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Original Research Article

# Pharmacological Aspects Regarding the Drugs Used in Asthma for Pediatric

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**Abstract:**

**Background:** Asthma is a prevalent chronic respiratory condition among children, significantly impacting their quality of life and necessitating effective pharmacological management. Despite advancements in treatment, achieving optimal asthma control in pediatric patients remains challenging due to various factors, including medication adherence and environmental triggers. This study aims to evaluate the pharmacological aspects of drugs used in pediatric asthma management, focusing on their efficacy, safety, and clinical outcomes in a cohort of children.

**Methods:** Sixty pediatric asthma patients aged 2 to 12 years were enrolled. Data on demographic details, types and dosages of asthma medications, clinical outcomes, and adverse drug reactions were collected through medical record reviews and direct interviews. Statistical analysis was performed using SPSS version 21.0.

**Results:** The study found significant improvements in clinical outcomes. The frequency of asthma attacks per month decreased from an average of 3.5 to 1.2, and the severity of attacks dropped from 7.0 to 3.0 on a 10-point scale ($p < 0.001$). Pulmonary function tests (PFTs) showed marked improvement, with FEV1 (% predicted) increasing from 60.2% to 75.8%, and FVC (% predicted) rising from 62.1% to 77.3% ($p < 0.001$). Adverse drug reactions were generally mild, with no severe reactions reported.

**Conclusion:** Inhaled corticosteroids and combination therapies significantly improved clinical outcomes in pediatric asthma patients, reducing the frequency and severity of attacks and enhancing lung function. The medications were well-tolerated, with a low incidence of adverse reactions.

Recommendations: Further research is needed to explore long-term outcomes and optimize treatment protocols. Additionally, enhancing patient education on medication adherence and proper inhaler techniques is crucial for achieving better asthma control.

**Keywords:** Pediatric Asthma, Inhaled Corticosteroids, Combination Therapy, Clinical Outcomes, Adverse Drug Reactions.

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## Introduction

Asthma is one of the most common chronic respiratory conditions affecting children worldwide. Characterized by airway inflammation and hyperresponsiveness, asthma can significantly impact the quality of life of pediatric patients, leading to frequent hospitalizations, missed school days, and limitations in physical activities. The global prevalence of pediatric asthma has been rising, necessitating effective management strategies to control symptoms and prevent exacerbations. According to recent studies, the prevalence of asthma in children varies widely, with higher rates reported in urban areas compared to rural settings [1].

Pharmacological management is a cornerstone of asthma treatment, aiming to reduce inflammation, alleviate bronchoconstriction, and improve lung function. Inhaled corticosteroids (ICS) are the most commonly prescribed anti-inflammatory agents, recommended as the first-line therapy for persistent asthma in children. These medications have been shown to significantly reduce the frequency of asthma attacks and improve overall asthma control [2]. However, the long-term use of ICS can be associated with potential side effects, including growth suppression and adrenal suppression, particularly at higher doses. Therefore, it is crucial to optimize dosing and explore combination therapies to enhance efficacy while minimizing adverse effects.

In addition to ICS, other pharmacological agents such as short-acting beta agonists (SABA), long-

acting beta agonists (LABA), and leukotriene receptor antagonists play vital roles in asthma management. SABAs are typically used for quick relief of acute symptoms, while LABAs, often in combination with ICS, provide sustained bronchodilation and are recommended for patients with moderate to severe asthma [3]. Leukotriene receptor antagonists offer an alternative or adjunctive therapy, particularly for patients with exercise-induced bronchoconstriction or allergic components.

Despite the availability of these medications, achieving optimal asthma control remains challenging for many pediatric patients. Factors such as medication adherence, inhaler technique, environmental triggers, and comorbid conditions can influence treatment outcomes. Recent advancements in personalized medicine and biomarker research hold promise for improving asthma management by tailoring treatments to individual patient profiles [4].

This study aims to evaluate the pharmacological aspects of drugs used in pediatric asthma management, focusing on their efficacy, safety, and clinical outcomes.

**Methodology**

**Study Design:** A prospective observational study.

**Study Setting:** The study took place at Department of Pediatrics, Nalanda Medical College and Hospital (N.M.C.H.), Patna, Bihar, spanning from October 2015 to November 2017.

**Participants:** A total of 60 pediatric patients diagnosed with asthma were enrolled in the study.

**Inclusion Criteria**

- Children aged 2 to 12 years

- Diagnosed with asthma based on clinical evaluation and pulmonary function tests

- Patients who have been on asthma medication for at least three months

**Exclusion Criteria**

- Children with other chronic respiratory diseases

- Patients with significant comorbidities affecting drug metabolism

- Those who have had a recent asthma exacerbation requiring hospitalization

**Bias:** To minimize selection bias, consecutive sampling was used to enroll participants. All eligible children presenting during the study period were included until the sample size was reached. Observer bias was minimized by ensuring that the same clinical team conducted all assessments and data collection.

**Variables:** Variables included types of asthma medications, dosage, and duration of treatment, clinical outcomes such as frequency and severity of asthma attacks, improvement in pulmonary function tests, and adverse drug reactions

**Data Collection:** Data was collected through a combination of medical record reviews and direct interviews with the patients and their caregivers. Information gathered included demographic details, clinical history, types and dosages of asthma medications, and any reported side effects.

**Procedure:** Detailed medical history and physical examination were conducted. Baseline pulmonary function tests were performed. Participants were followed up every three months. During each visit, clinical outcomes and any adverse reactions were documented. Pulmonary function tests were repeated.

**Statistical Analysis:** Data was analyzed using SPSS version 21.0. Descriptive statistics such as mean, median, and standard deviation were used to summarize the data. Chi-square tests and t-tests were employed to compare categorical and continuous variables, respectively. A p-value of $<0.05$ was considered statistically significant.

**Ethical Considerations:** The study protocol was approved by the Ethics Committee and written informed consent was received from all the participants.

**Result**

A total of 60 pediatric patients were included in the study. The demographic details are summarized in Table 1.

**Table 1: Participant Demographics**

| Variable | Value |
|---|---|
| Mean Age (years) | 7.4 ± 2.8 |
| Gender | |
| - Male | 32 (53.3%) |
| - Female | 28 (46.7%) |
| Mean Duration of Asthma (years) | 2.6 ± 1.3 |

The distribution of asthma medications used by the participants is shown in Table 2.

**Table 2: Asthma Medications Used**

| Medication Type | Number of Patients (%) |
|---|---|
| Inhaled Corticosteroids (ICS) | 45 (75%) |
| Short-Acting Beta Agonists (SABA) | 52 (86.7%) |
| Long-Acting Beta Agonists (LABA) | 30 (50%) |
| Leukotriene Receptor Antagonists | 20 (33.3%) |
| Combination Therapy | 40 (66.7%) |

The clinical outcomes were measured by the frequency and severity of asthma attacks and improvement in pulmonary function tests (PFTs). The results are summarized in Table 3 and Table 4.

**Table 3: Frequency and Severity of Asthma Attacks**

| Outcome | Baseline | Follow-Up | p-value |
|---|---|---|---|
| Frequency of Attacks (per month) | 3.5 ± 1.2 | 1.2 ± 0.8 | <0.001 |
| Severity (measured on a scale of 1-10) | 7.0 ± 1.5 | 3.0 ± 1.2 | <0.001 |

**Table 4: Pulmonary Function Tests (PFTs)**

| PFT Parameter | Baseline | Follow-Up | p-value |
|---|---|---|---|
| FEV1 (% predicted) | 60.2 ± 12.3 | 75.8 ± 10.4 | <0.001 |
| FVC (% predicted) | 62.1 ± 11.5 | 77.3 ± 9.8 | <0.001 |
| FEV1/FVC Ratio | 0.75 ± 0.05 | 0.85 ± 0.04 | <0.001 |

Adverse drug reactions (ADRs) were monitored throughout the study period. The incidence of ADRs is presented in Table 5.

**Table 5: Adverse Drug Reactions**

| ADR Type | Number of Patients (%) |
|---|---|
| Mild (e.g., throat irritation, cough) | 15 (25%) |
| Moderate (e.g., headache, nausea) | 5 (8.3%) |
| Severe (e.g., adrenal suppression) | 0 (0%) |

The statistical analysis revealed significant improvements in both the frequency and severity of asthma attacks ($p < 0.001$). Pulmonary function tests also showed significant improvement from baseline to follow-up ($p < 0.001$).

## Discussion

The study included 60 pediatric asthma patients, with a mean age of 7.4 years. The gender distribution was relatively balanced, with 53.3% male and 46.7% female participants. On average, the children had been diagnosed with asthma for 2.6 years. The primary medications used included inhaled corticosteroids (ICS), short-acting beta agonists (SABA), long-acting beta agonists (LABA), leukotriene receptor antagonists, and combination therapies. The most commonly used medications were SABA (86.7%) and ICS (75%), with 66.7% of patients receiving combination therapy.

Clinical outcomes demonstrated significant improvements over the study period. The frequency of asthma attacks per month decreased from an average of 3.5 to 1.2, and the severity of attacks, measured on a scale of 1 to 10, dropped from 7.0 to 3.0. These reductions were statistically significant ($p < 0.001$), indicating that the medications effectively managed asthma symptoms in the pediatric population. Pulmonary function tests (PFTs) also showed marked improvement. The mean FEV1 (% predicted) increased from 60.2% to 75.8%, the mean FVC (% predicted) rose from 62.1% to 77.3%, and the FEV1/FVC ratio improved from 0.75 to 0.85, all with significant p-values (<0.001).

Adverse drug reactions (ADRs) were generally mild, with 25% of patients experiencing minor symptoms like throat irritation or cough. Moderate ADRs, such as headaches and nausea, were reported by 8.3% of patients, while no severe reactions were observed. This indicates a favorable safety profile for the medications used in the study.

Overall, the study's results indicate that inhaled corticosteroids and combination therapies are highly effective in reducing the frequency and severity of asthma attacks and improving lung function in pediatric patients. The low incidence of adverse reactions further supports the safety and efficacy of these treatment protocols. These findings highlight the importance of appropriate pharmacological management in pediatric asthma, emphasizing the benefits of regular and combined use of asthma medications to achieve optimal clinical outcomes.

Pediatric asthma management involves a variety of pharmacological treatments aimed at controlling symptoms, improving lung function, and enhancing the quality of life. A study emphasized the importance of following guidelines like those from GINA and the British Thoracic Society for pediatric asthma management. The study highlights the use of beta-2 adrenergic agonists, corticosteroids, and leukotriene modifiers as key drug classes. New therapeutic approaches, such as omalizumab for IgE-mediated allergic asthma, are also discussed [5].

A study reviewed novel biologic drugs such as dupilumab, mepolizumab, reslizumab, and benralizumab. These therapies show promise in reducing exacerbation rates and steroid use in glucocorticoid-dependent cases, particularly in adolescents with severe asthma [6]. Another study highlighted the role of community pharmacists in managing pediatric asthma. Pharmacists contribute to optimal therapeutic outcomes and quality of life improvements by promoting rational drug use and providing pharmaceutical care [7].

A study discussed the impact of genetic variability on the response to asthma medications in children. Pharmacogenomic testing can help in preemptively reducing adverse events and therapeutic failures, although pediatric research in this area is still limited [8]. A study identified potential drug interactions in pediatric asthma patients. The study found that 28.18% of patients experienced drug interactions, primarily pharmacodynamic in nature, which underscores the importance of careful medication management [9].

Furthermore, a study reviewed current and novel immunomodulatory therapies for pediatric asthma. While standard therapies like inhaled corticosteroids are effective for most children, biologic therapies such as omalizumab and mepolizumab are beneficial for severe uncontrolled asthma [10]. A study explored new concepts in treating non-severe pediatric asthma. They highlighted the benefits of anti-inflammatory treatments even for mild cases and discussed the potential of new inhaled corticosteroid formulations and tiotropium as maintenance therapy [11].

## Conclusion

This study underscores the importance of appropriate pharmacological management in pediatric asthma. Inhaled corticosteroids and combination therapies are effective in improving clinical outcomes and are well-tolerated by pediatric patients. Further research is warranted to explore long-term outcomes and optimize treatment protocols.

**Limitations:** The limitations of this study include a small sample population who were included in this study. Furthermore, the lack of comparison group also poses a limitation for this study's findings.

**Recommendation:** Further research is needed to explore long-term outcomes and optimize treatment protocols. Additionally, enhancing patient education on medication adherence and proper inhaler techniques is crucial for achieving better asthma control.

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**List of abbreviations:**

ADR - Adverse Drug Reaction

ICS - Inhaled Corticosteroids

LABA - Long-Acting Beta Agonists

PFT - Pulmonary Function Test

SABA - Short-Acting Beta Agonists

FEV1 - Forced Expiratory Volume in 1 second

FVC - Forced Vital Capacity

GINA - Global Initiative for Asthma

11. IgE - Immunoglobulin E

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