EXTENDED REPORT

Pars plana vitrectomy with intravitreal triamcinolone: effect on uveitic cystoid macular oedema and treatment limitations

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Objective: To investigate the effect of pars plana vitrectomy (PPV) in combination with intraoperative intravitreal triamcinolone acetonide injection on the course of cystoid macular oedema (CME) in patients with uveitis.

Methods: Patients with uveitis with CME (n=19) not responding to systemic corticosteroids and/or immunosuppression combined with acetazolamide were retrospectively studied after PPV with additional intravitreal injection of 4 mg triamcinolone acetonide. Patients had chronic anterior uveitis (n=4), intermediate uveitis (n=9), posterior uveitis (n=3) or panuveitis (n=3). Visual acuity tests, tonometry, fluorescein angiographic appearance and postoperative complications were analysed. Mean follow-up was 14 months (SD 4.6).

Results: CME improved in 58% of the patients within the first 6 weeks postoperatively. After 12 months, CME was further improved in 44% and worsened in another 12%. Improvement of visual acuity was noted in 42% after 3 months and in 28% after 12 months. Cataract progressed in 85% of the phacic patients postoperatively. Increased intraocular pressure was detected in 27% at 2 weeks and in 11% at 12 months after surgery.

Conclusion: Uveitic CME that is unresponsive to systemic immunosuppression and acetazolamide may improve after PPV with additional intravitreal triamcinolone application. The effect seems to be transient in many of the patients. Frequent complications were cataract formation and ocular hypertension.

Cystoid macular oedema (CME) is a frequent cause for visual loss in patients with uveitis and has been noted in up to 26% of such patients.¹ Previously, improvement of CME has been observed with oral application of acetazolamide. However, its therapeutic value for reducing CME is controversial, and its use may be limited by side effects.^{2–7}

Anti-inflammatory drugs are a mainstay of CME treatment in uveitis. Corticosteroids given either by periocular application⁸ or systemically have been successfully applied for the treatment of chronic uveitic CME.⁹ In other patients, immunosuppression may be required for the improvement of inflammation and CME.^{10–17} Pars plana vitrectomy (PPV) has also been shown to improve CME in some patients with uveitis. The degree of improvement of the CME and visual acuity has been inconsistent in previous studies.^{18–24} Improvement has been restricted to selected patients or was only transient.

Recent studies suggested that intravitreal injection of triamcinolone acetonide may be effective in the management of CME in uveitis.^{10, 25–28} However, in most of the patients, visual acuity and CME worsened after several weeks. To achieve a better long-term improvement of CME in patients with uveitis, we investigated whether a combined PPV with additional intravitreal injection of triamcinolone might be of particular benefit.

PATIENTS AND METHODS

Nineteen consecutive patients with uveitis treated for refractory CME between 2002 and 2003 at the Department of Ophthalmology, St Franziskus Hospital, Muenster, Germany, were included in this study. The study followed the tenets of the Declaration of Helsinki. Informed consent was obtained from all patients before the surgery.

Patients with CME resulting in visual deterioration and not improving with oral corticosteroids combined with oral

acetazolamide were included in the retrospective study. Additional immunosuppressive drugs were added if clinically indicated. The PPV was performed in the eye with the more advanced CME.

Before treatment, a complete medical investigation was performed to determine the associated systemic disease. At baseline examination within 4 weeks before surgery, a complete eye examination was performed, including best-corrected visual acuity, tonometry (Goldmann), slit-lamp examination and ophthalmoscopy. Presence of CME was confirmed by fluorescein angiography.

The inflammatory activity was judged by the presence of cells in the anterior chamber or vitreous cavity, chorioretinal infiltration or vasculitis. Anatomical classification of uveitis was made in accordance with the recommendations provided by the International Uveitis Study Group.²⁹ Table 1 summarises the epidemiological data of the patients.

CME was treated if impaired visual acuity was caused by this macular lesion. All the patients had combined treatment with corticosteroids (initially 1 mg/kg daily) and acetazolamide (initially 500 mg daily) in the past.³⁰ Systemic immunosuppression was continued as required to maintain uveitis remission. In patients with unilateral CME, trans-septal triamcinolone acetonide injections were given. Date of onset of CME was evaluated from the patients' charts or the referring ophthalmologist.

Surgery was performed if CME had not improved after this treatment. No inflammation was observed at the time of surgery in all the patients. There were no other vision-compromising complications in any of the operated eyes, such

Abbreviations: CME, cystoid macular oedema; ILM, internal limiting membrane; IOP, intraocular pressure; PPV, pars plana vitrectomy

Table 1 Patients' epidemiological data before surgery

Sex, female:male	15:4
Mean (SD; range) age (years)	55 (16; 16–76)
Diagnosis of uveitis	
Anterior	4
Intermediate	9
Posterior	3
Panuveitis	3
Associated systemic disease	
None	12
Multiple sclerosis	2
Sarcoidosis	4
Mixed connective tissue disease	1
Lens status	
Phacic	13
Pseudophacic	6
Mean (SD; range) duration of CME before surgery (months)	25 (26; 5–96)

CME, cystoid macular oedema.

as dense vitreous opacity, cataract, epiretinal membrane or macular scar.

Complete PPV was performed under general anaesthesia using a standard three-port approach. The lamina limitans interna was then peeled off at the macular area without dye (eg, indocyanine green). Finally, 4 mg (0.1 ml) of triamcinolone acetonide (Kenalog, Bristol-Myers Squibb, Somerville, NJ, USA) was injected into the vitreous cavity. There were no intraoperative complications in any of the patients.

The follow-up examinations were scheduled after 2 and 6 weeks, and after 3, 6 and 12 months. The standardised examinations included visual acuity tests, tonometry, slit-lamp examination, ophthalmoscopy and fluorescein angiography. The fluorescein angiographic appearance was evaluated independently by two investigators in a blinded fashion. Perifoveal leakage of the dye that accumulates in cystic spaces in a petaloid pattern, continuing to diffuse positive staining at the fovea in the late frames, was diagnosed as CME. Macular leakage noted after about 3 min was rated as improved, unchanged or worsened compared with the baseline examination.

Open-angle glaucoma with preoperative intraocular pressure (IOP) <21 mm Hg on anti-glaucomatous drugs was present in one patient. Steroid-induced ocular hypertension had not been noted during the past follow-up in any of the patients.

All postoperative complications were documented. No second triamcinolone acetonide injection was given afterwards to any of the patients. The postoperative management included topical prednisolone acetate 1%, topical gentamycin and cycloplegics. The dosage of the systemic anti-inflammatory drug was adjusted to the inflammatory activity, as required to maintain quiescence of inflammation.

RESULTS

Table 1 summarises the patients' preoperative epidemiological data. Tables 2 and 3 summarise the postoperative courses of visual acuity and CME, respectively.

The preoperative mean visual acuity (logarithm of the minimum angle of resolution) was 0.54, and differed markedly (table 2).

Of the 19 operated eyes, 12 had improved visual acuity of ≥ 2 lines at any time during the postoperative follow-up period as compared with the preoperative examination. Six weeks postoperatively, visual acuity had improved in 25% of the patients and worsened in 19%. At this time point, the mean visual acuity was improved. At the 3-month follow-up, visual acuity had increased in 42%, but decreased in 11% of the patients. At the 6-month follow-up examination, only 3 of 17 patients still had increased visual acuity. At the 12-month follow-up, improvement of visual acuity >2 lines was observed in 5 of 18 patients. In half of the patients, visual acuity was similar to that before operation, and it had decreased in four patients.

After surgery, the CME improved, as measured by fluorescein angiography, in 11 of 19 eyes at any time during the entire follow-up compared with the appearance before surgery. At the first visit after 2 weeks, CME was improved in half of the patients, unchanged in about one third and worsened in only one eye. In the time period between 6 weeks and 3 months after surgery, CME was improved in 46%, unchanged in 6 eyes and worsened in 1 eye. After 6 months, CME was decreased in 46% and worsened in 31%. At 12-month follow-up, CME was improved in 44% of the patients compared with the preoperative imaging, unchanged in 44% and worsened in a few cases. It is noteworthy that the angiographic course of CME after surgery did not correlate well with the course of visual acuity.

No intraoperative complications were noted in any of the patients. Ocular hypertension, defined as an IOP of ≥ 22 mm Hg, was detected in 9 of 19 (47%) patients during the follow-up. At 2 weeks after the operation, 5 (26%) of the operated eyes had increased IOP. Although treated with drugs for glaucoma, ocular hypertension was still noted in 31%, 16% and 23% of patients at 6 weeks, 3 months and 6 months after surgery, respectively. In all, 11% of the patients showed a persisting increase of IOP until 12 months follow-up. One patient with panuveitis and sarcoidosis required an iridectomy 6 months after surgery because of iris neovascularisation with iris bombe. Interestingly, the patient with previously known glaucoma did not have increased IOP >21 mm Hg at any time after surgery.

Formation or progression of cataract, as determined by the lens Opacities Classification System III (Chylack *et al*, 1993),^{30a} was seen in 11 of the 13 phacic eyes (85%), and was detected after ≥ 6 months. In four of these eyes, phacoemulsification with implantation of a posterior chamber intraocular lens was performed during the follow-up period. No other complications, such as retinal detachment, delay of wound healing, or infectious or sterile endophthalmitis were observed in any of

Table 2 Course of best-corrected visual acuity after surgery

	Preop	Postoperative				
		2 weeks	6 weeks	3 months	6 months	12 months
VA*[logMAR]						
Better		2/19 (11%)	4/16 (25%)	8/19 (42%)	3/17 (18%)	5/18 (28%)
Unchanged		9/19 (47%)	9/16 (56%)	9/19 (47%)	9/17 (53%)	9/18 (50%)
Worse		8/19 (42%)	3/16 (19%)	(2/19) (11%)	5/17 (29%)	4/18 (22%)
Mean (SD)	0.54 (0.19)	0.64 (0.31)	0.48 (0.28)	0.46 (0.3)	0.57 (0.29)	0.57 (0.31)
Range	0.2–0.9	0.1–1.1	0–1	0–1.2	0.1–1.0	0–1.2

MAR, minimum angle of resolution; Preop, preoperative; VA, best-corrected visual acuity; significant change in VA: change ≥ 2 lines.

Table 3 Course of cystoid macular oedema after surgery as determined by fluorescence angiography

CME	2 weeks	6 weeks to 3 months	6 months	12 months
Less	6/12 (50%)	6/13 (46%)	6/13 (46%)	7/16 (44%)
Unchanged	5/12 (42%)	6/13 (46%)	3/13 (23%)	7/16 (44%)
More	1/12 (8%)	1/13 (8%)	4/13 (31%)	2/16 (12%)

CME, cystoid macular oedema.

the patients. Most of the patients required reduced corticosteroid dosages after surgery (data not shown).

DISCUSSION

Surgical treatment in this group of patients was considered after medical treatment regimens failed. In all our patients, the poor visual acuity was caused by CME, and pronounced opacities in the visual axis were absent. Our observations suggest that PPV with additional intraocular injection of triamcinolone may improve CME in selected patients. However, improvement of visual acuity and reduction of CME was only transient in many cases, and the approach was commonly complicated by cataract progression and increased IOP.

Although acetazolamide may be of benefit for CME in patients with uveitis,^{3 4 30} it did not improve the visual acuity and the fluorescein angiographic appearance of CME in our patients. Furthermore, inflammatory activity, visual acuity or CME in patients with uveitis has been improved previously with trans-septal or systemic steroids, or with immunosuppressive drugs.^{31–36} In all patients included in our study, quiescence of inflammation was achieved before surgery. Vitrectomy was only performed if treatment with trans-septal or systemic corticosteroids and/or immunosuppressive drugs did not improve the CME.

The major indications for PPV in patients with uveitis are vitreous opacity, macular pucker, tractional macular oedema or retinal detachment. Resolution of CME has occasionally been noted after surgery.^{21 37 38} In previous studies, visual acuity improved in 56% at any time after surgery²³ and in 64% at 1 month after surgery.²² Improvement of CME was seen in 11 of 18 patients by means of fluorescein angiography and in 3 by optical coherence tomography.²³ Dugel *et al*²² observed improvement of CME in 9 of 11 eyes.²² Most patients did not show a long-term benefit with regard to CME.

Several studies have shown that uveitic CME may completely resolve after an intravitreal injection of triamcinolone acetonide. Young *et al*,²⁶ experienced resolution of CME by fluorescein angiography within the first 3 months after injection. However, the CME recurred in 4 of 6 eyes after 12 months. In another study, visual acuity and macular thickness as measured by optical coherence tomography were improved at the 3-month visit, but worsened again after 6 months in patients with non-infectious uveitis.³⁹ Complete resolution of CME with improvement of visual acuity was also noted at 6 months after intraocular triamcinolone acetonide injection in two eyes with birdshot retinochoroidopathy.²⁵ Others reported an improvement of visual acuity in 2 of 3 eyes at 12 months after injection, when periocular triamcinolone acetonide injections were repeated.¹⁰ Furthermore, 5 of 10 eyes of patients with Behçet's disease with CME showed an increase in visual acuity after intravitreal triamcinolone acetonide injection at the 6-month visit. Additional intravitreal triamcinolone acetonide injections were given in 30% of these eyes.²⁸

Our observations show that after combined PPV with intravitreal triamcinolone acetonide injection, visual acuity

improved in 63% of the eyes during the follow-up period after surgery. This can be attributed exclusively to the improvement in CME, as vitreous opacities, cataract formation or macular puckers were not detected before surgery.

It has been shown previously that triamcinolone acetonide may be cleared more rapidly from the vitreous cavity of eyes after complete removal of the vitreous.^{40–42} In agreement with previous studies, white crystals were noted in the vitreous base of our patients 1 month after surgery,^{41 43} but not at a later time point. The restricted detection of triamcinolone acetonide conforms with the notion that improvement of visual acuity is not maintained for a long time in many patients. The mean visual acuity peaked at 3 months after surgery, with an improvement in 42% of the patients. After 6 months, there was an improvement in 18%, and after 12 months in 28% of the patients. In 58% of our patients, the blinded investigation of fluorescein angiographic appearance disclosed an improvement in CME at any time within the follow-up period. After 12 months, this effect was still seen in 44% of the patients. It is noteworthy that visual acuity and the fluorescein angiographic appearance did not always correlate well.

Taken together, our results suggest that additional intravitreal triamcinolone acetonide given during PPV did not provide a long-term improvement of visual acuity in our group of patients with uveitis. Although this study did not include a control group, the course of visual acuity was not apparently different compared with observations of previously reported case series after PPV alone. Irreversible macular damage from chronic CME might have precluded further improvement of visual acuity in some patients. It remains unclear whether or not early PPV with triamcinolone acetonide may have a better outcome. In addition, there was no clear correlation between the duration of CME and the response to surgery (data not shown).

Peeling off the internal limiting membrane (ILM) has been shown to be beneficial to the reduction of diabetic cystoid and diffuse macular oedema.^{44–46} By contrast, ILM peeling did not seem to improve uveitic CME in previous case series.^{24 47} No difference in visual acuity or angiographic outcome was observed between cases with or without ILM peeling. In this study, ILM was peeled to improve the access of triamcinolone acetonide to the retina. It was speculated that ILM peeling might augment the resolution of CME. Our observations suggest that ILM peeling did not improve the resolution of CME. Compared with the procedure in diabetic retinopathy, ILM peeling is technically more difficult in uveitic eyes and, therefore, may induce considerable tissue damage with consequent visual deterioration. For this reason, ILM peeling is discouraged in the absence of tractions to the macula.

An essential point of note is that PPV with intravitreal triamcinolone acetonide injection often induced marked vision-threatening complications. Firstly, development or progression of cataract was seen in 85% of the phacic patients in this series. After intravitreal injection of triamcinolone acetonide or PPV for uveitic CME, progression of cataract has been reported previously in up to 50%²⁶ and 100% of patients,²³ respectively.

Our findings suggest that combined PPV with intravitreal triamcinolone acetonide may even increase this complication. The high rate of cataract formation in our study caused the poor outcome at 12 months in many of the patients.

Secondly, increased IOP was commonly noted after combined surgery and triamcinolone acetonide injection, and the high IOP occasionally persisted for a long period of time. This is in agreement with previous observations after intravitreal or trans-septal triamcinolone acetonide injections.^{31–48} Interestingly, all patients who showed an increase of IOP after the combined treatment had not shown increased IOP during corticosteroid treatment in the past.

In conclusion, PPV with additional intravitreal injection of triamcinolone acetonide may improve CME by means of visual acuity and fluorescein angiographic appearance. Although CME improvement may be transient, improvement was maintained for at least 1 year after surgery in 28% of the patients who were unresponsive to systemic immunosuppression and acetazolamide. However, development or progression of cataract and increased IOP were frequent.

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