



## Broken synthetic tracheostomy tubes presenting as a foreign body in airways – Rare Case Series & Review of the literature

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### ABSTRACT

Tracheo-bronchial foreign body aspiration is a life threatening condition that can be seen in all age groups. Tracheostomy is a common lifesaving airway procedure. This procedure is although safe, early and late complications are known to occur. Broken

tracheostomy tube and the resulting airway complications are rare in ENT practice and it requires urgent diagnosis and prompt intervention. In Literature, various cases of broken metallic tracheostomy tubes in airway had been reported in many literatures. We report two cases of broken synthetic (PVC) tracheostomy tubes which were accidentally lodged in the airway. Although it is sometimes asymptomatic, but they present with cough, dyspnea, hemoptysis and stridor. Rigid bronchoscopy was preferred over flexible bronchoscopy to remove the foreign bodies under general anaesthesia.

**Keywords:** Tracheobronchial foreign body, bronchoscopy, tracheostomy tube

**Abbreviations:** PVC (Polyvinyl chloride), FOB (Flexible bronchoscopy)

## 1. INTRODUCTION

Tracheostomy is a common airway procedure performed by otolaryngologist for life support. The tracheostomy rate on an average ranges from 150 to 300 per 100,000 patients<sup>[1]</sup>. It is a safe procedure and the mortality rate is less than 5%.<sup>[2]</sup> Some known complications may occur. The early complications are tracheostomy tube obstruction, haemorrhage, pneumothorax and wound infection. The late complications are granulation formation, airway scarring, erosion of the innominate artery and tracheoesophageal fistula. Broken PVC tracheostomy tube and its lodgement in airway through the tracheostomy stomal opening is a rare complication, but we had encountered in two cases.

Foreign body aspiration is still an important health problem with various complications and sequels.<sup>[2]</sup> There are more than 3000 cases per year which has been reported in various literatures. Tracheobronchial foreign body aspiration can be seen in all age groups but it is mostly seen in childhood and can be a life-threatening condition.<sup>[3,4,5]</sup> About 75% to 85% of all foreign body aspiration cases occur in children younger than 15 years old; however, most are younger than 4 years of age. In our study, we reported two unusual foreign body aspiration cases-“broken PVC tracheostomy tube in trachea”.

However, no age is immune to foreign body aspiration. Therefore, it is important to suspect clinically and confirm radiographically for its safe removal and to avoid complications.<sup>[6]</sup> Longer the time it takes to intervene, higher is the incidence of complications including death. Flexible bronchoscopy (FOB) can be done to confirm but rigid bronchoscope is better for removal of foreign body from a tracheobronchial tree.

## 2. CASE REPORT

### Case-1

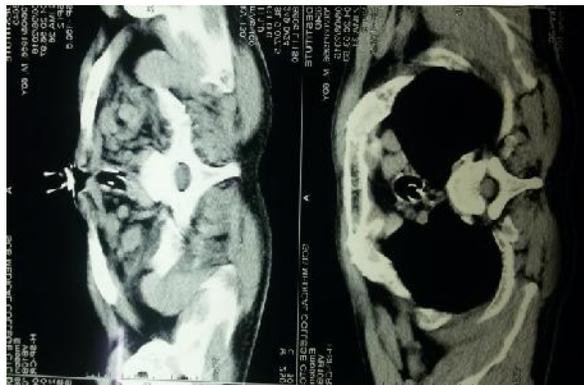
A 60 year year old man presented to our Emergency department with chief complaints of dyspnoea and continuous cough since 24 hours following aspiration of a broken PVC tracheostomy tube while changing of the tube by his wife at his residence. Detail history revealed that he had underwent emergency tracheostomy 9 months back when he first came to ENT outpatient department with stridor, hoarseness of voice and enlarged lymphnodes in the neck on left side. Direct laryngoscopy revealed an extensive mass involving left vocal cords, arytenoids and aryepiglottic folds with fixation of left hemilarynx. Biopsy was done and Histopathology revealed it to be a well differentiated squamous cell carcinoma of larynx, following which he received 33 cycles of radiotherapy along with oral chemotherapy. He was then on the synthetic tracheostomy tube for the last 9 months and his family members did regular cleaning and changing of the tube till accidental slippage of the tube into trachea occurred. Hurriedly in panic state, they accidentally inserted another synthetic tube at the same site of the stomal wound as the previous tube was missing.

At the time of admission, patient was conscious with mild respiratory distress. His pulse rate was 90/min, regular, blood pressure was 100/70 mmHg and pulse oximetry showed SpO<sub>2</sub> of 95%, with a respiratory rate of 24 min. On auscultation of chest there were decreased breath sounds on right side and wheezing but without any signs of chest retraction. X-ray chest AP & lateral view showed the radiopaque shadow of broken tracheostomy tube (Fig.1). CT scan of thorax was done on emergency basis and revealed displaced tracheostomy tube in the lower trachea and right main bronchus. There was evidence of air trapping in the right middle and lower lobe (Fig. 2).

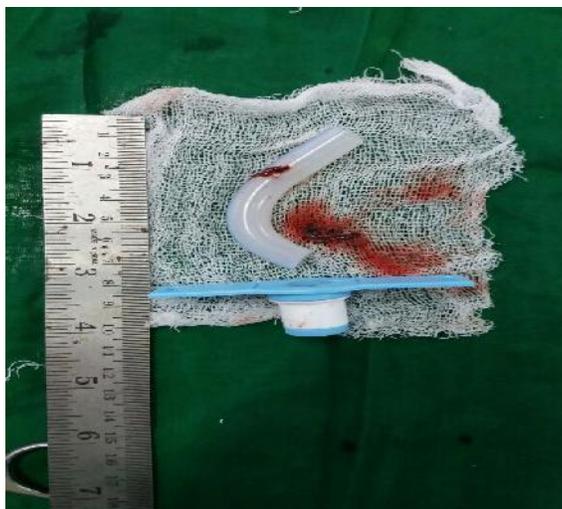
Patient was shifted to emergency OT and anaesthetic consultation was sought. Intravenous fluid support, intravenous antibiotics and steroids were started. Rigid bronchoscopy was performed under spontaneous ventilation technique, minimal sedation with midazolam and broken tracheostomy tube was removed through the tracheotomy opening (Fig.3). Following removal, a 7.5 PVC cuffed tracheostomy tube was inserted and secured. Therefore, the bronchoscope, forceps and the broken tracheostomy tube were removed as a single unit. The patient was discharged the following day. Post-operative chest x-rays was done and chest pathologies were not found. He had fully recovered at the one month follow-up and there were no signs of any late complications.



**Figure 1** Lateral view showing broken tracheostomy tube



**Figure 2** CT scan showing broken tracheostomy tube



**Figure 3** broken tracheostomy tube

**Case-2**

A 80 year old male patient, previously detected with laryngeal growth (Biopsy- Squamous cell Carcinoma) was admitted with PVC tracheostomy tube in situ in casualty with mild respiratory distress. He gave history of another broken PVC tube inside his trachea. He had undergone tracheostomy 2 years back for respiratory distress while undergoing Radiotherapy treatment. He was changed over to PVC tracheostomy tube and was continuing his treatment. One day his daughter was inserting the PVC tube when she noticed that the tube had separated from its flanges and gave way into the trachea. In a panicky state, she inserted another spare PVC tube into the trachea to relieve cough. Patient had respiratory distress when he presented to us. X-ray chest – AP/ LAT view was done to confirm the diagnosis (Fig.4). Since the broken tube was behind the cardiac shadow, it wasn't clear in AP view but was clearly marked in lateral view. Even though the tube wasn't metallic, due to the presence of radio-opaque line given on all PVC tubes, it could be easily detected on radiography. However, clinically no other was noted in chest.

We planned for removal under spontaneous TIVA using propofol, isoflurane with succinylcholine. Under Rigid bronchoscopy guidance the tube was dislodged and pulled up, however the stoma had to be widened by giving releasing incision (Fig.5). The PVC tube was splitted into two halves, by sharp knife as the tube was tough and unyielding and was safely removed (Fig.6). The stoma was widened and a larger PVC tube was reinserted. Patient was discharged next day to undergo his radiotherapy treatment with advice to regularly follow up.



**Figure 4** lateral view of chest with shadow of tracheostomy tube



**Figure 5** widening of stomal site



**Figure 6** shows splitted tracheostomy tube

### 3. DISCUSSION

Foreign body aspiration (FBA) is a very common occurrence in children, especially among those younger than 3 years of age (79%),<sup>[10]</sup> with a higher incidence in boys (63%).<sup>[11]</sup> Foreign body aspiration in adults is often seen in geriatric population because of some underlying diseases.

The most frequent foreign bodies that are aspirated are nuts, vegetable matter, bones, metal and plastic pieces or pills. There are many unusual objects such as metallic screws, safety pins, board screw pins, straight pin, or iron pill, tetracycline tablets, wood branch, plastic whistle and rarely metallic fractured tracheostomy canula via stomal wound.<sup>[18]</sup>

A number of complications of tracheostomy have been described but fracture of tracheostomy tube is rare. *Bossoe and Boe* (1960) reported the first case of fracture of the tracheostomy tube.<sup>[13]</sup> In India, *Maru Y.K. et al* (1978) reported the first case.<sup>[14]</sup> Most cases reported in various literatures are broken metallic tracheostomy tubes in trachea. *Alvi and Zahtz* reported 11 cases of non-synthetic and 12 cases of synthetic tube fracture.<sup>[15]</sup> *Gupta* in 1987 reported 9 case series of fractured tracheostomy tube (poly vinyl chloride or silicon) over a period of 8 years.<sup>[16, 17]</sup> Tracheostomy tubes are made from metal, PVC (polyvinyl chloride) or silicone. Most plastic pediatric tubes are disposable and are not reused. Traditional metallic tracheostomy tubes are made from silver, steel, copper or zinc, all of which are prone to corrosion by alkaline tracheal secretion.<sup>[15]</sup> Metallic tubes are usually placed for a period of 48-72 hours and patients are advised to repeatedly wash and clean the inner and outer tubes. When they remain for prolonged periods, they are prone to corrosive actions of alkaline tracheal secretions and so it easily fractures.<sup>[18]</sup> The modern stainless steel tubes are less corrosive and are less prone to fracture. Modern tracheostomy tubes are made from synthetic materials like PVC or silicone which is soft by nature, unaffected by body temperature and it rarely breaks.

The weak points where the tracheostomy tube fractures are the junction between the tube and the neck plate, the distal end of the tube and the fenestration site.<sup>[14,15]</sup> There are several predisposing factors leading to fracture like defective manufacture, prolonged wear and tear of the tube, ageing of the tube, mechanical factors (suctioning, cleaning, repeated removal) or chemical stress (alkaline tracheobronchial secretions, corrosive reactions).<sup>[14,15,19,20]</sup> In our case, the fracture of the tracheostomy tube was most likely due to prolonged wear and tear, ageing of the tubes and repeated sterilization which was evident from its fragile surface and colour of the tube. The most common site where the broken tubes are lodged are in the right main and distal bronchus followed by lower trachea and right main bronchus.<sup>[21]</sup> The location of foreign body lodgment in tracheobronchial tree is related to its peculiar anatomy and posture of patient during aspiration.<sup>[22]</sup> This is because of more vertical position and bigger diameter of right bronchus than the left bronchus.<sup>[23]</sup>

Patient is asymptomatic in most cases and in few cases patient may have acute or chronic respiratory symptoms. Dyspnoea and respiratory distress are the common presenting symptoms in acute phase.<sup>[24]</sup> Complications like persistent fever, chronic cough, hemoptysis, recurrent lung infections, bronchiectasis, bronchial stricture, atelectasis, lung abscess, pneumothorax and pneumomediastinum can be seen in chronic phase.<sup>[25,26]</sup> 21.8 % of patient with foreign body aspiration has delayed diagnosis (>3 months).<sup>[22]</sup> In auscultation of chest, wheezing can often be heard and ipsilateral chest sounds are limited.<sup>[20, 21]</sup>

Diagnosis is made by a detailed history, chest X-ray, CT scan thorax and flexible bronchoscopy. *Silvia et al.* reported that sensitivity and specificity of radiological imaging methods for foreign body aspiration are 73% and 45% respectively.<sup>[24]</sup> Bronchoscopy should be done for the patients with respiratory symptoms without any clinical findings. Therapeutic rigid bronchoscopic (RB) removal is the gold standard treatment since a larger foreign body cannot be retrieved with a flexible bronchoscope. RB has some

advantages like easy manipulation, facility of telescopic systems, cost-effectiveness, good visualization, and control of airway safety. [20, 26, 27] RB is usually the first preference in children. In patients with tracheostomy and in some emergency cases, RB can be done without general anesthesia like in the present case. FB have many advantages like facility of use, requires no anesthesia, enables to see distal bronchus but it is difficult to retrieve a large foreign body by Flexible bronchoscopy. In failed cases of rigid bronchoscopy, thoracotomy and the bronchotomy are done after consultation of the CTVS surgeon.

The morbidity rates of bronchoscopy vary from 2-22%. But this morbidity rate of bronchoscopy is very low with experienced surgeons. There is no current consensus on tracheostomy tube care. Therefore few recommendations have been suggested in various literatures to prevent the fracture of tracheostomy tubes and to avoid complications - [27, 28, 29, 30]

1. Periodic change of tracheostomy tube, preferably 3 monthly.
2. Daily or alternate day cleaning of inner cannula depending on the amount of patient's secretions.
3. Daily or alternate dressing of tracheostomy wound.
4. Tube ties should be changed weekly.
5. Alternative use of two sets of inner cannula at home to reduce wear and tear of the tube.
6. Patients should be periodically followed up.
7. Proper training should be provided to the family members to handle patients of quadriplegia with altered sensorium.
8. In the case of an emergency, immediate hospital contact and a good referral system are critical for the early detection and management of complications.

#### 4. CONCLUSION

Fracture of the synthetic tracheostomy tube is a rare complication and a potentially life threatening condition if not managed promptly. Inappropriate cleaning and replacement of the tracheostomy tube and socioeconomic condition of the caregivers at home may not always allow for a proper care to be given as required by current medical standards. Therefore the best way to minimize these complications is to properly train the patients in home tracheostomy care, to stress the importance of regular follow up and repeated change of tracheostomy tube. Regular check-up of all tracheostomy tubes to be done for identifying any manufacturing defects or signs of wear and tear before its insertion. The knowledge, experience of the otolaryngologist and prompt action for the retrieval of the foreign is very important to save the patient from fatalities.

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