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The Role of Magnesium Sulfate to Facilitate Classical LMA Insertion, in Spontaneous Breathing Anesthesia

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ABSTRACT

Background: Laryngeal Mask Airway (LMA) is a noninvasive supraglottic device that requires Smooth insertion and correct positioning of an LMA requires adequate through mouth opening and sufficient depth of anesthesia to prevent complications such as gagging, coughing, swallowing, head and limb movements and laryngospasm. Propofol is consider the induction agent of choice for LMA insertion but when used alone it provides less than satisfactory LMA insertion conditions.

Aim of the study: Is to find The role Of Magnesium Sulfate to facilitate classical LMA insertion, in spontaneous breathing anesthesia.

Patients and method: A prospective randomizes clinical trial study was carried out in General Surgery theatres of Baghdad Teaching Hospital. A 40 patients where included and they were undergoing minor elective surgery, divided into two groups equally, magnesium group (M group, n=16) and control group (C group, n=18), 6 cases were dropped from the study(2 from C group and 4 from M group).

All patients were premeditated with Ranitidine 50mg, Metoclopramide 10mg and Dexamethasone 8mg. Then patient would receive either a 100ml of (0.09% N/S) for the C group, or 30mg/Kg of Magnesium Sulfate in 100ml of (0.09% N/S) for the M group.

Results: that there were no significant differences between M group (n=16) and C group (n=18) in the age, weight and duration of surgery where p value was (0.571, 0.791 and 0.351 respectively). Also there was no improvement in LMA insertion condition in M group in compares to C group regarding number of insertion attempt where p value was non-significant(0.498),nor did it influence the easiness of LMA grading were P value was found to be(1,0.112 and 0.471 for grades I,II and III respectively),but an accidental finding that M group had a shorter time duration from skin closure until LMA removal which was significant (p=0.021).

Conclusion: We concluded that giving magnesium sulfate infusion at 30 mg/Kg prior to induction, does not improve LMA insertion condition in spontaneous breathing anesthesia.

KEYWORDS: LMA, Magnesium Sulfate, Propofol, Spontaneous breathing Anesthesia, Ketamine, Fentanyl, Midazolam.

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INTRODUCTION

Laryngeal Mask Airway (LMA):

Is a Supraglottic Airway Device (SAD) is used with both spontaneously and ventilated patients during anesthesia [1]. The inflatable oval head is inserted blindly into the pharynx to lie against the back of the larynx, and the circumferential cuff inflated to form a seal[2]. Insertion is easier following propofol induction of anesthesia than Thiopental induction, because of the former`s greater suppression of laryngeal reflexes [1]. Available in several sizes from 1 (neonate <5 Kg) to 6 (adults >100Kg)[2].

Used for:

- Routine inhalational anaesthesia

- Inhalational anaesthesia where holding a face piece is difficult, eg.due to patient position or site of operation.
- Airway maintenance in difficult intubation, in both previously unsuspected and known cases.
- Emergency management of failed intubation.

Cardio-Pulmonary Resuscitation [2].

The laryngeal mask airway (LMA) has proved to be a popular addition to the range of equipment available for airway management [3,4]. It appears to be relatively simple and safe to use across a wide range of surgical specialties [4]. The LMA offers several advantages over the tracheal tube, including improved hemodynamic stability ,reduced anesthetic requirement for airway tolerance ,lower frequency of coughing ,improved oxygen saturation during emergence and less sour throat [5,6,7], and does not require neuromuscular block[8]. But there are some reported complications with the use of LMA during either spontaneous or controlled ventilation, which can divided into three groups according to cause:

1. Misplacement and aspiration

The commonest and the most important are **regurgitation** of gastric content and chances of **aspiration**. **Direct trauma** to pharyngeal and upper airway structures, Misplacement of the LMA, with migration of the LMA tip into the glottis aperture, may also induce **bronchospasm.**

2. Pressure induced lesions

Lingual nerve injury, both unilateral and bilateral. Tongue cyanosis and swelling has also been reported after the use LMA. The incidence of **recurrent nerve paralysis** has also occurred by the use of LMA. Cuff volume also influences postoperative **sore throat** and **dysphagia**.

3. **Inadequate patient anaesthesia**

May result in **coughing, gagging, and bucking** on attempted LMA insertion [9].

MAGNESIUM

Magnesium is largely intracellular ion, present mainly in bone (over 50%) and skeletal muscles (20%); the remainder is found in the heart, liver and other organs. 1% is in the ECF. Normal plasma level: 0.75-1.05mmol/l (although the value of measurement has been questioned [10]. Magnesium sulfate can be given through intravenous or intramuscular routes(the latter is painful);when given intravenously (as anti-conversant)duration for about 30 min., aiming at a therapeutic level (2-3.5mmol/l OR 4-7Meq/l) has an onset of action almost immediately, and eliminated renally at a rate proportional to plasma concentration and glomerular filtration rate[11].Calcium chloride or calcium gluconate can be used to antagonize magnesium action especially in magnesium toxicity[12].Side effect may occur above(4-5mmol/l), with cardiac arrest (above12mmol/l)[10]. Each 1g = 4mmol = 8Meq of magnesium [12]. There are many indications for the use of intra-venous preparation of magnesium sulfate, some of these are:

1- Hypomagnesaemia
2- Arrhythmia (especially in the presence of hypokalaemia)
3- Eclampsia and Pre-Eclampsia (drug of choice)
4- Myocardial infarction (not recommended)

Also magnesium salts can be given to treat constipation, acute severe asthma and as paste for boils [11].

5- Premature labour (tocolytic action)[12].

The magnesium cat ion is said to have narcotic properties. Meltzer and Auer in 1906 observed depressive effects on the central nervous system of animals injected with magnesium (Mg) salts [13,14]. Magnesium has also been reported to produce local anesthesia [14] and to enhance the activity of other local anesthetic agents. [15].Magnesium at levels more than 2.5mmol/L produce a dose-dependent presynaptic inhibition of neurotransmitter release in peripheral nerves [16]. Different doses of the drug have been used by different authors to attenuate the response to endotracheal intubation ,magnesium in doses of40 and 50 mg/kg developed significant hypotension at various time points requiring intervention[17]. Altan et al. reported that magnesium sulfate 30 mg/kg infused over 15 minutes before induction of anesthesia with propofol, attenuated the press or response to intubation in normotensive patients [18]. Magnesium is an α-adrenergic antagonist and may lead to a transient decrease in BP associated with peripheral vasodilatation [19]. Nidhi B et al. (2013) observed that 30 mg/kg is the optimum dose of magnesium to prevent a hypertensive response to laryngoscopy and tracheal intubation in hypertensive patients[20].

PATIENTS & METHODS

A prospective randomize clinical trial study was carried out in General Surgery theatres of Baghdad Teaching Hospital, during the period from the 1st of august 2013 to the 15th of April 2014, the total number of patients included in this research were 40 patients undergoing minor elective surgeries(eg. breast mass excision, excisional lymph node biopsy ,inguinal hernia repair etc.), 6 cases were dropped from the study : 5 of them due to prolonged surgery (2 cases from the control group, 3 cases from the magnesium group) ,and one case was dropped because of failure of insertion of the LMA in the magnesium sulfate group.

Throughout this study patients were randomly allocated into either control group(n=18) or magnesium group (n=16),with the following inclusion criteria.

Inclusion criteria:

1- Age 18-60 years
2- 50 ≤ weight ≤ 100 Kg
3- ASA class I and II
4- Surgical operation less than 30mins.
5-Operation not requiring muscle relaxant

Exclusion criteria:

1- Patient refusal
2- Emergency cases
3- Any allergy to any drug used in the study
4- Cases indicated for endotracheal intubation

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5- Patient with neuromuscular disease

6- Predicted airway difficulty

All patients were premeditated with Ranitidine 50mg, Metoclopramide 10mg and Dexamethasone 8mg. Then patient would receive either a 100ml of (0.09% N/S) for the control group, or 30mg/Kg of Magnesium Sulfate in 100ml of (0.09% N/S) for the magnesium group; by infusion for both group over 10 minutes period. LMA sizes was determined according to the manufacturer's recommendations by the patient weight, and anesthesia was maintained using isoflurane 1% with 100% oxygen and intravenous fluid according to patient hemodynamics status.

Statistical analysis:

Data were analysed using SPSS (statistical package for social sciences) version 20/IBM. Descriptive statistics were expressed as mean ±SD (standard deviation).

RESULTS

From both groups there were 6 cases dropped from the study, 5 of them due to prolonged surgery (2 cases from the control group, 3 cases from the magnesium group) and one case was dropped because of failure for insertion of the LMA in the magnesium sulfate group.

By using the SPSS V20.0/IBM using the independent sample t-student test and the chi-square and using the epi-calculator, it's found that there were no significant differences between the magnesium group (n=16) and the control group (n=18) in the age, weight ,duration of surgery, no. of attempts for insertion of the LMA, where the p-value were >0.05 ,as shown in tables (1,2,3 and 4) .

Table (1): comparison between age in both groups in years

	Mean	Standard deviation	p-value
Magnesium	43.915	6.988	0.571
Control	46.771	4.183	

Table (2): comparison between weight in both groups in Kg

	Mean	Standard deviation	p-value
Magnesium	89.428	11.572	0.791
Control	93.561	9.445	

Table (3): comparison between Duration of surgery between both groups in minutes

	Mean	Standard deviation	p-value
Magnesium	36.571	5. 728	0.351
Control	33.182	5.331	

Table (4): percent of no. of attempt in both groups

	Attempt	No.	Percent	Standard deviation	p-value
Magnesium	1st	15	93.75%	0.043	0.498
	2nd	1	6.25%		
Control	1st	16	88.88%	0.061	
	2nd	2	11.11%		

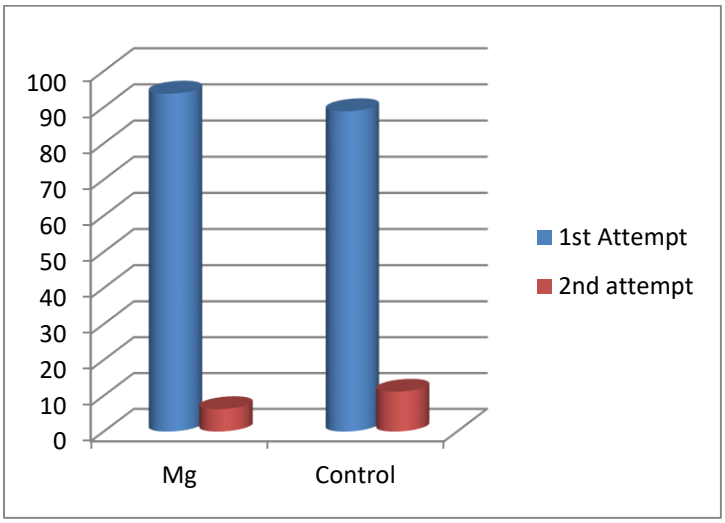

Figure (7): Percent of patient in both groups with the 1st and 2nd attempt for insertion of LMA.

Table (5): Grading of LMA ease of Insertion (all the 40 patients)

	Grade 1		Grade 2		Grade 3	
	No.	Percent	No.	Percent	No.	Percent
Control	5	25%	15	75%	0	0%
Magnesium	5	25%	14	70%	1 (droped)	5%
p-value	1		0.112		0.471	

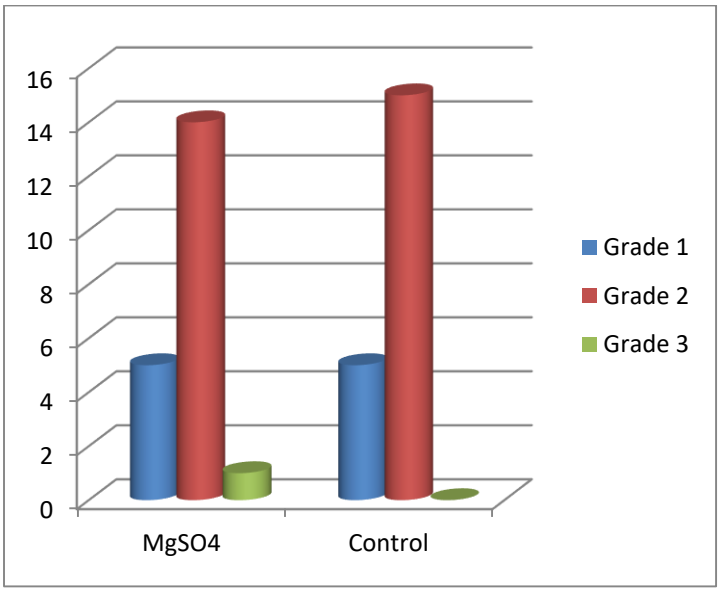

Figure (8): Grading of LMA ease of insertion between both groups

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But there was significant differences between both group in the time from skin closure till the removal of the LMA where the p-value was 0.021 and as shown in the table(6) and figures(9) below:

Table (6): comparison between both groups in the duration from skin closure to the removal of LMA

	Mean	Standard deviation	p-value
Control	6.327	3.220	0.021
Magnesium	2.119	2.019	

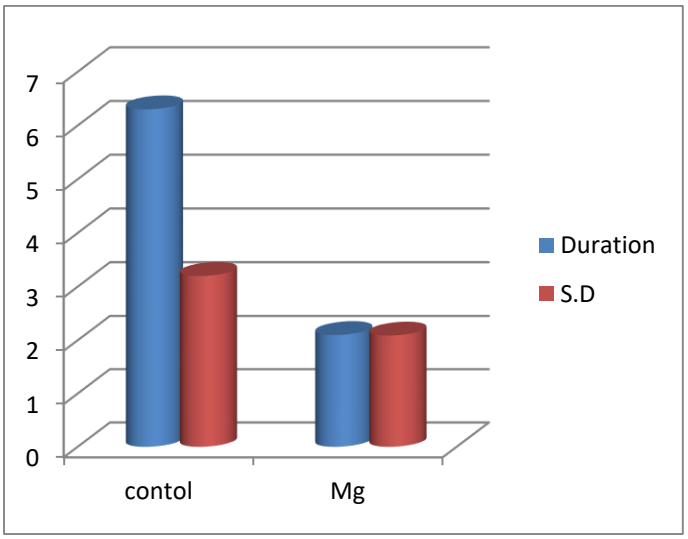

Figure (9): duration from skin closure to the removal of LMA

DISCUSSION

LMA has gained a wide acceptance around the world within the medic and recently the Para-medic staff. Smooth insertion and correct positioning of an LMA requires adequate mouth opening and sufficient depth of anesthesia to prevent complications such as gagging, coughing, swallowing, head and limb movements and laryngospasm [21,22]. Traumatic LMA insertion also increases post-operative sore throat [23]. Propofol is currently the induction agent of choice for LMA insertion. However when propofol is used alone it provides less than satisfactory LMA insertion conditions[24].Many drugs combination were studied and tried to create the optimum conditions for placement of this device. And with the growing interest in magnesium sulfate and its effect on muscle relaxant agent and its role on attenuation of intubation reflex [17] . From both groups there were 6 cases dropped from the study. In our study it was found that there were no significant differences between the magnesium group (n=16) and the control group (n=18) in the age, weight and duration of surgery where p value was (0.571, 0.791 and 0.351 respectively). Also we failed to demonstrate any improvement in LMA insertion condition in the magnesium group in compares to the control group regarding number of insertion attempt where p value was non-significant(0.498),nor did it influence the easiness of LMA grading were P value was found to be(1,0.112 and 0.471 for grades I,II and III respectively) which goes with what was concluded by Morris and Giesecke et al[25] that magnesium sulfate have an additive effect when administered with depolarizing or non-depolarizing agents ,but couldn`t establish their hypothesis that $MgSO_4$ had muscle relaxant properties(reported 1/10000 the potency of d-tubucurarine). An accidental and an expected finding that magnesium group had a shorter time duration from skin closure until LMA removal which was statistically significant (p=0.021), this finding may indicate that magnesium sulfate may enhance anesthetic agents elimination (on the extra cellular level), OR it might restore intra cellular ions balance by unclear mechanisms that we don`t know of. Same thing regarding LMA removal time were observed by C.Keller et al. (1998) [26] . With 1% and 1.5% sevoflurane compared with propofol ($p<0.0002$).

CONCLUSION

According to the results of our trial we found out that magnesium sulfate has no role in optimizing conditions for LMA insertion.

RECOMMENDATION

- It's not recommend the use of magnesium sulphate at the studied dose(30mg/Kg) to facilitate the insertion of classical LMA in spontaneous breathing anaesthesia.
- Larger sample sizes with larger dose of magnesium sulphate may be tried to identify the role of magnesium sulphate on the recovery time in the same setting of our study, with availability of more invasive monitoring (eg. invasive blood pressure, serum magnesium, arterial blood gas measurement and traces of anaesthetics agents).

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