

# Tracheostomy in Weaning Failure of Prolonged Mechanical Ventilation: A Case Study on Favorable Outcomes

I Putu Mahendra Yogi Semara<sup>1</sup>, Gede Eka Ari Wirawan<sup>2</sup>, Happy Rosyalynda<sup>3</sup>, Agus Adi Yastawa<sup>4</sup>

<sup>1,2,3,4</sup>Department of Anesthesiology dan Reanimation, Negara Hospital, Jembrana, Bali, Indonesia

<sup>1</sup>Corresponding Author Email: [yogisemara46\[at\]gmail.com](mailto:yogisemara46[at]gmail.com)

**Abstract:** *Weaning failure is a common issue in prolonged intubation, often leading to adverse effects and higher mortality rates. This case study aims to explore the effectiveness of tracheostomy in addressing weaning failure. We report a case of a 74-year-old male with respiratory failure type 2 due to acute exacerbation of COPD and pneumoniae, complicated by respiratory acidosis. The patient underwent a tracheotomy due to weaning failure after prolonged use of a mechanical ventilator. The outcome was favorable, with the patient in a stable condition in a nonintensive room posttracheotomy. This case study contributes to the ongoing discussion on the role of tracheostomy in managing weaning failure in prolonged mechanical ventilation.*

**Keywords:** weaning failure, mechanical ventilation, tracheostomy

## 1. Introduction

Weaning failure is commonly found in critically ill patients with mechanical ventilators. Up to a quarter of critically ill patients experience this problem, that causing longer lengths - of - stay in the intensive care unit (ICU) with prolonged mechanical ventilation. This failure also increases mortality and morbidity.<sup>1</sup> Weaning failure defines as a failed spontaneous breathing trial (SBT) or the reinstatement of mechanical ventilation within 2 to 7 days after extubation.<sup>2</sup> In 30% of successful spontaneous breathing trials will experience failure in extubation.<sup>3</sup> Many conditions such as diaphragmatic dysfunction, cardiac failure, and acute respiratory illness, intra - abdominal problems, and neurological status are the most common causes of weaning failure.<sup>3,4</sup>

Prolonged mechanical ventilation relates to many adverse effects such as ventilator - associated pneumonia, tracheal lesions, ventilator - induced diaphragm injury, and ventilator - induced lung injury.<sup>5,6</sup> Meanwhile, earlier extubation induces cardiovascular stress due to spontaneous breathing and frequently require ventilatory support reinstatement. So that, determining the optimal time to extubate is a challenge. Many studies have been conducted but there is no standard guideline to determine the ideal time to extubate.<sup>7</sup>

Concern with prolonged mechanical ventilation, a tracheotomy is often indicated to overcome this problem. Even though, the advantages of tracheotomy in prolonged mechanical ventilation remain controversial, this procedure has been shown to improve the clearance of airway secretion and reduce the work of breathing.<sup>8-9</sup> This case is a prolonged mechanical ventilation due to weaning failure which is overcome by tracheostomy.

## 2. Case

An 74 - year - old male, came to the emergency department at dawn complaining of shortness of breath since 1 day

before admission. Shortness of breath get worse in the supine position and reduced in a sitting position. Shortness of breath accompanied by coughing since 1 week ago and phlegm is difficult to expel. Fever, nausea, vomiting, chest pain, problems with food and drink intake were denied. The patient had a history of smoking since he was a teenager, but had quit in the last 10 years ago. The patient also has a history of Chronic obstructive pulmonary disease (COPD) and Cor pulmonale is routinely treated with Fluticasone Inhaler, Furosemide 20 mg sdd, Methylprednisolone 4 mg tid, Gigadryl Syrup tid.

On physical examination, the patient is in moderate pain, compos mentis awareness, vital signs; Blood pressure: 110/70 mmHg, heart rate: 88x/minutes, Respiratory rate: 30 x/minutes, Tax: 36.5° C, Body weight: 60 kg, Oxygen saturation: 92% in room air and 97% with Nasal Canul 2 liters per minute. On general status, rhonchi and wheezing were found in both lung, while other examinations were within normal limits.

On investigation, white blood cells were found 8.1 x 10<sup>9</sup> cells/L, hemoglobin 14.2 g/dL, hematocrit 42.4% and platelets 182, 000/microliter, renal function test found urea 22 mg/dL and serum creatinine 0.7 mg/dL, and blood sugar 149 mg/dL.

Based on the clinical and work up, the patient was diagnosed as acute exacerbation of COPD, Cor pulmonale, type II respiratory failure, and suspected pneumoniae. Therapy given oxygen 10 liters per minute with non - rebreathing mask (NRM), IVFD Hydromal: Renosan (1: 1) 40 ml/hour, Dexamethasone 10 mg q12 hours IV, Ranitidin 50 mg q12 hours IV, Furosemide 20 mg q12 hours IV, Digoxin 0.25 mg q12 hours PO, Ventolin Nebulizer 2 cc q6 hours. Monitoring vital signs q4 hours, motoring urine production q4 hours. Planning: blood gas analysis, Thorax Photo and Electrolyte Examination.

After four and a half hours of monitoring the patient, the patient experienced a decrease in consciousness and severe shortness of breath. Patient became coma (E1V1M1), blood pressure: 130/70 mmHg, heart rate: 90x/minutes, Respiratory rate: 28x/minutes, oxygen saturation: 98% 10 lpm with NRM, Tax: 37, 4 C. On general status There were rhonchi and wheezing in both lung. Blood gas analysis results: pH: 7.21, PCO<sub>2</sub>: 79.9 mmHg, PO<sub>2</sub>: 175.4 mmHg, HCO<sub>3</sub>: 31.3 mEq/L, SO<sub>2</sub>: 98.8%, and BE: 1.1. Electrolytes: Na<sup>2+</sup>: 126 mmol/L, K<sup>+</sup>: 3.7 mmol/L, CL<sup>-</sup>: 85 mmol/L. 24-hour reevaluation Blood gas analysis showed pH: 7.25, PCO<sub>2</sub>: 75.8 mmHg, PO<sub>2</sub>: 56.1 mmHg, HCO<sub>3</sub>: 32.3 mEq/L, SO<sub>2</sub>: 85.9%, BE: 2.7. Chest X-ray showed consolidation that supporting diagnosis pneumoniae. Based on the results of the examination, the patient was diagnosed as acute exacerbation of COPD, pneumoniae, Cor Pulmonale, Type 2 Respiratory Failure, Hyponatremia and Respiratory Acidosis. Dual antibiotics with ceftriaxone 2 grams q24 hours and Azithromycin were then administered to the patient.

After two days of hospitalization the patient was still in a coma (E1V1M1), then undergone intubation and used a mechanical ventilator. Other treatment given were IVFD NS 20 drops per minute, hydrocortisone 100 mg q12 hours IV, Lansoprazole q24 hours IV, Moxifloxacin 400 mg q24 hours IV, Furosemide Drip 7, 5 mg/hour, Digoxin 0, 25 mg q12 hours per oral (PO), Nebulizer Ventolin 2 cc q6 hours, Triple Drug (salbutamol, insulin in D40% 100 cc + D10% 100 cc, and Calcium Gluconate), Drip midazolam 2 mg/hour and Morphine 10 mg q24 hours intravenously (IV).

After 8 days of being treated, the shortness of breath was reduced and the patient was tried for spontaneous trial breathing, but the patient's breathing was inadequate, a tracheostomy was planned because of failure to wean from the ventilator. The patient was transferred from the ICU to non-intensive ward in a fully conscious condition, breathing was assisted by NRM through a tracheostomy cannula, the condition of vital signs was stable with drip norepinephrine and post-tracheostomy therapy was continued in non-intensive ward.

### 3. Discussion

In this case, the patient with prolonged intubation for 8 days and spontaneous trial breathing was performed but failed to wean the mechanical ventilator. From several previous studies, patients with prolonged intubation have a high risk of failing in the weaning process of the ventilator, even up to 25% of cases. This is because the disease has not been treated optimally, lack the strength of the respiratory muscles, the respiratory control center and the burden on the respiratory muscles is one of the causes of failure in the ventilator weaning process as in this case.<sup>1-5</sup>

Tracheostomy is an action that is often performed when there is failure in the process of weaning from the ventilator.<sup>9</sup> The advantages of tracheostomy compared to long-term endotracheal intubation include being able to increase patient comfort, oral hygiene, ability to communicate, the possibility of eating orally, reducing air resistance, reducing the use of sedation and analgesia and

prevent the risk of VAP (Ventilator Acquired Pneumonia).<sup>8-12</sup> In this case, tracheostomy was undergone after weaning failure and lead to favorable outcome.

However, making the decision for a tracheostomy is often difficult because it is uncomfortable and frightening for the patient and family. Additionally, some studies demonstrated an increase in mortality in tracheostomy especially in vulnerable populations. In addition, tracheostomy is also associated with serious complications such as increased bacterial colonization, tracheal stenosis and hemorrhage. Cosmetic and speech problems are also often an obstacle to doing this tracheostomy.<sup>9,13</sup>

The timing of tracheostomy in patients with prolonged intubation is still controversial. Hsu et aln 163 patients who underwent tracheostomy found that tracheostomy more than 3 weeks after intubation had higher mortality and weaning failure rates than before 3 weeks ( $r = 0.70$ ,  $p < 0.001$ ).<sup>9</sup> The old consensus suggested tracheostomy done after intubation for more than 21 days.<sup>14</sup> In this case, we performed a tracheostomy after 8 days of intubation. The timing of the tracheostomy that we performed was in accordance with some international surveys which state preferable timing for tracheostomy between 7 to 15 days postintubation.<sup>15-16</sup> According to the time, tracheostomy is classified as early and late tracheostomy. The cut off time for an early or late tracheostomy is 10 days.<sup>17-19</sup> Thus, the tracheostomy on day 8 that we performed was classified as early tracheostomy. Although there are other studies use cut off a 7-day post intubation.<sup>20</sup> According to a systematic review, using a shorter cut-off time (7 days) provides a more favorable outcome.<sup>21</sup>

In this case tracheostomy conducted on the 8th day and the outcome were favorable. The patient was stable after being transferred to the non-intensive ward. According to previous meta-analyses, early tracheostomy (7 days cut off) is associated with lower VAP, shorter ICU length of stay and lower mortality.<sup>22</sup> Similarly, the Cochrane analysis shows that early tracheostomy (10 days cut off) is associated with lower mortality rate, and higher probability of moving to a non-intensive care unit on day 28, but did not reduce the rate of pneumoniae.<sup>19</sup> Thus, an early tracheostomy is associated with a better outcome. However, the tracheostomy decision needs to be considered individually both from clinical aspects and other aspects such as family and patient acceptance.

### 4. Conclusion

In conclusion, tracheostomy is a viable procedure for managing weaning failure in patients with prolonged intubation. In this case, the tracheostomy led to a favorable outcome, with the patient in a stable condition postprocedure. These findings suggest that tracheostomy can be an effective strategy in similar cases. However, the decision to perform a tracheostomy should be made on a casebycase basis, considering the patients condition and the potential risks dan benefits. Further research is needed to establish guidelines for the optimal timing and procedure for tracheostomy in the context of weaning failure.

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