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A Study on Bacterial Profile of Lower Respiratory Tract Infections in Geriatric Population

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ABSTRACT

Background: *The Geriatric population refers to persons who are 65 years of age and above. Lower Respiratory Tract Infections are among the most common diseases encountered in elderly people. This study was conducted to determine the bacterial pathogens causing lower respiratory tract infections in geriatric population, and their antibiotic susceptibility pattern.* ***Materials & Methods:*** *The present study for a period of one year included 110 patients with lower respiratory tract infections, 65 years of age and above, admitted in Geriatric Medical ward, Rajiv Gandhi Government General Hospital, Chennai. The study population included 110 geriatric patients admitted in Geriatric Medical ward for lower respiratory tract infections. The respiratory samples and blood were collected and processed according to standard methods.* ***Results:*** *In this study, data showed that majority of patients with lower respiratory tract infections were in the age group of 65-74 years (82.0%) and predominantly males (62.7%) Among the 110 patients, significant bacterial growth was exhibited by 68 (61.8%) cases. Out of the 76 isolates, Klebsiella pneumoniae (36.8%) was the commonest pathogen. A total of 26 (34.2%) and 5 (6.6%) isolates were Extended Spectrum Beta-Lactamase and AmpC Beta-Lactamase producing organisms, respectively. About 7.9% of the total isolates were Methicillin-Resistant Staphylococcus aureus . Blood samples yielded growth in 2.7% cases.* ***Conclusion:*** *Due to the evolving nature of the epidemiology of lower respiratory tract infections in older persons, continued research and surveillance are essential to optimize the prevention and therapy of lower respiratory tract infections in the Geriatric population.*

Key words: *Lower Respiratory Tract Infections, Geriatrics, Klebsiella pneumoniae.*

INTRODUCTION

The term geriatric refers to the aging human population[1]. Geriatric population is defined as persons 65 years of age and older. [2] The number of people older than 65 will double to 14 percent from 7 percent of the world's population in the next 30 years, rising to 1.4 billion by 2040 from about 506 million in the middle of last year, said the report, "An Aging World: 2008," commissioned by the U.S. National Institute on Aging[3]. The older persons have age-related immunological changes, chronic cognitive and physical impairments, and diseases that alter host resistance. Therefore, they are highly susceptible to infections and their complications[4]. The elderly are more likely than younger patients to have nonspecific signs and symptoms of infection, more severe disease, and resistant microorganisms. Lower Respiratory Tract Infections [LRTI] remains the most important cause of hospitalization in the elderly people. It consisted of episodes of pneumonia, acute bronchitis and exacerbations of chronic obstructive pulmonary disease (COPD).

These patients were allowed to have more than one episode of LRTI with at least a 3-week symptom-free interval between each episode[5]. This study was conducted to determine the etiological agents causing lower respiratory tract infections in geriatric population attending tertiary care hospital. Antibiotic susceptibility patterns of the pathogens and the predisposing factors for LRTI were also evaluated, which would provide information to optimize accurate timely diagnosis, treatment and care of the elderly.

MATERIALS AND METHODS

This prospective study was conducted in the Institute of Microbiology in association with the Department of Geriatric Medicine, Madras Medical College and Rajiv Gandhi Government General Hospital, Chennai, over a period of one year from October 2010 to September 2011. The study population included 110 geriatric patients admitted in Geriatric Medical ward for lower respiratory tract infections. The study was approved by the Institutional Ethics Committee, Madras Medical College and Rajiv Gandhi Government General Hospital, Chennai. Patients below 65 years of age, and those who were being started on antibiotic therapy for lower respiratory tract infections in Geriatric medical ward, before collection of samples, and also patients admitted in Geriatric medical ward for diseases other than lower respiratory tract infections were not included in this study. The respiratory samples collected were sputum (93 samples), bronchial wash (11 samples), bronchoalveolar lavage (4 samples), and pleural fluid (2 samples).

Laboratory Assay: Blood was also collected from the 110 patients. The samples were processed according to the standard methods. The respiratory specimens were plated out on MacConkey agar, blood agar, and chocolate agar and incubated at 37^0 C for 24 hours. Blood was inoculated into the Brain-heart infusion biphasic medium bottle in the ratio of 1:5, and incubated at 35^0 C. Routine subcultures were performed after 48 hours of incubation at 35^0 C in 10% CO_2. Incubation was continued up to 14 days in the absence of negative subcultures[6]. Bacterial growth was identified by the colony morphology, Gram staining, motility, biochemical reactions. Antibacterial sensitivity tests [Disc Diffusion Method - Kirby Bauer's] was performed by standard microbiological techniques as recommended by Clinical and Laboratory Standards Institute (CLSI). Production of (ESBL) Extended spectrum β-Lactamases in Gram- negative bacilli was detected by screening test, Double disk diffusion synergy test (DDST) and CLSI phenotypic confirmatory disc diffusion test (PCDDT) . AmpC β-Lactamases producing Gram-negative bacilli were identified by screening methods.Imipenem-EDTA combined disk method was employed to determine Metallo β-Lactamases (MBL) production in Gram- negative bacilli.Disc diffusion method and Oxacillin agar method were used to isolate methicillin resistant *Staphylococcus aureus* (MRSA).

RESULTS

Majority of the patients were in the age group of 65 to 74 years (82%). Males (62.7%) were found to be predominantly affected than females (37.3%). AECOPD (55.5%) was the commonest lower respiratory tract infection, observed in our study. [Table 1] The older persons most often presents with atypical clinical features, which interferes with rapid diagnosis and treatment. In this study, patients presented with non-specific symptoms like myalgia (68.2%), chills (21.8%), confusion (18.2%), vomiting (10%) and diarrhea (1.8%). The respiratory symptoms noticed were cough (82.7%), dyspnea (71.8%), sputum production (67.3%) and pleuritic chest pain (35.5%). The risk factors that increases the morbidity and mortality of lower respiratory tract infections like hypertension (53.6%), smoking (50.9%), Diabetes Mellitus (49.1%), alcohol intake (44.5%), previous exacerbations of COPD (36.4%), poor oral hygiene (29.1%), dysphagia (24.5%), cardiac disease (17.3%), cognitive impairment (10.0%), malnutrition (6.4%), tumour (1.8%), renal disease (1.8%) and hemiparesis (1.8%) were observed in the study population. Among the 110 patients, significant bacterial growth was exhibited by 68 (61.8%) cases. [Table 2]. Polybacterial growth was observed in 8 (7.3%) cases. Of the 76 isolates, *Klebsiella pneumoniae* (36.8%) was the commonest pathogen, followed by *Pseudomonas aeruginosa* (22.3%), *Acinetobacter baumannii* (11.8%), *Staphylococcus aureus* (10.5%) *Proteus mirabilis* (5.3%), *Escherichia coli* (3.9%), *Streptococcus pneumoniae* (2.6%) and *Citrobacter koseri* (2.6%). A total of 26 (34.2%) and

5 (6.6%) isolates were ESBL and AmpC Beta-Lactamases producing organisms, respectively. 7.9% of the total isolates were Methicillin-Resistant *Staphylococcus aureus* (MRSA) . Blood samples yielded growth in 2.7% cases.

TABLE 1: AGE, SEX AND DISEASE DISTRIBUTION OF PATIENTS N=110

Age in years		65-74 yrs	75-84 yrs	≥ 85yrs	Total
AECOPD=61 (55.5%)	**M**	28 (25.5%)	9 (8.1%)	1 (0.9%)	38 (34.5%)
	F	20 (18.2%)	2 (1.8%)	1 (0.9%)	23 (20.9%)
Pneumonia=40 (36.4%)	**M**	23 (20.9%)	3 (2.7%)	-	26 (23.6%)
	F	13 (11.8%)	1 (0.9%)	-	14 (12.7%)
Acute Bronchitis=9 (8.2%)	**M**	5 (4.5%)	-	-	5 (4.5%)
Total	**F**	2 (1.8%)	1 (0.9%)	1 (0.9%)	4 (3.6%)
		91 (82.7%)	16 (14.5%)	3 (2.7%)	110

TABLE 2: CULTURE POSITIVITY OF RESPIRATORY SAMPLES N=110

Type of Sample	No. of samples collected	No. of culture positive samples
Sputum	93 (84.5%)	65 (59.1%)
Bronchial wash	11 (10.0%)	2 (1.8%)
Bronchoalveolar Lavage	4 (3.6%)	1 (0.9%)
Pleural Fluid	2 (1.8%)	-

DISCUSSION

Lower Respiratory Tract Infections are among the most common diseases encountered in elderly people. In most studies carried out, age is a major risk factor for both occurrence and severity of lower respiratory tract infections. Majority of the patients were in the age group of 65 to 74 years (82%). The p-value obtained is 0.04, which is statistically significant. The number of patients with LRTI decreased as age advanced. Jackson ML et al [7] showed an increase in the incidence of lower respiratory tract infections with increasing age, in their study of USA seniors. The low life expectancy at birth in India contributes to the decrease in population of oldest people.Among the 110 patients, admitted in Geriatric Medical ward for lower respiratory tract infections, males (62.7%) were found to be predominantly affected than females (37.3%). The male predilection seen in this study could be explained by the increase in frequency of co morbidities and the risk factors present in male patients. Similar finding was also observed in the study by E Hak et al from Netherlands, in which 63% of patients with LRTI were males.[8]History of smoking was presented by 56 male (50.9%) patients. The p-value obtained for smoking was <0.01. This shows significant association of smoking with LRTI. In the Leiden 85-plus study of A.Sliedrecht et al, [9] smoking was mentioned as the greatest contributor of LRTI with a population attributable risk of 32%. A total of 66 isolates (60%) of aerobic Gram negative bacilli and 10(9.1%) isolates of Gram positive cocci were cultured from 110 samples. Similar result was also seen in the randomized study by Phillip K. Peterson *et al*,[10] in which about 81% of the 123 cases yielded Gram negative bacteria. Belousov IuB et al, [11] in his study from Moscow, showed isolation of Gram positive cocci from 70% of the patients. In the current study, *Klebsiella pneumoniae* (25.5%) was the most frequent pathogen isolated from the respiratory samples. The study by Christopher Aye Egbe et al from Nigeria also showed the predominance of *Klebsiella pneumoniae* (30.16%) in lower respiratory tract infections. [12] The susceptibilities of the bacterial isolates towards the various antibiotics were determined by disc diffusion method and broth macrodilution method. Among the 76 pathogens isolated, 26 (34.2%) were Extended Spectrum Beta-Lactamase (ESBL) producers.

Klebsiella pneumoniae was the predominant ESBL producing organism. 12 (42.8%) strains of the 28 isolates of *Klebsiella pneumoniae* were confirmed to be ESBL producers. This result is in accordance with the study by MU Xin-lin *et al*[13] in which 39 strains (30.9%) out of the total 126 isolates of *Klebsiella pneumoniae* were ESBL producers. About 5(6.6%) AmpC Beta-Lactamase producing Gram negative bacteria were determined in this study by screening test. In the study conducted by Singhal S *et al*,[14] the occurrence of AmpC β-lactamases was found to be 8% of the total isolates.In the study under discussion, 7.9% of the total isolates were found to be *Methicillin-Resistant Staphylococcus aureus* (*MRSA).* Out of the 8 isolates of *Staphylococcus aureus*, 6 (75%) isolates were *MRSA*. All the strains of *Staphylococcus aureus* were sensitive to Vancomycin. Adel Khattab et al [15] isolated 8.1% of *MRSA* among the total isolates. Blood cultures from the 110 patients yielded 3 pathogens (2.7%) including 2 strains of *Klebsiella pneumoniae* and 1 isolate of *Streptococcus pneumoniae.* The sputum from the patients showing positive blood culture also reported the same pathogens with similar antibiogram. This finding was supported by the Nima Afshar *et al*[16] in their systematic review, in which they reported 0% to 14% of cases of community-acquired pneumonia showing true positive blood culture results.

CONCLUSION

From this prospective study, it is quite clear that the elderly patients are at high risk for contracting lower respiratory tract infections due to Gram negative bacteria. The emergence of resistant strains in the patients of the present study emphasize the need of prudent use of antibiotics. Due to the evolving nature of the epidemiology of lower respiratory tract infections in older persons, continued research and surveillance are essential to optimize the prevention and therapy of lower respiratory tract infections in the Geriatric population.

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