



ACUTE SEVERE ASTHMA IN CHILDREN; ROLE OF INTRAVENOUS MAGNESIUM SULFATE IN TREATMENT

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ABSTRACT... Objective: To compare the efficacy of intravenous magnesium sulfate and conventional treatment with conventional treatment alone in acute severe asthma in children of age group 5 to 15 years known cases of bronchial asthma. **Study design:** Randomized control trial. **Setting:** Indoor and outdoor patients of pediatrics department of DHQ hospital, Faisalabad. **Duration:** Six months. **Results:** In this study, 43.58%(n=17) in Exposed and 53.85%(n=21) in Un-exposed group were male and remaining 56.42%(n=22) and 46.15%(n=18) were females, mean pulse rate in both groups was recorded which shows 97.32 ± 6.58 in Exposed Group and 103.67 ± 8.32 in Un-exposed Group, p value was calculated as 0.02, mean FEV1 rate in both groups was recorded which shows 60.32 ± 7.56 in Exposed Group and 54.07 ± 6.43 in Un-exposed Group, p value was calculated as 0.03. **Conclusion:** We concluded that intravenous magnesium sulfate along with conventional treatment is significantly better than conventional treatment alone for the management of acute severe asthma attack.

Key words: Acute severe asthma, children, intravenous magnesium sulfate, conventional treatment, efficacy.

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INTRODUCTION

Asthma is a chronic inflammation of the airway mucosa, involving a complex interaction between T-lymphocytes, neutrophils, eosinophils, epithelial cells and mast cells.¹ It is characterized by variable and recurring symptoms, reversible airflow obstruction and bronchospasm. It is thought to be caused by a combination of genetic and environmental factors.²

The prevalence of asthma has increased significantly since the 1970s. Asthma is prevalent in 4-5 % of the population of developed countries and almost 27% of asthmatics presenting at emergency department require hospital admission.³ In 2009 asthma caused 250,000 deaths globally.⁴

An asthma attack is an acute exacerbation of

asthma. Its classic symptoms are respiratory difficulty, wheezing, coughing.⁵ It may be categorized as mild moderate or severe asthma attack.

An acute asthma attack is treated by use of inhaled bronchodilators such as beta2 agonist e.g Salbutamol. Anticholinergics like ipratropium bromide may provide additional benefits.^{4,5} Bronchodilators relieve respiratory symptoms by relaxing bronchial smooth muscles. Oral or inhaled corticosteroids may be used to reduce inflammation.⁴

Magnesium has a role in asthma but it is not clearly defined. In vitro studies have demonstrated that magnesium has a role in relaxation of bronchial smooth muscle cells.⁵

No previous local study has been conducted on role of intravenous magnesium sulfate in acute severe asthma attack in children. We are conducting this study to determine whether intravenous magnesium sulfate has a beneficial role in acute severe asthma attack so that it can be included in standard protocol of acute severe asthma attack management. Positive results of this study may help us to better manage acute severe asthma attack.

OBJECTIVES OF THE STUDY

The objective of the study was to:

- To compare the efficacy of intravenous magnesium sulfate and conventional treatment with conventional treatment alone in acute severe asthma in children of age group 5 to 15 years known cases of bronchial asthma.

OPERATIONAL DEFINITIONS

- Acute severe asthma attack was characterized by tachypnea (respiratory rate > 30), with any one of the following:
 - TACHYCARDIA : Pulse rate > 120 if aged over 5 years
 - Too breathless to talk
- **Efficacy** was determined in terms of pulse rate and FEV1 values from mean standard deviation. Pulse rate and FEV1 was taken before and at 120 minutes after intervention. Improvement was taken as pulse rate < or = 100. FEV1 was the volume of air expired in 1 second. It was taken by portable spirometer, spirolab3. It was a built in instrument, we put values in it like age, sex, height then performed spirometry and it gave predicted and % predicted FEV1 value of patient. Increase in FEV1% predicted value was compared between study and control group.

MATERIAL AND METHODS

Study design

Randomized control trial

Setting

Indoor and outdoor patients of pediatrics department of DHQ hospital, Faisalabad.

Study period & duration

Six months period starting from october2013 to march2014.

Sample size

By using WHO sample size calculator for 2 mean. Test value of population mean= 62.84(3), Anticipated population mean= 56.7(3), Pooled standard deviation= 8.11(3), Level of significance= 5%, Power of study= 90%, Sample size= 78, 39 patients in each group

Sampling type

Non-probability Consecutive sampling.

Inclusion Criteria

Children of either sex, of age group 5-15 year, having acute severe asthma diagnosed by presence of any one of following:

- TACHYPNEA: Respiratory rate > 30 if aged over 5 years
- TACHYCARDIA: Pulse rate > 120 if aged over 5 years

Too breathless to talk

Exclusion Criteria

Children having upper or lower respiratory tract infection:

- Diagnosed by fever and crepitations in chest on auscultation.
- Children with congenital or acquired heart disease:

Diagnosed by history of congenital or acquired heart disease and clinical findings like heart murmurs. Children with heart disease may have recurrent attacks of respiratory infection with wheezing due to respiratory infection or cardiac failure.

Children having respiratory failure:

- Respiratory failure was diagnosed by severe respiratory distress, low oxygen saturation, un-consciousness. As magnesium sulfate causes smooth muscle relaxation and hypotonia, in patients with respiratory failure it may cause collapse of respiratory tract and CNS depression.

Asthma with complications:

- Acute asthma may be severe due to complications such as pneumothorax.
- Pneumothorax is diagnosed by decreased chest movements, decreased air entry and hyperresonant percussion note on affected side. It was controlled only after treating complication.

DATA COLLECTION

78 Children of age group 5-15 years, of either sex having acute severe asthma were admitted from indoor and outdoor of pediatric department DHQ hospital Faisalabad. Acute severe asthma attack was confirmed by history and clinical examination. Children were excluded according to exclusion criteria. Risks and benefits of intravenous magnesium sulfate were discussed with the parents to take informed consent from them and approval of ethical committee was sorted.

Patients were divided equally into two groups, group A and group B, study and control group respectively. Each patient was enrolled in either group A or group B, by lottery method. Each patient in both groups was given conventional treatment of acute asthma attack with nebulized salbutamol every 20 min in a dose of 0.1 mg/kg for 1 hour, intravenous hydrocortisone stat dose of 10mg/kg and oxygen inhalation. Patients in group A were given intravenous magnesium sulfate in a dose of 25mg/kg, maximum 2.5g in 50 cc normal saline over 20 minutes. Patients in group B were given placebo normal saline 50 cc intravenously over 20 minutes. Condition of each patient was assessed and noted on proforma after 120 min. The criteria of efficacy was taken as improvement in pulse rate and FEV1 at 120 minutes after intervention.

DATA ANALYSIS

All the data was analysed by using SPSS version 10. Mean and standard deviation was calculated for all quantitative variables like age, FEV1, and pulse rate. Frequency and percentage were calculated for all quantitative variables like gender and efficacy. Independent sample t-test was efficacy. P-value less than 0.05 was taken as significant.

RESULTS

A total of 78 (39 in each group) were enrolled after fulfilling the inclusion/exclusion criteria to compare the efficacy of intravenous magnesium sulfate and conventional treatment with conventional treatment alone in acute severe asthma in children of age group 5 to 15 years known cases of bronchial asthma.

AGE DISTRIBUTION

Age distribution of the patients was done which shows 43.85%(n=21) in Exposed and 61.54%(n=24) in Un-Exposed Group while 46.15%(n=18) in Exposed and 38.46%(n=15) in Un-exposed group, mean±sd was calculated as 8.65±3.43 and 8.90±3.72 respectively. (Table-I)

GENDER DISTRIBUTION

Gender distribution of the patients was done which shows that 43.58%(n=17) in Exposed and 53.85%(n=21) in Un-exposed group were male and remaining 56.42%(n=22) and 46.15%(n=18) were females. (Table-II)

MEAN PULSE RATE

Mean pulse rate in both groups was recorded which shows 97.32±6.58 in Exposed Group and 103.67±8.32 in Un-exposed Group, p value was calculated as 0.02. (Table-III)

Age(in years)	Exposed Group (n=39)		Un-Exposed Group (n=39)	
	No. of patients	%	No. of patients	%
5-10	21	53.85	24	61.54
11-15	18	46.15	15	38.46
Total	39	100	39	100
Mean±SD	8.65±3.43		8.90±3.72	

Table-I. Age distribution (n=78)

Gender	Exposed Group (n=39)		Un-Exposed Group (n=39)	
	No. of patients	%	No. of patients	%
Male	17	43.58	21	53.85
Female	22	56.42	18	46.15
Total	39	100	39	100

Table-II. Gender distribution (n=78)

Mean Pulse Rate	Exposed Group (n=39)	Un-Exposed Group (n=39)
		97.32±6.58

Table-III. Mean pulse rate in both groups (n=78)

P value=0.02

MEAN FEV1 RATE

Mean FEV1 rate in both groups was recorded which shows 60.32±7.56 in Exposed Group and 54.07±6.43 in Un-exposed Group, p value was calculated as 0.03. (Table-IV)

Mean FEV1	Exposed Group (n=39)	Un-Exposed Group (n=39)
	60.32±7.56	54.07±6.43

Table-IV. Mean fev1 in both groups (n=78)

P value=0.03

DISCUSSIONS

In this study, we investigated the use of magnesium sulphate to determine role of intravenous magnesium sulfate in acute severe asthma attack so that it can be included in standard protocol of acute severe asthma attack management.

In our study, 43.85%(n=21) in Exposed and 61.54%(n=24) in Un-Exposed Group while 46.15%(n=18) in Exposed and 38.46%(n=15) in Un-exposed group, mean±sd was calculated as 8.65±3.43 and 8.90±3.72 respectively, 43.58%(n=17) in Exposed and 53.85%(n=21) in Un-exposed group were male and remaining 56.42%(n=22) and 46.15%(n=18) were females, mean pulse rate in both groups was recorded which shows 97.32±6.58 in Exposed Group and 103.67±8.32 in Un-exposed Group, p value was calculated as 0.02, mean FEV1 rate in both groups was recorded which shows 60.32±7.56 in Exposed Group and 54.07±6.43 in Un-exposed Group, p value was calculated as 0.03.

Our findings are in agreement with a study conducted in India in 2008, they recorded that in study group FEV1% predicted value at 120 minute was 62.84(10.2) and pulse rate at 120 min was 100(7.43). In placebo group FEV1% predicted value at 120 minute was 56.70(6.20) and pulse rate at 120 minute was 106.27 (8.34).³

Another study by Welman A Shrader investigated the use of magnesium and other nutrients in the treatment of both acute and chronic asthma and concluded that the use of intravenous treatment with multiple nutrients, including magnesium, for acute and chronic asthma may be of considerable benefit. Pulmonary function improved progressively the longer patients received treatment.⁶

Robert A. Silverman⁷ is of the view that administration of IV magnesium sulfate improves pulmonary function when used as an adjunct to standard therapy in patients with very severe, acute asthma.our study results also supports his views regarding magnesium sulfate.

Pullela Rama Devi and colleagues⁸ evaluated the effectiveness of early administration of intravenous Magnesium sulfate (IV MgSo4) in children with acute severe asthma not responding to conventional therapy, they recorded that MgSO₄ group showed early and significant improvement as compared to placebo group in PEFr and SaO₂ at 30 min and 1,2,3 and 7 hours after stopping the infusion (p ranging from <0.05 to <0.01). The clinical asthma score also showed significant improvement in the MgSO₄ group 1,2,3 and 11 hours after stopping the infusion (p <0.01) and concluded that addition of MgSO₄ to conventional therapy helps in achieving earlier improvement in clinical signs and symptoms of asthma and PEFr in patients not responding to conventional therapy alone.

The postulated mechanism of action of $MgSO_4$ is due to its modulatory role in calcium ion movement. Magnesium inhibits calcium uptake by cells thus inhibiting smooth muscle contraction.⁹⁻¹⁰

The hypothesis of this study that “In acute severe asthma attack in children the use of intravenous magnesium sulfate along with conventional treatment is significantly better than conventional treatment alone” is justified and in support with the other studies.

The limitation of the current trial was that we did not include any side effects of the therapy which may be done in next trials to further authenticate the current findings.

CONCLUSION


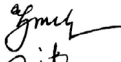

We concluded that intravenous magnesium sulfate along with conventional treatment is significantly better than conventional treatment alone for the management of acute severe asthma attack.

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REFERENCES

- Holgate ST. **Pathogenesis of asthma.** Clin Exp Allergy. 2008;38:872-97.
- Martinez FD. “**Genes, environments, development and asthma: a reappraisal**”. Eur Respir J. 2007;29:179–84.
- Silvio Torresa M.D., Nicolás Sticcoa M.D., Juan José Boscha M.D., Tomás Iolstera M.D., Alejandro Siabaa M.D., **Effectiveness of magnesium sulfate as initial treatment of acute severe asthma in children, conducted in a tertiary-level university.** Arch Argent Pediatr 2012;110(4):291-296 / 291.
- Saharan S, Lodha R, Kabra SK. **Management of status asthmaticus in children.** Indian J Pediatr. 2010;77(12):1417-23.
- Gontigo-Amaral C, Ribeiro MA, Gontijo LS, Condino-Neto A, Ribeiro JD. **Oral supplementation in asthmatic children: a double-blind randomized placebo-controlled trial.** Eur J Clin Nutr 2007;61:54–60.21.
- Shrader WA. **Short and long term treatment of asthma with intravenous nutrients.** Nutrition Journal 2004;3:6-10.
- BITTAR, Tânia Mara Baraky and GUERRA, Sérgio Diniz. **Use of intravenous magnesium sulfate for the treatment of severe acute asthma in children in emergency department.** Rev. bras. ter. intensiva [online]. 2012, vol.24, n.1.
- Pedersen SE, Hurd SS, Lemanske RF. **Global strategy for the diagnosis and management of asthma in children 5 years and younger.** Pediatr Pulmonol 2011;46(1):1–17.
- Altura BM, Altura BT, Carella A. **Magnesium deficiency induced spasms of umbilical vessels: Relation to preeclampsia, hypertension, growth retardation.** Science 1983;221:376-8.
- Robson AM. **Magnesium.** In: **Nelson Text Book of Pediatrics, 14th edn.** Eds. Behrman RE, Kliegman RM, Nelson WE, Vaughan VC. Philadelphia, WB Saunders Co, 1991, pp 185-6.

AUTHORSHIP AND CONTRIBUTION DECLARATION

Sr. #	Author-s Full Name	Contribution to the paper	Author=s Signature
1	Dr. Sumaira Irfan	Data collection	
2	Dr. Zahid Mahmood Anjum	Discussion writing	
3	Dr. Ali Asgher Taseer	References collection	
4	Prof. Hina Ayesha	Reviews and supervised whole study	