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A comparative study of fentanyl and fentanyl plus lidocaine on attenuation of haemodynamic stress response to laryngoscopy and tracheal intubation in hypertensive patients

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Abstract:

Introduction: Endotracheal intubation may create a period of hemodynamic instability in normotensive patients but more so in hypertensive patients. Endotracheal intubation produces stimulation of laryngeal and tracheal sensory receptors, resulting in a marked increase in the elaboration of sympathetic amines leading to hypertensive crisis. **Objectives**: The objective of study is to evaluate and compare the efficacy of fentanyl and fentanyl plus lidocaine in attenuating the stress responses to laryngoscopy and endotracheal intubation in hypertensive patients. **Material and Methods:** We conducted a prospective, randomized, double-blind study in 40 patients with controlled hypertension. All patients were randomly divided into two groups (fentanyl group and fentanyl plus lidocaine group). The fentanyl group received 2 mcg/kg and the fentanyl plus lidocaine group received 1.5mg/kg lidocaine and fentanyl 2mcg/kg, 3 min prior to intubation. Hemodynamic parameters were recorded at baseline, after giving induction agents, and 1, 3 and 5 minutes after endotracheal intubation. **Results:** There were no significant differences between the two groups regarding hemodynamic parameters like heart rate, systolic blood pressure and diastolic blood pressure before induction 1, 3 and 5 minutes after intubation. **Conclusion**: Both fentanyl and fentanyl plus lidocaine effectively decreased the stress response to endotracheal intubation.

Key words: Fentanyl, Hemodynamic stress, Intubation, Lidocaine

Introduction

Endotracheal intubation can induce hypertension, tachycardia, in normotensive patients and more so in hypertensive patients. These tracheal responses are mediated by sympathoadrenal responses and are normally well tolerated by normotensive patients. However, induction of anesthesia and endotracheal intubation may produces an exaggerated hypertensive response to laryngoscopy and endotracheal intubation. Endotracheal intubation of the trachea stimulates laryngeal and tracheal sensory receptors, resulting in

a marked increase in the elaboration of sympathetic amines. This sympathetic stimulation results in tachycardia and elevation of blood pressure [1-7]. Thus different drugs such as local anesthetics, opioids, calcium channel blockers, short acting β-adrenergic blockers, and their combinations have been used to prevent this hemodynamic responses but none was found to be most effective [8-14]. Fentanyl, a commonly used opioid along with hypnotic agents have been used to diminish hemodynamic responses to tracheal intubation [15-17]. Furthermore, lidocaine has a suppressive effect on the circulatory responses in patients undergoing laryngoscopy and tracheal intubation [18,19].

This study aimed to evaluate and to compare the efficacy of fentanyl and fentanyl plus lidocaine in attenuating haemodynamic stress responses to laryngoscopy and endotracheal intubation in controlled hypertensive patients.

Materials and Methods:

We conducted a prospective, randomized, double-blind trial in 40 patients with controlled hypertension in the SCB medical college from March to December 2013. The study protocol was approved by the hospital ethical committee. Written informed consent was obtained from all patients. All patients were posted for elective surgery under general anesthesia.

Inclusion criteria: Age < 65yrs and > 20yrs, ASA class II patients (hypertensive patients).

Exclusion criteria: Patients undergoing heart surgery, ASA III or above, CHF (congestive heart failure), arrhythmia, difficult airway, intubation time greater than 15 seconds.

All patients were randomly divided into two groups (fentanyl group and fentanyl plus lidocaine group). Patients received their morning dose of anti-hypertensive medication before surgery. A routine pre-operative check-up was done in all patients and baseline vitals were noted. Then patients received ringer's lactate 5ml/kg after starting an intravenous line. Patients were attached to the following monitors; ECG, noninvasive blood pressure monitor, pulse oximetery. The baseline mean arterial pressure (MAP), systolic blood pressure (SBP), diastolic blood pressure (DBP), and heart rate (HR) were recorded. All the patients were premedicated with Inj.Midazolam and Inj.Glycopyrrolate 0.02mg/kg i.v and were preoxygeneted. The fentanyl group received 2 mcg/kg and the fentanyl plus lidocaine group received 1.5mg/kg lidocaine and 2mcg/kg fentanyl. After 2 minutes anesthesia was induced by thiopentone, given in a dose of 3-5 mg/kg and succinylcholine was given in a dose of 2 mg/kg. Then a laryngoscopy was performed by an anaesthetist with a standard Macintosh laryngoscope and the trachea was intubated with an appropriate size cuffed endotracheal tube. Hemodynamic variables; MAP, SBP, DBP, and HR were recorded 1,3 and 5 minutes after performing endotracheal intubation. We also recorded any possible complications such as; bradycardia (HR < 50) and hypotension (SBP < 90). All results were expressed as mean ± SD. Hemodynamic variables in the present study were analyzed statistically by using by using the analysis of variance (ANOVA) and Student's t-test. P values ≤ 0.05 were considered significant.

Results

We evaluated 40 patients including 20 males (50%) and 20 females (50%) with a mean age of 54.08 ± 10.25 years. There was no significant difference between the two groups regarding HR, SBP and DBP in the patients before induction(base line), three minutes before intubation and 1, 3 and 5 minutes after intubation. Tables 1, 2 and 3 show changes in the hemodynamic variables in both groups.

Table 1: **Mean heart rate in fentanyl and fentanyl plus lidocaine groups**

Heart Rate Groups	Fentanyl, Mean±SD	Fentanyl+Lidocaine, Mean±SD	P value
Before induction(base line)	82.34±12.42	80.35±9.4	0.33
1 minutes after intubation	78.26±8.92	72.16±8.94	0.08
3 minutes after intubation	72.54±9.59	71.53±10.86	0.68
5 minutes after intubation	67.34±10.24	66.56±9.86	0.80

There was no significant difference in mean heart rate between the two groups (as shown in Table 1)

Table 2: Systolic blood pressure in fentanyl and fentanyl plus lidocaine groups

Systolic Blood Pressure Groups	Fentanyl (Mean±SD)	Fentanyl+Lidocaine, (Mean±SD)	P value
Before induction	147.46±22.46	160.30±24.78	0.15
1 minutes after intubation	121.48±21.25	122.28±13.76	0.95
3 minutes after intubation	115.56±23.24	112.76±23.18	0.74
5 minutes after intubation	106.24±20.68	112.34±28.84	0.52

There is no significant difference between two groups for systolic blood pressure (as shown in table 2)

Table 3: **Diastolic blood pressure in fentanyl and fentanyl plus lidocaine groups**

Diastolic Blood Pressure Groups	Fentanyl, Mean± SD	Fentanyl+Lidocaine, Mean±SD	P value.
Before Induction	85.30±11.26	92.35±11.64	0.63
1 minutes after intubation	72.38±10.76	77.34±12.58	0.28
3 minutes after intubation	72.37±13.64	72.75±16.27	0.28
5 minutes after intubation	76.24±18.68	72.34±13.84	0.62

There is no significant difference between two groups for diastolic blood pressure (as shown in table 3)

Discussion

We found that fentanyl and fentanyl plus lidocaine are equally effective medications in decreasing hemodynamic stress responses (HR, SBP and DBP). Endotracheal intubation is a stressful noxious stimuli, which result in a marked increase in the release of sympathetic amines (adrenaline and noradrenaline) by stimulating laryngeal and tracheal sensory receptors. This increase in the sympathetic amines leads to complications especially in patient with hypertension. In response to endotracheal intubation, there is increase in blood pressure, increases in heart rate and tachyarrhythmia arising essentially due to sympathetic stimulation. These responses are significantly high, but they are generally well tolerated in normal patients, but in patients with cardiovascular diseases, many complications like; increases in systolic and diastolic blood pressure, increases in heart rate, tachyarrhythmia, cerebral hemorrhage, left ventricular failure, and in rare conditions, myocardial ischemia may occur.[20-25] These hemodynamic responses to intubation were controlled effectively in our patients by using two drugs like fentanyl and lidocaine. But adding lidocaine to fentanyl did not increase the hemodynamic stability in comparison to fentanyl alone. Several previous studies have verified that lidocaine improves intraoperative and postoperative hemodynamic stability by stabilizing the changes in arterial pressure, heart rate and cardiac output, which is in contrast to our study. These beneficial effects of lidocaine on hemodynamic stability is possibly due to; direct myocardial depressant effect, peripheral vasodilating effect and the effect on synaptic transmissions [18,19]. Moreover, according to Ali et al. in 2010, pre-treatment with lidocaine improves intra- and post-operative hemodynamic stability during laparoscopic surgery without prolonging recovery [26]. Our study was in line with some previous studies such as Shin et al. that compared the effects of lidocaine, fentanyl, Nicardipine and Esmolol, on the hemodynamic response during intubation and those studies showed that all the agents are effective in producing hemodynamic stability [27]. According to Levitt et al. Esmolol and lidocaine have similar efficacies to attenuate moderate hemodynamic responses to intubation in patients with isolated head trauma [28]. Additionally, Malde and Sarode in a 2007 study compared lignocaine and fentanyl efficacy on hemodynamic stability and revealed that lignocaine and fentanyl both attenuated the rise in heart rate, however, fentanyl produced better results. Lignocaine attenuated the rise in blood pressure with intubation while fentanyl inhibits it totally [29]. We demonstrated that the two groups of medication were effective in maintaining hemodynamic stability but they could not inhibit all hemodynamic responses to intubation. In this case our results were in agreement

with Feng et al [30] and Salihoglu et al [9] who disclosed that lidocaine plus fentanyl may slightly be more effective in controlling PR following endotracheal intubation.

Conclusion

Our results were limited by the fact that we did not monitor the depth of anesthesia. Fentanyl and fentanyl plus lidocaine are equally effective in decreasing the hemodynamic stress response to tracheal intubation, but neither fentanyl nor fentanyl plus lidocaine could inhibit all hemodynamic responses, furthermore fentanyl plus lidocaine was not more effective than fentanyl alone.

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