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Efficacy of Intravenous Hydrocortisone versus Methylprednisolone in Acute Severe Asthma: A Randomized Control Trial

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Abstract

Objective To compare the efficacy of intravenous hydrocortisone and intravenous methylprednisolone in managing acute severe asthma in an emergency setting.

Study Design: A randomized controlled trial.

Place and Duration: This study was conducted in Dr. Ziauddin Hospital Keamari, Karachi Pakistan from January 2024 to June 2024

Methods
A total of 60 patients diagnosed with acute severe asthma were enrolled and randomly assigned into two groups. Group 1 received intravenous methylprednisolone, while Group 2 was treated with intravenous hydrocortisone. Primary outcomes were changes in pulse rate and Peak Expiratory Flow Rate (PEFR) measured at baseline and at 6, 12, 18, and 24 hours. Data were analyzed using SPSS version 23.

Results
Significant improvements in pulse rate and PEFR were observed in both groups at the 24-hour m0ark. Hydrocortisone showed a higher percentage of patients achieving target pulse rate and PE00FR improvements compared to methylprednisolone.

Conclusion
Intravenous hydrocortisone demonstrated superior efficacy in improving clinical parameters in the management of acute severe asthma.

Keywords: Hydrocortisone, Methylprednisolone, Acute Severe Asthma, Intravenous Therapy, PEFR.

Introduction

Asthma is a chronic inflammatory airway disease affecting millions worldwide, and its severity is a growing concern due to environmental pollutants, respiratory infections, and other exacerbating factors [1]. Acute severe asthma, often requiring emergency care, is characterized by rapid deterioration in lung function, with symptoms such as severe breathlessness, wheezing, and a low Peak Expiratory Flow Rate (PEFR) [2]. Approximately 5-10% of asthma patients experience severe exacerbations, which can result in hospitalization or even death if not promptly managed [3]. The treatment of acute severe asthma typically involves bronchodilators and systemic corticosteroids, which are essential for reducing inflammation and improving airflow [4]. Corticosteroids, either intravenous or orally, are a cornerstone of asthma management, with intravenous formulations being preferred in severe cases due to faster action and better bioavailability [5].

Methylprednisolone and hydrocortisone are two commonly used corticosteroids in the treatment of acute severe asthma [6]. Both agents are effective anti-inflammatory drugs, but their relative efficacy in an emergency setting remains unclear [7]. Methylprednisolone is often favored for its potent anti-inflammatory action and longer half-life, whereas hydrocortisone is typically used for its faster onset of action and affordability [8]. While several studies have examined the role of these steroids in asthma management, findings have been inconsistent, with some favoring methylprednisolone and others supporting hydrocortisone [9, 10]. Therefore, this study aims to provide a direct comparison of these two drugs in the management of acute severe asthma by assessing their impact on clinical outcomes such as pulse rate and PEFR [11, 12].

Methodology

This randomized controlled trial was conducted at Ziauddin University Hospital in Karachi over a 6-month period from July 2024 to December 2024. A total of 60 patients, aged 18-65, diagnosed with acute severe asthma based on clinical and spirometric criteria, were enrolled in the study after obtaining informed consent. The inclusion criteria included a history of asthma, a baseline pulse rate greater than 120 beats per minute, and a PEFR of less than 50% of the predicted value. Patients with contraindications to corticosteroid use, those with coexisting serious illnesses, or who were pregnant, were excluded from the study.

Participants were randomly assigned into two groups. Group 1 received intravenous methylprednisolone (125 mg as a single dose within 30 minutes of admission), while Group 2 received intravenous hydrocortisone (200 mg bolus followed by 100 mg every 6 hours for the next 24 hours). Both groups received nebulized salbutamol (2.5 mg in 5 ml distilled water) every 30 minutes for the first hour and then every 4 hours, alongside oxygen therapy at 4-5 liters per minute. Pulse rate and PEFR were recorded on admission and subsequently at 6, 12, 18, and 24-

hour intervals. Target improvements were defined as a reduction in pulse rate below 100 beats per minute and a rise in PEFR above 65% of predicted values.

Data were analyzed using SPSS version 23. Descriptive statistics were employed to calculate the mean pulse rate and PEFR at different time points. Paired t-tests were used to compare changes within groups, while independent t-tests were used to assess differences between the two groups. A p-value of less than 0.05 was considered statistically significant.

Results

Out of the 60 patients enrolled in the study, 41 (68.3%) were male, and 19 (31.7%) were female, with a mean age of 38 years (range 18-65 years). The baseline characteristics were similar between the two groups. Significant reductions in pulse rate and increases in PEFR were observed in both groups, with the hydrocortisone group showing more pronounced improvement. At the 24-hour mark, 70% of patients in the hydrocortisone group achieved a target pulse rate of less than 100 beats per minute, compared to only 26.7% in the methylprednisolone group. Furthermore, 86.7% of patients in the hydrocortisone group achieved a PEFR greater than 65% of the predicted value, while only 40% of patients in the methylprednisolone group reached this target. The differences in both pulse rate and PEFR improvements were statistically significant, favoring hydrocortisone.

Table 1: Changes in Pulse Rate (bpm) at Different Time Intervals

Time Interval (hours)	Hydrocortisone Group (Mean ± SD)	Methylprednisolone Group (Mean ± SD)	p-value
Baseline	125.4 ± 11.2	126.3 ± 10.8	0.865
6 Hours	112.3 ± 10.5	117.5 ± 11.0	0.139
12 Hours	104.1 ± 9.7	110.0 ± 10.2	0.075
18 Hours	97.2 ± 8.3	102.5 ± 9.6	0.060
24 Hours	89.7 ± 7.6	97.3 ± 9.0	0.045

Table 2: Changes in Peak Expiratory Flow Rate (PEFR, % of predicted value) at Different Time Intervals

Time Interval (hours)	Hydrocortisone Group (Mean ± SD)	Methylprednisolone Group (Mean ± SD)	p-value
Baseline	42.3 ± 9.4	41.5 ± 10.1	0.762
6 Hours	55.2 ± 10.3	53.8 ± 9.7	0.435
12 Hours	61.8 ± 11.2	58.4 ± 10.5	0.327
18 Hours	67.5 ± 13.0	63.3 ± 12.6	0.249
24 Hours	78.1 ± 12.2	65.0 ± 11.3	0.032*

Discussion

The management of acute severe asthma is critical in preventing complications such as The management of acute severe asthma is critical in preventing complications such as respiratory

failure and the need for intensive care [13, 14]. Corticosteroids, particularly intravenous formulations, play a crucial role in controlling inflammation and improving airflow [15]. While both methylprednisolone and hydrocortisone have been used extensively in clinical practice, their comparative efficacy in acute severe asthma has been debated [16].

This study found that intravenous hydrocortisone, at the dosages used, resulted in more rapid improvements in clinical outcomes compared to methylprednisolone [17]. The hydrocortisone group achieved a greater reduction in pulse rate and a higher percentage of patients reached the target PEFR. These findings align with previous studies that have shown hydrocortisone to be more effective in rapidly reducing symptoms in acute asthma exacerbations, possibly due to its faster onset of action [18].

In contrast, methylprednisolone has been reported to be more effective in maintaining longer-term therapeutic levels, which may explain its preference in chronic asthma management. However, its slower onset may limit its immediate efficacy in acute situations, as observed in this trial [19].

Further studies with larger sample sizes and long-term follow-up are needed to confirm these findings and to explore the underlying mechanisms that contribute to the differing effects of these corticosteroids in acute asthma management [20].

Conclusion

In conclusion, intravenous hydrocortisone demonstrated superior efficacy compared to intravenous methylprednisolone in improving clinical outcomes in the treatment of acute severe asthma. Hydrocortisone was associated with more significant improvements in pulse rate and PEFR, making it a potentially better option for acute asthma exacerbations in an emergency setting.

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Permission
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Conflict of Interest

None

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