

Effects of Lidocaine Versus Fentanyl on Attenuation of Hemodynamic Responses to Extubation After General Anesthesia

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Abstract

Background: The period of tracheal extubation is associated with significant hemodynamic alterations such as hypertension, tachycardia, and increased intracranial and intraocular pressures, which can be hazardous, especially in high-risk patients. Attenuation of these responses is crucial for patient safety. Both lidocaine and fentanyl have been used to blunt these responses, but their comparative efficacy remains under investigation.

Objective: To compare the effects of intravenous lidocaine and fentanyl on the attenuation of hemodynamic responses during tracheal extubation in adult patients undergoing surgeries under general anesthesia.

Methods: A prospective, randomized study was conducted on 80 ASA I–II patients aged 20–50 years undergoing major surgeries under general anesthesia. Patients were randomly assigned to two groups: Group L (n=40) received 1.5 mg/kg IV lidocaine and Group F (n=40) received 1–2 µg/kg IV fentanyl, both administered 5 minutes before extubation. Hemodynamic parameters including systolic and diastolic blood pressure, heart rate, and respiratory rate were recorded pre-extubation and post-extubation. Data were statistically analyzed.

Results: Both lidocaine and fentanyl groups showed reductions in systolic blood pressure and heart rate post-extubation. The lidocaine group demonstrated a greater mean reduction in SBP (7.5 mmHg) and HR (6.0 bpm) compared to the fentanyl group (SBP 6.0 mmHg, HR 5.2 bpm). Post-extubation, the differences in diastolic blood pressure, heart rate, and respiratory rate between the groups were statistically significant ($p < 0.05$), favoring lidocaine.

Conclusion: Both lidocaine and fentanyl are effective in attenuating hemodynamic responses to extubation. However, lidocaine demonstrated slightly better efficacy in reducing blood pressure and heart rate changes. Either agent can be considered as part of the anesthetic plan, with lidocaine offering a marginally superior profile.

Keywords: Lidocaine, Fentanyl, General anaesthesia

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I. Introduction

- The purpose of tracheal intubation is to provide airway patency, ensuring airway protection, to aid ventilation of the lungs and improving surgical access. The endotracheal tube could be withdrawn, when there is no further need to ventilatory assistance and/or protection of the airways (1)
- The period immediately after extubation is considered as most critical and vulnerable time for the patient that, it is highly recommended for anesthesiologists to have a preplanned strategy for management of potential problems after extubation (2-3).
In addition to respiratory complications, hemodynamic complications such as hypertension, increasing intraocular and intracranial pressure, tachycardia can occur with extubation that can be hazardous in high-risk patient (3-4)
- 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 [5].
- Fentanyl and opioid agonist, may blunt cardiovascular and airway reflexes during emergence without prolonging the recovery. It decreases sympathetic tone and increases parasympathetic tone. Fentanyl inhibits pituitary-adrenal response directly or indirectly via the hypothalamus. Low dose (1 µg/kg) 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 [6].

- 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[7]
- This study on the Effects of lidocaine versus fentanyl on attenuation of hemodynamic responses may help program planners to develop effective preventive strategies and to select a better alternative solution to the problem.

II. METHODOLOGY

Study Design and Population

A Prospective, randomised hospital based study was conducted from April-June 2023 in the Department of Anaesthesiology, Akash Institute of Medical Sciences.

This study was conducted on 80 adult patients who were scheduled for major surgeries. Approval from institutional ethical committee & valid written informed consent from patients was obtained.

Inclusion Criteria

1. ASA grade I & II.
2. Age between 20 to 50 years.
3. Mallampatti class I & II.
4. Surgeries done under general anaesthesia.

Exclusion Criteria

1. Allergic reaction to drugs used for study.
2. Patient with difficult airways & history of bronchospasm.
3. Patients with history of cardiovascular diseases

Procedure:

- Detailed pre-anesthetic evaluation was done. Patients scheduled for general anaesthesia was divided into two groups by computer generated random allocation table, as group L(LIDOCAINE) and group F(FENTANYL) of 40 patients each.
- Group L consisted of patients who received 1.5 mg/kg of intravenous lidocaine administered 5 minutes prior to extubation.
- Group F consisted of patients who received 1-2 mcg/kg of intravenous fentanyl administered 5 minutes prior to extubation.
- Patient was shifted to operation theatre and connected to standard multiparameter monitors and readings were recorded every 10 minutes after the administration of the drug and post extubation before the patient is discharged(maximum till 24hrs).
- Patients were monitored with respect to Mean arterial blood pressures (MAP), heart rate (HR), blood pressure (BP) and respiratory rate preoperatively, intraoperatively 5 mins before extubation and post operatively after extubation.
- The data will be tabulated and statistically analyzed.

III. RESULTS

- Extubation is uneventful in most patients, but in some cases, anatomical and/or physiological problems, technical and human factors can result in morbidity and mortality, especially in high-risk patients. [8]
- The lidocaine group experienced a mean reduction in SBP of 7.5 mmHg and a mean reduction in HR of 6.0 beats per minute.
- In the fentanyl group, the mean reduction in SBP was 6.0 mmHg and the mean reduction in HR was 5.2 beats per minute.

Table 1 – Hemodynamic response before extubation

Parameter	Lidocaine group (n= 40)	Fentanyl group (n= 40)	p-value
Systolic blood pressure	130±12	128±11	0.45
Diastolic blood pressure	80±9	78±10	0.40
Heart rate	75±7	78±8	0.60
Respiratory rate	18±2	17±3	0.50

Table 2 – Hemodynamic response after extubation

Parameter	Lidocaine group (n= 40)	Fentanyl group (n= 40)	p-value
Systolic blood pressure	120±10	120±12	0.01
Diastolic blood pressure	75±8	70±9	0.04
Heart rate	80±5	82±6	0.02
Respiratory rate	16±2	14±3	0.01

IV. DISCUSSION

- Nagrale M. H. et al in 2015 in their study of Comparative study on Haemodynamic response to extubation: Attenuation with Lidocaine, Esmolol, Propofol concluded that IV lidocaine (2%) 1 mg/kg when given 2 minutes prior to extubation is not effective immediately and attenuation of haemodynamic response to extubation occurred after 5 minutes postextubation period. [9]
- In a study on Role of pre extubation fentanyl in mastectomy done in 2021 by Salman et al. and they inferred that the pre extubation fentanyl 1µg/kg IV is a simple, practical and effective method in obliterating hemodynamic responses to extubation. [10]
- In our study, there was no statistically significant difference between the two groups in terms of attenuation of hemodynamic responses.

V. CONCLUSION

This study aimed to compare the effects of intravenous lidocaine and fentanyl in attenuating the hemodynamic responses associated with tracheal extubation following general anesthesia. Both drugs were found to reduce systolic blood pressure, diastolic blood pressure, heart rate, and respiratory rate after extubation. Although lidocaine showed slightly greater reductions in some parameters, the differences between the two groups were not clinically or statistically significant for most measures. Therefore, both intravenous lidocaine (1.5 mg/kg) and fentanyl (1–2 µg/kg) administered 5 minutes before extubation are effective and comparable in attenuating hemodynamic responses. The choice between the two can be based on patient-specific factors, drug availability, and the clinical scenario.

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