

Single-dose Dexamethasone versus multi-dose Prednisolone in the prevention of exacerbation and relapse in Asthmatic children; a Randomized Controlled Trial

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¹ Conception of study

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Analysis/Interpretation/Discussion

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^{1,3} Critical Review

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Abstract

Introduction: Asthma is a common chronic inflammatory disease of the airways characterized by reversible airflow obstruction, and bronchospasm. The first line of treatment in the management of acute asthma is inhaled beta 2 agonists (salbutamol). This study is designed to determine the effectiveness of intravenous dexamethasone compared to oral prednisolone in asthmatic children in preventing exacerbation and relapse. It may be more helpful in improving the quality of life of asthmatic children being a better convenient treatment modality.

Aim: To compare the frequency of relapse of asthma with dexamethasone and prednisolone in the treatment of asthma exacerbations in children.

Subject and Methods: This is a randomized controlled study that was conducted at the ICU of the Paediatric Department, Holy Family Hospital from 16th March 2016 to 15th September 2016. 468 patients with asthma exacerbation were selected in this study. Patients were randomly allocated into two groups. A total of 234 patients in group A were treated with single IV dose Dexamethasone and 234 in group B were treated with oral prednisolone. Baseline characteristics of children were recorded in the structured proforma along with signs and symptoms assessed through history, physical examination and PRAM (Paediatric Respiratory Assessment Measurement) Scoring. After treatment and assessment, the patients were discharged on day 5 and they were called back by the end of 2 weeks for the final follow up visit. In case of any relapse, they were clearly instructed to immediately return to the hospital which was recorded.

Results: The average age of the children 3.31 ± 0.97 years. There were 173(37%) females and 295(63%) males. The rate of relapse was significantly low in group A as compared to group B (9.8% vs. 17.9% $p=0.011$).

Conclusion: it is concluded that dexamethasone is an effective alternative to prednisone in the treatment of moderate acute asthma exacerbations in children, with the added benefits of improved compliance and cost.

Keywords: Asthma, Prednisolone, Relapse of dexamethasone.

Introduction

Asthma is a significant health problem worldwide, and it is one of the most common chronic diseases of childhood in many countries.¹ The prevalence in different countries ranges from 1 to 18 percent. In the United States, for example, asthma affects more than seven million children.²

Asthma is a common chronic inflammatory disease of the airways characterized by reversible airflow obstruction, and bronchospasm. Symptoms include wheezing, coughing, chest tightness, and shortness of breath. The diagnosis is clinical, made by physicians.³ Prevalence of asthma is increasing all over the world and is greater in children than adults.⁴

Prevalence rates for current asthma in children under age 18 years increased in the United States from 2001 to 2009 (8.7 to 9.7 percent) and then plateaued.⁵

Asthma is a major cause of morbidity and school absences³. Asthma exacerbations are the leading cause of emergency visits and hospitalization in children.⁶

A short course of systemic corticosteroids is an effective part of the management of acute asthma exacerbation. By reducing airway inflammation, steroids help manage acute symptoms and reduce bronchodilator use and relapse rates.⁷

The British Thoracic Society (BTS) Guidelines on the Management of Asthma (May 2008, revised January 2012) recommend commencing oral prednisolone early for children presenting with exacerbations of asthma and if discharged, continuing treatment, for up to three days.⁸

The first line of treatment in the management of acute asthma is inhaled beta 2 agonists (salbutamol) and is now the mainstay of treatment.

This study is designed to determine the effectiveness of intravenous dexamethasone compared to oral prednisolone in asthmatic children in preventing exacerbation and relapse. It may be more helpful in improving the quality of life of asthmatic children being a better convenient treatment modality.

Material and Methods

The study was conducted in admitted patients in the ICU of Paediatrics Department, Holy Family Hospital Rawalpindi from 16-03-2016 to 15-09-2016 (6-months). The study design was a randomized control trial.

468 patients with asthma exacerbation were selected in this study. Patients were randomly allocated into two groups. A total of 234 patients in group A were treated with single intravenous dose Dexamethasone and 234 in group B was treated with oral prednisolone. Baseline characteristics of children were recorded in the structured proforma along with the signs and symptoms assessed through history, physical examination and PRAM Scoring. After treatment and assessment, the patients were discharged on day 5 and they were called back by the end of 2 weeks for the final follow up visit. In case of any relapse, they were clearly instructed to immediately return to the hospital that was recorded. Inclusion criteria were as follows

- Children 2–5 years of age
- Both sexes
- Children presenting with moderate asthma exacerbation (PRAM Score 4–7) were included.

Patients who were fulfilling the criteria, admitted in Pediatric Ward Holy Family Hospital were divided randomly into two groups A and B by lottery method. PRAM score was assessed on day 0 before treatment, as baseline PRAM that was moderate for all children as specified in inclusion criteria. Group A was given single IV dose Dexamethasone at a dose of 0.6 mg/kg (Max 16mg) on day 0. Group B was given oral Prednisone at a dose of 2 mg/kg/day (Max 60mg) single dose for five days (day 0–5). Daily PRAM Scoring was done in both study groups from day 1–day 5 to assess the severity of exacerbation and occurrence of an episode of vomiting or discomfort. After treatment and assessment, the patients were discharged on day 5 and they were called back by the end of 2 weeks for the final follow up visit.

Data was entered and analyzed in SPSS version 19.0. A chi-square test was applied to compare the relapse rate within 2 weeks between groups. P-value ≤ 0.05 was taken as statistically significant.

Result

Four hundred and sixty-eight patients with asthma exacerbation were selected in this study. Patients were randomly allocated into two groups. A total of 234 patients in group A were treated with single IV dose Dexamethasone and 234 in group B were treated with oral prednisolone. The age distribution of the patients is shown in Figure 1. The average age of the children is 3.31 ± 0.97 years. The mean age with respect to groups is displayed in Table 1. There were 173(37%) females and 295(63%) male as shown in Figure 2.

The rate of relapse was significantly low in group A as compared to group B (9.8% vs. 17.9% $p=0.011$) as presented in Table 2. Stratification analysis, with respect to age groups, is showing that the rate of relapse was also low in group A than group B as shown in table 3 while the rate of relapse was not statistically significant between groups for 4 to 5 years of age group children (Table 4). Gender-wise stratification was performed and observed that in male cases there was no significant change while in female cases; the rate of relapse was also low in group A than group B as shown in Tables 5 and 6.

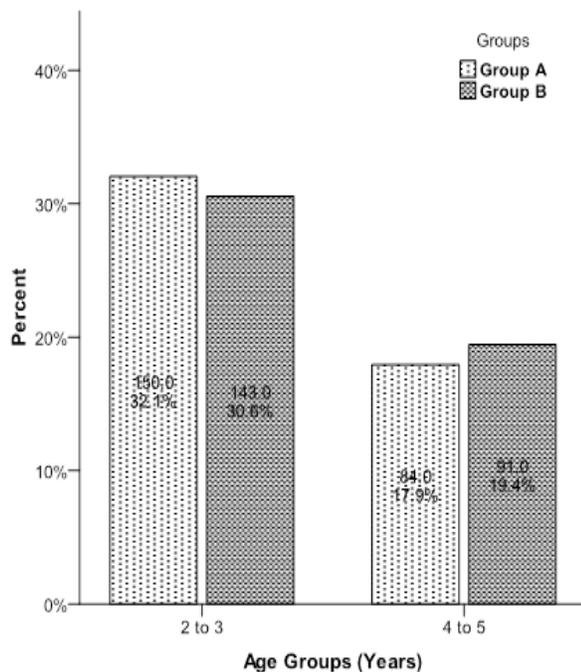


Figure 1: Age Distribution of the Patients

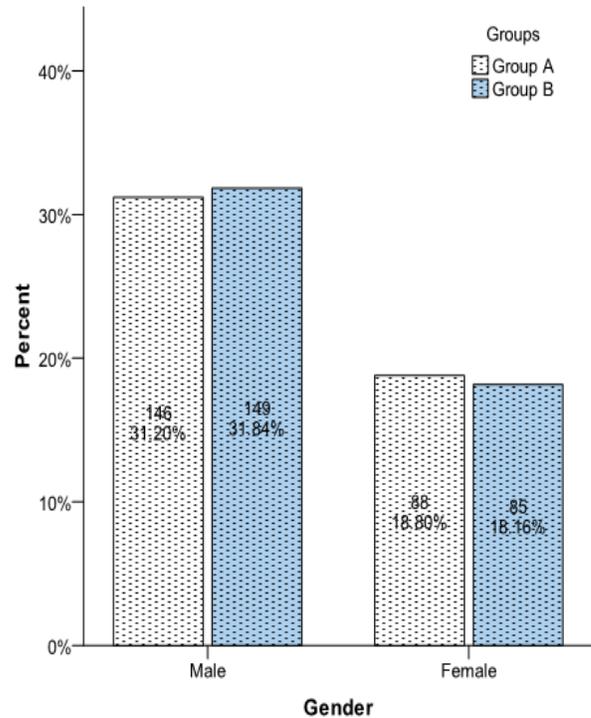


Figure 2: Gender Distribution of the Patients

Table 1: Descriptive Statistics of Age For Both Groups

Descriptive Statistics	Age (Years)	
	Group A	Group B
Mean	3.32	3.29
Std. Deviation	0.99	0.95
95% Confidence Interval for Mean	Lower Bound	3.20
	Upper Bound	3.45
Median	3.22	3.33
Interquartile Range	1	1
Minimum	2	2
Maximum	6	5

Table 2: Comparison of the frequency of relapse of dexamethasone prednisolone in the treatment of asthma exacerbation in children

Relapse	Group A n=234	Group B n=234	Chi-Square	P-Value
Yes	23(9.8%)	42(17.9%)	6.45	0.011
No	211(90.2%)	192(82.1%)		

Table 3: Comparison of the frequency of relapse between treatments of asthma exacerbation in children aged 2 to 3 years

Relapse	Group A n=150	Group B n=143	Chi-Square	P-Value
Yes	15(10%)	28(19.6%)	5.36	0.021
No	135(90%)	115(80.4%)		

Table 4: Comparison of the frequency of relapse between treatments of asthma exacerbation in children for 4 to 5 years of age

Relapse	Group A n=84	Group B n=91	Chi-Square	P-Value
Yes	8(9.5%)	14(15.4%)	1.36	0.24
No	76(90.5%)	77(84.6%)		

Table 5: Comparison of the frequency of relapse between treatments of asthma exacerbation in male children

Relapse	Group A n=146	Group B n=149	Chi-Square	P-Value
Yes	15(10.3%)	22(14.8%)	1.35	0.29
No	131(89.7%)	127(85.2%)		

Table 6: Comparison of the frequency of relapse between treatments of asthma exacerbation in female children

Relapse	Group A n=88	Group B n=85	Chi-Square	P-Value
Yes	8(9.1%)	20(23.5%)	6.64	0.010
No	80(90.9%)	65(76.5%)		

Discussion

Asthma is among the most common paediatric chronic diseases and a frequent reason for emergency department (ED) visits and hospitalization.⁹ There are various triggers of acute exacerbation of asthma. Bronchospasm and airway inflammation with edema and mucus production are key physiologic factors leading to clinical symptoms. One of the important mainstays in therapy for moderate to severe asthma exacerbations is a short course of systemic corticosteroids.¹⁰

Four hundred and sixty-eight patients with an asthma exacerbation aged from 2-5 years were selected in our study. The average age of the children was 3.31±0.97

years. There were 37% females and 63% males which demonstrate a higher prevalence of asthma in males. Osman et al.¹¹ showed that the prevalence of asthma per 100 populations was 9.8 for males and 7.3 for females at the age of 5 years. In general, the lifetime likelihood of developing asthma is about 10.5% greater in women than men.¹² When examined at specific time period, asthma is more common and more severe in pre-pubertal boys, with boys less than 18 years of age having a 54% higher rate of asthma than girls of the same age.¹²

In our study, the rate of relapse was significantly low in group A (single iv dose Dexamethasone) as compared to group B (oral prednisolone). In 2001, Qureshi et al.¹³ compared 2 days of dexamethasone (0.6 mg/kg daily; maximum 16 mg/d) to 5 days of prednisolone (1 mg/kg daily; maximum 60 mg/d). Dexamethasone had similar efficacy as measured by relapse rates, hospitalization rates, and the persistence of symptoms at 10 days. Altamimi et al.¹⁴ reported that a single dose of oral dexamethasone was no worse than a 5-day course of prednisone in mild or moderate asthma exacerbations. Gordon S et al.¹⁵ showed that a single intramuscular dose of dexamethasone did not result in meaningful differences in mean total asthma scores at 4-day follow-up for children discharged from the ED with moderate asthma exacerbation. Reviews of Cross et al.¹⁶ and Redman and Powell¹⁷ concluded that, according to the literature, dexamethasone and prednisone are of equal efficacy in treating pediatric asthma exacerbations.^{16,17}

In February 2014, a recent meta-analysis by Keeney et al. found the difference in relative risk of relapse between two groups (DEXA 6.6% vs prednisolone 3.6%) and suggested the use of single-dose dexamethasone as a viable alternative to a 5-day regimen of prednisolone.¹⁸ Recent studies have shown that a single dose of dexamethasone is as effective, if not more, as multi-dose prednisone with the added advantage of improved compliance.¹⁶

Kandasamy P. et al in their study conducted in 2018 concluded that a single dose of oral dexamethasone is as effective as 3 daily doses of prednisolone in children with moderate exacerbation of asthma.¹⁹ Cronin JJ et al revealed that in children with acute exacerbations of asthma, a single dose of oral dexamethasone is as effective as to a three-day course of oral prednisolone.²⁰ Paniagua N et al conducted a study in 2018 and they were of the opinion that two doses of dexamethasone may be an effective alternative to a 5-day course of prednisolone for asthma exacerbations.²¹ Grant E et al in their study conducted in 2014

emphasized that emergency physicians should consider a two-day dexamethasone regimen over 5-day prednisolone regimens for the treatment of acute asthma exacerbations.²² This is in accordance with our study results.

Conclusion

The current study of determining the effectiveness of dexamethasone compared to prednisolone in asthmatic children found that the rate of relapse was significantly low in group A (single IV dose of dexamethasone) as compared to group B (oral prednisolone). It is suggested that dexamethasone can be used as an effective alternative to prednisolone in the treatment of moderate acute asthma exacerbation in children with the added benefits of improved compliance and cost.

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