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# IMPROVING AIRWAY PATENCY DURING OPERATIONS IN THE MAXILLOFACIAL REGION IN CHILDREN

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**Abstract**

**Relevance of the Study:** One of the fundamental aspects of modern anesthesiology is ensuring reliable airway patency. According to several authors, 30 to 40% of cases of anesthetic complications and fatal outcomes are attributed to airway patency issues. During maxillofacial surgeries, nasotracheal intubation becomes more preferable for ensuring airway patency [El-Seify Z. A. et al., 2010]. However, performing nasotracheal intubation carries a high risk of nasal mucosa trauma, leading to bleeding, laryngospasm, and blood aspiration. Airway obstruction can result in hypoxemia, brain damage, and fatal outcomes [Sokolova O.G., 2007; Stosh V.I., 2007; Xue, F. S., 2009].

In this study, we present the results of applying a new method of nasotracheal intubation during maxillofacial surgeries in children. We conducted research on the effectiveness and safety of the method, as well as gas exchange and hemodynamic indicators in 22 patients undergoing maxillofacial surgeries. The research results demonstrated that two-stage nasotracheal intubation is effective and safe, associated with minimal complications, ensures adequate gas exchange during anesthesia, and does not induce pronounced hemodynamic reactions during tracheal intubation.

**Keywords:** children, airways, nasotracheal intubation; maxillofacial surgery.

## Introduction

One of the fundamental aspects in the practice of anesthesiology and resuscitation is the requirement to assess the condition of the upper airways, predict potential disruptions, and address them [1, 2]. Surgical interventions on the head, facial skeleton, neck (in maxillofacial surgery, otolaryngological procedures), where blood and secretions may enter the trachea, as well as extensive and prolonged dental procedures, are indications for tracheal intubation. Ensuring airway patency during operations in children in maxillofacial surgery is often a complex problem [3,4].

In some maxillofacial surgeries, ensuring upper airway patency through nasotracheal intubation is preferable from the perspective of adequate visualization

and patient safety [16]. There are known methods of nasotracheal intubation: under local anesthesia in consciousness, under intravenous or inhalation anesthesia using direct laryngoscopy and Magill's forceps, as well as using a fiberoptic bronchoscope [1,5,7]. Commonly accepted methods of nasotracheal intubation have drawbacks. Nasotracheal intubation is technically more challenging compared to orotracheal intubation, with a success rate of 72.23%, while the success rate of orotracheal intubations ranges from 91 to 98.2% [1].

Blind nasal endotracheal tube (ETT) placement carries the risk of nasal mucosa trauma, leading to bleeding, laryngospasm, and hemoaspiration [8, 9]. There is an increased risk of hypoxemia during intubation. Fiberoptic nasotracheal intubation is a relatively safe method, but it requires expensive equipment (fiberoptic bronchoscope) in the operating room [7,9,13].

Further developments in ensuring airway patency in children during maxillofacial surgeries can enhance the safety of anesthesia. The correct choice of airway patency method, adequate gas exchange, prevention of stress reactions, and improved surgical field visibility are important factors in refining safe anesthetic practices in pediatric maxillofacial surgery [4,5].

Research Objective: To develop a safe and effective method of nasotracheal intubation during maxillofacial surgeries, aiming to minimize the risk of gas exchange disturbances and traumatic injuries during tracheal intubation.

## Materials and Methods

The study included children aged 3 to 14 years with ASA physical status classification I-III, undergoing maxillofacial surgeries requiring nasotracheal intubation for upper airway patency. Patients were divided into two groups: Group 1 included patients whose upper airway patency was ensured by two-stage nasotracheal intubation using a guide. Group 2 included patients whose airway patency was ensured by one-stage nasotracheal intubation using a guide, without prior orotracheal intubation.

In Group 1, 22 patients were included, with an average age of 8.2 ±4.0 years. Procedures performed included uranoplasty in 17 children, cystectomy in 2, and mandibular osteosynthesis in 3. The duration of surgeries ranged from 75 to 90 minutes. ASA physical status classification assessed the anesthetic risk: 12 patients had ASA I, 6 patients had ASA II, and 4 patients had ASA III.

Group 2 comprised 19 patients with an average age of 7.1 ±3.7 years. Procedures performed included uranoplasty in 14 children, cystectomy in 2, hemangioma removal in 2, and correction of upper lip deformity in one child. The duration of surgeries was 60.9 ±27.8 minutes. ASA physical status classification assessed the

anesthetic risk: 9 patients had ASA I, 8 patients had ASA II, and 2 patients had ASA III.

Both groups underwent combined endotracheal anesthesia. In Group 1, premedication included intramuscular administration of atropine (10.5 ±2.0 μg/kg), diphenhydramine (0.21 ±0.04 mg/kg), and diazepam (0.2 ±0.1 mg/kg) 30 minutes before the procedure. Intravenous induction included propofol (3.3 ±0.5 mg/kg) and fentanyl (3.8 ±1.2 μg/kg), with a fentanyl saturation dose of (6.3 ±1.3 μg/kg). In Group 2, premedication was similar but administered 20 minutes before the procedure.

Parameters such as the effectiveness of the technique, complication rates, gas exchange, and systemic hemodynamics were studied. Hemodynamic and gas exchange parameters were measured using the "VITAS 300" monitor. Statistical analysis was performed using parametric methods, and results were considered significant at $p < 0.005$ in all cases.

**Research Results**

The developed two-stage method of nasotracheal intubation using a nasal endotracheal tube (ETT) through the nasal passage with a guide is more effective compared to the one-stage method of nasotracheal intubation. In Group 1, during intubation, there were no cases of hypoxia observed (100% success rate), with only one case (5%) requiring a second attempt. In Group 2, the success rate of intubation was 100%, but in 5 patients (26.4%), intubation was successful only on the second attempt. In both groups, the use of a guide to facilitate the passage of the ETT through the nasal passage resulted in minimal trauma during the intubation process. The safety was ensured by the two-stage nature of the intubation.

During direct laryngoscopy and orotracheal intubation, visualization of the larynx, tracheal entrance, and assessment of individual features of the upper airway structure were achieved. This aided in selecting the optimal ETT size for nasotracheal intubation and facilitated the procedure. Mechanical ventilation through the orotracheal ETT allowed adequate gas exchange during nasotracheal intubation itself. In Group 1, hypoxia was not observed. The developed method of ensuring airway patency was associated with minimal complications.

The dynamics of gas exchange parameters in Group 1 patients were different. High oxygenation was noted at all stages, including during tracheal intubation. $SpO_2$ and $SpCO_2$ levels were significantly ($p < 0.05$) higher during tracheal intubation and at the beginning of the operation. Subsequently, adequate gas exchange was maintained throughout anesthesia, with $SpO_2$ and $SpCO_2$ remaining within normal

ranges in both groups. Our results align with literature findings that tracheal intubation is a potentially hazardous procedure that can be associated with hypoxemia .Two-Stage Nasotracheal Intubation and Hemodynamic Responses:

The two-stage nasotracheal intubation using a guide provided good oxygenation and adequate carbon dioxide elimination. To study the sympathetic-adrenal system's response to tracheal intubation, we examined hemodynamics , as well as cortisol and glucose levels. Hemodynamics were studied at the following stages: 1 - baseline anesthesia, 2 - induction of anesthesia, 3 - tracheal intubation, 4 - start of the operation, 5 - traumatic stage of the operation, 6 - extubation, 7 - patient transfer to the recovery area. Hemodynamic studies revealed that during intubation in the control group, diastolic blood pressure significantly increased compared to baseline values and was also significantly higher than the diastolic blood pressure in the main group. When patients were transferred to the recovery area, heart rate and blood pressure returned to preoperative levels. Our results align with literature findings that tracheal intubation and extubation are often accompanied by tachycardia and arterial hypertension [1, 5, 8].

No statistically significant differences in hemodynamics between the two groups were observed. This suggests that performing two-stage nasotracheal intubation does not induce additional stimulation of the sympathetic-adrenal system. The two-stage approach in nasotracheal intubation does not cause arterial hypertension and tachycardia during the airway patency procedure, compared to one-stage intubation.

## Conclusions

1. Ensuring airway patency through nasotracheal intubation during maxillofacial surgeries in children provides adequate gas exchange in the lungs.
2. Nasotracheal intubation using a guide is a non-traumatic procedure and results in a minimal number of complications.
3. The two-stage method of nasotracheal intubation with a guide is more effective and safe, with fewer complications compared to the one-stage nasotracheal intubation using a guide.
4. Two-stage nasotracheal intubation with a guide does not induce arterial hypertension and tachycardia compared to one-stage intubation during the procedure to ensure airway patency.

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