboratory Standards Institute (CLSI) guidelines [8], [9]. Standard antibiotics like ampicillin (10 µg), gentamicin(10 µg), amikacin (30 µg),

piperacillin-tazobactum (100 /10 µg), cefepime (30 µg), cefotaxime (30 µg), ciprofloxacin (5 µg), imipenem (10 µg), erythromycin (15 µg), co-trimoxazole (1.25/23.75 µg), linezolid (30 µg), doxycycline (30 µg), vancomycin(30 µg) and ceftazidime (30 µg) discs were tested (HIMEDIA, Mumbai, India) .

Results obtained were analyzed by counts and percentages using Microsoft Excel, 2007 version.

4. Result

Out of 268 sputum samples processed, 130 (48.51%) showed growth on culture.

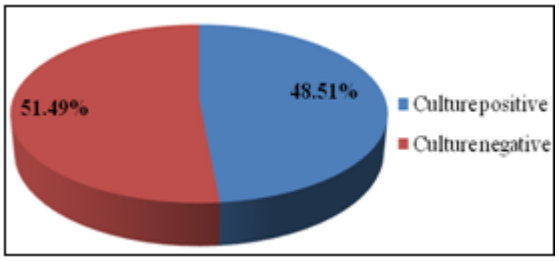

Figure 1: Culture positivity among sputum samples

Among culture positive samples, 91 were obtained from male patients and 39 from female patients.

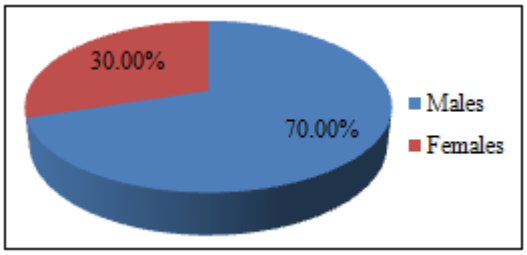

Figure 2: Sex wise distribution of culture positive sputum samples

Inpatient department contributed to 60% of culture positive samples.

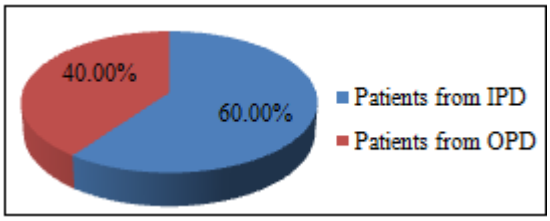

Figure 3: Patient distribution of culture positive sputum samples

Klebsiella pneumoniae (32.31%) was the most common organism isolated followed by *Staphylococcus aureus* (26.15%), *Pseudomonas aeruginosa* (18.46%), *Escherichia coli* (10.77%), Coagulase negative *staphylococci* or CONS (7.69%) and *Acinetobacter* sp. (4.62%) .

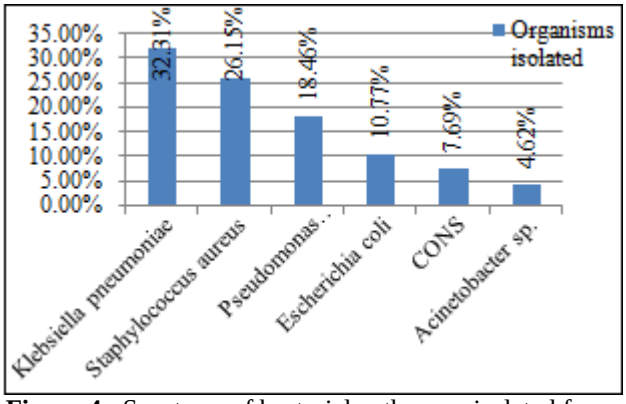

Figure 4: Spectrum of bacterial pathogens isolated from sputum samples

Gram-positive and Gram-negative organisms isolated were 44 and 86 in number respectively. 95.24% of *Klebsiella pneumoniae*, 92.86% of *Escherichia coli* and 87.5% of *Pseudomonas aeruginosa* were susceptible to imipenem. Piperacillin-tazobactum was sensitive in 90.48% of *Klebsiella pneumonia*, 85.71% of *Escherichia coli and* 87.5% of *Pseudomonas aeruginosa* isolated. *Staphylococcus aureus* isolated showed 100% susceptibility to vancomycin and linezolid. The antimicrobial sensitivity patterns of Gram-negative isolates of *Enterobacteriaeace* family, Gram-positive isolates and non-fermenting isolates are depicted below.

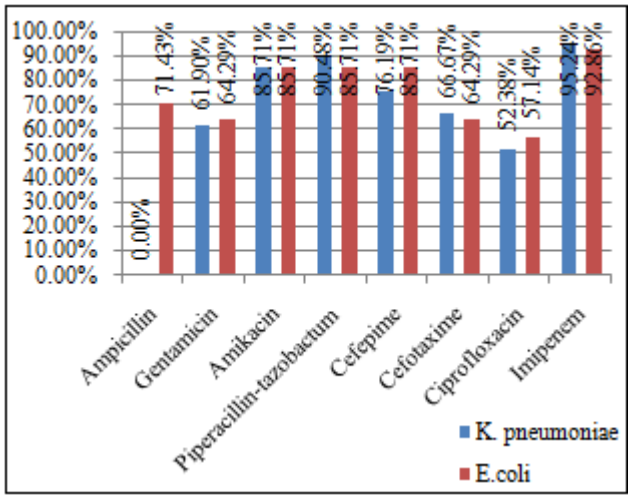

Figure 5: Antibiogram of Enterobacteriaceae

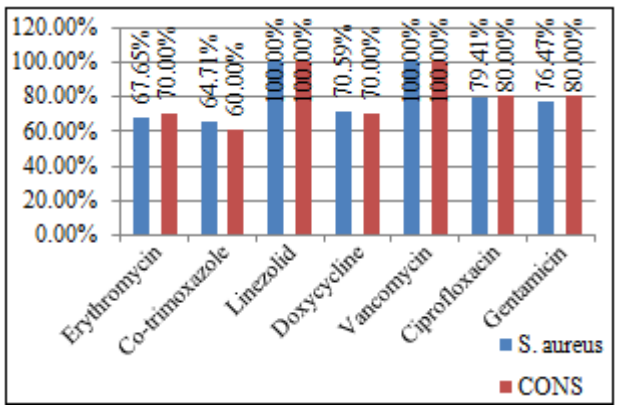

Figure 6: Antibiogram of Gram-positive cocci

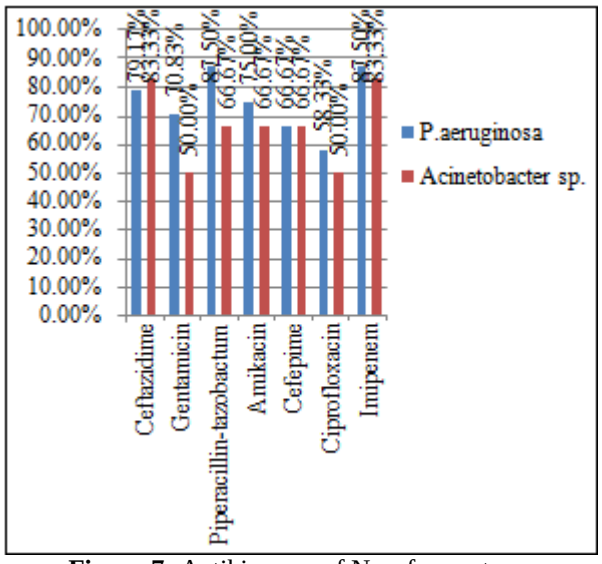

Figure 7: Antibiogram of Non-fermenters

5. Discussion

Our study showed a culture positivity rate of 48.51% which is comparable to the study by Salman Khan *et. al.* (49.3%) and Tamang *et. al.* (50.4%) [10], [11]. LRTIs were seen to occur more in males than in females which was also observed by Chawla K. *et.al.* [12].

The present study revealed *Klebsiella pneumoniae* to be the most commonly occurring pathogen in sputum samples which is in agreement with the studies by Madhavi *et. al*.,Chinnnusamy N *et. al.* and Dinesh Verma *et. al.* [13], [14], [15]. *Staphylococcus aureus* was the second common pathogen isolated in our study and also in the study by Sougrakpam Ratna *et.al.* [16].There was preponderance of Gram-negative isolates (66.15%) over Gram-positive isolates (33.85%), which was also shown by studies by Chinnnusamy N. *et. al.* and Amutha C. *et. al.* [14], [17].

Majority of Gram-negative isolates were susceptible to imipenem and piperacillin-tazobactam which was in concordance with the studies by Nidhi Goel *et.al*. and Anand K. Patel *et.al.* [18], [19]. Gram-positive isolates were most susceptible to vancomycin and linezolid which is similar to that found by Sougrakpam Ratna *et.al.* [16].

6. Conclusion

Respiratory infections were found to be prevalent at our tertiary care hospital. The most common causative agent of LRTIs was found to be *Klebsiella pneumoniae* in our study and resistance to different classes of antibiotics in bacterial isolates was seen.

The emergence of drug resistance is a major hurdle in antibiotic therapy and it can be prevented by avoiding the practice of administration of prophylactic antibiotics before culure reports are available. The antibiotic sensitivity data from our study will help in judicious selection of antibiotics which will contribute not only in successful treatment of these conditions but will also prevent the emergence of drug resistance.

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