Efficacy of Preoperative Posterior Sub-Tenon Injection of Triamcinolone Acetate to Control Postoperative Cataract Surgery Inflammation in Noninfectious Uveitis Patients

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Objective: *To evaluate the efficacy of a single preoperative posterior sub-Tenon's capsule triamcinolone acetonide injection in treating ocular inflammation after cataract surgery.*

Material and Method: *This monocenter study employed a retrospective descriptive study of 30 eyes (23 patients) with non-infectious uveitis receiving a single posterior sub-Tenon's capsule triamcinolone acetonide (PSTA 40 mg) injection before undergoing phacoemulsification with intraocular lens (IOL) implantation. Outcome measures were anterior chamber (AC) cell, intraocular pressure (IOP, Goldman applanation tonometry), best-corrected visual acuity (BCVA), and cystoid macular edema (CME) over a 3-month follow-up period.*

Results: *Thirty eyes of 23 patients completed three months after cataract surgery were included in the present study. Sixty-three-point-three percent of patients had an active inflammation (≥1+ cells in the AC) at postoperative day 7, which significantly decreased over the follow-up period ($p = 0.002$ at day 30 and $p<0.001$ at day 90). Ocular inflammation was controlled in 90% of patient at the end of the follow-up period. Mean BCVA compared with baseline improved significantly at each visit ($p<0.001$). The difference of IOP between baseline and each visit were not significant. Macular edema was observed among 10%.*

Conclusion: *A single preoperative posterior sub-Tenon injection of triamcinolone acetate was effective in controlling postoperative inflammation, decreasing incidence of macular edema, posterior synechiae formation, and rising IOP compared with other studies. It appears to be an alternative modality for preoperative medication or adjunct therapy to the conventional steroid management in treating ocular inflammation after cataract surgery.*

Keywords: *Preoperative cataract surgery, Uveitis surgery, Triamcinolone acetate*

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Cataracts in uveitis patients can result from degenerative change (age-related cataract) or complications resulting from uveitis and its treatment. While cataracts deteriorate visual ability, they can be cured by surgical treatment. Although good visual outcome is often obtained with phacoemulsification and posterior chamber intraocular lens (IOL) implantation, the absence of inflammation before and after surgery is critical to achieve a good visual outcome. Cataract extraction in patients with uveitis requires thoughtful planning of the perioperative anti-inflammatory regimen. Otherwise, complications such as uveitis recurrence, fibrin accumulation, posterior synechiae, pupillary membrane formation, IOL capture, cell deposition on the IOL surface, IOL decentration and dislocation, epiretinal membrane formation, intraocular pressure (IOP) rise, vitreous opacities, chronic hypotony and phthisis, or cystoid macular edema (CME) may occur.

Perioperative anti-inflammatory management is necessary for good postoperative visual outcome[1,2] and avoids those postoperative complications. Quiescence of inflammation (<1+ cell in AC) is attempted for at least three months before surgery[3]. Steroids are effective in controlling ocular inflammation and usually are continued for several weeks after surgery. Many routes are available to use such as intra-operative intravenous methylprednisolone injections, oral corticosteroids, subconjunctival injection, posterior sub-Tenon injection, and intravitreal steroid injections.

Currently, no standard treatment guidelines exist for preoperative steroid use to control post-operative inflammation in uveitis patients. No study has been conducted regarding the efficacy of steroid injection of the posterior sub-Tenon's capsule to control postoperative inflammation. Sub-Tenon's capsule injection of depot corticosteroids is a periocular route to treat various inflammatory eye diseases[4-6], with a

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good therapeutic response and high concentration of drugs available in vitreous, retina, and choroids. At the same time, systemic side effects of drug are minimized. Its prolonged therapeutic effect has provided the ophthalmologist with an alternative tool to treat different diseases[7-11] that may be expanded to the surgical arena to modulate postoperative inflammation.

The objective of the present study was to evaluate the efficacy of a single preoperative posterior sub-Tenon's capsule triamcinolone acetonide (TA) injection to treat ocular inflammation after cataract surgery.

Material and Method

In this monocenter study, the medical charts from 23 patients (30 eyes) treated for noninfectious anterior, intermediate, or posterior uveitis or panuveitis in the Ophthalmology Department of Phramongkutklao Hospital with cataracts were retrospectively reviewed.

We enrolled noninfectious uveitis patients with cataracts, who received single posterior sub-Tenon's capsule triamcinolone acetate one week before undergoing elective phacoemulsification with IOL implantation. Quiescence of inflammation (<1+ cell in AC) is required for at least three months before surgery. Patients with glaucoma must have controllable IOP before being enrolled. Patients with infectious uveitis, pregnancy, lactation, or undergoing complicated cataract surgery were excluded.

All surgeries were performed by the same surgeon, always using the same equipment, technique, and materials. Patients received a single preoperative 40 mg (1 ml) triamcinolone acetate posterior sub-Tenon's capsule injection (Smith and Nozik Method) one week before operation. The conjunctiva was anesthetized by tetracaine hydrochloride 0.5% eye drops. Patients were asked to look inferonasally. The conjunctiva was lifted. A syringe filled with 1 mL (40 mg) of TA and fitted with a 27-gauge needle was advanced with bevel facing toward the globe, superotemporally along the curve of the globe. An intermittent sidewise sweeping movement was performed to confirm the separation of needle from sclera. The needle was advanced until the hub touched the conjunctiva. The plunger was slightly withdrawn to rule out injecting steroids within a vessel. One milliliter of triamcinolone acetate was injected and the needle was withdrawn.

Surgical procedures

All eyes were dilated with 10% phenylephrine eye drops and 1% tropicamide eye drops were administered. Surgery was performed under local anesthesia. All patients underwent standard endo-capsular phacoemulsification with a 2.75 mm clear cornea incision, approximately 5.0 mm curvilinear capsulorhexis (CCC), phacoemulsification, and irrigation-aspiration to completely remove the lens cortex. An acrylic foldable IOL was implanted in the bag using an injector. Synechialysis, iris stretching was performed intraoperatively when required. After an operation, patients were prescribed by identical anti-inflammatory drug in equal quantity and frequency (prednisolone acetate eyedrop every two hours).

Baseline evaluations were performed one week before surgery, and follow-up examinations took place one week, one month, and three months after surgery. Best-corrected visual acuity by ETDRS chart (BCVA, logMAR unit), IOP (Goldmann applanation tonometry), a slit-lamp examination and ophthalmoscopy were performed. Inflammation in the anterior chamber was graded, and uveitis was classified anatomically in accordance with the recently published standards of the SUN working group[12]. On day 7 after cataract surgery, macular edema was evaluated by slit-lamp examination and optical coherence tomography (OCT) in every patient but in other visit, macular edema was evaluated by slit-lamp examination only. If macular edema was found, OCT was done and recorded. Safety variables monitored included adverse events, complications, and other biomicroscopic and ophthalmoscopic findings.

Sample size was calculated from a referenced study of Roesel et al[29], which anterior chamber (AC) cells were used as primary outcome in this study. Estimated number of case was 23 cases.

Data were analyzed with SPSS version 23. Chi-square test and Fisher's exact test for categorical data and Wilcoxon test, McNemar's test, Mann-Whitney U-test, and Student's t-test, when appropriate, p-value of less than 0.05 was judged as statistically significant.

Results

Thirty eyes of 23 patients were enrolled in the present study. The demographic characteristics of the patient population were listed in Table 1. Patient age ranged from 33 to 73 years, with a mean of 53.3±13.0 years. Forty-seven percent of the patients were males and 53% were females. The most common disease was Behcet (43.33%).

The BCVA at baseline and after treatment was summarized in Table 2. Mean BCVA compared with baseline improved significantly (p<0.001) at each

visit (day 7, 30, and 90). Percentage of patients who improved two or more lines after surgery at each visit was 80%, 83.3%, and 83.3%, respectively. No patient decreased in BCVA two or more lines.

The numbers of patients with active uveitis, as detected by the presence of ≥1+ AC cells were listed in Table 2. The number of patients with active inflammation (≥1+ cells in the AC) was 63.3% on postoperative day 7, and significantly decreased over the follow-up period (p<0.01 at day 30 and 90). Ocular inflammation was controlled in 90% of patients at the end of the follow-up period, which was a significant difference compared with baseline (p<0.01). No patient developed posterior synechiae in each post-operative period (p<0.004). Over the follow-up period, percentages of patients with macular edema at each visit were found up to 10% at second visit after surgery (day 30).

No significant different change was found in mean IOP between baseline and each follow-up visit (Table 3). Although, an increase in IOP to above 21 mmHg was observed in 20%, 10%, and 10% of eyes on day 7, 30, and 90, respectively, they did not significantly differ from baseline (p-value = 0.727, 1.000, 1.000, respectively).

The complications that occurred after pre-operative posterior sub-Tenon's capsule TA injection were subconjunctival hemorrhage (two eyes, 6.45%), globe perforation (one eye, 3.23%), and central serous retinopathy (one eye, 3.23%). In particular, none of the patients developed endophthalmitis, retinal detachment, or bleeding.

In the present study, we used two surgical procedures of which 70% were phacoemulsification with IOL implantation and 30% were phacoemulsification with IOL implantation with lysis synechiae. No significant difference was observed in the postoperative AC cell at each visit when compared between groups of surgical procedures.

Table 1. Characteristics of the patient population

Variable	Total n = 30
Age (years), mean ± SD	53.3±13.0
Sex, n (%)	
Male	14 (47)
Female	17 (53)
Visual acuity* (logMAR), mean ± SD	1.13±0.59
Intraocular pressure* (mmHg), mean ± SD	15.53±4.59
Range	10 to 30
Second-line systemic immunosuppressive drug, n (%)	18 (30)
Anatomic classification of uveitis, n (%)	
Anterior	10 (33)
Intermediate	0
Posterior	0
Panuveitis	20 (67)

logMAR = logarithm of the minimum angle of resolution
* Preoperative measures

Table 2. Efficacy and safety outcome at each study visit

Variable	Study visit			
	Day 0	Day 7	Day 30	Day 90
Anterior chamber cell (range)	0 to trace	1 to 4	0 to 2	0 to 2
Anterior chamber cell** (%)	0	63.3*	30.0*	10.0*
Visual acuity (logMAR), mean ± SD	1.13±0.59	0.43±0.49*	0.45±0.49*	0.47±0.48*
≥2 lines improvement (%)	0	80.0	83.3	73.3
Macular edema, n (%)	0	1 (3.3)	3 (10.0)	2 (6.7)
Posterior synechias, n (%)	10 (33.33)	0*	0*	0*

* p-value <0.05 (Wilcoxon signed rank test, McNemar's test, Friedman's test)
** Active uveitis = ≥1+ cells in 1x1 mm in the anterior chamber as detected by slit-lamp

Table 3. Intraocular pressure before and after phacoemulsification with preoperative posterior sub-Tenon's capsule triamcinolone acetonide injection outcome at each study visit (n = 30)

Variable	Study visit				
	Pre-injection	Day 0	Day 7	Day 30	Day 90
IOP (mmHg), mean ± SD	15.07±5.03	15.53±4.59	14.73±6.32	15.40±6.09	15.17±5.44
IOP range (mmHg), min to max	7 to 28	10 to 30	6 to 28	2 to 30	8 to 34
IOP ≥22 mmHg, n (%)	4 (13.3)	3 (10.0)	6 (20.0)	3 (10.0)	3 (10.0)
No. of anti-glaucoma drug, mean ± SD	1.60±1.38	1.60±1.38	1.20±1.29	1.40±1.38	1.70±1.60

IOP = intraocular pressure

Discussion

The present study retrospectively evaluated the effect of preoperative posterior sub-Tenon's capsule TA injection to control inflammation after cataract surgery in non-infectious uveitis, an issue that has not been specifically addressed in the literature to date.

Suppression of postoperative inflammation and prevention of the respective sequelae appears to be crucial for a good visual outcome. Historically, corticosteroids have been the drugs of choice to prevent or treat postoperative ocular inflammation and are commonly used for several weeks. In a comparative study by Ghate et al[13], posterior sub-Tenon's capsule injection was the best periocular route for vitreous delivery with minimal systemic levels. A posterior sub-Tenon's capsule depot corticosteroid injection may satisfy all the requirements for an ideal anti-inflammatory strategy and may have distinct advantages for reducing complications from the side effects of long-term systemic steroid therapy.

In our study, after phacoemulsification, all patients gradually decreased in AC cell during the course of the study (Fig. 1). In 90% of patients, who had preoperative posterior sub-Tenon's capsule TA injection, ocular inflammation was controlled, which significantly decreased in the AC cells from day 7 to day 90 (p<0.01). This effectiveness was maintained until the end of the study, and none of the eyes in the present study required additional posterior sub-Tenon's capsule TA injection. Active uveitis was found in three cases (10%) at day 90 of follow-up period. Roesel et al[14], found active uveitis three months after cataract surgery in 44% in the oral prednisolone group and 20% in the orbital floor group. In the study by Dada et al[28], recurrent rates of intraocular inflammation after cataract surgery occurred in 20% in the intravitreal TA (IVTA) group and in 25% in the oral prednisolone group. Relapse rates in the literature vary profoundly, ranging from 5% to 53%[15-20]. Ocular ischemic syndrome with NVD that resulted from the internal carotid artery and external carotid artery occlusion were responsible for progression of inflammation in one case. The others were Behcet's disease with AC cell grade 1 requiring additional treatment. The two methods of surgery were 70% in phacoemulsification with IOL and 30% in phacoemulsification with IOL with lysis synechiae. No differences were observed between method of surgery and AC cell change at each follow-up period. In our study, 16.67% of patients could reduce immunosuppressive drug intake during the follow-up period, corresponding to what the other authors have suggested[21].

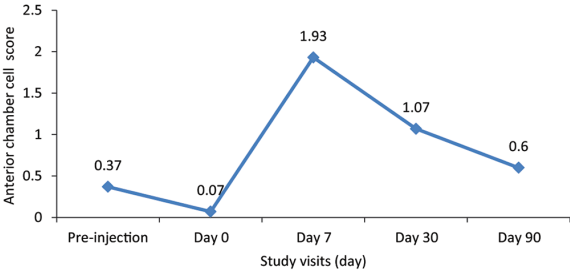

Fig. 1 Mean anterior chamber cell at each visit.

Formation of posterior synechiae as additional measures of inflammation was not found in the present study. Development of posterior synechiae was previously observed in less than 10% of subjects[15,18].

The presence of a CME before phacoemulsification is important for the final visual outcome. Results in the literature with regard to macular edema vary from 3% up to 35% after phacoemulsification in uveitic eyes[15,17,20,22]. Roesel et al[14] reported that CME was found up to 63% and 60% after one month and three months, respectively, following phacoemulsification with intraoperative orbital floor TA injection. In our study, CME was found to be 3.3%, 10%, and 6.7% on day 7, 30, and 90, respectively. Central serous chorioretinopathy (CSC) resulted in macular edema and visual deterioration in one patient with physical examination and fundus fluorescein angiography (FFA).

In the present study, visual acuity after phacoemulsification and IOL implantation in uveitic patients significantly improved from baseline (p<0.001). BCVA improved by two or more lines in up to 83.3% of cases. This was in close agreement with other authors. Akova et al reported a BCVA of 20/20 in nearly 60% of patients after phacoemulsification with IOL implantation[23]. Elgohary et al found the BCVA to have improved by two or more lines in up to 71.3% of cases[17]. Foster et al[24], Kawaguchi et al[18], and Okhravi et al[16] found a visual acuity of 20/40 or better in 74% to 90% of patients. In a retrospective case series, Suresh et al observed a VA of 6/9 or better in 72% of cases[25]. We observed a proportion of patients for whom visual acuity did not improve 16.7% in the course of the follow-up. Patients with lack of BCVA improvement involved ocular ischemic syndrome resulting from the internal carotid artery and external carotid artery occlusion, advanced glaucoma, atrophic macular, and chronic CSC.

No significant change was observed of IOP between baseline and each visit in our study (Fig. 2).

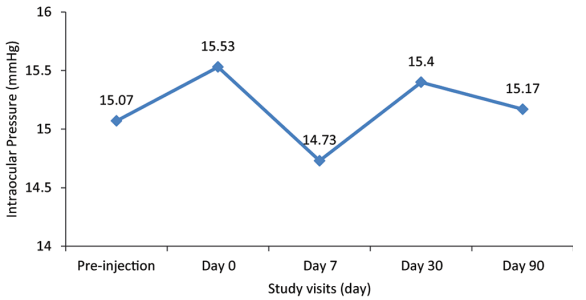

Fig. 2 Mean intraocular pressure (mmHg) at each study visit.

We observed increased in ocular pressure to over 21 mmHg up to 20%, 10%, and 10% at day 7, 30, and 90, respectively, with no significant difference from baseline. In all patients with elevated IOP, topical glaucoma medication, or systemic acetazolamide could successfully control IOP with no significant increase in number of anti-glaucoma drugs used. Seventy percent of patients in the present study could control IOP without increasing the number of anti-glaucoma drugs from baseline to the end of the follow-up period. Mean number of anti-glaucoma drugs was 1.7 at three months of follow-up period. No significantly changes were found in number of anti-glaucoma drugs between baseline and each visit. Although Kuo et al[26] reported ocular hypertension in nearly 79% of patients after sub-Tenon injection, Okada et al[27] observed ocular hypertension in 27% after transtenon retrobulbar infusion. Compared with our study, the ocular hypertension was less.

Globe perforation was a serious complication in preoperative posterior sub-Tenon TA injection in our study (3.23%), and one patient was excluded from this study. The patient with globe perforation had undergone pars plana vitrectomy with endolaser, after surgical treatment visual outcome was improved and no other complication was found. Globe perforation is related to a sharp-tipped needle being used for the injection and because the needle is advanced up to the hub without any visualization of its tip. To avoid this complication from posterior sub-Tenon injection, effective techniques are to bevel down the tip of the needle, while slide technique of injection, and good patient cooperation is necessary.

The present study was limited by its primarily retrospective nature and the lack of a control group. However, it does provide a useful overview of the efficacy of posterior sub-Tenon's capsule triamcinolone acetonide injections as they might be used clinically to manage uveitis with significant posterior segment inflammation. Patients must be selected carefully, especially to prevent IOP decompensation in steroid responders. Long-term studies concerning safety aspects are suggested. Posterior sub-Tenon's capsule injection is an alternative modality to control postoperative inflammation in uveitis patients such as those who cannot tolerate systemic side effects of steroids or poor compliance in oral medication use. It was effective in controlling postoperative inflammation, decreasing incidence of macular edema, posterior synechiae formation, and rising IOP compared with other studies.

What is already known on this topic?

There were many studies that used various method of steroid to control inflammation after cataract surgery in non-infectious uveitis patient. However, there was no standard treatment guideline for preoperative steroid use to control postoperative inflammation in uveitis patients.

What this study adds?

A single preoperative posterior sub-Tenon injection of triamcinolone acetate was safe and efficacious route of steroid delivery in phacoemulsification in non-infectious uveitis patients. It appeared to be an alternative modality for preoperative medication or adjunct to the conventional steroid management in treatment of ocular inflammation after cataract surgery.

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Potential conflicts of interest

None.

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การศึกษาการป้องกันการอักเสบในผู้ป่วยโรคม่านตาอักเสบแบบไม่ติดเชื้อที่ได้รับการผ่าตัดต้อกระจกโดยวิธีฉีดยาสเตียรอยด์เข้าใต้เยื่อบุทีนอน

บุษรัตน์ สุลีสถิร, นฤมล แก้วโรจน์, รวีวรรณ ชุนถนอม

ภูมิหลัง: *ผู้ป่วยโรคม่านตาอักเสบที่ได้รับการผ่าตัดต้อกระจก จะมีการอักเสบหลังการผ่าตัดและเกิดผลแทรกซ้อนหลังผ่าตัดได้มากกว่าปกติ จึงได้ทำการศึกษาผลของการใช้สเตียรอยด์แบบฉีดเข้าใต้เยื่อบุทีนอนก่อนการผ่าตัดต้อกระจกเพื่อลดและควบคุมการอักเสบ*

วัตถุประสงค์: *เพื่อศึกษาประสิทธิภาพของการใช้สเตียรอยด์แบบฉีดเข้าใต้เยื่อบุทีนอนก่อนการผ่าตัดต้อกระจกเพื่อลดการอักเสบในผู้ป่วยโรคม่านตาอักเสบ*

วัสดุและวิธีการ: *ศึกษาข้อมูลในเวชระเบียนย้อนหลัง ตั้งแต่ พ.ศ. 2556 ถึง พ.ศ. 2558 ของผู้ป่วยผู้ป่วยม่านตาอักเสบที่มาตรวจที่แผนกผู้ป่วยนอก กองจักษุกรรม โรงพยาบาลพระมงกุฎเกล้าและผ่าตัดต้อกระจกร่วมกับใส่เลนส์แก้วตาเทียม*

ผลการศึกษา: *ผู้ป่วยจำนวน 30 ตา ที่ได้รับการผ่าตัดและติดตามผลการรักษาครบ 3 เดือน พบว่า 90% ของผู้ป่วยสามารถควบคุมการอักเสบได้และการอักเสบลดลงอย่างมีนัยสำคัญในวันที่ 30 และ 90 หลังการผ่าตัด ($p = 0.002$ และ $p<0.001$ ตามลำดับ) ค่าเฉลี่ยของการมองเห็นหลังผ่าตัดดีขึ้นอย่างมีนัยสำคัญ ($p<0.001$) ไม่พบการเปลี่ยนแปลงของความดันลูกตาในแต่ละครั้งของการตรวจติดตามผลหลังการผ่าตัด และผู้ป่วยตรวจพบจุดรับภาพชัดบวมเพียง 10%*

สรุป: *การใช้สเตียรอยด์แบบฉีดเข้าใต้เยื่อบุทีนอนก่อนการผ่าตัดสามารถควบคุมการอักเสบได้ดี ช่วยลดการเกิดจุดรับภาพบวมพังผืดบริเวณม่านตา และไม่พบการเปลี่ยนแปลงของความดันตาลูกตาที่สูงผิดปกติเมื่อเทียบกับการศึกษาอื่น วิธีการใช้สเตียรอยด์แบบฉีดเข้าใต้เยื่อบุทีนอนจึงเป็นอีกทางเลือกหนึ่ง เพื่อใช้ในการรักษาการอักเสบของตาหลังการผ่าตัด*