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Original research article

EFFECT OF DEXMEDETOMIDINE VERSUS LABETALOL FOR ATTENUATION OF HEMODYNAMIC STRESS RESPONSE TO LARYNGOSCOPY AND INTUBATION

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Abstract

Introduction: In the field of anaesthesiology, attenuation of pressor response is one of the keenly researched subjects. As a standard practice we use rigid laryngoscope to view the larynx and adjacent structures for facilitating endotracheal intubation. This causes direct trauma to the oropharynx and larynx and apart from this it also causes stimulation resulting in a rise in heart rate, systolic blood pressure, diastolic blood pressure, and mean arterial pressure. Tachycardia, hypertension, and dysrhythmias all occur during laryngoscopy and intubations.

Aim: This study was done to compare the efficacy of dexmedetomidine 1 μg/kg; and labetalol 0.3 mg/kg in attenuating the cardiovascular responses to Laryngoscopy and Intubation, and to observe for adverse effects if any of these two in the specified dosage.

Materials and Methods: This randomized comparative double - blinded study was conducted in Kamineni medical college in the year JAN-DEC 2023. After obtaining ethical committee approval, the study population was chosen all the patients were assessed preoperatively with history, clinical examination, and required investigations, informed written consent was obtained from the patient. The patients were randomly allocated into two groups. Group D (n: 45) received Dexmedetomidine 1 μg/kg in 10ml normal saline IV. Over 10 min, and subsequently 5min after induction of anesthesia was done. Group L (n: 45) received Labetalol 0.3 mg/kg 10 ml normal saline IV. over 10 min, 5 min prior to induction of anesthesia. All patients were pre medicated with Inj. Midazolam 2 mg and Inj. Glycopyrrolate 0.2 mg IV. 45 min before surgery Heart rate, systolic and diastolic blood pressure, and oxygen saturation were recorded as the baseline value.

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Results: There was a reduction in the heart rate and mean arterial pressure response to intubation in both Dexmedetomidine and Labetalol groups, but when both the groups were compared there was a statistically significant reduction of heart rate and arterial pressure response to intubation in Dexmeditomidine group ($p< 0.05$). There was no significant hypotension or bradycardia in any of the groups.

Conclusion: We conclude that Dexmeditomidine 1 μg/Kg given slowly over 10 minutes intravenously 5 minutes before induction, attenuates the cardiovascular responses to laryngoscopy and intubation in a better manner than Labetalol 0.3mg/Kg.

Keywords: dexmedetomidine, labetalol, attenuation, haemodynamic, stress & laryngoscopy.

Introduction

Laryngocopy during endotracheal intubation [1, 2] produce mechanical and chemical stimulus that increase somatovisceral reflex caused by stimulation of epipharynx and laryngopharynx producing tachycardia, hypertension. This causes direct trauma to the oropharynx and larynx and apart from this it also causes stimulation resulting in a rise in heart rate, systolic blood pressure, diastolic blood pressure, and mean arterial pressure. The consequent rise in rate/pressure product may result in a myocardial oxygen demand which exceeds the oxygen supply resulting in myocardial ischemia [3], arrythmias. The exact pressor response is not known, but generally agreed to be it is a reflex phenomenon mediated by vagus (x) and glossopharyngeal (IX) which carry afferent signal from glottis and infra glottic region and activate vasomotor centre to cause peripheral sympathoadrenal response leading to hypertension, tachycardia and elevated serum catecholamines Average increase in heart rate and blood pressure was 20-27% and 30-50% respectively. This response is sympathetically mediated and can be attenuated by various drugs that block sympathetic activity and other drugs like calcium channel blocking drugs, lignocaine, and magnesium. Studies have documented myocardial ischemic changes due to reflex sympathoadrenal response immediately following laryngoscopy and intubation with a mean increase in systemic pressure of 40 mmHg even in normotensive patients [4]. An increase in heart rate is more likely to produce signs of myocardial ischemia than hypertension on the ECG. Indeed, in an anesthetized patient, the incidence of myocardial ischemia on the ECG sharply increases in patients who experience a heart rate greater than 110 bpm (ischemic threshold). A frequent recommendation is to maintain heart rate and blood pressure within 20% of the normal awake value for that patient. Many attempts have been made to attenuate the pressor response to laryngoscopy and intubation.

Materials and Methods

This randomized comparative double- blinded study was conducted in Kamineni medical college in the year January to December 2023. After obtaining ethical committee approval, the study population was chosen. The study was done in 90 patients belonging to ASA class I and II undergoing elective surgeries under general anesthesia, were assessed preoperatively with history, clinical examination, and required investigations, informed written consent was obtained from the patient. The patients were randomly allocated by computer generated random number table into two groups. Group D (n: 45) received Dexmedetomidine 1 μg/kg in 10 ml normal saline IV.

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Over 10 min, 5min before induction of anesthesia. Group L (n: 45) received Labetalol 0.3 mg/kg 10ml normal saline IV. Over 10 min, 5 min before induction of anesthesia. On the day of surgery all patients were pre medicated with Inj. Midazolam 2mg and Inj. Glycopyrrolate 0.2 mg IV. 45 min before surgery Heart rate, systolic and diastolic blood pressure, and oxygen saturation were recorded as the baseline value in preoperative room. IV fluid ringer lactate was administered as maintainance fluid through peripheral 18 G IV cannula. After shifting the patient in operative room, general anaesthesia techniques were standardised for both groups. Beside routine monitors, in operative room, additional monitors such as neuromuscular monitor, $ETCO_2$, were attached and monitoring was continued all patients were preoxygenated with 100% oxygen. Patients were induced with inj. Propofol 2 mg/kg, Inj. Fentanyl 2 μg/kg followed by Vecuronium 0.08 mg/kg. Entotracheal intubation was done 2 min after vecuronium. Anaesthesia was maintained with Isoflurane in oxygen and Nitrous oxide (33%and66%respectively).

Exclusion criteria

Difficult airway, uncontrolled Hypertension, uncontrolled Diabetes mellitus, Ischemic heart disease, Renal disease, Cerebrovascular disease, Patients on beta-blockers, alpha-blockers, Bronchial asthma, Allergy to study drug.

SBP, DBP, MAP, HR, and SpO_2 were monitored 1 minute after infusion of study drug, 1 minute after induction, and 1, 3, 5, 10 and 15 minutes after intubation. During intubation, laryngoscopy duration and Cormack Lehane score were noted. Any incidence of hypotension or bradycardia was recorded. Hypotension is defined as a decrease in MAP 30% or more from baseline and treated with inj. ephedrine 6 mg. Bradycardia is defined as HR<50/min and treated with inj. atropine 0.6 mg.

Statistical analysis

We used the Chi-Square test, ANOVA, and Post-Hoc test as appropriate. p<0, 05 was considered statistically significant. The results were presented as means and SD.

Results

The study was done in 90 patients belonging to ASA class I and II undergoing elective surgeries under general anesthesia. The patients were categorized into 2 groups. Group D -Dexmeditomidine, Group L - Labetalol.

The groups were matched for demographic data, and there was no statistically significant difference found between the groups in age, sex, and weight. Baseline parameters were compared between groups. There was no statistically significant difference between the group (SD-Standard deviation, 'P' Value>0.05).

	Group D	Group L	P- Value
SBP ± SD	120.38±9.48	121.40±9.86	0.6182
DBP ± SD	79.18±6.38	81.13±6.07	0.1410
MAP ± SD	92.76±6.54	94.22±6.95	0.3076
PR ± SD	84±9.45	85.36±11.16	0.5343
SPO2± SD	99± 0.06	99.13± 0.63	0.1717

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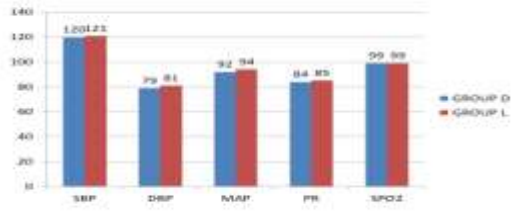
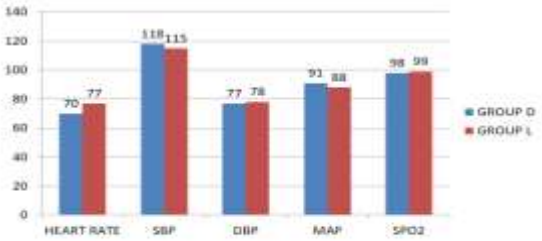


After administration of the study drug blood pressure, heart rate, and saturation were recorded 1 minute following the injection of the drug, 1 min after induction,1 min,3 min, 5 min, 10 min, and 15 min after laryngoscopy and intubation.

After Drug injection	Group D	Group L	P -Value	Significance
Heart rate	70.77± 9.68	77.89±8.58	0.0004	Significance
Systolic B.P.	118.67± 9.19	115.44± 8.43	0.0858	Not significance
Diastolic B.P.	77.47± 7.05	78.13± 6.24	0.6393	Not significance
MAP	91.04± 6.90	88.33± 13.80	0.2419	Not significance
SPO2	98.76± 0.65	99.56± 0.50	0.0001	Not significance



Heart rate response to laryngoscopy and intubation was effectively suppressed in the dexmed group (Group D) compared to the labetalol group (Group L). (SD- Standard deviation, 'P'<0.05-Significant).

Heart Rate	Group D	Group L	" P "
After Drug	70.73±9.68	77.89±8.58	0.0004
After Induction	77.98±8.93	83.80±7.68	0.0013
After Intubation 1 min	88.64±19.24	88.27±18.77	0.9266
3 min	85.71±17.80	92±10.72	0.0453
5 min	82.33±15.98	87.13±9.25	0.0847
10 min	78.20±12.30	83.36±7.31	0.0231
15 min	76.02±9.59	80.93±14.56	0.0622

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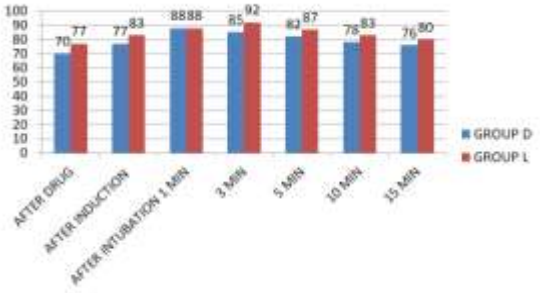

SAP, DAP, and MAP after injection of the drug and after induction were comparable between the groups. There was no statistically significant difference ('p'>0.05). After laryngoscopy and intubation SAP, DAP and MAP increased at 1 min, 3 min, 5 min, 10 min and 15 min in group L compared to group D. Airway scoring; MMS and CLG were comparable between the groups.

Comparison of systolic arterial pressure response

Blood Pressure (Mean±SD)	Group D	Group L	" p "
Baseline	120.38± 9.48	121.33± 9.86	0.6424
After Drug	118.67± 9.19	115.44± 8.43	0.0858
After Induction	115.58± 8.87	110.58± 8.53	0.0077
After Intubation 1 min	130.29± 18.57	128.62± 19.79	0.6628
3 min	126.31± 15.95	121.98± 20.09	0.2606
5 min	121.36± 13.39	124.47± 8.44	0.1909
10 min	118.31± 13.15	119.56± 17.86	0.7063
15 min	116.60± 9.78	119.76± 7.60	0.0905

Comparison of diastolic arterial pressure response

Blood Pressure (Mean ± SD)	Group D	Group L	" p "
Baseline	79.18±6.38	81.13± 6.07	0.1410
After Drug	77.47± 7.05	78.13± 6.24	0.6393
After Induction	73.22± 6.52	74.04± 5.98	0.5393
After Intubation 1 min	88.29± 14.23	86.49± 6.77	0.4456
3 min	81.60± 16.03	85.73± 5.96	0.1088
5 min	80.78± 9.80	84.67± 5.87	0.0248
10 min	78.40± 20.31	79.40± 12.03	0.7769
15 min	76.27± 5.88	79.67± 4.93	0.0038

Comparison of mean arterial pressure response

Blood Pressure (Mean ±SD)	Group D	Group L	" p "
Baseline	92.76±6.54	94.22±6.95	0.3076
After Drug	91.04±6.90	83.33±13.80	0.7793
After Induction	86.18±6.72	85.80±6.09	0.7793
After Intubation 1 min	102.27±15.22	97.04±11.59	0.0700
3 min	98.09±12.83	99.47±6.89	0.5266
5 min	94.29±10.26	97.18±6.34	0.1115
10 min	92.16±9.44	93.73±5.36	0.3346
15 min	89.47±6.44	91.56±5.96	0.1137

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SAP, DAP, and MAP after injection of the drug and after induction were comparable between the groups.

There was no statistically significant difference ('p'>0.05). After laryngoscopy and intubation SAP, DAP and MAP increased at 1 min, 3 min, 5 min, 10 min and 15 min in group L compared to group D. Airway scoring; MMS and CLG were comparable between the groups.

Discussion

Laryngoscopy and endotracheal intubation frequently induce a cardiovascular stress response characterized by hypertension and tachycardia [5]. Many attempts were made to attenuate the hemodynamic response to laryngoscopy and intubation [6]. This sympathoadrenal stress response to laryngoscopy increases myocardial O_2 demand leading to ischemia and acute heart failure in susceptible individuals [7]. In case of associated cvs diseases, intracranial aneurysm, space occupying lesions, intracranial av malformation stress response may lead to undesirable irreversible damage. Given the frequent occurrence of hypertension and tachycardia during laryngoscopy even in normotensive individuals, endotracheal intubation has been suggested to be one of the most invasive stimuli in anaesthesia, particularly it is perhaps rather surprising that complications have not been met very often [8]. One reason for this may be the transient nature of hypertension which usually lasts less than 10 minutes. It is possible however that some of the complications that occur during intubation or even later in the course of anesthesia may be precipitated by an episode of hypertension and tachycardia, following endotracheal intubation

ELLIOF (1980) observed left ventricular wall dysfunction following endotracheal intubation [9]. This reflex sympathetic response may be diminished or modified locally, centrally, and peripherally and attempts have been made to accomplish this using all these approaches with varying success [10]. In an attempt to blunt these potentially adverse hemodynamic responses, different techniques and agents were used by many with varying success. Sympathetic system activation plays the main role in the occurrence of transient but significant tachycardia and hypertension during intubation [11]. Use of Vasodilators like Sodium nitroprusside results in reflex tachycardia, lability in blood pressure, cerebral without the unwanted vascular effects from activation of alpha1-receptors. Also, Dexmedetomidine is a shorter- acting drug than clonidine. In our study, we used Dexmedetomidine 1 μ/kg and labetalol 0.3 mg/kg, Onset and peak action with labetolol is 2 to 5 min, and 5 to 15 minutes, duration of action lasts for 4 hrs. Onset and peak action with Dexmeditomidine is 5 min and 15 min respectively, duration of action lasts for 4 hrs.

The α2 receptors are involved in regulating the autonomic and cardiovascular systems. α2 receptors are located on blood vessels, where they mediate vasoconstriction, and on sympathetic terminals where they inhibit norepinephrine release. α2 receptors are also located within the central nervous system and their activation leads to sedation, a reduction of tonic levels of sympathetic outflow, and an augmentation of cardiac-vagal activity. This can result in a decrease in heart rate and cardiac output [12]. The use of α2 agonists in the perioperative period has been associated with reduced anesthetic requirements and attenuated heart rate and blood pressure responses to stressful events. Also, α 2 receptors within the spinal cord modulate pain pathways, thereby providing some degree of analgesia [13].

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In some patients dexmedetomidine resulted in a minimal increase in arterial pressure. This transient hypertension is due to α1mediated vasoconstriction. This transient hypertension is less than that seen with clonidine since dexmedetomidine has more selectivity over α2 receptors. Bradycardia after dexmedetomidine was reported in some studies with the bolus injection. In our study dexmedetomidine over 10 min with continuous monitoring of heart rate, none of the patients developed bradycardia that required atropine.

Dexmedetomidine over 10 min with continuous monitoring of arterial oxygen saturation with pulse oximeter showed no desaturation (SpO_2-<95%) in any patient, but there is significant reduction in heart rate. Labetalol in a dose of 0.3 mg/kg had reduced the heart rate. But the reduction was modest compared to dexmedetomidine the reduction in arterial pressure after labetalol was mild that was statistically insignificant.

Heart rate increase and arterial pressure reduction after induction were minimal in 2 groups and there was statistically significant difference between the groups. There was no significant hypotension on induction with dexmedetomidine or labetalol. After intubation, the blood pressure and heart rate were increased, while labetalol pre injection reduced the response significantly though there was a little rise in MAP and HR. Dexmedetomidine prior administration effectively attenuated the hemodynamic response to intubation compared to labetalol. Sympathetic response to intubation lasted for 15 minutes arterial pressure and heart rate returned to baseline values in 15 minutes.

In our study all the patients remained in supine position postoperatively.no postural hypotension-related side effects were reported. Side effect was seen with labetalol when the patient was allowed to sit within 3 hours after injection. Dexmedetomidine reduced the requirement of inhalational agents and opioids intraoperatively. A bolus dose of both Dexmedetomidine and Labetalol was effective in attenuating the hemodynamic response to intubation, in our study it was observed there was statistically significant difference with Dexmedetomidine over labetolol.

Previous studies: The authors as under have done similar study and their results are outlined in the following table.

D. Singla [17] concluded that in patients predisposed to significant fluctuations in blood pressure/Heart rate, dexmedetomidine 1 mcg/kg, more suitable than labetalol 0.5 mg/ kg.

Nagar. S, Ghada. F [14] concluded that Dexmedetomidine 1 mcg/kg attenuates hemodynamic stress response to laryngoscopy and intubation compared to labetalol 0.25 mg/ kg without any deliterous effects

Dr. Meenal bhatt [19] concluded that Dexmedetomidine 1mcg/kg attenuates the cardiovascular response to laryngoscopy with intubation in better manner than labetalol 0.5 mg/ kg.

Muralini Patel *et al*. [16] concluded that Dexmedetomidine1mcg/kg given slowly i.v prior to induction attenuated cardiovascular response to laryngoscopy in better way than labetalol 0.25 mg/ kg.

Our observations are similar to the results obtained by earlier studies done by different authors as above, we have used dexmedetomidine 1mcg/kg and labetalol 0.3 mg/kg for attenuation of hemodynamic response

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Table 1:

S. No.	Authors	Dosage	Conclusion	Year
1.	Nagar. S, Ghada. F [14]	Dexmedetomidine 1mcg/kg. Labetalol 0.25 mg/ kg.	Dexmedetomidine attenuates hemodynamic stress response to laryngoscopy and intubation compare to labetalol without any deliterous effects	2016
2.	D. Singla [17]	Dexmedetomidine 1mcg/kg. Labetalol 0.5 mg/ kg.	In patients predisposed to significant fluctuations in blood pressure/Heart rate, dexmedetomidine more suitable than labetalol.	2019
3.	Muralini Patel *et al*. [16]	Dexmedetomidine 1mcg/kg. Labetalol 0.25 mg/ kg	Dexmedetomidine given slowly i.v prior to induction attenuated cardiovascular response to laryngoscopy in better way than labetalol	2021
4.	Dr. Meenal bhatt [19]	Dexmedetomidine 1mcg/kg. Labetalol 0.5 mg/ kg.	Dexmedetomidine attenuates the cardiovascular response to laryngoscopy with intubation in better manner than labetalol	2023
5.	Our present study	Dexmeditomidine 1 µg/Kg labetalol 0.3 mg/Kg.	Dexmeditomidine given slowly over 10 minutes intravenously 5 minutes before induction, Attenuates the cardiovascular responses to laryngoscopy and intubation in a better manner than Labetalol.	

Conclusion

We concluded that Dexmeditomidine 1 µg/Kg given slowly over 10 minutes intravenously 5 minutes before induction, Attenuates the cardiovascular responses to laryngoscopy and intubation in a better manner than Labetalol 0.3 mg/Kg.

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