

A Pharmacoeconomic Analysis to Determine the Relative Cost-effectiveness of Timolol 0.5%, Brinzolamide 1% and Brimonidine 0.2% Eye Drops in Treatment of Primary Open Angle Glaucoma/Ocular Hypertension

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Abstract

Aim: A pharmacoeconomic analysis to determine the relative cost-effectiveness of timolol 0.5%, brinzolamide 1% and brimonidine 0.2% eye drops in treatment of Primary Open Angle Glaucoma (POAG)/ocular hypertension (OHT). **Settings and Design:** Comparative, open, randomized, parallel group prospective study. **Materials and Methods:** 60 patients of POAG or ocular hypertension were included in this study. Time period of study was 6 weeks. 60 eyes of 60 patients were included in the study. Patients were divided randomly into 3 groups of 20 each. Patients in group A, B and C received timolol, brinzolamide and brimonidine respectively. One drop of each medication was instilled twice a day at 9 am and 9 pm daily for 6 weeks. IOP was measured on day 0 at 9 am (before administration of drugs) and then at 11 am, to get baseline IOP. IOP was again measured on subsequent visits at 9 am and 11 am. Treatment outcome was number of mm Hg fall in IOP induced by the study drug. The daily cost of each drug was calculated by maximum retail price and the average number of drops per bottle. The cost-effectiveness was then calculated as the cost of drug/mm Hg fall in IOP. **Statistics:** Paired 't' test was used to analyze the parameters within the group. Independent samples t-test was used to compare the efficacy of drugs with each other. **Results:** The % reduction of brimonidine, timolol and brinzolamide at end of 6 weeks was $21.43 \pm 3.06\%$, $24.87 \pm 2.46\%$ and $18.78 \pm 1.73\%$ respectively. Timolol was superior in efficacy to other two drugs. The difference was statistically significant between the efficacy of timolol and brinzolamide ($p < 0.001$) as well as timolol and brimonidine ($p = 0.003$). There was no statistical significant difference in the efficacy of brimonidine when compared to brinzolamide ($p=0.26$). Timolol (5.87 ± 0.83 Rs/mm lowering after 6 weeks) was found to be most cost-effective followed by brimonidine (46.83 ± 7.37) and then brinzolamide (60.49 ± 6.77) in lowering IOP. **Conclusion:** All three drugs under the present study are useful in the treatment of POAG/OHT, but timolol is a better choice than other two drugs because of greater reduction in IOP and greater cost-effectiveness.

Keywords: Cost-Effectiveness, Glaucoma, Pharmacoeconomics, POAG

1. Introduction

Glaucoma is a chronic debilitating disease of eye.^[1] It refers to a group of multi factorial optical neuropathies associated with progressive loss of retinal ganglion cells, leading to a characteristic pattern of visual field loss.^[2] It is

a “silent killer” and remains asymptomatic. By the time it is diagnosed, it had already become irreversible.^[3]

It is a leading cause of irreversible blindness and 3rd major cause of blindness worldwide after cataract and refractive errors.^[4,5] It is second most common cause of bilateral blindness.^[6] In 2013, it was estimated that 64.3

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million people had glaucoma and this figure is projected to increase to 76.0 million by 2020 and 111.8 million by 2040.^[7] Glaucoma is 3rd leading cause of blindness in India (prevalence of 5.8%) and 1/5th of the total patients of glaucoma globally, are from India.^[5, 8]

Glaucoma encompasses a diverse group of disorders that have in common a potentially progressive and characteristic optic neuropathy which is associated with visual field loss as damage progresses and in which intraocular pressure is usually a key modifying factor.^[9]

Glaucoma may be congenital or acquired.^[9] According to another classification glaucoma may be open angle or closed angle based on the mechanism by which aqueous flow is impaired with respect to anterior chamber.^[10]

The most common form of open-angle glaucoma is primary open-angle glaucoma. Most POAG patients will have decreased visual function. By 2020, POAG is estimated to cause 6 million cases of blindness worldwide.^[11] It is estimated that worldwide between 35 and 58 million people had POAG in 2015.^[12]

Age is major risk factor in development of POAG.^[13] Other risk factors are increased IOP, male sex, high myopia, a thin central cornea, disc hemorrhage etc.^[11, 14] Elevated IOP remains the most prominent factor – shared among the primary and secondary glaucoma – and the only factor contemporary ophthalmic intervention can reliably affect.^[15]

It has been demonstrated that the reduction in the level of IOP lessens the risk of visual field progression in open angle glaucoma. Treatment strategies of glaucoma aim at lowering IOP, which helps to prevent optic nerve damage and glaucoma related blindness.^[16]

Topical administration of IOP lowering agents is the 1st line of therapy for treatment of glaucoma. Major drug classes for treatment are alpha agonist, betablockers, topical carbonic anhydrase inhibitors, oral carbonic anhydrase inhibitors, miotic agents, prostaglandin analogues. Brinzolamide which is a carbonic anhydrase inhibitor, timolol which is a beta blocker and brimonidine which is an alpha agonist are important drugs for medical management of POAG.^[17]

Brimonidine is a potent and highly selective α_2 -adrenoceptor agonist. It is used in Primary Open Angle Glaucoma and also in ocular hypertension to decrease IOP. Additional benefit of this drug is its neuroprotective mechanism.^[18] Allergic reactions are common with use of brimonidine.^[19]

Timolol is a non-cardio selective β -blocker. It is usually given twice daily although it may also be given

as single daily installation in the morning. Timolol is among the most effective ocular hypotensive agents in patients with primary open-angle glaucoma and ocular hypertension.^[18] Ocular discomfort, conjunctivitis may occur with its use.^[20] It should not be used in patients of bronchial asthma, severe chronic obstructive pulmonary disease, bradycardia, severe heart block.^[21]

Brinzolamide is a heterocyclic sulfonamide. It can be given twice a day or three times a day.^[18] It is a carbonic anhydrase II inhibitor.^[22] It is indicated for the topical management of primary open-angle glaucoma and ocular hypertension as either monotherapy or adjunctive therapy with topical β -blockers. Allergic reactions may be seen with its use.^[23]

Glaucoma needs long term treatment. Long term treatment is a financial burden to the patient and may result in low adherence to the treatment, which like in any other chronic disease, is a major hurdle in success of the treatment.^[24] There are plenty of options for treatment of glaucoma. The choices have to be made by prioritizing (rationing) all treatment strategies.^[25] The deciding criterion should be both efficacy and cost of treatment strategy rather than a single factor alone.^[26]

A full economic evaluation must compare minimum two alternatives and consider both the cost and consequences of each alternative.^[27] Main type of cost analysis include Cost of Illness analysis (COI), Cost minimization Analysis (CMA), Cost Effectiveness Analysis (CEA), Cost Utility Analysis (CUA), cost consequence analysis, and Cost Benefit Analysis (CBA).^[28]

Devising ways in which complex outcomes of health care can be reduced to a single monetary measure is not easy and is the main reason why CEA has been relied on more often in the health care sector.^[29]

To choose therapy for treatment of glaucoma one should consider cost of the drug along with its efficacy. To make best use of the resources, the therapy chosen must be cost-effective. Our study will strengthen the knowledge of physicians regarding the concept of cost-effectiveness and will also find out which alternative among brimonidine, timolol and brinzolamide is most cost-effective.

2. Materials and Methods

2.1 Study Design

In this open, comparative, randomized, parallel group prospective study, 60 subjects of POAG or ocular

hypertension attending the outpatient Department of Ophthalmology of a tertiary care hospital were included. The patient selected for the study fulfilled the inclusion criteria and had none of the exclusion criteria. Patients with minimum age of 18 years having unilateral or bilateral POAG or ocular hypertension with IOP < 30 mm Hg were included. Exclusion criteria for ocular conditions were patients who had acute angle closure glaucoma or closed anterior chamber, secondary glaucoma, intraocular surgery within 6 months of study, argon laser trabeculoplasty within 6 months of study, and any infection or inflammation of eye. Exclusion criteria for general conditions were pregnant females, lactating mothers, females not employing measure to prevent conception, obstructive airway disease, heart failure, 2nd and 3rd degree heart block, and contraindication to any of the study drugs.

2.2 IOP Lowering Determination

60 patients of POAG or ocular hypertension were included in this study. Time period of study was 6 weeks. Patients with bilateral POAG were treated for both eyes but only one eye was considered as the study eye. 60 patients included in the study were divided randomly into 3 groups of 20 each. Patients in group A, B and C received timolol, brinzolamide and brimonidine respectively. One drop of each medication was instilled twice a day at 9 am and 9 pm daily for 6 weeks. Washout period was given to patients already under treatment: Prostaglandin analogues- 6 weeks, β Blockers- 4 weeks, Brimonidine- 2 weeks, Dorzolamide- 2 weeks. Drugs taken in the study were: Timolol 0.5% (Iotim), Brinzolamide 1% (Azopt) and Brimonidine 0.2% (Alphagan- Z). IOP was measured on day 0 at 9 am (before administration of drugs) and then at 11 am, to get baseline IOP. IOP was again measured on subsequent visits at 9 am and 11 am. *Goldmann applanation tonometry* was used to measure IOP. Detailed medical and ocular history was taken and complete ocular examination was done on the baseline visit. Ocular examination included visual acuity estimation, slit lamp examination, ophthalmoscopy, and gonioscopy. Treatment outcome was number of mmHg fall in IOP induced by the study drug.

All observations were tabulated and subjected to statistical analysis using ‘t’ test. Paired ‘t’ test was used while analyzing parameters within the same group. For comparison of parameters in between the two tests unpaired/independent ‘t’ test was used.

2.3 Cost Analysis

Five bottles of each commercially available size of anti-glaucoma medications used in our study were taken. The actual volume (instead of labeled volume) was determined for each bottle. The drops were counted while emptying the contents of the bottles in a 5 ml graduated cylinder. The bottles were held at approximately 135° as the drops were collected. Like this actual volume and number of drops were counted for each bottle. Now number of drops per milliliter (drops/ml) was calculated.

Cost per day of particular anti-glaucoma medication for each eye was calculated by dividing the cost of one bottle by total number of drops in a bottle and multiplying by number of drops required daily.

$$\begin{aligned} & \text{Cost of anti - glaucoma medication per day per eye} \\ &= \frac{\text{Cost per bottle}}{\text{Number of drops per bottle}} \times \text{No. of drops required per day per eye} \end{aligned}$$

$$\text{Cost for 6 weeks per eye} = \text{Cost per day per eye} \times 42$$

$$\text{Cost per year per eye} = \text{cost per day per eye} \times 365$$

2.4 Cost-effectiveness Analysis

Cost-effectiveness of each drug was calculated by

$$\text{Cost - effectiveness} = \frac{\text{Cost of drug for 6 weeks}}{\text{IOP lowering at 6 weeks}}$$

The study was approved by the institutional ethics committee.

2.5 Observations

The age and gender related characteristics of study groups were as shown by (Table 1). There was no statistically significant difference between the age and gender of patients in three study groups.

Table 1. Mean age and sex distribution in three study groups.

	Mean age	Male	Female
Brimonidine	64.45 ± 12.01	12	8
Timolol	64.15 ± 10.28	11	9
Brinzolamide	66.20 ± 10.27	12	8

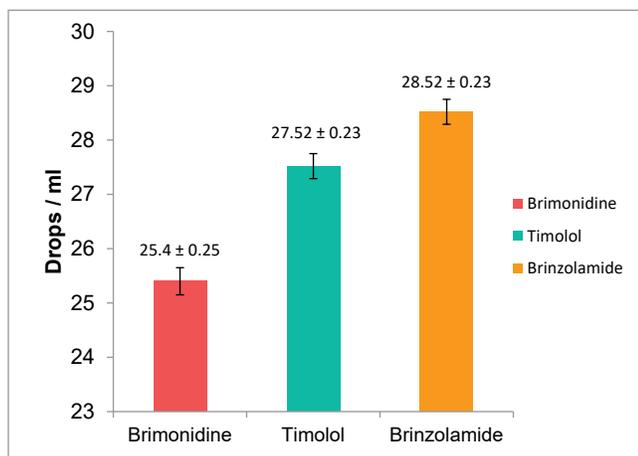


Figure 1. Volumetric analysis of brimonidine, timolol and brinzolamide.

Volumetric analysis of the drugs show that Brimonidine bottles were found to be underfilled while timolol and brinzolamide were overfilled with percentage underfills and overfills being -0.4%, 1.6% and 1.2% respectively (Table 2). Brinzolamide had maximum drops/ml (28.52±0.23) followed by timolol (27.52±0.23) and brimonidine (25.4±0.25) (Figure 1).

The cost analysis (Table 3) shows that brinzolamide was costlier than brimonidine followed by timolol with per day per eye costs of Rs. 6.45±0.05, 5.78±0.06 and 0.83±0.01 respectively. The 6-weekly cost for brinzolamide was found to be Rs. 270.98 ± 2.17 while for brimonidine and timolol was 242.56 ± 2.32 and 34.83 ± 0.29 respectively (Figure 2). The yearly costs for the drugs were Rs. 2354.96 ± 18.87, 2107.96 ± 20.17 and 302.68 ± 2.51 for brinzolamide, brimonidine and timolol respectively.

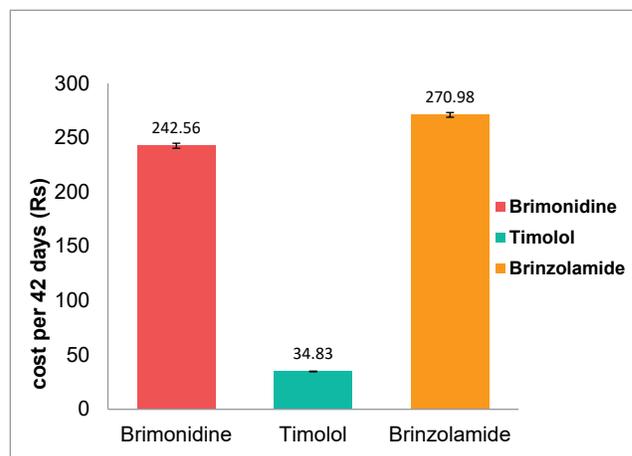


Figure 2. 6-weekly cost of therapy per eye.

The baseline, 2nd week and 6th week IOP for the study drugs are shown in (Figure 3). The baseline IOP (average reading of 9 and 11 am) for brimonidine, timolol and brinzolamide was 24.15 ± 1.17, 23.83 ± 1.28 and 23.83 ± 1.12 respectively.

For brimonidine the mean difference of 9 am IOP from baseline ranged from 4.9 ± 0.79 (20.46%) at 2 weeks to 5.1 ± 0.97 (21.29 %) at 6 weeks. The mean difference of 11 am IOP from baseline ranged from 5.2 ± 1.15 (21.15 %) at 2 weeks to 5.3 ± 1.13 (21.56 %) at 6 weeks. On statistical comparison of IOP at subsequent visits with baseline, a significant fall in IOP was seen on both visits in patients on brimonidine (P value < 0.001) (Table 4).

For timolol the mean difference of 9 am IOP from baseline ranged from 5.75 ± 0.64 (24.31 %) at 2 weeks to 5.85 ± 0.88 (24.74 %) at 6 weeks. The mean difference of 11 am IOP from baseline ranged from 5.95 ± 0.95

Table 2. Volumetric Analysis

Drug	Labelled Vol.(ml)	Actual vol. (average)	Percentage overfill (+) or under fill (-)	Drops/ml
Brimonidine	5	4.98 ± 0.08	- 0.4 %	25.4 ± 0.25
Timolol	5	5.08 ± 0.08	+ 1.6 %	27.52 ± 0.23
Brinzolamide	5	5.06 ± 0.05	+ 1.2 %	28.52 ± 0.23

Table 3. Cost Analysis

Drug	MRP (Rs)	Cost per day per eye (Rs)	Cost per 6 weeks per eye (Rs)	Cost per year per eye (Rs)
Brimonidine	366.7	5.78 ± 0.06	242.56 ± 2.32	2107.96 ± 20.17
Timolol	57.05	0.83 ± 0.01	34.83 ± 0.29	302.68 ± 2.51
Brinzolamide	460	6.45 ± 0.05	270.98 ± 2.17	2354.96 ± 18.87

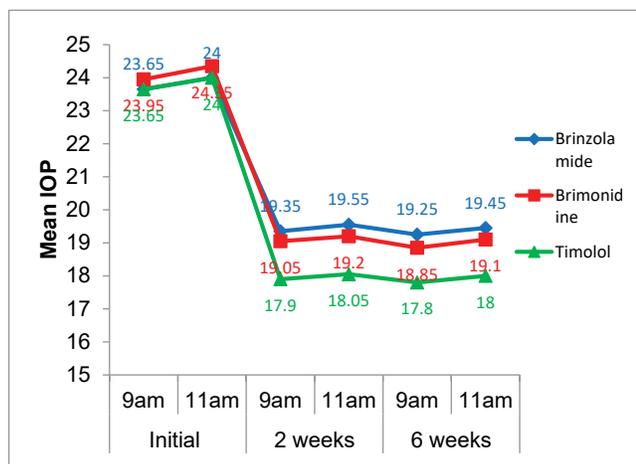


Figure 3. IOP changes in patients on brimonidine, timolol and brinzolamide.

(24.79 %) at 2 weeks to 6.00 ± 1.08 (25.00%) at 6 weeks. On statistical comparison of IOP at subsequent visits with baseline, a significant fall in IOP was seen on both visits in patients on timolol (P value < 0.001) (Table 4).

For brinzolamide the mean difference of 9 am IOP from baseline ranged from 4.3±0.57 (18.18%) at 2 weeks to 4.4±0.50 (18.60%) at 6 weeks. The mean difference of 11 am IOP from baseline ranged from 4.45±0.83 (18.54%) at 2 weeks to 4.55±0.83 (18.96%) at 6 weeks. On statistical comparison of IOP at subsequent visits with baseline, a significant fall in IOP was seen on both visits in patients on brinzolamide (P value < 0.001) (Table 4).

Table 4. IOP changes in three study groups

		Mean (mm of Hg) ± SD		% change		P value	
		9am	11am	9am	11am	9am	11am
Brimonidine	Pair 1 V1-V2	4.9±0.79	5.15±0.81	20.46 %	21.15 %	<0.001	<0.001
	Pair 2 V1-V3	5.1±0.97	5.25±0.79	21.29 %	21.56 %	<0.001	<0.001
Timolol	Pair 1 V1 - V2	5.75±0.64	5.95±0.95	24.31 %	24.79 %	<0.001	<0.001
	Pair 2 V1 - V3	5.85±0.88	6.00±1.08	24.74 %	25.00 %	<0.001	<0.001
Brinzolamide	Pair 1 V1 - V2	4.3±0.57	4.44±0.83	18.18%	18.54%	<0.001	<0.001
	Pair 2 V1 - V3	4.4± 0.50	4.55± 0.83	18.60%	18.96%	<0.001	<0.001

Table 5. % reduction in IOP after 6 weeks

Drug name	Average of 9 am and 11 am IOP		Difference between average of baseline and 6 week IOP	% Reduction
	Baseline	6 weeks		
Brimonidine	24.15 ± 1.17	18.98 ± 1.20	5.18 ± 0.77	21.43 ± 3.06 %
Timolol	23.83 ± 1.28	17.90 ± 0.90	5.93 ± 0.77	24.87 ± 2.46 %
Brinzolamide	23.83 ± 1.12	19.35 ± 0.86	4.48 ± 0.53	18.78 ± 1.73 %

The difference between the average readings of baseline and 6 weeks for three drugs was calculated as shown in the table 5. The % reduction of brimonidine, timolol and brinzolamide was 21.43±3.06%, 24.87±2.46% and 18.78±1.73% respectively. Statistical analysis between three drugs at the end of study period i.e., 6 weeks is shown in (Table 6). Mean of the average IOP reading at 6 week was calculated. Independent 't' test was applied. Timolol was superior in efficacy to other two drugs. The difference was statistically significant between the efficacy of timolol and brinzolamide (p < 0.001) as well as timolol and brimonidine (p=0.003). There was no statistical significant difference in the efficacy of brimonidine when compared to brinzolamide (p=0.26) (Table 5, 6).

Cost-effectiveness i.e., cost per mm reduction of IOP was calculated. The costs and effectiveness included in the calculation were the 6-weekly costs (42 days) and average (9 am and 11 am) IOP lowering at 6 weeks. Cost-effectiveness for brimonidine, timolol and brinzolamide were respectively Rs 46.83±7.37/mmHg lowering, 5.87±0.83/mmHg lowering and 60.49±6.77/mmHg lowering. Thus timolol was found to be most cost-effective followed by brimonidine and then brinzolamide in lowering IOP (Figure 4).

The 6 weekly cost and efficacy of brimonidine, timolol and brinzolamide was Rs 242.56±3.06 and 21.43±3.06 %, Rs 34.83±0.29 and 24.87±2.46 % and Rs 270.98±2.17 and 18.78±1.73 % respectively. From this data it is evident that

Table 6. Statistical analysis between three study drugs at end of 6 weeks

Comparison of average IOP readings at end of 6 weeks					
		Difference Between Mean	SEM	t	P
Timolol	Brimonidine	1.075	0.33	3.21	0.003 (HS)
	Brinzolamide	1.45	0.28	5.22	<0.001 (HS)
Brimonidine	Brinzolamide	0.38	0.33	1.14	0.26 (NS)

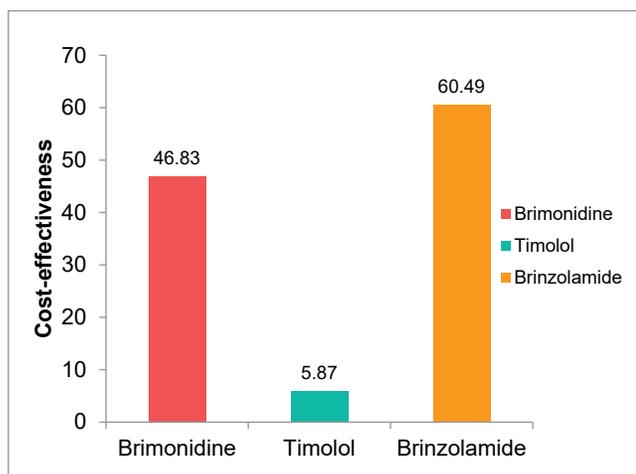


Figure 4. Comparison of cost-effectiveness.

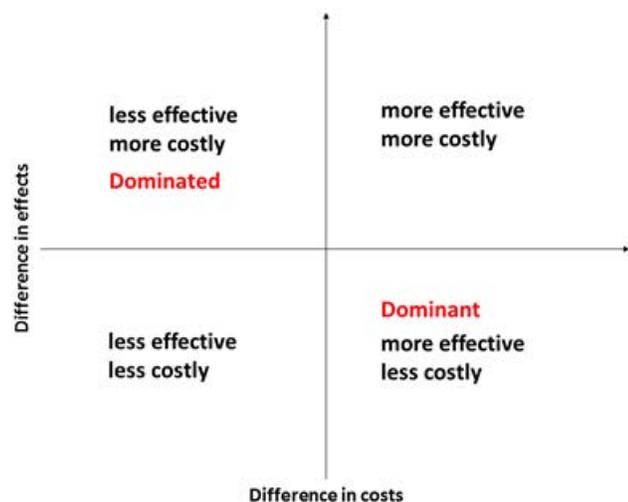


Figure 5. Cost effectiveness analysis plane.

brinzolamide has highest cost and lowest efficacy therefore falls in dominated quadrant i.e., northwest quadrant of cost effectiveness plane when compared to brimonidine and timolol. On comparing brimonidine and timolol groups separately, brimonidine has higher cost and lower

efficacy than timolol hence timolol therapy dominates brimonidine therapy and falls in southeast quadrant of the cost effectiveness analysis plane (Figure 5).

3. Discussions

Glaucoma is a major public health problem, being the largest cause of bilateral blindness, second only to the cataract. Progression of glaucomatous changes leads to visual impairment and require life-long therapy to halt further deterioration. As the global burden of glaucoma is high and predicted to rise as major cause of ocular morbidity; study of economic aspects of glaucoma are required.

For the medical management of glaucoma, an ophthalmologist has got a wide range of options. Brimonidine, timolol and brinzolamide are commonly prescribed drugs in glaucoma, each with its own advantages.

Timolol is among the older and effective ocular hypotensive agents in patients with primary open-angle glaucoma and ocular hypertension. Added benefit of this drug is its lower cost. Brimonidine and brinzolamide are relatively newer anti glaucoma drugs in the armamentarium of ophthalmologist for medical treatment of glaucoma, with brinzolamide being the newest. Additional benefit of brimonidine is its neuroprotective mechanism. Brinzolamide is also selected as monotherapy or fixed combinations for the treatment of POAG or ocular hypertension.

In the present study, we have done age analysis, volumetric analysis, cost analysis and compared efficacies and cost-effectiveness of these three drugs.

In the present study, maximum numbers of patients were in the age group of 61-70 years (28 out of 60; 46.67%). The mean age of presentation in brimonidine, timolol and brinzolamide groups was 64.45±12.01, 64.15±10.28 and 66.20±10.27 years respectively. Similar prevalence of glaucoma was found in the Singapore Indian eye Study in 2013. The prevalence of glaucoma increased with age and

was higher in participants aged 60 to 69 years compared with those aged 40 to 49 years.^[30] These findings are comparable with the mean age of presentation in our study.

In the present study, actual volume was found to differ slightly from the labeled volume in all three pharmaceutical preparations. Timolol and Brinzolamide were found to be overfilled by 1.6 % and 1.2 % respectively while brimonidine was underfilled by 0.4 %. In a study conducted by Rylander and Vold in 2008 brimonidine 0.2 % and timolol 0.5 % were found to be overfilled by 3 ± 1.4 % and 0.6 ± 1.0 % respectively and brinzolamide 1 % was underfill by 0.2 ± 2.0 %.^[31]

In the present study the cost per day per eye in rupees for brimonidine is 5.78 ± 0.06 , for timolol is 0.83 ± 0.007 and for brinzolamide is 6.45 ± 0.05 . In a study by Fiscella *et al.*, in 2003, the cost of brimonidine, timolol, brinzolamide per day for both eyes twice daily dosing was 1.29 \$, 0.42 \$ and 1.37 \$ respectively.^[32] This was in accordance with the present study.

Raylander and Vold in 2008 did cost analysis of different glaucomamedications. Cost of brimonidine 0.2%, timolol 0.5% and brinzolamide 1% per year for both eyes when two drops were instilled in both eyes was 374.44 ± 27.59 \$, 155.92 ± 7.55 and 373.76 ± 15.67 respectively. This is in contrast to the present study.^[31]

In the present study, the IOP lowering efficacy of timolol was 5.85 ± 0.88 (24.74%) and 6.00 ± 1.08 (25.00%) at 9 and 11 am respectively. In a similar study conducted by Netland PA *et al.*, in 2001, the mean IO Productions of timolol ranged from -4.7 to -7.1 mm Hg.^[33] Similarly, another study was done by Weinreb RN *et al.*, in 2016 showed IOP lowering efficacy of timolol ranging from -6.6 to -8.00 mm Hg.^[34]

In the present study, the IOP reducing efficacy of brimonidine was 21.29% (5.1 ± 0.97) and 21.56% (5.3 ± 1.13) at 9 am and 11 am respectively. The studies by Thomas *et al.*, in 2003 and Realini T *et al.*, in 2013 showed similar results with IOP lowering of 6 ± 3.3 mm Hg (21%) and 3.3-6.9 mm Hg (13.4-26.9 %) respectively.^[35, 36]

The IOP reducing efficacy of brinzolamide in the present study was 18.6% (4.4 ± 0.50 mm Hg) and 18.96% (4.55 ± 0.83 mmHg) respectively. Silver LH in 1998 performed a similar study in which the IOP lowering efficacy of brinzolamide was 3.8-5.7%.^[37]

Li T *et al.*, in 2016 conducted a meta-analysis in which efficacy of various anti-glaucoma drugs was compared. According to the analysis the mean IOP lowering efficacy

of timolol was maximum (3.7 mm Hg) followed by brimonidine (3.59 mm Hg) and then brinzolamide (2.42 mm Hg).^[38]

Cost-effectiveness for brimonidine, timolol and brinzolamide at end of 6 weeks was respectively Rs 46.83 ± 7.37 /mmHg lowering, 5.87 ± 0.83 /mmHg lowering and 60.49 ± 6.77 /mmHg lowering. In a similar study by El-Khamery AA-E *et al.*, in 2017, cost effectiveness of timolol was more favorable (Egyptian pounds 1525.33/ % reduction in IOP) as compared to brimonidine (Egyptian pounds 4298.08/ % reduction in IOP).^[39]

Many factors are considered by the physicians while prescribing for the patients of glaucoma. The ultimate goal of the health care providers is to give best, cost effective medicine to the patients and also considering the efficacy, tolerability and response and compliance to the medicine.

The deciding criteria for selecting any management option should be cost-effectiveness and not efficacy alone or cost alone. An option may be cheap but may also have less efficacy or more adverse effects. As glaucoma is a chronic disease therefore lifelong treatment is required. Options to treat glaucoma are many. Therefore future studies will be needed to update the rapidly changing economic information pertaining to the medical management of glaucoma.

4. Conclusions

Thus, in the present research, we have studied three anti glaucoma drugs: timolol 0.5%, brimonidine 0.2% and brinzolamide 1%. Timolol is a beta blocker which is commonly given by ophthalmologists due to its low cost and good efficacy. Brimonidine is an alpha-2 agonist which is effective and safe particularly in patients at risk of pulmonary or cardiovascular disease and has additional neuroprotective property. Brinzolamide is a carbonic anhydrase inhibitor used as monotherapy or fixed combinations to treat glaucoma.

The final conclusion of the study was that all three drugs under the present study are useful in the treatment of POAG/OHT, but timolol is a better choice than other two drugs because of:

- Greater reduction in IOP.
- Greater cost-effectiveness.

Glaucoma is a chronic disease requiring life long treatment. life-long treatment is a financial burden for a

patient. In a developing country like India it can be very difficult for patients to afford life-long treatment and this may result in non compliance to therapy. Therefore decisions regarding choosing a therapy in case of diseases requiring life-long treatment should be based on cost-effectiveness rather than costs or efficacy alone.

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