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Original Research Article

CLINICAL EFFICACY OF DEXAMETHASONE VERSUS HYDROCORTISONE IN ACUTE EXACERBATION OF ASTHMA IN CHILDREN

IMTIAZ R[*1], YAMEEN S[2], HASSAN A[3], RAMZAN HS[4], NIZAMI SA[4], AYUB Z[5]

[1]*Department of Pediatrics Medicine, Children Hospital Lahore, Pakistan*
[2]*Department of Pediatrics, Medicine, Faisal Masood Teaching Hospital, Sargodha, Pakistan*
[3]*Department of Emergency, Massachusetts General Hospital, Boston*
[4]*Department of Biochemistry, University of Lahore, Pakistan*
[5]*Satti Muhammad Lohsar Complex AJK, Pakistan*
**Corresponding author email address:* rabiaismail9387@gmail.com

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ABSTRACT

Background: *Asthma is a prevalent chronic respiratory condition among children worldwide, significantly impacting their health, quality of life, and healthcare systems. Acute exacerbations of asthma require prompt and effective management to reduce morbidity.* ***Objective:*** *To compare the clinical efficacy and safety of dexamethasone versus hydrocortisone in children with acute asthma exacerbations.* ***Study Design:*** *Randomized controlled trial.* ***Setting:*** *Emergency Pediatric Medicine Department and General Medical Ward of the Children's Hospital, Lahore.* ***Duration of Study:*** *September 2024 to February 2025.* ***Methods:*** *Children aged 6–15 years presenting with acute asthma exacerbations were enrolled and randomly assigned to receive either dexamethasone or hydrocortisone. Baseline characteristics, including age, gender, weight, respiratory rate, oxygen saturation, asthma history duration, and initial FEV1, were recorded. The primary outcomes assessed included changes in respiratory parameters, duration of respiratory support, and length of hospital stay.* ***Results:*** *The study included 110 participants, with 55 patients in each group. The mean age was 9.5±3.45 years in the dexamethasone group and 9.4±2.91 years in the hydrocortisone group. Both groups showed comparable gender distribution (60% male and 58% male, respectively) and baseline characteristics. The mean respiratory rate was 32±4.2 bpm in the dexamethasone group versus 31±4.1 bpm in the hydrocortisone group, while oxygen saturation was 94±2% versus 93±2.4%, respectively. The mean hospital stay was shorter in the dexamethasone group (3.1 ± 0.9 days) compared to the hydrocortisone group (3.6 ± 1.1 days). Dexamethasone demonstrated faster improvement in respiratory parameters and earlier cessation of respiratory support.* ***Conclusion:*** *Dexamethasone is a more effective and convenient option than hydrocortisone for managing acute asthma exacerbations in children, offering faster clinical improvement and shorter hospital stays.*

Keywords: Acute Asthma, Dexamethasone, Hydrocortisone, Pediatric, Randomized Controlled Trial

INTRODUCTION

Asthma is one of the most prevalent chronic respiratory conditions affecting children worldwide, with significant implications for their health, quality of life, and healthcare systems. It entails inflammation and sensitization of the airways, and maneuvers in asthmatic individuals may result in acute severity of the signs and symptoms, including wheezing, coughing, shortness of breath, and chest constriction, generally termed as an acute exacerbation (1). Asthma exacerbation is one of the common reasons for children to visit the ED and be admitted to the hospital, particularly if adequate and timely medical management is not received. Thus, the identification and timely, proper treatment of these relapses are crucial issues in the treatment of childhood asthma (2). The anchors of managing exacerbation are bronchodilators and systemic corticosteroid courses. The role of bronchodilators in the management of acute exacerbation of COPD is to relieve the exacerbation symptoms of dyspnoea, cough, and wheeze. Beta-agonists, like beta-aggregation inhibitors, provide quick relief from bronchoconstriction, but corticosteroids have another specific function in reducing airway inflammation, thereby inhibiting the worsening of symptoms and facilitating the recovery process (3). Corticosteroids help treat asthma episodes; however, efficacy data vary across different investigations due to the varying anti-inflammatory activities of these compounds. Hydrocortisone, prednisone, and methylprednisolone are used frequently in the treatment of acute asthma (4). Although many of these corticosteroids are equivalent in mitigating moderate to severe asthma's chronic inflammation, their relative effectiveness in managing severe acute asthma is still uncertain. Furthermore, there are some reports that glucocorticoids may be associated with increased sensitivity and an increased risk of case reports of anaphylactic reactions (5). Dexamethasone and hydrocortisone are two variations of corticosteroids; chemical variations may alter their clinical usage. Dexamethasone is an orally active, long-acting prednisolone with a high glucocorticoid/mineralocorticoid ratio, thereby providing a good anti-inflammatory index of action with a low sodium-retaining effect (6). Its long half-life means it should be taken once a day, sometimes in a single dose, or in an extended-release formulation, which may increase compliance, especially among children who may not like taking several doses every time (7). On the other hand, hydrocortisone is a short-acting synthetic corticosteroid that possesses both glucocorticoid and mineralocorticoid properties. This formulation is typically administered intravenously due to its rapid action, making it preferable in severe cases, such as in asthmatics who require rapid control (8). However, there are no precise comparative clinical data available regarding the most appropriate form of corticosteroids for the management of preschool children with acute exacerbation of asthma. It depends on the frequency of the exacerbation, the choice of administration route, the need for a rapid onset of the therapeutic effect, and the potential side effects (9). However, there is a significant paucity of specific guidelines regarding the equipoise of dexamethasone compared to hydrocortisone in this application, particularly in terms of effectiveness, side effect profile, and sustained

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durability of the treatment. There is considerable literature available on the use of dexamethasone in PA with a special focus on patient acceptability, side effects, simplicity of dosing, and the potential problem of nonadherence (10). Likewise, oral and intravenous hydrocortisone have effectively controlled severe asthma symptoms due to its potent anti-inflammatory effects. Nevertheless, the effects of these corticosteroids on side effects, particularly growth effects, metabolic effects, and adrenal suppression, remain a concern and require further study. Asteroid-induced acute severe exacerbation of asthma, which constitutes a medical emergency, can worsen and have serious repercussions. Two specific corticosteroids, dexamethasone and hydrocortisone, are administered in the management of acute severe asthma. A few of these investigations have suggested that these treatments may not be equivalent in efficacy to those in Australia; however, more such trials are required, particularly among the local populace (11). To compare the clinical efficacy and safety of dexamethasone versus hydrocortisone in children with acute asthma exacerbations.

METHODOLOGY

This randomized controlled trial was conducted at the Emergency Pediatric Medicine Department and General Medical Ward of the Children's Hospital Lahore from September 2024 to February 2025. The study population consists of children aged 6–15 years who visit the emergency department with acute asthma exacerbations and known asthmatic patients, presenting with acute exacerbation of asthma.

Presence of chronic lung diseases other than asthma. Comorbidities such as cardiac diseases. Requiring life-threatening asthma intervention at the time of admission. History of repeated corticosteroid use within the past four weeks.

The study involved 110 patients, with 55 patients in each group.

Data collection began with obtaining written informed consent from the guardians of all participants. Baseline demographic and clinical details, such as age, gender, weight, asthma history, and initial respiratory parameters, were recorded. Clinical monitoring continued throughout the intervention period to track progress and measure the predefined outcomes. The sample size consisted of 110 patients, divided equally into two groups of 55 patients each. Randomization was performed using a computer-generated sequence to ensure an unbiased allocation of participants into the intervention groups.

Group A: Dexamethasone was administered intravenously at a dose of 0.6 mg/kg (maximum 12 mg) as a single daily dose for two consecutive days.

Group B: Hydrocortisone was administered intravenously at a dose of 8–10 mg/kg/day, divided into four equal doses daily, for two days.

Group A received dexamethasone intravenously at a dose of 0.6 mg/kg (maximum 12 mg) as a single dose daily for two days. Group B received hydrocortisone intravenously at a dose of 8–10 mg/kg/day, divided into four equal doses daily for two days. These interventions were designed to assess the effectiveness of two corticosteroids commonly used in the treatment of acute asthma exacerbations. The primary outcomes assessed included improvement in respiratory function, cessation of respiratory support (if required), and length of hospitalization. Respiratory parameters, including respiratory rate, oxygen saturation, and symptom resolution, were monitored at baseline and regular intervals during the intervention.

Data were analyzed using SPSS v27. Continuous variables, such as length of hospitalization, were expressed as mean ± standard deviation and compared using t-tests. Categorical variables, such as cessation of respiratory support, were analyzed using chi-square tests. A p-value of less than 0.05 was considered statistically significant. 1.09.

RESULTS

The study included a total of 110 participants, with 55 patients in each group. The mean age was 9.5±3.45 years for the dexamethasone group and 9.4±2.91 years for the hydrocortisone group, with comparable distributions of males and females (60% male and 58% female in each group, respectively). Both groups had similar baseline characteristics, including weight, respiratory rate, oxygen saturation, asthma history duration, and initial FEV1. The mean respiratory rate was 32±4.2 bpm in the dexamethasone group and 31±4.1 bpm in the hydrocortisone group. The mean oxygen saturation was 94±2% in the dexamethasone group and 93±2.4% in the hydrocortisone group. Dexamethasone showed a greater improvement, with a reduction in respiratory rate from 32 bpm to 22 bpm ($p < 0.01$), compared to hydrocortisone's reduction from 31 bpm to 23 bpm ($p < 0.01$). The cessation of respiratory support was more frequent in the dexamethasone group, with 82% of patients no longer requiring support, compared to 69% in the hydrocortisone group ($p = 0.03$). Additionally, the length of hospitalization was shorter in the dexamethasone group (3.1 ± 0.9 days) compared to the hydrocortisone group (3.6 ± 1.1 days), with a statistically significant difference ($p = 0.02$). At baseline, Group A (Dexamethasone) had a mean respiratory rate of 32 bpm, and Group B (Hydrocortisone) had a mean respiratory rate of 31 bpm. By Day 1, the respiratory rates in Group A and Group B had decreased to 27 bpm and 26 bpm, respectively. On Day 2, Group A further improved to 22 bpm, while Group B improved to 23 bpm. Regarding cessation of respiratory support, 64% of patients in Group A (35/55) no longer required respiratory support by Day 1, compared to 55% in Group B (30/55). By Day 2, 82% of patients in Group A (45/55) had ceased respiratory support, while 69% of patients in Group B (38/55) were no longer dependent on respiratory support. The mean length of stay for patients in the Dexamethasone group was 3.1±0.9 days, while the Hydrocortisone group had a mean length of stay of 3.6±1.1 days. This indicates that patients in the dantrolene group had a shorter hospital stay compared to those in the Hydrocortisone group.

Table 1: Demographic and Baseline Characteristics

Category	Dexamethasone Group	Hydrocortisone Group
Number of Patients	55	55
Mean Age (years)	9.5±3.45	9.4±2.91
Gender - Male (%)	60	58
Gender - Female (%)	40	42
Mean Weight (kg)	28.3	27.9
Mean Respiratory Rate (bpm)	32	31
Mean Oxygen Saturation (%)	94	93
Asthma History - Duration (years)	5.4±1.09	5.2±1.81
Initial FEV1 (%)	65	63

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Table 2: Primary Outcomes

Outcome	Group A (Dexamethasone)	Group B (Hydrocortisone)	p-value
Improvement in Respiratory Rate	32 bpm → 22 bpm ($p < 0.01$)	31 bpm → 23 bpm ($p < 0.01$)	0.47
Cessation of Respiratory Support	45/55 patients (82%)	38/55 patients (69%)	0.03
Length of Hospitalization (Days)	3.1 days (SD = 0.9)	3.6 days (SD = 1.1)	0.02

Table 3: Respiratory Rate Improvement

Time Point	Group A (Dexamethasone) - Respiratory Rate (bpm)	Group B (Hydrocortisone) - Respiratory Rate (bpm)
Baseline	32	31
Day 1	27	26
Day 2	22	23
Cessation of Respiratory Support	Group A (Dexamethasone)	Group B (Hydrocortisone)
Day 1	35/55 (64%)	30/55 (55%)
Day 2	45/55 (82%)	38/55 (69%)

Table 4: Length of Hospitalization

Group	Mean Length of Stay (Days)	Standard Deviation
Dexamethasone	3.1	0.9
Hydrocortisone	3.6	1.1

DISCUSSION

This study aimed to evaluate and compare the clinical efficacy of dexamethasone and hydrocortisone in managing acute asthma exacerbations in children. The results also show that both corticosteroids are equally effective in increasing lung function, decreasing the need for respiratory support, and shortening the length of stay. Nevertheless, dexamethasone showed better efficacy in terms of recovery, as evidenced by improved respiratory rate and oxygen saturation, which do not require ongoing respiratory support, and a shorter mean duration of hospital stay (12). Perhaps the most striking discovery was that the symptoms resolved much faster in the group of patients who received dexamethasone. The above result may be ascribed to the fact that dexamethasone has a longer half-life and higher anti-inflammatory efficiency than hydrocortisone (13). Compliance has also always been an integral part of treatment adherence. Compared to a greater number of doses, a single-dose regimen with dexamethasone has been more effective, particularly in pediatric populations. Although hydrocortisone also produced substantial improvements in respiratory indices, the drug has a short half-life, and the requirement for multiple doses per day might account for the somewhat inferior results in some respects (14). However, it is a viable treatment modality useful in situations where a rapid intravenous administration is possible for severe scenarios. Thus, the incidence of side effects was almost equal in both groups; however, the level of impact was low, with nausea and headache being mentioned most often by the patients (15). Notably, there were no adverse experiences, such as anaphylaxis, associated with either treatment, which explains the safety of both treatments for pediatric patients. However, it should be noted that any corticosteroid administration may lead to various adverse outcomes in the long run, including growth and adrenal suppression; these aspects were not studied in this work and require further investigation (16). These results are supported by prior literature explaining the effectiveness of corticosteroids in treating acute asthma attacks and the benefits associated with using dexamethasone as a less burdensome treatment (17). Nonetheless, slight differences in the effectiveness of the two drugs highlight the importance of developing a more personalized approach to treating COPD patients, considering aspects such as the severity of exacerbations, delivery methods, and potential side effects (18). Additionally, the relative exclusion of patients with various comorbidities or those who had previously received repeated corticosteroids may limit the generalizability of the results in some ways.

CONCLUSION

It is concluded that dexamethasone is a more effective and convenient option than hydrocortisone for managing acute asthma exacerbations in children, as it demonstrated faster improvement in respiratory parameters, earlier cessation of respiratory support, and shorter hospital stays. Both corticosteroids were well-tolerated with no serious adverse effects.

DECLARATIONS

Data Availability statement
All data generated or analyzed during the study are included in the manuscript.
Ethics approval and consent to participate
Approved by the department Concerned. (IRBEC-CHL-02001/23)
Consent for publication
Approved
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Not applicable

CONFLICT OF INTEREST

The authors declared the absence of conflict of interest.

AUTHOR CONTRIBUTION

RABIA IMTIAZ *(*Resident)
Conception of Study, Development of Research Methodology Design, Study Design, Review of manuscript, final approval of manuscript.
SANA YAMEEN *(*Resident)
Study Design, Review of Literature.
AHMAD HASSAN *(*Research Fellow)
Conception of Study, Final approval of manuscript.

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HAFIZA SOBIA RAMZAN (PhD Scholar)
Manuscript revisions, critical input.
SALEHA AKRAM NIZAMI (PhD Scholar)
Data entry, data analysis, and drafting articles.
ZAWAR AYUB (Medical Officer)
Coordination of collaborative efforts.

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