The Effect of Posterior versus Anterior Subtenon Injection of Triamcinolone on Intraocular Pressure in Eyes with Retinal Vein Occlusion

Hamid Fesharaki, MD[1] • Farzan Kianersi, MD[1] • Hamidreza Riazi, MD[2]
Azar Mehrnia, MD[3] • Gholamali Naderian, MD[4]
Mehdi Moddares, MD[5] • Khalil Ghasemi Falavarjani, MD[6]

Abstract

***Purpose*:** To evaluate the intraocular pressure (IOP) rising effect of anterior versus posterior subtenon injection of triamcinolone in eyes with retinal vein occlusion

***Methods*:** This prospective nonrandomized study was performed on 57 eyes of 57 patients with macular edema due to retinal vein occlusion. 26 eyes received posterior subtenon injection of 40 mg triamcinolone acetonide [PSTT] and 31 eyes received anterior subtenon injection of 40 mg triamcinolone acetonide [ASTT]. IOP measurement was performed before the injection, and after the injection at one week, two weeks, one month and every month up to six months after the injection. IOP rise was treated accordingly by drops and filtering surgery.

***Results*:** IOP rise was found in 8% of the PSTT, and 67% of the ASTT injected eyes (P=0.001). All eyes with IOP rise in the PSTT group were controlled medically. Only 50% of eyes with IOP rise in the ASTT group could be controlled medically and filtering surgery was necessary for 33% of patients in the ASTT group. Visual acuity (VA) improvement was the same for both groups.

***Conclusion*:** More patients may have IOP rise after ASTT injection compared to PSTT injections.

***Keywords*:** Glaucoma, Intraocular Pressure, Subtenon Injection, Triamcinolon

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1. Associated Professor of Ophthalmology, Isfahan Eye Research Center, Isfahan University of Medical Sciences, Isfahan, Iran
2. Ophthalmologist, Isfahan Eye Research Center, Isfahan University of Medical Sciences, Isfahan, Iran
3. Medical Doctor, Isfahan Eye Research Center, Isfahan University of Medical Sciences, Isfahan, Iran
4. Assistant Professor of Ophthalmology, Isfahan Eye Research Center, Isfahan University of Medical Sciences, Isfahan, Iran
5. Professor of Ophthalmology, Eye Research Center, Rassoul Akram Hospital, Tehran University of Medical Sciences, Tehran, Iran
6. Assistant Professor of Ophthalmology, Eye Research Center, Rassoul Akram Hospital, Tehran University of Medical Sciences, Tehran, Iran

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Correspondence to: *Mehdi Moddares, MD*
Professor of Ophthalmology, Eye Research Center, Rassoul Akram Hospital, Tehran University of Medical Sciences, Tehran, Iran,
Email: mmodarres51@yahoo.com

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Introduction

Corticosteroids are being used to reduce inflammation and edema of the ocular tissue in various ocular diseases. Different rates of efficacy and safety have been reported for peribulbar or intravitreal use of depot steroids for the treatment of diabetic macular edema (DME) and macular edema secondary to retinal vein occlusion.[1-9] Intraocular pressure (IOP) rise was found to be one of the most important complications of periocular and intravitreal injection of depot steroids.[1-9] The rates of IOP rise after posterior subtenon triamcinolone injection (PSTT) in eyes with macular edema due to retinal vein occlusion was found to be 11% and 25%, in eyes with central retinal vein occlusion (CRVO) and branch retinal vein occlusion (BRVO), respectively.[3,4] The rates of IOP rise after subtenon injection of triamcinolone in eyes with DME has been observed in a wide range of 0-22.6% for posterior subtenon injection, and 0-33% for anterior subtenon injection.[1,2,5,7,9] IOP rise after intravitreal injection of triamcinolone in eyes with macular edema due to retinal vein occlusion was found to range between 17-60%.[4,10,11] We did not find any study evaluating the anterior subtenon injection of triamcinolone acetonide (ASTT) in retinal vein occlusions. On the other hand anterior subtenon space is more accessible for drug injection and also drug removal. Therefore, ASTT injection is much easier in comparison with PSTT injection. This study was performed to evaluate the safety, efficacy, and IOP rising effect of posterior versus anterior subtenon injection of triamcinolone in eyes with macular edema due to retinal vein occlusion.

Methods

This prospective nonrandomized trial was performed on 57 eyes of 57 patients with macular edema due to retinal vein occlusion. This study was performed on two patient groups. The first group included 26 eyes of 26 patients being selected according to the inclusion criteria from the outpatient department of Feiz hospital during 2005-2007. Each eye in this group received a single PSTT of 40 mg at the inferior temporal quadrant (crystal suspension, Hexal AG, Germany). The second group included 31 eyes of 31 patients being selected according to the same inclusion criteria from the outpatient department of Farabi eye hospital of Isfahan during 2007-2008. Each eye in this group received a single ASTT injection of 40 mg at the inferior temporal quadrant (crystal suspension, Hexal AG, Germany). Both hospitals are affiliated to the Isfahan University of Medical Sciences and the eye department of Isfahan Medical School. Posterior subtenon injections were performed by the second author in the inferotemporal quadrant according to the Nozik technique,[12] after topical anesthesia by tetracaine drops and insertion of the lid speculum, the patient was instructed to look up and nasally. A cotton swab soaked in tetracaine was applied over the conjunctiva at the site of injection. The 25 gauge tuberculin syringe was inserted bevel-up against the sclera and advanced through the conjunctiva and Tenon's capsule using a side-to-side movement to ensure that the sclera was not engaged. Once the needle was advanced to the hub the triamcinolone was injected.

Anterior subtenon injections were performed by the first author, after local anesthesia by tetracaine drops and insertion of the lid speculum, a cotton swab soaked in tetracaine was applied over the conjunctiva at the site of injection, the patient was instructed to look up and nasally, triamcinolone was injected by 25 gauge needle tuberculin syringe after being passed through the conjunctiva and Tenon's capsule about 7 mm behind the limbus. All injections were performed behind the slit-lamp.

The cases were patient with visual loss due to macular edema after a recent onset retinal vein occlusion in one eye with time duration of ≤ one month having the best corrected Snellen acuity ≤$^{5}/_{10}$, IOP≤21 mmHg in both eyes, and open angles. The patients with diabetic retinopathy, previous retinal photocoagulation, uncontrolled systemic hypertension, history of glaucoma or ocular hypertension, previous use of anti-glaucoma drops, history of uveitis, loss of follow-up, additional intervention other than glaucoma treatment during the follow-up period were excluded. All of the included patients signed the informed consent after being informed about the possible risks and benefits of the employed treatment. Complete eye

examination and medical consultation was performed for each patient at the beginning. Retinal vein occlusion and macular edema were diagnosed by slit-lamp ophthalmoscopy and Fluorescein angiography with or without optical coherence tomography. IOP was measured by slit-lamp applanation tonometry. Complete eye examination including the measurement of best corrected visual acuity (BCVA), and IOP was performed after the injection at follow-up steps of one week, two weeks, one month and every month up to six month. The follow-up examinations of the first group were performed by the second author, and the follow-up examinations of the second group were performed by the first author. 50 degree angle color fundus photography was performed before intervention and at 1, 3, 6 month follow-up steps (Topcon, Japan). The surface area of retinal hemorrhage and exudates was measured on each color fundus photograph by planimetry method using a grid patterned transparent sheet with 2×2 square millimeter frames. IOP rise of >21 mmHg was treated accordingly by drops and refractory cases underwent filtering surgery during the follow-up. The obtained values were collected in SPSS 11.5. Independent sample t-test was performed to compare age and visual acuity (VA) before and after treatment between groups. Paired t-test was used to compare VA before and after treatment. χ^2 tests were used to compare the character rates between the two groups.

ANOVA was used to compare the changes in VA values between the groups, and to evaluate the effect of concomitant factors.

Results

Twenty-five patients in the PSTT group and 30 patients in the ASTT group completed the follow-up. The patient characteristics are shown in table 1. Figure 1 shows the values of IOP before and after the intervention in PSTT and ASTT groups. IOP rise was found in 8% of eyes in the PSTT group, and 67% of eyes in the ASTT group (P<0.001). IOP was well controlled medically in all eyes with IOP rise in the PSTT group. IOP could be controlled medically in only 50% of eyes with IOP rise in the ASTT group and filtering surgery was necessary for 33% of the patients in the ASTT group. Figure 2 shows the IOP measurements and the mode of treatment in the ASTT group. In 66% of eyes the IOP rise started within two weeks after the injection. The mean of the IOP reached its maximum level at one month after subtenon injection. Medical control of the IOP improved toward the end of the follow-up. No statistically significant relation was found between the extent of IOP rise and the type of vein occlusion (P=0.45), the initial IOP (P=0.60), the past medical history (P=0.69), the age (P=0.43), the sex (P=0.91), the initial VA (P=0.09), and the involved eye (the left or the right eye) (P=0.08) in this study groups. VA improved from 0.91 logMAR before the intervention to 0.68 logMAR six months after the intervention in the PSTT injected eyes (P<0.05), and from 1.12 logMAR before the intervention to 0.84 logMAR six months after the intervention in the ASTT injected eyes (P<0.02).

Table 1. Primary Characteristics of the Patients

Groups Characters	Posterior subtenon Triamcinolone (PSTT) (25 patients)	Antereior subtenon Triamcinolone (ASTT) (30 patients)	P
Sex (female/male)	9/16	11/19	0.531
Mean Age (years)	56.8±5.5 (25-70)	57.6±7.7 (18-75)	0.985
RAPD (1+ to 3+)	48%	44%	0.456
Mean IOP (mmHg), of involved eyes	16.8±1.7 (12-21)	17.4±1.8 (14-21)	0.274
Mean IOP (mmHg), of sound eyes	16.1±2.4 (13-21)	17.1±1.4 (14-21)	0.099
Visual acuity, logMAR	0.91±0.51 (CF at1 meter-20/30)	1.12±0.55 (CF0.5 meter 20/30)	0.162
Surface area of hemorrhage and exudates (mm^2)	4140±758	4222±768	0.934
Types of vein occlusion, Concomitant systemic diseases	CRVO: 19 BRVO: 6 Hypertension: 32% Diabetes: 28%	CRVO: 24 BRVO: 6 Hypertension: 36% Diabetes: 36%	0,18 0.95 0.384 0.211

RAPD: Relative afferent pupillary defect
IOP: Intraocular pressure
BRVO: Branch retinal vein occlusion
CRVO: Central retinal vein occlusion

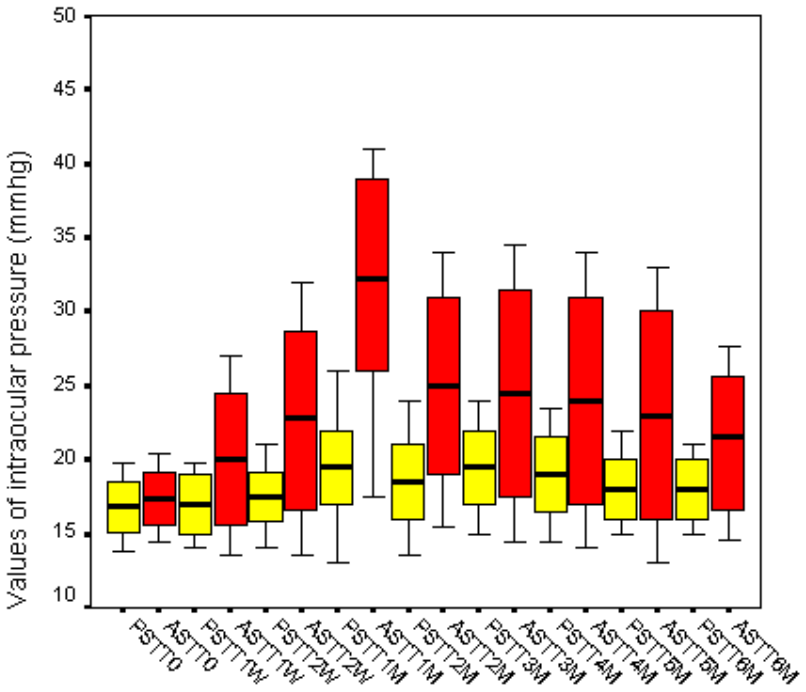

Figure 1. Values of intraocular pressure before and after posterior subtenon triamcinolon versus anterior subtenon tramcinolon injection in eyes with vein occlusion

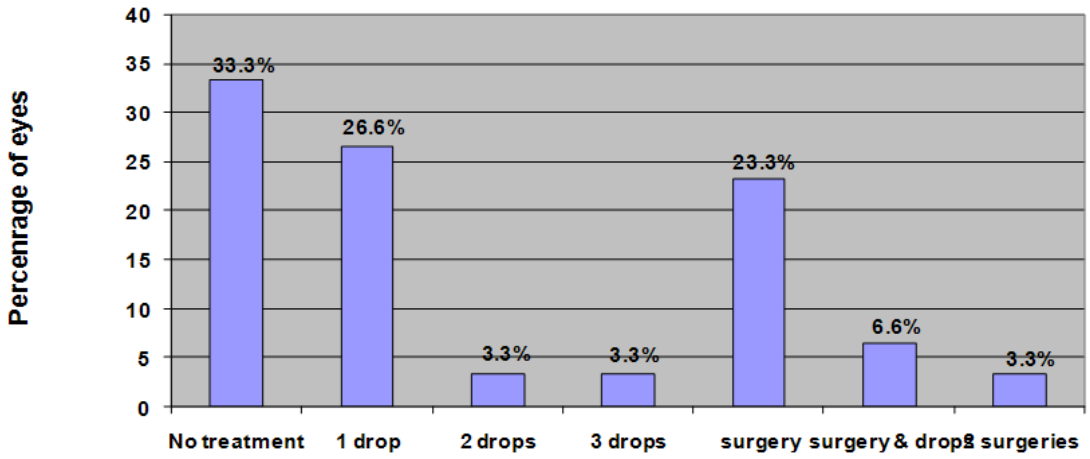

Figure 2. The rates of the treatment modes employed for IOP control after anterior subtenon triamcinolone injection in eyes with vein occlusion.

Visual improvement was not statistically different between the two groups (P=0.72). Surface area of retinal hemorrhage and exudates reduced from 4140±758 mm^2 to 2840±523 mm^2 in the PSTT group (P=0.001), and from 4,222±768 mm^2 to 2,930±543 mm^2 in the ASTT group (P=0.001). Reduction in surface area of retinal hemorrhage and exudates was not statically different between the two groups (P=0.81). No case of ptosis or globe needle penetration was detected.

Discussion

In this study significantly higher rates of IOP rise were found after ASTT injection in comparison with PSTT injection in eyes with retinal vein occlusion. The rate of IOP rise after PSTT injection in this study was lower than previous reports.[3,4] The IOP rise after ASTT injection in this study was 67%. This was significantly higher than PSTT; however, we could not find any previous study describing the effect of ASTT injection in eyes with retinal vein occlusion. The rate of IOP rise after ASTT in our study was found to be higher than those reported for DME. Chew et al found IOP rise rates of 33% and 15.5%, respectively following ASTT and PSTT injection in eyes with DME**.**[1]

One of the most important factors that could have affected these various rates of IOP rise might be the responsiveness of some eyes to corticosteroids. In a study by Levin et al, employing subtenon injection of depot steroids in 64 eyes with different forms of uveitis, the IOP rise rates of 13% and 44% were found for historical steroid non-responders and historical steroid responders, respectively.[13] On the other hand Kim et al compared the historical steroid non-responder eyes with the historical steroid responder eyes after PSTT injection; they concluded that for the actual amount of increase in the IOPs, the steroid responder group (39%) was shown to be statistically higher than the non-responder group (6%) (P=0.044). However, the mean pressure values did not show a significant difference (P>0.05). Only one eye required the use of glaucoma medications and the IOP remained normal after treatment.[14]

Another factor that might have influenced the rates of IOP rise could be the chemical preparation of the drug. In contrary to the findings of Chew et al with IOP rise rate of 33% after ASTT injection in eyes with DME, Dahr et al required no IOP lowering intervention after anterior subtenon injection of kenalog in eyes with DME.[2] Ferrante et al compared the efficacy and side-effects of injection of posterior subtenon triamcinolone with orbital floor methylprednisolone in 64 eyes with posterior uveitis, they found the two drugs to have similar efficacy with no complication in the methylprednisolone group, but they had two eyes with prolonged upper lid ptosis and two eyes with marked IOP rise in the triamcinolone group.[15]

Another participating factor could be the injection procedure employed by the surgeon and the site of drug delivery. In a randomized trial the rate of IOP rise after ASTT injection was two times higher than PSTT injection in eyes with DME.[1] Posterior subtenon injection may be found to be difficult by some less experienced surgeons, since it may be necessary to be performed without any direct observation on the tip of the injecting needle. During posterior subtenon injection the surgeon may be anxious about advancing the needle enough posterior and enough close to the sclera and inject the drug before the needle tip has properly entered into the posterior subtenon space. Therefore it is possible that some higher rates of IOP rise after PSTT injection could be due to the actual anterior subtenon release of the drug. Yamamoto et al found an overall 34.1% IOP rise after PSTT (66 eyes) and intravitreal (26 eyes) injection of triamcinolone in a mixed group of patients mostly with diabetic retinopathy or vein occlusion.[8] Among their cases only two eyes required glaucoma surgery, these were the left eyes of the two patients with DME who received PSTT injection in both eyes but did not develop IOP rise in their right eyes. This may be due to the inadvertent anterior subtenon injection of triamcinolone in the left eyes and proper posterior subtenon injection of triamcinolone in the right eyes of these two patients. IOP rise after the use of corticosteroids is believed to be due to the reduction of aquous outflow facility. Few mechanisms have been explained for the obstruction of outflow structures following steroid therapy.[16] The basic difference between anterior subtenon and posterior subtenon injection could be the anatomical location of the injectetion of the drug close to the outflow structure of the eye.

Conclusion

In conclusion, both injection modes had a similar efficacy in terms of visual and anatomic improvement; however, ASTT injections had a higher rate of IOP rise than PSTT injections in eyes with retinal vein occlusion. Further studies, with larger sample sizes and different vitreoretinal diseases will

help to elucidate our results. However, from this study it may be concluded that it is better to inject subtenon triamclnolone more posteriorly to avoid the IOP rising effect.

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