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MICROBIOLOGICAL PROFILE AND ANTIBIOGRAM PATTERN OF LOWER RESPIRATORY TRACT INFECTION

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ABSTRACT

Background: Lower respiratory tract infections (LRTI's) are the most frequent infections among patients. The consequences of increased drug resistance are far reaching since bacterial infection of the lower respiratory tract (LRT) is a major cause of death from infectious disease.

Objective: This study was focused on obtaining a comprehensive insight into the microbial profile, its prevalence and the antibiotic susceptibility patterns of the isolates in lower respiratory tract infections.

Materials and Methods: The present study was conducted in the Microbiology Department of a Teaching government hospital during September 2014 to December 2014. The LRT samples were obtained from the patients (n=66) of all the age and sex groups, with symptomatologies which were suggestive of LRTIs. Following culture, the isolated organisms were identified and antimicrobial sensitivity was performed by standard methods.

Results: Out of the 66 LRT specimens evaluated, 33(50%) were culture positive. Study showed predominance of Gram negative bacterial cause (66.67%) among the LRTI's with *Pseudomonas aeruginosa* (39.39%) as major pathogen followed by *Klebsiella pneumoniae* (24.24%), *Streptococcus pyogenes* (18.18%), *Streptococcus pneumoniae* (9.09%), *Staphylococcus aureus* (6.06%), *E.coli* (3.03%), Candida spp. (3.03%). Gram negative organisms showed increased resistance to routinely used antibiotic. Gram positive organisms showed 100% susceptibility to vancomycin, linezolid, clindamycin, tetracycline, amoxclav and followed by their susceptibility against gentamycin, penicillin.

Conclusion: Therefore, we can conclude that for effective management of LRTI's, an ultimate and detailed bacteriological diagnosis and susceptible testing is required to overcome global problem of antibiotic resistance.

KEYWORDS: Lower Respiratory Tract Infection, Antimicrobial Susceptible Pattern, Microbial Profile

INTRODUCTION

Lower Respiratory Tract Infection (LRTI) is one of the leading causes of the morbidity and mortality in the world. LRTI is not a single disease but a group of specific infection each with a different epidemiology, pathogenesis, clinical presentation and outcome. The etiology and symptomatology of respiratory diseases vary with age, gender, season, the type of population at risk and other factors. These are frequently the first infection to occur after birth and pneumonia is too often the final illness to occur before death. [1]

Infections of the Lower respiratory tract are responsible for 4.4% of all hospital admissions and 6% of all general practitioner consultations. They account for 3 to 5% of deaths in adults .The problem is much greater in developing countries where pneumonia is the most common cause of hospital attendance in adults.[2] In India, acute lower respiratory tract infection (ARI) is responsible for one million deaths. There is inadequate information from India on various lower respiratory tract bacterial pathogens and their resistance patterns in hospital settings. In addition, the emergence of resistance as a major problem has drawn attention to a need for better diagnostic techniques and newer drugs to allow more

specific therapy. [3] The etiologies of respiratory infections play a significant role in the decision making, as they concern the choice of empirical antibiotics, isolation and hospitalization measures. A variety of organisms are usually implicated in their etiologies, the most common ones being gram negative bacteria, [4] followed by gram positive organisms.

Specific microbiological investigations are essential for minimizing the consequent development of complications and for improving the outcomes. The dramatic rise in the antimicrobial resistance among the respiratory pathogens, [5] presumably due to the prophylactic administration of antibacterial therapy even before the availability of the culture results, is a matter of potential concern worldwide. This study has reviewed our current understanding on lower respiratory tract infections and it has emphasized the changing trends in their occurrence and the antimicrobial susceptibility pattern of the respiratory pathogens which were isolated in a government hospital of western India, thus enabling the clinicians to appropriately formulate and endorse a competent and rational antibacterial policy, to further curb the incidence of the disease.

OBJECTIVES OF THE STUDY

The objective of the present study is to find out the bacteriological spectrum and antibiotic susceptibility pattern of Lower Respiratory Tract Infection among the patients attending government hospital in western India.

METHODS

The present study was conducted in the Microbiology Department of a Teaching government hospital during September 2014 to December 2014. The LRT samples i.e. sputum, bronchoalveolar lavage (BAL) and pleural fluid were obtained from the patients (66) of all the age and sex groups, with symptomatologies which were suggestive of LRTIs. The samples were collected aseptically and processed immediately following collection, were processed by the standard laboratory methods. Microscopy was performed and quality of sample was decided using standard grading system. Satisfactory samples were further processed. Single or mixed growth (two or more than two isolates per specimen) isolated from all the eligible samples were identified by observing the colony characteristics on the blood agar, MacConkey agar plates and biochemical reactions using standard microbiological methods. Isolates from repeat culture of previously recruited patients and isolates identified as commensals or contaminants were excluded. The bacterial isolates were subjected to susceptibility testing by standard Kirby Bauer disc diffusion methods.[6] The susceptibility patterns of the bacterial pathogens were determined following the panel of antimicrobial agents as recommended by Clinical Laboratory Standard Institute (CLSI) -2014. Zone diameter was measured in millimetres and interpreted as per CLSI guidelines.[7] The entire testing was done under strict quality control and American Type Culture Collection (ATCC) strains were used as control strains.

RESULTS AND DISCUSSIONS

Among the 66 sample included were plural fluid (33), sputum (26) and bronchoalveolar lavage (7). The culture result of these 66 samples revelled 33(50%) were positive and remaining 33 samples either showed no growth or grown contaminant which was taken as no growth. Of the 33 (50%) plural fluid sample 13 were culture positive, of the 26(39.39%) sputum sample 17 were culture positive and of the 7 BAL samples 3 (10.61%) were culture positive. (Figure 1)

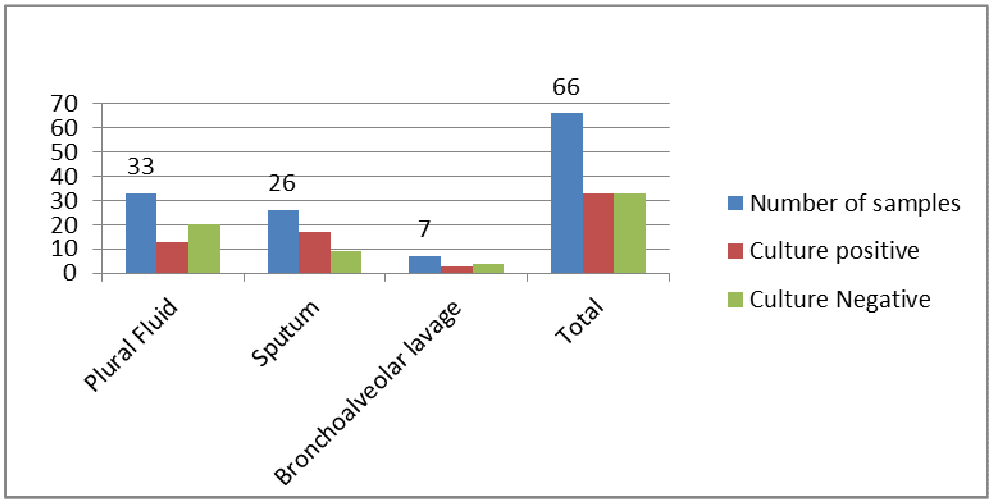

Figure 1: Culture Report of Respiratory Specimen

Pseudomonas aeruginosa (39.39%) was found to be the predominant organism which was isolated, followed by *Klebsiella pneumoniae* (24.24%), *Streptococcus pyogenes* (18.18%), *Streptococcus pneumoniae* (9.09%), *Staphylococcus aureus* (6.06%), *E.coli* (3.03%), Candida spp. (3.03%). (Table 1).

Pseudomonas aeruginosa showed maximum resistance to ceftazidime, Piperacillin and Piperacillin-tazobactum. (Table 2)

Klebsiella pneumoniae exhibited a higher sensitivity towards amikacin, gentamicin, and imipenem, followed by tetracycline. However ceftazidime and broad spectrum antibiotic cotrimaxzole showed lower susceptibility. (Table 2)

Gram positive organisms showed 100% susceptibility to vancomycin, linezolid, clindamycin, tetracycline, amoxclav and followed by their susceptibility against gentamycin, penicillin.

Table 1: Source of Specimen &Microbiological Cause

Type of Specimen	No (%)	Microorganism Isolated
Plural Fluid	33 (50%)	• No pathogen- 20 (60.60%) • *Pseudomonas aeruginosa*-9 (27.27 %) • *Klebsiella pneumoniae* -2 (6.06%) • *E.coli* -01 (3.03%) • Staphylococcus aureus-1 (3.03%)
Sputum	26(39.39%)	• No pathogen isolated - 9 (34.61%)
		• *Klebsiella pneumoniae* -5 (19.23%)
		• *Pseudomonas aeruginosa*- 4 (15.38 %)
		• Streptococcus pyogene- 4 (15.38%)
		• Streptococcus pneumoniae- 2 (7.19%)
		• Coinfection with *Klebsiella pneumoniae* & Streptococcus pyogene-1 (3.84%)
		• Candida spp. -1 (3.84%)
Bronchoalveolar lavage (BAL)	07 (10.7%)	• No pathogen-04 (57.14) • Streptococcus pneumoniae-01 (14.28%) • Streptococcus pyogene-01 (14.28%) • Staphylococcus aureus-01 (14.28%)

Table 2: Antibiotic Susceptibility Pattern of Organisms Isolated from LRTI Samples

Microorganism → / Antibiotic ↓	*Pseudomonas aeruginosa*	*Klebsiella pneumoniae*	*Streptococcus pyogenes*	*Streptococcus pneumoniae*	*Staphylococcus aureus*	*E. coli*
Ceftazidime	23.07%	25%	NT	NT	NT	100%
Gentamicin	53.84%	75%	66.66%	66.66%	50%	100%
Piperacillin	46.15	NT	NT	NT	NT	NT
Erythromycin	NT	NT	100%	33.33%	NT	NT
Penicillin	NT	NT	100%	33.33%	50%	NT
Cotrimaxzole	NT	37.5%	50%	NT	NT	NT
Amikacin	69.23%	87.5%	NT	NT	NT	NT
Ciprofloxacin	61.53%	87.5%	83.33%	66.66%	NT	100%
Imipenem	61.53%	75%	NT	NT	NT	100%
Piperacillin - Tazobactum	23.07%	75%	NT	NT	NT	100%
Linezolid	NT	NT	100%	100%	100%	NT
Tetracycline	61.53%	62.5%	100%	33.33%	100%	100%
Vancomycin	NT	NT	100%	100%	100%	NT
Tobramycin	61.53%	50%	NT	NT	NT	NT
Amox-clavulanic acid	NT	NT	100%	33.33%	100%	NT
Clindamycin	NT	NT	100%	66.66%	100%	NT

Note:- NOT TESTED

DISCUSSIONS

Management of LRTI's has been a challenge to the physicians, most recently due to the emergence of multi drug resistance. [8] The present study provides an insight on the prevalence and the antibiogram of the respiratory pathogens which were isolated in western India. Among the specimens processed, Pleural Fluid 20(60.60%), sputum 9(34.61%), bronchoalveolar lavage 5(57.14%) revealed no pathogens. *Klebsiella pneumoniae* was the predominant pathogen isolated from sputum 5 (19.23%) while in pleural fluid *Pseudomonas aeruginosa* was the predominant pathogen isolated 9 (27.27%). Overall specimens processed showed *Streptococcus pyogenes* 6 (18.18%) was the most common Gram positive bacterial isolate. Candida spp. was only isolated from one sputum samples (3.84%). One sputum sample showed mixed growth of Klebsiella pneumonia and Streptococcus pyogenes.

Our study showed predominance of Gram negative bacterial cause (66.67%) among the LRTI's.

A similar finding was observed by a recent study from Nepal by SK Mishra et al who reported 84.1% occurrence. However the same study reported Haemophilus influenzae (21%) as the most common Gram negative bacterium isolated in contrast to our study which showed Pesudomonas aeruginosa as predominant gram negative isolate. Similarly *Streptococcus pneumoniae* as a predominant Gram positive bacterial (8.6%) cause in contrast to the our study which showed *Streptococcus pyogenes* (18.18%) as predominant gram positive bacterial cause.[1] V.Olugue et al.,[5] Kaul et al.,[9] and Akingbade OA [10] found Klebsiella pneumonia as predominant pathogen in contrast to our study which showed Pesudomonas aeruginosa as the one.

The antimicrobial resistance among the respiratory pathogens is a major barrier that might interfere with an effective treatment. This study depicts the antimicrobial susceptibility patterns among the gram negative and gram positive , respiratory pathogens which were isolated during the study, as has been shown in [Table 2]. In present study Gram positive organisms showed 100% susceptibility to vancomycin, linezolid clindamycin, tetracycline, amoxclav and followed by their susceptibility against gentamycin, penicillin. (Table 2). There are similar reports from other investigators. [1, 11] For Gram positive Bacterial infections aminoglycosides and levofloxacin are recommended for empirical treatment

reserving vancomycin and Linezolid for resistant cases. The resistance among the respiratory pathogens especially *Pseudomonas aeruginosa* to the agents that have traditionally been recommended as the first line therapy, is on the rise. Like, our study showed *Pseudomonas aeruginosa* has maximum resistance to ceftazidime, Piperacillin and Piperacillin-tazobactum in contrast to study conducted by Ahemad M S et al.[12] which showed maximum susceptibility to piperacillin-tazobactum . But present study is in concordance with results found by Nidhi Goel et al. [4] In our study amikacin and ciprofloxacin had shown greater activity against *Klebsiella pneumoniae* similar to study conducted by Bajpai et al [13] and contrast to Ahmed et al study.[12]

CONCLUSIONS

The emergence of resistant strains poses a major threat to the patients globally. Inappropriate and irrational drug usage should be avoided. Owing to the increased concern which surrounds antibiotic resistance and the changing patterns of bacterial pathogens, the on-going surveillance of disease and a regular review of the management guidelines are critical. Educational campaigns have quite sensibly tried to convince both the doctors and the general public about the need to use appropriate, evidence based antibiotic treatment policy which is based on the infective organism. Ongoing community based studies are needed to identify the best management for individual patients. The therapy should be based on an aggressive diagnostic work up and the broad spectrum antimicrobial treatment which is guided by microbiological support.

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