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The Relation between Smoking and Intraocular Pressure

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Abstract
Background: Tobacco use has escalated into a major public health crisis, says the World Health Organization. Tobacco use is directly responsible for the deaths of more than 6 million people every year, out of an estimated 1.3 billion smokers globally. This research set out to compare the average intraocular pressure (IOP) of people who smoke now, have smoked in the past, and have never smoked to see whether there is any connection between the two. Methods: The participants in this observational cross-sectional research were divided into three (3) groups: The first group, G1, consists of 75 patients who do not smoke. The second group, G2, contains 75 patients who have smoked in the past year or more. The third group, G3, contains 75 patients who have smoked in the last year or more. The results showed that the non-smoker, past-smoker, and smoker groups were significantly different according to IOP. Patients with diabetes mellitus alone, hypertension (HTN) alone, diabetes mellitus plus hypertension (DM+HTN), and no comorbidities were significantly different from one another, according to IOP data. An increase in intraocular pressure was significantly associated with smoking, as we can see from the data.

Key words : Subjects; Intraocular Pressure; Glaucoma; Current Smokers; and Smoking.

1-Introduction

According In recent years, smoking has emerged as a major public health concern, according to the World Health Organization. Every year, tobacco causes the deaths of more than 6 million people among the world's 1.3 billion smokers [1]. There has been little research on the impact of smoking on eye illnesses like glaucoma, but there is evidence that smoking is associated with a number of other serious noncommunicable diseases, including lung disease, cardiovascular disease, and others. The gradual optic nerve degradation and visual field loss that define glaucoma are symptoms of a range of diseases. The majority of cases of glaucoma are primary open-angle glaucoma (POAG), which impacts 60 million individuals globally [2]. As the leading cause of permanent blindness, it ranks second globally. The pathophysiology of high intraocular pressure (IOP), the only known modifiable risk factor, is currently poorly understood (3). Because it reduces blood flow to the optic nerve head [4] and because smoking causes atherosclerotic plaques and intimal thickening [5] to occlude the arterial Lumina, many researchers think that POAG originates in the blood vessels.

Smoking causes significant levels of oxidative stress due to the free radicals produced by oxidizing chemicals {6}, and glaucoma is known to harm trabecular meshwork cells (TMC) and retinal ganglion cells (RGC), which involves inflammatory and apoptotic pathways. Tobacco smoking is regarded as a modifiable risk factor {7}, suggesting that it may be implicated in the pathogenesis of POAG along with other risk factors, such as advancing age, a family history of glaucoma, and African ancestry. The fact that this opens the door to the prospect of illness management by behavioral changes is significant. Efforts in public health to strengthen anti-smoking initiatives lend credence to this concept. The evidence linking glaucoma and tobacco use is still up for debate, but {8}. Heavy smoking may increase the incidence of POAG, according to a recent systematic study {9}. This research set out to compare the average intraocular pressure (IOP) of current smokers, ex-smokers, and never-smokers to see whether there was any association between the two.

2-Patients and methods

The ophthalmology unit of Benha University Hospital in Benha, Egypt, where the observational cross-sectional study was conducted.

In order to get informed permission, we had all patients' relatives or guardians sign a paper. The study was approved by the Institutional Review Board (IRB) of Benha University's Faculty of Medicine, therefore it complies with all ethical requirements.

All participants needed to meet three criteria: they needed to be 18 or older, they needed to have smoked for at least a year (at a suggested rate of 10–20 cigarettes per day), and they needed to have been smoke-free for at least that long.

We excluded patients who had any ocular or systemic diseases that may have an effect on intraocular pressure.

Grouping: Each patient was assigned to one of three{3} groups: There are three groups of

patients: 75 in Group 1 (G1) who do not smoke, 75 in Group 2 (G2) who smoked in the previous year but not in the last twelve months, and 75 in Group 3 (G3) who smoke presently but smoked in the last twelve months.

Each of the examples that were investigated had the following applied to them: The patient's medical history should include their age, gender, a rundown of any neurological, metabolic, or systemic diseases they may have had in the past or present, a record of their smoking habits (including the number of cigarettes smoked daily and the duration of smoking), and any pertinent family medical history. Trauma to the eye or previous intraocular surgery are all part of the patient's ocular history. Thorough eye examinations, which include a standard checkup that includes a visual acuity test using Landolt's broken ring chart. The Japanese-made Nidek-ARK-510A automated refractometer was used to examine the patient's refractive condition and best-corrected visual acuity (BCVA). Slit-Lamp microscopic examination, Dilated fundus examination. Analysis of eye movement.The intraocular pressure is measured using the Goldman applanation tonometer (Haag-Streit). The product is 90° Swiss made.

Intraocular pressure measurement

After the drops of local anesthetic have been applied, add the fuorescein solution. Just a little amount of fuorescein is needed. When taking an intraocular pressure (IOP) reading, adjust the tonometer such that the slit beam enters the eye from the patient's right side for the right eye and the left eye. To generate a blue beam, just reposition the filters and activate the blue filter. Maximize the light's brilliance and spread it out to its fullest possible angle. This makes it easier to see the fluorescein rings with the slit diaphragm fully extended. The first step is for the patient to stand up straight, eyes wide open, head up, and completely motionless. Avoid putting undue pressure on the patient's eyes when you delicately raise their top eyelid with your thumb. Under the blue light of the slit lamp, set the prism head. Keep your eyes directly above the tonometer head at all times. Make slow, steady progress with the tonometer until its prism just brushes against the middle of the cornea.

To compensate, turn the calibrated dial of the tonometer clockwise with the other hand until the two fluorescein semicircles in the prism head form a horizontal 'S' shape. Meeting at the inner boundaries is the correct endpoint for the two fluorescein semicircle photographs. Make a note of the number that shows on the dial. Get the prism from the cornea and give its tip a good cleaning. Repeat the process with your second eye. After cleaning the prism with a dry, clean swab, return it to the disinfection bottle.

Statistical analysis

Recorded SPSS Inc.'s (Chicago, Illinois, USA) statistical tool for the social sciences, version 25, was used to analyze the data. The mean ± standard deviation (SD) was used to represent the quantitative data. Qualitative data was presented using percentages and frequencies. Using a chi-square test, we compared the groups based on qualitative data. To determine how closely related two groups of variables were, we utilized Pearson's correlation coefficient (r) test. A 95% confidence interval and a 5% margin of error were both approved. Statistical significance was determined by a two-tailed P value less than 0.05.

3-Results

there When comparing the non-smoker, past-smoker, and smoker groups according to sex, there was a very significant difference, but no such difference when looking at age or comorbidities. There was no statistically significant difference between the non-smoker, previous smoker, and smoker groups according to visual acuity tests (Table 1). Table 2: The results show that the non-smoker, past-smoker, and smoker groups differed significantly according to IOP. Patients with diabetes mellitus alone, hypertension (HTN) alone, diabetes mellitus plus hypertension (DM+HTN), and no comorbidities were significantly different from one another, according to IOP data. There was a highly statistically significant difference between patients with a smoking duration of 20 years or less and patients with a smoking duration of 20 years or more, according to Table 3, which indicates the relationship between IOP and smoking duration. There was a significantly significant difference between patients who smoked 15 cigarettes or more per day and those who smoked less than 15 cigarettes per day, as determined by IOP in proportion to cigarettes per day. There was no statistically significant difference between men and females in the smoking group according to IOP in association with gender (Table 4). Section 5

Table(1) shows the distribution of demographic and comorbidity data across study groups.

	Non Smoker N=75		past smoker N=75		Smoker N=75		P-value
Age	48.46± 15.76		46.85± 14.49		50.56± 16.05		0.746
Sex							
Female	48 (64%)		16 (21.33%)		20 (26.67%)		≤0.001*
Male	27(36%)		59 (78.67%)		55 (73.33%)		
Comorbidities							
	N	%	N	%	N	%	0.974
HTN+DM	10	13.33	13	17.33	13	17.33	
DM	7	9.33	10	13.33	10	13.33	
HTN	14	18.67	8	10.67	7	9.33	
NO	44	58.67	44	58.67	45	60	

*: statistical significance is defined as a P value below 0.05.

Table (2) Visual Acuity Left and Right Distribution Among Research Groups

	Non Smoker N=75		past smoker N=75		Smoker N=75		P-value
	N	**%**	**N**	**%**	**N**	**%**	0.130
6/60 (.1)	٦	٨	8	10.67	٧	9.33	
6/36 (.17)	١١	14.67	7	9.33	١٢	16	
6/24 (.25)	٣	4	٣	4	٨	10.67	
6/18 (.33)	10	13.33	٧	9.33	١١	14.67	
6/12 (.5)	13	17.33	٢٣	30.67	٢٣	30.67	
6/9 (.67)	١٨	24	١٧	22.67	10	13.33	
6/6 (1)	١٤	18.67	10	13.33	٤	5.33	
Visual Acuity Left							
6/60 (.1)	٤	5.33	7	9.33	7	9.33	0.262
6/36 (.17)	9	12	6	٨	8	10.67	
6/24 (.25)	١١	14.67	7	9.33	16	21.33	
6/18 (.33)	5	6.67	9	12	10	13.33	
6/12 (.5)	١٤	18.67	18	24	19	25.33	
6/9 (.67)	16	21.33	16	21.33	9	12	
6/6 (1)	16	21.33	12	16	6	٨	

P value <0.05 indicates statistical significance.

Table (3) Intraocular pressure distribution across research groups and comorbidity distribution

	Non Smoker N=75	past smoker N=75		Smoker N=75	P-value
IOP	12.56± 2.60	12.80± 2.62		15.33± 2.70	≤0.001*
	DM only N=27	**HTN only N=29**	**DM+ HTN N=36**	**No comorbidities N=133**	**P-value**
IOP	14.16± 2.33	14.55± 2.55	15.95± 2.30	12.58± 2.79	≤0.001*

P value <0.05 indicates statistical significance.

Distribution of intraocular pressure (IOP) in relation to smoking duration and cigarettes per day (Table 4)

	Duration of Smoking ≤20 N=٤٢	Duration of Smoking >20 N=٣٣	P-value
IOP	14.32± 2.55	16.62± 2.35	≤0.001*
	Cigarettes/Day ≥١٥ N=٢٨	Cigarettes/Day <١٥ N=٤٧	**P-value**
IOP	17.05± 2.06	14.30± 2.53	≤0.001*

*: significantly significant as P value <0.05

Distribution of intraocular pressure (IOP) by gender in the smoking population (Table 5).

	males N=56	females N=19	P-value

IOP	15.27±2.70	15.5± 2.79	0.751

4-Discussion

Smoking generates a great deal of suffering and mortality on a global scale. Death rates are three times higher for middle-aged smokers compared to nonsmokers of the same age, education level, alcohol use, and body mass index who do not smoke. Between 2000 and 2050, 450 million people will die prematurely due to tobacco usage, with almost half of those deaths happening among those under the age of 30 {10}

There was no statistically significant difference in age between the non-smoker, past-smoker, and smoker groups when comparing them according to sex in this research.

In a research comparing average intraocular pressure (IOP) among current, former, and never smokers, Lee et al. used the American Academy of Ophthalmology Intelligent Research in Sight (IRISR) Registry; our results are consistent with theirs. The patients were divided into three categories: current smokers, past smokers, and never smokers. The International Classification of Diseases, Ninth and Tenth Edition codes were used to distinguish between patients with and without a glaucoma diagnosis. A mean reading was used to determine the IOP. To determine if there is a correlation between smoking and increased intraocular pressure (IOP), we ran a multivariate linear regression analysis and stratified descriptive data by glaucoma prevalence. Despite demonstrating a statistically significant gender gap, the authors failed to find a comparable age gap across the groups they examined {11}.

Also, Mukherji et al. who study the correlation between male smokers and high IOP. We included 60 adult male patients in our research; 31 (Group A) had a high intraocular pressure (IOP) of 21 mm Hg or more, coupled with other clinical characteristics; 29 (Group B) were healthy and had a normal IOP ranging from 10 to 21 mm Hg. The participants in Group A ranged in age from 41 to 69 years old, with an average age of 58.11 ± 4.56 years. In Group B, the average age was 56.28 ± 4.32 years, with a range of 41 to 69 years. Among all the participants, 28 people (or 47% of the total) were found to be smokers {12}.

The study concluded that, on average, people smoked 22.17±10.55 cigarettes per day and 11.53±5.54 total cigarettes based on smoking data.

This study's findings showed that current smokers, ex-smokers, and non-smokers all differed significantly from one another in terms of intraocular pressure (IOP).

Consistent with our results, Lee et al. discovered that current smokers (15.8% of the sample) had slightly higher mean intraocular pressures (16.34 mm Hg) than nonsmokers (16.04 mm Hg). Intraocular pressure (in the right eye) was significantly associated with current smoking when age and sex were considered (13).

Patients with diabetes mellitus (DM) and hypertension (HTN) or DM with no comorbidities had substantially different intraocular pressures (IOPs) and comorbidities.

The connection remained when researchers Lee et al. {13} controlled for other variables associated with intraocular pressure, such as diabetes, myopia, glaucoma, and family history.

A very significant difference was identified between patients whose smoking duration was 20 years or less and those whose smoking duration was 20 years or more, according to this study's analysis of IOP in connection to smoking duration.

According to IOP as a function of cigarette use, there was a statistically significant difference between patients who smoked fifteen cigarettes or more daily and those who smoked fifteen cigarettes or less daily.

The results are in agreement with those of Mukherji et al. {12}, as we observed a link between the number of years smoked and IOP (P=0.044), but no association between the number of packs smoked per day and IOP (P=0.309).

There was no statistically significant difference between the sexes in terms of intraocular pressure (IOP) in this study's smoking group.

Consistent with the results of Lee et al. {9}, we did not observe a statistically significant difference in intraocular pressure between the sexes.

Furthermore, it was discovered by Yoshida et al. {14 }that smoking causes an increase in intraocular pressure (IOP) in middle-aged and older Japanese males.

5-Conclusion

Smoking was significantly associated with an increase in intraocular pressure, according to our results.

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Author contribution

When it came time to write the study, each author had an equal voice.

Conflicts of interest

Absence of any potential bias

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