Original Research Article

"A Comparative Study Of Dexmedetomidine And Fentanyl For Attenuation Of Hemodynamic Response To Laryngoscopy And Endotracheal Intubation"

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Received: 09-11-2021 / Revised: 07-12-2021 / Accepted: 08-01-2022

Abstract

Background: Laryngoscopy and endotracheal intubation provoke a transient, but marked sympathetic and sympathoadrenal response leading to hypertension and tachycardia. No single anaesthetic technique has been accepted to be completely effective in preventing or attenuating this sympathetic response. Fentanyl, an opioid, and dexmedetomidine, a highly selective alpha-2 agonist, have shown to partially attenuate the hemodynamic response to laryngoscopy and intubation.

Aim: To compare the effect of iv.fentanyl and iv.dexmedetomidine for the attenuation of hemodynamic response to direct laryngoscopy and endotracheal intubation.

Materials and Methods: Sixty patients, of either sex, ASA I & II, admitted for elective procedure under general anaesthesia were randomised into two groups. Thirty patients received 1mcg/kg dexmedetomidine, 5 minutes before induction and the remaining 30 patients received 2mcg/kg fentanyl, also 5 minutes before induction. Patients were induced with thiopentone 5mg/kg and muscle relaxant rocuronium 0.6mg/kg given. Systolic, diastolic and mean blood pressures, along with heart rate, were measured in all the patients at baseline, before induction and intubation, and at 1,2,3 and 5 minutes post intubation.

Discussion: Both fentanyl and dexmedetomidine attenuated the rise in systolic, diastolic and mean arterial pressure, as well as the rise in heart rate. The rise in systolic pressure was significantly lower in the dexmedetomidine group at 1 to 5 minutes post intubation ($p< 0.001$). Dexmedetomidine was more successful in reducing the heart rate post intubation when compared to fentanyl ($p< 0.001$).

Conclusion: Dexmedetomidine was more effective than fentanyl in attenuating the rise in systolic pressure and heart rate due to laryngoscopy and intubation.

Keywords: Laryngoscopy, Hemodynamics, Fentanyl, Dexmedetomidine, Stress response.

Introduction

Direct laryngoscopy and endotracheal intubation is known to cause epipharyngeal and laryngopharyngeal stimulation. This stimulus is associated with reflex sympathetic discharge and rise in plasma catecholamine concentration, which can lead to increased heart rate, blood pressure and arrhythmia[1]. These changes are transient and usually well tolerated by healthy patients. Some patients with co-morbidities like hypertension, coronary heart disease and cerebrovascular accident, may develop fatal complications[2]. Various sympathetic antagonist and anaesthetic agents have been used to attenuate this reflex sympathetic response to direct laryngoscopy and tracheal intubation, such as; opioids, calcium channel blockers, local anaesthetics, beta-blockers, magnesium sulphate etc[3]. No single anaesthetic technique has been accepted to be completely effective in preventing or attenuating this sympathetic response. The methods being used are either partially effective or produce undesirable side effects[4]. Opioids may limit this hemodynamic response to a certain extent by deepening the level of anaesthesia, thereby decreasing sympathetic outflow. Fentanyl at a dose of 2mcg/kg has been shown to be effective in attenuating the sympathetic response to direct laryngoscopy and tracheal intubation[5]. Dexmedetomidine is a highly selective alpha-2 agonist, which has been used to attenuate the sympathetic response to direct laryngoscopy and endotracheal intubation and also for its anaesthetic sparing effects, anxiolysis and analgesia without respiratory depression[6].

The purpose of our study was to compare the effect of fentanyl and dexmedetomidine for the attenuation of hemodynamic response to direct laryngoscopy and endotracheal intubation.

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Materials and Methods

This is a prospective, interventional, double blinded, randomized controlled trial conducted at Alluri Sitarama Raju Academy of Medical Sciences, Eluru, on patients posted for elective procedures under general anaesthesia from December 2020 - December 2021after approval from institutional ethical committee.

Inclusion Criteria

- Men and women aged between 18-50 years, ASA I & II, Undergoing elective procedure under general anaesthesia

Exclusion Criteria

- Patients on drugs that could alter hemodynamic parameters such as beta blockers, clonidine, Preoperative ECG changes such as arrhythmias, bradycardia (HR<50) , Suspected difficult airway i.e Mallampati class III & IV, mouth opening less than two finger breadth, neck extension restricted, unanticipated difficult intubation, History suggestive of sensitivity to fentanyl or dexmedetomidine

Using a sample size of 60, patients of either sex, ASA I & II, admitted

for elective procedure under general anaesthesia were selected for this study.

The sampling procedure was the two groups were randomly allocated by drawing lottery

- Group D - 1mcg/kg of DEXMEDETOMIDINE diluted upto 5cc with distilled water
- Group F -2mcg/kg of FENTANYL diluted upto 5cc with distilled water

Procedure

After approval from institutional ethics committee, 60 patients were selected for the study.

Pre-anaesthetic evaluation was done and written informed consent was taken from all the patients.

Patients were kept NPO from midnight and premedicated with diazepam 10 mg on the previous day of surgery.

On the day of the surgery, after arrival to the operation theatre, 18G cannula was secured and an IV fluid (Ringer lactate) was started.

Standard monitor with electrocardiogram, non-invasive blood pressure, and pulse oximeter was connected.

Base line blood pressure, pulse rate and SpO2 were recorded. The study drug, either fentanyl 2mcg/kg diluted up to 5cc or dexmedetomidine 1mcg/kg diluted up to 5cc with distilled water was injected using a 5 ml syringe over 5 minutes.

Patients were then preoxygenated for three minutes. Anaesthesia was induced using 2.5% thiopentone 5mg/kg over 20 seconds intravenous along with Rocuronium 0.6mg/kg to facilitate tracheal intubation. Ventilation was assisted following the injection of Rocuronium, and after two minutes direct laryngoscopy was attempted. Intubation was done under direct vision using a Macintosh blade size 3 by the same experienced anaesthesiologist. Positioning of tube was confirmed by bilateral equal air entry and capnometry.

Heart rate, systolic and diastolic pressures, mean arterial pressure and SpO2 were documented by an independent observer who was blinded to the nature of the study. Intubation response was graded and recorded.

T0 - Baseline readings
T1 - Just before injection of study drug
T2 - Just before induction
T3 - Just before intubation
T4 - 1 minute after intubation
T5 - 2 minutes after intubation
T6 - 3 minutes after intubation
T7 - 5 minutes after intubation

Surgical stimulus was allowed only after 5 minutes following intubation. Any episode of bradycardia (heart rate less than 50) was recorded.

Results

Sixty patients, undergoing various surgeries under general anaesthesia, aged between 18 and 50, were studied. Thirty patients received dexmedetomidine 1mcg/kg (group D) and the remaining thirty received fentanyl 2mcg/kg (group F) prior to intubation. Hemodynamic parameters following intubation were observed.

Hemodynamic changes

The SBP, DBP, MAP, Heart rate and SpO2 were recorded at baseline, before injecting the study drug, before induction, just before intubation and 1,2,3 and 5 minutes after intubation.

Table 1: Changes to Systolic blood pressure

	Group	Mean±SD (mmHg)	P Value
Baseline (T0)	Group D	130.40±9.17	0.797
	Group F	130.97±7.74	
Before study drug (T1)	Group D	132.07±9.52	0.316
	Group F	129.67±8.86	
Just before induction (T2)	Group D	124.53±23.23	0.893
	Group F	123.93±7.56	
Just before intubation (T3)	Group D	114.97±10.08	0.008
	Group F	121.30±7.47	
1 minute post intubation (T4)	Group D	134.43±10.16	0.007
	Group F	143.27±11.41	
2 minute post intubation (T5)	Group D	129.73±9.35	<0.001
	Group F	142.30±12.97	
3 minutes post intubation (T6)	Group D	124.67±10.38	0.001
	Group F	134.13±10.23	
5 minutes post intubation (T7)	Group D	114.37±7.57	<0.001
	Group F	125.60±9.81	

The comparison between the two groups show no significant difference in systolic blood pressure at baseline (p=0.797), before injection of the drugs (p=0.316) or before induction (p=0.893). Just before intubation, the SBP in the dexmedetomidine group (114.97±10.1mmHg) was lower than in the fentanyl group (121.30±7.5mmHg). This was statistically significant (p = 0.008).

Table 2: Diastolic Blood Pressure Change

	GROUP	Mean±SD (mmHg)	P VALUE
Baseline (T0)	Group D	80.67±6.25	0.051
	Group F	77.23±7.06	
Before study drug (T1)	Group D	81.43±6.25	0.046
	Group F	77.77±7.60	
Just before induction (T2)	Group D	80.60±6.06	<0.001
	Group F	73.50±7.45	
Just before intubation (T3)	Group D	73.07±7.77	0.236
	Group F	70.67±7.76	
1 minute post intubation (T4)	Group D	86.27±9.28	0.116
	Group F	89.73±7.46	
2 minute post intubation (T5)	Group D	84.90±10.51	0.088

	Group F	89.03±7.75	
3 minutes post intubation (T6)	Group D	84.00±10.17	0.978
	Group F	83.93±8.01	
5 minutes post intubation (T7)	Group D	74.67±7.73	0.008
	Group F	79.97±7.32	

Statistical evaluations comparing the two groups show no significant difference at baseline. The diastolic pressure just before induction was significantly lower in the fentanyl group (5mmHg below baseline) when compared to the dexmedetomidine group (1mmHg above the baseline). This difference was statistically significant (p< 0.00).

Table 3: Changes in Heart Rate.

	Group	Mean±SD (mmHg)	P Value
Baseline (T0)	Group D	79.87±12.09	0.381
	Group F	82.83±13.89	
Before study drug (T1)	Group D	79.37±10.45	0.991
	Group F	79.33±11.22	
Just before induction (T2)	Group D	68.57±8.22	0.008
	Group F	75.17±10.26	
Just before intubation (T3)	Group D	64.87±6.29	0.001
	Group F	72.20±9.18	
1 minute post intubation (T4)	Group D	78.97±10.68	0.001
	Group F	88.37±11.06	
2 minute post intubation (T5)	Group D	76.60±10.39	<0.001
	Group F	89.17±12.37	
3 minutes post intubation (T6)	Group D	76.13±10.76	0.01
	Group F	83.63±11.10	
5 minutes post intubation (T7)	Group D	73.03±12.03	0.028
	Group F	79.57±10.38	

The fall in heart rate from baseline to just before intubation, was more in the dexmedetomidine group as compared to the fentanyl group. Also, dexmedetomidine was more successful in reducing the heart rate post intubation when compared to fentanyl.

Discussion

Laryngoscopy and endotracheal intubation provoke a transient, but marked sympathetic and sympathoadrenal response leading to hypertension and tachycardia. Various drugs have been used to attenuate this post intubation hemodynamic response such opioids, beta blockers, calcium channel blockers, local anaesthetics, magnesium sulphate etc[1].

This randomized, double blinded study was done to compare the efficacy of dexmedetomidine and fentanyl for the attenuation of hemodynamic response to direct laryngoscopy and endotracheal intubation.

Systolic, diastolic and mean blood pressures, along with the heart rate, were measured in all the patients at baseline, before induction and intubation, and at 1,2,3 and 5 minutes post intubation.

iv. Dexmedetomidine 1mcg/kg and iv.fentanyl 2mcg/kg, were diluted to 5cc and injected slowly over five minutes in the present study.

In our study we found an 11% fall in systolic pressure, just before intubation, after the injection of 1mcg/kg dexmedetomidine over 5 minutes.

The rise in systolic pressure is a stress response to intubation that is associated with increase in sympathetic outflow and stress catecholamine release. Dexmedetomidine causes hypotension via its effects on the autonomic nervous system and by suppressing the release of norepinephrine to stress. This is probably the reason for the lower systolic pressure in the dexmedetomidine group.

Dexmedetomidine was more useful in reducing the rise in systolic pressure, than fentanyl. Both dexmedetomidine and fentanyl equally blunted the rise in diastolic and mean arterial pressure. Neither 1mcg/kg of dexmedetomidine nor 2mcg/kg of fentanyl was sufficient to completely block the rise of arterial pressures due to laryngoscopy and endotracheal intubation. A higher dose of these drugs or a combination would be required to achieve the same.

Dexmedetomidine reduces heart rate by reducing the sympathetic tone and increasing the vagal tone. Additionally, the initial increase in the biphasic blood pressure response would result in baroreceptor mediated bradycardia. This explains the effectiveness of dexmedetomidine over fentanyl in attenuating the rise in heart rate, in response to laryngoscopy and intubation.

The findings of this study suggest that dexmedetomidine; at a dose of 1mcg/kg, can be used safely with a low incidence of intraoperative bradycardia or hypotension.

Conclusion

It can be concluded that, both Dexmedetomidine at 1mcg/kg and Fentanyl at 2mcg/kg, given 5 minutes before intubation, partially attenuate the hemodynamic response to laryngoscopy and intubation, but neither drug can completely blunt this response.

Dexmedetomidine is more successful than fentanyl, in attenuating the rise in systolic pressure and heart rate that follows laryngoscopy and intubation.

Both Dexmedetomidine 1mcg/kg and Fentanyl 2mcg/kg can be given 5 minutes before intubation with minimal side effects.

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Conflict of Interest: Nil Source of support: Nil