Facilitation of Endotracheal Intubation in Children with Topical Lidocaine during Sevoflurane Induction

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Citation

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Abstract

Background: Various combinations of anesthetic induction are used to achieve endotracheal intubation in pediatric patients. During ambulatory anesthesia, muscle relaxants may not be necessary for the surgical procedure; so using muscle relaxants for the sole purpose of facilitating intubation may impact on operating room efficiency. The present study reports use of instilling topical viscous lidocaine through one of the nostrils to facilitate intubation in children during sevoflurane induction.

Methods: We retrospectively reviewed the clinical records of the pediatric patients in whom topical lidocaine was used as an adjunct to intubation during inhalational induction with sevoflurane.
Viscous lidocaine 4% was instilled through one of the nares during inhalational induction and intubation was performed after few minutes.

Result: There were 41 patients identified on chart reviews of pediatric ambulatory surgical patients, who received topical lidocaine to facilitate intubation during inhalational induction with sevoflurane.
Induction to Intubation time ranged from 3-21 minutes. The success of intubation was better with younger patients as determined by no coughing during intubation. Induction to Intubation time ranged from 3-21 minutes and for 75% of the patient population was 9.5 minutes.
Lidocaine instillation to intubation time ranged from 1-7 minutes. Mean time of lidocaine instillation to intubation was 2.5 minutes. Lidocaine instillation to intubation time for 75% of the patient
population was 2 minutes.

Conclusion: In conclusion, from our retrospective review we can suggest that it is possible to use topical lidocaine to achieve successful intubating condition without use of muscle relaxant during induction with sevoflurane anesthesia. As the technique used was instilling of viscous 4% lidocaine through one of the nostrils, we did not have to perform an additional laryngoscopy to spray it directly on cords.

INTRODUCTION

Various combinations of anesthetic induction are used to achieve endotracheal intubation in pediatric patients. Propofol, remifentanyl, intravenous lidocaine have been used as adjuvants to endotracheal intubation without muscle relaxants. ([1],[2],[3])

Endotracheal spraying with lidocaine has been widely accepted as a useful method for obtunding the pressor response to intubation in adults. ([4])

During ambulatory anesthesia, muscle relaxants may not be necessary for the surgical procedure; so using muscle relaxants for the sole purpose of facilitating intubation may impact on operating room efficiency. Every muscle relaxant has the potential for morbidity and mortality, moreover adverse effects range from minimal to lethal.

The present study reports instillation of topical viscous lidocaine through one of the nostrils to facilitate intubation in children during sevoflurane induction.

METHODS

The Institutional Review Board of the Hospital approved the study protocol.

DATA COLLECTION

We retrospectively reviewed the clinical records of the

pediatric patients in whom topical lidocaine was used as an adjunct to intubation during inhalational induction with sevoflurane. These patients were scheduled to undergo outpatient ambulatory surgical procedures. None of these patients received any premedication.These procedures were of short time duration and did not need myorelaxation. Type of surgery and patient characteristics such as age, weight were noted. Data most importantly included time of anesthetic induction to intubation, amount of topical lidocaine used, time interval between use of topical lidocaine to intubation, coughing on laryngoscopy, coughing on intubation, attempts at intubation and use of additional intravenous medications after failed first attempt at intubation.

PATIENT MANAGEMENT

An electrocardiogram, pulse oximeter, noninvasive blood pressure monitor were attached to the patient. Anesthesia was induced by a circle system using vaporizer concentrations of 6% sevoflurane in an oxygen flow of 4 L/min and nitrous oxide flow of 6 L/min. After the loss of consciousness, intravenous catheter was inserted in all children. Topical 4% viscous lidocaine was taken in a plastic syringe and instilled through the nostril and was allowed to drip into the posterior pharynx into the supraglottic and glottic area. Trachea was then intubated with direct laryngoscopy using patient age and size appropriate endo-tracheal tube.

STATISTICAL ANALYSIS

Statistical Analysis was performed using Exel 2003 for windows and

GraphPad Prism Software (GraphPad Software, Inc., San Diago. CA). The parameters were analysed by One-way analysis of variance (ANOVA), Kruskal-wallis Test, and differences were regarded as significant with $p < 0.05$.

RESULTS

There were 41 patients identified on chart reviews of pediatric ambulatory surgical patients, who received topical lidocaine to facilitate intubation during inhalational induction with sevoflurane. We did not exclude any patient from our review. Age of the patient ranged from 1 year to 19 years. It is our practice to choose inhalational induction till the age of 7 years. Children more than 7 years of age are given a choice of inhalational versus intravenous mode of induction of anesthesia. All the patients in this review were ASA physical status I or II. Also none of the patients had any syndromes or airway abnormalities mentioned in the physical evaluation chart.

Case Demographics as shown in Table 1.

Figure 1

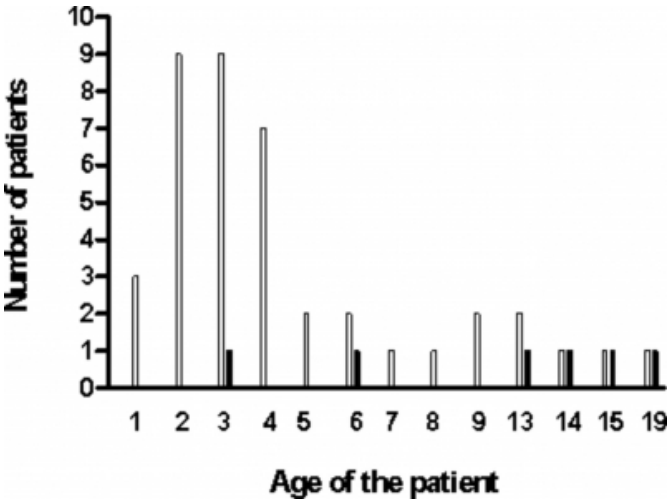
Table 1: Demographics and Clinical Data of the Patients

	Number of Cases	Range with SD (n=41)
Age in years		1-19 (5±4.2)
Weight in Kg		9-54 (20.8±12.2)
Type of the Procedure		
Circumcision	5	
Myringotomy and Adenoidectomy	10	
Tonsillectomy and Adenoidectomy	12	
Endoscopy	12	
Cystoscopy	2	
Lidocaine dose, mg/kg		1.6-3.2 (2.3±0.35)
Induction to Intubation time in minutes		3-21 (7.2±3.7)
Lidocaine instillation to Intubation time in minutes		1-7(2.5±1.2)

Most of the patients under the age of 10 years either opted for or were considered by the anesthesiologist suitable for inhalational induction. Very few older patients who are extremely anxious about intravenous line placement requested inhalational induction. The procedures included are outpatient procedures that did not need muscle relaxation and were procedures with short duration. Induction to Intubation time ranged from 3-21 minutes, with ease of intravenous catheter placement being the major determinant of this parameter. The success of intubation was better with younger patients as determined by absence of coughing during intubation, (Fig.1) $p < 0.0001$.

Figure 2

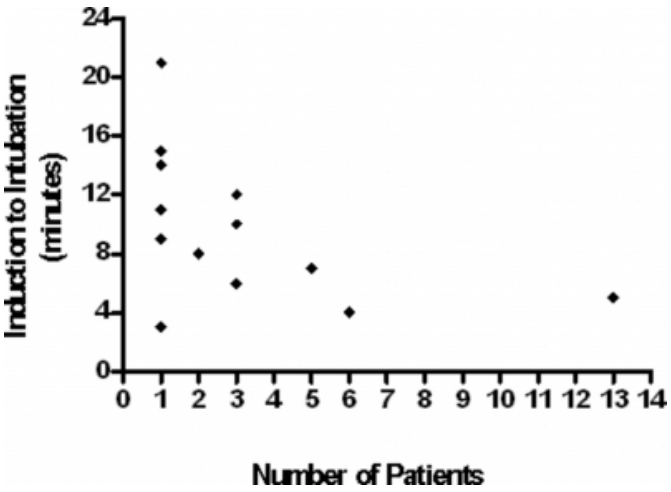
Figure 1: Bar graph showing number of patients who did not cough on intubation (hollow bars) and did cough on intubation (solid bars) and age of the patients. < 0.001.



Induction to Intubation time ranged from 3-21 minutes. (Fig.2)

Figure 3

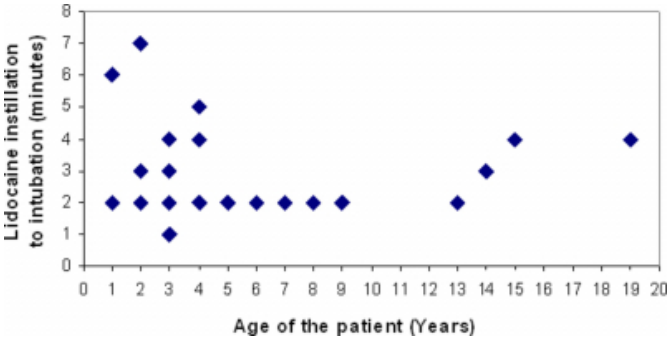
Figure 2: Scattergram depicting Induction to Intubation time in minutes to number of patients. Mean value of Induction to Intubation time is 7.2 minutes. < 0.0001.



Variability in time was higher in younger patient as the intravenous catheter placement can be technically challenging in younger patients. Induction to intubation time for 75% of the patient population was 9.5 minutes. Lidocaine instillation to intubation time ranged from 1-7 minutes. (Fig.3)

Figure 4

Figure 3: Scattergram depicting time from Lidocaine instillation to Intubation in minutes to Age of the patients. Mean value of Lidocaine instillation to intubation is 2.5 minutes.



None of the patients coughed on laryngoscopy. Only 6 patients out of 41 coughed on intubation (15%) and in 2 patients two intubation attempts were needed for intubation. Mean time of lidocaine instillation to intubation was 2.5 minutes with standard deviation of 1.2 minutes. Lidocaine instillation to intubation time for 75% of the patient population was 2 minutes. Standard error calculated was 0.18. Median and mode for the patient population analysed was 2 minutes. Mean induction to intubation time, mean lidocaine instillation to intubation time and lidocaine dose mg/kg are expressed with 95% confidence interval.

DISCUSSION

The larynx is a unique organ that has complex functions. Most of these functions are accomplished by neural control that includes reflexes elicited from the larynx itself. These reflexes consist of laryngeal closure, laryngospasm, apnea, cough or expiration reflex, and swallowing reflex. They can be categorized into the airway protective reflex, which is beneficial in protecting the lower airway from inhaling noxious substances. From a clinical standpoint, laryngeal sensitivity is essential for both preventing foreign substances from entering into the lower airway and for finely tuning upper airway resistance. Younger children have heightened airway reactivity.([5]) From an anesthesiologist's standpoint these reflexes need to be decreased or abolished for achieving smooth, non-traumatic intubation. If laryngoscopy and intubation are attempted under inadequate conditions, trauma to the airway or inadequate ventilation can result. Adequate intubating conditions can be achieved by use of a muscle relaxant as an adjuvant to induction. Whether to use neuromuscular blocking agents or not depends on the patient factors, the type of anesthesia planned, and the surgical

procedure. For procedures of short duration there is limited choice

of short acting muscle relaxants. Succinylcholine is a short acting muscle relaxant, however it has many side-effects and should be avoided for elective procedures, particularly in infants and children. Life-threatening side-effects occur occasionally, especially in children and infants. Several reports led the American manufacturers to revise the label in November 1993 and to restrict the use of succinylcholine in children in March 1995.([6]) Mivacurium, however, did have duration of action suitable for day case surgery, the major disadvantage being a long onset time, which is about 2–3 min, even after administering 0.25 mg kg 1 (3 × ED95 dose) ([7]). Abbott Laboratories has discontinued the manufacture of Mivacron (mivacurium chloride). On May 15, 2006; Abbott Laboratories sent out a newsletter which informed that, "Due to circumstances outside of company control,

Abbott Laboratories expects to have a shortage of our Mivacron®(mivacurium chloride) Injection (NDA 20-098) beginning in late May, 2006. Despite every effort to return this product to the market in a timely manner, it has become clear that the process timeline and competitive environment will prohibit a successful return. As a result, once current inventories are depleted, we do not anticipate availability of new inventory".

Pediatric anesthesiologists have been using alternatives to achieving intubation without muscle relaxation whenever indicated. In our study we have looked at one of the many ways this can be achieved. Viscous lidocaine is available as 4% solution which on topical application numbs mucous membrane. Lidocaine inhibits neuronal transmission by its action in stabilizing the neuronal membrane. Lidocaine, as a weak basic and lipophilic drug, binds avidly to the respiratory mucosa. The absorption characteristics of the mucosa, epithelial thickness, number of membrane pores, and tissue pH also serve to determine the binding. Mechanosensitive receptors of the airway are blocked. Systemic absorption of lidocaine from the topical system is dependent on the thickness of the mucosa, the duration of application, and the surface area over which it is applied. When used according to the recommended instructions, approximately 3% of the applied dose is absorbed.([8,9]). Intravenous lidocaine is used in adults to blunt hemodynamic responses such as tachycardia and high blood pressure during intubation which may have adverse effect on heart. In children these effects are well tolerated. Intravenous use of lidocaine has a potential to cause slowing of heart rate which may not be acceptable in infants and small children. Also as we squirted lidocaine through one of the nostrils, we did not have to perform an additional laryngoscopy to spray it directly on cords.

An advantage of topical application of local anesthesia (as for any topical method) is that there is no risk of an inadvertent intravascular injection. Absorption of lidocaine from the airway was generally rapid but variable.([10])

We realize that retrospective study has limitations. Randomized controlled trials need to be conducted to compare use of topical lidocaine with other intubation techniques.

In conclusion, from our retrospective review we can suggest that it is possible to use technique of instillation of topical lidocaine without the use of muscle relaxant as an adjuvant to achieve successful intubating conditions during induction with sevoflurane anesthesia.

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