Letter to the Editor

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An unusual case of ventilation disruption due to an asymmetrical balloon shape of the nasotracheal tube

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Dear Editor,

General anesthesia is commonly used for pediatric patients with severe dental phobia to ensure dental treatment safety. To ensure safe airway management, the preparatory process for general anesthesia requires a thorough understanding of the anatomical and physiological characteristics specific to children [1]. Preoperative inspection of anesthesia machines and intubation equipment is essential for patient safety. This letter aimed to examine a case of ventilation disruption caused by an abnormal ballooning of the endotracheal tube.

A 7-year-old boy (height, 124 cm; weight, 25 kg) was admitted for surgical extraction of a mesiodens located in the tooth #21 (left maxillary central incisor) area. The patient had no significant medical or surgical history, and preoperative evaluations were normal, including the absence of cardiac or pulmonary symptoms. The patient's functional capacity exceeded 4 METs. Upon entering the operating room, stable vital signs were confirmed and no abnormalities were noted. Induction and maintenance of anesthesia were initiated using sevoflurane with volatile induction and maintenance techniques. After the patient lost consciousness, adequate mask ventilation was confirmed. Subsequently, an intravenous line was cannulated, and 15 mg rocuronium was administered. Muscle relaxation was verified when the train-of-four count reached zero. A 5.0-sized nasotracheal tube was then inserted through the left nostril, and its placement past the vocal cords was confirmed using video laryngoscopy. The cuff pressure was manually checked and auscultation confirmed clear bilateral lung sounds. The anesthesia machine (Primus®, Dräger) was set to volume-controlled mode with a tidal volume of 250 ml and a respiratory rate of 15 breaths per minute. However, persistent leak alarms from the anesthesia machine indicated that the target tidal volume was not achieved despite additional air being injected into the cuff. The end-tidal CO_2 was detected normally during manual ventilation, but was not detected during volume-controlled mode ventilation. Consequently, the tube was extubated and replaced with a new 5.5-sized nasotracheal tube. Afterward, proper tidal volume delivery was confirmed, and the surgery proceeded uneventfully. Postoperatively,

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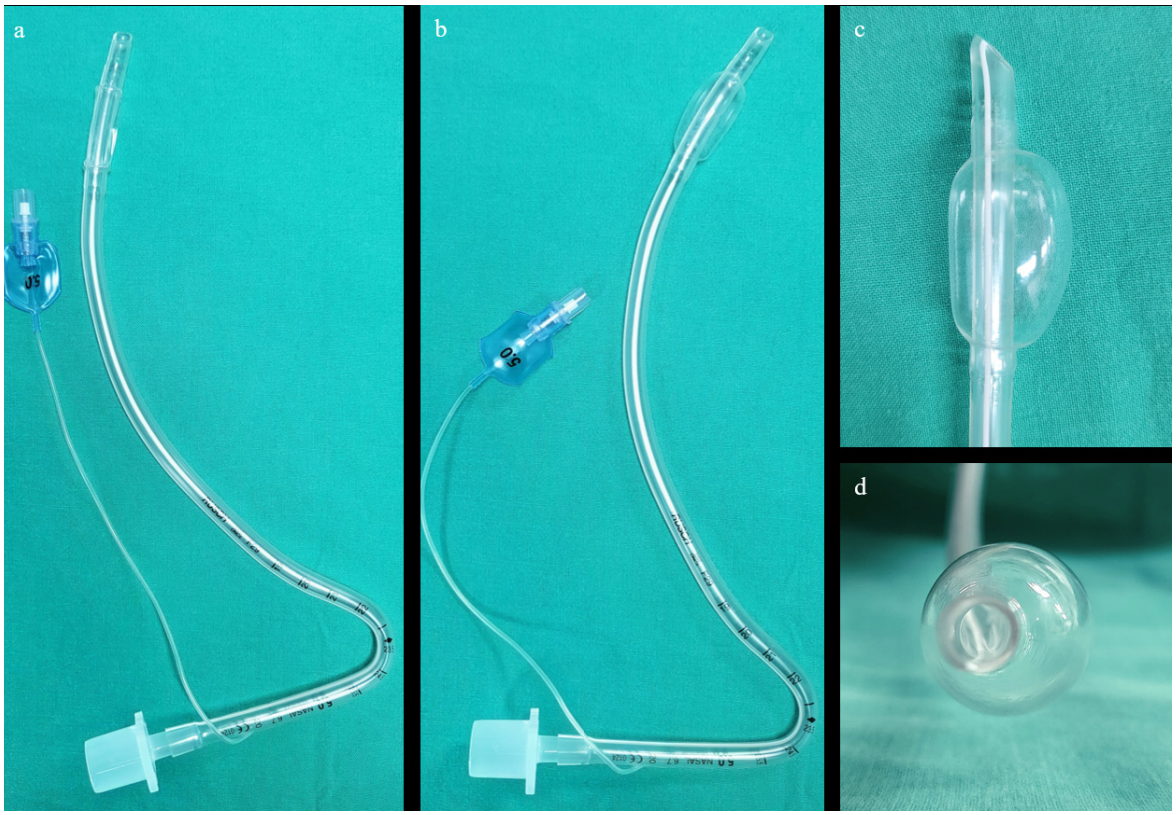

Fig. 1. The nasotracheal tube's cuff, with and without ballooning, which caused ventilation disruption. a. The entire appearance of the tube with the cuff deflated. b. The entire appearance of the tube with the cuff inflated after injecting 8 cc of air. c. An enlarged side view of the tube with the cuff inflated after injecting 8 cc of air, showing that the balloon is asymmetric. d. An enlarged view of the tip of the tube with the cuff inflated after injecting 8 cc of air, showing that the balloon is asymmetric.

the patient was extubated without any difficulties. The patient recovered in the post-anesthetic care unit. The patient was discharged in an alert state without any abnormalities.

For the 7-year-old boy, the nasotracheal tube size was determined using the Duracher formula (age/4 + 3.5) [2]. The appropriate size was determined as 5.0. When performing nasotracheal intubation, a smaller size nasotracheal tube is used to prevent epistaxis. Prior to the procedure, a ballooning test showed no leaks, and the ventilator self-test did not reveal any anomalies. Despite these initial checks, a persistent air leak occurred intraoperatively, prompting further investigation into the integrity of the tube cuff. Upon reexamining the problematic nasotracheal tube by inflating the cuff, it was observed that the cuff balloon was asymmetrically positioned around the tube and biased towards one side. This irregularity in the shape of the balloon likely contributed to the ineffective seal and consequent ventilation issues observed during the procedure. Figure 1 illustrates the asymmetrical ballooning of the cuff, highlighting the defect that necessitated tube replacement to achieve adequate ventilation and safely proceed with surgery.

Previously, the literature has discussed various issues encountered during intubation, such as cuff tearing, cuff deflation leading to leaks during surgery, or challenges with ventilation due to inadequate tube length [3,4]. Maintaining adequate cuff pressure at 20 mm Hg to 30 mmHg during surgery is crucial for effective nasotracheal tube function. This ensures unimpeded ventilation, while minimizing the side effects [5]. However, there have been no documented cases in which an abnormal cuff balloon shape has impaired proper ventilation.

When ventilation difficulties occur post-intubation, the choice of the tube size should be considered and checked

to ensure that it is appropriate for the patient. Whether intubation is performed correctly should also be verified [6]. Additionally, while preparing for surgery, it is essential to conduct a cuff ballooning test to check for leaks and carefully observe the shape of the balloon. Ensuring that the balloon symmetrically encircles the tube without causing visual abnormalities is a critical step that should be included in the preoperative checklist. This detailed examination can help prevent ventilation issues related to cuff anomalies, thereby enhancing patient safety during general anesthesia.

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REFERENCES

1. Kim J, Jeon S. Nasotracheal intubation in pediatrics: A narrative review. J Dent Anesth Pain Med 2024; 24: 81-90.
2. Duracher C, Schmautz E, Martinon C, Faivre J, Carli P, Orliaguet G. Evaluation of cuffed tracheal tube size predicted using the khine formula in children. Paediatr Anaesth 2008; 18: 113-8.
3. Seo SH, Lee JM, Lee JJ, Ahn EJ, Choi GJ, Kang H. Repeated endotracheal tube cuff tears during nasotracheal intubation due to nasal cavity orthodontic micro-implant - a case report. Anesth Pain Med (Seoul) 2021; 16: 398-402.
4. Ryoo SH, Karm MH, Park SU, Kim HJ, Seo KS. Air leakage due to the cuff hanging on the vocal cords during nasotracheal intubation: a case report. J Dent Anesth Pain Med 2023; 23: 39-43.
5. Moon KM, Donaworth S, Hagele MS, Kim SS, Willer BL, Tobias JD. Endotracheal tube cuff pressures in the operating room of a pediatric hospital: a quality improvement initiative. Pediatr Qual Saf 2022; 7: e619.
6. Ryoo SH, Park KN, Karm MH. The utilization of video laryngoscopy in nasotracheal intubation for oral and maxillofacial surgical procedures: a narrative review. J Dent Anesth Pain Med 2024; 24: 1-17.