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A Comparative Study of Dexmedetomidine Versus Esmolol To Attenuate The Haemodynamic Pressor Response To Laryngoscopy And Intubation

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Abstract:
Introduction: *The cardiovascular responses during laryngoscopy and endotracheal intubation should be abolished to balance the myocardial oxygen supply and demand which is a key note in the safe conduct of anaesthesia. Attempts to reduce these untoward haemodynamic responses lead to the trial of various systemic as well as topical agents. This study was conducted to compare the efficacy of IV Dexmedetomidine and IV Esmolol to attenuate cardiovascular response during laryngoscopy and endotracheal intubation in normotensive patients.*
Objective*: To compare the effectiveness of dexmedetomidine or esmolol in attenuating the hemodynamic responses during laryngoscopy and endotracheal intubation.* ***Methods:*** *Hundred adult ASA I and ASA II patients were included in the study who underwent elective surgical procedures. Patients were divided into two groups. Group D receiving Dexmedetomidine 1.0 µ/kg as slow IV infusion over 10 min and Group E receiving Esmolol 1.0 mg/kg as slow IV infusion over 10 min. Study drug was injected 3 min before induction of anesthesia. Heart rate, systolic blood pressure, diastolic blood pressure, mean arterial pressure were recorded baseline, after study drug infusion, immediately and 1, 3, 5, 7 and 10 min. after intubation.*
Results: *Reading of heart rate, blood pressure and mean arterial pressure were compared with baseline and among each group. The rise in heart rate was minimal in dexmedetomidine group. Also the increase in systemic blood pressures and mean arterial pressure at the time of intubation and upto 10 mins. after intubation was minimal in dexmedetomidine group.*
Conclusion: *Administration of 1µg/kg slow IV dose of dexmedetomidine before induction of general anaesthesia significantly attenuated heart rates, blood pressures when compared to 1mg/kg slow IV dose of esmolol.*
Key words: *Dexmedetomidine, Esmolol, laryngoscopy, endotracheal intubation, pressure response.*

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I. Introduction

Direct laryngoscopy and endotracheal intubation is always associated with haemodynamic changes due to reflex sympathetic discharge caused by epipharyngeal and laryngopharyngeal stimulation.[1,2,3] This increased sympathoadrenal activity results in tachycardia, hypertension[4] and dysrrhythmias[5,6] which are potentially dangerous especially in hypertensive patients. These changes are maximum at 1 minute after laryngoscopy and intubation and last for 5-10 min. This increase in blood pressure and heart rate are usually transitory, variable and unpredictable.

Esmolol hydrochloride[7,8,9] is a cardioselective, intravenous β adrenoceptor antagonist. It has a rapid onset of action, exerts a peak haemodynamic effect within minutes, and possesses a short elimination half life of 9 minutes. Consequently it is proved ideal for control of short lived haemodynamic sequelae, associated with laryngoscopy and intubation.

Dexmedetomidine is a highly selective, specific & potent alpha- 2 adrenergic agonist. Compared to clonidine it is said to be 7-10 times more alpha- 2 selective & has a shorter duration of action than clonidine. Pre-treatment with dexmedetomidine attenuates hemodynamic response to tracheal intubation [10] and centrally decreases the sympathetic tone. Hence it is used in attenuating the intubation responses.

II. Aims And Objectives Of The Study

AIMS & OBJECTIVES:

To compare the attenuation of haemodynamic changes to laryngoscopy and intubation with IV Dexmedetomedine 1µg/kg and IV Esmolol 1 mg/kg.

To evaluate haemodynamic control by comparing Heart rate, Systolic Blood pressure, Diastolic Blood pressure and Mean arterial pressure to laryngoscopy and intubation in general anaesthesia.

III. Materials And Methods

This study was conducted in Government General Hospital attached to Guntur Medical College, Guntur in the time period from January 2018 to October 2018. After obtaining institutional ethical committee approval and written, informed consent, 100 people belonging to both sexes of ASA grade I / II, aged 18 yrs – 50 yrs were randomly allocated into 2 groups of 50 each, group D and group E, for this study.

Group D: Dexmedetomidine (1.0 µ/kg)

Group E: Esmolol (1mg/kg).

EXCLUSION CRITERIA:

1. Patient refusal.
2. Anticipated difficult laryngoscopy and intubation.
3. More than one attempt of intubation.
4. Patients who have hypertension(BP above 160/90 mm hg)
5. Patients who are on preoperative sedative medication, β blocker therapy.
6. Emergency surgeries
7. Patients with cardiorespiratory, hepatic and renal medical problems.

IV. Methodology

Group D: Dexmedetomidine 1.0 µg/kg as slow IV infusion over 10 min was given 3 min. prior to induction.

Group E: Esmolol 1.0 mg/kg as slow IV infusion over 10 min was given 3 min. prior to induction.

After recording baseline parameters IV line was secured with an 18G I.V cannula and all standard monitors like ECG, SPO_2, NIBP, TEMP were connected to all the patients. All patients were premedicated with IV ondansetron 0.08mg/kg, glycopyrrolate 4 µg/kg. Study drugs were premixed to a volume of 10ml using distilled water and were presented as coded syringes by an anaesthesiologist who was not involved in the study. The patient was given study drugs as slow I.V infusion over 10 mins using a syringe pump. The patient was pre-oxygenated for 3 min. after the study drug was given. Then the patient was given fentanyl 2µg/kg and induced with thiopentone sodium I.V 5-6 mg/kg. and laryngoscopy was attempted after the administration of suxamethonium I.V 2 mg/kg. The trachea was intubated with a cuffed ET tube. Laryngoscopy and intubation was completed within 30 sec.

Patients in both groups were monitored for the following :

1. Heart Rate
2. Systolic Blood Pressure
3. Diastolic Blood Pressure
4. Mean Arterial Pressure

Above parameters were recorded baseline, after study drug infusion, immediately and 1, 3, 5, 7 and 10 min. after intubation using multipara monitor. No surgical intervention was allowed throughout the study period of 10 min.

Anaesthesia was maintained with 66% nitrous oxide, 33% oxygen, intermittent bolus doses of vecuronium. At the end of the surgery all patients were reversed with neostigmine(0.05mg/kg) and glycopyrrolate(0.4mg) given I.V.

Patients were shifted to anaesthesia recovery room and monitored for complications such as pain, respiratory depression, hypertension, hypotension, bradycardia, drowsiness, rigidity, nausea or vomiting.

The results of both groups were compared and statistically analysed. The haemodynamic parameters were compared between the groups using paired t-test. Data was expressed as mean± SD. p value <0.05 was considered significant.

V. Observations And Results

TABLE1: DEMOGRAPHIC DATA

	Group – D (Dexmedetomidine)	**Group – E (Esmolol)**	**P value**
Age (mean±SD)	37.30±6.35	36.88±8.12	0.774
Sex (M:F)	33:17	30:20	
Weight (in kgs)	57.86±5.88	57.4±6.27	0.706
ASA status(I/II)	36:14	32:18	

TABLE 2: BASELINE HAEMODYNAMIC PARAMETERS

	Dexmedetomidine no:50(mean± SD)	**Esmolol n:50(mean± SD)**	**P value**
Heart rate	75.8±3.54	76.9±4.56	0.181
SBP	123.22±5.33	123.14±5.43	0.941
DBP	79.22±2.50	79.96±2.94	0.178
MAP	93.82±2.54	94.44±2.74	0.244

TABLE 3: COMPARISON OF HEART RATE BETWEENTHE TWO GROUPS

	Group	**Heart rate (bpm) mean ± SD**	**P value**
Base line	Group D	75.80±3.54	0.181
	Group E	76.90±4.56	
after study drug	Group D	76.44±3.73	0.519
	Group E	76.94±3.97	
After intubation			
0 min	Group D	78.94±3.68	0.657
	Group E	79.28±3.94	
1 min	Group D	84.50±3.84	<0.001
	Group E	91.66±5.74	
3 min	Group D	81.46±3.77	<0.001
	Group E	86.58±5.49	
5 min	Group D	78.66±3.61	0.0062
	Group E	83.26±5.03	
7 min	Group D	76.14±3.43	0.008
	Group E	80.20±4.57	
10 min	Group D	73.68±3.25	0.009
	Group E	77.70±4.80	

GRAPH : HEART RATE CHANGES IN GROUP-D AND GROUP-E

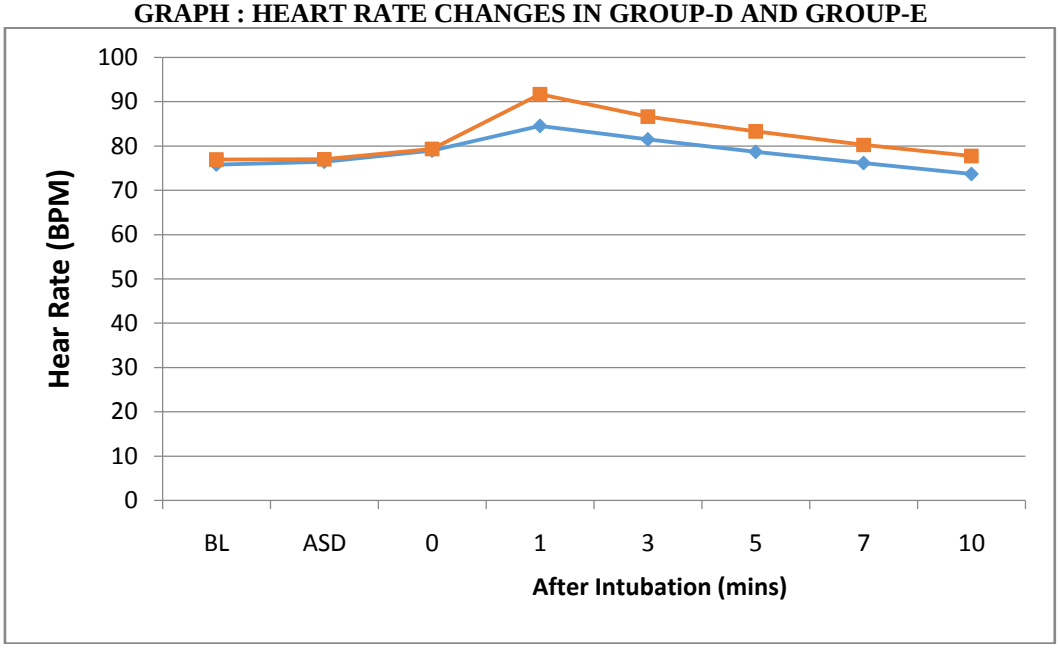


TABLE 4: COMPARISON OF SYSTOLIC BLOOD PRESSURE BETWEEN THE TWO GROUPS

	Group	SAP(mm of hg) mean ± SD	P value
Base line	Group D	123.22±5.33	0.941
	Group E	123.14±5.43	
after study drug	Group D	127.20±5.14	0.050
	Group E	125.28±4.51	
After intubation			
0 min	Group D	125.52±4.64	0.158
	Group E	123.96±6.20	
1 min	Group D	129.76±4.80	<0.001
	Group E	148.52±6.67	
3 min	Group D	121.04±5.62	<0.001
	Group E	139.52±6.65	
5 min	Group D	118.64±5.45	<0.001
	Group E	133.64±5.98	

7 min	Group D	117.6.±5.62	0.006
	Group E	128.34±5.53	
10 min	Group D	119.76±5.58	0.0071
	Group E	125.06±5.21	

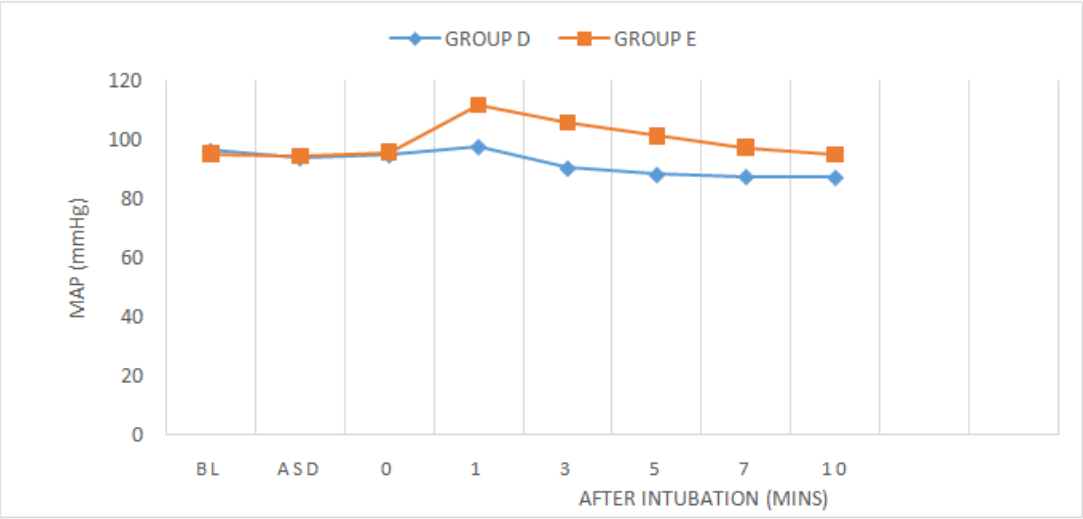
TABLE 5: COMPARISON OF DIASTOLIC BLOOD PRESSURE BETWEEN THE TWO GROUPS

	Group	DAP(mm of hg) mean ± SD	P value
Base line	Group D	79.22±2.49	0.178
	Group E	79.96±2.94	
after study drug	Group D	80.76±2.44	0.576
	Group E	81.06±2.88	
After intubation			
0 min	Group D	79.80±3.06	0.826
	Group E	79.94±3.27	
1 min	Group D	81.80±2.62	<0.001
	Group E	93.90±3.68	
3 min	Group D	75.16±2.63	0.002
	Group E	88.58±3.20	
5 min	Group D	73.04±2.52	<0.001
	Group E	84.92±3.26	
7 min	Group D	72.30±2.24	<0.001
	Group E	81.86±3.29	
10 min	Group D	70.78±1.70	0.004
	Group E	79.82±3.13	

TABLE 6: COMPARISON OF MEAN ARTERIAL PRESSURE BETWEEN TWO GROUPS

	Group	MAP	P value
Base line	Group D	93.82±2.54	0.244
	Group E	94.44±2.74	
after study drug	Group D	96.18±2.47	0.029
	Group E	95.06±2.57	
After intubation			
0 min	Group D	94.82±3.46	0.384
	Group E	95.58±5.07	
1 min	Group D	97.46±2.53	<0.001
	Group E	111.72±3.30	
3 min	Group D	90.30±2.66	0.001
	Group E	105.76±3.04	
5 min	Group D	88.18±2.66	0.007
	Group E	101.26±2.81	
7 min	Group D	87.48±2.52	0.010
	Group E	97.38±2.93	
10 min	Group D	87.24±2.63	0.032
	Group E	94.98±2.87	

GRAPH : MEAN ARTERIAL PRESSURE CHANGES IN GROUP- D AND GROUP- E



No patient in both the study groups got the adverse effects or complications like hypotension, bradycardia, or arrhythmias.

VI. Discussion

The efficacy of dexmedetomidine versus esmolol for attenuation of sympathomimetic response to laryngoscopy and intubation in elective surgeries was compared. Dexmedetomidine was administered in a dose of 1µg/kg over 10 min. as infusion, 3 min. prior to induction. Suppression of haemodynamic responses was found to be significant when compared to the baseline in this group of patients.

The most common side effects of dexmedetomidine are hypotension and bradycardia, which may occur more frequently during bolus dose. As we administered the prescribed dose over a period of 10 min. none of the patients in group – D had side effects like bradycardia and hypotension. Moreover haemodynamic stability is well maintained while attenuating haemodynamic responses to laryngoscopy and intubation.

In this study esmolol was administered in a dose of 1mg/kg over 10 min. as infusion, 3 min. prior to induction. Mercanooglu Efe et al[11].found that esmolol infusion was more effective than bolus esmolol on controlling systolic arterial pressure during both intubation and sternotomy, so we used esmolol as an infusion.

In the present study when comparing heart rates between the groups the attenuation of increase in heart rate is more significant in the group – D than group – E post intubation at 1,3,5,7 and 10 min.

Our study was in accordance with study of Nermin gogus et .al[12] who compared the effects of dexmedetomidine, fentanyl and esmolol on prevention of haemodynamic responses to intubation and concluded that dexmedetomidine(1µg/kg) was superior in the prevention of tachycardia when compared to esmolol and fentanyl.

In our study when comparing the SBP, DBP & MAP between the two groups, there was no significant change in the SBP, DBP & MAP in both the groups. The attenuation of SBP, DBP & MAP is more significant in the group – D than group – E post intubation 1,3,5,7 and 10 min.

Siddareddigari velayudha reddy et.al[13], did a similar study on dexmedetomidine versus esmolol to attenuate the haemodynamic responses to laryngoscopy and intubation and concluded that administration of single dose of dexmedetomidine before general anesthesia induction was an effective method for attenuating haemodynamic responses to tracheal intubation when compared to esmolol. The results of this study correlated with the results of our study.

Vinit kumar srivastava[14] et.al; did comparative evaluation of esmolol and dexmedetomidine for attenuation of sympathomimetic responses to laryngoscopy and intubation in neuro surgical patients and concluded that dexmedetomidine 1µg/kg is more effective than esmolol 1.5 mg/kg for attenuating the haemodynamic response to laryngoscopy and intubation in elective neuro surgical patients. The results of this study also correlated well with our study, the difference being the dose of esmolol(1.5mg/kg) given.

Venkatesh selvaraj et.al[15]; did a prospective randomized study to compare between IV dexmedetomidine 1µg/kg and esmolol 0.5 mg/kg for attenuation of haemodynamic responses to endotracheal intubation and concluded that dexmedetomidine 1µg/kg is more effective than esmolol 0.5mg/kg in attenuation haemodynamic responses to laryngoscopy and intubation in normotensive patients under general anaesthesia. The observations of this study were also similar when compared to present study, the difference being the dose esmolol 0.5mg/kg IV in this study in contrast to 1mg/kg IV in our study.

The main limitations of this study are firstly a placebo group should also be studied as a control in this study. In a control group, we expected abnormal haemodynamic responses which may lead to complications like exaggerated sympathetic responses of blood pressure and heart rates and also arrhythmias. Hence, to avoid these complications, we preferred a comparative study and we compared the haemodynamic variables after laryngoscopy and intubation with baseline preoperative values which are comparable in both groups. Second we included only normotensives because attenuation of intubation response is also important in normotensives and conducting the entire study in controlled hypertensives will be technically difficult to recruit patients as well as to standardize the confounding factors such as drug therapy. Our study has shown the effectiveness of Dexmedetomidine over Esmolol for attenuation of hemodynamic response in normotensive patients and further studies are awaited in hypertensive patients.

VII. Conclusion

In our study, comparison of dexmedetomidine versus esmolol for attenuation of haemodynamic responses during laryngoscopy and intubation demonstrated that administration of 1µg/kg slow IV infusion of dexmedetomidine before induction of general anaesthesia significantly attenuated heart rates and blood pressures when compared to 1mg/kg slow IV infusion of esmolol. Esmolol also attenuated heart rate and blood pressures, but the attenuation of blood pressure responses were more superior and significant with Dexmedetomidine.

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