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Original Research Article

Efficacy of Pre-Operative Salbutamol Nebulization in Improving Patient Comfort and Surgical Outcomes during Cataract Surgery in COPD and Asthma Patients

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Abstract

Background: Patients with bronchial asthma and chronic obstructive pulmonary disease (COPD) are at increased risk of perioperative respiratory discomfort even during minor procedures such as cataract surgery performed under local anesthesia. Intraoperative coughing, dyspnea, and poor cooperation may adversely affect surgical outcomes. Preoperative bronchodilation with salbutamol may improve respiratory stability and patient comfort; however, evidence in ophthalmic surgeries is limited.

Aim: To compare the efficacy of preoperative salbutamol nebulization in improving patient comfort and surgical outcomes during cataract surgery in patients with COPD and/or asthma, and to propose a standard preoperative protocol.

Methods: A hospital-based cross-sectional comparative study was conducted over one year in a tertiary care center. Thirty adult patients with bronchial asthma and/or COPD undergoing cataract surgery were randomly allocated into two groups: salbutamol group (n=15), receiving preoperative nebulization with salbutamol (2.5 mg), and control group (n=15), receiving standard care without nebulization. Patient comfort (better/uneventful vs breathlessness) and intraoperative surgical conditions (uneventful vs disrupted) were assessed. Statistical analysis was performed using Chi-square test, with $p<0.05$ considered significant.

Results: The mean age was comparable between the salbutamol (65.4 ± 7.3 years) and control groups (69.9 ± 7.8 years). Good patient comfort was observed in 86.7% of patients in the salbutamol group compared to 40.0% in the control group ($\chi^2=7.03$, $p=0.008$). Breathlessness was significantly lower in the intervention group (13.3% vs 60.0%). Uneventful surgical conditions were achieved in 86.7% of patients receiving salbutamol compared to 40.0% in controls ($\chi^2=7.03$, $p=0.008$).

Conclusion: Preoperative salbutamol nebulization significantly improves intraoperative patient comfort and surgical conditions in patients with COPD and asthma undergoing cataract surgery. Incorporating this simple and cost-effective intervention into routine preoperative protocols may enhance surgical outcomes and patient experience.

Keywords: Salbutamol Nebulization, Cataract Surgery, COPD, Bronchial Asthma, Patient Comfort, Surgical Outcomes.

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Introduction

Cataract surgery is one of the most commonly performed surgical procedures worldwide, predominantly conducted under regional or topical anesthesia with minimal sedation. Although generally considered low risk, the presence of chronic respiratory diseases such as chronic obstructive pulmonary disease (COPD) and bronchial asthma significantly increases perioperative morbidity due to airway hyperresponsiveness and impaired pulmonary reserve. These patients are particularly vulnerable to perioperative respiratory complications including bronchospasm, hypoxia, coughing, and increased work of breathing, even during minor procedures performed under local anesthesia.[1,2] COPD and asthma are characterized by chronic airway inflammation, airflow limitation, and dynamic hyperinflation, which result in

ventilation–perfusion mismatch and reduced gas exchange efficiency. These pathophysiological changes are exacerbated by surgical stress, anxiety, supine positioning, and sedation during ophthalmic procedures, thereby compromising intraoperative comfort and increasing the likelihood of adverse respiratory events. Furthermore, perioperative pulmonary complications in such patients are associated with prolonged recovery, increased healthcare costs, and reduced patient satisfaction.[3-6]

Preoperative optimization of pulmonary function is therefore a critical component of perioperative care in patients with obstructive airway diseases. Inhaled short-acting β2-agonists such as salbutamol are widely used due to their rapid bronchodilatory effects mediated through relaxation of airway smooth muscle, leading to improved airflow, reduced airway resistance, and enhanced oxygenation.

Nebulized delivery offers additional advantages, including better drug deposition in distal airways and ease of administration, especially in elderly or poorly coordinated patients undergoing cataract surgery.[7-9]

Evidence from perioperative studies suggests that preoperative administration of salbutamol can significantly reduce airway resistance, improve pulmonary mechanics, and decrease the incidence of bronchospasm and other respiratory adverse events. Randomized controlled trials in COPD patients undergoing surgery have demonstrated that inhaled salbutamol improves oxygenation parameters, reduces dead space ventilation, and lowers the incidence of postoperative pulmonary complications. Similarly, prophylactic use of inhaled β2-agonists has been shown to decrease perioperative bronchospasm, coughing, and hypoxia in high-risk patients.[10-12]

Despite these established benefits in general anesthesia settings, there is limited evidence regarding the role of preoperative nebulized salbutamol in patients undergoing cataract surgery under local or regional anesthesia. Unlike major surgeries, cataract procedures rely heavily on patient cooperation and immobility; thus, even mild respiratory discomfort, coughing, or dyspnea can compromise surgical precision and outcomes. Optimizing respiratory status in this subset of patients may therefore have dual benefits—improving both patient comfort and surgical conditions.

In this context, the present study is undertaken with the aim of comparing the efficacy of preoperative salbutamol nebulization in improving patient comfort and surgical outcomes during cataract surgery in COPD and asthma patients, and to propose a standardized preoperative protocol for these high-risk groups.

Methodology

Study Design and Setting: This study was conducted as a hospital-based cross-sectional comparative study in the Department of Ophthalmology at Shri B. M. Patil Medical College, Hospital and Research Centre, BLDE (Deemed to be University), Vijayapura, Karnataka, India. The study was carried out over a period of one year.

Study Population: The study population include adult patients diagnosed with cataract and scheduled for elective cataract surgery, with a known history of bronchial asthma and/or chronic obstructive pulmonary disease (COPD).

Sample Size and Sampling Technique: A total of 30 eligible patients were included in the study. Patients meeting the inclusion criteria were recruited consecutively and allocated into two groups using simple randomization sealed opaque envelope method to ensure allocation concealment.

- Group A (Intervention group): 15 patients receiving preoperative salbutamol nebulization
- Group B (Control group): 15 patients not receiving nebulization

Inclusion Criteria

- Patients aged ≥18 years
- Patients diagnosed with cataract and planned for surgery
- Patients with a documented history of bronchial asthma and/or COPD
- Patients who provided informed written consent

Exclusion Criteria

- Patients with other pulmonary diseases (e.g., interstitial lung disease, pulmonary tuberculosis)
- Patients with significant cardiac disorders
- Patients receiving systemic corticosteroids for other medical conditions
- Patients with other major comorbidities that may affect perioperative outcomes

Intervention: Patients in the intervention group received preoperative nebulization with salbutamol (2.5 mg in 2.5 mL normal saline) administered approximately 15–20 minutes prior to surgery using a standard nebulizer system. The control group received standard preoperative care without nebulization.

Preoperative Assessment: All patients underwent detailed preoperative evaluation including: Demographic details (age, sex), relevant systemic examination, Outcome Measures

Data Collection Procedure: Data was collected using a pre-designed, semi-structured proforma. Intraoperative parameters were recorded by the attending anesthetist or trained observer, while surgical outcomes were documented by the operating ophthalmologist. Postoperative observations were recorded in the immediate recovery period.

Statistical Analysis: Data was entered into Microsoft Excel and analyzed using appropriate statistical software such as SPSS version 26.0.Continuous variables were expressed as mean ± standard deviation (SD). Categorical variables were expressed as frequencies and percentages. Chi-square test for categorical variables. A p-value <0.05 was considered statistically significant

Ethical Considerations: The study was conducted after obtaining approval from the Institutional Ethics Committee of BLDE (Deemed to be University). Written informed consent was obtained from all participants prior to inclusion in the study. Confidentiality of patient information was strictly maintained.

Results

A total of 30 patients with bronchial asthma and/or COPD undergoing cataract surgery were included in the study and were equally distributed into two groups: the salbutamol nebulization group (n=15) and the control group (n=15).

The mean age of patients in the salbutamol group was 65.4 ± 7.3 years, whereas in the control group it was 69.9 ± 7.8 years, indicating a comparable age distribution between the two groups.

In terms of gender distribution, males constituted 53.3% of the salbutamol group and 60.0% of the control group, while females accounted for 46.7% and 40.0%, respectively.(Table 1) The distribution of age and sex was comparable between the groups, suggesting minimal baseline demographic variation and supporting the internal validity of the comparison.

Among participants in the salbutamol group, 60.0% were diagnosed with bronchial asthma and 40.0% with COPD. In contrast, the control group had a higher proportion of COPD patients (60.0%) compared to asthma patients (40.0%).(Table 2) Although there is a slight variation in disease distribution between the two groups, both groups included a mix of asthma and COPD patients, making them reasonably comparable for evaluating the intervention effect across obstructive airway diseases.

Patient comfort during surgery showed a marked difference between the two groups. In the salbutamol group, 60.0% of patients reported better comfort, and an additional 26.7% experienced an uneventful intraoperative course, resulting in a total of 86.7% with satisfactory comfort levels. Only 13.3% of patients reported breathlessness. (Table 3) In contrast, none of the patients in the control group reported “better” comfort. While 40.0% had an uneventful experience, a majority (60.0%) experienced breathlessness during the procedure. Difference observed between groups found to be statistically significant with P value of 0.007. These findings indicate that preoperative salbutamol nebulization is associated with a substantial improvement in intraoperative patient comfort and a significant reduction in respiratory discomfort.

Assessment of surgical conditions by the operating surgeon revealed that 86.7% of surgeries in the salbutamol group were uneventful, with only 13.3% experiencing disruption. In contrast, the control group demonstrated a significantly lower proportion of uneventful surgeries (40.0%), with the majority (60.0%) being disrupted due to factors such as patient discomfort, movement, or respiratory difficulty.(Figure 1) This suggests that preoperative salbutamol nebulization contributes to improved intraoperative stability and facilitates smoother surgical performance.

A consolidated analysis of outcomes further highlights the effectiveness of the intervention. Good patient comfort (defined as “better” or “uneventful”) was observed in 86.7% of patients in the salbutamol group compared to only 40.0% in the control group. The incidence of breathlessness was markedly lower in the salbutamol group (13.3%) compared to the control group (60.0%). Similarly, uneventful surgical procedures were significantly more frequent in the intervention group (86.7% vs 40.0%), while surgical disruptions were substantially reduced (13.3% vs 60.0%).(Table 4) Overall, these findings consistently demonstrate that preoperative salbutamol nebulization leads to improved patient comfort and better surgical conditions in patients with COPD and asthma undergoing cataract surgery.

Table 1: Demographic features of participants

Variable	Salbutamol Group (n=15)	Control Group (n=15)
Age (years)Mean±SD	65.4 ± 7.3	69.9 ± 7.8
Gender		
Male	8 (53.3%)	9 (60.0%)
Female	7 (46.7%)	6 (40.0%)

Table 2: Distribution of participants based on condition

Disease	Salbutamol Group (n=15)	Control Group (n=15)
Asthma	9 (60.0%)	6 (40.0%)
COPD	6 (40.0%)	9 (60.0%)

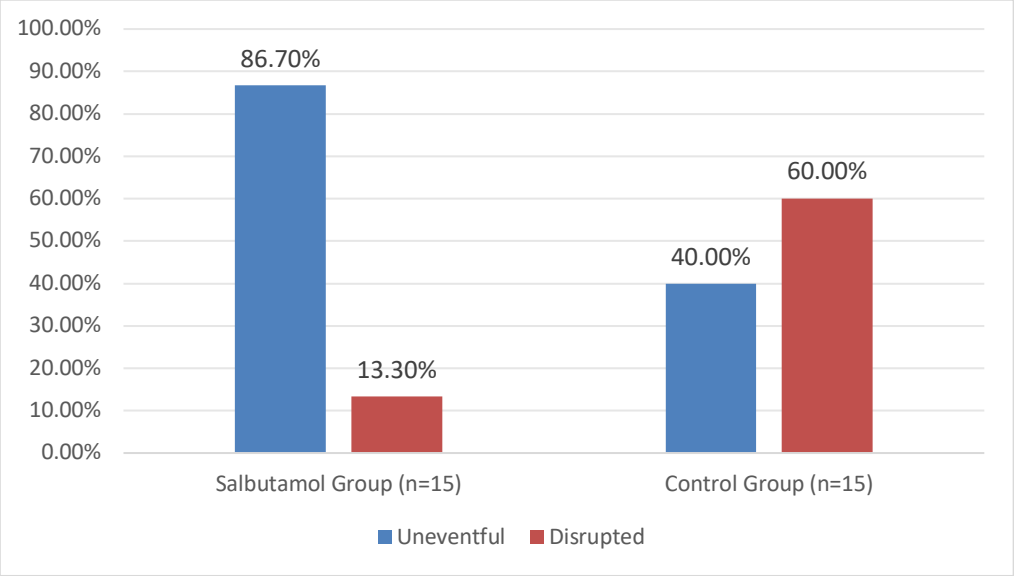

Figure 1: Outcome as per surgeon's response

Table 3: Outcome as per patient's response

Patient Response	Salbutamol Group (n=15)	Control Group (n=15)	Chi square test	P vale
Better	9 (60.0%)	0 (0%)	7.03	0.008
Uneventful	4 (26.7%)	6 (40.0%)		
Breathlessness	2 (13.3%)	9 (60.0%)		

Table 4: Comparative summary of out comes

Outcome Parameter	Salbutamol Group	Control Group
Good patient comfort (Better + Uneventful)	13 (86.7%)	6 (40.0%)
Breathlessness	2 (13.3%)	9 (60.0%)
Uneventful surgery	13 (86.7%)	6 (40.0%)
Surgical disruption	2 (13.3%)	9 (60.0%)

Discussion

The present study demonstrates that preoperative salbutamol nebulization significantly improves intraoperative patient comfort and surgical conditions in patients with bronchial asthma and COPD undergoing cataract surgery. The findings are particularly relevant in the context of ophthalmic procedures performed under local or topical anesthesia, where patient cooperation and respiratory stability are critical determinants of surgical success.

In this study, baseline demographic characteristics, including age and sex distribution, were comparable between the two groups, thereby minimizing confounding and supporting the internal validity of the findings. Although there was a slight variation in the distribution of asthma and COPD between groups, both cohorts included a mix of obstructive airway diseases, allowing for a reasonable comparison of intervention effects across these conditions. Similar methodological approaches have been adopted in perioperative respiratory studies where heterogeneous obstructive airway populations are included to reflect real-world clinical scenarios.[13]

A key finding of this study is the significant improvement in patient comfort in the salbutamol group, with 86.7% of patients experiencing satisfactory intraoperative comfort compared to only 40.0% in the control group ($p = 0.007$). The reduction in breathlessness (13.3% vs 60.0%) highlights the effectiveness of preoperative bronchodilation in mitigating perioperative respiratory distress.

These findings are consistent with previous studies demonstrating that inhaled β2-agonists improve airway caliber, reduce bronchial hyperresponsiveness, and enhance ventilation, thereby decreasing the incidence of perioperative respiratory complications.[3,14] The observed

improvement in surgical conditions further reinforces the clinical utility of salbutamol nebulization. In the present study, 86.7% of surgeries in the intervention group were uneventful compared to 40.0% in the control group.

This can be attributed to reduced coughing, dyspnea, and patient movement, which are known to interfere with microsurgical precision during cataract procedures. Groeben et al. reported that preoperative bronchodilator therapy significantly reduces airway resistance and perioperative bronchospasm, leading to improved intraoperative stability.[7] Similarly, perioperative optimization strategies targeting airway reactivity have been shown to enhance procedural conditions and reduce interruptions during surgery.[9]

The pathophysiological basis for these findings lies in the mechanism of action of salbutamol, a short-acting β2-adrenergic agonist that induces rapid bronchodilation by relaxing airway smooth muscle. This results in improved airflow, reduced dynamic hyperinflation, and better oxygenation.

In patients with COPD and asthma, who have baseline airway narrowing and increased airway reactivity, even minor stimuli such as anxiety, supine positioning, or surgical manipulation can precipitate bronchospasm.[8]

Preoperative nebulization helps attenuate these responses, thereby improving both subjective comfort and objective surgical conditions. The findings of the present study are also supported by evidence from perioperative medicine literature. Studies have shown that preoperative inhaled bronchodilators reduce postoperative pulmonary complications and improve intraoperative respiratory parameters in patients with obstructive airway diseases.[15]

Although most of these studies have been conducted in the setting of general anesthesia, the current study extends these benefits to minor surgical procedures such as cataract surgery, where evidence has been relatively limited.From a public health and clinical practice perspective, the results underscore the importance of preoperative respiratory optimization in high-risk populations. Given the increasing burden of COPD and asthma, particularly among the elderly who constitute the majority of cataract surgery candidates, simple interventions such as salbutamol nebulization can have substantial impact on surgical outcomes and patient experience.

The intervention is cost-effective, easy to administer, and associated with minimal adverse effects, making it highly feasible for routine use in resource-constrained settings.[16] Furthermore, the study provides a strong basis for the development of a standardized preoperative protocol for patients with obstructive airway diseases undergoing cataract surgery.

Incorporating salbutamol nebulization into routine preoperative care could improve consistency in practice, reduce intraoperative complications, and enhance overall quality of care.

However, certain limitations must be acknowledged. The relatively small sample size may limit the generalizability of the findings, and the study was conducted at a single center. Additionally, the inclusion of both asthma and COPD patients without subgroup analysis may mask disease-specific differences in response to the intervention. Future studies with larger sample sizes, multicentric design, and stratified analysis are recommended to validate and extend these findings.

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