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Research Article

BACTERIOLOGICAL PROFILE AND ANTIBIOTIC SUSCEPTIBILITY PATTERN OF LOWER RESPIRATORY TRACT INFECTION IN A TERTIARY HOSPITAL IN NORTH-EAST INDIA

Sougrakpam Ratna., Ksh. Mamta Devi., Somorjit Sharma H., Monika Yadav., Shan Damrolien and Kh. Sulochana Devi

Department of Microbiology, Regional Institute of Medical Science, Imphal, Manipur, India

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ABSTRACT

Background: Sputum samples are often sent in the microbiology department for culture and sensitivity as lower respiratory tract infections are frequent among patients. The consequences of increased drug resistance are far reaching since bacterial infection of the lower respiratory tract is a major cause of death from infectious disease.

Objective: To determine the commonly encountered bacterial pathogens in sputum samples along with their antibiogram in patients attending RIMS Hospital, Imphal.

Materials and Methods: This was a retrospective study conducted on sputum samples sent to the Microbiology Department during July 2015 to June 2016. Sputum samples were subjected to isolation and identification of bacteria by standard technique and subsequently antibiogram was carried out by Kirby-Bauer disc diffusion method.

Results: Out of the 523 sputum samples evaluated, 208(39.77%) were culture positive for pathogenic bacteria. Gram negative bacterial isolates (58.94%) were predominant, among which *Klebsiella pneumoniae* (28.77%) was the major pathogen followed by *Staphylococcus aureus* (27.35%), *Escherichia coli* (20.23%), *Pseudomonas aeruginosa* (6.60%), Coagulase Negative Stapylococcus (5.18%), *Streptococcus pyogenes* (4.71%), *Streptococcus pneumoniae* (3.77%), *Acinetobacter spp.* (1.41%), *Enterobacter spp.* (1.41%) and *Proteus spp.* (0.47%). Gram positive organisms showed high susceptibility to vancomycin and gentamicin; while majority of gram negative organisms had high susceptibility to aminoglycosides and carbepenems.

Conclusion: Before starting empirical antibiotics on patients with lower respiratory tract infection, it is always advisable to obtain sputum for culture and antibiotic sensitivity test so as to avoid irrational drug usage and emergence of resistant strains.

INTRODUCTION

Lower Respiratory Tract Infection (LRTI) is one of the important causes of the morbidity and mortality. LRTI comprises of 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 one of the first infections to occur soon after birth and very frequently the last illness to cause death (Mishra S K *et al*, 2012). 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. Lower respiratory tract infections are responsible for a significant percentage of all hospital admissions (4.4%) and they account for 3 to 5% of deaths in adults (Lata Baswanna Galate *et al*, 2015). The problem is much greater in developing countries where pneumonia is the most common cause of hospital attendance in adults (Panda S *et al*, 2012). There is inadequate information on various lower respiratory tract bacterial pathogens and their resistance patterns in hospital settings from north-east states of India like Manipur. Moreover, the development of drug resistance has become a major problem in antimicrobial therapy and has drawn attention to a need for better diagnostic techniques and treatment. 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,(Olugbue V *et al*, 2011) presumably due to the prophylactic administration of antibacterial therapy even before the availability of the culture reports, is a matter of potential concern worldwide. The emergence of antibiotic

Corresponding author:* **Sougrakpam Ratna
Department of Microbiology, Regional Institute of Medical Science, Imphal, Manipur, India

resistance in the management of infections is a serious public health issue, particularly in the developing world where apart from high level of poverty and ignorance, there is also high prevalence of fake and spurious drugs of questionable quality in circulation. (El-Astal Z, 2005) This study is aimed at understanding the current bacterial pathogens responsible for lower respiratory tract infections and their antimicrobial susceptibility pattern among these respiratory pathogens which were isolated in a government hospital of north-east 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 this study is to find out the bacteriological spectrum and their antibiotic susceptibility pattern of Lower Respiratory Tract Infection among the patients attending a government hospital in north-east India.

METHODS

The present study was conducted in the Department of Microbiology of a teaching government hospital during July 2015-June 2016. Sputum samples of all age and sex groups sent to the Microbiology laboratory were processed immediately following reception by following the standard laboratory methods.

Direct smear examination was performed after Gram staining and quality of the sample was decided using standard grading system. The samples were inoculated onto Blood agar and MacConkey agar and incubated at 37 ^{0}C for 24 hours. After incubation, identification of bacterium from positive cultures was done with standard microbiological techniques which include Gram staining, motility testing by hanging drop preparation and various biochemical reactions such as catalase, coagulase, indole, methyl red, Voges-Proskauer, citrate, urease and oxidase test etc.

The bacterial isolates were put up for susceptibility testing by standard Kirby Bauer disc diffusion methods on Muller Hinton agar. (Bauer AW *et al*, 1966) The susceptibility patterns of the bacterial pathogens were determined following the panel of antimicrobial agents as recommended by Clinical Laboratory Standard Institute (CLSI) -2014. Depending on the isolate, antibiotic discs were selected from among the following: Co-trimoxazole(25µg), Erythromycin(15µg), Ceftriaxone (30 µg), Gentamicin(10µg), Ciprofloxacin(5µg), Linezolid(30µg), Vancomycin(30µg), Ceftazidime(30µg), Ceftazidime+Clavulanate (30/10µg), Imipenem(10µg), Piperacillin+Tazobactum(100/10µg), Cefoxitin(30µg), Penicillin(10units), Clindamycin(2µg), Colistin, Cefipime(30µg). Zone diameter was measured in millimetres and interpreted as per CLSI guidelines.(CLSI-2014)

The entire testing was done under strict quality control and American Type Culture Collection (ATCC) strains were used as control strains.

RESULTS

Out of the 523 sputum samples processed 208(39.77%) samples have shown growth while the remaining samples either showed no growth or grown contaminant which was taken as no growth. Out of the 523 samples, 213 came from various wards while the rest 310 came from different OPDs. Medicine department contributed the maximum number of samples. Of all the positive samples, 136 were male and 72 were female patients. People in the 6th decade group were found to be affected the most. (figure1)

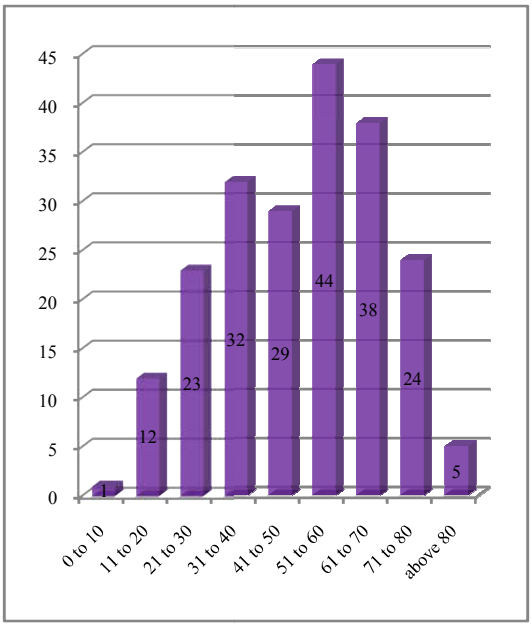

Fig 1 Age-wise distribution of positive samples

This study found Gram negative organisms to be more prevalent. The distribution of various sputum isolates are shown in figure 2. *Klebsiella pneumoniae* (28.77%) was found to be the most common organism isolated followed by *Staphylococcus aureus*(27.35%), *Escherichia coli*(20.28%), *Pseudomonas spp.*(6.60%), CoNS (5.18%), *Streptococcus pyogenes*(4.71%), *Streptococcus pneumoniae* (3.77%), *Acinetobacter spp.*(1.41%), *Enterobacter spp.*(1.41%) and *Proteus* spp.(0.47%).

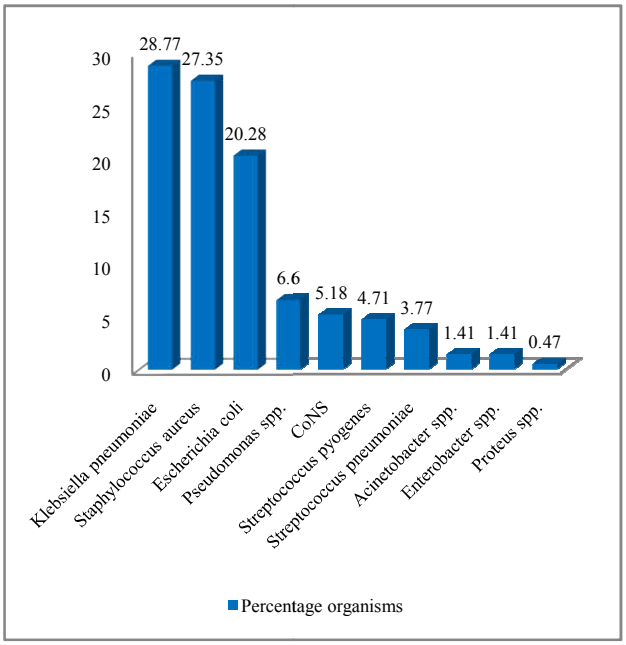

Fig 2 Distribution of various sputum isolates

K.pneumoniae showed high sensitivity to gentamicin and imipenem. Similar pattern was also shown by *E.coli*. Gram positive isolates were 100% sensitive to vancomycin and highly sensitive to gentamicin and linezolid. (Table 1)

amikacin and ciprofloxacin has greater activity against *Klebsiella pneumoniae.* The Gram positive isolates in our study was highly sensitive to gentamicin, linezolid and vancomycin.

Table 1 Antibiotic susceptibility pattern of different organisms isolated from sputum samples.

Antimicrobials	*K.pneumoniae*	*E.coli*	*S.aureus*	*CoNS*	*Pseudomonas spp.*	*Strep pyogenes*
Ceftazidime+Clavulanate	73.78	60.47	NT	NT	92.86	NT
Ceftriaxone	67.22	41.87	NT	NT	NT	NT
Ciprofloxacin	81.97	48.84	70.69	63.64	85.72	80
Gentamicin	96.73	93.03	98.28	100	92.86	NT
Cefipime	68.86	81.40	NT	NT	NT	70
Imipenem	95.09	76.75	NT	NT	92.86	NT
Piperacillin+Tazobactum	57.38	65.12	NT	NT	57.15	NT
Cefoxitin	NT	NT	37.94	54.55	NT	NT
Cotrimoxazole	NT	NT	43.11	18.19	NT	NT
Erythromycin	NT	NT	84.49	45.46	NT	80
Vancomycin	NT	NT	100	100	NT	100
Linezolid	NT	NT	84.49	87.55	NT	100
Ceftazidime	NT	NT	NT	NT	35.72	NT
Colistin	NT	NT	NT	NT	100	NT
Penicillin	NT	NT	NT	NT	NT	90
Clindamycin	NT	NT	NT	NT	NT	100

NT: Not Tested

DISCUSSION

The present study provides an insight on the prevalence and the antibiogram of the respiratory pathogens which were isolated in north-east India. Sputum-culture positivity was found to be 39.77% (208 out of 523). This is slightly similar to the study by Dinesh Verma *et al*, 2016 who found 30.33% sputum positivity while Dalvi *et al*, 1983 obtained 57% and 82% positivity by Anand K. Patel *et al,* 2015.

Low sputum positivity may be due to improper sample collection and/or delay in transportation or prior antimicrobial therapy before sputum collection.

Males were found to be more affected than females which is in concordance to a similar study by Chawla K *et al*, 2008 and Dinesh Verma *et al,* 2016. This may be explained by male behaviour of more outdoor stay exposing them to air pollution than the female counterparts. Moreover smoking habits are more pronounced in males that constitute one of the predisposing factors for the development of LRTIs. Smoking and air pollution are responsible for decrease in mucociliary clearance and innate immunity.(Chawla K *et al*, 2008). It leads to increased bacterial colonization that can give rise to increased airway inflammation and thus exacerbations.

LRTIs - found more prevalent in the 6th decade age groups. This is quite related to the fact that conditions like COPD are most commonly found in the 5th and 6th decades.(Chawla K *et al*, 2008) *Klebsiella pneumoniae* was the most predominant organism isolated in our study. In different studies conducted by Madhavi *et al,* 2012 and Dinesh Verma *et al*, 2016, they also found that *Klebsiella pneumoniae* to be the most commonly isolated organism. While Anand K. Patel *et al,* 2015 found *Streptococcus pneumoniae* to be predominant organism isolated.

This study showed that majority of Gram negative organisms were highly susceptible to gentamicin and imipenem. This finding is in concordance with the results found by Nidhi Goel *et al*, 2009. Whereas study by Lata B G *et al*, 2015 found that

Similar findings were also observed in the study by Lata B G *et al,* 2015. Whereas Anand K. Patel *et al,* 2015 showed piperacillin + tazobactum to be most effective against both Gram positive and Gram negative organisms.

Out of the total 58 *S.aureus* and 11 CoNS isolates, 62.06% and 45.45% were found to be Methicillin resistant i.e., MRSA and MRCoNS respectively. Study by Dalia Saad Elfeky *et al,* 2016 found 10% MRSA which was significantly lower than this study. This may be explained by regional variability of organisms as well as inadvertent use of antimicrobials.

CONCLUSION

The above study showed that the antibiotic susceptibility patterns of the isolates clearly suggests existence of drug resistant pathogens in patients suffering from LRTI's in our hospital set up. Indiscriminate use of antibiotics can be the reason for this situation. Rational and proper use of antibiotics will definitely contribute to control the infection. Hence, therapy should be initiated following antibiotic susceptibility testing and proper antimicrobial treatment policy which is guided by microbiological support.

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