



Original article

Effect of latanoprost on intraocular pressure, visual acuity and C-reactive protein

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ARTICLE INFO

Article history:

Received 13 January 2020

Revised 29 February 2020

Accepted 8 March 2020

Available online 16 March 2020

Keywords:

Latanoprost

POAG

Intraocular pressure

Visual acuity

CRP

ABSTRACT

Objective: To investigate the effect of latanoprost on intraocular pressure (IOP), visual acuity and C-reactive protein (CRP) in patients with primary open-angle glaucoma (POAG).**Methods:** A total of 163 POAG patients (266 eyes) admitted to our hospital from February 2015 to July 2017 were selected and divided into observation group (81 cases, 132 eyes, latanoprost eye drops) and control group (82 cases, 134 eyes, timolol maleate eye drops) according to different treatment plans. The clinical efficacy of the two groups after treatment was evaluated. The IOP, visual acuity and CRP level were compared between the two groups before and after treatment. Then the adverse reactions of the two groups were observed and recorded.**Results:** After treatment, the total effective rate was 92.59% (75 cases) in the observation group and was 80.49% (66 cases) in the control group, with statistic difference between groups ($P < 0.05$); The IOP, visual acuity and CRP level between the two groups before treatment showed no statistic difference, the mentioned three indexes of the two groups were significantly improved after treatment, and statistic difference was found before and after treatment ($P < 0.05$); Moreover, the above three indicators had statistically significant differences between groups after treatment ($P < 0.05$); The difference of intraocular pressure and visual acuity between the two groups before and after treatment were statistically different ($P < 0.05$); After treatment, the incidence of adverse reactions in the observation group such as allergy, vomiting, breathlessness and tachycardia were not significantly different from those in the control group ($P > 0.05$).**Conclusion:** Latanoprost can improve IOP, visual acuity, and CRP levels. It improves eye hemodynamics, and has significant efficacy in treating primary open-angle glaucoma. Also, it has good security.© 2020 The Authors. Published by Elsevier B.V. on behalf of King Saud University. This is an open access article under the CC BY-NC-ND license (<http://creativecommons.org/licenses/by-nc-nd/4.0/>).

1. Introduction

Primary open angle glaucoma (POAG), also called chronic open angle glaucoma, is a blind and irreversible eye disease with main clinic feature of continuous rise of intraocular pressure and open angle. Continuous high intraocular pressure will cause irreversible

damage for optic nerve, and then damage eyeballs of the patients, resulting in decrease of vision. If there is no timely and effective treatment, it will result in complete loss of vision or even blindness (Xiaojun and Xiaolong, 2017). POAG is the most common in African and European, morbidity of POAG is lower in our country (Weidong, 2014). The disease mainly occurs at 20–60. The higher the age is, the higher the morbidity becomes. Patients with diabetes, cardiovascular disease, retinal vein occlusion and myopia are high risk group (Yuanbi and Qinghua, 2014). At present, there is no effective cure for glaucoma. It can only retain the visual function to the maximum extent, and reduce the IOP to a safe level without damaging the optic nerve (Jiyuan, 2015). An and Ji conducted research on the analysis of changes in the outflow pathway of aqueous humor of open-angle glaucoma. It was shown that the incidence of open-angle glaucoma is closely related to the imbalance of endogenous regulatory factors in metabolic balance,

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Peer review under responsibility of King Saud University.



Production and hosting by Elsevier

increased resistance to the external drainage pathway, and abnormal metabolism of trabecular meshwork cells (Lin and Jian, 2011). Liu and Zhang studied the degree of visual field defect and related factors of POAG. It indicated that most patients with POAG have had severe visual field damage at the time of diagnosis. Risk factors included high IOP, glaucoma-related symptoms, combined high myopia, and low age at diagnosis (Chuan et al., 2016). Chen et al. (2013) have demonstrated that latanoprost, travoprost, and bimepropril eye drops have the effect of reducing IOP in POAG (Guangsheng et al., 2013). Pathologically elevated IOP is the main cause of POAG. The main principle of clinical treatment of POAG is to effectively reduce IOP and maintain normal IOP, prevent visual field loss and optic nerve damage. Commonly used treatment methods include lasers, surgery, and drugs, of which drug treatment is the most important and basic treatment (Ling et al., 2011).

Timolol maleate is commonly used as an intraocular pressure-lowering drug at home to treat POAG for good intraocular pressure-lowering effect. At abroad, latanoprost is first-line drug for POAG. This study respectively uses latanoprost and timolol maleate to treat POAG patients and analyzes effect of latanoprost on intraocular pressure, visual acuity and CRP in POAG patients. Also, it investigates the efficacy of latanoprost in the treatment of POAG.

2. Materials and method

2.1. General data

A total of 163 POAG patients (266 eyes) admitted to our hospital from February 2015 to July 2017 were selected and divided into Observation Group (81 cases, 132 eyes) and control group (82 cases, 134 eyes) according to different treatment plans. Inclusion criteria: clinic definite diagnosis was POAG (Ling et al., 2011), age was at 20–60, other intraocular pressure-lowering drugs were not used within two months, intraocular pressure was not greater than 35 mmHg before treatment, the patient and their family members knew and gave consent to treatment plan and cooperated with treatment. Exclusion criteria: had history of other types of glaucoma; patients who were allergic to latanoprost or timolol maleate; had other eye diseases, such as conjunctivitis, uveitis and keratitis; had had eye operation within two months; patients with severe heart, liver and kidney disease; women in pregnancy or lactation period; mental patients. Men had 42 cases (78) and women had 39 cases (74) in Observation Group; age was 21–60 years old and average age was (41.79 ± 6.85) years old; men had 42 cases (79) and women had 40 cases (75) in Control Group; age was 22–59 years old and average age was (41.12 ± 7.12) years old. General data such as gender, age, intraocular pressure, visual acuity and CRP between the two groups were not significantly different ($P > 0.05$) with comparability. This study has been approved by local Ethics Committee, and all patients have signed informed consent.

2.2. Method

The observation group received latanoprost eye drops (China Resources Zizhu Pharmaceutical Co., Ltd. H2093866) once a day

at 19:30, one drop at a time. In the control group, timolol maleate eye drops (Shandong Bausch Lomb Pharmaceutical Co., Ltd. H2002309) was dripped every morning and evening, one drop at a time. The efficacy was evaluated after 3 months of treatment.

2.3. Observation indicators

Adverse reactions of the patients were recorded during treatment. IOP, visual acuity and CRP level were recorded between the two groups before and after treatment. Then efficacy of all patients was evaluated after treatment. 24 h intraocular pressure of patients was detected with non-contact tonometer. Repeat three times for each measurement and take average value. Vision checklist was commonly used to detect visual acuity. CRP concentration was determined by taking blood samples from patients and using dry chemical chromatography.

Evaluation criterion of efficacy (Konstas et al., 2014): visual field got right and vision returned to 1.0 or pre-morbid level which was cure; expanded scope of visual field was greater than 10° and vision increased 4 rows, which was significant effect; expanded scope of visual field was greater than $5\text{--}10^\circ$ and vision increased 1–3 rows, which was effective; These not conforming to the above criteria are not effective. Total effective rate = $[(\text{cure} + \text{significant effect})/\text{total}] \times 100\%$.

2.4. Statistical method

Data in the article was collected by researchers participated and completely logged in the research database after statistics. For logging of the data investigated, SPSS22.0 software was adopted for statistical analysis, count data was expressed in %, and χ^2 examination was adopted for comparison. For count data, " $\bar{x} \pm s$ " was adopted for expression, t examination was adopted for comparison, inspection level was expressed with $P < 0.05$. Difference of data comparison results was statistically different.

3. Result

3.1. Comparison of clinic efficacy

For Observation Group after treatment, cure (49 cases), significantly effective (26 cases), total effective (75 cases) and total effective rate 92.59%; for Control Group, cure (37 cases), significantly effective (29 cases), total effective (66 cases) and total effective rate 80.49%. Comparison of clinic total effective rate had statistic difference between groups ($P < 0.05$), as shown in Table 1.

3.2. Comparison of intraocular pressure, visual acuity and CRP level

The IOP, visual acuity and CRP level between the two groups before treatment showed no statistic difference, the mentioned three indexes of the two groups were significantly improved after treatment. After treatment in the two groups of patients, the IOP gradually decreased, the vision gradually improved, and the CRP level gradually decreased. Comparison of these three indexes before and after treatment between the two groups was statistically significant ($P < 0.05$). Moreover, the above three indicators

Table 1
Comparison of clinic efficacy of both groups (cases, %).

Group	Cases	Cure	Significantly effective	Effective	Not effective	Total effective rate
Observation Group	81	49 (60.49%)	26 (32.1%)	3 (3.70%)	3 (3.70%)	75 (92.59%)
Control Group	82	37 (45.12%)	29 (35.37%)	11 (13.41%)	5 (6.10%)	66 (80.49%)
χ^2	–	–	–	–	–	5.114
P	–	–	–	–	–	0.024

Table 2
Comparison of intraocular pressure, visual acuity and CRP level of both groups ($\bar{x} \pm s$).

Group	Eye number	Intraocular pressure (mmHg)			Visual acuity (°)		
		Before treatment	After treatment	Difference	Before treatment	After treatment	Difference
Observation Group	132	26.87 ± 2.64	17.12 ± 2.06*	10.08 ± 1.02	16.35 ± 2.42	24.67 ± 3.84*	8.26 ± 1.43
Control Group	134	26.73 ± 2.61	20.16 ± 2.13*	6.62 ± 1.15	16.28 ± 2.37	20.19 ± 3.69*	4.12 ± 1.18
<i>t</i>	–	0.341	9.216	20.312	0.187	7.595	20.171
<i>P</i>	–	0.734	0.001	0.001	0.852	0.001	0.001

Note: *compared with the same group before treatment, $P < 0.05$.

Table 3
Comparison of CRP Level of both groups ($\bar{x} \pm s$).

Group	Cases	CRP (mg/L)		<i>t</i>	<i>P</i>
		Before treatment	After treatment		
Observation Group	81	15.32 ± 2.84	10.86 ± 2.36	10.91	0.001
Control Group	82	15.43 ± 2.79	12.67 ± 2.42	6.743	0.001
<i>t</i>	–	0.249	4.834	–	–
<i>P</i>	–	0.803	0.001	–	–

had statistically significant differences between groups after treatment ($P < 0.05$). And the changes in the observation group were larger than those in the control group. The difference of intraocular pressure and visual acuity between the two groups before and after treatment were statistically different ($P < 0.05$), as shown in Tables 2 and 3.

3.3. Comparison of incidence of adverse reactions

For Observation Group, two cases of allergy, two cases of vomiting, three cases of breathlessness and four cases of tachycardia, 11 cases in total; for Control Group, three cases of allergy, one cases of vomiting, four cases of breathlessness and five cases of tachycardia, 13 cases in total. After treatment, the incidence of adverse reactions in the observation group such as allergy, vomiting, breathlessness and tachycardia were not significantly different from those in the control group ($P > 0.05$). It showed that the difference in the incidence of adverse reactions between the two groups is not significant, the degree of adverse reactions was mild, and the symptoms were relieved after stopping the drug. It indicated that latanoprost eye drops have significant therapeutic effect and low adverse reaction rate (see Table 4).

4. Discussion

POAG is common blind eye disease with main clinic feature, of which angulus iridocornealis has normal appearance and is in open state and intraocular pressure continuous rise. Lesion occurs in outflow system of aqueous humor via trabecular outflow which results in increase of resistance to outflow of aqueous humor and thus causes rise of intraocular pressure (Wenqiang et al., 2014). POAG patients in early stage were expressed as unstable intraocular pressure with large fluctuation range. With development of course of disease, intraocular pressure gradually rises. When developing to certain degree, it will damage visual function of the

patients, making them have some feelings such as blurred vision, eye distention and headache. For patients in later stage, binocular visual field is constricted, nyctalopia, difficulty in action and other symptoms may occur. Therefore, intraocular pressure and visual function are important indicators for diagnosis of POAG and severity evaluation (Sanford, 2014). Lowering intraocular pressure and improving visual function is main direction for clinic treatment of POAG. At present, POAG is mainly treated with drug, operation, laser and other methods among which drug treatment is the first choice. Common drugs for treatment of POAG include timolol maleate and latanoprost. Timolol maleate has certain effect on reduction of intraocular pressure, but studies have shown that there is a bounce phenomenon in patients who have used such drugs for a long time (Kremmer et al., 2014).

Latanoprost is a new local anti-glaucoma drug. Its mechanism is that, it has effect on ciliary muscle and the uvea sclera, making the ciliary muscle relaxed, widening space of the ciliary muscles, enhancing activity of matrix of uvea sclera, reducing the resistance of aqueous humor outflow, thereby increasing the outflow of aqueous humor through uvea scleral pathway and finally reducing intraocular pressure (Wenqiang et al., 2014). Such drug has no effect in generation of aqueous humor, which is beneficial to nutrition and metabolism of tissues of anterior eye segment. Meanwhile, just take it once every day. It's convenient for use and beneficial for clinic promotion and application. In America, latanoprost approved by FDA is first-line drug for use in clinic treatment of POAG (Netland et al., 2001). Compared with prostaglandin as isopropyl esterified pro-drug, latanoprost has strong lipophilicity and cornea penetrability. It can be well absorbed through cornea and hydrolyzed to latanoprost acid under the effect of esterase, which has biological activity (Aihara et al., 2002).

Report of Wenqing (2015) shows that, latanoprost eye drops can effectively lower intraocular pressure of POAG patients and has less adverse reaction (Wenqing, 2015). This study shows that cure rate is 60.49% and total effective rate is 92.59% in Observation

Table 4
Comparison of incidence of adverse reactions of both groups (cases).

Group	Cases	Allergy	Vomiting	Breathlessness	Tachycardia	Total
Observation Group	81	2 (2.47%)	2 (2.47%)	3 (3.70%)	4 (4.94%)	11 (13.58%)
Control Group	82	3 (3.66%)	1 (1.22%)	4 (4.88%)	5 (6.10%)	13 (15.85%)
χ^2	–	0.219	1.050	0.137	0.105	0.168
<i>P</i>	–	0.640	0.305	0.712	0.746	0.682

Group which are obviously higher than 45.12% and 80.49% in Control Group, conforming to research results of Gao Wenqing et al. It's noted that efficacy of POAG patients with latanoprost is significant and superior to that of timolol maleate. Meanwhile, difference values of intraocular pressure and visual acuity in Observation Group are higher than those of Control Group before and after treatment, indicating use of latanoprost can better improve intraocular pressure and visual acuity. The reason could be that latanoprost can add outflow of aqueous humor of the patients, relieve pressure of aqueous humor on eyeball and ease damage on visual function. By comparing the CRP levels between the two groups after treatment, it was found that the CRP level in the observation group was significantly lower than that in the control group, indicating that latanoprost can better alleviate eye inflammation in patients. The reason may be to reduce IOP, reduce optic nerve damage, and improve the eye environment by increasing the outflow amount of aqueous humor. In this study, incidence of adverse reaction between both groups has no significant difference. There is no strict adverse reaction only with some slight adverse reactions, such as allergy, vomiting, breathlessness and tachycardia.

Above all, the effect of latanoprost in the treatment of POAG is significant, had good safety and less adverse reaction, which can ameliorate the IOP, visual acuity and CRP level.

5. Conclusion

In this paper, latanoprost is used to treat POAG patients. The IOP, visual acuity and CRP of the treated patients are tested. These factors are used to analyze the efficacy of latanoprost on POAG. The results show that the use of latanoprost can ameliorate the IOP, visual acuity and CRP level. It has been verified that latanoprost can alleviate eye inflammation in patients without severe adverse reactions. There are only minor adverse reactions, such as allergy, vomiting, breathlessness and tachycardia. In summary, the use of latanoprost eye drops for POAG has a significant effect, can significantly reduce IOP, improve eye hemodynamics, reduce the scope of visual field damage, and is relatively safe. However, the effects of latanoprost on other POAG treatments, such as the corneal thickness of patients, need to be further studied.

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