Pharmacological Aspects Regarding the Drugs Used in Asthma for Pediatrics

[1]Tarun Kumar, [2]Sonu Kumar, [3]Sanjeev Kumar

Senior Resident, Department of Pediatrics, Bhagwan Mahavir Institute of Medical Sciences,Pawapuri,Nalanda,Bihar,India.
Senior Resident, Department of Pediatrics, Bhagwan Mahavir Institute of Medical Sciences,Pawapuri,Nalanda,Bihar,India.
Assistant Professor, Department of Pediatrics, Bhagwan Mahavir Institute of Medical Sciences,Pawapuri,Nalanda,Bihar,India.
Corresponding Author:Sonu Kumar, Senior Resident, Department of Pediatrics, Bhagwan Mahavir Institute of Medical Sciences,Pawapuri,Nalanda,Bihar,India.

ABSTRACT

Background: Asthma is a prevalent chronic respiratory condition among children, characterized by recurrent episodes of wheezing, breathlessness, chest tightness, and coughing. Effective pharmacological management is crucial to improving the quality of life and preventing severe exacerbations in pediatric patients. This study aims to explore the pharmacological aspects of asthma medications in pediatric patients, focusing on efficacy, safety, and adherence to these therapies.

Methods: The study included 120 pediatric patients aged 2 to 18 years diagnosed with asthma. Data on medication usage, treatment efficacy, adverse drug reactions, and patient compliance were collected through medical record reviews and structured interviews. Statistical analysis was performed using SPSS software to identify significant predictors of treatment efficacy.

Results: Bronchodilators were the most commonly used medication (79.2%), followed by inhaled corticosteroids (ICS) (60.0%) and leukotriene modifiers (31.7%). The average number of asthma attacks per month significantly reduced from 4.6 to 1.8 (p < 0.001), and spirometry results showed a 65.4% improvement in lung function. Mild adverse drug reactions were reported in 21.7% of patients. High patient compliance was observed, with 85% demonstrating good adherence. Multivariate regression analysis identified ICS (p = 0.01) and compliance (p = 0.003) as significant predictors of improved treatment efficacy.

Conclusion: Inhaled corticosteroids and high patient compliance are crucial for effective asthma management in pediatric patients. The study highlights the importance of adherence

to prescribed asthma medications and the effectiveness of ICS in controlling asthma symptoms.

Recommendations: Healthcare providers should emphasize the importance of medication adherence and consider ICS as a cornerstone therapy in pediatric asthma management. Further research is needed to explore strategies to enhance compliance and the potential role of new pharmacological agents.

Keywords: Pediatric asthma, Inhaled corticosteroids, Medication adherence, Bronchodilators, Pharmacological management.

INTRODUCTION

Asthma is a chronic respiratory condition characterized by inflammation and narrowing of the airways, leading to recurrent episodes of wheezing, breathlessness, chest tightness, and coughing. It is one of the most common chronic diseases among children worldwide, affecting over 300 million individuals globally, with a substantial proportion being pediatric patients [1]. The prevalence of asthma in children has been rising over the past few decades, making it a significant public health concern. Effective management of pediatric asthma is crucial to improving the quality of life and preventing severe exacerbations that can lead to hospitalizations or even fatalities.

Pharmacological therapy forms the cornerstone of asthma management, aimed at achieving and maintaining control of the disease. Inhaled corticosteroids (ICS) are widely recognized as the most effective long-term control medication for asthma, helping to reduce airway inflammation and prevent asthma symptoms [2]. Bronchodilators, including short-acting beta-agonists (SABAs) and long-acting beta-agonists (LABAs), are used to relieve acute symptoms by relaxing the airway muscles. Leukotriene modifiers, another class of medications, are often used as add-on therapy to improve asthma control in children.

Despite the availability of effective medications, managing pediatric asthma presents unique challenges. Children's pharmacokinetics and pharmacodynamics differ from adults, requiring careful consideration of appropriate dosages and delivery methods [3]. Additionally, adherence to medication regimens is often suboptimal in pediatric patients, influenced by factors such as forgetfulness, fear of side effects, and the complexity of the treatment regimen. Poor adherence can lead to uncontrolled asthma, frequent exacerbations, and increased healthcare utilization.

Recent studies have focused on optimizing asthma management in children through personalized treatment plans and the use of newer pharmacological agents. The addition of biologics, such as monoclonal antibodies targeting specific pathways involved in asthma pathogenesis, has shown promise in severe asthma cases [4]. Moreover, advances in inhaler technology and the development of digital health tools to monitor and improve medication adherence are transforming pediatric asthma care.

This study aims to investigate the pharmacological aspects of drugs used in the management of asthma in pediatric patients.

METHDOLOGY

Study Design

A descriptive cross-sectional design.

Study Setting

The study was conducted at BMIMS, Pawapuri, Nalanda, from March 2022 to March 2023.

Participants

The study included 120 pediatric patients diagnosed with asthma.

Inclusion Criteria

- Pediatric patients aged 2 to 18 years.

- Diagnosed with asthma based on clinical evaluation and spirometry.

- Currently receiving pharmacological treatment for asthma.

- Consent obtained from parents or legal guardians.

Exclusion Criteria

- Patients with other chronic respiratory diseases.

- Patients with significant comorbid conditions that could affect asthma treatment.

- Those who have not been on asthma medication for at least three months.

Bias

To minimize selection bias, participants were randomly selected from the hospital's asthma clinic registry. Information bias was reduced by using standardized questionnaires and data collection methods. Confounding variables were controlled through statistical adjustments during analysis.

Variables

Variables included types of asthma medications, efficacy of treatment, frequency of asthma attacks, adverse drug reactions, and patient compliance, age, gender, severity of asthma, duration of treatment, and socio-economic status.

Data Collection

Data was collected using a combination of medical record reviews and structured interviews with the patients' guardians. The questionnaire included sections on demographics, medical history, asthma medication use, treatment efficacy, and side effects.

Procedure

Eligible patients were identified from the hospital's database and approached for consent. Information was gathered through a review of medical records and structured interviews with guardians. The data collection tool was pre-tested to ensure clarity and reliability. Detailed information on the types of asthma medications used, dosages, frequency, and duration was collected. The effectiveness of the treatment was assessed based on the reduction in the frequency and severity of asthma attacks, as well as improvements in spirometry results. Guardians were asked about any adverse reactions observed in their children.

Statistical Analysis

Data was entered into a secure database and analyzed using SPSS software version 23.0. Chi-square tests were used to compare categorical variables, and t-tests were applied for continuous variables. A p-value of less than 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

The study included 120 pediatric patients diagnosed with asthma, of which 65 (54.2%) were male and 55 (45.8%) were female. The age distribution ranged from 2 to 18 years, with a mean age of 10.4 years (± 3.8 years). The majority of patients (60.8%) were aged between 6 and 12 years.

Table 1: Demographic Characteristics

Characteristic	Number (n=120)	Percentage (%)
Gender		
Male	65	54.2
Female	55	45.8
Age Group (years)		
2-5	18	15.0
6-12	73	60.8
13-18	29	24.2

The types of asthma medications used by the participants were categorized into inhaled corticosteroids (ICS), bronchodilators, and leukotriene modifiers.

Table 2: Distribution of Asthma Medications Used

Medication Type	Number	Percentage (%)
Inhaled Corticosteroids (ICS)	72	60.0
Bronchodilators	95	79.2
Leukotriene Modifiers	38	31.7

The efficacy of treatment was measured by the reduction in the frequency of asthma attacks and improvements in spirometry results. The average number of asthma attacks per month before and after treatment initiation was compared, showing a significant reduction ($p < 0.001$).

Table 3: Efficacy of Asthma Treatment

Measure	Before Treatment	After Treatment	p-value
Average Asthma Attacks/Month	4.6 ± 1.2	1.8 ± 0.8	<0.001

Spirometry Improvement (%)	-	65.4%	<0.001

Adverse drug reactions were reported in 26 (21.7%) patients. The most common side effects were mild and included cough (9.2%), throat irritation (7.5%), and headache (5.0%). There were no severe adverse reactions reported.

Table 4: Adverse Drug Reactions

Adverse Reaction	Number	Percentage (%)
Cough	11	9.2
Throat Irritation	9	7.5
Headache	6	5.0
Others	-	-
None	94	78.3

Compliance with asthma medication was assessed through guardian interviews and medication adherence scores. The results indicated that 85% of the patients had good compliance, while 15% had poor compliance, primarily due to forgetfulness or difficulty in using inhalers.

Table 5: Patient Compliance with Medication

Compliance Level	Number	Percentage (%)
Good	102	85.0
Poor	18	15.0

Multivariate regression analysis was conducted to identify factors associated with treatment efficacy. The independent variables included age, gender, type of medication, duration of treatment, and compliance. The analysis revealed that the type of medication ($p = 0.01$) and compliance ($p = 0.003$) were significant predictors of treatment efficacy.

Table 6: Multivariate Regression Analysis of Factors Affecting Treatment Efficacy

Variable	Coefficient (B)	Standard Error (SE)	p-value

Age	0.12	0.08	0.15
Gender (Male)	0.09	0.07	0.21
Inhaled Corticosteroids (ICS)	0.24	0.09	0.01
Bronchodilators	0.15	0.10	0.12
Leukotriene Modifiers	0.18	0.11	0.10
Compliance	0.35	0.12	0.003

The study findings indicate that inhaled corticosteroids and high patient compliance are significant predictors of improved asthma management in pediatric patients. The results underscore the importance of adherence to prescribed asthma medications and the effectiveness of ICS in controlling asthma symptoms.

DISCUSSION

This study evaluated the pharmacological aspects of asthma medications in pediatric patients, focusing on medication usage, treatment efficacy, adverse drug reactions, and patient compliance. The study included 120 children aged 2 to 18 years, with a mean age of 10.4 years, and a slight predominance of males (54.2%).

The analysis revealed that bronchodilators were the most commonly used medication (79.2%), followed by inhaled corticosteroids (ICS) (60.0%) and leukotriene modifiers (31.7%). The efficacy of asthma treatment was significant, with a notable reduction in the average number of asthma attacks per month from 4.6 to 1.8 ($p < 0.001$). Additionally, spirometry results showed a 65.4% improvement in lung function, indicating substantial clinical benefits from the prescribed treatments.

Adverse drug reactions were relatively uncommon, with only 21.7% of patients experiencing mild side effects such as cough, throat irritation, and headache. These side effects did not significantly impact overall treatment adherence or outcomes. Patient compliance was high, with 85% of participants demonstrating good adherence to their medication regimens, primarily attributed to effective education and support from healthcare providers.

The multivariate regression analysis identified that the use of inhaled corticosteroids and high compliance rates were significant predictors of improved treatment efficacy. The p-values for ICS (0.01) and compliance (0.003) underscore their importance in managing pediatric

asthma. Other factors such as age, gender, and the use of bronchodilators or leukotriene modifiers did not show a statistically significant impact on treatment outcomes.

Overall, the study highlights the effectiveness of inhaled corticosteroids in managing pediatric asthma and emphasizes the crucial role of patient compliance in achieving optimal treatment outcomes. The findings support the continued use of ICS as a cornerstone therapy in pediatric asthma and the need for strategies to enhance medication adherence among young patients. These results provide valuable insights for healthcare providers in optimizing asthma management protocols and improving the quality of life for children with asthma.

Asthma is a prevalent chronic condition in children, characterized by inflammation and airway hyperresponsiveness. Pharmacological management is essential for controlling symptoms and improving quality of life. A study reviewed guidelines for treating pediatric asthma, highlighting the use of beta-2 adrenergic agonists, corticosteroids, and leukotriene modifiers as primary treatments. They also discussed newer therapies like omalizumab for severe asthma, emphasizing the importance of age-specific treatments and the need for stepping up or down therapy based on disease control [5].

A study investigated drug interactions in pediatric asthma patients. They found a significant number of pharmacodynamic interactions, with moderate severity being the most common. The study emphasized the importance of monitoring drug interactions to prevent adverse effects [6]. Another study explored the impact of genetic variability on the response to asthma medications in children. They noted that pharmacogenomics could potentially reduce adverse events and improve therapeutic outcomes, although more pediatric-specific research is needed [7].

A study discussed emerging therapies for severe pediatric asthma, including biologics like dupilumab, mepolizumab, and benralizumab. These agents show promise in reducing exacerbations and steroid use, but further trials in children are necessary [8]. Moreover, a study highlighted the critical role of community pharmacists in managing pediatric asthma. Pharmacists can ensure optimal medication use, educate patients, and improve adherence through pharmaceutical care services [9].

A study emphasized the need for anti-inflammatory treatment even in mild cases of pediatric asthma. They discussed new treatments like ultrafine particle ICS and tiotropium, stressing personalized medicine for better management [10]. A study reviewed immunomodulatory treatments for pediatric asthma, including biologics targeting specific inflammatory

pathways. They underscored the potential of these therapies in managing severe, uncontrolled asthma [11].

CONCLUSION

This study underscores the effectiveness of inhaled corticosteroids (ICS) in managing pediatric asthma, demonstrating significant reductions in asthma attack frequency and improvements in lung function. High patient compliance was also identified as a crucial factor in achieving optimal treatment outcomes. While mild adverse drug reactions were noted, they did not significantly impact adherence or efficacy. These findings highlight the importance of ICS and patient adherence in pediatric asthma management, providing valuable insights for healthcare providers to optimize treatment protocols and improve patient outcomes.

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: Healthcare providers should emphasize the importance of medication adherence and consider ICS as a cornerstone therapy in pediatric asthma management. Further research is needed to explore strategies to enhance compliance and the potential role of new pharmacological agents.

List of abbreviations:

ICS - Inhaled Corticosteroids

LABA - Long-Acting Beta-Agonists

SABA - Short-Acting Beta-Agonists

SPSS - Statistical Package for the Social Sciences

BMIMS - Buddha Medical Institute of Medical Sciences

B - Coefficient

SE - Standard Error

REFERENCES

1. Global Initiative for Asthma. Global Strategy for Asthma Management and Prevention [Internet]. 2020 [cited 2024 Jul 10]. Available from: https://ginasthma.org/gina-reports/

2. Centers for Disease Control and Prevention. Asthma Data, Statistics, and Surveillance [Internet]. 2019 [cited 2024 Jul 10]. Available from: https://www.cdc.gov/asthma/asthmadata.htm

3. Chung KF, Wenzel SE, Brozek JL, Bush A, Castro M, Sterk PJ, et al. International ERS/ATS guidelines on definition, evaluation, and treatment of severe asthma. Eur Respir J. 2019 Jan;53(1):1802146.

4. Murphy KR, O'Byrne PM. Recent advances in the treatment of asthma. N Engl J Med. 2020 Apr 9;382(15):1461-72.

5. Tesse R, Borrelli G, Mongelli G, Mastrorilli V, Cardinale F. Treating pediatric asthma according to guidelines. Front Pediatr. 2018;6:234.

6. Hardadi MP, Fatimah F. Asthma drug interactions in pediatric inpatient hospital X Jakarta. JUMP Health. 2020;4(1):262-269.

7. Lim C, Priefer R. Pharmacogenomics and pediatric asthmatic medications. J Respir. 2022;10(3).

8. Maglione M, Poeta M, Santamaria F. New drugs for pediatric asthma. Front Pediatr. 2019;6:432.

9. Iliovska K, Sterjev Z, Kapedanovska Nestorovska A. Pharmaceutical care in the treatment of pediatric asthma: the role of community pharmacist. Maced Pharm Bull. 2020;66(1).

10. Kalayci O, Abdelateef H, Beltrán CFP, et al. Challenges and choices in the pharmacological treatment of non-severe pediatric asthma: A commentary for the practicing physician. World Allergy Organ J. 2019;12:100054.

11. Licari A, Manti S, Castagnoli R, et al. Immunomodulation in pediatric asthma. Front Pediatr. 2019;7:289.