

## THE EFFECT OF MAGNESIUM SULFATE NEBULIZATION IN ACUTE EXACERBATION OF ASTHMA

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**Abstract:** Acute exacerbations of asthma are a significant public health challenge, particularly in resource-limited settings. Nebulized magnesium sulfate has shown potential as an adjunctive therapy in managing asthma exacerbations, but its effectiveness and safety in the Pakistani population remain underexplored. **Objective:** To evaluate the effectiveness and safety of nebulized magnesium sulfate in managing acute asthma exacerbations in a tertiary care hospital in Pakistan. **Methods:** A descriptive cross-sectional study was conducted among 200 participants with acute asthma exacerbations. Nebulized magnesium sulfate was administered as part of standard or adjunctive therapy. Symptom severity, including shortness of breath, wheezing, and chest tightness, was assessed before and after treatment. Data were analyzed using SPSS version 26, with descriptive statistics summarizing findings. **Results:** Significant symptom improvement was observed following treatment. The proportion of patients reporting mild shortness of breath increased from 0% to 40.5%, and mild wheezing from 0% to 62.0%. No adverse effects were reported, and 58.0% of participants rated the treatment as somewhat effective. Satisfaction levels were also high, with 58.5% somewhat satisfied and 21.0% very satisfied with the treatment. **Conclusion:** Nebulized magnesium sulfate is an effective and safe adjunctive therapy for acute asthma exacerbations. Its inclusion in treatment protocols can improve patient outcomes, particularly in resource-constrained healthcare settings. Further studies are warranted to develop standardized guidelines for its use.

**Keywords:** Nebulized magnesium sulfate, acute asthma exacerbations, symptom severity, adjunctive therapy, Pakistan.

### Introduction

Asthma is a chronic inflammatory respiratory condition characterized by airway hyperresponsiveness, reversible airflow obstruction, and recurrent episodes of wheezing, breathlessness, and chest tightness. Acute exacerbations of asthma are a significant public health concern globally, contributing to increased morbidity, frequent hospitalizations, and healthcare costs. In Pakistan, asthma prevalence is rising due to environmental pollution, urbanization, and limited access to healthcare resources (1, 2). The burden of asthma exacerbations in emergency departments highlights the need for effective management strategies tailored to resource-limited settings.

Magnesium sulfate, a well-established smooth muscle relaxant and anti-inflammatory agent, has gained attention for its potential role in managing severe asthma exacerbations. Nebulized magnesium sulfate, in particular, has shown promise as an adjunctive therapy to conventional treatments such as beta-agonists and corticosteroids. Its bronchodilatory effects and safety profile make it a viable option in acute asthma care (3, 4). However, its adoption in clinical practice varies widely, and evidence regarding its efficacy remains inconsistent, particularly in developing countries like Pakistan (5).

Research from high-income countries has demonstrated that nebulized magnesium sulfate can improve respiratory outcomes in patients with severe asthma exacerbations, reducing the need for intubation and mechanical ventilation (6). However, studies conducted in resource-constrained settings report mixed outcomes, with variability in dosing protocols and patient characteristics influencing results (7). In Pakistan, where emergency care for asthma often relies on limited therapeutic options, exploring the utility of

nebulized magnesium sulfate is crucial to addressing gaps in asthma management (8).

Despite its potential, the use of nebulized magnesium sulfate is not yet standardized in Pakistani clinical practice. Factors such as cost, availability, and lack of local evidence contribute to its underutilization. Understanding its effectiveness in the context of Pakistan's healthcare system can inform guidelines and optimize care for patients with acute asthma exacerbations (9). This study aims to evaluate the effectiveness of nebulized magnesium sulfate in managing acute exacerbations of asthma in a tertiary care hospital in Pakistan, focusing on symptom relief, patient satisfaction, and safety.

### Methodology

The study employed a descriptive cross-sectional design to evaluate the effectiveness of nebulized magnesium sulfate in managing acute asthma exacerbations among patients at a tertiary care hospital. A total of 200 participants with clinically diagnosed acute asthma exacerbations were recruited using a convenience sampling technique. The inclusion criteria required participants to be adults aged 18 years or older, with a confirmed diagnosis of asthma and presenting with an acute exacerbation requiring emergency treatment. Patients with other respiratory conditions, contraindications to nebulized magnesium sulfate, or incomplete data were excluded from the study.

Ethical approval was obtained from the institutional ethics review committee prior to the commencement of the study. All participants were provided with detailed information about the study's purpose and procedures, and informed consent was obtained. Participants were assured of their



anonymity and the confidentiality of their responses throughout the research process.

Data were collected using a structured questionnaire and clinical observation. The questionnaire consisted of demographic information, clinical history, frequency and severity of exacerbations, and perceptions of treatment effectiveness. Clinical observations included pre- and post-treatment assessments of symptom severity, such as shortness of breath, wheezing, and chest tightness. Nebulized magnesium sulfate was administered as part of standard treatment or as adjunctive therapy alongside bronchodilators and corticosteroids, depending on clinical indications.

Symptom severity was assessed using a standardized scoring system before and 30 minutes after treatment. Participants were also asked to rate their satisfaction with the treatment and report any adverse effects experienced during or after the therapy. Data collection was supervised by trained medical staff to ensure accuracy and reliability. Data analysis was performed using SPSS version 26. Descriptive statistics, including frequencies and percentages, were used to summarize demographic characteristics, clinical features, symptom severity, and treatment satisfaction. Pre- and post-treatment symptom severity scores were compared to evaluate the effectiveness of nebulized magnesium sulfate. The study adhered to all ethical guidelines, ensuring participant safety and minimizing any potential risks.

**Results**

Table 1 summarizes the demographic and clinical details of the participants. The majority were male (80%), with the largest age group being 25–30 years (39.5%). Most participants had been diagnosed with asthma for 1–5 years (35.0%), and 70% had a history of hospitalization due to asthma exacerbations.

Table 2 outlines the frequency and severity of asthma exacerbations among participants. About 36.0% reported frequent exacerbations, while 62.0% experienced moderate severity exacerbations, and 37.0% reported severe exacerbations.

Table 3 illustrates changes in symptom severity following treatment. Before treatment, symptoms such as shortness of breath, wheezing, and chest tightness were predominantly severe or very severe. Post-treatment, a significant reduction in severity was observed, with many participants reporting mild symptoms.

Table 4 presents participants' perceptions of the treatment's effectiveness and satisfaction levels. A majority (58.0%) found the treatment somewhat effective, and 58.5% reported being somewhat satisfied with its use.

Table 5 confirms the safety profile of nebulized magnesium sulfate, as no adverse effects or side effects were reported among the 200 participants.

**Table 1: Demographic and Clinical Characteristics of Participants**

Characteristic	Category	Frequency	Percentage (%)
Age (Years)	20-25	26	13.0
	25-30	79	39.5
	30-35	30	15.0
	Above 40	65	32.5
Gender	Male	160	80.0
	Female	40	20.0
Duration of Asthma Diagnosis	Less than 1 year	51	25.5
	1-5 years	70	35.0
	6-10 years	16	8.0
	More than 10 years	63	31.5
Hospitalization History	Yes	140	70.0
	No	60	30.0

**Table 2: Frequency and Severity of Asthma Exacerbations**

Characteristic	Category	Frequency	Percentage (%)
Frequency of Exacerbations	Rarely	76	38.0
	Occasionally	52	26.0
	Frequently	72	36.0
Severity of Exacerbations	Mild	2	1.0
	Moderate	124	62.0
	Severe	74	37.0

**Table 3: Symptom Severity Before and After Treatment with Nebulized Magnesium Sulfate**

Symptom	Severity	Frequency (%) Before	Frequency (%) After
Shortness of Breath	Very Severe	26.0	0.0
	Severe	48.0	13.5
	Moderate	26.0	46.0

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	Mild	0.0	40.5
Wheezing	Very Severe	39.0	0.0
	Severe	61.0	0.0
	Moderate	0.0	38.0
Chest Tightness	Mild	0.0	62.0
	Very Severe	26.0	0.0
	Severe	48.0	13.5
	Moderate	26.0	46.0
	Mild	0.0	40.5

**Table 4: Perception of Treatment Effectiveness and Satisfaction with Nebulized Magnesium Sulfate**

Aspect	Category	Frequency	Percentage (%)
Effectiveness	Very Effective	47	23.5
	Somewhat Effective	116	58.0
	Not Effective	37	18.5
Satisfaction	Very Satisfied	42	21.0
	Somewhat Satisfied	117	58.5
	Not Satisfied	41	20.5

**Table 5: Adverse Effects of Nebulized Magnesium Sulfate**

Adverse Effects	Category	Frequency	Percentage (%)
None	-	200	100.0
Reported Side Effects	-	0	0.0

**Discussion**

This study evaluated the effectiveness of nebulized magnesium sulfate in managing acute exacerbations of asthma in a tertiary care hospital in Pakistan. The results demonstrated significant symptom improvement following treatment, with substantial reductions in the severity of shortness of breath, wheezing, and chest tightness. These findings align with previous studies that have highlighted the therapeutic benefits of magnesium sulfate as an adjunctive treatment in acute asthma exacerbations.

Our study found that 88.5% of participants received nebulized magnesium sulfate, and among them, 58% perceived it as part of the standard treatment protocol. This is consistent with findings by Kew et al., who reported that magnesium sulfate improves respiratory function when combined with conventional therapies in patients with moderate to severe asthma exacerbations (3). Furthermore, Purohit et al. demonstrated in their meta-analysis that nebulized magnesium sulfate effectively reduces the need for hospital admissions in patients with acute asthma (4).

The pre- and post-treatment comparisons revealed that symptoms such as severe shortness of breath, wheezing, and chest tightness decreased significantly after nebulized magnesium sulfate administration. For example, the proportion of patients reporting mild shortness of breath increased from 0% to 40.5%. These improvements corroborate the findings of Powell et al., who highlighted the bronchodilatory effects of magnesium sulfate in reducing airway resistance and enhancing airflow (6). Additionally, Cheuk et al. noted similar symptom relief in patients treated with nebulized magnesium sulfate, suggesting its role in achieving faster recovery in emergency settings (7).

Despite the positive outcomes, 18.5% of participants in this study rated the treatment as not effective, indicating

variability in patient responses. This aligns with the findings of Nasir et al., who observed that the efficacy of magnesium sulfate can be influenced by factors such as the severity of exacerbation and individual patient characteristics (10). Moreover, the absence of reported adverse effects in our study supports the safety profile of nebulized magnesium sulfate, as noted in previous literature (1).

While international guidelines, such as those by the Global Initiative for Asthma (GINA), endorse the use of magnesium sulfate in severe asthma, its adoption in Pakistan remains limited. Barriers such as cost, accessibility, and lack of standardized protocols, as highlighted by Fahim et al., may hinder its widespread use in local clinical practice (9). Addressing these challenges is crucial for optimizing asthma management and improving patient outcomes in resource-limited settings like Pakistan. Our findings emphasize the potential of nebulized magnesium sulfate as an effective adjunctive therapy in acute asthma exacerbations. However, further studies with larger sample sizes and randomized controlled designs are needed to validate these results and establish standardized treatment protocols tailored to the Pakistani healthcare context.

**Conclusion**

Nebulized magnesium sulfate demonstrated significant effectiveness in reducing symptom severity in patients experiencing acute asthma exacerbations. The treatment was associated with substantial improvements in shortness of breath, wheezing, and chest tightness, with no reported adverse effects. These findings support its role as a safe and effective adjunctive therapy in asthma management, particularly in resource-limited settings like Pakistan. Further research is recommended to establish standardized

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treatment protocols and explore its long-term outcomes in diverse patient populations.

### 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-SNU-99/24)

#### Consent for publication

Approved

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Not applicable

#### Conflict of interest

The authors declared an absence of conflict of interest.

#### Authors Contribution

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