

PREVALENCE OF POST-EXTUBATION LARYNGOSPASM IN CHILDREN GETTING PROPHYLACTIC INTRAVENOUS LIDOCAINE DURING TONSILLECTOMY - A CROSS SECTIONAL STUDY

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ABSTRACT

BACKGROUND

Tonsillectomy with or without adenoidectomy is one of the most frequent surgical procedures that are carried out globally in children and it is associated with maximum incidence of laryngospasm during extubation. The present study is on prevalence of post-extubation laryngospasm in children getting intravenous lidocaine as prophylaxis.

Objectives - Primary objective is to study the prevalence of laryngospasm in children getting intravenous lidocaine as prophylaxis during extubation following tonsillectomy. Secondary objectives are to study the prevalence of coughing in children getting intravenous lidocaine as prophylaxis during extubation following tonsillectomy and to study the haemodynamic response during extubation in children getting intravenous lidocaine as prophylaxis of post-extubation laryngospasm following tonsillectomy.

MATERIALS AND METHODS

175 children who were given intravenous lidocaine 2 mg/kg before extubation after tonsillectomy were studied. The prevalence of laryngospasm, coughing and haemodynamic changes during extubation were studied.

RESULTS

4 children out of 175 had mild laryngospasm. 18 children had coughing after extubation. 5 children (2.9%) had mild coughing, 10 children (5.7%) had moderate coughing and 3 children (1.7%) had severe coughing. The prevalence of laryngospasm in our study population is 2.3%. The prevalence of coughing was 10.3%. Heart rate, systolic, and diastolic pressure changes following extubation were compared with pre-extubation values using paired t test. There was no significant change in heart rate, systolic, and diastolic pressure. The p value is more than 0.05. The oxygen saturation was maintained > 97%.

CONCLUSION

The prevalence of laryngospasm in children getting intravenous lidocaine as prophylaxis during extubation following tonsillectomy is 2.3%. The prevalence of coughing is 10.3%. There was no significant change in heart rate, systolic, and diastolic pressure and oxygen saturation.

KEYWORDS

Lidocaine, Laryngospasm, Tonsillectomy.

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BACKGROUND

Tonsillectomy with or without adenoidectomy is one of the most frequent surgical procedures that are carried out globally in children. Although it is a common procedure, it presents risks and challenges for both the surgeon and the anaesthetist. Tonsillectomy is an elective procedure with more than average mortality approximately 1 per 10-20000 cases.⁽¹⁾ Children had a twofold higher incidence of fatal respiratory events in the postoperative period.

In a study conducted by Brown. K. A in 2011 in children undergoing adenotonsillectomy, 44% of mortality or

profound brain injury resulted from postoperative respiratory complications.⁽²⁾ Among the respiratory causes of cardiac arrest, airway obstruction from laryngospasm was 6%. Laryngospasm is a serious complication which was the most common seen in anaesthesia during induction, intubation or extubation. It 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 0-9 years is 17.4% and is even higher in children between 1 and 3 months of age.⁽³⁾

The incidence of laryngospasm after adenoidectomy and tonsillectomy is reported to be as high as 21-26%.⁽⁴⁾ Children are more prone to airway obstruction as they have a narrow laryngeal and tracheal lumen that may be blocked by mucosal oedema.⁽⁵⁾ The complications resulting from laryngospasm are cardiac arrest 0.5%, obstructive negative pressure pulmonary oedema 4%, pulmonary aspiration 3%, bradycardia 6% and oxygen desaturation 61%.⁽⁶⁾ Various techniques to prevent or treat laryngospasm include intravenous lidocaine which is easily available in operation theatre and cheaper. It has an additional advantage of blunting pressor response during laryngoscopy and intubation.

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Its side effects are dose related and not seen at plasma concentration less than 5 µg/mL. The present study aims at the efficacy of a commonly available drug lidocaine in preventing laryngospasm. The primary outcome of our study is prevalence of post-extubation laryngospasm in children getting IV lidocaine as prophylaxis. We also study the prevalence of coughing in children getting IV lidocaine during extubation and also the haemodynamic changes associated with extubation.

Aim of Study

Objectives

Primary objective was to study the prevalence of laryngospasm in children getting intravenous lidocaine as prophylaxis during extubation following tonsillectomy.

Secondary

1. To study the prevalence of coughing in children getting intravenous lidocaine as prophylaxis during extubation following tonsillectomy
2. To study the haemodynamic response during extubation in children getting intravenous lidocaine as prophylaxis of post-extubation laryngospasm following tonsillectomy.

MATERIALS AND METHODS

The study was conducted in 175 children undergoing tonsillectomy with or without adenoidectomy aged between 3 and 12 years in the Department of Anaesthesiology, Government Medical College Trivandrum. Informed written consent from patients was taken. Result values were recorded using a pre-set proforma.

Study Design

Cross sectional study to study the prevalence of laryngospasm in children getting intravenous lidocaine as prophylaxis during extubation following tonsillectomy.

Study Population

Children getting IV lidocaine before extubation while undergoing tonsillectomy and satisfying inclusion and exclusion criteria.

Inclusion Criteria

- a. Children in the age 3-12 years.
- b. ASA I-II.

Exclusion Criteria

- a. Congenital heart disease.
- b. Bronchial asthma.
- c. Recent respiratory tract infection.

MATERIALS AND METHODS

After obtaining the approval from the hospital ethical community and the written informed consent from the patients, the study was conducted at Government Medical College, Trivandrum. Children with 3-12 years of age undergoing tonsillectomy and satisfying inclusion and exclusion criteria were included in the study. Informed written consent was taken from parents after explaining details of the study. Noninvasive monitors such as pulse oximeter, ECG, automated non-invasive blood pressure and end tidal CO2 monitor were used. All children had an appropriate sized IV cannula. The children were pre-oxygenated with 100% oxygen for 3 minutes and then

premedicated with Inj. Atropine 0.02 mg/kg IV, Inj. Midazolam 0.02 mg/kg IV and Inj. Metoclopramide 0.2 mg/kg IV. General anaesthesia was induced with Sevoflurane 1-2%, Inj. Propofol 2 mg/kg IV, Inj. Fentanyl 2 µg/kg IV and Inj. Vecuronium 0.1 mg/kg IV and intubated with appropriate size RAE tube. Anaesthesia was maintained with Sevoflurane 2%, Nitrous oxide 60% and oxygen 40% and IPPV. The neuromuscular blockade was antagonised with Inj. Neostigmine 0.05 mg/kg and Inj. Atropine 0.02 mg/kg. The heart rate, blood pressure and oxygen saturation 3 minutes after reversal is noted. 3 minutes after reversal IV lidocaine 2 mg/kg was given and the haemodynamic parameters like heart rate, systolic and diastolic blood pressures were noted. Then, children were ventilated with 100% oxygen for 90 seconds and then children were extubated. After extubation 100% O₂ was given for 3 minutes and then 40% O₂ through venture face mask. For 10 minutes following extubation, heart rate, blood pressure, oxygen saturation, breathing pattern, severity of coughing and laryngospasm were noted.

Coughing was evaluated using the modified four-point scale: 0= None, 1= Slight, 2= moderate, 3= severe.

Laryngospasm was graded using the four-point scale: 0=No laryngospasm, 1=Stridor during inspiration, 2=Total occlusion of cords, 3=Cyanosis. Cases with laryngospasm were immediately treated by giving positive pressure ventilation with 100% O₂, jaw thrust and Inj. Propofol 0.5 mg/kg. The haemodynamic parameters heart rate, blood pressures and O₂ saturation were monitored at 1-minute interval for 10 minutes after Extubation.

Sample Size: $n = \frac{(Z_{1-\alpha})^2 (P (1-P))}{D^2}$
 $Z_{1-\alpha} = Z_{0.90} = 1.645$
 $n = \frac{1.645 \times 1.645 (0.20 (1-0.20))}{0.05^2}$
 $= 173.1856$
 $N = 175$

Statistical Analysis

Data were analysed using computer software Statistical Package for Social Sciences (SPSS) latest version. Data were expressed in its frequency and percentage as well as mean and standard deviation. Paired t test was used to compare pre-extubation mean value and value at 1-10 minutes after extubation.

RESULTS

Age in Years	Frequency	Percentage
3	9	5.1
4	6	3.4
5	14	8
6	42	24
7	42	24
8	12	6.9
9	13	7.4
10	8	4.6
11	13	7.4
12	16	9.1
Total	175	100

Table 1. Age Distribution of Study Groups

Sex	Frequency	Percentage
Female	55	31.4
Male	120	68.6
Total	175	100

Table 2. Sex distribution of Study Groups

	N	Min	Max	Mean	Std.Deviation
Age in years	175	3	12	7.40	2.41
Weight in KG	175	15	45	24.31	8.66
Dose (Minimum)	175	30	120	70.54	22.98

Table 3. Table showing Mean Age, Weight and Duration of Surgery

The mean weight of children was 24.3 Kg and the mean duration of surgery was 70 minutes.

Laryngospasm	Frequency	Percentage	95% CI
Absent	171	97.7	
Grade1	4	2.3	0.8-5.7%
Grade 2	0	0	
Grade3	0	0	
Total	175	100	

Table 4. Frequency and Percentage of Laryngospasm

The prevalence of laryngospasm in our study population was 2.3% with a 95 % CI between 0.8 -5.7%.

Coughing	Frequency	Percentage
Absent	157	89.7
Grade1	5	2.9
Grade2	10	5.7
Grade 3	3	1.7
Total Children with coughing	18	10.3

Table 5. Frequency and Percentage of Coughing

18 children had coughing after extubation, 5 children had mild coughing, 10 had moderate coughing and 3 children had severe coughing. The prevalence of coughing was 10.3% with a 95% CI between 6.38 -16.01%. 89.7% of children did not have coughing after extubation.

	N	Heart Rate		Paired Comparison with base Line Value		
		Mean	SD	Mean difference	Se	P
HR pre	175	102.42	10.316			
HR 1	175	102.65	10.275	0.229	0.132	0.085
HR 2	175	102.66	10.439	0.240	0.144	0.097
HR 3	175	102.60	10.373	0.177	0.120	0.141
HR 4	175	102.57	10.327	0.143	0.079	0.072
HR 5	175	102.54	10.323	0.114	0.066	0.084
HR 6	175	102.44	10.352	0.017	0.059	0.771
HR 7	175	102.47	10.251	0.051	0.071	0.727
HR 8	175	102.35	10.314	0.074	0.085	0.386
HR 9	175	102.29	10.19	0.137	0.105	0.195
HR 10	175	102.22	10.16	0.200	0.200	0.139

Table 6. Changes in Heart Rate Following Extubation

	N	SBP		Paired Comparison with Baseline Value		
		Mean	SD	Mean Difference	Se	P
SBP PRE	175	102.99	5.217			
SBP1	175	103.28	5.361	0.286	0.152	0.061
SBP2	175	103.26	5.392	0.263	0.149	0.080
SBP3	175	103.15	5.518	0.160	0.126	0.206
SBP4	175	103.10	5.372	0.103	0.089	0.250
SBP 5	175	102.93	5.299	0.069	0.087	0.432
SBP6	175	102.96	5.317	0.034	0.112	0.759
SBP7	175	102.98	5.247	0.011	0.111	0.918
SBP8	175	102.88	5.285	0.114	0.118	0.333
SBP9	175	102.82	5.284	0.171	0.116	0.140
SBP10	175	102.78	5.194	0.217	0.144	0.132

Table 7. Systolic Blood Pressure Changes during Extubation

	N	DBP		Paired Comparison with Base Line Value		
		Mean	SD	Mean Difference	Se	P
DBP Pre	175	66.17	3.982			
DBP1	175	66.47	4.45	0.297	0.163	0.07
DBP2	175	66.45	4.197	0.274	0.149	0.067
DBP3	175	66.14	4.21	0.034	0.122	0.779
DBP4	175	66.14	3.975	0.034	0.103	0.74
DBP5	175	66.34	3.985	0.171	0.105	0.104
DBP6	175	66.31	3.968	0.137	0.103	0.186
DBP7	175	66.19	4.027	0.023	0.11	0.836
DBP8	175	65.98	3.812	0.194	0.128	0.132
DBP9	175	65.95	3.959	0.217	0.116	0.064
DBP10	175	65.95	3.977	0.217	0.122	0.076

Table 8. Changes in Diastolic BP during Extubation

	N	SPO2	
		Mean	SD
SPO2 1	175	97.91	0.83
SPO2 2	175	98.02	0.77
SPO2 3	175	98.12	0.77
SPO2 4	175	98.57	0.68
SPO2 5	175	98.89	0.45
SPO2 6	175	99.09	0.45
SPO2 7	175	99.15	0.36
SPO2 8	175	99.47	0.5
SPO2 9	175	99.47	0.5
SPO2 10	175	99.69	0.46

Table 9. Change in SPO2 following Extubation

DISCUSSION

Tonsillectomy with or without adenoidectomy is a common procedure in children. But it is associated with highest incidence (20-26%) of laryngospasm. Various measures for prevention and treatment of laryngospasm have been studied. This study was a cross sectional study carried out at Government Medical College Trivandrum. 175 children in the age group 3-12 years (ASA I and II) scheduled for tonsillectomy with or without adenoidectomy were included in this study. Children with history of respiratory tract infection within 4 weeks and history of asthma were excluded from the study. Children were anaesthetised with Sevoflurane, Propofol and Vecuronium and intubated with RAE tubes of appropriate size. At the end of the procedure, 3 minutes after reversal, IV lidocaine 2 mg/kg was given and 90 seconds later the children were extubated. Then, the prevalence of laryngospasm, coughing, changes in blood pressure, heart rate and O2 saturation after extubation were studied. In our study, children in the age group 5-7 years constituted 56%. This is in agreement with the study by J. Aleeson Glover - "The Incidence of Tonsillectomy in School children". According to him, the highest incidence is in the period 5-7 years, the peak being in the 6th year.

Our study group included 68.6% boys and 31.4% girls. According to study by Glover JA, the incidence of tonsillectomy is higher in boys than in girls.⁽⁷⁾ In our study, in 175 children who got IV Lidocaine 2 mg/kg 90 seconds before extubation, only 4 children (2.3%) had laryngospasm. This laryngospasm was mild and easily treated with 100% O2, positive pressure ventilation and propofol. According to study by Baraka et al, IV Lidocaine controls extubation laryngospasm in children. Intravenous Lidocaine 2% 2 mg/kg given 60 seconds before extubation reduced the incidence of laryngospasm to 0 % from 20% in children undergoing tonsillectomy.⁽⁸⁾

In our study, the 18 children out of 175 developed post-extubation coughing. The prevalence of coughing in children getting IV lidocaine during extubation was 10.3%. Out of 18 children, 5 (2.9%) had mild coughing, 10 (5.7%) had moderate coughing and 3 (1.7%) had severe coughing. According to study by Yukioka H Et al, IV lidocaine is a cough suppressant during tracheal intubation in elderly patients and incidence of coughing after giving 2 mg/kg lidocaine IV 1 minute before intubation was 10%. In their 2nd study, the incidence of coughing was only 7% with the same dose of lidocaine given 1 minute before intubation.⁽⁹⁾

A previous study by Bidwai and colleagues also showed decreased incidence of coughing after giving lidocaine before extubation and the dose given was 1 mg/kg 2% Lidocaine IV 2 minutes prior to extubation. This prevented significant change in BP, heart rate and reduced coughing.⁽¹⁰⁾

Study by CS Sanikop et al showed that IV Lidocaine produced little increase in heart rate and BP compared to placebo and also did not produce fall in SPO2 after extubation in children who got lidocaine before extubation.⁽¹¹⁾ These results were similar to our study.

CONCLUSION

The prevalence of laryngospasm in children undergoing tonsillectomy and getting IV lidocaine during extubation was 2.3%. It was much less than the usual incidence of laryngospasm 20-26% in children undergoing tonsillectomy. The prevalence of coughing in children getting IV lidocaine during extubation is 10.3%. There was no significant change in heart rate, systolic or diastolic blood pressure. The P value was more than 0.05. The oxygen saturation (SPO2) was maintained at > 97%. There was no fall in SPO2 after extubation.

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