

# **Bacterial Colonization Pattern of Sputum in Patients Suffering From Acute Exacerbation of Chronic Obstructive Pulmonary Diseases**

**Kamruzzaman Md. Zahir,<sup>1</sup> Kazi Fawzia Afreen,<sup>2</sup> Md. Obaidul Haque<sup>3</sup> Md. Ali Rumi,<sup>4</sup> Md. Zahidul Islam Khan<sup>5</sup>,**

## **ABSTRACT:**

**Background:** *The increased prevalence and mortality from COPD is occurring worldwide and is attributed to a rise in cigarette smoking and environmental pollution. The most common causes of an exacerbation are infection of the tracheobronchial tree and air pollution.*

**Methods:** *It is a case control prospective study. This study was carried out in the indoor and outdoor of National Institute of diseases of the Chest and Hospital (NIDCH), Mohakhali, Dhaka during the period September 2010 to August 2011 on 65 patients having the diagnosis of acute exacerbation of COPD.* **Result:** *In this study sputum culture was observed and found that Pseudomonous was found 35.4%, candida in 10.8%, klebsiella in 10.8%, 6.2% was E. coli, 3.1% was streptococcus, 3.1% was s. aureus and acinetobactor, H.Influnjae, pseudomonous klebsiella & stereptococcus pneumoni was 1.5% and no growth in 23.1%.* **Conclusions:** *It would be useful to know the bacterial colonization pattern in acute exacerbation of COPD to institute early antibiotic administration. Pseudomonous, klebsiella, streptococcus and H.influenjae are the main pathogen in acute exacerbation of COPD whereas standard number of patient had no growth of any pathogen.*

**Keywords:** *COPD, Pseudomonous.*

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## **INTRODUCTION:**

COPD Is Highly Prevalent, underdiagnosed, undertreated disease. It affects millions of individuals, limits the functional capacity of many, and has become an important cause of death worldwide.

COPD diagnosis is strongly suspected in the presence of greater than a 10 pack year smoking history in combination with a complaint of chronic cough with sputum production, shortness of breath, and

infection which takes longer to resolve than usual. By 2020 it will represent the third most important cause of death worldwide.<sup>1</sup> Exacerbations of COPD are important contributors to the severity of the patient's disease, by accelerating lung function decline, precipitating poor health status, increasing health care cost and negatively affecting survival.

The increased prevalence and mortality from COPD is occurring worldwide and is

attributed to a rise in cigarette smoking and environmental pollution.

The most common causes of an exacerbation are infection of the tracheobronchial tree (5) and air pollution (7), but the cause of approximately one-third of severe exacerbations cannot be identified (8). Conditions that may mimic an acute exacerbation include pneumonia, congestive heart failure, pneumothorax, pleural effusion, pulmonary embolism, and arrhythmia.

Increased breathlessness the main symptom of an exacerbation, is often accompanied by wheezing and chest tightness, increased cough and sputum, change of the color or tenacity of sputum, and fever. Exacerbations may also be accompanied by a number of nonspecific complaints, such as malaise, insomnia, sleepiness, fatigue, depression, and confusion. A decrease in exercise tolerance, fever, or new radiologic anomalies suggestive of pulmonary disease may herald a COPD exacerbation. An increase in sputum volume and purulence points to a bacterial cause, as does a prior history of chronic sputum production (6).

#### **Rationale of the study:**

COPD burden is increasing in developing countries like Bangladesh. Acute exacerbation of COPD compels patient to admit into hospital. There are several

factors causing acute exacerbation of COPD including respiratory tract infection. So it would be useful to know the bacterial colonization pattern in acute exacerbation of COPD to institute early antibiotic administration without the delay of sputum microbiological report and thus reducing mortality, morbidity and hospital stay.

#### **OBJECTIVES:**

General: To institute antibiotic early in patient of acute exacerbation of COPD without delay of sputum microbiological report.

#### **METHODS AND MATERIALS:**

**TYPE OF STUDY:** It is an observational study.

**PLACE OF STUDY:** This study was carried out in the indoor and outdoor of National Institute of diseases of the Chest and Hospital (NIDCH), Mohakhali, Dhaka. As NIDCH is the only referral center in Bangladesh and patients are coming from every corner of the country, the patients selected from NIDCH represent to some extent the whole Bangladesh

**PERIOD OF STUDY:** SEPTEMBER 2010 TO AUGUST 2011

#### **STUDY POPULATION:**

Although calculated sample size is 63, I'll take 65 patients having the diagnosis of acute exacerbation of COPD for my study.

$n = Z^2 pq / e^2$ n=sample size Z=1.96 at 95% confidence level P=4.3% q=1-p=1-4.3%=1-0.043=.957 e=acceptable error=.05	$n = 1.96^2 \cdot 4.30 \cdot 957 / 0.05^2$ = 3.8416 \cdot .043 \cdot 0.957 \cdot .0025 = 63.20792
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**Ethical Issue:**

Informed written consent was taken from all the subjects after full explanation. No invasive procedure will be adopted; patients will not be deprived of any known effective intervention

If symptoms are deteriorated during the run-in or study periods the patients will be withdrawn from the study. So, no violence of ethical issues will be taken place in this study.

**Sampling method:**

All COPD patient with acute exacerbation attending in NIDCH will be included in study population.

**SELECTION OF THE PATIENT:** A diagnosis of COPD and the presence of an exacerbation according to the Global initiative for Obstructive Lung Disease definition. Patient with FEV1/FVC<0.70 in a current or ex smoker older than 40 years of age with a compatible history. Exacerbation defined as acute onset sustained worsening in baseline dyspnoea, cough, and/or sputum beyond the normal variation and warranting a change in regular medication.

**INCLUSION CRITERIA:**

Patient age>40 years  
Smoker/biofuel massuser  
FEV1/FVC <0.70  
Worsening symptoms like breathlessness, increased respiratory rate, fever, purulent sputum.

**EXCLUSION CRITERIA:**

- Age <40 years
- Asthma
- Bronchiectasis
- Pneumonia
- Cancer
- Any active lung disease
- Cardiac involvement
- Antibiotic treatment within last month

**Data collection method:**

A standard proforma and questionnaire will be designed and filled up for each patient. Patient characteristics, changes in symptomatology and microbiological result of sputum will be recorded in specific proforma. Patients health related quality of life will be assessed by using the St. George's Respiratory Questionnaire (SGRQ)

**Required equipments:**

1. Spirometer,
2. Sphygmomanometer,
3. Weight machine

4. Will chart of measuring height,
5. Work sheets on a clipboard.
6. Standard microbiological lab
7. Sterile container to collect sputum

**Study design and methodology:** a standard questionnaire will be designed with a view to selecting patient who will be included as participants. The questionnaires will be analyzed to find out the patient in order to make the inclusion and exclusion criteria. Written informed consents will be obtained from all patients before the study procedure is undertaken. Specific demographic (age, gender) and clinical information (diabetes, allergies. Etc) will be collected from each eligible patient and their smoking habit will be recorded. Patient's prior history of taking steroid (oral/inhaler) and number of acute exacerbation in last year will be enquired. Patient will be asked to spontaneously expectorate a deep cough produced sputum sample under direct physician-investigator supervision/assistance, after thorough mouth washing. Patient unable to do this will be excluded from the study. The purulence of the sample will be judged by AMT on the site. Sputum sample will be collected in a sterile bottles and will be sent directly to the microbiology laboratory for processing. Patients spirometry will be done before and after bronchodilator when patient is in stable condition. Those will not be able to perform spirometry will be excluded from the study.

**RESULTS:**

**Table I: Age distribution of the study patients (n=65)**

Age (in year)	Number of patients	Percentage
40-50	20	30.8
51-60	17	26.2
61-70	18	27.7
71-80	7	10.8
>80	3	4.6
Mean ± SD	59.58±12.31	
Range (min-max)	(40-85)	

The above table shows the age distribution of the study patients. Most of the patients was found 20(30.8%) in age group of 40-50 years. The mean age was found 59.58±12.31 years with range from 40 to 85 years. Other results are depicted in the table.

**Table II: Sex distribution of the study patients (n=65)**

Sex	Number of patients	Percentage
Male	55	84.6
Female	10	15.4

The above table shows the sex distribution of the study patients. Male was found 55(84.6%) and female was 10(15.4%). Male to female ratio was 5.5:1.

**Table III: Distribution of the study patients according to fever (n=65)**

Fever	Number of patients	Percentage
Yes	40	61.5
No	25	38.5

The above table shows the fever of the study patients. Maximum patients had fever, which was 40(62.5%) and 25(38.5%) patients had no fever.

**Table IV: Distribution of the study patients according sputum (n=65)**

Sputum	Number of patients	Percent age
Yellow/purulent	36	55.4
Muco-purulent	12	18.5
Mucoid	17	26.2

The above table shows the sputum of the study patients. According to sputum, yellow/purulent was found 36(55.4%), Muco-purulent was 12(18.5) and Mucoid was 17(26.2%).

**Table V: Distribution of the study patients according to smoking (n=65)**

Smoking	Number of patients	Percentage
Smoker	50	76.9
Non smoker	10	15.4
Ex smoker	5	7.7

The above table shows the smoking of the study patients. Maximum patients were smoker, which was 50(76.9%), 10(15.4%) no smoker and 5(7.7%) ex smoker.

**Table VI: Distribution of the study patients according to use of antibiotics and steroid (n=65)**

Use of antibiotics and steroid	Number of patients	Percentage
Occasional	23	35.4
1/2 per yrs	20	30.8
1/3 per yrs	4	6.2
2/3 per yrs	13	20.0
¾ per yrs	5	7.7

The above table shows the use of antibiotics and steroid of the study patients. More than one third (35.4%) of the patients received antibiotics and steroid occasionally and 20(30.8%) received 1/2 per year and other results are depicted in the table.

**Table VII: Distribution of the study patients according to BMI (n=65)**

BMI (kg/m <sup>2</sup> )	Number of patients	Percentage
Under weight	1	1.5
Normal weight	55	84.6
Over weight	9	13.8
Obesity	0	0.0
Mean±SD	22.29±2.03	
Range (min-max)	(18-26)	

Under weight: <18.5 kg/m<sup>2</sup>  
 Normal weight: 18.5-24.9 kg/m<sup>2</sup>  
 Over weight: 25-29.9 kg/m<sup>2</sup>  
 Obesity: ≥30 kg/m<sup>2</sup>

The above table shows the body mass index of the study patient. Most 55(84.6%) of the patients had normal body weight (18.5-24.9 kg/m<sup>2</sup>) followed by 9(13.8%) over weight, 1(1.5%) underweight and obesity was not found. The mean BMI was 22.29±2.03 kg/m<sup>2</sup> with range from 18 to 26 kg/m<sup>2</sup>.

**Table VIII: Distribution of the study patients according to Sputum culture (n=65)**

Sputum culture	Number of patients	Percent age
Pseudomonous	23	35.4
No growth	15	23.1
Candida	7	10.8
Klebsiella	7	10.8
E. Coli	4	6.2
Streptococcus	2	3.1
S.aureus	2	3.1
Acinetobactor/Psudomonous	1	1.5
Haemophilus influenzae	1	1.5
H.influenjae	1	1.5
Pseudomonous, Klebsiella	1	1.5
Streptococcus pneumoni	1	1.5

The above table shows the sputum culture of the study patients. Pseudomonous was found 23(35.4%) followed by no growth was 15(23.1%), candida was 7(10.8%), klebsiella was 7(10.8%), 4(6.2%) was E. coli, 2(3.1%) was streptococcus, 2(3.1%) was s. aureus and acinetobactor/psudomonous, haemophilus influenzae, H. influnjae,

pseudomonous klebsiella & stereptococcus pneumoni was 1(1.5%).

## DISCUSSION:

A total number of 65 consecutive patients having acute exacerbation of COPD with FEV1/FVC <0.70 who came in the National Institute of Diseases of the Chest and Hospital,(NIDCH) Mohakhali, Dhaka, during the period of September 2010 to August 2011 were included in this study. The present study findings were discussed and compared with previously published relevant studies.

In this present study it was observed that more than one third (35.4%) of the patients was in 6<sup>th</sup> decade and the mean age was 59.58±12.31 years with range from 40 to 85 years. Almost similar age range observed by Tsimogianni et al. (2009) where they found age ranged between 44-91 years<sup>2</sup>. Similar almost consistent mean age observed by Patel et al. (2002) where they found age mean age 65.9±7.84 years<sup>3</sup>. Patel et al. (2002) found the mean±SD age was 66.9±9.5 years. On the other hand, Allegra et al. (2005) and Diamantea et al. (2007) has observed higher mean age in their study patients, where the authors found mean age were 69.3±8.8 years and 71.9±8.2 years respectively, the higher mean age found in their study patients may be due to increased life expectancy in their study patients.

Regarding the sex incidence male was predominant, which was 84.6% and male to female ratio was 5.5:1, which indicates that male was predominant in this current study. Similarly, Tsimogianni et al. (2009) and

Diamantea et al. (2007) showed male female ratio were 2.8:1 and 8:1 respectively, which is closely resembled with the current study<sup>2,4</sup>.

In this present series it was observed that 62.5% patients were suffering from fever. According to sputum, yellow/purulent was found in 55.4%, Muco-purulent in 18.5% and Mucoid in 26.2%.

In this current study it was observed that maximum patients were smoker, which was more than three fourth 76.9%, had previous history of smoking 7.7% and rest 15.4% was never smoke, which is comparable with Tsimogianni et al. (2009), where they found 55.3% were currently smoker, 44.7% had previous history of smoking and never smoker was not found.

Regarding the history of antibiotics and steroid used in this current it was observed that more than one third (35.4%) of the patients received antibiotics/steroid occasionally and 30.8% received 1/2 per year, 6.2% received 1/3 per year, 20.0% received 2/3 per year and 7.7% received ¾ per yrs.

In this study sputum culture was observed and found that Pseudomonas was found 35.4%, candida in 10.8%, klebsiella in 10.8%, 6.2% was E. coli, 3.1% was streptococcus, 3.1% was s. aureus and acinetobacter/pseudomonas, haemophilus influenzae, H. influenzae, pseudomonas klebsiella & streptococcus pneumoniae was 1.5% and no growth in 23.1%. Bari et al. (2010) observed 30 patients with stable COPD, out of which 3(20.0%) patients

showed positive sputum culture for bacteria, Pseudomonas 3, Klebsiella 1, Streptococcus pneumoniae 1, Haemophilus influenza 1 and majority were Gram-negative organism. Patients with acute exacerbation of COPD out of 60 patients 39(65.0%) showed positive culture for bacteria. Pseudomonas 15, Klebsiella 2, Pseudomonas+ Acinobacter 1 and majority were Gram-negative bacilli viz. Pseudomonas and Klebsiella spp. Species. The prevalence of lower airway bacterial colonization in outpatients with stable COPD is high and is mainly due to Gram-negative bacilli like Pseudomonas spp<sup>5</sup>.

The greater rate of isolation of pathogenic bacteria in exacerbated COPD than in stable COPD in their study, supports the pathogenic role of bacteria in a proportion of acute exacerbations of chronic obstructive pulmonary disease.

#### **CONCLUSIONS:**

It would be useful to know the bacterial colonization pattern in acute exacerbation of COPD to institute early antibiotic administration without the delay of sputum microbiological report and thus reducing mortality, morbidity and hospital stay. The organism commonly play pathogenic role in acute exacerbations of COPD are Pseudomonas, Klebsiella, Acinobacter, streptococcus and H.influenjae though significant number of patient had no growth of any pathogen.

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