Original Research Article

Low dose fentanyl attenuates hypertension but not tachycardia during laryngoscopy and tracheal intubation in a three arm study

Valluri Anil Kumar[1*], Vaddineni Jagadish[1], Netra Chavali[2]

[1]Assistant Professor, Department of Anesthesia, Narayana Medical College, Nellore, Andhra Pradesh, India
[2]Senior Resident, Department of Anesthesia, Bollineni Super Specialty Hospital (KIMS), Nellore, India
[*]Corresponding author email: **aniljyoin@gmail.com**

International Archives of Integrated Medicine, Vol. 3, Issue 4, April, 2016.

Available online at http://iaimjournal.com/
ISSN: 2394-0026 (P) **ISSN: 2394-0034 (O)**
Received on: 27-03-2016 **Accepted on:** 03-04-2016
Source of support: Nil **Conflict of interest:** None declared.
How to cite this article: Valluri Anil Kumar, Vaddineni Jagadish, Netra Chavali. Low dose fentanyl attenuates hypertension but not tachycardia during laryngoscopy and tracheal intubation in a three arm study. IAIM, 2016; 3(4): 72-77.

Abstract

Background: Tracheal intubation may induce; hypertension, tachycardia, and/or arrhythmia. Fentanyl is a frequently used opioid that joins with hypnotic agents to diminish hemodynamic responses to tracheal intubation. Furthermore, lidocaine has a suppressive effect on the circulatory responses in patients undergoing laryngoscopy and tracheal intubation. However, intravenous lignocaine has shown variable results and large doses of fentanyl causes hypotension and cough. We compared the effectiveness of intravenous lignocaine 1.5 mg/kg bolus and intravenous fentanyl 2 mcg/kg bolus in attenuating the sympathetic response to laryngoscopy and tracheal intubation.

Materials and methods: One hundred and fifty ASA physical status I or II patients undergoing elective, non-cardiac procedures were randomized, to one of the three treatments such as either normal saline or lignocaine 2 mg/kg or fentanyl 2 mcg/kg. Intubation was carried out 3 minutes after administration of these study drugs. Patients received Midazolam before induction, and Thiopental, Rocuronium during anesthesia. The heart rate, blood pressure and SPO_2 were recorded a day before (B), before intubation (0) at 1 2 3 4-5 minutes after induction.

Results: Tachycardia (HR>100 beats/min) after intubation was statistically similar across 85% (17/20), 75% (15/20) and 55% (11/20) saline, lignocaine, and fentanyl respectively (p>0.05). Hypertension (SBP > 180 mmHg) was seen in 80% (16/20), 70% (14/20) and 40% (8/20) with saline,

lignocaine and fentanyl respectively. The incidence of hypertension with fentanyl was significantly ($p<0.05$) lower than saline; however, such a meaning was not observed with lignocaine.

Conclusion: Low dose of fentanyl prevented hypertension but not tachycardia as compared to normal saline; on the other hand, lignocaine did not attenuate cardiovascular responses during laryngoscopy and tracheal intubation.

Key words

Fentanyl, Lignocaine, Laryngoscopy, Intubation, Attenuation of cardiovascular responses.

Introduction

Intubation is associated with a cardiovascular response of elevated blood pressure and pulse, cough reflexes, occasional dysrhythmias**,** increased intracranial pressure, and increased intraocular pressure [1]. Even though such responses are brief, patients with cardiovascular or cerebral disease may be at increased risk of morbidity and mortality from the tachycardia and hypertension [2]. Fentanyl is a frequently used opioid that joins with hypnotic agents to diminish hemodynamic responses to tracheal intubation. Furthermore, lidocaine has a suppressive effect on the circulatory responses in patients undergoing laryngoscopy and tracheal intubation [3]. No studies document any harmful effects of prophylactic lidocaine given pre intubation [4]. A dose of prophylactic lidocaine of 1.5 mg/kg given intravenously 3 minutes before intubation is optimal in blunting rises in pulse, blood pressure, intracranial and intraocular pressure [4]. However, intravenous lignocaine has shown variable results. Fentanyl is a synthetic opioid; it can be used as a premedicant, as an induction agent in patients with cardiac problems coming for non cardiac surgery. Fentanyl in small doses (2 to 5 mcg/kg) infrequently causes significant decrease in arterial blood pressure when given alone, even in patients with poor left ventricular function, causes little or no change in myocardial contractility [5]. However, large doses of fentanyl may cause hypotension [6], cough [7] and postoperative respiratory depression [8]. To this purpose, we studied the efficacy of intravenous lignocaine 1.5mg/kg bolus and low dose of intravenous fentanyl 2 mcg/kg bolus in attenuating the sympathetic response to laryngoscopy and tracheal intubation.

Material and methods

This study was carried out in the department of Anesthesiology at Narayana medical college and Hospital, Nellore (AP) during the period of two years. 150 ASA I and II patients aged 20-50 years scheduled for elective surgery requiring general anesthesia with endotracheal intubation having Mallampati airway assessment of grades-I and II were included. Patients undergoing emergency surgeries, or anticipated difficult intubation, or patients with ASA grades III or higher or patients with cardiovascular diseases were excluded. All the selected patients were randomized, to one of the three treatments such as either normal saline or lignocaine 2mg/kg or fentanyl 2mcg/kg. Intubation was carried out 3 min after administration of these study drugs. Patients were premedicated with intra-muscular atropine 0.01mg/kg, tramadol 2mg/kg midazolam 0.01 mg/kg half an hour prior to induction. Patients received 100% oxygen for 3 minutes using Mapleson A circuit with a close-fitting face-mask. The heart rate, blood pressure and SPO_2 were recorded a day before (B), before intubation (0) at 1, 2, 3, 4, and 5 minutes after induction. No additional agents were given for the first five-minute post-intubation, nor were any surgical stimuli given to these patients. Furthermore, anesthesia in all three groups of patients was carried out using thiopental and rocuronium. Patients who required a second attempt at intubation were excluded from the study.

Statistical analysis

The results were presented as mean ± standard deviation, numbers and percentages. Inferential analysis was performed using Chi-square and ANOVA and posthoc tukey test. A two-tailed p-value <0.05 was considered as statistically significant.

Results

It can be seen from **Table - 1,** that the tachycardia (HR>100 beats/min) after intubation was statistically similar across 85% (17/20), 75% (15/20) and 55 % (11/20) saline, lignocaine, and fentanyl respectively (p>0.05). Hypertension (SBP > 180 mmHg) was seen in 80% (16/20), 70% (14/20) and 40% (8/20) with saline, lignocaine and fentanyl respectively. The incidence of hypertension with fentanyl was significantly (p<0.05) lower than saline; however, such a meaning was not observed with lignocaine. Following pretreatment with fentanyl, heart rate response during laryngoscopy and intubation was significant lower when compared with the saline (p<0.001). Such a difference was continued until the 5th minute. The maximum percentage change in heart rate from baseline, was (6.25%), with fentanyl was significantly less t was significantly less than lignocaine and saline (16.66% and 32.19% respectively). There was significance between fentanyl and lignocaine during 2nd, 3rd, 4th and 5th minutes. The systolic as well as diastolic blood pressure responses during laryngoscopy and intubation showed highly significant difference, when compared with the saline (1st minute to 4th minute). The maximum percent change in mean systolic blood pressure from base line was (0.3%) with fentanyl which was significantly less than lignocaine and saline (9.09% and 30.76%) respectively. Similar changes were noted in diastolic blood pressure with fentanyl (5.93%) as compared with (12.19% and 30.76%) lignocaine and saline. In our present study, two patients became apneic after receiving 2 mcg/kg dose of fentanyl and required assisted ventilation before laryngoscopy and were managed effectively with assisted ventilation.

Discussion

The present study was conducted to evaluate the efficacy of fentanyl and lignocaine versus placebo in attenuating the cardiovascular response induced i.e., rise of blood pressure and heart rate during direct laryngoscopy and endotracheal intubation in ASA grade-I and II patients. In our study, low dose fentanyl 2 mcg/kg, blunts systolic blood pressure response during laryngoscopy and intubation (only 0.3% increase from the baseline value against 30.76% increase from the base line value in control group). A study [9] pretreated 15 patients with 5mcg/kg fentanyl scheduled for elective neurosurgery and found that the blood pressure rise was 14 mmHg whereas it was 50 mmHg with saline. Heart rate response to laryngoscopy and intubation also followed the same pattern. The observed CVS depression after fentanyl is due to inhibition of central sympathetic outflow that is independent from analgesia or other sensory depressant effect [10]. Additionally, hypotension produced by fentanyl was ancillary in nature. Fentanyl also modulates nociceptive input and provides effective blunting of responses to laryngoscopy and intubation. Similar observation was noted by Helfman, et al. [11], Sam Chung K, et al. [12] and J.E. Smith, et al. [13].

However they used a higher dose of fentanyl as compared to our study. One study [14] have shown that the optimal injection time of fentanyl for intubation is 5 min before intubation. A study [15] compared fentanyl versus lignocaine and found that low dose of fentanyl prevented hypertension but not tachycardia, and lidocaine had no effect to blunt adverse hemodynamic responses during laryngoscopy and tracheal intubation. Similar response was found in our study too. Laryngoscopy and tracheal intubation induces significant changes in circulating catecholamine levels [16]. Fentanyl at a dose of 50 mcg/kg of fentanyl prevents increase in plasma catecholamine levels during cardiac surgery. Above 60mcg/kg, prevents increase in plasma ADH, renin, aldosterone. Although

fentanyl weakened the hemodynamic responses to intubation, moderate to high doses of fentanyl were not given for the fear of being unable to ventilate the lungs prior to induction or following a failed attempt at intubation. A recent study has shown that fentanyl attenuates the hemodynamic response to endotracheal intubation more than the response to laryngoscopy [17]. Furthermore another study reports, that addition of low dose clonidine (1.0 μg/kg) to low dose fentanyl (2 μg/kg) has safe minimal side effects to attenuate the hyperdynamic response to laryngoscopy and intubation [18].

Table - 1: Demographic and Hemodynamic data

	Fentanyl	**Lignocaine**	**Saline**
Sex (M/F)	10/15	11/14	8/17
Age (Year)	34±8.2	37±13.54	35±10.2
Weight (Kg)	54±4.91	56±6.9	57±5.5
Heart Rate (beats/min)			
B	80±6.7	78±5.5	76±2.28
0	83±7.54	81±2	84±2.6
1	80±5.62	82±1.9	86±2.31
2	86±4.14	91±2.9	101±2.92
3	85±2.13	90±2.4	95±2.5
4	84±2.21	90±2.8	94±2.3
5	82±1.65	89±2.03	90±2.03
Systolic blood pressure (mmHg)			
B	131.6±3.83	132±6.48	130±5.5
0	124.08±3.42	123±5.6	128±5.4
1	124.8±3.1	128±5.06	130±5.58
2	128±3.65	138±5.35	166±4.6
3	130±3.29	144±4.39	170±5.95
4	132±2.35	140±4.08	156±5.44
5	130±2.88	132±4.39	136±3.48
Diastolic blood pressure (mmHg)			
B	77±4.37	82±4.12	78±5.44
0	78±4.55	80±4.12	84±4.84
1	78±4.88	88±4	86±4
2	81.57±4.45	92±4.28	102±6.27
3	84±3.26	86±4.04	94±5.7
4	81.52±4.73	82±3.74	92±5.5
5	77.76±4.7	82±3.16	88±4.04
% Tachycardia *	55% (11/20)	75% (15/20)	85% (17/20)
% Hypertension ^	40% (8/20)	70% (14/20)	80% (16/20)

*-$p>0.05$, ^-$p<0.05$. B = Baseline, 0 = Zero min, 1 = 1st min, 2 = 2nd min, 3 = 3rd min, 4 = 4th minute, 5 = 5th minute.

Conclusion

Low dose of fentanyl prevented hypertension but not tachycardia as compared to normal saline; on the other hand, lignocaine did not attenuate cardiovascular responses during laryngoscopy and tracheal intubation.

References

1. Lev R, Rosen P. Prophylactic lidocaine use preintubation: A review. Journal of Emergency Medicine, 1994; 12(4): 499-506.
2. Kovac AL. Controlling the hemodynamic response to laryngoscopy and endotracheal intubation. Journal of Clinical Anesthesia, 1996; 28(1): 63-79.
3. Hassani V, Movassaghi G, Goodarzi V, Safari S. Comparison of Fentanyl and Fentanyl Plus Lidocaine on Attenuation of Hemodynamic Responses to Tracheal Intubation in Controlled Hypertensive Patients Undergoing General Anesthesia. Anesth Pain Med., 2013; 2(3): 115-8.
4. Lev R, Rosen P. Prophylactic lidocaine use preintubation: a review. The Journal of emergency medicine, 1994; 12(4): 499-506.
5. Roig JC, Fink J, Burchfield DJ. Pharmacologic Adjuncts I. Goldsmith J, Karotkin E (eds) Assisted Ventilation of the Neonate, 5th edition, Philadelphia: Elseiver, Inc. 2010, p. 347-70.
6. Reich DL, Hossain S, Krol M, Baez B, Patel P, Bernstein A, et al. Predictors of hypotension after induction of general anesthesia. Anesthesia and analgesia, 2005; 101(3): 622-8.
7. Pandey CK, Raza M, Ranjan R, Lakra A, Agarwal A, Singh U, et al. Intravenous lidocaine suppresses fentanyl-induced coughing: a double-blind, prospective, randomized placebo-controlled study. Anesthesia and analgesia, 2004; 99(6): 1696-8.
8. Gupta S, Tank P. A comparative study of efficacy of esmolol and fentanyl for pressure attenuation during laryngoscopy and endotracheal intubation. Saudi journal of anaesthesia, 2011; 5(1): 2.
9. Dahlgren N, Messeter K. Treatment of stress response to laryngoscopy and intubation with fentanyl. Anaesthesia, 1981; 36(11): 1022-6.
10. Stanley TH, Bailey PL. Opioids in Patients with Cardiac Disease. Anesthesiology and the Heart: Springer; 1990, p. 191-229.
11. Helfman SM, Gold MI, DeLkser EA, Herrington CA. Which Drug Prevents Tachycardia and Hypertension Associated with Tracheal Intubation: Lidocaine, Fentanyl, or Esmolol? Anesthesia & Analgesia, 1991; 72(4): 482-6.
12. Chung KS, Sinatra RS, Halevy JD, Paige D, Silverman DG. A comparison of fentanyl, esmolol, and their combination for blunting the haemodynamic responses during rapid-sequence induction. Canadian Journal of Anaesthesia, 1992; 39(8): 774-9.
13. Smith J, King M, Yanny H, Pottinger K, Pomirska M. Effect of fentanyl on the circulatory responses to orotracheal fibreoptic intubation. Anaesthesia, 1992; 47(1): 20-3.
14. Ko S-H, Kim D-C, Han Y-J, Song H-S. Small-Dose Fentanyl: Optimal Time of Injection for Blunting the Circulatory Responses to Tracheal Intubation. Anesthesia & Analgesia, 1998; 86(3): 658-61.
15. Feng CK, Chan KH, Liu KN, Or CH, Lee TY. A comparison of lidocaine, fentanyl, and esmolol for attenuation of cardiovascular response to laryngoscopy and tracheal intubation. Acta anaesthesiologica Sinica., 1996; 34(2): 61-7.
16. Hassan HG, el-Sharkawy TY, Renck H, Mansour G, Fouda A. Hemodynamic and catecholamine responses to laryngoscopy with vs. without endotracheal intubation. Acta anaesthesiologica Scandinavica, 1991; 35(5): 442-7.

17. Adachi YU, Satomoto M, Higuchi H, Watanabe K. Fentanyl Attenuates the Hemodynamic Response to Endotracheal Intubation More Than the Response to Laryngoscopy. Anesthesia & Analgesia, 2002; 95(1): 233-7.
18. Arora S, Kulkarni A, Bhargava AK. Attenuation of hemodynamic response to laryngoscopy and orotracheal intubation using intravenous clonidine. Journal of Anaesthesiology, Clinical Pharmacology, 2015; 31(1): 110-4.