Assessing Preoperative Nepafenac 0.1% For Post-Surgical Inflammation Control In Cataract Procedures

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Abstract:

Introduction: Cataract surgery, widely performed for significant visual improvement, often encounters postoperative inflammation, potentially leading to complications like cystoid macular edema (CME) and elevated intraocular pressure (IOP). Effective management of inflammation is critical for optimal recovery. This study evaluates the impact of preoperative nepafenac 0.1% on postoperative inflammation in uncomplicated cataract surgeries in healthy subjects.

Aims and Objectives: To assess the effectiveness of preoperative topical nepafenac 0.1% in controlling postoperative inflammation. Primary objectives include measuring best-corrected visual acuity (BCVA), central macular thickness (CMT), intraocular pressure (IOP), and aqueous flare values preoperatively and at 15, 30, and 60 days postoperatively.

Materials and methods: A prospective, randomized, controlled study with 100 healthy subjects undergoing uncomplicated cataract surgery. Group A (n=50) received preoperative nepafenac 0.1%; Group B (n=50) did not. Standard phacoemulsification was performed by a single surgeon. Postoperative evaluations included BCVA, IOP, CMT, and aqueous flare values.

Results: No significant differences were observed between Group A and Group B in terms of age, gender distribution, preoperative BCVA, IOP, or CMT. Postoperatively, Group A showed significantly lower aqueous flare values ($p<0.05$) on days 1, 15, 30, and 60. BCVA and CMT improvements were not statistically significant, and IOP remained stable across both groups.

Conclusion: Preoperative nepafenac 0.1% significantly reduces postoperative aqueous flare, indicating reduced intraocular inflammation. However, its impact on BCVA and CMT was not statistically significant. These findings support nepafenac's role in perioperative inflammation management in cataract surgery.

Keywords:
Cataract surgery, Nepafenac 0.1%, Postoperative inflammation, Aqueous flare, Central macular thickness, Intraocular pressure, Best-corrected visual acuity.

Introduction:

Cataract surgery is one of the most commonly performed surgical procedures worldwide, with a high success rate and significant improvement in visual outcomes for patients[1,2]. However, despite the advancements in surgical techniques and intraocular lens (IOL) technology, postoperative inflammation remains a common concern[3]. Inflammation can lead to complications such as cystoid macular edema (CME), elevated intraocular pressure (IOP), and prolonged visual recovery, which can compromise the overall success of the surgery and patient satisfaction[4].

The inflammatory response following cataract surgery is primarily due to the disruption of the blood-aqueous barrier, leading to the release of pro-inflammatory cytokines and mediators into the anterior chamber[5]. This response can manifest as increased aqueous flare, cell infiltration, and changes in central macular thickness (CMT), all of which can negatively impact visual outcomes[6]. Therefore, effective management of postoperative inflammation is crucial to ensure optimal recovery and visual rehabilitation.

Nonsteroidal anti-inflammatory drugs (NSAIDs) have become a cornerstone in the management of postoperative inflammation in cataract surgery. These agents inhibit cyclooxygenase (COX) enzymes, thereby reducing the synthesis of prostaglandins and other inflammatory mediators[7]. Among the various NSAIDs available, nepafenac has gained attention due to its unique properties. Nepafenac is a prodrug that is rapidly converted to its active form, amfenac, in the intraocular tissues, providing potent anti-inflammatory effects with minimal systemic absorption and side effects[8].

Preoperative administration of topical NSAIDs has been hypothesized to provide additional benefits by reducing the inflammatory response before it peaks post-surgery[9]. This prophylactic approach aims to stabilize the blood-aqueous barrier and reduce the initial inflammatory surge that follows surgical manipulation. However, there is limited evidence on the efficacy of preoperative nepafenac in this context, particularly in healthy subjects undergoing uncomplicated cataract surgery.

Several studies have highlighted the effectiveness of postoperative NSAIDs in managing inflammation and preventing CME. However, the preoperative use of these agents is less explored, and existing studies often focus on mixed populations, including those with pre-existing conditions that may predispose them to greater inflammatory responses[10]. Understanding the impact of preoperative nepafenac specifically in healthy individuals undergoing routine cataract surgery can provide valuable insights into its role in standard clinical practice and potentially enhance postoperative care protocols.

This study aims to fill this gap by systematically evaluating the effectiveness of preoperative topical nepafenac 0.1% in controlling postoperative inflammation in healthy subjects. The primary objectives include assessing best-corrected visual acuity (BCVA), central macular thickness (CMT), intraocular pressure (IOP), and aqueous flare values at various postoperative intervals. By comparing these parameters between treated and untreated groups, this research seeks to determine whether preoperative nepafenac can offer significant benefits in reducing postoperative inflammation and improving surgical outcomes.

Aims and objectives:

To evaluate the effectiveness of preoperative topical nepafenac 0.1% in controlling postoperative inflammation in healthy subjects undergoing uncomplicated cataract surgery.

Objectives:

- To assess and compare best-corrected visual acuity (BCVA), central macular thickness (CMT), intraocular pressure (IOP) and aqueous flare values preoperatively and at 15, 30, and 60 days postoperatively between the two groups.

Materials and methods:

Study Design: This is a prospective, randomized, controlled study designed to evaluate the effectiveness of preoperative topical nepafenac 0.1% in controlling postoperative inflammation in healthy subjects undergoing uncomplicated cataract surgery.

Study Population: A total of 100 healthy subjects/eyes undergoing uncomplicated cataract surgery will be recruited for the study. The subjects will be randomly assigned into two groups, with 50 subjects in each group.

- Group A (n=50): Subjects receiving preoperative topical nepafenac 0.1%
- Group B (n=50): Subjects not receiving preoperative topical nepafenac 0.1% (control group)

Inclusion Criteria:

- Age 40-80 years
- Diagnosed with age-related cataract
- Healthy subjects with no significant ocular or systemic comorbidities
- Willingness to provide informed consent and comply with study procedures

Exclusion Criteria:

- History of ocular surgery in the study eye
- Presence of any ocular pathology other than cataract
- Use of systemic or topical anti-inflammatory drugs within 30 days prior to surgery
- Known hypersensitivity to nepafenac or any component of the study medication

Sample size calculation: Power analysis performed to determine the appropriate sample size, aiming for 80% power to detect a significant difference in postoperative inflammation between the two groups at a 5% significance level.

Study Procedure:

1. **Preoperative Assessment:**
    - Record demographic data (age, gender).
    - Measure best-corrected visual acuity (BCVA) using a standardized Snellen chart.
    - Measure intraocular pressure (IOP) using Goldmann applanation tonometry.
    - Assess central macular thickness (CMT) using optical coherence tomography (OCT).
    - Measure aqueous flare values using a laser flare meter.
2. **Randomization:**
    - Subjects will be randomly assigned to either Group A or Group B using a computer-generated randomization list.
3. **Surgical Procedure:**
    - All subjects will undergo standard phacoemulsification cataract surgery with intraocular lens implantation performed by the same surgeon to ensure consistency.
4. Intervention:
    - Group A: Subjects will receive nepafenac 0.1% eye drops three times daily starting one day before surgery and continuing for 15 days postoperatively.
    - Group B: Subjects will receive standard postoperative care without preoperative nepafenac.
5. **Postoperative Assessment:**
    - Subjects will be evaluated at 15, 30, and 60 days postoperatively.
    - BCVA, IOP, CMT, and aqueous flare values will be measured and recorded at each follow-up visit.
6. **Outcome Measures:**

- **Primary Outcome:** Postoperative aqueous flare values at 30 and 60 days, as an indicator of intraocular inflammation.
- **Secondary Outcomes:** BCVA, IOP, and CMT at 15, 30, and 60 days postoperatively.

Surgical Procedure: All cataract surgeries will be performed using phacoemulsification under topical anesthesia by the same experienced surgeon to ensure consistency. Standard postoperative medications will include a combination of antibiotics and steroids as per routine clinical practice.

Statistical Analysis:

- Continuous variables compared using Student's t-test or Mann-Whitney U test.
- Categorical variables analyzed using Chi-square test or Fisher's exact test.
- A p-value of <0.05 considered statistically significant.
- Data presented as mean ± standard deviation (SD) for continuous variables and frequency (percentage) for categorical variables.
- Software: Statistical analysis conducted using SPSS version 25.0.

Ethical Considerations:

- Study approved by the Institutional Review Board.
- Written informed consent obtained from all participants.
- Study conducted in accordance with the Declaration of Helsinki.

Results:

Table: 1 Preoperative and postoperative characteristics of the study population

		Group A	Group B	P value
Age (years)		65.3 ± 7.4	66.1 ± 7.2	0.0603
Gender M:F (n,%)		28:22 (56%:44%)	26:24 (52%:48%)	0.0721
BCVA	Pre	0.55 ± 0.15	0.54 ± 0.16	0.320
	Day 15	0.35 ± 0.10	0.40 ± 0.12	0.0701
	Day 30	0.30 ± 0.08	0.35 ± 0.10	0.072
	Day 60	0.28 ± 0.07	0.33 ± 0.09	0.0691
IOP (mmHg)	Pre	14.8 ± 2.3	14.6 ± 2.4	0.0732
	Day 15	15.0 ± 2.1	15.2 ± 2.2	0.0933
	Day 30	14.7 ± 2.0	14.9 ± 2.1	0.0823
	Day 60	14.6 ± 2.1	14.8 ± 2.2	0.0912

The mean age of the group was 65.3 ± 7.4 years, with no significant difference between the groups. The gender distribution was similar, with Group A consisting of 28 males and 22 females, and Group B consisting of 26 males and 24 females. Best-corrected visual acuity (BCVA) was comparable between the groups preoperatively and postoperatively, with Group A showing slightly better outcomes at each follow-up. Intraocular pressure (IOP) measurements were similar between the groups throughout the study period. Preoperatively, Group A had an IOP of 14.8 ± 2.3 mmHg, compared to 14.6 ± 2.4 mmHg in Group B. Postoperative IOP values remained stable and comparable between the groups. Overall, there were no statistically significant differences between Group A and Group B in terms of age, gender distribution, BCVA, or IOP, indicating that the baseline characteristics and postoperative outcomes were similar between the two groups.

Table:2 Preoperative and postoperative central macular thickness values of the study population

		Group A	Group B	P value
CMT(µm)	Pre	260 ± 20	258 ± 22	0.321
	Day 15	265 ± 18	275 ± 21	0.451
	Day 30	262 ± 17	272 ± 19	0.387
	Day 60	260 ± 16	268 ± 18	0.41

The study found no significant difference in central macular thickness (CMT) between the groups of patients who received topical nepafenac 0.1% before and after surgery. The mean CMT was 260 ± 20 µm in Group A and 258 ± 22 µm in Group B preoperatively. However, it increased slightly to 265 ± 18 µm in Group A and 275 ± 21 µm in Group B postoperatively, but this difference was not statistically significant. By day 30, CMT values were 262 ± 17 µm in Group A and 272 ± 19 µm in Group B, but no significant difference was observed at day 60. The results suggest that the use of topical nepafenac 0.1% before surgery does not significantly affect CMT postoperatively compared to the control group.

Table:3 Preoperative and postoperative aqueous flare values of the study population

		Group A	Group B	P value
Aqueous flare (ph/ms)	(ph/ms) Pre	6.2 ± 1.1	6.1 ± 1.2	0.312
	Day 1	12.5 ± 1.8	16.0 ± 2.1	0.003*
	Day 15	8.3 ± 1.4	12.2 ± 1.7	0.002*
	Day 30	6.7 ± 1.2	10.0 ± 1.4	0.001*
	Day 60	6.4 ± 1.1	9.5 ± 1.3	0.001*

The study examined the impact of preoperative topical nepafenac 0.1% on postoperative aqueous flare values in uncomplicated cataract surgery patients. Preoperatively, the aqueous flare values were similar between Group A and Group B, with no significant difference. However, postoperatively, Group A showed significantly lower aqueous flare values. This trend continued throughout the follow-up period, with Group A having a lower mean aqueous flare value than Group B. By Day 15, Group A had a lower mean aqueous flare value than Group B. At Day 60, Group A maintained a lower mean aqueous flare value than Group B. The results suggest that preoperative topical nepafenac 0.1% effectively reduces postoperative inflammation, as shown by consistently lower aqueous flare values in Group A.

Discussion:

The present study investigated the efficacy of preoperative topical nepafenac 0.1% in controlling postoperative inflammation in healthy subjects undergoing uncomplicated cataract surgery. The results demonstrated that preoperative administration of nepafenac significantly reduced postoperative aqueous flare values, indicating reduced intraocular inflammation.

Our findings align with those of previous studies that have shown the anti-inflammatory benefits of nepafenac in the perioperative period. For instance, Rishi et al[11]. (2017) reported

that nepafenac effectively reduced inflammation and pain following cataract surgery, with a significant decrease in aqueous flare values postoperatively. Similarly, another study by Keerthi et al[12]. (2020) confirmed that preoperative nepafenac minimized postoperative inflammation and maintained lower flare values compared to prednisolone. Both studies corroborate our results, highlighting nepafenac's role in mitigating postoperative inflammatory response.

However, contrasting outcomes were observed in some studies where the reduction in inflammation did not translate to significant differences in visual acuity or macular thickness. For instance, Giarmoukakis et al[13]. (2020) found that while nepafenac reduced flare and inflammatory markers, the differences in central macular thickness (CMT) between the treatment and control groups were not significant . This is consistent with our study, where no significant differences in CMT were observed between Group A and Group B at any postoperative interval. This suggests that while nepafenac is effective in reducing anterior chamber inflammation, its impact on macular edema might be limited.

Moreover, the visual acuity outcomes in our study, although showing a trend towards better improvement in the nepafenac group, did not reach statistical significance. This is in line with findings from Cagini et al[14]. (2020), where the improvement in best-corrected visual acuity (BCVA) was noted but not significantly different between the treatment and control groups . The subtle improvements in BCVA seen in our study could be attributed to reduced inflammation and better optical clarity, but these changes might not be large enough to achieve statistical significance given the sample size.

Our study also monitored intraocular pressure (IOP), with results indicating no significant differences between the two groups throughout the postoperative period. This outcome supports findings from other research, such as a study by Mathys et al[15]. (2008), which reported stable IOP values following cataract surgery with the use of nepafenac, suggesting that it does not adversely affect IOP .

Clinical Implications

The reduction in postoperative aqueous flare values in the nepafenac group underscores its effectiveness in controlling inflammation, which is crucial for preventing complications such as cystoid macular edema and ensuring a smoother recovery. The lack of significant impact on CMT and BCVA might reflect the multifactorial nature of these parameters, influenced by factors beyond inflammation alone.

Limitations:

A limitation of our study is the relatively short follow-up period of 60 days. Longer follow-up could provide insights into the sustained effects of nepafenac on inflammation and visual outcomes. Additionally, the study did not assess subjective measures such as pain or discomfort, which could further validate the benefits of nepafenac from a patient's perspective.

Conclusion

In conclusion, preoperative topical nepafenac 0.1% significantly reduces postoperative aqueous flare values, indicating reduced intraocular inflammation, although its impact on visual acuity and macular thickness is not statistically significant. These findings support the use of nepafenac as an effective anti-inflammatory agent in the perioperative management of cataract surgery.

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