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Effects of Pharmacological Agents on Glaucoma in Daily Life

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Abstract Glaucoma is a silent killer worldwide. The impact of this disease is increasing drastically in the country. Yet health administrations and policy-makers face the increasingly unpleasant causes of glaucoma as a highly variable global problem. The study aims to outline the scientific recovery of glaucoma with comprehensive follow-up and services. Adverse effects were estimated at the Ophthalmology OPDs of three hospitals. Statistical analysis was performed at the Department of Pharmacology, Chittagong Medical College. Primary data were collected from laboratory examinations of patient glaucoma and secondary data were obtained from various sources including national, regional and global perspectives. The primary outcome measure was response rate, defined as the percentage of patients with a ≥ 20 percent reduction in IOP from baseline to three months, and secondary outcome measures were reduction in IOP and ocular adverse effects of medication as assessed by patient history and slit-lamp examination. A total of 80 primary open angle glaucoma patients of both sexes were selected from age (40–90) years. The study shows that there was a significant difference in IOP between the latanoprost and brimonidine groups, but no significant difference in baseline IOP. The results of this study demonstrated that once-daily latanoprost is more effective and safer than brimonidine in lowering IOP.

Keywords IOP, POAG, Age gradation, Pharmacological agent

1. Introduction

Glaucoma is a silent killer in today's world. It is a common disease that leads to optic nerve damage [1]. This damage to the optic nerve, which transmits information from the eye to the brain, results in vision loss. The number of people with glaucoma worldwide was 64.3 million in 2013, 76.0 million in 2020, 80 million in 2022 and will increase to 111.8 million in 2040, which is very alarming [2]; [3]. This disease occurs suddenly even if the optic nerve is damaged due to other reasons. The impact of this disease can be enhanced by tracking wireless sensors on the eyes of healthy individuals at specific GPS locations [4]. It can also occur due to a sudden increase in intraocular pressure [9]; [13]; [15]; [27]. In some cases, the disease is caused by radiofrequency abuse even if the intraocular pressure is normal [49]; [64]; [68]. But this disease has nothing to do with high blood pressure [33]. If not treated at the right time, glaucoma patients can lose their sight forever. However, if the disease is diagnosed early and treated quickly, the patient can cope with such a situation. Otherwise, the patient may suffer permanent or temporary vision loss. A variety of pharmacological agents are used in daily life to prevent glaucoma. These agents include, (i) Dorzolamide and timolol (Cosopt®) [36], [74], (ii) Latanoprost and timolol (Xalacom®) [41]; [48], (iii) Brimonidine and timolol (Combigan™) [52], (iv) Brinzolamide and brimonidine (Simbrinza®) [168], and (v) Netarsudil and latanoprost (Rocklatan™). Glaucoma is the second most prevalent eye condition, after cataracts, known to cause blindness worldwide, which is irreversible [1]. This disease is a chronic, progressive, degenerative disorder of the optic nerve that causes characteristic visual field loss [169]. However, the actual etiology of the condition remains unknown and there is no known cure [5]. Glaucoma consists of (i) congenital glaucoma, (ii) secondary glaucoma, (iii) primary angle closure glaucoma (PACG), (iv) normal tension glaucoma (NTG), (v) pigmentary glaucoma and (vi)

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primary Open-angle glaucoma (POAG). These disorders destroy the optic nerve, which sends visual information to the brain, leading to blindness [6]; [154]. POAG is described distinctly as a multifactorial optic neuropathy [44] that is chronic, progressive, and irreversible, with a characteristic acquired loss of optic nerve fibers. Such loss develops in the presence of open anterior chamber angles, characteristic visual field abnormalities and intraocular pressure (IOP) [28]; [40]; [76]; [84], [93] [103] that is too high for the continued health of the eye. It manifests by cupping of the optic disc in the absence of other known causes of the disease [7]. Risk factors for primary open-angle glaucoma include [10]; [14]; [162]; [165]; [166]: Older age, genetic predisposition, certain eye characteristics (such as a pupillary defect, thin cornea, myopia), low educational status, smoking, African descent and visual problems (such as ocular hypertension [42]; [100]; [102]; [126]; [134]; [237]; [242]; [244] larger horizontal or vertical cup disc ratio, greater Humphrey visual field pattern deviation, asymmetries in the visual field and Myopia [17]. This fluid nourishes and cleanses the eye and mainly exits through the Trabecular meshwork (TM) [16] and another pathway that is insensitive to eye pressure [243]. The pressure points damage of optic nerve. This is analogous to a hinged door closing and squeezing in on one's fingers [6]. The aim of the study was to compare the effects of pharmacological agents in glaucoma.

2. Materials and Methods

2.1. Study Site

The study was triple blind randomized clinical trial from the period of 1st December 2018 to 30 December 2019. This study was conducted in Department of pharmacology & Therapeutics, Chittagong Medical College, in collaboration with Department of Ophthalmology in Chittagong Medical college Hospital; Chattogram Eye Infirmary & Training Complex and Chattogram International Medical College Hospital, Chattogram. All the newly diagnosed case of primary open angle [75]; [232] glaucoma [88] patients (IOP 22-34 mm Hg) attended in out-patient department of Ophthalmology in Chittagong Medical college Hospital; Chattogram Eye Infirmary &Training Complex; Chattogram International Medical College Hospital, during the study period.

2.2. Sample Size Determination Technique

To observe outcome the sample size was determine by the following formula:

$$n = \left(Z_\alpha + Z_\beta\right)^2 \frac{p(100-p)+q(100-q)}{(p-q)^2}$$ [63]. (1)

Where,

n= Sample size in each group

p= Proportion of the subjects with favorable outcome (IOP reduction ≥20 percent after twelve weeks of treatment) in Group A (Latanoprost group)

q= Proportion of the subjects with favorable outcome (IOP reduction ≥20 percent after twelve weeks of treatment) in Group B (Brimonidine group)

Z_α= Z- value of SND at a given level of significance

Z_β= Z- value of SND at a given power

Here,

p= 87%; q= 55% (from previous study [313]; Z_α = 1.96 at 5% level, Z_β =1.282 at 90% power.

So, $n = (1.96 + 1.282)^2 \frac{87\times13+55\times45}{(87-55)^2} = 36.97 \approx 37$

Adjusted for 5% patients lost to follow-up:

$$n_c = n + n\times l = 37+37\times0.05 \approx 40$$

This means that a sample size of 40 subjects per arm was needed to test the hypothesis.

2.3. Sample Size

Forty patients in each arm.

2.4. Trial Registration

Trial Registration was done at 20/9/2019 (www.Clinical Trials.gov) and trial registration, No: NCT04205201.

2.5. Study Group

Arm-A included 40 patients of Primary Open Angle Glaucoma who were treated with Latanoprost plus placebo (distil water) and Arm-B included 40 patients of Primary Open Angle Glaucoma who were treated with Brimonidine.

2.6. Screening Technique

From the study population appropriate numbers of patients were recruited purposively through screening by the following eligibility criteria.

2.6.1. Inclusion Criteria

1. Newly diagnosed case of bilateral Primary Open Angle Glaucoma fulfill the following criteria
   a. IOP (22 – 34) mm of Hg.
   b. Wide open angle on Gonioscopy.
   c. Cup disk ratio > 0.40.
   d. Not started any medication or underwent any surgical intervention [43].
2. Age (40-90) years of both sexes.

2.6.2. Exclusion Criteria

i. Patient who were selected for Trabeculectomy.
ii. H/O ocular inflammation or infection within the last 3 months of baseline visits.
iii. Pregnant and lactating women.
iv. Patients who were treated with (Prednisolone/ Diazepam/Imipramine/Paroxetine) drugs.

2.7. Data Collection Procedure

80 patients of both sexes were selected from outpatient department of above mention three hospitals in Chattogram according to inclusion and exclusion criteria.

Patients were diagnosed as a case of Primary Open Angle Glaucoma by Ophthalmologist. Voluntary informed written consent was taken from each patient or attendants after full explanation of the nature and purpose of the study. Then the eligible patients were randomly allocated in two arms. One arm was treated with Latanoprost and another group was treated with Brimonidine. Each patient was seen at three office visits: At baseline (day -0) visit-one, at one month-visit-two, at three months- visit-three. At the baseline, demographic data and a complete medical and ophthalmic history were obtained.

Best corrected Snellen visual acuity testing, slit-lamp biomicroscopy and IOP measurement (conducted between 7.30AM-12.30PM) were performed. Women of childbearing potential underwent pregnancy testing. At the baseline visit, patients were randomly assigned to treatment and given two bottles of masked study medication and dosing instructions. At follow-up visits (one month and three months), the medical and medication history were updated, patients were questioned about adverse events, best corrected Snellen visual acuity was obtained Slit-lamp biomicroscopy was performed and IOP was measured (between 7.30 AM and 12.30 PM). At one month (visit-two), IOP was measured 2 hours ± 30 minutes after instillation of study medication, at the same time (±1 hour) as during the baseline visit. At three months (visit-three) included measurement of IOP as at one month. In addition, women of childbearing potential were given a repeat pregnancy test. Patients were queried about compliance with the dosing regimen by study period at one month and three months. IOP was measured using a Goldmann applanation tonometer affixed to a slit lamp, with the patient in a seated position. IOP measured at the peak effect of Latanoprost (12-14hours) was compared with that the peak effect of Brimonidine (two hours). To minimize the effects of diurnal variations, IOP measurements were taken at approximately the same time in the morning at each visit.

2.8. Follow up

Follow up visit were done on the one month (Visit- two), three months (Visit-three) of treatment. At every follow up visit evidence of any adverse effect and IOP were recorded.

2.9. Data Analysis

Categorical variables were expressed as frequency and percentage and continuous variables as mean (±Standard deviation). Comparisons of categorical variables were done with Chi-square test or Fisher Exact test. The continuous variables were compared between two groups by Independent sample t- test. Within group's effect at different time interval were assessed by Paired sample t test. Analysis was done in intention to treat all basis. To handle the missing data derived from lost to follow-up patients; the series mean value was used for analysis. To determine the effect size, favorable outcome ≥20 percent reduction of IOP from baseline at final follow-up was considered as final outcome. Statistical significance was defined as $P < 0.05$ and confidence interval set at 95 percent level.

2.10. Ethical Consideration

This document was a protocol for human study. This study was conducted according to Bangladesh and international standards of good clinical practice, applicable government regulations and institutional research policies and procedures.

Ethical Clearance was undertaken by Ethical Reviews Committee (ERC) of the Chittagong Medical College. The Ethical clearances memo no was: CMC/PG/2018/429.

Permission was taken from the concerned Departments and Authorities.

Voluntary informed written consent was taken from each patient.

Every patients were informed about the study and they were also informed that there was no chance of any significant harm by inclusion in this study.

All measures were taken to preserve patient's anonymity and privacy. Evaluation of each research participant were done thoroughly. Required investigations including radio–imaging and biochemical tests were done in the CMCH if facilities are available. All patients were informed about the nature and purpose of the study. They got informed that their participation in the coming study research would not only benefit them but also the whole community as well.

3. Result & Observation

The results included different observations, which are illustrated sequencially.

3.1. Demographic Characteristics

The study showed the demographic characteristics of patients between study groups including Latanoprost group, Brimonidine group, follow up Intraocular pressure (IOP) in Table 1.

Table 1. Demographic Characteristics of Patients between Study Groups

Variables		Assigned group		P value
		Latanoprost (n=40)	Brimonidine (n=40)	
Age	Mean ±SD	60.98±9.31	59.78±6.69	0.510
	Range	50-87	50-80	
Gender	Male	22 (55.0%)	22 (55.0%)	1.0
	Female	18 (45.0%)	18 (45.0%)	

Data were expressed as frequency (percentage) if not otherwise mentioned. *p value was derived from independent sample t test, †p value was derived from Chi-square test as appropriate.

Patient demography is shown in Table 1. It shows that, both of the groups were comparable with respect to age and sex. Overall, the mean age ranges from 50 to 87 years with slight male predominance (Maletofemaleratiowas 1.2:1).

3.2. Changes of IOP in Latanoprost Group

The study shows the changes of IOP in Latanoprost Group in Table 2.

Table 2. Changes of IOP in Latanoprost group at different time interval (n=40)

Follow up time		Intraocular pressure (mmHg)	Intraocular pressure difference (mm Hg)	P value*
Pair 1	Baseline	26.80±1.15	5.63±1.10	0.001
	Month -1	21.17±1.59		
Pair 2	Baseline	26.80±1.15	7.34±1.53	0.001
	Month -3	19.46±1.81		

Data were expressed as Mean ±SD
*P values derived from paired sample t test.

Effect of Latanoprost in reduction of IOP were analyzed by paired sample t test from baseline to month 1 and month 3 and presented in the Table 2. It shows that IOP was significantly lower than baseline IOP at 0ne month and three months after the treatment.

3.3. Changes of IOP in Brimonidine Group

The study shows the changes of IOP in Brimonidine Group in Table 3.

Table 3. Changes of IOP in Brimonidine group at different time interval (n=40)

Follow up time		Mean IOP, mmHg	Mean IOP difference	P value*
Pair 1	Baseline	26.38±1.72	5.22±1.42	0.001
	Month -1	21.16±1.59		
Pair 2	Baseline	26.38±1.72	5.50±1.59	0.001
	Month- 3	20.88±1.54		

Data were expressed as Mean ±SD
*P values derived from paired sample t test.

Effect of Brimonidine in reduction of IOP were analyzed by paired sample t test from baseline to different time interval and presented in the Table 3. It shows that IOP was significantly lower than baseline IOP at one month and three months after the treatment.

3.4. Comparative Study on Follow up

The study shows the comparative analyses baseline and relevant agent's application follow up of IOP in Latanoprost Group Brimonidine Group, which as shown in Table 4.

Table 4, shows mean IOP at various follow-up visits (upto three months) for both groups. The IOP of patients in the Brimonidine group was 20.88±1.54mmHg, while the Latanoprost group was 19.46±1.81 mmHg at month three from enrollment, which were both lower than baseline. The mean IOP was significantly lower in the Latanoprost group compared to Brimonidine group at the study endpoint (P=0.001).

Table 4. Comparison of mean Intraocular pressure (IOP) at different follow up

Follow up time	IOP in mmHg		P value*
	Latanoprost (n=40)	Brimonidine (n=40)	
Baseline	26.80±1.15	26.38±1.72	0.212
Month-1	21.17±1.59	21.16±1.59	0.972
Month-3	19.46±1.81	20.88±1.54	0.001

Data were expressed as Mean ±SD
*p value was derived from independent sample t test.

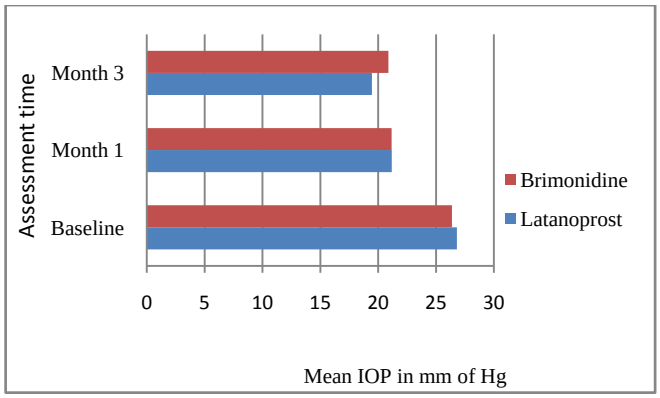

Figure 1. Mean (±SD) IOP at baseline, one month and three months in two groups

Table 5. Comparison of mean IOP reduction from baseline to different follows up

Follow up time	Change IOP from baseline		p value*
	Latanoprost (n=40)	Brimonidine (n=40)	
Month -1	5.63±1.10	5.22±1.42	0.164
Month -3	7.34±1.53	5.50±1.59	0.001

Data were expressed as Mean ±SD
*P values were derived from Independent sample t test.

Table 5, shows mean IOP reduction from the baseline values at various month one and month three for both groups. It shows that, the IOP reduction was significantly more at three months from baseline in Latanoprost group than Brimonidine group.

Table 6. Comparison of Mean percentage change of IOP from Baseline to one Month and three Months between study groups

Follow-up time	Percentage change of IOP		p value*
	Latanoprost (n=40)	Brimonidine (n=40)	
Month -1	21.02±3.84	20.00±4.96	0.193
Month -3	27.39±5.26	20.72±5.42	0.003

Data were expressed as Mean ±SD
*P values were derived from Independent sample t test.

Table 6, shows that mean percentage change IOP at month one was similar in both groups. At three months mean percentage change of IOP was significantly more in Latanoprost compared to Brimonidine.

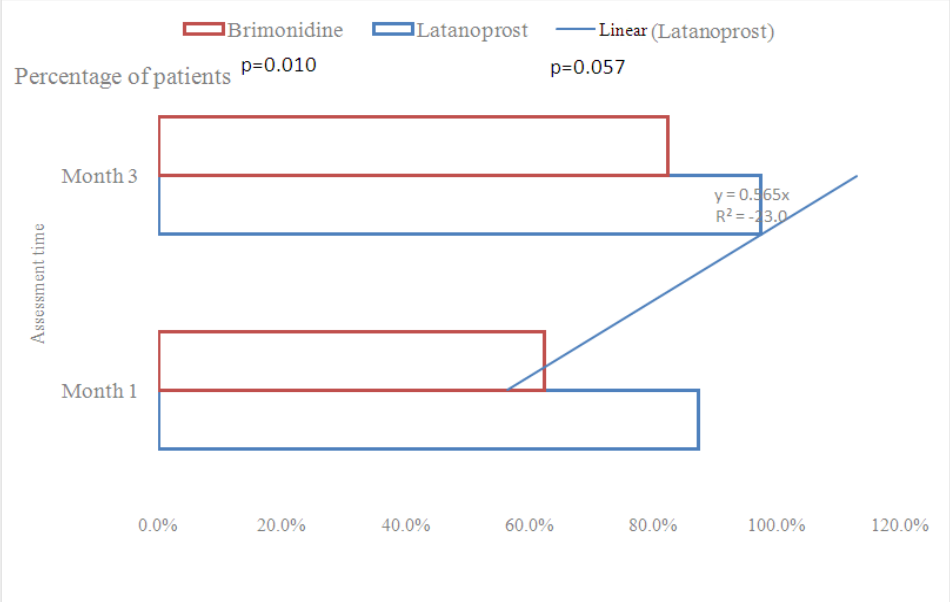

Figure 2. ≥20 percent reduction of IOP from baseline to one month and three months in two groups

Table 7, shows that, both after one months and three months significantly greater proportion of patients treated with Latanoprost achieved ≥20 percent reduction of IOP compared to the patients treated with Brimonidine.

Table 7. Comparison of IOP ≥ 20 percent reduction from baseline to one month and three months between study groups

Follow-up time	≥20% reduction of IOP from baseline		P value
	Latanoprost (n=40)	Brimonidine (n=40)	
Month-1	35 (87.5%)	25 (62.5%)	0.01
Month-3	39 (97.5%)	33 (82.5%)	0.02

*P value derived from Chi-square test;

3.5. Adverse Events Rate

The study shows a comparison study on adverse events rate between the Latanoprost and Brimonidine groups, which as shown in Table 8.

Table 8. Comparison of adverse events rate between study groups

Adverse events	Frequency (Percentage) of patients in		P value*
	Latanoprost (n=40)	Brimonidine (n=40)	
Photophobia	0 (0%)	0 (0%)	-----
Visual disturbance	0 (0%)	0 (0%)	----
Dry eye	0 (%)	1 (2.5%)	1.00
Headache	0 (0%)	3(7.5%)	0.24
Drowsiness	1 (2.5%)	2 (5.0%)	1.00
Macular edema	0 (0%)	0 (0%)	-----
Conjuntival hyperemia	3(7.5%)	2 (5.0%)	1.00
Ocular irritation	0 (0%)	0 (0%)	---

*p values were derived from Fisher Exact test.

Table 8, shows ocular and systemic adverse events infrequently in both groups. There was no statistically significant difference in the distribution of adverse events between two groups.

Table 9. Calculation of effect size measures

≥20 percent reduction of IOP	Latanoprost (n=40)	Brimonidine (n=40)	Total
Yes	39 (97.5%)	33 (82.5%)	40
No	1 (2.5%)	7 (17.5%)	40

The study observed the effect size measures:
(i) ERR (Experimental Event Rate): 0.97
(ii) CER (Control Event Rate): 0.82
(iii) ARR (Absolute Risk Reduction): 0.15
(iv) NNT (Number Needed to Treat): 7
(v) RR (Relative Risk): 1.18
(vi) RRR (Relative Risk Reduction): 0.18

Table-9, shows to calculate the effect size of the patients were categorized into two groups: favorable outcome was achieving ≥20 percent reduction of IOP after three months and unfavorable outcome failed to achieve ≥20 percent reduction of IOP after three months. The Proportion of patients achieved ≥20 percent reduction of IOP was 97.5 percent and 82.5 percent respectively in Latanoprost and Brimonidine group and NNT was7. To get one additional favorable outcome with Latanoprost seven additional patients need to be treated with the drug.

3.6. Inference

The study shows that both agents are more effective and well tolareted.

4. Discussion

The study was conducted to evaluate the effect of pharmacological agents on glaucoma to reduce intraocular pressure (IOP) in 80 patients with bilateral POAG [238]. From September to December 2019, patients from three hospitals in Chittagong, Bangladesh were selected to evaluate the effects of purposefully applied pharmacological agents. They were followed for three months with treatment randomized into two intervention groups. Among the study groups, one group of 40 patients was treated with latanoprost plus distilled water and another group of 40 patients was treated with brimonidine to compare the results. Patients, ophthalmologists, and researchers were unaware of the study medication. The IOP among patients veried in both latanoprost and brimonidine groups [20];[21]; [111]; [112]; [114]; [121]; [123]; [124]; [138]; [139]; [157]; [173]; [189]; [241]; [257]; [267]; [278]; [285]; [324]; [325]; [327]; [335] & [348].

4.1. Impact of Pharmacological Agents

The results of the study showed that both latanoprost administered once daily and brimonidine administered topically [113] twice daily resulted in effective reduction of IOP, and the IOP-lowering effect with latanoprost [104] was very good. The study showed that 55.0% of the 80 patients were male and the male to female ratio was 1.2:1. This finding is consistent with [80]; [81]; [105]; [302] where the male to female ratio was 1.06:1. A study conducted on an Indian population [313] found that baseline IOP was 26.9 ± 6.1 mmHg in the latanoprost group and 26.5 ± 5.7 mmHg in the brimonidine group. This study was similar to the corresponding values, which were 26.80±1.15 mmHg in the latanoprost group and 26.38±1.72 mmHg in the brimonidine group. Luo et al [188] showed that, at the end of the study (after 12 weeks), the mean IOP was 18.1 ± 1.3 mm Hg in the latanoprost group and 17.0 ± 0.9 mm Hg in the brimonidine group, which closely resembled the corresponding values in this study, which were in the latanoprost group and brimonidine group [136]. The values were 19.46 ± 1.81 mmHg and 20.88 ± 1.54 mmHg, respectively.

In treatment-dependent patients, the mean IOP reduction was 5.2±3.0 mmHg in the latanoprost group and 6.9±3.7 mmHg in the brimonidine group [85]. In this study, the researchers found that the IOP reduction was 7.34±1.53 mm Hg in the latanoprost group and 5.50±1.59 mm Hg in the brimonidine group. The study directly compared the two drugs in a multicentre, crossover and double-masked manner [302]. In Caucasian eyes, baseline pressure was reduced by 31% in the latanoprost group and 15.5% in the brimonidine group. The results of their study were consistent with this study, where the latanoprost was 27.39% and the brimonidine group was 20.72%. Some studies reported that the percentage of patients achieving a 20% reduction in IOP from baseline to three months was 85.7% and 46.4% in the latanoprost group and brimonidine group [277], respectively [313]; [354]. The corresponding values in this study were not significantly different from the values in the latanoprost group and the brimonidine group, namely 97.5% with the latanoprost group and 82.5% with the brimonidine group.

Previous studies have shown that the overall incidence of adverse events was low and that both study drugs were generally well tolerated [61]; [82]; [85]; [130]; [[252]. No significant difference was observed between the two groups in the incidence of adverse events [301]. Conjunctival hyperemia occurred in 11.5% of patients in the latanoprost group and 6.3% of patients in the brimonidine group [148]. The corresponding values in this study were 2.5% and 7.5% of conjunctival hyperemia in the latanoprost group [192]. In the brimonidine group—conjunctival hyperemia was 5.0%, headache was 7.5%, somnolence was 5.0%) and dry eye was 2.5%. Any comments regarding the short duration of treatment and the purely clinical examination are included again [53]; [54]. A documented side effect of headache with brimonidine was also seen in this study, but was not severe enough to warrant withdrawal of the drug. No patients in this study had allergies, a known side effect, again possibly explained by the short nature of the study. In a meta-analysis of randomized trials, latanoprost was statistically more effective than daily brimonidine as monotherapy in lowering IOP [101]; [172]; [177]; [308]. This study did not include any trials conducted in the Bangladeshi population. This study conducted in such a population will add to this growing body of evidence for the superiority of latanoprost [343]; [344] over brimonidine and generate new insights. Factors such as treatment and cost need to be considered when differentiating anti-glaucomatous drugs, including efficacy, applicability and tolerability [346]; [347]. Latanoprost has the advantage of once-daily dosing [320]. Two studies have shown better treatment persistence [304] and adherence with prostaglandins [23]; [67]; [131]; [353] than with α2 agonists [247]; [284]; [305]; [306]; [314]; [315]; [316]; [336]. Latanoprost has been shown to be cheaper [302]; [326] comparable [95]; [331]; [332]; or more expensive [325] than brimonidine on a daily basis [318]. These issues were not addressed in the current study that could be evaluated in future studies [337].

4.2. Innovative Research

Every year awareness is raised among people to prevent glaucoma [25]. This year from March 12 to 18, “World Glaucoma Week” is observed around the world. The theme of the week in 2023 was 'Protect Your Sight, Enjoy the Beautiful World' [254]. In this theme, everyone's participation and awareness in glaucoma treatment is mentioned. Many people think that when a person is diagnosed with glaucoma, they are destined to become blind. In today's society, blindness is considered to be a curse of human life. Due to this disease, the patient is often depressed. Research shows that, with advanced wireless sensor technology to treat this disease, patients with this disease have no reason to despair [4]; [155]. Experts say that to stay away from this terrible disease, everyone needs awareness, participation in prevention and assurance in using safe

wireless sensor technology. Some say that there is no cure for glaucoma blindness, so the patient's world is bleak. The study shows that awareness is the only way to prevent this disease [4]. Glaucoma is the leading cause of irreversible blindness, but science today has proven that glaucoma can be cured through advanced technology. It is possible to provide this treatment to about eight million glaucoma patients worldwide, most of whom are people from underdeveloped countries in Asia. But as 90 percent of people do not know about the cure for this disease [254], the affected person becomes blind due to lack of proper and timely treatment. Some ophthalmologists said that due to the misuse of advanced technology, the exact cause of this disease is not known in most cases [4]. Research has shown that glaucoma patients are digitally tracked by tracking a person or animal at a specific GPS location through advanced wireless sensor technology [4]. But many give wrong information about the causes of this disease, such as- (a) age-related disease [29], (b) hereditary disease, (c) disease due to multimorbidity, and (d) congenital disease. Surprisingly, the disease can be caused by the misuse of advanced technology - no one is talking about it, which is known by the ISNAPHO (Impact of Sensor Networks towards Animals-Plants-Human beings and Objects) test in the higher research [228]. Treatment Glaucoma/ blindness can be easily prevented if glaucoma is diagnosed at an early stage [122]; [123]; [124]; [139]; [179]; [180]; [194]; [275]; [293]; [295]. The patient, his family and the surrounding community need to be aware of glaucoma [260]; [272] and unite under the same umbrella to prevent blindness [181]; [182]. Glaucoma [96] is usually treated [11]; [19]; [89]; [90]; [133]; [201]; [350] in following ways-

(i) Prescription eye drops [26]; [108]; [120]; [160], [272]; [309]

(ii) Oral medicine [70]; [118]; [185]; [186]; [187]; [191]; [195]; [250]; [251]; [258]; [297]; [307]; [310]; [338]; [349].

(iii) Laser treatment [18]; [22]; [30]; [31]; [35]; [37]; [38]; [46]; [51]; [55]; [56]; [59]; [60]; [69]; [71]; [73]; [77]; [86]; [91]; [92]; [94]; [106]; [107]; [109]; [111]; [112]; [114]; [116]; [119]; [125]; [139]; [143]; [145]; [153]; [156]; [161]; [163]; [164]; [167]; [170]; [171]; [173]; [174]; [175]; [176]; [178]; [184]; [193]; [194]; [196]; [197]; [198]; [230]; [231]; [239]; [240]; [249]; [259]; [263]; [266]; [267]; [268]; [270]; [273]; [274]; [281]; [289]; [292]; [298]; [300]; [322]; [334]; [341]; [342]; [352].

(iv) Surgery [50]; [57]; [72]; [73]; [87]; [99]; [115]; [117]; [128]; [149]; [152]; [153]; [164]; [183]; [190]; [199]; [200]; [230]; [233]; [248]; [261]; [262]; [267]; [271]; [279]; [280]; [288]; [290]; [294]; [296]; [303]; [319]; [323]; [328]; [340]; [345].

(v) Advanced sensor technology [4]; [32]; [97]; [210]; [351]; [355].

(vi) Combination of approaches [13]; [24]; [36]; [39]; [62]; [65]; [66]; [79]; [103]; [110]; [127]; [129]; [135]; [142]; [150]; [158]; [159]; [253]; [264]; [265]; [269]; [286]; [321].

All types of conventional treatment of glaucoma [137]; [234] [235] are possible and affordable worldwide [8]; [329]; [339]. The affected person suffers permanent blindness if not treated properly at the right time [236]. Glaucoma is a very serious disease at cloud networks. Since it has no symptoms, regular eye exams are the main way to prevent glaucoma. Glaucoma is called the silent killer of the eyes. Most glaucoma is asymptomatic. Glaucoma can be easily diagnosed by testing eye pressure, nerve condition and visual range [330]. Some people sometimes say that this disease is congenital, but research shows that this idea is wrong [4]. In that case, after birth, the child's eyes [219] should be examined without delay if these symptoms appear, such as watery eyes, sensitivity to light, opaque pupils, and enlargement of the eyeball. Therefore, regular eye examination and following the advice of an ophthalmologist as per the report is the most effective way to prevent glaucoma [47].

4.3. A World Free of Glaucoma

Research has revealed that cybercriminals track designated human/animal [226]; [311] eyes around cloud networks with wireless sensor devices/smartphones [4]. When the electromagnetic needle hits the person/animal's eye during tracking, the person/animal suddenly feels itching or pain. Node pointers are generated by coding painful eye. If this node point is retracked several times, the person/animal will develop glaucoma. Cybercriminals control glaucoma patients 24/7 through cloud networks. If the person/animal closes their eyes as soon as they feel pain, changes their current location, does not speak instantly, holds anti-radiation sunglasses on the painful part, activates the network isolator on their GPS location, shuts down the wireless network between them. For a few minutes, using a personal area network control unit (PANCU), finally, EDRAST (Eye Disease Recovery through Advanced Sensor Technology) in the eye uses digital sensor lasers/Neuralink to cure blindness while improving mental health [37]; [355]. If these principles are followed as advised by the doctor, the person/pet remains free from glaucoma. However, be careful not to use the patient's own hand when the eye is painful or itchy, as cybercriminals use the patient's hand as a control indicator, causing the pain or itchiness to increase as patients touch their eyes. If these principles are followed at national and international levels, the world will be free from glaucoma/blindness, creating a peaceful world with light for all.

4.4. Risks in Daily Life

Biometric systems based on retina scanning and fingerprint recognition use different sensor technologies to know the exact identity and location of a person [83]. But due to lack of proper security [202]; [203]; [214]; [215]; [216]; [219]; [220], cybercriminals misuse retina scanning and fingerprinting, as a result selected people are affected in various ways, sometimes they get sick in different Common Acute Sensorineural Infection and Disorder (CASSID) and their brains are controlled by cybercriminals [4]. As a result, they lose health and decision-making ability. Although

different studies have observed different results [78], the misuse of advanced wireless sensor technology is a risk factor for environmental diseases [207]; [218]; [255], climate change [204]; [205]; [211], heatwaves [213] linking to mental health, glaucoma [256], allergy [34]; [45]; [208] and cataract [98]; [299]. So, to stay healthy, ensure the use of safe wireless sensor technology, make common people aware of its effects and enforce laws against cyber criminals [4]; [202]; [203]; [210]. This study indicates that more future research is needed to guide the design of public health strategies related to glaucoma risk factors, screening, treatment, and routine follow-up.

4.5. Future Direction

More than 360 sensor diseases including glaucoma [4], covid-19 [4]; [202]; [206]; [210]; [212]; [214]; [216]; [220]; [221]; [222]; [223]; [224]; [287], sudden cardiac arrest [146]; [147]; [203]; [245]; [246]; [276]; [317]; [333], ARDS (acute respiratory distress syndrome) [214], digital dermal disease [58]; [208], stomach cancer [227]; [283], sensor paralysis / numbness [225], diabetes [209;217], Alzheimer's disease [4]; [282]; [312], sudden stroke [4]; [144], dengue [215], liver cirrhosis [4], chronic kidney disease [4], oral cancer [132], pneumonia [151], acute lymphoblastic leukemia [321], alopecia [4]; [140]; and cataract [4] are spreading due to misuse of advanced wireless sensor technology. Due to the daily reliance on wireless sensor technology - some users do not consider this abuse very important. If the eye is damaged by glaucoma, the idea of how to use technology is really deep, but their knowledge is limited. Research shows that future misuse of wireless sensor technology will increase exponentially if security measures are not ensured for users of current wireless sensor technology. Ensuring use of safe wireless sensor technology for present and future generations to create a glaucoma free world, raising awareness through participation of all, ensuring user safety through media gateways, proper enforcement of laws against cyber criminals and providing all kinds of support to victims. Because, at the root of all problems is the reluctance of people to participate and in all solutions, there is a collective effort of people to participate [141]. EDRAST is an advanced glaucoma treatment tool that prevents current and future blindness through sensor technology.

5. Conclusions

Finally, the study examined the effect of pharmacological agents in the patient's glaucoma. Both latanoprost and brimonidine effectively lower IOP in patients with POAG. Both drugs were well tolerated and patient had no side effects that required study drug withdrawal. An economic evaluation of latanoprost showed that latanoprost was superior to brimonidine, future studies should consider the cost-effectiveness ratio, since latanoprost, like all other glaucoma therapies, is a chronic therapy. The research trajectory recommends for alternative policy linking with national health and sustainable development goals 2030.

Declaration

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Data Availability

The data being used to support the findings of this research work are available from the corresponding author upon request.

Competing Interests

The authors declare no potential conflict of interests in this research work.

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Appendix

CASE RECORD FORM

lD. No: Reg. No: Date: / /

Place of data collection:

☐ Dept. of Ophthalmology-CMCH.

☐ Chattogram Eye Infirmary & Training Complex.

☐ Chattogram International Medical College Hospital.

Particulars of the patient:

Name:

Age: Sex: Male/Female. Marital status: M/Um. Iris color: Blue/Brown/Green/Hazel Add:

Guardian's name: Drug history:

Chief Complaints:

H/O past illness: CVD/HTN/DM/BA.

F/H: DM/HTN/BA

General exam: Pulse b/m BP: mm of Hg

Diagnosis: POAG (Bilateral). **Follow Up Chart:**

	Name of Drug:		
	Baseline visit	At one month	At three months
	/ / 2019	/ / 2019	/ / 2019
IOP	Rt- Lt- mm of Hg	Rt- Lt- mm of Hg	Rt- Lt- mm of Hg
Visual acuity	6/12	6/12	6/12
Headache	Present/Absent	Present/Absent	Present/Absent
Drowsiness	Present/Absent	Present/Absent	Present/Absent
M.edema	Present/Absent	Present/Absent	Present/Absent
Conjuntival hyperemia	Present/Absent	Present/Absent	Present/Absent
Ocular irritation	Present/Absent	Present/Absent	Present/Absent
Dry eye			

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