Zagazig University Medical Journal
www.zumj.journals.ekb.eg
Volume 29, Issue 1, January 2023 https://dx.doi.org/10.21608/zumj.2021.50227.2015
Manuscript ID ZUMJ-2011-2015 (R3)
DOI 10.21608/zumj.2021.50227.2015

ORGINAL ARTICLE

Tracheal Intubation Without Using Neuromuscular Blocking Drugs in Elective Surgery. A Comparative Study

Samar Abdel-Aziz Ahmed El-Sayed*, Zainab Mostafa Attia, Amal Abdelazeem Ali, Ahmed Mosallam Mohammed

Anesthesia and Surgical Intensive Care, Faculty of Medicine, Zagazig University, Zagazig, Egypt

Corresponding Author:
Samar Abdel-Aziz Ahmed El-Sayed
Anesthesia and Surgical Intensive Care, Faculty of Medicine, Zagazig University, Zagazig, Egypt
dr.samar91@gmail.com

Submit Date	2020-11-17 17:27:38
Revise Date	2022-11-03 20:17:48
Accept Date	2021-04-28 12:21:57

ABSTRACT

Background: Usually, neuromuscular blocking drugs are used for facilitating tracheal intubation but sometimes limitations exist as in procedures where neuromuscular monitoring is required or that of short duration. So, using an alternative method is important for providing good intubating conditions.

Methods: Eighty-eight patients in Zagazig University hospitals were randomly divided into two equal groups, group-M (Magnesium group) and group-P (high dose of propofol group). Group (M) received Magnesium sulfate (40 mg/kg), Fentanyl (2 µg/kg) and Propofol (2 mg/kg). Group (P) received Fentanyl (2 µg/kg), and Propofol (3 mg/kg). An assessment of the quality of intubation conditions and hemodynamic response to tracheal intubation was done.

Results: Group (M) had a better intubation score and a less hemodynamic response to endotracheal intubation than group (P).

Conclusion: Intravenous infusion of magnesium sulfate (40 mg/kg) before induction leads to better intubation score and a less hemodynamic response to endotracheal intubation than a high dose of propofol.

Keywords: Magnesium sulfate, propofol, neuromuscular blocking drugs, endotracheal intubation, stress response.

INTRODUCTION

Laryngoscopy and intubation of the trachea resulting in a reflex sympathetic response due to mechanical stimulation of the larynx and trachea. However, using muscle relaxants inhibits muscular contractions and also improves tracheal intubation conditions [1].

Tracheal intubation without using neuromuscular blocking drugs is used if there is a contraindication for their use as in procedures where neuromuscular monitoring is required or that of short duration [2].

Magnesium sulfate is used for decreasing the hemodynamic reaction to airway management as it blocks the release of catecholamine from both adrenergic nerve terminals and the adrenal gland. Additionally, it has antiarrhythmic action and induces coronary and systemic vasodilation as it antagonizes calcium ions in vascular smooth muscle [3].

Propofol is a drug that is commonly used as a hypnotic agent for general anesthesia and as a sedative agent used in the intensive care unit [4]. Although propofol is associated with hemodynamic stability, it has dose-dependent effects resulting in a decrease in blood pressure and heart rate on increasing the dose [5].

Using depolarizing muscle relaxants such as suxamethonium may be associated with hyperkalemia, cardiac dysrhythmia, postoperative myalgia, allergic reaction, prolonged paralysis, raised intracranial pressure, and malignant hyperthermia [6]. Also, non-depolarizing muscle relaxants may cause prolonged blockade, potentiate histamine release, and the inability to rapidly reverse the blockade in case of unexpected difficult intubation [7]. When using muscle relaxants is contraindicated or undesirable as in procedures in which neuromuscular monitoring is required, using an alternative method is important for providing good intubating conditions [8].

METHODS

Approval from Institutional Review Board (IRB), and written consent from all patients were obtained then this prospective

comparative randomized double-blind clinical Study was conducted in Zagazig University Hospitals from August 2019 to March 2020. The study was done according to The Code of Ethics of the World Medical Association (Declaration of Helsinki) for studies involving humans. A sample size of 88 American Society of Anesthesiologists (ASA) physical status I and II patients aged between 21 and 60 years with BMI < 35 kg/m2 and Mallampati score I & II having an elective surgery were enrolled in the study.

Patients with central nervous system disorder, hepatic, renal, cardiovascular, metabolic diseases, increased risk of regurgitation, electrolyte imbalance, anticipated difficult intubation, known history of allergy to study drugs, and emergency operations were excluded. To be excluded from the study patients had more than two intubation attempts (intubation attempt: 15 sec).

Enrolled patients were randomly selected into one of the two groups using a computer-generated randomization table. Assuming the mean and standard deviation of time to achieve target mean arterial blood pressure in patients using lidocaine and in those using magnesium sulfate is (87.03 mmHg±10.05 mmHg vs 80.9 mmHg ±8.88 mmHg respectively) [9], so the sample size was calculated to be 80 patients, 40 in either group (magnesium sulfate group and high dose of propofol group) were calculated using Open Epi program with CI 95% & power of test 80%. 10% of the total number of patients was added to compensate for dropout so the total sample size was 88 patients.

All patients were evaluated the day before surgery including history taking, clinical examination, laboratory investigations (complete blood picture, kidney function tests, liver function tests, prothrombin time, and partial thromboplastin time), and electrocardiogram (ECG) were done.

Premedication by midazolam (0.02-0.05 mg/kg) was given intravenously to all patients. Full monitoring including heart rate, mean arterial blood pressure, ECG, respiratory rate, and peripheral oxygen saturation were recorded (as baseline readings). Preoxygenation was done with 100% oxygen for 3 min before induction. Patients were divided into two equal randomized groups:

- **Magnesium group** (**M**): Magnesium sulfate 10% (Magnisol -Memphis - Egypt) (40 mg/kg), Fentanyl (Fentanyl Hameln - sunny pharma- Egypt) (2 µg/kg), Propofol (Propofol Lipuro- B Braun- Germany) (2mg/kg).
- **High dose of propofol** (**P**): Fentanyl (Fentanyl Hameln - sunny pharma- Egypt) (2 µg/kg), Propofol (Propofol Lipuro- B Braun- Germany) (3mg/kg).

Before induction, Patients in [group M] received magnesium sulfate (40 mg/kg) as an infusion in one hundred ml of saline over ten min. Patients in [group P] received 100 ml of normal saline over ten min. After that, fentanyl (2 µg /kg) was administered and two minutes later patients were induced with propofol intravenously. After the loss of consciousness, mask ventilation was initiated and maintained for 60 seconds until intubation.

Intubation was done and assessed by a skilled anesthesiologist who was blind to the group assignments by using Macintosh 3 laryngoscope blade and a 7.0 mm endotracheal tube for females. Also using Macintosh 4 laryngoscope blade and 7.5 mm endotracheal tube for males. Then, the cuff of the tracheal tube was inflated to the minimum pressure required to prevent a gas leak. Assessment of the quality of intubation conditions was done according to the scoring system for endotracheal intubation conditions [10] Table (1).

The quantitative intubation score was obtained by summing the scores assigned to the factors laryngoscopy, vocal cords, and response to intubation while the qualitative intubation scores were defined as follows:

- **Excellent** intubation condition in which all three factors were rated with a score of 3.
- **Good** intubation condition in which all three factors were rated either with a score of 3 or 2.
- **Poor** intubation condition in which the presence of one factor was rated with a score of 1.

Excellent and good intubation conditions were regarded clinically acceptable while poor intubation conditions were regarded

clinically unacceptable. Muscle relaxant was used in poor intubation conditions.

Heart rate, mean arterial pressure, and oxygen saturation were noted at different time intervals (baseline value, after tested drug, post-induction, and post-intubation at 0, 1, 3, and 5 min).

After intubation, patient was ventilated by adjusting tidal volume 6-8 mg/kg and inspiratory: expiratory ratio 1:2). Ventilator parameters were adjusted to keep the end tidal CO_2 between 35-40 mmHg. Maintenance of anesthesia was done by using isoflurane inhalation. IV fluids were calculated and given. Muscle relaxant was given in poor intubation conditions to make intubation easier.

At the end of surgical procedure, tracheal extubation was carried out when extubation criteria were met (ability to follow commands, opening the eyes, stable hemodynamic status, spontaneous breathing, regular respiratory rate, adequate tidal volume >5 ml/kg).

Consequently, intubation conditions and hemodynamic changes were the primary and secondary outcome measures for the current research.

STATISTICAL ANALYSIS

The collected data were analyzed by computer using Statistical Package of Social Services (SPSS) version 25 [11]. Data was presented in tables and figures. Quantitative data was presented as mean and standard deviation. Qualitative data was presented as frequencies and proportions. For testing the differences for significance, the variance and association of qualitative variable have been clarified by Chi square test (X2) while variances between independent quantitative multiple groups are assessed by (ANOVA) analysis of variances.

RESULTS

- ***Demographic characteristics:***

Statistically, the patients' demographic data (age, sex, body mass index, and physical status classification by ASA) in both tested groups were comparable ($P > 0.05$). Table (2)

- ***Quality of intubation conditions:***

1) Laryngoscopy: Statistically, Patients in group **M** had better mandibular muscle relaxation and less resistance to laryngoscopy blade than group **P** ($P < 0.001$). Table (3)
2) Vocal cords: Statistically, the position and movement of the vocal cords during intubation in both tested groups were comparable ($P > 0.05$). Table (4)
3) Intubation response: Statistically, Patients in group **M** had less intubation response than group **P** ($P < 0.05$). Table (5)

- ***Total qualitative intubation score:***

Excellent intubation score was significantly higher in group **M** than group **P**. Table (6).

- ***Hemodynamic response:***

1) Heart rate: Statistically, the patients in group **M** demonstrated significantly lower heart rate in comparison to group **P** (postinduction and postintubation) ($P < 0.05$). Figure (1).
2) Mean arterial pressure (MAP): Statistically, the patients in group **M** demonstrated significantly lower MAP compared with group **P** (postinduction and postintubation) ($P < 0.05$). Figure (2).
3) Oxygen saturation: Statistically, peripheral Oxygen saturation between the studied groups was comparable ($P > 0.05$). Figure (3).

Table 1: Scoring system for endotracheal intubation conditions

Score	Score 3	Score 2	Score1
1.**Laryngoscopy**: - Mandibular muscle relaxation - Resistance to blade insertion	 - relaxed - None	 - Acceptable relaxation - slight resistance	 - Poor relaxation - Active resistance
2.**Vocal cords**: - Position - Movement	 - Abducted - None	 - Intermediate - Moving	 - Closed - closing
3.**Intubation response**: - Limb movement - Coughing	 - None - None	 - Slight - Diaphragmatic	 - Vigorous - Severe coughing or bucking

Table 2: Demographic characteristics of the studied groups

Variables	Group M (n=44)	Group P (n=44)	Test of sig.	P
Age (years):			F	
Mean ± SD	39.7 ± 11	38.5 ± 9.7	0.3	0.6
Sex, n (%):			χ^2	
Male	23 (52.3%)	20 (45.5%)	0.4	0.5
Female	21 (47.7%)	24 (54.5%)		
BMI (kg/m^2):			F	
Mean ± SD	26.2 ± 2.0	27.0 ± 3.0	1.8	0.2
ASA, n (%):			χ^2	
I	39 (88.6%)	41 (93.2%)	0.6	0.5
II	5 (11.4%)	3 (6.8%)		

- **Group M:** Magnesium group. **Group P:** High dose of propofol group. **BMI:** Body Mass Index. **ASA ps:** American Society of Anesthesiologists physical status.
- Data of age and BMI were presented as mean± standard deviation, compared using F test: ANOVA
- Data of sex and ASA were presented as No. and %, compared using χ2: chi-square test.
- P value < 0.05 was considered statistically significant otherwise it was insignificant.

Table 3: Comparison of laryngoscopy findings in the studied groups

Laryngoscopy findings	Group M (n=44)		Group P (n=44)			
	No.	%	No.	%	χ^2	P
Mandibular muscle relaxation:						
relaxed					16.3	
Acceptable relaxation	37	84.1	19	43.2		**<0.001**
Poor relaxation	6*	13.6	18	40.9		**HS**
	1*	2.3	7	15.9		
Resistance to blade:					14.8	
None	37	84.1	20	45.5		**<0.001**
Slight resistance	6*	13.6	17	38.6		**HS**
Active resistance	1*	2.3	7	15.9		

- **Group M:** Magnesium group. **Group P:** High dose of propofol group.
- Data were presented as No. and %, compared using χ2: chi-square test.
- P value < 0.05 was considered statistically significant otherwise it was insignificant.
- P value < 0.001 was considered statistically highly significant (HS).
- (*) Significantly lower than group P

Table 4: Comparison of vocal cords in the studied groups

Vocal cords	Group M (n=44)		Group P (n=44)			
	No.	%	No.	%	χ^2	P
Position:						
Abducted	34	77.3	30	68.2	2.1	0.3
Intermediate	9	20.4	10	22.7		
Closed	1	2.3	4	9.1		
Movement:						
None	35	79.5	32	72.7	1.9	0.4
Moving	8	18.2	8	18.2		
closing	1	2.3	4	9.1		

- **Group M:** Magnesium group. **Group P:** High dose of propofol group
- Data were presented as No. and %, compared using χ2: chi-square test.
- P value < 0.05 was considered statistically significant otherwise it was insignificant.

Table 5: Comparison of Intubation response in the studied groups

Intubation response	Group M (n=44)		Group P (n=44)		χ^2	P
	No.	%	No.	%		
Limb movement:						
None	33	75	26	59.1	6.3	**0.04**
Slight	10	22.7	10	22.7		**S**
Vigorous	1*	2.3	8	18.2		
Coughing:						
None	33	75	24	54.5	7.9	**0.01**
Diaphragmatic	10	22.7	11	25		**S**
Severe	1*	2.3	9	20.5		

- **Group M:** Magnesium group. **Group P:** High dose of propofol group.
- Data were presented as No. and %, compared using $\chi 2$: chi-square test.
- P value < 0.05 was considered statistically significant otherwise it was insignificant.
- (*) Significantly lower than group P

Table 6: Comparison of total intubation score in the studied groups

Total intubation score	Group M (n=44)	Group P (n=44)	KW	P
Median	9	*7	18.1	**<0.001**
Range	5-9	5-9		**HS**

- **Group M:** Magnesium group. **Group P:** High dose of propofol group
- Data were presented as median and range, compared using KWt: Kruskal Wallis test.
- P value < 0.001 was considered statistically highly significant (HS).
- (*) Significantly lower than group P

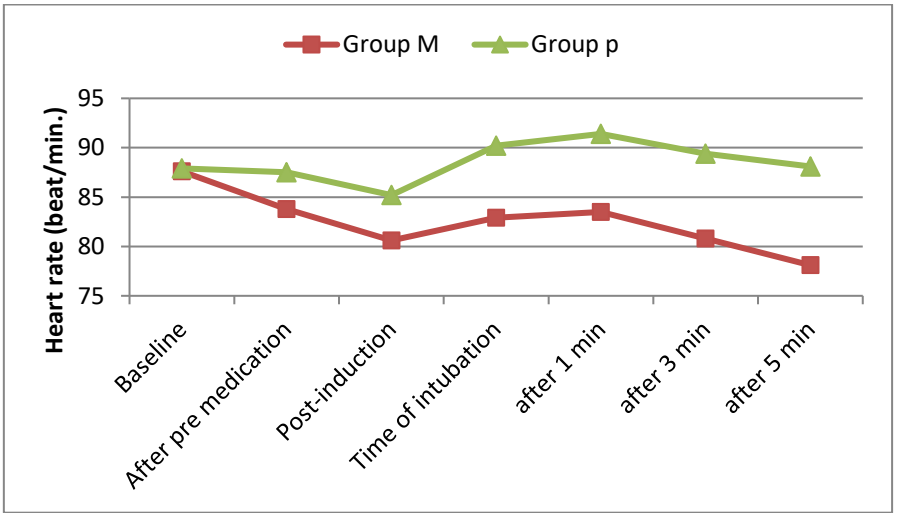

Figure 1: Heart rate of the studied groups at different time interval

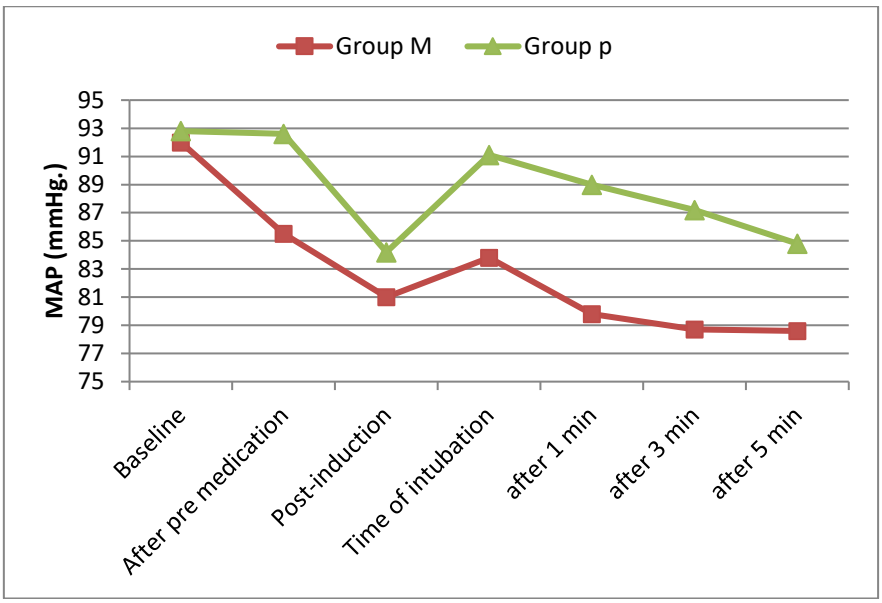

Figure 2: Mean arterial pressure of the studied groups at different time interval

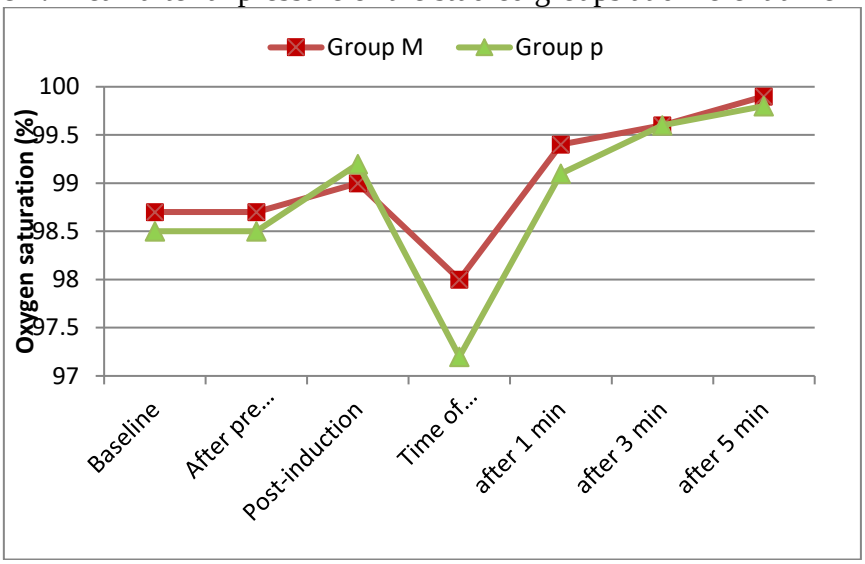

Figure 3: Oxygen saturation of the studied groups at different time interval

DISCUSSION

The current research established that patients in group **M** had better mandibular muscle relaxation and less resistance to laryngoscopy blade than group **P**. Although there was no statistical difference between the tested groups in vocal cords position and movement, there was a statistical difference in the intubation response as it was significantly lower in group **M** than group **P**. On comparing total intubation score between the studied groups, excellent intubation score was significantly higher in group **M** than group **P.**

In this study, patients of group **M** had lower HR and MAP than group **P**. Additionally, there was no statistically significant difference in peripheral oxygen saturation between the two groups although oxygen saturation was improved within the tested groups after intubation.

Soltani et al. [12] did a study to detect the role of magnesium sulfate in tracheal intubation without using muscle relaxants. The patients received 40 (Group 1), 45 (Group 2), 50 (Group 3) mg/kg of Mg sulfate in 100 ml of saline and saline alone (Group 4). They noticed that laryngoscopic difficulty was present in 4% of the patients in (Group 1) which is similar to the present research in which 2.3% of patients of group **M** were difficult. Also, it was difficult in 12% of patients (Group 4) which is similar to the current research in which 15% of patients of group **P** were difficult.

Aissaoui et al. [13] did a study to detect the magnesium sulfate effect on intubation

without using muscle relaxant. Patients received 10 min infusion of (45mg/kg) magnesium sulphate in 100 ml of isotonic saline (magnesium group) or the same volume of saline (control group) then fentanyl (3µg/kg) was given and followed 3 min later by propofol (2.5mg/kg). They found that vocal cords were abducted in 74% of patients of magnesium group. This is similar to the current research in which 77% of patients in group **M** had abducted vocal cords.

Durga et al. [14] did a study to detect the effect of different doses of propofol (group (I) 2mg/kg, (II) 2.5mg/kg, (III) 3mg/kg) on hemodynamic response to tracheal intubation without muscle relaxants. Premedicated with glycopyrrolate (5µg\kg) IV, midazolam (0.02mg\kg) IV and fentanyl (2µg \kg) IV one after other as slow intravenous bolus. They founded that vocal cords were abducted in 53% of patients of group III. This is similar to the present study where 68% of the patients in group **P** had abducted vocal cords.

Also, the present study shows an excellent intubating condition in (68.2%) of patients and good intubating conditions in (25%) of patients in group M. Thus, clinically acceptable intubating conditions were present in (93.2%) of patients in group M. These results agree with the study conducted by **Aissaoui et al** [13]**.**

By using (3mg /kg) propofol in the present study, there were an excellent intubating conditions in (13.6%) of patients and good intubating conditions in (40.9%) of patients so, clinically acceptable intubating conditions were present in (54.5%) of patients in group **P** and this disagrees with the study conducted **by Gore and Harnagale** [15] in which (100%) of patients had clinically acceptable intubating conditions.

In agreement with the results of the current study, **Vallabha et al.** [9] found that there was fall in heart rate occurred following induction, laryngoscopy, and tracheal intubation in magnesium group. Additionally, the heart rate which increased after tracheal intubation in group P in the current research is similar to the study of **Durga et al.** [14]

In the current study, magnesium attenuated the increase in mean arterial blood pressure after laryngoscopy and endotracheal intubation and this is similar to the study conducted by **Honarmand et al.** [16]

CONCLUSIONS

Using intravenous infusion of magnesium sulfate (40 mg/kg) over 10 min before induction leads to better intubation score and also less hemodynamic response to tracheal intubation than using high dose of propofol (3 mg/kg).

RECOMMENDATIONS

- Magnesium sulfate can be used in a dose (40 mg / kg) over 10 minutes before induction in cases where the use of muscle relaxants is undesirable.
- Further study on intubation without the use of muscle relaxants, using different drugs and different doses suitable for children and the elderly.

Conflict of interest

None

Financial disclosures

None

REFERENCES

1. **Lundstrøm L. H., Duez C. H. V., Nørskov A. K., Rosenstock C. V., Thomsen J. L., Møller A. M., et al.** Effects of avoidance or use of neuromuscular blocking agents on outcomes in tracheal intubation: a Cochrane systematic review. Br J Anaesth. 2018; 120(6):1381-1393.
2. **Imani F., Alebouyeh M. R., Anvari Z. T., Faiz S. H. R.** Use of remifentanil and alfentanil in endotracheal intubation: a comparative study. Anesth Pain Med. 2011; 1(2):61-65.
3. **Nooraei, N., Dehkordi, M. E., Radpay, B., Teimoorian, H., Mohajerani, S. A.** Effects of intravenous magnesium sulfate and lidocaine on hemodynamic variables following direct laryngoscopy and intubation in elective surgery patients. Tanaffos. 2013; 12(1):57-63.
4. **Adler A. C.** Propofol: Review of potential risks during administration. AANA J. 2017; 85(2): 104-107.
5. **McKeage K and Perry C. M.** Propofol. CNS drugs. 2003; 17(4):235-272.
6. **Bohringer C., Moua H., Liu H.** Is There Still a Role for Succinylcholine in Contemporary Clinical Practice? Transl Perioper Pain Med. 2019; 6(4):129-135.
7. **Hanci V.** Tracheal Intubation without Use of Muscle Relaxants: Comparison of Remifentanil and Alfentanil. Anesth Pain Med. 2012; 1(3): 210-211.
8. **Imani F., Alebouyeh M. R., Anvari Z. T., Faiz S. H. R.** Use of remifentanil and alfentanil in endotracheal intubation: a comparative study. Anesth Pain Med. 2011; 1(2):61-65.
9. **Vallabha R. and Muthayala V. K.** Attenuating the Haemodynamic Stress To Laryngoscopy And Intubation With IV Magnesium Sulphate And Lignocaine. IOSR-JDMS. 2018; 17(4):19-27.

10. **Sluga M, Ummenhofer W, Studer W, Siegemund M, Marsch SC.** Rocuronium versus succinylcholine for rapid sequence induction of anesthesia and endotracheal intubation: a prospective, randomized trial in emergent cases. Anesth Analg. 2005; 101(5):1356-1361.
11. **IBM.** IBM SPSS Statistics for Windows, Version 25. Armonk, NY: IBM Corp 2017. http://www01.ibm.com/support/docview.wss?uid=swg27049428.
12. **Soltani H. A., Hashemi S. J., Montazeri K., Dehghani A., Nematbakhsh M.** The role of magnesium sulfate in tracheal intubation without muscle relaxation in patients undergoing ophthalmic surgery. J Res Med Sci. 2016; 21(1):96-100.
13. **Aissaoui Y., Qamous Y., Serghini I., Zoubir M., Salim J. L., Boughalem M.** Magnesium sulphate: an adjuvant to tracheal intubation without muscle relaxation–a randomised study. Eur J Anaesthesiol. 2012; 29(8):391-397.
14. **Durga S., Harsh K., Chittora S. P., Lakshmipathi V.** Comparative Evaluation of Different Doses of Propofol without Muscle Relaxants for Intubation. **IOSR**-JDMS. 2016; 15(11): 19-26.
15. **Gore M. S and Harnagale K. D.** Evaluation of intubating conditions with varying doses of propofol without muscle relaxants. J anaesthesiol Clin Pharmacol. 2011; 27(1):27-30.
16. **Honarmand A., Safavi M., Badiei S., Daftari-Fard N.** Different doses of intravenous Magnesium sulfate on cardiovascular changes following the laryngoscopy and tracheal intubation: A double-blind randomized controlled trial. J Res Pharm pract. 2015; 4(2):79-84.

ORGINAL ARTICLE
ZAGAZIG UNIVERSITY MEDICAL JOURNAL

To cite:
Ahmed, S., Attia, Z., Salah, A., Mohammed, A. Tracheal intubation without using neuromuscular blocking drugs in elective surgery. A Comparative Study. *Zagazig University Medical Journal*, 2023; (9-16): -. doi: 10.21608/zumj.2021.50227.2015