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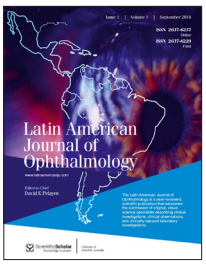

Original Article

Effect of postural changes on intraocular pressure in patients with acute angle-closure glaucoma in Indian population

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ABSTRACT

Objective: The objective of the study was to compare the posture-induced intraocular pressure (IOP) changes in primary angle-closure glaucoma (PACG) with or without glaucoma medications, and healthy control eyes with normal IOPs in Indian subjects.

Materials and Methods: The IOP was measured in the sitting position and the supine position after 10, 20, and 30 min with a rebound tonometer.

Results: Twenty-five patients with PACG and 30 controls with normal IOPs were studied. The IOP in the sitting position measured with the rebound tonometer was 13.8 + 3.2 mm Hg in eyes with PAC, and 12.9 + 2.9 mm Hg in eyes with normal IOPs. The IOP increased to 14.4 mm Hg, 16.8 mm Hg, and 18.9 mm Hg at 10 min, 20 min, and 30 min in PACG subjects. In normal age-matched controls, the IOP increased to 13.4 mm Hg, 14.9 mm Hg, and 17.8 mm Hg at 10 min, 20 min, and 30 min, respectively, but none of these differences were significant ($P = 0.09$; $P = 0.08$, $P = 0.08$). The mean postural IOP change from baseline was also not significant between the two groups. Only three patients were on single antiglaucoma medication with well-controlled IOP in the PACG group.

Conclusions: Postural IOP changes are comparable among eyes with PACG with and without glaucoma medications, and control eyes.

Keywords: Intraocular pressure, Primary angle closure glaucoma, Rebound tonometer, Postural changes on IOP

INTRODUCTION

Increased intraocular pressure (IOP) has long been identified as an important risk factor for the onset and progression of glaucoma.[1,2] Posture is one factor that has a longer effect on IOP. The postural change from the sitting to supine can increase IOP significantly with these IOP fluctuations suggested to be related to structural and functional deterioration in glaucomatous eyes.[3-5] Therefore, it is important for clinicians to know whether the IOP in the sitting posture is significantly different from that in the supine in eyes with glaucoma.

Literature review revealed that some authors have reported higher posture-induced IOP changes in glaucomatous eyes than those in normal eyes.[6,7] On the other hand, Liu *et al.* stated that there was no difference in postural IOP changes between glaucomatous and control eyes between sitting to the supine position.[8] There is definitive lack in studies comparing the effect of posture change on eyes with primary angle-closure glaucoma (PACG) with none of them

involving Indian population. Sawada *et al*. compare the posture-induced IOP changes in eyes with open-angle glaucoma, primary angle-closure with or without glaucoma medications, and healthy control eyes with normal IOPs but in Japanese population.[9]

Thus, the purpose of our study was to compare the posture-induced IOP changes among eyes with angle-closure glaucoma with or without medication and control eyes with normal IOPs in Indian population. To the best of our knowledge, this is the first reported study of its kind.

MATERIALS AND METHODS

A prospective cross-sectional study was done in the outpatients department of a tertiary eye care center in North India. A total of 25 cases of diagnosed PACG with or without medications and 30 normal healthy age-matched controls were included in our study. The study was conducted between July 2017 and June 2019. The study was approved by the Institutional Ethical Committee. All patients were fully informed on the procedures and written consent was obtained before participation. The procedures used conformed to the tenets of the Declaration of Helsinki.

The inclusion criteria were diagnosed cases of PACG with or without medication, aged between 40 and 80 years with the refractive error between +3D and −3D with no history of glaucoma surgery.

Optic nerve head changes of glaucoma and visual field changes on perimetry. The exclusion criteria were any history of glaucoma surgery, refractive error more than 3D, patients with corneal scar precluding IOP measurement history of glaucoma other than PACG such as secondary glaucoma (including exfoliation glaucoma, pigmentary glaucoma, and uveitis glaucoma), ocular trauma, ocular diseases, or general medical conditions affecting the optic nerve or retina All patients in angle-closure glaucoma group had undergone peripheral iridotomy.

The ocular diagnostic examinations included best-corrected visual acuity (BCVA), slit-lamp examination, central corneal thickness (CCT) measurements by ultrasonic pachymetry (SP-100 Handy Pachymeter; Tomey, Nagoya, Japan), AL measurements by A-scan biometer (IOL Master; Zeiss 500), IOP measurements by rebound tonometry (ICare; Tiolat Oy, Helsinki, Finland), ophthalmoscopy, and evaluation of the structure and width of the anterior chamber angle with a Goldmann two-mirror gonioscopic lens. IOP measurements were taken with the help of rebound tonometer first in the sitting position and then in supine positions at 10 min, 20 min, and 30 min interval, respectively, after instilling topical 4% lignocaine drops by a single examiner. Three consecutive measurements were taken at each time and the average of all was taken as reading at that time and these values were used for statistical analyses. The level of significance for each comparison was set at $P < 0.05$. All statistical analyses were performed using commercial software (SPSS, version 16.0).

RESULTS

A total of 25 eyes of 25 patients with PACG and 30 eyes of age-matched controls were included in the study.

Eleven (44%) patients were male in the PACG group which was comparable to the control group with 43.3% being male. The mean age was 65.0 ± 9.4 (41–79) in the PACG patients, and 67.2 ± 8.5 (40–80) in control group ($P = 0.954$). The baseline demographic and clinical data of the subjects are shown in Table 1. The CCT measurement was 537.0 ± 31.2 um in the PACG patients and 538.1 ± 34.9 um in control group with no statistically significant difference ($P = 0.98$). The mean AL was 22.53 ± 0.79 mm in the PACG group and 23.51 ± 1.37 mm in the control group ($P = 0.20$). The baseline IOP in sitting position in the PACG group was 13.8 ± 3.2 mm of Hg and 12.9 ± 2.9 mm of HG in control patients ($P = 0.07$), which was not statistically significant also.

The IOP changes from the sitting posture to the supine posture measured with the I-Care rebound tonometer was 14.4 mm of Hg at 10 min post supine positioning; 16.8 mmHg at 20 min and 18.9 mmHg at 30 min in the PACG group with corresponding value for control group 13.4 mmHg at 10 min, 14.9 mmHg at 20 min, and 17.8 mmHg at 30 min post supine positioning with no statistically significant correlation between two groups ($P = 0.7$; $P = 0.1$; $P = 0.9$) [Tables 2 and 3]. Out of 25 patients in the PACG group, three patients were on single antiglaucoma medication in the form of prostaglandin analogs with well-controlled IOP.

Table 1: Demographic profile and clinical features of patients at base line.

Characteristic	PACG (25)	Control (30)	*P*-value
Sex, M/F	11/14	13/17	—
Age, years	65.0±9.4 (41-79)	67.2±8.5 (40–80)	0.95
CCT, um	537.0±31.2 (491–602)	538.1±34.9 (478–664)	0.98
Axial length, mm	22.53±0.79 (20.47–24.78)	23.01±1.37 (21.23–28.45)	0.20
IOP with rebound tonometer, mm Hg	13.8±3.2 (9-–25)	12.9±2.9 (10–19)	0.07

IOP: Intraocular pressure, PACG: Primary angle-closure glaucoma

Table 2: Mean IOP measurements in different postures.

Posture	PACG	Control	*P*-value
Sitting (Baseline)	13.8	12.9	0.07
Lying down for 10 min	14.4	13.4	0.09
Lying down for 20 min	16.8	14.9	0.08
Lying down for 30 min	18.9	17.8	0.08

IOP: Intraocular pressure, PACG: Primary angle-closure glaucoma

Table 3: Change in IOP measurement from baseline.

Rise of mean IOP	PACG	Control	*P*-value
From sitting to lying down for 10 min	0.6	0.5	0.7
From sitting to lying down for 20 min	3.0	2.0	0.1
From sitting to lying down for 30 min	5.1	4.9	0.9

IOP: Intraocular pressure, PACG: Primary angle-closure glaucoma

DISCUSSION

IOP is dynamic and can change continuously in different situations. The extent of the posture-induced IOP changes is greater in glaucoma patients than in normal subjects.[10,11] Earlier studies comparing the posture-induced IOP changes between eyes with open-angle glaucoma and normal eyes have been published which reported an increase in IOP on postural changes.[6,7] In all of them, the postural IOP changes were evaluated by changing the body position from the sitting to the supine position.

Our study results showed that the posture-induced IOP changes varied among individual eyes, and the variations were comparable among eyes with PACG and normal controls. Our findings were comparable with Sawada *et al*. who demonstrated similar IOP changes in different subgroups of open-angle glaucoma, PACG as well as normal control.[9] Our study is the first attempt to study postural changes effect in PACG patients in Indian population subset. Yamabayashi *et al*. also reported similar results where posture-induced IOP changes in OAG patients were more on the average than that in control normal eyes but there was no significant difference between the two groups.[12] The younger normal subjects with eyes of shorter axial length had been shown to have higher 24-h IOP fluctuations than those with longer eyes.[13] Our study also had no statistically significant difference in axial length as well as CCT between PACG and control group. Moreover, our study subjects as well as control comprised older patients more than 40 years of age only.

The exact mechanism of posture-related IOP change has not been clearly outlined as yet. In the supine position, IOP elevation is hypothesized to occur due to an increase in episcleral venous pressure and ophthalmic artery pressure, alteration in the rate of uveoscleral outflow due to increased choroidal blood volume.[14,15] In the current study, all subjects were of PACG which has undergone peripheral iridotomy maintaining outflow facility more better in these subjects, could have been responsible for a non-significant rise of IOP on the postural change to the supine position.

To the best of our knowledge, this study is the first to assess the effect of the postural change on IOP in the PACG patients. However, this study has several limitations that need to be acknowledged. First, the sample size was small, and the accuracy of the IOP measurements by rebound tonometry in different positions is difficult and can be unpredictable. However, published literature has shown, the accuracy of rebound tonometry is comparable with that of Tono-pen and Goldman applanation tonometry.[16]

CONCLUSIONS

Our study shows that there was no significant difference in posture-induced IOP changes among eyes with PACG and normal control eyes. The posture-induced IOP change also varied individually, which may explain why significant changes were not found. However, it is important for the management of glaucoma to evaluate the IOP, including its fluctuation due to the body position even in patients of PACG who have been treated with laser iridotomy or controlled with medications.

Declaration of patient consent

The authors certify that they have obtained all appropriate patient consent.

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Nil.

Conflicts of interest

There are no conflicts of interest.

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