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Comparison of Hemodynamic Changes with Fentanyl and Lignocaine as Adjuvant Agents during Induction of Anesthesia

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ABSTRACT

Objective: To determine the influence of fentanyl and lignocaine on hemodynamic changes during induction of anesthesia.
Study Design: Quasi-Experimental Study.
Place and Duration of Study: Combined Military Hospital Rawalpindi, Pakistan from Feb to Aug 2021.
Methodology: Patients of age range 35 - 55 years belonging to American Society of Anesthesiologists (ASA) group I, II, III undergoing elective surgeries under general anesthesia who gave informed written consent were included in the study. Under standardized general anesthesia Group-A (Fentanyl) received 04 micrograms/kg intravenous bolus of fentanyl and Group–B (Lignocaine) was administered 1.5mg/kg intravenous bolus of Lignocaine. The surgical stimulus was avoided during the first five minutes of post-intubation monitoring. Recorded variables were heart rate, diastolic and systolic blood pressure, before intubation and 1, 3, 5 minutes after intubation.
Results: A total of 108 patients enrolled in the study out of which 53(49.07%) were males whereas 55(50.9%) were females with a mean age of 42.74±7.06 (35–55 years). Out of participants, 25(23.1%), 65(60.1%), and 18(16.66%) patients were from the American Society of Anesthesiologists status I, II, and III respectively. No significant relationship enumerated in heart rate (*p*-value 0.011) whereas systolic and diastolic blood pressure represented significant difference between two batches (*p*-value<0.001).
Conclusion: Attenuation of hemodynamic response can be achieved with both intravenous bolus of fentanyl or lignocaine, however fentanyl has a more stable influence on the heart rate, and systolic and diastolic blood pressure when compared with lignocaine.

Keywords: Anesthesia, Fentanyl, Laryngoscopy, Lignocaine.

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INTRODUCTION

Hemodynamic reaction to laryngoscopy and endotracheal intubation had been discovered long ago when explained by Reid and Brace in 1940.[1,2] Since then efforts are made to attenuate raised mean arterial pressure and heart rate caused by airway manipulation. Agents used for this purpose must not compromise cerebral blood flow, safe extubation of the patient and should not delay patient recovery or influence anesthetic considerations execution.[3,4]

To date, numerous methods have been incorporated in the anesthetic technique to achieve the goals of laryngoscopy and intubation response attenuation. A few to name are oropharyngeal topical anesthesia, laryngotracheal lignocaine administration preceding endotracheal intubation, intravenous adjuvants such as lignocaine, alpha or beta-adrenergic agents, vasodilators (hydralazine, sodium nitroglycerine, nitroprusside), increased depth with volatile anesthetic agents, intravenous opioids, etc., however, none of the remedies gave the desired results.[5] Intravenous lignocaine or fentanyl has been recommended with the exclusivity of accomplishment of the subject purpose.[6,7]

Lignocaine, an amide local anesthetic agent has been used as a multimodal agent for the management and prevention of ventricular conduction defects occurring in conjunction with myocardial and mechanical dysfunction of cardiac cells.[8,9]

Fentanyl is recognized to be a rapid-acting, formidable synthetic opioid agonist having a potency of 75-125 times of morphine. It is an accepted intravenous analgesic adjuvant, a constituent of inhalational anesthesia and neurolept anesthesia in addition to utility as an exclusive anesthetic agent. Intravenous bolus gives onset at 1-2 minutes and duration of action approximately an hour, resultantly has proved a great deal of potential in diminution

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laryngoscopy and endotracheal intubation hemodynamic response.[10]

The rationale of the study was to evaluate the influence of lignocaine and fentanyl for alleviation of cardiovascular reflex surge to laryngoscopy and intubation, when employed as adjuvants upon induction of general anesthesia.

METHODOLOGY

This Quasi-experimental study was conducted at Combined Military Hospital, Rawalpindi, Pakistan after obtaining approval from the Institutional Ethical Review Board (ERB No. 203/02/2021) from February to August 2021.

Inclusion Criteria: Patients of either gender, aged between 35 - 55 years, having American Society of Anesthesiologists (ASA) status of I, II, III who were scheduled for elective surgeries under general anesthesia were included.

Exclusion Criteria: Patients having past pertinent history (e.g. hypertensive disorders, allergy to the study drug contents, coagulation disorders, thrombosis, chronic kidney disease, on cardiovascular medications), difficult intubation or who required multiple attempts for intubation, mentally incapacitated individuals and those presenting for emergency surgeries were excluded.

Using the WHO calculator, sample size came to 108, employing diastolic blood pressure means (Lidocaine; 86±4.04 mmHg) and (Fentanyl; 84±3.27 mmHg) as per a study conducted by Samuel *et al*.[11] After obtaining written informed consent, non-probability consecutive sampling was used to recruit participants, who were then randomly distributed into two uniform groups Group–A (fentanyl) and Group–B (lignocaine). Patient flow can be seen in the figure.

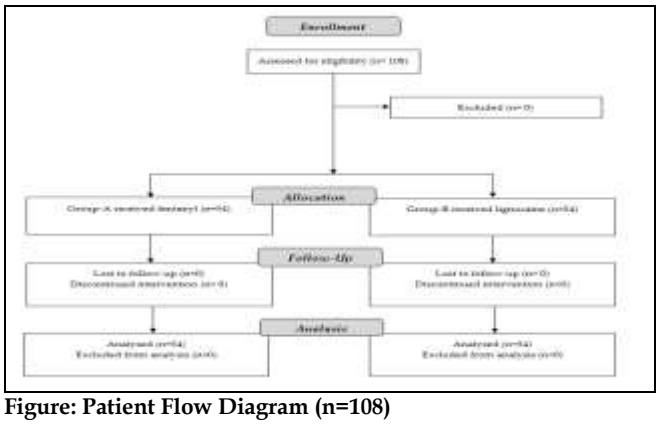

Figure: Patient Flow Diagram (n=108)

Preoperative preparation including completion of essential documentation and Nil Per Oral status was confirmed. Pre-anesthesia assessment performed as per guidelines (standard laboratory tests, chest x-ray, echocardiography) before scheduling surgery and reevaluated on day of surgery by a senior consultant anesthetist. Standard monitoring such as noninvasive blood pressure, pulse oximetry, capnography and electrocardiography were applied.

Premedication included intravenous nalbuphine 0.1 mg/kg, Paracetamol 15 mg/kg, dexamethasone 0.08 mg/kg and Metoclopramide 0.1 mg/kg via 18 G cannula passed under aseptic conditions. Preoxygenation was carried out with 100% oxygen. Induction was achieved with intravenous propofol (2mg/kg) and muscle relaxation with intravenous atracurium (0.5 mg/kg) followed by endotracheal intubation after 03 minutes later.

Group-A (fentanyl) received 04 micrograms/Kg intravenous bolus of fentanyl and Group–B (lignocaine) was administered 1.5mg/kg intravenous bolus of lignocaine. The surgical stimulus was avoided during the first five minutes of post-intubation monitoring. Recorded variables were heart rate, diastolic and systolic blood pressure, before intubation and 1, 3, 5 minutes after intubation.

Upon completion of surgery, muscle relaxant antagonism was achieved by intravenous neostigmine and glycopyrrolate (0.05 mg/kg + 0.01 mg/kg). After initiation of spontaneous ventilation, patient extubated awake and shifted to post-anesthesia care unit where baseline pulse rate, mean arterial pressures and SpO2 were recorded and ultimately shifted to ward on achievement of satisfactory recovery scores.

Statistical Package for Social Sciences (SPSS) version 23.0 was used for data entry and analysis. Categorical variables were presented as frequency and percentage whereas quantitative variables were presented as mean and standard deviation. T-test was used to compare mean values among groups. A *p*-value ≤0.05 was considered significant.

RESULTS

A total of 108 patients were enrolled in the study out of which 53(49.07%) were males whereas 55(50.9%) were females with a mean age of 42.74±7.06 (35–55 years). Out of participants, 25(23.1%), 65(60.1%), and 18(16.66%) patients were from the American Society of Anesthesiologists status I, II, and III respectively.

No significant relationship was seen in heart rate (*p*-value 0.011) whereas systolic and diastolic blood pressure had a statistically significant difference between groups A and B (*p*-value <0.001).

Baseline heart rate of Group-A at 0,1,3 and 5 minutes of laryngoscopy was 81.50±1.14 ,80.00±.82 ,84.00±.82 and 80.96±.82 respectively. In case of Group-B baseline systolic blood pressure at 0,1,3 and 5 minutes was 82.00±0.82 , 82.00±0.82, 90.00±.82 and 89.00±.82 respectively (*p*<0.001) as shown in Table–I.

Table–I: Baseline Heart Rate Record Between Groups at 0, 1, 3 and 5 Minutes of Laryngoscopy (n=108)

	Group-A (n= 54) Mean±SD	Group-B (n =54) Mean±SD	*p*-value
0 minute	81.50±1.14	82.00±0.82	0.011
1 minute	80.00±.82	82.00±0.82	<0.001
3 minutes	84.00±.82	90.00±.82	<0.001
5 minutes	80.96±.82	89.00±.82	<0.001

Baseline systolic blood pressure of Group-A at 0,1,3 and 5 minutes of laryngoscopy was 124±.82, 123.94±.85, 130±.82 and 130±.91 respectively. In case of Group-B baseline systolic blood pressure at 0,1,3 and 5 minutes was 123±.82, 128±.82, 143±.82 and 132±.82 respectively(*p*-value<0.001) as elaborated in Table–II.

Table–II: Systolic Blood Pressure Record Between Groups at 0, 1, 3 and 5 minutes of Laryngoscopy (n=108)

	Group-A (n = 54) Mean±SD	Group-B (n =54) Mean±SD	*p*-value
0 minute	124±.82	123±.82	<0.001
1 minute	123.94±.85	128±.82	<0.001
3 minutes	130±.82	143±.82	<0.001
5 minutes	130±.91	132±.82	<0.001

Baseline diastolic blood pressure of Group-A at 0,1,3 and 5 minutes of laryngoscopy was 78.00±0.82, 78.00±0.82, 84.00±0.82 and 77.96±0.88 respectively. In case of Group-B baseline systolic blood pressure at 0,1,3 and 5 minutes was 80.00±0.82, 88.00±0.82, 86.00±0.82 and 82.00±0.82 respectively(p-value<0.001) as elaborated in Table–III.

Table–III: Diastolic Blood Pressure Record Between Groups at 0, 1, 3 and 5 Minutes of Laryngoscopy (108)

	Group-A (n=54) Mean±SD	Group-B (n =54) Mean±SD	*p*-value
0 minute	78.00±0.82	80.00±0.82	<0.001
1 minute	78.00±0.82	88.00±0.82	<0.001
3 minutes	84.00±0.82	86.00±0.82	<0.001
5 minutes	77.96±0.88	82.00±0.82	<0.001

DISCUSSION

This Quasi-experimental study was designed to investigate the role of lignocaine and fentanyl for alleviation of cardiovascular reflex surge to laryngoscopy and intubation, when employed as adjuvants at the induction of general anesthesia. Results of the study supported a superior impact of Fentanyl on the hemodynamic stability followed by laryngoscopy and endotracheal intubation when compared with Lignocaine.

The sequel of laryngoscopy and endotracheal intubation at induction of anesthesia is raised heart rate, increased mean arterial pressure, and cardiac dysrhythmias. Although these effects are transient this exaggerated hypertensive anesthetic induction response associated with laryngoscopy and airway manipulation with intubation is particularly detrimental in hypertensive patients, those suffering from a cardiovascular ailment, raised intracranial pressure or pathology of the cerebral vasculature.[12,13]

Kumar *et al.*, evaluated attenuation of the hemodynamic responses associated with endotracheal intubation with use of fentanyl, lignocaine nebulization, and their combination in a trial conducted on 96 patients enrolled for elective surgeries under general anesthesia. From baseline maximal rise in mean arterial pressure was recorded was 7.4%, 14.6%, and 5.4% in the fentanyl, lignocaine, and combined Fentanyl- Lignocaine group respectively. Study results support the results above where fentanyl is better in alleviating hemodynamic responses when compared with lignocaine (*p*-value<0.001).[14]

Gurulingappa *et al.*, compared intravenous fentanyl and lignocaine with placebo in reducing the pressor response and concluded both agents of utility when compared to placebo however labeled fentanyl was found superior adjuvant for the attenuation of the hemodynamic response.[15]

Endotracheal intubation is a recognized noxious stimulus resulting in a surge of sympathetic agents' adrenaline and noradrenaline, which could be well tolerated in healthy patients however this stimulation can be detrimental in compromised patients therefore recruitment of a rescue agent is desirable.[16,17]

Hassani et al. analyzed the role of fentanyl and its combination with Lidocaine for reduction of hemodynamic responses to endotracheal intubation in controlled hypertensive patients undergoing general

anesthesia and concluded that none of the drugs or combination can achieve inhibition of hemodynamic responses, an analysis contradictory to this study results.[18]

Hence our study approves the use of lignocaine and fentanyl as adjuvants for alleviation of hemodynamic flare associated with endotracheal intubation.

LIMITATIONS OF STUDY

This study included a relatively small sample size of only 108 patients. In addition, this was a single center study. Future studies should include a larger sample size and collect data from multiple centers. Comparison of efficacy of various anesthetic drugs or the same drugs in different concentrations amongst hypertensive patients and patients having ischemic heart diseases are further avenues that need to be explored, however, they are beyond the scope of this study.

Attenuation of hemodynamic response can be achieved with both intravenous bolus of fentanyl or lignocaine, however fentanyl has a more stable influence on the heart rate, systolic and diastolic blood pressure when compared with lignocaine.

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Authors Contribution

Following authors have made substantial contributions to the manuscript as under:

HAHB & MRI: Conception, study design, drafting the manuscript, approval of the final version to be published.

KB & SS: Data acquisition, data analysis, data interpretation, critical review, approval of the final version to be published.

CRR & MA: Conception, data acquisition, drafting the manuscript, approval of the final version to be published.

Authors agree to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved.

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