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Determination of Association Between Respiratory Tract Infections with Age, Gender and Socio-economic Status

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Abstract*: Respiratory tract infections are one of the leading causes of morbidity and mortality accounting for millions of deaths worldwide. Treatment of these infections is usually based upon symptomatic relief through antibiotics. This study was designed to investigate bacterial RTI and antimicrobial susceptibility pattern determined by Kirby Bauer's disc diffusion method. Sputum samples (n=48) were analyzed to determine the bacterial infections and relationship with age, gender and social status of patients was determined. Results of the study revealed that higher number of samples (61%) were positive for Pseudomonas spp.14 (29.16%). Other contributing bacteria were Staphylococcus aureus (12.5%), Klebsiella pneumoniae (16.7%), Streptococcus spp. (12.5%), Acinetobacter spp. (14.58%), E. coli (6.25%) and some other coliforms (8.33%). Number of cases was more in adult males than females and the incidence was gradually increasing with age due to consistent habit of smoking. Socioeconomic analysis of data revealed that maximum number of patients visiting hospital for UTI belongs to rural areas followed by small cities and developed cities. It is concluded that adult males having low socioeconomic status with habit of smoking or tobacco consumption are at greater risk of UTI.*

Key words: *Respiratory tract infections, Antimicrobial susceptibility test, Kirby Bauer's disc diffusion method.*

INTRODUCTION

Respiratory tract infections (RTI) are one of the most common reasons to consult physician and above 80 percent of these cases are prescribed with antibiotics (Cals et al., 2010). Upper Respiratory Tract Infections (URTI) are generally characterized by sneezing, coughing, nasal discharge, nasal congestion and sore throat. Due to limited options available for prevention and control, treatment is often based on symptomatic relief (Ginde et al., 2009). Lower respiratory tract infections (LRTI) include asthma, bronchitis

and pneumonia with symptoms of coughing, shortening of breath, fever, weakness and fatigue (Nair et al., 2013).

Acute RTI accounts for 20 percent of deaths in pre-school children worldwide and out of these, 90 percent cases are of pneumonia. *Streptococcus pneumoniae* and *Haemophilus influenza* are predominantly contributing bacteria in acute RTI (Bezerra et al., 2011). *Klebsiella pneumoniae* is associated with ventilator associated nosocomial infections with mortality rate up to 72 percent Tumbarello et al., 2015, Hirsch and Tam, 2010).

Rapid tests for detection of respiratory pathogens such as Gram staining, PCR and Urinary antigen tests are useful in pathogen targeted therapy. However, use of conventional methods such as antibiotic susceptibility testing (AST) is helpful in switching from initial broad-spectrum therapy to narrow spectrum therapy thus reducing the chances of antibiotic resistance (Stralin k. 2008). According to Clinical Laboratory Standards Institute (CLSI), AST is one the most acceptable methods for determination of antibiotic susceptibility and routinely practiced in clinical laboratories (Jorgensen et al.,2015).

MATERIALS AND METHODS

Sample collection

Sputum samples (n=48) were collected from outdoor and indoor patients visiting National Hospital, Lahore. Sputum sample was collected in early morning before consumption of any food. Sterile containers/swabs were used for collection of sputum and properly labeled with required parameters i.e. date and time of sample collection, age of patient, gender, smoking habit and socioeconomic status (Ssengooba et al., 2012).

Bacterial isolation and identification:

Blood and Chocolate agar were used for initial isolation of bacteria from sputum sample. Gram staining and biochemical tests were performed for identification of bacterial species.

Antibiotic susceptibility test:

Kirby Bauer's disc diffusion method was used to determine antibiotic sensitivity pattern for isolated strains. Zone of inhibition was measured as sensitive, resistant or intermediate resistant bacteria according to CLSI criteria. Different antibiotics were used for sensitivity test of isolated bacteria (Table I).

RESULTS AND DISCUSSION

Samples (n=48) were analyzed for antibiotic sensitivity testing. Results revealed different patterns of antibiotic sensitivity in different samples (Fig. 1). Majority of the samples i.e. 14 (29.16%) were found positive for *Pseudomonas spp*. Other organisms found contributing in RTI infections were *Staphylococcus aureus* (12.5%), *Klebsiella pneumonea* (16.7%), *Streptococcus spp.* (12.5%), *Acinetobacter spp.* (14.58%), *E. coli* (6.25%) and some other coliforms (Table II). Previous studies also indicated the asymptomatic colonization of nasophyranx by *S. aureus, S. pneumonea, H. influenza* and *Moraxella catarrhalis* (Pettigrew et al., 2008). Recent studies conducted by Ciofu et al., (2015) and Tilahun et al., (2015) indicated the presence of biofilm forming *Pseudomonas*

aeroginosa and methicillin resistant *S. aureus* respectively.

Out of 48 samples received and analyzed, 30 (62.5%) samples were of males and 18 (37.5%) of females indicating more prevalence of RTI in males. A population-based study performed in UK by Millett et al., (2013) depicted slightly higher incidence of LRTI in elder males than females. Higher level of asthma is also reported as acute lower respiratory tract infections in boys than girls of Thailand and United states despite equal exposure to respiratory pathogens (Hasan et al., 2014). Notable fact is that General lifestyle survey (2012) conducted in different regions of England have also reported higher cases in females of North East region where smoking is equally common among females.

Distribution of data in different categories of age groups revealed majority of the positive samples (37.5%) inage group of 25-45 years followed by elderly (20.83%). Less number of cases was found in infants and children at percentage of 6.25% and 16.66% respectively but young adults were also positive at higher percentage of 18.75% (Table 3). Results of this study are contrary to findings of Bezerra et al., 2011 and Harish et al., 2013 which reported greater percentages of respiratory infections in infants. Similarly, greater number of lower respiratory tract infections and community acquired pneumonia were observed in people of UK above 65years of age and this number was doubled in persons above 80 years (Millet et al., 2013).

Analysis of data for socioeconomic statutes was performed by categorizing living facilities in three groups as villages, small cities and developed cities. Result of data distributed in above groups revealed that 26(54.16%) samples belongs to villages, 14(29.16%) from small cities and 8(16.67%) from developed cities (Table 4). The trend showed gradual decrease in number of samples with improvement in socioeconomic status and available health facilities. The ratio of deaths due to pneumonia is also reported higher in rural areas of Pakistan than urban areas (Soofi et al., 2012). Passive smoking, low socioeconomic status, malnutrition, overcrowding and immunodeficiency are some of the major contributing factors for acute respiratory infections in developing countries (Bezerra et al.,2011).

Table 1: Antibiotics for susceptibility testing

Antibiotics	**Concentration**	**Bacterial strains**
Cefepime	30µg	*klebsiella pneomoniae*
Rifampin	30µg	*Acinetobactor spp.*
Doxycycline	110µg	*Acinetobactor spp.*
Amikacin	30µg	*klebsiella pneomoniae*
Meropenem	10µg	*E. coli*
Ceftazidime	30µg	*Pseudomonas spp.*
Gentamicin	10µg	*Pseudomonas spp.*
Tetracycline	30µg	*Staph. Aureus*
Chloramphenicol	30µg	*Staph. Aureus*
Streptomycin	10µg	*Staph. Aureus*
Colistin	30µg	*Acinetobactor spp.*

Table 2: Percentage of isolated bacteria from positive samples

Bacteria	Number of positive samples (n=48)	Percentage positivity
Pseudomonas spp.	14	29.16
Staphylococcus aureus	6	12.5
Klebsiella pneumoniae	8	16.7
Streptococcus spp.	6	12.5
Acinetobacter spp.	7	14.58
E. coli	3	6.25
Other coliforms	4	8.33

Table 3: Percentage positivity for different age groups

Age Group	Number of positive samples (n=48)	Percentage positivity
Infants (0-5 years)	3	6.25
Children (5-15 years)	8	16.66
Young adults (15-25 years)	9	18.75
Elder adults (25-45 years)	18	37.5
Elderly (Above 45 years)	10	20.83

Table 4: Percentage positivity on the basis of socioeconomic status

Socioeconomic status	Number of positive samples (n=48)	Percentage positivity
Rural areas	26	54
Small cities	14	29
Developed cities	8	17

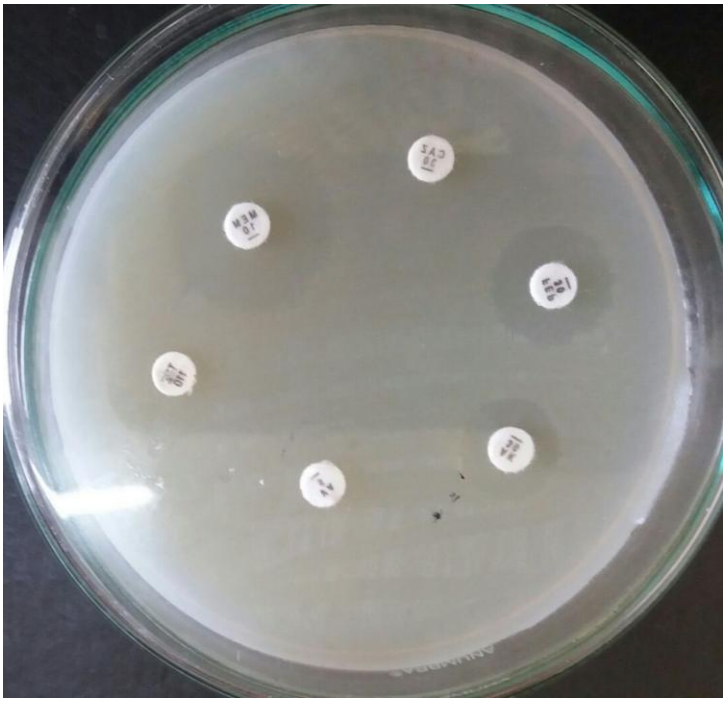

Fig 1: Antibiotic Sensitivity Test with different zones of inhibition

CONCLUSION

It is concluded through analysis that adult males are more prone to respiratory tract infections as compared to females due to increased habit of smoking in adult or elder males. Higher number of patients visiting hospital for RTI belongs to small villages having lower socioeconomic status, habitual of tobacco and practicing poor hygienic measures. Awareness about harmful effects of smoking and tobacco among public may help reduce the cases of UTI. Further research is required to investigate the factors involved in RTI infecting males of lower socioeconomic status.

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