Effect of magnesium sulfate on the hemodynamic changes by laryngoscopy and endotracheal intubation

Mehdi Dehghani Firoozabadi 1, Ahmad Ebadi 2*

1.Assistant Professor of Cardiac Anesthesiology MD, Department of anesthesiology, Shahid Sadoughi University of Medical Sciences-Yazd, Iran
2.Associate Professor of Cardiac Anesthesiology MD, Department of Cardiac Anesthesiology, Golestan Hospital, and Pain Research Center, Ahvaz Jundishapur Universityof Medical Sciences, Ahvaz, Iran
*Corresponding Author E-mail: Ebadi1959@ajums.ac.ir
Contact us :Ahvaz Jundishapur Universityof Medical Sciences, Golestan Hospital Cardiovascular Anesthesia, Ahwaz, Khuzestan, IRAN, Dr Ahmad Ebadi Telephone: +989161110099 Work Fax: +986113743017

Abstract: **Background**: Air way management by direct laryngoscopy and endotracheal intubation cause hemodynamic changes during analgesia. The researchers tried to reduce its effects that each of them has different success rate and still try to find a method or medicine to reduce these effects. Therefore, purpose of this study is to investigate Effect of magnesium sulfate on the hemodynamic changes by laryngoscopy and endotracheal intubation. **Method**: 90 patients in the age range 20-41 years old who were candid for elective surgery were selected in double blinded randomized, clinical trial study. All patients were is ASA class I and II. Patients were divided randomly to study and control groups then magnesium sulfate 20% (for study group) or normal saline (for control group) was administred. Systolic and diastolic blood pressure and pulse rate before and after analgesia and after laryngoscopy were recorded and then measured every 1 to 3 minutes. Data analysis was done by SPSS software. **Results:** There was no significant difference for change in diastolic blood pressure, systolic blood pressure and heart rate between the two groups($p>0.05$), except in diastolic blood pressure after laryngoscopy($p=0.002$).
Conclusion: magnesium sulfate cannot prevent hemodynamic responses caused by laryngoscopy and intubation.
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Introduction:

One of major problems in anesthesia is managing air way and endotracheal intubation is golden standard for securing patients' air way (1). Air way management by direct laryngoscopy and endotracheal intubation cause hemodynamic changes during analgesia (2) because during laryngoscopy and tracheal intubation larynges, tracheal and brunches stimulate with mechanical and chemical stimuli (3). Endotracheal intubation changes concentration of Catecholamine and increases stimulation and sympathetic activity which lead to arrhythmia, tachycardia and hypertension (4). In addition to hypertension, pulmonary wedge pressure occurs and increases risk of pulmonary edema and heart failure. Increasing intra-cranial pressure increases risk of cerebral hemorrhage(5). Increasing sympatho-adrenal activity in blood pressure and pulse rate is transient, variable and unpredictable (6) but it occurs more in those patients with diabetes, cardiac failure and brain diseases(7, 8), although increase in hemodynamic responses caused by laryngoscope and intubation is not preventable even with pre-hemindication(9). But in previous years there were more attempts in order to decrease hemodynamic responses caused by laryngoscope and intubation that some researchers tried to reduce its effects by techniques and some with pharmacological interventions (10-12). Among them we can refer to varied doses of opioids, direct acting vasodilators, adrenergic blocker, calcium blocker and lidocain that each of them has different success rate and researchers still try to find a method or medicine to reduce these effects (13-19). Magnesium sulfate is antiarrhythmic drug (20) that can block release of catecholamine by adrenal gland and adrenergic neuronal terminals(21). Magnesium sulfate can act through direct impact on blood veins and by reducing stimulation of blood veins creates vasodilatation (22).it is reported that effect of magnesium sulfate on adrenal is effective for reducing blood pressure caused by laryngoscope and tracheal intubation(23). Researchers have measured effect of this medicine on endotracheal intubation and reached different results without a certain conclusion(24). Therefore, purpose of this study is to investigate effect on intravenous magnesium sulfate on hemodynamic effects caused by laryngoscopy and patient's intubation.

Method: after approval of ethic committee of Ahvaz Medical Sciences University, 90 patients in the age range 20-41 years old who were candid for elective surgery were selected in double blinded randomized, clinical trial study. All patients were is ASA class I and II regarding physical examination and cardiovascular condition. Patients with hypertension history and other cardiovascular diseases, pregnant women and those with sensitivity history to magnesium sulfate were excluded from the study. Patients were divided randomly to study and control groups. Their vital symptoms were recorded before inducting analgesia and patients were controlled for vital symptoms, ECG monitoring and pulse-oxymeter. Then analgesia was inducted in patients. Analgesia was same in both groups as pre-oxygenation, infusing 5mg/kg sodium thiopental, 0.1mg/kg morphine and 0.6mg/kg atracorium, then 50mg/kg magnesium sulfate 20% (for study group) or equivalent normal saline (for control group) in one minute. Systolic and diastolic blood pressure and pulse rate before and after analgesia and after laryngoscopy (patients were undergone laryngoscope and intubation by one person and patients without first intubation were excluded from the study) were recorded and then measured every 1 to 3 minutes. Data analysis was done by SPSS software.

Results: studies showed that patients in both group had not significant difference in age, gender, weight, systolic and diastolic blood pressure and pulse rate as the beginning of study (table 1). In intervention group, 35 ASA patients were from class 1 and 10 from ASA class 2 but in control group 40 patients were ASA class 1 and 5 ASA class 2 which has not significant difference (p=0.153). About effect of magnesium sulfate on atrocoriumm mean interval of repeating loosening after first infusion was 27.777 in study group and 29.688 in control group which there was no significant difference between both groups (p=0.49). Number of flushing was 4 in study group and 5 in control group without any significant difference between both groups (p=0.725). Precipitation was occurred in 6 patients in study group and 2 patients in control group; rash occurred in 10 patients in study group and 13 patients in control group which there was no significant difference in each of them (precipitation p=0.130; rash p=0.467).Mean systolic and diastolic blood pressure in analgesia and after intubation (except systolic pressure which was higher in magnesium sulfate group) in magnesium sulfate group was lower than control group but this was not significant except in diastolic pressure after laryngoscopy and only in this case p=0.002 which indicates that magnesium sulfate is more effective than placebo in preventing increase in diastolic pressure immediately after laryngoscope but this difference fades in one minute (figures 1, 2). In the case of magnesium sulfate effect of pulse rate there was a slight increase in pulse rate in study group after infusion which continued in experiment but there was no significant statistical difference between both groups (figure 3).

Table 1. Preoperative characteristics (No Statistically Significant Difference)

Variable	Magnesium sulfate group (n = 45)	Control group (*n* = 45)	*P* Value
Age (mean±SD)	28.89±6.96	29.88±6.50	0.483
Male sex	22	25	0.526
Weight (mean±SD)	64.78±11.72	62.58±9.45	0.330
Systolic blood pressure (mean±SD)	119.82±12.09	120.33±12.63	0.845
Diastolic blood pressure (mean±SD)	74.93±9.73	75.78±8.98	0.670
Heart Rate (mean±SD)	93.18±16.41	89.71±14.77	0.295

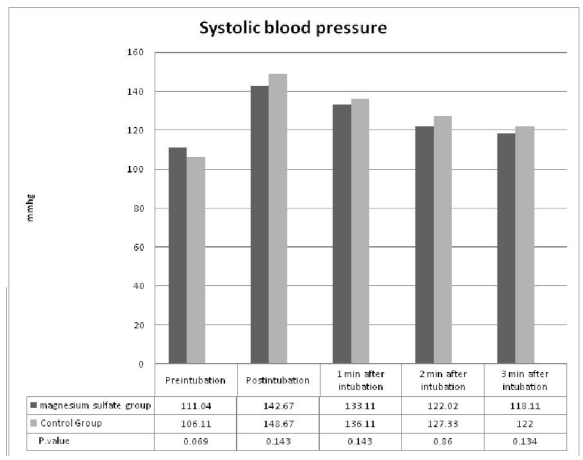

Fig 1. Effect of magnesium sulfate on the Systolic blood pressure

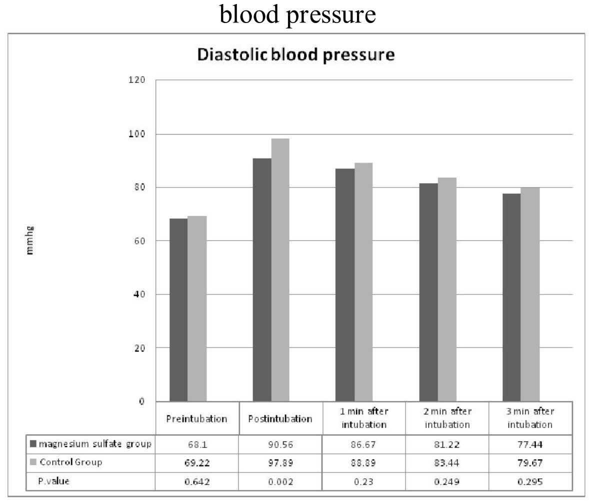

Fig 2. Effect of magnesium sulfate on the Diastolic blood pressure

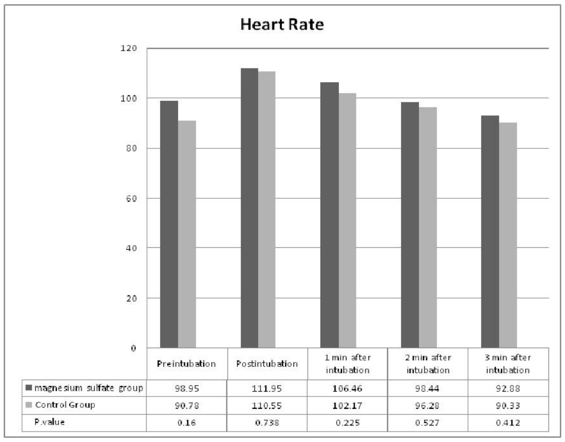

Fig 3. Effect of magnesium sulfate on the Heart Rate

Discussion: As results of this study showed in this study magnesium sulfate created significance statistical differencein diastolic blood pressure after laryngoscopy and there was no significant difference in other parameters and times. Other researchers had investigated effect of magnesium sulfate on patient's hemodynamic responses after intubation among them Nooraei et.al (25), by studying effect of magnesium sulfate and lidocain on patients hemodynamic changes after laryngoscope and intubation, stated that magnesium sulfate is more effective than lidocain because in addition to comparing effect of both medicines on systolic pressure in first minute (0.001), diastolic pressure in second minute (0.023), pulse rate in second minute (0.038), pulse rate in third minute (0.027), venous pressure in first minute (0.012), venous pressure in second minute (0.04), there was a significant difference and indicated that these parameters had less increase in magnesium sulfate group. Their results are similar to our results only in diastolic pressure after intubation. Shin et. al (26)studies effects of different magnesium sulfate doses on hemodynamic responses after intubation and found that doses 5 and 15mg/kg magnesium sulfate increase diastolic pressure after laryngoscope while dose 20mg/kg was ineffective. In their study doses 5 and 15mg/kg were contrary with Nooraei study and dose 20mg/kg was near to our study. Zhang et.al (27)in a study about effect of magnesium sulfate on hemodynamic responses caused by laryngoscope had stated that doses 15 and 25mg/kg magnesium sulfate prevents increase in systolic pressure and blood pressure. This finding is contrary with our findings but was near to Nooraei study.By considering other studies about effect on magnesium sulfate on hemodynamic changes in patients during surgeries, we will find different results. Some of these studies are: Jee et.al (22)by investigating effect of magnesium sulfate on blood pressure during laparoscopic cholecystectomy stated that magnesium sulfate cause slight increase in patient's blood pressure because systolic and diastolic pressures and nor-epinephrine level in magnesium sulfate group was lower than control group ($p<0.05$). Altan et.al (20)studies dose 30mg/kg magnesium sulfate on patients and stated that this medicine had no effect on blood pressure and pulse rate, although their patients has spinal analgesia but it is showed that magnesium sulfate was not effective in hemodynamic changes. Ray et.al (28) studied effect of magnesium sulfate on patients' hemodynamic undergone upper limp orthopedic surgery and argued that this medicine significantly increases blood pressure during surgery and pulse rate after surgery. Other studies found different results for effects of this medicine on hemodynamic responses which makes it difficult to reach to final conclusion. It is suggested that other researchers try to study different doses of this medicine after intubation to reach solid conclusions. We suggest that regarding effects of this medicine on diastolic pressure in different studies, next research team tries to study effect of magnesium sulfate on diastolic blood pressure.

Conclusion: Results of this study show that magnesium sulfate cannot prevent hemodynamic responses caused by laryngoscopy and intubation. Of course, confirming this result needs other research.

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Corresponding Author:
Ahmad Ebadi
2.Associate Professor of Cardiac Anesthesiology MD, Department of Cardiac Anesthesiology, Golestan Hospital, and Pain Research Center, Ahvaz Jundishapur Universityof Medical Sciences, Ahvaz, Iran. E-mail: Ebadi1959@ajums.ac.ir

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