

Assessment of efficacy of intravenous fentanyl citrate for attenuation of hemodynamic responses during laryngoscopy and endotracheal intubation

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Abstract

Introduction: Laryngoscopy and intubation result in stimulation of larynx, pharynx, epipharynx and trachea, which are extensively innervated by autonomic nervous system. The parasympathetic supply is via the vagus and sympathetic supply via superior cervical ganglion. To diminish hemodynamic responses to tracheal intubation, Fentanyl along with hypnotic agents commonly used. Keeping in mind, an attempt has been made to assess the efficacy of injection fentanyl for attenuation of sympathetic response to intubation.

Aims and objective: To assess efficacy of 2microgram/kg body weight fentanyl and 3 microgram/kg body weight fentanyl administered before laryngoscopy and endotracheal intubation for attenuation of hemodynamic response.

Materials and Methods: 90 normotensive adult patients, belonging to ASA physical status I, of either sex, age group of 18-65 years, free from inter current cardiovascular and neurological disease, were posted for elective surgical procedures under general anaesthesia requiring orotracheal intubation were selected. All were elective cases. Three groups were made. **Group I-**Control group-10 cc normal saline IV. **Group II-** 2microgram/kg body weight fentanyl IV diluted to 10 cc with Distillate Water (DW). **Group III-** 3 microgram/kg body weight fentanyl IV diluted to 10 cc with D.W. Each group comprised of 30 patients.

Result: The rise in pulse rate in both the fentanyl groups, was less and statistically significant than control group ($p < 0.001$). Mild changes in systolic blood pressure were observed in group I and III from baseline. In our study both fentanyl groups II and III showed increase in diastolic blood pressure from baseline. 2 microgram/kg and 3 microgram/kg IV fentanyl showed less rise in mean arterial pressure, which was statistically significant than control group ($p < 0.001$).

Conclusion: Use of intravenous fentanyl in both doses, i.e. 2 mcg/kg as well as 3 mcg/kg is safe and effective for attenuation of hemodynamic response to laryngoscopy and intubation.

Keywords: Fentanyl, Intubation, Laryngoscopy, Hemodynamic.

Introduction

Since 1940s, Hemodynamic responses to laryngoscopy and endotracheal intubation has attracted the attention of anesthesiologists. Endotracheal intubation and artificial control of ventilation marked a new era in the history of anesthesia. This had resulted in better control of airway and ventilation making administration of anaesthesia safer. Stimulation of larynx, pharynx, epipharynx and trachea, which are extensively innervated by autonomic nervous system by resultant of Laryngoscopy and intubation.¹ Stimulation of aforementioned areas results in stimulation of autonomic nervous system which in turn leads to various cardiovascular changes, coughing, laryngospasm, bronchospasm, vomiting, pulmonary aspiration, increase in intracranial and intraocular pressures. Hypoxemia and hypercarbia may also occur.

Various methods to reduce these responses have been advocated. These included epinephrine, deep intravenous general anaesthesia, topical anaesthesia with lignocaine, drugs like anti hypertensives, beta adrenoreceptor antagonists (propranolol, metoprolol, esmolol,² labetalol), Gabapentine,³ peripheral vasodilators, intravenous lignocaine- lignocaine aerosol^{4,5} Angiotension

converting enzyme blockers, Magnesium sulphate,⁶ alpha2 agonist (Dexmedetomidine,⁷ Clonidine⁸), Droperidol, intravenous Ketorolac, Nitroglycerine ointment, Calcium channel blocker, Buprenorphine, Fentanyl⁹⁻¹³ and Alfentanil.¹⁴⁻¹⁶

During laryngoscopy and intubation, fentanyl, μ receptor agonist is a natural choice to attenuate pressor response.¹⁷ Low dose fentanyl decreases the circulatory response to tracheal intubation, reduces the dose of thiopentone, has rapid onset of action, extremely lipid soluble, provides cardiovascular stability throughout the operative period, blocks sympathetic stress response to surgical stimulation, rapid and potent analgesic, anxiolytic and sedative and decreases the concentration of inhaled agent requirement. In this study an attempt has been made to assess the efficacy of injection fentanyl for attenuation of sympathetic response to intubation.

Aims and Objectives

To assess the efficacy of 2microgram/kg body weight fentanyl and 3 microgram/kg body weight fentanyl administered before laryngoscopy and endotracheal intubation for attenuating the changes in

the hemodynamic parameters in normotensive individuals.

Materials and Methods

A total 90 normotensive adult patients belonging to American Society of Anesthesiologists (ASA) physical status I, of either sex between age group of 18-65 years, free from intercurrent cardiovascular and neurological disease undergoing general anaesthesia with orotracheal intubation were selected for study. Institutional ethical committee approval was obtained before beginning of the study. For the conduct of study as well as for administration of general anaesthesia, informed written consent from the patients was obtained.

Patients on any drug therapy, menstruating, pregnant and lactating women, pre-existing systematic arterial hypertension, cardiovascular disease, respiratory disease, pre-existing neurological and neuromuscular disorder, anticipated difficulty in mask ventilation or oral endotracheal intubation and patients who required more than 20 seconds for performance of laryngoscopy and intubation were excluded. Under nutrition, anemia, drug dependence, diabetes mellitus, patients not willing to participate in the study were also excluded from the study.

Patients were randomly allocated in three groups, comprising 30 patients in each group.

Group I-Control group-10 cc normal saline IV

Group II- 2microgram/kg body weight fentanyl IV diluted to 10 cc with Distillate Water (DW)

Group III- 3 microgram/kg body weight fentanyl IV diluted to 10 cc with D.W.

Results

Table 1: Comparison of mean Pulse Rate (bpm) in three groups

	Group			p-value
	I	II	III	
Mean baseline Pulse rate (per min)	79.4 ± 5.7	78.7 ± 5.44	79.06 ± 5.37	0.89
During laryngoscopy	101 ± 5.7	97.86 ± 7.94 *	96.13 ± 5.6**	0.02
After Laryngoscopy and Intubation				
30 sec.	109.96 ± 5.7	107.4 ± 4.90 ^a	96.2 ± 5.31 **	<0.0001
1 min	110.4 ± 5.6	99.73 ± 5.11 **	91.0 ± 5.37 **	<0.0001
2 min	110.0 ± 5.07	99.73 ± 5.37 **	89.06 ± 5.37 **	<0.0001
5 min	85.0 ± 5.5	79.3 ± 5.36**	71.06 ± 5.37 **	<0.0001

'a': No significant compared to changes in control group (p>0.05), *:Statistically significant compared to control group (p <0.05), **: Highly significant compared to control group (p < 0.001)

During laryngoscopy at 1 min, 2 min and 5 min post intubation, increase in pulse rate in group II was less and statistically significant (p<0.001) compared to group-I. At 30 seconds, changes in group II compared to group I were not significant (p>0.05). As there is

All patients were premedicated with intramuscular Glycopyrrolate 4 microgram/kg, 30 minutes before induction. Mean arterial pressure, pulse rate, systolic blood pressure, diastolic blood pressure, respiratory rate were recorded and continuous ECG monitoring was done. Preoxygenation with 100% oxygen was carried out for 3 minutes. General anaesthesia was induced with inj. thiopentone sodium 4-5 mg/kg IV till loss of eyelash reflex. This was followed by Inj. Succinylcholine 1.5-2 mg/kg IV. Intubation was done after 90 seconds. Direct laryngoscopy and oral endotracheal intubation was performed. Patients in whom intubation took more than one attempt or took more than 20 seconds were excluded from the study. Anaesthesia was maintained with oxygen, nitrous oxide, sevoflurane with controlled ventilation with pancuronium bromide as muscle relaxant. The person making the recordings was kept blind regarding the administered drug. Pulse rate, Systolic Blood Pressure (SBP), Diastolic Blood Pressure (DBP), Mean Arterial Pressure (MAP), Rate Pressure Product (RPP) were recorded before premedication, during laryngoscopy and intubation, 30 seconds, 1 minute, 2 minute and 5 minutes after intubation.

Statistical analysis

Data were expressed as mean ± SD. Comparison between two groups was done by student 't' test. Comparison between three groups was performed by Analysis of variance test for continuous variables and Chi-square test for categorical variable. A p-value of less than 0.05 was considered significant.

maximum sympathetic stimulation at 30 sec. post-intubation, so low dose of fentanyl i.e. 2µg/kg is ineffective in attenuation of sympathetic overactivity at 30 seconds. In group I and II, the increase in pulse rate at 30 sec, 1 min and 2 min post intubation were significantly more (p<0.001) compared to group III.

Intra group comparison

Group I /Control group: In the control group i.e. group I, the baseline mean pulse rate was 79.4 ± 5.7090 . There was a classical pressor response to laryngoscopy and intubation and mean pulse rate showed maximum increase to 110.46 ± 5.6795 , a rise in pulse by 31.06 (39.12%) at 1 min. Pulse rate rose significantly above the baseline value during scopy, 30 sec, 1 min, 2 min, and 5 min.

Group II: The baseline mean pulse rate was 78.73 ± 5.4452 . Mean pulse rate showed maximum increase to 107.4 ± 4.9032 , a rise in pulse by 28.67 (36.41%) at 30

seconds of laryngoscopy and intubation. Pulse rate rose significantly above the baseline value during scopy, 30 sec, 1 min, 2 min except at 5 min where the rise was not significant.

Group III: The baseline mean pulse rate was 79.06 ± 5.3751 . Mean pulse rate showed maximum increase to 96.2 ± 5.3136 , a rise in pulse by 17.14(21.68%) at 30 seconds of laryngoscopy and intubation. Pulse rate rose significantly above the baseline value during scopy, 30 seconds, 1 min and 2 min. At 5 minute there was significant drop in pulse by 8 (10.11%).

Table 2: Comparison of mean Systolic Blood Pressure (SBP) in three groups

	Group			p-value
	I	II	III	
Mean Baseline SBP (mmHg)	115.6 ± 8.09	115.73 ± 7.96	115.86 ± 7.96	0.99
During laryngoscopy	127.93 ± 8.11	$123.87 \pm 7.08^*$	$121.86 \pm 7.96^{**}$	0.01
After Laryngoscopy and Intubation				
30 sec	145.6 ± 8.31	$139.6 \pm 7.86^{**}$	$125.4 \pm 7.98^{**}$	<0.0001
1 min	157.6 ± 8.21	$134.73 \pm 7.94^{**}$	$117.86 \pm 7.96^{**}$	<0.0001
2 min	147.53 ± 8.29	$133.6 \pm 9.01^{**}$	$107.86 \pm 7.96^{**}$	<0.0001
5 min	110.73 ± 7.96	$111.53 \pm 8.43^{**}$	$105.9 \pm 7.91^*$	0.01

During laryngoscopy, 30 sec, 1 min., 2 min post intubation, increase in SBP of group-II was significantly less ($p < 0.001$) compared to group-I. Fall in SBP at 5 min, in group II was insignificant ($p > 0.05$) compared to group I. After 30 sec and 1 min, post intubation, the increase in SBP of group III was significantly less ($p < 0.001$) compared to group-I. At 2 min and 5 min, fall in SBP of group III was significant more ($p < 0.05$) compared to group I.

Intra group comparison

Group I /Control group: The mean baseline systolic blood pressure was 115.6 ± 8.0925 . After laryngoscopy and intubation, there was a classical pressor response and mean SBP showed maximum increase to 157.6 ± 8.2110 , a rise by 42 (36.33%) at 1 min. Mean systolic blood pressure rose significantly above the baseline value during scopy, 30 sec, 1 min, 2 min post intubation. At 5 min. of post intubation there was

significant fall in systolic blood pressure by 4.87 (4.21%).

Group II: The mean baseline systolic blood pressure was 115.73 ± 7.9608 . Due to laryngoscopy and intubation, mean systolic blood pressure showed maximum increase to 139.6 ± 7.8623 , a rise by 23.87 (20.62%) at 30 seconds. Rise in mean systolic blood pressure was significantly above the baseline value through the study except 5 min. At 5 min., there was significant fall in systolic blood pressure by 4.2 (3.63%).

Group III: The baseline mean systolic blood pressure was 115.86 ± 7.9642 . Mean systolic blood pressure showed maximum increase to 125.4 ± 7.9853 , a rise by 9.54 (8.23%) at 30 seconds. Rise in mean systolic blood pressure was significant above the baseline value during scopy, 30 seconds. Rise was not significant at 1 min. There was significant fall in mean systolic blood pressure at 2 min. and 5 min. by 8 (6.9%) and by 9.96 (8.6%) respectively.

Table 3: Comparison of Diastolic Blood Pressure (DBP) in three groups

	Group			p-value
	I	II	III	
Mean Baseline DBP (mmHg)	73.73 ± 3.63	74.06 ± 3.73	74.66 ± 3.79	0.62
During laryngoscopy	91.67 ± 3.75	$86.06 \pm 4.21^*$	$74.53 \pm 3.78^{**}$	<0.0001
After Laryngoscopy and Intubation				
30 sec	112.06 ± 4.21	$101.46 \pm 3.96^{**}$	$76.8 \pm 4.06^{**}$	<0.0001
1 min	113.6 ± 3.76	$95.66 \pm 4.17^{**}$	$76.6 \pm 3.79^{**}$	<0.0001
2 min	105.73 ± 3.78	$94.73 \pm 3.95^{**}$	$74.6 \pm 3.79^{**}$	<0.0001
5 min	73.8 ± 3.87	73.26 ± 4.02^a	73.8 ± 4.05^a	0.85

After 30 sec, 1 min and 2 min post intubation increase in mean DBP of group II were less ($p < 0.001$) than group-I and statistically significant. And at 5 min, fall in DBP of group II was insignificant ($p > 0.05$) compared to group I. The rise in mean DBP from baseline at 30 sec and 1 min in group III was significantly less ($p < 0.001$) compared to group I. During scopy, at 2 min, in group III, there was significant fall in mean DBP from baseline, while in group I there was significant rise at 2 min. At 5 min, fall in mean DBP of group III was not significant compared to group-I.

Intra group comparison

Group I /Control group: The mean baseline diastolic blood pressure was 73.73 ± 3.6287 . Due to laryngoscopy and intubation, there was a classical pressor response and mean DBP showed maximum increase to 113.6 ± 3.7655 , a rise by 39.87 (54.07%) at 1 min. Mean diastolic blood pressure rose significantly above the baseline value during scopy, 30 sec, 1 min. 2

min post intubation. At 5 min., there was insignificant rise in systolic blood pressure ($p > 0.05$).

Group II: The mean baseline diastolic blood pressure was 74.06 ± 3.7318 . Due to laryngoscopy and intubation, mean diastolic blood pressure showed maximum increase to 101.46 ± 3.9630 , a rise by 27.4 (37%) at 30 seconds. There was significant rise in mean diastolic blood pressure above the baseline during scopy, 30 sec, 1 min, and 2 min. Fall in mean diastolic blood pressure below the baseline by 0.8 (1.08%) at 5 min was insignificant.

Group III: The mean baseline diastolic blood pressure was 74.66 ± 3.7995 . Mean diastolic blood pressure showed maximum increase to 76.8 ± 4.0576 , a rise by 2.14 (2.87%) at 30 seconds. During laryngoscopy and intubation, there was insignificant fall in mean diastolic blood pressure by 0.13 (0.17%). At 1 min insignificant rise in mean diastolic systolic pressure above the baseline by 1.94 (2.6%), means there was maximum attenuation and insignificant fall in mean diastolic blood pressure at 2 min. and 5 min.

Table 4: Comparison of Mean Arterial Pressure (MAP) in three groups

	Group			p-value
	I	II	III	
Mean Baseline MAP	87.65 ± 4.50	87.92 ± 4.39	88.36 ± 4.71	0.83
During laryngoscopy	103.73 ± 4.46	$98.67 \pm 4.37^{**}$	$90.26 \pm 4.63^{**}$	<0.0001
After Laryngoscopy and Intubation				
30 sec	123.21 ± 4.68	$114.17 \pm 4.50^{**}$	$93.02 \pm 4.85^{**}$	<0.0001
1 min	128.23 ± 4.52	$108.65 \pm 4.62^{**}$	$90.36 \pm 4.71^{**}$	<0.0001
2 min	119.63 ± 4.70	$107.58 \pm 4.67^{**}$	$85.7 \pm 4.70^{**}$	<0.0001
5 min	86.07 ± 4.63	85.98 ± 4.59^a	84.44 ± 4.81^a	0.32

During scopy, 30 sec, 1 min and 2 min post intubation, rise in mean MAP in group II was significantly less ($p < 0.0001$) compared to group I. At 5 min., fall in MAP of group II was not significant ($p > 0.05$) compared to group I. During scopy, at 30 sec and 1 min, the rise in MAP above baseline in group III was significantly less ($p < 0.001$) compared to group-I. At 2 min., there was significant fall in MAP of group III, while in group-I there was significant rise. Whereas at 5 min fall was statistically not significant in group III as compared to group I.

Intra group comparison

Group I /Control group: The mean baseline mean arterial pressure was 87.65 ± 4.5024 . After laryngoscopy and intubation, the mean arterial pressure showed maximum increase to 128.23 ± 4.5225 , a rise by 40.58 (46.30%) at 1 min. Mean MAP rose significantly above the baseline value during scopy, 30

sec, 1 min. 2 min. At 5 min., there was fall in mean MAP by 1.58 (1.8%) which was insignificant ($p > 0.05$).

Group II: The mean baseline mean arterial pressure was 87.92 ± 4.3914 . Mean arterial pressure showed maximum increase to 114.17 ± 4.5058 , a rise by 26.25 (29.85%) at 30 seconds. Mean MAP rose significantly above the baseline during scopy, 30 sec, 1 min, and 2 min. At 5 min there was fall in mean MAP by 1.94 (2.21%) which was insignificant.

Group III: The mean baseline mean arterial pressure was 88.36 ± 4.7155 . Mean arterial pressure showed maximum increase to 93.02 ± 4.8516 , a rise by 4.66 (5.27%) at 30 seconds. Mean MAP rose significantly above the baseline at 30 sec. Rise was not significant during scopy and at 1 min of post intubation. There was significant fall in mean arterial pressure at 2 min and 5 min by 2.66 (3.01%) and 3.92 (4.44%) respectively.

Table 5: Comparison of Mean Rate Pressure Product (RPP) in three groups

	Group			p-value
	I	II	III	
Mean Baseline RPP	9174 ± 894.32	9109.7± 888.46	9148 ± 748.24	0.83
During laryngoscopy	12910.26±85.08	12132.4 ±994.12**	11702.53±877.27**	<0.0001
After Laryngoscopy and Intubation				
30 sec	15932.26±1167.08	15001.73±1125.15 **	12057.73±861.22**	<0.0001
1 min	17407.06±1257.25	13431.33±996.40**	10720.53±812.70**	<0.0001
2 min	16231.73±1163.92	13326.8 ±1201.74**	9594.13 ±775.32**	<0.0001
5 min	9415.73±887.41	8844.8±883.76*	7510.4±679.86**	0.32

During scopy, 30 sec, 1 min and 2 min post intubation, rise in mean RPP in group II was significantly less ($p < 0.0001$) compared to group I. At 5 min., fall in RPP of group II by 264.93 (2.91%) which was not significant ($p > 0.05$) compared to group I. During scopy, at 30 sec, 1 min, and 2 min, the rise in RPP in group III was significantly less ($p < 0.001$) compared to group-I. At 5 min., there was significant fall shown in RPP of group III, while in group-I there was insignificant rise in RPP.

Intra group comparison

Group I /Control group: The mean baseline rate pressure product was 9174 ± 894.3227 . The rate pressure product showed maximum increase to 17407.06 ± 1257.253 , a rise by 8233.06 (89.74%) at 1 min. Mean rate pressure product rose significantly above the baseline value during scopy, 30 sec, 1 min, 2 min. post intubation. Rise was not significant at 5 min (2.63%).

Group II: The mean baseline rate pressure product was 9109.73 ± 888.4631 . The mean rate pressure product showed maximum increase to 15001.73 ± 1125.153 , a rise by 5892 (64.68%) at 30 seconds. The mean rate pressure product rose significantly above the baseline during scopy, 30 sec, 1 min, and 2 min post intubation. There was fall in mean rate pressure product at 5 min. by 264.93 (2.91%) which was not significant.

Group III: The mean baseline rate pressure product was 9148 ± 748.2415 . The mean rate pressure product showed maximum increase to 12057.73 ± 861.2239 , a rise by 2909.73 (31.81%) at 30 seconds. Mean rate pressure product rose significantly above the baseline during scopy, 30 sec., 1 min, 2 min. At 5 min, there was not significant fall in rate pressure product by 1637.6 (17.90%).

Adverse Events observed during study:

1. None of the 90 patients (of all the groups) had significant hypotension (ie. 30% fall of SBP from the baseline preoperative value).
2. No serious bradycardia or other rhythm disturbances, truncal rigidity or recall of the

laryngoscopy and intubation were noted in any patients (of all the groups).

3. No respiratory depression had been observed in any fentanyl treated patients.

Discussion

It is understood that, fentanyl suppresses the hemodynamic response during laryngoscopy and intubation by increasing the depth of anesthesia and by decreasing sympathetic discharge.¹⁸

Pulse Rate: U.M Kautto et al,⁹ studied effect of fentanyl in two different doses ie 2 microgram/kg and 6 microgram/kg showed that, a significant increase ($p < 0.001$) in pulse rate was observed only in control group. We found similar results with inj. fentanyl 2microgram/kg and 3 microgram/kg IV in significant attenuation of increase in pulse rate during laryngoscopy. In another study, it was observed that, in hypertensive patients, hemodynamic responses to intubation were controlled effectively in the fentanyl 2 mcg/kg groups as well.¹⁹

Chung and Evans¹⁰ study showed that no significant increase in heart rate above base line at any level in study group while in control group rise in heart rate was significantly above the baseline at 1and 2 min post intubation. Similar results found in our study that pulse rate rose significantly above the baseline at each instance from laryngoscopy, in all three groups but in both fentanyl groups, the increase in pulse rate was statistically significantly less ($p < 0.001$) as compared to control group.

V. Abraham and B. Kaur,¹⁷ studied effect of 3 microgram/kg fentanyl IV, used adjunct to thiopentone, on the circulatory response to tracheal intubation and showed that statistically significant reduction in post intubation tachycardia. The pulse rate showed mild change from baseline. When compared between the groups, this was not significant throughout the study period ($p > 0.05$). In study group, increase in mean pulse rate during scopy by 17.6(19.90%), at 1 min by 12.25 (13.85%), at 2 min by 11.85(13.40%). These results were similar to results obtained by us. In our study, there was rise in pulse rate during scopy by

17.07(21.59%), at 1 min by 12 (15.18%), at 2 min by 10 (12.65%).

Systolic blood pressure: U.M. Kautto⁹ study showed that SBP in F6 group did not rise above control level. In control group ($p < 0.001$) and F2 group ($p < 0.02$), SBP increased significantly after intubation compared with baseline values, but the elevation in F2 group was significantly less than the control group ($p < 0.05$). In our study also, 2 microgram/kg fentanyl showed less increase in mean SBP ($p < 0.001$) during scopy at 30 sec, 1 min, 2 min post intubation compared to control group. Fentanyl 3 microgram/kg IV showed similar changes except at 2 min. At 5 min with fentanyl 2 microgram/kg IV, fall in SBP was below baseline but it was not significant ($p > 0.05$) and with 3 microgram/kg fentanyl IV, fall in SBP at 2 min, 5 min was significantly more ($p < 0.05$) compared to group I.

After laryngoscopy and intubation, in control group there was a classical pressor response and mean SBP showed maximum increase to 157.6 ± 8.2110 , a rise by 42 (36.33%) at 1 min. At 5 min of post intubation there was significant fall in SBP by 4.87(4.21%). These findings were similar to the study done by P Agarwal et al.²⁰

Chung and Evans,¹⁰ study showed that, increase in SBP was significantly less in fentanyl group at 1 min post intubation. In fentanyl groups, SBP was lower than baseline value at 5 min post intubation. In our study also, 3 microgram/kg IV fentanyl causes increase in SBP above baseline but it is significantly smaller ($p < 0.01$) compared to control group during scopy, 30 sec, 1 min. post intubation. Similar results were observed with 2 microgram/kg IV. In both the fentanyl groups, there was fall in SBP below baseline at 5 min and at 2 min, 5 min respectively. Fall was significant with group III and it was insignificant with group II.

William M. Splinter et al²¹ used fentanyl in two different dose ie 1.5 microgram/kg and 3 microgram/kg in geriatric patients, above 64 years. It was showed that fentanyl in both doses reduced the rise in SBP significantly ($p < 0.05$). Our results of present study are comparable with the results obtained by William et al.

V. Abraham and B. Kaur¹⁷ study found that, study group showed only mild change in mean SBP from baseline. All these changes were statistically significant. It was concluded that with 3 microgram/kg IV fentanyl, significant attenuation of cardiovascular response to intubation was achieved. In our study also, in group II and III there was mild change in SBP from baseline but when both were compared to control group the rise was significantly ($p < 0.001$) smaller in group II and III. Rise in mean SBP during intubation and fall at 2 min were statistically significant ($p < 0.01$) while rise in SBP at 1 min was insignificant ($p > 0.05$).

Diastolic blood pressure: U.M. Kautto⁹ study showed that DBP did not increase significantly after intubation

in F6 Group, whereas the increase in control and F2 group was significant ($p < 0.001$) compared to baseline value. It was concluded that 6 microgram/kg fentanyl prevented the Arterial pressure increase during scopy and intubation and even a small dose of fentanyl 2 microgram/kg, significantly attenuated this response. In our study, in group II increase in DBP above baseline during scopy, 30 sec, 1 min, 2 min post intubation were significantly less ($p < 0.001$) than group I.

Chung and Evans¹⁰ studied showed that increase in DBP was significantly smaller in the fentanyl group at 1 min post intubation. It was demonstrated that 3 microgram/kg IV fentanyl significantly attenuate the cardiovascular stress response to intubation. In our study, increase in DBP in group II and group III were significantly smaller ($p < 0.001$) at 1 min post intubation. DBP increased by 39.87 mm of Hg increase in control group compared to 21.6 mm of Hg increase in group II and 1.94 mm of Hg increase in group III.

William M Splinter et al²¹ study showed that fentanyl in both doses reduced the rise in DBP significantly ($p < 0.05$). It was concluded that low dose fentanyl attenuated the haemodynamic response to laryngoscopy and intubation. In our study both fentanyl groups II and III showed increase in DBP above baseline which was significantly less ($p < 0.001$) than group I.

V. Abraham and B. Kaur¹⁷ studied effect of 3 microgram/kg IV fentanyl, used adjunct to thiopentone sodium, and found that the control group and the study group showed very little change in mean DBP from baseline value. This was not significant when compared between the groups during study period. Change in DBP in study group, were not significant ($p > 0.05$) statistically. In our study, in group III, changes in DBP from baseline were, during scopy – decrease by 0.13(17%), at 1 min – increase by 1.94 (2.6%), At 2 min – decreased by 0.06(0.08%). These changes were not significant ($p > 0.05$) statistically.

Mean arterial pressure: One result of present study is comparable to the results obtained by William M. Splinter et al.²¹ In our study both the doses, 2 microgram/kg and 3 microgram/kg IV fentanyl, caused rise in MAP which was significantly smaller ($p < 0.001$) as compared to group I or control group. At 2 min post intubation, group III causes significant fall in MAP below the baseline. In another study conducted by Channaiah VB et al.,¹¹ found that, for all recorded time duration, inter-group MAP yielded significant attenuation in the Fentanyl group.

Rate pressure product: Chung and Evans¹⁰ studied 28 patients aged between 65-84 years, were randomly assigned to either a control group (12) or treatment group (16) induced with 3 microgram/kg fentanyl IV followed by thiopentone. It was showed that increase in rate pressure product were significantly smaller in the

fentanyl group at 1 min post intubation. Increase was 2-4 times greater in control group. Rate pressure product increased by 72.2% in control group and by 36% in treatment group. It was concluded that 3 microgram/kg fentanyl caused significant attenuation of cardiovascular stress response to intubation.

Our results of present study are comparable with the results obtained by Chung and Evans. In our study, fentanyl in both doses showed rise in rate pressure product during scopy, 30 sec, 1 min, and 2 min. But it was significantly smaller than in control group. In our study rate pressure product increased by 82.33.06 (89.74%) in control group and in group III increase was by 2909.73(31.8%).

Conclusion

From the present study, use of intravenous fentanyl in both doses, i.e. 2 mcg/kg as well as 3 mcg/kg is safe and effective for attenuation of hemodynamic response to laryngoscopy and intubation. At 30 sec of intubation with fentanyl 2 mg/kg, the change in pulse rate was insignificant compared to control group. But with 3 mg/kg of fentanyl, the attenuation was significant at all the instances. Further, intravenous fentanyl citrate even in low dose of 2 microgram/Kg body weight provide a simple, safe and effective method whereas intravenous fentanyl 3 microgram/Kg body weight provides excellent attenuation of the hemodynamic response to laryngoscopy and intubation.

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