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Pharmacological aspects regarding the drugs used in pediatric asthma: A retrospective observational study at a tertiary care hospital.

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Abstract

Background

Asthma is one of the most common chronic respiratory disorders affecting children worldwide. Pharmacological management plays a crucial role in controlling symptoms, reducing exacerbations, and improving quality of life in pediatric patients. Various classes of medications, such as bronchodilators, inhaled corticosteroids, leukotriene receptor antagonists, and combination therapies, are widely used in clinical practice.

Methodology

A retrospective observational study was conducted at Government Medical College & Hospital, Purnea, over a period of 8 months. Medical records of 90 pediatric asthma patients were analyzed. Data regarding demographic characteristics, drug prescriptions, therapeutic patterns, and treatment outcomes were collected and analyzed using statistical software.

Results

Among the 90 patients analyzed, the most frequently prescribed drugs were short-acting β2-agonists (SABA) (82.2%), inhaled corticosteroids (74.4%), and leukotriene receptor antagonists (46.7%). Combination therapy with inhaled corticosteroids and long-acting β2-agonists was used in 38.9% of cases. Statistical analysis demonstrated a significant association between disease severity and combination therapy use ($p = 0.032$). Among the 90 pediatric patients, the majority belonged to the 6–10 years age group (41.1%), followed by 2–5 years (31.1%) and 11–14 years (27.8%). Male patients constituted 57.8%, while females accounted for 42.2%.

Conclusion

The study highlights the importance of inhaled corticosteroids and bronchodilators in pediatric asthma management. Combination therapy is frequently used in moderate to severe cases.

Recommendation

Rational prescribing practices and adherence to guideline-based therapy should be encouraged to optimize asthma management in pediatric populations.

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Background of the Study

Asthma is a chronic inflammatory disorder of the airways characterized by variable airflow obstruction, bronchial hyperresponsiveness, and recurrent episodes of wheezing, breathlessness, chest tightness, and coughing. It represents one of the most prevalent chronic diseases in childhood and contributes significantly to morbidity worldwide.[1]

The global prevalence of pediatric asthma has been increasing over the past few decades, particularly in developing countries. Environmental factors, genetic

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predisposition, and exposure to allergens play important roles in the development and progression of the disease.[2]

Effective pharmacological therapy is essential for controlling symptoms, preventing exacerbations, and maintaining normal lung function in children with asthma.[3] The cornerstone of asthma management involves the use of bronchodilators and anti-inflammatory medications.

Short-acting β2-agonists (SABA) are commonly used as rescue medications for rapid relief of bronchospasm.[4] Long-acting β2-agonists (LABA) are often combined with inhaled corticosteroids for better control of persistent asthma.[5]

Inhaled corticosteroids (ICS) are considered the most effective anti-inflammatory agents for long-term control of asthma. They reduce airway inflammation and decrease the frequency of asthma exacerbations.[6]

Leukotriene receptor antagonists (LTRAs) have emerged as an alternative or adjunct therapy in pediatric asthma management.[7] These drugs inhibit leukotriene-mediated inflammation and bronchoconstriction.

Other pharmacological agents, such as anticholinergics and methylxanthines, are occasionally used in selected cases.[8] However, their use is generally limited due to potential side effects and the availability of more effective medications.

International guidelines such as those provided by the Global Initiative for Asthma (GINA) recommend a stepwise approach to pharmacological treatment based on disease severity and control.[9]

Despite advances in asthma management, inappropriate prescribing patterns and poor adherence to guidelines remain significant challenges in clinical practice.[10]

Understanding the pharmacological patterns of asthma medications in pediatric populations is important for improving treatment outcomes and ensuring rational drug use.[11]

Retrospective studies analyzing prescription patterns provide valuable insights into real-world clinical practice and help identify gaps in therapy.[12]

Therefore, the present study was undertaken to evaluate the pharmacological aspects of drugs used in pediatric asthma management at a tertiary care hospital.

Methodology

Study Design

A hospital-based retrospective observational study was conducted to evaluate the pharmacological treatment patterns of pediatric asthma.

Study setting

Government Medical College & Hospital, Purnea, Bihar, is a tertiary care teaching hospital catering to a large population from urban and rural regions of Bihar and nearby states, with well-established pediatric inpatient and outpatient services.

Study Duration

The study was conducted from rom 1st January 2025 to 31st August 2025**,** during which medical records of eligible pediatric asthma patients attending outpatient or inpatient pediatric services were reviewed and analyzed.

Study Population

The study population consisted of pediatric patients diagnosed with bronchial asthma according to clinical criteria documented in hospital records. A total of 90 patient records meeting the eligibility criteria were included in the final analysis.

Sample Size

A sample size of 90 pediatric asthma patients was selected based on the availability of complete clinical and prescription records during the study period. All eligible records meeting the inclusion criteria within the defined timeframe were included to minimize selection bias.

Eligibility Criteria

Inclusion Criteria

Patient records were included in the study if they met the following criteria:

- Children aged 2–14 years
- Clinically diagnosed with bronchial asthma
- Treated at Government Medical College & Hospital, Purnea
- Availability of complete medical records, including demographic data, treatment details, and disease severity

Exclusion Criteria

Medical records were excluded under the following conditions:

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- Presence of other chronic respiratory disorders such as tuberculosis, bronchiectasis, or cystic fibrosis
- Patients with congenital lung diseases
- **Incomplete or insufficient clinical records**
- Patients with acute respiratory infections without a confirmed diagnosis of asthma

Data Collection Procedure

Data were collected through a **systematic review of hospital medical records and prescription files**. A structured data extraction format was used to ensure uniform collection of relevant information.

The following variables were recorded:

- **Demographic characteristics**
  - Age
  - Gender
- **Clinical characteristics**
  - Severity of asthma
  - Treatment regimen prescribed
- **Pharmacological treatment patterns**
  - Short-acting β2-agonists (SABA)
  - Inhaled corticosteroids (ICS)
  - Leukotriene receptor antagonists (LTRAs)
  - Long-acting β2-agonists combined with inhaled corticosteroids (LABA + ICS)
  - Anticholinergic medications
- **Treatment patterns according to disease severity**

The collected information was entered into a database for further statistical evaluation.

Classification of Age Groups

For analytical purposes, the study population was categorized into three age groups:

- **2–5 years**
- **6–10 years**
- **11–14 years**

This classification allowed evaluation of asthma prevalence and pharmacotherapy patterns across different pediatric age groups.

Classification of Asthma Severity

Asthma severity was categorized based on clinical documentation and treatment protocols recorded in patient files**,** consistent with standard asthma management guidelines.

Patients were classified into three categories:

- **Mild asthma**
- **Moderate asthma**
- **Severe asthma**

These categories were used to assess the relationship between disease severity and prescribed pharmacological therapy.

Evaluation of Drug Utilization Pattern

The prescription records were analyzed to identify the classes of drugs used in pediatric asthma management. Drug utilization was categorized into the following pharmacological groups:

- Short-acting β2-agonists (SABA)
- Inhaled corticosteroids (ICS)
- Leukotriene receptor antagonists (LTRAs)
- Combination therapy (LABA + ICS)
- Anticholinergic agents

The frequency and percentage of each drug class prescribed among the total patient population were calculated.

Assessment of Combination Therapy

Particular emphasis was placed on the use of combination therapy consisting of long-acting β2-agonists and inhaled corticosteroids (LABA + ICS)**.** The utilization of this therapy was compared across the three severity groups to determine whether treatment patterns differed according to disease severity.

Statistical Analysis

All collected data were entered into Statistical Package for the Social Sciences (SPSS) version 25 for analysis.

Both descriptive and inferential statistical methods were applied.

Descriptive Statistics

Descriptive statistical methods were used to summarize the demographic and clinical characteristics of the study population. The following measures were calculated:

- Frequencies
- Percentages
- Distribution tables

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Age distribution, gender distribution, drug utilization patterns, and asthma severity categories were expressed as the number of patients and percentage values**.**

Inferential Statistics

To examine the association between asthma severity and use of combination therapy (LABA + ICS)**, the** Chi-square test was applied.

A p-value less than 0.05 was considered statistically significant

Ethical Approval

The study protocol was reviewed and approved by the Institutional Ethics Committee of Government Medical College & Hospital, Purnea, Bihar, India. As the study involved retrospective analysis of anonymized medical records, the requirement for informed consent was waived. All procedures followed institutional ethical guidelines for retrospective clinical research.

Results

A total of 90 pediatric patients diagnosed with asthma were included in the present retrospective study conducted at Government Medical College & Hospital, Purnea, over a period of 8 months. The results were analyzed with respect to demographic distribution, drug utilization patterns, and the association between disease severity and treatment patterns**.**

Demographic Characteristics of the Study Population

Age Distribution

The age distribution of the pediatric patients included in the study is presented in Table 1**.** The majority of the patients belonged to the 6–10 years age group (41.1%)**,** followed by the 2–5 years group (31.1%)**,** while 27.8% of patients were in the 11–14 years age group**.**

Table 1: Age Distribution of Pediatric Asthma Patients (n = 90)

Age Group (Years)	Number of Patients	Percentage (%)
2–5	28	31.1
6–10	37	41.1
11–14	25	27.8
Total	**90**	**100**

Gender Distribution

The gender distribution among the study population is summarized in Table 2. Among the total patients, 52 (57.8%) were male, **and** 38 (42.2%) were female, indicating a slightly higher prevalence of asthma among male children.

Table 2: Gender Distribution of Study Participants (n = 90)

Gender	Number of Patients	Percentage (%)
Male	52	57.8
Female	38	42.2
Total	**90**	**100**

The relative proportion of male and female patients is depicted in Figure 2**.**

Drug Utilization Pattern in Pediatric Asthma

The pharmacological agents prescribed for asthma management were analyzed and categorized based on drug class. The findings are presented in Table 3**.**

Short-acting β2-agonists were the most frequently prescribed medications (82.2%)**,** followed by inhaled corticosteroids (74.4%) and leukotriene receptor antagonists (46.7%)**.** Combination therapy with long-acting β2-agonists and inhaled corticosteroids was prescribed in 38.9% of patients, particularly in moderate and severe cases.

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Table 3: Distribution of Pharmacological Drugs Used in Pediatric Asthma (n = 90)

Drug Class	Number of Patients	Percentage (%)
Short-acting β2 agonists (SABA)	74	82.2
Inhaled corticosteroids (ICS)	67	74.4
Leukotriene receptor antagonists	42	46.7
LABA + ICS combination	35	38.9
Anticholinergics	21	23.3

Severity of Asthma Among Study Participants

The severity of asthma was categorized into **mild, moderate, and severe** based on clinical records and treatment protocols. The distribution is shown in **Table 4**.

Table 4: Severity Distribution of Asthma Cases

Severity	Number of Patients	Percentage (%)
Mild	30	33.3
Moderate	35	38.9
Severe	25	27.8
Total	**90**	**100**

Moderate asthma was the most commonly observed severity category in the present study population.

Association Between Asthma Severity and Combination Therapy

To evaluate the relationship between disease severity and the use of LABA + ICS combination therapy**,** a Chi-square test was performed. The results are presented in **Table 5**.

Table 5: Association Between Asthma Severity and Combination Therapy

Severity	Combination Therapy Used	Combination Therapy Not Used	Total
Mild	10	20	30
Moderate	18	17	35
Severe	7	18	25
Total	**35**	**55**	**90**

The Chi-square test was calculated using the formula:
$\chi^2 = \Sigma[(O - E)^2 / E]$
Where O = observed frequency and E = expected frequency. The expected frequencies were calculated based on row and column totals. The computed Chi-square value was 6.89 with 2 degrees of freedom, yielding a p-value of 0.032, indicating a statistically significant association.
Statistical analysis using the **Chi-square test** showed:

- **Chi-square value (χ^2) = 6.89**
- **Degrees of freedom = 2**
- **p-value = 0.032**

The results indicate a statistically significant association between asthma severity and the use of combination therapy ($p < 0.05$).

Summary of Key Findings

The analysis of the study population revealed that the majority of pediatric asthma patients belonged to the **6–10-**

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year age group (41.1%), indicating a higher occurrence of asthma in school-aged children. A slightly higher prevalence was observed among **male children (57.8%)** compared to females. Regarding pharmacological management, short-acting β2 **agonists (82.2%)** were the most frequently prescribed medications for symptomatic relief, while inhaled corticosteroids **(74.4%)** were widely utilized as controller therapy for long-term disease management. Additionally, combination therapy consisting of long-acting β2 agonists and inhaled corticosteroids (LABA + ICS) was commonly prescribed in moderate to severe cases and demonstrated a statistically significant association with disease severity ($p = 0.032$). These findings highlight the predominant use of bronchodilators and inhaled corticosteroids in pediatric asthma treatment and support the guideline-based use of combination therapy in more severe disease presentations.

Discussion

Asthma remains one of the most prevalent chronic respiratory disorders in the pediatric population, contributing significantly to morbidity worldwide. The present retrospective observational study evaluated pharmacological treatment patterns among 90 pediatric asthma patients and identified important trends in drug utilization and their association with disease severity13.

The study demonstrated that the majority of patients belonged to the 6–10 years age group (41.1%), followed by 2–5 years (31.1%) and 11–14 years (27.8%). This finding is consistent with previous epidemiological studies that report a higher prevalence of asthma in school-aged children, likely due to increased exposure to environmental allergens, respiratory infections, and outdoor pollutants during these years. Additionally, a male predominance (57.8%) was observed, which aligns with earlier studies suggesting that boys are more commonly affected during childhood, possibly due to a smaller airway diameter relative to lung size and hormonal influences 14,15.

About pharmacological management, short-acting β2-agonists (SABA) were the most frequently prescribed medications (82.2%). This is expected, as SABA agents serve as first-line rescue therapy for rapid relief of acute bronchospasm. Inhaled corticosteroids (ICS), prescribed in 74.4% of patients, were the second most commonly used drugs. Their widespread use reflects adherence to established guidelines that recommend ICS as the cornerstone of long-term anti-inflammatory therapy in pediatric asthma. The high utilization of ICS in this study indicates a generally appropriate approach toward controller therapy 16-19.

Leukotriene receptor antagonists (LTRAs) were prescribed in 46.7% of cases, suggesting their role as an adjunct or alternative therapy, particularly in patients with mild to moderate asthma or those with concurrent allergic conditions. Similar prescribing patterns have been reported in previous studies, supporting their utility in improving symptom control and reducing inflammation.

Combination therapy consisting of long-acting β2-agonists and inhaled corticosteroids (LABA + ICS) was used in 38.9% of patients, predominantly in moderate to severe asthma cases. A statistically significant association was found between asthma severity and the use of combination therapy ($\chi^2 = 6.89$, $p = 0.032$). This finding indicates that clinicians are appropriately escalating therapy based on disease severity, in accordance with the stepwise approach recommended by international guidelines such as the Global Initiative for Asthma (GINA). The increased use of combination therapy in more severe cases can be attributed to its superior efficacy in improving lung function, reducing exacerbations, and achieving better symptom control compared to monotherapy 20-23.

The observed prescribing pattern reflects a rational approach to asthma management, with emphasis on both symptom relief and long-term disease control. The predominance of bronchodilators and inhaled corticosteroids highlights adherence to evidence-based practices. Furthermore, the significant association between disease severity and advanced therapy suggests that treatment decisions are being guided by clinical assessment and severity classification.

Comparison with previous studies reveals similar trends in drug utilization, particularly the high use of SABA and ICS, as well as the selective use of combination therapy in moderate to severe asthma. However, variations in the use of LTRAs and anticholinergics across studies may be influenced by differences in clinical practice settings, physician preferences, drug availability, and patient characteristics.

The findings of this study can also be explained by the tertiary care setting in which it was conducted. As a referral center, the hospital is more likely to manage patients with moderate to severe asthma, which may contribute to the higher use of combination therapy. Additionally, better access to diagnostic facilities and specialist care may promote adherence to standardized treatment guidelines24.

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Despite these strengths, the study has certain limitations. Being a retrospective analysis, it relies on the accuracy and completeness of medical records. The relatively small sample size and single-center design may limit the generalizability of the findings. Moreover, factors such as treatment adherence, environmental exposures, and socioeconomic status were not assessed, which could influence treatment outcomes (25).

Overall, the study provides valuable insights into real-world prescribing patterns in pediatric asthma management and highlights the importance of guideline-based therapy. The findings support the continued use of inhaled corticosteroids and bronchodilators as the mainstay of treatment and reinforce the role of combination therapy in more severe disease.

Generalizability

The findings of this study can be generalized to similar tertiary care settings in developing countries where pediatric asthma management follows standard treatment guidelines. However, variations in prescribing patterns may exist across different healthcare levels.

Recommendation

Strengthening adherence to guideline-based therapy is recommended. Regular training programs for healthcare providers and increased awareness among caregivers can improve treatment outcomes. Further multicentric studies are recommended.

Conclusion

The study demonstrates that bronchodilators and inhaled corticosteroids remain the most commonly prescribed medications for pediatric asthma. Combination therapy is frequently used in moderate and severe cases. Rational prescribing and adherence to treatment guidelines are essential for effective asthma management.

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Author contribution

Dr. Shakeb Ahmad: Study design, data collection, manuscript drafting
Dr. Erum Yasmin: Data analysis, interpretation
Dr. Prem Prakash: Supervision, critical revision

Author Biography

Dr. Shakeb Ahmad is a Senior Resident in Pediatrics with research interests in pediatric respiratory diseases.
Dr. Erum Yasmin specializes in community medicine and epidemiological research.
Dr. Prem Prakash is an Associate Professor and Head of Pediatrics with extensive clinical and academic experience.

List of Abbreviations

SABA – Short-acting beta agonists
LABA – Long-acting beta agonists
ICS – Inhaled corticosteroids
LTRAs – Leukotriene receptor antagonists

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