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Original Research Article

EFFICACY OF SUPRACHOROIDAL TRIAMCINOLONE ACETONIDE INJECTION IN THE TREATMENT OF RESISTANT DIABETIC MACULAR EDEMA

BUTT SS[1*], IQBAL RN[2], SIDDIQ S[2], WAHEED K[2], JAVED T[3]

[1]*Department of ophthalmology, Mughal Eye Hospital Trust Lahore, Pakistan*
[2]*Department of ophthalmology, Eye Unit 1, Services Institute of Medical Sciences (SIMS) Lahore, Pakistan*
[3]*Department of ophthalmology, PICS, Lahore, Pakistan*
**Corresponding author email address: drilyas123@yahoo.com*

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Abstract: *This study aimed to assess the efficacy of suprachoroidal TA injection for treating diabetic macular edema resistant to anti-VEGF agents. A prospective study was conducted in Ophthalmology Department Service Hospital, Lahore, from December 2020 to December 2021. A total of 60 patients were included in the study. Suprachoroidal TA injection 4 mg/0.1 mL was given after diagnosing resistant DME. The injection was administered every 3 months during the follow-up period (12 months) if intraretinal cysts, intraretinal or subretinal fluid persisted and CMT remained > 250 µm. The primary endpoint was CMT reduction and BCVA improvement after 12 months of injection. The secondary endpoint was assessing the safety of TA injection. The mean CMT at baseline was 478.6±170.1 µm, and after 12 months, it was 230.1 ± 47.5 µm. This decrease was statistically significant (P< .001). The mean BCVA at baseline was 1.194±0.1; after 12 months, it was 0.75±0.2 (P<.001). After one month of injection, IOP reached the maximum value (13.2±0.4 mmHg) compared to the baseline (12.32±0.1 mmHg). It gradually declined with the use of topical beta blockers and reached baseline value at 3rd month, and glaucoma surgery was not needed in any patient. Suprachoroidal TA injection effectively treats resistant DMA and leads to SCVA improvement and CMT reduction.*

Keywords: Suprachoroidal Injection, Triamcinolone Acetonide, Resistant Diabetic Macular Edema

Introduction

Diabetic macular edema (DME) is the major cause of vision loss in diabetics. Previously DME was mainly treated by lasers(Blinder et al., 2017), but these days anti-vascular endothelial growth factors(anti-VEGF agents) are increasingly being used for its treatment. Despite their increasing use, some patients do not respond to this therapy(Schmidt-Erfurth et al., 2017). Triamcinolone acetonide (TA), a systemic corticosteroid, is used to treat different inflammatory conditions. It has been reported to improve macular edema and visual activity(He et al., 2018). Anti-VEGF agents are expensive and have poor patient compliance; intravitreal injection of TA (IVTA) provides an alternative in such cases. However, IVTA leads to cataract progression and secondary glaucoma(Nawar, 2022). Recently, a dexamethasone implant has been used, sustaining steroid release in the vitreous cavity for 6 months. Its complication rate is lower than IVTA but may increase intraocular pressure(Nawar, 2022). This brought researchers' attention to other routes of delivery. Now TA is delivered through the suprachoroidal space in the posterior segment of the eye. A study showed that TA concentration in the posterior segment was twelvefold higher with suprachoroidal injection compared to the intravitreal route. Moreover, the concentration in the crystalline lens and anterior segment was also lower with suprachoroidal injection, thus reducing the risk of cataracts and IOP elevation(Kansara et al., 2022). Different studies have reported suprachoroidal injection's effectiveness for managing cystoid macular edema associated with retinal vein occlusion and uveitis(Campochiaro et al., 2018; Yeh et al., 2019). However, local studies are scarce on this subject. Thus, this study aims to assess the efficacy of suprachoroidal Triamcinolone acetonide (SCTA) injection for treating diabetic macular edema resistant to anti-VEGF agents.

Material and Method

A prospective study was conducted in Ophthalmology Department Service Hospital, Lahore, from December 2020 to December 2021. The study included patients over 30 years with DME

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and diabetes mellitus. Subjects who had previous eye surgery, steroid injections, and chronic illness were excluded. A total of 60 patients were included in the study. Informed consent of the participants was taken. The ethical board of the hospital approved the study.

Resistant DME was diagnosed if the patient had one of the following characteristics after being administered three consecutive doses of anti-VEGF agents: 1) No improvement of best corrected visual acuity (BCVA) according to Snellen chart, 2) failure to gain > 10% decrease of the central macular thickness (CMT) (from the baseline), 3) CMT > 300 µm. The ophthalmic evaluation was performed in all patients, including BCVA, intraocular pressure (IOP), retinal examination, anterior segment evaluation, and Spectral-domain optical coherence tomography (SD-OCT)of the fovea. Suprachoroidal TA injection 4 mg/0.1 mL was given after diagnosing resistant DME. After injection, the patch was placed on the eye. The injection was administered every 3 months during the follow-up period (12 months) if intraretinal cysts, intraretinal or subretinal fluid persisted and CMT remained > 250 µm. Patients were monitored for 3 days after injection and then examined monthly. Slit lamp examination, IOP measurement, and BCVA were assessed every visit. OCT evaluation of macular areas was done after the first, third, sixth, ninth, and twelfth months. The primary endpoint was CMT reduction and BCVA improvement after 12 months of injection. The secondary endpoint was assessing the safety of TA injection. Data were analyzed using SPSS 23.0. Categorical variables were represented as frequency and percentage. Continuous variables were represented as mean and standard deviation. IOP, BCVA, and CMT at baseline, first, third, sixth, ninth, and twelfth months were compared through the ANOVA test. Multivariable linear regression model detected independent predictors of BCVA. A *p*-value ≤0.05 was considered statistically significant.

Results

Six subjects administered a single dose of TA injection did not come for a follow-up 6 months; they were excluded from the study. Data from 54 patients (85 eyes) was evaluated. The mean age of the participants was 53.6±10.4 years; there were 40 females and 14 males. The mean HbA1c was 8.5±.7%, and the mean diabetes mellitus duration was 14.8±4.2 years.

Neurosensory detachment (NSD) was present in 30 (35.2%) eyes, and inner segment/outer segment (IS/OS) disruption in 40 (47.0%) eyes. Regarding the frequency of injections, only 2 injections were needed in most eyes (32, 37.6%), of which a second injection was required in the 3rd month in 19 (59.7%) eyes. 20 (23.5%) eyes needed 3 injections, of which the second injection was administered in the 3rd month in 12 (60%) eyes.

Mean CMT at baseline was 478.6±170.1 µm, and after 12 months, it was 230.1±47.5 µm; this decrease was statistically significant (P< .001). The mean BCVA at baseline was 1.194±0.1; after 12 months, it was 0.75±0.2 (P<.001). After one month of injection, IOP reached the maximum value (13.2±0.4 mmHg) compared to the baseline (12.32±0.1 mmHg). It gradually declined with the use of topical beta blockers and reached baseline value in the 3rd month, and glaucoma surgery was not needed in any patient (Table I).

There was a positive correlation between the final CMT and frequency of injection (P<.001). Additionally, eyes with worse BCVA and high CMT at baseline had worse BCVA after 12 months, which showed a positive correlation between baseline and final outcomes (P<.001). Moreover, IS/OS disruption and NSD were associated with worse final BCVA (P<.001). According to the linear regression model, baseline BCVA, NSD, and IS/OS disruption are independent predictors of BCVA after treatment with P <.001, .01, and <.001, respectively (Table II). There was no vitreous hemorrhage, retinal detachment, endophthalmitis, and uveitis. There were no systemic adverse effects during the study duration.

Table I Comparison of IOP, BCVA, and CMT changes over the study period

Parameters	Mean	P value
IOP (mmHg)		<.001
Baseline	12.32±0.1	
1 month	13.2±0.4	
3 months	12.27 ±0.1	
6 months	12.35± 0.2	
9 months	12.32± 0.1	
12 months	12.2± 0.2	
BCVA (logMAR)		<.001
Baseline	1.194±0.1	
1 month	0.91± 0.1	
3 months	0.91± 0.2	
6 months	0.86± 0.2	
9 months	0.82± 0.2	
12 months	0.75±0.2	
CMT(µm)		<.001
Baseline	478.6±170.1	
1 month	295.8 ±108.7	
3 months	326.4± 137.5	
6 months	284.4 ±111.6	
9 months	259.7 ±103.8	
12 months	230.1±47.5	

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Table II Independent predictors of BCVA

Variable	Final BCVA	
	β regression coefficient	**P value**
Baseline BCVA	0.6	<.001
NSD	0.1	.01
IS/OS disruption	0.3	<.001

Discussion

Anti-VEGF is standard for managing DME; however, the need for more injections and high cost limits their use. Previous studies show that 9 to 11 injections are only needed in the first year, and almost 17 injections are required for five years(Haider et al., 2023; Zafar et al., 2021). SCTA is the new method for treating DME. The results of this study show that SCTA led to significant improvement in mean BCVA and CMT reduction. A previous study reported that pseudophakic cystoid macular edema management using SCTA significantly improved BCVA(Marashi and Zazo, 2022).

Similarly, another study showed that SCTA injection using a microneedle led to significant CMT reduction and BCVA improvement without an increase in IOP(Oli and Waikar, 2021). Another previous study on the evaluation of SCTA reported that mean CMT decreased from 636.6±200.10µm to 302.67 ± 66.94 µm after three months of the treatment. The baseline BCVA score was 0.8±0.25 and improved to 0.46±0.26 after three months(Tayyab et al., 2020). However, the follow-up duration of the study was only three months, unlike ours, which had to follow-up of 12 months. In this study, because of recurrent edema, a second injection was required mostly in the third month, and its effects persisted throughout the study period. This finding was in contrast to a previous study on dexamethasone implants, which reported that the effect of steroids was maintained only for 6 months(Kuppermann et al., 2019). In this study, after one month of injection, IOP reached the maximum value compared to the baseline. It gradually declined with the use of topical beta blockers and reached baseline value in 3rd month. It was in contrast to the previous study, which reported no increase in IOP(Goldstein et al., 2016). This study reported that SCTA was safe regarding IOP. Conversely, a previous study reported an increase in IOP in 25% of subjects eight weeks after injection(Fraser-Bell et al., 2023). The current study reported a positive correlation between high baseline CMT and worse final BCVA. This was in line with a previous study that reported that macular edema affects the retina's stretching ability which damages bipolar axons and causes vision loss(Markan et al., 2020). The current study reported baseline BCVA, NSD, and IS/OS disruption as independent predictors of BCVA after treatment, NSD was associated with worse final BCVA. It was in line with a previous study that reported an association between NSD and impairment of macular function and retinal sensitivity(Vujosevic et al., 2017).

In contrast, a study reported good visual outcomes in subjects with NSD after one year of treatment with dexamethasone implants(Korobelnik et al., 2019). In line with the result of our study, a previous study showed that disrupted IS/OS and poor BCVA is associated with poor final BCVA(Eski Yucel et al., 2019). Limitations of our study include short follow-up duration, small study sample, and lack of a control group. A more extensive, thorough study should be done for further analysis.

Conclusion

Suprachoroidal TA injection effectively treats resistant DMA, leads to SCVA improvement and CMT reduction, and has no serious systemic or ocular adverse effects.

Conflict of interest

The authors declared absence of conflict of interest.

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