

RESEARCH ARTICLE

Relationship between intraocular pressure and body mass index

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ABSTRACT

Background: Glaucoma is a potentially blinding disease and is the second leading cause of blindness after cataract. It is a neurodegenerative disease of the optic nerve characterized by accelerated ganglion cell death, axonal loss, optic nerve damage, and eventually visual field loss. The most important and probably the only modifiable risk factor for glaucoma is raised intraocular pressure (IOP). Various modifiable risk factors such as socioeconomic status, diet, exercise, body mass index (BMI), and smoking have been implicated in the pathogenesis of glaucoma. There are very little data available regarding the relationship between BMI and IOP, more so in our setup, therefore, the need for the present study.

Aims and Objectives: This study aims to study the relationship between IOP and BMI. **Materials and Methods:** This is a case-control study which was conducted on 40 outdoor patients attending Al-Kabir Eye Care Centre. Informed written consent was taken from all the subjects that fulfilled the inclusion exclusion criteria and then a detailed ophthalmological examination was done. Their height and weight were measured and BMI was calculated. The association between IOP and BMI was studied by Chi-square test. **Results:** Our results show a strong positive association between BMI and IOP. **Conclusion:** Higher BMI is a risk factor for higher IOP. Therefore, one must adapt a healthy lifestyle, eat balanced diet, do some sort of exercise, and keep ones weight under check so as to avoid many health hazards of obesity including ophthalmological disorders like glaucoma.

KEY WORDS: Intraocular Pressure; Body Mass Index; Lifestyle Modification; Glaucoma

INTRODUCTION

Glaucoma is a potentially blinding disease and is the second leading cause of blindness after cataract.^[1] It is a neurodegenerative disease of the optic nerve characterized by accelerated ganglion cell death, axonal loss, optic nerve damage, and eventually visual field loss. It may be classified

as congenital and acquired; open-angle and angle-closure glaucoma; and primary and secondary glaucoma. Primary open-angle glaucoma (POAG) is more common affecting 1 in 100 over the age of 40 years. It is predominantly a disease of the elderly. However, there is a lack of a single tool that evaluate all facets of prescription quality and which can be used to measure the quality of prescription in chronic diseases. It often goes undetected till an advanced stage is reached. Glaucoma symptomatology may vary from a headache to hazy vision, blurring of vision, halos, etc. Diabetes mellitus, central retinal vein occlusion, and history of myopia are some of the associated risk factors. The most important and probably the only modifiable risk factor for glaucoma is raised intraocular pressure (IOP). The normal IOP is 11–21 mmHg. Women and elderly people tend to have higher IOP. It is estimated that

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approximately 7% of population above the age of 40 years have IOP >21 mmHg without any obvious glaucomatous damage on clinical examination.^[2-5] The Baltimore eye study and the Barbados eye study have documented a positive association between IOP and POAG. As per the Baltimore eye study, the risk of POAG increases 39 times if IOP is >35 mmHg as compared to the reference group with IOP of >17 mmHg.^[6,7]

At present, several studies are being done to ascertain the role of different lifestyle modifications that could influence IOP and possibly alter the progression of glaucoma. Various modifiable risk factors such as socioeconomic status, diet, exercise, body mass index (BMI), smoking, and sleep apnea have been evaluated.^[7-9] Furthermore, obesity is being linked to glaucoma. Obesity, which is emerging as a new epidemic in many countries and is the fifth leading cause of deaths worldwide, is not only a risk factor for many systemic ailments such as diabetes mellitus, hypertension, myocardial infarction, stroke, and osteoarthritis but the role of obesity has also been implicated in the pathogenesis of various ocular conditions such as age-related cataract, age-related maculopathy, diabetic retinopathy, and glaucoma.^[10-13] The Beaver Dam Eye Study has also suggested a significantly positive relationship between higher IOP and higher BMI.^[14]

In 2008, >1.4 billion adults above the age of 20 years were overweight. In 2010, >40 million children under the age of 5 were overweight. Obesity is expressed in terms of BMI which is defined as weight in kilograms (Kg) divided by the square of height in meters. Obesity is classified as BMI >30.^[10,11]

There are very little data available regarding the relationship between BMI and IOP, more so in our setup, therefore, the need for the present study. Since BMI is a modifiable risk factor, effective inexpensive lifestyle modifications that could favorably alter the risk of developing glaucoma would certainly be welcome. The visual loss due to glaucoma is irreversible; therefore, early detection and timely treatment is crucial in its management.

Therefore, the aim of the present study is to find the relation, if any, between BMI and IOP.

MATERIALS AND METHODS

This is a case-control study which was conducted on the outdoor patients attending Al-Kabir Eye Care Centre, Srinagar, from December 2018 to January 2019 ($n = 40$) after obtaining permission from the institutional ethical committee. Informed written consent was taken from all the subjects that fulfilled the inclusion-exclusion criteria.

Inclusion Criteria

Known cases of glaucoma on treatment and newly diagnosed cases of glaucoma were included in the study. Diagnosis of glaucoma was made by a single ophthalmologist after detailed

ophthalmological examination. Age- and gender-matched patients without history of glaucoma were taken as controls. Height was measured in meters and weight was measured in kilograms (Kg), and then, BMI was calculated as weight in Kgs divided by height in meter square. Based on the BMI, individuals were classified as underweight (BMI <18), normal (BMI 18.5–24.9), overweight (BMI 25–29), and obese (BMI >30).

Statistical Analysis

The association between BMI and IOP was studied using Chi-square test.

RESULTS

Of the 40 subjects enrolled for the present study, none was underweight, nine of them had a normal BMI, 23 were overweight (BMI 25–29.9), and eight were obese. Our results show that people with higher BMI had raised mean IOP (at least in one eye) and this difference was statistically significant ($P < 0.05$) as shown in Table 1.

DISCUSSION

Our study shows a positive association between BMI and IOP. Higher BMI is a risk factor for raised IOP levels and, therefore, for glaucoma.

The study by Louisraj *et al.*, on 200 outpatient department patients, has shown that there is a statistically significant association between BMI and IOP ($P < 0.004$) and women were found to have higher IOP than men.^[15] Baisakhiya *et al.* in their study found that increasing age and higher hip-waist ratio are potential risk factors for higher IOP, but there is no difference in the IOP of males and females.^[16] George and Ajali in their study found a statistically significant positive association between BMI and IOP, BMI and blood pressure, and BMI and age in overweight and obese individuals ($P < 0.001$).^[17] A strong positive association between BMI and IOP has been shown by many other researchers' also.^[18-22]

A clear understanding of the association between IOP and BMI is still lacking; however, it is postulated that due to obesity,

Table 1: Relationship between intraocular pressure and BMI

BMI	IOP mmHg (right eye)		IOP mmHg (left eye)		IOP mmHg (mean)	
	<21	>21	<21	>21	<21	>21
<18.5						
18.5–24.9	8	1	8	1	8	1
25–29.9	13	10	14	9	13	10
>30	1	7	1	7	1	7
P value	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05

IOP: Intraocular pressure, BMI: Body mass index

there is excessive intraorbital adipose tissue, increased blood viscosity, increased episcleral venous pressure, and impaired aqueous outflow.^[4,18,19]

However, there are some researchers who have found results contradictory to ours.^[23,24]

Limitations

Small sample size, however, remains a limitation of the present study.

CONCLUSION

Higher BMI is a risk factor for increasing IOP and, hence, for glaucoma too. Therefore, the authors strongly advocate incorporating activities consistent with overall well-being such as quitting cigarette smoking, consuming healthy diet rich in antioxidants, doing some form of exercise, and keeping one's body weight under check.

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