

Correlation Body Mass Index, Blood Pressure and Intraocular Pressure in Obesity

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Abstract

Intraocular pressure is fluid pressure inside the eye. Elevated IOP is an important risk factor in obesity. Obesity does not only risk factor of elevated intraocular pressure, but also increase risk in elevated blood pressure. An increase Body Mass Index also significantly associated with increase blood pressure. This study investigate the correlation between body mass index, blood pressure and intraocular pressure in obesity. A prospective, analytical observational with cross sectional design was conducted at Sumatera Utara Universitas Hospital from July 2017 to August 2017 after approved by the Ethics Committee for Health Research Medical Faculty Universitas Sumatera Utara. Fifty six patients diagnosed with obesity were evaluated. Obesity was measured by using Body Mass Index, while Body Mass Index was calculated as body weight (kg) divided by height (m) squared, blood pressure was measured by using GEA mercurial sphygmometer and Litmann Stethoscope, and Intraocular Pressure was measured by Non-contact tonometer TOPCON CT-80A (Tokyo, Japan). There was a significant correlated between intraocular pressure with obesity ($p < 0,05$) and significant correlated between intraocular pressure and blood pressure ($p < 0,05$). Elevated Intraocular pressure and blood pressure is a risk factor in obesity

Keyword: *obesity, intraocular pressure, blood pressure, body mass index*

Introduction

Intraocular pressure is fluid pressure inside the eye.[1] Although intraocular pressure (IOP) is considered to be a major risk factor for glaucoma, there is considerable evidence suggest that glaucoma may continue to develop despite lowering the patient's IOP to target levels. Several studies have looked at the presence of vascular risk factors in the pathogenesis of glaucoma. Among the vascular risk factors are blood pressure and blood flow perfusion pressure.[2] In addition to blood pressure, weight is more especially obesity is also one of the risk factor to elevated intraocular pressure.[3] Obesity is a condition that is associated with having an excess amount of body fat, defined by genetic and environmental factors that are difficult to control

when dieting. Obesity does not only constitute an increase of intraocular pressure, but obesity also a risk factor of hypertension, diabetes mellitus, stroke, and sleep apnoe syndrome. Obesity can also caused of eye diseases such as cataract, glaucoma, diabetic retinopathy and age macular degeneration.[4,5,6,7] World Health Organization (WHO) estimates in 2000, there are 35% adults over 20 years have an overweight, while about 10% of men and 14% of women suffer from obesity.[8] Based on background, so the purpose of this study is to investigate correlation between body mass index, blood pressure and intraocular pressure in obesity.

Materials and Methods

Study Design

This was a prospective, cross sectional study were recruited consecutively at Universitas Sumatera Utara Hospital, Indonesia comprising with obesity patients from June 2017 to August 2017. The study was conducted in accordance with the ethical standards of Declaration of Helsinki and approved by Universitas Sumatera Utara Ethics Committee. A written informed consent was obtained from all patients by the researchers

Subjects

The study was conducted on 56 obesity patients and divided into two groups, 33 patients in obesity grade 1 if body mass index $25-29,9 \text{ kg/m}^2$ and 23 patients in obesity grade 2 if body mass index $>30 \text{ kg/m}^2$. The obesity patients referred from Nutritional Department. All subjects underwent measured of body mass index, blood pressure by GEA mercurial sphygmometer and Litmann stethoscope, and intraocular pressure by non-contact tonometry TOPCON CT-80A (Topcon, Tokyo, Japan)

Inclusion criteria: We included patients who fulfilled the following criteria: obesity patients and age >18 years old. Exclusion criteria: eye infection, glaucoma, hypertension, diabetes mellitus, taking of steroid

Measurement of BMI

Body Mass Index is one the most specific and objective measurement to define obesity was calculated as weight (kg) divided by heigh (m) squared. BMI of each subject was categorized using World Health Organization categorization. (Obese grade 1: BMI $25,0-29,9 \text{ kg/m}^2$, Obese Grade 2: BMI: $>30 \text{ kg/m}^2$)

Measurement of Blood Pressure

Blood pressure is measured by GEA mercury sphygmometer. First, a cuff is placed around arm an inflated with a pump until the circulation is cut off. A small valve slowly deflates the cuff, and doctor measuring blood pressure uses a stethoscope, place over arm, to listen for the sound of

blood pulsing through the arteries. That first sound of rushing blood refers to the systolic blood pressure, once the sound fades, the second number indicates the diastolic pressure, the blood pressure of heart at rest. Blood pressure is measured in millimeter of mercury (mmHg) and recorded with the systolic number first, followed by the diastolic number.

Measurement of Intraocular Pressure

A non-contact tonometer (TOPCON CT-80A, Topcon, Tokyo, Japan) was used to measure the eye pressure. After the measurement is triggered, the tonometer send an air pulse to the eye with a pressure profile. The time dependent pressure profile and peak pressure were evaluated in advance.

Statistical Analysis

The collected data write in the research publication and keep in the computer analysed by using the statistical software. Fischer Exact test was used to analyse between obesity, blood flow and intraocular pressure. Statistical analyses were performed with SPSS 19,0 and the level significance was $p < 0,05$.

RESULT

The study was conducted from June 2017 to August 2017 in fifty six patients with obesity

Table 1. The demographic parameters from 56 patients with obesity

Characteristic		N	%
Sex	Male	27	48,2
	Female	29	51,8
Age	20-29	41	73,2
	30-39	10	17,9
	>40	5	8,9
Obesity	Grade 1	33	58,9
	Grade 2	23	41,1
BloodPressure	Normal (<120/90mmHg)	28	50
	Pre Hipertensi (>120/90 mmHg)	28	50
Intraocular Pressure	Normal (<21 mmHg)	47	83,9
	Higher (>21 mmHg)	9	16,1

Table 2. Correlation between body mass index with intraocular pressure

BMI/Obese	IOP						
	Normal		Mean	Higher		Mean	P
	N	%		N	%		
Grade 1	29	51,8	16,24	2	3,6	23,4	0,013*
Grade 2	18	32,1	17,05	7	12,5	25,1	

From table 2, there was significantly differences between body mass index and intraocular pressure in obesity ($p < 0,05$)

Table 3. Correlation Blood Pressure and Intraocular Pressure

Blood Pressure	IOP						P
	Normal		Mean	Higher		Mean	
	N	%		N	%		
Normal	28	50,0	15,76	3	5,3	22,25	0,042*
Pre Hypertension	19	34,0	16,53	6	10,7	23,97	

From table 3, there was significantly differences between blood pressure and intraocular pressure in obesity ($p < 0,05$)

DISCUSSION

Potential pathological link between obesity and intraocular pressure has been proposed. Based on our study showed obesity grade 1 with normal IOP 29 patients and obesity grade 1 with elevated IOP 2 patients, while obesity grade 2 with normal IOP 18 patients and obesity grade 2 with elevated IOP 7 patients and from the statistical analysis, there was a significant differences correlations between body mass index and intraocular pressure ($p < 0,05$). These study is suitable with the study of Gindah and Ikhlas, 2009 in Jogjakarta where they conducted a relationship between body mass index and intraocular pressure in normotensive subjects.[9] Zafar in Pakistan was investigated correlation between body mass index and intraocular pressure in adults, and found significance differences between body mass index and intraocular pressure, especially in adults.[10]

The proposed mechanism while IOP may be elevated due to excess intraorbital fat tissue leading to increased episcleral venous pressure and subsequently decreased aqueous outflow facility. Obesity increases blood viscosity through increasing red cell count, haemoglobin, haematocrit and consequently increasing outflow resistance of episcleral vein.[11,12,13]

From this study found a significant differences correlations between blood pressure and intraocular pressure in obesity patients ($p < 0,05$). This study suitable with Tina et al study in 2009, where they conducted a study on relationship between intraocular pressure with age, blood pressure and central corneal thickness.[14] Also in Bravian et al study, India, from the two groups normotensive and hypertensive criteria found the correlation between blood pressure and intraocular pressure.[15] In the Beaver Dam longitudinal Eye study of Klein et al (2005), the relationship between intraocular pressure and systemic blood pressure was investigated and

studies showed there was significant correlations between changes in systemic blood pressures and changes intraocular pressure over five years of the study. Blood pressure has been found to increase with age in most populations. The positive correlation suggested that rising in systemic blood pressure caused increase IOP by increasing ciliary artery pressure and ultrafiltration of the aqueous humor.[16] In the light of our findings and the evidence from previous reports confirms that the importance of weight control in preventing increased of IOP and blood pressure. But further studies are needed to prospective longitudinal clinical trials on larger populations and longer times to conclude the exact role of mechanism risk factor obesity caused elevated intraocular pressure and elevated blood pressure and the other effects obesity in eye.

Acknowledgment

The authors are deeply indebted to Faculty of Medicine University Sumatera Utara for providing equipment and scientific apparatus.

Conflict of Interest

The authors declare that there are no conflicts of interest

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