

Original Research Article

A comparative study of intraocular pressure in myopia and hyperopia among a Nigerian population just diagnosed with primary open angle glaucoma in Benin City

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ABSTRACT

Background: Increasing evidence suggests that high myopia is salient in the pathologic process of POAG, and IOP (Primary Open Angle Glaucoma (POAG), and Intra-ocular Pressure (IOP)) remains the crucial risk factor for this condition. Still, some other studies have signified that glaucoma was diagnosed in myopes independent of IOP, suggesting that predisposition to glaucoma in myopes may not be dependent on mechanisms related to high pressures. The aim of this study was therefore to compare the intraocular pressure in myopes and hyperopes in a Nigerian population just diagnosed with POAG to ascertain if proclivity to glaucoma in myopes is mainly dependent on IOP.

Methods: This research was conducted as a retrospective study in the Optometry/Ophthalmology Department at Stella Obasanjo Women and Children Hospital, Benin City, Nigeria. The sample consisted of cases seen between 2011 and 2013. A total of 166 eyes with glaucoma and refractive errors (80 (48.19%) with myopia, and 86 (51.81%) with hyperopia) with an age range of 10 to 85 years, were used for this study.

Results: Newly diagnosed glaucomatous myopes had a significantly higher mean IOP than recently diagnosed hyperopes (unpaired t- test, $p = 0.004$). Also, a significant inverse correlation was obtained between refractive errors and intraocular pressure (Pearson correlation, $r = -.245$, $p = 0.001$) i.e. as refractive errors progressed deeply into more minus (myopic) regions, IOP increased.

Conclusions: The relationship between glaucoma and myopia is pressure mediated. The ascending levels of intraocular pressure that occurred with increasing extents of myopia demonstrate that POAG evolves too soon in participants with high myopia than in hyperopia and accentuates the seriousness of glaucoma surveillance in the myopic population.

Keywords: Hyperopia, Intra-ocular pressure, Myopia, Primary open angle glaucoma

INTRODUCTION

Glaucoma is described by the depletion of retinal nerve fiber tissues, identified clinically as visual field abnormality and loss of the neuroretinal rim of the optic nerve head, designated glaucomatous optic neuropathy. Primary open angle glaucoma (POAG) is the most typical

reported type of glaucoma in population-based prevalence investigations globally; and the most frequent source of irremediable adult blindness in African nations, inflicting a considerable misfortune both on individuals and society.^{1,2} The comparative chance of open angle glaucoma has been observed to heighten increasingly as refractive level shifts from hypermetropia to myopia.^{3,4}

Accordingly, there is a prominent prevalence of glaucoma in myopic eyes than in any other refractive errors or emmetropic eyes.^{4,5} Myopia is linked with open angle glaucoma in both white and black adult.^{1,6} The Beaver Dam eye study showed that, after taking into account the effects of age, sex, and other risk factors, persons with myopia were 60% more likely to have glaucoma than those with emmetropia.¹

Whilst, the processes responsible for the connection between glaucoma and myopia are poorly apprehended, it has been proposed that the relationship may be pressure mediated.^{3,4} An additional hypothesis is that the optic nerve head in myopic eyes may be structurally more sensitive to glaucomatous damage because of the nature of connective tissue structure and ordering.³ The heightened risk of development of glaucomatous alteration may be incidental to the already decreased retinal nerve fiber layer (RNFL) in myopic eyes or the lessened RNFL in myopia may itself depict likelihood for the evolution of glaucoma.^{1,7}

Raised intraocular pressure (IOP) is the most principal risk component for POAG advancement and is the paramount therapeutic index.² In white populations, the correspondence between IOP and refractive error has been reported. In these studies, myopia and hyperopia were associated with the risk of ocular hypertension, however, myopic eyes were more predisposed to higher IOPs than hyperopic or emmetropic eyes.³⁻⁸ As a consequence, myopic refractive error is known to be an independent indicator of higher IOP non-glaucomatous eyes.⁹

The increases in IOP with advancing levels of myopia buttress the hypothesis that the link between glaucoma and myopia might be pressure moderated.^{6,10} For example, an extensive glaucoma screening of inhabitants of three towns in southern Israel, aged 40 years and above revealed that there were significantly more myopes among persons with IOPs of more than 20mmHg than with lesser IOPs-with mean IOP increasing gradually from 14.19mmHg in hypermetropes to 16.00mmHg among high myopes.¹¹

While little or no comparative investigation of intraocular pressure in myopia and hyperopia has been carried out in a Nigerian population, increasing evidence suggest that high myopia is salient in the pathologic process of glaucoma, to a large extent for POAG, and IOP remains the crucial risk factor for this condition. Still, some other studies have signified that glaucoma was diagnosed in myopes independent of IOP, suggesting that predisposition to glaucoma in myopes may not be dependent on mechanisms related to high pressures.^{6,1} The aim of this study was therefore to compare the intraocular pressure in myopes and hyperopes in a Nigerian population just diagnosed with POAG to ascertain if proclivity to glaucoma in myopes is mainly dependent on IOP.

METHODS

This research was conducted as a retrospective study carried out at the Optometry/Ophthalmology Department, Stella Obasanjo Women and Children Hospital, Benin City, Nigeria. The sample population consisted of cases (166 eyes presenting with glaucoma and refractive error) seen between 2011 and 2013. Due to the fact that glaucomatous changes, refractive errors and IOPs often occur asymmetrically, the study focused on eyes rather than individuals. Patients aged 10-85 years, of either gender were incorporated into the study. Diagnosis of primary open angle glaucoma was based on the three diagnostic tests for glaucoma: fundoscopy, tonometry and perimetry. Aphakic and pseudo-aphakic patients were excluded from the study because eyes with intraocular lenses exhibit refractive powers that differ from their pre-operative values. Also excluded from the research were patients with significant cataract (due to cataract induced myopia) and secondary glaucoma. The data was gathered from the case files of fitting patients based on accessibility. The pertinent data worked with were patient's age, refractive findings, gender, cup to disc ratios and intraocular pressures and visual field test results. The refractive findings were collected in mean spherical equivalent warranted by the reality that astigmatic findings were frequently unavailable, even when the diagnosis was astigmatism. Most times the final prescription was just the sphere portion.

RESULTS

A total of 166 eyes with glaucoma and refractive errors (80 (48.19%) with myopia, and 86 (51.81%) with hyperopia) were used for this study with a mean age of 42.85 years \pm 1.067. The age range was 10 to 85 years. There was no significant difference in the binomial distribution of hyperopes and myopes with glaucoma ($p = 0.698$). The mean IOP was 21.11 \pm 0.60mmHg, with a range of 10.5mmHg to 45.9mmHg. The mean refractive error was -0.11DS \pm 0.11 with a range of -8.00DS to +4.50DS.

Newly diagnosed glaucomatous myopes had a significantly higher mean IOP than recently diagnosed hyperopes (unpaired t- test, $p = 0.004$). The mean IOP for glaucomatous myopes was 22.90mmHg \pm 1.05 while the mean IOP for glaucomatous hyperopes was 19.458mmHg \pm 0.579.

Myopes also had a wider and higher range of IOP values compared to hyperopes. A significant number of myopes had IOP values that could be rated as higher than normal. While a greater number of hyperopes had IOP ranging between 12-20mmHg, with more individuals concentrated on 17-20mmHg, close to the upper limit of normal IOP range (Figure 1).

Also, a significant but weak inverse correlation was obtained between refractive errors and intraocular

pressure (Pearson correlation, $r = -.245$, $p = 0.001$) i.e. as refractive errors progressed deeply into more minus (myopic) regions, IOP increased. This was also observed in the relationship between solely myopia and intraocular pressure (Pearson correlation, $r = -0.207$, $p = 0.046$), in which IOP values elevated with higher minus powers (lower refractive powers). It was not seen exclusively between hyperopia and IOP (Pearson correlation, $p = 0.271$).

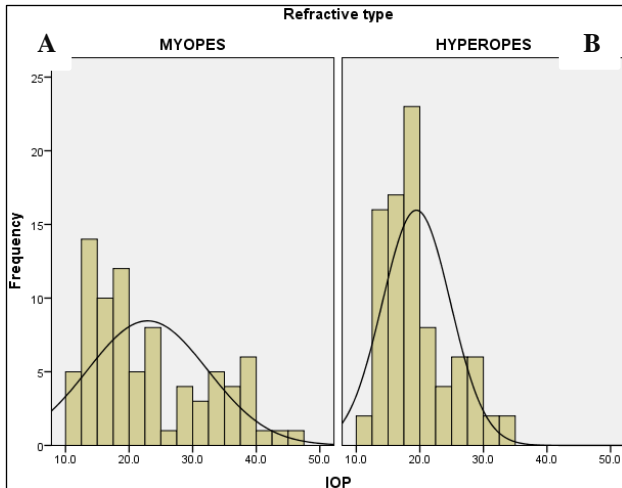


Figure 1: A) Frequency histogram showing distribution of intraocular pressure in myopes and hyperopes. B) frequency histogram showing distribution of intraocular pressure in hyperopes.

DISCUSSION

Our results demonstrate that in the Nigerian population recently diagnosed with POAG, myopes had a higher mean intraocular pressure as compared to hypermetropes. The myopes also had a mean IOP value higher than normal when contrasted with hyperopes. This particular finding is similar to an observation by David et al, who in a study, showed that there were significantly more myopes among persons with IOPs of more than 20 mmHg than with hypermetropes.¹¹ Inasmuch as the myopes just diagnosed with glaucoma in the study here had higher mean intraocular pressure when juxtaposed with their hypermetropic peers, our finding corroborates the postulation that high myopia is one of the cardinal risk features for ocular hypertension.^{3,9} This discovery also substantiates the hypothesis that the relationship between glaucoma and myopia may be pressure mediated.^{3,4,10} It denotes that myopic refractive errors are an independent predictor of high IOP which is conceivably the ground for myopia being counted a risk determinant for primary open angle glaucoma.^{3,7,8} It also bears basis for the increased pervasiveness of glaucoma among myopic eyes when set side by side with non-myopic eyes.^{4,8}

The positive correlation discovered between IOP and increasing degrees of myopia in the current study

signifies that as the magnitude of myopia surged, intraocular pressure increased. This finding is similar to observations made in studies by Mathapathi et al, Mathapathi and Pathil, Joseph et al, Choi et al, Nomura et al, and Manny et al.^{3,4,8-10,12} Considering high IOP is the greatest important alterable risk influence for glaucoma, this result describes that gradual intensified relative risk of POAG increases with shifts in refractive rankings from hypermetropia to myopia.^{4,9} It also explains the increased risk for glaucoma with high grade myopia, well-matched with more severe myopia being related with a greater likelihood of glaucoma.^{8,9}

Myopia or short sightedness is that form of refractive error wherein parallel rays of light come to a focus in front of the sentient layer of the retina when the eye is at rest. The eye is thus relatively too oversized. The condition is the converse to that of hypermetropia.⁷ Intraocular pressure is the tension exerted by the aqueous humour in the intraocular tissue as a consequence of the equilibrium between its production and drainage. Any irregularities in the intra-ocular pressure of a given eye can result in dysfunction of the eye.³ It is not very plain why myopia engenders an increased intraocular pressure.⁹ One concept is that raised intraocular pressure is related to an increased stress of the global wall and decreased ocular inflexibility in the myopic eye.⁸

However, it is plausible that the persistent rise in intraocular pressure in myopic eyes in this study played a crucial role in the damage of the delicate optic nerve of the myopes just diagnosed with glaucoma.³ The ascending levels of intraocular pressure that occurred with increasing extents of myopia demonstrate that POAG evolves too soon in participants with high myopia than in hyperopia and accentuates the seriousness of glaucoma surveillance in the myopic population. POAG screening should therefore be conducted earlier in participants with high myopia because both raised IOP and myopia are salient risk elements for the development of glaucoma.^{5,9}

A main limitation in this study is that the investigative groups were not age or gender matched which may have influenced the results. However, no significant differences were found in glaucomatous status between the hypermetropes and myopes. Also, existing diagnosis formed the principal mode of data collection which may have been inaccurate due to human error or lack of complete diagnostic equipment. Furthermore, the IOP values may have been the reading after some patients started taking IOP lowering medication, and so could have been artificially low.

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