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RESEARCH ARTICLE

Role of Magnesium Sulfate on the Prevention of Post-extubation Sore Throat in Patients Undergoing Endoscopic Sinus Surgery

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The study was approved by the ethics committee of Ahvaz university of medical sciences (ethics code:IR.AJUMS.REC. 1396.946).

Abstract

A postoperative sore throat is one of the most frequent complaints of anesthesia after endotracheal intubation.The present study aims to investigate the effect of intravenous magnesium sulfate on the severity of a sore throat after removing the tracheal tube under general anesthesia in the endoscopic sinus surgery. It was a double-blind randomized clinical trial conducted on ninety patients aged 18 to 60 yrs. The patients underwent general anesthesia using fentanyl 2 µg/kg, midazolam 0.2 mg/kg and propofol 2 mg/kg and intravenous injection of atracurium 0.5 mg/kg to facilitate the endotracheal intubation. After intubation, 40 mg/kg of magnesium sulfate was injected in 20 minutes and it was also injected for the same volume of normal saline for the other group. HR, systolic and diastolic blood pressure (mmHg), and sore throat (ranged between 0 and 10) were evaluated and recorded. The results showed that the severity of a sore throat in control group was significantly higher than the treatment. Moreover, a significant difference was witnessed between the experimental groups at 20min prior to extubation, immediately after and 30min after extubation. The average diastolic pressure in the treatment group significantly changed compared with the control group at immediately and 2h after extubation. However, the average HR showed a significant change only immediately after extubation compared with the control group. Conclusively, the magnesium sulfate could be a useful option to affect the severity of a sore throat. In addition, the data showed that injecting magnesium sulfate can control systolic and diastolic blood pressure.

Introduction:

Endotracheal intubation is an invasive procedure usually performed under general anesthesia (Ozaki *et al.*, 2001) which in spite of its high success rate in extubation, it is associated with different long-term complications (Agarwal *et al.*, 2006, Canbay *et al.*, 2008; Ebneshahidi *et al.*, 2010). Sore throat is one of the most frequent complaints of anesthesia for endotracheal intubation that may have pharyngeal, laryngeal, and/or tracheal sources (Ozaki *et al.*, 20011; Canbay *et al.*, 2008). Airway inflammation and irritation caused by tracheal tube has been identified as the notable reason for a sore throat induced following the surgery. Post-extubation sore throats and coughing usually produce various side effects such as increased blood pressure, elevated heart rate, increased intraocular pressure and intracranial pressure (Carlton *et al.*, 1998). Coughing in patients with sensitive airway can lead to bronchospasm and pulmonary edema with negative pressure, displacement of central venous catheters and bleeding (Ozaki *et al.*, 2001). Different therapeutic methods have been used to decrease the likelihood and the severity of the post-extubation sore throat (Agarwal *et al.*, 2006; Canbay *et al.*, 2008; Ebneshahidi & Mohseni, 2010). The prevention methods are divided into 2 categories including non-pharmacological prevention options such as using a smaller trachea tube, dipping the tube into a water-soluble gel, intubation after complete numbing, slow suction of

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Ambient Science, 2018: Vol. 05(Sp1); 68-71
RESEARCH ARTICLE
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mouth and throat and reducing the pressure of the cuff (Agarwal *et al.*, 2009; Sumathi *et al.*, 2007) and also pharmacological prevention methods such as beclomethasone inhalation, gurgling magnesium sulfate, using topical lidocaine and lidocaine sprays into the cuff (Fawcett *et al.*, 1999). Magnesium produces an inhibitory effect on the excitation pathways through the initial impact and inhibition of calcium influx into the cell and n-methyl D aspartate receptors (Carlton *et al.*, 1998). Therefore, magnesium can reduce the central sensitivity by inhibiting the peripheral stimulation of the pain. Magnesium is also a physiological blocker of calcium channels and non-competitive antagonist of NMDA receptors and consequently it can decrease the post-extubation pain through blocking the NMDA receptors (James, 1992). Clinical research on chronic and acute pain has revealed the post-extubation analgesic role of magnesium (Ryu *et al.*, 2009; Miller *et al.*, 2014). In this regard, previous studies have demonstrated that intravenous magnesium injection before and during the surgery could reduce the post-extubation pain as well as the need for analgesic drugs (Koinig et al., 1998; Seyhan et al., 2005; Tauzin-Fin et al., 2006; Malleeswaran et al., 2010). However, some studies suggested that administration of magnesium solution at the time of surgery has little effect on post-extubation pain (Bhatia *et al.*, 2004; Dubé *et al.*, 2004). Considering the high rate of sore throat following general anesthesia undergoing endotracheal intubation and also its irritating nature for the mentioned patients and given the analgesic effects of intravenous magnesium sulfate that have recently drawn considerable attention, the present study aims to investigate the effect of intravenous magnesium sulfate on the severity of sore throat after removing the tracheal tube in the surgery.

Methodology:

This was a double-blind randomized clinical trial conducted on ninety patients aged 18 to 60 years old who were identified as class I and II according to the American Society of Anesthesiology who were under FESS surgery at Imam Khomeini Hospital in 2017-2018 were used in the study. After clearance from the ethical committee and consent from patients, they were randomly divided into two groups including treatment and control groups.

Exclusion criteria: its included patients with preoperative sore throat history, upper respiratory tract infection, colds, smoking, liver and kidney failure, pregnancy, magnesium allergy, trying to endotracheal intubation more than once, mallampati score 3 and more, chronic consumption of calcium blockers or magnesium.

Anesthetic procedure: the patients underwent general anesthesia using fentanyl 2 μg/kg, midazolam 0.2 mg/kg and Propofol 2 mg/kg and intravenous injection of atracurium 0.5 mg/kg to facilitate the endotracheal intubation. In case of returning the patient from atracurium,0.15 mg/kg was injected to continue muscle-numbing. Laryngoscopy was performed by the anesthesiologist with a laryngoscopy blade 3-4. Trachea tube with an inner diameter of 8 mm and 7.5 mm was intubated for male and female patients respectively. After intubation, 40 mg/kg of magnesium sulfate (Pasteur Institute, Iran) was injected within 20 minutes and it was also injected for the same volume of normal saline for the other group. The syringes were prepared, pre-numbered and coated by an anesthetist technician who was not involved in the study. Since this is a double-blind study, the executor of the study, the patients, and the results recorder were not aware of the type of injectable solution. Moreover, isoflurane 1.2%, nitrous oxide and oxygen 50% and also 25 μg to 50 μg of fentanyl were used if necessary to maintain the anesthesia. At the end of the muscle relaxant surgery using neostigmine (0.05 mg/kg) and atropine-reversal (0.2 mg/kg), and in case of favorable for the patient's ability to maintain the airway (proper spontaneous breathing, obedience to the speech commands such as open the eyes, raising the head for 5 seconds, and hand punching or performing targeted actions), the tracheal tube was removed and the patient was recovered. In the recovery section and after complete consciousness of patient, the sore throat was questioned and recorded at 5 different times including 20 minutes before extubation, immediately after extubation, 30 minutes, 2 hours and 24 hours after extubation.

Statistical Analysis: data were reported using descriptive statistics including mean, standard deviation, frequency and percentage. In addition, t-test was used to compare the mean of studied variables in two groups. The statistical significance was set at $p< 0.05$. All statistical analyses were performed using IBM SPSS software version 22. .

Results:

The present study investigated the prevention role of magnesium sulfate in the post-FESS surgery sore throat in 90 patients (n=45) aged between 18 and 60 years. The demographic information of the patients is demonstrated in Table-1.

Table 1. Comparison of the age average according to the group and gender.

Groups	Mean ± SD	p-value	Mean ± SD	p-value
Treatment (n=45)				
Male (23)	31.13±7.307	<0.001	33.31±9.737	<0.871
Female (22)	35.59±11.492			
Control (n=45)				
Male (23)	34.65±11.645	<0.001	33.64±9.828	
Female (22)	32.59±7.62			

There was a significant difference between the age average of male and female patients in both treatment and

RESEARCH ARTICLE

control groups; however, the difference in the age average of patients regardless of their gender in both treatment and control groups was not significant (Table-1; p>0.05).

None of the patients in the treatment and control groups had a history of smoking tobacco. The severity of a sore throat was evaluated immediately after extubation to 24 after extubation at 4 different times and the results were recorded in Table-2.

Table-2: Alterations in the severity of sore throat at various times.

Time of evaluation	Groups	Mean ± SD	p-value
Immediately after extubation	Treatment	0.04±0.298	0.000*
	Control	3.07±2.897	
30 minutes after extubation	Treatment	0.27±0.78	0.000*
	Control	4.6±2.499	
2 hours after extubation	Treatment	0.31±0.821	0.000*
	Control	4.76±2.423	
24 hours after extubation	Treatment	0±0.00	0.000*
	Control	3.53±1.866	

According to Table-2, the sore throat significantly differed in both groups at different evaluated times in such a way that the severity of this complication in the control group was higher than the treatment (p<0.05). The highest severity of a sore throat was observed at 30 minutes and 2 hours after extubation. HR, systolic and diastolic blood pressure (mmHg) of patients were measured and recorded from 20 minutes before to 20 hours after extubation at 5 different times (Table-3).

Table-3: Alterations in HR, systolic and diastolic blood pressure at different times

Time of evaluation Groups	SBP (mmHg) Mean± SD	DBP (mmHg) Mean ±SD	HR Mean±SD
20 minutes before extubation			
Treatment	98.82±8.510	59.02±7.750	79.29±15.491
Control	95.78±6.905	56.89±5.466	82.80±13.577
	p- <0.028	p-<0.122	p-<0.290
Immediately after extubation			
Treatment	118.69±15.409	74.73±9.096	80.04±14.657
Control	126.33±9.851	81.78±5.347	87.04±12.345
	p- <0.007	p-<0.001	p-<0.018
30 minutes after extubation			
Treatment	120.62±10.857	78.04±7.56	78.16±12.537
Control	129.22±11.429	83.84±5.881	82.58±11.232
	p- <0.001	p-<0.001	p-<0.094
2 hours after extubation			
Treatment	123.96±13.415	79.18±6.001	78±12.011
Control	128.78±11.035	82.67±5.179	80.6±11.571
	p- <0.079	p-<0.006	p-<0.307
24 hours after extubation			
Treatment	121.89±7.094	78.89±6.981	76.29±10.727
Control	119.44±10.935	81.18±5.553	74.89±9.227
	p- <0.201	p-<0.064	p-<0.523

SBP- Systolic Blood Pressure; DBP- Diastolic Blood Pressure; HR- Heart Rate

For the time period of 20 minutes before extubation, the systolic blood pressure of treatment group was significantly higher than the control; however, administration of magnesium sulfate led to a significant reduction systolic blood pressure immediately after (p<0.05) and 30 minutes after extubation, compared with the control (p<0.05) (Table-3). In this regard, the difference in the systolic pressure at 2 and 24 hours after extubation was not borne significant between the two groups.

In addition, the diastolic blood pressure average at immediately and 2 hours after extubation was significantly lower in the treatment group as compared with the control (p<0.05). Nevertheless, the diastolic pressure at 20 minutes before and 24 hours after extubation did not significantly change in the treatment group in comparison with the control. According to the results, the average of HR only at immediately after extubation significantly changed in the treatment group as compared with the control (p<0.05) whereas there was no significant difference in the other measured times between the experimental groups (p>0.05).

Discussion:

Several studies have investigated the effects of magnesium sulfate on the variables measured in this study. Our findings showed that the severity of a sore throat was significantly higher in the control group as compared with the treatment (p<0.05). The most severe sore throat occurred at 30 minutes and 2 hours after extubation for both groups. The results are correlated with the results Borazan *et al* . (2012), Park *et al.* (2015), Yadav *et al* . (2016), and Sane *et al* . (2016). Borazan *et al* . (2012) demonstrated no significant difference in the severity of a sore throat from 4 hours after the extubation between treatment and control groups whereas the present results confirmed significant alterations in the sore throat severity of the treatment group compared to the control (p<0.05). Besides, Yadav *et al* . (2016) also found no significant change in the severity and the number of a sore throat immediately, 2 hours and 4 hours after extubation which can hardly confirm our results. Although the systolic pressure of patients in the treatment group 20 minutes before extubation was significantly higher than the control, injecting magnesium sulfate led to a significant reduction of systolic pressure immediately and 30 minutes after extubation in comparison with the control. The results revealed that using magnesium sulfate significantly decreased the diastolic pressure immediately, 30 minutes, and 2 hours after extubation as compared with the control (p<0.05). According to the results, the HR average only immediately after extubation significantly reduced in the treatment group as compared with the control but the difference in the other measured times was not statistically significant.

Ambient Science, 2018: Vol. 05(Sp1); 68-71
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Conclusion:

The results showed that magnesium sulfate injection considerably affects the severity of a sore throat. It was also concluded that using magnesium sulfate can be a useful option to control systolic and diastolic pressure after extubation; however, it cannot considerably regulate HR alterations.

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