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Original research article: Study of efficacy of lignocaine given intravenously as a suppressant of post extubation laryngospasm and cough in children undergoing cleft lip and cleft palate surgeries

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Abstract
Background: Lignocaine is amide type local anaesthetic with antiarrhythmic properties, produces electrical stabilization of cell membrane by blocking the sodium conductance.
Aims & Objectives: The aim of our study was to evaluate the effect of intravenous lignocaine in prevention of post extubation laryngospasm and coughing in children undergoing cleft lip and cleft palate surgeries.
Methodology: Eighty ASA grade I and II patients between three months to nine year age posted for cleft lip and cleft palate repair surgery, were randomly allocated to 2 groups, 40 patients in each group. Group A (n= 40) received lignocaine1.5 mg/kg intravenously and group B (n= 40) received normal saline 0.075 ml/kg intravenously 2 minute before extubation. Hemodynamic parameters (Heart rate, Blood pressure), oxygen saturation and severity of laryngospasm and coughing were observed for ten minutes following extubation.
Results: There was statistically significant reduction in the incidence of laryngospasm and coughing in lignocaine pretreated group.
Conclusion: Intravenous lignocaine is very effective drug in the prevention of post extubation laryngospasm and coughing in children undergoing cleft lip and cleft palate surgery.

Keywords: Laryngospasm, Coughing, Children, Cleft lip and cleft palate surgery

Introduction

Anaesthesiologists do experience varying degree of complications during intubation and extubation. The frequency of complications during tracheal extubation probably exceeds the complications encountered during endotracheal intubation [1]. The commonly encountered problems associated with tracheal extubation are airway obstruction mainly due to laryngospasm, pulmonary oedema, oxygen desaturation and coughing [2]. Respiratory events are one of the greatest causes of morbidity and mortality during anesthetic-surgical procedures, especially in pediatric anesthesia because children are more susceptible to hypoxemia due to the smaller residual functional capacity and greater tendency to develop collapse of the airways [3]. Hypoxia and laryngospasm represent approximately 30% of respiratory events during pediatric anaesthesia [4].

In general, laryngospasm is considered a physiological exaggeration of the glottic closure reflex [5]. This complication is more frequent in: 1) children, 2) airways infection, 3) manipulation of the airways, 4) use of specific anesthetics, and 5) oral or pharyngeal surgeries. Laryngospasm is a frequently encountered complication in children undergoing upper airway surgery, which, if left untreated can lead to an increase in morbidity and mortality. The reported incidence of laryngospasm in patients aged zero to nine years is 17/1000 and even higher in children between one to three months age [6]. The incidence of laryngospasm after adenoidectomy and tonsillectomy is reported to be as frequent as 21-26% [7]. Children are more prone to airway obstruction, as they have a narrow laryngeal and tracheal lumen that may be blocked by mucosal oedema following trauma [8].

Different drugs and techniques have been suggested and used for prevention of laryngospasm including anticholinergics which reduce secretions like atropine [9], nebulised topical and iv lidocaine (reducing sensitivity of upper airway reflexes), cocaine, benzodiazepines like diazepam (decrease upper airway reflexes) [10], doxapram in dose 1.5mg/kg over 20 seconds (increased respiratory drive), propofol (depresses airway reflexes) [11]. The intravenous administration of 15 mg.kg-1 of magnesium before extubation reduces the incidence of laryngospasm probably by relaxing the laryngeal muscles [7]. Acupuncture in the Shao Shang point has also proven to be very effective on the prevention of laryngospasm [12]. 'No touch extubation technique is also used to prevent laryngospasm [13].

Paediatric patients with cleft lip and cleft palate are usually associated with upper respiratory tract infections and hence have hyper-reactive airway which can precipitate laryngospasm. The studies with I.V lignocaine in prevention of post extubation laryngospasm in children with cleft lip and cleft palate surgeries are few and hence there is a need for this study in our set up. Laryngospasm occasionally presents atypically and may be precipitated by factors which are not immediately recognized, increasing the potential for patient harm and further complications such as pulmonary aspiration and post-obstructive pulmonary edema. Hence the anaesthesiologist needs to take proactive approach for preventing and terminating laryngospasm.

Methodology

This prospective study was conducted in the department of Anaesthesiology at S.M.S medical College and attached group of hospitals, Jaipur, Rajasthan, India from May 2011 to April 2012 with due permission and approval from the institutional ethical committee and written informed parental consent. This interventional type of randomized double blind study was carried out on 80 ASA grade I and II patients between three months to nine year age posted for cleft lip and cleft palate repair surgery. All patients were thoroughly examined. Routine investigations were carried out in all the patients including Hb, complete blood count, blood sugar, serum urea and creatinine, chest X ray and ECG. Children with untreated upper respiratory tract infection and two or more attempts of intubation were not considered for the study. Patients were randomly allocated to 2 groups (40 patients in each group). Group "A" (Lignocaine Group) and Group "B" (Normal saline Group).

After taking on the operation table children were monitored with Electrocardiogram ECG, Non invasive blood pressure, Pulse oximeter and End tidal carbon dioxide (ETCO2).

Patients were premedicated with inj. glycopyrolate (0.005 mg/kg) and inj midazolam (0.1 mg/kg). Intravenous fentanyl (2 µg/kg) was given for analgesia. The patients were preoxygented with 100% oxygen for 3 minutes. Induction was done with inj thiopentone 5 mg/kg. Inj scoline 1 mg/kg was given. Oral intubation was performed with ET tube according to the age after 30 seconds of oxygenation with 100% O_2. Tube position was checked by auscultation. Anaesthesia was maintained with 60% nitrous oxide in 40% oxygen and isoflurane. Muscle relaxation was provided with inj atracurium 0.1 mg/kg. Hemodynamic parameters were recorded.

At the end of surgery, reversal of residual neuromuscular block done with inj glycopyrolate (0.01mg/kg) and neostigmine (0.05 mg/kg). After reversal of residual neuromuscular block; either Lignocaine 1.5 mg/kg or equal volume of normal saline was administered IV, 2 minutes prior to extubation.

After extubation 100% oxygen was administered for three minutes. Heart rate, Blood pressure, oxygen saturation, severity of laryngospasm and coughing were noted for 10 minutes following extubation. Heart rate, Blood pressure and oxygen saturation observed at one, two, three, five and ten minutes following extubation. Oxygen saturation of < 95% for 30 or more seconds will be taken as desaturation event.

Severity of laryngospasm was graded using four point scale[14].
0 – no laryngospasm
1 – Stridor on inspiration
2 – Total occlusion of cords
3 – Cyanosis

Coughing was evaluated using modified four point scale[14].
0 – none
1 – slight
2 – moderate
3 – severe

Statistical analysis

The sample size was calculated at 80% study power and α level 0.05 assuming occurrence of cough of 40.59% in control group and 10.80% in lignocaine group. Minimum sample required in each group comes to 39 patients. Rounding up this figure we took 40 patients in each group.

Statistical analysis was done by unpaired Student's *t* – test, Mann- Whitney U test and chi square test.

Demographic variables like age, weight, duration of surgery were compared using unpaired Student's *t* – test.

Laryngospasm and coughing were evaluated by Mann-Whitney U test.

Oxygen saturation was evaluated by chi square test.

Percentage incidence of the side effect will be noted.

A p-value < 0.05 was considered statistically significant.

Results

Both the groups under study were comparable to each other with respect to age, sex weight, duration of surgery and anaesthesia [Table 1].

Table 1: Demographic characteristics and duration of surgery and anaesthesia

Parameters	Group A (%)	Group B (%)	P value
Age in months (mean ± SD)	37.83 ± 26.76	36.90 ± 24.82	0.873
Sex M F	 24 (60) 16 (40)	 23 (57.50) 17 (42.50)	1.000
Weight in Kg (mean ± SD)	13.70 ± 5.60	13.68 ± 4.62	0.983
Duration of surgery (in minutes)	56.93 ± 20.12	60.30 ± 21.18	0.467
Duration of anaesthesia (in minutes)	67.20 ± 20.64	72.03 ± 21.36	0.307

Table 2: incidence of Coughing

Cough scale	Group A		Group B		Reduction in incidence %
	No.	%	No.	%	
Grade 1	3	07.50	5	12.50	05.00
Grade 2	2	05.00	6	15.00	10.00
Grade 3	0	00.00	1	02.50	02.50
Total	5	12.50	12	30.00	17.50

P value = 0.048

Table 3: incidence of laryngospasm

Laryngospasm scale	Group A		Group B		Reduction in incidence %
	No.	%	No.	%	
Grade 1	3	07.50	7	17.50	10.00
Grade 2	0	00.00	3	07.50	07.50
Grade 3	0	00.00	0	00.00	00.00
Total	3	07.50	10	25.00	17.50

P value = 0.030

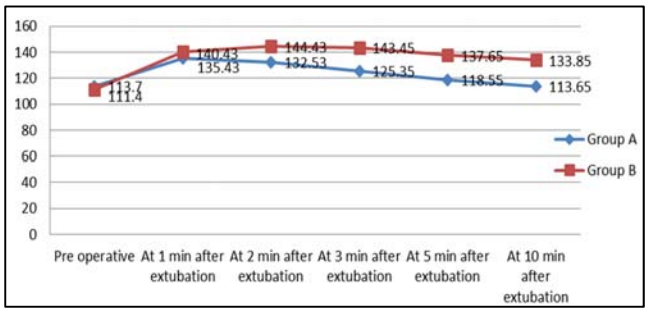

Fig 1: Comparison of Pulse Rate (Mean ± SD) at various intervals

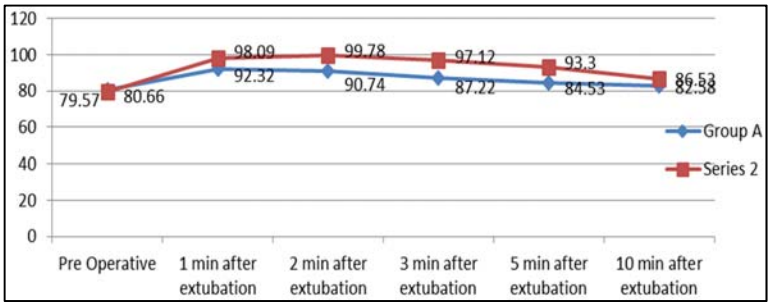

Fig 2: Comparison of Mean BP (Mean ± SD) at various intervals

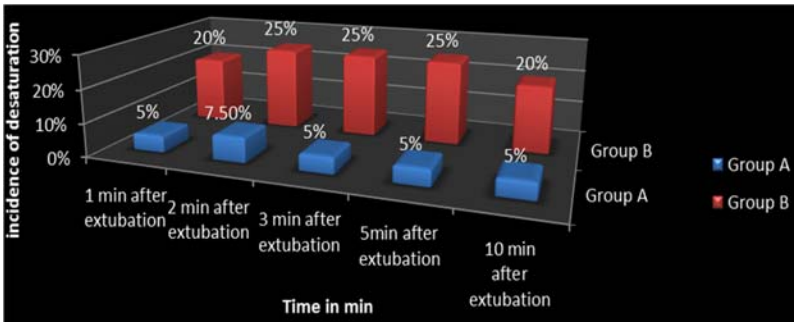

Fig 3: Comparison of incidence of oxygen desaturation at various intervals

Preoperatively there was no significant difference in the pulse rate, systolic and diastolic blood pressure in both groups. There was a significant increase in the pulse rate at two, three, five and ten minutes, following extubation in group B compared to group A. Difference in pulse rate at one minute post extubation was not significant. A significant increase in systolic and diastolic blood pressure was noted in group B compared to group A following extubation. Thus the pulse rate, systolic and diastolic blood pressures were well maintained after extubation in group A receiving IV Lignocaine [Fig 1 & 2].

The incidence of oxygen desaturation in Group A was 05.00% and 20.00% in Group B at 1 min and 10 min after extubation. The difference in incidence between two Groups is not significant (p-value >0.05). At 2 min the incidence was 7.50% in Group A and 25.00% in Group B. It was 5.00% in Group A and 25.00% in Group B at 3 and 5 min. The difference in incidence between two Groups is significant (p-value <0.05). The oxygen saturation was well maintained following extubation at one, two, three, five and ten minutes in Group A [Fig 3].

The incidence of coughing was 30.00% in Group B and 12.50% in Group A. The reduction in incidence of coughing was by 17.50% on administration of lignocaine. The difference in incidence between two groups is statistically significant (p-value <0.05) [Table 2].

The incidence of laryngospasm was 25.00% in Group B and 07.50% in Group A. The reduction in incidence of laryngospasm was by 17.50% on administration of lignocaine. The difference in incidence between two groups is statistically significant (p-value <0.05) [Table 3].

Discussion

In the practice of Anaesthesia airway management is one of the most important task. During intubation the patient is more protected by anesthesia induction than during extubation, therefore the cardiovascular responses may be even more exaggerated and the incidence of complications is more after extubation. Laryngospasm is the most frequent cause of postextubation airway obstruction. Pediatric airway management is always challenging. Laryngospasm occurs more commonly in pediatric anaesthetic practice than in adults. Postextubation laryngospasm is the frequently encountered complication in children undergoing upper airway surgery. The optimal course for dealing with laryngospasm is to avoid it.

The Lignocaine when administered I.V bolus has an onset of action within 45-30 seconds with peak effect at 1-2 minutes, t ½ ß = 9.6 minutes[15]. As lignocaine blunts the pressure response and laryngeal reflexes during extubation it was given two minutes prior to extubation and the children were fully awake before extubation.

Hypoxemia frequently occurs after termination of general anaesthesia during immediate post-operative period [8]. Oxygen consumption per kg body weight in children is more compared to adults. The low functional residual capacity in children is substantially below the closing capacity and results in airway closure, ventilation / perfusion imbalance and desaturation [16].

Baraka A (1978) studied fourty children undergoing tonsillectomy. 20 children were injected with 2% lidocaine bolus one minute prior to extubation and there was no incidence of laryngospasm in the study group, other twenty were extubated without lidocaine. The incidence of laryngospasm inthe control group was found to be 20.00% and 0% in lignocaine group. The reduction in incidence was 20.00% [17].

Woo Sik Kim, Sook Ju Park designed a study to see if intravenous lignocaine can be safely used to prevent or control extubation laryngospasm in children. In 20 children a bolus of 1% lignocaine 2 mg/kg was injected intravenously two to three minutes prior to extubation; in the other 20 children extubation was carried out without prior injection of lignocaine. The incidence of laryngospasm, coughing, respiratory depression

and changes in blood pressure, pulse rate were measured. Incidence of cough and laryngospasm were moderately reduced in lignocaine pretreated group. Blood pressure and pulse rate showed a tendency to decrease about 15% in lignocaine pretreated group [18].

Chang SH, Kim DH *et al* studied that intravenous administration of lidocaine 1 mg/kg 5 minutes before extubation in strabismus surgery did not prevent laryngospasm or stridor. They carried out a study to investigate the effect of intravenous lidocaine on the prevention of laryngospasm or stridor by checking oxygen saturation using a pulse oximeter in sixty children undergoing strabismus surgery [19].

Leicht P, Wisborg T, Chraemmer-Jørgensen B *et al* (1985) investigated one hundred otherwise healthy children undergoing tonsillectomy. They were randomly given lidocaine, 1.5 mg/kg, or saline intravenously prior to extubation, which took place at the same depth of anesthesia, namely when there were signs of swallowing activity. Eleven children (2%) in each group of 50 developed laryngospasm. From their findings it is concluded that lidocaine, 1.5 mg/kg, does not prevent laryngospasm upon extubation when extubation is carried out at the start of swallowing activity [20].

The present study was conducted to know the effectiveness of intravenous lignocaine in prevention of post extubation laryngospasm and coughing in children undergoing cleft lip and cleft palate surgeries, associated alterations in heart rate, blood pressure, oxygen saturation observed following extubation. 80 patients were randomly divided in two study groups of 40 each. Group A (n= 40) received lignocaine1.5 mg/kg intravenously and group B (n= 40) received normal saline 0.075 ml/kg intravenously 2 minute before extubation.

The heart rate, blood pressure and oxygen saturation following extubation were well maintained on administration of I.V lignocaine in Group A in comparison to the Group B. Our study showed a reduction in incidence of coughing by 17.50% on administration of I.V lidocaine and p value = 0.030 which was considered statistically significant.

The incidence of laryngospasm in Group B was 25.00% and in Group A it was 7.50%. The reduction in incidence of laryngospasm was significant i.e. 17.50% (p value = 0.048) on administration of intravenous lignocaine two minutes before extubation.

Conclusion

From our study we would like to conclude that intravenous lignocaine is a very effective drug in preventing the laryngospasm, cough and to minimize the hemodynamic alterations in response to extubation. There is no adverse effect reported in both the groups. In the light of the present literature, Lignocaine can be considered a safe drug to prevent post extubation laryngospasm.

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