Original Research Article

A prospective randomized trial on alkalinized lignocaine preloaded endotracheal tube cuffs to reduce emergence cough following brief surgery

S Lakshmi Tirumala[1],KSSGC Kumar[2], Ramella Manoj[3]

[1]Postgraduate, Department of Anaesthesiology, Alluri Sitarama Raju Academy of Medical Sciences, Eluru, West Godavari District, Andhra Pradesh, India

[2]HOD, Department of Anaesthesiology, Alluri Sitarama Raju Academy of Medical Sciences, Eluru, West Godavari District, Andhra Pradesh, India

[3]Assistant Professor, Department of Anaesthesiology, Alluri Sitarama Raju Academy of Medical Sciences, Eluru, West Godavari District, Andhra Pradesh, India

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Abstract

Background and Objectives: Endotracheal intubation is required during general anesthesia to secure the airway. As a result of coughing during emergence, patients have hypertension, tachycardia, elevated intracranial and intraocular pressure, bronchospasm, wound dehiscence, and surgical bleeding. Our goal is to determine whether alkalinized lignocaine preloaded endotracheal tube cuffs are effective at reducing the emergence of cough following minor surgery.

Methods: This prospective randomized controlled trial was conducted on ASA grade I and II patients between the ages of 25 and 50 after gaining approval from the institutional ethics committee, They were scheduled for a variety of short-duration surgeries under general anesthesia at Alluri Sita Rama Raju Academy Of Medical Sciences Hospital for one year. A total of 100 patients are divided into two groups, Group AL, and Group S (50 patients in each Group). Group AL: (study group) these patients received preloaded (alkalinized lignocaine in ET cuff 90 min before intubation) 2% alkalinized lignocaine in the ET cuff, volume decided by minimum occlusion volume technique. Group S: (control group): these patients received normal saline in the ET cuff after intubation.

Results: Patients in the AL Group had a mild cough in 12% of the population, while Patients in the S group had a mild cough in 14%, moderate cough in 10%, and severe cough in 4% of the group population. Emergence cough is significantly less in the AL group compared to the S Group (p=0.39).

Conclusion: Alkalinized lidocaine in ETTs preloaded with the same solution before surgery appears to significantly lower the incidence of emergency cough during short surgical procedures. Eliminating the pressor reaction also lessens emergence agitation and offers hemodynamic stability during extubation.

Keywords: Emergence cough, alkalinized lignocaine, preloaded ET cuff.

Introduction

Tracheal intubation with an endotracheal tube is necessary during general anesthesia. To preserve a seal after intubation, a cuff is inflated around the endotracheal tube. The tube and its cuff are thought to be the mechanisms that irritate or stretch the trachea, causing a cough to develop. Smooth emergence from anesthesia has long been seen as a method of preventing potential respiratory and hemodynamic instability [1, 2]. Smooth emergence from General anesthesia is frequently complicated by coughing induced by stimuli from the ET tube cuff. Coughing during emergence results in Hypertension, tachycardia, increased intraocular pressures, raised Intra cranial pressure, Myocardial infarction, bronchospasm, and wound dehiscence [1-5]. Multiple techniques such as deep extubation [1], administration of intravenous opioids before extubation [6], the "no touch emergence" technique [7], and most recently alkalinized lidocaine in the ETT cuff [8]. Have been described as effective in reducing the cough and cardiovascular response associated with ETT during emergence. The nociceptive stimuli in the trachea caused by the cuff can be blocked by topically applied anesthetics. Multiple techniques such as deep extubation, administration of intravenous opioids before extubation and most recently instilling lignocaine in the ET cuff have been described as effective in reducing cough and cardiovascular response associated with ETT during emergence. The use of the ETT cuff as a reservoir for lignocaine to provide local anesthesia at points of contact with the trachea was first described in 1990. Since then, studies have shown that adding bicarbonate to lignocaine drastically increases its diffusion across the polyvinyl chloride (PVC) cuff membrane and decreases the incidence of cough on emergence after surgery lasting more than 2 hrs [12, 13]. The reduction of emergency cough in surgeries lasting< 2hr is also desirable. Alkalinized lidocaine may be useful for cough control during shorter procedures, according to a small series [8]. Conversely, in vitro data suggest that 30-180 minutes are necessary for alkalinized lidocaine to diffuse across the PVC cuff material In our study, we want to evaluate the efficacy of preloaded alkalinized lignocaine in reducing emergency cough in surgeries of short duration.

*Correspondence

Dr. Ramella Manoj

Assistant Professor, Department of Anaesthesiology, Alluri Sitarama Raju Academy of Medical Sciences, Eluru, West Godavari District, Andhra Pradesh, India

E-mail: asramlibrary@gmail.com

Materials And Methods

The present study was done at Alluri Sita Rama Raju Academy Of Medical Sciences Medical College and Hospital, Eluru, from September 2021 to September 2022 on 100 ASA-1 and ASA-2 patients scheduled for elective surgeries under general anesthesia after getting approval from the institutional ethical committee and written informed consent from the patients. It was a Randomized prospective

study done by lottery method. Patients aged between 25 and 50 years, scheduled for different surgeries for a short duration under general anesthesia were included in this study. Patients who were excluded from the study were Patients who refused to consent, patients with asthma, COPD, respiratory tract infections, patients using preoperative cough suppressants, Patients with anticipated difficult intubation, altered sensorium, documented history of allergy to lignocaine, surgeries on the airway. The pre-anesthetic check-up was carried out preoperatively with a detailed history, general physical examination, and systemic examination. An airway assessment was done. Routine investigations were done. Preoperatively, Nil per oral status was confirmed-8 hours. They were premedicated with Tab. Alprazolam 0.5mg on the night before surgery. 100mins Preoperatively, the ET cuff was inflated with 2% alkalinized lignocaine (9ml of 2% lignocaine and 1 ml of 8.4% sodium bicarbonate). Age and weight were recorded before shifting the patients to Operation Theatre. Anaesthetic Monitors- Non-invasive BP, Pulse Oximeter, and Electrocardiogram were connected and IV access was established with an 18 gauge I.V cannula. Baseline values-pulse rate, blood pressure, saturation- SPO2 were noted and patients in both groups were premedicated with inj. Glycopyrrolate 5 mcg/kg, inj. Midazolam .05mg/kg, inj. Ondansetron 0.15mg/kg and inj. Fentanyl 1mcg/kg. Patients were induced with Inj. Propofol 1.5-2.5 mg/kg I.V and intubated after giving inj. Vecuronium 0.12 mg/kg using an appropriately sized ET tube. For Group AL: ET cuff was inflated with 2% alkalinized lignocaine (9 ml of 2% lignocaine and 1 ml of 7.5% W/V sodium bicarbonate) by minimum occlusion volume technique. The cuff is inflated slowly to prevent damage to tracheal mucosa or cuff rupture. Group S: ET cuff was inflated with normal saline by minimum occlusion volume technique. Maintenance was done with O2 + N2O and inj. Dexmedetomidine. Neuromuscular blockade was continued with vecuronium. At the end of the surgery, neuromuscular blockade was antagonized with neostigmine and glycopyrrolate. No ET cuff perforations were noted, and no airway trauma or laryngospasm was noted.

Results

Demographic data were analyzed by using Student's t-test. The incidence of coughing was compared by using the one-tailed Fisher exact test. Continuous data are presented as means ± SD. P value < 0.05 was statistically significant.

Table 1: The demographic information for this study is shown in this table

Parameter	Group AL	Group S	P Value
Age	34 (± 8)	35 (± 8)	0.80
Weight (in Kg)	67 (± 7)	68 (± 8)	0.85
Duration of Surgery (min)	91 (±17)	93 (±17)	0.69
Preloading time (min)	100 (± 13)	101 (± 14)	0.56
The volume of the Cuff (ml)	6 (± 1)	7 (± 1)	0.32

Table 2: This table shows the presence of emergency cough in Alkalinised lignocaine and Normal saline groups

	Cough	No Cough
Alkalinized Lignocaine	6 (12%)	44
Normal Saline	14 (28%)	36

Table 3: Three-category scale for assessing cough on the emergence

Mild	A single episode of cough
Moderate	More than 1 episode of unsustained cough for < 5 sec
Severe	Sustained cough for > 5 sec

Table 4: Severity of cough

	Alkalinised Lignocaine Group	Normal Saline Group
Mild	6 (12%)	7 (14%)
Moderate	-	5 (10%)
Severe	-	2 (4%)

Discussion

The present investigation showed a significant decrease in cough upon awakening from general anesthesia following brief surgical operations using a straightforward preloading strategy for alkalinized lidocaine in the ETT cuff. There was a case report done previously on this topic, but scant articles on this topic Rizvanović, *et al.*, proved that Cuff inflation media has a significant effect on postoperative throat mucosal injuries and emergence phenomenon, It was proved that with lidocaine alone, the rate of diffusion through the cuff was low (<8% over 24h), whereas the L-B solution had a high diffusion (>90% over 24h) [19]. The effectiveness of alkalinized lidocaine in longer procedures has long been established [12], and its use in shorter surgeries had previously been reported in only one small series of patients [8]. The 12% incidence of cough in group AL in the present study is slightly more than the 5% cough obtained by Estebe *et al.* in their alkalinized lidocaine group. However, in this study, patients in the saline control group coughed considerably less than previously reported: 28%vs 70% [8]. It was proved by Estebe *et al.*, that use of a small dose of alkalinized lidocaine (40mg) instead of air is a relatively easy and safe practice that avoids the use of large doses of lidocaine [18]. The pH of a commercially available local anesthetic solution must be acidic to maximize stability in the solution and shelf-life. The reasons include: solubility-local anesthetic solutions are aqueous solutions and if provided at a pH close to 7.4 the lipid-soluble uncharged form could precipitate out due to its lower water solubility; stability-the uncharged base form is more unstable at physiological pH, so degradation is minimized at a low pH where the drug is predominantly in the charged form [17]. Preloading of ETT tube cuffs before the use of alkalinized lidocaine during short surgical procedures required a minor change in preoperative anesthesia procedures and very little preparation time. Though the exact time of intubation for each case in an operating room schedule is not possible to predict, the requirement of at least 90 minutes of prefilling is easy to integrate into clinical practice. Relatively few patients were excluded from the present study and several different procedures including gynecological, otolaryngological (not involving the airway), plastic, and general surgery was included, improving generalizability. Nonetheless, certain limitations apply to our findings. First, although this limitation applies to both research groups, cough-inducing activities after learning that the sedated patient was a participant in our study (Hawthorne effect). Second, the study was designed to evaluate the prevention of cough at deeper levels of anesthesia where laryngospasm more often occurs if extubation is attempted Third, Over a very brief period, alkalinized lidocaine in the ETT cuff (<30

minutes) procedures cannot be ascertained from this study. Fourth, our results are statistically fragile: if only one more patient had coughed in the study group, the resulting differences would not have been judged significant, even with the 1-sided testing this study was designed for, based on the results of previous studies. This fragility was also reflected in the wide confidence intervals of the 1-tailed risk ratio for cough and is the result of the study design using numbers of patients just sufficient to demonstrate statistical differences greater than the admittedly arbitrary limit of "significance", usually defined as $p<.05$. When defining the number of patients necessary in each group in this way, P values very close to .05 will be always be generated when the actual difference is similar to the expected difference, as was the case in this study. Finally, this study shows that prefilling ETT cuffs with alkalinized lidocaine before using alkalinized lidocaine in the ETT cuff for short procedures is effective in preventing emergency cough but was not designed to show whether prefilling is necessary. 2% alkalinized lignocaine was placed in the cuff of an endotracheal tube and diffused across the cuff membrane. The cuff could act as a potential reservoir for a local anesthetic, allowing diffusion and subsequent anesthesia of the underlying mucosa. The simple preloading technique for alkalinized lignocaine ET cuff demonstrated a significant reduction in emergency cough. The basis of our study was that lignocaine instilled into the endotracheal cuff might cause anesthesia of the trachea by diffusing across the polyvinyl chloride membrane of which the cuff is composed. Though in vitro studies argue against the effectiveness of alkalinized lidocaine in the ETT cuff without prefilling. The local anesthetic effect should be confined to the mucosa in contact with the cuff and the protective cough reflexes above the tube cuff and of the vocal cords should remain intact. The mean volume that was inflated into the ET tube cuff was 6.6±2 ml, but no signs of lignocaine toxicity were observed during intraoperative & post-operative periods in our study. There is a risk of cuff damage and leakage, in our study, all tubes were intact post-extubation. Alkalinizing lignocaine with sodium bicarbonate allowed better diffusion as the hydrophobic neutral base can diffuse better than plain lignocaine and the dose of lignocaine can be reduced. The dose of lignocaine used to produce clinical effects is also reduced by alkalinization. Thereby reducing the plasma concentration and toxicity.

Conclusion

The occurrence of an emergency cough during brief surgical procedures appeared to be significantly reduced (p=0.38) by alkalinized lidocaine in ETTs preloaded with the same solution before surgery. Eliminating the pressor reaction also lessens emergence agitation and offers hemodynamic stability during extubation.

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