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## LETTER

### Inhalation Insufflation Technique with Local Anaesthetic Spray without Intubation and Opioids for Paediatric Upper Airway Surgery - Observational Case Series Study

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#### Abstract:

##### Background:

Anaesthetic management of upper airway surgery in paediatric is challenging. Total intravenous anaesthesia with opioid or inhalation technique with spontaneous respiration has been used but studies are limited on inhalation technique. This study aimed to use tubeless inhalation insufflation technique without opioids at a tertiary centre.

##### Methods:

All paediatric patients coming for elective upper airway surgery to the centre, were included. Mask induction was with 5-8% sevoflurane in O<sub>2</sub> and maintenance with 2-3%, via a nasopharyngeally placed Endotracheal Tube (ETT) or catheter on spontaneous ventilation with flow between 8-10 l/min. Lidocaine up to 5 mg/kg was then sprayed to the mucosa of larynx and trachea. Once adequate depth was attained, suspension laryngoscope was placed by a surgeon for surgery. Some complications were observed *i.e* inadequate anaesthesia requiring rescue drugs like opioids or propofol, intubation, desaturation events from laryngospasm and delayed recovery. Surgical technique involved was diagnostic and therapeutic for the upper airway lesions.

##### Results:

Fifteen paediatric patients (2 months to 7 yrs) were included in the study with tubeless anaesthesia. None of them required intubation during the procedure. The mean time from induction of anaesthesia to unconsciousness was  $15 \pm 3$  s and attainment of necessary anaesthetic depth for surgery was  $4.7 \pm 0.90$  min. None had desaturation events or required opioids. However, propofol was required in one and delayed anaesthetic recovery was observed in one patient.

##### Conclusion:

This study on tubeless anaesthesia with Local Anaesthetic (LA) spray with spontaneous inhalation insufflation technique provided an opioid-free, interference-free operative field without airway compromise, not requiring intubation, therefore, further studies are required.

**Keywords:** Anaesthetic technique, Inhalational, Airway management, Suspension laryngoscopy, Upper airway, Opioid.

#### Article History

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## 1. INTRODUCTION

Anaesthetic management of upper airway surgery in paediatric is challenging, requiring a high level of skill and cooperation between surgeon and anaesthetist. There are various anaesthetic techniques used in managing upper airway surgery. The number of different methods reported are: tube-

less inhalation anaesthesia with tube at the nasal airway or bronchoscope, Total Intravenous Anaesthesia (TIVA) technique spontaneous or with IPPV after paralysis or using jet ventilation [1 - 5]. Inhalation technique with spontaneous respiration has been used effectively but there are limited studies [6 - 10]. The aim of this study was to use tubeless inhalation insufflation technique without opioids at the tertiary centre in the paediatric age in patients coming for elective upper airway surgery.

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## 2. METHODS

In this observational study, all the paediatric patients coming for elective upper airway surgery to the tertiary centre were included after the institutional permission. Patients without parental consent and incomplete record were excluded. Premedication was with oral midazolam 0.5 mg/kg and atropine 0.02 mg/kg in orange juice to make it 5 ml. Mask induction was up to 5-8% sevoflurane in O<sub>2</sub> with high flow rates (8-10 l/min). The maintenance anaesthesia with sevoflurane was 2-3% with low O<sub>2</sub> flow rates, *via* nasopharyngeally placed Endotracheal Tube (ETT) size 4 or suction catheter connected to Jackson Rees circuit on spontaneous ventilation. The scavenging system was in use, with the possibility of gas leaking around the tube. Lidocaine up to 5mg/kg was then sprayed to the mucosa of larynx and trachea. Once adequate depth was attained with sevoflurane (minimum alveolar of concentration >1), suspension laryngoscope was placed by a surgeon for surgery. A stethoscope was placed on the chest to monitor breath sounds (end-tidal monitoring not available). Time of induction to unconsciousness and time from unconsciousness to the insertion of suspension laryngoscope, which is the time for adequate deep anaesthesia were measured by the parameters. Some complications were observed such as inadequate anaesthesia requiring rescue drugs like opioids or Propofol, intubation, desaturation events from laryngospasm and delayed recovery. When oxygenation was compromised and intubation was necessary, the prior discussion was made with the surgeon to make way for it. Diagnostic and therapeutic surgical techniques were involved like a laser for the upper airway lesions. They were assessed for surgical conditions, being satisfactory or not.

**Table 1. Patient characteristics.**

Variables	
Average Time of induction to unconsciousness(in seconds)	15 ± 3 s
Average Time for deep anaesthesia (min)	4.7 ± 0.90 min
Age (yrs.)	3 - 7 months
Gender M:F	8/7
Pathology	
Laryngeal papillomatosis	4
Laryngeal web	2
Laryngeal polyp	1
Subglottic stenosis	5
Subglottic granuloma	3

## 3. RESULTS

The demographics of the basic clinical profile is summarised in Table 1. Except for one patient, all the remaining patients were successful in utilising insufflation technique for anaesthesia. Propofol was used in only one patient which was a single bolus dose to increase the depth of anaesthesia. None of them required any opioids. The mean time from induction of anaesthesia to unconsciousness was 15 ± 3 s and attainment of necessary anaesthetic depth for surgery was 4.7 ± 0.90 min. None had desaturation events or showed local anaesthetic toxicity signs during the intraoperative and recovery period. None of the surgeons expressed unsatisfactory

conditions. Though routine observations were not studied, none of them deviated from the normal range. There was no morbidity related to the cardiovascular changes in the postoperative period and they fulfilled the recovery discharge criteria.

## 4. DISCUSSION

Our study with tubeless anaesthesia with Local Anaesthetic (LA) spray on spontaneous inhalation insufflation technique provided opioid-free anaesthesia. Local anaesthesia applied to airway has decreased anaesthetic needs like opioids sparing and maintained cardiovascular stability. These results were similar to the study of Richards and Jing Xu Zheng Yao [2, 6].

Justifying inhalation anaesthesia as better than TIVA propofol is a subject of major debate and beyond the reach of this manuscript. Though there are few studies TIVA reported to be effective, there may be an issue with increased depth of anaesthesia requiring intubation and reduced depth having airway issues like desaturation and hypoxia. Such events were reported in a study by Lin *et al.* [11]. Inhalation technique was first used in children by Spargo *et al.* [1]. It can have satisfactory conditions provided that a high enough vapour concentration is utilised to guarantee adequate depth of anaesthesia. An advantage is that with stimulation, the respiratory rate increases and the increase in the depth of anaesthesia results in self-regulation. However, to achieve adequate depth of anaesthesia before surgery begins, shared airway, tube migration into the surgical field, high fresh gas flow required (up to 10 l/min) to decrease the effect of dilution of inspired gases and difficulty to scavenge anaesthetic gases are assessed. If a child is too sensitive, at the induction time, any coughing can cause laryngospasm and complicate desaturation. This can be avoided by increasing the depth of anaesthesia with sevoflurane. If desaturation or apnoea occurs during the maintenance period, this may be treated by gentle CPAP. We inserted either ETT or nasopharyngeal catheter placed above the glottis. Other innovative methods used were, a central venous catheter inserted below the glottis and S.Q. Li *et al.* used muscle relaxant to insert ETT and when part of the procedure was performed, the ETT was pulled to the laryngopharynx to facilitate remaining surgery with few complications [9, 12]. Limitations of the study are that this is a non-randomised study and there exists the possibility of biases. We did not have the facility of high flow O<sub>2</sub> devices, as facilities are limited in third world countries. Therefore, this technique is still useful. We did not use any specific surgeon satisfaction scale, which could be one of the limitations. If this was used in the form of Likert score then that could have been a better tool of assessment. The main emphasis of the study is the effective use of lidocaine by sparing the use of opioid and its side effects. The possible opioid side effects may be sedation, nausea/vomiting, respiratory depression and, delayed discharge from post anaesthesia care unit.

## CONCLUSION

This study on tubeless anaesthesia with Local Anaesthetic (LA) spray with spontaneous inhalation insufflation technique provided an opioid-free, interference-free operative field without airway compromise, not requiring intubation, therefore, further studies are required.

## ETHICS APPROVAL AND CONSENT TO PARTICIPATE

The study was done after obtaining institutional permission at the Department of Anaesthesia Al Nahdha hospital, Ministry of Health, Muscat Oman.

## HUMAN AND ANIMAL RIGHTS

No animals were used in this research. All human research procedures followed were in accordance with the ethical standards of the committee responsible for human experimentation (institutional and national), and with the Helsinki Declaration of 1975, as revised in 2013.

## CONSENT FOR PUBLICATION

All paediatric patients were included after institutional permission and parental consent.

## FUNDING

None.

## CONFLICT OF INTEREST

The author declares no conflict of interest, financial or otherwise.

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