

Pediatric Cataract Surgery and Intraocular Lens Implantation with and without Intracameral Triamcinolone Acetonide

Kamal AM Solaiman*, Sadek Maaly, Hani A Albialy and Reem A Desouky

Faculty of Medicine, Zagazig University, Zagazig, Sharkeya, Egypt

*Corresponding author: Kamal AM Solaiman, Professor, Faculty of Medicine, Zagazig University, 11 Osman Ben Afan St, Vilal Al-Game'a, Zagazig, Sharkeya, Egypt, Tel: +201000384330; E-mail: kams_8866@yahoo.com

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Abstract

Purpose: To evaluate the safety and efficacy of a single intracameral injection of triamcinolone acetonide in controlling postoperative ocular inflammation and improving the outcome of pediatric cataract surgery with intraocular lens implantation.

Setting: Prospective interventional comparative Quasi study.

Patients and methods: The study was performed on eyes of children between 6-12 years old having significant cataract and subjected to cataract extraction with primary IOL implantation. Patients were divided into two almost equal age and sex matched groups. The study group included eyes that received intracameral injection of 4 mg/0.13 ml of preservative-free triamcinolone acetonide at the end of surgery while the control group included eyes that did not receive intracameral injection of triamcinolone acetonide. Postoperative examinations were done on day 1 then weekly for 1 month, and monthly for another 2 months. Primary outcome measures included any sign of anterior segment inflammation, while secondary outcome measures included best corrected visual acuity, intraocular pressure and any reported complication caused by intracameral triamcinolone acetonide.

Results: The study included 42 eyes (35 patients); 21 eyes in each group. Postoperative inflammatory membrane was statistically significant higher in the control group than in the study group ($P=0.018$). The mean duration of using topical steroids in the study group (17.2 ± 4.1 days) was statistically significant less than its mean duration (28.3 ± 3.4 days) in the control group ($P<0.05$). No statistically significant differences were detected between pre and postoperative intraocular pressure in each group and in between both groups. No significant complications related to intracameral triamcinolone acetonide were reported.

Conclusion: A single intracameral injection of 4 mg preservative free triamcinolone acetonide at the end of uncomplicated pediatric cataract surgery could be an effective and safe adjunct to postoperative topical steroids in controlling postoperative ocular inflammation.

Keywords: Pediatric cataract; Triamcinolone acetonide; Intracameral

Introduction

Pediatric cataract surgery is followed by a high incidence of postoperative inflammation of varying severities in almost all patients. Intensive topical steroid therapy is still the mainstay for prevention and treatment of postoperative inflammation. Frequently, adjuvant systemic steroids may be needed for further control. Topical and oral steroids require frequent doses and strict compliance. Non-compliance and missed doses interfere with proper control of postoperative uveitis [1]. Subconjunctival or sub-Tenon's steroid injection is sometimes needed which means repeated exposure to general anesthesia.

Triamcinolone acetonide is crystalline cortisone that has been used in adult cataract surgery for identification of vitreous in the anterior chamber following posterior capsule tear with vitreous prolapse [2]. Recently, intracameral TA has been reported to be safe and effective in controlling postoperative inflammation after phacoemulsification in adults [3,4]. Praveen et al. [5] studied the use of intracameral preservative-free TA for anterior vitrectomy during pediatric cataract

surgery. It improved visualization of the vitreous, thereby ensuring thorough and complete anterior vitrectomy. Intraocular pressure (IOP) was not elevated, and no adverse postoperative results were observed. In addition, anterior segment inflammation in terms of posterior synechiae and cell deposits was minimal. This study was designed to evaluate the safety and efficacy of a single intracameral injection of triamcinolone acetonide immediately at the end of surgery in controlling ocular inflammation following cataract surgery with intraocular lens (IOL) implantation in children.

Patients and Methods

This study is a prospective interventional comparative Quasi study which included eyes of children with visually significant cataract and planned to have cataract surgery with IOL implantation. Patients were divided into two almost equal age and sex matched groups. The study group included eyes that received a single intracameral injection of preservative-free TA at the end of surgery while the control group included eyes that had surgery with a similar technique but without intracameral injection of TA at the end of surgery. The parents/

guardians received an explanation about the nature, purpose and potential risks of all procedures of the study. An informed written consent was taken prior to surgery.

The inclusion criteria included children between 6 and 12 years old having visually significant cataract and in whom primary IOL implantation was planned. On the other hand, children with a history of uveitis associated ocular pathology and those under current systemic anti-inflammatory therapy were excluded. Also, those with intraoperative complications were not included in the study.

All patients were subjected to full history taking as well as complete ophthalmic and systemic examinations. Normal IOP was defined as <21 mmHg without medication. Contact A-scan echography (Nidek echoscan US-3300, Japan) and keratometry (Potec AutoRef-Keratometer PRK-5000, Korea) were performed for IOL power calculation; the goal was to approach refraction in the fellow eye and to avoid anisometropia. In bilateral cases, IOL power was adjusted to achieve emmetropia postoperatively.

Preservative free TA was prepared before surgery according to Garcia-Arumi et al. [6]. Commercially prepared TA suspension (Kenacort-A 40 mg/ml; SmithKline Beecham, Eg), was allowed to sediment overnight and 0.9 ml of the supernatant was extracted with a tuberculin syringe. The pellet was resuspended with 0.9 ml of balanced salt solution. Triamcinolone acetonide concentration reached around 75% of the original concentration.

The same surgeon performed all the surgeries under general anesthesia. A three piece AcrySof (hydrophobic acrylic) IOL was implanted in the bag in all eyes. In the study group, 4 mg (0.13 ml) of preservative-free triamcinolone acetonide was injected into the anterior chamber at the end of surgery. All incisions were sutured with 10-0 nylon.

Postoperative medications included only the following topical medications: prednisolone acetate 1% eye drops (Pred Forte, Allergan) every 2 hours for 1 week then every 4 hours for 2 weeks and then 4 times daily for 4 weeks, moxifloxacin 0.5% eye drops (Vigamox, Alcon) four times a day for two weeks, cyclopentolate 1% eye drops (Cyclopentolate, Alcon) twice a day for 2 weeks as well as a combination of polymyxin B, neomycin and dexamethasone eye ointment (Maxitrol, Alcon) once daily before sleep.

Follow up examinations were done by the same investigator on day 1 then weekly for 1 month, and monthly for 2 months. Examinations included evaluation of signs of anterior segment inflammation

(anterior chamber cells, aqueous flare, conjunctival injection and corneal clarity), other signs of ocular inflammation (e.g. fibrinous reaction, exudative membrane and posterior synechiae), intraocular pressure and best corrected visual acuity. The study results were collected, analyzed, tabulated and summarized statistically using SPSS version 20 for data processing and statistics. Chi square test was used to compare grades of anterior segment inflammation between the two groups. T-test was used to compare mean IOP between the two groups. Paired t test was used to compare mean preoperative IOP with mean postoperative IOP of the same group. A P value of less than 0.05 was considered statistically significant.

Results

The study included 42 eyes of 35 patients, 7 of them presented with bilateral cataract. Each group included 15 males (71.4%) and 6 females (28.6%). The mean age of the patients at time of presentation was 9.11 ± 2.55 years in the study group and 9.07 ± 2.46 years in the control group. Each group included 12 eyes (57.1%) with total (white) cataract due to trauma, 8 eyes with developmental cataract of which 5 (23.8%) were lamellar, 2 (9.5%) were nuclear and 1 (4.8%) was anterior polar, and 1 eye (4.8%) with PSC secondary to uveitis (complicated cataract).

Anterior chamber cells, aqueous flare and ciliary injection were less severe in the study group than in the control group but the difference was statistically not significant (P>0.05). Inflammatory membrane formation occurred in 5 eyes (23.8%) of the control group compared with 0 eyes (0%) of the study group. The difference between groups was statistically significant (P=0.018) (Table 1). The inflammatory membranes appeared on days 1 - 7 postoperative. All cases with membrane formation received 1-2 subconjunctival steroid injections in addition to frequent topical steroids for a longer duration. More frequent follow ups were scheduled to monitor response to treatment and modify it accordingly. Two eyes showed complete resolution of the membrane by the end of 1st month, while in three eyes it persisted till the end of 2nd month. Three eyes (14.3%) in the control group had posterior synechiae of variable degrees by the end of the follow up duration compared with 0 eyes (0%) in the study group. The difference between the two groups was statistically not significant (P=0.07). The mean duration of using topical steroids after surgery was 17.2 ± 4.1 days in the study group and was 28.3 ± 3.4 days in the control group. The difference between both groups was statistically significant (P<0.05).

| Postoperative inflammatory membrane | Group 1 | | Group 2 | | X ² | P |
|-------------------------------------|---------|-----|---------|------|----------------|-------|
| | No | % | No | % | | |
| No | 21 | 100 | 16 | 76.2 | 5.54 | 0.018 |
| Yes | 0 | 0 | 5 | 23.8 | | |

P<0.05 = significant; X² = Chi square test.

Table 1: Inflammatory membrane formation in eyes of both groups.

Two eyes (9.5%) in the study group and three eyes (14.3%) in the control group had increased IOP on the 1st postoperative day. These eyes received topical anti glaucoma monotherapy. All eyes responded well to treatment and IOP returned to preoperative values within weeks with the resolution of postoperative acute inflammation. None

of these eyes required surgical intervention for control of IOP. The rise in the mean IOP did not reach statistical significant level at any follow up visit. PCO occurred in 2 eyes (9.5%) in the control group compared with 0 eyes (0%) in the study group within 3 months of surgery. The

difference between the two groups was statistically not significant ($P=0.15$).

Both groups showed significant improvement in BCVA as compared with preoperative vision. The difference in postoperative BCVA between the two groups was statistically not significant ($P>0.05$) at all follow up visits except on day 7 ($P=0.02$) when it was significantly better in the study group. This was due to more severe anterior segment inflammation and inflammatory membrane formation in the control group. On the last postoperative visit, two eyes (9.5%) in the control group had a BCVA of equal to or less than 6/60 due to PCO formation. Two eyes (9.5%) in the control group and 3 eyes (14.3%) in the study group had a BCVA of 6/36-6/18 due to amblyopia. These patients were referred for appropriate amblyopia treatment once amblyopia was diagnosed.

Discussion

The risk for complications after pediatric cataract surgery is higher than after cataract extraction in adults, and this is attributed mainly to the greater postoperative inflammatory response in children [7]. Postoperative severe inflammatory reaction can lead to poor visual outcome and long term morbidity. Control of postoperative inflammation in pediatric cataract surgery is therefore essential for improving visual outcomes [8]. The usual postoperative treatment includes intensive topical steroids tapered over several weeks along with regular cycloplegic drops. However, some children still develop fibrinous uveitis resistant to intensive topical steroids. High intraocular steroid levels may be obtained by systemic route but can induce systemic side effects especially with high doses and long duration of treatment [9]. Subconjunctival and posterior sub-Tenon injections may cause subconjunctival hemorrhage and chemosis [10,11], in addition to hazard of general anesthesia. Intracameral injection of steroids into the anterior chamber immediately after surgery avoids these possible disadvantages and provides higher concentrations of the drug at the target tissue [12].

Intracameral TA has been reported to be safe and effective in controlling postoperative inflammation after phacoemulsification in adults [3,4]. Praveen et al. studied the use of intracameral preservative-free TA for anterior vitrectomy during pediatric cataract surgery [5]. Intraocular pressure (IOP) was not elevated, and no adverse postoperative results were observed. In addition, anterior segment inflammation in terms of posterior synechiae and cell deposits was minimal. Results of cataract surgery in children are generally problematic to interpret and the results are difficult to compare because of general limitations including heterogeneous age at time of surgery, non-identical age in comparison groups, variable surgical techniques and variations of underlying diseases that have caused cataract [13]. To avoid these limitations, this study was designed as a Quasi experimental trial in which each group included an equal number of age and sex matched patients. The etiology of cataract was the same for each matched pair. In addition, all operations were performed by the same surgeon who used the same technique in all eyes. The narrow age range in this study (6-12 years) was an advantage to avoid variable inflammatory response between the maximum and minimum ages which could affect interpretation of our results [14]. We used the sedimentation technique reported by Garcia-Arumi et al. [6] for purification of the commercially available triamcinolone acetonide. They concluded that this sedimentation technique effectively reduced the concentration of benzyl alcohol with little influence on the final triamcinolone concentration.

Signs of anterior segment inflammation in the form of anterior chamber cells, aqueous flare and ciliary injection were less severe in the study group than the control group but this difference was statistically not significant at any follow up visit. This is similar to the results of Li et al. who used an intracameral triamcinolone in children with cataract and having juvenile rheumatoid arthritis [15]. Cleary et al. found that the use of intracameral triamcinolone as an adjunct to topical steroids after pediatric cataract surgery resulted in quiet eyes with few inflammatory signs (grade 0 - 1) in most cases [16]. Postoperative inflammatory membrane formation was statistically significant higher in the control group than in the study group ($P=0.018$). No patient in the study group had postoperative inflammatory membrane. This is consistent with the results of Li et al. and Dixit et al. [15,17]. However, Cleary et al. reported fibrin formation in a 6 weeks old infant (2.8%) who received intracameral injection of triamcinolone [16]. This could be explained by the very young age of the patient. In the control group, 5 eyes (23.8%) had inflammatory membranes which is matching with the results of Sethi et al. (23.07%) and Iqbal et al. (20.68%) who had patients with a similar age group to our study (mean age was approximately 8 years in both studies) [18,19]. However, Li et al. observed membrane formation in 38.5% of their control group [15]. This is probably because children included in their study had juvenile rheumatoid arthritis which has a well-known higher incidence of fibrin formation. Posterior synechiae were not detected in any of the eyes of the study group and were detected in 3 eyes in the control group (14.3%). Cell deposits on the IOL were not reported in any patient in both groups. This is matching with Li et al. who did not report posterior synechiae or cell deposits on the IOL in any of their patients [15]. However, Wilson et al. reported posterior synechiae in 4.5% and IOL deposits in 6.4% in their study that included 110 eyes [20]. The mean duration of using topical steroids in the study group (17.2 ± 4.1 days) was statistically significant less than its mean duration in the control group (28.3 ± 3.4 days). This indicates that intracameral TA is effective in controlling the postoperative anterior chamber reaction and eliminates the need for prolonged use of topical steroids as well as subconjunctival or systemic steroids.

A potential side effect of corticosteroid administration by any route is increased IOP. Compared to preoperative IOP, no significant difference was found between the mean IOP values of patients in both groups obtained at each follow up visit. Also, the difference in IOP between the two groups did not reach statistical significance at any point during follow up. However, IOP was temporary elevated above normal in 2 eyes (9.5%) in the study group and in 3 eyes (14.3%) in the control group. Topical anti-glaucoma monotherapy was sufficient to control IOP in those eyes and no eye required glaucoma surgery. The elevation in IOP in those eyes was temporary and the anti-glaucoma medication was stopped within few weeks after surgery. Normalization of IOP and stoppage of anti-glaucoma medication within few weeks in spite of presence of TA in the anterior chamber and continuation of topical steroids indicate that the elevation of IOP was most probably secondary to postoperative inflammation and not steroid - induced. Many studies reported no postoperative increase in IOP after pediatric cataract surgery with triamcinolone injection into the anterior chamber throughout the postoperative follow up [15-17]. Unlike intravitreal TA that could persist in the vitreous up to 90 days, intracameral TA is expected to disappear from the anterior chamber faster due continuous drainage of aqueous out of the eye. This could explain the higher incidence of steroid-induced IOP elevation

following intravitreal injection of TA than following its intracameral injection.

PCO occurred in 2 eyes (9.5%) in the control group compared with no eye in the study group. This is matching with the results of Dixit and colleagues who reported PCO in 10.8% of the control group and 0% of the study group that received intracameral TA [17]. The reasons for clear visual axis in the study group cannot be fully explained. It may be in part due to less postoperative inflammation seen in this group and short follow up duration (3 months). In a study conducted by Kuchle and colleagues, PCO developed in 10% of children with a mean age of 8.6 ± 4.6 years who underwent cataract extraction and hydrophobic acrylic PC IOL implantation with no intracameral TA. This is matching with the results of the control group in this study [13].

The BCVA was better in the study group than in the control group at all-time points of follow up, but the difference was statistically significant only at 1 week. Similar results were reported by other studies [15,21]. After disappearance of the signs of anterior segment inflammation and corneal edema, three eyes (14.3%) in the study group and two eyes (9.5%) in the control group did not show significant improvement in their postoperative BCVA due to presence of amblyopia caused by longstanding unilateral cataract. Retardation of BCVA occurred in another 2 eyes (9.5%) in the control group during the third month of follow up due to development of PCO.

In summary, a single intracameral injection of 4 mg preservative free triamcinolone acetonide at the end of uncomplicated pediatric cataract surgery could be an effective and safe adjunct to postoperative topical steroids in controlling postoperative ocular inflammation. This eliminates the need for prolonged use of topical steroids as well as subconjunctival and systemic steroids with their related complications. It also improves the outcome of pediatric cataract surgery especially in children with poor compliance to topical steroids.

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