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Comparison of Intravenous Fentanyl vs Dexmedetomidine in Attenuation of Pressure Response during Laryngoscopy and Endotracheal Intubation

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Abstract: ***Background: Haemodynamic changes during laryngoscopy and endotracheal intubation is usually transient, variable and unpredictable and proved to be fatal in patients with hypertension, coronary artery disease or intracranial hypertension which may lead to left ventricular failure, myocardial ischemia and cerebral hemorrhage. To 'blunt' this pressure response, various pharmacological agents have been tried which include adrenergic blockers, vasodilators, calcium channel blockers, lignocaine and opioids. We aimed to study comparative effect of i.v. Fentanyl vs Dexmedetomidine in attenuation of the pressure response during laryngoscopy and endotracheal intubation. Objective: This study was carried out to compare the effectiveness of Fentanyl vs Dexmedetomidine in attenuating the pressure response associated with laryngoscopy and endotracheal intubation. Materials and methods: The study was carried out on 40 patients belongings to ASA grade I and II, aged 15 to 65 years, including either gender, scheduled for elective surgical procedures under general anaesthesia. After ethical committee clearance, patients were divided into two groups.Group F: Inj. Fentanyl 2 mcg/kg diluted in 10 ml saline intravenously,Group D: Inj. Dexmedetomidine 0.5 mcg/kg diluted in 10 ml saline intravenously.Study drugs were administered 10 minutes before laryngoscopy and intubation.Hemodynamic parameters like heart rate, systolic, diastolic and mean arterial blood pressure, spo2 were measured at 2 minutes interval.Result:Increase in heart rate, systolic and diastolic blood pressure were more observed in fentanyl group and were statistically significant as compared to dexmedetomidine group fallowing administration of study drug. Conclusion: We conclude that i.v. Dexmedetomidine (0.5mcg/kg) is superior to i.v. Fentanyl (2 mcg/kg) as far as sympathetic stimulation concern.***

Keywords: Dexmedetomidine, fentanyl, Heamodynamic response, Intubation

1. Introduction

Intense noxious stimuli such as laryngoscopy and endotracheal intubation activate the sympathetic nervous system, inducing tachycardia and hypertension.[1] Controlling this post intubation pressure response is an important goal for modern anesthesia.

The pressure response, which is part of a huge spectrum of stress response, results from the increase in sympathetic and sympathoadrenal activity, as evidence by increased plasma catecholamines concentration in patients undergoing surgery under general anaesthesia.[2]

This hemodynamic change is due to reflex sympathetic discharge caused by epipharyngeal and laryngopharyngeal stimulation.[3]The rise in the heart rate and blood pressure is usually transient, variable and unpredictable. Though these changes are well tolerated by healthy individuals, they may be fatal in patients with hypertension, coronary artery disease or intracranial hypertension. Left ventricular failure, myocardial ischemia and cerebral haemorrhage may occur in high risk patients.[4]

To 'blunt' this pressor response, various methods have been tried, which includes,

- Deeper plane of anaesthesia with intravenous or inhalation agent
- Use of Propofol
- Curtailing the duration of laryngoscopy to less than 15 seconds
- Sympathetic blockage
- Lidocaine spray or gargles 3 minutes prior to intubation
- Use of intravenous Lidocaine to blunt the pressure response
- Use of ACE inhibitors e.g. Captopril, Enalapril 45 minutes prior to intubation
- Use of Magnesium sulphate
- Various antihypertensive and vasodilators e.g. IV Hydralazine, Ca+2 channel blocker like Nifedipine, beta blockers like Esmolol
- Use of Nifedipine
- Use of Opiods prior to induction e.g. Fentanyl, Sufentanyl or Alfentanyl
- Use of Nitroglycerine ointment, intravenous, sublingual spray, intranasal spray
- Use of Gabapentine
- Alpha -2 agonists like Clonidine

Various studies have shown that fentanyl is effective in blunting the pressure response to laryngoscopy and endotracheal intubation. If a small dose of fentanyl which is administered 5 minutes before an intubation can prevent this haemodynamic response.

Recently, Dexmedetomidine, an alpha -2 adrenergic agonist has been used for premedicationto blunt the stress response to surgical stimuli. It also decreased narcotic and anaestheticrequirements.

2. Materials and Methods

After approval from Institutional Ethical Committee, 40 patients of ASA Grade I and II in age group 15 - 65 years were included in the study.

The exclusion criteria were patient'srefusal,ASA physical status III and IV, patient with history of hypersensitivity to fentanyl and dexmedetomidine, patients with cardiovascular diseases like ischemic heart disease or hypertension, pregnant or lactating women.

Thorough pre-anaesthetic evaluation was carried out on the previous day and patients were explained regarding the procedure. Written informed consent was taken.In recovery room, Preoperative pulse and blood pressure were measured and considered as baseline parameters.All patients were pre-medicated with injection Glycopyrolate 0.04 mg/kg i.v. and injection Ondensetron 0.15 mg/kg i.v.

Study group

Group F – Inj. Fentanyl 2 mcg/kg diluted in 10 ml saline.

Group D- Inj. Dexmedetomidine 0.5 mcg/kg diluted in 10 ml saline.

Both drugs were given intravenously before 10 min of laryngoscopy andintubation according to their groups.

Preoxygenationdone with 100% O2 for 3 minutes.Patients were induced with inj.Thiopentone sodium (4-7 mg/kg) i.v. and inj. Succinylcholine(2 mg/kg) i.v. followed by laryngoscopy and intubation.Heart rate, systolic and diastolic blood pressure, spo2 recorded at 2 minute interval of drug administration up to 10 minutes.After intubation patients were maintained with isoflurane, O2 (50%), N2O (50%) and non-depolarizing muscle relaxant.At the end of surgery, patients were reversed with Inj. Glycopyrolate (0.01 mg/kg) i.v. and Inj. Neostigmine (0.05 mg/kg) i.v. and patients were extubated.

3. Results

(1)Patient Demographics:
The mean age of the patients in group F and D were 39.15±11.77 years and33.05±11.72 respectively. The mean weight of patients in groups F and D were 53.7±11.52 and 57 ±9.23 respectively (Table 1).Demographic data in both groups are comparableand there is no statistical difference between them(P value > 0.05).

(2)Heart Rate
It is observed that the heart rate increased in both groups immediately after endotracheal intubation and started to return to baseline value at the end of 10 minutes post intubation(Table 2).Base line heart rate of all patients of both groups were comparable andthere were no statistical difference between them (P value > 0.05).The increase in Heart rate was highly significant in group F as compared to group D during laryngoscopy and 1, 3, 5, 7 and 10 minutes after intubation (P value < 0.001).

(3)Systolic Blood Pressure
It is observed that the systolic blood pressure increased in both groups immediately after endotracheal intubation and started to return to baseline value at the end of 10 minutes post intubation(Table 3).Base line systolic blood pressure of all patients of both groups were comparable and there were no statistical difference between them (P value > 0.05).Theincrease in Systolic blood pressure was highly significant in group F as compared to group D during laryngoscopy and 1, 3, 5, 7 and 10 minutes after intubation (P value < 0.001).

(4)Diastolic Blood Pressure
It is observed that the diastolic blood pressure increased in both groups immediately after endotracheal intubation and started to return to baseline value at the end of 10 minutes post intubation(Table 4).Base line Diastolic blood pressure of all patients of both groups were comparable and there were no statistical difference between them (P value > 0.05).The increase in Diastolic blood pressure was highly significant in group F as compared to group D during laryngoscopy and 1, 3, 5, 7 and 10 minutes after intubation (P value < 0.001).

(5)Mean Arterial Blood Pressure
It is observed that the Mean Arterial Blood pressure increased in both groups immediately after endotracheal intubation and started to return to baseline value at the end of 10 minutes post intubation (Table 5).Base line Mean Arterial Blood pressure of all patients of both groups were comparable and there were no statistical difference between them (P value > 0.05).The increase in Mean Arterial blood pressure was highly significant in group F as compared to group D during laryngoscopy and 1, 3, 5, 7, and 10 after intubation (P value < 0.001).

4. Discussion

Laryngoscopy and intubation are two of the most consistent maneuvers that lead to significant increases in blood pressure and heart rate. This has been attributed to asympathetic response as evidenced by an increase in the circulating catecholamine levels. These changes were reported to be greatest 60 seconds after intubation of the trachea that last for 5-10 minutes.[5] Increase in the pulse rate and blood pressure which are usually transitory, variable and unpredictable. These are hazardous to those patients with hypertension, myocardial insufficiency or cerebrovascular diseases.[6] This reaction to laryngoscopy in such individuals may predispose to development of pulmonary edema, myocardial insufficiency and

cerebrovascular accident. Intravenous anesthetic induction agents do not adequately or predictably suppress the sympathetic responses evolved by endotracheal intubation.[7]This is by far the most important indication for attenuation of hemodynamic response to laryngoscopy and tracheal intubation.

Dexmeditomidine is safely and extensively used drug as a sedative and analgesic in general anaesthesia which provides hemodynamic stability. In our study we sought to compare fentanyl, one of the standard drug used for analgesia with Dexmedetomidine in regard to hemodynamic response during laryngoscopy and endotracheal intubation in adult patients undergoing elective surgery under general anaesthesia.

In our study, the mean age was 33.05 ± 11.72 years for Dexmeditomidine and 39.15 ± 11.77years for fentanyl group and mean weight of patients in groups F and D were 53.7±11.52 kg and 57 ±9.23 kg respectively. Demographic data in both groups are comparable and there is no statistical difference between them (P value > 0.05). There was no difference in the baseline parameters in our study (P >0.05). After drug administration heart rate (HR), Systolic blood pressure (SBP), Diastolic blood Pressure (DBP) and Mean arterialpressure (MAP) were more and statistically significant in Fentanyl group as compared to Dexmeditomidine group at 1, 3, 5, 7 and 10 minute after intubation (<0.001).

In study by SagarGandhi et al[8] it was observed that Dexmedetomidine when used as I.V. premedicant in dose of 0.6 µg/kg provides beneficial effect in attenuation of pressure response to laryngoscopy and endotracheal intubation as compare to fentanyl in dose of 2 µg/kg. The heart rate increased after laryngoscopy and intubationin both groups and it started to return to near normal values at the end of 10 minutes post intubation.Dexmedetomidine produces more significant attenuation of increase in heart rate, systolic blood pressure, diastolic blood pressure and mean blood pressure during laryngoscopy andintubation as compared to Fentanyl.

Sameenakousar et al[9] studiedcomparison of Fentanyl and Clonidine for attenuation of the haemodynamic response to laryngocopy and endotracheal intubation. This study showed that clonidine (2µg/kg) was superior to fentanyl (2µg/kg) in the attenuation of the pressure response and that the ideal time for its administration would be about 5 min before a laryngoscopy and an intubation.

Sanjeetaumbarkar et al[10] studied comparison of i.v. Fentanyl vs i.v. Dexmedetomidine for attenuation of cardiovascular response during laryngoscopy and trachealintubation in adult cardiac surgery. Dexmedetomidine is anexcellent drug even at 0.5µg/kg iv as compared to 2 µg/kg fentanyl iv before induction as an adjunct to generalanaesthesia for attenuation of hemodynamic cardiovascular response to laryngoscopy and tracheal intubation.

In a study by Karwar et al[7] they found dexmedetomidine 1µg/kg, i.v is more effective in attenuating hemodynamic pressure responses to laryngoscopy and intubation than inj. fentanyl 2µg/kg, i.v when given as premedication.

5. Conclusion

Dexmedetomidine(0.5mcg/kg) proved better than Fentanyl(2 mcg/kg) when given 10 minutes prior to intubation as far as attenuation of pressure response is concerned as i.v. premedicant.

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Table 1: Demographic data

	Group F	Group D	P value
Age (in years)	39.15±11.77	33.05±11.72	>0.05
Weight (in kgs)	53.7±11.52	57 ±9.23	>0.05

Table 2: Changes in heart rate in both groups

Heart rate (beats per min)		At Baseline	Pre Induction	After Induction	1 min after ETI	3 min after ETI	5 min after ETI	7 min after ETI	10 min after ETI
Group F	Mean	94.4	98.6	104.6	117.7	112.8	108.6	103.8	99.5
	SD	16.31	15.53	25.07	15.41	12.34	12.30	12.40	12.80
Group D	Mean	90.7	79.3	82.3	86.5	84	80.4	76.7	74.8
	SD	14.24	12.40	12.49	13.59	12.07	11.44	9.09	9.66
	P value	>0.05	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001

Table 3: Changes in systolic blood pressure in both groups

Heart rate (beats per min)		At Baseline	Pre Induction	After Induction	1 min after ETI	3 min after ETI	5 min after ETI	7 min after ETI	10 min after ETI
Group F	Mean	115.3	121.2	130.1	136.7	130.5	125.4	122.7	119.4
	SD	8.57	9.66	7.88	8.34	8.26	9.47	8.76	8.21
Group D	Mean	118.5	101.2	106.4	111	108.7	103	99	98
	SD	8.13	6.50	5.17	5.09	5.04	6.57	4.47	5.23
	P value	>0.05	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001

Table 4: Changes in Diastolic blood pressure in both groups

Heart rate (beats per min)		At Baseline	Pre Induction	After Induction	1 min after ETI	3 min after ETI	5 min after ETI	7 min after ETI	10 min after ETI
Group F	Mean	77.4	80.8	83.2	86.9	84	81.3	79.2	78
	SD	4.99	5.04	5.56	5.05	4.40	5.67	4.96	4.54
Group D	Mean	84.4	72.9	74.5	78	73.1	72.5	68.9	68
	SD	5.01	4.61	4.05	3.95	4.52	4.44	4.23	4.10
	P value	>0.05	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001

Table 5: Changes in Mean Arterial Pressure in both groups

Heart rate (beats per min)		At Baseline	Pre Induction	After Induction	1 min after ETI	3 min after ETI	5 min after ETI	7 min after ETI	10 min after ETI
Group F	Mean	90.03	94.27	98.83	103.5	99.5	96	93.7	91.8
	SD	5.57	6.22	5.71	5.59	5.24	6.61	5.83	5.16
Group D	Mean	95.77	82.33	85.13	89	84.97	82.67	78.93	78
	SD	3.82	3.99	3.41	3.69	3.52	4.13	3.46	3.65
	P value	>0.05	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001