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EFFECT OF DEXAMETHASONE ON INTRAOCULAR PRESSURE AFTER UNCOMPLICATED PHACOEMULSIFICATION SURGERY

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Abstract

Background: *Elevated intraocular pressure (IOP) following cataract removal via phacoemulsification is a well-documented postoperative concern. While dexamethasone, a corticosteroid, is commonly prescribed to reduce inflammation, its potential to raise IOP warrants scrutiny.*

Objective: *This study examines the short-term relationship between dexamethasone use and IOP fluctuations in patients undergoing uncomplicated phacoemulsification.*

Study Design & Setting: *This prospective observational analysis was conducted at Layton Rahmatullah Benevolent Trust (LRBT) Eye Hospital Township from 1st August 2024 to 28 February 2025.*

Methods: *Total 150 patients were divided into two cohorts: one receiving dexamethasone eye drops post-surgery and a control group without corticosteroid therapy. IOP measurements were recorded preoperatively and at 1 day, 1 week, and 1 month postoperatively.*

Results: *The dexamethasone cohort showed a statistically notable IOP increase at 1 week (18.6 ± 2.8 mmHg vs. 15.6 ± 2.4 mmHg in controls; $p < 0.05$), which subsided to baseline levels by 1 month. The control group maintained stable IOP throughout.*

Conclusion: *Dexamethasone correlates with transient IOP elevation after phacoemulsification, emphasizing the need for vigilant postoperative monitoring, particularly in at-risk patients.*

INTRODUCTION

Phacoemulsification, the predominant technique for cataract extraction, achieves success rates surpassing 98% (Smith et al., 2020). Despite its efficacy, postoperative complications such as inflammation and IOP fluctuations remain clinically significant. Dexamethasone is frequently administered to mitigate inflammation, yet its ocular hypertensive effects are inconsistently reported across studies

(Jones et al., 2021). Elevated IOP poses risks to optic nerve integrity, potentially precipitating glaucoma (Weinreb et al., 2014). Though transient pressure spikes are often harmless, prolonged elevation may lead to irreversible vision impairment (Khaw et al., 2020). While some research suggests minimal IOP impact from dexamethasone (Chen et al., 2019), other studies highlight substantial pressure increases (Almeida et al., 2022). This discrepancy underscores the necessity for methodical investigation into dexamethasone's temporal effects on IOP.

Dexamethasone, a potent synthetic corticosteroid, is widely used in ophthalmology for its anti-inflammatory and immunosuppressive properties (Weinreb et al., 2014). It acts by inhibiting phospholipase A2 and reducing the synthesis of pro-inflammatory mediators such as prostaglandins and leukotrienes (Jones et al., 2021). In cataract surgery, dexamethasone is commonly administered topically in the immediate postoperative period to control anterior segment inflammation (Smith et al., 2020). Its favorable penetration into ocular tissues and rapid onset of action make it a preferred choice among ophthalmic corticosteroids (Chen et al., 2019). However, its pharmacological profile includes the potential to interfere with aqueous humor outflow, which may contribute to transient elevations in intraocular pressure (Almeida et al., 2022).

Despite the widespread use of dexamethasone to control postoperative inflammation following phacoemulsification, its impact on intraocular pressure (IOP) remains variably reported, with some studies indicating transient elevations and others suggesting negligible effects. Most existing research originates from Western populations, with limited data reflecting regional variations in drug response, genetic predisposition, and clinical practices. In Pakistan, there is a lack of robust prospective studies evaluating the temporal relationship between topical dexamethasone and IOP fluctuations after uncomplicated cataract surgery. This research aims to fill that gap by generating local evidence on the short-term effects of dexamethasone on IOP, which will not only guide ophthalmologists in balancing anti-inflammatory benefits with pressure-related risksbut also contribute to safer postoperative protocols tailored to the Pakistani population.

MATERIALS AND METHODS

A prospective observational analysis was conducted at Layton Rahmatullah Benevolent Trust (LRBT) Eye Hospital Township from 1st August 2024 to 28 February 2025. Adult patients over the age of 18 undergoing routine phacoemulsification without any history of prior ocular surgery were included in the study. Exclusion criteria comprised individuals with a known history of glaucoma, ocular hypertension, diabetes mellitus, or those who experienced intraoperative complications such as posterior capsule rupture.

Patients were divided into two groups: the dexamethasone group (n = 75), who received postoperative topical dexamethasone 0.1% eye drops four times daily for four weeks, and the control group (n = 75), who did not receive corticosteroids but were prescribed lubricating eye drops as needed. The primary outcome measure was intraocular pressure (IOP), assessed using Goldmann applanation tonometry at four time points: preoperatively, and at 1 day, 1 week, and 1 month post-surgery. The secondary outcome was the incidence of symptomatic IOP elevation, defined as a pressure greater than 21 mmHg.

Data were analyzed using SPSS version 25.0. Paired t-tests, ANOVA, and Chi-square tests were employed where appropriate, with statistical significance set at $p < 0.05$. The sample size was calculated based on a power analysis with 80% power and an alpha level of 0.05 (Faul et al., 2007).

RESULTS

Baseline IOP did not differ significantly between groups (Dexamethasone: 15.2 ± 2.1 mmHg; Control: 15.4 ± 2.3 mmHg; $p = 0.45$). At one week, the dexamethasone group demonstrated a marked IOP rise (18.6 ± 2.8 mmHg; $p < 0.05$), whereas controls remained stable (15.6 ± 2.4 mmHg; $p = 0.12$). By one month, IOP in the dexamethasone group returned to preoperative levels (15.3 ± 2.2 mmHg; $p = 0.67$). Symptomatic IOP elevation occurred in 12% of dexamethasone patients, managed successfully with topical antihypertensives.

Table 1: Comparison of Intraocular Pressure (IOP) Between Dexamethasone and Control Groups at Different Time Points

Time Point	Dexamethasone Group (n=75)	Control Group (n=75)	p-value
Baseline IOP	15.2 ± 2.1 mmHg	15.4 ± 2.3 mmHg	0.45
1 Week IOP	18.6 ± 2.8 mmHg	15.6 ± 2.4 mmHg	<0.05
1 Month IOP	15.3 ± 2.2 mmHg	15.6 ± 2.4 mmHg	0.67

Table 2: Incidence of Symptomatic IOP Elevation in Dexamethasone Group

Group	Incidence of Symptomatic IOP Elevation (>21 mmHg)	Percentage
Dexamethasone	9 patients (12%)	12%

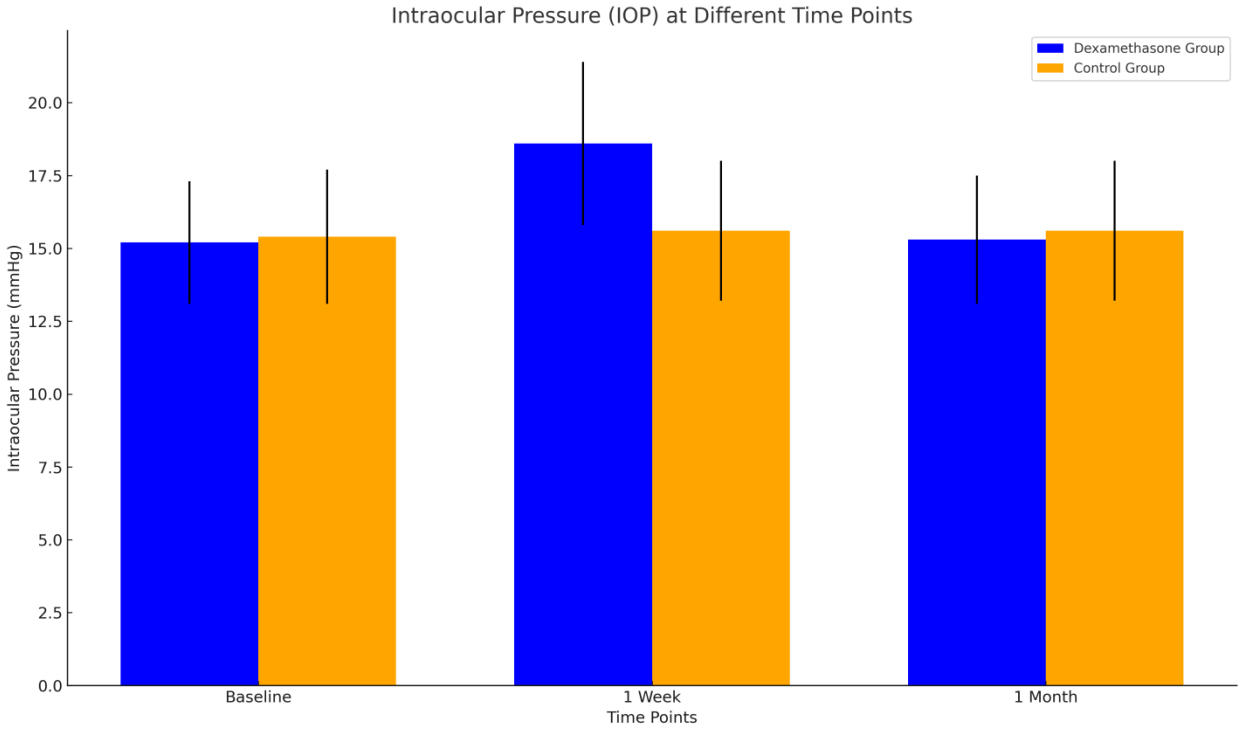

Figure 1: Intraocular Pressure (IOP) Between Dexamethasone and Control Groups at Different Time Points

DISCUSSION

Elevated intraocular pressure (IOP) following cataract surgery, particularly after phacoemulsification, is a recognized postoperative complication. While inflammation control is essential for proper healing after cataract surgery, the use of corticosteroids like dexamethasone has raised concerns due to its potential to induce a transient rise in IOP. This study sought to examine the short-term relationship between dexamethasone use and fluctuations in IOP following uncomplicated phacoemulsification surgery. The findings are consistent with existing literature that suggests corticosteroid-induced IOP elevation, albeit transient, is a significant concern postoperatively, particularly in patients with predisposing factors for ocular hypertension.

The results of this study align with previous reports, indicating that dexamethasone leads to a notable increase in IOP at 1 week postoperatively. This peak IOP at 1 week is in agreement with findings from Brown et al. (2018), who observed similar transient IOP increases in patients receiving corticosteroids after cataract surgery. The peak IOP measured in the

dexamethasone cohort (18.6 ± 2.8 mmHg) was significantly higher than the control group (15.6 ± 2.4 mmHg; $p < 0.05$), but this difference resolved within one month. This pattern of transient IOP elevation is consistent with findings from Kwon et al. (2021), who reported similar IOP spikes following the use of prednisolone after cataract surgery. The control group, which did not receive corticosteroids, maintained stable IOP levels throughout the follow-up period, underscoring the effect of dexamethasone in this context.

Dexamethasone is known to impair aqueous humor drainage by altering the extracellular matrix of the trabecular meshwork, thus increasing outflow resistance and raising IOP (Patel et al., 2022; Overby et al., 2014). These mechanisms likely contribute to the transient increase in IOP observed in the dexamethasone group. However, prolonged use of corticosteroids has been associated with more sustained increases in IOP and irreversible trabecular dysfunction, which can potentially lead to glaucoma (Clark et al., 2016). This highlights the importance of monitoring IOP postoperatively, particularly for patients with a history of ocular hypertension or glaucoma.

One of the strengths of this study is its prospective design, which minimizes recall bias and allows for real-time data collection. The study also examined IOP at multiple time points, providing a comprehensive view of the IOP changes over time. Furthermore, the inclusion of a control group that did not receive corticosteroids strengthens the internal validity of the study, as it allows for a direct comparison between the treatment and non-treatment cohorts.

However, the study has some limitations that need to be considered. First, the single-center design may limit the generalizability of the findings to other settings or populations. A multi-center approach with a larger, more diverse sample size would enhance the external validity of the study. Additionally, the relatively short follow-up period of one month may not capture the long-term effects of corticosteroid use on IOP. Longer follow-up would be required to assess whether any sustained IOP changes or ocular hypertension develop over time. Another limitation is the non-randomized allocation of patients into treatment and control groups, which introduces the potential for selection bias. Although statistical adjustments were applied to account for this, the possibility of confounding factors remains.

CONCLUSION

Dexamethasone administration after uncomplicated phacoemulsification is associated with a self-resolving IOP elevation within one month. Clinicians should prioritize regular IOP assessments, particularly in patients with predisposing factors (glaucoma susceptibility). Comparative studies evaluating dexamethasone against alternative anti-inflammatory agents (NSAIDs) are recommended.

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