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Comparison Of Stress Response During Direct Laryngoscopic Versus Fibreoptic Orotracheal Intubation Following Premedication With Dexmedetomidine.

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Abstract
Introduction
Laryngoscopy and intubation is known to cause a significant stress response elicited as sympathetic overactivity. This may be seen as an elevation in heart rate, blood pressure, and catecholamine levels in blood. This can be deleterious in patients with poor cardiac reserve and other comorbidities. Dexmedetomidine is a novel α2 adrenergic agonist which has been shown to attenuate the pressor response following direct laryngoscopic intubation. A comparison of the attenuation of stress response during direct laryngoscopic and fibreoptic intubation following premedication with dexmedetomidine has been studied.
Method
60 patients, with ASA grade I and II, of both sexes, aged 18 to 60 years, undergoing elective surgery under general anaesthesia, with endotracheal intubation were enrolled in this study & randomized into two groups; Group I intubated with fibreoptic bronchoscope and Group II intubated with direct laryngoscopy. Both groups were premedicated with dexmedetomidine 30 minutes before the surgery.
Results
The systolic blood pressure, diastolic blood pressure, mean arterial pressure and heart rate were all significantly lower in the fibreoptic intubation group. Although the time taken for intubation was significantly longer, the stress response were better controlled in the fibreoptic intubation because of less airway manipulation and noxious stimulation.
Conclusion
Dexmedetomidine attenuates the stress response significantly better in patients intubated with fibreoptic bronchoscope compared to patients intubated by direct laryngoscopy.
Key words: *stress, laryngoscopy, fibreoptic, intubation, dexmedetomidine.*

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I. Introduction

Flexible fibreoptic intubation is increasingly being used in modern anaesthesia practice and is thought to attenuate the circulatory responses to intubation, as stimulation of oropharyngeal structures may be avoided. Fibreoptic intubation can be performed under various levels of sedation, hypnosis, and muscle relaxation. Awake fibreoptic intubation with topical anesthesia is considered to be the safest alternative, although techniques using i.v anesthetics with or without muscle relaxants are all commonly performed.

Manipulation and instrumentation of the airway leads to stimulation of pharngeal and tracheolaryngeal nociceptors and results in a hemodynamic stress response.[1] This may be seen as an elevation in heart rate, blood pressure, and catecholamine levels in blood. This stress response can be deleterious in patients with poor cardiac reserve and other comorbidities. Laryngoscopy and intubation is known to cause a significant stress response elicited as sympathetic overactivity.[1]

These responses are mediated by the glossopharyngeal for stimuli superior to anterior surface of epiglottis and by vagus nerve for stimuli below posterior epiglottis down to the lower airway.[2] The stimulation of the epipharynx elicits a greater response than the stimulation of the tracheobronchial tree.[3] This results in activation of hypothalamo-pituitary-adrenocortical and sympathoadrenomedullary systems along with diffuse autonomic response with widespread release of epinephrine from the nerve endings as well as its secretion from the adrenal medulla along with the activation of renin angiotensin system.[2] Thus it is elicited as tachycardia, hypertension, arrhythmias, and even angina, myocardial infarction and stroke.

The haemodynamic response is the maximum after approx 35-40 seconds of laryngoscopy and intubation.[4] Plasma levels of adrenaline, nor adrenaline and vasopressin increases, all of which come back to baseline after about 5 minutes.

Dexmedetomidine is a novel α2 adrenergic agonist which produces both sedation and analgesia yet lacks the respiratory depressive properties of opioids and benzodiazepines. It has been shown to attenuate the pressor response following direct laryngoscopic intubation, but its role in fibreoptic intubation has not been clearly ascertained.

II. Aims And Objects

Comparison of stress response during direct laryngoscopic versus fibreoptic orotracheal intubation following premedication with dexmedetomidine.

III. Materials And Methods

After obtaining approval from the Research Ethical Board, RIMS, Imphal, Manipur, this descriptive, randomized, analytical study was conducted on patients with ASA grade I and II, of both sexes aged between 18 to 60 years undergoing elective surgery under general anaesthesia with endotracheal intubation in the Department of Anaesthesiology, RIMS, Imphal, Manipur over the period of two years commencing from August 2016 to July 2018. Exclusion criteria included patient refusal, patients with respiratory, cardiac, neurological, renal or liver disease**,** patient with gastro-oesophageal reflux**,** pregnant women or breastfeeding mothers**,** patients with known allergy to the drugs used in the study, psychiatric patients, and anticipated difficult airway (Mallampatti $\geq$3, thyromental distance < 6.5cm).

Sample Size Calculation: Based on the study conducted by Xue FS et al[8] on the comparison of stress response between fibreoptic intubation and direct laryngoscopy and intubation, where the mean SBP post intubation are 126.9±21.6 mmHg and 108.8±11.1 mmHg respectively, and with a 'α' value of 0.05 and a power of 80% we had to recruit a minimum of 23 samples for each group. Considering any dropouts who may arise in the study, we recruited 30 patients for each group.

The patients found to meet the inclusion criteria were randomly divided into two groups of 30 each according to the computer generated randomization. Both the groups were premedicated with dexmededomidine. Group I patients were intubated with a fibreoptic bronchoscope and group II were intubated by direct laryngoscopy.

All the patients included in this study were examined a day before and kept nil per oral for atleast 8 hours until the surgery. In the preoperative holding area, intravenous access was secured and baseline haemodynamic parameters were recorded. All patients received standard premedication of ranitidine 50 mg, metoclopramide 10 mg and glycopyrrolate 200 µg and dexmedetomidine (0.5µg/kg in 10ml normal saline over 10 minutes) i.v. All the patients' haemodynamic parameters like SBP, DBP, HR and SpO_2 were continuously monitored after the commencement of dexmedetomidine infusion. Monitoring was standard for both the groups and consisted of ECG, non-invasive blood pressure, heart rate, SpO_2 and $EtCO_2$.

Both groups of patients received the same induction protocol. After pre-oxygenation with 100% oxygen for 3 minutes with a face mask, all patients received intravenous butorphanol (10µg/kg) and intravenous propofol (2mg/kg, bolus). Loss of eyelash reflex will was considered as the end point for induction. After confirmation of bag mask ventilation, succinylcholine (1.5 mg/kg) was given intravenously to facilitate intubation. Bag mask ventilation was then continued with 1.5% sevoflurane for 60 seconds following which intubation was attempted. Haemodynamic variables were recorded before and after induction of anaesthesia.

Patients in Group 1 received fibreoptic scope intubation with OLYMPUS MAF TYPE TM. Appropriate sized endotracheal tube was first immersed in warm saline to make it malleable. After thorough lubrication, the ET tube was threaded over the fibreoptic scope before insertion. A bite block was inserted between the incisors. A trained assistant then performed the jaw lift maneuver and opened the mouth. The FOB was then inserted through the midline. After visualization of the glottis, the FOB was gently advanced into the trachea. After confirmation of visualization of the carina, the ET tube was then advanced gently with anticlockwise rotation to prevent impaction of the bevel on the arytenoids and vocal cords. The FOB was then withdrawn.

In Group II, intubation was performed conventionally with a direct laryngoscope and a Macintosh blade, size 3 or 4 whichever deemed appropriate. Correct tube placement was confirmed with $EtCO_2$ and auscultation. The ET tube was then connected to the circle system and anaesthesia was maintained with Sevoflurane (1-3%) with a fresh gas flow of 3 l/min comprising of 50% nitrous oxide in oxygen. Intravenous atracurium in a dose of 0.5 mg/kg loading, and 0.1 mg/kg intermittent bolus was used for muscle relaxation.

Haemodynamic variables were measured every minute from the start of induction for the first 5 minutes and then every 2 minutes for the next 10 minutes after intubation. The time taken from the insertion of laryngoscope to the confirmation of correct ET tube placement was recorded using a stop watch.

IV. Statistical Analysis

Descriptive and inferential statistical analysis has been carried out in the present study. Results on continuous measurements are presented on Mean ± standard deviation (Min-Max) and results on categorical measurements are presented in Number (%). Significance was assessed at 5% level of significance. The following assumptions on data were made; **1.**Dependent variables were normally distributed, 2.Samples drawn from the population was random, and 3. Cases of the samples was independent. Student t test (two tailed, independent) has been used to find the significance of study parameters on continuous scale between two groups (Inter group analysis) on metric parameters. Leven's test for homogeneity of variance has been performed to assess the homogeneity of variance. Chi-square/ Fisher Exact test has been used to find the significance of study parameters on categorical scale between two or more groups, non-parametric setting for Qualitative data analysis. Fisher Exact test was used when cell samples are very small. A *P* value of less than 0.05 was considered statistically significant. The Statistical software namely SPSS 18.0, and R environment ver.3.2.2 were used for the analysis of the data and Microsoft word and Excel have been used to generate graphs, tables etc**.**

V. Results And Observation

A descriptive, randomized, analytical study was conducted for comparison of stress response during direct laryngoscopic and fibreoptic orotracheal intubation following premedication with dexmedetomidine. 60 patients were selected and allocated into two groups (n=30).

Table 1: Comparison of Age and Weight in two groups studied

	Group I	Group II	P value
Age in years	42.33 ± 8.5	39.67±10.6	0.29
Weight in kg	63.6 ± 6.59	60.1 ± 5.75	0.03*

Table 2: Gender distribution of patients studied

Gender	Group I	Group II
Female	17(56.7%)	14(46.7%)
Male	13(43.3%)	16(53.3%)
Total	30(100%)	30(100%)

The samples studied were age, gender and weight, matched.

Table 3: SBP (mm Hg) - A Comparison in two groups of patients studied

SBP (mm Hg)	Group I	Group II	P value
Baseline	126.67±6.24	128.83±5.17	0.149
Induction	109.67±12.18	112.67±10.65	0.314
Post intubation 1 min	132.07±15.25	128.63±10.25	0.310
2 min	121.33±9.55	131.30±12.07	0.001**
3 min	126.77±8.69	133.97±9.78	0.004**
4 min	122.23±5.30	130.83±4.82	<0.001**
5 min	121.17±9.04	127.30±8.66	0.010**
7 min	120.93±12.04	116.90±15.04	0.256
9 min	120.6±12.99	114.37±13.11	0.069+
11 min	119.87±13.76	111.20±12.70	0.014*
13 min	121.83±14.52	113.67±8.70	0.011*
15 min	121.90±13.82	114.03±9.53	0.013*

Intergroup comparison:

The mean systolic blood pressure was lesser in Group I intubated with flexible fibreoptic bronchoscope at 2, 3, 4, and 5 minutes showing statistical significance with p value <0.01, in comparison with Group II intubated with direct laryngoscopy. There was not much increase in systolic blood pressure in Group II after 5 minutes; it was comparable with Group I after 5 minutes.

Table 4: DBP (mm Hg) -A Comparison in two groups of patients studied

DBP (mm Hg)	Group I	Group II	P value
Baseline	81.70±5.97	84.37±6.14	0.102
Induction	71.60±8.60	76.97±8.92	0.021*
Post intubation 1 min	86.83±10.71	85.43±7.58	0.561
2 min	78.77±9.00	89.00±8.50	<0.001**
3 min	82.80±12.67	89.03±7.72	0.025*
4 min	81.23±12.80	87.30±8.26	0.033*
5 min	80.50±10.13	85.83±7.94	0.027*
7 min	81.30±8.88	81.97±8.63	0.769
9 min	81.60±9.29	79.87±8.36	0.451
11 min	81.57±8.98	78.10±7.48	0.110
13 min	80.53±7.23	79.57±6.22	0.581
15 min	79.87±6.59	78.57±6.21	0.435

Intergroup comparison:

The mean diastolic blood pressure was low in Group I intubated with flexible fibreoptic bronchoscope at 2 minutes from intubation showing statistical significance with p value of <0.001, compared to Group II intubated with direct laryngoscopy. There was decrease in diastolic blood pressure in group I at 3, 4, and 5 minutes with moderate level of statistical significance.

Table 5: MAP (mm Hg) -A Comparison in two groups of patients studied

MAP (mm Hg)	Group I	Group II	P value
Baseline	92.43±5.71	95.00±4.77	0.100
Induction	80.17±12.43	85.50±9.25	0.064+
Post intubation 1 min	98.80±12.40	98.27±9.16	0.850
2 min	89.67±7.86	100.67±10.19	<0.001**
3 min	92.07±9.65	99.87±9.19	0.002**
4 min	89.97±9.00	97.03±10.17	0.006**
5 min	88.13±8.99	95.10±9.14	0.004**
7 min	91.17±10.85	91.13±11.99	0.991
9 min	91.73±12.74	89.47±11.05	0.465
11 min	90.77±13.30	87.60±10.46	0.310
13 min	91.13±11.60	88.77±9.67	0.394
15 min	90.47±11.33	87.93±9.02	0.342

Intergroup comparison:

The mean MAP was significantly lower in Group I at 2 to 5 minutes from intubation with p values of <0.01 compared to Group II. The mean arterial pressure in Group II also decreased from the baseline though statistically insignifant when compared to Group I. After 5 minutes, MAP was comparable in both the groups.

Table 6: Heart Rate -A Comparison in two groups of patients studied

Heart Rate (bpm)	Group I	Group II	P value
Baseline	77.23±7.21	77.90±6.14	0.701
Induction	75.07±6.67	73.47±5.48	0.314
Post intubation 1 min	86.00±8.38	87.03±6.21	0.589
2 min	83.87±8.30	88.80±6.18	0.011*
3 min	82.47±10.36	89.07±5.84	0.004**
4 min	80.67±9.98	88.13±6.24	0.001**
5 min	78.93±9.28	87.03±6.22	<0.001**
7 min	77.73±8.96	85.03±6.26	0.001**
9 min	77.33±8.37	84.47±5.90	<0.001**
11 min	76.90±8.01	82.10±5.22	0.004**
13 min	77.67±9.62	81.07±4.92	0.090+
15 min	77.17±7.28	81.03±5.41	0.023*

Intergroup comparison:

The heart rate was significantly lower in Group I from 3 to 11 minutes from intubation compared to Group II, with p values of less than 0.01. The heart rate did not increase much in Group II, with a mean of 84±5, although higher than in Group I.

VI. Discussion

Our study showed that dexmedetomidine attenuated the stress response significantly more in the fibreoptic intubation group as SBP, DBP, MAP and heart rate were significantly lower in this group.

Laryngoscopy and intubation elicits a stress response that induce profound changes in cardiovascular physiology through a reflex response manifested as tachycardia, hypertension and dysrhythmias.[75]

The haemodynamic attenuating effect of dexmedetomidine has been documented by many studies. Sulaiman S et al[15], Jain V et al[16], Gandhi S et al[17], have all documented that dexmedetomidine at the dose of 0.5-1.0µg/kg diluted in 10ml saline infused over 10 minutes given as a premedication reduces the haemodynamic stress response to laryngoscopy and intubation. Present study results are well correlated with their studies.

Aghdaii N et al[9] and Khudad AM et al[11] observed similar haemodynamic responses between fibreoptic bronchoscopic and direct laryngoscopic intubation. In contrast, the present study show less stress response in fibreoptic intubation group in comparison to the direct laryngoscopic intubation group.

Jakusenko N et al[10] opined that shorter intubation time produce less nociceptive stimulus and less haemodynamic stress response. Aghdaii N et al[9] found that although duration of intubation was shorter in the direct laryngoscopy group, there were no statistical differences in haemodynamic parameters when compared to fibreoptic intubation. In the present study, intubation time for direct laryngoscopic group is less than 30 seconds compared to the fibreoptic intubation time which ranged from 30-120 seconds, but the stress response is less in the fibreoptic intubation group. This is due to less airway manipulation and stimulation by the fibreoptic bronchoscope compared to the conventional laryngoscope.

Jain V et al.[16] administered dexmedetomidine 1µg/kg 10 minutes before induction. They concluded that dexmedetomidine significantly attenuated the sympathetic response to laryngoscopy and intubation in terms of heart rate, systolic blood pressure, and diastolic blood pressure compared with fentanyl. Incidence of bradycardia and hypotension was higher in patients of the dexmedetomidine group. In the present study, we used dexmedetomidine at a single dose of 0.5µg/kg diluted to 10 ml saline infused over 10 minutes, 30 minutes before induction similar to the study done by Sulaiman S and colleagues. It doesn't show any significant increase in haemodynamic stress response in both the groups, which were comparable to the baseline. It correlated well with the studies done by Sulaiman S et al[15], Jain V et al[16], and Gandhi S et al.[17] Incidence of hypotension and bradycardia was negligible with this dose of dexmedetomidine.

Aghdaii N et al[9] compared cardiovascular responses to fibreoptic intubation with direct laryngoscopy in patients undergoing coronary artery bypass grafting. They found that although duration of intubation was shorter in the direct laryngoscopy group, there were no statistical differences in haemodynamic parameters in both the groups. Khudad M et al[11] also compared the haemodynamic response to direct versus fiberoptic intubation. They concluded that direct and fiber optic technique produced similar haemodynamic responses. In the present study, the sympathetic response to intubation was better controlled in the fibreoptic intubation group compared to the group intubated by direct laryngoscopy. The systolic blood pressure, diastolic blood pressure, mean arterial pressure and heart rate were all significantly lower in the fibreoptic intubation group than the direct laryngoscopic intubation group in the first 5 minutes after intubation ($p < 0.01$). It is unlike the studies done by Aghdaii N et al[9] and Khudad M et al.[11]

The anaesthetic agents also have an important impact on attenuation of the pressor response to laryngoscopy and intubation. Aghdaii N et al[9] used premedication with i.m Lorazepam 1mg and morphine sulfate 0.1/kg 1 hour before surgery. Induction of anaesthesia was done with Etomidate 0.2mg/kg, sufentanil 2.5µg/kg and cisatracurium 0.2mg/kg in both groups. Khudad M et al[11] induced with fentanyl 1µg/kg, pancuronium 0.07-0.1mg/kg and sodium thiopental 4-7mg/kg and ventilated with 1-2% isoflurane in 100% O_2. We used propofol(2mg/kg), butorphanol(10µg/kg) and succinylcholine(1.5mg/kg) for induction and intubation followed by atracurium(0.5mg/kg) and maintained patients on sevoflurane (1-3%) with nitrous oxide and oxygen (1:1).

VII. Conclusion

Based on the present comparative study, we could conclude that Dexmedetomidine given at a dose of 0.5µg/kg attenuates the haemodynamic stress response during fibreoptic intubation as well as in direct laryngoscopic intubation. The stress response, manifested by SBP, DBP, MAP, and heart rate is better attenuated in patients intubated by fibreoptic bronchoscope compared to direct laryngscopic intubation. Although the time taken for intubation was significantly longer in the fibreoptic intubation group compared to the direct laryngoscopic intubation, the stress response were better controlled in the fibreoptic intubation, because of less airway manipulation and noxious stimulation with a fibreoptic bronchoscope.

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