

# Relationship between Smoking and Obstructive Airways Disease

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## Abstract

Obstructive airways disease is an important cause of mortality and morbidity around the world and smoking has a significant role in the development and progression of the disease. **Objective:** To analyse the relationship between smoking and obstructive airways disease. **Method:** A cross-sectional study was conducted among 100 patients with obstructive airways disease attending Respiratory Medicine outpatient services in Regional Institute of Medical Sciences (RIMS), Imphal from January 2015 to September 2016. Patients aged 18-67 were included in the study after obtaining Ethical approval from the Research Ethics Board, RIMS, Imphal. Computerized Spirometer Helios 401 was the instrument used to measure lung volumes and capacities. **Results and observation:** The present study was conducted on 100 patients with obstructive airways disease. The lung function test values of OAD patients showed that FVC, FEV<sub>1</sub>, and FEV<sub>1</sub>/FVC values were within normal limits. But FEF<sub>25-75%</sub> and PEFR were lower suggesting that smaller airways were affected in obstructive airway disease. In our study we found that OAD was strongly associated with smoking status (p<0.001), smoking pack-years (p=0.000), and smoking duration (p<0.001). **Conclusion:** From the study results we conclude that that Obstructive airway disease was strongly associated with smoking. Smoking cessation is the best and most effective solution to this problem. Other measures such as screening with spirometric tests in high risk individuals especially the smokers in age group of 40-55 should be considered to reduce the mortality and morbidity due to Obstructive airway disease.

**Keywords** - Obstructive airways disease (OAD), smoking, spirometric test

## Introduction

Obstructive airways disease is a group of condition distinguished by increased resistance and obstruction in the air passages, especially during expiration. The term OAD includes bronchial asthma; chronic obstructive pulmonary disease, consisting of chronic bronchitis and emphysema; bronchiectasis; cystic fibrosis and bronchiolitis.<sup>1</sup>

Asthma is one of the most common chronic disease and currently affects nearly 300 million people globally.

The prevalence of asthma has risen in affluent countries over the past 30 years with 10-12% of adults and 15% of children affected by the disease.<sup>2</sup>

COPD is a characterized by airflow limitation that is not fully reversible. The airflow obstruction is usually progressive and associated with an abnormal inflammatory response of the lungs to noxious particles. There are around 50 million patients with COPD in India and COPD is the second leading cause of death in India. Estimate suggests that COPD will rise from the sixth to the third most common cause of death worldwide by 2020.<sup>3</sup>

The WHO has estimated that there are around one billion smokers around the world of which around two thirds live in the developing countries. Even in the

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developed countries one fourth of the adults with asthma are smokers. Active smoking causes increased bronchial responsiveness, increased frequency and exaggeration of acute episodes, also decline in lung function. There is also increased sensitization of occupational agents in patients who smoke compared to non smokers.

Diagnosis is based on the patient's history, signs, and symptoms, and on the results of spirometry and other pulmonary function tests. Spirometry assesses the obstruction of expiratory airflow, which is the characteristic functional defect. Spirometry is the most effective way of determining the severity of obstructive airway diseases.<sup>4</sup>

The aim of our study is to analyse the relationship between smoking and Obstructive airways disease

### Method

**Study design:** A Cross-sectional study was conducted among 100 patients with Obstructive airways disease attending Respiratory Medicine outpatient services in Regional Institute of Medical Sciences (RIMS), Imphal from January 2015 to September 2016. Patients aged 18-67 were included in the study after obtaining Ethical approval from the Research Ethics Board, RIMS, Imphal. The participants were recruited by Purposive sampling. Diagnosed patients sent from Respiratory Medicine OPD, RIMS, Imphal were included in this study.

Socio-demographic characteristics like age, sex, smoking history were recorded. Thorough physical examination was done and the degree of airflow obstruction was recorded after obtaining Prior written informed consent form from all the participants. The patients with chronic disorders like hypertension, diabetes mellitus, cardiovascular diseases, bleeding disorders, inflammatory disorders, infection, malignancy and patients who had recent surgery were excluded from the study.

#### Sample size:

Sample size was calculated based on the formula

$n=4pq/l^2$  where,  $p$  is prevalence,  $q=1-p$ , and  $l$  is allowable error

The calculated sample size was 100. There was not much knowledge about the prevalence of OAD in Indian population, so 50% prevalence was taken with 10%

allowable error

Computerized Spirometer Helios 401 of the Recorders and Medicare System, Chandigarh, India was the instrument used to measure lung volumes and capacities. The Helios software contains set of prediction equations for computation of predicted parameter values.

The procedure was explained to the patient followed by a demonstration. The patient was asked to "take as deep a breath as possible" and then "blast as fast and hard as you can" and "keep blowing until I ask you to stop" preferably at least 3 seconds followed by a rapid inhalation (expiration). A tight seal was ensured around the mouthpiece. During the test, soft nose clip was used to prevent air escaping through the nose. Three consecutive maneuvers were performed with a rest of 5 to 10 minutes between two maneuvers.

The best result among the three tests was recorded. The results were compared with the predicted values for the same age, sex, height, and weight.

The study variables which include Forced Vital Capacity (FVC), Forced Expiratory Volume in one second ( $FEV_1$ ),  $FEV_1/FVC$  ratio, Forced Expiratory Flow during 25-75% of expiratory flow ( $FEF_{25-75\%}$ ), and Peak Expiratory Flow Rate (PEFR), were recorded by Helios Computerized Spirometer Model No. 401, in a sitting position.

#### Working Definition

Patients were classified on the basis of following

- 1) GINA Classification of asthma(2006)<sup>5</sup>
- 2) GOLD Classification of COPD (2006)<sup>6</sup>

#### Statistical Analysis:

The collected data were entered and analyzed using IBM SPSS Statistics V21.0 (IBM Corporation, US). Summarizations of data for frequency distribution for variables of interest were carried out by using descriptive statistics such as mean, standard deviation and percentages. Chi-square test was employed to test the association between asthma with variables of interest. A p-value of <0.05 was considered to be statistically significant.

### Results and Observation

A total of 100 patients with obstructive airway

disease were included in the study. 50% of the patients were diagnosed with Asthma and 50% of the patients were diagnosed with COPD. In each of the diagnosed group, 17 cases were female and 33 cases were male. Of which Maximum percentage (64%) of patients belong to the age group (38-67 years) while minimum percentage (36%) of the patients belong to age group (18-37 years). Out of 100, 57% patients were non-smoker, 25% were smoker, and 18% were ex smokers.

Patients with COPD were classified on the basis of GOLD Classification of COPD. We found that 22% of COPD patients were in moderate category ( $FEV_1/FVC < 0.70$  and  $FEV_1=0.50-0.80$ ), 18% of patients were in severe category ( $FEV_1/FVC < 0.70$ , and  $FEV_1=0.30-0.50$ ), and 14% of patients were classified as very severe ( $FEV_1/FVC < 0.70$ , and  $FEV_1 < 0.30$ ). Only 6% of the

patients had mild airflow limitation while 40% of COPD patients had no airflow limitation during spirometry.

Patients with Asthma were classified on the basis of GINA Classification of asthma. In our study group shows 46% belonged to intermittent persistent category of asthma ( $FEV_1 \geq 0.80$  and PEF variability  $< 20\%$ ), and 20% were in mild persistent category ( $FEV_1 \geq 0.80$  and PEF variability 20-30%). 16% of the patients were in moderate persistent category ( $FEV_1=0.60-0.80$  and PEF variability  $>30\%$ ), while 18% of the patients were in very severe persistent category ( $FEV_1 \leq 0.60$  and PEF variability  $>30\%$ ).

Mean  $\pm$ SD of different parameters of spirometry in the study participants

**Table 1: Mean $\pm$ SD of FVC, FEV<sub>1</sub>, FEV<sub>1</sub>/FVC, FEF<sub>25-75%</sub>, and PEFR in OAD patients (n=100)**

| Spirometric parameters | Minimum Value(%pred) | Maximum Value(%pred) | Mean(%pred) | Standard Deviation |
|------------------------|----------------------|----------------------|-------------|--------------------|
| FVC                    | 36.00                | 158.00               | 91.99       | 28.99              |
| FEV1                   | 9.00                 | 155.00               | 75.99       | 34.74              |
| FEV1/FVC               | 11.00                | 115.00               | 80.16       | 19.98              |
| FEF25-75%              | 6.00                 | 138.00               | 46.19       | 31.51              |
| PEFR                   | 6.00                 | 107.00               | 49.05       | 25.96              |

Table 1 shows the lung function test values of OAD patients as measured by spirometer. FVC, FEV<sub>1</sub>, and FEV<sub>1</sub>/FVC values were within normal limit. But the mean values of FEF<sub>25-75%</sub> and PEFR were lower. The results suggest that smaller airways were more affected in obstructive airway disease.

#### Association of OAD with different variables

**Table 2: Association of Obstructive Airway Disease patients with age (N=100)**

| AGE GROUP ( in years) | OAD       |             | TOTAL N(%) | p-value* |
|-----------------------|-----------|-------------|------------|----------|
|                       | COPD N(%) | ASTHMA N(%) |            |          |
| 18-27                 | 1(2)      | 17(34)      | 18(18)     | <0.001   |
| 28-37                 | 3(6)      | 15(30)      | 18(18)     |          |
| 38-47                 | 4(8)      | 10(20)      | 14(14)     |          |
| 48-57                 | 14(28)    | 4(8)        | 18(18)     |          |
| 58-67                 | 28(56)    | 4(8)        | 32(32)     |          |
| TOTAL                 | 50        | 50          | 100        |          |

\*Chi-Square test

Table 2 shows that Asthma was associated with younger age group whereas COPD was associated with higher age group ( $p < 0.001$ ).

**Table 3: Association of Obstructive Airway Disease patients with smoking habit (N=100)**

| SMOKING HABIT | OAD       |             | TOTAL N(%) | p-value* |
|---------------|-----------|-------------|------------|----------|
|               | COPD N(%) | ASTHMA N(%) |            |          |
| SMOKER        | 19(38)    | 6(12)       | 25(25)     | <0.001   |
| NON-SMOKER    | 16(32)    | 41(82)      | 57(57)     |          |
| EX-SMOKER     | 15(30)    | 3(6)        | 18(18)     |          |
| TOTAL         | 50        | 50          | 100        |          |

\*Chi-Square Test

Above table shows that obstructive airway disease was strongly associated with smoking ( $p < 0.001$ ).

**Table 4: Association of Obstructive Airway Disease patients with smoking pack-years (n=100)**

| SMOKING PACK-YEARS | OAD       |             | TOTAL N(%) | p-value* |
|--------------------|-----------|-------------|------------|----------|
|                    | COPD N(%) | ASTHMA N(%) |            |          |
| 0                  | 16(32)    | 41(82)      | 57(57)     | <0.001   |
| Less than 100      | 3(6)      | 4(8)        | 7(7)       |          |
| 100-200            | 6(12)     | 0(0)        | 6(6)       |          |
| 200-300            | 13(26)    | 3(6)        | 16(16)     |          |
| More than 300      | 12(24)    | 2(4)        | 14(14)     |          |
| TOTAL              | 50        | 50          | 100        |          |

\*Chi-Square Test

Table 3 shows that the obstructive airway disease was strongly associated with smoking pack-years ( $p < 0.001$ ).

**Table 5: Association of Obstructive Airway Disease patients with duration of smoking (N=100)**

| SMOKING DURATION (in years) | OAD       |             | TOTAL | p-value* |
|-----------------------------|-----------|-------------|-------|----------|
|                             | COPD N(%) | ASTHMA N(%) |       |          |
| 0                           | 16(32)    | 41(82)      | 57    | <0.01    |
| Less than 5                 | 1(2)      | 2(4)        | 3     |          |
| 5-10                        | 1(2)      | 3(6)        | 4     |          |
| 10-15                       | 1(2)      | 0(0)        | 1     |          |
| 15-20                       | 4(8)      | 2(4)        | 6     |          |
| 20-25                       | 10(20)    | 2(4)        | 12    |          |
| More than 25                | 17(34)    | 0(0)        | 17    |          |
| TOTAL                       | 50        | 50          | 100   |          |

### \*Chi-Square Test

Above table shows that the duration of smoking was associated with obstructive airway disease. Obstructive airway disease was more common among the patients who had long history of smoking years ( $p < 0.01$ ).

## Discussion

A total of 100 OAD patients were included of which 50 patients were suffering from asthma and 50 were COPD patients. Among the 100 OAD patients 66% were men and 34% were women. We found that Asthma was associated with younger age group whereas COPD was associated with higher age group ( $p < 0.001$ ).

The lung function test values of OAD patients showed that FVC, FEV<sub>1</sub>, and FEV<sub>1</sub>/FVC values were within normal limits. But FEF<sub>25-75%</sub> and PEF were lower suggesting that smaller airways were affected in obstructive airway disease. In our study we found that OAD was strongly associated with smoking status ( $p < 0.001$ ), smoking pack-years ( $p = 0.000$ ),  $p < 0.001$  and smoking duration ( $p < 0.001$ ). The present study found that asthma was more common in men which is in agreement with Razi E et al<sup>7</sup> and Halvani A et al<sup>8</sup> studies. Also in common with their studies, the present study found that the 50 asthmatic patients were in the mean age  $\pm$  SD 34.08  $\pm$  12.83 years.<sup>7,8</sup>

The Latin American Project for the Investigation of Lung Disease (PLATINO), a population-based study of 5,315 subjects including 2,278 non smokers, and 3,036 current or ex-smokers showed that COPD was observed in 3.5% of those who had never smoked and in 7.5% of those who had smoked.<sup>9</sup> The study shows association between smoking and OAD which is in accordance with our study results.

Our findings are in line with the PLATINO study which showed that tobacco smoking was higher in subjects with COPD compared with those without COPD (19.4 vs 9.1 pack-years). The proportions of current smokers and ex-smokers were found to be higher in those with COPD than in those without the disease (current smokers: 36.0% vs 28.8%; ex-smokers: 32.5% vs 26.8%).<sup>10</sup> They also found that females and males with COPD reported higher tobacco smoking compared with persons without COPD (females: 11.6 pack-years vs 6.0 pack-years; males: 26.5 pack-years vs 14.1 pack-years).<sup>11</sup>

Data from a study conducted by Llorde's M et al<sup>12</sup> of subjects at least 45 years of age and with a history of smoking showed that subjects with COPD have a higher smoking index than those without COPD (52.6 pack-years vs 32.1 pack-years) which is similar to our study.

The Indian study on Epidemiology of Asthma, Respiratory symptoms and chronic bronchitis (INSEARCH) carried out in a population of 169575 adults over 15 years of age demonstrated odds ratio of 1.82 for cigarette and 2.87 for bidi smoking.<sup>13</sup> Also In a study by Agrawal S et al<sup>14</sup> which used data on self-reported asthma from the India's third National Family Health Survey (NFHS) reported odds ratios of 1.72 and 1.35 for women and men respectively leading to similar conclusion as our study.

## Conclusion

From the study results it is clear that Obstructive airway disease was strongly associated with smoking. Smoking cessation is the best and most effective solution to this problem. But smoking cessation is challenging so optimal approach for smoking cessation should be such as education advice, behavioural intervention along with drug therapy like nicotine replacement therapy with gums, patch or inhaler can be tried for better results. Other measures such as screening with spirometric tests in high risk individuals especially the smokers in age group of 40-55 should be considered to reduce the mortality and morbidity due to Obstructive airway disease.

## Limitations

Although smoking is a widely recognized risk factor for Obstructive airway disease, the interaction of other less traditional risk factors such biomass exposure, occupational pollutants and environmental toxins with smoking have not been studied.

**Ethical Clearance-** Ethical approval was obtained from the Research Ethics Board, RIMS, Imphal before the beginning of the study.

**Source of Funding-** Self

**Conflict of Interest -** Nil

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