

## ORIGINAL ARTICLE

## EFFICACY OF INTRAVENOUS LIGNOCAIN VS SEVOFLURANE IN PREVENTION OF COUGHING AND DESATURATION AT EXTUBATION IN CHILDREN

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**Background:** Inadvertent coughing and desaturation are the most commonly faced and feared respiratory complications in post-anaesthesia period. The study was done to compare the efficacy of intravenous lignocaine versus sevoflurane in prevention of coughing and desaturation at extubation in children less than 6 years of age. **Methods:** This Randomized Control Trial was carried out from May 2013 to May 2016, at Combined Military Hospital Nowshera after obtaining approval from the hospital ethics committee (IREC-0003/5/13/Aneas). Children aged three months to six years undergoing surgical procedures requiring the placement of definitive airway were randomly assigned into two groups. Patients were anaesthetized by standardized balanced anaesthesia technique. In Group A (n=355), three minutes prior to extubation lignocaine 2% was used intravenously. In Group B (n=355), isoflurane was switched off, breathing circuit changed and sevoflurane started at minimum alveolar concentration (MAC 3–4%) for 3 minutes prior to extubation. Assessment for extubation was clinical. Oxygen saturation and severity of coughing were noted for 5 consecutive minutes, after extubation. **Results:** In group-A, 156 patients were less than 2 years of age while in group-B, 135 patients were less than 2 years old. In group-A, 199 and in group-B, 220 children were 2–6 years of age respectively. Post stratification the *p*-value for weight was 0.17 (*p*-value >0.05) and *t*-statistic was 1.36. Post stratification *p*-value for gender was 0.12 (*p*-value >0.05) and chi square statistic was 2.49. Group A had more eventful extubation with 270 cases of cough (76%) as compared to group-B where it was noted in 199 cases (56%). Similarly, desaturation was observed in 85 cases in group-A (24%) as compared to 28 cases (8%) in group-B. The difference between the groups was statistically significant. **Conclusion:** Sevoflurane based anaesthetic vapours mixture causes statistical significant prevention from events like coughing episodes and desaturation in post-extubation in children less than six years of age undergoing elective surgery.

**Keywords:** Intravenous lignocaine (IV); Sevoflurane; Laryngospasm; Post extubation

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### INTRODUCTION

Inadvertent coughing and desaturation are the most commonly faced and feared respiratory complications in post-anaesthesia period.<sup>1</sup> These occur either due to the lack of inhibition of glottis reflexes resulting from inadequate central nervous system depression or because of increased local stimuli. Closure of the glottis occurs as afferent fibres of the internal branch of the superior laryngeal is stimulated, initiating laryngeal muscle contraction.<sup>2</sup> Desaturation due to coughing is not uncommon in patients undergoing endotracheal based general anaesthesia, upper airway surgery, and otolaryngology procedures. It can be potentially life threatening causing negative pressure pulmonary oedema, abrupt increase of intra-cavitary pressures (intracranial, intraocular, intrathoracic and intraabdominal) which could jeopardize patient's outcome. Children are more prone to airway problems

due to peculiar anatomic differences whereby oedema of small diameter airways cause tremendous obstruction, equated as halving the diameter increases resistance of flow by 16 times.<sup>3,4</sup> The precipitating factors can be patient related<sup>5,6</sup> (asthma, respiratory tract infections), surgery related<sup>5-8</sup> (head and neck surgeries) and anaesthesia related<sup>5-12</sup> (airway catheters and drugs).

Intravenous lignocaine has the advantage of blunting the pressor response during laryngoscopy, intubation and at extubation. Numerous studies<sup>10-12</sup> on the prevention of such events have been carried out in paediatric population, but still the evidence is lacking on the effectiveness. Amongst the halogenated agents new and relatively more expensive agents like isoflurane and desflurane have lost popularity in paediatric anaesthesia, for being severely irritant to airways.<sup>12</sup> Sevoflurane is a versatile sweet-smelling agent best suited for induction and emergence for paediatrics, although in an editorial

in 2010, Dr. Eger<sup>13,14</sup> stated that the unit cost of sevoflurane is higher than desflurane as a maintenance anaesthetic agent. In our setup considering the cost ineffectiveness of sevoflurane, we improvised a regime wherein sevoflurane was used before extubation for three minutes rather than throughout the entire procedure. The aim of our study was to evaluate the comparative efficacy of intravenous lignocaine 1.5 mg/kg versus sevoflurane vapours started at MAC 3–4%, in terms of coughing and desaturation at extubation.

**MATERIAL AND METHODS**

This study was conducted at Combined Military Hospital Nowshera from May 2013 to May 2016 after obtaining approval from the hospital ethics committee (IREC-0003/5/13/Aneas). Sample size 710 (355 patients in each group) was calculated using WHO Sample Size calculator with confidence level of 90%, Level of significance 5% and Power of test 80, anticipated population proportion-1 (P1) equal to 0.174 (incidence of severe coughing/desaturation with sevoflurane)<sup>2</sup> and anticipated population proportion-2 (P2) equal to 0.260 (incidence of severe coughing/desaturation with lignocaine)<sup>3</sup>.

Sampling technique was consecutive probability (Simple random sampling) method. Children were randomly divided into Group-A and Group-B (each having 355 patients). Inclusion criteria were all children aged 3 months to 6 years, ASA I-II status, and due for all sorts of elective general surgical, ENT and Ophthalmologic procedures requiring the definitive airway placement. Patients with difficult airways, congenital defects, patients on steroids and having respiratory tract infections were excluded. Anaesthetists and surgical team members remained the same. All monitoring standards as dictated by the American society of anaesthesiologists (ASA) were followed considering the co-morbidities, planned procedures, availability and expertise of the anaesthetist. The anaesthesia was induced by either “Pedi mask technique” using 100% oxygen in sevoflurane vapours or standardized balance intravenous techniques; injection nalbuphine 0.1 mg/kg as analgesic, injection atracurium 0.50mg/kg for intubation and muscle relaxation was used. Maintenance of anaesthesia was carried out with 100% oxygen in isoflurane vapors, titrated to clinical effects with conventional paediatric

circuits of ventilation. The neuromuscular blockade was antagonized with glycopyrrolate 0.01 mg/kg and injection neostigmine 0.05 mg/ kg was administered at the end of surgical procedure.

Three minutes prior to the reversal of anaesthetics, the study drug (Group-A) lignocaine 1.5 mg/kg was administered, and in group-B isoflurane was switched off, breathing circuit changed and 3–4% sevoflurane started. Once the patient fulfilled clinically the extubation criteria, extubation was done. Following extubation, Coughing was defined as an act with or without apnoea or cyanosis. Similarly, desaturation was defined as oxygen saturation on pulse oximeter less than 90%. Data for each patient was collected on a proforma and was analysed using SPSS-20. Mean and standard deviation was calculated for quantitative variable, i.e., weight. Frequency and percentages were calculated for qualitative variables like gender. Effect modifiers like age, gender and weight were controlled by stratification. Chi-square test was applied post stratification for age and gender and independent sample t-test was applied to weight. A p-value ≤0.05 was considered to be statistically significant.

**RESULTS**

In group-A, 156 patients were less than 2 years of age while in group-B, 135 patients were less than 2 years old. In group-A, 199 and in group-B, 220 children were 2–6 years of age respectively.

The male to female ratio of children less than 2 years old in group-A and group-B was 56:100 and 62:73 respectively while from 2–6 years old it was 113:86 and 128:92. The mean weight in group-A was 11.8±4.88 (Range: 3.5–20.8 kgs) while in group-B it was 11.3 kgs±4.72 (Range: 3.8–19.5 kgs). Post stratification the p-value for weight was 0.17 (p-value> 0.05) and t-statistic was 1.36. Post stratification p-value for gender was 0.12 (p-value>0.05) and chi square statistic was 2.49. Group A had more eventful extubation with 270 cases of cough (76.05%) as compared to group-B where it was noted in 199 cases (56.05%). Similarly, desaturation was observed in 85 cases in group-A (23.94%) as compared to 28 cases (7.88%) in group-B. The difference between the groups was statistically significant as shown in table-1 and table-2.

**Table-1: Comparison of coughing**

	Coughing		No-coughing		Marginal Row Totals
Group-A	270	(76%)	85	(24%)	355
Group-B	199	(56%)	156	(44%)	355
Marginal Column total	469		241		710

The chi-square statistic is 31.66. The p-value is 0.0001.

**Table-2: Comparison of desaturation**

	Desaturation		No-Desaturation		Marginal Row Totals
Group-A	85	(24%)	270	270 (76%)	355
Group-B	28	(8%)	46	327 (92%)	355
Marginal Column Total	113		84	597	710

The chi-square statistic is 34.19. The p-value is 0.0001.

## DISCUSSION

Exaggerated laryngeal or respiratory reflexes resulting in coughing and desaturation are considered as significant complications in post-anaesthesia phase. Reducing the incidence of these is of paramount vitality in peri-operative period. Sevoflurane is widely used in children, not only due to a sweet taste but also due to its ability to obtund airway reflexes. The results of our study suggest that incidence of coughing and desaturation is decrease significantly after sevoflurane as compared to intravenous lignocaine; however, the timing of administration must be carefully planned to obtain optimum effects.

We administered the study drug by selecting three min prior to extubation considering the studies conducted by Mikawa *et al*<sup>15</sup> and Bidwai *et al*<sup>16</sup> where it was described as increase of 20% from baseline in the haemodynamic parameter readings; and Sanikop CS *et al*<sup>17</sup> who found that heart rate, blood pressure and oxygen saturation were maintained at 1,2,3,5 and 10 minutes following administration of intravenous lignocaine. The results of Orliaguet *et al*<sup>18</sup> did not show any significant difference in post-extubation scenarios in children undergoing tonsillectomy. Tsui Ban CH *et al*<sup>19</sup> also concluded the effectiveness of 'No touch' extubation technique on the incidence of coughing, oxygen desaturation, or laryngospasm in children undergoing adeno-tonsillectomy using sevoflurane as anaesthetic agent.

Our studies were somewhat comparable to Iliar H *et al*<sup>20</sup>, where 8% sevoflurane was used throughout anaesthesia rather than at 3–4% MAC as was in our case, and showed promising effects to Propofol. We consider this as a cost ineffective regimen. We switched over to sevoflurane at the end of surgery 4 minutes prior to a likelihood of extubation; however, exact calculation of cost was not done except the fact that our monthly stock of sevoflurane lasted longer by (9±1.0 day) keeping in view the average number of patients in month. However, we felt few limitations worth mentioning such as a small sample size, use of nalbuphine altering airway reflexes and inter-individual variation in clinical assessment of depth of anaesthesia.

## CONCLUSION

Switching over to sevoflurane three minutes prior to extubation showed statistically significant reduction in post-extubation coughing and desaturation as compared to intravenous lignocaine (1.5 mg/kg) in children less than six years old undergoing elective surgery. However, of paramount vitality is to have an institutional standardized protocol for every patient

rather a fixed regimen in addressing potentially lethal events at or after extubation.

## AUTHORS' CONTRIBUTION

RK: Conceived and designed study, Data collection, analysis and writeup. AA: Data collection, analysis IUH: Conceived and designed study. TA: Analysis and writeup. SAK: Data Collection. MHR: Analysis and writeup. SAK: Analysis and Writeup.

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