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A Comparative Study of Pulmonary Function Test Parameters between the Smokers and Non-Smokers among the Three Wheeler Auto-Rickshaw Drivers in Puducherry Region

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Abstract

Background: Occupational health is attaining significance for the reason that long term exposure to automobile fumes and environmental pollutants can lead to irreversible morbidity. This study will help in assessing the effects of smoking and occupational exposure to ambient air pollution on respiratory functions.

Aim: To assess and compare pulmonary function parameters among smoking and non-smoking auto rickshaw drivers.

Methodology: Auto rickshaw drivers between 20 to 50 years of age were recruited in the study and grouped into smokers and non smokers. Anthropometric parameters, pack years of smoking amongst smokers, years of driving were obtained. The Pulmonary function test parameters were recorded by a standard computerized Spirometer model "SPIROLAB III". All parameters were analyzed using Student's independent 't' test in SPSS 19 version.

Results: There was a statistically significant reduction in PEFR among smokers when compared to non smokers. The mean FVC, FEV_1, FEV_1/FVC and FEF_{25-75} were also found to be reduced in smokers when compared to non-smokers but were not statistically significant.

Conclusion: The study showed that Peak Expiratory Flow Rate is reduced significantly among smokers when compared to non smokers in three wheeler auto rickshaw drivers.

Keywords: *PEFR, auto rickshaw drivers, Pulmonary function test, duration of driving.*

Introduction

Outdoor air pollution one of the major cause of non–communicable cardiopulmonary diseases worldwide attributes to 5.4% of the total deaths every year[1]. Automobile emission is the outstanding cause of outdoor air pollution[2]. Automobile fumes contain hazardous pollutants like carbon monoxide, carbon dioxide, nitrogen dioxide, sulfur dioxide and ozone that may lead to respiratory and systemic illness[2]. Petrol is a combination of complex hydrocarbons and 95% of it is constituted by aliphatic hydrocarbons and less than 2% by aromatic hydrocarbon (benzene). Benzene is the most hazardous pollutant. Various studies have concluded that long term exposure to Benzene and other polyaromatic hydrocarbons contribute to increase in respiratory morbidity[3]. The major mode of public transport in developing countries like India is the buses

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and auto rickshaws. Occupational health is attaining significance for the reason that long term exposure to automobile fumes and environmental pollutants can lead to irreversible morbidity. Smoking, a proven risk factor of Chronic Obstructive Pulmonary Disease (COPD), can act as a confounding factor in evaluating the adverse effects of ambient air pollution. Very few studies which have been conducted are in the taxi drivers, petrol pump workers which do not specify the groups aptly. [3, 4, 5.] Our study aimed at evaluating the effects of ambient air pollution, compares the pulmonary functions among smoking and non-smoking three wheeler auto rickshaw drivers of Puducherry region. This is the first study of its kind in this region with the auto rickshaw drivers.

Materials and Method

The study was approved by scientific committee and ethics committee of the institute.

Methodology

Study design: The study design is observational type of study. We stratified the study group based on a major earlier studied confounding variable i.e. smoking.

Study population: Male auto rickshaw drivers of age group 20-50 years who are driving open cabin type of auto-rickshaw for more than 8hours /day for two successive years and above in Puducherry were included in the study. Subjects with present or past history of any respiratory illness (Tuberculosis, COPD), cardiovascular diseases and alcoholics were excluded from the study. Selection of cases and controls was based on feasibility and compliance.

Study procedure: Forty seven, three wheeler auto–rickshaw drivers, 23 in non smoking group and 24 in smoking group who met the inclusion criteria were included in the study. The participants were advised to come 2 hours after light breakfast to the pulmonary function testing laboratory. Written informed consents were obtained from them. The participants were clearly informed about the procedure. Confidentiality of the study of subjects were assured. Recording was carried out between 8.30am and 11.00am.

Anthropometric parameters, blood pressure, heart rate and respiratory rate were recorded. The pulmonary function assessment was performed by a standard computerized Spirometer model "SPIROLAB III". The subjects were familiarized with the instrument with proper instructions and demonstration. The procedure was done with the subject in sitting position. The subjects were asked to breathe forcefully following deep inspiration into the mouthpiece attached to the pneumotachometer. Each subject was instructed to perform at least three forced expiratory maneuvers while sitting with free mobility and nose closed with a nose clip to prevent the passage of air through the nose and to ensure reproducibility of results. The best of the three was taken as the actual value. Forced Vital Capacity (FVC) [defined as the volume of air in liters that can be forcefully and maximally exhaled], Forced expiratory volume in 1 s (FEV_1) [defined as the volume of air (in liters) that can be forcefully exhaled in the first second], FEV_1/FVC ratio and Peak Expiratory Flow Rate (PEFR) which is the maximum velocity in litres per minute with which air is forced out of lungs were obtained. Additional data on years of driving, smoking status were obtained from the study participants.

Statistical analysis: The sample size was calculated to be 58 as a single group based on the percentage of ambient air pollution and the mortality rates pertaining to it. In our study 48 subjects were recruited and further subgrouped into smokers (23) and nonsmokers (24) based on compliance. Analysis was done using SPSS version 19. Normality was tested using Kolmogrov Smirnov test. Values were expressed as mean ± SD for normally distributed variables and as median with range for non-normally distributed variables. Comparison of groups (smokers and non-smokers) was done by student's unpaired ***t*** test. The P values less than 0.05 were considered statistically significant.

Results

Table 1: Comparison of age, BMI, years of driving and pulmonary function testing parameters among smoking and non-smoking auto-rickshaw drivers

Variables	Smokers	Non-Smokers	P–Value
Age[#]	44.00 (22)	39 (24)	0.176
BMI	25.878 ± 4.55	25.141 ± 4.9	0.596
Years of Driving	18.09 ± 6.80	14.88 ± 7.57	0.133
FVC	78.52 ± 14.35	83.54 ± 9.39	0.166
FEV1	86.65 ± 16.36	92.79 ±9.33	0.119
FEV1/FVC	115.26 ± 7.66	116.21 ± 6.26	0.646
PEFR	70.00 ± 18.55	82.67 ± 16.01	0.016*
FEF25-75	84.43 ± 22.62	92.08 ± 18.56	0.211

Table 1 depicts the comparison of age, BMI, years of driving and pulmonary function testing parameters among smoking and non-smoking auto-rickshaw drivers.

Age is non-normally distributed and expressed as Median with Range. All other parameters are normally distributed and expressed as Mean ± SD. *p value < 0.05 is considered statistically significant.

The mean Peak Expiratory flow rate among smokers (70 ± 18.55) was found to be reduced when compared to non-smokers (82.67 ± 16.01) and it was statistically significant. The mean FVC, FEV1, FEV1/FVC and FEF25-75 were also found to be reduced in smokers when compared to non-smokers but were not statistically significant. This study being an observational one amongst auto rickshaw drivers is not an exact age matched grouping. Age was not normally distributed. Hence median was preferred than mean for age.

Discussion

Peak expiratory flow is the maximal flow achieved during a forceful expiration following a maximum inspiration. This depends on the strength of expiratory muscles, mechanical properties of the lung airways and the inertia, the resistance and sensitivity of the recording equipment. Peak expiratory flow is susceptible to dynamic compression of extra pulmonary airways. The bronchi and bronchioles are subjected to reflex bronchoconstriction in extrinsic asthma. This index is widely used for screening occupational asthma[5].

In our study significant reduction in PEFR was found in smokers when compared to non-smoking three wheeler auto rickshaw drivers of Puducherry region [Figure 1]. The results are similar to the previous study conducted in traffic policemen in Puducherry, which showed reduction in FVC, FEV1, PEFR, MMEF and 28% prevalence of obstructive disease among the study population[6]. This reduced PEFR in the smoking group in our study is the index of variable airflow obstruction among smoking auto drivers.

The ventilatory impairment assessed by PEFR may be underestimated compared with using FEV1, which is the preferred index. There are various studies in the past which showed decline in FEV1, FVC in auto drivers. A comparative study conducted among three wheeler automobile drivers of Gulbarga city, by Afshan et al showed significant decrease in FVC and FEV1 in auto drivers when compared to the controls. This study also revealed restrictive pattern of lung impairment[7]. This study also stated that the auto rickshaw drivers who were exposed to inhalation of dust and automobile exhaust for more than 8 hours per day for the duration of at least 1 year have increased likeliness to develop the disease. The study also showed that smoking affects FEV1 significantly.

A study conducted by Ibrahim et al among auto rickshaw drivers in Kerala showed strong association of duration of work and pulmonary impairment. In this study 67% of auto drivers showed mixed pattern of lung involvement[8]. Ajay et al conducted a comparative study of PEFR between auto drivers with residents of urban Davangaer, Karnataka. This study showed strong association of reduction in PEFR and duration of driving in auto drivers[9].

A study conducted among healthy non smoking drivers and conductors of metropolitan transport corporation, Chennai showed reduction in mean values of Pulmonary Function Test in non smoking drivers and conductors when compared to healthy controls[10.] Bijendra et al assessed pulmonary functions of three wheeler taxi drivers in Baikaner city and the results indicated restrictive pattern of lung involvement[11].

Our study was aimed at comparing the lung functions between smoking and non-smoking auto drivers. That is, to study the effect of smoking in addition to the automobile exhaust exposure among auto drivers of Puducherry region. In addition to PEFR, our study also showed decreased FVC, FEV1, FEV1/FVC in smokers when compared to non-smokers, but the difference in not statistically significant. This may be attributed to the sample size. With higher sample size statistical significance may be obtained. Auto rickshaw drivers being engaged with their works during most hours of the day, we faced practical difficulties in recruiting them to the study. And this is the major limitation of our study. Participants with reduced Pulmonary Function Test parameters were advised smoking cessation and participants with severe pulmonary impairments were referred to the department of Pulmonary medicine for further management. FEV1, FEV1/FVC, PEFR, FEF25%-FEF75% in the cases show a substantial reduction in their values as opposed to their predicted values indicating a greater influence of the ambient air pollution on the lung functions, both the smaller airways and larger airways.

By virtue of induction in the groups based on feasibility and compliance and the time period for the undergraduate MBBS student we could get this

distribution only. Hence it could seem as age being an important implicator in the responses though we consider it due to the fact of ambient air pollution.

Our study stated that the auto rickshaw drivers who were exposed to inhalation of dust and automobile exhaust for more than 8 hours per day for the duration of at least 1 year have increased likeliness to develop the disease. The study also showed that smoking affects FEV1 significantly. Also significant reduction in PEFR was found in smokers when compared to non-smoking three wheeler auto rickshaw drivers of Puducherry region [Table1]. The results are similar to the previous study conducted in traffic policemen in Puducherry, which showed reduction in FVC, FEV1, PEFR, MMEF. In addition to PEFR, our study also showed decreased FVC, FEV1, FEV1/FVC in smokers when compared to non-smokers, but the difference is not statistically significant. This may be attributed to the sample size. With higher sample size statistical significance may be obtained.

A study by balashanmugam et al (6) states that the percentage of autorickshaw drivers was around 11% in Puducherry in 2009. The study also takes the percentage of other type of drivers and quantifies the ambient air pollution. Hence this being an occupational hazard does significantly contribute to the morbidity of the said group of subjects and thence their effects on the PFT. Our study was aimed at observing the responses pertaining to the effects of air pollution based on their work nature and duration mainly. Hence it does not necessarily imply or attribute the effects only due to smoking.

Also the age and duration of driving in the smokers were more when compared to non smokers, which could have acted as confounding variable.

Auto rickshaw drivers being engaged with their daily routine (driving) during most hours of the day lead to practical difficulties in recruiting them to the study. And this is the major limitation of our study.

Conclusion

Our study showed significant reduction in Peak Expiratory Flow Rate in smokers when compared to non-smokers among three wheeler auto rickshaw drivers of Puducherry region. Further studies with a bigger sample size may help to demonstrate significant difference in other spirometric parameters, between smoking and non smoking autorickshaw drivers.

Ethical Clearance: Our proposal was carried out after obtaining the institute ethics committee clearance and permission.

Source of Funding: Self.

Conflict of Interest: NIL.

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