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Research Article

Etiology Analysis and Antimicrobial Selection in Acute Exacerbation of Chronic Obstructive Pulmonary Disease

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Abstract

Objective: This study was conducted to prospectively analyze the clinical features of hospitalized patients with Acute Exacerbation of Chronic Obstructive Pulmonary Disease (AECOPD), sputum culture and drug susceptibility results, and the use and efficacy of antimicrobial to guide the pathogens of AECOPD hospitalized patients. Learning judgment and choice of antimicrobial drugs.

Materials and Methods: A total of 327 patients with acute exacerbation of chronic obstructive pulmonary disease admitted to the Department of Respiratory Medicine, Jingzhou Central Hospital from January 1, 2018 to December 31, 2018 were enrolled. Among them, 46 patients were positive for sputum microbial culture, and 48 positive sputum culture results were obtained. The demographic characteristics (age, gender, BMI index), smoking history, acute exacerbation/year, mMRC score were statistically analyzed. CAT score, lung function index, presence or absence of respiratory failure, sputum culture type and drug sensitivity, antibacterial drug selection. All data were tabulated and divided into 2 groups according to the presence or absence of respiratory failure. The clinical data and etiology differences of the 2 groups were counted. According to the sputum culture, G-negative bacilli or fungi were divided into two groups, and the clinical data of the two groups were counted. The measurement data were mean±standard error, and the percentage was used. The statistical analysis was performed by Fisher's exact test. The measurement data were analyzed by independent sample t test. The count data were analyzed by chi-square test. The P value was less than 0.05, which was statistically significant.

Results: A total of 327 cases were involved in the study, of which 48 were positive for sputum culture (46 patients). In the positive patients, 41 males (89.10%) and 5 females (10.4%) showed that males had higher prevalence than females. The most common age group is mostly 70-79 years old, with an average age of 73.08 years. During the follow-up, 8 people died in first year (58-83 years old, average 70.1 years old), and the mortality rate was 17.39%. Among the 46 patients, the available data were analyzed, BMI: 22.68 ± 0.67 (N = 28), AE / year: 1.82 ± 0.12 (N = 46), age (years): 73.52 ± 1.22 (N = 46), mMRC: 2.82±0.20 (N=28), CAT: 23.55±1.43 (N=27), FEV1:1.05±0.08 (N=28), FEV1%: 45.21%±3.29% (N=28), FVC: 2.25±0.11 (N=28), FVC%: 75.07% ± 3.4% (N=28). The most common microorganism in sputum culture was Candida albicans (50%), a total of 24 cases. There were 14 cases (30%) of bacterial infections and 34 cases (70%) of fungal infections. The most commonly used antibiotics for AECOPD patients are fluoroquinolones, followed by ceftazidime, followed by carbomycins, and antifungal drugs are most commonly fluconazole, followed by voriconazole. There was a statistically significant difference in the composition ratio between bacteria

and fungi between the first sputum culture and the non-first sputum culture (P=0.018), suggesting that the late stage of hospitalization was fungal infection. FEV1 and FVC between the respiratory failure group (14 cases) and the non-respiratory failure group (34 cases). AE/year was statistically significant (P<0.05), 2 groups. Candida albicans is the main pathogen in the patients. According to the pathogen, G-negative bacilli and fungi were divided into two groups. There was no significant difference in age, BMI, mMRC, CAT, AE times/year, FEV1 and FVC between the two groups.

Conclusion: G-negative bacilli and fungal infections were the most common in male, elderly, and recurrent AECOPD hospitalized patients, with the highest incidence of Candida albicans infection. Fungi was main source of infection in the late stay after 5 to 7 days of hospitalization. Candida albicans is most common positive pathogen in hospitalized patients regardless of whether it is associated with respiratory failure. This suggests that our combination of antibacterial and antifungal drugs in clinical treatment, especially in the late hospital stay can benefit these patients.

Keywords: Chronic obstructive pulmonary disease; acute exacerbation; respiratory failure; sputum culture

Abbreviations

COPD: Chronic obstructive pulmonary disease.
FEV1: Forced expiratory volume in 1 second.
FVC: Forced vital capacity.
GOLD: Global Initiative for Chronic Obstructive Lung Disease.
BOLD: Burden of Obstructive lung Diseases.
GBD: Global Burden of disease.
DALY: Disability-Adjusted Life Year.
MMP12: Matrix Metalloproteinase 12.
AATD: Alpha-1 Antitrypsin Deficiency.
HHIP: Hedge Hog Interacting Protein.
ETS: Environmental Tobacco Smoke.
PM: Particulate Matter.
NO_2: Nitrogen Dioxide.
EGFR: Epidermal Growth Factor Receptor.
LLN: Lower Limit of Normal.
mMRC: Modified British Medical Research Council.
CRQ: Chronic Respiratory Questionnaire.
SOB: Shortness of Breathing.
SGRQ: St. George's Respiratory Questionnaire.
CATTM: COPD Assessment Test.
The CCQ©: The COPD Control Questionnaire.
LABA: Long Acting Beta-Agonist.
SABA: Short Acting Beta-Agonist.
LAMA: Long Acting Muscarinic Antagonist.
ICS: Inhaled Corticosteroid.
RCT: Randomized Controlled Trial.
NIV: Non Invasive Ventilation.

NPPV: Non Invasive Positive Pressure Ventilation.

AE: Acute Exacerbation.

Introduction

Background

Chronic obstructive pulmonary disease (COPD) is defined as an illness state characterized by persistent respiratory symptoms and air flowing limitation that is not absolutely reversible however is inevitable and treatable. COPD comprise of emphysema, an anatomically defined condition characterized by obliteration of the alveoli with air space enlargement; chronic bronchitis is clinically defined condition with chronic cough and phlegm; and small airway disease, a form in which small bronchioles are narrowed and reduce in quantity. The definitive definition of COPD requires the presence of chronic flow of air obstruction, determined by spirometry, that usually happens within the setting of toxic environmental exposures-most frequently cigarette smoking. Emphysema, chronic bronchitis, and small airway illness existing in variable degrees in diverse COPD patients. COPD is the 4th leading reason for death and is expected to be third leading reason for death by 2020 [1]. COPD is also illness of accelerating public health importance around the world. COPD (AECOPD) is defined as continuous worsening of the patient's status, from the stable condition and beyond usual day-to-day differences, that's acute in onset and need change in daily medication in an exceedingly patient with underlying COPD [2]. COPD is related with high comorbidity from all organ systems, including anxiety and depression yet, respiratory diseases such as bronchial asthma and pulmonary vascular disease, and cardiovascular sicknesses such as ischemic cardiovascular disease, congestive heart failure and arrhythmias, are the most frequent comorbidities [3] In addition to negative effect on patients' quality of life, COPD accounts for a high societal burden with extensive economic impact on health care systems. Costs increase with COPD severity, prevalence of comorbidity and with inpatient treatment. Exacerbations of COPD are the main reason for hospitalizations and driver for hospitalized patient treatment expenditure.

Aims and objectives

The prime objective is to find the infective causes of acute exacerbation of chronic obstructive pulmonary disease with the help of sputum culture along with their treatment.

Materials and Methods

Study design

After approval by the ethics committee of Yangtze University, a prospective study was conducted over a period of one year (January 2018 to December 2018) on those patients with clinically diagnosed as Acute Exacerbation of Chronic Obstructive Pulmonary Disease admitted in the Department of pulmonology at Jing Zhou Central Hospital, affiliated to medical school of Yangtze university. All subjects provided written informed consent.

Inclusion criteria

All the patients with clinically diagnosed as Acute Exacerbation of Chronic Obstructive Pulmonary Disease admitted in the Department of pulmonology at Clinical Medical College of Yangtze University, Jing Zhou Central Hospital.

History of exposure to risk factors

Clinical history and examination supported by spirometry Exclusion criteria all patients treated with antibiotics in the past 48 hours Known cases of malignancy or immunosuppression Patient less than 40 years of age.

Patients having bronchiectasis, tuberculosis, pneumonia, malignancy, cerebral infarction, inhalation of foreign body, patient with poor glycemic control and other evident disease on chest x-ray, CT scan Patients having sputum positive for acid fast bacilli (AFB). Unqualified sputum culture specimen.

Sputum culture and sensitivity reports were prospectively analyzed for the microbial profile and their antimicrobial sensitivity pattern, each patient's data are categorized under demographic characteristics (age, gender, BMI index, smoking history), acute exacerbation/year, mMRC score were statistically analyzed. CAT score, lung function index, presence or absence of respiratory failure, sputum culture type and drug sensitivity, antimicrobial drug selection. All the collected data were tabulated and statically analyzed by using SPSS software.

Sample size

A prospective study was carried over a period of one year (January 2018 to December 2018) on those patients with clinically diagnosed as Acute Exacerbation of Chronic Obstructive Pulmonary Disease admitted in the Department of pulmonology at Jingzhou Central Hospital which comprised of 327 patients in which we had 46 patients with 48 cases of positive sputum culture for micro-organisms. Sputum culture and sensitivity reports were prospectively analyzed for the bacteriological profile and their antimicrobial sensitivity pattern, each patient's data were categorized under demographic characteristics microbial organism and sensitive antimicrobial drug selection. The data are expressed as the means±standard error (SEM) or %. All the collected data were tabulated and stastically analyzed by using SPSS software and Fisher's exact test.

Research methods and tools

Excel tables were designed to record demographic characteristics (age, gender, BMI index, smoking history), acute exacerbation/year, mMRC, CAT score, and other clinical data. Dyspnea was examined by using mMRC shown in below table 1 and CAT scoring shown as below table 2.

Please tick in the box that applies to you (only one box) (grade 0-4)	
mMRC Grade 0	I only get breath less with strenuous exercise
mMRC Grade 1	I get short breath when hurrying on the level or walking up as light hill.
mMRC Grade 2	I walk slower than people of the same age on the level becauseofbreathlessnessorI-havetostopforbreathwhenwalkingonmyownpaceonthelevel
mMRC Grade 3	I stop for breath after walking about 100 meters or after a few minutes on the level
mMRC Grade4	I am too breathless to leave the house or I am breathless when dressing or undressing

Table1: modified MRC dyspnea scale.

In CAT we used following table.

For each item below place a mark (x) in the box that describes you currently. Be sure to only select one response for each question			
Example: I am very happy	(0)(x)(2)(3)(4)(5)	I am very sad	score
In ever cough	(0)(1)(2)(3)(4)(5)	I cough all the time	[]
I have no phlegm (mucus) in my Chest at all	(0)(1)(2)(3)(4)(5)	my chest is completely full of phlegm	[]
My chest does not feel tight at all	(0)(1)(2)(3)(4)(5)	my chest feel tight	[]
When I walk uphill or once flight of stairs I am not breathless	(0)(1)(2)(3)(4)(5)	when I walk uphill or one flight of stairs I am very breathless	[]
I am not limited doing any Activities at home	(0)(1)(2)(3) (4)(5)	I am very limited doing activities at home	[]

I am confident leaving my home despite my lung condition	(0)(1)(2)(3)(4)(5)	I am not at all confident leaving my home because of my lung condition	[]
I sleep soundly	(0)(1)(2)(3)(4)(5)	I can't sleep soundly because of my lung condition	[]
I have lot of energy	(0)(1) (2)(3)(4) (5)	I have no energy at all	[]

Table 2: CAT assessment.

Acute exacerbation/year, Patients can experience a wide variety of symptoms during an exacerbation. It is generally agreed that the most distinct or cardinal symptoms of an exacerbation are increased dyspnoea, sputum purulence, and sputum volume. Their grading is based upon presence of cardinal signs. These signs and symptom were used as to describe as acute exacerbation shown in table 6.

Type	***Signs and symptoms***
Type 1	All three cardinal symptoms
Type 2	Two cardinal symptoms
Type 3	one cardinal symptoms plus one of the following an upper respiratory tract infection in past 5days, fever without other cause, increased wheezing or cough or an increase in heart or respiratory rate by 20%comparedwithbaseline reading

Table 3: grade of exacerbation.

Sputum cultures performed in routine practice of the identified COPD patients during exacerbation episodes were assessed for a microbial etiology.

All pulmonary function tests were performed using a multifunctional spirometer (Power Cube, Ganshorn Medizin Electronic GmbH, Niederlauer, Germany), according to the guidelines of the American Thoracic Society and European Respiratory Society 2.3 Data analysis Diagnostic evaluation via: average, rate, T-test and Fisher's exact test.

All the data was entered and analyzed through Statistical Package for Social Science [SPSS] ver. 23 of Microsoft America.

References and bibliography was maintained by using Endnote X7.

Results

Gender distribution among cases

According to the results, out of all 46 (14.67%) culture positive patient on total of 327 samples, 41 cases (89%) were male and 3 cases (11%) were female. This shows that prevalence of male among the culture positive patients were higher in comparison to females as shown in table 4. This gender distribution is shown in Figure 1.

Gender	***No of patients***	***Percentage***
Male	41	89%
Female	5	11%
Total	46	100%

Table 4: Gender wise distribution.

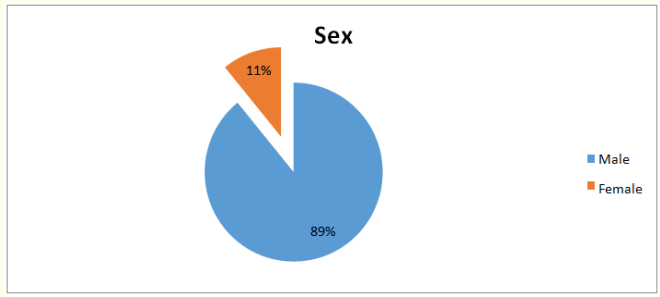

Figure 1: Prevalence of male and female in percentage.

Age group distribution

Regarding age distribution out of 48 sputum culture case 89.58% (n=23) of were more than 70 years of age. The patients selected for study were between 50-99 years of age with mean age of 73.08 years as shown in table 5. Patient was highest in the age group 70-79 years (48%). Which is also shown by graphical representation in figure 2.

Age in years	*No of cases*	*Percentage*
50-59	5	10%
60-69	11	23%
70-79	23	48%
80-89	8	17%
90-99	1	2%

Table 5: Age group distribution.

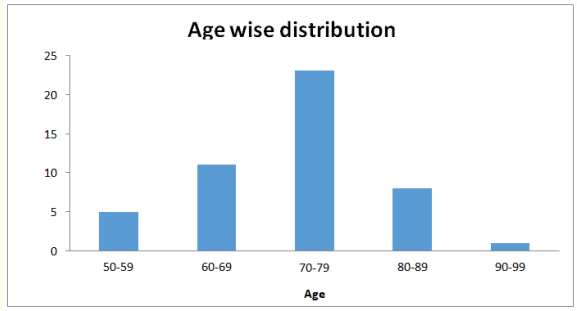

Figure 2: Age wise distribution.

Organisms in sputum culture

46 cases whose sputum cultured done and had 48 sputum positive samples as 2 samples were doubled as per repeated admission for acute exacerbation which showed mainly of fungal microorganism in the sample as table 6. Candid Albicans was present in the most number of patient (50%). Most of the patient had more than one microorganism cultured positive in sputum sample.

Name of the microorganism	*percentage of patient isolated*	*No. of Cases Fungal*
A) Fungal	70%	34
Aspergillus Fumigatus	6.25%	3
Candida Albicans	50%	24
Candida Glabrata	10.41%	5
Candidakrusei	4.16%	2
B) Bacterial	30%	14
Acinetobacter Abalone	8.33%	4
Escherichia Coli	6.25%	3
Haemophilus influenza	2.08%	1
Klebsiella pneumonia	4.16%	2
Pseudomonas Aeruginosa	6.25%	3
Stenotrophomonas maltophilia	2.08%	1

Table 6: Organisms in sputumculture.

Etiology of microorganism

48 sputum cultured positive during exacerbation of COPD had fungal cause of exacerbation with 34 cases (70%) and then bacterial of 14 cases (30%) and we could not find any statistics data in the viral components in acute exacerbation of COPD. This is also shown in table 6 and figure 3.

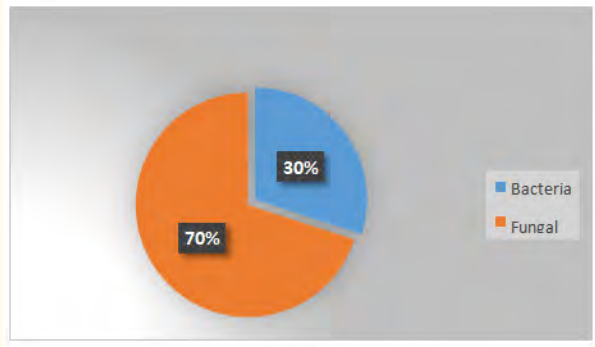

Figure 3: Pie chart of Etiology.

Microorganism with their treatment

Out of positive sample most of the patient was treated with floroquinolone, piperacillin, ceftazidime as antibiotic and fluconazole as anti-fungal medication. Shown in table 7.

Organism	*Treatment*
Acinetobacter Abalone	Piperacillin, Ceftazidime, moxifloxacin
Aspergillus Fumigatus	Ceftazidime, piperacillin, Meropenam, Voriconazole
Candida Albicans	Moxifloxacin, Meropenam, Fluconazole
Candida Glabrata	Moxifloxacin, Ceftazidime
Candidakrusei	Biapenem
Escherichia Coli	Levofloxacin
Haemophilus influenza	Levofloxacin, cefnesiumsodium
Klebsiella pneumonia	Ceftazidime, piperacillin
Pseudomonas Aeruginosa	Ceftazidime, Piperacillin, St
Enotrophomonas maltophilia	Levofloxacin, Meropenam

Table 7: Organism with treatment.

Comparison of different variables in total cases of sputum culture

In this table we have done comparison between different variable and their condition at the time of admission and their habit shown in table 8.

	No.	*means±SEM*
Ageinyrs.	46	73.52±1.22
Smoking(packs/yrs)	46	33.80±3.05
BMI(Kg/m^2)	28	22.68±0.67
AE	46	1.82±0.12
CAT	27	23.55±1.43
mMRC	28	2.82±0.20
FVC	28	2.25±0.11
FVC%	28	75.07±3.4%
FEV1	28	1.05±0.08
FEV1%	28	45.21±3.29%

Table 8: Comparison of different variables in total cases of sputumculture.

Comparison of different variables between two groups

In this table we have divided the entire cultured patient into 2 groups ie. Group 1. Sputum culture at the time of admission and Group 2. Sputum culture during hospitalization with the different variables like age, smoking, BMI, AE (acute exacerbation), CAT assessment test, mMRC, FVC, FVC%, FEV1, FEV%. Here only AE is significant having p-value of 0.002. However, there is a significant difference in the composition ratio between bacteria and fungi between these two groups. This means that fungi was the main source of infection in the late stay (after 5 to 7 days) of hospitalization Shown in table 8.

Variables	*Group 1 (means±SEM)*	*Group 2 (means±SEM)*	*p-value*
Age in yrs.	73.45±1.35	73±2.61	0.2
Smoking (packs/yrs)	37.96±3.48	34.13±4.62	0.86
BMI(Kg/m^2)	22.87±0.72	21.66±1.85	0.43
AE	1.81±0.15	2±0.13	0.002*
CAT	24.05±1.81	22.30±2.15	0.63
mMRC	2.84±0.25	2.90±0.34	0.62

Group1: Sputumculture at the time of admission.

Group2: Sputumculture during hospitalization.

*Group 1 vs Group 2, significant difference.

Table 9.1: Comparison of different variables between two groups.

Variables	*Gram Negative Bacilli*	*Fungi*	*Total*	*P-value*
Group 1 (cases)	13	19	32	
Group 2 (cases)	1	15	16	
Total	14	34	48	0.018

Fisher's exact test indicated that P=0.018

Group 1: Sputumculture at the time of admission.

Group 2: Sputumculture during hospitalization.

Table 9.2: Comparison of different variables between two groups.

Comparison of different variables between Bacterial and Fungal groups

In this we have compared different variable according to presence of organism divided into two groups (group 1 as bacteria and group 2 as fungal) shown in table 9.

Variables	*Bacterial(Mean±SEM)*	*Fungal(Mean±SEM)*	*p-value*
Age in yrs.	73.07±1.38	73.06±1.68	0.06
BMI(Kg/m^2)	22.72±0.74	21.82±0.84	0.15
AE	1.67±0.18	1.94±0.15	0.96
CAT	18.57±2.76	25.55±1.44	0.46
mMRC	2.43±0.48	3.05±0.22	0.45
FVC	2.50±0.18	2.23±0.13	0.77
FEV1	1.31±0.19	0.97±0.07	0.16

Table 10: Comparison of different variables between Bacterial and Fungal groups.

Pathogens in two different groups

We had 48 positive sputum culture cases among which we divided into 2 groups according to presence of respiratory failure and non-respiratory failure. In this table we had highest number of Candida Albicans in common infection in both groups (group 1 without respiratory failure have 15 and in group 2 respiratory failure have 9 patients) and also differentiated different type of fungus and bacteria shown in table 10.

Pathogens	*Group1*	*Group2*	*p-value*
Acinetobacter Abalone	3	1	
Aspergillus Fumigatus	1	2	
Candida Albicans	15	9	
Candida Glabrata	5		
Candidakrusei	2		
Escherichia Coli	3		
Haemophilus influenza	1		
Klebsiella pneumonia	2		
Pseudomonas Aeruginosa	1	2	
Stenotrophomonas maltophilia	1		
Gram Negative Bacilli	11	3	
Fungi	23	11	
Total	34	14	0.746

Gram Negative Bacillivs Fungi, Fisher's exact test indicated that P=0.746.

Group1: COPD without Respiratory failure.

Group2: COPD with Respiratory failure.

Table 11: Individual Causative Organisms in two different group.

Variables	*Group 1 (means±SEM)*	*Group 2 (means±SEM)*	*p-value*
Ageinyrs.	73.45±1.35	73±2.61	0.865
Smoking(packs/yrs)	37.96±3.48	34.13±4.62	0.879
BMI(Kg/m^2)	22.98±0.71	20.706±1.50	0.139
AE	1.81±0.15	2±0.13	0.480
CAT	24.05±1.81	22.30±2.15	0.553
mMRC	2.84±0.25	2.90±0.35	0.895
FVC	2.31±0.12	1.84±0.25	0.065
FVC%	78.00±3.66	62.50±4.60	0.030*
FEV1	1.09±0.09	0.83±0.14	0.139
FEV1%	47.69±3.64	33.00±4.41	0.037*

Group 1: COPD without Respiratory failure.

Group 2: COPD with Respiratory failure.

*Group 1 vs Group 2, significant difference.

Table 12: Comparison of different variables between wogroups.

Discussion

A prospective observational study was conducted to investigate the etiology of microorganism and their sensitivity pattern of antibiotic and anti-fungal in patients with COPD. In our study, only a few people (14.67%) have positive cultures. Among which, fungus was isolated from majority of patients. We had fungus as a prevalence of 70% and bacteria of 30%. More prevalence of fungus than bacteria has also shown by Jin Su, Hai-Yue Liu, Xi-Lan Tan [6]. This was due to elderly age and use of corticosteroid to treat the exacerbation and use of high dose suggest colonization of fungus in respiratory tract [7]. Accordingly, anti-fungal and antibiotics was administered in inpatients and outpatients with AECOPD exacerbations and change in sputum characteristics suggestive of fungal or bacterial in-

fections. COPD exacerbations may be triggered by acquisition of new bacterial species or fungal species by an increase in the absolute number of same bacteria and fungus or their different strain that colonize the airways, culture positivity depends on nature of sputum, transportation time and the number of organism present in the sample.

Forty eight sputum cultured positive cases were included in the study. The mean age of patient was 73.08 years (50-99) which comprises of 89% male and 11% female patients. Maximum number of patient were in the age group of 70-79 years (Table 6). Other study also show that in China males have more prevalence rate than female [8].

Smoking habits are more pronounced in males that constitute one of the predisposing factors for the development of COPD. Cigarette smoking induces structural and functional changes in airway epithelium in vitro and in vivo [9]. Cigarette smokers have a higher occurrence of respiratory symptoms and lung function deviations, and decrease in FEV1 annually, and a greater COPD mortality rate than non-smokers. Alternative varieties of tobacco and marijuana are jointly risk factors for COPD [4, 5]. Tobacco exposure and biomass fuel/solid fuel usage are documented as two important risk factors of COPD [10]. Smoking and air pollution are responsible for decrease in mucociliary clearance and innate immunity. Workers in mining industries are predominantly males which is one of the risk factor to develop COPD. It leads to increased bacterial and fungal colonization that can give rise to increased airway inflammation and thus exacerbations. As the age advances mucociliary clearance decreases due to weakness of the intercostal muscle which does not allow expulsion of mucous formed in the lungs.

The most common pathogen isolated from sputum culture was Candida Albicans (50%) in COPD patients during their exacerbation. What's more, fungi was the main source of infection in the late (after 5 to 7 days) stay of hospitalization. Out of positive sample most of the patient was treated with Floroquinolone, piperacillin, Ceftazidime as antibiotic and fluconazole as anti-fungal medication. We observed that Floroquinolone, Piperacillin, Ceftazidime as antibiotic and fluconazole as anti-fungal was most sensitive, but these results is contrary to Shrestha, Shrestha B, Shakya Shrestha S, Pant A, Prajapati B, Karmacharya BM which found that most common bacteria isolated were found to be Escherichia coli (14%), followed by Streptococcus pneumonia (11.6%) [11]. However, other studies have shown different types of pathogens distribution. Some study has shown the highest growth of Streptococcus pneumonia, [12] while other study has shown was Klebsiella pneumonia. This various results from different study shows a geographical variation of pathogens and strongly suggests that the use of antibiotics should be based on the antibiotic sensitivity test or on the basis of its local pathogenic epidemiological features As per the comparison of different variable in time duration of sputum culture done to see the Acute Exacerbation mean age of having highest frequency of exacerbation was 73.52±1.22 years. Here we had only one observation index (AE) had a significant differences (p-value is 0.02). Although there are no any differences in observational index such as FEV1, FEV1% it may not be true as per our data is too little, and as complete PFT could not be done in the patient having type II respiratory failure. Candid Albicans was most common double infection along with bacteria as per patients age was at 73.52±1.22 years of age. During this age patient's health condition is weak and mucociliary clearance action is weak so cannot expel the sputum properly outside of lungs or body. This leads to colonization of bacteria and fungus into lungs and respiratory tracts.

Conclusions

The AECOPD is a major cause health and economic burden to society. Infectious etiologies that are connected to AECOPD involved of bacteria, fungi and viruses. In our prospective study we analyzed the micro-organism profile of the patients with COPD at acute exacerbation and their antimicrobial sensitivity. G-negative bacilli and fungal infections were the most common in male, elderly, recurrent and severely symptomatic AECOPD hospitalized patients, with the highest incidence of Candida Albicans infection. Fungi was the main source of infection in the late stay (after 5 to 7 days) of hospitalization. Candida Albicans is the most common positive pathogen in hospitalized patients with AECOPD regardless of whether it is associated with respiratory failure. This suggests that our combination of antibacterial and antifungal drugs in clinical treatment can benefit these patients, especially in their late hospital stay. However, due to the small sample size of the positive sputum, the conclusion may be selective bias. A Large sample and/or multi-center data statistics are necessary to get closer to the clinical reality. Environmental factors including air pollution influence the rate of AECOPD.

The approach to diagnostic tests for AECOPD consists of characterizing gas exchange, infection and inflammation. It is less efficient to judge the etiology results of AECOPD hospitalized patients by sputum culture. In our study, the positive rate is just 14.67%, which means more methods are needed to discover pathogenic findings in the future. Next Generation sequencing for the sputum or some other methods maybe good additions. Acute management typically involves use of bronchodilators, antibiotics and/or systemic steroids and, if severe, oxygen and NIV. Further studies are required to assess the completely different varieties of non-pharmacological interventions out there shortly post AECOPD, as well as pharmacotherapy to decrease future risk of exacerbations, for identification of the efficacious components and overall cost-effectiveness.

Acknowledgments

This master thesis represents the final part of my education and is based on research work carried out from January 2018 to December 2018, at Department of Respiratory; the Jingzhou Central Hospital of Yangtze University. It presents Etiology analysis and antibiotic selection in AECOPD. The aim of the research was to find out the different causes of organisms that lead to acute exacerbation in COPD patients and their treatment according to their sensitivity which reduce their exacerbation and increased patient's quality of life.

I had tough time during selection of patients, data collection and data processing, but Professor Jing Ping ma's valuable advises, encouragement and constant guidance gave it a smooth pass. I would like to thank him for believing in me. Without his support and guidance, this dissertation would not have been a reality. It was a privilege to have such an involved supervisor.

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