Section: Anaesthesiology

Original Research Article

A STUDY TO COMPARE ADMINISTRATION OF DEXMEDETOMIDINE AND FENTANYL FOR STRESS ATTENUATION DURING LARYNGOSCOPY AND ENDOTRACHEAL INTUBATION

Syed Asrar Hussain[1], Khaja Ali Hassan[2], Hafsa Mehveen[3], Mohammed Irfan[3], Anwesh Farhana[3]

[1]Associate Professor, Department of Anaesthesiology, Deccan College of Medical Sciences, Hyderabad, Telangana, India.
[2]Professor, Department of Anaesthesiology, Deccan College of Medical Sciences, Hyderabad, Telangana, India.
[3]Post Graduate Student, Department of Anaesthesiology, Deccan College of Medical Sciences, Hyderabad, Telangana, India.

Received : 05/09/2023
Received in revised form : 03/10/2023
Accepted : 15/10/2023

Keywords:
Catecholamine release; Dexmedetomidine; Hemodynamic.

Corresponding Author:
Dr. Syed Asrar Hussain,
Email: drasrarh@gmail.com

DOI: 10.47009/jamp.2023.5.6.129

Source of Support: Nil,
Conflict of Interest: None declared

Int J Acad Med Pharm
2023; 5 (6); 625-628

Abstract

Background: Haemodynamic changes like hypertension and tachycardia occurs in response to instrumentation of larynx and trachea during direct laryngoscopy & endotracheal intubation. This is mainly due to reflex sympathetic stimulation. This is usually transient and variable, and is well tolerated by healthy individuals. However, these changes may be fatal in patients with hypertension, coronary artery disease and intracranial hypertension. **Materials and Methods:** Study – randomized, double blind, prospective. Ethical committee approval - obtained from Institute, Written informed consent - obtained from all the patients. 30 patients belonging to ASA I and II of both sexes divided into two groups(n=15) undergoing surgery under general anaesthesia were randomly selected for study. Patients of either sex with ASA I and II between 20 to 50 years of age undergoing surgeries were taken into study. **Result:** From our study, we observed that fentanyl attenuated but did not fully abolish the pressure response to laryngoscopy and intubation. Also we adequately establish that Dexmedetomidine 0.75 µg/kg was comparatively superior in attenuation of the haemodynamic changes during direct laryngoscopy. **Conclusion:** We conclude that Fentanyl when given before laryngoscopy and intubation was not fully effective in attenuating the sympathetic response, while Dexmedetomidine efficiently attenuates the haemodynamic changes to laryngoscopy and endotracheal intubation.

INTRODUCTION

The hemodynamic response to laryngoscopy and endotracheal intubation were recognised early through various studies. The induction of anaesthesia, laryngoscopy, endotracheal intubation and the surgical stimuli evoke cardiovascular responses that is manifested as alteration in systolic blood pressure, diastolic blood pressure, mean arterial pressure, heart rate and cardiac rhythm. This occurs mainly due to catecholamine release in response to sympathetic stimulation that occurs during tracheal intubation.

The response following laryngoscopy and intubation peaks at about 1 to 2 minutes and return to baseline within 5 to 10 minutes. Although the sympatho-adrenal responses probably cause little consequences in healthy patients, it is hazardous in patients with comorbid illness such as systemic hypertension, coronary artery disease (CAD), cerebrovascular disease (CVA), intracranial pathology and hyperactive airways.

In such cases, reflex circulatory response to tracheal intubation such as an increase in heart rate, blood pressure and disturbances in cardiac rhythm should be suppressed. Prof. King et al,[1] (1951) documented myocardial ischemic changes due to reflex sympatho-adrenal changes immediately following laryngoscopy and endotracheal intubation with a mean increase in systolic pressure of 40mmHg even in normotensive individuals. The hemodynamic responses during laryngoscopy and endotracheal intubation should be abolished to balance the myocardial oxygen supply demand which is a key note in the safe conduct of anaesthesia.

Attempts to reduce these untoward cardiovascular responses during laryngoscopy and endotracheal intubation lead to the trial of various systemic as well as topical agents. Various systemic and topical agents have been used to reduce these adverse hemodynamic

ISSN (O): 2687-5365; ISSN (P): 2753-6556

responses during laryngoscopy. The present concept of a definitive sympathetic over activity during laryngeal intubation clearly shows that a more protection against vagal over activity and the use of anticholinergic drugs alone may not be sufficient. Compared to systemic agents, administration of local anaesthetic solutions is likely to be of limited value in reducing these responses. The commonest strategies adopted are narcotics, vasodilator agents, β-blockers, calcium channel blockers, lignocaine, alpha 2 agonists and other sympatholytic agents. In our study, we have compared dexmedetomidine and fentanyl.[2]

Dexmedetomidine is a highly selective α2 receptor agonist having 8 times higher affinity and α2 selectivity compared to clonidine. Alpha 2 to alpha1 selectivity for dexmedetomidine is 1620:1 compared to 220:1 for clonidine. The different benefits of this drug are anxiolysis, sedation, analgesia and much better hemodynamic control without producing any respiratory depression. Because of the short duration of action, it does not interfere much with recovery from anaesthesia.[3]

Fentanyl is a potent narcotic with fast onset and short duration of action and it is commonly used in the context of balanced anaesthesia. Fentanyl given at a dose of 2 mcg /kg over 5 minutes before laryngoscopy and intubation attenuates the hemodynamic stress responses 21. Fentanyl is a synthetic opioid blunting the cardiovascular responses by its action on opioid receptors and thus decreasing sympathetic outflow.[4]

MATERIALS AND METHODS

After obtaining Institutional Review Board and patients written informed consent, the study was conducted in 30 patients belonging to ASA I and II of both sexes undergoing surgery under general anaesthesia were randomly selected for study. Patients of either sex with ASA I and II between 20 to 50 years of age undergoing elective surgeries requiring intubation were taken into study. All the patients were assessed clinically preoperatively and presence of any History regarding previous anaesthesia, surgery, any significant medical illness, medications and allergy were recorded. All patients were assessed by detailed physical examination supported by routine investigations. The study was carried out in a double-blind manner only the attending anaesthesiologist, but neither the patients nor the observer during the study period knew which study agent had been used.

The patients were randomly allocated to two groups of 30 with the help of a computer generated table of random numbers to receive following drugs:

Group D: Patients in this group received 0.75 microgram/kg of dexmedetomidine in 100ml of normal saline over 10 minutes and 5ml of normal saline given 5 minutes prior to laryngoscopy and intubation

Group F: Patients in this group received 100ml of normal saline over 10 minutes and 2 microgram/kg of fentanyl in 5ml of normal saline, 5 minutes prior to laryngoscopy and intubation

On admission, a thorough preoperative evaluation of the patient was done. A written informed consent was taken from the parents after explaining the procedure, its advantages and disadvantages. All the patients were given preoperative night sedation diazepam 10 mg orally. Basal vital parameters like heart rate, blood pressure and Oxygen saturation and ECG were recorded. Intravenous access was secured with appropriate size intravenous cannula. Group D received 0.75mcg/kg of Injection Dexmedetomidine in 100 ml of normal saline IV over 10 minutes and 5ml of normal saline 5 minutes before induction. Group F received 100 ml of normal saline over 10 minutes and Injection Fentanyl 2mcg/kg in 5ml of normal saline 5 minutes before induction. All these solutions of 100 ml and 5 ml were prepared by first anaesthesiologist. The second anaesthesiologist was blinded and was not aware of the groups, administered the drugs and monitored the patient recording vital parameters before intubation and at 1min, 5 min and 10min after laryngoscopy and endotracheal intubation according to the group to which they were assigned. The laryngoscopy and endotracheal intubation was performed by a third anaesthesiologist, who was also blinded to the drug given.

Patients were preoxygenated with 100% oxygen for 3 minutes. Patients were induced with Inj. Thiopentone 5mg/kg IV followed by Inj. Succinylcholine 1.5 mg IV. Laryngoscopy and intubation was then done and the time taken for the same was noted. After confirming the position of the endotracheal tube, anaesthesia was maintained for the next 10 minutes with 66% nitrous oxide, 33% oxygen and 1% isoflurane. All patients received Injection Vecuronium 0.1mg/kg IV bolus. No surgical stimulation was permitted for 10 minutes after intubation. The baseline, 1 minute, 5 minute and 10 minutes after intubation values of circulatory variables such as HR, SBP, DBP and MAP were recorded.

RESULTS

Out of 30 Subjects in the study, 15 subjects are in the Dexmedetomidine group and 15 subjects are in the Fentanyl group. Heart rate, SBP, DBP were compared in both the groups as follows.

- The mean values of baseline heart rate in the groups Dexmedetomidine and Fentanyl were 88.53 and 86.50 respectively and p value 0.52 is statistically non-significant.
- The mean heart rate at 1 minute after intubation in the groups Dexmedetomidine and Fentanyl were 87.97 and 103.23 respectively and p value less than 0.0001 is statistically significant.

ISSN (O): 2687-5365; ISSN (P): 2753-6556

- The mean heart rate at 5 minutes after intubation in the groups Dexmedetomidine and Fentanyl were 78.83 and 92.90 respectively and p value less than 0.0001 is statistically significant
- The mean heart rate at 10 minutes after intubation in the groups Dexmedetomidine and Fentanyl were 75.17 and 85.10 respectively and p value less than 0.0001 is statistically significant

Table 1: Base line heart rate and post intubation heart rate in both the groups at 1,5,10 minutes

HR (per min)	Group	N	Mean	Std. Deviation	P value
BASELINE	Group D	15	88.53	11.69	0.52
	Group F	15	86.50	12.63	
1 MINUTE	Group D	15	87.97	10.44	<0.0001
	Group F	15	103.23	14.41	
5 MINUTES	Group D	15	78.83	7.87	<0.0001
	Group F	15	92.90	13.46	
10 MINUTES	Group D	15	75.17	7.17	<0.0001
	Group F	15	85.10	11.94	

Systolic Blood Pressure (SBP) [Table 2]

- The mean values of baseline SBP in the groups Dexmedetomidine and Fentanyl were 121.23 and 124.40 respectively and p value 0.18 is statistically non-significant.
- The mean SBP at 1 minute after intubation in the groups Dexmedetomidine and Fentanyl were 122.10 and 136.80 respectively and p value less than 0.0001 is statistically significant.
- The mean SBP at 5 minutes after intubation in the groups Dexmedetomidine and Fentanyl were 112.67 and 125.20 respectively and p value less than 0.0001 is statistically significant
- The mean SBP at 10 minutes after intubation in the groups Dexmedetomidine and Fentanyl were 109.93 and 120.07 respectively and p value less than 0.0001 is statistically significant

Diastolic blood pressure (DBP) [Table 3]

- The mean values of baseline DBP in the groups Dexmedetomidine and Fentanyl were 79.10 and 79.60 respectively and p value 0.755 is statistically non-significant.
- The mean DBP at 1 minute after intubation in the groups Dexmedetomidine and Fentanyl were 78.23 and 87.00 respectively and p value less than 0.0001 is statistically significant.
- The mean DBP at 5 minutes after intubation in the groups Dexmedetomidine and Fentanyl were 72.33 and 80.00 respectively and p value less than 0.0001 is statistically significant
- The mean DBP at 10 minutes after intubation in the groups Dexmedetomidine and Fentanyl were 70.20 and 77.33 respectively and p value less than 0.0001 is statistically significant.

Table 2: Baseline SBP and Post intubation SBP at 1,5 and 10 minutes in both groups

SBP (mm Hg)	Group	N	Mean	Std. Deviation	P value
BASELINE	Group D	15	121.23	8.05	0.18
	Group F	15	124.40	9.94	
1 MINUTE	Group D	15	122.10	7.46	<0.0001
	Group F	15	136.80	9.37	
5 MINUTES	Group D	15	112.67	8.10	<0.0001
	Group F	15	125.20	9.58	
10 MINUTES	Group D	15	109.93	6.80	<0.0001
	Group F	15	120.07	9.53	

Table 3: Baseline DBP and Post intubation DBP at 1, 5 and 10 minutes in both group

DBP (mm Hg)	Group	N	Mean	Std. Deviation	P value
BASELINE	Group D	15	79.10	6.01	0.755
	Group F	15	79.60	6.33	
1 MINUTE	Group D	15	78.23	5.68	<0.0001
	Group F	15	87.00	5.53	
5 MINUTES	Group D	15	72.33	4.48	<0.0001
	Group F	15	80.00	5.81	
10 MINUTES	Group D	15	70.20	4.42	<0.0001
	Group F	15	77.33	5.77	

DISCUSSION

The sympathomimetic stress responses to laryngoscopy and endotracheal intubation results in an increase in myocardial oxygen supply demand ratio and might cause ischemia and acute heart failure in susceptible patients. Hypertension and tachycardia can occur even in normotensive patients during tracheal intubation and it is surprising that complications are rare in these patients probably because of its transient nature.[5]

Although many drugs have been tried to blunt these haemodynamic responses, none of them are fully satisfactory. But alpha 2 receptor agonists such as dexmedetomidine proved to be much efficacious compared to other agents that are currently employed to blunt pressor responses during tracheal intubation. An advantage of dexmedetomidine is the ability to provide a dose dependent sedation without producing respiratory depression. Fentanyl acts on the opioid μ receptors for its analgesic action. Since it also reduces

ISSN (O): 2687-5365; ISSN (P): 2753-6556

sympathetic outflow, it blunts the pressor response to laryngoscopy.[6]

Fentanyl is commonly used as part of general anaesthesia in a dose of 2 mcg/kg and this dose is effective for blunting the pressor response to laryngoscopy, when given five minutes before induction. In the present study, heart rate was significantly reduced in the dexmedetomidine group compared to fentanyl group and there was statistically significant reduction in heart rate up to 10 min after tracheal intubation in the dexmedetomidine group. The attenuation in systolic, diastolic and mean arterial pressures were significantly better in the dexmedetomidine group compared to the fentanyl group. These findings were also observed by Laha et al., and Bloor et al. In dexmedetomidine group, systolic and diastolic blood pressure did not significantly rise following laryngoscopy and tracheal intubation.[7]

Laha et al., studied the effect of pre induction intravenous loading dose of dexmedetomidine 1 mcg/kg on attenuation of sympatho-adrenal responses and requirements of anaesthetic agents. They concluded that the administration of dexmedetomidine not only attenuates the increase in heart rate and systolic blood pressure after intubation at 1, 2, 3 and 5 minutes but also significantly reduces the requirement of anaesthetic agents. The dose of dexmedetomidine used in this study was 1mcg/kg, in our study we used 0.75mcg/kg but the results were similar to our study.[8]

Scheinin et al., did a study on the effect of dexmedetomidine on laryngoscopy and endotracheal intubation and dose of thiopentone and fentanyl needed for surgery. They observed that dexmedetomidine not only blunts the haemodynamic response to tracheal intubation but also reduces the dose requirements of thiopentone and fentanyl. The plasma catecholamine concentrations were measured in this study and it was found that the concentration of norepinephrine in mixed venous plasma was lesser in the dexmedetomidine group during all phases of induction. This study measured plasma catecholamine levels but it was not done in our study.[9,10]

CONCLUSION

We conclude that dexmedetomidine in the dosage of 0.75 µg/kg given over ten minutes as an infusion in 100 ml normal saline, 5 minutes before intubation efficiently attenuates the haemodynamic changes to laryngoscopy and endotracheal intubation. Fentanyl in the dosage of 2 µg /kg given 5 minutes before laryngoscopy and intubation was not fully effective in reducing the increase in heart rate and blood pressure. Dexmedetomidine 0.75 µg/kg has proved to keep the haemodynamic in stable manner during laryngoscopy and endotracheal intubation. Hence Dexmedetomidine may be beneficial for cardiac patients where the haemodynamic responses to laryngoscopy and intubation are highly detrimental. In conclusion, dexmedetomidine is a highly selective α2 agonist has many desirable clinical benefits that encourage its use in the perioperative period.

REFERENCES

1. King BD, Harris LC Jr, Greifenstein FE, Elder JD Jr, Dripps RD. Reflex Circulatory response to direct laryngoscopy and intubation performed during general anaesthesia. Anesthesiology 1951; 12: 556-66.
2. Prys-Roberts C, Greene LT, Meloche R, Foex P. Studies of anaesthesia in relation to hypertension. Haemodynamic consequences of induction and endotracheal intubation. British Journal of Anaesthesia 1971;43: 531-47.
3. Russell WJ, Morris RG, Frewin DB. Changes in plasma catecholamine concentrations during endotracheal intubation. Br J Anaesth; 1981, 53:837-9.
4. D. R. Derbyshire 1983. Plasma catecholamine response to tracheal intubation. Br. J. Anaesth. 55(9); 855-860.
5. Scheinin B, Lindgren L, Randell T, Scheinin H, Scheinin M. Dexmedetomidine attenuates sympathoadrenal responses to tracheal intubation and reduces the need for thiopentone and preoperative fentanyl. Br J Anaesth 1992;68:16-31.
6. Bloor BC, Ward DS, Belleville JP, Maze M. Effects of intravenous dexmedetomidine in humans. II. Haemodynamic changes. Anaesthesiology. 1992;77:1134-42.
7. Uysal HY, Tezar E, Turnkoglu M. The effect of Dexmedetomidine on haemodynamic responses to tracheal intubation in hypertensive patients: a comparision with Esmolol and SuFentanyl. J Res Med Sci. 2012;17:22-31.
8. Laha A, Ghosh S, Sarkar S. Attenuation of sympathoadrenal responses and anaesthetic requirement by dexmedetomidine. Anaesth Essays Res. 2013;
9. Gandhi S, Goyal V, Radhakrishnan K, Balakrishnan M. Comparison of Dexmedetomidine with Fentanyl in Attenuation of Pressor Response during Laryngoscopy and Intubation. IOSR Journal of Pharmacy. 2014;4(2):28-38.
10. Bajwa SS, Kaur J, Singh A, et al. Attenuation of pressor response and dose sparing of opioids and anaesthetics with preoperative dexmedetomidine. Indian J Anaesth. 2012;56:123-28.

ISSN (O): 2687-5365; ISSN (P): 2753-6556