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Original Research Article

Comparison of diurnal intraocular pressure control between patients treated with latanoprost & surgically in primary open angle glaucoma

Debajyoti Nanda[1], Manisha sarkar[2], A K Chandrakar[3], M L Garg[3], N Pandey[3], Eesh Nigam[3]
[1]Department of Ophthalmology, Dr B.C. Roy post graduate institute of Pediatric sciences. Kolkata, West Bengal
[2]Department of Pathology, I.P.G.M.E. &R, Kolkata, West Bengal
[3]Upgraded Department of Ophthalmology, Pt. J.N.M. Medical College, Raipur, C.G

***Corresponding author**
Dr. Debajyoti Nanda
Email debajyotinanda@yahoo.co.in

Abstract: The aim of this study is to compare the diurnal IOP fluctuations of Primary open angle glaucoma (POAG) patients treated with latanoprost 0.005% once a day with patients having controlled IOP after trabeculectomy. A total 40 POAG patients were prospectively studied. The medical group consisted of 20 patients with controlled IOP (<18 mm Hg) under latanoprost 0.005% monotherapy with no history of previous intraocular surgery or laser therapy. The surgical group included 20 patients with controlled IOP after trabeculectomy without any hypotensive agent. All patients were underwent a diurnal tension curve (8:00-17:00/three hour interval), followed by a water drinking test (WDT) with last IOP measurement taken at 21:00 hours. Base line IOP (IOP at 8:00 am) was significantly lower in trabeculectomy group (10.8 mmHg) than latanoprost group (15.5 mmHg). The mean IOP during diurnal tension curve was higher in latanoprost group (15.8mm Hg) than trabeculectomy group (11.0 mmHg). After WDT, elevation of IOP was significantly higher in latanoprost than trabeculectomy group. Trabeculectomy patients had a significant lower mean IOP in diurnal tension curve than latanoprost group. Elevation of IOP in WDT and fluctuation is also lower in case of trabeculectomised patients than latanoprost group.
Keywords: diurnal IOP fluctuations, Primary open angle glaucoma (POAG)

INRODUCTION

Intraocular pressure (IOP) is one of the major risk factor for the development of glaucoma. Glaucoma treatment is based mainly on IOP reduction to a level at which no further damage is expected to occur. Lowering IOP is believed to be helpful in slowing down glaucomatous changes of the optic nerves and visual field [1-3]. However, lowering of IOP to a preselected level (target IOP) does not always prevent glaucomatous damage and its progression [4-6]. So factors other than IOP may also be responsible for the continued progression of glaucoma [7]. But it has been suggested that in some cases the progressive damage could be caused by peaks of IOP or diurnal IOP variability not detected by tonometry during office hours [8-11] The IOP is subject to cyclic fluctuations throughout the day. Diurnal variation in glaucoma was first reported in 1898. The diurnal fluctuation of IOP has been considered as an independent risk factor for glaucoma progression. The mean amplitude for daily fluctuation ranges from 3 mm of Hg to 6 mm of Hg. Amplitude greater than 10 mm of Hg is generally considered to be pathologic [12] Drance, who found that if one IOP measurements was taken at office hours then only one third patients will show pressure peaks, detected by a 24 hour tension curve [13].Thus a diurnal IOP curve gives a better estimate of an individual's IOP level and fluctuations than a single measurement during the office visit. But it demands hospital admission where IOP is measured over 24 hours [9] Some authors have demonstrated "home tonometry" as another form to obtain 24 hour IOP data,[10,11,14] however, this kind of monitoring is demanding and may be susceptible to bias. In spite of its importance, a 24 hour diurnal tension curve (DTC) is not always feasible in the routine practice. Alternatively, a modified diurnal tension curve (mDTC) has become a common practice and consists of four to five IOP measurements during office hours (from 8 am to 6 pm). However, this test may miss as much as 70% of IOP peaks as a result of IOP variability and also because up to 70% of the highest IOP levels occur at 6 am in supine position [8].

The water drinking test (WDT) was a popular provocative test in 1950s and 1960s. But it loses its popularity due to low sensitivity and specificity. In recent years it regains its diagnostic value to predict maximum IOP values during diurnal tension curve (DTC) and to assess the patency of surgical interventions [15, 16]. The prostaglandin analogue latanoprost 0.005% seems to lead to uniform circadian reduction in IOP without peaks, compared with other antiglaucoma medications such as timolol and dorzolamide [17]. There is evidence that patients controlled after filtering surgery have lower IOP fluctuations during the diurnal tension curve and after a water drinking test than medically controlled patients [18]. The purpose of this study is to compare the diurnal IOP fluctuations of primary open angle glaucoma (POAG) patients treated with latanoprost 0.005% once a day with patients having controlled IOP after trabeculectomy.

MATERIALS AND METHODS

This prospective study was conducted in the upgraded department of ophthalmology, Pt. J.N.M. Medical College, Raipur from 01.05.08 to 30.04.09. 40 eyes of 40 patients with primary open angle glaucoma were studied. The medical group consisted of 20 patients with controlled IOP (<18 mm of Hg) under latanoprost 0.005% monotherapy once at evening and with no history of previous intraocular surgery or laser therapy. The surgical group consisted of 20 patients after trabeculectomy. The surgical group had a controlled IOP without any hypotensive medication. In the medical group the patients had been on a stable ocular hypotensive medication regimen for at least three months. Trabeculectomy had been performed at least one year before inclusion in the study. The exclusion criteria were [i] baseline untreated (surgical) or treated IOP equal to or higher than 18 mm of Hg [ii] pseudo exfoliation glaucoma [iii] previous laser therapy [iv] corneal abnormality.

After admission, all patients were submitted to a diurnal tension curve. In diurnal tension curve, four IOP measurements were done at three hour interval (8:00 to 17:00). Patients in medical group were advised to stop medication during the study period. After the 17:00 hour IOP measurement the patients were submitted to the water drinking test. The patients were instructed not to take orally during the four hour period preceding the test. The patients were instructed to drink one litre of water over 10 minutes. After that IOP was measured a total of three times at 15 minutes interval. The last IOP measurement was taken at 21:00 hour. All IOP measurements were performed using the same Goldmann applanation tonometer.

The following parameters were used for data analysis: the mean diurnal IOP was obtained by averaging all of the IOP readings of diurnal tension curve. The difference between the highest and the lowest value was taken as diurnal range. The difference in IOP between the peak of the three measurements after the water drinking and the baseline (IOP immediately before water drinking test) was considered as the IOP fluctuation during the water drinking test.

RESULTS

Baseline IOP of diurnal tension curve (IOP at 8:00 am) was significantly varied between the trabeculectomy group (10.8 mm of Hg) and latanoprost group (15.5 mm of Hg). The mean IOP during diurnal tension curve was also higher in case of latanoprost group (15.8 mm of Hg) than trabeculectomy group (11.0 mm of Hg). After water drinking test, elevation of IOP was significantly higher in latanoprost group than trabeculectomy group. Peak values were reached after 30 min of ingestion of water. The IOP fluctuation during water drinking test were also higher in latanoprost group (+5.4 mm of Hg) than Trabeculectomy group (+2.1 mm of Hg). The results are statistically significant.

Table-1: Results between the trabeculectomy group and latanoprost group

IOP	Trabeculectomy group mm of Hg	Latanoprost group mm of Hg
IOP pre WDT	10.2	15.6
WDT 15 minutes	11.6	19.1
WDT 30 minutes	12.3	21
WDT 45 minutes	12.1	20.2
WDT IOP fluctuation	+2.1	+5.4

DISCUSSION AND CONCLUSION:

Primary open angle glaucoma patients are generally managed by lowering the IOP to a level that the physician believes will prevent further glaucomatous damage. However, in a significant proportion of patients, the visual field continues to deteriorate in spite of outdoor pressure within the normal values. So, there may be some factors other rhan IOP responsible for this damage. It has been suggested that diurnal IOP fluctuation may be responsible for this damage. Drance, who found that if one IOP measurements was taken at office hours then only one third patients will show pressure peaks, detected by a 24 hour tension curve [13]. A study from Zeimer *et al.;* showed that 29% of patients with progressive visual field damage presented IOP peaks whereas only 5% of

patients presented with stable visual fields[8]. Also, the occurrence of IOP peaks was related to visual field loss progression in comparison with patients with stable visual fields in a study from Martinez-Belló *et al.;* which also did not demonstrate any significant difference between mean IOP levels of patients who developed progression in comparison to stable ones[19]. R susanna *et al.;* showed mean IOP peak and percentage of IOP variation during water drinking test were significantly higher in patients with visual field progression compared with patients who did not progress[20].These studies support the importance of detecting IOP peaks in glaucoma treatment. The water drinking test is a provocative test that was widely used a few decades ago to help in the diagnosis of open angle glaucoma,[21,22] but was found to be inadequate due to many false positive and false negative results in 10 year prospective studies [21] However, after some years, the emphasis on the value of this test has changed. As a result of the correlation with the diurnal tensional curve,[22] the water drinking test has been proposed as an alternative method to check IOP control.

Previous studies had already suggested the importance of the water drinking test to determine a risk factor for the development of glaucomatous visual field defect. In the 1980s, based on a large prospective study (Collaborative Glaucoma Study), Armaly and coworkers reported the pressure change after drinking water as one of five potential risk factors significantly related to the development of glaucomatous visual field defects in patients with ocular hypertension[23,24].

Another study performed by Yoshikawa *et al.;* in normal tension glaucoma patients showed that the maximum IOP levels after the water drinking test in patients with progressive visual field loss was significantly greater than the levels observed for the non-progressive group[15].

F K Malerbi *et al.;* showed IOP variability using the mDTC and the WDT in patients with primary open angle glaucoma (POAG) undergoing clinical treatment who were considered to be well controlled with IOP equal to or under an established target pressure based on isolated office readings. Both tests were capable of demonstrating the existence of IOP peaks [25].

Brubaker proposed that the water drinking test could be used as an indirect measurement of outflow facility to compare the IOP responses of glaucoma eyes to different drugs [26]. Drugs such as prostaglandins improve the outflow facility and are expected to show less IOP variation secondary to water challenge. The presence or not of any filtration surgery should also be considered when comparing water drinking test results between eyes.

Medeiros et al demonstrated that patients submitted to trabeculectomy showed less IOP fluctuations during diurnal tension curve and following a water drinking test than patients under a mixed group of ocular hypotensive treatment [18]. Konstas *et al.;* demonstrated that well-functioning trabeculectomy provides a statistically lower mean, peak and range of IOP for 24-hour day than maximum tolerated medical therapy in advanced glaucoma patients [27]. Mansouri et al demonstrated that trabeculectomy patients had a statistically significant lower average IOP in diurnal tension curve and less wider fluctuations in water drinking test than patients on latanoprost monotherapy [28].

The aim of our study was to show if fluctuations in IOP differ significantly between POAG patients controlled by trabeculectomy and latanoprost. Our results showed trabeculectomy patients had a significant lower mean IOP in diurnal tension curve than latanoprost group. Elevation of IOP in water drinking test and the IOP fluctuations was also lower in case of trabeculectomy group than latanoprost group.

Prostaglandin analogue have become an important element of medical antiglaucomatous therapy in developed countries. Latanoprost was chosen because it has shown less significant fluctuations compared with timolol and dorzolamide. Glaucoma needs long term therapy. Though antiglaucoma medications are the mainstay of treatment in glaucoma patients but in developing countries like India, where cost of therapy is a factor, it is not possible to continue glaucoma medications for long time. So, trabeculectomy may be a safe alternative procedure which can maintain the IOP much lower side and can prevent further glaucomatous field loss.

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