ORIGINAL ARTICLE

Comparative Study on the Efficacy of Lignocaine Nebulisation Vs Topical Lignocaine Spray in Attenuation of Haemodynamic Surge in Patients Undergoing Surgery Under General Anaesthesia - A Single Blinded Randomized Controlled Study

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ABSTRACT

Introduction: Laryngoscopy and tracheal intubation are powerful noxious stimuli that should be attenuated. The present study is to compare the efficacy of lignocaine nebulisation vs topical lignocaine spray in attenuation of haemodynamic surge in patients undergoing surgery under general anaesthesia. **Methodology:** After ethical committee clearance, a single blind randomized control study was done on sixty patients of either sex aged between 18-55 years of ASA status I undergoing elective surgery under general anaesthesia with endotracheal intubation. Patients were randomly allocated into 2 groups: GROUP A:received nebulised Lignocaine Hydrochloride 4% at 2 mg/kg. GROUP B: received Topical Lignocaine spray 10% at 2mg/kg. Heart rate, Systolic, diastolic and mean blood pressure was documented before administering premedication (T0), at the time of intubation (TI) and at 1min (T-1), 2min (T-2) & 5min (T-5) after intubation. Attenuation in HR, SBP, DBP and MBP were found statistically significant ($p<0.05$) in group A in comparison to group B. Thus in conclusion Lignocaine nebulisation is far more effective in comparison to topical lignocaine spray in attenuation of the laryngoscopic surge. **Results:** After conducting the study on a total of sixty patients it was found that there was statistically significant reduction in SBP, DBP, MBP and HR in GROUP A receiving lignocaine nebulisation compared to GROUP B receiving topical lignocaine spray. **Conclusion:** Lignocaine nebulisation is more effective than topical lignocaine spray in attenuation of haemodynamic surge following laryngoscopy and intubation in patients undergoing surgery under general anaesthesia.

KEY WORDS: Laryngoscopy, Tracheal Intubation, Lignocaine Nebulisation, Lignocaine Spray, Heamodynamic Surge.

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Introduction

Laryngoscopy and tracheal intubation marked the beginning of a new era of anaesthesiology practice and has led to a safer anaesthesia practice because of more control of airway and ventilation. A sympathoadrenal response is thought to be started by stimulation of epipharynx and laryngopharynx during laryngoscopy and tracheal intubation [1].

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These responses start within 5 sec, reaches a peak in 1-2 min and returns to baseline within 5 min[2,3]. These responses include increased circulatory catecholamines, heart rate (HR), Blood pressure (BP), myocardial oxygen demand and dysrthymias. Average increase in HR has been reported to be 23 beats and increase in blood pressure by 53/54 mm of Hg and decrease in left ventricular ejection fraction by 20%. A study was also conducted recently in 2021 which showed that there was peak rise in mean blood pressure by 3% after laryngoscopy and tracheal intubation[4]. Although this response would likely to be tolerated by healthy patients, these changes may be associated with myocardial ischaemia and cerebral haemorrhage in those with a significant coronary artery or cerebrovascular disease[5]. Hence, Effective attenuation of haemodynamic surge has become an important part in modern anesthesiology and various pharmacological methods have been tried for this. A wide variety of drugs are used to attenuate the hemodynamic response of laryngoscopy and intubation like Lignocaine[4,6–18], fentanyl[19–23], alfentanyl, ramifentanyl[24] nifedipine[25], beta blockers like, labetalol[26], metoprolol, esmolol, gabapentin, pregabalin, magnesium sulphate, ivabradine, dexmedetomidine[27], cloning[28]. Lignocaine is an aminoethylamide and prototype of amide local anesthetic group. Introduced in the year 1948, it is the most widely used local anesthetic. Lignocaine has a better safety profile than the other agents used for airway anaethesia. Lignocaine has been used in several techniques of airway anaesthesai like nebulisation, topical spray and gel, transtracheal injection, Spray and you go (SAYGO) and nerve blocks. Each has advantages and disadvantages. Using nebulizer which is very readily available and simple technique, inhalation of aerosol of lignocaine is usually well tolerated and can anesthetize the entire respiratory tract[3]. Following topical administration and its rate and extent of absorption depends upon concentration of total dose administered, the specific site of action and duration of exposure. The present study was undertaken to compare the efficacy of lignocaine 2% nebulisation versus oropharyngeal topical 10% xylocaine spray both @1.5mg/ kg before induction of anaesthesia in attenuating the pressor response to direct laryngoscopy and endotracheal intubation.

Methodology

After obtaining approval from hospital ethics committee, the study was conducted in the Department of Anaesthesiology and Murshidabad Medical College and hospital, West Bengal from January 2020 to February 2021. Based on the previous studies a sample size of 60 patients was taken in the age group of 18 to 45 years of either sex scheduled for routine elective surgical procedure (ASA grade I and II) under general anesthesia with endotracheal intubation were enrolled in the study. Patients with uncontrolled hypertension, significant hepatic or renal disease, antecipated difficult intubation, history of hypersensitivity to amide local anaesthetics, seizure disorder, patients taking any systemic medication and pregnant/lactating women were excluded from the study. Informed written consent was taken from each patient fulfilling inclusive criteria. Pre-anaesthetic check-up was done a day before surgery including a detailed history, a thorough physical and systemic examination and relevant demographic characteristics and baseline haemodynamic parameters were recorded. Routine investigations were done. Written informed consent was taken from the patient before including them in this study. Total 60 patients were randomly divided into two groups containing 30 patients in each group. Group A - Patients receive 4% lignocaine hydrochloride without preservative (Xylocard) given through nebulisation at 2mg/kg (2.5ml containing 100mg for a patient with 50kg weight) 3 minutes prior to laryngoscopy and intubation. Group B - Patients receive 10 puffs of topical spray with 10% lignocaine hydrochloride without preservatives (Xylocard) at 2mg/kg (100mg for a patient with 50 Kg weight) 3 minutes before laryngoscopy and intubation along with pre-oxygenation. Both the groups were double blinded by the sealed envelope method that means both the observer and the patients were unaware of the drug received in the sealed envelope. Heart rate, systolic blood pressure (SBP), diastolic blood pressure (DBP), and mean blood pressure (MBP) are documented 10 minutes before intubation, at the time of intubation, and 1,2 & 5 minutes after completion of laryngoscopy and intubation. After pre-oxygenation with 100% oxygen for 2 minutes, anesthesia was induced with 1.5 mg/kg propofol, followed by 1.5 mg/kg succinylcholine (muscle relaxant). After ventilation with 100 percent oxygen via a face mask for 1 minutes, endotracheal intubation was achieved using a Portex® ETT (cuffed). The cuff of the endotracheal tube was inflated until the cessation of air leakage around the tube. Inj. Fentanyl 2 mcg/kg is given intravenously after taking all post intubation readings. Isoflurane inhalation is added immediately after taking post intubation readings if there is no significant fall in blood pressure.

Maintenance of anaesthesia was achieved with 60 per cent nitrous oxide in oxygen. Atrracurium is given intravenously when patient recovers from scholine relaxation. During anesthesia, a standard monitoring device to be used to non-invasively measure blood pressure and heart rate (HR). We also employed electrocardiography, pulse oximetry and capnography for monitoring. MBP, SBP, DBP, HR and peripheral oxygen saturation were recorded at the following time points: before the induction of anesthesia (baseline/ pre-induction); at 1, 2 and 5 minutes after endotracheal intubation. Outcome definition and parameters are HR (Heart rate), SBP (systolic blood pressure), DBP (diastolicblood pressure) and MBP (mean blood pressure) are the markers for hemodynamics stress response to laryngoscopes and intubation. The values obtained from each group are compared and comparison made among those two groups to assess the efficacy of nebulisation and topical lignocaine in suppression of hemodynamic surge.

Plan of Statistical analysis: Data will be entered in MS Excel and analyzed by SPSS Version 16.0 or later, IBM, Chicago USA. Unpaired independent t-test has been used for testing hypothesis about difference of arithmetic means between the 2 groups. Chi-square and Mann-Whitney U tests are used for comparing distribution of sex and mallampati classification among the participants of two groups respectively.

Results

Demographic data like age, sex, height and weight were compared and which are statistically not significant as shown in Table 1 that means these are comparable among the groups. When we compare heart rate among the groups, we can as per Table 2 that difference in heart rate at 2 minute and 5 minutes after intubation was statistically significant. When we compared the Systolic Blood Pressure (SBP), Diastolic Blood Pressure (DBP) and Mean Blood Pressure (MBP) among these two groups, we found significant difference in all these parameters 1 minute, 2 minutes and 5 minutes after laryngoscopy and intubation as shown in Tables 3, 4 and 5.

Discussion

The most important indications for attenuation of haemodynamic responses to laryngoscopy and endo-tracheal intubation, are in patients with Ischemic heart disease, hypertension and in patients with intracranial aneurysms[29,30]. Even these transient changes can result in potentially deleterious effects

Table 1: Comparsion of the demographic parameters between two groups

Parameter	Group A (Mean±Sd)	Group B (Mean±Sd)	P Value	Statistical Significance
Age	37.43± 6.06	38.76± 4.02	0.321	Not significant
Sex (Male /Female)	12/18	17/13	0.301	Not significant
Height	158.4±7 7.8	159.13± 6.7	0.724	Not Significant
Weight	65.60±4.80	63.3±6.92	0.164	Not significant

No significant difference were noted in demographic parameters between the two groups

Table 2: Comparison of heart rate (HR) readings between and within the study groups at different points of time

Parameter	Group A (Mean ±SD)	Group B (Mean ±SD)	P Value	Significance
HR 10min before intubation	83.53 ±3.48	84.80± 5.08	0.378	Non significant
HR Intubation	74.4± 2.86	75.8± 4.43	0.141	Non significant
HR 1minute	80.03± 3.35	82.07 ±4.83	0.062	Non significant
HR 2 minutes	76.30± 3.32	79.80±4.43	0.001	Significant
HR 5mins	72.30± 3.29	77.80±4.43	0.000	Significant

Significant difference in HEART RATE (HR) were noted 2 minutes and 5 minutes after laryngoscopy and intubation

Table 3: Comparison of systolic blood pressure (SBP) between and within the study groups at different points of time

Parameter	Group A (Mean ±SD)	Group B (Mean ±SD)	P Value	Significance
SBP 10min before intubation	133.5 ±4.26	133.7 ± 3.86	0.850	Non significant
SBP Intubation	119.6 ± 4.26	119.8 ± 3.86	0.849	Non significant
SBP 1minute	125.7 ± 4.17	129.1 ±4.06	0.002	Significant
SBP 2 minutes	121.7± 4.4	126.4 ±3.94	0.000	Significant
SBP 5mins	117.2 ± 4.16	121.1 ±4.06	0.000	Significant

Significant difference in SYSTOLIC BLOOD PRESSURE (SBP) were noted 1 minutes, 2 minutes and 5 minutes after laryngoscopy and intubation

Table 4: Comparison of Diastolic blood pressure (DBP) between and within the study groups at different points of time

Parameter	Group A (Mean ±SD)	Group B (Mean ±SD)	P Value	Significance
DBP 10min before intubation	79.36 ±3.80	79.46 ±2.96	0.910	Non significant
DBP Intubation	71 ± 3.29	70.5 ± 2.9	0.539	Non significant
DBP 1minute	76.27 ± 2.85	77.83 ±2.05	0.017	Significant
DBP 2 minutes	72.00 ± 3.29	75.77 ±2.02	0.000	Significant
DBP 5mins	70.53 ± 3.17	73.73 ±2.76	0.000	Significant

Significant difference in DIASTOLIC BLOOD PRESSURE (DBP) were noted 1 minutes, 2 minutes and 5 minutes after laryngoscopy and intubation

Table 5: Comparison of Mean blood pressure (MBP) between and within the study groups at different points of time

Parameter	Group A (Mean ±SD)	Group B (Mean ±SD)	P Value	Significance
MBP 10min before intubation	98.53 ±3.0	98.30 ±2.0	0.719	Non significant
MBP Intubation	87.23 ± 3.0	86.92 ± 2.35	0.593	Non significant
MBP 1minute	92.83 ± 2.49	94.90 ±2.0	0.001	Significant
MBP 2 minutes	88.50 ± 2.62	92.70 ±2.0	0.000	Significant
MBP 5mins	86.00 ± 2.31	89.10 ±2.0	0.000	Significant

Significant difference in MEAN BLOOD PRESSURE (MBP) were noted 1 minutes, 2 minutes and 5 minutes after laryngoscopy and intubation

like left ventricular failure, pulmonary edema, myocardial ischaemia, dysrhthmias and cerebral haemorrhage. Lignocaine has been successfully used to blunt the haemodynamic responses[6,7] due to the following properties: Suppression of the airway reflexes, effectively prevents and treat laryngospasm, good cough suppressant, myocardial depressant, peripheral vasodialation and antiarrythmic properties. The present study was undertaken to evaluate the efficacy of Lignocaine nebulisation vs topical lignocaine spray in the attenuation of hemodynamic surge during laryngoscopy and intubation in patients undergoing surgery under general anesthesia[8,9]. Attenuation in the SBP, DBP, MBP, HR were found statistically significant in the lignocaine nebulisation group when compared with the group receiving topical lignocaine spray. Our findings are similar to other studies[17–19]. Our study is also in accordance with study conducted by Dhasmana S. Singh S. Pal US. J Maxillofac oral surg.2015 found lignocaine nebulisation is effective in airway block[31]. Where Mostafa SM. Murthy BV. Barrett PJ. McHughP. Eur J Anaesthesiol in 1999 found orolaryngeal lignocaine spray cannot abolish haemodynamic stress response due laryngoscopy and intubation[32]. Nebulizer is a readily available machine in OT complex, it is very simple to use, as well as it's well tolerated to patients and it can anaesthetize the entire airway. The quality of topical anaethesia achieved with nebulisation is not as good as that achieved by the other techniques but use full options when other technique cannot be used or coughing is particularly undesirable. Where topical spray achieve rapid anaesthesia only to nose mouth and pharynx. Pressurized aerosol spray contains preservative that may cause sore throat postoperatively. Moreover most of the lignocaine applied with spray is swallowed and the absorbed drug metabolized in first-pass hepatic metabolism. It was found that there was better distribution of the drug via nebulisation in comparison to topical spray due to more duration available to achieve satisfactory topical anaesthesia[3]. Further nebulisation resulted in better drug absorption from the pharyngeal and laryngeal area as well[33].

Conclusion

Lignocaine Nebulisation is more effective than topical lignocaine spray in attenuation of hemodynamic surge following laryngoscopy and intubation in patients undergoing surgery under general anaesthesia. This improved the safety profile of patients with hypertension, ischaemic heart disease, or any other comorbidites in which the haemodynamic surge could be harmful. Limitations of use of lignocaine nebulisation is in patients with history of allergy to local anaesthetic, asthma and pregnant patients as well as it cannot be used in emergency situation.

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