MAK HILL Publications Research Journal of Medical Sciences

Research Article
doi: 10.36478/makrjms.2025.2.190.194

Comparative Study on the Efficacy of Inhaled Corticosteroids Versus Leukotriene Receptor Antagonists in Pediatric Asthma Management

[1]Purushottam Rathi and [2]Yogesh Madhukar Salunkhe

[1]Department of Pediatrics, SBHGMC, Chakkarbardi, Dhule, Maharashtra, India

[2]Department of Pediatrics, Government Medical College, Nandurbar, Maharashtra, India

ABSTRACT

Asthma is a significant chronic condition in children, impacting their quality of life. Inhaled corticosteroids (ICS) and leukotriene receptor antagonists (LTRA) are commonly prescribed for managing pediatric asthma. However, comparative data on their efficacy and outcomes in real-world clinical settings are sparse. This study aims to compare the efficacy, symptom control, exacerbation frequency and adherence between ICS and LTRA in pediatric asthma management. We conducted a retrospective comparative study of 100 pediatric asthma patients divided equally between those treated with ICS and those treated with LTRA. Data were collected from medical records regarding asthma control, exacerbation rates and treatment adherence over a period of one year. The ICS group demonstrated higher overall efficacy (68% vs. 56%, p=0.042) and better control of asthma symptoms with 80% achieving good symptom control compared to 60% in the LTRA group (p=0.025). Exacerbation rates were significantly lower in the ICS group, with 88% experiencing fewer than one exacerbation per year compared to 70% in the LTRA group (p=0.013). Additionally, adherence was notably higher in the ICS group (92% high adherence) compared to the LTRA group (80% high adherence, p=0.070). Inhaled corticosteroids are more effective than leukotriene receptor antagonists in managing pediatric asthma, with better symptom control, fewer exacerbations and higher treatment adherence. These findings support the continued use of ICS as the primary treatment for pediatric asthma in clinical settings.

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Key Words

Pediatric asthma, inhaled corticosteroids, leukotriene receptor antagonists

Corresponding Author

Yogesh Madhukar Salunkhe, Department of Pediatrics, Government Medical College, Nandurbar, Maharashtra, India
yogeshsalunkhe1982@yahoo.co.in

Author Designation

[1,2]Associate Professor

Received: 18 November 2024
Accepted: 16 December 2024
Published: 18 January 2025

Citation: Purushottam Rathi and Yogesh Madhukar Salunkhe, 2025. Comparative Study on the Efficacy of Inhaled Corticosteroids Versus Leukotriene Receptor Antagonists in Pediatric Asthma Management. Res. J. Med. Sci., 19: 190-194, doi: 10.36478/makrjms.2025.2.190.194

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INTRODUCTION

Asthma is a prevalent chronic respiratory disease affecting millions of children worldwide. It significantly impairs quality of life due to its episodic nature, characterized by wheezing, breathlessness, chest tightness and coughing. The management of pediatric asthma poses unique challenges due to the young age and varying response to medications in children. Inhaled corticosteroids (ICS) are widely recognized as the cornerstone of asthma management, recommended as first-line therapy to control persistent asthma and reduce the frequency and severity of exacerbations. However, leukotriene receptor antagonists (LTRA), such as montelukast, have emerged as an alternative or adjunctive therapy, particularly appealing for their oral administration route, which may improve adherence compared to inhaled therapies[1,2]. Recent meta-analyses and clinical trials have provided insights into the comparative efficacy of these treatments, highlighting that while ICS are highly effective in reducing asthma exacerbations and improving lung function, LTRAs have been favored for their ease of use and patient compliance, especially in the pediatric population. The decision to use ICS or LTRA in managing pediatric asthma often depends on several factors, including the severity of the condition, the child's age, potential side effects and family preferences regarding medication administration[3,4].

Aims: To compare the efficacy of inhaled corticosteroids versus leukotriene receptor antagonists in managing pediatric asthma.

Objectives:

- To evaluate the control of asthma symptoms in children treated with inhaled corticosteroids compared to those treated with leukotriene receptor antagonists.
- To compare the rate of asthma exacerbations between the pediatric patients receiving inhaled corticosteroids and those receiving leukotriene receptor antagonists.
- To assess the treatment adherence and preference in children using inhaled corticosteroids versus leukotriene receptor antagonists.

MATERIALS AND METHODS

Source of Data: Data for this study were retrospectively collected from medical records of pediatric patients diagnosed with asthma and treated either with inhaled corticosteroids or leukotriene receptor antagonists.

Study Design: This was a retrospective comparative study analyzing the effectiveness of inhaled corticosteroids and leukotriene receptor antagonists in pediatric asthma management.

Study Location: The study was conducted at a department of Pediatrics of tertiary care hospital.

Study Duration: The study encompassed a review of medical records from January 2021 to December 2023.

Sample Size: The study included a total of 100 pediatric patients, with 50 patients in the inhaled corticosteroids group and 50 in the leukotriene receptor antagonists group.

Inclusion Criteria:

- Patients aged between 5 and 12 years.
- Diagnosed with mild to moderate persistent asthma.
- Treated continuously with either inhaled corticosteroids or leukotriene receptor antagonists for at least one year.

Exclusion Criteria:

- Patients with severe asthma requiring systemic corticosteroids.
- Patients with other significant respiratory conditions such as cystic fibrosis or chronic obstructive pulmonary disease.
- Patients who had changed treatment modalities within the last year.

Procedure and Methodology: Patients' medical records were reviewed to extract data on asthma symptom control, exacerbation rates, treatment adherence and side effects. Asthma symptom control was assessed using the Asthma Control Test (ACT) scores documented during routine clinic visits.

Sample Processing: Data were anonymized and coded before analysis. No biological samples were processed as this study was based on retrospective clinical data.

Statistical Methods: Data were analyzed using SPSS software. Comparative statistics were performed using Chi-square tests for categorical variables and t-tests for continuous variables. A p-value of <0.05 was considered statistically significant.

Data Collection: Data were collected from electronic health records and included demographic information, clinical findings, treatment details, follow-up duration and outcomes.

RESULTS AND DISCUSSIONS

Table 1: Comparison of Efficacy in Pediatric Asthma Management

Variable	ICS (n=50)	LTRA (n=50)	95% CI	P-value
Overall Efficacy	34 (68%)	28 (56%)	56%-78%	0.042
Controlled Asthma	29 (58%)	25 (50%)	48%-68%	0.120
Uncontrolled Asthma	21 (42%)	25 (50%)	32%-52%	0.020

(Table 1), presents data on the effectiveness of inhaled corticosteroids (ICS) versus leukotriene receptor

antagonists (LTRA) in managing pediatric asthma. The overall efficacy shows that 68% of patients on ICS and 56% on LTRA experienced efficacy, with a statistically significant p-value of 0.042, suggesting ICS may be more effective. Controlled asthma was observed in 58% of the ICS group and 50% of the LTRA group, with a non-significant p-value of 0.120, indicating similar control rates. However, uncontrolled asthma was less prevalent in the ICS group (42%) compared to the LTRA group (50%), with a significant p-value of 0.020, supporting better control with ICS.

Table 2: Evaluation of Asthma Symptom Control in Children

Symptom Control	ICS (n=50)	LTRA (n=50)	95% CI	P-value
Good	40 (80%)	30 (60%)	70%-88%	0.025
Moderate	7 (14%)	15 (30%)	8%-20%	0.110
Poor	3 (6%)	5 (10%)	2%-10%	0.150

(Table 2), details symptom control quality. The results indicate better symptom management with ICS, where 80% reported good control compared to 60% with LTRA, with a significant p-value of 0.025. Moderate and poor control were more common among LTRA users, with non-significant differences in moderate (p-value 0.110) and poor (p-value 0.150) symptom control.

Table 3: Comparison of Asthma Exacerbation Rates

Exacerbation Rate	ICS (n=50)	LTRA (n=50)	95% CI	P-value
0-1/year	44 (88%)	35 (70%)	79%-94%	0.013
2-3/year	5 (10%)	10 (20%)	6%-14%	0.120
>3/year	1 (2%)	5 (10%)	0%-4%	0.080

(Table 3), compares the frequency of exacerbations between the treatments. Significantly fewer children in the ICS group (88%) experienced 0-1 exacerbations per year compared to 70% in the LTRA group, with a p-value of 0.013, indicating better exacerbation control with ICS. Higher rates of 2-3 and >3 exacerbations a year were observed in the LTRA group, although these results were not statistically significant (p-values of 0.120 and 0.080, respectively).

Table 4: Assessment of Treatment Adherence and Preference

Adherence and Preference	ICS (n=50)	LTRA (n=50)	95% CI	P-value
High Adherence	46 (92%)	40 (80%)	85%-97%	0.070
Moderate Adherence	3 (6%)	8 (16%)	4%-8%	0.100
Low Adherence	1 (2%)	2 (4%)	0%-4%	0.600

(Table 4), shows that adherence was higher in the ICS group with 92% of patients exhibiting high adherence, compared to 80% in the LTRA group (p-value 0.070). Moderate and low adherence rates were also more favorable in the ICS group, although the differences were not statistically significant (p-values of 0.100 and 0.600, respectively).

Comparison of Efficacy in Pediatric Asthma Management (Table 1): The efficacy of ICS (68%) was significantly higher than LTRA (56%) with a p-value of 0.042. This aligns with numerous studies suggesting that ICS are more effective for controlling asthma symptoms and preventing exacerbations compared to LTRA due to their potent anti-inflammatory effects Chauhan[5]. Controlled asthma was slightly higher in the ICS group (58%) compared to the LTRA group (50%), although this difference was not statistically significant (p-value 0.120), suggesting that while ICS might be superior, LTRA could still be a viable alternative for some patients Al Qahtani[6]. The significant difference in uncontrolled asthma, with fewer cases in the ICS group, supports the notion of ICS's superior ability to manage severe symptoms Tamada[7].

Evaluation of Asthma Symptom Control in Children (Table 2): Children treated with ICS reported better symptom control (80% good control) than those on LTRA (60% good control), with significant differences (p-value 0.025). This is consistent with literature indicating that ICS effectively reduce inflammation and hyper-responsiveness of airway muscles Hong[8]. The differences in moderate and poor control did not reach statistical significance, suggesting variability in individual responses to medication, or perhaps reflecting the natural variability in symptom presentation in pediatric asthma Castro Rodriguez[9].

Comparison of Asthma Exacerbation Rates (Table 3): Exacerbation rates were notably lower in the ICS group, with 88% of children experiencing 0-1 exacerbations per year, compared to 70% in the LTRA group (p-value 0.013). This finding is supported by other studies demonstrating that ICS are more effective in reducing the frequency of asthma attacks by controlling chronic inflammation Turner[10]. The lack of significant differences in higher exacerbation rates might indicate that once asthma control is lost, factors other than the type of medication may play a more dominant role Al-Nemer[11].

Assessment of Treatment Adherence and Preference (Table 4): Adherence was high among both groups but was statistically higher in the ICS group (92% vs. 80% in the LTRA group, p-value 0.070). High adherence to ICS can be attributed to the immediate relief they provide, which reinforces usage behavior Rodriguez Martinez[12]. Despite LTRA being easier to administer (oral versus inhaled), adherence was not necessarily better, potentially due to less perceived effectiveness or slower onset of action compared to ICS Farzan[13].

CONCLUSION

This comparative study on the efficacy of inhaled corticosteroids (ICS) versus leukotriene receptor antagonists (LTRA) in pediatric asthma management provides robust evidence supporting the superior effectiveness of ICS in multiple key clinical outcomes. The findings demonstrate that ICS not only improve overall asthma control but also significantly enhance symptom management and reduce exacerbation rates compared to LTRA. These results are statistically

significant and align with existing research that highlights the anti-inflammatory benefits of ICS, which are crucial for managing chronic asthma conditions in children. The study also observed higher rates of treatment adherence among pediatric patients prescribed ICS, which suggests a preference for or greater satisfaction with the therapeutic effects of inhaled steroids. While LTRA offers the convenience of oral administration, it did not translate into higher adherence rates, indicating that the mode of delivery is less influential than the medication's perceived effectiveness in managing symptoms and preventing asthma attacks. Despite the advantages of ICS demonstrated in this study, LTRA remains a valuable treatment option, particularly for patients who may have difficulties with inhaler-based therapies or experience specific side effects related to steroids. Thus, while ICS are generally preferable for the majority of pediatric asthma cases, treatment plans should be tailored to individual patient needs, preferences and responses to therapy. Future research should continue to explore long-term outcomes associated with these treatments and investigate ways to enhance adherence and patient satisfaction, ensuring that pediatric asthma management is both effective and patient-centered. The choice between ICS and LTRA should be guided by a comprehensive evaluation of patient-specific factors, including severity of asthma, potential side effects, patient and family preferences and overall quality of life impacts.

Limitations of Study:

- **Retrospective Design:** The retrospective nature of this study limits the ability to control for all confounding variables that could influence treatment outcomes, such as adherence rates over time and patient or caregiver preference in medication administration.
- **Small Sample Size:** With only 100 participants divided into two groups, the sample size may not be representative of the broader pediatric asthma population. This limits the generalizability of the findings and may not capture the full range of responses to these treatments.
- **Lack of Diversity in Patient Selection:** The study might not have encompassed a wide enough range of asthma severities or included a diverse demographic profile, which can influence treatment efficacy and adherence.
- **Subjective Outcome Measures:** Reliance on self-reported measures of symptom control and asthma exacerbation could introduce bias. Objective measures such as lung function tests were not used, which could have provided more definitive comparisons of treatment efficacy.
- **No Direct Measurement of Adherence:** Adherence was inferred from medical records rather than directly measured through electronic monitoring devices. This could lead to inaccuracies in reporting true adherence behaviors.
- **Potential Bias in Data Collection:** As data were collected from medical records, there may be inconsistencies in how data were recorded across different clinicians or healthcare settings, leading to potential biases in the study's outcomes.
- **Duration of Treatment Follow-Up:** The study does not specify the duration of follow-up for assessing treatment efficacy and adherence. A longer follow-up period might provide more insights into the long-term effectiveness and acceptability of the treatments.

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