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Assessment of Magnesium Sulfate in Bronchospasm Treatment

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Original Article

Summary

Bronchospasm is one of the most feared emergencies during airway instrumentation. Magnesium sulfate, administered intravenously, has a bronchodilator effect by antagonizing calcium channels, inhibiting calcium-mediated muscle contraction, and promoting relaxation of bronchial smooth muscle. To assess the efficacy of intravenous magnesium sulfate in patients with bronchospasm during bronchoscopies an observational, cross-sectional study was conducted included 20 patients with bronchospasm, triggered by manipulation of the airway with a flexible bronchoscope, treated with magnesium sulfate 50 mg / kg, (maximum 2 g), intravenously for 5 min. Results revealed that men between 50-59 years (75%) predominated, all the patients were smokers, 15 patients were classified as ASA III physical state. They suffered bronchospasm of moderate intensity 60%, classified according to the clinic and SpO2 monitoring. In 75% of the patients, bronchospasm resolved after treatment without administering another drug. No adverse effects were recorded. No patient required orotracheal intubation for ventilation or required hospitalization for more than 8 hours. In conclusions, it the treatment of bronchospasm with magnesium sulfate constitutes a fast and effective pharmacological option, without adverse effects

Keywords: *Bronchospasm, Ventilation, Management, Magnesium Sulfate*

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1. INTRODUCTION

Inability to ventilate a patient is one of the most serious problems that anesthesiologists deal with in their daily practice. Among the reasons for this medical catastrophe is the inability to access the airway or the appearance of bronchospasm in response to the administration of some medication or due to a specific reaction of an affected airway.(1) Bronchospasm is a narrowing of the bronchial diameter, caused by the contraction of the muscles of the lung walls and by inflammation of the mucosa. These events are mediated by the parasympathetic autonomic system and acetylcholine is its main neurotransmitter. Patients with bronchial asthma and chronic obstructive pulmonary disease react easily to chemical and / or mechanical irritants, the latter includes approaching the upper or lower airway by orotracheal intubation or during bronchoscopy, with an incidence of bronchospasm in 64%. Bronchospasm can be diagnosed by the characteristic wheezing (usually more pronounced during expiration) and is associated with tachypnea and dyspnea in the awake patient. Severity should be determined by an objective measure of airway obstruction both by physical examination and by monitoring of partial oxygen saturation (SpO2). (2, 3)

The use of intravenous magnesium sulfate (MgSO4) in the treatment of bronchospasm in bronchial asthma dates back to 1936. The possible mechanisms of action attributed to it are: competing with Ca2 + in the entry of muscle cells smooth; inhibition of Ca2 + release by the sarcoplasmic reticulum; inhibition of histamine release by mast cells and inhibition of acetylcholine release from nerve endings. There has been no research on the use of magnesium sulfate for the treatment of bronchospasm triggered during the airway border. Therefore, the objective of the research is to evaluate the efficacy of intravenous magnesium sulfate in patients with bronchospasm during bronchoscopies. (4,5)

2. PATIENTS and METHODS

A cross-sectional study included 20 patients underwent bronchoscopy, under topical anesthesia with 2% lidocaine, presented bronchospasm of different degrees of intensity. All were treated with magnesium sulfate, 50 mg / Kg (maximum 2 g), intravenously, administered for 5 min. The preoperative consultation for outpatient flexible bronchoscopy within the period from the first of January 2021 to the end of March 2021, in the Outpatient

Surgery Department of our hospital.

The sample consisted of patients who presented bronchospasm during the diagnostic procedure, without contraindications for the administration of the study drug. A primary registry was created with the variables: age, sex, associated diseases, physical state according to the classification of the American Society of Anesthesiology (ASA). The intensity of bronchospasm (it was classified as mild (superficial dyspnea and isolated wheezing, with SpO2 between 91-95%), moderate (dyspnea when speaking, use of accessory respiratory muscles, auscultation of disseminated wheezing in both lung fields, and SpO2 between 85-90%) and severe (severe dyspnea, auscultatory silence and SpO2 <85%) and the time to resolution were the main variables (the time elapsed in minutes, from the administration of the drug and until its therapeutic effect appeared).

Statistical analysis

A database was arranged and entered to excel file, the operationalization of variables was carried out in the statistical program SPSS version 21, the frequency and percentage of all the variables analyzed were calculated. The relevant results are shown in contingency tables. All patients signed the informed consent for participation.

3. RESULTS

Older adult patients, between 60 and 69 years of age, predominated in the study, representing 35% of the sample analyzed. The patients included in the groups under 40 years of age were less represented, and they behaved similarly when registering only one patient, in each of them (Table 1). There was a predominance of male patients in 60% (12 patients), compared to the female who represented 40% of the sample (8 patients) (Figure 1).

Smokers represented 100% of the patients. Chronic obstructive pulmonary disease (COPD) was the main associated condition, reported by 75% of the patients analyzed, then arterial hypertension (40%), DM (10%), asthma (10%) and IHD in (5%) of the sample (Table 2).

The patients were distributed according to ASA. Of them, 75% were in the ASA III classification for being carriers of a severe respiratory disease. Of the total sample, 60% (12 patients) presented bronchospasm that was classified as moderate, based on the clinical picture and pulse oximetry values. Only three patients (15%) were diagnosed with severe bronchospasm (Table 3).

When evaluating the time elapsed between the administration of magnesium sulfate intravenously and the appearance of the therapeutic effect, it was recorded that the majority of patients (75%) had a rapid improvement before 15 min (table 4). No adverse effects associated with intravenous administration of magnesium sulfate were reported.

Table 1 Distribution of patients according to age groups (n = 20)

Age group	No.	%
20-29	1	5.0
30-39	1	5.0
40-49	3	15.0
50-59	4	20.0
60-69	7	35.0
70-79	4	20.0
Total	20	100.0

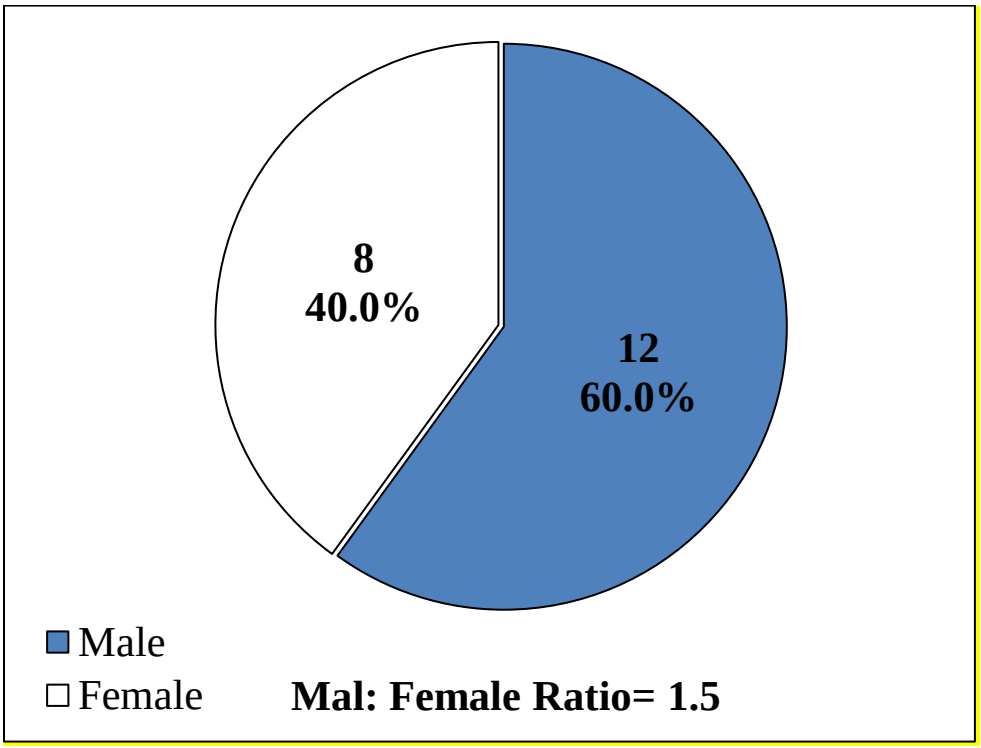

Figure 1: Gender distribution of the studied group with male to female ratio

Table 2 Distribution of patients according to associated diseases

Variable	**No.**	**%**
Smokers	20	100.0
COPD	15	75.0
Arterial HT	8	40.0
DM	2	10.0
Asthma	2	10.0
Ischemic heart disease	1	5.0

Table 3 Distribution of patients according to the intensity of bronchospasm

Bronchospasm	**No.**	**%**
Mild	5	15.0
Moderate	12	60.0
Severe	3	15.0
Total	20	100.0

Table 4: Time needed for therapeutic effect

Time	**No.**	**%**
<15 min	15	75.0
≥ 15 min	5	25.0
Total	20	100.0

4. DISCUSSION

In 2017, Powell C and others published a study on the use of magnesium sulfate as a treatment for bronchospasm, the sample was also made up of adults, but the ages fluctuated between 19-65 years. It differs that there was a greater range of ages in the patients studied. (6) Hirota K et al, conducted an investigation in 2012, where they administered magnesium sulfate as a treatment for bronchospasm in pediatric patients and reported good results in a total of 143 children. (7)

Powell C and others did not describe a similar distribution in terms of the sex of the patients analyzed because 64.3% (45 patients) were female, while 35.7% (25 patients) were male. Smoking was undoubtedly the main risk factor in the patients. (6) Studies have been published on the lung risks of smoking, but one of the most recent is by the Japanese Hirota and others, in 2018, who described that the airway of the smoker patient is more reactive to any stimulus and can more easily trigger complications such as laryngospasm or bronchospasm. (7) Pre-existing disease (COPD) should also be considered a risk factor that predisposed to perioperative respiratory failure, to be taken into account because perioperative respiratory events are the most important source of injury and are characterized by a high frequency of devastating effects. (8) The bronchodilator effect of magnesium sulfate has been described for the treatment of bronchospasm crises during exacerbations of bronchial asthma, but its use to treat bronchospasm triggered by manipulation of the airway has not been recorded. Mangat HS achieved resolution of bronchospasm after administering magnesium sulfate in patients who had not improved with the use of salbutamol. (9) Even Blitz and others described the option of using inhaled magnesium sulfate, with excellent results, during bronchospasm but always in patients with acute asthma. (10) The literature describes some adverse effects associated with the intravenous administration of magnesium sulfate, occasionally pain at the injection site and vasodilation with a sensation of heat. Rarely and only in the case of toxic doses, they have described flushing, hypotension, circulatory collapse and cardiac depression, central nervous system depression, sweating, hypothermia, and flaccid paralysis. (11)

5. CONCLUSIONS

The treatment of bronchospasm with magnesium sulfate constitutes a fast, and effective and safe pharmacological option, without serious adverse effects.

Ethical Clearance: Ethical clearance and approval of the study are ascertained by the authors. All ethical issues and data collection were in accordance with the World Medical Association Declaration of Helsinki 2013 of ethical principles for medical research involving human subjects. Data and privacy of patients were kept confidentially.

Conflict of interest: Authors declared none

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