Original Article

DOI: 10.7860/JCDR/2022/49987.16502

Anaesthesia Section

Intravenous Dexmedetomidine versus Intravenous Esmolol in Blunting the Laryngoscopy Response in Adult Normotensives undergoing Elective Surgeries: A Randomised Clinical Trial

JOHNS RACHEL JEMMIE[1], MV VIDYA[2], SEGARAN SIVAKUMAR[3], P NAGALAKSHMI[4], RV RANJAN[5], GEORGE KOSHY SAGIEV[6]

ABSTRACT

Introduction: A wide array of drugs are available for blunting the laryngoscopy response. Amongst them both dexmedetomidine, and esmolol belong to the non opioid group having least interference with the recovery process without causing significant respiratory depression, thus are suitable intervention for this purpose. Dexmedetomidine a sedative highly selective $\alpha 2$ adrenoceptor agonist and has an anaesthetic-sparing effect at induction. It suppresses the release of catecholamine in response to a noxious stimulant because of its central sympatholytic action. Esmolol with a different pharmacokinetic profile is a water soluble, cardio-selective, an ultrashort acting beta blocker has a short half-life ($t^{1/2}$) thus suited for suppressing the transient pressor reflexes following acute noxious surgical or anaesthesia stimuli.

Aim: To compare the degree of attenuation of the laryngoscopy response following the use of single preinduction dose (Intravenous infusion at a dose of 1 µg/kg) of dexmedetomidine with that of esmolol (intravenous bolus at a dose of 0.5 mg/kg) in adult normotensives undergoing elective intubations.

Materials and Methods: The randomised clinical trial was conducted in Pondicherry Institute of Medical Sciences, Puducherry, India from September 2016 to March 2018, on 60 patients of either sex, aged between 20-60 years with American Society of Anaesthesiologist (ASA) physical status I or II requiring elective intubations for general surgical procedures. The patients were randomly divided into two groups (n=30 each). Prior to induction group A received 1 µg/kg dexmedetomidine Intravenous (i.v.) infusion over 10 minute, and group B received 100 mL IV infusion of normal saline over 10 minute. Also 2 minute before laryngoscopy group A received 10 mL of normal saline (IV) bolus, whereas, group B received esmolol 0.5 mg/kg IV diluted in 10 mL of normal saline as a bolus. Heart Rate (HR), Systolic Blood Pressure (SBP), Diastolic Blood Pressure (DBP) and Mean Arterial Pressure (MAP) were recorded at baseline i.e, preprocedure before the study drug infusion, preinduction, at laryngoscopy (0 min) and 1, 3, 5 minute after intubation. A rise of MAP and/or HR more than 20% from the baseline was considered as positive laryngoscopy response. Student's unpaired t-test was used for analysis of intergroup variables. Intragroup variables were analysed using repeated measures Analysis of Variance (ANOVA).

Results: Mean age of patients in group A was 38.77±13.082 years and group B was 37.20±13.069 years (p-value=0.644). Results revealed that both the groups had an increase in HR and MAP at 1 minute after laryngoscopy and intubation. Mean readings of MAP showed a maximum rise of group A (2.15%) vs group B (7.25%) from the baseline readings at 1 minute following laryngoscopy which showed no statistical significance. The maximum HR increase following laryngoscopy was at 1 minute in group A (8.28%) vs group B (13.59%), which were below the positive laryngoscopy response. The mean HR, SBP, DBP and MAP recorded at preinduction, at laryngoscopy, 1, 3 and 5 minutes following intubation showed no statistical difference (p-value >0.05) between the two groups.

Conclusion: Usage of single dose preinduction dexmedetomidine iv infusion 1 µg/kg over 10 minute was found to be equally effective in blunting the pressor response to laryngoscopy and intubation when compared to bolus dose of iv esmolol 0.5 mg/kg given 2 minute prior to laryngoscopy.

Keywords: Anaesthesia, Haemodynamic response, Intubation, Laryngoscopy

INTRODUCTION

The pressor response to laryngoscopy is a recognised phenomenon in anaesthesia. Laryngoscopy and intubation causes an intense reflex which produces a significant rise in heart rate, blood pressure, due to an increase in sympathoadrenergic pressor response. The response begins within 5 sec of laryngoscopy, peaks at 1-2 min and returns to normal levels in 5 min [1].

Variety of agents targeting either peripheral or central components of pressor response have been used to blunt intubation response which includes short acting opioids, calcium channel blockers, topical lignocaine spray, cardioselective beta-blockers, magnesium sulphate, α^2 adrenergic agonist, vasodilators with varying degree of success. But the search for an ideal agent still continues [2,3].

Dexmedetomidine primarily a sedative is a highly selective α^2 agonist, has been tried at variable doses for the purpose of blunting the pressor response and also for its varied properties of anxiolysis and anaesthetic adjuvant effect without respiratory depression when used as sedative analgesic [4]. Dexmedetomidine acts at locus coeruleus to produce its sympatholytic action. However, data on the equivalent dose of dexmedetomidine with that of esmolol which is already a known drug for attenuation of pressor response to direct laryngoscopy and tracheal intubation are limited.

Esmolol is a cardioselective β1- adrenergic receptor blocker and its ultra-short action is due to its short distribution half-life of 2 min and an elimination half-life of 9 min. The negative chronotropic and ionotropic effects of esmolol is due to its β adrenergic antagonism which leads to a decrease in cardiac output [5]. Doses ranging from 0.5-2 mg/kg iv have been used in previous studies for the purpose of obtunding pressor response [6-8]. As the consensus regarding the optimum dose as well as the mode and timing of delivery for esmolol has not been reached [9], this study is among the few studies conducted to determine the efficacy and the comparability of these two drugs with different pharmacokinetic profile in attenuation of pressor response following elective intubations.

The primary outcome was to study and compare the efficacy of intravenous dexmedetomidine versus intravenous esmolol in ablating the pressor response to laryngoscopy and endotracheal intubation in normotensives undergoing elective surgeries. The secondary outcome was to assess the associated complication that may arise during laryngoscopy and intubation following the drug administration.

MATERIALS AND METHODS

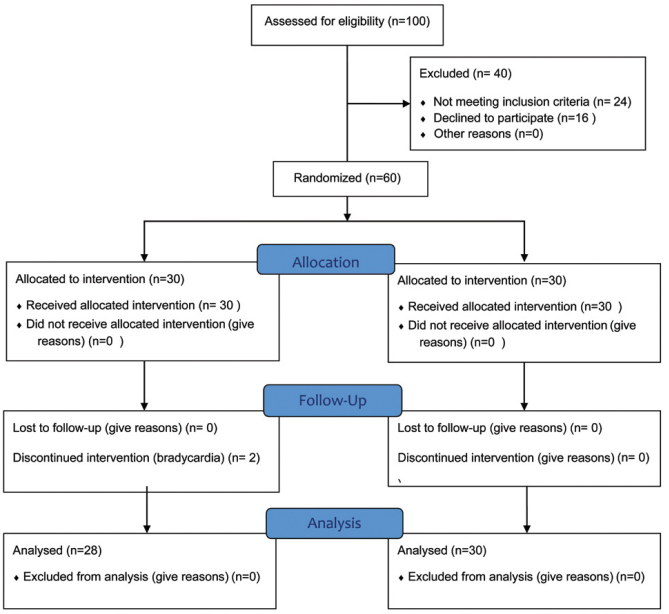
The randomised double-blinded clinical study was conducted in Pondicherry Institute of Medical Sciences, Puducherry, India from September 2016 to March 2018, after approval by the Ethical and Scientific Committee. The protocol was registered at Clinical.Trial.Gov (CTRI Reg.No-REF/2018/03/018870).

Sample size calculation: In a study by Gogus N et al., [10] the mean HR of dexmedetomidine and esmolol group at 1 min postintubation was 82.27±8.25 beats/min and 89.38±10.6 beats/min, respectively. The sample size was calculated by estimating the difference between two means, with the level of significance at 0.05% (95% Confidence) and 80% power. The sample size was estimated at 54 for two groups, i.e. 27 samples per group. Finally, 30 patients in each group were recruited to compensate for a probable 10% non response rate.

Inclusion criteria: Total 60 patients aged between 20-60 years of age undergoing elective surgeries under general anaesthesia, were included for the study, after taking informed and written consent.

Exclusion criteria: Patients with anticipated difficult intubation, patients with ischaemic heart disease, hypertension, chronic obstructive pulmonary disease, diabetes, and those on any cardiovascular medications were excluded from the study.

Total 100 patients were assessed for eligibility. Sixty patients completed the study criteria for randomisation. Forty patients dropped out of the study. A total of 60 patients who met the inclusion criteria were studied. Out of 60 patients two patients developed complications and had to be excluded, the rest completed the study [Table/Fig-1].



[Table/Fig-1]: Consolidated Standards of Reporting Trials (CONSORT) flow diagram of the patients included in the study.

Study Procedure

Patients and the observer recording the parameters were blinded to the study. The patients were randomised into two groups with computer generated random numbers. Patients were kept nil per oral for 8 hours prior to surgery. Intravenous (iv) maintenance fluid with ringer lactate was started for all patients in the holding area.

Following the transfer to the operation room patients were premedicated with 0.01 mg/kg iv midazolam. There after standard monitors like Non Invasive Blood Pressure (NIBP), SpO_2 and Electrocardiogram (ECG) with-II and V5 lead were connected and baseline parameters were recorded. A qualified anaesthesiologist who was not involved in the recording of study parameters or performance of laryngoscopy administered the loading dose of the study drug as per group allotted .

- Group A received dexmedetomidine 1 µg/kg added to 100 mL normal saline infusion which was started by a separate set through a three-way connector at a rate of 10 mL/min 10 minutes prior to induction.
- Group B had no drug added to 100 mL normal saline. Similarly, 2 minutes prior to laryngoscopy, Group B received esmolol 0.5 mg/kg diluted to 10 mL with normal saline as bolus over 30 sec and Group A received 10 mL of normal saline as bolus.

Patients were preoxygenated during infusion of the study drug for 3 minutes with 100% oxygen after which general anaesthesia was induced with fentanyl, iv 2 µg/kg; Induction agent thiopentone, iv (titrated untill the eyelash reflex was lost); with sevoflurane, 2% in 100% oxygen and checked for mask ventilation following which vecuronium, iv 0.1 mg/kg was given. Laryngoscopy and intubation was performed after mask ventilation for 4 minutes by the consultant anaesthesiologist blinded for the group allocation. Those patients in whom endotracheal intubation took more than 45 sec, those in whom heart rate dropped to less than 50 bpm, a drop in SBP more than 20% of baseline were appropriately managed but were excluded from the study.

Patients who presented with heart rate of 50 beats per min with haemodynamic compromise received atropine 0.5 mg as required and decrease in MAP <65 mmHg or SBP less than 20% below the baseline value for >60 sec was defined as hypotension received a dose of rescue with ephedrine of 100 µg/kg.

Anaesthesia was maintained with isoflurane 1-1.5% with a fresh gas flow of 2 L per minute (50% N_2O in O_2).The haemodynamic parameters Heart Rate (HR), Systolic Blood Pressure (SBP), Diastolic Blood Pressure (DBP), and Mean Arterial Pressure (MAP) were measured and recorded by the observer prior to induction (p), immediately at laryngoscopy (t0) and 1 (t1), 3 (t2), 5 (t3) minutes after intubation in all patients. Baseline haemodynamic parameters were measured prior to infusion of study drug that is preprocedure (p) and all the other measurements were compared with these basal levels. The MAP and/or HR >20% rise from baseline was taken as positive laryngoscopy response.

After the measurements were noted, the surgical incision was given. The rest of the anaesthetic management was decided by the attending anaesthesiologist.

STATISTICAL ANALYSIS

Statistical Package for Social Sciences version 17.0 for windows was used for all statistical methods. Demographic data was presented as frequency and percentage. Categorical variables were analysed using the Chi-square test. Repeated-measurements one-way Analysis of Variance (ANOVA) was used for intragroup analysis of haemodynamic responses to induction and intubation followed by

paired t-test with Bonferroni's correction. Student's unpaired-t test was used for analysis of inter group variables. Continuous variables are presented as mean±SD. A value of p<0.05 was considered the minimum level of statistical significance.

RESULTS

The two groups had comparable demographic profile [Table/Fig-2]. Regarding complications however, two patients in the dexmedetomidine group developed bradycardia which required intervention and hence were excluded from the study. They were excluded from the study following initial randomisation; for the comparison of demographic profile their data has been included, however, further statistical analysis was not carried out for these subjects.

Demographic profile (mean)	Group A (n=30)	Group B (n=30)	p-value
Age (years) mean±SD	38.77±13.082	37.20±13.069	0.644
Weight (Kg) mean±SD	68.30±10.419	64.60±7.691	0.124
Gender			
Male	20	21	0.781
Female	10	9	
American society of anaesthesiology status			
I	24	22	0.542
II	6	8	

[Table/Fig-2]: Distribution of study population by age and weight.

Mean HR at baseline was comparable in both the groups (p-value=0.273). There was no statistical difference between the two groups in terms of heart rate response at any of the time points. In group A, HR reached below the baseline at the end of 5 min [Table/Fig-3].

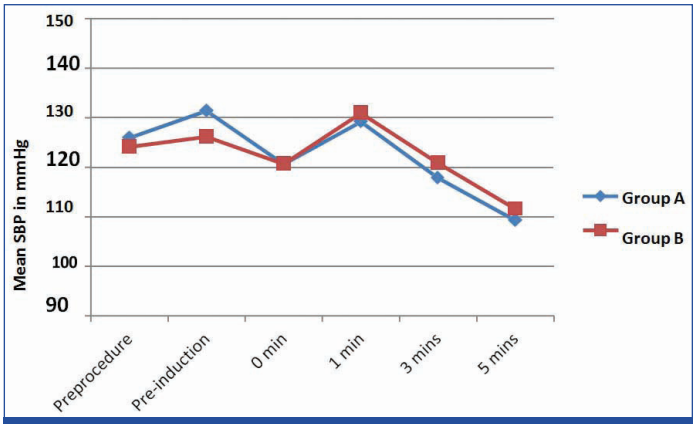
Heart beat (beats/min) time	Group A (n=28) Mean±SD	Group B (n=30) Mean±SD	p-value (Unpaired t-test)
Baseline preprocedure	82.1±12.6	78.50±12	0.273
Preinduction	86.2±17	81.03±14	0.212
At laryngoscopy-0 min	85.4±10.5	85.3±18	0.995
After intubation			
At 1 min	88.9±14.2	89.2±15.7	0.952
At 3 min	83.75±13.6	84.67±15.54	0.812
At 5 min	80.86±12.3	80.40±15.12	0.90

[Table/Fig-3]: Mean Heart Rate (HR) among groups.
*p-value <0.05 was considered as statistically significant

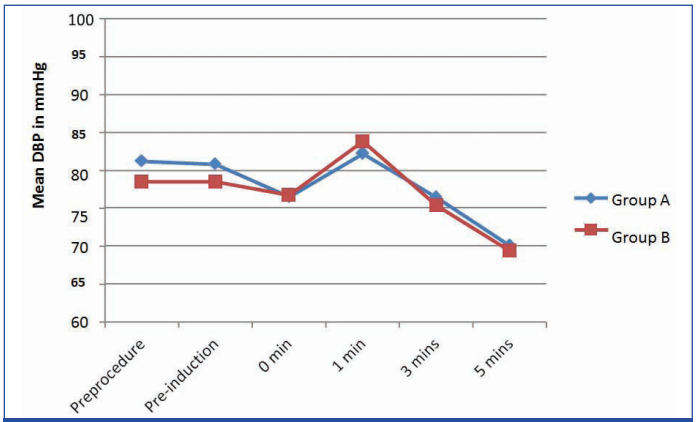
The mean SBP at baseline was comparable to start with and following the drug infusion, the difference between the two groups was not statistically significant at any of the time points (p=0.622). On intragroup analysis, there was a maximum rise of SBP from the baseline values at 1 min following laryngoscopy (2.62% vs 5.39%) group A vs group B not exceeding the positive laryngoscopy response (MAP >20% baseline). In both the groups following induction the mean SBP at laryngoscopy (0 min) and 3 min values of SBP were below the baseline and the changes persisted thereafter [Table/Fig-4].

There was no statistically significant difference in the mean diastolic blood pressure at various time intervals between the two groups (p-value=0.838). The values of mean diastolic blood pressure at laryngoscopy and subsequent values following 3 min of intubation were all below the baseline values in both the groups [Table/Fig-5].

Regarding MAP both the groups had a decrease in MAP readings below the baseline at laryngoscopy that is at 0 min readings and following 3 min of laryngoscopy. However there was no episode of hypotension in either of the groups. Both the groups had a maximum rise in MAP readings at 1 min following which was not statistically significant [Table/Fig-6]. There was no group-wise difference at any of the time points (p-value=0.737).



[Table/Fig-4]: Comparison of mean Systolic Blood Pressure (SBP) between group A and group B. (p-value was calculated using unpaired t-test).



[Table/Fig-5]: Comparison of mean Diastolic Blood Pressure (DBP) between group A and group B (p-value was calculated using unpaired t-test).

MAP (mmHg) time	Group A (n=28)	Group B (n=30)	p-value (Unpaired t-test)
Baseline preprocedure	96.09±8.1	93.7±9.7	0.308
Preinduction	97.7±14.9	94.89±14.9	0.465
At laryngoscopy-0 mins	93.82±20.3	90.9±16.5	0.559
After intubation			
At 1 min	98.16±17.6	100.5±17.5	0.616
At 3 min	90.35±14.1	90.11±11.8	0.943
At 5 min	82.7±11.9	82.7±9.6	0.997

[Table/Fig-6]: Comparison of Mean MAP in Group A and Group B.
MAP: Mean arterial pressure
*p-value <0.05 was considered as statistically significant

There was an increase in heart rate maximally at 1 min following intubation, the percentage rise (8.28% vs 13.59%) from the baseline values were below the margin for positive laryngoscopy response in both the groups. Although 1 min HR response in group B showed statistically significant rise in heart rate it was not considered clinically significant.

Repeated measures ANOVA for group A and group B in relation to HR revealed that both the groups had <15% increase in heart rate rise from the baseline and the HR reached the baseline within 5 min in group A. Whereas, it took more than 5 min in group B [Table/Fig-7,8]. There was no group-wise difference at any of the time points (p-value=0.471).

On intragroup analysis there was a rise of SBP from the baseline values in both the groups following the drug infusion that is preinduction (4.36% vs 1.61%) and in both the groups percent rise in SBP readings at 1min following laryngoscopy (2.62% vs 5.39%) did not exceed the positive laryngoscopy response (MAP >20% baseline). Repeated measures ANOVA for group A and group B with relation to SBP revealed statistically significant decrease in SBP from baseline values at 5 min following intubation which was well above the range of hypotension [Table/Fig-7,8].

Parameters \ Time interval	Baseline (Mean±SD)	Before induction		At laryngoscopy 0 min		1 min after intubation		3 min after intubation		5 min after intubation	
		(Mean±SD)	p-value	(Mean±SD)	p-value	(Mean±SD)	p-value	(Mean±SD)	p-value	(Mean±SD)	p-value
HR (beats/min)	82.1±12.6	86.2±17	1	85.4±10.5	1	88.9±142	0.58	83.7±13.6	1.00	80.8±12	1.000
SBP (mmHg)	125.9±13	131.43±21.7	1	120.64±26.6	1	129.21±25	1	117.86±17.6	0.25	109.32±18	0.002*
DBP (mmHg)	81.21±8.302	80.82±11.2	1	76.54±23.6	1	82.21±15.2	1	76.46±13.1	0.94	70.07±11.4	<0.001
MAP (mmHg)	96.09±8.1	97.77±14.9	1	93.82±20.33	1	98.16±17.7	1	90.35±14.1	0.36	82.69±11.9	<0.001

[Table/Fig-7]: Comparison of study parameters to baseline parameters within the group Dexmedetomidine group (n=28).
Repeated measure ANOVA was used for intragroup comparison of haemodynamic variables at various time intervals to the baseline value; *p-value <0.05 was considered as statistically significant

Parameters \ Time interval	Baseline (Mean±SD)	Before induction		At laryngoscopy 0 min		1 min after intubation		3 min after intubation		5 min after intubation	
		(Mean±SD)	p-value	(Mean±SD)	p-value	(Mean±SD)	p-value	(Mean±SD)	p-value	(Mean±SD)	p-value
HR (beats/min)	78.5±12	81.0±14	1	85.3±17.9	0.701	89.17±15.7	0.01*	84.67±15	0.496	80.40±15	1.00
SBP (mmHg)	124.17±13.2	126.2±20.8	1	120.70±23.1	1	130.97±23.9	1	120.87±17.7	1	111.6±11.87	0.001*
DBP (mmHg)	78.50±9.45	78.5±12.3	1	76.7±16.3	1	83.80±14.4	1	75.4±11.8	1	69.4±10.03	0.001*
MAP (mmHg)	93.7±9.7	94.9±14.9	1	90.9±16.5	1	100.5±17.5	0.894	90.11±11.8	1	82.7±9.6	<0.001

[Table/Fig-8]: Comparison of study parameters to baseline parameters within the group Esmolol group (n=30).
Repeated measure ANOVA was used for intragroup comparison of haemodynamic variables at various time intervals to the baseline value; *p-value <0.05 was considered as statistically significant

Similar trends were observed for the mean DBP readings which showed a maximum rise of (1.23% vs 6.75%) from the baseline values of DBP at 1 min of laryngoscopy between the two groups, following which the mean DBP readings reached below the baseline values at 3 min of laryngoscopy [Table/Fig-7,8].

On intragroup analysis the mean readings of MAP showed a maximum rise of (2.15% vs 7.25%) from the baseline readings at 1 min following laryngoscopy which showed no statistical significance. Also similar to SBP readings there was a decrease in MAP readings from the baseline values in both the groups at laryngoscopy that is 0 min values, 3 min and 5 min following laryngoscopy. Although the 5 min laryngoscopy values showed a statistically significant decrease in MAP readings (13.94% vs 11.755%) from the baseline, in both the groups, there was no drop in the hypotensive range, thus it was not considered clinically significant [Table/Fig-7,8].

DISCUSSION

Both esmolol and dexmedetomidine have been studied for their role in ablation of the pressor response to laryngoscopy and tracheal intubation. The adjuvant effect of these drugs, with anaesthesia induction agents, result in hypotension and bradycardia when given before laryngoscopy is dependent on the dose used.

In this study iv dexemedetomidine infusion in a dose of 1 µg/kg 10 min prior to induction was found to be equally effective to iv esmolol bolus in a dose of 0.5 mg/kg when given 2 minutes prior to laryngoscopy in attenuating the response to endotracheal intubation.

Both the pressor response and the haemodynamic effects of esmolol are short-lived. The peak of transient haemodynamic reflexes occurs approximately 60-90 seconds after the laryngoscope is first introduced [11-13]. Therefore, it is assumed that maximum sympathetic response occurs 30-80 seconds after endotracheal intubation as routine laryngoscopy and intubation takes (approximately 10-30 seconds) [14-19]. The pharmacokinetic profile of esmolol, having a distribution half time of approximately 2 minutes, with a peak effect at 2 min after a bolus injection and an elimination half-life of 9 minutes is ideal for blunting the pressor response during the transient period following laryngoscopy and tracheal intubation [20,21]. Various studies have compared both bolus dose versus continuous dose of esmolol for this purpose. In the meta-analysis conducted by Figueredo E and Garcia-Fuentes EM it was concluded that iv esmolol, when used as a continuous infusion in a dose of iv bolus loading dose of 500 µg/kg/min over 4 min followed by continuous infusion dose of 200-300 µg/kg/min, for the purpose of blunting laryngoscopy response following rapid sequence induction, had minimal adverse effects [9].

In a study by Bensky KP et al., the dose-related effects of two low bolus doses 0.2mg/kg and 0.4 mg/kg of esmolol on HR and BP responses to laryngoscopy and intubation were compared [22]. Their results were similar to the Canadian Multicentre trial, that is the control of SBP increase following laryngoscopy was blunted more effectively when esmolol was used in a dose of 0.4 mg/kg along with the narcotic as compared to the esmolol dose of 0.2 mg/kg with the same dose of narcotic comparing dose-related effects.

As the effects of esmolol rapidly dissipates, peak effects of beta blockade can be timed to occur simultaneously with the peak of stimulation from laryngoscopy and intubation for effective blunting of haemodynamic changes [23]. Thus, in this study esmolol iv bolus was timed 2 min prior to laryngoscopy.

As both the drugs compared have a totally different pharmacokinetic profile, this study compared the efficacy of iv dexemedetomidine vs iv esmolol on attenuation of pressor response to laryngoscopy. As both the drugs have shown to have anaesthetic sparing effect at induction, thus low dose narcotic was used in a dose of 2µg/kg fentanyl after induction. Also the purpose of selecting low dose esmolol iv bolus compared to infusion of iv dexmedetomidine was to avoid any adverse effects of either of the drugs [24,25].

Dexmedetomidine is a potent alpha-2 agonist, when used as an iv infusion at a dosage of 1 µg/kg, has an onset of action at about 5 min and has a peak effect which occurs within 15 min. Its elimination half life is about 2-3 hrs [26,27]. The biphasic blood pressure response is seen with dexmedetomidine. Following a bolus dose initially at higher concentrations, a transient increase in blood pressure and systemic vascular resistance is seen due to its action on peripheral $\alpha 2$ receptors on vascular smooth muscle. With decaying concentration, activation of postjunctional vascular α 2 receptors leads to decrease in blood pressure and cardiac output. Non linear concentration-dependent pharmacokinetics of dexmedetomidine is accounted for its sympathetic and its sympatholytic effects [28,29].

In the study by Alagol A et al., compared iv dexmedetomidine vs iv esmolol in an infusion form for attenuating laryngoscopy response. Esmolol was found to be more efficacious in an infusion form when used in a dose of 1mg/kg followed by 250 µg/kg/min [30].

Li Z et al., conducted a meta-analysis comparing iv dexmedetomidine vs iv esmolol for blunting pressor response following rapid sequence Intubation [31]. It was concluded that compared to esmolol, dexmedetomidine is more effective in blunting the haemodynamic response to tracheal intubation after rapid sequence induction. In yet another study by Ebert TJ et al., patients receiving a single preinduction intravenous bolus 200 mg of esmolol had a 50% attenuation of pressor response following rapid sequence induction, as compared with the placebo group (p-value <0.05) [32].

The above studies point out that as rapid sequence induction poses an exaggerated pressor response thus, explaining the shortfall of

esmolol in low doses when compared to dexmedetomidine in blunting the pressor response.

In this study, dexmedetomidine at 1.0 µg/kg as intravenous infusion over 10 min was administered and two patients had bradycardia and hypotension. Dexmedetomidine can have an adjuvant effect with opioids in causing bradycardia and has shown to reduce opioid requirements [33]. Higher doses of dexmedetomidine have been associated with the risk of bradycardia and hypotension and 1 µg/kg dexmedetomidine was considered as a safer dose. However, bradycardia was encountered in two patients for whom dexmedetomidine 1 µg/kg was given which was treated with injection atropine 0.6 mg.

This was in extrapolation to the study conducted by Bloor BC et al., where in amongst healthy young men with low resting heart rates, three patients had bradydysarhythmia within minutes of dexmedetomidine infusion. However, in this study, both the patients who had bradycardia were ASA I normotensives, and had normal resting heart rates [29].

When compared for HR and SBP, there was a mild preinduction rise in HR (4.99% vs 3.18%) and SBP (4.36% vs 1.61%), noted in the dexmedetomidine group, The findings were similar to the study conducted by Bajwa SJ et al., where they noted a transient rise in HR and MAP for 3-5 min after the start of dexmedetomidine infusion which can be explained by the appearance of vasoconstriction effect before the central sympathetic action [34].

However, comparing postintubation values there was a maximum rise of heart rate (8.28% vs 13.59%) at 1 min following intubation, in both the groups, reaching baseline values at 5 min in dexmedetomidine group. Maximum percentage rise in SBP readings were noted at (2.62% vs 5.39%) 1 min following intubation which was less than positive laryngoscopy response (MAP >20% from baseline). There was a statistically significant decrease in SBP following 5 min after intubation however there was no episode of hypotension. There was no statistically significant difference (p-value=0.993) between the postinduction values of SBP between the two groups.

Most of the studies, where dexmedetomidine was compared with esmolol for obtunding the responses during rapid sequence intubation, considered dexmedetomidine to be more efficacious in this regard [31]. This study followed an elective intubation with the use of low-dose narcotic along with iv induction agent and the test drug. Thus, timing these drugs by making use of the pharmacokinetic properties of these two drugs and the choice of drug dosage will determine the efficacy of its action. However as discussed in the study by Miller DR et al., various factors could independently influence the pressor response like the baseline values of haemodynamic parameters, premedication and the effect of opiates [23]. Thus, comparison of these two drugs in various studies in the same dosages have given varied results, which calls for the need to determine other factors which may have a role in effecting its efficacy like patient factors, choice of induction agents, usage of narcotics.

Limitation(s)

Firstly, the results cannot be applied to ASA III and IV. Secondly, as authors did not opt for invasive arterial BP monitoring and the lack of serum catecholamine level measurements would have given more objective results.

CONCLUSION(S)

This study showed that both intravenous dexmedetomidine 1 mcg/kg infused over 10 minutes prior to induction and esmolol intravenous bolus 0.5 mg/kg given 2 minutes prior to intubation were equally effective in suppressing the laryngoscopic response to intubation. To conclude both the drugs were able to attenuate the pressor response by almost two-third as seen by percentage limitation of the post-intubation rise of heart rate and blood pressure within 10-15%.

REFERENCES

[1] Keniya VM, Ladi S, Naphade R. Dexmedetomidine attenuates sympathoadrenal response to tracheal intubation and reduces perioperative anaesthetic requirement. Indian J Anaesth. 2011;55(4):352-57.
[2] Kovac AL. Controlling the haemodynamic response to laryngoscopy and endotracheal intubation. J Clin Anesth. 1996;8(1):63-79.
[3] Bruder N, Ortega D, Granthil C. Consequences and prevention methods of haemodynamic changes during laryngoscopy and intratracheal intubation. Ann Fr Anesth Reanim. 1992;11(1):57-71.
[4] Shin HW, Yoo HN, Kim DH, Lee H, Shin HJ, Lee HW. Preanesthetic dexmedetomidine 1 µg/kg single infusion is a simple, easy, and economic adjuvant for general anaesthesia. Korean J Anesthesiol. 2013;65(2):114-20.
[5] Srivastava VK, Agrawal S, Gautam SK, Ahmed M, Sharma S, Kumar R. Comparative evaluation of esmolol and dexmedetomidine for attenuation of sympathomimetic response to laryngoscopy and intubation in neurosurgical patients. J Anaesthesiol Clin Pharmacol. 2015;31(2):186-90.
[6] Kindler CH, Schumacher PG, Schneider MC, Urwyler A. Effects of intravenous lidocaine and/or esmolol on haemodynamic responses to laryngoscopy and intubation: A double-blind, controlled clinical trial. J Clin Anesth. 1996;8(6):491-96.
[7] Ghause MS, Singh V, Kumar A, Wahal R, Bhatia VK, Agarwal J. A study of cardiovascular response during laryngoscopy and intubation and their attenuation by ultra-short acting β-blocker esmolol. Indian J Anaesth. 2002;46:104-06.
[8] Moon YE, Lee SH, Lee J. The optimal dose of esmolol and nicardipine for maintaining cardiovascular stability during rapid-sequence induction. J Clin Anesth. 2012;24(1):08-13.
[9] Figueredo E, Garcia-Fuentes EM. Assessment of the efficacy of esmolol on the haemodynamic changes induced by laryngoscopy and tracheal intubation: A meta-analysis. Acta Anaesthesiol Scand. 2001;45(8):1011-22.
[10] Gogus N, Akan B, Serger N, Baydar M. The comparison of the effects of dexmedetomidine, fentanyl and esmolol on prevention of haemodynamic response to intubation. Rev Bras Anestesiol. 2014;64(5):314-19.
[11] McCoy EP, Mirakhur RK, McCloskey BV. A comparison of the stress response to laryngoscopy. The Macintosh versus the McCoy blade. Anaesthesia. 1995;50(11):943-46.
[12] Nishikawa K, Omote K, Kawana S, Namiki A. A comparison of haemodynamic changes after endotracheal intubation by using the lightwand device and the laryngoscope in normotensive and hypertensive patients. Anesth Analg. 2000;90(5):1203-07.
[13] Kimura A, Yamakage M, Chen X, Kamada Y, Namiki A. Use of the fibreoptic stylet scope (Styletscope) reduces the haemodynamic response to intubation in normotensive and hypertensive patients. Can J Anaesth. 2001;48(9):919-23.
[14] Araki K, Nomura R, Tsuchiya N, Yoshikawa Y. Cardiovascular responses to endotracheal intubation with the Bullard and the Macintosh laryngoscopes. Can J Anaesth. 2002;49(5):526.
[15] Adachi YU, Satomoto M, Higuchi H, Watanabe K. Fentanyl attenuates the haemodynamic response to endotracheal intubation more than the response to laryngoscopy. Anesth Analg. 2002;95(1):233-37.
[16] Montes FR, Giraldo JC, Betancur LA, Rincón JD, Rincón IE, Vanegas MV, et al. Endotracheal intubation with a lightwand or a laryngoscope results in similar haemodynamic variations in patients with coronary artery disease. Can J Anaesth. 2003;50(8):824-28. Doi: 10.1007/BF03019380. PMID: 14525823.
[17] Kanaide M, Fukusaki M, Tamura S, Takada M, Miyako M, Sumikawa K. Haemodynamic and catecholamine responses during tracheal intubation using a lightwand device (Trachlight) in elderly patients with hypertension. J Anesth. 2003;17(3):161-65.
[18] Pandazi AK, Louizos AA, Davilis DJ, Stivaktakis JM, Georgiou LG. Inhalational anesthetic technique in microlaryngeal surgery: A comparison between sevoflurane-remifentanil and sevoflurane-alfentanil anaesthesia. Ann Otol Rhinol Laryngol. 2003;112(4):373-78. Doi: 10.1177/000348940311200414. PMID: 12731635.
[19] Kovac AL, Maye JP, Devane GG, Calkins JW. Haemodynamic comparison of direct vision versus blind oral endotracheal intubation. J Clin Anesth. 1995;7(5):411-16.
[20] Ellenbogen KA, McCarthy EA, Pritchett EL. Effects of bolus injection of esmolol in healthy, exercising subjects. Clin Pharmacol Ther. 1987;41:455-59.
[21] Wiest D. Esmolol: A review of its therapeutic efficacy and pharmacokinetic characteristics. Clin Pharmacokinet. 1995;28(3):190-02.
[22] Bensky KP, Donahue-Spencer L, Hertz GE, Anderson MT, James R. The dose-related effects of bolus esmolol on heart rate and blood pressure following laryngoscopy and intubation. AANA J. 2000;68(5):437-42.
[23] Miller DR, Martineau RJ, Wynands JE, Hill J. Bolus administration of esmolol for controlling the haemodynamic response to tracheal intubation: The Canadian Multicentre Trial. Can J Anaesth. 1991;38(7):849-58.
[24] Johansen JW, Schneider G, Windsor AM, Sebel PS. Esmolol potentiates reduction of minimum alveolar isoflurane concentration by alfentanil. Anesth Analg. 1998;87(3):671-76.
[25] Khan ZP, Munday IT, Jones RM, Thornton C, Mant TG, Amin D. Effects of dexmedetomidine on isoflurane requirements in healthy volunteers. 1: Pharmacodynamic and pharmacokinetic interactions. Br J Anaesth. 1999;83(3):372-80.
[26] Aho MS, Erkola OA, Scheinin H, Lehtinen AM, Korttila KT. Effect of intravenously administered dexmedetomidine on pain after laparoscopic tubal ligation. Anesth Analg. 1991;73:112-18.
[27] Kaur M, Singh PM. Current role of dexmedetomidine in clinical anaesthesia and intensive care. Anesth Essays Res. 2011;5(2):128-33.
[28] Sudheesh K, Harsoor S. Dexmedetomidine in anaesthesia practice: A wonder drug? Indian J Anaesth. 2011;55(4):323-24.

[29] Bloor BC, Ward DS, Belleville JP, Maze M. Effects of intravenous dexmedetomidine in humans. II. Haemodynamic changes. Anesthesiology. 1992;77(6):1134-42.
[30] Alagol A, Arar C, Kaya G, Colak A, Turan N, Gunday I. Effects of dexmedetomidine and esmolol on haemodynamic response to tracheal intubation. Eur J Anaesthesiol. 2005;22:134-35.
[31] Li Z, Xu L, Zheng J, Wang Q. Comparison of intravenous dexmedetomidine versus esmolol for attenuation of haemodynamic response to tracheal intubation after rapid sequence induction: A systematic review and meta-analysis. Biomed Res Int. 2019;2019:6791971.
[32] Ebert TJ, Bernstein JS, Stowe DF, Roerig D, Kampine JP. Attenuation of haemodynamic responses to rapid sequence induction and intubation in healthy patients with a single bolus of esmolol. J Clin Anesth. 1990;2(4):243-52.
[33] Khan ZP, Ferguson CN, Jones RM. alpha-2 and imidazoline receptor agonists. Their pharmacology and therapeutic role. Anaesthesia. 1999;54(2):146-65.
[34] Bajwa SJ, Kaur J, Singh A, Parmar SS, Singh G, Kulshrestha A, et al. Attenuation of pressor response and dose sparing of opioids and anaesthetics with pre-operative dexmedetomidine. Indian J Anaesth. 2012;56(2):123-28.

PARTICULARS OF CONTRIBUTORS:
1. Assistant Professor, Department of Anaesthesiology, Mount Zion Medical College, Chayalode, Adoor, Kerala, India.
2. Assistant Professor, Department of Anaesthesiology, Pondicherry Institute of Medical Sciences, Puducherry, India.
3. Associate Professor, Department of Anaesthesiology, Pondicherry Institute of Medical Sciences, Puducherry, India.
4. Associate Professor, Department of Anaesthesiology, Pondicherry Institute of Medical Sciences, Puducherry, India.
5. Professor, Department of Anaesthesiology, Podicherry Institute of Medical Sciences, Puducherry, India.
6. Professor and Head, Department of Anaesthesiology, Pondicherry Institute of Medical Sciences, Puducherry, India.

NAME, ADDRESS, E-MAIL ID OF THE CORRESPONDING AUTHOR:
Dr. MV Vidya,
D-II, Flat No-4, JIPMER Faculty Quarters, Dhanvantri Nagar-605006, Pondicherry, India.
E-mail: drmvvidya@gmail.com

PLAGIARISM CHECKING METHODS: [Jain H et al.]
- Plagiarism X-checker: Apr 28, 2022
- Manual Googling: Mar 28, 2022
- iThenticate Software: May 19, 2022 (19%)

ETYMOLOGY: Author Origin

AUTHOR DECLARATION:
- Financial or Other Competing Interests: None
- Was Ethics Committee Approval obtained for this study? Yes
- Was informed consent obtained from the subjects involved in the study? Yes
- For any images presented appropriate consent has been obtained from the subjects. NA

Date of Submission: **Apr 27, 2021**
Date of Peer Review: **Jun 17, 2021**
Date of Acceptance: **Mar 29, 2022**
Date of Publishing: **Jun 01, 2022**