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Original Research Article

The effect of travoprost on subfoveal choroidal thickness in primary open angle glaucoma

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ABSTRACT

Purpose: To assess the effect of topical travoprost on subfoveal Choroidal Thickness in Primary open glaucoma patients. The choroidal thickness, a sign of ocular blood flow can be altered by prostaglandin analogues. Hence this study was done to analyse the choroidal thickness after travoprost therapy.
Materials and Methods: This Prospective, interventional study included 41 eyes of treatment naive POAG patients. Subfoveal choroidal thickness was measured at first visit and after 3 months of topical travoprost therapy by Enhanced Depth Imaging Optical Coherence Tomography (EDI-OCT). The measurements were compared before starting the treatment and after 3 months of treatment with travoprost therapy.
Result: The mean choroidal thickness pre-treatment was 296.73 ± 28.07 mm post treatment was 311.56 ± 33.38 μm. The mean difference in choroidal thickness between pre-treatment and post-treatment was found to be 14.8 ±15.1 μm with median value(IQR) of 8 (3 - 30) μm (p-value< 0.00) which was statistically significant.
Conclusion: The current study showed that Subfoveal choroidal thickness(SFCT) changes with travoprost therapy.

1. Introduction

Glaucoma is a neurodegenerative disease resulting from the loss of retinal ganglion cells due to multifactorial etiology.[1] In few patients glaucomatous progression occurs even after the target intraocular pressure is maintained, this enlightens the importance of factors independent of intraocular pressure responsible for glaucoma progressions like ocular blood flow abnormalities, vascular dysregulation, and genetic predisposition.[2–4] Histopathological evaluation of choroid in POAG (Primary open angle glaucoma) patients showed loss of both chorio-capillaries and large vessel layer.[5,6] The choroid has the highest blood flow per unit tissue body weight and it supplies optic nerve head and outer retina.[7] Therefore measuring choroidal thickness using OCT(optical coherence tomography) will indicate the perfusion status of ONH (Optic nerve head).[8,9] Aim of our study was to highlight the role of choroid in POAG.

The choroidal thickness, a sign of ocular blood flow can be altered by prostaglandin analogues.[8] The aim of Modern glaucoma therapy is not only to reduce the intraocular pressure but also to increase the optic nerve head perfusion.[10] Evidences reported Prostaglandin analogue increases ONH perfusion in addition to reducing IOP (intra ocular pressure). Travoprost (0.004%), a synthetic prostaglandin (PG-F_2alpha) analogue increases

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both uveoscleral out flow as well as trabecular meshwork outflow.[11] Travoprost being lipophilic and because of its higher affinity for FP receptors is ten times more potent than latanoprost. Travoprost and latanoprost increase the pulsatile ocular blood flow but long term effect seen with travoprost.[10,12,13] Travoprost has a better side effect profile compared to latanoprost and Bimatoprost. According to best of our knowledge no previous studies assessed the effect of topical travoprost therapy on choroidal thickness. Hence, this study was done to analyse the effect of travoprost on subfoveal choroidal thickness.

2. Materials and Methods

This Prospective study was carried out at a tertiary care centre, New Delhi, India. Fourty one eyes of treatment naive primary open-angle glaucoma were enrolled in this study after the approval from institutional ethical committee. This study was done over the period of 18 months. The Patients diagnosed with any other type of glaucoma except POAG, in need of more than one anti-Glaucoma drug, Ocular pathologies such as cataract, diabetic retinopathy, hypertensive retinopathy, age-related macular degeneration, central serous retinopathy, allergy to travoprost and hyperopia/ myopia more than +/-6D were excluded in this study. A preliminary screening assessment & examination was done on patients such as BCVA by log MAR chart, refraction, IOP by Goldman applanation tonometry, slit-lamp bio microscopy, Gonioscopy was done by Goldman 2 mirror lens using slit lamp and was graded by Shaffer's grading, Visual field analysis by Humphrey visual field analyser(HVF 30-2), OCT- RNFL analysis, Fundus examination by 90D and Sub-foveal choroidal thickness measured by SD-OCT(EDI mode) at first visit and at 3 months post treatment.

The subfoveal choroidal thickness was measured by spectral-domain OCT (Spectralis/Heidelberg version 1.9.10.0). The patient was positioned properly in front of the machine without dilating the pupil and a horizontal line scan passing over the fovea was taken for analysis. (Figure 1). All OCT(EDI) was done between 9 AM to 12 PM to avoid the influence of diurnal variation on choroidal thickness. The choroidal thickness was measured at the subfoveal level from hyperreflective retinal pigment epithelial layer to hypo reflective sclerochoroidal interface.[14] The SFCT (subfoveal choroidal thickness) was measured at first visit before initiation of treatment with topical travoprost and again at 3 months post treatment.

2.1. Statistical analysis

The subfoveal choroidal thickness and IOP before starting travoprost and after 3 months of travoprost was done using Wilcoxon signed rank test. To account for potential skewness in the data distribution both mean and median are reported.

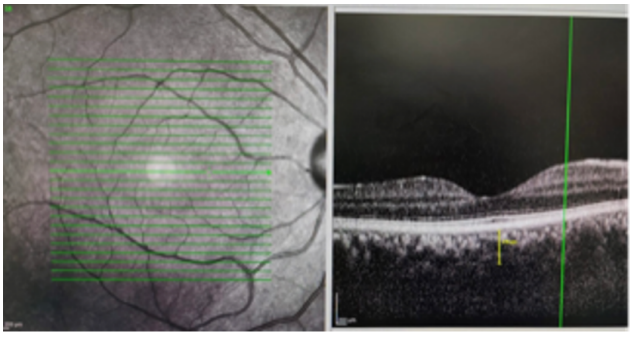

Figure 1: SD-OCT (EDI) scan showing measurement of choroidal thickness at subfoveal level

3. Results

In our study, 41 eyes of POAG patients (25 males and 16 males) were taken. The average age of the study population was 54±9 years. 41% of study population had BCVA of log MAR 0.0, 39% of them had log MAR 0.1 and 20% of them had log MAR 0.2. (Table 1)

Table 1: Descriptive statistics of best-corrected visual acuity of study subjects

Visual Acuity	Number of Cases	Percentage
Log MAR 0.0	17	41%
Log MAR 0.1	16	39%
Log MAR 0.2	8	20%
Total	41	100%

The mean value of IOP at the first visit was 23.56 ± 3.30 mm of Hg and the mean value of IOP after travoprost therapy was 17 ±3.9 mm of Hg.(Table 2) The average IOP reduction was 5.8 ± 2.1 mm of Hg with median value of 6 mm of Hg which was clinically significant (P value <0.001). The IOP is significantly reduced after travoprost therapy in all age groups but the maximum IOP reduction was 7 mm of Hg in 31 to 40 years.(Table 3)

The mean choroidal thickness noted at first visit was 296.73 μm and post treatment was 311.6 μm.(Table 4) The average change in choroidal thickness in this study was 15.85 μm with median value of 8 μm which was clinically significant value<0.001). In our study, an increase in choroidal thickness was noted in all age groups but a significant difference was found in 31 to 40 years of age group.(Table 5)

4. Discussion

Primary open-angle glaucoma is defined as raised IOP more than 21 mm of Hg, characteristic glaucomatous optic disc changes, and visual field changes corresponding to retinal nerve fiber defects with open angles. Vascular

Table 2: Comparison of IOP at first visit and after 3 months

	Mean ± SD	Min - Max	Median (IQR)
IOP first visit	23.56 ± 3.30	18 - 30	24 (22 - 26)
IOP after 3 months	17.52 ± 4.85	0 - 26	18 (16 - 20)
Difference in IOP (first visit-3 months)	5.76 ± 2.10	2 - 10	6 (4 - 8)
Difference between IOP %	24.78% ± 10.12%	8.3% - 45.5%	23.07% (16.66% - 32.05%)
p value	<0.001**		

Table 3: Distribution of IOP in various age groups at the first visit and after 3 months of travoprost therapy

Age group	IOP(pre-treatment in mm of Hg)	IOP(post-treatment in mm of Hg)	Mean difference in IOP
31 to 40	25.3±3.7	18.3±3.3	7
41 to 50	24.2±2.3	19.2±1.6	5
51 to 60	22.5±3.3	17.3±4.4	5.2
61 to 70	23.6±3.3	17.6±5	5.7

Table 4: Comparison of choroidal thickness at the first visit and after 3 months

	Mean ± SD	Min - Max	Median (IQR)
CT at first visit	296.73 ± 28.07	243 - 370	295 (283 - 312.5)
CT at 3 month	311.56 ± 33.38	246 - 373	318 (289.5 - 343)
Difference in CT (first visit-3 months)	15.85 ± 14.02	2 - 52	8 (3 - 30)
Difference between CT %	5.29% ± 4.65%	0.6% - 17.4%	2.85% (1.08% - 9.38%)
p value	<0.001**		

Table 5: Comparison of choroidal thickness at various age groups before and after travoprost

Age group	Choroidal thickness (pre-treatment in Micrometre)	Choroidal thickness (post-treatment in (Micrometre)	Mean choroidal thickness difference in (Micrometre)
31 to 40	308.3±12.1	336.6±14.3	28.3
41 to 50	315.1±26.9	332.2±24.4	17.5
51 to 60	290.8±26	300.7±30.5	11.3
61 to 70	279.2±23.6	291.2±31.2	12

etiology plays an important role in understanding the pathophysiology of open-angle glaucoma. Majority of ONH perfusion is contributed by choroidal circulation (90%) and 10% by retinal circulation.[10,15]The role of choroid in open-angle glaucoma is of increasing interest in recent times. Various mechanisms for increase in choroidal thickness following prostaglandin analogue therapy such as vascular permeability, proinflammatory effect, increase in the blood flow velocity as well as ocular perfusion pressure, decrease in the resistive index of central retinal artery and ophthalmic artery.[16] Among the above mentioned effects of prostaglandin analogues, travoprost has better long term effect than latanoprost and bimatoprost.[10,12,13]

We evaluated the SFCT using EDI mode by SD- OCT to analyse the choroidal thickness which is an indirect measure of ocular perfusion meanwhile some studies have used doppler ultrasound, laser velocimetry and assessment of ocular pulse amplitude to evaluate choroidal thickness which is difficult and time consuming.[10,13,17] Therefore measuring SFCT by SD-OCT was a better alternative to doppler ultrasound and laser velocimetry.

A study by Osamastated that the mean age group of POAG patients were 54.4± 9 years.[18] According to a study done in south India by Vijaya et al, the mean age of POAG patients was 58.4 years where they had included patients more than 40 years of age.[19] In our study the average age of the study population was 54±9 years. Denis P et al concluded that the mean IOP reduction by travoprost was 6.5 to 9 mm of Hg.[12] In another study Ozlem et al compared the effect of travoprost, latanoprost, bimatoprost on IOP.[13] After 6 months of the treatment trial, statistically significant IOP reduction was found in all three prostaglandin analogues groups (P<0.0001). Likewise in our study the mean IOP reduction was 5.7+2.3 mm of Hg after 3 months of travoprost therapy which is comparable to the above mentioned studies.

The mean difference in choroidal thickness between pre-treatment and post-treatment was found to be 15.85 ±15.1 μm with (p-value< 0.00) which was statistically significant. A study by Bayraktaret al used all antiglaucoma medications (prostaglandin analogues, carbonic anhydrase inhibitors, beta blockers and alpha agonists) as well as fixed

drug combination and concluded that SFCT was higher in the treatment group.[9] Duru et al[20] in 2019, assessed the effect of latanoprost on SFCT by SD-OCT (EDI) and found significant increase in SFCT after 3 months of latanoprost therapy.[20] Akyol et al. compared the choroidal thickness after using topical bimatoprost, brinzolamide and timolol in POAG patients and he observed significant increase in choroidal thickness with bimatoprost therapy compared to brinzolamide and timolol.[8] Based on these studies, its proven that prostaglandin analogues increases the choroidal perfusion and thereby act as neuroprotective agents.

A study by Sahinoglue et al evaluated the effect of latanoprost on choroidal thickness after 1 month of therapy, this study did not show the increase in SFCT.[21] Artunayet al reported a case of Central serous chorioretinopathy after one month of starting latanoprost therapy for glaucoma.[22] The possible reason could be increased choroidal permeability. Choroidal permeability being the common mechanism shared by both increase in choroidal thickness as well as development of central serous retinopathy. In view of avoiding side effect associated with latanoprost, travoprost is better option with similar action on choroidal system. Travoprost, being one of the first line drug in the management of POAG has a capability of reducing IOP as well as increases the ONH perfusion. Our study found that Travoprost has the tendency for significant increase choroidal thickness.

5. Conclusion

The current study showed a statistically significant increase in choroidal thickness and IOP reduction after 3 months of travoprost therapy. Because of the influence of travoprost on vascular supply, acts as neuroprotective agents thus fulfils the modern aim of glaucoma therapy. Additional large sample studies need to conclude this effect.

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7. Conflicts of Interest

None.

8. Authors Contribution

Dr Gajashree S: Conceptualization, Formal analysis, Writing - original draft preparation. Dr Neha Chawla: Methodology, Data Curation. Dr Sangeeta Abrol/ Dr Rajshekhar Vemparala/ Dr Brahm Prakash Guliani: Writing- review & editing, supervision.

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