e-ISSN: 0975-1556, p-ISSN:2820-2643

Available online on www.ijpcr.com

International Journal of Pharmaceutical and Clinical Research 2024; 16(3); 638-644

Original Research Article

# Study of Efficacy and Safety of Topical 2% Dorzolamide and 0.5% Timolol in Open Angle Glaucoma in Andhra Pradesh Population

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**Received: 25-12-2023 / Revised: 23-01-2023 / Accepted: 26-02-2024**

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**Conflict of interest: Nil**

**Abstract:**

**Background:** Glaucoma is a group of eye diseases characterized by bilateral optic nerve neuropathy and atrophy of the optic nerve disc. The drug timolol is a non-selective β blocker that has no local anesthesia but stabilizes the membrane, and dorzolamide lowers the intraocular pressure (IOP) and enhances the blood flow.

**Method:** 80 adults' patients with open angle glaucoma were studied. 40 patients were randomly selected as group-I (IOP between 20 to 30 mm Hg) 40 group-II (IOP between 31 to 40) according to their IOP., Further, both groups were divided into IA (20), IB (20), IIA (20), IIB (20), Groups IA and IIA were administered Dorzolamide 2% and one drop thrice daily in both eyes. Groups IB and IIB were administered 0.5% Timolol; one drop was administered twice daily in both eyes. General examination includes examination by torch light. Slit-lamp, distant visual acuity tested by illuminated Snellen's chart, Schistz tonometry, gonioscopy, fundus examination, and field analysis by the octopus auto-field analyzer. Ophthalmoscopy and slit-light biomicroscopy were used.

**Results:** Comparison of IOP at 24 weeks has significant p values ($p<0.001$). In comparison of IOP reduction by different drugs, Dorzolamide 2% had a significant p value ($p<0.001$). In comparison of IOP reduction by the same drug in different groups, Dorzolamide has a significant p value. But the effects of both drugs on blood pressure and heart rate had a significant p value ($p<0.001$).

**Conclusion:** During the comparative study, it was observed that dorzolamide is well tolerated, efficacious for reducing IOP, and has a low allergic response as compared to timolol.

**Keywords:** intra-ocular pressure, open-angle glaucoma, Dorzolamide, Timolol, Andhra Pradesh.



## Introduction

Glaucoma's are a group of eye diseases characterized by progressive bilateral optic neuropathy. Pathologically, they are distinguished by excavation and atrophy of the optic nerve (optic disc) and clinically visual field loss in the periphery. In many patients, glaucoma is accompanied by raised intraocular pressure (IOP), and IOP > 21 mm Hg is considered a major risk factor for glaucoma.

However, the majority of glaucoma patients had IOP within the normal range (i.e., ≤ 21 mm HG) [1]. Other pathogenesis factors may contribute to the severity of the disease, such as increasing age, nutritional and environmental factors [2]. 15% of glaucoma patients have an incidence of blindness, and 6.7 million are believed to be bilaterally blind among the 66.8 million people affected by glaucoma globally [3].

There are a number of forms of glaucoma, including congenital primary and secondary. These are further categorized as open angles or closed angles [4]. The angle refers to the irido-corneal recess of the anterior chambers. 75% have primary open-angle glaucoma.

The topical drugs used have different pharmacological actions. Timolol is a non-selective β-blocker (β1 and β2) that has no local anesthetic, membrane stabilizing, or sympatho-mimetic properties. Dorzolamide's action is to lower IOP and enhance ocular blood flow. Hence, an attempt is made to compare and evaluate the efficacy and safety of both drugs in open-angle glaucoma.

## Material and Method

80 (eighty) patients visited the Department of Ophthalmology, Pinnamaneni Siddaratha Institute of Medical Sciences and the Research Foundation Chinoutpalli Gannavaram Krishna district, Andhra Pradesh – 521286 were studied.

**Inclusive Criteria:** Patients above 21 years old patients with chronic open-angle glaucoma, ocular

hypertension, pseudo-exfoliative glaucoma, and pigmentary glaucoma were selected for study.

**Exclusion Criteria:** Patients already under treatment, pregnant and lactating mothers's patients with dry eyes, corneal abnormalities, or any other conditions that prevent related applanation tonometry, patients with ocular infection, advanced cataract ocular inflammation, or a history of renal or hepatic impairment were excluded from the study.

**Method or plan of study:** Out of 80 patients, 40 patients were randomly selected as group-I (IOP between 20 to 30 mm of Hg, number 40), group-II (IOP between 31 to 40 mm of Hg, number 40). According to their intraocular pressure (IOP), measured by schiotz tonometry, both groups were further divided into IA (n = 20), IB (n = 20), IIA (n = 20), and IIB (n = 20).

1. Groups IA and IIA: Patients were administered 2% Dorzolamide Hydrochloride, one drop thrice daily, in both eyes.
2. Group IB and IIB B: 0.5% Timolol maleate one drop, was administered twice daily to both eyes.

During each visit, the following examinations were done on the day of enrollment and then on the 1st, 4th, 8th and 24th weeks.

1. History and chief complaints were any ocular or systemic and complaints suggestive of narrow angle and open angle glaucoma. Duration of illness and family history of glaucoma. If any were noted, anti-glaucoma medication, if taken previously, was also noted.
2. General examination: including external examination by torch light and slit-lamp examination. Distant visual acuity was tested by illuminated Snellen's chart, schiotz tonometry, gonioscopy, fundus examination, and field analysis by the Humphreys filed analyzer. Ophthalmoscopy and slit lamp biomicroscopy were also used.
3. Any complaint regarding adverse effects of the drug during the study period was noted.

Every patient was instructed not to administer their eye drops on the morning of the check-up visits (1st, 4th, 8th and 24th weeks) in order to measure the efficacy 12 hours after the previous evening dose.

Duration of study: December 2023 to January 2024

**Statistical analysis:** Various parameters between Dorzolamide and Timlol were compared with the t test. The statistical analysis was carried out in SPSS software. The ratio of males and females was 2:1.

**Observation and Results**

**Table 1:** Comparative Study of Intraocular Pressure

The end of the 24th week has a significant p value ($p<0.001$).

**Table 2:** Comparison of IOP reduction by different drugs in the same groups: Timolol maleate 2% had an insignificant p value, and Dorzolamide Hcl (2%) had a significant p value ($p<0.001$).

**Table 3:** In the comparison of IOP reduction by the same drug in different groups, Timolol maleate 0.5 was insignificant and Dorzolamide HCL had a significant p value ($p<0.001$).

**Table 4:** Effect of Dorzolamide and Timolol HCL on Blood Pressure Level had a significant p value ($p<0.001$).

**Table 5:** The effect of both drugs on heart rate has a significant p value ($p<0.001$).

**Table 1: Comparative study of intraocular pressure**

| Pre treatment | Group | Right Eye (mm Hg) Mean ±SD | t test | p value | Left Eye (mm Hg) Mean ±SD | t test | p value |
|---|---|---|---|---|---|---|---|
| Pre-treatment | IA | 28.04 (±3.80) | 1 | p>0.3 | 26.90 (±2.15) | 2.61 | p>0.01 |
| | IB | 26.90 (±3.40) | | | 25.75 (±2.09) | | |
| | IIA | 31 (±5.30) | 2.30 | p>0.6 | 34.03 (±2.84) | 0.19 | p>0.84 |
| | IIB | 34.15 (±2.40) | | | 33.80 (±4.50) | | |
| End of Week 1 | IA | 22.34 (±2.60) | 2.44 | p>0.62 | 21.80 (±2.62) | 1.74 | P<0.01 |
| | IB | 25.02 (±4.15) | | | 20.60 (±1.60) | | |
| | IIA | 24.90 (±5.10) | 2.84 | P<0.001 | 26.86 (±2.50) | 1.74 | P<0.01 |
| | IIB | 28.60 (±2.10) | | | 29.88 (±4.60) | | |
| End of Week 4 | IA | 20.04 (±1.80) | 0.84 | p>0.40 | 20.06 (±1.70) | 2.73 | P<0.01 |
| | IB | 20.50 (±1.65) | | | 19.40 (±2.10) | | |
| | IIA | 26.14 (±3.80) | 3.15 | P<0.001 | 27.40 (±2.80) | 10.2 | P<0.001 |
| | IIB | 20.50 (±2.81) | | | 28.15 (±3.20) | | |
| End of Week 8 | IA | 19.07 (±3.2) | 1.9 | p>0.6 | 20.26 (±1.28) | 1.70 | P>0.1 |
| | IB | 20.69 (±1.80) | | | 19.48 (±1.75) | | |
| | IIA | 25.98 (±3.80) | 2.31 | P<0.02 | 27.20 (±1.80) | 1.51 | P<0.15 |
| | IIB | 28.82 (±3.84) | | | 28.44 (±3.20) | | |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| End of Week 24 | IA | 20.80 (±2.50) | 2.12 | p>0.01 | 20.42 (±1.62) | 1.18 | p>0.24 |
| | IB | 20.90 (±2.52) | | | 19.75 (±1.95) | | |
| | IIA | 25.30 (±3.60) | 3.67 | P<0.001 | 27.68 (±2.20) | 1.08 | p>0.29 |
| | IIB | 29.05 (±2.80) | | | 28.04 (±3.58) | | |

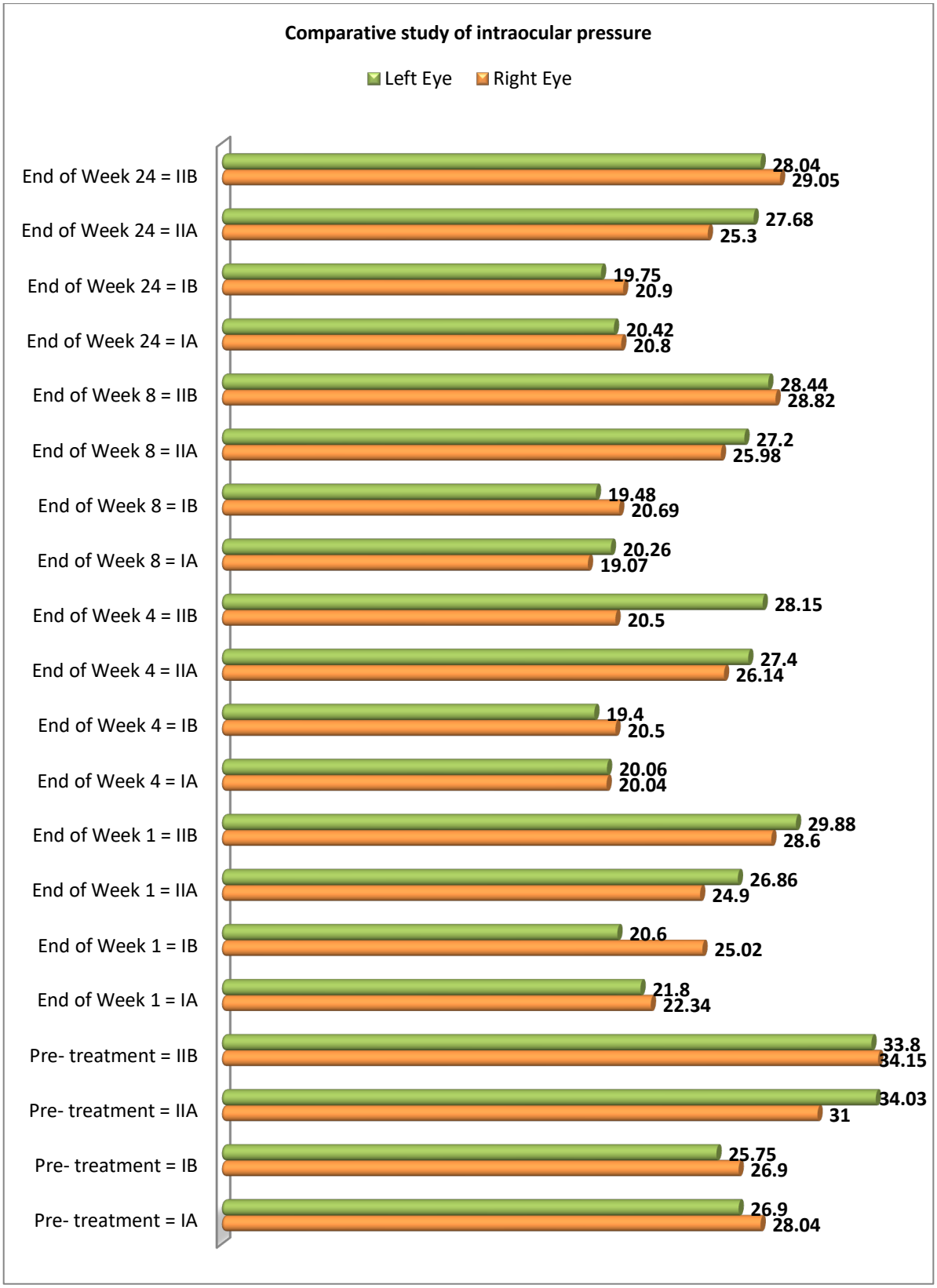


**Figure 1: Comparative study of intraocular pressure**

**Table 2: Comparison of IOP reduction by different drugs in same groups IOP Reduction (mm Hg) (Means ±SD)**

| Group | Drug | Rt. Eye | Lt. Eye | t test | p value |
|---|---|---|---|---|---|
| IA | Dorzolamide HCL 2% | 6.4 (± 1.85) | 5.52 (±1.6) | 2.60 | P<0.05 |
| IB | Timolol Maleate 2% | 5.05 (±1.60) | 4.30 (± 1.92) | 0.92 | p>0.38 |
| IIA | Dorzolamide HCL 2% | 4.60 (± 2.90) | 5.40 (± 1.22) | 3.65 | P<0.001 |
| IIB | Timolol Maleate 0.5% | 4.82 (± 1.42) | 4.14 (±2.4) | 2.60 | p>0.22 |

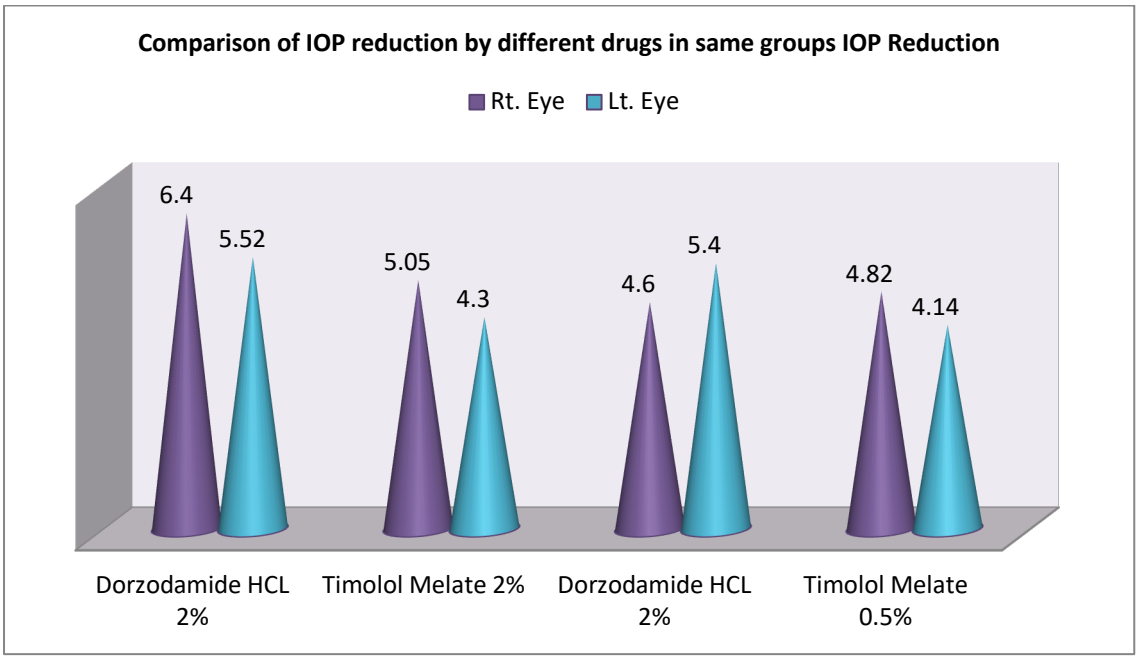


**Figure 2: Comparison of IOP reduction by different drugs in same groups IOP Reduction**

**Table 3: Comparison of IOP reduction by same drug in different group**

| Drug | Group | Right Eye | Left Eye | t test | p value |
|---|---|---|---|---|---|
| Dorzolamide HCL % | G. IA | 6.4 (± 1.80) | 5.54 (±1.64) | 2.23 | P<0.001 |
| | G. IIA | 4.74 (±2.95) | 5.39 (±1.22) | 2.1 | P<0.001 |
| Timolol Maleate 0.5 | G. IB | 5.10 (±1.60) | 4.42 (±1.94) | 0.80 | p>0.23 |
| | G. IIB | 4.32 (±1.40) | 4.14 (±2.06) | 0.92 | p>0.32 |

Timlol HCL p value are insignificant (p>0.23) and Dorzolamide values are highly significant

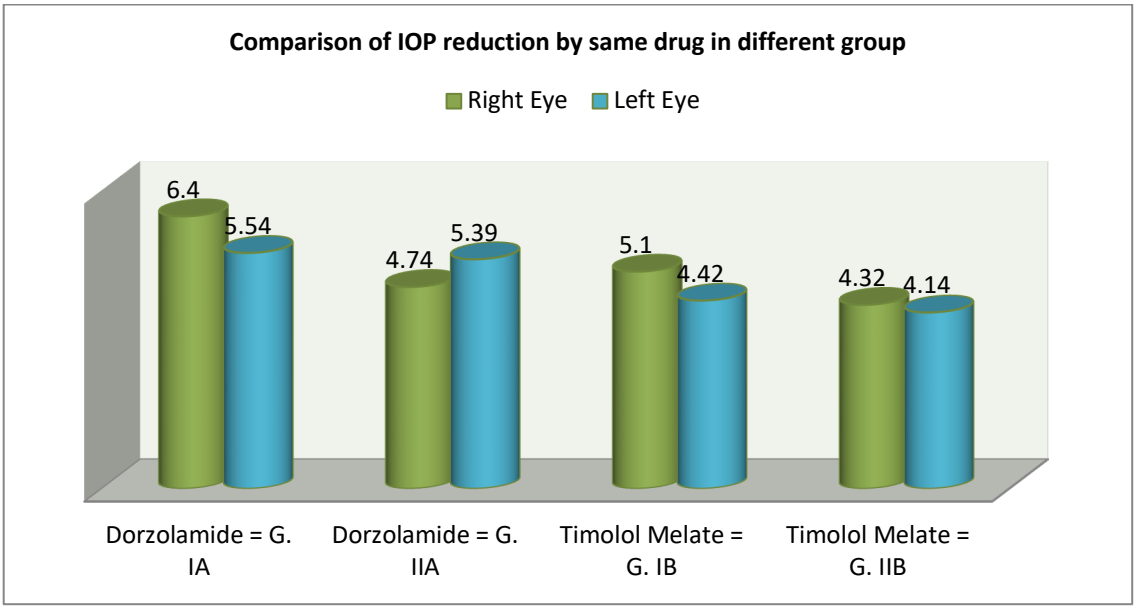


**Figure 3: Comparison of IOP reduction by same drug in different group**

**Table 4: Effect of Dorzolamide and Timolol HCL on Blood pressure**

| | Dorzolamide HCL | | Timolol Maleate 0.5 | |
|---|---|---|---|---|
| Pre treatment | 129.76 (±5.36) | 82.24 (±4.18) | 132 (±10.68) | 85.84 (±5.68) |
| End of 24th week | 126 (±4.76) | 78.74 (±3.8) | 126 (±10.04) | 82.55 (±5.04) |
| t test | 3.31 | 3.91 | 2.58 | 2.74 |
| p value | P<0.001 | P<0.001 | P<0.001 | P<0.001 |

P value are highly significant (P<0.001)

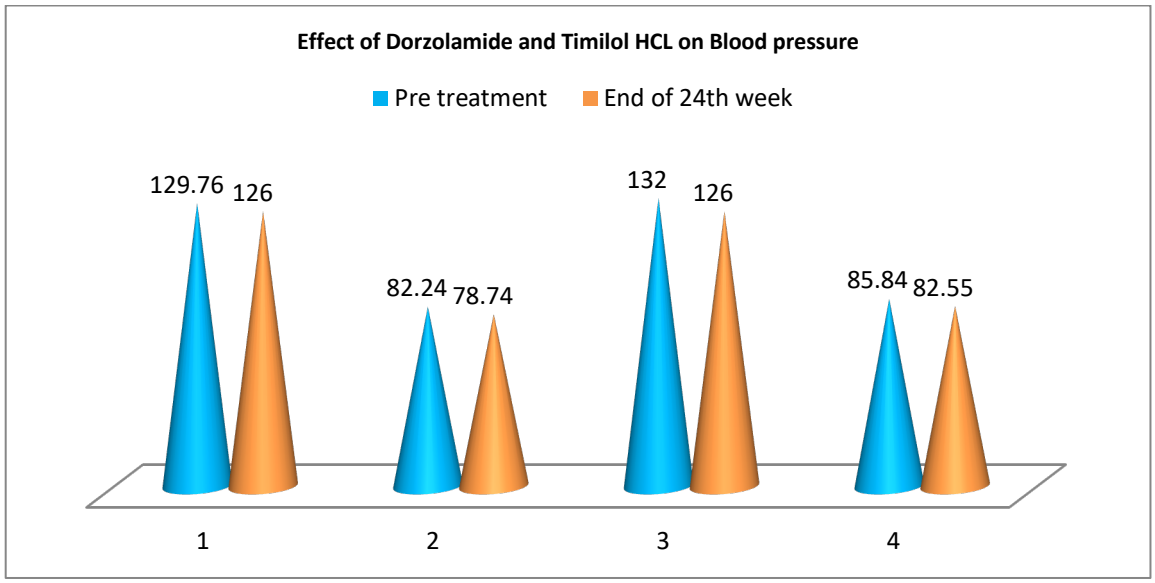


**Figure 4: Effect of Dorzolamide and Timilol HCL on Blood pressure**

**Table 5: Effect of both drugs on Heart rate (Mean ± SD)**

| | Dorzolamide HCL (2%) (Beats/ minute) Mean ± SD | Timolol Maleate 0.5 (Beats/ minute) Mean ± SD |
|---|---|---|
| Pre treatment | 76.78 (±6.24) | 78.18 (±3.14) |
| End of 24th week | 75.0 (±7.10) | 74.18 (±3.68) |
| t test | 2.91 | 5.23 |
| p value | P<0.02 | P<0.001 |

P value are highly significant (p<0.002)

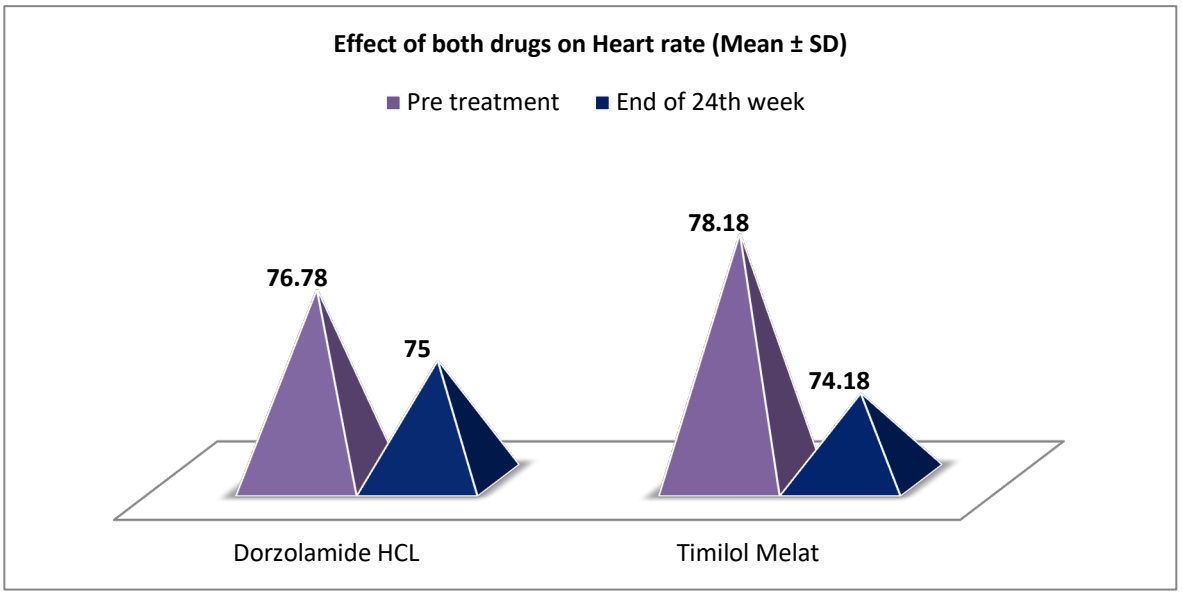


**Figure 5: Effect of both drugs on Heart rate (Mean ± SD)**

## Discussion

Present study of efficacy and safety of topical 2% Dorzolamide and 0.5% Timolol in open-angle glaucoma in the Andhra Pradesh population. In the comparison, IOP in both groups with different ocular pressures was significant at the end of the 24th week of the study ($p<0.001$) (table 1).

In comparison of IOP by different drugs (i.e., Dorzolamide and Timolol), Dorzolamide had a significant p value ($p<0.001$) (Table 2). In the comparison study of IOP reduction by the same drugs in different groups, Dorzalamide had a significant p value ($p<0.001$). The effects of Dorzolamide and timolol had a significant value in the study of blood pressure ($p<0.001$) (Table 4). The effect of both drugs on heart rate had a significant p value ($p<0.001$) (Table 5). These findings are more or less in agreement with previous studies [5,6,7].

It is reported that in patients with open-angle glaucoma or ocular hypertension, Dorzolamide hydrochloride 2% administered three times daily lowers the IOP by approximately 4-6 mm Hg at peak (2 hours post-dosage) and 3-4.5 mm Hg at peak (8 hours post-dosage) [8]. It is also confirmed that there is a 20% reduction in IOP after administration of 2% Dorzolamide hydrochloride three times daily into the conjunctival sac of affected eyes [9].

It is also reported that mean IOP reductions ranging from 3.8 to 5.1 mm Hg were achieved by Timolol maleate 0.5% administered for 4 weeks [10]. In another study, it was confirmed that Timolol maleate 0.5% reduced 5.8 to 6 mm Hg at 2 hours. At 12 hours, Timolol maleate had a mean IOP lowering ranging from 3.8 to 4.8 mm Hg [11].

After systemic absorption, Dorzolamide is preferentially taken up by erythrocytes as a result of binding to CA-II in patients with glaucoma or ocular hypertension. The terminal elimination of half-life Dorzolamide in erythrocytes is <120 days, so there is potential for systemic accumulation during long-term administration.

However, in patients with glaucoma treated with Dorzolamide 2%, three-time daily plasma concentrations after 12 months were similar to those after 6 months [12]. Both drug regimens were well tolerated, and no serious drug-related adverse effects were reported in the present study.

## Summary and Conclusion

Although both drugs were safer without any adverse reactions, Dorzolamide had an edge over Timolol in terms of reduction in intraocular pressure. Dorzolamide is well tolerated, has a low allergic response, and has a favourable ocular and systemic safety profile. Such a comparative study has to be carried out in a large number of patients where all super-specialized techniques are available to combat any adverse reactions to confirm these significant and positive findings.

**Limitation of Study:** Owing to the tertiary location of the research center, the small number of patients, and the lack of the latest techniques, we have limited findings and results.

This research paper has been approved by the ethical committee of the Pinnamaneni Siddaratha Institute of Medical Sciences and the research foundation in Chinoutpalli Gannavaram, Krishna district, Andhra Pradesh – 521286

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