



## The patient with spontaneous dislodgement of tracheostomy tube

**Dr. Leung Ka Yee**

A 66-year-old man on tracheostomy tube presented to the Accident and Emergency Department with sudden dislodgement of his tracheostomy tube. He suffered from laryngeal cancer with upper airway obstruction and was put on emergency tracheostomy around 5 weeks ago. On physical examination, the case doctor confirmed dislodged tracheostomy tube, but the tracheostomy site was patent. Air entry of bilateral chest was equal, and oxygen saturation (SpO<sub>2</sub>) was maintained at 96% on room air. Blood pressure and pulse were both stable.

Reinsertion of his tracheostomy tube was attempted. The case doctor started with reinsertion of tracheostomy tube of the original size 7.5mm, but he failed to do so. He then attempted insertion of smaller tracheostomy tubes of size 7.0mm and 6.0mm, but these attempts were not successful as well.

Ear nose and throat (ENT) surgeon was consulted on phone, and reinsertion with

patient in supine position was suggested. Unfortunately, this also failed as the patient was choking severely. Subsequently, ENT surgeon suggested to use tracheal dilator and tracheostomy tubes of smaller size. However, patient struggled and choked during the process. The saturation of the patient was maintained, and the patient could breathe through the stoma, so further attempt was therefore aborted until ENT surgeon's assessment.

Upon ENT surgeon's assessment, the tracheostoma was oedematous with peristomal circumferential granulation. Despite this, the passage of suction catheter was successful and tracheostoma remained patent. With the help of xylocaine spray, cuffless Shiley tracheostomy tube size 4 (5.0 mm) was inserted after several attempts. Position was confirmed with fiberoptic laryngoscopy. Patient was then admitted for observation. He remained stable during observation, and eventually, the tube was upsized to Shiley size 6 (6.4mm) and he was discharged.

### Tracheostomy airway emergencies

Emergency physicians should be familiar with the management of tracheostomy complications, as many of these are potentially life-threatening. The acute complications include displacement or dislodgement (accidental decannulation),

tube blockage, haemorrhage and infection. Tracheostomy tube dislodgement and obstruction will be covered in this article. First, it is essential to have some basic understanding on tracheostomy.

### What are the components of a tracheostomy tube?

The tracheostomy tube may consist of an outer cannula, an inner cannula, a flange (neck plate), a cuff, a pilot balloon, or an obturator for insertion, but not all these parts are present in different types of tubes. Some of these parts are as shown in Fig.1. There is usually some important information on the flange, including the presence of a cuff, the outer diameter (OD) and internal diameter (ID). The tube size is usually defined by the inner diameter. The inner cannula, which is usually secured to the outer cannula by a locking mechanism, can be easily removed or replaced. The end of the inner cannula has a standard 15mm connector that can be connected to a bag-valve device or mechanical ventilator.

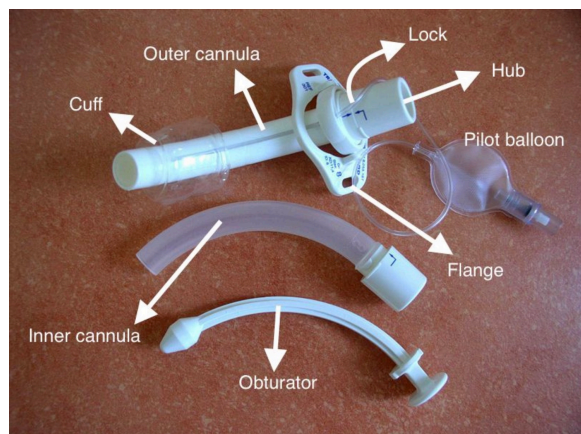


Fig.1 Different parts of a tracheostomy tube  
(Modified from *Tracheostomy Tube* attributed to Klaus D. Peter) (CC BY 3.0 DE license)

Sometimes, there may also be other attachments connected to the hub of the tracheostomy tube, such as a speaking valve, a cap, or a heat moist exchanger (HME), which can be removed when changing the tube. Patients with laryngectomy may have a voice prosthesis (e.g. Tracheoesophageal Puncture prosthesis), which is located inside the stoma, as shown in Fig. 2. The voice prosthesis should not be removed.

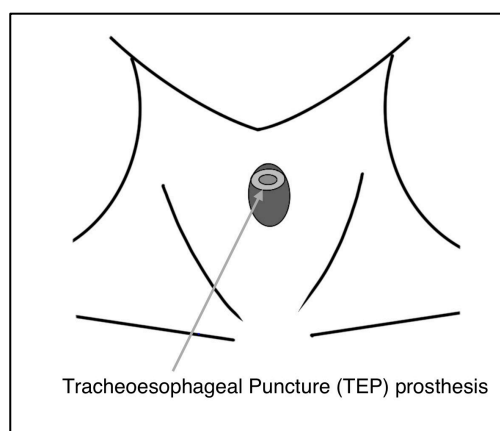


Fig.2 Laryngectomy with a voice prosthesis also known as Tracheoesophageal Puncture (TEP) device that is inside the stoma

### What are the types of tracheostomy tube?

There are different types of tracheostomy tubes that may vary in their composition:

- 1) Cuffed or uncuffed
- 2) Double cannula or single cannula (no inner cannula)
- 3) Fenestrated or non-fenestrated

For a patient with a tracheostomy emergency, it is important to know the type of tracheostomy tube that the patient has. Meanwhile, it is equally important to know if the patient has a simple tracheostomy or end tracheostomy (laryngectomy).

### Is it simple tracheostomy or end tracheostomy?

Simple tracheostomy is usually indicated in patients who require long term mechanical ventilation, airway protection and aspiration prevention (e.g. neuromuscular disorder), or in patients with facial or upper airway trauma.<sup>1</sup> On the other hand, end-tracheostomy or total laryngectomy, is usually performed in patients with laryngeal carcinoma.<sup>1</sup> The patient in this case had laryngeal cancer with upper airway obstruction, so the tracheostomy also serves a similar function as an end-tracheostomy.

The major difference of the two types is that oxygenation couldn't be provided via mouth or nose for end-tracheostomy, due to the underlying anatomical difference. For those patients, oxygenation is solely provided via the stoma site. Intubation, if required, can only be performed via the stoma site.<sup>1</sup> The difference is illustrated as shown below in Fig.3.

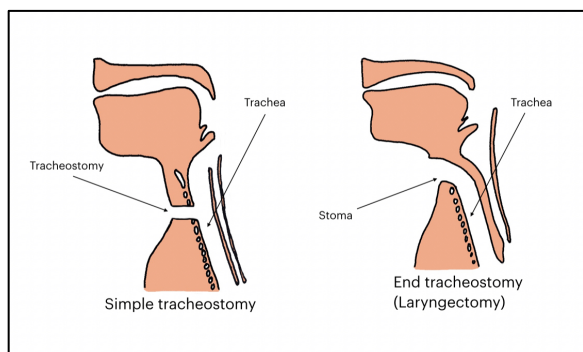


Fig.3 The anatomical difference between simple tracheostomy and end tracheostomy (laryngectomy)

### How to approach to tracheostomy patients presenting with shortness of breath?

In cases suspected to have a tracheostomy airway emergency, especially when there is desaturation, we should first perform basic airway opening manoeuvres to ensure airway patency and provide oxygenation.

The “ABCDE approach” can be used for identification of red flags<sup>1</sup>:

- A:** Airway (stridor, partial speech, oral secretions)
- B:** Breathing (apnoea, tachypnoea, cyanosis, accessory muscle use)
- C:** Circulation (tachycardia, hypotension)
- D:** Disability (reduced responsiveness, increased pain around stoma)
- E:** Exposure (tracheostomy signs, e.g. displaced tube, obstruction, haemorrhage, air leak or requirement of large volume to inflate the cuff)

If the above red flags are recognised, we can check for tracheostomy patency or confirm tube obstruction or displacement by connecting it to end-tidal CO<sub>2</sub> (waveform capnography). The ENT surgeon should be consulted urgently. At the same time, high flow oxygen should be given. If the patient is in apnoea or cardiac arrest, resuscitation should be performed immediately.

The next step is to check whether it is a simple tracheostomy or end tracheostomy and determine if the tracheostomy is patent. The management approach can be referred to the flowchart shown in Fig.4, which is modified from the National Tracheostomy Safety Project (NTSP) algorithms.<sup>1,2</sup>

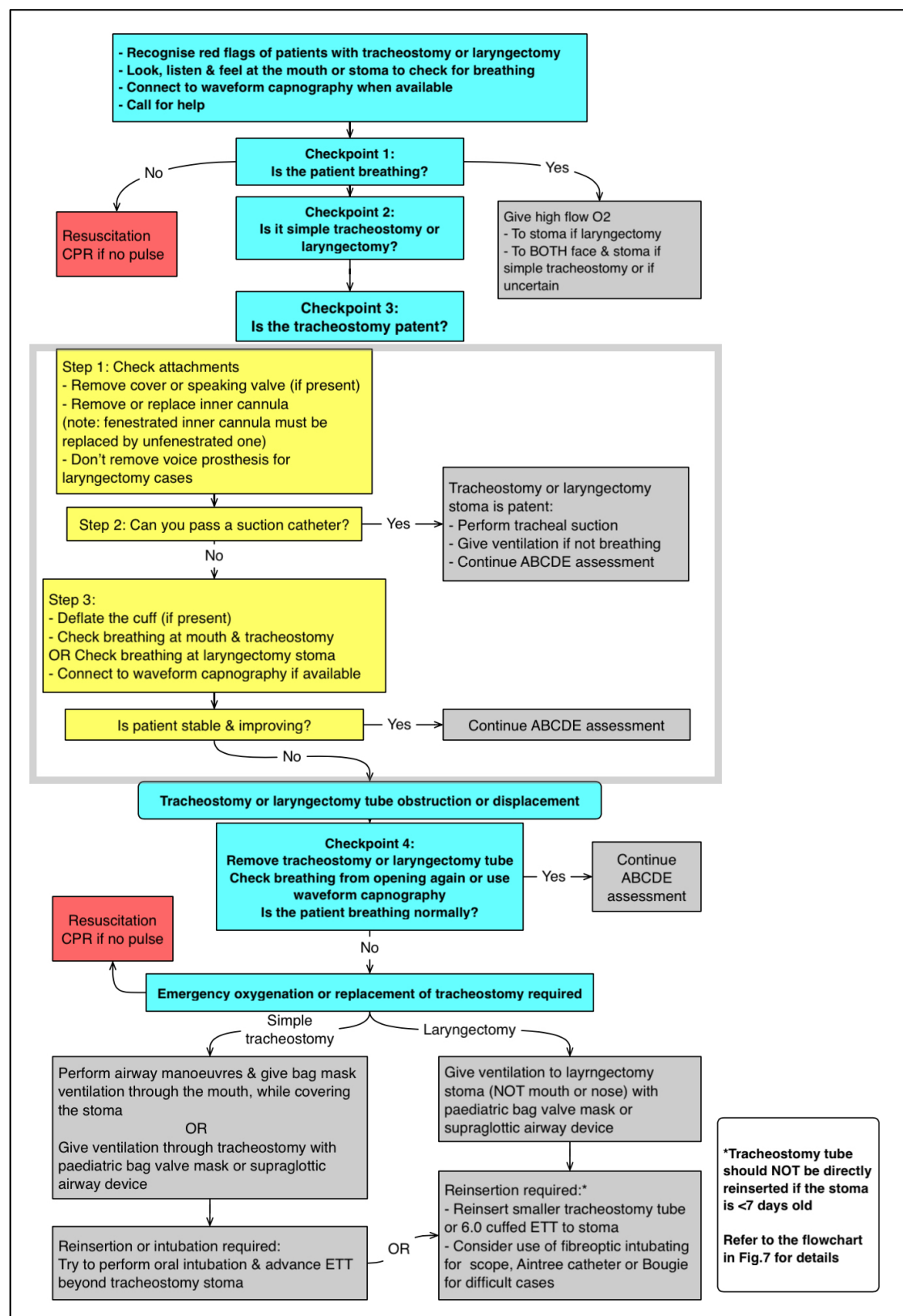


Fig 4. Management flowchart of tracheostomy airway emergencies

### How should tracheostomy be assessed?

First, assess the patency of the tracheostomy tube by removing all external adjuncts if present, including speaking valves, humidifiers and inner tube. Next, we should attempt to pass a suction catheter into the tracheostomy tube. The tracheostomy tube is considered patent if the suction catheter can be successfully passed beyond the tip of the tube. Afterwards, perform suction through the tracheostomy tube to remove any secretions. If passage of suction catheter fails, cuff of the tracheostomy (if any) should be deflated. Improvement after deflating cuff indicates that the tracheostomy tube is partially obstructed or displaced.

If all the above manoeuvres failed to show improvement, then the tracheostomy tube should be removed since ventilation would not be effective in a blocked or displaced tube. After removal of tracheostomy tube, attempts should be made to maintain the airway, and oxygenation should be provided. If the patient is not breathing, ventilation should be provided. At each of the above attempt, if there is improvement, we can continue with ABCDE assessment.

### How should oxygenation and ventilation be provided to patients with tracheostomy?

If the patient is breathing, high-flow oxygen could be given. Depending on the type of tracheostomy that the patient has, if the patient is on simple tracheostomy, oxygen can be given via both stoma and upper airway via nose and mouth. However, if the patient is on end tracheostomy or laryngostomy, oxygen can only be given via the stoma.<sup>1,2</sup> Oxygen to the stoma could be

provided via specially designed tracheostomy mask while oxygen to the face is provided via simple face mask.

However, if the patient is not breathing, ventilation should be given. If the patient has a patent upper airway or simple tracheostomy, ventilation could be provided to upper oral airway via bag-valve-mask, with or without oral airway adjunct and supraglottic airway device. To facilitate ventilation, the stoma should be covered. Another option of ventilation is via the stoma, with a bag-valve-mask attaching to a paediatric face mask or supraglottic airway device held over the stoma. In cases with end tracheostomy or laryngectomy, ventilation to the stoma would be the only possibility.<sup>1,4</sup>

### **Dislodgement of tracheostomy tube**

The most obvious sign of tracheostomy dislodgement is an elevated flange above skin level. Tube dislodgement should also be considered in patients with respiratory distress, desaturation, increased work of breathing, difficulty in passing suction catheter and surgical emphysema etc. (5,6)

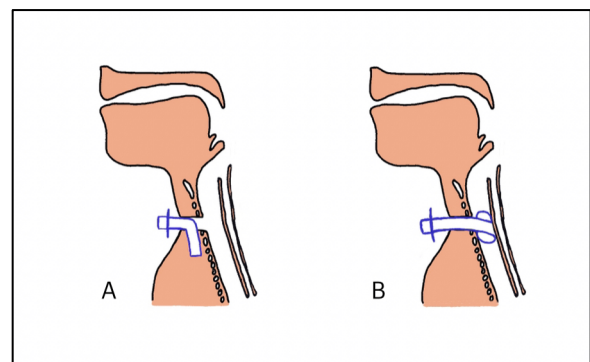


Fig. 5 Tracheostomy tube displaced to the soft tissue anterior to the trachea (A) and partial dislodgment with the inflated cuff causing airway obstruction (B)



It should be noted that dislodgement can be partial or complete. Complete dislodgement with false passage to the anterior neck is possible. In partial dislodgement, the cuff of the tube may cause an obstruction to the airway. These are illustrated in Fig .5.

#### Risk factor for tracheostomy tube dislodgement

Tracheostomy tube is easier to get dislodged if the stoma is new, i.e. within 7 to 10 days of stoma creation. It can also be dislodged easily if the sutures or straps are loosened, in agitated patients, or when there is plenty of airway secretion or with vigorous coughing. Besides, patients with thicker neck are at greater risk as there are more subcutaneous tissue which allows displacement.<sup>6</sup>

#### Problems associated with tracheostomy tube dislodgement

When a tracheostomy tube is dislodged or displaced, the airway could be lost, causing devastating complications including hypoxic brain injury or even death. For a fresh tracheostoma tract created <7 days, there would be misalignment of the cutaneous stoma and the tracheal stoma once the tube is dislodged, as illustrated in Fig.6.

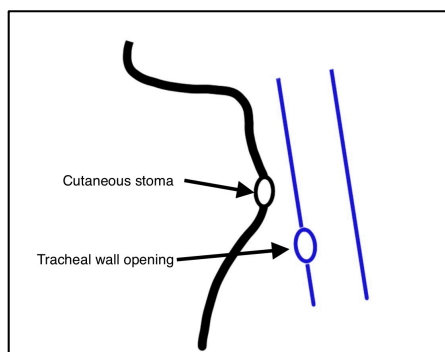


Fig.6 Misalignment of the cutaneous stoma and tracheal stoma

If the tracheostomy tube is reinserted directly, the result would be formation of a pseudo-tract. Besides, ventilation via a dislodged tracheostomy tube could result in subcutaneous emphysema or pneumothorax, complicating subsequent airway intervention and ventilation.<sup>1</sup>

#### The approach to manage a dislodged tracheostomy tube

The management decision pathway can be referred to the flowchart in Fig.7. The approach would be different depending on the maturity of the tracheostoma tract. The tract is considered mature after at least 7-10 days of creation.<sup>8</sup> Attempts at reinsertion before 7-10 days increases risk of creating a false tract anterior to the trachea.<sup>8</sup> We should consult ENT expert in cases with immature stoma.

For a patient with a mature stoma and normal neck anatomy, accidental dislodgement of tracheostomy tube is usually uncomplicated, and reinsertion is usually simple. However, in patients with recently established stoma, increased neck circumference or with substantial airway pathology and marginal oxygenation, reinsertion can be challenging, and morbidity and mortality can result.<sup>7</sup>

The first step to manage a displaced or dislodged tracheostomy tube is to remove the tube and adopt basic airway manoeuvres to maintain airway patency. Oxygenation and ventilation should be prioritized and provided as mentioned above. Once oxygenation and ventilation have been ensured, we should be prepared to reinsert the tracheostomy tube.

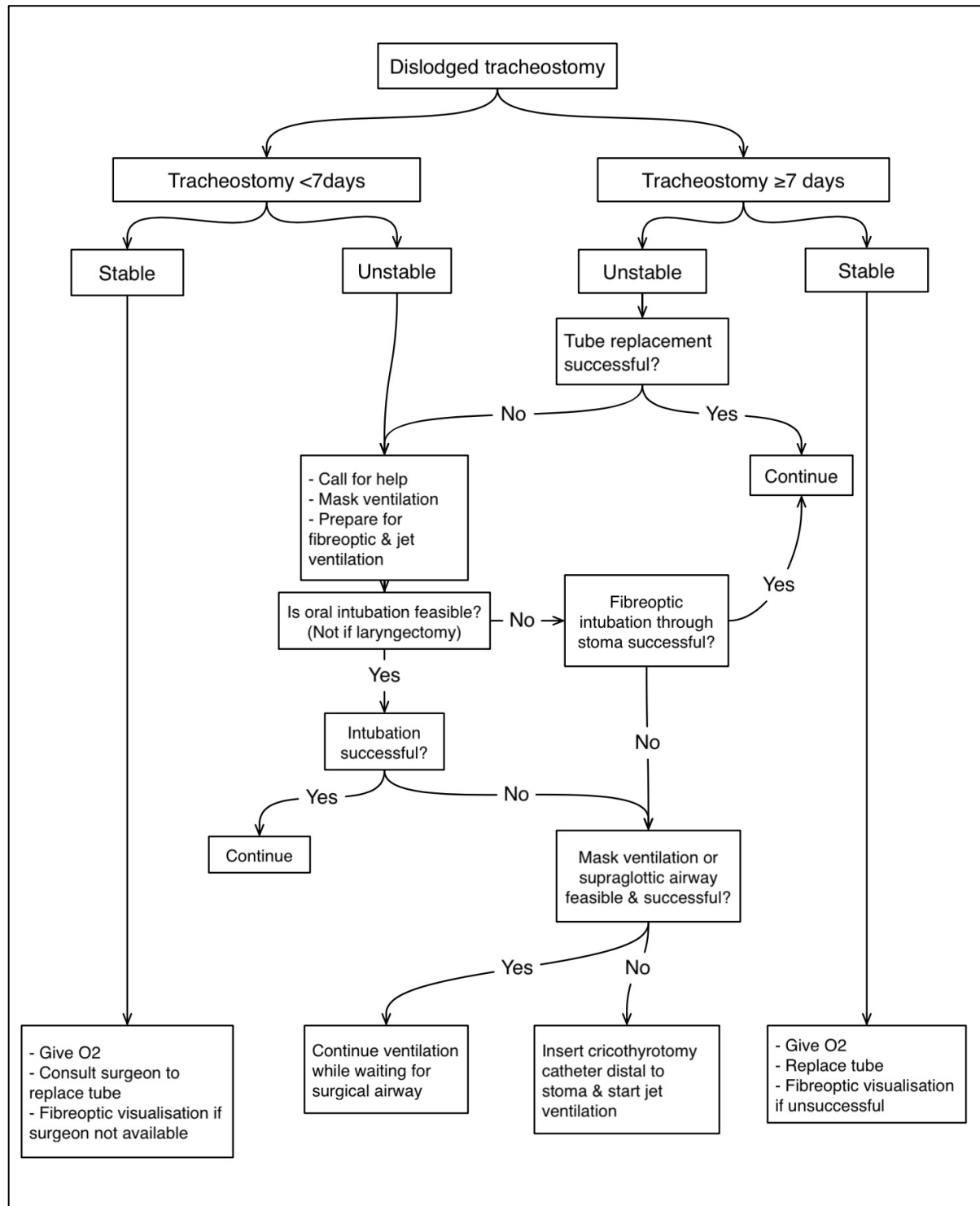


Fig.7 Management pathway of a dislodged tracheostomy tube

For a simple case with a mature tract, the tracheostomy tube can be reinserted directly with an obturator in place. Prepare a spare tracheostomy set of equivalent or smaller size, with integrity of equipment set checked.

Position the patient either supine or in a reclined position with a gently extended neck to bring the trachea anteriorly. Insert the obturator into the tracheostomy tube and apply lubricant. Apply firm pressure to the obturator as you insert the tracheostomy tube and slide the tube into the trachea. Then, remove the obturator and secure the tracheostomy tube.

There are several tips to improve successful rate of re-insertion. The cutaneous stoma and the tracheal lumen should be aligned for successful re-insertion of tracheostomy tube. If reinsertion attempt failed, one should first examine the stoma to see if the tracheal lumen can be visualized.<sup>6</sup> One tip for insertion is, first pointing the tube upward, catching the tracheal lumen, and then turn caudally. The tube should be turned through 90 degrees after entering the trachea, but the turning should not be done too early as there is risk to create a false passage to the anterior soft tissue of the neck.

If difficulty is anticipated, a suction catheter or tube exchanger could be used as guidewire to access the tracheal lumen to facilitate the procedure.<sup>6,7</sup> The use of fiberoptic bronchoscopy as guidance should also be considered if the equipment is available. Under fiberoptic inspection, the new tube can be inserted into the airway by railroading it over the scope.

Occasionally, tube insertion may still be difficult with the above methods. In that case, choose a smaller tube for reinsertion. If expertise is available, gentle dilation of stoma with a tracheal dilator can be done whilst insertion of the tube is performed. However, formal dilation can be performed in a later time by the ENT surgeons if insertion of a smaller tube is successful.

#### Confirmation of successful reinsertion

There are different ways of confirming successful reinsertion. Simple bedside examination includes assessing air flow through the tube and listening for breath sounds. Correct placement should be confirmed with fiberoptic bronchoscopy if available<sup>5</sup>, or with end tidal CO<sub>2</sub> tracing. Passing the bronchoscope through existing tracheostomy tube and visualizing the trachea and carina confirms correct position within the airway, as shown in Fig.8.

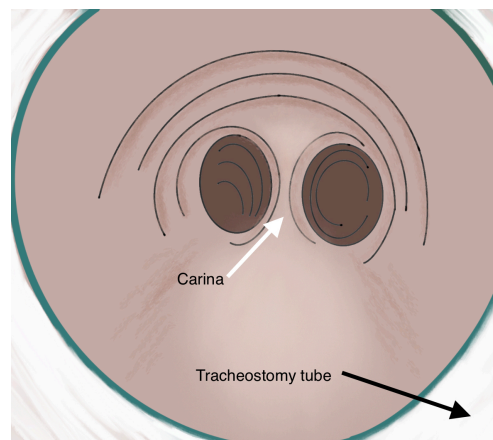


Fig.8 Endoscopic view of a correctly placed tracheostomy tube by flexible bronchoscopy through the tube



The approach to failed re-insertion

If time is allowed, we should consult and await ENT specialist. However, if the patient is crashing, intubation should be attempted. Provided oral intubation is feasible, the safest approach is to intubate patient via oral route with endotracheal tube of a similar or lower size, and inflate the cuff distal to the stoma site.<sup>8</sup> If oral intubation is not feasible (i.e. end-tracheostomy), reinsertion should be performed by expert under fiberoptic guidance. If attempt fails, responder can insert a cricothyrotomy catheter into the distal trachea (e.g. at sternal notch level), and jet ventilation can be provided while waiting for a surgical airway to be established.<sup>4</sup>

## Learning points:

- 1) Use the “ABCDE” approach to identify red flags of tracheostomy complications
- 2) Understand the difference between simple tracheostomy and end tracheostomy, and the different approaches in managing their complications
- 3) Know how to evaluate tracheostomy tube patency and manage obstructed tracheostomy tubes
- 4) Beware of concealed or partial tracheostomy tube dislodgement and understand the management of the dislodged tube
- 5) Be able to appreciate the difference in management approach for tube dislodgement in a fresh stoma from that of a mature tracheostomy tract
- 6) Know the reinsertion techniques and the management of failed reinsertion

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