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ORIGINAL ARTICLE

Anatomical changes after suprachoroidal triamcinolone acetonide in patients with diabetic macular edema.

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ABSTRACT… Objective: To evaluate average change in central macular thickness (CMT) and central subfield thickness (CST) in patients with DME following suprachoroidal triamcinolone acetonide injection. **Study Design:** Quasi-experimental study. **Setting:** LRBT, Lahore. **Period:** June 2025 to December 2025. **Methods:** Included were 135 patients with DME diagnoses. OCT was used to measure baseline CST and CMT. At four weeks, a follow-up evaluation was conducted. **Results:** The mean age of patients was 58.9 ± 6.4 years, with the majority being males. 5.5 ± 2.1 years was the average duration of diabetes. The mean baseline CST was 468.90 ± 25.10 µm, which significantly reduced to 293.10 ± 9.20 µm at four weeks (mean reduction 175.80 ± 16.20 µm; $p < 0.001$). Similarly, the mean baseline CMT decreased from 470.20 ± 24.80 µm to 294.00 ± 10.10 µm (mean reduction 176.20 ± 15.90 µm; $p < 0.001$). Stratification analysis showed that age and duration of diabetes significantly influenced anatomical response ($p < 0.05$). **Conclusion:** The central subfield thickness and central macular thickness were statistically reduced in diabetic macular edema patients four weeks after suprachoroidal triamcinolone acetonide injection. The outcomes suggest that SCTA is an effective method of treatment to achieve short-term morphological change, particularly in elderly patients and those with chronic diabetes.

Key words: Central Subfield Thickness, Central Macular Thickness, Diabetic Macular Edema, Suprachoroidal Injection, Triamcinolone Acetonide.

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INTRODUCTION

Diabetic Macular Edema, which is a condition where there is the accumulation of fluid in the macula caused by the leaking of the fluid from the blood vessels in the retina, is the main cause of the impairment of vision among diabetic patients.[1] Diabetes causes the capillaries in the eye to be permeable, resulting in the leaking of the fluid into the inner and outer plexiform layers of the retina, which causes Diabetic Macular Edema (DME).[2] The occurrence of Diabetic Macular Edema (DME) among diabetic patients causes them to lose their sight, resulting in blindness. The DME among diabetic patients occurs at a rate of 3-14%.[3]

Early detection of diabetic macular edema is important to avert the situation where patients lose their vision. The duration of diabetes mellitus has been shown to be directly related to the emergence of diabetic retinopathy (DR). [4] Diabetic retinopathy and diabetic macular edema have been proven to be the major cause of blindness in wealthy countries, with a 12 percent emergence per year.[5-6] It has been established that photocoagulation, vitrectomy, and anti-VEGF are able to reduce the sight loss.[7]

Restoring visual acuity once it declines due to advanced diabetic macular edema can be challenging, as irreversible phases may develop with few symptoms. Early treatment is crucial to prevent significant vision impairment. Research shows better outcomes with early screening and intervention. Timely detection and management are vital for a positive prognosis in diabetic macular edema cases, underscoring the importance of early intervention to halt disease progression.[8-9]

Triamcinolone Acetonide is an alternative approach for patients who have not responded well to anti-VEGF drugs, or for those patients for whom compliance has always been a problem.

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Even though Triamcinolone Acetonide has a very good result in the reversal of macular edema and the re-establishment of the blood-retinal barrier, the use of the drug has always been characterized by a number of undesirable effects. For example, the use of the drug has always been associated with the need for repeated injections because of the waning effects of the drug, including the occurrence of rebound macular edema.[10]

Increased interest in using the suprachoroidal space for drug delivery is an attempt to minimize the side effects of intravitreal steroids. Researchers balance the risk of using this method for steroid delivery. They examine the rate of the , level of intervention, concentration and drug delivery in the posterior segment relative to the systemic and anterior segment.[11] In a study, the Mean pre-injection CST was found to be 636.5±200.11 µm. The Mean post-injection CST at one month was found to be 304.54±67.43 µm. The Mean change in CST after treatment was found to be 331.96±132.68 µm.[12] In another study, the central macular thickness after suprachoroidal Triamcinolone injection was found to change from 556.2±10.9 to 313.6±7.2 µm. The Mean change in CMT after treatment was found to be 242.54±78.[13]

As the usage of this drug is rising exponentially, the safety of this procedure is of utmost importance. There is a need to investigate the change in CST and CMT after this procedure. If there is a sustained change in central subfield thickness, it could affect the blood and axonal supply to the optic nerve. In individuals with diabetic macular edema, we plan to examine how the injection of triamcinolone acetonide affects the thickness of the central subfield. This will provide us with a firm understanding of the safety of this therapy approach with regard to CST fluctuation in patients with diabetes. So the current study is to determine the average change in central subfield thickness and central macular thickness in individuals with diabetic macular edema following suprachoroidal injection of triamcinolone acetonide.

METHODS

The quasi-experimental research design was conducted at the Department of Ophthalmology of Layton Rahmatulla Benevolent Trust (LRBT) Hospital, Lahore from June 2025 to December 2025 after taking approval from institutional ethical committee (No. 4870). One hundred and thirty-five (135) patients diagnosed with diabetic macular edema (DME) were recruited based on a non-probability consecutive sampling method. A total of 135 cases is obtained using a 95% confidence level and 5% margin of error, with an expected mean change in CMT of 242.54 ± 78.27 µm after treatment.[13]

The patients who were aged 25-60 years old, both males and females, as per the operation definition, and whose central macular thickness exceeded 350 µm were included in the study. DME was characterized as thickening of the retina in 500 µm of the fovea center; hard yellow exudates in 500 µm of the fovea center relative to the adjacent retinal thickening; at least one disc area of disc retinal thickening, with any of it falling within one disc diameter of the fovea center. The study excluded patients who had already undergone local therapy to treat clinically significant macular edema (CSME), patients with tractional maculopathy, ischemic maculopathy, hemoglobin A1c (HbA1c) more than 10%, patients who were on chronic renal failure under dialysis or kidney transplantation, and patients whose blood pressure was more than 170/100 mmHg.

Written informed consent was obtained. Strict aseptic conditions were used for every procedure. The suprachoroidal injection of triamcinolone acetonide (SCTA) was preceded by pupillary dilatation. To regulate the depth of penetration, a 24-gauge intravenous cannula was used in conjunction with a 30-gauge 1 cc insulin syringe (BD Insulin Syringe with BD Ultrafine Needle). The branula was cut so that only 1000 µm of the needle was visible past the edge. Up to 0.1 mL (or 4 mg) of triamcinolone acetonide (40 mg/mL) was added to the syringe.

Povidone-iodine 10% solution was then put on the periocular area, and 5% put in the fornices and left for 30 s. Then a sterile covering was placed over the eye, similar to any intraocular operation. Marking the supratemporal quadrant 3.5 mm behind the limbus was then done. Thereafter, 4 mg (0.1

mL) triamcinolone acetonide was injected in the suprachoroidal space with the positioning of the needle perpendicular to the sclera with the bevel facing backwards. A cotton tip applicator was touched to the injection site after letting the needle go slowly to avoid reflux.

Immediately after the injection procedure, indirect ophthalmoscopy was done in order to check the patency of the central retinal artery and identify the presence of drug reflux into the vitreous. The procedure was then followed by the instillation of one drop of a topical antibiotic. The patients were then planned to be followed up after 4 weeks. The outcome measures were the difference between the mean values at baseline and the mean values after four weeks.

The SPSS version 25.0 was used, providing gender as frequencies and percentages; age, CST, and CMT, as mean ± standard deviation. The evaluation of the changes in means was conducted with the help of a paired t-test. The stratification was carried out by age, gender, and the duration of diabetes to have effect modifiers under control. To compare the two groups of participants, the independent sample t-test was used, and the p-value was ≤0.05.

RESULTS

A total of 135 patients with diabetic macular edema were included in the study. The mean age of the participants was 58.9 ± 6.4 years, with the majority of patients (73.3%) belonging to the 56–70 years age group, while 26.7% were between 30–55 years. There was a male predominance in the study population, with 101 (74.8%) males and 34 (25.2%) females. The mean duration of diabetes was 5.5 ± 2.1 years. These findings indicate that diabetic macular edema was more common in older individuals and in patients with a moderate duration of diabetes in our study population.

TABLE-I

Demographic profile of patients (n = 135)

Variable	Frequency (n)	% / Mean ± SD
Age (years)		58.9 ± 6.4
30–55 years	36	26.7%
56–70 years	99	73.3%
Gender		
Male	101	74.8%
Female	34	25.2%
Duration of Diabetes (years)		5.5 ± 2.1

The mean baseline CST was 468.90 ± 25.10 µm, which significantly reduced to 293.10 ± 9.20 µm at four weeks, demonstrating a mean reduction of 175.80 ± 16.20 µm. Similarly, the mean baseline CMT was 470.20 ± 24.80 µm, which decreased to 294.00 ± 10.10 µm after four weeks, showing a mean reduction of 176.20 ± 15.90 µm. The reduction in both CST and CMT was statistically significant ($p < 0.001$).

The mean reduction in CMT was slightly higher in the 56–70 years age group (178.10 ± 25.60 µm) compared to the 30–55 years group (172.40 ± 28.50 µm), and this difference was statistically significant ($p < .05$). Regarding gender, females showed a slightly greater mean reduction (178.90 ± 24.90 µm) compared to males (175.30 ± 26.80 µm); however, this difference was not statistically significant. Patients with a duration of diabetes greater than 7 years demonstrated a greater mean reduction in CMT (181.20 ± 23.40 µm) compared to those with ≤7 years (174.60 ± 27.20 µm) ($p < .05$).

DISCUSSION

The significant decrease in central subfield thickness (CST) and central macular thickness (CMT) in the study, following the administration of suprachoroidal triamcinolone acetonide, is consistent with the previous studies that have proven the efficacy of SCTA in the treatment of diabetic macular edema.

TABLE-II

Assessment of mean changes at baseline and 4 weeks post-treatment (n = 135)

Variable	Baseline	After 4 Weeks	Mean Change	P-Value
Central Subfield Thickness (µm)	468.90 ± 25.10	293.10 ± 9.20	175.80 ± 16.20	<0.001
Central Macular Thickness (µm)	470.20 ± 24.80	294.00 ± 10.10	176.20 ± 15.90	<0.001

TABLE-III

Stratification of mean changes by age, gender, and duration of diabetes (n = 135)

Variable	Category	N	Mean Change in CMT (µm) ± SD	P-Value
Age Group (years)	30–55 years	36	172.40 ± 28.50	<.05
	56–70 years	99	178.10 ± 25.60	
Gender	Male	101	175.30 ± 26.80	>.05
	Female	34	178.90 ± 24.90	
Duration of Diabetes	≤7 years	82	174.60 ± 27.20	<.05
	>7 years	53	181.20 ± 23.40	

Another study reported a pooled CMT reduction from about 545 µm to 316 µm, consistent with the approximately 176 µm decrease observed here, while also noting stable intraocular pressure (IOP) and no significant visual acuity changes at early follow-up.[14] Comparative studies have shown SCTA to be as effective as intravitreal triamcinolone but with potentially longer-lasting effects and fewer steroid-related complications.[15,16] Longer-term studies on resistant DME cases found sustained anatomical and functional improvements up to 6 to 12 months post-SCTA, with transient IOP increases that returned to baseline, supporting the safety profile observed in this study.[17-19] Combination therapy of SCTA with anti-VEGF agents has also demonstrated additive benefits in both visual acuity and macular thickness reduction without increased adverse events.[20]

Our study is aligned with previous literature, as another study shows that the duration of diabetes was 5.36 ± 1.94 years. The central macular thickness was 469.31 ± 24.12 at baseline and 292.48 ± 8.38 after therapy. and the thickness of the central macula was 176.83 ± 15.74 (p=0.000). There were 25.0% (n=15) girls and 75.0% (n=45) males in our study.[21] One study found improved central macular thickness by 331.96 ± 132.68 (from 636.5 ± 200.1 to 304.54 ± 67.43).[12]

Studies have shown that SCTA has equivalent, if not better, anatomical outcomes compared with the use of triamcinolone acetonide injection, and the effect may be prolonged, and steroids may be avoided, which reduces the risk of side effects such as increased IOP and cataracts.[22,23] In the studies on the resistant DME cases, significant anatomical and functional improvements were observed for 6 to 12 months following the SCTA injection, with a transient IOP increase that normalized at 3 months, confirming the safety results obtained in the present study.[18,19,20] Combination therapy with anti-VEGF drugs and SCTA has shown additive effects on visual acuity and macular thickness, with no increase in side effects, and appears to offer promise for the difficult cases of DM.[18-20]

Strengths of the current study include a robust sample size and stratified analysis by age and diabetes duration, while limitations involve the short four-week follow-up and lack of functional vision outcomes; future research should focus on longer-term efficacy, visual function correlation, and comparative effectiveness against other treatments to optimize SCTA use in DME management.

CONCLUSION

The injection of triamcinolone acetonide, which is a suprachoroidal injection, has been proven to have a significant anatomic effect on patients where there is a manifestation of diabetic macular edema, as indicated by the reduction of the central subfield thickness and the central macular thickness of the eye after four weeks from the therapy. Nonetheless, the age and period of diabetes affected the response to the treatment, but not gender. Thus, the application of the suprachoroidal route in the delivery of drugs can be suggested as an effective and promising method of managing diabetic macular edema, particularly when patients fail to respond to traditional therapies. It is advised that long-term research should be done to determine the safety and effectiveness of outcomes.

CONFLICT OF INTEREST

The authors declare no conflict of interest.

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1	**Momina Malik:** Manuscript writing.
2	**Hammad Asghar:** Data collection.
3	**Ali Hashim Zubair:** Data entry.
4	**Muhammad Suhail Shehzad:** Revisions.
5	**Amtul Mussawar Sami:** Proof reading.
6	**Taqwa Tariq:** Data interpretation.