Section: Microbiology

Research

PREVALENCE OF BACTERIAL AND FUNGAL AGENTS IN LOWER RESPIRATORY TRACT INFECTIONS REGARDING CHRONIC OBSTRUCTIVE PULMONARY DISEASE IN A TERTIARY CARE HOSPITAL

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Abstract

Background: In India, ARI is responsible for one million deaths, 10-15% of which are due to lower respiratory tract infections (ALRTI). The aim is to study the prevalence of bacterial and fungal agents causing lower respiratory tract infections with special reference to COPD. **Materials and Methods:** A Prospective study was conducted at the Department of Microbiology and Department of Chest and TB, AVMCH, Puducherry from February 2010 to March 2011. 138 patients who were clinically diagnosed to have COPD, attended the chest clinic OPD of AVMCH, Puducherry. A full history was taken, with specific attention on any probability of developing COPD and predisposing factors for infection, as well as a thorough clinical evaluation. **Result:** The total numbers of Male patients were 114, and Female patients 24, most COPD patients were in the 61-70 year age group. Low socioeconomic status 102 (73.91%), Exposure to cow dung and wood smoke 85 (61.59%), and agriculture 95 (68.84%) as an occupation were additional risk factors in the study. Out of 138 patients, bacteria were isolated from 74 (53.62%) cases, fungi from 8 (5.80%) cases, bacteria + fungi in 2 (1.45%) cases, and 54 (39.13%) cases showed growth of normal oropharyngeal flora. Out of 10 Candida species that were isolated, 9 (90%) were Candida albicans and 1 (10%) was Candida tropicalis. **Conclusion:** We conclude the candida isolates from patients must be clinically connected to eliminate any suspicion that may occur as a result of releasing such a report, according to the authors.

INTRODUCTION

When animals migrated from aquatic to terrestrial life they had modifications of their respiration from breathing air dissolved in an aquatic environment with the use of gills to breathe air in a gaseous environment of terrestrial life using lungs. This evolutionary improvement had its pitfalls as they faced the onslaught of infectious agents, environmental pollutants, and morbid diseases of the respiratory system.[1]

Despite the huge surface area of the lungs and airways, few bacteria colonise and cause illness in this tissue. During sleep, thousands of microorganisms are ingested from the air and aspirated with pharyngeal secretions. Microbial burden and host defenses are always balancing acts. The goal of host defenses is to keep the gas-exchange zones sterile. When local defenses are defeated, inflammatory cells are recruited to destroy the pathogen.[2] Acute respiratory infection (ARI) is the leading cause of morbidity and mortality throughout the world, particularly in developing countries. In India, ARI is responsible for one million deaths, 10-15% of which are due to lower respiratory tract infections (ALRTI).[3]

Chronic obstructive pulmonary disease (COPD) is a leading cause of morbidity and mortality globally. COPD exacerbations have a significant impact on health primary care at both the primary and tertiary care levels since they are the leading cause of antibiotic usage and hospitalizations; also, exacerbations result in indirect expenses due to days lost from work.[4] COPD affects 30% of all patients

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treated in chest clinics and accounts for 1-25% of all hospital admissions in India. The disease is also related to job and social impairment and tends to recur infective and noninfective exacerbations. Cigarette smoking and inhaling dust or fumes are significant contributors.[5]

Bacterial infections are often regarded as the most prevalent cause of COPD. Bacterial exacerbations are thought to account for more than 40% of all exacerbations.[6] Over 90% of people with Acute Exacerbation of Chronic Obstructive Pulmonary Disease (AECOPD) are prescribed antibiotics, however much of their efficacy is questionable due to the advent of resistant strains of the most prevalent respiratory infections in the last 15 years. Acute exacerbations can contribute to the disease's irreversible course. As a result, prompt implementation of proper care is critical for a better prognosis of the condition.[7]

Fungi are ubiquitous plants devoid of chlorophyll and have to survive on decaying organic matter as parasites. Out of more than 100, 000 odd species, only a few are of importance to human health. Antifungal susceptibility testing is performed to help the clinician to select appropriate antifungals useful for treating a particular fungal infection.[8]

AIM

To study the prevalence of bacterial and fungal agents causing lower respiratory tract infections with special reference to COPD.

MATERIALS AND METHODS

A Prospective study was conducted at the Department of Microbiology and Department of Chest and TB, AVMCH, Puducherry from February 2010 to March 2011.

138 patients who were clinically diagnosed to have COPD, attended the chest clinic OPD of AVMCH, Puducherry.

A full history was taken, with specific attention on any probability of developing COPD and predisposing factors for infection, as well as a thorough clinical evaluation.

Inclusion Criteria

The clinician in charge identified patients based on the existence of the following symptoms: increased cough, increased purulence and/or volume of expectorations, and increased degree of dyspnea.

Exclusion Criteria

All instances with clinical or radiographic indications of pneumonia or bronchiectasis as a result of other disorders (postero-anterior view). Those people who were already at the hospital for treatment. Any antibiotic therapy received in the five days before the sputum sample for culture.

All subjects were ambulatory, and sputum samples were collected during the initial outpatient visit. Before the administration of antibiotics, sputum samples were obtained. The patient was asked to rinse the mouth thoroughly and gargle it with clean water. The patient was asked to take a deep breath and expectorate with a deep cough. Expectorated sputum was collected into a clean, sterile, dry wide-mouthed container which was immediately closed, labeled, and transported to the laboratory without delay.

Macroscopic and microscopic examinations were used to evaluate the quality of expectorated sputum. Any samples that were thin, watery, or lacking purulent content were deemed unfit for further processing. The sputum sample was assessed accordingly based on its colour and other characteristics.

RESULTS

The total numbers of Male patients were 114, and Female patients 24, the Male Female ratio is 4.75:1. The maximum numbers of COPD patients were in the 61-70years age group, which is 39 (28.26%) patients of the total 138 COPD patients.

Table 1: Distribution of patient's characteristics

No (%)		
Age	**Males**	**Females**
11 - 20	0	1 (4.16%)
21 - 30	11 (9.64%)	2 (8.33%)
31 - 40	16 (14.03%)	4 (16.67%)
41 - 50	19 (16.67%)	7 (29.16%)
51 - 60	27 (23.68%)	3 (12.5%)
61 - 70	34 (29.82%)	5 (20.83%)
71 - 80	7 (6.14%)	2 (8.33%)

Table 2: Demographic data of the study

		No (%)	**Sputum positive**
Nature of Sputum	Purulent	102 (73.91%)	74 (72.55%)
	Mucopurulent	23 (16.67%)	7 (30.43%)
	Mucoid	13 (9.42%)	3 (23.07%)
Comorbid or risk factors	Smoking	67 (48.55%)	42 (62.68%)
	Alcohol abuse	24 (17.39%)	23 (95.83%)
	Diabetes mellitus	26 (18.84%)	18(69.23%)
	Heart disease	7 (5.07%)	3 (42.85%)

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	Agriculturists	95 (68.84%)	36 (37.89%)
	Domestic fuel (cow dung, wood)	85 (61.59%)	32 (37.6%)
	Low socio-economic status	102(73.91%)	35 (34.31%)

Among smokers with COPD of 67 (48.55%) patients, the bacterial isolates were predominantly Klebsiella pneumoniae (14 patients) and Pseudomonas aeruginosa (13 patients) followed by Candida species (7 patients), Streptococcus pneumoniae (6 patients) and Staphylococcus aureus (2 patients).
Among diabetics with COPD 26 (18.84%), alcoholics with COPD 24 (17.39%) and patients with Congestive cardiac failure 7 (5.07%), Corpulmonale and COPD, Pseudomonas aeruginosa were the predominant bacteria isolated, in all the mentioned patient subgroups.
Low socioeconomic status 102 (73.91%), Exposure to cow dung and wood smoke 85 (61.59%), and agriculture 95 (68.84%) as an occupation were additional risk factors in the study.

Table 3: Distribution of sputum among the study

		No (%)
Type of AECOPD	I	28 (20.29%)
	II	63 (45.65%)
	II	47 (34.06%)
Isolated in culture	Bacteria	81 (89.01%)
	Fungi	10 (10.99%)
Isolated from sputum samples	Bacteria	74 (53.62%)
	Fungi	8 (5.80%)
	Bacteria + Fungi	2 (1.45%)
	Oropharyngeal Flora	54 (39.13%)
Mono microbial	Bacteria	69 (82.15%)
	Fungi	8 (9.52%)
Poly microbial	Bacteria	5 (5.95%)
	Bacteria + Fungi	2 (2.38%)

According to the Anthonisen classification system, 138 cases were divided into 3 types. 28 (20.29%) cases met Type - I AECOPD criteria, 63 (45.65%) cases fall under Type - II AECOPD, and 47 (34.06%) cases under Type - III AECOPD.
Out of 84 culture-positive cases, a total of 91 organisms were isolated. Bacterial isolates were 81 (89.01%) and fungal isolates were 10 (10.99%).
Out of 138 patients, bacteria were isolated from 74 (53.62%) cases, fungi from 8 (5.80%) cases, bacteria + fungi in 2 (1.45%) cases, and 54 (39.13%) cases showed growth of normal oropharyngeal flora.
16 (11.59%) cases showed gram-positive cocci on gram staining of the sputum smear and 20 (14.49%) cases yielded the growth of gram-positive cocci. Gram-negative bacilli + Yeast were seen in 1 (0.72%) case but only on culture. No hyphal elements were seen in 10% KOH preparation in any of the cases. It is possible to conclude that Gram staining findings correlated with culture findings in 88.10% of instances.

Table 4: Distribution of type of organism

Type of organism		**No (%)**
Isolated in monomicrobial flora	Staphylococcus aureus	8 (10.39%)
	Streptococcus pneumoniae	11 (14.28%)
	Streptococcus pyogenes	1 (1.30%)
	Klebsiella pneumoniae	24 (31.17%)
	Pseudomonas aeruginosa	19 (24.68%)
	Acinetobacter species	2 (2.60%)
	Escherichia coli	4 (5.19%)
	Fungi (Candida species)	8 (10.39%)
Isolates in polymicrobial flora	Pseudomonas aeruginosa + Klebsiella pneumoniae	3 (42.84%)
	Escherichia coli + Staphylococcus aureus	1 (14.29%)
	Streptococcus pneumoniae + Klebsiella pneumoniae	1 (14.29%)
	Staphylococcus aureus + Candida albicans	1 (14.29%)
	Candida albicans + Pseudomonas aeruginosa	1 (14.29%)
Candida species	Candida albicans	9 (90%)
	Candida tropicalis	1 (10%)

Out of 77 samples with monomicrobial growth, 20 (25.97%) gram-positive organisms, 49 (63.64%) gram-negative organisms, and 8 (10.39%) fungi were isolated. The gram-positive organisms isolated were Staphylococcus aureus (10.39%), Streptococcus pneumoniae (14.28%), and Streptococcus pyogenes (01.30%). The gram-negative organisms isolated include Klebsiella

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pneumoniae (31.17%), Pseudomonas aeruginosa (24.68%), Acinetobacter species (02.60%), and Escherichia coli (5.19%).

Out of 8 samples with polymicrobial growth, 3 (42.84%) samples showed Pseudomonas aeruginosa + Klebsiella pneumoniae, 1 (14.29%) sample showed growth of Escherichia coli + Staphylococcus aureus, 1 (14.29%) sample with Streptococcus pneumoniae + Klebsiella pneumoniae growth, 1 (14.29%) sample showed colonies of Staphylococcus aureus + Candida albicans and 1 (14.29%) sample had growth of Candida albicans + Pseudomonas aeruginosa.

Out of 10 Candida species that were isolated, 9 (90%) were Candida albicans and 1 (10%) was Candida tropicalis

The most common organism isolated was Klebsiella pneumoniae (28 isolates, 31%) followed by Pseudomonas aeruginosa (23 isolates, 25%), Streptococcus pneumoniae (12 isolates, 13%), Staphylococcus aureus (10 isolates, 11%), Candida species (10 isolates, 11%), Escherichia coli (5 isolates, 6%), Acinetobacter (2 isolates, 2%) and Streptococcus pyogenes (1 isolate, 1%).

All 10 Staphylococcus aureus isolates were resistant to Methicillin but sensitive to Vancomycin (100%), Linezolid (100%) Clindamycin (80%), and Amikacin (90%) and Ofloxacin. Isolates of Klebsiella pneumoniae were susceptible to Ampicillin (92.9%) and Cefuroxime (78.6%) as well as Cefotaxime (75%) and Gentamycin (45.45%). Acinetobacter species were sensitive to Ciprofloxacin (100), Erythromycin (91.7%), and Oxacillin (100). Sputum antibiotic sensitivity tests reduced sputum purulence and improved clinical outcomes in COPD patients.

DISCUSSION

The age range of patients included in this present study varied from 11 years to 80 years. As per the age-wise distribution of patients in 10 years, the majority of patients (39 patients, 28.26%) were between the ages of 61 and 70. The peak age incidence of this study (61-70 years) correlates with Weiss et al.[9] 224 discovered that above the age of 60, a typical lung loses roughly 1 liter of FEV 1 or around 20 ml/year.

The age incidence of impaired pulmonary function coincides rather well with the studies of Celli et al.[10] that the natural history of COPD is directly related to loss of lung function with aging. In this present study of 138 COPD patients, the number of male patients is 114 (82.6%) and female patients 24 (17.39%), and the male-female ratio is (4.75: 1). Studies were done by Arora et al.[11] (67.24% males and 32.76% females) and Chawla et al.[12] (88% males and 12% females) showed higher male preponderance than females.

The sputum positivity of 62.68% in smokers with COPD in this present study is supported by Weiss et al.[9] and Yaetes et al.[13] 2 of the 24 patients had abstinence from alcohol for a period of 8 months to 11 months. The amount of alcohol consumption was 150ml to 200ml per day over the past 7 to 9 years. Sullivan et al.[14] in a study of 171 COPD patients in a general hospital setting reported that congestive cardiac failure was the most common antecedent disorder after alcoholism and smoking to cause pulmonary infections in COPD patients, and Streptococcus pneumoniae was the most common pathogen isolated from the sputum in 34 patients of his study.

In the present study, the total number of patients with congestive cardiac failure and Cor pulmonale are 7 of which a positive culture was obtained in 3 patients and Streptococcus pneumoniae was isolated in all 3 patients. Chan et al.[15] have studied the exposure of endotoxin grain dust in farmers and grain elevator workers and concluded that exposure was associated with accelerated decline in lung function, and a condition is an occupational form of COPD.

In the present study 95 patients (M=83, F=12)) which comprised about 68.84% of the study group were involved in agriculture or related occupation as farm helpers. Out of the 95 patients involved in farming, 36 (37.89%) patients had sputum positivity. The role of occupation had a positive association with COPD in this present study. The type of fuel used at home for cooking has been studied by several authors for its impact on the causation and severity of COPD. In the present study of 138 patients (M=114; F=24) a positive history of the use of wood and dung as the major source of domestic fuel was noted in 85 patients, which accounted for 61.59%.

In the present study, 102 patients had purulent sputum; of which 74 (72.55%) patients had positive sputum cultures. 23 patients had mucopurulent sputum samples, of which 7 (30.43%) patients had positive sputum cultures. Similarly, 13 patients had mucoid sputum of which only 3 (23.07%) patients had positive sputum cultures. The utility of sputum culture to establish the microbiological (bacterial) aetiology of lower respiratory tract infection has been debated by Rennard et al.[16] based on the study of 249 patients and reported sputum gram stain nor sputum culture are neither specific non-sensitive as diagnostic tools.

The type of sputum, the length of transit, and the number of organisms present in the sample all influence culture positively. Arora et al.[11] observed an increase in 72% of instances, but Dalvi et al.[17] observed growths in 57% of samples, which is consistent with our findings.

Lees et al.[18] observed staphylococcus and gram-negative organisms such as Pseudomonas and Klebsiella species have been reported to colonise bronchiectasis lung, particularly in patients whose common invader or coloniser has been subdued by antibiotics. Woodhead et al.[19] found that prior antibiotic usage enhanced the isolation of coliform

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bacilli from sputum in their group. Streptococcus pneumoniae was found in 11 (13.10%) of the patients in this study.

Candida species were isolated from 10 (10.99%) samples. Candida isolation was maximum between the ages of 71 and 80 years. A study done by Resende et al.[20] observed that isolation rates of Candida species were high in people aged 60 to 80 years. Candida species were the fourth most prevalent organisms recovered from sputum specimens (10.99%). This observation is consistent with the findings of Resende et al.[20] The prevalence of Candida pneumonia varies throughout studies. The incidence ranges from 0.23 to 4.5%, according to data from multiple studies that included a distinct group of individuals. Rello et al.[21] found that fungi and yeasts were isolated in 4.5 and 3.5% of ventilator-associated pneumonia patients, respectively.

The majority of Candida species amongst the Candida isolates were Candida albicans 9 (90%) followed by Candida tropicalis 1 (10%). All antifungal medications tested were effective against Candida tropicalis. The findings of the present study are similar to those of Capoor et al.[22] and Chakrabarti et al.[23] resistances to ketoconazole (from 0% to 13%) and 5-fluorocytosine (from 1% to 8%) increased, but resistance to fluconazole (from 13% to 6%) decreased. Itraconazole resistance was found in 17% of Candida strains. Rizvi et al.[24] in their study showed 19.8% resistance to amphotericin B and 0% resistance to fluconazole.

CONCLUSION

We conclude that candida isolation from sputum samples is essential, as evidenced by the fact that Candida species were the fourth most prevalent pathogens commonly isolated with lower respiratory tract infection in the current study. Candida isolates from patients must be clinically connected to eliminate any suspicion that may occur as a result of releasing such a report.

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