DOI: https://doi.org/10.53350/pjmhs22165287

ORIGINAL ARTICLE

Comparison of Efficacy of Lidocaine Vs. Fentanyl in Reducing Hemodynamic Response to Endotracheal Intubation

TAHIR ALI[1], ZAHID AZIZ SOOMRO[2], SYED FARJAD SULTAN[3], ASHOK PERCHANI[4]
[1]Senior Registrar, Department of Anaesthesia, Surgical ICU and Pain Management Dow University of Health Sciences, Karachi
[2]Senior Registrar, Department of Anaesthesia, Surgical ICU and Pain Management Dow University of Health Sciences, Karachi
[3,4]Assistant Professor, Department of Anaesthesia, Surgical ICU and Pain Management Dow University of Health Sciences, Karachi
Correspondence to: Tahir Ali, Email: 89taher@gmail.com, Email: Cell: +92 321 2820603

ABSTRACT
Objective: To compare the mean change in hemodynamics between patients undergoing endotracheal intubation with lidocaine vs fentanyl.
Design of the Study: randomized controlled trial.
Study Settings: This study was conducted at Department of Anaesthesiology, SICU and Pain Management, Civil Hospital Karachi, Dow University of Health Sciences from 21 September 2019 to 21 March 2020.
Material and Methods: A total of 92 patient's elective surgery was randomly allocated into two groups, 46 Patients in group A were treated with lidocaine and 46 in group B were treated with fentanyl. Heart rate and MAP was recorded 5 minutes post-intubation by independent observer (postgraduate trainee 1-2 years).
Results of the Study: Attenuating the hemodynamic response was most successfully accomplished by administering IV fentanyl 3 g/kg 5 minutes prior to induction, in our case.
Conclusion: Attenuating the hemodynamic response was most successfully accomplished by administering IV fentanyl 3 g/kg 5 minutes prior to induction, in our case. It is a standard aspect of anaesthetic care and has been shown to reduce the hemodynamic response to laryngoscopy and intubation in a safe and effective manner.
Keywords: Hemodynamics, Endotracheal intubation, Lidocaine, Fentanyl

INTRODUCTION
Manipulation and irritation of airway by laryngoscopy and endotracheal intubation are frequently associated with hypertension and tachycardia as a consequence of catecholamine release secondary to sympathetic nervous system stimulation.[1,2] The hemodynamic changes are usually transitory and of variable time period; and well tolerated by healthy individual.[3] However, the intensity of response is more in hypertensive patients,[4] and up to 40% of critically ill patients show exaggerated response.[5] The resulting tachycardia and hypertension may lead to undesirable effects like enlarged intracranial pressure, cardiac failure with pulmonary edema and cerebral hemorrhage.[6] To stand this response, several operations have been tried comprising adrenergic blockers (labetalol),[7] vasodilators (nitroglycerine),[8] opioids (Nalbuphine) and calcium channel blockers (nicardipine)[11]; but these drugs cause additional burden as they are costly with no role for maintenance of anesthesia. Therefore, various opioid derivatives are utilized for this pressure response control.[9,10]

Nalbuphine is traditionally used opioid agent in attenuating hemodynamic response to laryngoscopy and endotracheal intubation as a result of its easy availability and low cost.[9,10, 12] Intravenous lidocaine (local anesthetic agent) is associated with lesser MAP variation from baseline values.[13,14] however few author claimed the superiority of fentanyl in suppressing hemodynamic response.[15,16] In a study conducted by Hassani et al, they compared fentanyl alone with fentanyl and lidocaine combined, in terms of attenuation of hemodynamic response after intubation and reported that in both groups there was an effectively decreased hemodynamic response to tracheal intubation in terms of heart rate, systolic and diastolic blood pressure[20], Gurulingappa et al. found similar finding in his study. Hashemian et al. reported that mean MAP in lidocaine group as 88.33±13.13 in 5 min post intubation period from 88.10±13.86 in pre-intubation period and fentanyl group as 85.61±14.17 in 5 min post intubation period from 87.97±18.54 in pre intubation period.[17]

The rationale of this study is that as seen from aforementioned studies, there is a varied opinion whether lidocaine or fentanyl is better at attenuation of cardiovascular response at intubation, with some studies preferring lidocaine while other saying that fentanyl is better. However, the ideal pharmacological dosage choice and optimal care for reducing hemodynamic responses in patients are not yet clear. Lidocaine and fentanyl will be compared to see which one is better in reducing the hemodynamic response to intubation in this study.

MATERIAL AND METHODS
The Dow University of Health Sciences in Karachi's Ethical Committee approved this study before it could be carried out there. This study was conducted at Department of Anaesthesiology Civil Hospital Karachi from 21 September 2019 to 21 March 2020. Totally 92 patients undergoing elective surgery and visiting preoperative anesthesia clinic and fulfill the inclusion criteria, was enrolled in the study. The sample size of 92 patients was calculated using Open Epi, taking confidence interval 95%, power of test 80% taking mean change in MAP as 0.23±0.73 in lidocaine group and MAP 2.36±4.37 in fentanyl group. ASA status I and II, Mallampati class I and II, and patients undergoing elective surgery of both sexes between the ages of 18 and 60 were included in this study. Normotensive and normal baseline heart rate as evaluated by preoperative examination. Patients taking beta-blockers and calcium channel blockers, obesity with body weight >30% were excluded. Group A (lidocaine) and Group B (fentanyl) each had 46 patients in each group.

All patients will receive midazolam 7.5 mg orally one hour preoperatively as premedication. Then intravenous 1.5mg/kg lidocaine as a bolus was administered for lidocaine group A and 3 µgm/kg of fentanyl was administered for fentanyl group B. Propofol (2 mg/kg) and Atacurium (0.5 mg/kg) are administered intravenously after preoxygenation for five minutes at 100%.

Once the right tonsillar pillar was exposed, the laryngoscope blade was advanced until the epiglottis could be seen. Using an anesthesiologist's right hand, an ETT of a moderate diameter (7 mm internal diameter for female and 7.5-8 mm for male patients) was kept in the mouth. Proximal to the vocal chords, the ETT cuff's proximal end is positioned. An examination of the tube and its corresponding marks on the patient's teeth was conducted. Then verification of tube position was checked by auscultation over both lung field and over epigastrium. Isoflurane 1% was used to maintain anaesthesia after the endotracheal tube was successfully inserted. 5 minutes after intubation, an impartial observer recorded the patient's heart rate and arterial pressure (MAP) (postgraduate trainee 1-2 years). Change in heart rate and MAP at five minutes after intubation was considered as main outcome variables.

For the purposes of this study, we used SPSS for Windows as our statistical software of choice (version 22). In order to explain numerical data the mean standard deviation was used. Data like gender, ASA status, and Mallampati class were summarised by using frequencies and percentages. The mean difference in heart rate and MAP between two groups was compared using an unpaired student t-test at baseline and 5 minutes later. This study was considered significant when the p-value was set at less than 0.05. The patient's age, gender, ASA score, and Mallampati class were stratified to adjust for potential impact modifiers.

RESULTS

Table 1: Demographics details of the included patients

Characteristics	Detail	Participants
Age	years	34.91±9.50 (18-60)
Gender	Male	43(46.7%)
	Female	49(53.3%)
Weight (kg)	Kg	63.82±11.34
Height (cm)	Cm	162.29±8.77
Body mass index	kg/m^2	24.26±4.08
ASA Class	Class-I	54(58.69)
	Class-II	38(41.30)
Mallampati Class	Class-I	49(53.26)
	Class-II	43(46.73)

Demographic detail of the patients was 43(46.7%) male and 49(53.3%) were female patients with average age 34.91±9.50 years, ASA status and mallamptti class is also given in Table 1. Mean heart rate did not differ substantially (p=0.448), however mean MAP did (p=0.0005), meaning that MAP was stable between groups in group B and group A as seen in table 2. There was a statistically significant difference in the mean HR between groups A and B (p=0.003), whereas the mean MAP was statistically lowered for all stratified groups as indicated in table 2 to 4..

Table 2: Ccomparison of the mean change in hemodynamics between groups undergoing endotracheal intubation

HemodynamicsVariables	Group A Mean±SD	Group B Mean±SD	P-Value
Heart Rate			
Before induction	87.46±9.69	85.00± 11.28	0.266
After 5 min induction	79.09±8.91	77.63± 10.84	0.483
Change in HR	8.37±6.79	7.37±5.76	0.448
Mean Arterial Pressure (MAP)			
Before induction	94.15±8.61	94.09±9.19	0.942
After 5 min induction	81.30±8.13	88.17±8.92	0.0005
Change in MAP	12.85±8.77	5.91±8.34	0.0005

Table 3: Comparison of the mean change in heart rate between Lidocaine Vs. Fentanyl groups and stratification with male and female patients

Hemodynamics Variables	Comparison b/w groups		Gender (Male)		Gender (Female)	
Heart Rate	A-Group	B- Group	A- Group	B- Group	A-Group	B- Group
Before induction	87.6±9.9	85.00± 11.28	87.43±10.36	86.4±12.97	87.48±9.31	83.67±9.56
After 5 min induction	79.09±8.91	77.63± 10.84	80.10±9.31	79.7±12.89	78.24±8.66	75.71±8.38
Change in HR	8.37±6.79	7.37±5.76	7.33±7.41	6.73±5.92	9.24±6.24	7.96±5.67

Table 4: Comparison of the mean change in (MAP) between Lidocaine Vs. Fentanyl groups and stratification with male and female patients

Hemodynamics Variables	Comparison b/w groups		Gender (Male)		Gender (Female)	
Mean Arterial Pressure (MAP)	A- Group	B-Group	A-Group	B-Group	A-Group	B-Group
Before induction	94.15±8.61	94.09±9.19	93.90±10.30	94.18±9.43	94.36±7.11	94.00±9.18
After 5 min induction	81.30±8.13	88.17±8.92	82.19±8.29	87.59±9.45	80.56±8.09	88.71±8.58
Change in MAP	12.85±8.77	5.91±8.34	11.71±9.23	6.59±6.85	13.80±8.44	5.29±9.62

DISCUSSION

An overreaction to laryngoscopy and intubation has been documented in a variety of ways. The change in mean heart rate was not statistically significant between groups (p=0.448), although mean MAP was substantially lower in group A (lidocaine) than group B (fentanyl). Khan and Hoda, as well as Dahlgren,[22] It's Parida et al. [23] An IV fentanyl study by Mireskandari et al.[24] similarly indicated that the hemodynamic response to intubation could be blunted by the drug. During a double-blind trial, Hoda and Khan[22] compared the hemodynamic response to laryngoscopy and intubation with and without fentanyl. In the group given IV fentanyl 2 g/kg with sevoflurane, HR and SBP increased by 15% and 6%, respectively, following intubation. HR and SBP increased by 11.3% and 5.1 percent on average in these studies, which is in line with our own findings. A full reduction of the hemodynamic response to intubation has been demonstrated by Black et al.25 and Kay et al.[26]

The hemodynamic response to intubation is blunted, but not eliminated. In these investigations, fentanyl doses of 5–6 g/kg were employed, whereas our study used 3 g/kg. When it comes to reducing a patient's hemodynamic reaction to intubation, lidocaine is the least effective. This could be for a variety of reasons. Both laryngoscopy and intubation contribute to a patient's hemodynamic response. These reactions are caused by the laryngoscope blade's pressure not only on the mucous membrane but also on the sub mucosal deep proprioceptors, which cannot be stopped by topical anaesthetic. [27] Intravenously administered Lidocaine provides analgesic effects on the dorsal horn neurons and has a direct influence on the cardiovascular system. [28]

I/V lidocaine does not reduce the cardiovascular response to laryngoscopy and tracheal intubation, as previously demonstrated by Miller & Warren Both Laurito and coauthors[30] and Chara-Emmer-Jorgensen and Coworkers[31] provided nebulized lidocaine 4 mg/kg over 15minutes and IV lidocaine 1.5 mg/kg beginning 2 minutes before laryngoscopy found that lidocaine had no significant effect on the cardiovascular consequences of intubation and laryngoscopy.

CONCLUSION

Attenuating the hemodynamic response was most successfully accomplished by administering IV fentanyl 3 g/kg 5 minutes prior to induction, in our case. It is a standard aspect of anaesthetic care and has been shown to reduce the hemodynamic response to laryngoscopy and intubation in a safe and effective manner.

REFERENCES

1. W Burstein CL, Lopinto FJ, Newman W. Electrocardiographic studies during endotracheal intubation and effects during usual routine technics. J Am Soc Anesth.2009;11(2):224-37.
2. Sameenakousar M, Srinivasan KV. Comparison of fentanyl and clonidine for attenuation of the haemodynamic response to laryngocopy and endotracheal intubation. J Clin Disease Res. 2013;7(1):106.
3. Khan AA, Khan FA. Hemodynamic response to induction, laryngoscopy and tracheal intubation in diabetic and non-diabetic patients. J Pak Med Assoc. 2009;59:27-30.
4. Kihara S, Brimacombe J, Yaguchi Y, Watanabe S, Taguchi N, Komatsuzaki T. Hemodynamic responses among three tracheal intubation devices in normotensive and hypertensive patients. Anesth Analg. 2003;96:890-5-9.
5. Simpson GD, Ross MJ, McKeown DW, Ray DC. Tracheal intubation in the critically ill: a multi-centre national study of practice and complications. J Brit Anaesth. 2012;108(5):792-9.
6. Ali L, Mushtaq R. Laryngoscopy and tracheal intubation. J Prof Med. 2005;12:267-72.
7. Kumar R, Gandhi R, Mallick I, Wadhwa R, Adlakha N, Bose M. Attenuation of hemodynamic response to laryngoscopy and

endotracheal intubation with two different doses of labetalol in hypertensive patients. J Egypt Anaesth. 2016;32(3):339-44.
8. Firoozbaksh F, Mohammadi FH, Safari S, Khashayar P. the effect of intravenous nitroglycerine on blood pressure during intubation. Middle East J Anesthesiol. 2008;19:859-67.
9. Min JH, Chai HS, Kim YH, Chae YK, Choi SS, Lee A, et al. Attenuation of hemodynamic response to laryngoscopy and tracheal intubation during rapid sequence induction: remifentanil vs. lidocaine with esmolol. Minerva Anesthesiol. 2010;76:188-92.
10. Minai FN, Khan FA. A comparison of morphine and nalbuphine for intraoperative and postoperative analgesia. J Pak Med Assoc. 2003;53:391-6.
11. Kovac AL, Masiongale A. Comparison of nicardipine versus esmolol in attenuating the hemodynamic response to anesthesia emergence and extubation. J Cardiothorac Vasc Anesth. 2007;21:45- 50.
12. Asad N, Ali K, Iqbal M, Qayyum A. Comparison of Nalbuphine and Midazolam on the cardiovascular response to Laryngoscopy and intubation. Ann King Edward Med Coll. 2005;11:253-5.
13. Pouraghaei M, Moharamzadeh P, Soleimanpour H, Rahmani F, Safari S, Mahmoodpoor A, et al. Comparison between the effects of alfentanil, fentanyl and sufentanil on hemodynamic indices during rapid sequence intubation in the emergency department. J Anesthes Pain Med.2014;4(1).
14. Hernandez-Palazon J, Tortosa JS, Garcia-Palenciano C, Molero EM, Burguillos SL, Pérez-Flores D. Cardiovascular response to tracheal intubation in patients with intracranial tumor. Comparative study between urapidil and lidocaine. Revista espanola de anestesiol. 2000;47(4):146-50.
15. Malde AD, Sarode V. Attenuation of the hemodynamic response to endotracheal intubation: fentanyl versus lignocaine. J Anesthesiol. 2007;12(1):22-31.
16. Aouad MT, Sayyid SS, Zalaket MI, Baraka AS. Intravenous lidocaine as adjuvant to sevoflurane anesthesia for endotracheal intubation in children. Anesth Analg. 2003;96:1325-7.
17. Hashemian AM, Doloo HZ, Saadatfar M, Moallem R, Moradifar M, Faramarzi R, et al. Effects of intravenous administration of fentanyl and lidocaine on hemodynamic responses following endotracheal intubation. J Am Emer Med. 2018;36(2):197-201.
18. Baxendale BR. Preoperative assessment and premedication.Textbook of Anaesthesia. Netherland: Churchill Livingstone; 2007;45(19):280-96.
19. Fell D, Kirkbride D. The practical conduct of anaesthesia.Textbook of Anaesthesia. Netherland: Churchill Livingstone; 2007:297- 314.
20. Amir MH, Hamid Z, Maziar S, Roya M, Maryam M, Raheleh F et al. Effects of intravenous administration of fentanyl and lidocaine on hemodynamic responses following endotracheal intubation. Am J Med. 2017;10(7):1016-21.
21. Gurulingappa MA, Awati MN, Adarsh S. Attenuation of cardiovascular responses to direct laryngoscopy and intubation-a comparative study between iv bolus fentanyl, lignocaine and placebo (NS). J Clin Dis Res. 2012;6(10):1749-51.
22. Hoda A, Khan FA. Effect of one minimum alveolar concentration sevoflurane with and without fentanyl on hemodynamic response to laryngoscopy and tracheal intubation. J Anaesthesiol Clin Pharmacol. 2011;27913):522‑6.
23. Parida S, Ashraf NC, Mathew JS, Mishra SK, Badhe AS. Attenuation of the haemodynamic responses to tracheal intubation with gabapentin, fentanyl and a combination of both: A randomised controlled trial. Indian J Anaesth. 2015;59:306‑11.
24. Mireskandari SM, Abulahrar N, Darabi ME, Rahimi I, Haji‑Mohamadi F, Movafegh A. Comparison of the effect of fentanyl, sufentanil, alfentanil and remifentanil on cardiovascular response to tracheal intubation in children. Iran J Pediatr. 2011;21:173‑80.
25. Black TE, Kay B, Healy TE. Reducing the haemodynamic responses to laryngoscopy and intubation. A comparison of alfentanil with fentanyl. Anaesthesia. 1984;39:883‑7.
26. Kay B, Healy TE, Bolder PM. Blocking the circulatory responses to tracheal intubation. A comparison of fentanyl and nalbuphine. Anaesthesia. 1985;40:960‑3.
27. Barton S, Williams JD. Glossopharyngeal nerve block. Arch Otolaryngol. 1971;93:186‑8.
28. Blair MR. Cardiovascular pharmacology of local anesthetics. Br J Anaesth . 1975;47: 247-52
29. Miller CD, Warren SJ. I.V lignocaine fails to attenuate the cardiovascular response to laryngoscopy and tracheal intubation. Br J A 1990;65(2):216-9.
30. Laurito CE, Baughman VL, Becker GL, Polek WV, Riegler FX, VadeBoncouer TR. Effect of aerosolized lignocaine. A Haemodynamic response to laryngoscopy and intubation. Anaesth analg. 2008;67:389-92.
31. Chraemmer-Jørgensen B, Høilund-Carlsen PF, Marving J, Christensen V. Lack of effects of intravenous lidocaine on nemodynamic response to rapid sequence induction of general anaesthesia. Anaesth Analg. 2002; 65(10):1037-41.