Clinical Ophthalmology

Dovepress
Taylor & Francis Group

Open Access Full Text Article

ORIGINAL RESEARCH

The Incidence of Post-Operative Fibrinoid Syndrome in Diabetic Eyes Receiving a Dexamethasone Implant During Pars Plana Vitrectomy Surgery

Reem ElSheikh, Sairi Zhang, Mohammad Z Siddiqui, Muhammad Z Chauhan, Ahmed B Sallam, Sami H Uwaydat

Department of Ophthalmology, Jones Eye Institute, University of Arkansas for Medical Sciences, Little Rock, AR, USA

Correspondence: Sami H Uwaydat, Department of Ophthalmology, Jones Eye Institute, University of Arkansas for Medical Sciences, 4301 W. Markham Street, Slot #523, Little Rock, AR, 72205, USA, Tel +1 501 686 582, Email SHUwaydat@uams.edu

Introduction: The dexamethasone implant (DEX) and pars plana vitrectomy (PPV) are both used to treat diabetic retinopathy. A rare complication of vitrectomy is post-operative fibrinoid syndrome (POFS). We report the incidence of POFS when PPV is combined with DEX injection in diabetic eyes.

Methods: One hundred and five eyes of patients with diabetic retinopathy undergoing concurrent PPV and DEX were retrospectively analyzed.

Results: Mean BCVA improved from 1.06 logMAR to 0.78 (p=0.05) at final follow-up. Mean CST was found to have a statistically insignificant decrease from 360 ± 154 µm to 314 ± 99 µm at final visit (p=0.13). Four eyes (3.8%) developed POFS. No major surgical complications were encountered.

Conclusion: Combining PPV with DEX is safe and effective in patients with diabetic retinopathy. Our results showed an improvement in mean BCVA and a decrease in CST. The incidence of POFS was 3.8%, which is not significantly different from previously published data in 1982.

Keywords: Ozurdex, diabetic retinopathy, fibrin formation, intravitreal

Introduction

Diabetic retinopathy (DR) is a significant cause of blindness in developed countries, representing a leading cause of visual impairment in the working age group.[1,2] The pathogenesis of diabetic macular edema is multifactorial. Inflammatory pathways involve many mediators, such as vascular endothelial growth factor (VEGF), tumor necrosis factor-alpha, and interleukin-1 beta. Tight glycemic control and lifestyle management, including blood pressure control, are pivotal in management, namely in the primary prevention of DR.[3] Anti-inflammatory measures commonly used in the treatment of DR include intravitreal corticosteroids such as triamcinolone acetate and dexamethasone.[4] Dexamethasone intravitreal implant (DEX) (Ozurdex®; Allergan Inc., Irvine, CA, USA) is a sustained-release bio-degradable formulation used for the treatment of diabetic macular edema (DME). The therapeutic effect of DEX spans a duration of four months with peak levels at two months.[5]

Pars plana vitrectomy (PPV) is used in the management of late complications of DR. Indications of PPV include vitreous hemorrhage, pre-macular hemorrhages, tractional retinal detachments, and DME caused by a taut posterior hyaloid or vitreomacular traction.[6] Complications of diabetic PPV include cataract progression, glaucoma, retinal detachment, endophthalmitis, and post-operative fibrinoid syndrome (POFS). In 1982, Sebestyen described POFS as the development of transvitreal or retropupillary fibrinoid bands following vitrectomy, which can ultimately result in

Received: 24 April 2025
Accepted: 29 August 2025
Published: 30 September 2025

tractional retinal detachment and neovascular glaucoma.[7] The incidence of POFS was reported to be 5.4% (15 out of 280 eyes).[7] The exact cause of POFS is not well understood, but it is believed to be related to several factors, including surgical stress, underlying medical conditions, intra-operative medications, and excessive intra-operative laser application. Once fibrin bands have been identified and an infectious etiology has been ruled out, POFS is typically treated through prompt control of the inflammation, most commonly with corticosteroids (systemic, periocular, or intraocular), intra-ocular tissue plasminogen activator (tPA), or streptokinase. However, severe cases have a poor prognosis.[8]

Our study aims to assess the safety and efficacy of combining PPV with intraoperative DEX in diabetic eyes. The primary outcome measure was the incidence of POFS, and the secondary outcome measures were the changes in intraocular pressure and best-corrected visual acuity.

Methods

We conducted a retrospective review of patients treated at the Jones Eye Institute between August 2016 and December 2019. Data was collected on 105 eyes with diabetic retinopathy undergoing PPV with concurrent intravitreal dexamethasone implantation by two retinal surgeons. In our case series, the indications for pars plana vitrectomy were non-clearing VH, tractional retinal detachment, ERM with recalcitrant DME, or a combination of the previously listed pathologies. Patients who had bilateral PPV with DEX implantation were included in the total number of eyes.

The patient demographics, surgical procedure details, pre- and post-operative treatments (laser, intraocular steroid injections, or anti-VEGF injections), best-corrected visual acuity (BCVA), intraocular pressure (IOP), central subfield thickness (CST), and development of POFS were recorded for each eye over a total period of 11 months after surgery, with each data point recorded and analyzed at various timepoints after surgery. The CST was obtained using either the Zeiss Cirrus® device with macular edema (ME) defined as CST ≥300 µm, or the Heidelberg Spectralis® device with ME defined as CST ≥320 µm. We defined POFS as the finding of interlacing fibrin-like strands in the vitreous cavity or retrolental space, as described by Sebestyen in 1982, within one week from vitrectomy (Figure 1).

Probabilities of events occurring after the initial surgery were presented using Kaplan-Meier survival curves. Paired *t*-test was used to compare the mean changes in the subjects' IOP, VA and BCVA, and CST with a significant p-value of <0.05. A chi-square test was used to compare the incidence of PFOS in our study with the previously published incidence in 1982.

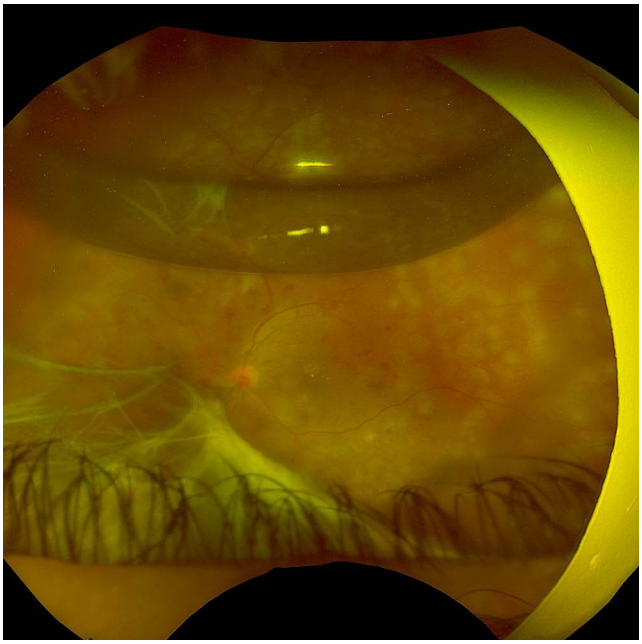

Figure 1 Color fundus photo showing interlacing fibrin-like strands in the vitreous cavity, characteristic of post-operative fibrinoid syndrome (PFOS).

Table 1 Summary of Pre-Operative Vs Post-Operative Visit Timelines

Mean BCVA (logMAR)		CST (μm)	IOP (Δ mmHg)
Baseline	1.06 + 0.77	360.23 ± 153.72	15.2 + 3.5
1 week	1.38 ± 0.93	334.68 ± 104.31	16.2 ± 7.4
1 month	0.97 ± 0.85	308.95 ± 88.02	18.8 ± 6.4
2 months	0.82 ± 0.83	302.95 ± 89.26	18.0 ± 7.4
4-6 months	0.69 ± 0.73	337.20 ± 101.28	16.2 ± 5.1
7-11 months	0.78 ± 0.79	314.38 ± 98.53	16.4 ± 4.9

Abbreviations: BCVA, best-corrected visual acuity; CST, central subfield thickness; IOP, intraocular pressure.

Results

The mean age of our subjects was 54.6 years ± 11.9 years, with 55 males (52.4%) and 50 females (47.6%). Fifty-seven subjects were Black or African American (54.3%), forty-seven were White (44.8%), and one was American Indian or Alaskan Native (0.9%). Of the 105 eyes included in this study, 77 were phakic prior to the PPV. In terms of diagnosis, 99 of the 105 eyes studied had a confirmed diagnosis of proliferative diabetic retinopathy (PDR), while the remaining 6 eyes had non-proliferative diabetic retinopathy (NPDR). Approximately 74%, or 78 of the eyes studied, had preoperative DME of varying severity. In addition, 31.4% of eyes were treated with intravitreal anti-VEGF injections, 4.8% had intravitreal triamcinolone acetonide injections, 53.3% had previous panretinal photocoagulation, and 5.7% had previous pars plana vitrectomy.

After analyzing pre-operative and post-operative measures, mean BCVA was found to have improved from 1.06 logMAR to 0.78 (p=0.05) at the final follow-up (Table 1). Mean CST was found to have a statistically insignificant decrease from 360 ± 154 μm to 314 ± 99 μm at the final visit (p=0.13). The change in mean CST at months 1 and 2 was significant (Figure 2). Overall, the incidence of POFS for this study was lower than previously published results of 5.4%; only four eyes in our study were found to have POFS, representing a 3.8% incidence (p=0.53). No statistically significant difference was found when compared to the 5.4% incidence in Sebestyen's study.[7]

41.9% of the eyes studied (44 out of 105 eyes) had initiation of IOP-lowering medication. 25.7% of eyes had a postoperative IOP response of >10mmHg from baseline readings at any given point, 18.1% had a response of

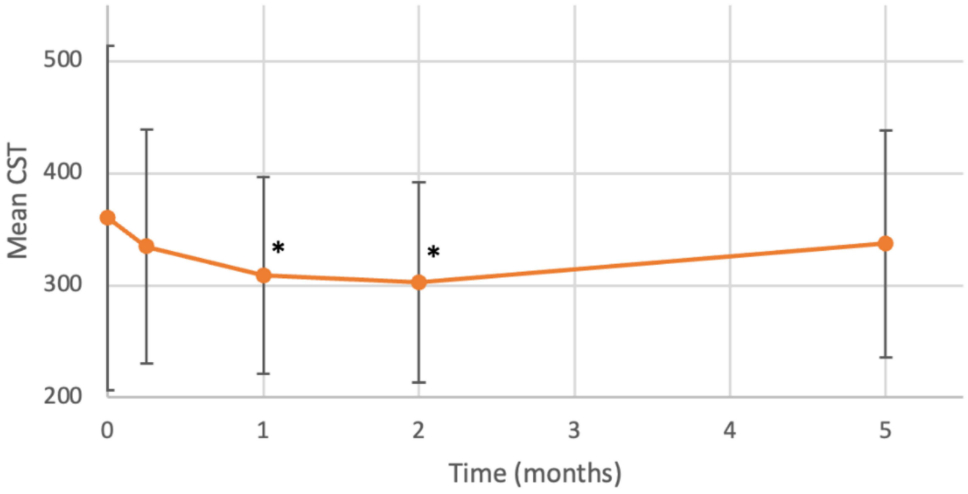

Figure 2 Change in mean central subfield thickness (CST) over 5 months (*p<0.05).

https://doi.org/10.2147/OPTH.S536499

>15mmHg, and 9.5% had a response of >20mmHg. 8.6% (9 out of 105 eyes) had either incisional or laser glaucoma surgery due to these findings. No inadvertent retinal trauma was reported during this study. There were no major surgical complications recorded.

Discussion

The Food and Drug Administration (FDA) has approved the use of DEX for macular edema associated with central and branch retinal vein occlusion (CRVO/BRVO, 2009), noninfectious posterior uveitis (2010), and diabetic retinopathy (2014).[9]

Both the ocular pathologies requiring PPV as well as the surgeries themselves are associated with a pro-inflammatory response. Thus, the use of DEX with PPV has been a subject of interest. PPV acts by removing the mechanical components causing traction as well as improving oxygenation of the retina, while DEX acts by inhibiting the production of VEGF and other inflammatory mediators.[10,11]

Our study assessed the safety and efficacy of the use of DEX with PPV in diabetic eyes. The results of our study showed an improvement in mean BCVA and a decrease in CST. The incidence of POFS was 3.8% (4 out of 105 eyes). This is less than the incidence of 5.4% reported by Sebestyen,[7] though the difference was not statistically significant.

The efficacy of DEX in our study compares to previous data. A study by Kim et al evaluated PPV with dexamethasone implant for tractional and non-tractional macular edema, with a statistically significant improvement in BCVA ($p<0.002$) for both groups.[12] There was a non-statistically significant decrease in central macular thickness (CMT) at one year for the non-tractional edema and a statistically significant decrease in CMT at one year ($p<0.001$) for the tractional group.[12] The authors stated that their anatomic results were comparable to a previous study by Bonnin et al[13] that involved only PPV while functional results (BCVA) were superior, indicating that dexamethasone has a potential role with PPV to obtain better visual outcomes in diabetic patients. Similarly, Pang et al showed statistically significant improvement in BCVA ($p=0.011$) and central retinal thickness (CRT) ($p<0.001$) in patients undergoing PPV with DEX for DME.[14] Jung and Lee evaluated the safety and efficacy of combining DEX with PPV for DME and found a statistically significant improvement in BCVA and CMT ($p<0.05$) during all follow-up visits.[15]

One important side effect of DEX is the associated rise in intraocular pressure (IOP) which must be closely monitored in these patients. Our study showed that 41.9% (44 out of 105 eyes) needed pressure-lowering medication at some point during the study, while 8.6% (9 out of 105 eyes) needed either incisional or laser glaucoma surgery to aid in IOP control. Results also showed that average peak IOP levels were recorded at the 2-month follow-up (18.0 ± 7.4 mmHg) with a subsequent decline in the next follow-up visits. This is in agreement with another study performed by Hostovsky et al that showed that peak rises in IOP were at 1 and 2 months, followed by a gradual decline to baseline.[16]

While increased IOP is a well-documented side effect of any ocular steroid use, the results of our study were comparable to those previously reported. The patients' IOP were adequately controlled with no documented adverse effects due to the increased IOP. Moreover, several studies have shown that IOP rise associated with DEX use is less than that with triamcinolone acetonide or fluocinolone acetonide. It is usually transient and well-controlled with topical medications.[17]

Extensive intravitreal fibrin formation following vitrectomy surgeries represents the severe end of the spectrum of POFS. Fibrin formation is often limited to the anterior chamber. Factors that increase fibrin formation include extensive intraoperative membrane dissection, endolaser photocoagulation, scleral buckling, and lensectomy.[7] In fibrinoid syndrome, a gelatinous mass forms in the vitreous cavity with subsequent tractional retinal detachment and rubeosis iridis with neovascular glaucoma. The patient with fibrinoid syndrome is usually a young patient with poorly controlled diabetes and rapidly progressive diabetic retinopathy. While steroids may have a potential therapeutic role in mild cases, severe cases usually have very poor prognoses.[8]

Surgical techniques may be adjusted to reduce possible complications. In our previous study, we noted that a 23-G trocar was preferred to a 25-G trocar for DEX injection to reduce possible damage, such as shattering of the implant.[18] Injection should be done under basic saline solution (BSS) rather than air to avoid retinal damage that could occur due to

the implant's kinetic energy. There were no surgical complications reported in our study nor complications related to the implant itself.

Conclusion

Our study shows a potentially important role of DEX in diabetic patients undergoing PPV to provide better anatomical and functional results. However, our results are limited due to the retrospective nature of the analysis. Further prospective comparative studies could help establish the role of DEX as an adjunct treatment with PPV.

Data Sharing Statement

The datasets used and/or analyzed during the current study are available from the corresponding author upon reasonable request.

Ethical Approval and Informed Consent

This retrospective study was conducted in accordance with the Declaration of Helsinki and was approved by the Institutional Review Board (IRB) of the University of Arkansas for Medical Sciences (UAMS), with the need for written informed consent waived. All patient data were de-identified before analysis, and the IRB determined the risk for adults who enter this study to be minimal.

Acknowledgments

This paper was presented at the 2025 Association for Research in Vision and Ophthalmology Annual Meeting as a poster presentation with interim findings. The poster's abstract was published in 'ARVO Annual Meeting Abstract' in Investigative Ophthalmology & Visual Science June 2025, Vol.66, 6347: https://iovs.arvojournals.org/article.aspx?articleid=2808889

Funding

This study was not supported by any sponsor or funder.

Disclosure

The authors declare no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

References

1. Cheung N, Mitchell P, Wong TY. Diabetic retinopathy. *Lancet*. 2010;376(9735):124–136. doi:10.1016/S0140-6736(09)62124-3
2. Heng LZ, Comyn O, Peto T, et al. Diabetic retinopathy: pathogenesis, clinical grading, management and future developments. *Diabet Med*. 2013;30(6):640–650. doi:10.1111/dme.12089
3. Mohamed Q, Gillies MC, Wong TY. Management of diabetic retinopathy: a systematic review. *JAMA*. 2007;298(8):902–916. doi:10.1001/jama.298.8.902
4. Yang Y, Bailey C, Loewenstein A, Massin P. Intravitreal corticosteroids in diabetic macular edema: pharmacokinetic considerations. *Retina*. 2015;35(12):2440–2449. doi:10.1097/IAE.0000000000000726
5. Chauhan MZ, Rather PA, Samarah SM, Elhusseiny AM, Sallam AB. Current and novel therapeutic approaches for treatment of diabetic macular edema. *Cells*. 2022;11(12):1950. doi:10.3390/cells11121950
6. Gupta V, Arevalo JF. Surgical management of diabetic retinopathy. *Middle East Afr J Ophthalmol*. 2013;20(4):283–292. doi:10.4103/0974-9233.120003
7. Sebestyen JG. Fibrinoid syndrome: a severe complication of vitrectomy surgery in diabetics. *Ann Ophthalmol*. 1982;14(9):853–856.
8. Ho T, Smiddy WE, Flynn HW Jr. Vitrectomy in the management of diabetic eye disease. *Surv Ophthalmol*. 1992;37(3):190–202. doi:10.1016/0039-6257(92)90137-I
9. Kishore K, Bhat PV, Venkatesh P, Canizela CC. Dexamethasone intravitreal implant for the treatment of macular edema and uveitis: a comprehensive narrative review. *Clin Ophthalmol*. 2022;16:1019–1045. doi:10.2147/OPTH.S209395
10. Stefánsson E. The therapeutic effects of retinal laser treatment and vitrectomy. A theory based on oxygen and vascular physiology. *Acta Ophthalmol Scand*. 2001;79(5):435–440. doi:10.1034/j.1600-0420.2001.790502.x
11. Antonetti DA, Wolpert EB, DeMaio L, Harhaj NS, Scaduto RC Jr. Hydrocortisone decreases retinal endothelial cell water and solute flux coincident with increased content and decreased phosphorylation of occludin. *J Neurochem*. 2002;80(4):667–677. doi:10.1046/j.0022-3042.2001.00740.x

12. Kim KT, Jang JW, Kang SW, Chae JB, Cho K, Bae K. Vitrectomy combined with intraoperative dexamethasone implant for the management of refractory diabetic macular edema. *Korean J Ophthalmol*. 2019;33(3):249–258. doi:10.3341/kjo.2018.0100
13. Bonnin S, Sandali O, Bonnel S, Monin C, El Sanharawi M. Vitrectomy with internal limiting membrane peeling for tractional and nontractional diabetic macular edema: long-term results of a comparative study. *Retina*. 2015;35(5):921–928. doi:10.1097/IAE.0000000000000433
14. Pang JP, Son G, Yoon YH, Kim JG, Lee JY. Combined vitrectomy with intravitreal dexamethasone implant for refractory macular edema secondary to diabetic retinopathy, retinal vein occlusion, and noninfectious posterior uveitis. *Retina*. 2020;40(1):56–65. doi:10.1097/IAE.0000000000002358
15. Jung YH, Lee Y. Efficacy of vitrectomy combined with an intraoperative dexamethasone implant in refractory diabetic macular edema. *Acta Diabetol*. 2019;56(6):691–696. doi:10.1007/s00592-019-01305-w
16. Hostovsky A, Muni RH, Eng KT, Mulhall D, Leung C, Kertes PJ. Intraoperative dexamethasone intravitreal implant (Ozurdex) in vitrectomy surgery for epiretinal membrane. *Curr Eye Res*. 2020;45(6):737–741. doi:10.1080/02713683.2019.1697454
17. Dot C, El Chehab H, Russo A, Agard E. Ocular hypertension after intravitreal steroid injections: clinical update as of 2015. *J Fr Ophtalmol*. 2015;38(7):656–664. doi:10.1016/j.jfo.2015.03.002
18. Uwaydat SH, Wang H, Sallam AB. Intraoperative injection of intravitreal dexamethasone implant using a vitrectomy trocar-assisted technique. *Retina*. 2019;39(Suppl 1):S123–S124. doi:10.1097/IAE.0000000000001853