

## Effectiveness of Magnesium Sulphate in Acute Asthma

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### ABSTRACT

**Aim:** To study the effectiveness of Magnesium Sulphate in Acute Asthma.

**Study design:** It was a retrospective study.

**Place and Duration of Study:** The study was conducted at the Emergency Department Nishtar hospital Multan from January 2014 to January 2018.

**Methodology:** This study included 336 patients who had history of acute asthmatic exacerbations. They were given standard therapy for asthma prior to magnesium sulphate. Standard therapy included nebulized salbutamol, ipratropium bromide and systemic hydrocortisone. All the patients who had received standard therapy for asthma were given 4ml of 50% MgSO<sub>4</sub> (2g) diluted in 250 ml of normal saline slowly over 20 minutes. The patients who did not get stabilized were referred to Intensive Care Unit Nishtar hospital in Multan.

**Results:** A total number of n=336 patients were included in this study, both genders. Gender distribution revealed as 193(57.4%) males and 143(42.6%) females. The mean age of the patients was 42.85±9.18 years. The cured patients were 116(34.5%), 199(59.2%) were expired and 21(6.3%) were referred. The difference was statistically insignificant between the gender (p=0.355) and age (p=0.076) for the outcome.

**Conclusion:** Out of 336 patients, only 116 were cured. Expired cases were 199 and 21 patients were referred to a tertiary care hospital. So it can be concluded that magnesium sulphate plays no role in treatment of acute asthma.

**Keywords:** Magnesium Sulphate (MgSO<sub>4</sub>), Acute Asthma,

### INTRODUCTION

Asthma is a chronic inflammatory disorder of the lung airways. It is very common disease which is characterized by a variety of recurring symptoms, bronchospasm and obstruction of airflow<sup>1</sup>. The most common symptoms of asthma include coughing, wheezing, shortness of breath and tightness of chest<sup>2</sup>. These symptoms can manifest few times a day or week. The manifestation of symptoms varies in different people. Acute exacerbation of asthma is called acute asthma or previously known as status asthmaticus which does not respond to standard bronchodilators and corticosteroids<sup>3</sup>. This episode of airway obstruction is life threatening and a medical emergency. Histologically it is characterized by thickening of basement membrane and hypertrophy of smooth muscles of respiratory system. Asthma can be caused by various genetic and environmental factors like allergens and pollution<sup>4</sup>. It can also be caused by drugs like aspirin and beta blockers<sup>5</sup>. It can also be exercise induced. It is usually classified into atopic and non-atopic. Atopy refers to an allergic reaction. There is no cure for asthma. Best treatment is to avoid the triggers and inhale corticosteroids. Long acting beta agonists and antileukotrienes can also be used<sup>6</sup>. In severe cases intravenous corticosteroids can also be given<sup>7</sup>. In 2015, about 358 million people had asthma which caused the death of 397,100 people<sup>8</sup>. The rates of asthma have significantly increased since 1960s.

The standard treatment of asthma includes inhaled anticholinergic agents, beta2 agonists, short acting bronchodilators and corticosteroids. Magnesium sulphate (MgSO<sub>4</sub>) can also be a treatment option in the patients who do not respond to the above mentioned treatment and those with severe life threatening acute exacerbations<sup>9</sup>.

Magnesium sulphate is an inorganic salt which is used to treat and prevent different medical conditions like low blood magnesium and seizures in women with eclampsia<sup>10</sup>. It is also used in the treatment of constipation, torsades de pointes and asthma exacerbations. Magnesium sulphate can be used as an adjunct with mainline drugs to reduce the hospital stay and improve the pulmonary functions. Safety profile for intravenous MgSO<sub>4</sub> is high. There are minor side effects like flushing, dry mouth, malaise and numbness at the site of injection. The drug can possibly have an interaction with glucagon, potassium-sparing diuretics and calcium channel blockers like nifedipine. MgSO<sub>4</sub> should not be used in patients with cardiac conditions, myasthenia gravis and renal failure. This study was conducted to see the effect of magnesium sulphate (MgSO<sub>4</sub>) in acute asthma based on its outcomes.

### MATERIALS AND METHOD

The study was conducted at the BHU Qasim Bela Multan. It was a retrospective study which went on for a period of two years commencing from January 2016 to January 2018. Over this period of time, 336 patients suffering from asthma were included in this study. The technique used for sampling was non probability consecutive sampling technique. Ethical approval regarding this study was obtained from the Hospital Ethics Committee.

The study which was taken as a reference was conducted by Khaskheli MS. et al<sup>11</sup>. The variables under consideration were age and outcome. Outcome was denoted by the number of cured cases, number of expired cases and number of referred cases. Before admission to the hospital, most patients had a history of asthma and had received treatment with rescue or maintenance treatment at home. The magnesium sulphate MgSO<sub>4</sub> treatment was not given directly to the patients with acute exacerbation of asthma. They received standard therapy beforehand which included nebulized salbutamol and ipratropium bromide,

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and systemic hydrocortisone. As per recent recommendations, all the patients who had received standard therapy for asthma were given 4ml of 50% MgSO<sub>4</sub> (2g) diluted in 250 ml of normal saline slowly over 20 minutes<sup>12</sup>. The patients who did not get stabilized were referred to tertiary care hospital in Multan. The patients were followed through and the data was recorded in the form of cured, expired and referred cases.

The patients included in this study had a previous history of asthma and acute exacerbation attacks. They had received maintenance therapy at home or at a medical care facility. Both male and female patients were included in the study. The patients with a history of trauma and poisoning were not included. Patients who had received any surgical treatment and those who were on ventilatory support were also excluded.

The variables used for this study were age and outcome (cured, expired and referred). Gender and outcomes were presented in percentages and frequencies while age was presented as mean standard deviation. All the data was collected by the researcher himself on a preformed Performa. Data was analyzed using the software SPSS v.23. Chi square test was applied. p≤ 0.05 was considered significant.

Table II: Association of Outcome with Effect modifiers

Variable		Outcomes			Total	Chi-Square P-value
		Cured	Expired	Referred		
Gender	Male	72	111	10	193	0.355
	Female	44	88	11	143	
	Total	116	199	21	336	
Age	18-30 years	18	16	1	35	0.076
	31-55 years	98	183	20	301	
	Total	116	199	21	138	

**DISCUSSION**

Magnesium Sulphate has been used in managing acute asthma but its effectiveness is not supported by any hard evidence. A little number of studies has been conducted about the effectiveness of MgSO<sub>4</sub> in Asia-Pacific region. The mechanism of action of MgSO<sub>4</sub> in treating acute asthma is still unclear but some studies have helped explain its role. There is a possibility that MgSO<sub>4</sub> activates the sodium-calcium pumps in smooth muscles of respiratory system and blocks the release of calcium from endoplasmic reticulum which in turn lowers intracellular calcium levels. Another function of MgSO<sub>4</sub> is the inhibition of acetylcholine release and depression of muscle fiber excitability in cholinergic motor nerve terminals which in turn relaxes the bronchial smooth muscles<sup>13</sup>. Moreover, Magnesium Sulphate also inhibits calcium myosin interaction resulting into smooth muscle relaxation. Magnesium reduces the mediators of inflammation by stabilizing the T-cells and degranulation of mast cells<sup>14</sup>. It may also stimulate the synthesis of nitric oxide and prostacyclin, thereby directly reducing the severity of asthma<sup>15</sup>. We found out that the expired cases were a lot more than the cured cases even after the management of asthma with magnesium sulphate. The study was designed to find out the effectiveness of magnesium sulphate in treatment of acute asthma. Most of the previous studies were randomized control trials but we tried a different

**RESULTS**

A total number of n=336 patients were included in this study, both genders. Gender distribution revealed as 193(57.4%) males and 143(42.6%) females. The mean age of the patients was 42.85±9.18 years. The cured patients were 116(34.5%), 199(59.2%) were expired and 21(6.3%) were referred (Table I).

The difference was statistically insignificant between the gender (p=0.355) and age (p=0.076) for the outcome (Table II).

Table I: Demographic variables and outcomes

Variable	Data
<b>Gender</b>	
Male	(57.4%) n=193
Female	(42.6%) n=143
Total	<b>(100%) n=336</b>
Age (years)	42.85±9.18
<b>Outcomes</b>	
Cured	(34.5%) n=116
Expired	(59.2%) n=199
Referred	(6.3%) n=21
Total	<b>(100%) n=336</b>

approach. This was an outcome based study in a retrospective review. And we concluded that magnesium sulphate was ineffective in management of acute asthma.

A randomized, placebo controlled trial was conducted by Powell CV et al. to find out the effectiveness of nebulized magnesium sulphate in the adjunct therapy for acute asthma<sup>16</sup>. In this study, patients were given salbutamol and ipratropium bromide along with isotonic MgSO<sub>4</sub>. This study supports the use of nebulized MgSO<sub>4</sub> as an adjuvant to standard treatment for severe asthma. This study focused on children and it was concluded that magnesium sulphate may be clinically helpful along with salbutamol and ipratropium bromide. It was also noticed nebulized MgSO<sub>4</sub> has a greater effect in children with severe exacerbation of asthma with shorter duration of symptoms.

A study was conducted by Albuali WH. Et al. to look into the uses of inhaled and intravenous use of magnesium sulphate in the management of children with bronchial asthma<sup>(17)</sup>. The author recommended the use of intravenous MgSO<sub>4</sub> as effective and safe adjunct to standard bronchodilator therapy. He concluded that magnesium had an anti-inflammatory and bronchodilating effect and it improved respiratory functions. Similar results were concluded by Cheuk DK. et al<sup>(18)</sup> and Hughes R. et al<sup>19</sup>.

Not all the studies were in favor of magnesium sulphate being useful in acute asthma. Goodacre S et al.

conducted a double blind randomized control trial to compare magnesium sulphate with standard therapy for acute asthma<sup>20</sup>. The researcher suggested that nebulized magnesium sulphate had no role in management of acute asthma in adults while intravenous magnesium sulphate had a limited role at best. Aggarwal P et al compared nebulized magnesium sulphate and salbutamol combined with salbutamol alone for the treatment of acute asthma<sup>21</sup>. He concluded that magnesium sulphate had no role in treatment of acute asthma.

A study which was conducted by Levy Z et al. can be cited here in reference to the question that whether or not the use of magnesium reduces the need of hospitalization in people with acute asthmatic exacerbations<sup>(22)</sup>. It was concluded that magnesium sulphate, when given with standard therapies may result in slight reduction in hospital admission of adult patients suffering from acute exacerbations of asthma.

## CONCLUSION

Out of 336 patients, only 116 were cured. Expired cases were 199 and 21 patients were referred to a tertiary care hospital. So it can be concluded that magnesium sulphate plays no role in treatment of acute asthma. It may have some role in dilation of bronchial airways. And some studies show its effectiveness in treatment of asthmatic children. But there is no definite and authentic role whatsoever.

**Conflicts of Interest:** Nil

**Funding Source:** Nil

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