Evaluation of the role of Dexmedetomidine premedication on rate pressure product following tracheal intubation

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ABSTRACT

Objectives: Laryngoscopy and tracheal intubation produce sympathetic overdrive by catecholamine release resulting in hypertension and tachycardia. This is usually tolerated by healthy individuals but susceptible patients are likely to succumb to the hemodynamic fluctuations. Various agents are being tried to combat the intubation response over the years. This study is aimed at evaluating the efficacy of Dexmedetomidine which is a highly selective alpha2 agonist in attenuating the hemodynamic response to laryngoscopy and tracheal intubation.

Methodology: 60 patients scheduled for general anaesthesia were divided into two groups, D and C with 30 patients in each group. Hypertension, diabetes mellitus, thyroid disease, treatment with beta blockers and difficult airway constituted the exclusion criteria. Group-D patients received Dexmedetomidine 0.5mcg/kg and group-C patients received normal saline [placebo] as intravenous premedication over 5min before a rapid sequence induction and tracheal intubation. Blood pressure and heart rate were measured using invasive arterial line and rate pressure product [RPP] was calculated at various time points including baseline, before induction, before intubation, at every 5sec after intubation up to 1min and at 5, 10 and 15min. Mean RPPs were compared between the groups at the said time points.

Results: Mean RPP in Dexmedetomidine group was significantly less than in control group at almost all the time points of measurement.

Conclusion: Dexmedetomidine is effective in attenuating the hemodynamic response to laryngoscopy and tracheal intubation.

Introduction

Laryngoscopy and tracheal intubation have become an integral part of anaesthetic management and critical care since their description in 1921 by Rowbotham and Magill. Circulatory response to laryngeal and tracheal stimulation was known since 1940[Reid and Bryce]. The principle mechanism behind hypertension and tachycardia is an exaggerated sympathetic action due to increased catecholamine release. This rise in heart rate and blood pressure is usually transient, variable and unpredictable, which may not be of much significance in healthy individuals but can be hazardous in those with hypertension, cardiac dysfunction, coronary artery disease or cerebrovascular disease. Laryngoscopic response in such individuals can precipitate coronary insufficiency, pulmonary edema, arrhythmias, left ventricular failure and cerebrovascular hemorrhage. Various pharmacological and non pharmacological methods are in vogue to counter this hemodynamic response. Alpha-2 agonists have recently gained significance in attenuating the laryngo-sympathetic response. Dexmedetomidine, the pharmacologically active di-isomer of medetomidine, is a highly specific and selective α2 adrenoceptor agonist. In recent studies, Dexmedetomidine was shown to have clinically significant effects on anaesthetic requirement, and hemodynamic responses induced by anaesthesia and surgery in patients. We sought to evaluate the role of dexmedetomidine in stabilizing the hemodynamics during laryngoscopy and tracheal intubation by beat to beat monitoring of blood pressure and heart rate using invasive arterial line in this prospective randomized double blind controlled study.

Materials and methods:

Approval from institutional ethics committee was obtained before starting the study. Written informed consent was obtained from all the patients enrolled in the study. Patients in the age group of 20 to 50 years belonging to ASA status I and II were included for general anesthesia between January 2013 and June 2013. Patients with heart disease, hypertension, diabetes mellitus, thyroid abnormalities and those on treatment with beta blockers were excluded from the study. Patients with an anticipated difficult airway and those in whom tracheal intubation took more than 30 seconds were also excluded from the study. Patients were randomly segregated into two groups D and C using a computer generated randomization programme. Patients in group-D received Dexmedetomidine 0.5 mcg/kg body weight in 20ml normal saline over 5minutes before induction. Patients in group-C received 20ml normal saline over 5min before induction. After shifting the patient into the operating room, non invasive blood pressure monitor, pulse oxymeter and ECG were connected and an intra venous [IV] line was secured with 18G canula. Inj Midazolam 1mg was given IV as premedication. Arterial line was secured in radial artery after giving local anaesthesia and base line hemodynamics were recorded. All the patients were pre oxygenated for 5minutes during when the study drugs were also administered as IV infusion. The study drugs were loaded by an anesthetist who was blinded to the study in 20ml syringe, coded and handed over to another anesthetist who was blinded to the drug present in the syringe for administration. After 5minutes of infusion and pre oxygenation, anesthesia was induced with Thiopentone 5mg/kg body weight and Succinyl choline 2mg/kg body weight in a rapid sequence followed by tracheal intubation by a reasonably experienced anesthetist. Subsequently Fentanyl 2mcg/kg and Vecuronium 0.1mg/kg body weight were administered intra venously and the anesthesia was maintained on Sevoflurane in oxygen and nitrous oxide gas mixture. Invasive systolic blood pressure [SBP] and heart rate [HR] were recorded before giving the study drug, before induction of anesthesia, before tracheal intubation, immediately after tracheal intubation, at every 5seconds in the first minute and at 5min, 10min and 15min after tracheal intubation. The rate-pressure product [RPP] was calculated with the above parameters at all the said time points. Power of the study was calculated at the same time points.

Results:

A total of 60 patients were enrolled in the study with 30 in each group. Power of the study with 30 as size in each sample was 99%. So the sample size was adequate. The demographic profile was comparable in two groups [table 1]. The mean RPP was ob-
served to be less in group-D than in group-C at all time points of measurements[Fig 1]. The difference in the mean RPPs was statistically significant at 17 time points out of a total of 19 time points of measurement[Table 2].

Discussion
Cardiovascular response is a reflex phenomenon mediated by vagus (x) and glossopharyngeal (ix) nerves. Vagus and glossopharyngeal nerves carry afferent stimulus from epiglottis and infraglottic region and activate the vasomotor centre to cause peripheral sympathetic adrenal response to release catecholamines. Nor-epinephrine, epinephrine and dopamine levels rise, but the raise in nor-epinephrine levels is consistently associated with elevation of blood pressure and heart rate11,12,13. Although these responses of blood pressure and heart rate are transient and short lived they may prove to be detrimental in high risk patients especially in those with cardiovascular disease, increased intracranial pressure or anomalies of the cerebral blood vessels.

We employed rate-pressure product as the comparing variable between the two groups. This is the product of systolic arterial pressure and heart rate and is an index of myocardial oxygen consumption14. It is said that the rate-pressure product of more than 22000 often signifies the risk of myocardial ischemia and anginal15. During laryngoscopy, the pressor response is influenced more by the duration rather than the force applied16. A substantial amount of clinical research was done so far evaluating the efficacy of dexmedetomidine in countering the pressor response. In most of the previous clinical trials, NIBP was employed to analyse the hemodynamic variations. The difference in the methodology of our study is employing invasive arterial blood pressure monitoring. It usually takes an average of 40 seconds to measure blood pressure in oscillometry through non invasive blood pressure monitoring. But hemodynamic fluctuations occur continuously during and after laryngoscopy and tracheal intubation. Thus with NIBP recording the hemodynamic variations before 40 seconds is not possible. The mean RPP was not only observed to be less in Dexmedetomidine group at all time points, but also the difference was statistically significant at 17 time points out of 19 time points of measurement emphasizing the efficacy of Dexmedetomidine in blunting the pressor response to laryngoscopy and tracheal intubation.

Conclusion:
We conclude that Dexmedetomidine when given as pre-medication, is effective in attenuating the hemodynamic response to laryngoscopy and tracheal intubation.

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Table
Demographic profile

<table>
<thead>
<tr>
<th>Patients characteristics</th>
<th>Group D</th>
<th>Group C</th>
<th>t-value</th>
<th>Z-value</th>
<th>P-value</th>
<th>Result</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age (years)</td>
<td>35.9±5.25</td>
<td>33.3±6.91</td>
<td>-1.57</td>
<td>0.12</td>
<td>NS</td>
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<tr>
<td>WEIGHT(Kg)</td>
<td>36±13.3</td>
<td>37±7.7</td>
<td>0.534</td>
<td>0.59</td>
<td>NS</td>
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<tr>
<td>Males</td>
<td>14</td>
<td>19</td>
<td>1.322</td>
<td>0.18</td>
<td>NS</td>
<td></td>
</tr>
<tr>
<td>Females</td>
<td>16</td>
<td>11</td>
<td>-1.32</td>
<td>0.18</td>
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<td></td>
</tr>
</tbody>
</table>

NS-Not Significant, HS-Highly Significant, S-Significant

Analysis of mean rate pressure product[RPP]
REFERENCE

1. Reid LC, Brace DB. Irritation of respiratory tract and its reflex effect on heart rate. Surg Gynaec Obstet 1940; 70: 157-162