Research Article

Evaluation of pulmonary function test on auto drivers

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ABSTRACT

Introduction: Air pollution is widespread where vehicles are the major contributor. One such people who are exposed to air pollution are auto drivers. Their lung function is measured using the spirometer. Measurements include forced vital capacity (FVC), forced expiratory volume in one second (FEV1), VC, peak expiratory flow, maximal mid-expiratory flow curve, and forced expiratory flow rate (25–75%). **Background and Reason:** Air pollution is widespread where vehicles are the major contributor. One such people who are exposed to air pollution are auto drivers. Their lung function is measured using the spirometer. Measurements include FVC, FEV1, VC, peak expiratory flow, maximal mid-expiratory flow curve, and forced expiratory flow rate (25–75%). Long-term exposure to traffic air pollution is associated with a decrease in lung function and an increase in respiratory disorders. Traffic air pollution includes a list of pollutants but the major being particulate matter, sulfur dioxide, oxides of nitrogen, ozone, lead, and carbon monoxide (CO). Drivers who spend 10 h daily in traffic pollution are at higher risk of restrictive lung disorders. Long-term exposure to ozone produces mainly pulmonary fibrosis, which could be associated with a decrease in FVC and FEV1. CO is one of the most air pollutants and has been associated with lung diseases. The present study was conducted to assess the prevalence of restrictive lung diseases amongst the open cabin auto rickshaw drivers. **Materials and Methods:** A total of 40 members of auto drivers were chosen in Chennai city. Data collection and analysis were done over a period of 2 months from November to December 40s male auto rickshaw drivers working for a minimum of 6 h per day in the Chennai Metropolitan Area were selected. Various auto rickshaw stands in Chennai were approached for obtaining 40 auto rickshaw drivers for selection criteria. **Results:** The study shows the mean FVC of the group I is (2.94 ± 0.58 L) when compared with the mean FVC of the group II (3.27 ± 0.33 L) showed highly significant reduction value of about ($P < 0.01$). The mean FEV1 recorded in Group I was 2.67 ± 0.51 L which showed statistically significant reduction, but for $P < 0.05$ as compared to control group whose mean FEV1 was 2.91 ± 0.34 L, however, the FEV1/FVC % did not show statistically significant. **Conclusion:** The findings of the study show that air pollution has an adverse effect on the ventilatory lung function on chronic long-term exposure to air pollution with the prevalence of the restrictive type of lung disorder. Although some of the parameters were significantly altered in some subjects, suggesting a restrictive type of disorder were apparently asymptomatic.

KEY WORDS: Auto drivers, Pollution, Pulmonary function test, Spirometer, Traffic

INTRODUCTION

Pulmonary function test (PFT) is tests of pulmonary function pulmonary impairment, PFT has diagnostic and therapeutic roles and helps clinicians answer some general questions about patients with lung disease.[1] This measure the lungs' capacity to hold air, to move air in and out, detecting severe lung disorder than at defining the specific cause of problems professionals tests can be used to diagnose some specific disorders, asthma, and emphysema important information relating to the large, small airways, and the pulmonary parenchyma.[2] They not provide a diagnosis, different patterns of abnormalities in various respiratory diseases helps to a diagnosis indications for performing PFTs, abnormal results. Inspiration and expiration measured by apparatus[3] ventilation, movement of air in and out of lungs and shows abnormal ventilation patterns, obstructive, and restrictive. Spirometers varieties can use a number of various methods for measurement. Main piece of equipment used for basic PFTs. Lung capacity, for instance, may vary temporally, increasing, and then decreasing in one person's lifetime. It is performed using a device called a spirometer, which comes in several different varieties.[4] This shows that the volume-time curve, showing volume along the Y-axis and time (seconds) along the X-axis flow-volume loop, graphically shows the rate of airflow on the Y-axis and the total volume inspired or expired on the X-axis standing the sources of variabilities to be left for the interpretation. It has high patient cooperation and effort and is normally repeated at

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least 3 times to ensure reproducibility.[5] Results are dependent on patient cooperation. The most common parameters measured in spirometry are Vital capacity (VC), Forced VC (FVC), Forced expiratory volume (FEV) at timed intervals of 0.5, 1.0 (FEV1), 2.0, and 3.0 s, forced expiratory flow 25–75% and also known as maximum breathing capacity.[6] Spirometry includes tests of pulmonary mechanics – measurements of FVC and FEV1 value. It shows the ability of the lungs to move volumes of air quickly through the airways to identify airway obstruction. The measurements are taken by the spirometry device that can help to assess lung conditions such as asthma, pulmonary fibrosis, cystic fibrosis, and chronic obstructive pulmonary disease.[7] The physician may also use the test results to find out the bronchial hyperresponsiveness to exercise, cold air, or pharmaceutical agents. Outdoor air quality is an important determinant of a healthy individual.[8] It is observed that the cardiovascular and respiratory system related is high in the city. The WHO estimates that outdoor air pollution caused is increasing by 3.7 million death.[9] These numbers are especially high in developing countries in the Asia-Pacific region, such as India, where urban air pollution causes over 500,000 deaths annually. The burden on developing countries continues to increase every year. Rapid urbanization and industrialization of the Chennai metropolitan area have contributed to a sharp decline in the city's urban outdoor air quality.[10] Automobile exhausts, heightened by the rising influx of migrants to the city, continue to deteriorate the air quality.[18] Petroleum and diesel fumes, which contain Particulate Matter (PM2.5 and PM10), nitrogen dioxide (NO_2), sulfur dioxide (SO_2), carbon monoxide (CO), and ozone (O_3) form the major source of these air pollutants. A 2010 study conducted by The Energy and Resources Institute under Central Pollution Control Board revealed that the ambient levels of $PM_{2.5}$, NO_2, CO, and O_3 in Chennai were in violation of the accepted levels. Exposure to these fumes has shown to negatively affect the health of the population.[11] Research shows that long-term exposure to automobile exhausts can lead to a decrease in lung compliance function. It has also been attributed to heart and lung diseases, chronic bronchitis, asthma attacks, and other respiratory illness an increase in benzene levels. Auto rickshaw drivers depend on driving as their livelihood.[12] Outdoor air pollution is a significant occupational hazard. Our study confirms that exposure to outdoor air pollution is detrimental to the health of the auto rickshaw drivers and points to a restrictive type of lung disease.[13] Preventive measures need to be taken and social measures to reduce the levels of outdoor air pollution; use of personal anti-pollution protective equipment, awareness drives and health education about the detrimental effects of air pollution on lung function and health. More awareness about the effect of preventive measures against air pollution on lung function is needed.[14,15]

MATERIALS AND METHODS

A total of 40 members of auto drivers were chosen in Chennai city. Data collection and analysis were done over a period of 2 months from November to December, 40s male auto rickshaw drivers working for a minimum of 6 h per day in the Chennai Metropolitan Area were selected. Various auto rickshaw stands in Chennai were approached for obtaining 40 auto rickshaw drivers for selection criteria. The sample was randomized by selecting auto drivers from various localities of Chennai city. All the participants had been driving auto rickshaws in Chennai for more than 10 years. Our inclusion criteria were included male auto rickshaw drivers aged 18–60 years, smoking and they should not use face mask. Auto rickshaw drivers working at night time was working <6 h per day the history of smoking cigarettes, thoracic surgery, current respiratory infections, structural abnormalities of the thorax and vertebral and cardiovascular disease, heart disease, myocardial infarction, and with the cardiorespiratory system. The study was entirely individual. The procedure and purpose of the experiment were explained to them, and they interested, and the procedure was done. Questions were asked and answers recorded regarding education and socio-economic status, work experience such as years of driving experience in Chennai, shift timings, locality of work to assess traffic density and use of protective equipment like face masks. Enquired about symptoms of any respiratory disease in the past 2 months, any confirmed diagnosis of respiratory disease and any medications taken, history of any systemic disease such as heart disease, family history of any respiratory disease, and smoking were also asked. The age, sex, weight, and height using of drugs of the subject were recorded. Thorough general physical examination and a systemic experiment about the respiratory system were taken.

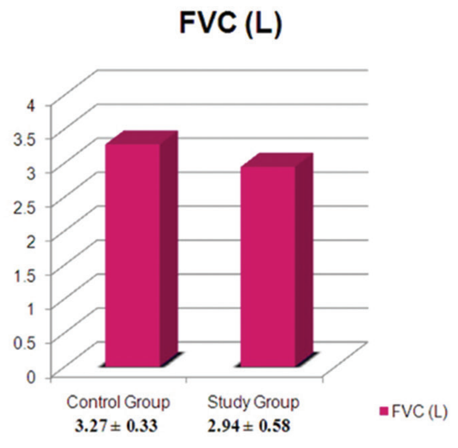
RESULTS

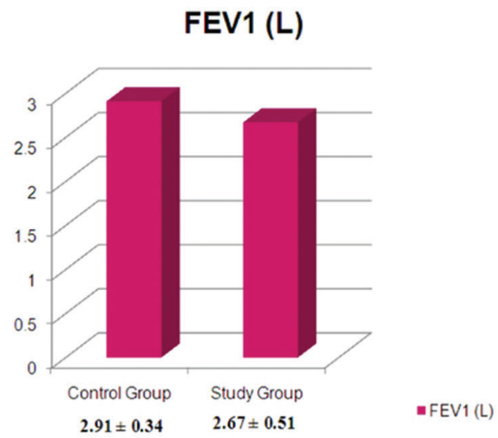
The age in years, weight in kilograms, and height in centimeters in mean ± SD of groups were: Group I (auto rickshaw drivers) age 35.93 ± 5.83, height 166.51 ± 5.41, and weight 70.21 ± 10.69 wherein Group II (non auto rickshaw drivers) age 33.8 ± 6.15, height 163.25 ± 9.34, and weight 67.4 ± 9.12.

Table 1 shows the mean FVC of the Group I (2.94 ± 0.58 L) when compared with the mean FVC of the Group II (3.27 ± 0.33 L) showed highly significant reduction ($P < 0.01$). The mean FEV1 recorded in Group I was 2.67 ± 0.51 L which showed a statistically significant reduction, but for $P < 0.05$ as compared to control group whose mean FEV1 was 2.91 ± 0.34 L; however, the FEV1/FVC% did not show statistically significant change. Table 2 shows a statistically significant reduction of PEFR, 480.8 ± 22.14 in Group I but for P value.

Table 1 : Comparison of pulmonary function test between control and study group

Parameters	Control Group II MEAN±SD (n=100)	Study Group I MEAN±SD (n=100)	*P* value	Significance
FVC (L)	3.27±0.33	2.94±0.58	<0.01	Highly significant
FEV1	2.91±0.34	2.67±0.51	<0.05	Significant
FEV1/FVC%	89.93±7.09	90.47±4.89	>0.05	Not significant
PEFR	491.7±17.41	480.8±22.14	<0.05	Significant





DISCUSSION

In the present study, we recorded FVC, FEV1, FEV1/FVC %, and of 40 auto rickshaw drivers and compared with the control of 40 individuals (non auto rickshaw drivers) from the general public who were height, weight, and age-matched with the auto rickshaw drivers. FVC reduction was highly significant in the study Group I whereas FEV1 showed a slight statistically significant reduction, but FEV1/FVC% did not show a reduction. On the contrary, FEV1/FVC% in study group depicted in Table 1 showed slight increase in Group I. This could be because the numerator FEV1 was not significantly reduced as compared to denominator FVC which was significantly reduced. The PEFR values though slightly reduced in the Group I were near the lower limit of the normal predicted values.

The auto rickshaw drivers are exposed to motor vehicle exhaust both from diesel and petrol machines along with other pollutants already existing on roads. Long-term exposure to pollutants has been associated with a decrease in lung function and an increase in respiratory symptoms. Sources of air pollution especially in urban areas are industrial complexes, power plants, and automobiles. The pollutants present in the ambient air, which are harmful to human health have been identified by numerous studies.[16,17] Particulate matter <10 μm in size (PM10), Particulate matter <2.5 μm in size (PM2.5), Oxides of sulfur (SOx), Oxides of nitrogen, Ozone (O_3), Lead (Pb), CO comprise bulk of the traffic pollution.

Oxides of nitrogen present in the ambient air cause injury in the terminal bronchioles, decrease the pulmonary compliance, and reduce the VC. The extremely high ambient concentration of coarse particulate matter <10 μm in size (PM10) was strongly associated with a significant reduction in pulmonary function.[19-23] The study of the effect of ozone on rat lungs showed a strong association between long-term exposure to ozone and restrictive type of lung disease and appeared to have occurred due to the stiffened lung without overt fibrosis. Tropospheric ozone is an oxidant air pollutant formed from oxides of nitrogen and volatile organic compounds in the presence of sunlight. Long-term exposure to ozone produces mainly pulmonary fibrosis, which could be associated with a decrease in FVC.

CO is one of the major pollutants and the toxic effects of CO on respiratory muscles cause muscle weakness in both expiratory muscles and inspiratory muscles leading to restrictive as well as obstructive lung disease. Many studies have reported that airborne iron was possibly associated with a decline in PEFR as iron in airborne particles was known to cause oxidative damage. Ultrafine particles with diameters 0.005–1 μm get deposited on alveolar walls and in the nuclei of the cells by diffusion and retained in lung parenchyma. These small-sized particles are responsible for oxidative stress and mitochondrial damage probably because of their smaller size, larger surface to volume ratio and ability to penetrate the cell interior and localize near mitochondria.

CONCLUSION

The findings of the study show that air pollution has an adverse effect on the ventilatory lung function on chronic long-term exposure to air pollution with the prevalence of the restrictive type of lung disorder. Although some of the parameters were significantly altered in some subjects, suggesting a restrictive type of disorder were apparently asymptomatic. The lungs have a large functional reserve, and the person will become symptomatic only when the lung functions are diminished markedly. A large sample and longitudinal study in this field will definitely be of greater value in predicting the relationship between traffic pollution and ventilatory lung function.

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