EFFECT OF INTRACUFF LIGNOCAINE VERSUS LIGNOCAINE WITH DEXAMETHASONE ON ENDOTRACHEAL TUBE INDUCED EMERGENCE PHENOMENA AFTER GENERAL ANAESTHESIA- COMPARATIVE STUDY

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ABSTRACT

BACKGROUND

Inflating the ETT cuff with local anaesthetic would allow diffusion locally to produce anaesthesia to the mucosa, thereby attenuating stimulation during extubation. Dexamethasone, a corticosteroid, has anti-inflammatory action along with its analgesic and antiemetic properties.

The aim of the study is to compare the efficacy of lignocaine 2% alone versus lignocaine 2% with dexamethasone on post-extubation emergence.

MATERIALS AND METHODS

60 patients undergoing surgery under general anaesthesia were included in the study. They were randomly included into group A- ETT cuff filled with lignocaine 2% and Group B- ETT cuff filled with lignocaine 2% with dexamethasone. All were induced and intubated with propofol, muscle relaxant and maintained with sevoflurane. Cough reflux (present or absent) assessed from when inhalational anaesthetics stopped and reversal given to 30 minutes post extubation.

RESULTS

Data from the study was subjected to bi-variable analysis. Cough reflex was recorded in 6 subjects in lignocaine alone group vs. 1 in lignocaine with dexamethasone group. This was the only statistically significant ($p<0.05$) difference between the two groups.

CONCLUSION

Better postop emergence (reduced incidence of cough) with endotracheal tube cuff filled with lignocaine with dexamethasone than with lignocaine alone.

KEYWORDS

Endotracheal Tube, Post Extubation Emergence, Post Extubation Cough, Intracuff Lignocaine, Intracuff Lignocaine with Dexamethasone.

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BACKGROUND

Cuffed Oral Endotracheal Tubes (CoETT) being standard for general anaesthesia, associated complications can be pretty common. Tracheal tube cuff pressure can cause complications in the tracheal mucosa ranging from loss of mucosal cilia, ulceration, haemorrhage and tracheal stenosis to tracheoesophageal fistula.[1]

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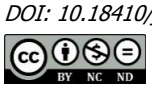

Coughing occurring during the period of emergence from general anaesthesia can lead to potential complications like hypertension, tachycardia, dysrhythmia, increased intraocular pressure, increased intracranial pressure, wound dehiscence and bronchospasm. This can be detrimental to patients leading to deleterious consequences.

When nitrous oxide is used as a part of fresh gas flow in general anaesthesia, it diffuses into the air-filled endotracheal tube cuff, which can increase the volume of the cuff, especially in longer duration surgeries, thereby increasing the pressure inside the cuff and in effect pressure exerted on the surrounding mucosa it is in contact with. This is due to the fact that nitrous oxide enters the air-filled cuff faster than the exit of nitrogen from the cuff. Studies have shown that using a liquid inside the cuff instead of air minimises this risk.[2-4]

Prior to intubation, intravenous lignocaine is frequently used to suppress cough associated with ETT. Intravenous dexamethasone, a corticosteroid, has anti-inflammatory action along with its analgesic and antiemetic properties.[5-7]

Inflating the ETT cuff with local anaesthetic would allow diffusion locally to produce anaesthesia to the mucosa, thereby attenuating stimulation during extubation. This study aims to compare the efficacy of lignocaine 2% alone versus lignocaine 2% with dexamethasone on post-extubation emergence.

MATERIALS AND METHODS

The study was done as a double-blind clinical trial after approval from the Institutional Ethics Committee. Written informed consents were obtained from all participants included in this study conducted in Sree Gokulam Medical College and Research Foundation, Trivandrum, from January 10, 2017, to June 10, 2017.

A total of 60 subjects were included. ASA (American Society of Anaesthesiologists) class I and II male patients falling in the age group from 18 to 60 years who were posted for elective surgeries were chosen. Only surgeries lasting from 1.5 hours to 3 hours were included in the study. Exclusion criteria involved patients with raised ICP, respiratory tract infection, smokers, chronic obstructive pulmonary disease or any other respiratory or cardiac pathology. Patients on antihypertensives (angiotensin-converting enzyme inhibitors), steroids, anticipated difficult airway, history of drug allergies, patients requiring Ryle's tube during intraoperative period or immediate postoperative period and surgeries involving airway were also excluded. All participants had good effort tolerance (METS >4).

Out of the 60 subjects selected for the study, 30 each were randomly selected into two groups (group A and group B) using sealed envelope method. One investigator, who was not involved in anaesthesia, induction, intubation, monitoring or extubation was assigned to fill the endotracheal tube cuffs with a 10 mL syringe containing 10 mL of either 2% lignocaine plain for group A or 2% lignocaine with 8 mg dexamethasone for group B.

General anaesthesia was induced after premedication (Inj. Midazolam 0.02 mg/kg IV, Inj. Glycopyrrolate 0.2 mg IV, Inj. Ondansetron 0.1 mg/kg IV and Inj. Fentanyl 1-2 mcg/kg) and preoxygenation with 100% oxygen for 3 minutes. Following Inj. Lignocaine 1.5 mg/kg IV, induction was done with Inj. Propofol 2 mg/kg. After bag and mask ventilation was confirmed, Inj. Atracurium 0.5 mg/kg IV was given. Trachea was intubated with Soft Seal® cuffed sterile polyvinyl chloride ETT with standard high volume-low pressure cuff. Cuffs in the group A and group B were filled with lignocaine 2% and lignocaine 2% with dexamethasone respectively to a peak cuff pressure around 25 cm H20. Cuff pressure was monitored after inflation and at 10-minute intervals with cuff manometer. Anaesthesia was maintained with sevoflurane, oxygen 50%, nitrous oxide 50% and adequate analgesia was provided with Inj. Paracetamol IV (10-15 mg/kg) and Inj. Morphine.

We used the same criteria for extubation in all groups. The criteria set was full reversal of neuromuscular blockage by giving neostigmine and glycopyrrolate, spontaneous ventilation, following verbal commands, eye opening or handgrip. After criteria was met, tracheal extubation was done by anaesthetist in charge (at full discretion by him/her). Time to extubation (time from beginning of anaesthesia to end of extubation) and spontaneous ventilation time (time from start of spontaneous breathing to extubation) were recorded.

The patient was assessed during the emergence and 30 minutes and 2 hours post extubation for haemodynamic indices by an independent blinded observer (an anaesthesiologist uninvolved with the case). The variable monitored and recorded for this study was whether or not cough was present from stopping inhalational anaesthetics towards end of surgery to 30 minutes post extubation. It was recorded as a 2-point scale- 0 (absent) or 1 (present). The number of cough was not considered for the study. Laryngospasm and hoarseness of voice were also recorded as present (1) or absent (0).

DATA ANALYSIS AND RESULTS

Analysis of data was performed using SPSS software. Quantitative analysis of the study was compared using "t" test. Data was presented as mean ± SD or number (%) and p values <0.05 were considered as statistically significant.

Out of the 60 subjects included in the study, there were no statistically significant differences between the two groups regarding anaesthesia and baseline characteristics. We encountered no problems during tracheal intubation or cuff inflation in these cases. No significant differences were observed between the two groups in the incidence of hoarseness of voice or laryngospasm. Addition of dexamethasone to lignocaine showed no extra benefit for these symptoms.

When cough was used as a variable, findings were significantly different between the groups. Lignocaine with dexamethasone as intracuff fluid was seen as more effective in reducing the incidence of cough than lignocaine alone. However, there was no significant difference either in prolongation of spontaneous ventilation or time to extubation between the groups (increase in tolerance to endotracheal tube). Regarding blood pressure and heart rates, there were no significant differences.

T-test assuming unequal variances was conducted.

Test was conducted at 95% significance level (alpha=0.05).

Statistically significant difference exist only if p-value is less than alpha value (0.05) and t-value is greater than t-critical value.

In our case, statistically significant difference exists between the two groups only on the parameter of cough reflex.

Parameter	P-value	t-value	t Critical	Statistically Significant Difference	Statistical Reason
Cough reflex	0.0473	2.0471	2.0211	Yes	p-value <0.05 and t-value >t-critical
SBP during emergence	0.6424	0.4669	2.0025	No	p value >0.05
SBP 2 hours post-extubation	0.3771	0.8902	2.0017	No	p value >0.05
DBP during emergence	0.8830	-0.1479	2.0017	No	p value >0.05
DBP 2 hours post extubation	0.5632	0.5814	2.0017	No	p value >0.05
Hoarseness of voice	1.0000	0.0000	2.0017	No	p value >0.05

Table 1. Results of t-Test Conducted on Various Parameters for the Groups

	Cough Reflex Yes-1, No-0	
	Variable 1	**Variable 2**
Mean	0.20	0.03
Variance	0.17	0.03
Observations	30	30
Hypothesised mean difference	0	
Df	40	
t-Stat	**2.0471**	
P (T<=t) one-tail	0.02	
t-critical one-tail	1.68	
P (T<=t) two-tail	0.0473	
t-critical two-tail	2.0211	

Table 2. T-Test- Two-Sample Assuming Unequal Variances

	SBP During Emergence		SBP 2 Hours Post Extubation	
	Variable 1	**Variable 2**	**Variable 1**	**Variable 2**
Mean	126.57	125.90	125.03	124.03
Variance	34.05	27.13	20.52	17.34
Observations	30	30	30	30
Hypothesised mean difference	0		0	
Df	57		58	
t-Stat	**0.4669**		**0.8902**	
P (T<=t) one-tail	0.32		0.19	
t-critical one-tail	1.67		1.67	
P (T<=t) two-tail	0.6424		0.3771	
t-critical two-tail	2.0025		2.0017	

Table 3. Systolic BP

	DBP During Emergence		DBP 2 Hours Post Extubation	
	Variable 1	**Variable 2**	**Variable 1**	**Variable 2**
Mean	80.87	81.00	79.50	79.03
Variance	12.19	12.21	8.88	10.45
Observations	30	30	30	30
Hypothesised mean difference	0		0	
Df	58		58	
t Stat	**-0.1479**		**0.5814**	
P (T<=t) one-tail	0.44		0.28	
t-critical one-tail	1.67		1.67	
P (T<=t) two-tail	0.8830		0.5632	
t-critical two-tail	2.0017		2.0017	

Table 4. Diastolic BP

	Hoarseness of Voice Yes 1/No 0	
	Variable 1	**Variable 2**
Mean	0.03	0.03
Variance	0.03	0.03
Observations	30	30
Hypothesised mean difference	0	
df	58	
t Stat	**0.0000**	
P(T<=t) one-tail	0.50	
t-critical one-tail	1.67	
P (T<=t) two-tail	1.0000	
t-critical two-tail	2.0017	

Table 5. Hoarseness of Voice

Alpha level for all tests = 0.05 (it means 95% (1-0.05=0.95) confidence interval; results can be stated with 95% confidence). Normally, for studies, we take alpha value as 0.1, 0.05 or 0.01, i.e. 90%, 95% and 99% confidence levels. Our null hypothesis is that population variances are equal, which means that there is no statistically significant differences between the two populations.

If p value is less than the alpha value we take (in our case 0.05), we reject the null hypothesis. Also, 'T-stat' has to be outside range of ± t critical two tail to reject null hypothesis.

Rejecting null hypothesis implies that population variances are unequal and there is a statistically significant difference between the two populations in terms of variable under consideration.

In case of cough reflex as variable, p value=0.0473 <0.05, hence we can reject null hypothesis. Also, T-stat (2.0471) > t critical (2.0211). Hence, there is a statistically significant difference in terms of cough reflex between the two populations.

In case of all other parameters, p-value >0.05, hence null hypothesis can't be rejected, i.e. there is no statistically significant difference.

DISCUSSION

Various methods are commonly used to prevent or reduce the incidence of post extubation reactions like using low pressure cuff endotracheal tubes, smaller-sized endotracheal tube, steroid-coated ETT, applying topical lignocaine and inhalation of steroids. To avoid confounding factors of age and sex, which was seen in some previous studies, we selected only male population in similar age range for this study.

Our study results showed that there was no significant differences in the incidence of post-extubation sore throat, hoarseness of voice or laryngospasm. So, it was concluded that both lignocaine and lignocaine with dexamethasone as intracuff fluid had similar effect on sore throat, hoarseness of voice and laryngospasm. But, when incidence of cough was compared, it showed significant difference between intracuff lignocaine and intracuff lignocaine with dexamethasone as the latter proved more effective in preventing cough reflex.

A study by Park et al showed prophylactic use of 0.2 mg/kg of dexamethasone significantly decreased the incidence and severity of sore throat and hoarseness, 1 and 24 hours following tracheal extubation of a double-lumen endobronchial tube.[8] A study by Sumathi et al used betamethasone gel to reduce the incidence of post-extubation reactions. The study showed that widespread application of betamethasone gel on the tracheal tube decreased the incidence and severity of postoperative sore throat, cough and hoarseness of voice.[9]

A study by Stride concluded that the use of water soluble 1% hydrocortisone cream was ineffective for reducing the incidence of postoperative sore throat.[10] The difference in the findings of these two studies may have resulted from the amount of steroid used. Stride lubricated the ETT only to the 5 cm mark, while Sumathi et al lubricated the tube to the 15 cm mark. Therefore, more widespread application of steroid gel to the tube caused more gel to come in contact with the posterior pharyngeal wall, vocal cords and trachea. However, Stride confined gel contact only to the tip and cuff of the tracheal tube. This may have been the reason for the different results in two studies.

Dexamethasone used as intracuff liquid delivers the drug in smaller doses and is not in direct contact with the patient's airway when compared to widespread lubrication of the tube with betamethasone, which will increase the drug dose in contact with the mucosa of the oropharynx, larynx and trachea. This can result in higher systemic absorption (and a possible aggravation of local subtle infection, especially in pregnant patients).

It is presumed that the potential mechanism of action of intracuff dexamethasone is based on its anti-inflammatory activity, which includes inhibition of leucocyte migration, maintenance of cell membrane integrity, attenuation of lysosome release and reduction of fibroblast proliferation.[8]

In a study done by Singh et al, it was reported that the use of saline or 2% lignocaine as a liquid media for filling the endotracheal tube cuff reduced postoperative sore throat and thereby tracheal morbidity. Wetzel et al in a study injected 4% lignocaine into the endotracheal tube cuff to reduce post-extubation reactions. Fagan et al suggested that inflating the endotracheal tube cuff with lignocaine instead of air can indeed reduce the incidence of post-extubation cough.[11] Randomised high quality studies in a systematic review of more than 1200 patients evaluated the effectiveness of lignocaine as an intracuff liquid to prevent post-extubation sore throat. Out of this, 672 patients received topical or systemic lidocaine therapy and 560 patients were allotted to the control group. The results indicated that both topical and systemic lignocaine therapy significantly reduced the risk of postoperative sore throat.[11]

In all of the research studies mentioned, the endotracheal tube cuff acted as a reservoir of lignocaine and the drug was released across the cuff membrane, which anaesthetised the tracheal mucosa. But, lignocaine release through the cuff membrane depends on time, dose and pH. Alkalinised lignocaine is thus used for quicker and more efficient diffusion of lignocaine through the cuff membrane.[12-14]

Lignocaine alone when used as an intracuff liquid has preventive effects on cough incidence owing to its effect on suppressing mechanical and chemical-induced airway reflexes, which includes cough reflex. When dexamethasone and lignocaine mixture was used as intracuff liquid, there was an added effect of dexamethasone. It acted as a mast cell stabiliser and enhanced the activation of neutral endopeptidase, which reversed the increased reactivity of epithelial cells of the airway. Dexamethasone has also shown its effect in increasing beta adrenergic receptors on lung cells.

CONCLUSION

To conclude, using dexamethasone with lignocaine for filling, the ETT cuff to reduce post-extubation reactions was more effective than lignocaine alone. Therefore, the drug combination can be considered in clinical practice to reduce cough reflex in general anaesthesia and to improve tolerance to endotracheal tube in mechanically-ventilated patients in critical care units. A reduced cough reflex can be extremely useful in patients with raised intracranial and intraocular pressure as well as in pulmonary hyperreactivity cases.

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