

# Successful application of early tracheostomy in an intubated patient who suffered from irritative stimuli by an oral tracheal tube

### ABSTRACT

We experienced a case in which simultaneous weaning from sedation and mechanical ventilation were difficult because of instability of tracheal tube fixation that was caused by size mismatch between the trachea and the tube and by severe tracheal deviation. Irritative stimuli caused by the oral tracheal tube prevented conversion from deep sedation to light or no sedation. In this case, very early tracheostomy, which provided better tube fixation and successfully reduced the irritative stimuli to the trachea, was effective to help achieve discontinuation of sedation and facilitated successful weaning from mechanical ventilation. Eventually, the tracheostomy tube was successfully removed immediately after discontinuation of mechanical ventilation.

**Key words:** Early tracheostomy; trachea–tube size mismatch; weaning from sedation

### Introduction

In patients with respiratory failure, simultaneous weaning from sedation is essential for weaning from mechanical ventilation.<sup>[1]</sup> Tracheal tube placement itself causes discomfort in intubated patients.<sup>[2]</sup> Instability of tracheal tube fixation may cause tube tip movement, similar to tracheal suctioning, and may initiate violent cough and further unpleasant sensation.<sup>[3]</sup> We experienced a case in which simultaneous weaning from sedation and mechanical ventilation were difficult because of instability of tracheal tube fixation. In this case, very early tracheostomy was effective to help achieve discontinuation of sedation and facilitated successful weaning from mechanical ventilation.


### Case Report

Patient consent was obtained, but institutional review board approval was exempted, because there were no ethical problems or descriptions to identify the patient in this case report. A 68-year-old man, who was 168-cm tall and weighed 48 kg, was admitted to the intensive care unit (ICU) because of acute respiratory failure. He previously underwent left upper lobectomy for lung cancer and developed a large cavity in the left lung secondary to chronic aspergillosis. Chest computed tomography scan revealed interstitial pneumonia in the dependent right lung [Figure 1].

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Immediately after admission, airway was established using an 8.5-mm cuffed tracheal tube (TaperGurd Evac™, Covidien Japan, Tokyo). Tazobactam/piperacillin 18 g/day and itraconazole 400 mg/day were administered, although subsequent laboratory data showed negative procalcitonin and serum  $\beta$ -D glucan levels. Echocardiography showed moderately reduced left ventricular function, with an estimated ejection fraction (EF) of 30%; the brain natriuretic peptide (BNP) level was 150 pg/ml. High positive end expiratory pressure (PEEP) of 15 cmH<sub>2</sub>O combined with low tidal volume was applied. At that time, a relatively high intra-cuff pressure of 35 cmH<sub>2</sub>O was required to stop the air leakage that was brought about by the acquired tracheal deformity [Figure 2]. Initially, a deep sedation protocol with fentanyl, dexmedetomidine, and propofol was used to achieve a Richmond agitation sedation scale (RASS) of -3 to -4. Noradrenaline (0.1–0.2  $\mu$ g/kg/h/min) was administered to keep the mean arterial blood pressure at >70 mmHg. Oxygenation was moderately impaired, as shown by a ratio of arterial oxygen partial pressure to fractional inspired oxygen (*P/F*) of 200.

The following day, EF further decreased to 10%, and apical ballooning was observed. SBP decreased to around 50 mmHg and the *P/F* decreased to around 100. At this time, the troponin-I level was negative and the BNP level was up to 2300 pg/ml. Based on the immediate diagnosis of Takotsubo cardiomyopathy, dobutamine (5–7  $\mu$ g/kg/min) and furosemide (1 mg/kg/day) were administered.<sup>[4]</sup> Thereafter, hemodynamic stability was obtained and the respiratory status improved.

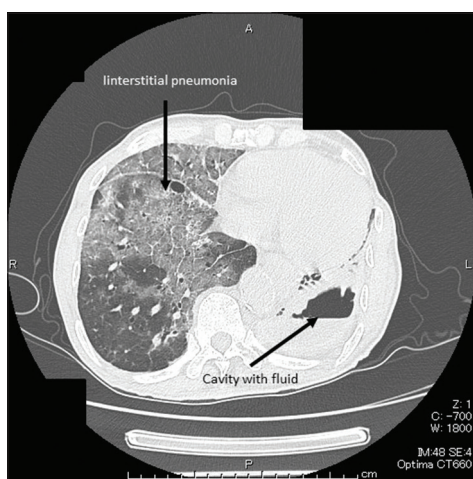
Three days after ICU admission, both noradrenaline and dobutamine were discontinued, and the *P/F* improved to over 300. The EF and BNP level improved to 40% and

500 pg/ml, respectively. Under deep sedation, the PEEP level was successfully decreased to 5 cmH<sub>2</sub>O. Light sedation (i.e., RASS 0 to -1) was tried, but the patient developed continuous violent cough, which prevented us from communicating with him. Moreover, he developed hypertension (SBP >200 mmHg) and tachycardia (130–150 bpm). Desaturation secondary to air leakage and secretion dropping to the lung were observed, prompting us to resume deeper sedation.

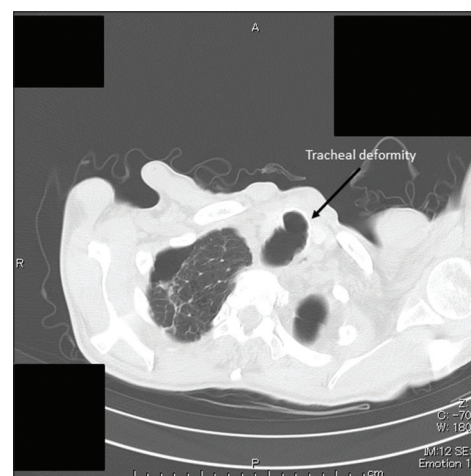
The following day, his BNP level increased again to nearly 2,000 pg/ml. We judged that the violent cough was stimulated by tracheal tube discomfort from the movement of the tracheal tube tip, which was brought about by size mismatch between the trachea and the tube and by severe deviation of the trachea [Figure 3]. We supposed that fixation of the tube tip could be better obtained by tracheostomy than by an oral tracheal route. Based on this hypothesis, percutaneous tracheostomy using an 8.5-mm commercially available kit (Neo Perc™, Covidien Japan, Tokyo) was performed on day 4 of ICU admission. After tracheostomy, the violent cough or air leakage became seldom, even in the absence of sedation. After successful spontaneous breathing trial (SBT), he was weaned from mechanical ventilation 2 days after tracheostomy, and the tracheostomy tube was successfully removed the following day.

## Discussion

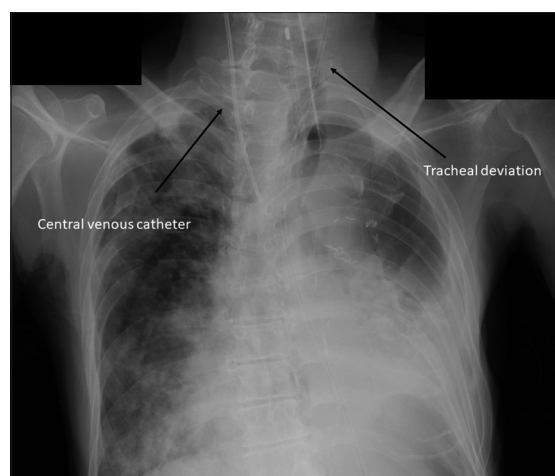
As mentioned, simultaneous weaning from sedation is essential for weaning from mechanical ventilation.<sup>[1]</sup> In our case, this was difficult to achieve, probably because of the trachea–tube size mismatch and severe tracheal deviation. Irritative stimuli caused by the oral tracheal tube prevented conversion from deep sedation to light or no sedation. In this case another option would have been extubation under deep



**Figure 1:** Interstitial pneumonia in the dependent right lung. The arrows show interstitial pneumonia in the dependent right lung and a large cavity with fluid in the left lung



**Figure 2:** Tracheal deformity. The arrow shows his acquired tracheal deformity



**Figure 3: Tracheal deviation. The arrows show his severe tracheal deviation and central venous catheter**

sedation without confirmation of successful SBT. However, this was judged to be dangerous because of his poor baseline respiratory status from the loss of left lung function. In addition, there was a concern of Takotsubo cardiomyopathy aggravating the situation.

Successful simultaneous weaning from both sedation and mechanical ventilation was important and essential in this case. Both persistence of the same situation and failed weaning from mechanical ventilation would have finally resulted in the requirement for tracheostomy. Therefore, instead of repeated spontaneous awakening trial (SAT) and SBT under oral tracheal intubation, early tracheostomy was suggested as the therapeutic option.

The optimal timing for tracheostomy in mechanically ventilated patients remains under debate. Very early tracheostomy (i.e., within 4 days) may be not beneficial, but it was concluded that there was no reason to delay tracheostomy for more than 10 days.<sup>[5,6]</sup> However, in cases in which the oral tracheal tube itself causes irritative stimulus and prevents SAT and SBT, early tracheostomy may be considered rather than repeating failed SATs and SBT under oral tracheal intubation. In our case, the frequent violent cough caused by the irritative stimuli following repeated SAT under oral tracheal intubation might have resulted in ventilator-associated events, such as pneumonia and lung injury. In fact, increase in secretion dropping to lung was observed during SAT and increased the risk for aspiration pneumonia. High ventilation pressures and global or regional over-distension of the airways have been traditionally recognized as responsible for most cases of barotrauma<sup>[7]</sup> and may be generated by violent cough. Over-inflation of the tracheal tube cuff and sudden movement of the tube have been known as common causes of tracheal rupture.<sup>[8]</sup> In

our case, over-inflation of the tracheal tube cuff was applied to prevent air leakage. In addition, frequent violent cough could cause sudden movement of the tube. Considering the situation at that time, early tracheostomy was considered the best choice to avoid these adverse events.

In conclusion, tracheostomy was effective in this case of difficult simultaneous weaning from sedation and mechanical ventilation secondary to irritative stimuli caused by an oral tracheal tube. Very early tracheostomy may be one of the choices to facilitate successful weaning from mechanical ventilation in similar cases.

#### Declaration of patient consent

The authors certify that they have obtained all appropriate patient consent forms. In the form the patient(s) has/have given his/her/their consent for his/her/their images and other clinical information to be reported in the journal. The patients understand that their names and initials will not be published and due efforts will be made to conceal their identity, but anonymity cannot be guaranteed.

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Nil.

#### Conflicts of interest

There are no conflicts of interest.

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