How to Cite:
Ranjan, A., & Prasad, A. (2022). Effectiveness of intravenous lidocaine and fentanyl on attenuation of hemodynamic response to extubation for ear, nose and throat surgeries at JLNMCH, Bhagalpur, Bihar. *International Journal of Health Sciences*, *6*(S1), 13157–13164.
https://doi.org/10.53730/ijhs.v6nS1.8430

Effectiveness of intravenous lidocaine and fentanyl on attenuation of hemodynamic response to extubation for ear, nose and throat surgeries at JLNMCH, Bhagalpur, Bihar

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***Abstract*---**Background**:** Tracheal extubation, the purposeful removal of the endotracheal tube from the trachea, can be associated with detrimental hemodynamic and airway responses. Lidocaine and fentanyl are known to suppress hemodynamic response to extubation during Ear, nose, and throat surgeries. Smooth tracheal extubation is important after Ear, nose, and throat surgeries. Objective**:** To compare the effect of intravenous lidocaine and fentanyl on attenuation of hemodynamic response to extubation for Ear, nose, and throat (ENT) surgeries at JLNMCH, Bhagalpur, Bihar. Methods**:** This prospective cohort study recruits 74 American Society of Anesthesiologist (ASA) class I and II, age between 18 and 60 patients who underwent Ear, Nose and Throat surgeries. Unpaired T test was used to compare the mean of heart rate and mean arterial blood pressure between groups. Mann Whitney U Test was used for distribution free data. Association of categorical independent variables between two groups were analyzed using Chi Square or fisher exact test. P-values < 0.05 were considered as statistically significant with a power of 80%. Results**:** The demographic and clinical characteristics were comparable between groups. The pulse rate and mean arterial blood pressure were significantly lower in fentanyl group at 1, 5, and 10 min after extubation with p values < 0.05. There was no statistically significant difference between two groups with decreasing the incidence of coughing in the Periextubation period with a p value of 0.857. Conclusion and Recommendation: The findings of our study demonstrate that fentanyl 1µg/kg IV, administered 10 min before end

Manuscript submitted: 18 March 2022, Manuscript revised: 9 April 2022, Accepted for publication: 27 May 2022

of operation, was more effective in attenuating hemodynamic response to tracheal extubation compared with lidocaine 1.5 mg/kg IV in patients underwent ENT surgeries. We recommend that fentanyl administered 10 minutes before the end of operation for ENT surgeries is effective in attenuating hemodynamic response to extubation.

***Keywords*---**Extubation, Endotracheal tube, ENT, ASA, Lidocaine, Fentanyl.

Introduction

Tracheal extubation can be associated with detrimental hemodynamic and airway responses. Smooth extubation requires the absence of straining, coughing, breath holding and laryngospasm[1]. Deep extubation refers to the removal of a tracheal tube in a spontaneously breathing patient who is sufficiently anesthetized to obtund the laryngeal reflexes. This technique offers the advantage of a smooth extubation with less airway stimulation, thereby reducing cardiovascular stimulation, coughing, intraocular, intracranial, and middle ear pressure changes. However, the risks of deep tracheal extubation include increased incidence of airway obstruction and aspiration[2].

In order to control hemodynamic changes during tracheal intubation and extubation, local anaesthetics, opioids, beta-blocking agents, and calcium channel blockers have been used with varying success rates[3]. Fentanyl, an opioid agonist, may blunt cardiovascular and airway reflexes during emergence without prolonging the recovery. It predominantly acts on μ receptors. Fentanyl brings hemodynamic stability during perioperative period by its action on cardiovascular and autonomic regulatory areas. It decreases sympathetic tone and increases parasympathetic tone. Fentanyl inhibits pituitary adrenal response directly or indirectly via hypothalamus. Low dose (1 microgram/ kilogram) of fentanyl was employed because a large dose may lead to muscular rigidity, bradycardia, nausea and vomiting. Large doses may also cause postoperative respiratory depression[4].

Lidocaine attenuates the hemodynamic response to tracheal extubation by its direct myocardial depressant effect, central stimulant effect, and peripheral vasodilatory effect and finally it suppresses the cardiovascular and airway reflexes, an effect on synaptic transmission[5]. So we had considered lidocaine in our study. Hence, the aim of this study was to compare the effect of intravenous lidocaine and fentanyl on attenuation of hemodynamic response to extubation for ENT surgeries.

Objectives

To compare the effect of lidocaine and fentanyl on heart rate to extubation.
To compare the effect of lidocaine and fentanyl on blood pressure to extubation.
To compare the effect of lidocaine and fentanyl on quality of extubation.

Material and Methods

This prospective study was done at Jawaharlal Nehru Medical College and Hospital, Bhagalpur, Bihar from October 2020 to March 2021. All adult patients who underwent elective ENT surgeries under GA with ETTI at JLNMCH, Bhagalpur, Bihar during the study period.

Inclusion and Exclusion criteria

Inclusion criteria

- Elective ENT surgeries under GA with ETTI
- ASA status I and II
- Patients age between 18 and 60.
- Patients BMI between 18.5 and 29.5 (6).

Exclusion criteria

- Patients with cardiorespiratory abnormalities (Hypertension, New York Heart Association heart failure grades 3 and 4, bronchial asthma, chronic obstructive pulmonary disease, and restrictive lung disease).
- Active upper respiratory tract infection
- Renal dysfunction
- Liver dysfunction.
- History of allergy of the study drugs
- Patients on beta blockers
- Patient refusal

Results

Demographic and clinical Characteristics

Seventy four patients under general anesthesia with endotracheal tube intubated and scheduled for elective ENT surgeries who full filled inclusion criteria were included and completed the study. There was no statistically significant difference between two groups in age. The demographic status and clinical characteristics of data were comparable between groups (table 1).

Table 1: Demographic and clinical characteristics of patients who underwent ENT surgeries

	Fentanyl group (n=37)	Lidocaine group (n=37)	p- value
Age(years) (mean ± SD)	26.32 ± 4.52	26.41 ± 4.18	0.936
Sex Male (n, %) Female (n, %)	 24(64.9%) 13(35.1%)	 21(56.8%) 16(43.2%)	 0.634
ASA Status ASA 1 (n, %) ASA 2 (n, %)	 31(83.8%) 6(16.2%)	 35(94.6%) 2(5.4%)	 0.261
BMI (Kg/m^2) (mean ± SD)	21.34 ± 1.15	21.66 ± 1.25	0.252
HR before anesthesia (mean ± SD)	80.35 ± 3.58	79.46 ± 4.60	0.335

MAP before anesthesia (mean ± SD)	88.16 ± 4.91	87.84 ± 3.63	0.747
SPO2 before anesthesia #	96(96-97)	97(96-97)	0.676
Procedure Tonsillectomy (n, %) Tympanoplasty (n, %) Polypectomy (n, %)	 20(54.1%) 6(16.2%) 11(29.7%)	 19(51.4%) 7(18.9%) 11(29.7%)	0.950
Tramadol dose (milligram) #	60(10)	60(10)	0.807
Induction agent Propofol Ketamine & propofol	 28(75.7%) 9(24.3%)	 22(59.5%) 15(40.5%)	0.214
Anesthetist experience(years) #	5(2)	5(2)	0.554
Surgeon experience Resident (n, %)Senior (n, %)	 8(21.6%) 29(78.4%)	 11(29.7) 26(70.3%)	0.595
Blood loss (milliliter) #	200(200)	100(300)	0.186
Duration of surgery (minute) #	60(30)	60(35)	0.711
Duration of anesthesia (minute) #	90(40)	85(43)	0.736

= Median (Interquartile range); n (%) = number (proportion), SD=Standard deviation

Comparison of hemodynamic parameters between Lidocaine and Fentanyl groups

The pulse rate and the mean arterial blood pressure were analysed by unpaired student t test and expressed in mean and standard deviation (mean ± SD). Spontaneous oxygen saturation (SPO2) was analysed by Mann Whitney test and expressed in median and inter quartile range (IQR). The PR and MAP taken before extubation were comparable between two groups except there was a significant difference between two groups in MAP after drug administration (p-value= 0.021). There was a statistically significant difference in PR with mean ± SD in fentanyl group (79.11 ± 3.36) when compared to lidocaine group (81.16 ± 4.24) immediately after extubation with p value of 0.024. There was a statistically significant difference in MAP in fentanyl group (74.97± 3.25) and in lidocaine group (81.65±6.40) at 1 min after extubation (p <0.0001). There were also a statistically significant difference in PR and MAP at 5 and 10 min after extubation (p < 0.05) as shown in Table 2 below.

Table 2: Comparison of hemodynamic parameters for patients underwent ENT surgeries

Vital sign	Fentanyl group (n=37)	Lidocaine group (n=37)	p- value
Vital sign before study drug administration			
PR in bpm (mean ± SD)	80.59 ± 4.96	79.51 ± 4	0.306
MAP in mmHg (mean ± SD)	87.03 ± 4.11	86.35 ± 3.96	0.474

SPO_2 in % #	100(99-100)	99(99-100)	0.109
Vital sign after study drug administration			
PR in bpm (mean ± SD)	76.35 ± 5.02	76.25 ± 3.25	0.935
MAP in mmHg (mean ± SD)	70.84 ± 3.69	73.38 ± 5.40	0.021*
SPO_2 in % #	100(99-100)	100(99-100)	0.714
Vital sign immediately after extubation			
PR in bpm (mean ± SD)	79.11 ± 3.36	81.16 ± 4.24	0.024*
MAP in mmHg (mean ± SD)	74.97 ± 3.25	81.65 ± 6.40	<0.0001*
SPO_2 in % #	96(96-97)	97(96-97)	0.505
Vital sign 5 min. after extubation			
PR in bpm (mean ± SD)	75.16 ± 3.45	77.62 ± 3.26	0.002*
MAP in mmHg (mean ± SD)	74.27 ± 4.83	79.68 ± 5.31	<0.0001*
SPO_2 in % #	97(96-97)	97(96-98)	0.229
Vital sign 10 min. after extubation			
PR in bpm(mean ± SD)	76.84 ± 3.12	78.97 ± 2.57	0.002*
MAP in mmHg (mean ± SD)	72.54 ± 4.12	77.11 ± 7.44	0.002*
SPO_2 in % #	97(96-97)	97(96-97)	0.844
Vital sign 15 min. after extubation			
PR in bpm (mean ± SD)	79.57 ± 4.69	80.57 ± 4.63	0.359
MAP in mmHg (mean ± SD)	73.92 ± 4.43	75.68 ± 5.79	0.147
SPO_2 in % #	97(96-97)	97(96-97)	0.565

IQR- inter quartile range, SD- standard deviation, PR- pulse rate, MAP- mean arterial blood pressure, *- statistically significant, # = Median (Interquartile range).

Comparison on the effect of the Lidocaine and Fentanyl groups on quality of extubation

The association of coughing between groups were analysed by Chi square. The proportions of patients with no coughing were 59.5% in fentanyl group and in lidocaine group which was 64.9%. The proportion of patients with minimal coughing was 27% in fentanyl group and in lidocaine group which is 21.6% and patients with moderate coughing is 13.5% in both groups. Though there was a proportion difference, there was no statistically significant difference between two groups with decreasing the incidence of coughing in the Periextubation period with a p value of 0.857.

Discussion

Extubation of the trachea should be devoid of significant changes in hemodynamic parameters and adverse events, such as coughing, breathe holding, or laryngospasm. The receptors, particularly in the larynx, trachea and bronchi, are stimulated by mechanical and chemical factors during extubation as in laryngoscopy and intubation, which produces cardiovascular and respiratory reflex responses. During laryngoscopy, intubation, and extubation, the plasma

concentrations of noradrenaline and adrenaline causing tachycardia and hypertension which may result in complications such as cardiac failure, pulmonary edema, and cerebrovascular hemorrhage[3].

Fentanyl acts at opioid receptors and predominantly acts on μ receptors. It decreases sympathetic tone and increases parasympathetic tone. Low doses of fentanyl were employed because a large dose can lead to muscular rigidity, bradycardia, nausea and vomiting postoperative respiratory depression[4].

Lidocaine attenuates the hemodynamic response to tracheal extubation by its direct myocardial depressant effect, central stimulant effect, and peripheral vasodilatory effect and it also suppresses the cough reflex, an effect on synaptic transmission. So we had considered lidocaine in our study[5]. Our study demonstrate there was statistically significant difference in mean HR 1 min after extubation with p value of 0.024. There was also a statistically significant difference 1 min after extubation ($p < 0.0001$). There was statistically significant difference in mean PR and MAP at 5 and 10 min after extubation ($p < 0.05$).

A randomized control study in India shows similar finding to our study observed that heart rate was significantly lower in fentanyl group compared with the control group ($p<0.0001$)[7]. The likely explanation for the similarity may be the dose of fentanyl and time of administration of the study drugs were the same. In line with our result Gurulingappa et al. compared Between IV Bolus Fentanyl and Lidocaine efficacy on hemodynamic stability and revealed that HR was significantly greater in lignocaine group than in fentanyl group ($p<0.05$). BP was also statistically significant in lignocaine group than in fentanyl group ($p<0.05$) in patients scheduled for elective surgical procedures[4]. Another study conducted by Kumar et al. shows comparable result to our finding. This study compared fentanyl and fentanyl plus lidocaine on attenuation of hemodynamic stress response to laryngoscopy in controlled hypertensive patients posted for laparoscopic cholecystectomy. The mean heart rate 1 min after intubation with mean ± SD is 78.26 ± 8.92 and 72.16 ± 8.94 in fentanyl group and fentanyl with lidocaine group respectively with p value of 0.80 [8].

A randomized control trial conducted by Savitha et al observed thatcompared 0.5mg/kg of IV lignocaine with 1mg/kg of IV lignocaine for attenuation of hemodynamics response to extubation. Mean arterial pressures attenuation with lignocaine 1mg/kg found to be superior when compared to saline group ($P<0.001$). There was no significant difference in heart rate attenuation between patients who received 0.5mg/kg and 1 mg/kg lidocaine at 1min with p value of 0.101[5]. The difference to our study may be due to study participants were all elective surgeries under GA, which includes patients scheduled for General Surgery, Orthopedic, Gynecological, Plastic and Neurosurgical procedures, therefore, there is no manipulation of the airway by the surgeon. In our study there was no statistically significant difference between two groups with decreasing the incidence of coughing in the Periextubation period with a p value of 0.857.

Indian study shows a comparable result to our finding. Ten minutes prior to extubation, patients were infused with 0.9% normal Saline, Fentanyl 1μg /kg and

Dexmedetomidine 1µg /kg over 10 minutes period. The extubation quality in Fentanyl group had statistically significant lower scores compared to saline group ($p<0.001$) which shows better quality of extubation [7]. Khezri et al. shows 1.5 mg/kg intravenous lidocaine effects on bucking, cough, and emergence time at the end of anesthesia. Mild cough following extubation was observed in 4(3.3%) patients of groups IV lidocaine group. No case with moderate or severe cough was detected. There was no significant difference in incidence of cough during the thirty minutes after extubation between two groups (P=0.97). When we compared this result to our finding the proportion of coughing was lower[9]. This may be due to study participants were elective minor orthopedic surgery, lower abdominal surgery or gynecological surgery but in our study there was a shared airway between the anesthetist and the surgeon in the perioperative period which makes the airway more irritant.

Conclusion

The findings of our study demonstrate that fentanyl l µg/kg IV administered 10 min before the end of operation was effective in attenuating hemodynamic response to tracheal extubation when compared to lidocaine 1.5 mg/kg IV in patients underwent ENT surgeries.

Funding: *No funding sources*
Conflict of interest: *None declared*
Ethical approval: *The study was approved by the institutional ethics committee*

References

1. Rani P, Kumar VRH, Ravishankar M, Sivashanmugam T, Sripriya R, Trilogasundary M. Rapid and reliable smooth extubation – Comparison of fentanyl with dexmedetomidine : A randomized , double - blind clinical trial. Anesth Essays Res. 2016;10(3):597–601.
2. Fan Q, Hu C, Ye M, Shen X. Dexmedetomidine for tracheal extubation in deeply anesthetized adult patients after otologic surgery : a comparison with remifentanil. BMC Anesthesiol. 2015;15(106):1–7.
3. Murat Alp Alkaya, Kemal Tolga Saraçoğlu, Gökhan Pehlivan, Zeynep Eti FYG. Effects of Esmolol on the Prevention of Haemodynamic Responses to Tracheal Extubation after Craniotomy Operations. Turk J Anaesth Reanim. 2014;42:86–90.
4. GURULINGAPPA, MD ASIF ALEEM, M.N. AWATI AS. Attenuation of Cardiovascular Responses to Direct Laryngoscopy and Intubation-A Comparative Study Between iv Bolus Fentanyl, Lignocaine and Placebo (NS). J Clin Diagnostic Res. 2012;6(10):1749–52.
5. Savitha K.S, Joylin Stephany D'Souza ANK. ATTENUATION OF HEMODYNAMIC RESPONSE TO EXTUBATION WITH I.V. LIGNOCAINE: A RANDOMIZED CLINICAL TRIAL. J Evol Med Dent Sci. 2014;3(4):838–46.
6. Aksu R, Akın A, Biçer C, Esmaoglu A. Comparison of the Effects of Dexmedetomidine Versus Fentanyl on Airway Reflexes and Hemodynamic Responses to Tracheal Extubation During Rhinoplasty : A Double-Blind , Randomized , Controlled Study. Curr Ther Res per. 2009;70(3):209–20.

7. Liyakhath Ali, Siddhram Jamgond JMB. ATTENUATION OF HEMODYNAMIC STRESS RESPONSE DURING EMERGENCE FROM GENERAL ANAESTHESIA : A PROSPECTIVE RANDOMIZED CONTROLLED STUDY COMPARING FENTANYL AND DEXMEDETOMIDINE. J Evol Med Dent Sci. 2014;3(62):13686–96.
8. Kumar B, Raut K, Routray SS. Fentanyl and fentanyl plus lidocaine on attenuation of haemodynamic stress response to laryngoscopy: a comparative study in controlled hypertensive patients posted for laparoscopic cholecystectomy. Int J Res Med Sci. 2015;3(12):3687–90.
9. Khezri1 M-B, Jalili2 S, , Saeid Asefzadeh3 HK, ABSTRACT. Comparison of intratracheal and intravenous lidocaine effects on bucking , cough , and emergence time at … Pakistan J Med Sci. 2011;27(4):793–6.