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Original Article

Age, gender and refractive error association with intraocular pressure in healthy Saudi participants: A cross-sectional study

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Abstract

Purpose: To determine the distribution of intraocular pressure (IOP) and its association with age, gender and refractive error in non-glaucomatous Saudi participants.
Design: Hospital-based cross-sectional observational study during Vision Day Screening Program. Participants: 458 participants living in the Al-Khobar, Saudi Arabia.
Methods: Recruited participants (aged 20 years or over) underwent a comprehensive questionnaire and ocular examination, including measurement of IOP with Perkins hand-held applanation tonometry and autorefraction.
Main outcome measures: The distribution of IOP of either of the eyes (right or left eye by randomization) and associations with age, gender and refractive error.
Results: Median IOP was 15.0 (range: 6–28) mmHg in the total population. There is no significant difference between the overall IOP of male participants, median 15 (range: 6–28) mmHg and female participants, median 16 (range: 6–28) mmHg ($p = 0.180$). No statistically significant difference in IOP in relation to age comparing 20–45 years group to 46–69 years group was documented ($p = 0.751$). There was no statistically significant relationship between refractive error category and IOP ($p = 0.405$). Ocular hypertension with IOP > 21 mmHg was found in 8.7% of the participants.
Conclusion: Variation in IOP by gender, age group and type of refractive error was not statistically significant. The observations need confirmation by study with larger sample representing Saudi population.

Keywords: Intraocular pressure, Age, Gender, Refractive error, Saudi

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Introduction

From a clinical perspective, high intraocular pressure (IOP) is a major risk factor for glaucoma,[1–3] and it is the only proven treatable risk factor. People with a high IOP with no proof of having primary open-angle glaucoma are considered at risk of developing optic nerve damage, even if they do not suffer from any ocular disease.

Several studies demonstrated variability in the IOP distribution among different ethnicities. Population-based studies in Europe including the Netherlands,[4] Italy,[5] Greece,[6] United Kingdom,[7] Norway,[8] and other screening surveys on white populations in Australia,[9] Iceland,[10] and North America[11] reported mean IOPs between 14.3 and 17.2 mmHg. However, higher mean IOP between 16.5 and 18.7 mmHg was reported in populations of Afro-Caribbean origin.[1,12,13]

Furthermore, IOP distribution and associated ocular features and its correlation with age are of clinical interest. The relationship between IOP and age varies in different ethnicities. Studies conducted in Western countries,[3,4,14] Iran,[15]

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and Barbados[16] show a positive correlation between IOP and age. On the contrary most of the East Asia studies reported a negative correlation between IOP and increasing age.[17–19]

The relationship between refractive error and IOP is another area of discrepancy. Some studies have suggested that myopia may be associated with risk of primary open-angle glaucoma,[9,20] and hyperopia with possible risk of ocular hypertension.[21] Considering this variability in IOP in different populations and the inconsistencies in relation to IOP with age, gender and refractive error, it is interesting to investigate the distribution of IOP and its associated factors in various populations.

This study examined the distribution of IOP and its association with age and the refractive error in non-glaucomatous Saudi participants as a hospital-based cross-sectional screening survey carried out in Al-Khobar, Saudi Arabia.

Methods

Participants' enrolment

The experimental design of this study is a hospital-based observational, prospective cross-sectional study. The peoples were selected by the convenient sampling method. The screening survey was carried out in Al-Khobar city as part of Vision Day Screening Program (2013). The study sample consisted of healthy Saudi participants, aged 20 years or over, and who volunteered to present to the screening site and participated in the survey. Examination protocols followed the tenets of the Declaration of Helsinki. All participants included in this study were informed about the project and the procedures before being enrolled. The participants' consent for examination was obtained verbally.

Eye examination protocol

The standardized protocol for all participants in the study included an interview, and an eye examination. Trained ophthalmic interns carried out the interview, obtaining demographic details, medical and family history including history of diabetes and hypertension and information about eye diseases. Participant's age was recorded according to national identification card.

Uncorrected visual acuity and corrected visual acuity with the participants' glasses were measured by optometrists for all participants. Refraction was checked using a Topcon automated refractometer (Topcon KR Topcon Corporation, Tokyo, Japan). Spherical equivalent (SE) was calculated by adding the spherical correction value plus half the cylinder value. Three measurements were obtained. The average value was recorded as the refractive error. For analysis purposes of refractive error, myopia was defined as SE of $\leqslant -0.50$ diopter (D); mild, moderate, and high myopia was defined as SE > -3.00 D $\leqslant -3.00$ D, and $\leqslant -6.00$ D, respectively. Hyperopia was defined as SE of $\geqslant +0.50$ D; mild, moderate, and high hyperopia was defined as SE $< +3.00$ D, $\geqslant +3.00$ D, and $\geqslant +6.00$ D, respectively.

Fellowship-trained ophthalmology residents completed the eye examination. IOP was measured using a Perkins hand-held applanation tonometer after instillation of a drop of oxybuprocaine Hydro 0.4% in each eye of the participant and tear was stained with fluorescein. Two measurements were obtained. The average value was recorded as the IOP. If the IOP measurements were higher than 21 mmHg, tonometry was repeated, and the mean of at least 3 measurements was taken for further statistical analysis. If IOP was greater than 25 mmHg, the participant was referred to the eye clinic and informed about the disease. Slit lamp bio-microscopy was performed and any abnormality in the anterior segment was noted. All participants underwent a fundus examination using direct ophthalmoscopy. The examiner inspected the optic nerve head assessing disc size, colour, vascularity and degree of cupping.

Exclusion criteria

In order to ascertain inclusion of healthy eyes only with no suspicion or evidence of glaucoma, participants with a history of glaucoma and eye surgery, those who were using anti-glaucoma medication in either eye, or those with cup to disc ratio more than 0.5 or cup to disc asymmetry more than 0.2 were excluded from the analysis.

Statistical analysis

All categorical data were represented by frequency with percentage and it was analysed by chi-square, Fisher's exact test. Continuous data were presented by Median with Range and it was tested by using Mann–Whitney *U* test and Kruskal–Wallis test because the continuous data are not normally distributed. Univariate analysis was used to test the statistical significance of the associations between IOP and age, gender or refractive error. All *P* values were 2-sided and were considered statistically significant when the *P* value is less than 0.05. Statistical analysis was carried out using a commercially available statistical software package (SPSS for Windows, Version 20.0).

Results

Surveyed population number was 655, but after excluding 194 subjects due to missing data, 2 subjects who were known to have glaucoma and were using anti-glaucoma medication, and one subject because of the outlier on statistical analysis, 458 people were included in the study. History of diabetes was present in 24 participants and hypertension in 12 participants.

A total of 458 eyes (randomly chosen either right or left eye) of healthy Saudi peoples, 269 males (58.7%) and 189 females (41.3%) were selected in this study. The Mean (SD) age was 43.0 ± 12.6 years (Table 1). There was no significant difference in age between the male participants (43.7 ± 12.5 years) and female participants (42.0 ± 12.7 years), ($p = 0.159$).

The overall mean of IOP was 15.8 ± 3.6 mmHg, and the median IOP of total subjects was 15 (range: 6–28) mmHg. The median IOP of men was 15 (range: 6–28) mmHg and 16 (range: 6–28) mmHg for women, which was not statistically significant ($p = 0.268$) (Table 2). Additionally, Table 2 shows a relationship between the overall median IOP and age comparing 20–45 years group to 46–69 years group, and there was no statistically significant difference ($p = 0.748$).

Ocular hypertension, defined as intraocular pressure >21 mmHg, was found in 8.7% of the participants. Further