Original Research Article

Journal of College of Medical Sciences-Nepal, Vol-21, No.2, Apr-Jun 2025

ISSN: 2091-0657 (Print); 2091-0673 (Online) Open Access
DOI: 10.3126/jcmsn.v21i2.72354

Fentanyl and Dexmedetomidine in Stress Attenuation During Laryngoscopy and Endotracheal Intubation

Samir Shakya[1], **Jeevan Singh**[1], **Bibek Shrestha**[1], **Sumit Chikanbanjar**[1]

[1]Department of Anesthesiology, Dhulikhel Hospital, Kathmandu University, School of Medical Sciences, Dhulikhel, Kavre, Nepal.

ABSTRACT

Background

Stress response to laryngoscopy and endotracheal intubation leads to stroke, myocardial ischemia, and acute heart failure in high-risk populations. Among various agents, fentanyl and dexmedetomidine are commonly used drugs to blunt the hemodynamic response to laryngoscopy and endotracheal intubation with significant side effects. Objective of this study is to find out the best drug that blunts stress response to laryngoscopy and endotracheal intubation with lesser side effects between fentanyl and dexmedetomidine.

Methods

One hundred patients planned for elective surgery under general anesthesia were enrolled in this double-blind, observational, cohort, prospective study. Patients were randomly divided into two groups: Group X received 0.5mcg/kg of dexmedetomidine intravenous 10 minutes prior to laryngoscopy via infusion whereas Group Y received 2mcg/kg fentanyl intravenous bolus 5 minutes prior to laryngoscopy. Hemodynamic parameters before and after laryngoscopy and intubation as well as adverse side effects were compared between two groups.

Results

Dexmedetomidine (0.5mcg/kg) given 10 minutes prior to laryngoscopy was equally effective as fentanyl (2mcg/kg) given 5 minutes prior to laryngoscopy in blunting the hemodynamic response to laryngoscopy and endotracheal intubation. The change in hemodynamic parameters were comparable between two groups. However, 11 patients (out of 14) who developed hypotension were in the fentanyl group.

Conclusions

Dexmedetomidine (0.5mcg/kg) given 10 minutes prior to laryngoscopy was found to be superior to fentanyl (2mcg/kg) given 5 minutes prior to laryngoscopy. Because dexmedetomidine was associated with lesser side effects and was equally effective as fentanyl in blunting the stress response to laryngoscopy and endotracheal intubation.

Keywords: bradycardia; dexmedetomidine; fentanyl; hypotension; intubation; laryngoscopy; stress response.

Correspondence: Dr. Samir Shakya, Department of Anesthesiology, Dhulikhel Hospital, Kathmandu University School of Medical Sciences, Dhulikhel, Kavre, Nepal. Email: reemas4765@gmail.com, Phone: +977-9841864765. **Article received**: 2024-12-08. **Article accepted**: 2025-05-15. **Article published**: 2025-06-30.

INTRODUCTION

Stress response to laryngoscopy and endotracheal intubation is the major concern. Huge spectrum of responses such as tachycardia, hypertension, and dysrhythmias are associated with the surge of plasma catecholamine concentration due to reflex sympathoadrenal stimulation after laryngoscopy and endotracheal intubation.[1] This hemodynamic response is short-lived and may not have detrimental effects for normal people but rather could be dangerous in patients with cerebrovascular disease, hypertension or myocardial insufficiency, increased intracranial pressure or anomalies of cerebral vessels.[2-3] Various strategies have been tried to blunt this stress response like: local anesthetics, intravenous opioids, beta-blockers, alpha-2 adrenergic agonists, vasodilators, magnesium or by increasing volatile anesthetic concentration.[4] None have been established as the most appropriate for this purpose. Some have inadequate control of hemodynamic responses whereas some have serious adverse effects. Among them, opioids and alpha-2 adrenergic agonists were frequently used with adverse effects. In this study, we compare fentanyl and dexmedetomidine to find out the best agent to blunt stress response along with minimal side effects.

METHODS

A comparative study was was conducted in the Department of Anesthesiology, Dhulikhel Hospital, Kathmandu University School of Medical Sciences (KUSMS), Kathmandu University, Dhulikhel, Kavre, Nepal during the period (25th December 2022 to 25th April, 2023) after obtaining written informed consent from all included patients. Ethical approval for this study was provided by Kathmandu University School of Medical Science Institutional Review Committee on 22nd December, 2022 (Ref. No. 242/22). Eligible 100 Nepalese participants aged (18-60)years, weighing (50-70)kgs with Mallampatti grade (I, II) and ASA grade (I, II) undergoing elective surgeries under general anesthesia requiring endotracheal intubation were included in this study. Exclusion criteria were unwilling patients, emergency surgeries (patients with full stomach), anticipated difficult intubation and mask ventilation, patients with Mallampatti Grade III and IV, patients with Cormak- Lehane score III and above, patients with prolong laryngoscopy duration lasted more than 25 seconds and need of second attempt of laryngoscopy, patients with cardiovascular disease (Hypertension, Angina, coronary artery disease, recent myocardial infarction, congestive cardiac failure, heart blocks, cardiac pacemaker, COPD), patients on beta-blocker or calcium channel blockers, patients undergoing procedures requiring the head/neck manipulation, throat packing, epinephrine infiltration, pregnancy and lactating women, patients on antihypertensive and anti-arrhythmic drugs, patients with pathology of neck, upper respiratory tract and upper elementary tract, patients with obesity (BMI >30), patient with heart rate <50 bpm and mean blood pressure <65 mmHg.

After obtaining signed informed written consent from patients; 100 eligible patients posted for elective surgeries under general anesthesia (GA) were divided into two groups using computer generated list. The group assignment was enclosed in a sealed envelope to ensure concealment of allocation sequence. The sealed envelope was opened by an anesthesiologist not involved in the study who then prepared the study drug solution according to computer generated list. Two sets of drug preparation were given to the patients. Drug A containing 20 ml solution was given to patients via infusion pump intravenous 10 minutes before laryngoscopy at the rate of 120ml/hr. Drug B containing 5ml solution was given to patients 5 minutes prior to laryngoscopy. Group X received 0.5mcg/kg of Dexmedetomidine diluted in 20ml of NS in the form of Drug A and 5ml of NS in the form of Drug B whereas Group Y received 20 ml of NS in the form of Drug A and 2 mcg/kg of Fentanyl diluted in 5ml of NS in the form of Drug B. Detail Pre-anesthetic evaluation was performed and anxiolysis done with tablet Lorazepam 2mg orally on the night before surgery. After shifting the patient to the operation theater, non-invasive monitors such as blood pressure (BP), oxygen saturation (SpO_2),

electrocardiogram (ECG) were applied, and their baseline values were recorded. Intravenous (IV) access was established using 18G cannula and IV fluids; Ringer's lactate (RL) was started @ 100ml/hr. All drugs and equipment were checked and kept ready before starting anesthetic procedures. A pre-induction heart rate (HR), systolic blood pressure (SBP), diastolic blood pressure (DBP), mean blood pressure (MBP) and SpO_2 were recorded. Drug A was started at the rate of 120 ml/hr., 10 minutes before the laryngoscopy whereas Drug B was given 5 minutes before the laryngoscopy. All the patients were pre-oxygenated with 100% oxygen (O_2) for 3 minutes before the induction of anesthesia with close-fitting facemask. Induction of general anesthesia was done according to the standard institutional practice with injection Propofol 2 mg/kg mixed with 1ml of 2% Lignocaine. Bag and mask ventilation was checked, and muscle relaxation was done with an injection Vecuronium 0.1mg/kg. Patients was ventilated with 5L/min O_2 and Isoflurane 1% until laryngoscopy. Laryngoscopy and endotracheal intubation were performed by an experienced anesthesiologist who was blinded about the group allocations with appropriate size cuff endotracheal tube. All the patients who required the second attempt of intubation, use of Bougie or laryngoscopy duration more than 25 seconds were excluded from the study. The anesthesia was maintained with Oxygen (FiO260%) and Isoflurane 1%. No surgical stimulation was allowed for 10 minutes after intubation. Heart rate (HR), Oxygen saturation (SpO_2), systolic blood pressure (SBP), diastolic blood pressure (DBP), mean blood pressure (MBP) was recorded before the start of study drug A as baseline vitals, at (2,5,8) minutes after the start of study drug A, at the end of study drug A, immediately after intubation, each minute after intubation for 10 minutes. Any alteration in hemodynamic parameter beyond the 20% margin from the baseline was recorded as a significant finding. Hypotension (if MAP<65mmHg) was managed with intermittent dose of injection mephenterimine 6mg and intravenous fluids(100ml). Bradycardia (if HR <50bpm) was managed with injection atropine 0.6mg. Data collection was done by the person who was blinded about the group allocations. Cormack-Lehane score; total laryngoscopy time; need for OELMA (optimal external laryngeal manipulation of Airway) maneuver; procedure related complications were monitored and recorded. Sample size calculation was done based on a pilot study of 10 patients (5 in each group). To detect an observed difference of 10 beats per minute in heart rate immediately after intubation between two groups with the type I error of 5% and power of 80%, the minimum sample size required was 40.14. We included 50 patients in each group (total 100 patients) for better validation of results. Data was checked, entered and analyzed using SPSS version 24 for windows (IBM corp., Armonk, NY, USA). Quantitative data was represented as mean ± standard deviation and for qualitative data; number, ratio and percentages were used. Demographic data and clinical variables were compared using chi-square test. Hemodynamic parameters at different intervals were compared using ANOVA test. A p-value of less than 0.05 was considered significant. Data was analyzed with Microsoft word and excel to generate graphs and tables.

RESULTS

A total of 116 patients were enrolled in this study. Out of which, 16 patients were excluded from the study because of anticipated difficult airway (5 patients), difficult laryngoscopy and intubation with C-L grade more than II (3 patients), prolong laryngoscopy with duration more than 25 seconds (4 patients), need of second attempts to laryngoscopy (4 patients). No significant difference was observed in demographic and clinical variables (Age, Weight, ASA grade, Gender, Mallamptti grade, C-L grade, Duration of laryngoscopy and need of OELMA) between two groups (Table 1). Baseline hemodynamic parameters (HR, SBP, MBP, DBP) were comparable between two groups (Table no. 2,3,4 and Figure 1). Similarly, hemodynamic parameters after the start of the drug till intubation were also comparable and were statistically not significant (Table no. 2, 3, 4 and Figure 1).

Table 1. Comparison of Demographic and clinical variables. (n=116)			
Variables	**Fentanyl Group**	**Dexmedetomidine Group**	**p-value**
Age (Years ±_SD)	40.18 ± 15.20	42.36 ±11.74	0.424
Weight (KGS ± SD)	62.08 ± 9.43	62.84 ± 11.03	0.712
Gender (M: F)	23:27	16:34	0.151
ASA grade (I: II)	40:10	36:14	0.349
Mallampatti grade (I: II)	31:19	27:23	0.473
Cormack-Lahane Score (I: II)	29:21	29:21	1.000
Need of OELMA (NO: YES)	39:11	43:07	0.298
Duration of Laryngoscopy and Intubation (Seconds)	13.36 ± 4.01	14.04 ± 4.42	0.423
Complications; Hypotension (NO: YES)	39:11	47:03	0.041*

Chi-Square test, ANOVA test, p-value <0.05- significant.

Table 2. Comparison of Heart rate between two groups. (n=116)			
Heart rate (beats per minute)	**Fentanyl Group**	**Dexmedetomidine Group**	**p-value**
Baseline	80.62 ± 15.70	78.30 ± 12.88	0.421
After 2minutes of start of drugs:	80.26 ± 16.12	76.30 ± 11.69	0.163
After 5minutes of start of drugs:	77.32 ± 15.52	74.08 ± 11.07	0.232
After 8minutes of start of drugs:	71.72 ± 11.34	69.42 ± 10.61	0.298
Immediately after intubation:	88.16 ± 16.54	88.60 ± 15.09	0.888
1 minute after intubation:	82.86 ± 16.54	81.48 ± 13.48	0.649
2 minutes after intubation:	76.08 ± 13.85	78.24 ±12.25	0.411
3 minutes after intubation:	71.56 ± 13.61	75.98 ± 12.27	0.099
4 minutes after intubation:	70.14 ± 12.89	75.16 ± 11.19	0.040*
5 minutes after intubation:	67.10 ± 11.91	73.54 ± 11.13	0.006*
6 minutes after intubation:	65.20 ± 11.37	72.46 ± 10.33	0.001*
7 minutes after intubation:	66.02 ± 11.09	72.38 ± 10.51	0.004*
8 minutes after intubation:	63.74 ± 10.46	71.80 ± 10.82	0.000*
9 minutes after intubation:	64.18 ± 10.54	70.12 ± 10.87	0.001*
10 minutes after intubation:	64.86 ± 12.63	69.88 ± 9.89	0.029*

Chi-Square test, ANOVA test, p-value <0.05 - significant, p-value<0.01 - highly significant.

Maximum rise in the heart rate from the baseline values was observed immediately after the intubation and was slightly higher in dexmedetomidine group than fentanyl group but comparable and statistically not significant. (p-value>0.05) In fentanyl group HR increase by 9.35% from the baseline whereas in dexmedetomidine group it increases by 13.15% which was comparable. Similarly, maximum rise in SBP, MBP and DBP from the baseline values were also observed immediately after the intubation and were comparable between two groups. (p-value>0.05) In fentanyl group; SBP, MBP and DBP increase by 3.22%, 7.24% and 11.13% respectively from baseline values whereas in dexmedetomidine group; SBP, MBP and DBP increase by 2.97%, 11.57% and 19.65% respectively and were comparable between two groups. The maximum rise in the hemodynamic parameters from the baseline in both the groups were within the 20% range of the baseline values and needed no intervention. So, both fentanyl and dexmedetomidine were equally effective in blunting the hemodynamic response to laryngoscopy and intubation.

HR was higher for the first 3 minutes after intubation and comparable between two groups. Whereas, after 4 minutes till 10 minutes after intubation, HR was significantly lower in Fentanyl group compared to Dexmedetomidine group. (p-value<0.05; Table no. 2,3,4; Figure 1). Similarly, Blood pressure (SBP, MBP, DBP) were also higher for the first 2 minutes after intubation but were comparable between the two groups. Whereas, after 2 minutes till 8 mniutes; blood pressure was significantly lower in the fentanyl

Table 3. Comparison of systolic blood pressure. (n=116)			
Systolic blood pressure(mmHg)	**Fentanyl Group**	**Dexmedetomidine Group**	**p-value**
Baseline	136.62 ± 15.71	134.92 ± 15.02	0.582
After 2minutes of start of drugs	133.92 ± 18.52	131.20 ± 14.14	0.411
After 5minutes of start of drugs	130.66 ± 17.68	128.78 ± 14.89	0.567
After 8minutes of start of drugs	108.64 ± 18.11	112.56 ± 16.41	0.260
Immediately after intubation	141.02 ± 28.73	138.94 ±24.37	0.697
1 minute after intubation	131.84 ± 26.38	137.68 ± 22.71	0.238
2 minutes after intubation	116.06 ± 18.24	127.36 ± 22.79	0.007*
3 minutes after intubation	108.42 ± 13.34	119.24 ± 19.76	0.002*
4 minutes after intubation	103.52 ± 13.23	114.28 ± 18.06	0.001*
5 minutes after intubation	101.86 ± 13.16	111.04 ± 16.61	0.003*
6 minutes after intubation	99.74 ± 12.11	106.66 ± 16.05	0.029*
7 minutes after intubation	98.42 ± 10.58	104.00 ± 15.07	0.035*
8 minutes after intubation	98.24 ± 12.16	103.76 ± 15.12	0.047*
9 minutes after intubation	98.64 ± 13.13	103.22 ± 15.17	0.110
10 minutes after intubation	101.30 ±11.69	101.22 ± 13.11	0.974

Chi-Square test, ANOVA test, p-value <0.05 - significant, p-value<0.01- highly significant.

Table 4. Comparison of mean blood pressure. (n=116)			
Mean blood pressure(mmHg)	**Fentanyl Group**	**Dexmedetomidine Group**	**p-value**
Baseline	105.52 ± 12.92	103.80 ± 12.75	0.505
After 2minutes of start of drugs:	102.78 ± 13.40	102.22 ± 11.07	0.820
After 5minutes of start of drugs:	99.86 ± 13.46	100.98 ± 12.21	0.664
After 8minutes of start of drugs:	84.86 ± 14.59	88.72 ± 13.62	0.175
Immediately after intubation:	113.16 ± 23.31	115.84 ±19.59	0.535
1 minute after intubation:	103.26 ± 21.80	109.82 ± 20.07	0.121
2 minutes after intubation:	88.34 ± 13.82	100.10 ± 19.04	0.001*
3 minutes after intubation:	82.60 ± 11.05	93.74 ± 17.80	0.000*
4 minutes after intubation:	79.36 ± 11.13	90.22 ± 16.69	0.000*
5 minutes after intubation:	76.98 ± 11.37	86.22 ± 14.70	0.001*
6 minutes after intubation:	75.08 ± 10.49	82.60 ± 14.10	0.003*
7 minutes after intubation:	75.10 ± 8.84	80.40 ± 14.00	0.026*
8 minutes after intubation:	74.68 ± 10.19	80.12 ± 13.17	0.023*
9 minutes after intubation:	75.96 ± 10.78	78.08 ± 12.19	0.359
10 minutes after intubation:	78.24 ± 11.00	77.62 ± 11.41	0.783

Chi-Square test, ANOVA test, p-value <0.05- significant, p-value<0.01- highly significant.

group in compared to dexmedetomidine group (p-value<0.05; Table no. 2,3,4; Figure 1). In contrast, after 9 and 10 minutes of intubation; SBP, MBP and DBP were comparable between two groups.

Hypotension was observed more in the fentanyl group than dexmedetomidine group and was statistically significant (p-value<0.05; Table 1). A total of 14 patients developed hypotension who required treatment with crystalloids and inj. Mephentermine 6mg. Among them, 11 patients were in fentanyl group and only 3 patients were in dexmedetomidine group. Hypotension was observed mainly in the post induction phase after the intubation. There was no episode of hypoxia, oxygen saturation was comparable between two groups (Data not mentioned in the table). Similarly, none of the patients in either group developed bradycardia.

DISCUSSION

The sympathomimetic stress response to laryngoscopy and endotracheal intubation results in an increase in the myocardial oxygen demand and may lead to ischemia and acute heart failure in susceptible individuals. Increase in mean arterial pressure of an

Table 5. Comparison of diastolic blood pressure. (n=116)			
Diastolic blood pressure(mmHg)	**Fentanyl Group**	**Dexmedetomidine Group**	**p-value**
Baseline	84.98 ± 10.50	83.52 ± 12.02	0.519
After 2minutes of start of drugs:	82.72 ± 11.92	83.28 ± 10.93	0.807
After 5minutes of start of drugs:	80.12 ± 11.69	81.98 ± 11.51	0.425
After 8minutes of start of drugs:	69.32 ± 12.90	72.92 ± 13.04	0.168
Immediately after intubation:	94.44 ± 19.67	99.94 ±17.52	0.143
1 minute after intubation:	83.78 ± 18.56	90.16 ± 17.11	0.077
2 minutes after intubation:	71.04 ± 13.00	81.60 ± 16.92	0.001*
3 minutes after intubation:	65.20 ± 10.77	76.96 ± 16.97	0.000*
4 minutes after intubation:	63.40 ±10.87	73.60 ± 15.78	0.000*
5 minutes after intubation:	61.56 ± 11.57	69.78 ± 14.22	0.002*
6 minutes after intubation:	59.66 ± 10.51	66.56 ± 14.07	0.007*
7 minutes after intubation:	58.96 ± 9.64	65.18 ± 13.78	0.009*
8 minutes after intubation:	58.68 ± 10.45	64.24 ± 12.38	0.017*
9 minutes after intubation:	59.14 ± 11.21	63.42 ± 13.34	0.086
10 minutes after intubation:	62.26 ± 11.82	61.40 ± 10.91	0.706

Chi-Square test, ANOVA test, p-value <0.05 - significant, p-value<0.01 - highly significant.

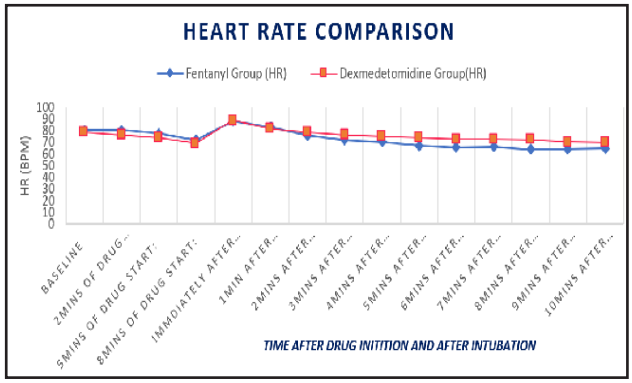

Figure 1. Comparison of heart rate parameter between two groups.

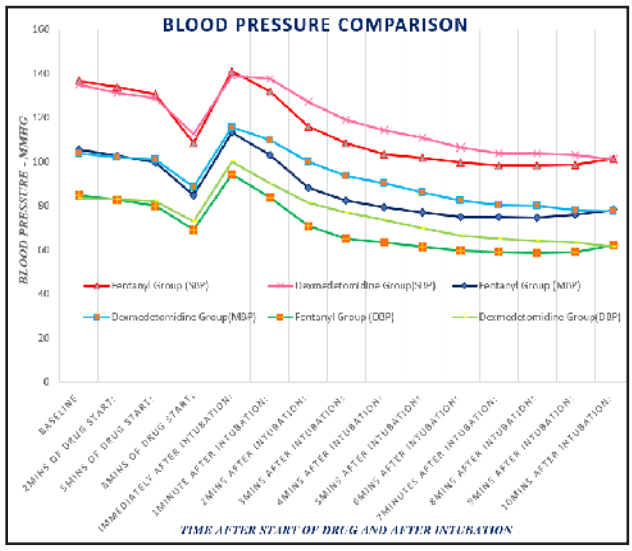

Figure 2. Comparison of blood pressure parameter between two groups.

average of 25mmHg was observed in normotensive patients following laryngoscopy and intubation under anesthesia with thiopentone, nitrous oxide, oxygen and succinylcholine.[5] The elevation in arterial pressure generally starts before five seconds of laryngoscopy, peaks in 1-2 minutes and returns to normal level inside 5minutes.[6] Catecholamines levels change significantly. Norepinephrine levels may double and continues for 4-8minutes; epinephrine levels may quadruple.[7] This changes may not be harmful to normal people but could be dangerous in patients with cerebrovascular diseases, hypertension or myocardial insufficiency.[2] These was the reason behind observing and recording the hemodynamic parameters for 10 minutes after intubation and to observed pressure response and post induction complication of this drugs. The hemodynamic response to laryngoscopy and tracheal stimulation following laryngoscopy and tracheal intubation was first documented by Reid and Brace in 1940.[8] Shribman in 1987 described two components of pressor response: the first being the response to laryngoscopy and the second, the response to intubation.[9] Many modalities have been tried in an effort to attenuate adverse hemodynamic responses to intubation, but no single technique is ideal. Among them, fentanyl and dexmedetomidine are the most studied drug and proven to be effective

agents in attenuating the pressure response to laryngoscopy and intubation with their own adverse effect like postintubation hypotension and bradycardia. Therefore, in this study we compared the minimal dose of these two agents in blunting the hemodynamic response to laryngoscopy and intubation and to find out the best agents with minimal side effects. Fentanyl blunts this stress response by its action on opioid receptors and by decreasing sympathetic outflow. Fentanyl, a fast-acting synthetic mu-receptor stimulating opioid, has been commonly prescribed in preventing the sympathetic stimulation during intubation.[10-11] A linear relationship exists between increasing opioid dose and cardiovascular response reduction.[12] Fentanyl is used routinely as part of general anesthesia in a dose of 2mcg/kg and this dose is effective for stress attenuation when given 5 minutes before laryngoscopy.[13] Fentanyl produces analgesia and stable hemodynamic by modulating stress response through receptor mediated actions on hypothalamic-pituitary-adrenal axis. Yukari et al. discovered that fentanyl 2 mcg/kg in patients without hypertension and 4 mcg/kg in those with hypertension are preferable in order to minimize the changes in vital signs and cardiac output associated with tracheal intubation.[14] Ko et al. discovered that the optimal time of fentanyl (2mcg/kg) injection is 5minutes before laryngoscopy to blunt the stress response.[15] Therefore , in this study fentanyl was given 5 minutes before the laryngoscopy. Since we felt fentanyl in a dose more than 4 mcg/kg could have an impact on postoperative recovery, we used conventional minimal dose of 2 mcg/kg in our study. Alpha-2 adrenergic agonists like clonidine and dexmedetomidine decrease sympathetic tone and has been demonstrated to reduce stress response to laryngoscopy.[16,17] Dexmedetomidine are sedative, hypnotic and antinociceptive due to its agonism of the presynaptic alpha-2 adrenergic receptor which is situated in the locus coeruleus, that blocks the release of norepinephrine thus terminating the pain signals and inhibits sympathetic activity which contributes in decreasing the blood pressure and heart rate.[18] Several studies have highlighted that the use of dexmedetomidine in a dose of 0.5mcg/kg to 1mcg/kg is effective in obtunding hemodynamic stress response following laryngoscopy and endotracheal intubation.[19-20] Disadvantages of higher dose of dexmedetomidine like hypotension, bradycardia forced us to use much safer low dose (0.5mcg/kg) of dexmedetomidine. Rapid bolus dose of dexmedetomidine results in initial transient increase in blood pressure and reflex decrease in heart rate which is due to peripheral alpha 2 adrenoceptor stimulation of vascular smooth muscle and can be attenuated by slow infusion over 10minutes. And the distribution half-life of intravenous dexmedetomidine is approximately 6minutes. So, in this study dexmedetomidine was started 10minutes before laryngoscopy. Both the study drugs were given in such a way that the plasma peak effect of the drugs occurred at the time of laryngoscopy and intubation. The dose of the study drug was also selected as minimal dose to blunt the laryngoscopy and intubation reflex.

In this study, we found that both fentanyl (2 mcg / kg) given 5 minutes before and dexmedetomidine (0.5mcg/kg) given 10minutes before laryngoscopy and intubation were equally effective in blunting the hemodynamic response to laryngoscopy and intubation. The maximum rise in HR from the baseline was observed immediately after the intubation. HR raised by 9.35% from baseline in fentanyl group versus 13.15% in dexmedetomidine group. Similarly, maximum rise in SBP, MBP and DBP from baseline were also observed immediately after intubation. SBP, MBP and DBP raised by 3.22%, 7.24% and 11.13% respectively from baseline in fentanyl group versus 2.97%, 11.57% and 19.65% respectively from baseline in dexmedetomidine group. Maximum rise in these hemodynamic parameters were comparable between two groups and were statistically not significant (p-value >0.05). As well as these values were within 20% range of the baseline values and need no interventions. This rise in HR, SBP, MBP and DBP were observed till 2 minutes of post intubation and then came to baseline values. In contrast to this study, Gunalan S et al[21], Hyndavi KS et al[22], Sahu AK et al[23], Jain V et al[24], Gauchan S et al[25], Patel ND et al[26],

Sheikh TA et al[27] had shown that dexmedetomidine was statistically superior to fentanyl in blunting the hemodynamic response to laryngoscopy and intubation. These might be due to the higher dose of dexmedetomidine (1mcg/kg) that were used in their study. Our aim in this study was to use the minimal dose of dexmedetomidine to prevent the adverse effects. In our study, we did not find any adverse effects related to dexmedetomidine like bradycardia. Whereas, Hypotension and bradycardia were significant higher with dexmedetomidine in various studies where higher dose of dexmedetomidine (1mcg/kg) were used to blunt the hemodynamic response to laryngoscopy and intubation.[24- 29] Similarly, Raiger LK et al.,[28], Sumathi N et al.,[29], Gandhi S et al.,[30], Rinkal B et al.,[31], Tyagi SR et al.,[32], Jethani K et al.,[33] compared lower dose of dexmedetomidine (0.5 to 0.6 mcg/kg) to fentanyl (2mcg/kg) to blunt the stress response of laryngoscopy and intubation. And they found that dexmedetomidine even in the lower dose was statistically superior to fentanyl. In contrast, our study showed that dexmedetomidine (0.5mcg/kg) and fentanyl (2mcg/kg) were equally effective in blunting stress response to laryngoscopy and intubation. The difference in result might be due to the method of fentanyl administration. In their study, both dexmedetomidine and fentanyl were given to patients 10 minutes before laryngoscopy whereas in our study, dexmedetomidine was given 10 minutes and fentanyl was given 5 minutes before laryngoscopy. In our study, we considered that the timing of laryngoscopy coincides with peak plasma concentration of the study drug. Ko S et al suggested that the optimal time of fentanyl(2mcg/kg) injection is 5 minutes before laryngoscopy to blunt the stress response.[15] Similarly, dexmedetomidine should be used as slow infusion over 10 minutes to prevent transient increase in BP and reflex decrease in HR associated with rapid bolus dose.[18] Mahiswar AP et al also compared dexmedetomidine (0.5mcg/kg) and fentanyl (2mcg/kg) to attenuate stress response to laryngoscopy and intubation. Both drugs were given 5 minutes prior to laryngoscopy and found that both drugs were equally effective in blunting the stress response.[34] In our study, we also found that HR had fallen below the baseline value 2 minutes after the intubation. HR was significantly low in fentanyl group in compared to dexmedetomidine group from 4 to 10 minutes after intubation. Similarly, SBP, MBP and DBP had also fallen below the baseline values 2 minutes after intubation and was significantly low in the fentanyl group in compared to dexmedetomidine group from 2 to 8 minutes after intubation. Total 14 patients developed post intubation hypotension and was significantly more in fentanyl group in compared to dexmedetomidine group (p-value <0.05). Hypotension was responsive to fluids and vasopressors. There was no episode of bradycardia and hypoxia in any groups. Hypotension might occur due to decrease in sympathetic outflow as a synergistic effect of both general anesthesia and study drugs.

CONCLUSIONS

Dexmedetomidine (0.5mcg/kg) given 10 minutes prior to laryngoscopy was equally effective as fentanyl (2mcg/kg) given 5 minutes prior to laryngoscopy in blunting the stress response to laryngoscopy and endotracheal intubation. However, adverse effects in terms of post intubation hypotension were significantly higher in fentanyl group. So, to select the drug with low dose to blunt stress response along with minimal side effects; dexmedetomidine will be the better drug than fentanyl. To conclude, dexmedetomidine (0.5mcg/kg) was superior to fentanyl (2mcg/kg) as dexmedetomidine at low dose was equally effective as fentanyl in attenuation of stress response to laryngoscopy and endotracheal intubation with lesser side effects.

Limitations

We did not measure plasma catecholamines level, which was not feasible in our institute. We choose only healthy patients and without co-morbid conditions. Adequate depth of anesthesia and neuromuscular relaxation was monitored by clinical observation. Hemodynamic changes associated with two stages i.e., direct laryngoscopy and passage of tracheal tube into trachea were not studied separately.

ACKNOWLEDGEMENTS

We would like to thank all the patients involved in this study, faculties from the department of Anesthesiology, anesthesia residents and medical officers, and anesthesia nursing staffs for their continuous support to complete this study.

Lists of abbreviations

ASA - American Society of Anesthesiology, BP - Blood Pressure, Bpm - Beats per minute, BMI - Body Mass Index, COPD - Chronic Obstructive Pulmonary Disease, DBP - Diastolic Blood Pressure, ECG - Electrocardiogram, GA - General Anesthesia, HR - Heart Rate, IV - Intravenous, MAC - Minimal Alveolar Concentration, MBP - Mean Blood Pressure, NS - Normal saline, O_2 - Oxygen, OELMA - Optimal External Laryngeal Manipulation Of Airway, RL - Ringer's Lactate, SBP - Systolic Blood Pressure, SpO_2 - Oxygen Saturation.

Conflict of interest: None

Funding: None

REFERENCES

1. Derbyshire DR, Chmielewski A, Fell D, Vater M, Achola K, Smith G. Plasma catecholamine responses to tracheal intubation. Br J Anaesth. 1983;55(9):855–60. [DOI] [PMID]
2. Kovac A. Controlling the hemodynamic response to laryngoscopy and endotracheal intubation. J Clin Anesth. 1996;8:63–79. [DOI]. [PMID]
3. Swarnamba UN, Veena K, Shaikh SI. Comparison of the efficacy of lornoxicam and fentanyl in attenuating the hemodynamic response to laryngoscopy and intubation. Anesth Essays Res. 2016;10(3):478–82. [DOI] [PMID]
4. Laha A, Ghosh S, Sarkar S. Anesthesia : Essays and Researches Attenuation of sympathoadrenal responses and anesthetic requirement by dexmedetomidine. Anesth Essays Res. 2013;7(1):65–70. [DOI] [PMID]
5. Forbes A, Dally F. Acute hypertension during induction of anaesthesia and endotracheal intubation in normotensive man. Br J Anaesth. 1970;42(7):618–24. [DOI] [PMID]
6. Rose DK, Cohen MM. The airway: problems and predictions in 18,500 patients. Can J Anaesth. 1994;41(5):372–83. [DOI] [PMID]
7. Collins VJ. Principles of Anesthesiology. Philadelphia: Lea and Febiger, editor. Princ Anesthesiol Reg Anesth. 3rd editio. 1993;124–6. [DOI]
8. Reid L, Brace D. Irritation of the respiratory tract and its reflex effect upon the heart. Surg Gynecol Obs. 1940;70:157–62. [DOI]
9. Shribman AJ, Smith G, Achola KJ. Cardiovascular and catecholamine responses to laryngoscopy with and without tracheal intubation. Br J Anaesth. 1987;59(3):295–9. [DOI] [PMID]
10. Park K bum, Ann J, Lee H. Effects of different dosages of oxycodone and fentanyl on hemodynamic changes during intubation. Saudi Med J. 2016;37(8):847–52. [DOI] [PMID]
11. Stanley TH. The Fentanyl Story. J Pain. 2014;15(12):1215–26. [DOI]
12. Safavi M HA. Attenuation of cardiovascular responses to laryngoscopy and tracheal intubation - intravenous sufentanil vs pethidine. Middle East J Anesth. 2008;19(6):1349–60. [PMID]
13. Gurulingappa MAA, Aleem A, Awati MN AS. Attenuation of Cardiovascular Responses to Direct Laryngoscopy and Intubation-A Comparative Study Between iv Bolus Fentanyl , Lignocaine and Placebo (NS). J Clin Diagnostic Res. 2012;6(10):1749–52. [DOI] [PMID]
14. Yukari. Optimal fentanyl dosage for attenuating systemic hemodynamic changes, hormone release and cardiac output changes during the induction of anesthesia; a prospective, randomised, double-blinded study. J Anaesthesiol. 2013;27:505–11. [DOI]
15. Ko S, Kim D, Han Y, Song H. Small-Dose Fentanyl: Optimal Time of Injection for

Blunting the Circulatory Responses to Tracheal Intubation. Anesth Analg. 1998;86(3):658–61. [DOI]

16. Aantaa R SM. α-2-adrenergic agents in anaesthesiology. Acta Anaesthesiol Scand. 1993;37:433–48. [DOI] [PMID]
17. Quintin L, Bonnet F MI. Aortic surgery: Effect of clonidine on intraoperative catecholaminergic and circulatory stability. Acta Anaesthesiol Scand. 1990;34:132–7. [DOI] [PMID]
18. Keith A, Sergio D, Paula M, Marc A, Wisemandle W AY. Monitored anaesthesia care with dexmedetomidine: A prospective, randomized, double-blind, multicenter trial. . Anaesth Analg. 2010;110:47–56. [DOI] [PMID]
19. Aho M, Lehtnen AM EO. The effect of intravenously administered dexmedetomidine on perioperative haemodynamics and isoflurane requirements in patients undergoing abdominal hysterectomy. Anaesthesiology. 1991;74:997-1002. [DOI] [PMID]
20. Kallio A, Scheinin M, Koulu M PR, Ruskoaho H VO. Effects of Dexmedetomidine, a selective alpha-2 adrenoceptor agonist, on hemodynamic control mechanism. ClinPharmacolTher. 1989;46:33–42. [DOI] [PMID]
21. Gunalan S, Venkatraman R, Sivarajan G, Sunder P. Comparative Evaluation of Bolus Administration of Dexmedetomidine and Fentanyl for Stress Attenuation During Laryngoscopy and Endotracheal Intubation. J Clin Diagnostic Res. 2015;9(9):UC06–9. [DOI]
22. Hyndavi K, Prashant L, Patil DJ, Paranjpe J. A comparative study of Dexmedetomidine versus Fentanyl for attenuation of hemodynamic response to laryngoscopy and endotracheal intubation. MedPulse Int J Anesthesiol. 2023;25(1):01–5. [DOI]
23. Sahu AK, Varghese K, Ahmed A. Comparison of Fentanyl with Dexmedetomidine on attenuating the haemodynamic response to intubation : A randomized double blind clinical study. IOSR J Dent Med Sci. 2021;20(4):13–8. [DOI]
24. Jain V, Chandak A, Ghosh A, Golhar M. Comparison of dexmedetomidine and fentanyl for attenuation of the hemodynamic response to laryngoscopy and tracheal intubation. Ain-Shams J Anaesthesiol. 2015;8(2):236–43. [DOI]
25. Gauchan S, Thapa C. Comparative Study of Dexmedetomidine and Fentanyl for Attenuation of Hemodynamic Response to Laryngoscopy and Intubation. J Coll Med Sci. 2019;15(3):191–6. [DOI]
26. Patel ND, Patel JJ, Patel DD. A study on comparison of intravenous dexmedetomidine with intravenous fentanyl for suppression of hemodynamic responses to laryngoscopy and endotracheal intubation during general anaesthesia. Natl J Med Res. 2015;5(2):127–31. [Link]
27. Sheikh DTA, Nazir DI, Ara DM. A comparative analysis of bolus dose of dexmedetomidine and fentanyl in attenuating haemodynamic stress responses following laryngoscopy and intubation. Int J Adv Res Med. 2021;3(2):452–4. [DOI]
28. Raiger L, Gokulakrishnan L, Chandramohan M, Aseri A, Gehlot R. Attenuation of pressor response to laryngoscopy and intubation: Dexmedetomidine Vs. fentanyl premedication. Indian J Clin Anaesth. 2018;5(4):486–90. [DOI]
29. Natta S, Dasari P, Singh B. Comparison of Dexmedetomidine With Fentanyl in Attenuation of Pressor Response To Laryngoscopy and Intubation. J Evid Based Med Healthc. 2017;4(54):3281–7. [DOI]
30. Gandhi S, Goyal V, Radhakrishnan K, Balakrishnan M. Comparison of Dexmedetomidine with Fentanyl in Attenuation of Pressor Response during Laryngoscopy and Intubation. IOSR J Pharm. 2014;04(02):28–38. [DOI]
31. Bhadiyadra R, Vaghela A, Patel S, Vachharajani P. Comparison of Intravenous Fentanyl vs Dexmedetomidine in Attenuation of Pressure Response during Laryngoscopy

and Endotracheal Intubation. Int J Sci Res. 2018;7(2):306–9. [DOI]

32. Tyagi S, Goyal S. A comparative clinical study of dexmedetomidine and fentanyl in attenuating stress response during laryngoscopy and endotracheal intubation. Indian J Appl Res. 2018;8(10):17–8. [DOI]
33. Jethani K, Khushboo, Ann S. A Comparative Study of Dexmedetomidine and Fentanyl in Attenuating Stress Response during Direct Laryngoscopy and Tracheal Intubation. Int J Med Sci Innov Res. 2020;5(4):57–61. [PMID]
34. Mahiswar AP, Dubey PK, Ranjan A. Comparison between dexmedetomidine and fentanyl bolus in attenuating the stress response to laryngoscopy and tracheal intubation: a randomized double-blind trial. Brazilian J Anesthesiol. 2022;72(1):103–9. [DOI]

Citation: Shakya S, Singh J, Shrestha B, Chikanbanjar S. Fentanyl and Dexmedetomidine in Stress Attenuation During Laryngoscopy and Endotracheal Intubation. JCMS Nepal. 2025; 21(2): 136-146.