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EFFECTS OF PERIOPERATIVE LIGNOCAINE INFUSION ON HEMODYNAMIC CHANGES TO INTUBATION

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ABSTRACT

Background: Laryngoscopy followed by tracheal intubation is known to trigger a significant sympathetic surge, often leading to acute hemodynamic alterations such as elevated heart rate and blood pressure. These responses typically persist for approximately ten minutes and may pose risks, especially in vulnerable patients. Various pharmacological interventions have been proposed to manage these responses, with differing levels of efficacy. Recent findings suggest that perioperative intravenous lignocaine infusion may effectively blunt these stress responses. However, existing literature remains limited, particularly within the local context, prompting the need for further investigation into its potential benefits.

Methods: A randomized controlled trial was conducted in the Department of Anesthesiology at Sir Ganga Ram Hospital, Lahore, over a six-month period from August 21, 2017, to February 20, 2018. Sixty adult patients aged 20 to 70 years, scheduled for elective surgery under general anesthesia requiring tracheal intubation, were enrolled and randomly assigned into two groups. Group A received conventional general anesthesia, while Group B was administered lignocaine infusion perioperatively. Key outcome measures included mean heart rate and mean arterial pressure, recorded immediately after intubation and at 3 and 5-minute intervals post-intubation. All participants provided informed written consent prior to enrollment.

Results: The study included 60 patients with a mean age of 45.3 ± 14.8 years and a mean BMI of 25.9 ± 2.7 kg/m². Of these, 61.7% were male and 18.3% had a history of hypertension. No statistically significant differences were observed in baseline heart rate (90.97 ± 6.56 vs. 90.33 ± 7.31 bpm; $p = 0.725$) or mean arterial pressure (82.57 ± 5.50 vs. 82.13 ± 5.31 mmHg; $p = 0.757$) between the two groups prior to intubation. However, patients in the lignocaine group demonstrated significantly lower heart rate and mean arterial pressure immediately after intubation (102.67 ± 5.73 vs. 122.77 ± 5.94 bpm; $p < 0.001$ and 106.57 ± 3.83 vs. 124.10 ± 4.66 mmHg; $p < 0.001$), at 3 minutes (87.47 ± 6.62 vs. 95.67 ± 7.83 bpm; $p < 0.001$ and 95.60 ± 4.21 vs. 106.53 ± 5.79 mmHg; p

< 0.001), and at 5 minutes post-intubation (81.87 ± 6.69 vs. 89.93 ± 7.67 bpm; p < 0.001 and 93.73 ± 4.23 vs. 100.40 ± 6.21 mmHg; p < 0.001).
Conclusion: The administration of intravenous lignocaine during the perioperative period effectively mitigates the hemodynamic response to tracheal intubation, as evidenced by significantly lower heart rate and mean arterial pressure at critical time points. Its incorporation into anesthetic protocols may enhance patient stability during induction and is recommended for routine practice in suitable cases.

Keywords: Tracheal Intubation, Hemodynamic Response, Lignocaine Infusion, General Anesthesia, Perioperative Care

1. INTRODUCTION

Cardiovascular complications during tracheal intubation, such as arrhythmias and elevated blood pressure, are particularly concerning in individuals with untreated hypertension[1]. Laryngoscopy and intubation stimulate airway protective reflexes, and when performed under inadequate anaesthesia, commonly provoke transient yet marked increases in heart rate and arterial pressure[2].
These procedures are considered among the most painful interventions in clinical anaesthesia, eliciting acute haemodynamic responses that may persist for at least ten minutes[3]. Numerous pharmacological agents have been proposed to manage these changes, including lignocaine, esmolol, alfentanil, and fentanyl[4]. Lignocaine administered as an intravenous bolus prior to intubation has been shown to significantly reduce the cardiovascular response[4]. Furthermore, intravenous lignocaine infusion before surgery has been considered both safe and effective in controlling maternal stress response during caesarean section[5].
Lignocaine remains one of the oldest, most affordable, and widely available options to blunt the haemodynamic impact of airway instrumentation[6]. The rise in blood pressure associated with intubation can be diminished in many cases by giving intravenous lignocaine at a dose of one point five milligrams per kilogram approximately one to three minutes before the procedure[2,7]. It also contributes to a decreased requirement for inhalational agents and opioid use during surgery[8]. In addition to its analgesic properties, lignocaine exhibits anti inflammatory activity[9].
It is the most widely used local anaesthetic due to its safety, rapid metabolism, and short duration of action, and it is also used systemically as a class one b anti arrhythmic agent[1]. The peak of the haemodynamic response usually occurs at one minute post intubation and returns towards baseline within three minutes[7]. Jain et al. (2017) documented that perioperative lignocaine infusion significantly attenuates the stress response to intubation, demonstrating reduced heart rate and mean arterial pressure at multiple time intervals[4].
This study aims to evaluate intravenous lignocaine infusion preoperatively, as most prior studies employed only a bolus dose. Given the limited availability of other agents locally, this research seeks to establish evidence to guide future anaesthetic practice.

2. METHODS

This study was designed as a randomised controlled trial and was carried out in the Department of Anaesthesiology at Sir Ganga Ram Hospital, Lahore. A sample size of 60 patients, with 30 participants allocated to each study group, was calculated based on a 95 percent confidence interval and 80 percent statistical power. The expected mean heart rate was estimated at 115.7 ± 13.44 beats per minute in the group receiving lignocaine infusion, compared to 105.13 ± 13.40 beats per minute in the placebo group. A non probability, consecutive sampling technique was used to recruit eligible patients.
Participants included in the study were of both gender, aged between 20 and 70 years, classified as ASA physical status I, scheduled for elective surgical procedures, and having a body mass index up to 30 kilograms per square metre. Patients were excluded if they had an anticipated difficult airway, such as Mallampati classification III or IV or a thyromental distance exceeding 6 centimetres.

Further exclusion criteria included emergency surgeries, documented hypersensitivity to lignocaine, and those undergoing regional anaesthesia.

Following ethical approval from the institutional review board, patients from various surgical disciplines including general surgery, gynaecology, ENT, ophthalmology, urology, neurosurgery, and orthopaedics were considered. Informed written consent was obtained from all participants. Demographic data, including name, age, sex, and diagnosis or surgical indication, were recorded. Using block randomisation, patients were divided into two groups.

All patients received premedication with intravenous midazolam at a dose of 0.025 millilitres per kilogram. In Group A, patients were administered 6 millilitres of normal saline intravenously over ten minutes, followed by a continuous infusion of 6 millilitres per hour. In Group B, patients received preservative free lignocaine 2 percent, at a dose of 1.5 milligrams per kilogram intravenously, diluted to 6 millilitres with normal saline and administered over ten minutes. This was followed by a lignocaine infusion at 1.5 milligrams per kilogram per hour, similarly diluted to 6 millilitres per hour, continued until five minutes after intubation.

Anaesthesia induction was achieved with intravenous propofol at a dose of 2 milligrams per kilogram, and neuromuscular blockade was facilitated with atracurium at 0.5 milligrams per kilogram. Haemodynamic parameters, specifically heart rate and mean arterial pressure, were measured at intubation and at three and five minutes thereafter, in accordance with predefined operational definitions. All clinical data were recorded using a structured proforma.

All data were entered and analysed using the Statistical Package for Social Sciences (SPSS), version 21.0. Continuous variables, such as age, heart rate, and mean arterial pressure, were summarised as mean with standard deviation. To compare the mean heart rate and mean arterial pressure between the two groups, the independent sample t-test was employed, with a p-value of 0.05 or less considered statistically significant.

Categorical variables, such as gender, were expressed in terms of frequencies and percentages. Additionally, data were stratified for age, gender, history of hypertension (defined as blood pressure exceeding 160 over 90 millimetres of mercury), and body mass index to control for potential confounding variables. Following stratification, the independent sample t-test was re-applied to assess statistical significance.

3. RESULTS

The age of the patients included in the study ranged from 21 to 70 years, with a mean age of 45.3 ± 14.8 years. There were 37 male patients (61.7 percent) and 23 female patients (38.3 percent), resulting in a male to female ratio of approximately 1.6 to 1. The body mass index (BMI) of the patients varied between 21.2 and 29.9 kilograms per square metre, with a mean value of 25.9 ± 2.7 kilograms per square metre. A total of 11 patients (18.3 percent) were found to be hypertensive. These baseline characteristics are summarised in Table 1.

Both groups under investigation were statistically comparable in terms of mean age ($p = 0.911$), mean BMI ($p = 0.756$), and the distribution of patients across subgroups based on age ($p = 0.793$), gender ($p = 0.791$), BMI ($p = 0.791$), and hypertension status ($p = 0.739$), as detailed in Table 2.

Prior to intubation, no statistically significant difference was noted between the two groups in terms of mean heart rate (90.97 ± 6.56 versus 90.33 ± 7.31 beats per minute; $p = 0.725$) or mean arterial pressure (82.57 ± 5.50 versus 82.13 ± 5.31 millimetres of mercury; $p = 0.757$) between the lignocaine and control groups.

However, immediately following intubation, patients who received lignocaine exhibited a significantly lower mean heart rate (102.67 ± 5.73 versus 122.77 ± 5.94 beats per minute; $p < 0.001$) and mean arterial pressure (106.57 ± 3.83 versus 124.10 ± 4.66 millimetres of mercury; $p < 0.001$) when compared to those receiving normal saline. This significant difference persisted at the three-minute mark, where the mean heart rate (87.47 ± 6.62 versus 95.67 ± 7.83 beats per minute; $p < 0.001$) and mean arterial pressure (95.60 ± 4.21 versus 106.53 ± 5.79 millimetres of mercury; $p < 0.001$) remained lower in the lignocaine group. At five minutes post intubation, the mean heart rate

(81.87 ± 6.69 versus 89.93 ± 7.67 beats per minute; $p < 0.001$) and mean arterial pressure (93.73 ± 4.23 versus 100.40 ± 6.21 millimetres of mercury; $p < 0.001$) also continued to demonstrate a statistically significant difference in favour of the lignocaine group. These findings are illustrated in Table 3.

Table 1: Baseline Characteristics of Study Population

Characteristic	Value
Age (years)	45.3 ± 14.8
21–45 years	25 (41.7%)
45–70 years	35 (58.3%)
Gender (Male)	37 (61.7%)
Gender (Female)	23 (38.3%)
BMI (Kg/m²)	25.9 ± 2.7
20–25 Kg/m²	23 (38.3%)
25–30 Kg/m²	37 (61.7%)
Hypotensive	11 (18.3%)
Non-Hypotensive	49 (81.7%)

Table 2: Baseline Comparison Between Study Groups

Characteristic	Lignocaine (n=30)	Normal Saline (n=30)	P Value
Age (years)	45.47 ± 15.11	45.03 ± 14.76	0.911
21–45 years	13 (43.3%)	12 (40.0%)	0.793
45–70 years	17 (56.7%)	18 (60.0%)	0.793
Gender (Male)	18 (60.0%)	19 (63.3%)	0.791
Gender (Female)	12 (40.0%)	11 (36.7%)	0.791
BMI (Kg/m²)	25.83 ± 2.56	26.04 ± 2.83	0.756
20–25 Kg/m²	12 (40.0%)	11 (36.7%)	0.791
25–30 Kg/m²	18 (60.0%)	19 (63.3%)	0.791
Hypotensive	5 (16.7%)	6 (20.0%)	0.739
Non-Hypotensive	25 (83.3%)	24 (80.0%)	0.739

Table 3: Haemodynamic Response Between Study Groups

Time Point	Parameter	Lignocaine (n=30)	Normal Saline (n=30)	P Value
Before Intubation	Heart Rate (bpm)	90.97 ± 6.56	90.33 ± 7.31	0.725
	MAP (mmHg)	82.57 ± 5.50	82.13 ± 5.31	0.757
Immediately After Intubation	Heart Rate (bpm)	102.67 ± 5.73	122.77 ± 5.94	<0.001*
	MAP (mmHg)	106.57 ± 3.83	124.10 ± 4.66	<0.001*
3 Minutes After Intubation	Heart Rate (bpm)	87.47 ± 6.62	95.67 ± 7.83	<0.001*
	MAP (mmHg)	95.60 ± 4.21	106.53 ± 5.79	<0.001*
5 Minutes After Intubation	Heart Rate (bpm)	81.87 ± 6.69	89.93 ± 7.67	<0.001*
	MAP (mmHg)	93.73 ± 4.23	100.40 ± 6.21	<0.001*

*Independent sample t-test, * observed difference was statistically significant*

4. DISCUSSION

During laryngoscopy, stimulation of the supraglottic region activates the sympathoadrenal system, leading to elevated plasma catecholamine levels[1]. The passage of the endotracheal tube and inflation of the cuff within the infraglottic area also contribute to this response, though less significantly than the mechanical pressure applied to the tongue to elevate the epiglottis[1,2]. These manoeuvres can result in tachycardia, raised vascular, intraocular, and intracranial pressures, arrhythmias, and bronchoconstriction[1]. The magnitude of the cardiovascular response correlates with the applied force and laryngoscopy duration[3,4]. Techniques minimising force, repeated

attempts, and procedural time have proven effective in reducing this response. Lignocaine, a widely used anaesthetic, offers perioperative benefits including haemodynamic stability and reduced postoperative discomfort[4,10,11], though evidence remains limited, particularly in local settings, warranting further investigation.

The results indicated that the mean heart rate and mean arterial pressure immediately following intubation were significantly lower in patients administered lignocaine (102.67 ± 5.73 versus 122.77 ± 5.94 beats per minute; p less than 0.001 and 106.57 ± 3.83 versus 124.10 ± 4.66 millimetres of mercury; p less than 0.001, respectively). These differences persisted at three minutes (87.47 ± 6.62 versus 95.67 ± 7.83 beats per minute; p less than 0.001 and 95.60 ± 4.21 versus 106.53 ± 5.79 millimetres of mercury; p less than 0.001) and five minutes post intubation (81.87 ± 6.69 versus 89.93 ± 7.67 beats per minute; p less than 0.001 and 93.73 ± 4.23 versus 100.40 ± 6.21 millimetres of mercury; p less than 0.001).

These observations are consistent with the findings of Jain et al.[4], who reported significantly reduced heart rate (105.13 ± 13.49 versus 115.57 ± 13.44 beats per minute; p less than 0.001) and arterial pressure (105.82 ± 5.04 versus 124.69 ± 11.75 millimetres of mercury; p less than 0.001) following lignocaine administration. At three minutes, the reductions were also statistically significant (89.43 ± 13.75 versus 98.37 ± 10.68 beats per minute; p equals 0.001 and 96.93 ± 6.98 versus 106.02 ± 8.07 millimetres of mercury; p less than 0.001), and similar trends were seen at five minutes (84.83 ± 13.14 versus 93.83 ± 20.74 beats per minute; p equals 0.005 and 95.91 ± 7.37 versus 100.29 ± 7.58 millimetres of mercury; p equals 0.003).

A similar comparative study conducted by Hashemian et al.[12] in the year two thousand eighteen found lignocaine to be superior to fentanyl in reducing haemodynamic responses, with significantly lower heart rate (95.80 ± 30.72 versus 106.00 ± 35.55 beats per minute; p-value equals 0.036) and mean arterial pressure (87.90 ± 12.59 versus 91.74 ± 18.95 millimetres of mercury; p-value equals 0.048) observed immediately after intubation.

To the best of our knowledge, this study represents the first of its kind within the local population and contributes to the growing international evidence that supports the use of perioperative lignocaine infusion to control haemodynamic fluctuations during tracheal intubation. The findings affirm that lignocaine infusion is associated with significantly lower mean heart rate and mean arterial pressure compared to placebo in patients receiving general anaesthesia. In addition to its cardiovascular benefits, lignocaine may also offer improved postoperative outcomes through reductions in pain, nausea, duration of ileus, opioid consumption, and hospital stay[13,14,15].

In addition, a clinical investigation by Silva et al. (2023) found that lignocaine infusion not only reduced cardiovascular responses but also improved patient comfort and facilitated faster recovery following anaesthesia.[16] Likewise, Yang et al. (2023)[17] highlighted the perioperative benefits of intravenous lignocaine in colorectal surgery, including enhanced analgesia and improved haemodynamic stability. Similarly, Pramanik et al. (2025)[18] observed attenuated cardiovascular responses during endotracheal intubation with lignocaine administration, indicating its potential as an effective agent in anaesthetic protocols. These concordant findings reinforce the potential utility of lignocaine in routine anaesthetic care, especially for patients at risk of adverse haemodynamic shifts. Thus, the evidence collectively suggests that intravenous lignocaine infusion may offer a clinically relevant advantage over placebo and potentially other commonly used agents in the management of haemodynamic stress associated with airway manipulation.

A notable limitation of this study is the absence of assessment regarding potential adverse effects of lignocaine infusion. Furthermore, no comparisons were made with other pharmacological agents such as fentanyl, paracetamol, or esmolol. Inclusion of such comparators could have provided insight into the relative safety and efficacy of lignocaine, and would assist in determining the most appropriate agent for minimising haemodynamic responses to intubation. Future studies addressing these comparisons are strongly recommended.

5. CONCLUSION

Perioperative intravenous lignocaine infusion was associated with attenuation of hemodynamic response to tracheal intubation in terms of significantly lower mean heart rate and mean of mean arterial pressure as compared to controls which is preferable in patients undergoing general anesthesia and is therefore recommended in future practice.

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