Original Research Paper

Volume - 11 | Issue - 10 | October - 2021 | PRINT ISSN No. 2249 - 555X | DOI : 10.36106/ijar

Anaesthesiology

COMPARISON OF INTRACUFF LIGNOCAINE VERSUS AIR FOR ATTENUATING EMERGENCE PHENOMENA AND POSTOPERATIVE SORE THROAT AFTER GENERAL ANAESTHESIA

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ABSTRACT **Background and Aims:** Postoperative sore throat is one of the most common complications results from laryngeal mucosal injury or inflammation, which occurs due to airway instrumentation or irritating effects of the endotracheal tube. This effect is aggravated by diffusion of nitrous oxide into the cuff. Postoperative sore throat occurs in approximately 50% of patients after intubation and general anaesthesia. Lignocaine, when administered as a cuff inflation medium despite air, it diffuses across the cuff and desensitizes the laryngeal mucosa, and prevents diffusion of nitrous oxide into the cuff, this decreases the incidence of multiple laryngeal morbidities.

Material And Methods: In this study106 patients were randomized into two groups of 53 each. Group- L: received 2% lignocaine solution as cuff inflation medium, and Group-A: received air. Hemodynamic parameters, the severity of cough, post-operative sore throat and hoarseness of voice were compared.

Results: Increase of mean heart rate, systolic BP and diastolic BP from baseline is more in Group A than Group L at the time of extubation,1min,2min,5min,10min,15min,20min and after extubation with P value <0.05. There was significant difference in Cough severity, post-operative sore throat, hoarseness of voice after extubation with P value ≤0.05, the severity is less in Group L than Group A.

Conclusion: We observed that inflating endotracheal tube cuff with lignocaine is having a better profile in terms of fewer hemodynamic changes during extubation, reduced cough severity, less incidence of sore throat, and hoarseness of voice.

KEYWORDS : Lignocaine, Cough, Sore throat, Hoarseness, Extubation.

INTRODUCTION:

Airway morbidities that occur as a complication of intubation and airway instrumentation have a significant effect on postoperative outcome and patient's satisfaction. Postoperative sore throat (POST) is one of the most undesirable morbidities that occurs in approximately 50% of patients after intubation and general anaesthesia.[1][2] Other complications like hoarseness of voice, dysphagia were also observed in the postoperative period after intubation. Factors like laryngoscopy, suctioning, irritating effect of the endotracheal tube, intracuff diffusion of nitrous oxide may cause laryngeal mucosal injury and inflammation that leads to the above-mentioned complications.[3]

Rapidly acting receptors present in tracheal mucosa are the irritant receptors which are involved in the cough reflex. These receptors are stimulated by endotracheal tube or increased intracuff pressure while using air to inflate the endotracheal tube cuff. Nitrous oxide tends to diffuse into the cuff and increases the cuff pressure. The increased cuff pressure is transmitted to tracheal mucosa and jeopardizes the mucosal blood supply which leads to ischemia of mucosa that results in complications like post-operative sore throat, hoarseness of voice and tracheal stenosis.

During emergence from general anaesthesia, patients may experience vigorous coughing, agitation, tachycardia, hypertension which increases intracranial, intra-thoracic and intra-abdominal pressure, which results in bronchospasm, wound dehiscence and bleeding.[4]This emergence response is very significant in patients with cardiac disease, reactive airway and patients undergoing neurosurgery, major abdominal surgeries and ophthalmic surgeries.

Various prophylactic interventions such as anti-inflammatory drugs, opioids, steroids and local anesthetics have been used to decrease the severity of airway complications after intubation and general anaesthesia. Lignocaine is one of the most commonly used drugs to prevent emergence response and postoperative airway complications.[5]

Lignocaine is being used in many ways to prevent postoperative airway complications. 5% jelly applied over endotracheal cuff, 10% spray over vocal cord during intubation, 4% nebulization prior to induction, 2% intravenously but all of them have failed to give good results. Following intravenous or intratracheal administration, lidocaine blood concentrations quickly decrease and the topical anaesthesia of the upper airway only lasts for 20-30 min. [1] Using 2%Lignocaine as an inflation medium for endotracheal tube cuff, may protect the tracheal mucosa through its continuous topical anesthetic effect and prevent diffusion of nitrous oxide into the cuff.[6][7][8] Lignocaine reduces the injury to tracheal mucosa by its vasodilatory effect and improves ETT tolerance in intubated patients and reduces sedation requirement.[9,10]

The study we conducted is one of the evidences available till date regarding patient outcomes where lignocaine was administered as a cuff inflation medium. Our primary aim was to compare the incidence and severity of postoperative sore throat among the groups. Secondary aims were the hemodynamic changes, severity of cough during extubation and in immediate postoperative period, hoarseness of voice in postoperative period.

METHODS:

This is a prospective, double-blinded, randomized controlled study of interventional type. Institutional ethical committee approval was

obtained before starting the study. This study is registered in the Clinical trial registry of India. The registration number is CTRI/2020/07/026638. The procedure was explained to the patient and written informed consent was taken.

Inclusion criteria were ASA-PS Grade 1 or 2 patients posted for elective surgery under general anaesthesia with the minimum surgical duration of 120 minutes and need minimum two days of hospital stay after general anaesthesia, age group between 18 to 65 years of both genders. Patients having hypersensitivity to local anesthetic drugs, refusing to give consent for the study, history of polytrauma, head injury, loss of consciousness, history of reactive airway disease, smoking, anticipated difficult intubation, hemodynamic instability were excluded.

A thorough history was taken and a detailed examination was carried out. Patients were subjected to routine and relevant investigations and kept nil per oral as per ASA guidelines. Inj. lignocaine intradermal test dose was given. Patients were randomized by computer-generated random number into two groups. GROUP- L: received 2% lignocaine solution into endotracheal tube cuff and GROUP -A: received air into endotracheal tube cuff. The volume was decided according to minimal occlusion volume technique.[2] There were three observers in this study, the first observer was the anaesthesia consultant or resident who performed intubation and assessed post-extubation coughing and hemodynamic response. The second observer was the anaesthesia resident who inflated the cuff with air or lignocaine. The third observer was the ward nurse, postop ICU nurse or anaesthesia resident who assessed sore throat and hoarseness.

On the day of surgery at the operation theatre, iv access was established with 18G/20G cannula. ASA standard monitors were applied and baseline pulse rate, systolic blood pressure, diastolic blood pressure, mean arterial blood pressure and Spo_2 were recorded. The patient was pre-medicated with Inj. Glycopyrrolate 0.004 mg/kg iv, Inj. Ondansetron 0.15 mg/kg iv, Inj. Fentanyl 2 mcg/kg iv. After preoxygenation, Induction was done with Inj.Propofol 2-2.5 mg/kg iv and Inj.Succinylcholine 2 mg/kg iv. Intubation was done with polyvinyl chloride high volume low pressure cuffed ETT of proper size, for adult female- 7/7.5 ID and for adult male-8/ 8.5 ID. In GROUP -L: ETT cuff was inflated with 2% Lignocaine and in GROUP- A: ETT cuff was inflated with air. The volume of lignocaine and air was decided by the minimum occlusion volume technique when no audible leak from cuff was present while giving IPPV.[1]

Anaesthesia was maintained with O_2+N_2O+Sevoflurane+ Inj. Vecuronium 0.08-0.12mg/kg iv loading followed by 0.01 mg/kg iv intermittently. After surgery with the return of spontaneous respiration, the neuromuscular block was reversed with inj. glycopyrrolate 0.008 mg/kg iv and inj. neostigmine 0.03-0.07 mg/kg iv. When the patient was fully awake and all extubation criteria were met, thorough oral suction was done the cuff was deflated and patient was extubated.

Parameters observed and compared were heart rate, systolic BP, diastolic BP, SPO_2 during extubation, at 1min,2min,5min,10 min,15min and 20min after extubation.[2]

Severity of cough:[1]
During extubation, at 1min,2min,5min,10 min,15min and 20min after extubation
Grade -0: No cough
Grade -1: Cough lasting for <15 seconds
Grade -2: Cough lasting for >15 seconds

Sore throat:[1]
Within 24 hrs of post-extubation.
Grade- 0: No sore throat at any time since the operation
Grade -1: The patient answered in the affirmative when asked about sore throat (minimal sore throat)
Grade -2: The patient complains of sore throat on his own (moderate sore throat)
Grade -3: The patient is in obvious distress (severe sore throat)

Hoarseness of voice: [1]
Within 24 hrs of post-extubation
Grade - 0: No complaint of hoarseness at any time since the operation
Grade -1: Minimal change in the quality of speech. patient answers in the affirmative only when enquired about (minimal hoarseness)
Grade -2: Moderate change in the quality of speech of which the patient complains on his/her own (moderate hoarseness)

Grade - 3: Gross change in the quality of voice perceived by the observer (severe hoarseness)

Statistical Analysis Methods:
According to Navarro et al study 1997[17], considering the incidence of POST (Post-Operative Sore Throat) in the air group as 59% and incidence of POST in lignocaine group as 32% at 95% confidence interval with 80% power, the sample size calculated as

$$N = (Z_{1-\alpha/2} + Z_{1-\beta})^2 * 2 * P * (1-P) / (P_1 - P_2)^2$$

$Z_{1-\alpha/2}$ -Two tailed probability for 95% confidence interval
$Z_{1-\beta}$- Two tailed probability for 80% power
P_1 **(%)**-Prevalence of POST in air
P_2**(%)** Prevalence of POST in lignocaine
P-Average Prevalence of POST in air and POST in lignocaine

The sample size was calculated to be 106. Patients were divided into two groups of 53 each.

All data entry was entered in MS excel 2017 and analysis was done in epi info version 7.2. The continuous variable was expressed as mean with standard deviation. For qualitative data chi-square test was applied and for quantitative data, unpaired t-test was applied to determine the statistical difference between the two groups. P value less than or equal to 0.05 was considered statistically significant.

RESULTS:
The mean age in Group A was 37.4 ± 13.3 years, in group L it was 39.6 ± 9.5 years.

The sex distribution was equal in both groups 33(62.3%) female, 20(37.7%) male in Group A. 32(60.4%) female, 21(39.6%) male in group L.

ASA distribution was equal in both groups 5(9.4%) ASA 1, 48(90.6%) ASA 2 in Group A. 3(5.6%) ASA 1, 50(94.3%) ASA2 in group L.

The mean weight in Group A was 61.14 ± 8.3 kg, in group L it was 63.6 ± 6.5 kg.

The mean duration of surgery in Group A was 145.8 min, in group L it was 151.1 min.

Both groups were comparable on basis of age, sex distribution, weight, ASA grade and duration of surgery with P value >0.05.

The baseline hemodynamic parameters such as heart rate, SBP, DBP, SPO_2 were compared between 2 groups. The P value was > 0.05 and not significant. [table-1,2,3]

The mean heart rate was higher at the time of extubation and subsequently lower at 1 min, 2 min, 5 min,10 min and 20 min after extubation in both the groups. But in Group L there is comparatively less rise of heart rate from the baseline than Group A. [table-1]

The mean SBP and mean DBP was higher at the time of extubation and gradually decreased at 1 min, 2 min, 5 min, and 10 min,20 min post-extubation, in both the groups. But in Group L there is comparatively less increase of SBP and DBP from the baseline than Group A. [table-2,3]

Group L showed a significant difference in attenuating the rise in Heart rate, SBP, DBP during emergence in all six periods of assessment with P value < 0.05.

Cough severity showed significant difference at the time of extubation,1min,2min,5min,10min,15min,20min after extubation in between groups with P≤0.05. [table-4]

The severity of sore throat is significant after 1,2,4,8,16 hours of extubation. With P value≤ 0.05 between groups. [table-5]

The severity of hoarseness is significant after 1,2,4 hours of extubation between groups with P value < 0.05.[table-6]

The severity of cough, postoperative sore throat and hoarseness were less in Group L than Group A with statistical significance.

Table -1: Heart Rate Changes From Baseline Of Patients In Both Groups At Different Interval.

HEART RATE CHANGES FROM BASELINE									
		Baseline	During extubation	1 min	2 min	5 min	10 min	15 min	20 min
Group A	Mean	80.1	+22.7	+18.6	+14.5	+10.9	+7.2	+4.5	+2.3
	SD	8.1	4.8	4.1	4.4	3.7	2.9	1.9	1.2
Group L	Mean	80.4	+14.7	+12.2	+9.4	+7.2	+4.5	+2.8	+1
	SD	7.7	5.6	4.9	5.01	5.1	4.2	4.2	3.1
t value		0.229	7.95937	7.23571	5.60102	4.33078	3.87151	2.75112	3.28752
P value		0.819	0.00001	0.00001	0.00001	0.000031	0.00011	0.0039	0.00095
		Not significant at P>0.05	Significant at P<0.05	Significant at P<0.05	Significant at P<0.05	Significant at P<0.05	Significant at P<0.05	Significant at P<0.05	Significant at P<0.05

Table -2 Systolic BP Changes From Baseline Of Patients In Both Groups At Different Interval

SYSTOLIC BP CHANGES FROM BASE LINE									
	Baseline	During extubation	1 min	2 min	5 min	10 min	15 min		20 min
Group A	Mean	124.3	+16.7	+13.6	+10.3	+7.5	+5.5	+3.1	+1.8
	SD	9.1	4.2	3.8	3.6	2.9	3.2	1.5	1.1
Group L	Mean	124.4	+11.5	+8.5	+6.3	+4.4	+2.7	+0.2	-3.2
	SD	8.7	5.8	5.7	5.6	5.6	5.9	5.1	13.3
t value		0.065	5.32836	5.45205	4.35866	3.57664	3.11865	3.93059	2.73689
P value		0.948	0.00001	0.00001	0.00031	0.00053	0.0023	0.00015	0.0072
		Not significant at P>0.05	Significant at P<0.05	Significant at P<0.05	Significant at P<0.05	Significant at P<0.05	Significant at P<0.05	Significant at P<0.05	Significant at P<0.05

Table -3 Diastolic BP Changes From Baseline Of Patients In Both Groups At Different Interval

DIASTOLIC BP CHANGES FROM BASELINE									
		Baseline	During extubation	1 min	2 min	5 min	10 min	15 min	20 min
Group A	Mean	77.3	+12.3	+10.8	+9.4	+7.1	+5.6	+3.4	+2.1
	SD	4.7	2.9	2.4	2.3	2.5	1.9	1.7	O.95
Group L	Mean	77.2	+10.4	+8.3	+6.7	+5.2	+3.4	+1.5	-0.03
	SD	5.4	4.9	5.1	5	4.7	4.9	4.1	3.7
t value		0.076	2.40091	3.17499	3.46763	2.56732	2.99173	3.00743	4.05733
P value		0.938	0.018	0.0019	0.0076	0.011	0.0034	0.0033	0.00009
		Not significant at P>0.05	Significant at P<0.05	Significant at P<0.05	Significant at P<0.05	Significant at P<0.05	Significant at P<0.05	Significant at P<0.05	Significant at P<0.05

Table-4: Cough Severity:

	GRADE	GROUP A	GROUP L	Chi square	P value
During extubation	0	5	12	15.3	0.0004
	1	14	27		
	2	34	14		
At 1 min	0	5	13	14.8	0.0005
	1	23	6		
	2	25	34		
At 2 min	0	5	13	9.8	0.007
	1	27	32		
	2	21	8		
At 5 min	0	5	13	5.7	0.05
	1	33	32		
	2	15	8		
At 10 min	0	3	17	10.144	0.0062
	1	49	36		
	2	1	0		
At 15 min	0	29	46	11.67	0.00293
	1	24	7		
	2	0	0		
At 20 min	0	34	49	10.88	0.00433
	1	19	4		
	2	0	0		

Table-5: Postoperative Sorethroat:

	GRADE	GROUP A	GROUP L	Chi square	P value
1HR	0	5	8	15.198	0.001
	1	14	29		
	2	28	16		
	3	6	0		
2HR	0	5	11	19.5	0.0002
	1	22	38		
	2	25	4		
	3	1	0		
4HR	0	1	15	20.65	0.000123
	1	40	38		
	2	12	0		
	3	0	0		
8HR	0	11	26	8.646	0.04
	1	39	27		
	2	3	0		
	3	0	0		
16HR	0	31	45	7.57	0.05
	1	22	8		
	2	0	0		
	3	0	0		
24HR	0	40	50	5.96	0.113
	1	13	3		
	2	0	0		
	3	0	0		

Table-6: Hoarseness Of Voice

	GRADE	GROUP A	GROUP L	Chi square	P value
1HR	0	0	10	16.289	0.0009
	1	24	32		
	2	24	11		
	3	5	0		
2HR	0	5	13	12.17	0.002
	1	27	35		
	2	21	5		
	3	0	0		
4HR	0	5	17	10.851	0.0044
	1	41	36		
	2	7	0		
	3	0	0		
8HR	0	24	33	3	0.39
	1	26	20		
	2	3	0		
	3	0	0		
16HR	0	31	50	3	0.39
	1	22	3		
	2	0	0		
	3	0	0		
24HR	0	43	52	6.492	0.09
	1	10	1		
	2	0	0		
	3	0	0		

DISCUSSION:

The cuffed endotracheal tubes were introduced by Waters and Guedel.

The Cuff system protects the airway from aspiration and prevents air leak during positive pressure ventilation. [11] Over inflation of cuff which occurs due to diffusion of nitrous oxide into cuff while using air as an inflation medium causes damage to the laryngeal mucosa leads to complications like postoperative sore throat, cough, hoarseness of voice and dysphagia with an incidence varying from 40–100%, [3,5] which is supported by the study done by Eger and Saidman, in which they found that a gas-filled space in the body will expand if the gas within the space is less soluble in blood than the inspired gas. As nitrous oxide is 34 times more soluble in blood than nitrogen it increases the volume of gas-filled space over a period of time.[15]

Lignocaine instilled in the endotracheal tube cuff diffuses slowly across the cuff membrane.[11] The cuff acts as a reservoir for lignocaine allowing its spread through the semipermeable membrane wall and induces anesthetic action in the tracheal mucosa.[12] This increases tolerance to the cuffed endotracheal tube. Hemodynamic alterations during tracheal extubation are thereby minimized, the incidence of coughing and postoperative sore throat are also reduced.

In a RCT done by Lokvendra S et al to evaluate the effect of air, anesthetic gas mixture, saline or 2% lignocaine used to inflate endotracheal tube cuff on coughing and laryngotracheal morbidity after tracheal extubation, they found that liquid inflation media is better than gaseous media in situations where prolonged exposure to nitrous is likely by reducing cough and post-operative sore throat.[3]

In-vitro study done by Huang et al have demonstrated that lignocaine diffused across the membrane of the cuff of the endotracheal tube and the diffusion of which depended on various factors such as the non-ionized fraction of local anesthetic, alkalinization, temperature, duration of the procedure, and concentration of local anesthetic.[14]

In our study on comparing the effect of lignocaine and air as inflation medium of the cuff, it was found that using lignocaine as the cuff inflation medium leads to good hemodynamic stability during emergence from general anaesthesia, a significant reduction in the severity of cough after extubation, decreased incidence of postoperative sore throat and post-operative hoarseness of voice.

Fai Lam et al has done a systematic review and meta-analysis of randomized controlled trials on the effect of intracuff lidocaine on postoperative sore throat and the emergence phenomenon. They used PubMed, EMBASE, and Cochrane databases for RCTs that have evaluated the outcome of intracuff lidocaine versus air or saline in patients after intubation and general anaesthesia. They used random effect model and have done meta-analysis. They have assessed relative risk and mean difference of the incidence and intensity of relevant adverse outcomes. They reviewed nineteen trials which are comprised of 1566 patients. Their results showed that both alkalinized and non-alkalinized intracuff lidocaine can prevent and decrease the severity of postoperative sore throat and postintubation-related emergence phenomena[8], which supports the results of our study.

Our study is different from the studies done by Sagar Jolly et al[1], Pallavi Gaur et al[5], J.P. Estebe et al[13], in which they have used alkalinized lignocaine to alleviate post-intubation laryngeal morbidity and found it successful.

Navarro et al. compared alkalinized intracuff 2% lignocaine with intracuff saline and concluded that intracuff lignocaine was superior to saline in decreasing incidence of emergence coughing and sore throat during the postoperative period in smokers.[16]

B V Mahesh Babu et al [2], Karuna Taksande et al [7] and Manimala Rao et al [11] have used 4% lignocaine to inflate endotracheal tube cuff. And they found it reduces the severity of cough and postoperative sore throat after intubation. In our study, we have used 2% lignocaine to avoid the remote complication of local anesthetic systemic toxicity.

However, if cuff damage occurs, there is always the risk of leakage and systemic absorption of lignocaine can occur. The backup plan to handle accidental cuff damage was to deflate the remaining volume of injected lignocaine if cuff damage was suspected as low tidal volume delivery, fall in cuff pressure, audible leak. We used intravenous compatible preservative-free lignocaine and we have never exceeded the toxic dose of lignocaine so the concern of lignocaine toxicity is negligible. In our study, it was observed that none of the patients had signs of lignocaine toxicity and all cuffs of ETT was examined and found intact after extubation.

CONCLUSION:

To conclude the study, we observed that inflating endotracheal tube cuff with lignocaine is having better profile in terms of less hemodynamic changes during extubation, reduced cough severity, less incidence of sore throat and hoarseness of voice in post-operative period, offers an alternative to room air for inflating endotracheal tube cuff for administration of general anaesthesia. And it is remarkably safe method.

LIMITATION:

There were some limitations associated to our study. The severity of sore throat and hoarseness of voice were scored on patient's subjective assessment and we need a better scoring system. We have excluded less than 18 year population. We have not done visual assessment with fiber-optic bronchoscope to estimate the extent of tracheal mucosal damage.

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