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Original Research Article

Efficacy of Intravenous Fentanyl and Magnesium Sulfate in Attenuating Haemodynamic Response to Laryngoscopy and Endotracheal Intubation

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Abstract

Introduction: Magnesium sulfate is cheap, readily available and widely used in obstetric practice with an established anaesthetic adjunct effect on hemodynamic parameters during anaesthesia and surgery. Narcotics have been extensively used for blunting the pressor response to endotracheal intubation. One of the most popular opioids used to attenuate this response is fentanyl**.**

Aim: To compare the efficacy of fentanyl and magnesium sulfate in attenuating hemodynamic response during laryngoscopy and intubation.

Methodology: A Comparative prospective randomized double blind study between two groups with 30 patients in Group F (Fentanyl) and 30 patients in Group M (MgSo4) was conducted. The study was conducted in the Department of Anaesthesiology at Bangalore Baptist Hospital, Bangalore.

Results: There was insignificant rise in diastolic blood pressure in both groups after giving the study drug. Rise was strongly significant immediately after intubation and at 10th minute following intubation. Mean arterial pressure increased in both groups after intubation. Comparison of changes in mean arterial pressure across the groups indicated strong significance ($P < 0.05$) consistently following intubation till the end of study.

Conclusion: It is possible that a combination of magnesium sulfate and fentanyl in lower doses may produce the benefits of both and is worthy of further studies and analysis.

Keywords: Magnesium sulfate, fentanyl, hemodynamic parameter, Systolic Blood pressure

Background

Endotracheal intubation is a noxious stimulus provoking a marked sympathetic response [1]. Laryngoscopy results in stimulation of larynx, pharynx and trachea which are extensively innervated by autonomic nervous system leading to various cardiovascular changes like increase in heart rate, blood pressure, intracranial pressure, intraocular pressure, dysrhythmias, cardiac asystole and even sudden death [2-4]. These changes may prove to be detrimental especially in

patients with ischaemic heart disease, cerebrovascular disease, hypertension, old age and diabetes mellitus.

Since the time King and colleagues (1951) first described the reflex circulatory responses to direct laryngoscopy and tracheal intubation there have been numerous publications concerning both the response and methods by which it can be attenuated [1].

Narcotics have been extensively used for blunting the pressor response to endotracheal intubation. One of the most popular opioids used to attenuate this response is fentanyl. Its analgesic effect suppresses the noxious stimulus caused by intubation and partly decreases centrally mediated sympathetic tone but it has the disadvantage of bradycardia, respiratory depression and post operative nausea and vomiting. In addition, it is less cost effective and difficult to procure in most of the hospitals in India.

Magnesium sulfate is cheap, readily available and widely used in obstetric practice with an established anaesthetic adjunct effect on hemodynamic parameters during anaesthesia and surgery. Magnesium sulfate has major role in decreasing catecholamine release and peripheral vasodilatation that helps in attenuating haemodynamic response to laryngoscopy and endotracheal response. It has added advantage of reducing anaesthetic requirement during surgery and also provides better postoperative analgesia [5].

Based on available clinical literature, we compared the efficacy of fentanyl and magnesium sulfate in attenuating hemodynamic response during laryngoscopy and intubation.

Methodology

A prospective randomized double blinded clinical study was conducted in the Department of Anaesthesiology at Bangalore Baptist Hospital, Bangalore. After approval from the hospital ethical committee and with informed written consent 60 patients were selected according to the following criteria:

A. **Inclusion Criteria:** Age: 20-50 years • Category: ASA I and II • Elective surgeries • Surgeries lasting for more than 60 minutes • Airway: Mallampatti grade I and II • Laryngoscopy and intubation within 30 seconds
B. **Exclusion Criteria:** Age: above 50 years • Category: ASA III and above • Pregnancy • Emergency surgeries • Laryngoscopy and intubation • >30 seconds Patients with predicted difficult airway • Procedures requiring head and neck manipulations, nasogastric • intubation and throat packing for surgery Patients with known allergy to study drugs

60 patients were allocated into two groups by simple random sampling (card draw method).

Group F: (n=30) patients received intravenous fentanyl 2mcg/kg body weight, diluted in 10ml of distilled water over two minutes.

Group M: (n=30) patients received intravenous 50% magnesium sulfate 30mg/kg bodyweight, diluted in 10ml of 5% Dextrose over two minutes.

The Statistical software namely SAS 9.2, SPSS 15.0, Stata 10.1, Med Calc 9.0.1, Systat 12.0 and R environment ver.2.11.1 were used for the analysis of the data and Microsoft word and Excel were used to generate graphs, tables etc.

Results

All the groups studied were comparable with respect to age, gender, weight and ASA distribution. There were no significant difference in the demographic data ($P > 0.05$).

There was no statistical significance in the heart rate before intubation or 10 minutes after intubation. Across the groups changes in systolic blood pressure following intubation at 3rd minute and at the end of study was strongly significant ($P< 0.05$).

There was insignificant rise in diastolic blood pressure in both groups after giving the study drug. Rise was strongly significant immediately after intubation and at 10th minute following intubation.

Systolic blood pressure in both groups decreased after giving magnesium sulfate and prior to induction. Across the groups changes in systolic blood pressure following intubation at 3rdminute and at the end of study was strongly significant (P< 0.05). There was insignificant rise in diastolic

blood pressure in both groups after giving the study drug. Rise was strongly significant immediately after intubation and at 10th minute following intubation.

Mean arterial pressure increase in both groups after intubation. Comparison of changes in mean arterial pressure across the groups indicated strong significance (P < 0.05) consistently following intubation till the end of study.

There was increase in RPP [Rate Pressure Product] after administering magnesium sulfate in group M.RPP increases in both groups after intubation and remains high compared to baseline at all-time intervals in group M and is statistically significant also (P < 0.05).

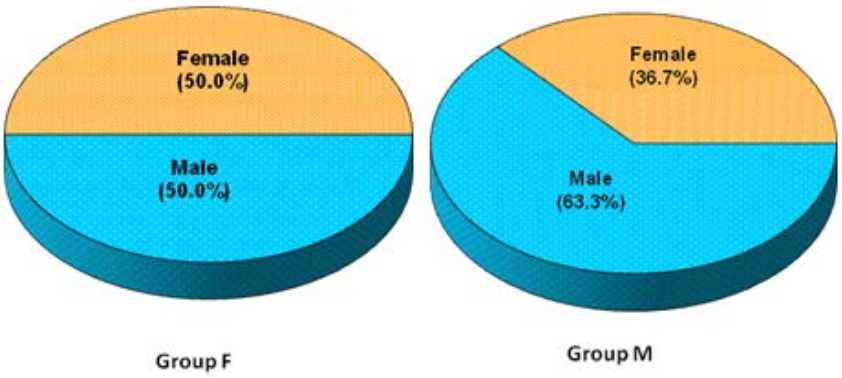

Figure 1: Distribution of ASA grade graphically

Table 1: Comparison of SBP (mm Hg) in two groups of patients

SBP (mm Hg)	Group F	Group M	P value
Baseline	128.20±15.5	133.40±12.87	0.163
Pre- induction	128.00±15.87	130.73±15.37	0.501
Pre- Intubation	117.53±13.81	124.33±13.99	0.063+
Immediately after Intubation	147.80±11.88	157.8±17.01	0.011*
1 min after Intubation	135.33±10.90	145.33±19.37	0.017*
3 min after Intubation	127.20±10.95	137.47±12.37	0.001**
5 min after Intubation	125.67±11.54	133.73±12.34	0.011*
10 min after Intubation	123.27±9.89	132.93±12.31	0.001*

Table 2: Comparison of MAP (mm Hg) in two groups of patients

MAP (mm Hg)	Group F	Group M	P value
Baseline	96.15±8.50	97.85±4.91	0.347
Pre- induction	96.26±8.67	98.46±8.38	0.322
Pre- Intubation	90.11±8.73	96.06±9.72	0.015*
Immediately after Intubation	111.89±9.84	122.53±11.82	<0.001**
1 min after Intubation	104.62±8.62	112.71±12.38	0.005**
3 min after Intubation	99.55±8.04	106.75±8.79	0.002**
5 min after Intubation	97.75±8.55	105.38±8.97	0.001**
10 min after Intubation	95.60±7.93	103.89±7.84	<0.001**

Discussion

This study was intended to compare the efficacy of intravenous fentanyl and intravenous magnesium sulfate in attenuation of haemodynamic response to laryngoscopy and intubation.

Fentanyl plays an important role in anaesthesia by the virtue of meeting most of the aspects of balanced anaesthesia like narcosis, analgesia and attenuation of stress response. It is associated with respiratory depression, rigidity and post-operative nausea and vomiting [6]. Procurement in India is difficult due to rigid narcotic regulation. The usefulness of magnesium sulfate in attenuation of stress response to laryngoscopy and intubation was demonstrated earlier and is still an ongoing evaluation in this area of anaesthesia [7-10].

In the index study, even though there was no statistical significance at any time interval during the study ($p > 0.05$), variations in heart rate among patients of group M were more compared to those in group F giving us an inference that suppression of heart rate was better with fentanyl than magnesium sulfate.

Similar findings were observed by Kothari D *et al* [11], who showed a clinically significant increase in heart rate after injecting magnesium sulfate compared to fentanyl during laryngoscopy and intubation, which stabilized near to baseline values during the course of study.

Our findings show that the efficacy of magnesium sulfate is less when compared to fentanyl in attenuation of rise in systolic blood pressure during laryngoscopy and intubation. Our observation is consistent with the study by Puri G D *et al* [12] and Kumar A *et al* [13] who also observed fall in systolic blood pressure at pre induction stage with a sudden rise in the same during post intubation time following administration of magnesium sulfate. In contrast to our observation, James MFM *et al* [14] observed that patients who received magnesium sulfate showed less increase in systolic blood pressure compared to lignocaine.

Allen RW *et al* [15] in their study on hypertensive proteinuric pregnant patients reported that the mean increase in systolic, diastolic and mean arterial pressure following intubation was significant with magnesium sulfate but lesser than that in other groups receiving lignocaine or alfentanil. Although magnesium sulfate in their study produced greater reductions in arterial pressure, the mean arterial pressure remained more than 90mmHg at all times. In our study, basal values of mean arterial pressure indicate statistical insignificance in both groups which shows strongly significant rise immediately after intubation. This variation was more in group M (+24.67mmHg) compared to group F (+15.73mmHg).

In our study the observation found is consistent with studies performed by Helfman SM *et al* [16] and Chung F *et al* [17] using fentanyl (2.5mcg/kg and 3mcg/kg respectively) to avoid stress response during tracheal intubation who noticed that the drug is effective in attenuating increase in rate pressure product during laryngoscopy and intubation.

In contrast to our observations on Rate pressure product during the course of study, Guptha K, Vohra V and Sood J [18] in their study administered magnesium sulfate 30mg/kg bolus intravenously followed by 10mg/kg infusion till the end of surgery and compared its efficacy with the control group. They concluded that magnesium sulfate has anaesthetic, analgesic, muscle relaxant effects and is also useful to attenuate haemodynamic response to tracheal intubation.

Conclusion

Magnesium sulfate and fentanyl have been shown to provide adequate control of cardiovascular response to intubation although magnesium sulfate is less reliable compared to fentanyl. As the two drugs act

through entirely different mechanisms, it is possible that a combination of magnesium sulfate and fentanyl in lower doses may produce the benefits of both and is worthy of further studies and analysis.

References

1. Bhardwaj N, Panda N, Kumar A. Pressor response to laryngoscopy and intubation – A Review. Journal of Anaesthesiology Clinical Pharmacology. 2003; 19 (3) : 237-249.
2. Prys Roberts C, Green LT, Meloche R, Foex P. Studies of anaesthesia in relation to hypertension II: Haemodynamic consequences of induction and endotracheal intubation. British Journal of Anaesthesia. 1971; 43: 531-46.
3. Takeshima K, Noda K, Higaki M. Cardiovascular response to rapid anesthesia induction and endotracheal intubation. Anesthesia Analgesia. 1987; 66 : 1036.
4. Misganaw A, Sitote M, Jernal S, Melese E, Hune M, Siyoum F, etal. Comparison of intravenous magnesium sulfate and lidocaine for attenuation of cardiovascular response to laryngoscopy and endotracheal intubation in elective surgical patients at Zewditu Memorial Hospital Addis Ababa, Ethiopia. 2021. PLOS ONE 16(6): e0252465.
5. Koinig H, Wallner T, Marhofer P, Andel H, Hörauf K, Mayer N. Magnesium sulfate reduces intra- and postoperative analgesic requirements. Anesthesia Analgesia. 1998; 87: 206–10.
6. Neme Doba, Derartu, Ferede, Zemedu Aweke, Mola Kasa, Simeneh, Comparison of intravenous fentanyl versus lidocaine for attenuation of hemodynamic response to laryngoscopy and endotracheal intubation in patients undergoing elective surgery in Dilla University Referral Hospital, Ethiopia, a randomized controlled trial, International Journal of Surgery: Global Health: November 2020; 3(6):27.
7. Raviteja Vallabha DVKM Dr. Attenuating the Haemodynamic Stress to Laryngoscopy and Intubation with IV Magnesium Sulfate and Lignocaine. ISOR GDMS. 2018;17(4):19–27
8. Mendonça F T, Queiroz L M, Guimarães C C, Xavier A C. Effects of lidocaine and magnesium sulfate in attenuating hemodynamic response to tracheal intubation: single-center, prospective, double-blind, randomized study. Brazilian Journal of Anesthesiology (English Edition). 2017;67(1):50-6.
9. Panda NB, Bharti N, Prasad S. Minimal effective dose of magnesium sulfate for attenuation of intubation response in hypertensive patients. J Clin Anaesth. 2013 Mar;25(2):92-7.
10. Megalla S A, Abdou K A, Mohamed A I. Bispectralindex guided attenuation of hemodynamic and arousal response to endotracheal intubation using magnesium sulfate and fentanyl. Randomized, controlled trial. Egyptian Journal of anaesth. 2019;35 (1):43-8.
11. Kothari D, Mehrotra A, Choudary B, Mehra A. Effect of intravenous magnesium sulfate and fentanyl citrate on circulatory changes during anaesthesia and surgery: Aclinical study. Indian Journal of Anaesthesia. 2008; 52(6):800-804.
12. Puri GD, Marudhachalam KS, Pramila Chari, Suri RK. The effects of magnesium sulfate on haemodynamics and its efficacy in attenuating the response to endotracheal intubation in patients with coronary artery disease. Anesthesia Analgesia. 1998; 87:808-11.
13. Kumar A, Seth A, Gogia A R. attenuation of the hemodynamic response to laryngoscopy and tracheal intubation with fentanyl, lignocaine nebulization and a combination of both: A randomized controlled trial. Anesthesia, essays and researches. 2016Sep-Dec;10(3):43-8.

14. James MFM, Beer RE, Esser JD. Intravenous magnesium sulfate inhibits catecholamine release associated with tracheal intubation. Anesthesia Analgesia. 1989;68:772–776.
15. Allen RW, James MFM, Uys PC. Attenuation of pressor response to tracheal intubation in hypertensive proteinuric pregnant patients by lignocaine, alfentanil and magnesium sulfate. British Journal of Anaesthesia.1991; 66:216-223.
16. Helfman SM, Gold MI, DeLisser EA, Herrington CA. Which drug prevents tachycardia and hypertension associated with tracheal intubation : Lignocaine, Fentanyl or Esmolol ? Anaesthesia Analgesia. 1991; 72: 482–486.
17. Chung F, Evans D. Low – dose fentanyl: haemodynamic response induction and intubation in geriatric patients. Can Anaesth Soc J. 1985; 32(6): 622-8.
18. Gupta K, Vohra V, Sood J. The role of magnesium as an adjuvant during general anaesthesia. Anaesthesia. 2006; 61(11):1058-63.