The Internet Journal of Asthma, Allergy and Immunology
Volume 2 Number 1

Intravenous Magnesium Sulfate As An Adjunct In The Treatment Of Severe Asthmatic Patients Non-Responding To Conventional Therapy

K Bijani, A Moghadamnia, E Islami Khalili

Citation

K Bijani, A Moghadamnia, E Islami Khalili. *Intravenous Magnesium Sulfate As An Adjunct In The Treatment Of Severe Asthmatic Patients Non-Responding To Conventional Therapy*. The Internet Journal of Asthma, Allergy and Immunology. 2001 Volume 2 Number 1.

Abstract

Treatment of acute asthma is based on rapid reversal of bronchospasm and arresting airway inflammation. This study was done to determine the effect of IV MgSO4 for improvement of pulmonary function in patients with acute asthma non - responding to routine therapy presenting to the pulmonary department.
These randomized, double- blind, controlled study was conducted on patients (magnesium sulfate group, n=48, aged 12-85 years, 26 men, 22 women and control(saline) group, n=33, aged 15-80 years, 17 men, 16 women) who non-responding to routine treatment. Peak expiratory flow rate (PEFR) was done before MgSO4 (25 mg/kg) and normal saline (100 ml) as a baseline criteria and after infusion of drugs at 30 min and 3 hr. All patients were also given bronchodilators. The main outcome was PEFR. Data were analyzed by x2 and t-test and differences between each point, was considered significant at $p< 0.05$.
The Peak expiratory flow rate 3 hrs after baseline increased in MgSO4 group in comparison with saline group (82.60 5.8 versus 47.8 8.7 p=0.002). The number of breathing in MgSO4 was also increased at 30 min and 3 hr after baseline. Cyanosis, diaphoresis and using of respiratory accessory muscles by patients were decreased in MgSO4 in comparison with saline group. According to the results, it is suggested that MgSO4 can be as an adjunct agent for the treatment of patients with acute non-responding asthma.

INTRODUCTION

Despite advancing knowledge of the pathophysiology and treatment of asthma, its morbidity and mortality are on the rise ([1,2]). To help avert this trend, clinicians and patients must focus their attention on the early identification and treatment of asthma exacerbation. Management of severe acute asthma attacks sometimes brings difficulty to the physician ([3]). The goal of management of patients with respiratory failure is to restore then to a state of quiet breathing, without complication. This goal is often achieved by pharmacology alone ([4]). Brnochodilator management of acute severe asthma has evolved considerably in recent years. Beta–2 agonists have emerged as the single most potent class of bronchodilator available, and the inhalational route of administration has proven to be the most effective and least toxic method of delivery except among apneic or highly uncooperative patients ([5]). Some current treatment strategies have focused on intravenous (IV) magnesium sulfate (MgSO4) administration in some disease (3).

Magnesium sulfate as IV form has been suggested as a treatment for certain emergence conditions for more than 60 years and it is currently proposed to be beneficial in treating asthma, preeclampsia, eclampsia, myocardial infarction and cardiac arrhythmia ([6]). Intravenous magnesium sulfate has successfully been used in the treatment of acute asthma. There is some evidence that IV form of MgSO4 can provide additional bronchodilation when gives in conjunction with standard bronchodilating agent and corticosteroids ([7]). One of the important problem for clinicians is managing of drug-resistant disease and non-responding patients. This study was conducted to determine whether IV MgSO4, when used as part of a standardized treatment protocol can improved pulmonary function in non- responding patients to therapy with beta-2 agonists and corticosteroids, presenting to the our pulmonary department with exacerbation of asthma.

MATERIALS AND METHODS

This was a randomized, double –blind, controlled clinical trial. Asthmatics aged 12-85 years in acute exacerbation with

a peak expiratory flow rate (PEFR) less than 200 (l/min) having taken bronchodilators, corticosteroids and requiring assisted ventilation were included. All patients, who had not responded to treatment during next 6 hr, were selected for this investigation. They were randomized to receive treatment with MgSO4 (25 mg/kg, as MgSO4 group) and saline (100 ml normal saline, as placebo group). Drugs were given as infusion over the 30-45 minutes. For all patients peak expiratory flow, arterial blood gas (ABG), vital signs, rate of cyanosis and diaphoresis, and using respiratory accessory muscles were monitored before starting treatment (as baseline findings). In the start of MgSO4 or placebo patients were monitored continuously for 6 hr. MgSO4 solution and normal saline were coded and dispensed in identical containers. Decoding was done at the completion of the study. All the patients reserved oxygen, neubolized salbutamol, IV aminophyllin and corticosteroids. PEFR was the main outcome variable. Frothy-eight patients (aged 12-85 years, 26 men, 22 women) as sulfate group and thirty three patients (aged 15-80 years, 17 men, 16 women) as control group were studied. Data collected from this investigation, were analyzed using x^2 and t-test and difference between data was considered significant at $p<0.05$.

RESULTS

MgSO4 group showed early and significant improvement as compared to placebo group in PEFR at 30 min, and 3 hours after stopping the infusion (p= 0.00, 95%CI= 11.85, 27.77). The clinical asthma score also showed significant improvement in the MgSO4 group at 30 min and 3 hrs after stopping the infusion (p<0.0005). PEFR at baseline was similar in the two groups. 30 minutes after baseline (MgSO4 and saline) the mean (± SEM) increase in PEFR was greater in the MgSO4 group (62.81 ± 6.7) than in the normal saline group (46.52 ± 8.3). At 3hr, increase in peak flow was 82.6 ± 5.8 in the MgSO4 group compared with saline group (p<0.005, 95%CI= -55.8, -13.77). There was a significant difference in PEFR from initiation of the infusion to 30 min (p=0.00, 95%CI= -40.1, -22.55) and 3hrs later for the MgSO4 group (p=0.00, 95%CI= 11.85, 27.77). There was also a considerable decrease in number of breathing at base line, 30 min and 3hr in MgSO4 group (table 1). Patients in $MgSo_4$ group had been shown significant decrease in diaphoresis, cyanosis and using respiratory accessory muscles (table 2.)

Figure 1

Table 1. Mean ± SEM of peak expiratory flow rate and the number of breathing in MgSO4 and saline groups.

	Baseline (the time of zero)		30 min after infusion		3 hr after infusion	
	MgSo4	Saline	MgSo4	Saline	MgSo4	Saline
PEFR	31.46 ±5.6	30.00 ±5.9	62.81 ±6.7	46.52 ±8.3	82.60 ±5.8	47.8 ±8.
No. of breathing	34.38	35.1	27.21	33.20	24.42	30.22

Figure 2

Table 2. Frequency (%) of some variables in MgSO4 in comparison with saline group.

	Baseline		30 min		3 hr		p. value
	MgSo4	Saline	MgSo4	Saline	MgSo4	Saline	(X^2)
Diaphoresis	14 (29.2)	20(30.3)	4 (8.3)	14(21.2)	1 (2.10)	8(12.1)	0.02 (7.43)
Cyanosis	17 (35.4)	15(22.7)	3 (6.3)	13(19.7)	1(2.10)	8(12.1)	0.0003 (15.74)
Using Respiratory Accessory Muscles	48 (100)	27(40.9)	34 (78)	17(25.8)	11(22.9)	12(18.2)	0.06 (5.38)

DISCUSSION

According to the results, it is suggested that MgSO4 can improve the respiratory function in the non-responding patients with acute severe asthma presenting to the our pulmonary department. It could improve and increase the peak expiratory flow rate and decreases the number of breathing. The increase of PEFR was statistically significant in MgSO4 to else (saline) group, then magnesium sulfate appears to be safe and beneficial in patients who present with severe acute asthma. This finding could be supported with other studies ($_{1,3,4,7,8}$). Inhaled beta-2 agonists, oxygen and systemic conticosteroids are main stays of acute care drug management, whereas other data support the use of inhaled steroids, ipratropium bromide, magnesium sulfate ($_{9,10,11}$) and theophyllin (4). Assisted ventilation by face mask or intubated patients, a ventilatory strategy that prolongs exhalation time and accepts hypercapnia minimizes lung hyperinflation and generally results in a good outcome. Non-responding asthmatic patients are the important clinical problem for clinicians. Some studies suggested that administration of systemic corticosteroids and beta-adrenergic agonists are useful for those patients (5, 10). Authors suggested that MgSO4 could be used as an adjunct

agent in the treatment of acute asthma (10,[12]). MgSO4 was used as inhalation dosage form and as a vehicle for nebulized beta-2 agonists in acute asthma. It had shown therapeutic effectiveness in those cases (9,11). Many reports has shown that magnesium sulfate has certainly a role as an adjunct to traditional therapy in asthma and asthma-like conditions and has been helpful in the treatment of acute exacerbation of asthma (10). Intravenous MgSO4 may be useful when conventional treatment has failed (12, [13]). It seems clear that IV MgSO4 also is effective for the suppression of bronchial smooth muscle contractions. Children who treated with IV MgSO4 for moderate to severe asthma had significantly greater improvement in short-term pulmonary function without, any considerable alteration in blood pressure ([14]), suggesting a role for this agent as an adjunct in the treatment of such patients. Mg^{2+} is a natural calcium antagonist and intracellular Mg^{2+} is thought to modulate smooth muscle contractions and it is known to have a direct effect on calcium uptake, resulting in smooth muscle relaxation (10). Finally our data also supported previous studies ([15,16]) that MgSO4 is helpful for decrease of asthma complications. It seems that administration of MgSO4 in addition to improvement of pulmonary function and helpfulness in the treatment of our patients with acute non-responding asthma, can decrease admission rate in patients with acute severe asthma.

ACKNOWLEDGEMENT

The authors gratefully appreciate staffs and nursing group of Department Of Pulmonary, Shahid Beheshti General Hospital, Babol University Of Medical Sciences.

CORRESPONDENCE TO

Kh. Bijani, MD Pulmonary Ward Beheshti Hospital Sargord Ghasemi Street Keshvari Sq. Babol , Iran tel (+98)1112252071-2 E-mail : drbijani@altavista.com

References

1. Levy BD, Kitch B, Fanta CH. Medical and ventilatory management of status asthmaticus. Intensive Care Med 1998; 24 (2): 341-4.
2. Corbridge TC, Hall JB. The assessment and management of adults with status asthmaticus. Am J Respir Crit Care Med 1995; 151(5): 1296-316.
3. Curkan F, Haspolat K, Bosnak M, Dikici B, Dorman O, Ece A. Intrarvenous magnesium sulfate in the management if moderate to severe acute asthmatic children non-respoding to conventional therapy. Eur J Emerg Med 1999; 6(3): 201-5.
4. Gluckman TJ, Corbridge T. Management of respiratory failure in patients with asthma. Cuvr Opin Pulm Med 2000; 6(1): 79-85.
5. Moan MJ, Fanta CH. Bronchodilator therapy in the management of acute asthma. Compr Ther 1995; 21(8): 421-7.
6. Frakes MA, Richardson LE. Magnesium sulfate therapy in certain emergency conditions. Am J Emerg Med 1997; 15(2): 182-7.
7. Mangat HS, D'Souza GA, Jacob MS. Nebulized magnesium sulfate versus nebulized salbutamol in acute bronchial asthma: a clinical trial. Eur Respir J 1998; 12 (2): 341-46.
8. Nannini LJ, Pendino JC Corna RA, Mannarino S, Quispe R. Magnesium sulfate as a vehicle for nebulized salbutamol in acute asthma. Am J Med 2000; 108(3): 193-7.
9. Rodrigo C, Rodrigo C, Burschtin O. Efficacy of magnesium sulfate in acute asthma; a meta-analysis of randomized trails. Am J Emerg Med 2000; 16(2): 216-21.
10. Skotniki AB, Jablonski MJ, Musial JS. The role of magnesium in the pathogenesis and therapy of bronchial asthma. Przegl Lek 1997; 54(9): 630-3.
11. Meral A, Coker M, Tanac R. Inhalation therapy with magnesium sulfate and salbutamol sulfate in bronchial asthma. Turk J Pediatr 1996; 38(2): 169-75.
12. Bloch H, Silverman R, Mancherje N, Grants, Jagminas L, Scharf SM. Inteavenous magnesium sulfate as an adjunct in the treatment of acute asthma. Chest 1995; 107(6): 1576-81.
13. Swain R, Kaplan - Machlis B. Magnesium for the next millennium. South Med J 1999; 92(11): 1040-7.
14. Clarallo L, Saner AH, Shannon MW. Intravenous magnesium therapy for moderate to severe pediatric asthma; results of a randomized placebo - controlled trial. J Pediatr 1996; 129(6): 809-14.
15. Skorodin MS, Tenholder MF, Yetter B, Owen KA, Waller RF. Magenesium sulfate in exacerbations of choronic obstructive pulmonary disease. Arch Intern Med 1995; 155(5): 496-500.
16. Emelianova AV, Goncharova VA, Sinitisinga TM. Magnesium Sulfate in management of bronchial asthma. Klin Med Mosk 1996; 74(8): 55-8.

Author Information

Kh. Bijani, MD
Pulmonary Ward , Beheshti Hospital

A.A. Moghadamnia, PhD
Pharmacology Department , Babol University

E. Islami Khalili, MD
Pulmonary Ward , Beheshti Hospital