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NURSING CARE ANALYSIS IN A COVID-19 PATIENT WITH TRACHEOSTOMY IN THE INTENSIVE CARE UNIT: A CASE REPORT

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ABSTRACT

Background: The coronavirus disease (COVID-19) pandemic has posed significant challenges in critical care, particularly for patients with severe acute respiratory distress syndrome (ARDS), ventilator weaning failure, and septic shock requiring tracheostomy. **Case Presentation**: This report presents the clinical course and nursing management of Mrs. X, a COVID-19 patient who presented to the emergency department with severe dyspnea, hypoxia (SpO_2 69%), and tachypnea (30 breaths/min). Despite initial noninvasive ventilation (NIV), her condition deteriorated, requiring endotracheal intubation and intensive care unit (ICU) admission. She was diagnosed with moderate ARDS (P/F ratio: 146 mmHg) and ventilator weaning failure after 15 days, leading to tracheostomy. **Results:** Key nursing diagnoses included impaired spontaneous ventilation and impaired gas exchange. ICU nurses implemented comprehensive tracheostomy care, adhered to ventilator-associated pneumonia (VAP) prevention bundles, and performed continuous assessments to minimize infection risks. These interventions successfully prevented common tracheostomy-related complications such as ulcers and site infections. However, the patient developed septic shock and multiple organ dysfunction syndrome (MODS), ultimately resulting in death on the 27th day of admission. **Conclusion:** This case highlights the essential role of ICU nursing in managing complex COVID-19 patients with tracheostomy. Effective tracheostomy care, stringent infection control, and timely nursing interventions are crucial to optimizing patient outcomes. Nevertheless, the progression to septic shock underscores the challenges of managing critically ill patients with COVID-19.

Keywords: COVID-19, nursing care, critical care, ventilator weaning, tracheostomy, ARDS

BACKGROUND

Since late 2019, the emergence of a novel pneumonia in Wuhan, China, caused by severe acute respiratory syndrome Coronavirus-2 or SARS-CoV-2), has led to a global health crisis. The disease, named Coronavirus Disease 2019 (COVID-19), rapidly spreads worldwide, including in Indonesia, resulting in significant mortality (Bhimraj *et al*., 2020; Ghafoor *et al*., 2022).

SARS-CoV-2 primarily targets cells expressing Angiotensin-Converting Enzyme 2 (ACE-2) receptors, particularly type II pneumocytes in the lungs, which produce surfactants to maintain alveolar stability. Viral destruction of these cells reduces surfactant

levels, resulting in alveolar collapse and pneumonia (Alipoor *et al.,* 2020; Rodrigues *et al*., 2021). Pneumonia in COVID-19 patients can progress to acute respiratory distress syndrome (ARDS), characterized by severe respiratory failure requiring intensive care (Aslan *et al.,* 2021).

Severe cases of COVID-19 pneumonia frequently necessitate invasive mechanical ventilation, with many patients experiencing longer ventilation compared to non-COVID-19 ARDS (Bain *et al.,* 2021). Tracheostomy is often indicated in cases of weaning failure, offering benefits such as reduced sedation needs, improved secretion management, and decreased airway resistance. Studies report tracheostomy rates of 13–16% among COVID-19 ICU patients, highlighting its critical role in prolonged ventilatory support (Evrard *et al*., 2021; Farlow *et al*., 2021).

Tracheostomy may be considered for patients with ARDS who are anticipated to require prolonged mechanical ventilation. Tracheostomy offers numerous advantages, including improved patient comfort, reduced requirements for sedative and paralytic medications, and decreased dead space. Moreover, tracheostomy decreases airway resistance, thereby facilitating optimal tracheal secretion management while reducing the work of breathing (Mattioli *et al.,* 2020). One study reported 11 tracheostomies performed over two months in a tertiary care hospital for patients requiring prolonged ventilation. The procedures were performed after 10 days of intubation to facilitate weaning and optimize ICU capacity (Mishra *et al*., 2022).

This case study presents a complex patient journed in the ICU of a newly established university hospital that quickly became a referral center during the crisis. The case exemplifies the resilience of ICU nurses and the importance of multidisciplinary collaboration in delivering high-quality care under extraordinary circumstances. By documenting this representative case, we aim to highlight best practices in nursing care and interprofessional teamwork, offering valuable insights for enhancing critical care management in both crisis and routine settings.

METHOD

This single-case report was conducted following the principles outlined in the CARE (Case Report) guidelines to ensure accuracy, transparency, and reproducibility (Gagnier *et al.,* 2014). This case report analyses nursing care provided to a critically ill COVID-19 patient who underwent tracheostomy in the ICU. The data were collected retrospectively from the patient's medical records and supplemented with observations from the nursing team involved in the case.

The case occurred in the ICU of a university hospital equipped to manage severe COVID-19 cases requiring advanced respiratory support, including tracheostomy care. Data collection focused on the patient's clinical course, including demographic and clinical characteristics, ICU admission details and interventions, tracheostomy care, nursing interventions and care plans, and overall outcomes. The evaluation process incorporated both the patient's clinical parameters and family involvement through video call services, which helped maintain their connection and awareness of the patient's condition.

Nursing care was categorized according to NANDA-I (Ackley *et al*., 2021) and Indonesian nursing care framework (Kristina *et al.,* 2024) ensuring a structured approach to assess physical, psychological, and social aspects of care. Ethical approval was obtained from Universitas Indonesia hospital number 04/29/SI/RSUI/IV/2024. We obtained the patient's consent from a general consent when admitted to the ICU. Patient confidentiality

and data anonymity were strictly maintained throughout the study.

The nursing care interventions were analyzed qualitatively to identify best practices, challenges, and outcomes. The analysis was supported by a review of existing literature to contextualize the findings and explore implications for clinical practice.

1. Patient's Information

Mrs. X, a 55-year-old woman, was admitted to the Universitas Indonesia Hospital Emergency Department due to worsening dyspnoea. The patient presented with an elevated respiratory rate (RR) of 30 breaths/minute, oxygen saturation (SaO2) of 69%, blood pressure 166/94 (118) mmHg, heart rate (HR) indicating sinus tachycardia at 145 beats/minute, pyrexia (38.2 degrees Celsius), and a Glasgow Coma Scale (GCS) of E4V5M6.

Following 5 hours of oxygen therapy via Non-Rebreathing Mask (NRM) at 15 litters per minute and 9 hours of Non-Invasive Ventilation (NIV), the patient continued to exhibit dyspnoea (RR increased to 38 breaths/minute) with persistent signs of desaturation (SpO2 90-94%) and increased work of breathing (WOB).

Arterial blood gas (ABG) analysis revealed respiratory alkalosis with a partial pressure of oxygen to fraction of inspired oxygen (PaO2/FiO2-P/F) ratio of 146, indicative of moderate ARDS. Chest radiography demonstrated pneumonia in the right lung center and bilateral pericardial fields.

Additionally, reverse transcription polymerase chain reaction (RT-PCR) test confirmed a positive result for SARS-CoV-2. Consequently, due to the hypoxemic condition and to ensure airway protection, the patient underwent endotracheal intubation with a 7.5 mm endotracheal tube (ETT) and was connected to mechanical ventilation. Subsequently, the patient was admitted to a COVID-19 Intensive Care Unit (ICU) from August 13 to September 8, 2020, and succumbed to septic shock after 27 days of treatment.

2. Therapeutic Intervention

Nursing care of Mrs. X was provided according to NANDA-I and the Indonesian nursing diagnosis standards. The nursing team identified six actual nursing diagnoses: impaired spontaneous ventilation, impaired gas exchange, risk of ineffective renal perfusion, unstable blood glucose, impaired skin/tissue integrity, risk of infection, and risk of fall.

We focused on two major diagnoses of the patient's pulmonary condition in this study: impaired spontaneous ventilation due to respiratory muscle fatigue and impaired gas exchange due to ventilation perfusion imbalance. Impaired spontaneous ventilation had the characteristics of dyspnoea (RR up to 38 breaths/minutes), low SaO_2 (SpO2 90-94%), and use of accessory muscles or work of breathing (WOB). The purpose was after 7 days the intervention was given, the patient could have spontaneous ventilation by showing normal RR (12-24 breaths/minutes), PaO_2 (75-100 mmHg) and SaO_2 (95-100%), and no sign of WOB.

The nursing care plan included maintaining the airway patency; assessing the patient's RR, depth, and pattern, including the use of accessory muscles; assessing the patient's HR and blood pressure; monitoring SaO2; monitoring ventilator settings and the patient's response; giving a semi fowler or fowler positions; monitoring patient's sputum; and collaboration usage of bronchodilator (Ventolin inhalation). Mrs. X had re-intubated with ETT number 8.0 at 6 days of treatment to prevent mucus plug because she had a lot of mucus every time the nurses suctioned her ETT.

After 7 days Mrs. X still used a mechanical

ventilator with mode PSIMV PEEP 8, RR 12, PC 14, PS 12 FiO_2 65%. TV was normal 373-541 mL, MV 7.9-8.5 L, and PPeak 22-23. PaO2 was high from the normal range (126.50 mmHg), RR 15-22 breaths/minute, SpO_2 96-100%, and there was no sign of WOB. Her GCS was E1M4Vett with propofol 20 mg/hours and midazolam 1 mg/jam (iv). Blood pressure 118/62 (80) mmHg, HR 83-91 beats/minutes with norepinephrine 0.1 mcg/kg/minutes and dobutamine 1 mcg/kg/minutes.

On the 14th day, ventilator weaning remained unsuccessful, and a tracheostomy was planned. The procedure was performed on day 16 to facilitate prolonged ventilation, ease secretion evacuation, reduce infection risk, and prevent ventilator-associated pneumonia (VAP).

Impaired gas exchange had the characteristics of high/low pH and PCO_2, low PaO_2, and dyspnoea. The purpose was after 7x24 hours the intervention was given, the patient could show signs of improvement of ABG, chest x-ray, and sputum production. Mrs. X's ABG on 13rd August 2020 was respiratory alkalosis with pH 7.410, PaO_2 146.60 mmHg, PCO_2 25.40 mmHg, HCO_3 16.20 mmol/L, BE -6.20 mmol/L, SaO_2 98.40%. The chest X-ray showed pneumonia in the right lung center and bilateral pericardial fields, and there were no signs of pneumothorax, pneumomediastinum, or emphysema subcutis.

This nursing diagnosis plan monitored ABG values, chest x-ray, and sputum production. During treatment ABG, Mrs. X showed respiratory alkalosis up to metabolic acidosis with a fluctuated P/F ratio. Then, Mrs. X had 8 chest x-rays for diagnostic and procedure evaluation (such as post intubation, central venous central/CVC, and bronchoscopy).

The first x-ray showed pneumonia in the right lung center and bilateral pericardial fields. The pulmonary infiltrates persisted until the last time examination. There were no signs of pneumothorax, pneumomediastinum, or subcutaneous emphysema. Mrs. X's sputum production has varied since using ETT until tracheostomy. She had produced a lot of sputum, from whitish to yellowish sputum with thick consistency. From the patient's sputum, *Klebsiella pneumoniae* and *Chryseomonas luteola* was found.

3. Monitoring Results

Before ICU admission, echocardiography showed a left ventricular ejection fraction of 75% with normal right and left ventricles, but low systemic vascular resistance, indicating sepsis. D-dimer and urea/creatinine levels were elevated: 16.29 mg/L and 39/0.74 mg/dL (eGFR 91.5 mL/min/1.73 m2), respectively. On the initial day in the ICU, Mrs. X was placed on mechanical ventilation using the PCMV (pressure-controlled mandatory ventilation) mode with the following parameters: Positive End Expiratory Pressure (PEEP) 8, Pressure Control (PC) 12, RR 14, and FiO2 100%. Mrs. X exhibited a Glasgow Coma Scale (GCS) score of E2M4Vett while receiving intravenous sedation and analgesia (propofol 70 mg/hours, morphine 2 mg/hours, and midazolam 2 mg/hours).

Her hemodynamic status was relatively stable, with SpO2 100%, RR 15-16 breaths/minute, blood pressure 118/56 (82) mmHg, and HR 101 beats/minute, supported by continuous intravenous norepinephrine at 0.3 mcg/kg/minute. The patient had a fever, reaching 38.2 degrees Celsius, necessitating the administration of intravenous paracetamol 1 gram and antibiotics (ceftriaxone and levofloxacin), along with the application of tepid water sponging and a cooling blanket. As a COVID-19 patient, Mrs. X underwent daily ABG analysis to assess mechanical ventilation efficacy. The ABG's trend values indicated

respiratory alkalosis progressing to metabolic acidosis. Additionally, the patient's P/F ratio demonstrated improvement but remained variable (as illustrated in Figure 1).

On the 5th day, ventilator mode was changed to PSIMV: PEEP 8, PC 12, PS 12, RR 12, FiO_2 65%. Sedation was reduced (propofol 30 mg/hour, midazolam 1 mg/hour), and the patient began spontaneous breathing triggers. For 43 kg ideal body weight (60 kg weight and 150 cm tall) and 4-8 mL/kg tidal volume (VT) standard, the patient demonstrated a normal range of 526-643 mL, minute volume (MV) of 7.0-8.3 L, RR 13-15 breaths/minutes, SpO2 99-100%, and there were no signs of WOB) barotrauma, or volutrauma (PPeak 21). Ionotropic support (norepinephrine 0.1 mcg/kg/min and dobutamine 1 mcg/kg/min) maintained BP at 132/65 mmHg (MAP 87), HR 78 bpm.

Ventilator settings (shown in Table 1) exhibited an increasing trend, complicating the weaning process for the patient, despite administration of the complete COVID-19 protocol therapy, including oseltamivir, chloroquine, methylprednisolone, dexamethasone, and anticoagulant (shown in Table 2). Consequently, the patient required re-intubation 6 days after initial mechanical ventilation, followed by tracheostomy on the 16th day of treatment. On the 20th day of treatment, the patient underwent bronchoscopy for airway clearance, mucus plug prevention, and clinical examination.

During hospitalized, Mrs. X showed signs of sepsis due to COVID-19 infection which expressed with a high leukocyte (13430/μL), neutrophil (93.3%), c-reactive protein/CRP (98.4 mg/L) and procalcitonin (0.67 ng/mL). D-dimer value also was found high at 16.29 mg/L. On 14th August 2020, sputum culture showed there was no bacterial growth. But then *Klebsiella pneumoniae* was found on 21st August 2020 from the culture.

Antibiotics were escalated to meropenem and moxifloxacin. Nine days later, there was no bacterial growth from sputum culture. Another finding which came from bronchoscopy was no yeast cell growth, no tuberculosis bacteria, but *Chryseomonas luteola*. After the 19th day in the ICU, Mrs. X showed worsening condition. The temperature was extremely subfebrile up to febrile starting from 37 to 39 degrees Celsius.

Her hemodynamics also became unstable, GCS of E1M2Vett without sedation and analgesic medication, blood pressure 119/62 (85) mmHg and HR 109 beats/minutes with norepinephrine 0.27 mcg/kg/minutes (iv), SpO2 92-97%, RR 22-28 breaths/minutes, showed sign of WOB, and looks like gasping. After resuscitation, Mrs. X passed away at 01.38 AM on 8th September 2020.

DISCUSSION

Based on the clinical manifestation, the patient presented with moderate ARDS, sepsis and pneumonia that led to hypoxemia, impaired gas exchange and spontaneous ventilation failure. Mrs. X's condition could be classified as a critical condition based on the severity of COVID-19, because it showed ARDS and sepsis symptoms (World Health Organization, 2021). The Berlin Definition (2012) defined Mrs. X conditions by moderate to mild ARDS for P/F ratio 132-306 mmHg (Yoo *et al*., 2016).

Mrs. X presented with sepsis before ICU admission, evidenced by low systemic vascular resistance and elevated D-dimer and urea/creatinine levels. Echocardiography showed normal ventricular function with a left ventricular ejection fraction of 75%. In the ICU, Mrs. X required mechanical ventilation, intravenous sedation, and inotropic support. She developed a fever requiring antipyretic and antibiotic therapy. Her arterial blood gas (ABG) analyses indicated progression from respiratory alkalosis to metabolic acidosis,

reflecting her complex condition.

During her ICU stay, ventilator settings and sedation regimens were frequently adjusted. On the fifth day, she begun initiating spontaneous breaths but had persistent difficulty weaning. COVID-19 treatment protocols were implemented, and antibiotic regimens were escalated based on culture results showing *Klebsiella pneumoniae* and later *Chryseomonas luteola.* Despite re-intubation, tracheostomy, and bronchoscopy, her condition remained unstable due to ongoing sepsis and organ dysfunction.

By day 19, clinical deterioration was marked by febrile episodes, unstable hemodynamics, and increased respiratory effort. Despite maximal interventions, Mrs. X died on September 8, 2020. This case illustrates the challenges of managing critically ill COVID-19 patients and highlights the importance of meticulous nursing care and interdisciplinary collaboration. The following discussion addressed initial management and weaning challenges in the care of Covid-19 ARDS and tracheostomy considerations.

A. Initial Management

The initial management were carried out in accordance with the protocol, namely: Oxygen Therapy and Ventilation, Covid-19 Specific Therapy, Antimicrobial Management, Hemodynamic support, Sedation and Analgesia.

1. Oxygen Therapy and Ventilation

Patients with moderate-to-severe ARDS need a mechanical ventilator and have a poor prognosis (Tzotzos *et al.,* 2020). Upon arrival at the emergency department, Mrs. X was in critical condition, presenting with dyspnea, signs of WOB, desaturation, tachycardia, hypertension, and fever. Dyspnea resulted from hypoxemia due to impaired alveolar gas exchange. (Brosnahan *et al.,* 2020). Moreover, the terms of hypoxemia which can then lead to hypoxia can cause symptoms of tachycardia so that the body can meet the oxygen needs of the tissues (Bhutta, Alghoula, & Berim, 2022).

The appearance of fever in Mrs. X could result from the circulation of interleukins in the blood vessels that reach the hypothalamus which acts directly on neurons in hypothalamus and essential in the development of fever (Hoevenaar & Goossens, 2020). Patients got 15 L/min by NRM and change to NIV were ineffective in reversing hypoxemia. Hence, the transition to mechanical ventilation with PEEP of 8 and FiO2 of 100%, following ARDS guidelines to ensure lung-protective ventilation.

Mrs. X was on a ventilator using ETT for 16 days. We performed Ventilator-associated pneumonia (VAP) prevention during that time using VAP bundle. VAP is defined by the presence of pneumonia on a mechanical ventilator patient for more than 2 consecutive days on the date of event, with day of ventilator placement being day 1, and the ventilator was in place on the date of event or the day before (Khan *et al.,* 2019). There were several recommendations for VAP prevention. As a nurse we did prevention by performing early exercise and mobilization (performed passive range of motion to patient); elevating the head of the bed to 30-45 degree; changing the ventilator circuit as needed (closed suction and bacteria filter every 3 days); maintenance of endotracheal cuff pressure; and oral hygiene with chlorhexidine (Klompas *et al.,* 2014). However, unfortunately, we found *klebsiella pneumoniae* on the 9th day of treatment.

2. COVID-19 Specific Therapy

The pathophysiology of SARS-CoV-2 in ARDS is not yet fully understood; however, cytokine storm is considered one of the major contributing mechanisms (Aslan *et al.,* 2021). Cytokine storms is a term of systemic inflammatory response to infection and leads to excessive activation of immune cells, characterized by multiple organ dysfunction syndrome (MODS). Studies have reported elevated levels of pro-inflammatory cytokines, especially interleukin-6 (IL-6), in COVID-19 patients (Tang *et al.*, 2020).

In this case, IL-6 levels were not measured due to hospital policy. However, Mrs. X had elevated leukocyte and neutrophil counts, as well as high levels of CRP and procalcitonin. These laboratory findings are associated with increased mortality risk in COVID-19 patients (Keski, 2021; Xu *et al.,* 2020). Antiviral drugs (oseltamivir and chloroquine), corticosteroids (methylprednisolone and dexamethasone), and anticoagulants were administered to manage viral replication, inflammation, and COVID-19-associated coagulopathy (as evidenced by a D-dimer of 16.29 mg/L).

3. Antimicrobial Management

Clinical, radiographic, and microbiological criteria usually define VAP. These signs are neither sensitive nor specific relative to histopathology (Klompas *et al.,* 2014). Mrs. X was diagnosed with pneumonia due to viral COVID-19 infection since she was administered to the hospital. Thus, diagnosing VAP in COVID-19 patients can be challenging.

The clinical features of bacterial pneumonia, ARDS, and COVID-19-related pneumonia often overlap—manifesting as pulmonary infiltrates, impaired oxygenation, fever, and leukocyte abnormalities. In mechanically ventilated patients, airway colonization and positive cultures are common, which complicates differentiation between true VAP and bacterial colonization (Danin *et al.,* 2015; Prinzi *et al*., 2021). Clinically, this makes it very challenging to distinguish between genuine cases of VAP versus bacterial colonization alone superimposed on ARDS and actual bacterial superinfection (Fumagalli *et al.,* 2022). Hence, it should not be a surprise that the absolute rate of VAP during this pandemic has increased (Ryder & Kalil, 2022).

A study in January 2021 found COVID-19 patients were significantly more likely to develop VAP than patients without COVID (Maes *et al.,* 2021). A 2021 meta-analysis reported VAP incidence in COVID-19 patients ranging from 7.6% to 86%, with an average rate of 45.4% (Fumagalli *et al*., 2022). Mrs. X received empirical broad-spectrum antibiotics (ceftriaxone and levofloxacin) that were escalated to meropenem and moxifloxacin following the identification of *Klebsiella pneumoniae* in sputum culture

4. **Hemodynamic support**

Management of ARDS in COVID-19 patients requires a nuanced hemodynamic approach, including hemodynamic assessment, ventilator strategies, fluid management, vasopressor and inotropic therapy, and hemodynamic monitoring (Carrillo-Esper *et al.,* 2020; Tsolaki, Zakynthinos, & Makris 2020). From a nursing perspective, early recognition of hemodynamic instability is essential to maintain organ perfusion through appropriate fluid resuscitation and

vasopressor support.

Nurse should identify using clinical indicators such as: Hypotension with the Mean Arterial Pressure < 65 mmHg; sign of tissue hypoperfusion such as: cold extremities, capillary refill > 3 seconds, oliguria < 0.5 mL/kg/hour, or altered mental status, serum lactate levels > 2 mmol/L which indicates shock. Fluid resuscitation with Crystalloids were the first-line fluid for resuscitation. Recommended practice includes a conservative bolus of 250–500 mL over 30 minutes, with reassessment to prevent fluid overload (Dian & Faradita, 2024; Guarino *et al.,* 2023; Kimmoun *et al*., 2015).

When fluid resuscitation was insufficient, norepinephrine was used as the first-line vasopressor, followed by vasopressin when norepinephrine exceeded 0.3 mcg/kg/min. Hemodynamic monitoring included continuous arterial line measurements, central venous catheter (CVC) placement for CVP monitoring, and collaboration with physicians for non-invasive tools like echocardiography to assess cardiac function and volume status (Rali *et al.,* 2022).

5. **Sedation and Analgesia**

Sedation and analgesia are essential in the management of mechanically ventilated patients. According to the Society of Critical Care Medicine (SCCM) guidelines, patients with COVID-19-associated ARDS often require deep sedation and neuromuscular blockade early in their course (Alhazzani *et al.,* 2020). Patients often require higher levels of sedation because of increased ventilator asynchrony, dyspnea, anxiety and severe hypoxemia. Commonly used agents include propofol, midazolam, dexmedetomidine, and opioids (Karamchandani *et al.,* 2021). In this case, Mrs. X received propofol (70 mg/hour), morphine (2 mg/hour), and midazolam (2 mg/hour), with doses titrated based on her condition.

The ICU nurses role for mechanically ventilated patients who require sedation and analgesia is critical for ensuring patient comfort, safety, and positive outcomes. ICU nurse should doing pain and sedation continuous assessment and monitoring with some tools such as: Behavioral Pain Scale (BPS) or Critical-Care Pain Observation Tool (CPOT), assess the level of sedation using Richmond Agitation-Sedation Scale (RASS) or Sedation-Agitation Scale (SAS), monitor for signs of oversedation and undersedation, assess for delirium (Alnajar *et al.,* 2021; Bardwell, Brimmer, & Davis 2020).

ICU nurses' role also to implement sedation and analgesia protocols such as, using light sedation strategies, adjust doses of sedation based on continuous assessment and maintain sedation levels according to goals set by multidisciplinary team in the ICU.

B. Weaning Challenges

Mrs. X failed to wean from mechanical ventilation. During treatment, Mrs. X never tried spontaneous mode in the ventilator, but it was stagnant in PSIMV mode. The patient's PEEP was still high even until the 15th day of treatment, which was 7-10 cmH2O. The same thing was also seen in FiO2 which was in the range of 55-75%.

According to the National Institutes of Health (NIH) and the National Heart, Lung, and Blood Institute (NHLBI), ARDS management involves adjusting PEEP and FiO_2 settings according to clinical guidelines (Shah *et al.,* 2021). However, Mrs. X did not meet criteria

for extubation (Zhang *et al.,* 2020). She also showed inadequate respiratory work, persistent unconsciousness, and had adrenaline therapy to support the blood pressure and heart rate. P/F ratio was not stable above 200 mmHg. As a result, re-intubation was performed on the 6th day of treatment.

Following re-intubation, Mrs. X could not be weaned from the ventilator, leading to a tracheostomy on the 16th treatment day. Tracheostomy in COVID-19 patients poses a dilemma: it aids ventilator weaning but risks viral transmission during the aerosolizing procedure. Studies indicate that 21 days after symptom onset, most patients cease viral shedding, although viral detection may not accurately reflect infection potential (Vena *et al.,* 2021).

Some patients may require earlier tracheostomy for secretion clearance or sedation weaning (Chao *et al.,* 2020). Early tracheostomy is linked to faster ICU discharge (Staibano *et al.,* 2021). Chao *et al.* (2020) reported that among 53 patients who underwent tracheostomy, 30 were ventilator-free, 16 discharged alive, 7 decannulated, and 6 died. Another study found that tracheostomy within 14 days of intubation shortened ventilation duration. Despite similar APACHE-II scores, 30-day survival was higher in tracheostomized patients compared to non-tracheostomized patients (Breik *et al.*, 2020).

Tracheostomy was performed using open surgical tracheostomy with a number 8.0 tube. Chao *et al.* (2020) recommended open surgical over percutaneous dilatational tracheostomy (PDT) to reduce aerosolization. Safety guidelines include using appropriate PPE, limiting personnel, and performing procedures in negative pressure rooms (Chao *et al.,* 2020).

Mrs. X used a cuffed and fenestrated tracheostomy. The cuff should be inflated to 20-30 cmH2O (15-22 mmHg) to provide positive-pressure ventilation and prevent aspiration; low pressure increases silent aspiration risk, while high pressure risks tracheal wall injury. Fenestrated tracheostomy allows breathing through the fenestration and around the tube when the inner cannula is removed. With speaking valves, patients can perform speaking exercises (which is possible once extubated from the mechanical ventilator.

Following Mrs. X's tracheostomy, we continued VAP prevention with a VAP bundle and added tracheostomy care. The VAP bundle was fully implemented while she used the ETT. Tracheostomy care involved four main areas: inner cannula observation, suctioning, cuff pressure maintenance, and stoma care (Farlow *et al.,* 2021; Imo, 2020). Mrs. X's tracheostomy had inner cannulas that were removed, inspected, and cleaned every 4 hours with a brush from the tracheostomy box.

Sterile cotton swabs or gauze soaked in sterile saline were used to clean the inner cannula, stoma, external cannula, and tracheostomy flange. The peristoma area was cleaned from inside out and dried with sterile gauze to prevent skin damage. Deep suctioning was performed using a closed suction system as needed, but at least every 4 hours, and we monitored the characteristics of her mucus (Blakeley, 2020; Parker, 2014).

We changed the tracheostomy strap when wet or dirty, ensuring one person held the tube while another exchanged the strap. The skin under the old ties was assessed, and the new strap was secured, allowing only one finger to fit between the strap and neck (Everitt, 2016; Morris *et al.,* 2016; Parker, 2014). Cuff pressure was checked at least once per shift following best practices.

O'Toole *et al.* (2017) proposed a tracheostomy stoma care bundle: (1) hydrocolloid dressing under the tracheostomy flange postoperatively, (2) removal of plate

sutures within 7 days, (3) polyurethane foam dressing after suture removal, and (4) neutral head positioning. This resulted in reduced pressure ulcers, with significant differences noted in Chi-square analysis.

Based on our hospital policy, gauze dressings were used for all tracheostomy patients at the time. For Mrs. X, whose mucus production was high, the gauze was changed every 6 hours. Despite not using hydrocolloid dressings initially, Mrs. X did not develop pressure ulcers. Since 2021, we have adopted hydrocolloid dressings as primary dressings with gauze as secondary. This combination has better protected the stoma area, with gauze being changed when full of mucus, and hydrocolloid being replaced when dirty or every 3 days (Dixon *et al.*, 2018; Yue *et al.,* 2019).

Ahmadinegad *et al.* (2014) compared foam and gauze dressings in 80 tracheostomy patients, reporting no significant difference in infection rates, although Gram-negative bacteria (e.g., *Acinetobacter*) were more common in gauze groups, and Gram-positive (e.g., *S. epidermidis*) in foam groups. A meta-analysis found that moist dressings (e.g., foam, hydrocolloid, Mepilex Ag, transparent film, hydrogel) reduced tracheostomy site infections and pressure ulcers and required fewer dressing changes than gauze (Yue *et al.,* 2019).

In ICU patients, sutures were not removed within 7 days post-tracheostomy to prevent cannula dislodgement, with sutures removed upon discharge. Ideally, the stoma matures by the 7th day (Hashimoto *et al.*, 2021). Patients were positioned with the head neutral and the bed elevated 30-45 degrees. Mrs. X had no tracheostomy ulcers or site infections post-care but died 12 days after the procedure due to a poor COVID-19 prognosis, ARDS, sepsis, and likely cytokine storms leading to MODS.

This nursing care analysis shows how ICU nurses took care of the patients, especially in ICU isolation for covid 19. This case report is reporting the nursing care in mechanical ventilated and tracheostomy. Nurses should do the assessment regarding airway clearance and patency, breathing patterns and its risk of disruptions, circulation and hemodynamic parameters, disabilities, exposures, nutrition, sedation scale, pain scale, and all objectives indicators that present from the patient.

Additionally, nurse should analyse all the data regarding to ensuring the quality of nursing care by make the nursing diagnosis and its nursing care plans. Thirdly, in this report also showing the implementation of how nurses work by make a nursing care plan and implemented to the patients. Lastly, Nurse has important role to patients changes by delivering a best practice in nursing care, such as in this report, showing the best practice of ventilator care and tracheostomy care.

There was a limitation of this study. Due to COVID-19 pandemic, some restrictions were existing in the ICU care. Such as, there were a rapid change in hospital policy that also influencing a nursing care to the patients. However, we are still focusing on patient and staff safety to give the best care to the patients.

PATIENTS' PERSPECTIVE

Due to tracheostomy and mechanical ventilated, we took the patient's perspectives from non-verbal communications. A common non-verbal behaviour observed among Mrs. X is the use of hand gestures to indicate discomfort or the need for suctioning. For example, patient may point to their throat or gesticulate toward their ventilator equipment when they experience excessive secretions or feel the need for airway clearance. Grimacing or furrowing of the brows often signals pain or distress, while a relaxed facial expression may indicate comfort or satisfaction with care.

The inability to speak can contribute to feelings of isolation and frustration, making it imperative for healthcare providers to prioritize patient-centred communication. Simple interventions, such as maintaining eye contact, acknowledging non-verbal cues, and responding promptly, can enhance the patient's sense of agency and reduce anxiety. Understanding the patient's gestures and non-verbal communication is crucial for tailoring care to their individual needs and fostering a supportive therapeutic relationship.

CONCLUSION

Nurses play a vital role in the care of tracheostomy patients. In the ICU, nurses are responsible for monitoring oxygen requirements, assessing readiness for tracheostomy in patients unable to wean from ventilation after 7 to 14 days, and preventing ICU-acquired infections such as VAP through the implementation of VAP bundles. Nurses also carry out comprehensive tracheostomy care, which includes inner cannula management, suctioning, cuff pressure monitoring, and stoma care. In this case, diligent nursing interventions successfully prevented tracheostomy-related ulcers and site infections. However, despite these efforts, the patient succumbed to septic shock that progressed to MODS by day 27 of treatment. This case highlights the critical role of ICU nurses in ensuring high-quality care and underscores the complex challenges faced in managing critically ill COVID-19 patients.

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REFERENCES

Ackley, B. J., Ladwig, G. B., Makic, M. B. F., Martinez-Kratz, M. R., & Zanotti, M. (2021). *Nursing Diagnosis Handbook, 12th Edition Revised Reprint with 2021-2023 NANDA-I® Updates - E-Book*. St. Louis, Missouri: Mosby.

Ahmadinegad, M., Lashkarizadeh, M. R., Ghahreman, M., Shabani, M., Mokhtare, M., & Ahmadipour, M. (2014). Efficacy of Dressing with Absorbent Foam versus Dressing with Gauze in Prevention of Tracheostomy Site Infection. *Tanaffos, 13*(2), 13-19.

Alhazzani, W., Møller, M. H., Arabi, Y. M., Loeb, M., Gong, M. N., Fan, E., ... & Rhodes, A. (2020). Surviving Sepsis Campaign: guidelines on the management of critically ill adults with Coronavirus Disease 2019 (COVID-19). *Intensive Care Medicine, 46*, 854-887.

Alipoor, S. D., Jamaati, H., Tabarsi, P., & Mortaz, E. (2020). Immunopathogenesis of Pneumonia in COVID-19. *Tanaffos, 19*(2), 79-82.

Alnajar, M. K., Shudifat, R., Mosleh, S. M., Ismaile, S., N'Erat, M., & Amro, K. (2021). Pain Assessment and Management in Intensive Care Unit: Nurses' Practices, Perceived Influencing Factors, and Educational Needs. *The Open Nursing Journal, 15*, 170-178. https://doi.org/https://doi.org/10.2174/1874434602115010170

Aslan, A., Aslan, C., Zolbanin, N. M., Jafari, R. (2021). Acute respiratory distress syndrome in COVID-19: possible mechanisms and therapeutic management. *Pneumonia (Nathan), 13*(1), 14.

Bardwell, J., Brimmer, S., & Davis, W. (2020). Implementing the ABCDE Bundle, Critical-Care Pain Observation Tool, and Richmond Agitation-Sedation

Scale to Reduce Ventilation Time. *AACN advanced critical care, 31*(1), 16-21. https://doi.org/10.4037/aacnacc2020451

Bhimraj, A., Morgan, R. L., Shumaker, A. H., Lavergne, V., Baden, L., Cheng, V. C. C., …, & Falck-Ytter, Y. (2020). Infectious Diseases Society of America Guidelines on the Treatment and Management of Patients with COVID-19. *Clinical infectious diseases: an official publication of the Infectious Diseases Society of America*, ciaa478.

Bain, W., Yang, H., Shah, F. A., Suber, T., Drohan, C., Al-Yousif, N., …, & Kitsios, G. D. (2021). COVID-19 versus non-COVID-19 acute respiratory distress syndrome: Comparison of demographics, physiologic parameters, inflammatory biomarkers, and clinical outcomes. *Annals of the American Thoracic Society, 18*(7), 1202-1210.

Bhutta, B. S., Alghoula, F., Berim, I. (2022). *Hypoxia*. Retrieved from: https://www.ncbi.nlm.nih.gov/books/NBK482316/

Blakeley, S. *Tracheostomy care in critical care*. Retrieved from: https://www.portsmouthicu.com/resources/2017-06-30-TracheCare(2017).pdf

Breik, O., Nankivell, P., Sharma, N., Bangash, M. N., Dawson, C., Idle, M., ... & Tasker, L. (2020). Safety and 30-day outcomes of tracheostomy for COVID-19: a prospective observational cohort study. *British Journal of Anaesthesia*, *125*(6), 872-879.

Brosnahan, S. B., Jonkman, A. H., Kugler, M. C., Munger, J. S., & Kaufman, D. A. (2020). COVID-19 and respiratory system disorders: Current knowledge, future clinical and translational research questions. *Arteriosclerosis, thrombosis, and vascular biology, 40*(11), 2586-2597.

Carrillo-Esper, R., Mejia-Gomez, L., Monares-Zepeda, E., Chavarria-Martinez, U., Diaz-Carrillo, A., Ayala-Leon, M., ... & Perez-Calatayud, A. A. (2020). Hemodynamic and mechanical ventilation approach in patients with COVID-19. *Cirugía y cirujanos*, *88*(6), 805-817.

Chao, T. N., Harbison, S. P., Braslow, B. M., Hutchinson, C. T., Rajasekaran, K., Go, B. C., ... & Rassekh, C. H. (2020). Outcomes after tracheostomy in COVID-19 patients. *Annals of surgery*, *272*(3), e181-e186.

Danin, P. E., Girou, E., Legrand, P., Louis, B., Fodil, R., Christov, C., Devaquet, J., Isabey, D., & Brochard, L. (2015, Jan). Description and microbiology of endotracheal tube biofilm in mechanically ventilated subjects. *Respir Care, 60*(1), 21-29. https://doi.org/10.4187/respcare.02722

Dian, R., & Faradita, A. D. (2024). One-hour sepsis bundle in patients with sepsis shock: A case report of nursing care implementation. *The Journal of Palembang Nursing Studies, 3*(2), 109-116.

Dixon, L. M., Mascioli, S., Mixell, J. H., Gillin, T., Upchurch, C. N., & Bradley, K. M. (2018). Reducing tracheostomy-related pressure injuries. *AACN advanced critical care, 29*(4), 426-431.

Everitt, E. (2016). Caring for patients with a tracheostomy. *Nurs Times, 112*(19), 16-20.

Evrard., D., Jurcisin, I., Assadi, M., Patrier, J., Tafani, V., Ullmann, N., …, & Rozencwajg, S. (2021). Tracheostomy in COVID-19 acute respiratory distress syndrome patients and follow-up: A parisian bicentric retrospective cohort. *PLoS One, 16*(12), e0261024.

Farlow, J. L., Park, P. K., Sjoding, M. W., Kay, S. G., Blank, R., Malloy, K., M., …, &

De Cardenas, J. (2021). Tracheostomy for COVID-19 respiratory failure: Timing, ventilatory characteristics, and outcomes. *J Thorac Dis, 13*(7), 4137-4145.

Fumagalli, J., Panigada, M., Klompas, M., Berra, L. (2022). Ventilator-associated pneumonia among SARS-CoV-2 acute respiratory distress syndrome patients. *Current opinion in critical care, 28*(1), 74-82.

Gagnier, J. J., Kienle, G., Altman, D. G., Moher, D., Sox, H., & Riley, D. (2014, Jan). The CARE guidelines: consensus-based clinical case report guideline development. *J Clin Epidemiol, 67*(1), 46-51. https://doi.org/10.1016/j.jclinepi.2013.08.003

Ghafoor, H., Abdus Samad, A., Bel Khair, A. O. M., Ahmed, O., & Khan, M. N. A. (2022). Critical Care Management of Severe COVID-19 in Pregnant Patients. *Cureus*, *14*(5), e24885. https://doi.org/10.7759/cureus.24885

Guarino, M., Perna, B., Cesaro, A. E., Maritati, M., Spampinato, M. D., Contini, C., & De Giorgio, R. (2023). 2023 Update on Sepsis and Septic Shock in Adult Patients: Management in the Emergency Department. *J Clin Med, 12*(9), 3188. https://doi.org/10.3390/jcm12093188

Hashimoto, D. A., Axtell, A. L., & Auchincloss, H. G. (2021, 2021/02//). Percutaneous Tracheostomy. *The New England journal of medicine, 384*(8), 780-781. https://doi.org/10.1056/nejmc2035339

Hess, D. R., & Altobelli, N. P. (2014). Tracheostomy Tubes. *Respiratory Care*, *59*(6), 956-971.

Hoevenaar, M., & Goossens, D. (2020). *Fever & COVID-19-Complications*. https://doi.org/10.13140/RG.2.2.34099.17445/2

Imo, I. C. (2020). *Improving Ventilator Acquired Pneumonia Bundle Compliance in Mechanically Ventilated Patients in an Intensive Care Unit* [Doctoral Dissertation]. Grand Canyon University, Arizona, United States. https://www.proquest.com/dissertations-theses/improving-ventilator-acquired-pneumonia-bundle/docview/2445584941/se-2?accountid=17242

Karamchandani, K., Dalal, R., Patel, J., Modgil, P., & Quintili, A. (2021). Challenges in sedation management in critically ill patients with COVID-19: a brief review. *Current Anesthesiology Reports*, *11*, 107-115.

Keski, H. (2021). Hematological and inflammatory parameters to predict the prognosis in COVID-19. *Indian Journal of Hematology and Blood Transfusion, 37*(4), 534-542.

Khan, R. M., Al-Juaid, M., Al-Mutairi, H., Bibin, G., Alchin, J., Matroud, A., Burrows, V., Tan, I., Zayer, S., Naidv, B., Kalantan, B., & Arabi, Y. M. (2019). Implementing the comprehensive unit-based safety program model to improve the management of mechanically ventilated patients in Saudi Arabia. *American Journal of Infection Control, 47*(1), 51-58. https://doi.org/https://doi.org/10.1016/j.ajic.2018.06.022

Kimmoun, A., Novy, E., Auchet, T., Ducrocq, N., & Levy, B. (2015, Apr 9). Hemodynamic consequences of severe lactic acidosis in shock states: from bench to bedside. *Crit Care, 19*(1), 175. https://doi.org/10.1186/s13054-015-0896-7

Klompas, M., Branson, R., Eichenwald, E. C., Greene, L. R., Howell, M. D., Lee, G., …, & Berenholtz, S. M. (2014). Strategies to prevent ventilator-associated pneumonia in acute care hospitals: 2014 update. *Infection Control & Hospital Epidemiology,*

35(8), 915-936.

Kristina, K., Sasmito, P., Bawa, N. N. R., Azizah, L. N., Suratmiti, N. N., Sari, N. M. S., Muhalla, H. I., Surasta, I. W., & Sari, P. M. P. (2024). *Buku Ajar Asuhan Keperawatan Medikal Bedah: Menggunakan SDKI, SIKI, SLKI*. Jambi: Sonpedia Publishing Indonesia.

Maes, M., Higginson, E., Pereira-Dias, J., Curran, M. D., Parmar, S., Khokhar, F., …, & Morris, A. C. (2021). Ventilator-associated pneumonia in critically ill patients with COVID-19. *Crit Care, 25*(1), 25.

Mattioli, F., Fermi, M., Ghirelli, M., Molteni, G., Sgarbi, N., Bertellini, E., …, & Marudi, A. (2020). Tracheostomy in the COVID-19 pandemic. *European archives of oto-Rhino-Laryngology, 277*, 2133-2135.

Mishra, P., Jedge, P., Kaushik, M., Artham, P., & Kumari, S. (2022). Our experience of tracheostomy in COVID-19 patients. *Indian Journal of Otolaryngology and Head & Neck Surgery, 74*, 1-4.

Morris, P. E., Berry, M. J., Files, D. C., Thompson, J. C., Hauser, J., Flores, L., …, Young, M. P. (2016). Standardized rehabilitation and hospital length of stay among patients with acute respiratory failure: A randomized clinical trial. *JAMA, 315*(24), 2694-2702.

O'Toole, T. R., Jacobs, N., Hondorp, B., Crawford, L., Boudreau, L. R., Jeffe, J., …, & LoSavio, P. (2017). Prevention of tracheostomy-related hospital-acquired pressure ulcers. *Otolaryngology–Head and Neck Surgery, 156*(4), 642-651.

Parker, L. C. (2014). Tracheostomy care. *Nursing2020 Critical Care*, *9*(6), 38-41.

Prinzi, A., Parker, S. K., Thurm, C., Birkholz, M., & Sick-Samuels, A. (2021). Association of Endotracheal Aspirate Culture Variability and Antibiotic Use in Mechanically Ventilated Pediatric Patients. *JAMA Network Open, 4*(12), e2140378-e2140378. https://doi.org/10.1001/jamanetworkopen.2021.40378

Rali, A. S., Butcher, A., Tedford, R. J., Sinha, S., Mekki, P., Spall, H. V., & Sauer, A. J. (2022). Contemporary Review of Hemodynamic Monitoring in the Critical Care Setting. *US Cardiology Review 2022;16:e12.* https://doi.org/10.15420/usc.2021.34

Rodrigues, S. O., Cunha, C. M. C. D., Soares, G. M. V., Silva, P. L., Silva, A. R., & Gonçalves-de-Albuquerque, C. F. (2021). Mechanisms, Pathophysiology and Currently Proposed Treatments of Chronic Obstructive Pulmonary Disease. *Pharmaceuticals (Basel, Switzerland)*, *14*(10), 979.

Ryder, J. H., & Kalil, A. C. (2022). The puzzles of ventilator-associated pneumonia and COVID-19: Absolute knowns and relative unknowns. *Critical Care Medicine, 50*(5), 894-896.

Shah, F. A., Meyer, N. J., Angus, D. C., Awdish, R., Azoulay, É., Calfee, C. S., Clermont, G., Gordon, A. C., Kwizera, A., & Leligdowicz, A. (2021). A research agenda for precision medicine in sepsis and acute respiratory distress syndrome: an official American Thoracic Society research statement. *American journal of respiratory and critical care medicine, 204*(8), 891-901.

Staibano, P., Levin, M., McHugh, T., Gupta, M., & Sommer, D. D. (2021). Association of tracheostomy with outcomes in patients with COVID-19 and SARS-CoV-2 transmission among health care professionals: a systematic review and meta-analysis. *JAMA Otolaryngology–Head & Neck Surgery*, *147*(7), 646-655

Tang, Y., Liu, J., Zhang, D., Xu, Z., Ji, J., Wen, C. (2020). *Front Immunol, 11*, 1708.

Tsolaki, V., Zakynthinos, G. E., & Makris, D. (2020). The ARDSnet protocol may be detrimental in COVID-19. *Critical Care, 24*(1), 351.

Tzotzos, S. J., Fischer, B., Fischer, H., & Zeitlinger, M. (2020). Incidence of ARDS and outcomes in hospitalized patients with COVID-19: A global literature survey. *Critical Care, 24*, 1-4.

Vena, A., Taramasso, L., Di Biagio, A., Mikulska, M., Dentone, C., De Maria, A., …, & group, G. s. (2021). Prevalence and Clinical Significance of Persistent Viral Shedding in Hospitalized Adult Patients with SARS-CoV-2 Infection: A Prospective Observational Study. *Infectious Diseases and Therapy, 10*(1), 387-398. https://doi.org/10.1007/s40121-020-00381-8

World Health Organization. (2021). Care of COVID-19 patients after acute illness (new chapter). In *Clinical Management of COVID-19: Living guidance,* 60-61. Retrieved from http://www.jstor.org/stable/resrep30113.28

Xu, J. B., Xu, C., Zhang, R. B., Wu, M., Pan, C. K., Li, X. J., …, & Zhu, S. (2020). Associations of procalcitonin, C-reaction protein and neutrophil-to-lymphocyte ratio with mortality in hospitalized COVID-19 patients in China. *Scientific reports, 10*(1), 15058.

Yue, M., Lei, M., Liu, Y., & Gui, N. (2019). The application of moist dressings in wound care for tracheostomy patients: A meta-analysis. *Journal of Clinical Nursing*, *28*(15-16), 2724-2731.

Yoo, E. J., Edwards, J. D., Dean, M. L., & Dudley, R. A. (2016, Jun). Multidisciplinary Critical Care and Intensivist Staffing: Results of a Statewide Survey and Association With Mortality. *J Intensive Care Med, 31*(5), 325-332. https://doi.org/10.1177/0885066614534605

Zhang, J., He, X., Hu, J., & Li, T. (2020). Failure of early extubation among cases of coronavirus disease-19 respiratory failure: case report and clinical experience. *Medicine, 99*(27), e20843.

Table 1. Ventilator setting (27 days)

Day	Ventilator Mode	PEEP	PC	PS	RR	FiO2 (%)
1	PCMV	8	12	N/A	14	100
2	PCMV	7	11	N/A	12	70
3	PCMV	7	11	N/A	12	65
4	PCMV	7	11	N/A	12	65
5	PSIMV	8	12	12	12	65
6	PSIMV	8	12	12	12	65
7	PSIMV	8	14	12	12	65
8	PSIMV	8	14	12	12	65
9	PSIMV	8	14	12	12	65
10	PSIMV	8	14	12	8	55
11	PSIMV	8	14	12	8	55
12	PSIMV	10	14	12	6	60
13	PSIMV	10	10	12	10	60
14	PSIMV	10	10	12	10	60
15	PSIMV	10	10	12	10	55
16	PSIMV	10	10	10	12	70
17	PSIMV	10	10	10	12	65
18	PSIMV	10	10	10	12	50
19	PSIMV	10	10	10	12	50
20	PSIMV	10	10	10	14	70
21	PSIMV	10	10	10	14	55
22	PSIMV	10	10	10	12	50
23	PSIMV	10	10	10	12	50
24	PSIMV	10	13	13	10	45
25	PSIMV	10	13	13	10	45
26	PSIMV	10	13	13	12	60
27	PSIMV	10	13	13	12	60

Figure 1. Patient's P/F ratio by length of intubated in ICU (26 days)

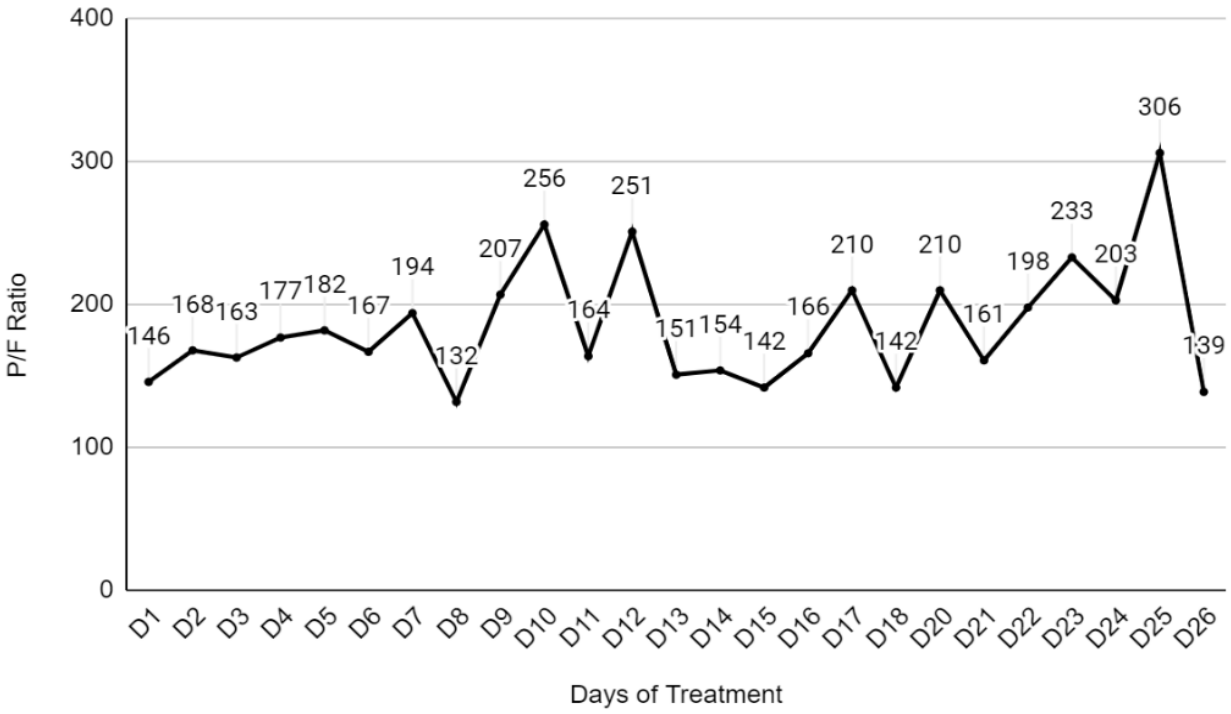

Table 2. Mrs. X's summary of medication and procedure (27 days) year 2021

Date		Aug-21																				Sep-21							
Day of Treatments (ICU Days)		12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	1	2	3	4	5	6	7	8
		0 (ER)	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27
Medication	Antibiotic	Ceftriaxone 2x2gr IV																											
	Antibiotic	Levofloxacin 1x750mg IV																											
	Antibiotic									Fluconazole 1x400mg IV																			
	Antibiotic											Meropenem 3x1gr																	
	Antibiotic											Moxifloxacin 1x400mg																	
	Anti-inflamation	Metyl Prednisolone 1x125mg IV																											
	Anti-inflamation								Dexamethasone 1x5mg IV																				
	Anti-viral					Oseltamivir 2x75 mg PO																							
	Anti-viral					Chloroquine 2x250 mg PO																							
Procedures	Endotracheal Tube (ETT)	1st						2nd (Re-intubation)																					
	Tracheostomy																	On Tracheostomy											
	Bronchoscopy																												

Notes	
	Antibiotic
	Anti-inflamation
	Anti-viral
	Procedures