Original Article

A Comparative Study of Fentanyl and Dexmedetomidine in Attenuating Haemodynamic Response of Laryngoscopy and Intubation

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ABSTRACT

Background: Dexmedetomidine is a centrally acting alpha-2 adrenoceptor agonist. In this study, we compared dexmedetomidine to fentanyl in attenuating sympathetic response to laryngoscopy and tracheal intubation. **Methods:** Eighty ASA grade I-II patients requiring tracheal intubation were included in this prospective study and were randomly assigned to the dexmedetomidine (Group D) and fentanyl group (Group F) (40 patients in each group). Both the drugs were given at 1 µg/kg dose prior to laryngoscopy. We assessed heart rate, blood pressures and complications (bradycardia, hypotension and sedation). **Results:** The two groups were comparable in demographic parameters. The baseline mean heart rate (P=0.94) was not significantly different between Group F and Group D. Increase in heart rate after laryngoscopy and intubation was significantly lower in Group D compared to Group F (P=0.039). Mean heart rate remained lower at one minute after intubation in Group D but it was not statistically significant (94.64 s vs 86.28 sec). The difference in mean heart rate between two groups was comparable at three, five, ten and fifteen minutes after intubation. The baseline Mean arterial pressure was comparable between the groups (P=0.83) and remained similar throughout 15 minutes after intubation. Group D showed significant hypotension compared to Group F (P=0.03), whereas there was no significant bradycardia between these groups (P=0.19). Mean sedation score is higher in Group D compared to Group F. **Conclusion:** At 1 µg/kg dose, both dexmedetomidine and fentanyl cause partial attenuation of sympathetic response to laryngoscopy and intubation but dexmedetomidine blunts this response more effectively than fentanyl.

Key Words: *Blood pressure, dexmedetomidine, fentanyl, heart rate, intubation, laryngoscopy.*

INTRODUCTION

Laryngoscopy and intubation is associated with sympathetic response which is manifested as raised blood pressure and heart rate. This response is due to rise in plasma concentration of catecholamine and may be detrimental to cardiac compromised patients.[1, 2]

Various drug regimens and techniques have been used from time to time for attenuating the stress response to laryngoscopy and intubation, including opioids, barbiturates, benzodiazepines, beta blockers, calcium channel blockers, vasodilators, etc.[3,4]

Alpha-2 agonists like clonidine has been being used extensively to attenuate the haemodynamic pressor response.[5] Dexmedetomidine is the new alpha-2 agonist having eight-times more affinity for alpha-2 adrenoceptors as compared with clonidine, which has shown only partial agonist activity and is known to decrease the plasma catecholamines levels and suppressing the release of catecholamines.[6,7]

In this study, we compared the efficacy of dexmedetomidine with fentanyl in attenuating sympathetic response of laryngoscopy and intubation. The primary outcome measures were heart rate (HR) and mean arterial pressure (MAP). We also compared hypotension, bradycardia and sedation between these two drugs.

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MATERIALS AND METHODS

After obtaining the Ethics committee approval, 80 American Society of Anaesthesiologist (ASA)-I/II patients, aged 20-45 years, undergoing elective general surgical procedures were enrolled in the present study. Patients with ASA grade III and IV, Mallampati classification of 3 or 4, age >60 years & <20 years, pregnant and nursing women, patients with a BMI>30, cardio-pulmonary compromised patients, major hepatic, renal or endocrine dysfunction; allergy to anaesthetic drugs were excluded from the study.

The research methodology was prospectively randomized with the help of computer-generated coded envelopes and patients were divided into two groups: Group F and Group D.

In the pre-op room, a good intravenous access was secured and baseline parameters were observed and recorded, which included heart rate (HR), mean arterial blood pressure (MAP), electrocardiogram, respiratory rate and pulse oximetry (SpO_2). Patients were premedicated with injection ondansetran 4 mg (i.v) and injection midazolam 0.03 mg/kg (i.v). Thereafter, Group F received 1µg/kg fentanyl whereas, Group D received 1 µg/kg of dexmedetomedine 10 mins before laryngoscopy as slow i.v. infusion in 100 ml normal saline.

Induction was done with injection propofol 2 mg/kg followed by 0.1 mg/kg of injection vecuronium bromide to provide neuromuscular blockade. Thereafter, laryngoscopy was performed with a Macintosh laryngoscope and intubation was performed with a cuffed endotracheal tube of appropriate size. Patient's haemodynamic parameters were recorded immediately one minute after intubation (T1) and 3, 5 and 10 and 15 minutes after intubation (T3, T5, T10, and T15) respectively till completion of surgery. Response to skin incision was also observed and recorded in a similar manner. During surgery, anaesthesia was maintained with isoflurane and 66% nitrous oxide in oxygen. Patients who developed significant hypotension (reduction of >20% from their MAP or BP <90 mmHg systolic) during induction were first treated with fluid loading (10mL/Kg), lowered concentration of the inhalational gas, and/ or mephentermine (6 mg IV) if BP became worse or did not improve. Bradycardia was defined as a HR of less than 50/minute and was corrected, if associated with haemodynamic instability, with atropine 0 5mg (i.v).

At the end of the surgical procedure, neuromuscular blockade was reversed with neostigmine 0.05 mg/kg and glycopyrrolate 0.01 mg/kg intravenously (i.v). Extubation was carried out as routine procedure. Post-operative sedation was assessed using the Ramsay sedation score (1: Patient is anxious and agitated or restless, or both; 2: Patient is cooperative, oriented and tranquil; 3: Patient responds to commands only; 4: Patient exhibits brisk response to light glabellar tap or loud auditory stimulus; 5: Patient exhibits a sluggish response to light glabellar tap or loud auditory stimulus; 6: Patient exhibits no response).

Statistical Analysis: Demographic data was analysed using Fisher's exact test while all the continuous variable were analysed using student's t test. Power analysis was carried out using SPSS version 20 for windows and assuming α=0.05 and β=0.8, the effective sample size on the basis of haemodynamic differences turned out be 78 for the comparison of independent means. So, total 80 patients were chosen for possible dropout. A value of P<0.05 was considered significant and P<0.001 was considered highly significant.

RESULTS

All the data is expressed as mean and standard deviation. The two groups were comparable in patient characteristics with respect to age, gender, ASA physical status and mean weight (P>0.05) [Table 1].

Table 1: Demographic Profile of Patients in Both the Groups. Data are Mean (SD).

Demographic parameters	Group F	Group D	P value
Age (years)	37.56 (8.45)	33.08 (6.25)	0.97
Gender (m:f)	31:9	28:12	0.61
Weight (kg)	59.40 (6.94)	62.40 (16.65)	0.68
ASA* grade (I/II)	23/17	20/20	0.65

ASA* = American Society of Anesthesiologists

The baseline mean HR (P=0.94) was not significantly different between Group F and Group D. Just after the laryngoscopy and intubation, though the mean HR increased from baseline, but it was significantly lower in Group D compared to Group F (P=0.039). Mean HR remained lower at T1 in Group D but it was not statistically significant (94.64 s vs 86.28 s). The difference in Mean HR between two groups was comparable at T3, T5, T10 and T15. Mean HR returned to baseline in both groups at 10 minute (85.92 s and 82.32 s in Group F and Group D respectively) [Figure 1].

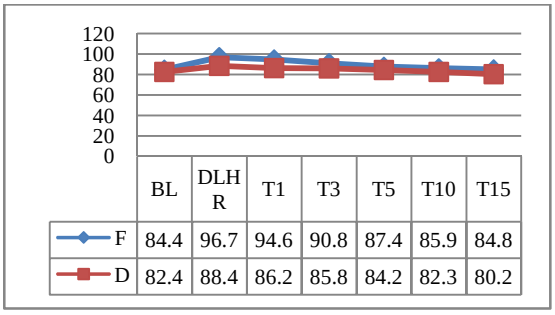


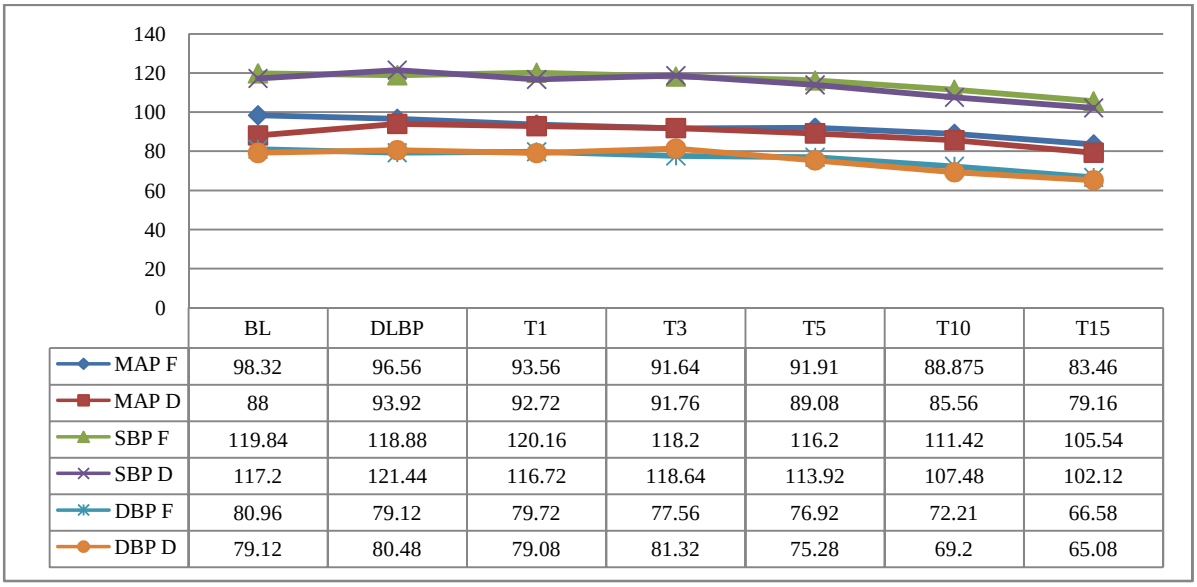
Figure 1: Comparison of mean heart rate in groups F and D (BL: Baseline; DLHR: Direct Laryngoscopy Heart Rate).

The baseline MAP was comparable between the groups (P=0.83) and remained similar throughout 15 minutes after intubation. There was also no significant difference in systolic as well as diastolic blood pressure starting from baseline up to 15 minutes post-intubation [Figure 2].

Table 2: Complications between Two Groups. Data are Number (%) And Mean (SD).

Variables	Group F	Group D	P-value
Bradycardia	4 (10)	13 (32.5)	0.03
Hypotension	3 (7.5)	8 (20)	0.19
Sedation	1.875 (0.72)	2.475 (0.82)	0.99

Group D showed significant hypotension compared to Group F (P=0.03), whereas there was no significant bradycardia between these groups (P=0.19). Mean sedation score was 1.875 in Group F and 2.475 in Group D (P=0.99) [Table 2].



	BL	DLBP	T1	T3	T5	T10	T15
MAP F	98.32	96.56	93.56	91.64	91.91	88.875	83.46
MAP D	88	93.92	92.72	91.76	89.08	85.56	79.16
SBP F	119.84	118.88	120.16	118.2	116.2	111.42	105.54
SBP D	117.2	121.44	116.72	118.64	113.92	107.48	102.12
DBP F	80.96	79.12	79.72	77.56	76.92	72.21	66.58
DBP D	79.12	80.48	79.08	81.32	75.28	69.2	65.08

Figure 2: Comparison of systolic, diastolic and mean blood pressures in groups F and D (BL: Baseline; DLBP: Direct Laryngoscopy Blood Pressure).

DISCUSSION

Haemodynamic pressor response to laryngoscopy and intubation has been a constant problem for anaesthesiologists and multiple pharmacological agents have been used to counteract this. One of the recent drugs used to blunt this response is centrally acting alpha-2 agonists. Dexmedetomidine (alpha-2 agonist) shows eight times more alpha-2 selectivity compared to clonidine.[8] In this present study, we compared dexmedetomidine to fentanyl in attenuating sympathetic response to laryngoscopy and intubation.

Both the groups were comparable in terms of demographic as well as baseline haemodynamic parameters. Mean heart rate increased after intubation, but the increase in heart rate is significantly lower in Group D compared to Group F. In Group D, heart rate after intubation increased 7%, whereas, in Group F, it increased 14%. Bajwa et al[9] also observed similar result in their study. The dose of 1µg/kg dexmedetomidine attenuated but did not completely obtund the sympathetic response of laryngoscopy and intubation.[10] Similiarly, 1µg/kg dose of fentanyl was not sufficient to blunt the stress response. This can be explained on the basis of decreased CNS sympathetic activity.[11]

Systolic, diastolic and mean arterial pressure remained unchanged before and after intubation. Elevation of blood pressure due to sympathetic response was effectively attenuated by the dose of 1µg/kg dexmedetomidine as well as fentanyl. Suparto et al[12] also had similar observation. According to them, mean increase in the systolic and diastolic blood pressure at 30 and 60 seconds post intubation in patients given either drugs were similar and statistically insignificant. Bajwa et al[9]. showed 15-25% increase in blood pressure after laryngoscopy in both fentanyl and dexmedetomidine group, though they used different dosing of fentanyl. They used fentanyl 2µg/kg dose Hypotension was significantly more in dexmedetomidine group compared to fentanyl group. Techanivate et al[13] also revealed similar result in their study. They observed 20% patients of dexmedetomidine group had hypotension. The hypotension due to dexmedetomidine can be explained by two ways. First, stimulation of central α-2 adrenoceptor leads to decrease norepinephrine release.[14] Second, dexmedetomidine could result in direct cardiovascular depression which results in hypotension.[15]

Incidence of bradycardia was similar in both groups. Prasad et al[16] also showed no difference in incidence of bradycardia between dexmedetomidine and fentanyl in pediatric cardiac surgical patients. Petroz et al[17] commented that incidence of bradycardia was modest at lower dose and did not warrant corrective action. They observed significant bradycardia with higher doses of dexmedetomidine (2, 4 and 6µg/kg/h).

Though the mean sedation score was higher in patients receiving dexmedetomidine than to fentanyl but it was not statistically significant. Prasad et al[17] also showed insignificant difference

in Ramsay Sedation Score between dexmedetomidine and fentanyl. Aksu et al[18] compared post-operative sedation between dexmedetomidine and fentanyl with a 3 point sedation scale and they also found no significant difference between these two drugs.

CONCLUSION

Both fentanyl and dexmedetomidine attenuate sympathetic response to laryngoscopy and intubation but this effect is not complete at lower doses. Blunting of heart rate is more effective with dexmedetomidine compared to fentanyl. Fentanyl causes fewer complications in terms of hypotension than dexmedetomidine.

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