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A Comparative Study Between Fentanyl and Lignocaine on Attenuation of Hemodynamic Response to Laryngoscopy and Intubation in Cardiac Patients

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ABSTRACT

Objective: To evaluate and compare the efficacy of intravenous low-dose fentanyl versus lignocaine in mitigating the occurrence of hemodynamic response during endotracheal intubation.

Study Design: Quasi –experimental study.

Place and Duration of Study: Pak Emirates Military Hospital, Rawalpindi, Pakistan, from Feb to Jul 2023.

Methodology: The study included 82 patients, aged between 30 and 65 years, undergoing elective non-cardiac surgery requiring general anesthesia and randomized them into two groups to compare the effects of intravenous Lignocaine (Group L) and Fentanyl (Group F) before laryngoscopy, on patients with moderate lower ventricular dysfunction (left ventricular ejection fraction between 35- 45%). All patients had mean arterial pressure (MAP) and pulse rate recorded during laryngoscopy and intubation.

Results: The baseline pulse rate in Group F was 73.76±4.90 beats per minute, increasing to 84.53±6.32 during laryngoscopy and intubation while baseline MAP was 91.85±1.93 mm of Hg which increased to 95.55±4.09 mm. However, in Group L, the heart rate escalated substantially upon laryngoscopy and intubation and increased to 91.78±1.84 beats per minute from baseline heart rate of 72.85±4.95 beats per minute, while MAP during laryngoscopy and intubation increased to 106.57±4.401 mm of Hg from 91.78±1.84mm of Hg (*p*-value <0.001) indicating that fentanyl caused lesser pressor response than lignocaine

Conclusion: Fentanyl was noted to be superior to lignocaine for mitigating stress response in cardiac patients during laryngoscopy and intubation.

Keywords: Hemodynamics; Intubation, Intratracheal; Fentanyl; Lidocaine.

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INTRODUCTION

Laryngoscopy and tracheal intubation can elicit a significant sympathetic response, resulting in an increase in heart rate (HR) and blood pressure,[1] triggered by reflex sympathetic discharge resulting from stimulation in the epipharynx and laryngopharynx, leading to increased plasma norepinephrine concentrations, resulting in elevated blood pressure and heart rate.[2] In patients with coronary artery disease, these hemodynamic fluctuations can pose life-threatening risks, including myocardial ischemia, acute heart failure, and cerebrovascular accidents as among healthy individuals these changes are typically short-lived and well-tolerated.[3] Laryngoscopy and endotracheal intubation are essential components of general anesthesia but the process of direct laryngoscopy and passing the endotracheal tube through the larynx is a nociceptive stimulus, potentially triggering adverse responses in the cardiovascular and respiratory systems and proving harmful in vulnerable individuals due to which various approaches have been explored to effectively manage these responses, such as intravenous or topical lidocaine, vasodilators, adrenergic blockers, narcotics, and inhaled anesthetics.[4] While narcotics like fentanyl, when administered in appropriate doses, can control both heart rate and blood pressure responses, they may also lead to complex respiratory depression and truncal rigidity as common side effects.[5] While lignocaine seems promising when given either through inhalational or intravenous route, scarce literature is available on its use among patients with cardiac disease.[6] On the other hand, vasodilators like nitrates offer a partial solution by controlling hypertension but increasing heart rate,[7] with esmolol emerging as a suitable option due to its beta-(cardio selective) adrenergic receptor-blocking properties and short duration of action, however, it has limited availability and not affordable for all patients.[8] The rationale of our study was to compare opioids to lignocaine for

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attenuation of intubation response in patients who are more vulnerable to stress response.

METHODOLOGY

After obtaining approval from the Institutional Ethics Committee (IERB#A/28/EC/483/2022) and written informed consent from the patients, a quasi-experimental study was conducted over a period of six months from February to July 2023 at PEMH, Rawalpindi, Pakistan.

Inclusion Criteria: Patients of either gender with moderate ventricular dysfunction (left ventricular ejection fraction between 35 to 45%), aged between 30 and 65 years, undergoing elective non-cardiac surgery requiring general anesthesia.

Exclusion Criteria: Patients with severe or good LV dysfunction, difficult airway pulmonary hypertension, cardiac arrhythmias, and history of allergy to local anesthetics or opioids were excluded.

The sample size calculation was performed using WHO (World Health Organization) sample size calculator with anticipated population proportion (P1) being 4.34%,[9] and anticipated population proportion (P2) was 2.02%,[9] yielding a sample size of n=82, which was divided equally between two groups of 41 patients each, through non-probability consecutive sampling. The enrolled patients were then assigned to the two treatment groups: Group L, which received injection lignocaine, and Group F, which received an injection fentanyl before laryngoscopy and patient randomization was done through sealed envelope technique. The administering anesthetist was blinded to the drug assignment and also recorded baseline MAP and pulse rate (PR). Standard monitoring of ECG and pulse oximetry was initiated when the patient was brought to the operation theater. The patients received 0.1mg/kg of intravenous morphine and were induced with ketamine (0.25mg/kg) and propofol (1mg/kg) was titrated to achieve hypnosis. Muscle relaxation was achieved using atracurium (0.5mg/kg), and positive pressure ventilation was performed for three minutes with a mixture of oxygen and isoflurane (2%). Two minutes before laryngoscopy, patients in Group L received 1.5mg/kg lignocaine, while patients in Group F received 4ug/kg fentanyl. Laryngoscopy was performed using a Macintosh curved laryngoscope, and the endotracheal tube was inserted. The MAP and pulse rate were recorded during laryngoscopy and intubation. Anesthesia was maintained using a mixture of air (50%) and oxygen (50%) along with isoflurane (1 MAC). Top of Form All statistical analysis was conducted using Statistical Package for Social Sciences (SPSS) version 26.0. Quantitative variables were summarized using mean and standard deviation while For qualitative variables frequency and percentage was measured. The independent Sample t t est and Chi-square test were applied to determine the statistical significance of the results where p-value ≤ 0.05 was considered significant.

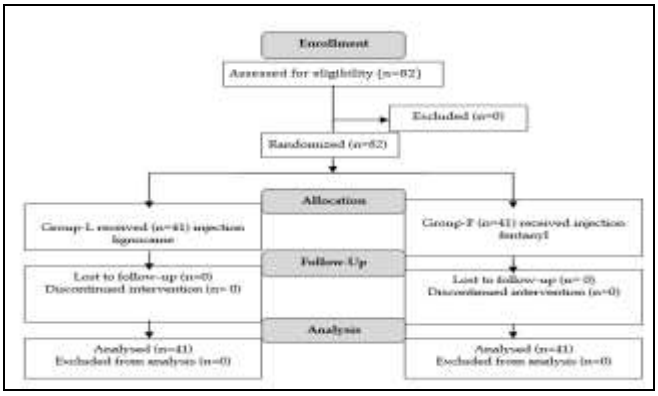

Figure: Patient Flow Diagram (n=82)

RESULTS

Primary outcome was to note if any change in heart rate and mean arterial pressure occurred upon laryngoscopy and intubation. The baseline pulse rate in Group F was 73.76±4.90 beats per minute and it went up to 84.53±6.32 during laryngoscopy and intubation while baseline mean arterial pressure (MAP) was 91.85±1.93 mm of Hg which increased to 95.55±4.09 mm Hg (p-value<0.001). However, in Group L, the heart rate escalated substantially upon laryngoscopy and intubation, and it increased to 91.78±1.84 beats per minute from baseline heart rate of 72.85±4.95 beats per minute. Similarly, mean arterial pressure (MAP) during laryngoscopy and intubation increased to 106.57±4.401 mm of Hg from 91.78±1.84mm of Hg (p-value <0.001), indicating that fentanyl caused lesser pressor response than lignocaine.

The demographic parameters and baseline clinical characteristics of both groups are shown in Table-II. Mean age of Group F was 57.95±5.54 years versus 59.15±3.88 years in Group L (p-value=0.421). There were 25(61.0%) males and 16(39.0%) females in Group F while there were 23(56.1%) males and 18(43.9%) females in Group L (p-value=0.654). The mean ejection fraction of Group F patients was 39.39±3.39 % and that of Group L was 40.0±4.03%. In

Group F, 10(24.4%) patients had diabetes mellitus, 11(26.8%) had hypertension and 11(26.8%) had history of smoking while in Group L, 3(7.3%) patients had diabetes mellitus, 8(19.5%) had hypertension and 8(19.5%) patients had history of smoking. The most frequent surgery reported was for inguinal hernia in both groups with frequency of 18(43.9%) in Group F versus 11(26.8%) in Group L, respectively.

Table-I: Mean Change in MAP and Pulse Rate at Induction in Both Study Groups (n=82)

Group	Parameter	Mean±SD	*p*-value
Group F	Baseline Heart Rate (BPM)	73.76±4.903	<0.001
	Heart Rate During Laryngoscopy and Intubation (BPM)	85.02±5.964	
	Baseline Mean Arterial Pressure (MAP) in mm of Hg	91.95±1.802	<0.008
	Mean Arterial Pressure (MAP) During Laryngoscopy and Intubation in mm of Hg	95.46±4.160	
Group L	Baseline Heart Rate (BPM)	72.27±4.995	0.785
	Heart Rate During Laryngoscopy and Intubation (BPM)	108.12±1.792	
	Baseline Mean Arterial Pressure (MAP) in mm of Hg	91.76±1.841	0.929
	Mean Arterial Pressure (MAP) During Laryngoscopy and Intubation in mm of Hg	106.17±4.701	

**SD: Standard Deviation, MAP: Mean Arterial Pressure, BPM: beats per minute*

Table-II: Demographic Characteristics of Both Study Groups (n=82)

		Group F Mean± SD (n=41)	Group L Mean±SD (n=41)	*p*-value (≤0.05)
Age (years)		57.95±5.541	59.15±3.889	0.471
Height (cm)		161.10±4.689	165.05±6.910	0.374
Weight (kg)		74.54±5.688	80.07±7.715	0..002
Ejection Fraction (%)		39.39±3.39	40.0±4.03	0.206
		Frequency(%)	Frequency(%)	
Gender	Male	25(61.0)	23(56.1)	0.654
	Female	16(39.0)	18(43.9)	
ASA Class	ASA II	23(56.1)	31(75.6)	0.062
	ASA III	18(43.9)	10(24.4)	
Diabetes Mellitus	Yes	10(24.4	3(7.3)	0.654
	No	31(75.6	38(92.7)	
Hypertension	Yes	11(26.8)	8(19.5)	0.432
	No	30(73.2	33(80.50)	
Smoker	Yes	11(26.8	8(19.5)	0.594
	No	30(73.2	33(80.5)	
Surgery	Inguinal Hernia	18(43.9)	11(26.8)	0.533
	Appendectomy	3(7.3)	7(17.1)	
	Incisional Hernia	2(4.9)	1(2.4)	
	Epigastric Hernia	2(4.9)	1(2.4)	
	Paraumbilical Hernia	1(2.4)	21(51.2)	
	Cholecystectomy	15(36.6)	11(26.80)	

DISCUSSION

Our study investigated the hemodynamic profile of fentanyl as compared to lignocaine to determine extent of stressor response as local Pakistani evidence in scarce on this topic. A prospective, randomized, double-blind trial found that at 5 minutes after intubation, Fentanyl showed a fall in pressure below baseline, whereas Lignocaine maintained pressure above baseline, but our investigation aimed at blunting the response at induction and intubation.[10] Another study aimed to investigate the hemodynamic responses to laryngoscopy and intubation after induction of anesthesia using thiopentone alone or in combination with lidocaine and/or fentanyl, where fentanyl's benefits were found to be superior to those of lidocaine but patients treated with fentanyl were susceptible to hypotension several minutes after intubation which is why in our study, we used propofol as induction agent along with ketamine to avoid post-induction hypotention.[11] In a prospective, randomized, double-blind trial, it was found that combination of Fentanyl and lidocaine was more effective in reducing hemodynamic responses three minutes before intubation when given before induction and at subsequent one, three and five minutes after intubation, however, no significant difference in efficacy was observed between the two medications when they were used alone but as this study used very low dose of fentanyl (2ug/kg), we used higher dose in comparison (4ug/kg).[12] In another study, it was established that Fentanyl consistently and effectively attenuated the hemodynamic response to laryngoscopy and endotracheal intubation, demonstrating its reliability when compared to an intravenous bolus of lignocaine, however, this study included three groups with one group receiving placebo, while our study compared two groups.[13] As myocardial infarction with left ventricular dysfunction can occur in at-risk patients during surgery,[14] several factors, including the nature of the surgery, the choice and administration of anesthesia, and post-surgical physiological challenges, can collectively contribute to negative patient outcome.[15] According to one retrospective cohort study on patients with low EF, it was found that use of remifentanil was associated bradycardia and hypotension, however, our study used fentanyl only,[16] similar to another study which noted that fentanyl appeared to be a better option when compared to lignocaine and its efficacy was comparable to esmolol,[17], a beta blocker which can be

used in cardiac patients,[18] although this usage remains controversial.

LIMITATIONS OF STUDY

As a single-center, quasi-experimental study, these findings may not be widely generalizable. The study focused exclusively on a narrow patient population, limiting its applicability to other patient groups. Furthermore, double blinding of participants or clinicians was not done, introducing potential for bias. The assessment was also limited to immediate hemodynamic parameters (MAP and pulse rate) during intubation, leaving the longer-term clinical outcomes and side effects of the medications unexamined.

CONCLUSION

Fentanyl was noted to be superior to ligocaine for mitigating stress response in patients with cardiac disease during laryngoscopy and intubation.

Conflict of Interest: None.

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Authors Contributions

NK & AK: Drafting of work, design analysis, data acquisition, data interpretation and approval of final version to be published

UEM & AMR: Data analysis, data acquisition, drafting of work, critical revision, approval of final version to be published

NS & KA: Drafting of work, critical review, approval of final version to be published.

Authors agree to be responsible for all aspects of work in making sure that truthfulness and authenticity of any piece of work is investigated and ensured.

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