Research Article

Intraocular pressure changes in smokers and nonsmokers

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Abstract

Background: Smoking is a known risk factor for several diseases and is a modifiable risk factor for several ocular diseases. Cigarette smoke contains toxic chemicals such as polycyclic aromatic hydrocarbons, tar, carbon monoxide, and heavy metals. Nicotine is a psychoactive component of tobacco that can affect the eye causing cataracts and macular degeneration leading to loss of vision.

Objectives: To see the effects of tobacco smoke on the intraocular pressure and systemic blood pressure and to assess the visual acuity of smokers.

Materials and Methods: A total of 100 male participants between 40 and 60 years were included in the study of which 50 were controls who were nonsmokers and 50 participants grouped as cases had variable smoking history. A questionnaire was given to all participants to obtain information about smoking in terms of number of cigarettes smoked and duration (number of years). Anthropometric measurements were taken to determine their weight in Kg and height in cm. Blood pressure was measured using a sphygmomanometer to obtain both systolic and diastolic pressures. Normal blood pressure was considered as systolic blood pressure between 100 and 140 mmHg and diastolic blood pressure between 60 and 90 mmHg. Pulse rate and respiratory rate were also recorded. Examination of the eye was done to measure their visual acuity using a Snellen's chart and intraocular pressure was measured using Schiotz tonometer.

Results: There was a statistically significant fall in visual acuity and a rise in intraocular pressure with $p < 0.0001$.

Conclusion: It is clear from the study that cigarette smoking causes systemic diseases general and ocular diseases in particular.

KEY WORDS: Smoking, intraocular pressure, visual acuity

Introduction

The World Health Organization (WHO) has declared smoking as a global problem that needs to be solved.[1] Smoking is a well known risk factor for several diseases including cardiovascular and pulmonary disease. Smoking is also known to cause several types of cancers especially oral cancers.[2] Smoking is a modifiable risk factor for several ocular diseases.[3] Cigarette smoke contains toxic chemicals such as polycyclic aromatic hydrocarbons, tar, carbon monoxide, and heavy metals. Nicotine is a psychoactive component of tobacco that affects the nervous system and eye.[4] Some studies have shown that smoking causes cataracts and macular degeneration both of which might lead to loss of vision. Tobacco smoke can cause conjunctival redness, excessive lacrimation, and discomfort.[5,6] Few studies from different parts of the globe have also shown the association of smoking with glaucoma and intraocular pressures (IOP).[7-11] Recent statistics from India have shown that while smoking is very common among men, the rates in women have more than doubled. Not many studies from India are available to show the effects of cigarette smoke

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on intraocular pressure and quality of vision. Ocular hypertension is defined as IOP above 21 mmHg and is a risk factor for open angle glaucoma.[12,13] The aim of this study was to measure the systemic blood pressure, intraocular pressure, and also assess the visual acuity of smokers and compare them with their normal counterparts.

Materials and Methods

A total of 100 male participants between 40 and 60 years were included in the study of which 50 were controls who were nonsmokers and 50 participants grouped as cases had variable smoking history. Subjects with HTN, diabetes, and obesity were excluded from the study. As the effects of smoking on gender are variable, female participants were not included in the study. A questionnaire was given to all participants to obtain information about smoking in terms of number of cigarettes smoked and duration (number of years). Anthropometric measurements were taken to determine their weight in Kg and height in cm. Blood pressure was measured using a sphygmomanometer to obtain both systolic and diastolic pressures. Normal blood pressure was considered as systolic blood pressure between 100 and 140 mmHg and diastolic blood pressure between 60 90 mmHg. Pulse rate and respiratory rate were also recorded. Examination of the eye was done to measure their visual acuity using a Snellen's chart and intraocular pressure was measured using Schiotz tonometer. Normal intraocular pressure ranges between 10 and 21 mmHg. The study was conducted in a medical college in Hyderabad. An informed consent was taken from all the study participants and the Institutes' Ethics committee permission was obtained.

Statistical Analysis

Mean and standard deviation was calculated. Significance was established by performing '*t*-test' using statistical software.

Result

The mean age of group I subjects (controls) was 47.76 years and that of group II (cases) was 51.88 years. The average number of cigarettes smoked was 8.64 per day with ±1.78 SD by group II participants (cases: smokers) [Table 1]. In this study, the mean weight of smokers was less than that of non-smokers. The body weight and body mass index (BMI) was less in smokers [Table 2].

Both the mean systolic and diastolic blood pressures of smokers were found to be higher than nonsmokers. This increase was found to be significant ($p < 0.001$). The mean respiratory rate and pulse rate were also significantly higher in smokers than non-smokers with $p < 0.0001$ [Table 3]. Visual acuity was lower in smokers in both the eyes compared to nonsmokers and the decrease was found to be statistically significant. The intraocular pressure was found to be raised in smokers in both the eyes which was also statistically significant.

Table 1: Anthropometric data of controls and cases

Anthropometric parameters	Group I (Controls) Mean (± SD)	Group II (Cases) Mean (± SD)
Mean weight (Kg)	66.56 (± 5.39)	63.68 (± 10.04)
Mean height (cm)	162.62 (± 6.53)	160.88 (± 6.21)
BMI (kg/m^2)	25.02	24.59

Table 2: Systemic parameters of non-smokers and smokers

Parameters	Non-smokers Group I (Controls) Mean (± SD)	Smokers Group II (Smokers) Mean (± SD)	*P*-value Significance
Mean SBP (mm of Hg)	126.4 (± 6.31)	135.8 (± 10.51)	<0.0001
Mean DBP (mm of Hg)	83.6 (± 5.9)	92.6 (± 6.9)	<0.0001
Respiratory Rate (breaths /min)	16.08 (± 2.32)	17.5 (± 1.65)	<0.0006
Pulse (rate/min)	88 (± 8.21)	96.24 (± 8.29)	<0.0001
Body temperature (°)F	98.6 (± 0.56)	98.81 (± 0.78)	0.125

Table 3: Visual function parameters in non-smokers and smokers

Eye parameters	Group I (Controls) Mean (± SD)	Group II (Cases) Mean (± SD)	*P*-value (Significance)
Visual acuity right eye	7.14 (± 1.47)	9.54 (± 2.62)	<0.0001
Visual acuity left eye	7.92 (± 1.98)	9.9 (± 2.28)	<0.0001
Intaocular pressure right eye (mm of Hg)	19.38 (± 1.5)	23.65 (± 1.4)	<0.0001
Intraocular pressure left eye (mm of Hg)	19.39 (± 1.53)	23.46 (±1.46)	<0.0001

Discussion

Smoking has a significant effect on both systemic and ocular parameters of the body. In this study, the mean weight of smokers was less than that of nonsmokers which is in accordance with previous studies done. Several studies have shown that the body weight and body mass index (BMI) was less in smokers.[14] Smoking could lead to weight loss due to increase in the metabolic rate and reduced appetite. Smoking also tends to cause a rise in energy expenditure.[15] Cigarette smoke activates mechanism that cause atherosclerosis such as thrombus formation, vascular inflammation, and disruption of endothelial homeostatic functions. The polycyclic aromatic hydrocarbons are particularly responsible for atherogenesis. Nicotine causes a rise in catecholamines leading to a rise in heart rate and blood pressure. The carbon monoxide in cigarette smoke especially in chronic smokers causes structurally irreversible damage leading to a rise in blood pressure which is in accordance with other previous studies.[16,17] This effect also increases platelet aggregation, thrombus formation, and release of growth factors that lead to vascular smooth muscle cell proliferation. Smoking also promotes macular degeneration by interfering with blood flow to retina causing deterioration of macula leading to disturbed central vision.

Ocular hypertension occurs when the IOP is >21mmHg in the absence of optic nerve damage or visual field loss.[18] Our study shows an increase in IOP in smokers which is in accordance with studies done earlier.[19] Studies have shown that there occurs a reduction in choroidal blood flow by a single inhalation of cigarette smoke.[20] It is thought that this reduction in blood flow in the peripheral ocular circulation might elevate IOP which may occur due to an increase in the outflow resistance of the aqueous humor.[21]

This study has clearly established a link between smoking and changes in systemic and ocular parameters. However, a much larger sample size and follow up would be needed to compare the pathological changes between smokers and nonsmokers in a more efficient way that would substantiate the finding of our study, which is the main limitation.

Conclusion

Based on the findings of the study, it maybe concluded that awareness needs to be created among the population about the ill effects of smoking in general and its effects on vision in particular.

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