ORIGINAL ARTICLE https://doi.org/10.52206/jsmc.2025.15.1.948 OPEN ACCESS

Efficacy and Safety of Suprachoroidal Triamcinolone Acetonide in Center Involving Diabetic Macular Edema in Pseudophakic Patients.

Imran Ahmad, Nazli Gul, Bilal Khan, Jawad Humayun, Fahad Khan

Khyber Medical College / Khyber Teaching Hospital, Peshawar, Pakistan

ABSTRACT

Background: Diabetic macular edema is the common cause of decrease vision in diabetics. The treatment of diabetic macular edema is challenging and the options available are laser, intravitreal anti-VEGF and steroids or combination of these treatment modalities.

Objective: The objective of the study is to determine the efficacy of suprachoroidal triamcinolone alone in the treatment of diabetic macular edema.

Materials and Methods: This quasi-experimental study was carried out in the department of Ophthalmology of Khyber Teaching Hospital, Peshawar from August 2023 till February 2024. Pseudophakic patients with center involving diabetic macular edema on optical coherence tomography were enrolled in the study by consecutive convenient sampling method. Patients with history of glaucoma, phakic patients, those with corneal opacity, vitreous hemorrhage, proliferative diabetic retinopathy, macular edema from causes other than diabetes, history of pan-retinal photocoagulation for proliferative diabetic retinopathy were excluded from the study. The enrolled patients were given suprachoroidal triamcinolone acetonide injection of 0.1 ml (4mg) using a specialized syringe in the operating room.

Results: Total of 42 patients were recruited in the study. The mean age of the participants were 59.12 $\pm$ 8.15 years. One-month post-injection there was statistically significant improvement in visual acuity from pre-treatment level with a p-value 0.001. No statistically significant changes were detected in IOP in pre-treatment and post-treatment suprachoroidal triamcinolone acetonide injection (p-value 0.21). There was statistically significant decrease in the central macular thickness in post-treatment patients 383.68 $\pm$ 62.64 and 324.14 $\pm$ 57.96 respectively with a P-value 0.02.

Conclusion: Suprachoroidal triamcinolone acetonide injection is associated with improvement in visual acuity and reduction in central macular thickness without significant increase in intraocular pressure in patients with diabetic macular edema.

Keywords: Central macular thickness, Macular edema, suprachoroidal, Triamcinolone acetonide.

This article may be cited as: Ahmad I, Gul N, Khan B, Humayun J, Khan F. Efficacy and Safety of Suprachoroidal Triamcinolone Acetonide in Center Involving Diabetic Macular Edema in Pseudophakic Patients. *J Saidu Med Coll* 2025;15(1):50-55. https://doi.org/10.52206/jsmc.2025.15.1.948

INTRODUCTION

The diabetic population is increasing and it is estimated that it will affect 600 million people worldwide by 2030.[1] Pakistan ranks third in terms of diabetic population in the world after China and India with an increase prevalence from 11.7% in 2016 to 26.7% in 2022 which is alrming.[2] With increasing prevalence of diabetes, the people affected by diabetic retinopathy is also increasing. The most common cause of reduced vision in diabetics is diabetic macular edema (DME) in working age population worldwide.[3] There are various modalities for management for diabetic macular edema. In Early Treatment of Diabetic Retinopathy Study (ETDRS) focal laser was considered to be gold standard for clinically significant diabetic macular edema (CSME).[4] With the introduction of Anti-VEGF in ophthalmology, the use of laser for macular edema has reduced and anti-VEGF are considered to be treatment of first choice for DME.[5] The availability of Anti-VEGF in developing countries, affordability of the people for the drugs and response of DME to anti-VEGF in some patients are the issues. Despite of the wide use of anti-VEGF therapy for center involving DME, some patients do not respond to this form of therapy due to multifactorial origin of the disease.[6]

Before the introduction of anti-VEGF, intravitreal steroids were widely used and research have proved the effectiveness of intravitreal steroids in treatment of DME, but associated with complications of raised intraocular pressure and cataract.[7] Steroids is also an effective therapy for diabetic macular edema due to its anti-inflammatory, anti-angiogenic factors which decreases permeability of blood vessels.[8] It is also given in some countries in early stages of DME if the patient is not falling in the criteria for anti-VEGF therapy.

Suprachoroidal triamcinolone injection route has the benefit of better accessibility of the drug to macula due to high vascularity of the choroid with minimal concentration in the anterior segment in comparison to the intravitreal steroids leading to lesser chances of glaucoma and cataract formation.[9]

The availability of bevacizumab in Pakistan has been an issue and most of the patients went untreated due to non-availability of the drug resulting in worsening of macular edema and visual loss. Suprachoroidal route is minimally invasive with long lasting availability provide effective delivery of the drug to the retina and maintain its high biocompatibility to the eye.[10,11]

Correspondence: Dr. Nazli Gul
Assistant Professor,
Khyber Medical College / Khyber Teaching Hospital,
Peshawar, Pakistan
Email: drnazli83@gmail.com

Received: April 08th, 2024 - 1st Revision: November 07th 2024
2nd Revision: December 16th 2024 - Accepted: December 19th, 2024

The purpose of the study is to determine the efficacy and safety of suprachoroidal triamcinolone acetonide in the treatment of diabetic macular edema in pseudophakic patients.

MATERIALS AND METHODS

The Quasi experimental study was caried out in the Ophthalmology Department of Khyber Teaching Hospital Peshawar after taking approval from Institute Ethical & Review Board (IERB), through notification No. 154/DME/KMC, Peshawar, Pakistan. The duration of study was 8 months from 1st August 2023 to 31st March 2024. The patients were selected by consecutive convenient sampling method.

The sample size for the study was 42 keeping confidence level as 95% with 5% margin of error and prevalence of diabetic macular edema 8%[12] in diabetic population using online sample size calculation software Openepi version 3.

Pseudophakic patients with diabetic macular edema were advised optical coherence tomography using Spectralis (Heidelberg-Germany) to check the center involving diabetic macular edema and to measure the central macular thickness (CMT). Patients were categorized as having center involving diabetic macular edema (Ci-DME) if the edema is involving any layer of the retina in the central sub-foveal 1000 microns region detected on optical coherence tomography (OCT).[13]

Pseudophakic patients with center involving diabetic macular edema on OCT were included in the study. Patients with history of glaucoma or IOP above 21 mm of Hg, phakic patients, those with corneal opacity, vitreous hemorrhage, proliferative diabetic retinopathy, macular edema from causes other than diabetes were excluded from the study. Patients already undergone pan-retinal photocoagulation for proliferative diabetic retinopathy were also excluded from the study.

Suprachoroidal triamcinolone acetonide injections were given in the operating room. During the procedure patient eye was anesthetized with Proparacaine eye drops and 10% Povidone-iodine solution was used as ocular surface disinfectant for 3 minutes. Lids were opened with speculum. From the sterile injection 0.1ml (4mg) of triamcinolone acetonide were drawn in a specially designed 30G suprachoroidal syringe with only 1 mm tip visible as shown in figure 01. The patient was asked to look down and injections were given trans-conjunctively 4 mm from the limbus measured through caliper in supero-temporal quadrant into the suprachoroidal space. After injection tobramycin eye drops were instilled into the injected eye 4 times a day for 3 days.

Patients were followed after one month with visual acuity, intraocular pressure (IOP) and central macular thickness through optical coherence tomography. The treatment was said to be effective if on post-operative visit the patient have an improvement of visual acuity by one line on Snellen chart, improvement of macular thickness more than 10% of pre-treatment readings on OCT.[8] The procedure was documented to be safe if the IOP remain below 21 mm of Hg on Goldman applanation tonometry.[14]

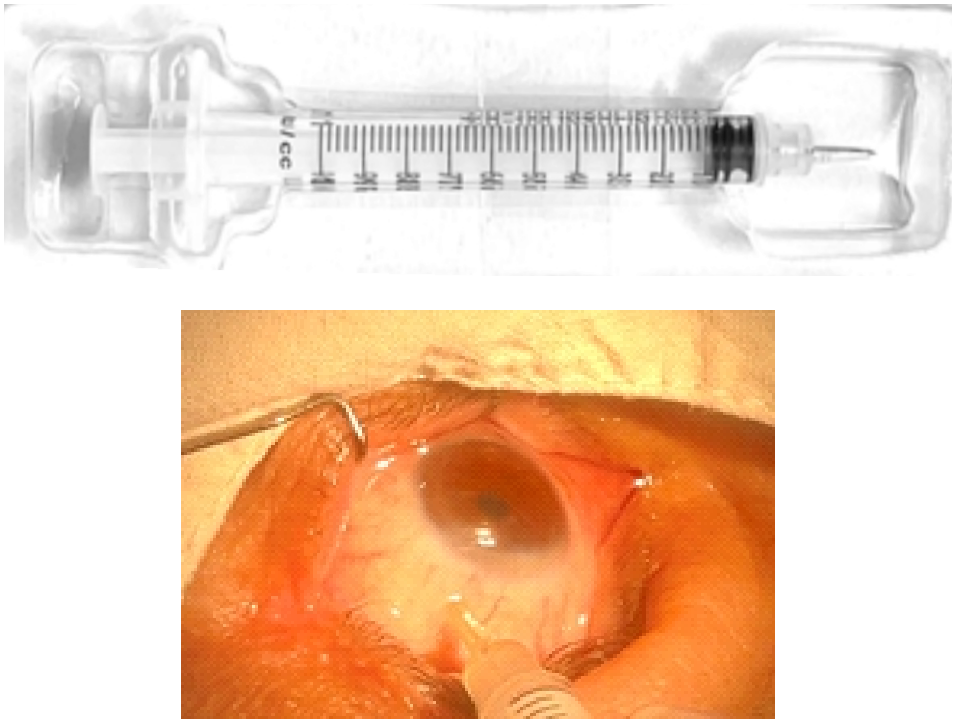


Figure 01. Left: Suprachoroidal syringe with tip exposed, Right: suprachoroidal injection.

Data Collection
Patients were collected from Outpatient Department of ophthalmology of Khyber Teaching Hospital, Peshawar. The pseudophakic patients with center involving diabetic macular edema with enrolled in the study. Informed consent was taken from all the participants of the study.

Patient's best corrected visual acuity, intra ocular pressure and central macular thickness on OCT were measured at pre-treatment and post-treatment level for comparison. All the data was recorded in a pre-designed proforma.

Data Analysis
Data analysis was done through SPSS software 26. Variables of study were be best corrected vision (BCVA), intraocular pressure (IOP) and central macular thickness (CMT) measured on optical coherence tomography (OCT). For quantitative variables we calculated mean, mode and standard deviation, whereas for qualitative variables frequencies were used. For comparison of pre-treatment and post-treatment changes in intraocular pressure (IOP) paired t-test was used. Paired t-test will be used for comparison of pre-treatment and post-treatment parameters. P-value was calculated for changes in IOP and central macular thickness and a value of less than 0.05 was considered as statistically significant.

RESULTS
The study was carried to determine the efficacy and safety of suprachoroidal triamcinolone acetonide in diabetic macular edema in pseudophakic patients.

A total of 41 pseudophakic patients with diabetic macular edema were included in the study. Means age was 59.12 $\pm$ 8.158 years as shown in Table 01 along with demographic data.

Pre-treatment and post-treatment visual acuity has been shown in table 02, indicating that 51.3% of the patients were having pre-treatment visual acuity less than 6/36 whereas post-injection follow up 73.1% of the participants having visual acuity better than 6/36.

The mean pre-treatment central macular thickness before suprachoroidal triamcinolone acetonide injection was 383.68 $\pm$ 62.64 microns, whereas post-treatment central macular thickness was reduced to 324.14 $\pm$ 57.96 microns showing a mean reduction of 59.54 microns as shown in table 04. Regarding safety of suprachoroidal triamcinolone acetonide the rise in pre-treatment and post-treatment IOP is insignificant with a p-value of 0.21 as shown in the table 03.

The difference between pre-treatment and post-treatment central macular thickness statistically significant (p-value 0.02) as shown in table 04. Table 05 shows a high t-value of 8 (above the critical t-value of $\pm$ 2 with degree of freedom 40 and significance level of 0.05), showing statistically significant difference between the pre-treatment and post-treatment central macular thickness value.

Table 01. Demographic distribution of data

Gender	Frequency	Percentage (%)	Mean Age + SD (Year)
Male	23	56.1	58.67 + 8.15
Female	18	43.9	59.48 + 7.73

Table 02. Pre-treatment and post-treatment VA

	Pre-Treatment VA		Post-Treatment VA		P-value
Vision	**Frequency**	**Percentage**	**Frequency**	**Percentage**	
6/9	0	0	1	2.4	0.001
6/12	2	4.9	8	19.5	
6/18	4	9.8	8	19.5	
6/24	8	19.5	6	14.6	
6/36	9	22.0	7	17.1	
6/60	12	29.3	7	17.1	
Counting Fingers	6	14.6	4	9.8	
Total	**41**	**100**	**41**	**100**	

VA= Visual Acuity

Table 03. Pre-Treatment and Post-Treatment IOP comparison using t-test

	Mean + SD	P-value
Pre-Treatment IOP	17.76 + 1.743	0.21
Post-Treatment IOP	18.24 + 1.20	

IOP= Intra Ocular Pressure

Table 04. Pre-Treatment and Post-Treatment CMT paired sample statistics

	Mean	Std. Deviation	Std Error of Mean
Pre-Treatment CMT	383.68	62.64	9.782
Post-Treatment CMT	324.14	57.96	9.052

CMT= Central Macular Thickness

Table 05. Central macular thickness Paired sample t - test

Paired Differences								
	Mean	Std Deviation	Std Error Mean	95% Confidence Interval of the Difference		t	df	Sig (2-tailed)
				Lower	Upper			
Pre-treatment CMT & Post-treatment CMT	59.536	45.89	7.167	45.05	47.02	8.307	40	0.01

CMT = Central Macular Thickness, t= t-test, df= degree of freedom

DISCUSSION

Triamcinolone acetonide is used for diabetic macular edema for 3 decades. Anti VEGF is the treatment of first choice but if contraindicated, availability or affordability is the issue then suprachoroidal triamcinolone acetonide is also effective in the treatment of center involving diabetic macular edema. Our study showed that suprachoroidal triamcinolone acetonide is effective in the treatment of center involving diabetic macular edema.

Alternative therapy was needed to combat DME which is cheaper and easily available. In this study we started the patients on monotherapy of suprachoroidal triamcinolone acetonide injections as a rescue modality for diabetic macular edema.

Our study showed that there was improvement in visual acuity in patients with Ci-DME after suprachoroidal triamcinolone acetonide injections as diabetic macular edema is multifactorial in origin and sometime not responding to anti-VEGF injections. A study was done by Tayyab H and Ahmad CN which showed that suprachoroidal triamcinolone is an effective therapy in resistant diabetic macular edema, in patients not responding to anti-VEGF injections.[14]

We noted visual improvement with suprachoroidal triamcinolone acetonide injection and found that most patients experienced statistically significant visual improvement (p-value 0.001). The same observation was made by Nawar AE in their article in which they used suprachoroidal triamcinolone injection in patients resistant to conventional treatment of DME with intravitreal anti-VEGF injection, concluded that suprachoroidal injections are associated with significant visual improvement in diabetic macular edema patients.[15]

Reduction in central macular thickness was noted by Fazel F and Malekahmdi M in which they compared monotherapy with intravitreal bevacizumab with combination therapy of intravitreal bevacizumab and suprachoroidal triamcinolone acetonide for diabetic macular edema.[16] The results of their study showed that there was much more reduction in the combination group with addition of suprachoroidal triamcinolone than monotherapy of intravitreal bevacizumab, establishing the efficacy of suprachoroidal triamcinolone acetonide in diabetic macular edema.

In our study we used suprachoroidal route for drug delivery having higher concentration of drug availability for macular edema due rich vascularity of choroid and associated with lesser complications than intravitreal triamcinolone injections. The same findings were also noted by Table A and Soliman T when they compared intravitreal triamcinolone acetonide injections with suprachoroidal injections.[17]

Our study showed that monotherapy with suprachoroidal triamcinolone is effective in reducing central macular thickness and improving visual acuity in patients with diabetic macular edema. The efficacy of

suprachoroidal triamcinolone injection has also been established in study by Muslaim I and Chaudhry N in which they compared suprachoroidal triamcinolone acetonide injection with intravitreal bevacizumab injection for macular edema.[18] They concluded that both are equally effective in reducing the central macular thickness and improving visual acuity.

We did not notice any significant rise in intraocular pressure as this route is considered to be safer than intravitreal route due to decrease penetration of the drug into the anterior chamber. In a systematic review and metanalysis by Ghanzanfar AS and Khowaja AH showed that suprachoroidal route is safe in terms of IOP elevation than intravitreal route of triamcinolone injections.[19]

Suprachoroidal triamcinolone acetonide injection is an effective treatment modality for diabetic macular edema in pseudophakic and can be used as second line treatment for Ci DME.

CONCLUSION

Suprachoroidal triamcinolone acetonide can be used for the treatment of diabetic macular edema in pseudophakic patients and is an effective and safe alternative to other treatment modalities. It can also be used as an alternative treatment option in resistant diabetic macular edema.

Ethical Consideration

This study was approved by Institutional Review Board of Khyber Teaching Hospital, (154/DME/KMC), Peshawar, Pakistan.

Funding

There is no role of any funding agency in this study.

Conflict of Interest

Authors declared no conflict of interest.

REFERENCES

1. Dugalic S, Petronijevic M, Vasiljevic B, Todorovic J, Stanisavljevic D, Jotic A. Trends of the prevalence of pre-gestational diabetes in 2030 and 2050 in Belgrade cohort. *Int J Environ Res Public Health* 2022;19(11):6517. https://doi.org/10.3390/ijerph19116517
2. Azeem S, Khan U, Liaqat A. The increasing rate of diabetes in Pakistan: A silent killer. *Ann Med Surg* 2022;79:103-8. https://doi.org/10.1016/j.amsu.1022.103901
3. Cooper OE, Taylor DJ, Crabb DP, Sim DA, McBain H. Psychological, social and everyday visual impact of diabetic macular edema and diabetic retinopathy: A systematic review. *Diabet Med* 2020;37(6): 924-33. https://doi.org/10.1111/dme.14125
4. Everett LA, Paulus YM. Laser therapy in the treatment of diabetic retinopathy and diabetic macular edema. *Curr Diab Rep* 2021;6:21-9. https://doi.org/10.1007/s11892-021-01403-6
5. Blinder KJ, Dugel PU, Chen S, Jumper JM, Walt JG, Hollander DA, et al. Anti-VEGF treatment of diabetic macular edema in clinical practice: effectiveness and patterns of use (ECHO Study Report 1). *Clin Ophthalmol* 2017;11:393–401. https://doi.org/10.2147/OPTH.S128509
6. He Y, Ren XJ, Hu BJ, Lam WC, Li XR. A meta-analysis of the effect of a dexamethasone intravitreal implant versus intravitreal anti-vascular endothelial growth factor treatment for diabetic macular edema. *BMC Ophthalmol* 2018;18(1): 121-6. https://doi.org/10.1186/s12886-018-0779-1
7. Patil NS, Mihalache A, Hatamnejad A, Popovic MM, Kertes PJ, Muni RH. Intravitreal steroids compared with anti-VEGF treatment for diabetic macular edema: A meta-analysis. *Ophthalmol Retina* 2023; 7(4):289-99. https://doi.org/10.1016/j.oret.2022.10.008
8. Zakaria YG, Salman AG, Said AMA, Abdelatif MK. Suprachoroidal versus intravitreal triamcinolone in the treatment of diabetic macular edema. *Clin Ophthalmol* 2022;16:733-46. https://doi.org/10.37939/jrmc.v27i4.2430
9. Habot-Wilner Z, Noronha G, Wykoff CC. Suprachoroidally injected pharmacological agents for the treatment of chorio-retinal diseases:a targeted approach. *Acta Ophthalmol* 2019;97(5): 460–472. https://doi.org/10.1111/aos.14042.
10. Wu KY, Fujioka JK, Gholamian T, Zaharia M, Tran SD. Suprachoroidal Injection: A novel approach for targeted drug delivery. *Parmaceuticals* 2023;16(9): 1241-5. https://doi.org/10.3390/ph16091241
11. Chiang B, Jung JH, Prausnitz MR. The suprachoroidal space as a route of administration to the posterior segment of the eye. *Adv Deliv Rev* 2018;126:58-66. https://doi.org/10.1016/j.addr.2018.03.001
12. Campochiaro PA, Wykoff CC, Brown DM, Boyer DS, Barakat M, Taraberelli D et al. Tanzanite study group. Suprachoroidal triamcinolone acetonide for retinal vein occlusion: Results of the Tanzanite study. *Ophthalmol Retina* 2018;2(4):320-8. https://doi.org/10.1016/j.oret.2017.07.013
13. Syed AN, Safdar M, Abbas S. Systemic predictors of diabetic macular edema in patients visiting tertiary hospital. *Pak J Surg* 2020;36(4):343-8. https://doi.org/10.53350/pjmhs22162744
14. Hanif J, Iqbal K, Perveen F, Arif A, Iqbal RN, Jameel F et al. Safety and efficacy of suprachoroidal injection of triamcinolone in treating macular edema seconday to non-infectious uveitis. *Cureus* 2021. 30;13(11):e20038. https://doi.org/10.7759/cureus.20038
15. Yu QS, Tsuboi K, Guo Y, Wang J, Flaxel CJ, Bailey ST *et al*. Comparison of central macular fluid volume with central subfield thickness in patients with diabetic macular edema using optical coherence tomography angiography. *JAMA Ophthalmol* 2021; 139(7):734-41. https://doi.org/10.1001/jamaophthalmol.2021.1275
16. Tayyab H, Ahmed SN, Sadiq MA. Efficacy and safety of suprachoroidal triamcinolone acetonide in cases of resistant diabetic macular edema. *Pak J Med Sci* 2020;36(2):42-7.

17. Nawar AE. Effectiveness of Suprachoroidal injection of triamcinolone acetonide in resistant diabetic macular edema using a modified microneedle. *Clin Ophthalmol* 2022;16:3821-31. https://doi.org/10.2147/OPTH.S391319
18. Fazel F, Malekahmadi M, Feizi A, Oliya B, Tavakoli M, Fazel M. Suprachoroidal injection of triamcinolone acetonide plus intravitreal bevecizumab in diabetic macular edema: a randomized pilot trial. *BMC Ophthalmol* 2023; 23:40-7. https://doi.org/10.1186/s12886-023-02790-y
19. Tabl AA, Soliman TT, Elsayed MA, Tabl MA. A randomized trial comparing suprachoroidal and intravitreal injection of triamcinoloone acetonide in refractory diabetic macular edema due to epiretinal membrane. *J Ophthalmol* 2022;7:254-8. https://doi.org/10.1155/2022/7947710
20. Muslim I, Chaudhry N, Javed RM. Effect of suprachoroidal triamcinolone injection on best corrected visual acuity and central retinal thickness in patients with macular edema secondary to retinal vein occlusion. *Pak J Ophthalmol* 2022;38(1): 67-70. https://doi.org/10.36351/pjo.v38i1.1347
21. Ghazanfar AS, Khowaja AH, Tayyab H. Effect of suprachoroidal triamcinolone on intraocular pressure: s systematic review and metanalysis. *Ther Adv Ophthalmol* 2024;5:1625158414 241228671. https://doi.org/10.1177/25158414241228671

DATA SHARING STATEMENT: The data that support the findings of this study are available on request from the corresponding author. The data is not publicly available due to privacy or ethical restrictions.

AUTHORS' CONTRIBUTION

The following authors fulfill authorship criteria as per ICMJE guidelines;

Ahmad I, Gul N: Substantial contribution to conception and design, drafting the manuscript, final approval, agreed to be accountable for all the work.

Khan B: Substantial contribution to conception and design, data acquisition, drafting the manuscript, final approval, agreed to be accountable for all the work.

Humayun J: Analysis and interpretation of data, drafting the manuscript, final approval, agreed to be accountable for all the work.

Khan F: Analysis and interpretation of data, critical revision, final approval, agreed to be accountable for all the work.

This is an Open Access article distributed under the terms of the Creative Commons Attribution-NonCommercial 4.0 International License, which permits unrestricted use, distribution & reproduction in any medium provided that original work is cited properly.

CORRIGENDUM

The article title **"Dental Anomalies in Children with Unilateral and Bilateral Cleft Lip and Plate"** having citation link "http://doi.org/10.52206/jsmc.2024.14.4.905" has been published in **JSMC 2024; 14 (4): 330-4**, with authors names as per the submitted Author's Declaration Form, One of the author, **Mr. Noman Khan** has requested that his name may be spelled as **Muhammad Noman**. JSMC editorial board has decided that **Noman Khan** may be spell and read as **Muhammad Noman** in the above mentioned published article.