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Evaluation of Pulmonary Function in Traffic Policemen

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Abstract

Introduction: The nature of some jobs and the related exposures predispose certain groups of workers to considerably larger risk of developing occupational lung diseases. Occupational lung disorders studies in India have mostly been among industrial workers exposed to occupational hazards. Traffic police, who are continuously exposed to high levels of ambient air pollution, however has attracted less attention. This study was done in this context, among 40 traffic policemen to assess effect of exposure to traffic pollution on pulmonary function. *Aims and Objectives*: To study the pulmonary functions in traffic policemen and to compare the same with matched control group. *Materials and Methods*: In this study pulmonary functions such as FVC, $FEV_{1,}$ FEV_1/FVC, MVV, PEFR parameters were studied in 40 traffic policemen in the age group of 30-45 years. These parameters were compared with matched apparently normal healthy control group selected from general population using unpaired 't' test. *Results*: The present study shows that among traffic policemen and controls, traffic policemen have statistically significant low values of forced vital capacity (FVC) (P=0.0015), Forced expiratory volume in first second (FEV_1) (P=0.0012), FEV_1/FVC (P=0.0001), Maximum Voluntary Ventilation (MVV) (P=0.0153) and Peak Expiratory Flow Rate (PEFR) (P=0.0016). *Conclusion*: There is significant decrement in pulmonary function parameters in the traffic policemen exposed to vehicle exhaust as compared to control group. This reduction in pulmonary function can be detected with spirometry before pulmonary functions are grossly impaired.

Keywords: Traffic Policemen; FEV1; FVC; PEFR; Pulmonary Function.

Introduction

Health of a person is mainly affected by the atmosphere in which they work, thus making occupation an important determinant of health [1]. Air pollution in cities is mainly due to emissions from automobile vehicles. Indian cities are growing rapidly. This has led to an increase in the use of motor vehicles with a subsequent rise in the levels of air pollution. Exposure to air pollutants is known to be harmful to health in general, and to the lungs. Especially traffic policemen are at high risk [2]. Airborne dust constitutes most significant source of ultrafine particles in urban environment. Automobile exhaust is a major hazard for traffic policemen.

Present day urban environment is polluted by vehicular exhaust due to increase in number of automobile vehicles working on diesel and petrol fuels. They emit hydrocarbons, carbon monoxide, lead, nitrogen oxides and particulate matters. Carbon monoxide is one of the common and widely distributed air pollutants produced by incomplete combustion of carbon containing materials. Coarse particle of size more than 2.5 μm usually contains earth's crustal material and fugative dust from vehicular source mainly. Smaller particles less than 2.5 μm contain secondarily formed aerosols, combustion particles and recondensed organic and metal vapours [3].

According to the World Health Organization (WHO), air pollution is responsible for increase in morbidity and mortality due to respiratory diseases [4]. Chronic exposure to air pollution may cause reversible reduction in lung function and can produce symptoms of asthma and chronic obstructive lung disease [5]. Many studies have shown significant reduction of pulmonary function parameters (FVC,

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FEV1, FEV1/FVC% etc) in traffic policemen [2,6,7].

High concentrations of traffic fumes affects urban workers such as traffic policemen, street sweepers, postman, and newspaper vendors, indicating health risks related to outdoor environment.. Traffic policemen are in outdoor environment exposed to dust and other pollutants without any preventive measures makes them susceptible for reduced pulmonary functions [8].

The present study is conducted to evaluate the pulmonary functional status in traffic policemen of Bidar city, Karnataka, India who have exposed to long term vehicular pollution and to compare the findings with normal healthy matched controls.

Materials and Methods

The present comparative cross sectional study was conducted on randomly selected 40 male policemen from those engaged in traffic control in Bidar city, Karnataka, India. A similar number of age and sex matched persons were randomly selected from general population as controls who were not occupationally exposed to ambient air pollution at work place. Strict inclusion criteria was followed which included - age group of 30 to 45 years, service period above 3 years, non-smokers. The informed consent was taken after the detailed procedure and purpose of the study was explained. Ethical committee clearance was taken from ethical committee.

Those with history of chronic respiratory disorders, cardiac disease, systemic disorders affecting respiratory system, mentally handicapped and smokers were excluded from the study. A thorough history taking & clinical examination was carried out to rule out the exclusion criteria and the vital data was recorded.

Various spirometric measurements were made on both control and study groups with a portable, computerized spirolyzer. The recordings were carried out between 10am-12noon. All the manoeuvres were performed in sitting position. Thorough instructions were given to each subject regarding the test and sufficient time was provided to practice the manoeuvres. A soft nose clip was put over the nose to occlude the nostrils and disposable mouthpieces were used to minimize cross infection.

Statistical Analysis

The data obtained were expressed as mean $\pm$ standard deviation and analyzed using the student unpaired t-test. A 'p' value less than 0.05 was considered to be statistically significant.

Results

The recorded anthropometric data in traffic police personnel and control groups did not show any statistical significance as shown in Table 1. The present study shows that among traffic policemen and controls, traffic policemen have statistically significant low values of forced vital capacity (FVC) (P=0.0015), Forced expiratory volume in first second (FEV_1) (P=0.0012), FEV_1/FVC (P=0.0001), Maximum Voluntary Ventilation (MVV) (P=0.0153) and Peak Expiratory Flow Rate (PEFR) (P=0.0016) as shown in Table 2.

Table 1: Anthropometric Data.

Parameters	Traffic Police Mean ± SD	Controls Mean ± SD	P value
Age(yr)	35.30 ± 2.10	36.22 ± 2.16	P=0.0571
Height(cm)	169.33 ± 2.44	168.19 ± 4.24	P=0.1445
Weight(kg)	69.35 ± 6.48	68.66 ± 22.14	P=0.8505
BMI (kg/m^2)	24.15± 40.26	24.09± 42.26	P=0.9948

Table 2: Pulmonary Function Parameters of Traffic policemen and controls

Parameters (Ltrs)	Traffic police Mean ± SD	Controls Mean ± SD	P value
FVC(L)	2.62 ± 2.40	3.10 ± 2.61	P=0.0015
FEV_1(L/sec)	2.12±0.84	2.62±0.42	P=0.0012
FEV_1/FVC (%)	80.91 ± 3.21	84.51 ± 1.21	P=0.0001
PEFR(L/sec)	7.48 ± 0.88	8.34 ± 1.41	P=0.0016
MVV(L)	131.46±22.62	144.42 ±24.10	P=0.0153

Discussion

Traffic police are one of the major groups who are exposed to toxic fumes and exhaust from vehicles throughout their work. Out of the 40 traffic police personnel studied, no one reported the use of an appropriate respirator during their duty hours. Thus

there are many health and safety issues surrounding them as they are involved in traffic control activity in a polluted atmosphere. Health of traffic police personnel, who serves the need of the public, is very important because it could affect the well being of the community. In this regard this study was conducted to evaluate pulmonary functions in traffic police personnel. A computerized portable spirometer was used in this study. Similar spirometers are used in hospitals and research labs to evaluate pulmonary parameters.

Our study clearly shows that among traffic policemen and controls, traffic policemen have statistically significant low values of forced vital capacity (FVC) (P=0.0015), Forced expiratory volume in first second (FEV_1) (P=0.0012), FEV_1/FVC (P=0.0001), Maximum Voluntary Ventilation (MVV) (P=0.0153) and Peak Expiratory Flow Rate (PEFR) (P=0.0016).

We observed significantly low FVC values in traffic policemen as compared to control group. There may be some degree of restriction present in the lungs of study group. This might be due to chronic irritation of lungs by air pollutants. FEV_1 values which denote strength of expiratory muscles were also reduced in the study group than controls possibly due to obstruction of air ways during expiration.

A better indicator of the condition of the bronchial musculature FEV_1/FVC was also reduced significantly in traffic policemen than controls. It indicates that they suffer from combined obstructive and restrictive type of pulmonary disorder. These findings are in agreement with findings of other investigators [9-15].

Maximum voluntary ventilation (MVV) which depend both on the patency of airways and strength of respiratory musculature was significantly low in the study group than the control group. MVV reduction might be due to increased resistance to air movement in the lungs [16].

Peak expiratory flow rate (PEFR) was significantly decreased in case of study group than controls. The PEFR is an effort dependent parameter emerging from the large airways within about 100–120 ms of the start of the forced expiration [17-18] thus indicates the capacity of expiratory muscles. In this study the low PEFR values denote presence of some obstruction during expiration. This is in agreement with the findings of other investigators [2,19,20].

Reduced pulmonary parameters in apparently healthy traffic policemen compared to control group signify the harmful effect of exposure to polluted air on pulmonary function. From this study the exact cause of decreased pulmonary function due to inhalation of polluted air is not clear. But some studies conducted show that inhaled noxious particles and gases cause inflammatory response in the lungs that cause activation of proteinase and inactivation of antiproteinase. This cause destruction of pulmonary parenchyma, increased secretion of mucous and hyperplasia of epithelial cells [21]. The particulate matter of automobile exhaust enters into the trachea and bronchi and deposit there. Particles of less than 2.5 microns can reach the small airways and the alveoli thus may cause lung disorders like asthma, bronchitis, COPD and interstitial lung disease [22].

Conclusion

In the present study, pulmonary function parameters FVC, FEV_1, FEV_1/FVC, PEFR and MVV were significantly reduced in the traffic policemen. Thus it may be concluded that air pollution has harmful effect on pulmonary function of traffic policemen. This is a matter of concern since it may be due to their occupational exposure to vehicular exhaust related air pollution. Periodic medical check up could be made more structured including serial pulmonary function measurements using spirometry to detect those at risk and initiate appropriate preventive measures. Periodic monitoring can detect early signs of dysfunctions and measures including supply of appropriate and acceptable personal protective equipments could be taken. Such interventions will improve the overall health and productivity of a critical work force like the traffic police.

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