

## Aspiration of a Dislodged Endotracheal Tube: A Rare Cause of Acute Total Airway Obstruction

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We report an unusual cause of acute total airway obstruction after aspiration of a dislodged tube that was separated from its metallic connector. A 5-year-old boy had an emergence agitation and bucking to the endotracheal tube with a vigorous bite before extubation of the trachea. The whole uncuffed endotracheal tube was aspirated deep into the lower trachea causing laryngotracheal obstruction. The patient showed sudden oxygen desaturation and was then in an immediate life-threatening airway obstruction. We could not rescue oxygenation and were unable to establish a patent airway. Mask ventilation failed to relieve the progressive hypoxemia. Immediate extraction of the tube using a pair of Magill's forceps before irreversible exacerbation was performed. We discuss our experience and the importance of prompt decision making and management for the extraction of the dislodged tube. (*Chang Gung Med J* 2003;26:515-9)

**Key words:** vigorous bite, tube dislodgment, total airway obstruction.

Various types of foreign bodies in the airways of young children have been reported that resulted in injury and death.<sup>(1-3)</sup> Endotracheal tube kinking, occlusion, apparatus separation, structure fault<sup>(4,5)</sup> or mechanical factors may cause intra-operative airway obstruction. Biting down on an endotracheal tube (ETT) for general anesthesia is common during emergence from general anesthesia.<sup>(6)</sup> We report a case of acute total airway obstruction caused by a dislodged uncuffed ETT. This kind of mechanical obstruction presented a great challenge of airway management during that unexpected critical moment.

### CASE REPORT

A 5-year-old healthy boy was scheduled for Furlow's palatoplasty and revision of lip. He had bilateral incomplete cleft lip/palate and received cheiloplasty and palatoplasty at 3-month-old and 1

year old, respectively. The previous anesthetic courses were rather smooth. On preanaesthesia evaluation, he had only mild upper respiratory tract infection with slight rhinorrhea and sneezing. No cough or fever was noted. He looked thin and slightly underweight. His body weight was only 17.5 kg.

In the operating room, examination revealed a heart rate of 111, and blood pressure of 110/69 mmHg. The patient was unpremedicated. After attachment of routine standard monitors (electrocardiogram, automated blood pressure device and pulse oximeter), he was anesthetized under the mask induction with halothane-N<sub>2</sub>O-O<sub>2</sub>. After set up of intravenous line, 0.2 mg atropine was given which was followed by 7 mg atracurium for tracheal intubation. A size of 6.0 mm uncuffed modified Baxter tracheal tube was used. The tube was positioned and affixed at 14 cm at the lips without air leakage. General anaesthesia was maintained with a mixture

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of N<sub>2</sub>O in oxygen and isoflurane.

The anesthetic course was uneventful. He was fully awakening from general anesthesia with adequate spontaneous breathing and eyes opening. We were ready for extubation of the trachea after routine suctioning of the endotracheal tube and the oropharynx. Suddenly, he developed emergence agitation and vigorously bit down on the tube. The whole uncuffed tube disappeared from sight, and only the metallic connector was still fixed with tape to the patient's mouth angle. We had difficulties handling the patient's obstructed airway in this situation. The boy was suffering from progressive obstructive apnea and life-threatening oxygen desaturation (pulse oximetry displayed signal value below 85%) with severe stridor, air hunger and cyanosis. The patient was then unconscious and his mouth could not be opened. After the boy had been paralyzed with a dose of 20 mg succinylcholine, the vocal cords and the rim of the proximal tip of tube could be visualized. The dislodged tube was then extracted successfully using with a pair of Magill's forceps. The tube had many bite imprints over the proximal round tip. The opening of the steel metallic connector was deformed and flattened (Fig. 1). He was intubated with a size of 6.0 mm uncuffed tube again. An oral airway opener was inserted and he was ventilated with pure oxygen without any difficulties. The duration of the tube aspiration to the reintubation lasted less than 3 minutes. Five minutes after the occurrence, he regained consciousness and was fully

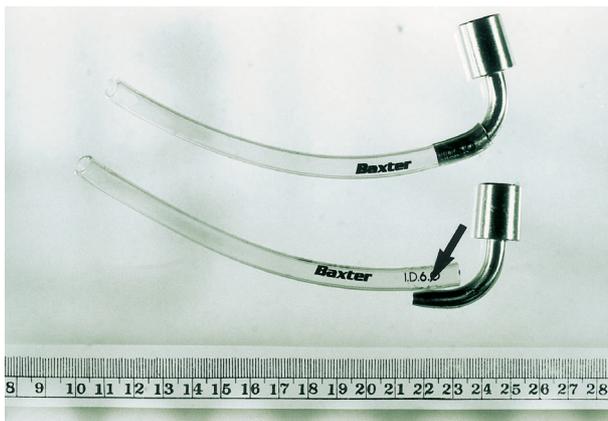
awake. He could obey our spoken commands and was kept in close observation for 20 minutes more in the operating room. The breathing sounds in both lung fields were clear, moist rales were not heard. The pulse oximetry revealed high readings with the peripheral oxygen saturation (SpO<sub>2</sub>) of 99-100%. After extubation, there was no stridor or wheezing. The respiratory pattern and effort were normal. The boy was not complicated with hypoxic pulmonary edema.

The patient was transferred to the recovery room for vigilant observation and for use of humidified oxygen. He was then transported to the ward for further care. The day after the incident, a chest radiograph was obtained showing no significant abnormalities. He experienced no sequelae. He was discharged on the third postoperative day with a favorable outcome.

## DISCUSSION

To the best of our knowledge, this is the first reported case of aspiration of a dislodged endotracheal tube (ETT) causing total airway obstruction. There was panic as our patient aspirated the whole uncuffed ETT after a vigorous bite before extubation of the trachea. The patient had complete loss of airway. It was an immediate life-threatening airway complication following total trachea obstruction with impending asphyxiation. The uncuffed ETT itself acted as a large airway foreign body in the tracheobronchial tree.<sup>(3)</sup> The proximal opening of the tube might have been covered by the downward displacement of the enlarged epiglottis. The distal beveled tip of the ETT might have impacted the tracheal bifurcation (carina). These caused mechanical total tracheal obstruction and might have develop respiratory failure with hypoxemia or anoxic encephalopathy. Airway foreign body must be removed quickly, or fatal complications will be associated.

Mitchell et al. described the deglutition of an ETT to the esophagus into the antrum of the stomach in a newborn.<sup>(7)</sup> The patient had no respiratory distress. Using a rigid esophagoscope, the swallowed tube was visualized and removed. However, our case required aspiration of a dislodged ETT in the trachea. It means that the tube lodged in the larynx and the entire portion of the trachea. We believe that this unusually dangerous incident has not been reported in the literature. It might have been



**Fig. 1** Top: The modified ETT with a steel metallic connector. Bottom: The damaged tube with bite imprints (arrow), deformed and flattened opening of the metallic connector.

entrapped and resulted in a disastrous outcome if removal of tube had been delayed. Our terrifying experience might offer some useful guidance.

We have used modified disposable ETT with metallic connectors (available in varying sizes appropriate for the patient's needs) in children who need cheiloplasty or palatoplasty for more than 25 years in our hospital. Using this simple modified tube, the surgeon has a more space in pediatric oral and maxillofacial surgery. We often renew the steel metallic connector and double check each tube for tightness and fitness between the proximal round tip junction and the metallic connector. Tube separation after a bite during emergence from general anesthesia has never occurred in our previous clinical experience. At the initial moment, we thought that the metallic connector between the proximal tip was insufficiently tight. However, there was obvious deformity of the metallic connector causing the ETT dislodgment. In fact, the damaged metallic connector was really caused by the patient's newly grown permanent teeth. As the patient aspirated the uncuffed ETT, he became cyanotic. It was difficult to open his mouth due to his trismus, and airway management posed a great challenge to us during this critical situation. He was in a position that was difficult to mask ventilation although we used the jaw-lift method.<sup>(8)</sup> Placement of a nasopharyngeal airway may open an airway. Emergency use of the laryngeal mask airway may solve some causes of upper airway obstruction.<sup>(9)</sup> Both of them had little benefit in this case. A dose of succinylcholine before the occurrence of sinus bradycardia was the drug of choice because of the rapid action for laryngoscopy.

During laryngoscopy, we did not find any tube shadow in the hypo-oropharynx or posterior retropharyngeal region. There was blood oozing in these areas. We tried mask ventilation again but still were unable to ventilate the patient. We were ready to perform an emergency tracheotomy for this patient. However with a careful inspection of the larynx, the protrusion of the proximal round tip of the ETT could be visualized just underneath the epiglottis at the second attempt of direct laryngoscopy. The dislodged tube was then extracted using a pair of Magill's forceps. Emergency tracheotomy may be necessary for some kinds of upper airway obstruction. Surgical tracheotomy was less helpful in this patient to resolve his total laryngotra-

cheal obstruction. We believed that the distal beveled end of the ETT impacted in the ridge of the tracheal carina and did not slide down into the right or left main bronchus because of their small size. The distance from epiglottis to the carina may approximately equal the whole length of the dislodged tube in this boy. According to this hypothesis of explanation, we were able to see the proximal round tip at the laryngeal level. If the tube had migrated into any side of the main bronchi, a rigid bronchoscope would have been the preferential equipment. However in this condition, patency of the ETT lumen often occurs, or only causing single-lung ventilation. We had no time to take a portable chest x-ray to prove the obstruction during the critical episode. The ideal solution to dislodge a tube is immediate removal of it as quickly as possible.

The patient did not develop subsequent laryngeal and subglottic edema, tracheobronchial injury, atelectasis, or pulmonary edema after the relief of total airway obstruction.<sup>(10,11)</sup> Hypoxia could have been the cause of pulmonary edema with airway obstruction. Post-obstruction pulmonary edema did not develop in our patient because the tube was removed in less than 3 minutes. Before extubation, the boy was allowed to breathe with 100% oxygen to wash out any residual nitrous oxide. Therefore, within the first several critical minutes, we had time to relieve the airway obstruction in the patient who still had adequate arterial oxygen tension.

We must avoid strong endotracheal toilet, oronasopharynx and gastric suctioning. In children, any stimulation and emergence agitation may cause tightening of the jaw, occlusion of the teeth on the ETT, laryngospasm and compromise of the airway. Serious oozing over the oral surgical site often made airway management more problematic in our patient.

A plan is needed to prevent the ETT separation. Patient's teeth may be considered as a potential hazard of complication during general anaesthesia. Most pediatric anesthesiologists are familiar with children biting down on tubes during emergence. To avoid compression of the tube or other objects in the mouth, we must insert an appropriate size of plastic oral airway, a suitable bite-block or even a hand-made rolled soft pad at the end of these kinds of oral surgery. In an awakening older child, it should be left in place until the removal of the ETT to prevent airway obstruction due to the patient's bite. For oral

and maxillofacial surgery, a waterproof surgical tape (3M Durapore) with firm fixation and adhesive strength directly on connector is also important. Moreover, we must ascertain the tightness of the attachment junction between the tube and the steel metallic connector before use. The possibility that this could happen due to a disconnection between the endotracheal tube and an inserted connector still exists. The use of a cuffed or preformed tracheal tube (Mallinckrodt) can prevent the occurrence of whole tube aspiration. Furthermore, we must ensure that all the necessary equipment for airway management is readily available. The Magill's forceps played an essential role for removal of the dislodged tube in this episode.

We concluded that the importance of early and promptly retrieval of the aspirated airway foreign body resulted in minimizing serious and fatal complications. Immediate proper airway management and preventive methods are also important.

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## 吸入脫落內管導致急性完全呼吸道阻塞

黃樹欽 曾紀浩 黃潔文 陳國鼎<sup>1</sup> 陳捷

我們報告一病例，因為氣管內管自金屬連接處脫落而吸入呼吸道，導致急性完全呼吸道阻塞。一位五歲男孩在開刀後清醒準備拔管時，用力咬管，致使氣管內管（無氣囊）整條吸入氣管深處，而造成聲門—氣管阻塞。小病人發生缺氧與立即的脅迫性生命危機。我們不能有效的建立暢通的呼吸道，給予純氧的面罩換氣並不能解決缺氧問題，我們討論如何處置及快速移除此脫落內管，以免造成不可逆的不幸後果。(長庚醫誌 2003;26:515-9)

**關鍵字：**用力咬管，脫落氣管內管，完全呼吸道阻塞。

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