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Case report

Fractured metallic tracheostomy tube: A rare complication of tracheostomy

Apichart So-ngern [a, b], Viboon Boonsarngsuk [a, *]

[a] Division of Pulmonary and Critical Care Medicine, Department of Medicine, Ramathibodi Hospital, Mahidol University, Thailand
[b] Division of Sleep Medicine, Department of Internal Medicine, Faculty of Medicine, Srinagarind Hospital, Khonkaen University, Thailand

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ABSTRACT

Although tracheostomy is a well-accepted procedure for airway management, some early and late complications may occur. Fracture of the tracheostomy tube (TT) is a rare complication, particularly in a patient with long-term use. Herein we report a case of fractured metallic TT migrating into the tracheobronchial tree. Rigid bronchoscopy was performed through the tracheostomy stoma and the fractured tube was successfully removed by a balloon catheter. Appropriate cleaning, routine careful examination, and scheduled replacement of the TT may help prevent this complication.

1. Introduction

Tracheostomy is a well-accepted procedure for airway management in patients who need prolonged intubation. Although the procedure itself is considerably safe, many early and late complications have been described. Among reported complications, fracture of the tracheostomy tube (TT) is a rare complication, particularly in a patient with long-term use, and carries the potentially fatal risk of airway obstruction. Herein we report a case of a fractured metallic TT migrating into the tracheobronchial tree. We also simulated mechanical and chemical stresses to the metallic TT and observed the long-term changes.

1.1. Case presentation

A 65-year-old Thai man had been bed-bound from hemorrhagic stroke for 18 months and required TT placement for managing secretions. Although the inner cannula tube was routinely cleaned by his relatives, the stainless steel TT had never been changed. Five days prior to his presentation, his relatives noted some difficulty in suction. The inner tube did not show any suspicious signs. One day later, he developed fever and cough with purulent sputum, without any improvement with antibiotic therapy. At a suburban hospital, a chest radiograph was performed and disclosed a metallic density foreign body in his left main bronchus (Fig. 1A). The tracheostomy tube was removed and demonstrated fracture at the neck of the outer cannula tube, while the body was missing. The patient was then referred to our hospital.

At our hospital, on examination, the patient was febrile (body temperature 38.5 °C) with mild tachypnea (respiratory rate 24/min). Chest auscultation revealed rhonchi on the left side. Rigid bronchoscopy was performed through the tracheostomy stoma under general anesthesia. The fractured outer cannula tube was found lodged in the left main bronchus (Fig. 1B). The proximal end of the tube was severely corroded; thus, removal with a foreign body grasping forceps might cause additional breakage. A 7-Fr balloon wedge-pressure catheter (Arrow®; Arrow International, Reading, PA) was inserted into the working channel of the flexible bronchoscope and advanced through the fractured tube. The balloon was then inflated with 1.25 cc of air to achieve the maximum balloon diameter of 10 mm. The catheter was gently pulled up, which hooked the tube along with it (Fig. 1 C), until reaching the tracheostomy stoma; the rigid bronchoscope tube, flexible bronchoscope, balloon catheter, and fractured tube were then withdrawn simultaneously through the stoma. Inspection of the fractured metallic TT showed severe corrosion at the neck and mild corrosion at the body of the outer cannula tube, while the

Abbreviations: TT, tracheostomy tube.

* Corresponding author. Division of Pulmonary and Critical Care Medicine, Department of Medicine, Faculty of Medicine, Ramathibodi Hospital, Mahidol University, Bangkok, 10400, Thailand.
E-mail addresses: api_chart108@hotmail.com (A. So-ngern), bss-vb@hotmail.com (V. Boonsarngsuk).

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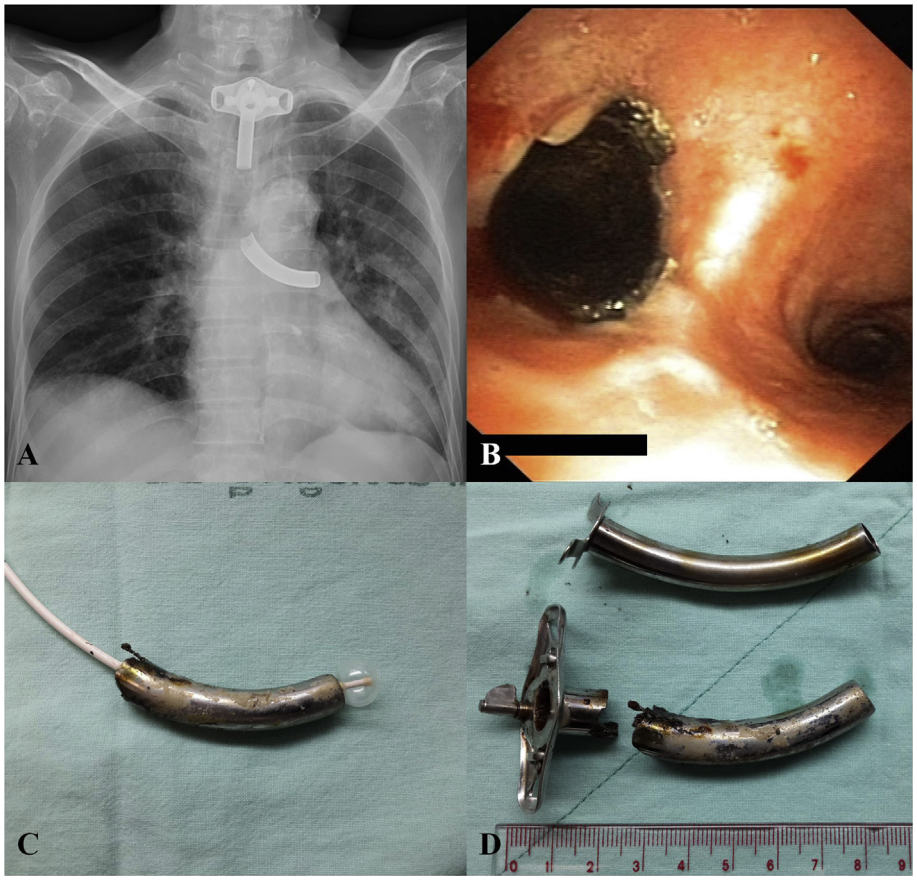

Fig. 1. (A) A chest radiograph at presentation showed a fractured metallic tracheostomy tube in the left main bronchus. (B) Bronchoscopic view of the fractured tube in the left main bronchus. (C) Balloon catheter technique to remove the fractured tube. (D) The fractured outer cannula of the metallic tracheostomy tube; severe corrosion at the fracture site is noted.

inner tube was intact (Fig. 1D). A PVC tracheostomy tube (Portex®; Smiths Medical, Dublin, OH) was inserted and secured.

The patient's postoperative period was uneventful. He was treated with intravenous ceftazidime and clindamycin and also received tetanus toxoid vaccination and tetanus antitoxin. After two days, he was transferred back to the primary care hospital.

To study the effect of mechanical and chemical stresses on the metallic TT, we simulated the situation mimicking the routine use of a TT. Two types of metallic TT are commonly used in Thailand: the first, as in this case, is made of stainless steel (Premier®; Premier Medical Products, Plymouth Meeting, PA), and the second is made of silver-plated brass (QMC®; Qureshi Manufacturing Corp., Sialkot, Pakistan) (Fig. 2A). Both of the TTs were submersed in pooled saliva from healthy volunteers and kept in the room temperature. The pooled saliva was exchanged every week. The inner tubes were removed and cleaned daily with half-strength solution of hydrogen peroxide, followed by normal saline before re-insertion. Then, the whole bodies of the TTs were tapped forcefully with a finger, to mimic mechanical injury to the tubes, before re-submersion in pooled saliva. Every two weeks, the inner tubes were also removed and placed in the hot water until the water became warm. Then, the inner tubes were clean and dry with a towel before re-insertion into the outer tubes and re-submersion in pooled saliva. Six months later, both the inner and outer tube of the silver-plated

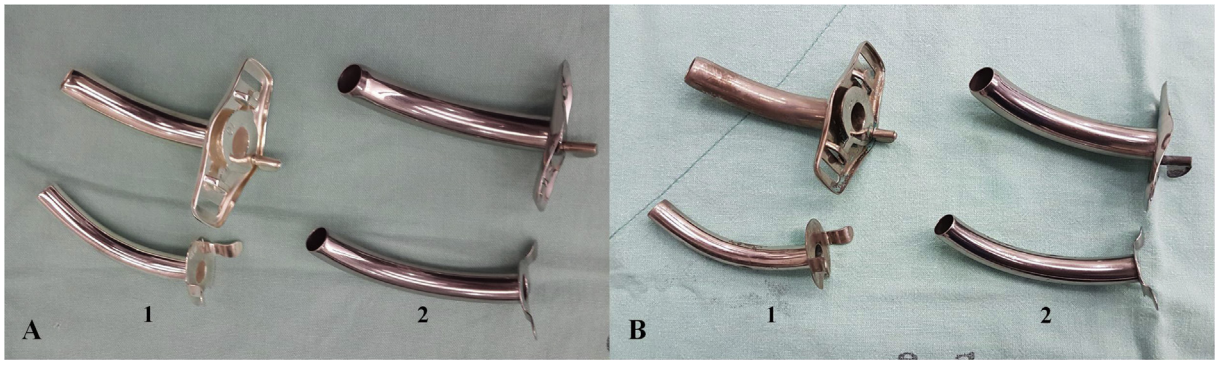

Fig. 2. Metallic tracheostomy tubes before (A) and after (B) 6 months of saliva submersion; (1) is a silver-plated brass tracheostomy tube, (2) is a stainless steel tracheostomy tube.

brass TT showed mild corrosion, while the stainless steel TT remained unchanged (Fig. 2 B).

2. Discussion

Due to the properties of the metal, it was believed the TT was unlikely to fracture when applied in the human body. In addition, it can be easily cleaned. Therefore, the metallic TT was once believed to be suitable for prolonged use. The first fractured and dislodged tracheostomy tube was reported by Bassoe and Boe in 1960 [1]. Since then, reported cases of fractured TT have been published from time to time. The early metallic TTs that were made from silver, steel, copper or zinc proved to be corrodible by alkaline tracheal secretions and repeated boiling [2]. Therefore, stainless steel, which is a chemical corrosion-resistant material, is used to make metallic TTs instead nowadays. In our experiment, we found that the stainless steel TT remained unchanged under alkaline secretion exposure and standard routine cleaning for 6 months while the silver-plated brass TT was mildly corroded. However, fracture of a stainless steel TT has occasionally been reported [3,4]. The possible causes of fracture that have been proposed include manufacturing defects, design flaws, continued high internal stresses on the surface, corrosion by alkaline bronchial secretions, exposure to the atmosphere, disinfectant fluids (sodium hypochlorite solution), repeated cleaning/boiling or sterilization, repeated removal and reinsertion, and aging of the tube [2].

After placement, TT fracture may occur after time periods varying from 5 days to 22 years [5]. As in our case, the most common site of a fractured metallic TT is the neck of the tube which is the weak point that is prone to be injured by repeated mechanical stress [4]. After fracture, the right main bronchus is a more common lodging site than the left main bronchus due to the anatomy of the bronchus. Presenting symptoms include, cough, hemoptysis, wheezing, recurrent pneumonia, respiratory distress, difficulty in suction or re-insertion of the inner tube, or notice of any change of the tube. The durations of symptoms before diagnosis vary, ranging from 1 day to 132 months [6]. Although rare, fractured metallic TT should be included in the differential diagnosis in patients who wear a TT and present with these respiratory symptoms to avoid delay in diagnosis. A chest radiograph can easily help in diagnosis due to the radiopacity property of the TT.

Rigid bronchoscopy is the preferred procedure for removal of large foreign bodies. A rigid bronchoscope tube has a large bore which provides adequate ventilation and allows insertion of various types of instruments for operating. Rigid bronchoscopy was used for removal of fractured metallic TTs in most previously reported cases. Thoracotomy or bronchotomy was rarely required. Insertion through the tracheostomy stoma is the preferred route in order to prevent mechanical injury by the fractured tube to the vocal cords and oral cavity during removal. In general, rigid grasping forceps is used for removal; however, in our case the proximal end of the tube was severely corroded, and might be broken during grasping. Using a balloon catheter that hooks from the distal end of the tube is a feasible technique in this troublesome situation.

Tracheostomy care is essential in order to prevent this complication. The inner tube should be cleaned daily both inside and outside. When removing for cleaning, the caregiver should routinely inspect for abnormalities of the inner tube such as wear and tear, corrosion, and hairline fracture. The TT needs to be carefully examined by the physician at follow-up visits for evidence of impending fracture [2]. Finally, scheduled replacement should be performed. Although there is no consensus regarding the frequency of TT changes, most experts recommend changing the TT every three to six months [4,7].

In conclusion, we report a rare complication of a metallic TT. Bronchoscopic removal of the fractured tube with a balloon catheter is feasible and causes less injury to the airway wall. Appropriate cleaning, routine careful examination, and scheduled replacement of the TT may help prevent this complication.

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Conflict of interests

None.

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