

Innovative Techniques for Pediatric Airway Management: Intubation in Children with Maxillary Alveolar Cleft: A Case Report

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ARTICLE INFO

Article history:

Received 22 December 2024

Revised 12 January 2025

Accepted 26 January 2025

Keywords:

Cleft palate;
Armored endotracheal tube;
Autoclave;
Maxillary alveolar closure surgery

ABSTRACT

The patient was an 11-year-old girl, weighing 25 kg and measuring 125 cm in height, with a history of congenital cleft palate and previous surgeries (including cleft palate repair and cardiac procedures). She was referred for maxillary alveolar closure surgery. She experienced difficulty swallowing and dyspnea when consuming solids and liquids. During the preoperative evaluation, no significant comorbidities were identified, but anatomical changes in the nasopharynx suggested a defect in the previous repair. To ensure safe airway management and avoid nasopharyngeal injury during surgery, a modified intubation technique was employed. We used a flexible armored endotracheal tube that had been autoclaved at 45°C for 2 min. Anesthesia induction included propofol, fentanyl, and cis-atracurium. Intubation was successfully performed without complications. Postoperatively, the patient recovered well, showing no signs of trauma or airway distress. She was discharged on the first postoperative day with appropriate care recommendations.

Introduction

Cleft lip and cleft palate are congenital malformations that occur when the frontonasal and palatine processes of the maxilla fail to fuse properly. This condition leads to structural abnormalities in the airway and the nasopharynx, which can result in airway obstruction [1]. Consequently, managing anesthesia in these patients can be challenging and requires careful planning to ensure safety and achieve optimal outcomes [2]. Additionally, repeated surgical

interventions can complicate airway management due to scarring and changes in tissue flexibility [1].

The purpose of this article is to report on airway management for an 11-year-old child with a maxillary alveolar cleft, utilizing innovative techniques to prepare an armored endotracheal tube aimed at minimizing nasopharyngeal injury during intubation.

Case Report

The patient is an 11-year-old girl, weighing 25 kg and measuring 125 cm in height, with a history of congenital

The authors declare no conflicts of interest.

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DOI: [10.18502/aacc.v11i5.19941](https://doi.org/10.18502/aacc.v11i5.19941)

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cleft palate. She was referred for surgery to close the maxillary alveolar ridge. The patient has reported experiencing shortness of breath when swallowing both liquids and solids. Her medical history includes four surgeries: two for cleft palate repair at ages 2.5 and 4 years (pictures before the first cleft palate surgery and the last picture are shown in (Figure 1)), and two cardiac surgeries for patent ductus arteriosus and tricuspid valve repair at ages 1.5 and 10 years.



Figure 1- The treatment process, from initial photo to final result.

During the preoperative evaluation, no significant comorbidities were identified. However, anatomical changes in the nasopharynx indicated a defect related to the cleft palate repair. To address potential challenges with airway management and minimize the risk of injury to the nasopharynx, a modified intubation technique was developed. A size 3 Macintosh curved laryngoscope and a size 5-armored endotracheal tube were chosen based on their flexibility and appropriate size for intubation. The endotracheal tube was autoclaved at 45°C for 2 minutes to enhance its flexibility and reduce the risk of mucosal injury during nasal insertion.

After the preoxygenation phase, anesthesia was induced using propofol (2 mg/kg) and fentanyl (1 µg/kg) and muscle relaxation was induced with cis-atracurium (0.15 mg/kg). The modified endotracheal tube was gently inserted through the right nostril and advanced into the trachea using Magill forceps. Intubation was successful on the first attempt, with no bleeding or mucosal injury. Intraoperative ventilation was uneventful, and the surgery lasted approximately 90 min.

After the operation was completed and the tube was removed, there were no signs of injury, airway obstruction, bleeding, or discomfort. The patient was discharged on the first postoperative day with appropriate recommendations.

Discussion

Airway management in patients with congenital cleft palate requires careful attention to ensure effective ventilation while minimizing airway trauma. Previous surgeries may alter and complicate airway anatomy, increasing the risk of injury during endotracheal intubation [3]. The primary question in airway

management for patients with cleft palate is: which type of laryngoscopy, optimal endotracheal tube size, and best technique are most suitable for their care?

Airway management in these patients is a topic of debate and can be accomplished using various devices, including single-lumen endotracheal tubes, armored tubes, video laryngoscopes, fiberoptic bronchoscopes, and supraglottic airways. The selection of the appropriate device should be based on discussions among the multidisciplinary team and tailored to each patient's specific condition and the potential for airway obstruction [4]. In a study conducted by Abdollahi et al., it was concluded that children with cleft palates are more susceptible to subglottic stenosis. We recommend using a smaller-sized endotracheal tube (with a smaller internal diameter) for these children due to their age and anatomical considerations. Our case also incorporated this recommendation [5].

Ray et al. compared video laryngoscopy and direct laryngoscopy for intubating children with cleft palates and found no significant difference in success rates between the two techniques, although video laryngoscopy required more time to perform [1]. In our case, considering the patient's history of cardiac surgery and the need to minimize the risk of hypoxia, we chose direct laryngoscopy as the preferred method. In their study, Pat et al. suggested that for intubation in patients with a maxillary alveolar cleft, it is preferable to perform it nasally through the nostril opposite the cleft soft palate [6]. In our study, we performed the intubation through the right nasal passage.

The key finding of our report was the observation that individualized anesthetic strategies, tailored to the patient's specific anatomical and clinical contexts, can significantly reduce complications and improve outcomes. Notably, we implemented an innovative technique not previously described in the literature: autoclaving the endotracheal tube at 45°C for 2 minutes. This adaptation enhanced tube flexibility, thereby minimizing the risk of mechanical damage during passage through the narrow nasopharynx. Our results underscore the effectiveness of this customized approach. Nevertheless, further research is required to assess the reproducibility and safety of this technique across a broader patient population.

Conclusion

Managing the airway in patients with congenital cleft palate poses unique challenges due to altered anatomy, prior surgical interventions, and the risk of airway obstruction. This report emphasizes the necessity of developing individualized anesthetic strategies that cater to the specific clinical and anatomical features of each patient. Notably, an innovative technique that involves autoclaving the endotracheal tube at 45°C for 2 minutes has been shown to increase tube flexibility, reduce the risk of nasopharyngeal injury, and enhance the success rate of uncomplicated intubation. But more research

needs to be done to make sure that this technique can be used again and again and is safe in a larger group of patients. If it is, it might be possible to add it to standard airway management protocols for similar cases.

Data Availability

Radiographs, tests, and procedure descriptions of this study are available upon reasonable request from the corresponding author.

Acknowledgements

The authors would like to express their gratitude to the patient and her family for granting permission to publish the clinical data.

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