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Original Research Article

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

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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:*** *November 2023 to April 2024.* ***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 comprise acute severity of the signs, and symptoms including wheezing, coughing, shortness of breath, and chest constriction generally termed as acute exacerbation (1). Asthma exacerbation is one of the common reasons for children to visit the ED and admit to the hospital particularly if adequate and timely medical management is not received. Thus, the identification and the timely and adequate treatment of these relapses are an important issue of childhood asthma treatment (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-aggregation inhibitors like beta-agonists give quick relief from bronchoconstriction but corticosteroids have another specific function in the reduction of airway inflammation, inhibiting the worsening of the symptoms and helping in the recovery process (3). Corticosteroids are useful for treating asthma episodes, though efficacy data are discussed in different investigations due to the different 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 sensitive and constrain case reports of anaphylactic reactions (5). Dexamethasone and hydrocortisone are two variations of corticosteroids, chemical variations may alter their usage in clinical settings. Dexamethasone is an orally active long-acting prednisolone with a high glucocorticoid/mineralocorticoid ratio, thereby providing good anti-inflammatory index 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 normally given intravenously because of its fast action this makes it preferable in severe cases such as in asthmatics who need quick control (8). However, there are no clear 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 the administration route, the need in a fast onset of the therapeutic effect, and the possible side effects (9). However, there is a significant paucity of specific guidelines regarding the equipoise of dexamethasone as compared to hydrocortisone in this application in terms of effectiveness, side effect profile, and sustained durability of the treatment. There are considerable literature reviews available on the use of dexamethasone in PA with a special focus on patient

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acceptability, side effects, simplicity of dosing, and a potential problem of nonadherence (10). Likewise, oral and intravenous hydrocortisone have controlled severe asthma symptoms well because of its potent anti-inflammatory effects. Nevertheless, the influences of these corticosteroids on the side effects especially growth effects, metabolic effects, and adrenal suppression effects are still a problem and need more study. Asteroid-induced acute severe exacerbation of asthma which constitutes a medical emergency can worsen and have serious repercussions. Two particular corticosteroids: dexamethasone and hydrocortisone are administered in managing acute severe asthma. A few of these investigations have proposed that these treatments are not AU equivalent in efficacy, but more such trials are required such as in 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 during November 2023 to April 2024.The study population include children aged 6–15 years visiting the emergency department with acute asthma exacerbations. Aged between 6 and 15 years. 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 included 110 patients, divided equally into two groups of 55 each. Randomization was performed using a computer-generated sequence to ensure an unbiased allocation of participants into the intervention groups.

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

Group B: Hydrocortisone were 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 such as respiratory rate, oxygen saturation, and symptom resolution were monitored at baseline and at 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 a comparable distribution of males and females (60% male and 58% male 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 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 rate in Group A decreased to 27 bpm, and in Group B, it decreased to 26 bpm. 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 Dexamethasone 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

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

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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 instances of requirement of respiratory support, and shortening the length of stay. Nevertheless, dexamethasone showed a better efficacy in terms of recovery in respiratory rate and oxygen saturation do not require ongoing respiratory support and have a shorter mean duration of hospital stay (12). Perhaps, the most striking discovery arose from the fact that the symptoms have 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 and, compared to greater numbers 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, 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 – nausea and headache were mentioned by the patients most often (15). Notably, there were no adverse experiences ranked as serious such as anaphylaxis to either of the treatments explaining 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, small differences in the effectiveness of the two drugs reveal the significance of the development of a more personalized approach to the therapy of COPD patients, regarding aspects including severity of exacerbations, delivery methods and possible side effects (18). Also, the relative exclusion of patients with various comorbidities or who had previously received repeated corticosteroids may reduce 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
Funding
Not applicable

CONFLICT OF INTEREST

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

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