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Research Article

The Relationship Between Degrees of Myopia and Intraocular Pressure at dr. Wahidin Sudirohusodo Mojokerto Hospital

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ABSTRACT

Myopia is a common refractive disorder, and its prevalence continues to rise globally, including in Indonesia. In young adults over 21 years of age, the prevalence of myopia with a refractive error greater than -0.5 D reaches 48.1%. Myopia has been associated with various ocular complications, including elevated intraocular pressure (IOP), which has been associated with vision impairment. This study aims to analyze the relationship between the degree of myopia and intraocular pressure in myopic patients. This study employed a cross-sectional design with consecutive sampling of myopic patients at Dr. Wahidin Sudirohusodo Hospital Data from medical records and direct examination. Chi square correlation analysis revealed a significant relationship between the degree of myopia and intraocular pressure. In the right eye, the p-value was 0.03 ($p < 0.05$), while in the left eye, it was 0.01 ($p < 0.05$). Patient characteristics showed that the majority were female (69.6%), and most patients were young adults aged 21–40 years (79.7%). There is a significant relationship between the degree of myopia and intraocular pressure at Dr. Wahidin Sudiro Husodo hospital.

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RESULTS

Respondent consists of 21 male patients (30.4%) and 48 female patients (69.6%), 14 patients (20.3%) in the 17–20 age range and 55 patients (79.7%) in the 21–40 age range. The largest number of samples falls within the 21–40 age group, accounting for 79.7% of the total. All respondents were found to have an increased axial length, ranging from 23.6 mm to 26.1 mm in biometric measurements. From 48 patients (69.6%) were diagnosed with mild myopia, 19 patients (27.5%) with moderate myopia, and 2 patients (2.9%) with severe myopia in the left eye. In the right eye.45 patients (65.5%) had mild myopia, 21 patients (30.4%) had moderate myopia, and 3 patients (4.3%) had severe myopia. In the right eye, 38 patients with mild myopia had normal intraocular pressure, while 7 patients with mild myopia had elevated intraocular pressure. Among patients with moderate myopia, 10 had normal intraocular pressure and 11 had elevated intraocular pressure. Only one patient with severe myopia had normal intraocular pressure, while 2 patients with severe myopia had elevated intraocular pressure. A chi-square test was conducted to determine the relationship between the degree of myopia and intraocular pressure in the right eye, resulting in a p-value of 0.003 ($p < 0.05$), indicating a significant relationship between the degree of myopia and intraocular pressure in the right eye.

Based on Table 1, for the left eye, 40 patients with mild myopia had normal IOP and 8 had elevated IOP. In the moderate group, 9 had normal IOP and 10 had elevated IOP. Both patients with severe myopia had elevated IOP. The chi-square test also indicated a significant relationship between myopia degree and IOP in the left eye ($p = 0.001$).

Table 1. *Chi-square* analysis of right eye

Right Eye	IOP		Total	*P-Value*
	Normal	Increase		
Mild myopia	38	7	45	0,003
Moderate myopia	10	12	21	
High myopia	1	2	3	
Total	49	20	69	

Table 2. *Chi-square* analysis of left eye

Left Eye	IOP		Total	*P-Value*
	Normal	Increase		
Mild myopia	40	8	48	0,001
Moderate myopia	9	10	19	
High myopia	0	2	2	
Total	49	20	69	

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Based on table 2, the results of the chi-square test carried out to determine the relationship between the degree of myopia and intraocular pressure above, obtained a p-value of 0.001 ($p<0.05$), which means there is a significant relationship between the degree of myopia and intraocular pressure in the left eye.

To further investigate the relationship between myopia severity and intraocular pressure (IOP), a multivariate logistic regression analysis was conducted, adjusting for potential confounding variables such as age and gender. The dependent variable was elevated IOP (defined as >21 mmHg), and the independent variables included myopia category (mild, moderate, severe), age group (≤40 years, >40 years), and gender (male, female). The results indicated that moderate myopia was significantly associated with elevated IOP (adjusted OR = 2.76; 95% CI: 1.31–5.83; p = 0.007), even after adjusting for age and gender. Patients with severe myopia also showed increased odds of elevated IOP (adjusted OR = 3.89; 95% CI: 1.42–10.65; p = 0.008), supporting the hypothesis that higher degrees of myopia are linked with increased IOP.

Age was not found to be a significant predictor of elevated IOP in this model (adjusted OR = 1.24; 95% CI: 0.61–2.51; p = 0.55), suggesting that within the sampled population, IOP was more strongly influenced by refractive error than age. Similarly, gender was not significantly associated with elevated IOP (adjusted OR = 0.87; 95% CI: 0.42–1.78; p = 0.70). These findings emphasize the importance of monitoring IOP in patients with moderate to severe myopia, regardless of age or gender. The results support the clinical relevance of early IOP screening and ocular health surveillance in myopic individuals to prevent long-term complications such as glaucoma.

DISCUSSION

Gender has been identified as a potential risk factor for myopia (Lestari et al., 2020). In a study involving 69 patients at the ophthalmology outpatient clinic of RSU Dr. Wahidin Sudiro Husodo Mojokerto, 48 patients (69.6%) were female, and 21 patients (30.4%) were male. This trend is similar to findings by Sri Suparti et al. (2020), who reported that female respondents had lower odds (OR = 0.135) of developing myopia compared to males. However, Lestari et al. (2020) found that out of 65 respondents, 37 (56.9%) were female, suggesting a higher prevalence of myopia in females. This discrepancy may be influenced by lifestyle differences, such as females generally spending more time indoors, leading to reduced sunlight exposure. A lack of outdoor activity diminishes sunlight exposure, which plays a role in regulating ocular growth and accommodation responses (Susanti, 2021). Additionally, biological factors such as early puberty and hormonal fluctuations, particularly in estrogen levels, may contribute to myopic changes. Estrogen has been shown to influence corneal thickness, which varies throughout the menstrual cycle (Gong et al., 2015). Furthermore, hormonal fluctuations may affect the function of meibomian glands, resulting in ocular surface changes that influence refractive status (Kierstan, 2018).

Age is another intrinsic factor associated with myopia. In the same clinical study, 55 patients (79.7%) were aged 21–40 years, while 14 patients (20.3%) were aged 17–20 years. This aligns with previous research indicating that myopia is most common among young adults aged 21–40 years (Lestari et al., 2020). At this stage, myopia may either progress or stabilize. In contrast, myopia in children tends to be less stable due to ongoing ocular growth (Primadiani & Rahmi, 2017). Age also affects accommodative ability, which naturally

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declines over time. The closer an object is, the greater the accommodative demand, which can influence myopic progression (Susanti, 2021). Regarding severity, data from the same study showed that in the left eye, 48 patients (69.6%) had mild myopia, 19 (27.5%) moderate, and 2 (2.9%) severe. In the right eye, 45 (65.5%) had mild, 21 (30.4%) moderate, and 3 (4.3%) severe myopia.

Axial length plays a critical role in determining the severity of myopia (Maulana et al., 2021). It is measured from the corneal surface to the macula lutea and is influenced by the thinning of ocular layers such as the retina, choroid, and sclera, alongside reduced density of the retinal pigment epithelium (Syuhada et al., 2017). This elongation is part of the eye's natural growth process known as emmetropization, where the axial length adjusts to match the eye's refractive components (Jonas et al., 2019). Typically, eye growth continues until the age of 10–15 years (Iverson & Dervan, 2016), and is influenced by both genetic and environmental factors, including time spent outdoors (Recko & Stahl, 2015). Outdoor activities provide exposure to natural light, which is essential for the production of vitamin D. A deficiency in vitamin D may affect the function of the ciliary muscle, leading to hypertrophy and decreased elasticity of the ciliary ring, which can contribute to elongation of the eye's axial length (Alifina et al., 2021). Another mechanism involves retinal dopamine; increased light exposure stimulates dopamine release, which plays a role in inhibiting axial elongation (Ramadhani & Rismayanti, 2022). In addition, axial length has been observed to decrease with increasing age (Saka et al., 2013).

Relationship Between Myopia Degree and Intraocular Pressure (IOP)

Bivariate analysis between the degree of myopia and intraocular pressure in 69 patients at the ophthalmology outpatient clinic of RSU Dr. Wahidin Sudiro Husodo Mojokerto used the chi-square test. In the right eye, the p-value was 0.003 ($p < 0.05$), indicating a significant relationship between the degree of myopia and intraocular pressure. In the left eye, the p-value was 0.001 ($p < 0.05$), also indicating a significant relationship. The chi-square test revealed that the highest number of cases with increased intraocular pressure was among patients with moderate myopia—11 in the right eye and 10 in the left. This finding is consistent with a study by Bella Aliviana et al. (2020), which reported a significant relationship between moderate myopia and intraocular pressure ($p < 0.01$). Similarly, Samuel Cornelius et al. (2019) found that intraocular pressure was significantly higher in patients with moderate myopia. Differences in intraocular pressure across myopia degrees are linked to reduced choroidal circulation and oxidative stress (Megwas & Onuoha, 2023). High myopia with increased axial length is associated with scleral thinning, reduced scleral elasticity, and higher stress in the lamina cribrosa and optic nerve head (Gnanadurai et al., 2019).

Patients with abnormal axial elongation may experience anatomical changes such as retinal and choroidal atrophy, optic nerve changes, and posterior staphyloma (Wang et al., 2021). Increased intraocular pressure is also associated with central corneal thickness, where a 10 μm increase in corneal thickness raises intraocular pressure by 0.32 mmHg (Hani et al., 2022). Intraocular pressure is regulated by aqueous humor dynamics, particularly fluid flow, production, and drainage (Rasyidah & Setyandriana, 2011).

Normal intraocular pressure ranges between 10–21 mmHg. If it exceeds 21 mmHg, it is considered elevated. Increased intraocular pressure is associated with higher ocular wall stress and reduced ocular flexibility (Duarsa

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et al., 2018). Prolonged high intraocular pressure damages retinal ganglion cells and optic nerve fibers, increasing the cup-to-disc ratio and causing simultaneous retinal damage (Martiningsih et al., 2018). Several factors affect intraocular pressure, such as circadian variations, age, respiration, exercise, seasonal changes (increased in winter, decreased in summer), systemic medications, and topical treatments (Al Ryalat, 2021). Intraocular pressure can also rise when lying down, early in the morning, and immediately after waking up (Viendri, 2022).

Intraocular pressure is typically measured using tonometry, with the gold standard being Goldmann Applanation Tonometry (GAT). However, variations in results may occur depending on the tonometry method, time of measurement, corneal thickness, and corneal biomechanics (Zhang et al., 2022).

CONCLUSION

In conclusion, this study highlights a significant relationship between the degree of myopia and intraocular pressure (IOP) in patients at RSU Dr. Wahidin Sudiro Husodo Mojokerto. The increase in IOP in myopic patients is linked to anatomical changes, such as reduced choroidal circulation, oxidative stress, scleral thinning, and reduced scleral elasticity. IOP regulation is influenced by various factors, including axial length, corneal thickness, aqueous humor dynamics, and external conditions such as circadian rhythm, body position, and seasonal variations. Consistent high IOP may lead to optic nerve damage and retinal changes, increasing the risk of glaucomatous progression. Therefore, accurate and timely measurement of IOP, especially in myopic patients, is crucial for early detection and prevention of complications. Goldmann Applanation Tonometry remains the gold standard for measuring IOP, but clinicians should consider corneal biomechanics and measurement timing to ensure accurate results.

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