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Research Article

### THERAPEUTIC EFFICACY OF INTRAVENOUS VERSUS INHALED MAGNESIUM SULPHATE IN THE TREATMENT OF ACUTE ASTHMA

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**Abstract:**

**Background:** Asthma is the one of the most common chronic diseases afflicting man in the modern day world, leading to significant levels of morbidity and mortality if left uncontrolled. The use of Magnesium Sulphate (MgSO<sub>4</sub>) is among the many therapeutic agents used to manage acute exacerbations of severe asthma. The efficacy of intravenous, or inhaled MgSO<sub>4</sub> is encouragingly positive, however comparative data is scarce.

**Objective:** To compare the therapeutic efficacy of intravenous and inhaled magnesium sulphate in treatment of acute asthma.

**Methods:** This comparative analysis was carried out at the Dept. of Chest Medicine at Liaquat University Hospital (Hyderabad & Jamshoro) from January to December 2018 on a sample of 112 patients of both genders aged 18 and above (chosen via consecutive no-probability sampling) presenting to the study setting with acute exacerbation of asthma. After taking written informed consent from the study subjects, data was collected using a structured, interview based questionnaire containing inquiries about basic biodata, sociodemographic details and disease particulars. Inferences obtained from clinical evaluation, laboratory results and eventual therapeutic outcome of each of the methods of administration (intravenous and inhalation) was also noted. Randomization was done using a computer based software. The data obtained was analyzed using MS. Excel 360 and SPSS v. 21.0.

**Result:** Among the 112 patients, 63.4% were males, while the remaining 36.6 were females. The mean age of sample stood at 44 years (SD ± 13.11) and most (33.03%) of the subjects were aged 56 and above. The mean duration of acute exacerbatory distress, mean hospital stay, and post-intervention increase in peak expiratory flow rate was compared for each route of administration of magnesium sulphate.

**Conclusion:** Although both are known to yield significant improvement as compared to placebo, but after careful consideration and analysis of results, it can be concluded that there was no significant different between the therapeutic efficacy of each of the two methods of administration. The results of intravenous administration however yielded more encouraging result.

**Keywords:** Magnesium Sulphate, Intravenous Route, Inhalational Route, Acute Asthma & PEFr.

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**INTRODUCTION:**

The prevalence of asthma is rather high, with every one in ten adults and every 1 in three children are suffering from this ailment around the world. [1] During the last decade, the prevalence of this condition has risen further and continues to move at a steep trajectory upwards, leading researchs to forecast a grim future both at a personal and societal level for all around the world. [2] Despite the fair warnings and the already dismal condition, efforts directed towards control of asthma remain rather poor and thus hope for them to yield any solid benefits is dismal. [3]

In addition to the general management, the standard treatment protocol for this disease in acute conditions comprises of administration of numerous therapeutic agents such as short-acting bronchodilator (SAB),  $\beta_2$ -agonists, inhaled anticholinergic agents and corticosteroids. [4] Yet patients with moderate to severe acute asthma exacerbations, continue to suffer grim fates [5] such as repeated hospital admissions, [6] high morbidity and even mortality. [7] Numbers of studies suggest magnesium sulfate as an additional treatment option in patients resistant to standard therapy. [8, 9]

In smooth muscle, magnesium decreases intracellular calcium by blocking its entry and its release from the endoplasmic reticulum and activating sodium-calcium pumps. [10] Furthermore, inhibition of the interaction between calcium and myosin results in muscle cell relaxation. [11] Magnesium also stabilizes T cells and inhibits mast cell degranulation, leading to a reduction in inflammatory mediators. [12] In cholinergic motor nerve terminals, magnesium depresses muscle fiber excitability by inhibiting acetylcholine release. [13] Lastly, magnesium stimulates nitric oxide and prostacyclin synthesis, which might reduce asthma severity. [14]

Magnesium has been evaluated in both the intravenous and nebulized dosage form. [15] The aerosolized route offers the advantage of a quick onset of action and lower incidence of side effects. [16] Its disadvantages include a lower percentage of drug being delivered to the site of action and the patient requiring some respiratory effort to maximize its effectiveness. [17] The intravenous route provides direct access to the venous system, allowing the delivery of high drug concentrations. [18] The disadvantages include a cannula being sited and the drug being administered over 20 min. [19]

**METHODOLOGY:**

This comparative analysis was carried out at the Dept. of Chest Medicine at Liaquat University Hospital (Hyderabad & Jamshoro) from January to December 2018 on a sample of 112 patients of both genders aged 18 and above (chosen via consecutive no-probability sampling) presenting to the study setting with acute exacerbation of asthma.

After taking written informed consent from the study subjects, data was collected using a structured, interview based questionnaire containing inquiries about basic biodata, sociodemographic details and disease particulars. Inferences obtained from clinical evaluation, laboratory results and eventual therapeutic outcome of each of the methods of administration (intravenous and inhalation) was also noted. Randomization was done using a computer based software. The data obtained was analyzed using MS. Excel 360 and SPSS v. 21.0.

**RESULTS:**

Among the 112 patients, 63.4% were males, while the remaining 36.6 were females. The mean age of sample stood at 44 years (SD  $\pm$  13.11) and most (33.03%) of the subjects were aged 56 and above.

AGE GROUP (YEARS)	MALE	FEMALE	TOTAL
Up to 25	11 (9.82%)	2 (1.79%)	13 (11.61%)
26 to 35	9 (8.04%)	5 (4.46%)	14 (12.5%)
36 to 45	13 (11.6%)	7 (6.25%)	20 (17.86%)
46 to 55	17 (15.2%)	11 (9.8%)	28 (25%)
56 and above	21 (18.75%)	16 (15.72%)	37 (33.03%)

The mean duration of acute exacerbatory distress, mean hospital stay, and post-intervention increase in peak expiratory flow rate was compared for each route of administration of magnesium sulphate.

Variable	Pre-Intervention	Post-Intervention	
		Intravenous	Inhalational
PEFR (L/min)	208	297	225

Variable	Intravenous	Inhalational
Mean Hospital Stay	13 hours	19 hours
Mean Duration of Exacerbation	34 minutes	41 minutes

### DISCUSSION:

Our sample showed a predominance of elderly males presenting with acute exacerbation of asthma. This is synonymous with literature which shows that episodes of asthma become more severe with age, and with increasing age, the body's ability to handle acute exacerbations diminishes, and even milder acute attacks meriting emergency room visits and hospital admissions. [20, 21]

A variety of therapeutic agents are employed upon visiting the hospital, and as of late, magnesium sulphate is becoming a mainstay, with some administering in via the inhalational route to achieve a faster onset of action and quicker relief to the patient, however it comes at a cost. Large doses cannot be administered and patients presenting with more severe episodes often do not find much relief upon inhalational administration. While other resorting to intravenous administration to administer larger doses and achieve more stable results but often leading to morbidity and mortality owing to slower onset of action especially in exacerbations of very acute nature that merit very fast relief. [22, 23]

Research clearly shows that magnesium sulphate administration, regardless of what route is used, brings significant benefit to the patients and is recommended. However, much debate can be done on which route of administration is ideal. Each has its own advantages and disadvantages, but our research shows that the overall therapeutic efficacy of intravenous

administration is superior to inhalational administration. This is evident from all of the variables studied. [24, 25]

Intravenous administration of magnesium sulphate yielded better results in terms of improved peak expiratory flow rate within 90 minutes than inhalational administration of magnesium sulphate. Additionally, intravenous administration of magnesium sulphate reduced the mean number of minutes that patients had to struggle with the exacerbatory episode of asthma. Furthermore, it reduced the overall mean hospital stay required after each episode of asthma. [26, 27]

The study however lacked a prospective element so no follow-up could be carried out to determine the long term efficacy in terms of acute exacerbatory episodes in the immediate future and need for re-hospitalization.

### CONCLUSION:

Although both are known to yield significant improvement as compared to placebo, but after careful consideration and analysis of results, it can be concluded that there was no significant difference between the therapeutic efficacy of each of the two methods of administration. The results of intravenous administration however yielded more encouraging results.

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