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ORIGINAL RESEARCH ARTICLE

CHANGES IN BLOOD PRESSURE IN RESPONSE TO LARYNGOSCOPY AND INTUBATIONBETWEEN LIGNOCAINE AND FENTANYL

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Abstract

Laryngoscopy and tracheal intubations are also employed for non-anaesthetic purposes. Diagnostic direct laryngoscopy and fibreoptic bronchoscopy for diagnosis or intubation are being commonly used. Endotracheal intubation may be required for prevention of aspiration, airway protection and for mechanical ventilation. These entire procedures can also produce sympathetic responses. Many of these patients are critically ill and are at increased risk. All the patients were visited the day before surgery and pre-anaesthetic counselling was done. All patients received Diazepam 10 mg orally at night on the previous day before surgery.On the day of surgery, Tablet Diazepam 5 mg and Tablet Pantoprazole 40 mg was given with a sip of water at early morning. Attenuation of systolic blood pressure is highly significant with fentanyl when compared with lignocaine at 1, 3, and 5 minutes interval following laryngoscopy and intubation.When compared with lignocaine, fentanyl showed a highly significant suppression of diastolic blood pressure.

Keywords: Blood pressure, laryngoscopy, lignocaine

Introduction

Endotracheal intubation has been practised following its description by Rowbotham and Magillin 1921. It has become an integral part of the anaesthetic management and critical care of the patient.

The circulatory responses to laryngeal and tracheal stimulation following laryngoscopy and tracheal intubation were documented by Reid and Brace in 1940 and King *et al*., in 1951 interpreted it as reflex sympathoadrenal stimulation [1, 2]. Increase in mean arterial pressure of an average of 25 mmHg was observed in normotensive patients following laryngoscopy and intubation under anaesthesia with thiopentone, nitrous oxide, oxygen

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and suxamethonium[1].

Although increases in heart rate and blood pressure due to sympathoadrenal response are short lived, they might have detrimental effects in high risk patients especially those with cardiovascular diseases, increased intracranial pressure or anomalies of cerebral vessels[3].

Left ventricular failure, myocardial ischemia and cerebral haemorrhage may occur in high risk patients. Convulsions may be precipitated in preeclampsia patients[1].

Post intubation pressor responses have been associated with ST segment changes and ventricular arrhythmias. Catecholamine levels increases significantly. Norepinephrine levels may double and continue for 4 to 8 minutes, epinephrine levels may quadruple. Endocrine stress response is also seen. Some authors consider the intubation period as one of the periods of greatest risk in surgical patients with coronary artery diseases.

Although the response may be transient, it is invariable, significant, often persistentand of great concern[4].

Laryngoscopy and tracheal intubations are also employed for non-anaesthetic purposes. Diagnostic direct laryngoscopy and fibreoptic bronchoscopy for diagnosis or intubation are being commonly used. Endotracheal intubation may be required for prevention of aspiration, airway protection and for mechanical ventilation. These entire procedures can also produce sympathetic responses. Many of these patients are critically ill and are at increased risk.

With advances in medicine, the number of high-risk patients coming for surgeries have been increased. Therefore, it is important to find an effective means of attenuating sympathetic response to laryngoscopy and intubation.

Many strategies have been advocated to minimise the haemodynamic adverse responses and are aimed at different levels of the reflex arc[4]. Example:

1. Block the peripheral sensory receptors and afferent input by topical application and infiltration of superior laryngeal nerve.
2. Block the central mechanisms of integration of sensory input by fentanyl, morphine, droperidol etc.
3. Block the efferent pathway and effector sites by intravenous lignocaine, β blockers, calcium channel blockers, hydralazine etc.

No single drug or technique is satisfactory[4].

Recommendations for attenuation of reflex hypertension and tachycardia are therefore manifold. Besides minimising the cardiovascular responses, anaesthesia for patients at risk must also satisfy the following requirements; it must be applicable regardless of patient's cooperation, prevent impairment of cerebral blood flow and avoid arousal of the patients. It should neither be time consuming nor affect the duration or modality of the ensuing anaesthesia[3].

Among the recommended procedures intravenous lignocaine and fentanyl appear to best fulfil the above-mentioned criteria[3]. Large doses of fentanyl may cause unwanted side effects[5]. In a study by Miller and Warren lignocaine failed to attenuate the cardiovascular responses to laryngoscopy and tracheal intubation. Intravenous lignocaine has shown variable results in different studies.

The present study is undertaken to determine the efficacy of low dose of fentanyl (2 µg/kg)[5, 6]and lignocaine (1.5 mg/kg)[3, 4] in attenuating sympathetic response to

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laryngoscopy andtracheal intubation.

Methodology

A clinical comparative prospective study of attenuation of sympatheticresponse to laryngoscopy and intubation was done in 150 patientsposted for elective surgeries. General anaesthesia was provided withendotracheal intubation for all the patients.

Patients undergoing various Orthopaedic, Ear, Nose and Throat surgeries, Gynaecological, Neurosurgical and Laparoscopic procedures were selected. Following criteria's were adopted for selecting patients.

Inclusion criteria

- Patients scheduled for elective surgeries.
- Age between 20 to 50 years of both the sexes.
- Patients with ASA class I and II.
- Mallampati airway assessment of class I and II.

Exclusion criteria

- Unwilling patients.
- Emergency surgeries.
- Anticipated difficult airway.
- Patients with ASA class III or higher.
- Patients with asthma, hypertension and other cardiovascular diseases.
- Patients on antihypertensive medications like beta blockers, calcium channel blockers and angiotensin converting enzyme inhibitors.
- Patients in whom laryngoscopy and intubation proved to be prolonged (more than 20 seconds) or difficult.

Patients were selected after thorough pre-anaesthetic assessment and investigations. An informed consent was taken with all the patients.

150 cases were divided into three groups of 50 each by *double blind randomization using a chit method.*

Group-I was Control group: In this group no drug was administered for attenuating sympathetic response to laryngoscopy and intubation.

Group-II was Lignocaine group: Here patients received 1.5 mg/kg of lignocaine intravenously 3 minutes before laryngoscopy and intubation.

Group-III was Fentanyl group: All the patients in this group received 2 µg/kg of fentanyl intravenously 5 minutes before laryngoscopy and intubation.

Investigations

Hb%, Haematocrit, TC, DC and ESR.

RBS.

Blood Urea and Serum Creatinine.

ECG.

Chest x-ray.

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Premedication

All the patients were visited the day before surgery and pre-anaesthetic counselling was done. All patients received Diazepam 10 mg orally at night on the previous day before surgery.

On the day of surgery, Tablet Diazepam 5 mg and Tablet Pantoprazole 40 mg was given with a sip of water at early morning.

On shifting the patient to operation theatre Pulse oximeter, Non-invasive blood pressure and ECG monitors were connected. Intravenous line was secured with 18 gauge cannula; patency of cannula was confirmed with flushing Normal Saline. Injection Midazolam 1mg was given intravenously, patient was monitored for 15 minutes. A pre-induction heart rate, systolic and diastolic blood pressures were recorded. Intravenous infusion of Ringer Lactate (RL) solution was started for maintenance.

Anaesthesia technique

All the patients were pre-oxygenated with 100% Oxygen for 3 minutes before induction. Induction was achieved with Injection Propofol 2 mg/kg intravenously.

After induction of anaesthesia, heart rate, systolic and diastolic blood pressure was recorded. Injection Vecuronium 0.1 mg/kg was administered. Patient was ventilated with O_2 and Isoflurane 1% for 3 minutes. Laryngoscopy was done using rigid laryngoscope with standard Macintosh blade. Intubation was done with appropriate sized, disposable, high volume low pressure cuffed endotracheal tube. Oral intubation was done for all surgical procedures. Laryngoscopy and intubation was done within 15 to 20 seconds.

Heart rate, systolic, diastolic and mean arterial pressures were recorded at 1, 3, 5, 7 and 10 minutes intervals from the onset of laryngoscopy.

In group-II, lignocaine intravenously was administered 3 minutes before laryngoscopy and intubation.

In group-III, fentanyl intravenously was administered 5 minutes before laryngoscopy and intubation.

Patients were connected to Circle system and anaesthesia was maintained with a mixture of oxygen, Air, Isoflurane (0.6-1%) with fractional inspired concentration of Oxygen (FIO_2) 0.4.

Adequacy of ventilation was monitored clinically and SpO_2 was maintained at 99-100%.

Positioning, epinephrine infiltration, throat packing and surgery were withheld till the completion of recording.

At the end of the surgery reversal was done with injection Neostigmine 0.05 mg/kg and injection Glycopyrrolate 0.01 mg/kg intravenously.

An observation was made related to adverse effects of drugs, anaesthesia related complications and were attended to appropriately.

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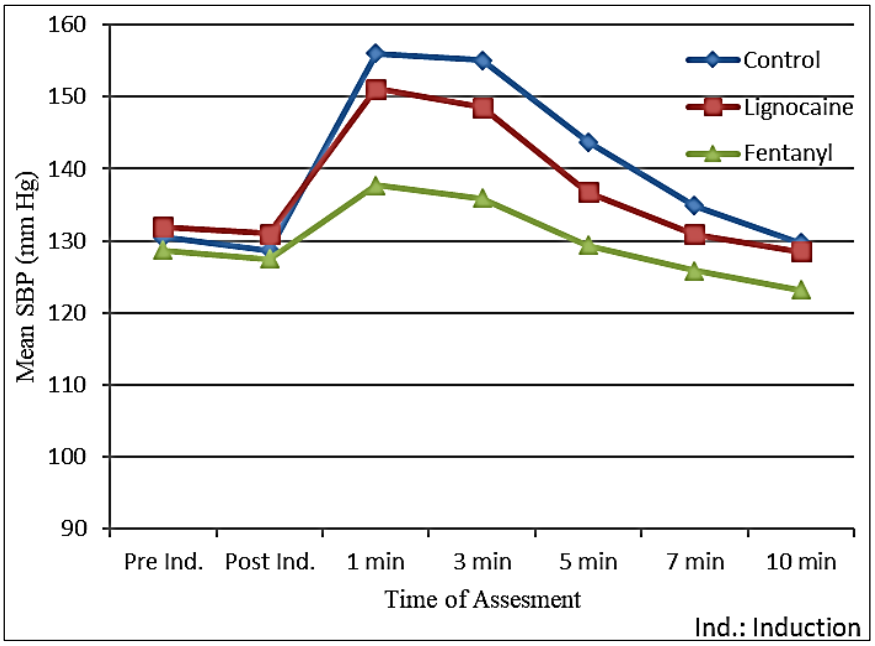
Results

Table 1: Comparison of Changes in Systolic Blood Pressure

Time of Assessment	Control (I)		Lignocaine (II)		Fentanyl (III)		Anova 'F'* P	Diff. between groups**		
	Mean ± SD	% diff	Mean ± SD	% diff	Mean ± SD	% diff		I-II	I-III	II-III
Pre-induction	130.5 ± 10.9	-	131.9 ± 11.5	-	128.7 ±11.8	-	1.01 0.37	0.53	0.17	0.19
Post-induction	128.7 ± 11.3	-1.4	131.0 ± 11.4	-0.7	127.5 ±11. 5	-0.9	1.21 0.30	0.31	0.60	0.12
1 min	156.0 ± 11.2	19.8	151.1 ± 13.7	14.5	137.7 ± 10.9	7.0	32.0 <0.001	<0.05	<0.001	<0.001
3 min	155.1 ± 11.5	19.2	148.5 ± 14.2	12.6	135.9 ± 10.8	5.6	31.3 <0.001	<0.05	<0.001	<0.001
5 min	143.7 ± 13.1	10.1	136.8 ± 11.3	3.7	129.4 ± 10.4	0.5	18.9 <0.001	<0.01	<0.001	<0.01
7 min	134.9 ± 11.0	3.4	130.5 ± 10.7	-1.1	125.8 ± 10.2	-2.3	9.1 <0.001	<0.05	<0.001	<0.05
10 min	129.7 ± 9.7	-0.6	128.5 ± 10.6	-2.6	123.2 ± 14.6	-4.3	4.24<0.05	0.55	<0.05	<0.05

-ve sign indicates decrease, *one-way ANOVA, **Unpaired 't' test, $p<0.05$ is significant, $p<0.001$ is highly significant, $p>0.05$ is not significant.



Graph 1: Systolic Blood Pressure

The changes in systolic blood pressure assessed before and after induction of anaesthesia and at various time intervals from the onset of laryngoscopy and intubation

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in control and study groups and their statistical comparison are presented in the table VI.

Control group

The mean systolic blood pressure was 130.5 ± 10.9 before induction. It decreased to 128.7 ± 11.3 (1.4% below preinduction level) after induction. At 1 minute from the onset of laryngoscopy and intubation systolic blood pressure increased to 156.4 ± 11.2 (19.8% above preinduction level) was noticed. It remained almost at the same level 155.1 ± 11.5 (19.2% above preinduction level) by the end of 3 minutes. It further decreased to 143.7 ± 13.1(10.1% above preinduction level) and 134.9 ± 11.0 (3.4% above preinduction level) at the end of 5 and 7 minutes respectively. The mean value at the end of 10 minutes was 129.7 ± 9.7 with decrease of 0.6% from the pre-induction level.

Lignocaine group

The mean systolic blood pressure in this group was 131.9±11.5. An insignificant decrease in systolic blood pressure of 0.7% (131.0 ± 11.4) from the basal level (131.9 ± 11.5) occurred with induction of anaesthesia. With the onset of laryngoscopy and intubation, rise in systolic blood pressure was 151 ± 13.7 (14.5% above preinduction level) at 1 minute. Subsequent observation showed 148.5±14.2 (12.6% above preinduction level) at 3 minutes and 136.8 ± 11.3 (3.7% above preinduction level) at the end of 5 minutes. It is further decreased to 130.5 ± 10.7 (1.1% below preinduction level) at the end of 7 minutes was observed. A decrease of 2.6% from the basal value to 128.5 ± 10.6 was recorded at 10 minutes.

Fentanyl group

The mean systolic blood pressure in this group was 128.7±11.8. A small insignificant fall in systolic blood pressure of 0.9% from pre-induction level to 128.7 ± 11.8 was observed following induction. The rise in systolic blood pressure was only 7% from basal level at 1 minute with the onset of laryngoscopy and intubation (137.7 ± 10.9).

It decreased to 135.9 ± 10.8 (5.6% above preinduction level) and 129.4 ± 10.4 (0.5% above preinduction level) at 3 and 5 minutes after laryngoscopy and intubation. There was further decrease beyond basal levels by 2.3% (125.8 ± 10.2) and 4.3% (123.2 ± 14.6) at 7 and 10 minutes respectively.

No significant variations were found in all the groups between pre and post induction values ($p=0.37$ and $p=0.30$).

A statistically significant difference was observed among all the groups at subsequent assessments ($p<0.05$).

Attenuation of increase in systolic blood pressure was significant in lignocaine group. A rise of only 14.5% in systolic blood pressure from the preinduction level was observed in lignocaine group as compared with 19.8% in control group ($p<0.05$).

A similar attenuation was highly significant with fentanyl group. i.e., There was only 7% rise in systolic blood pressure from the preinduction level ($p<0.001$).

It returned nearer to basal values earlier in both lignocaine and fentanyl groups (5 minutes) than in control group (7 minutes).

Attenuation of systolic blood pressure is highly significant with fentanyl when

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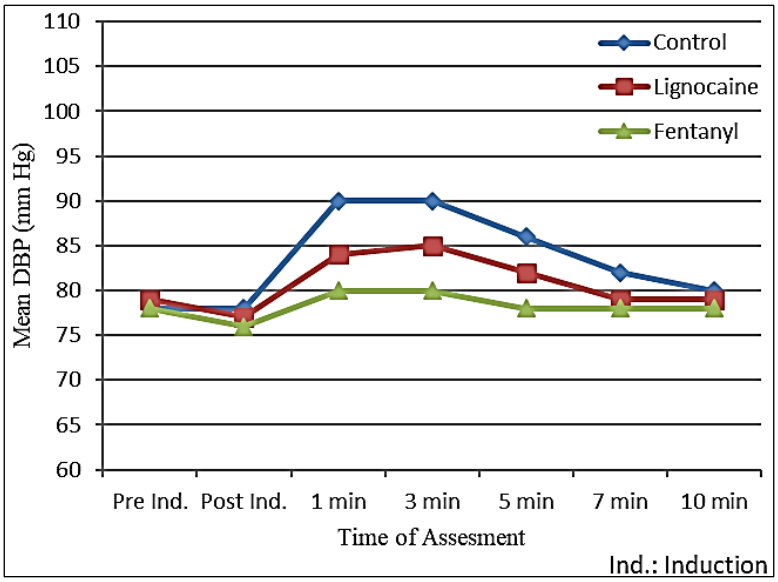
compared with lignocaine at 1, 3- and 5-minutes interval following laryngoscopy and intubation.

Table 2: Comparison of Changes in Diastolic Blood Pressure

Time of Assessment	Control (I)		Lignocaine (II)		Fentanyl (III)		Anova 'F'* p	Diff. between groups**		
	Mean ± SD	% diff	Mean ± SD	% diff	Mean ± SD	% diff		I-II	I-III	II-III
Pre-induction	76.3 ± 6.1	-	76.7 ± 5.8	-	76.0 ± 5.1	-	-0.220.81	0.73	0.79	0.52
Post-induction	74.0 ± 6.4	-3.0	75.7 ± 5.4	-1.0	74.9 ± 4.7	-1.4	1.230.29	0.15	0.42	0.43
1 min	89.8 ± 5.2	17.7	86.2 ± 5.2	12.4	80.4 ± 4.6	5.8	44.6 <0.001	<0.01	<0.001	<0.001
3 min	89.4 ± 5.2	17.2	84.9 ± 5.3	10.7	79.4 ± 4.6	4.5	49.1<0.001	<0.001	<0.001	<0.001
5 min	84.6 ± 6.0	10.9	79.8 ± 4.3	4.0	76.4 ± 4.3	0.5	34.6<0.001	<0.001	<0.001	<0.01
7 min	79.2 ± 5.5	3.8	76.1 ± 4.7	-0.8	74.9 ± 4.5	-1.4	10.2 <0.001	<0.01	<0.001	=0.18
10 min	76.7 ± 5.5	0.5	75.1 ± 4.4	-2.1	74.8 ± 4.5	-1.6	2.18 0.12	=0.12	0.07	0.74

-ve sign indicates decrease, *one-way ANOVA, **Unpaired 't' test, $p<0.05$ is significant, $p<0.001$ is highly significant, $p>0.05$ is not significant.

Graph 6



Graph 2: Diastolic Blood Pressure

The changes in diastolic blood pressure assessed at pre and post induction and at

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various time intervals from the onset of laryngoscopy and intubation in control, lignocaine and fentanyl groups are shown in the table VII.

Control group

The mean diastolic blood pressure before induction was 76.3 ± 6.1. With the induction of anaesthesia, it decreased by 3% below from basal value to 74.0 ± 6.4. From the onset of laryngoscopy and tracheal intubation a rise of 89.8 ± 5.2 (17.7% above preinduction level) was noticed at the end of 1 minute ($p<0.001$). It remained at 89.4 ± 5.2 (17.2% above preinduction level) at 3 minutes. At 5 and 7 minutes it decreased further to 84.6 ± 6.0 (10.9% above preinduction level) and 79.2 ± 5.5 (3.8% above preinduction level) respectively. It was almost nearer to pre-induction level at 10 minutes 76.7 ± 5.5 (0.5% above preinduction level).

Lignocaine group

Pre-induction basal value was 76.7 ± 5.8 and followed by a small decrease to 75.7 ± 5.4 (1% below preinduction level) was observed after induction of anaesthesia.The maximum increase in diastolic blood pressure [86.2 ± 5.2 (12.4% from the basal level)] was observed at 1 minute interval from the onset of laryngoscopy and intubation. It decreased to 84.9 ± 5.3 (10.7% above preinduction level) at 3 minutes and 79.8 ± 4.3 (4% above preinduction level) at 5 minutes respectively. The mean values at 7 and 10 minutes were slightly less than basal values.

Fentanyl group

This group showed mean pre-induction value of 76.0 ± 5.1. There was a small decrease by 1.4% below basal level (74.9 ± 4.7) after induction. The maximum rise was seen at 1 minute by 80.4 ± 4.6 (5.8% above preinduction level). It rapidly returned to basal level by 5 minutes. The mean values at 7 and 10 minutes showed a small decrease.

One-way ANOVA shows no significant difference among all the groups at pre and post induction levels ($p=0.81$; $p=0.29$).

A significant difference was observed in all the groups at subsequent assessments up to 7 minutes ($p<0.01$).

Suppression of maximum rise in diastolic blood pressure by lignocaine was statistically significant ($p<0.01$) at 1, 3, 5 and 7 minutes intervals when compared to control group. Maximum rise was 12.4% in lignocaine group and 17.7% in control group at 1 minute interval.

Fentanyl was also efficient in attenuating the rise in diastolic blood pressure. The maximum rise was only 5.8%, and was statistically highly significant ($p<0.001$).

When compared with lignocaine, fentanyl showed a highly significant suppression of diastolic blood pressure. The maximum rise was 12.4% and 5.8% in lignocaine and fentanyl groups respectively at 1 minute interval ($p<0.001$).

Discussion

Pernerstorfer T *et al*. showed that greater time needed to perform blind oralintubation was not associated with a more pronounced haemodynamic or hormonal stress response. Patients intubated with direct laryngoscopy showed significant response[7]. Topical anaesthesia is controversial due to submucosal location of receptors. In our

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study adequate care was taken to achieve required depth of anaesthesia avoiding hypoxia and hypercarbia which can influence the haemodynamic variables.

A diversity of results exists about the protective measures against haemodynamic and catecholamine responses to laryngoscopy and intubation, but no single anaesthetic technique has become generally accepted as being effective in preventing or attenuating these responses[2]. Many techniques have been recommended. The drugs used were either partially effective or had other undesirable effects on the patients. Topical application of local anaesthetics, infiltration or nerve blocks, β-blockers, calcium channel blockers, droperidol, clonidine, sodium nitroprusside, lignocaine and fentanyl etc. are being used. No single drug or technique is satisfactory[4].

Bachofen M. stated the criteria for selection of an appropriate drug to prevent sympathetic response. The drug must be applicable regardless of patient cooperation, prevent impairment of cerebral blood flow and avoid arousal of the patient. It should neither be time consuming nor affect the duration or modality of the ensuing anaesthesia. Intravenous lignocaine and fentanyl appear to best fulfil the above criteria[3].

Though intravenous lignocaine failed to attenuate the cardiovascular response to laryngoscopy and tracheal intubation in a study conducted by Miller CD and warren SJ[8],its usefulness was noted by others. Lignocaine also prevents rise in intracranial pressure, rise in intraocular pressure associated with laryngotracheal stimulation. It suppresses cough related to extubation. It is recommended to use at a dose of 1.5 mg/kg intravenously. Optimal time of administration is 3 minutes before laryngoscopy and intubation.

Fentanyl is advocated for attenuation of sympathetic response to laryngoscopy and intubation [3, 5, 6]. Blunting of sympathetic response is dose dependent. At high doses fentanyl produces tissue accumulation and thus longer lasting plasma and brain concentration of the drug. These patients may require mechanical respiratory support. Fentanyl at 6 µg/kg completely abolishes while at 2 µg/kg significantly attenuates arterial pressure and heart rate increase during laryngoscopy and intubation[6]. Administration of fentanyl at optimal time reduces the dose required. The optimal time for injection of fentanyl is 5 minutes before intubation at a dose of 2 µg/kg[5].

In the control group systolic blood pressure increased maximally by 19.8%after 1 minute from the onset of laryngoscopy and intubation. It gradually decreased to preinduction level at 10 minutes. With administration of lignocaine, maximum increase when compared to pre-induction value was 14.5% and with fentanyl it was only 7% at 1 minute interval. Both groups when compared to the control group showed significant suppression ($p<0.05$ and $p<0.001$). Among the two drugs fentanyl showed better results ($P<0.001$).

Maximum increase in diastolic blood pressure was 17.7% when compared with pre-induction value in control group ($p<0.001$). It was 12.4% and 5.8% in lignocaine and fentanyl groups respectively at 1 minute interval. A ‘p’ value of <0.01 with lignocaine and <0.001 with fentanyl was obtained and both were significant. Attenuation by fentanyl is highly significant when compared to lignocaine ($p<0.001$).

The efficacy of fentanyl over lignocaine has been verified in many other studies. Both lignocaine and fentanyl together is also recommended to suppress the pressor response.

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Conclusion

Attenuation of systolic blood pressure is highly significant with fentanyl when compared with lignocaine at 1, 3, and 5 minutes interval following laryngoscopy and intubation.

When compared with lignocaine, fentanyl showed a highly significant suppression of diastolic blood pressure. The maximum rise was 12.4% and 5.8% in lignocaine and fentanyl groups respectively at 1 minute interval ($p<0.001$).

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