Post-print of a Nursing Care Case Report: Successful Weaning and Extubation in a Critically Ill Patient with Refractory Laryngeal Edema on Mechanical Ventilation

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Abstract

This report summarizes the nursing care of a critically ill patient with refractory laryngeal edema who required continuous mechanical ventilation and was successfully weaned and extubated. An emergency response plan and protocol for weaning and extubation in refractory laryngeal edema was developed, with active and accurate implementation of comprehensive nursing measures, close monitoring of changes in the patient' s condition, and meticulous management of artificial airway and mechanical ventilation, medication nursing care, nutritional support, basic nursing care, and health education. Through personalized medical and nursing interventions, the patient ultimately achieved successful ventilator weaning and extubation, and was discharged following recovery.

Full Text

Preamble

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Case Report: Successful Weaning and Extubation of a Critically Ill Patient with Refractory Laryngeal Edema Requiring Mechanical Ventilation

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Abstract

This case report summarizes the nursing care of a critically ill patient with refractory laryngeal edema who required continuous mechanical ventilation and ultimately achieved successful weaning and extubation. By developing an emergency protocol and workflow for extubation in refractory laryngeal edema, implementing nursing measures actively and accurately, closely monitoring changes in the patient' s condition, and providing comprehensive care including artificial airway management, medication administration, nutritional support, basic nursing, and health education, the patient successfully weaned from mechanical ventilation and was extubated following personalized medical and nursing interventions.

Keywords: refractory laryngeal edema; mechanical ventilation; successful weaning and extubation; nursing care

Laryngeal edema refers to the infiltration of fluid into the submucosal tissue of the laryngeal lax area. It is a common complication following tracheal intubation, characterized by acute onset and rapid progression. Patients typically develop stridor, hoarseness, dyspnea, and even asphyxia within minutes or hours, which can be life-threatening if not managed properly or in a timely manner. Establishing an effective airway is a crucial life-saving measure [**?**]. The Coronary Care Unit of Beijing Hepingli Hospital admitted a patient with acute pancreatitis complicated by refractory laryngeal edema on February 9, 2021. Through personalized medical and nursing interventions, the patient successfully weaned from mechanical ventilation, was extubated, and discharged. The nursing experience is summarized herein.

2.1 General Information

The patient, Liu 某某, female, 81 years old, married, was admitted to the general surgery department on February 9, 2021, with a chief complaint of abdominal pain for three days. She had a history of hypertension for over ten years and was diagnosed with acute pancreatitis, gastrointestinal bleeding, pulmonary infection, cholecystitis, respiratory failure, pulmonary encephalopathy, hypoalbuminemia, gallstones, pleural effusion, and abnormal liver function one month prior. On admission, physical examination revealed comatose consciousness and rapid breathing: temperature 37°C, pulse 76 beats/min, respiratory rate 28 breaths/min, blood pressure 85/50 mmHg. The aspiration/asphyxiation risk assessment score was points (15-20 points indicates severe risk).

2.2 Transfer to ICU

On February 19, the patient developed type 2 respiratory failure due to aspiration and was transferred to the ICU on February 20. Arterial blood gas analysis showed pH 7.31, PCO_2 91 mmHg, PO_2 43 mmHg, and SaO_2 80.1%. Trypsinogen was positive, and serum amylase was 48 U/L. Abdominal ultrasound revealed

multiple low-density lesions in the neck and body of the pancreas, suggesting pancreatitis. On February 20, the patient' s condition deteriorated, and she was transferred to the ICU for further treatment with a diagnosis of acute pancreatitis. Upon admission, she was comatose with obvious dyspnea and productive cough. Venturi mask oxygen therapy and intravenous respiratory stimulants were administered. Two and a half hours later, oxygen saturation dropped to 76%, prompting emergency endotracheal intubation. Laryngoscopy revealed laryngeal edema, but the artificial airway was successfully established. The endotracheal tube was positioned 22 cm from the incisors, with the cuff inflated without leakage (30 cmH_2O). Mechanical ventilation was initiated in IPPV mode with a respiratory rate of 16 breaths/min, tidal volume 400 ml, FiO_2 100%, and PEEP 3 cmH_2O, with the ventilator functioning normally. From February 27 to March 9, 2021, targeted treatments including anti-inflammatory therapy, cough relief and bronchodilation, acid suppression, fluid resuscitation, and fasting were provided. A weaning and extubation plan was developed, and personalized medical and nursing interventions were implemented concurrently with the emergency protocol for extubation in refractory laryngeal edema, which resolved the patient' s ineffective airway clearance and impaired gas exchange due to laryngeal edema.

3.1 Environment Requirements

A clean and comfortable environment was maintained, with the ward kept tidy and air fresh through regular ventilation. Temperature was maintained at 18-22°C and humidity at 50-60%, with attention to keeping the patient warm.

3.2.1 Medication Nursing

Vital signs were closely monitored during medication administration, with careful observation of post-medication responses. When administering theophylline drugs, infusion rate was strictly controlled and patients were observed for arrhythmias and other adverse events. Antitussive, bronchodilator, and mucolytic agents were administered intravenously to relieve dyspnea, and anti-infective therapy was provided intravenously.

3.2.2 Pain Nursing

Pain scores were assessed, and the nature and location of pain were observed, particularly abdominal pain symptoms, with pharmacological treatment provided [**?**]. The patient' s bowel movements and flatus were monitored. A quiet, comfortable, and softly lit environment was provided to avoid environmental stimuli.

3.3.1 Ventilation Effect Observation

First, the ventilator's performance and working status were effectively evaluated, with mastery of ventilation modes, operating principles, operation procedures, and familiarity with respiratory parameters and alarm ranges [**?**]. Second, airway patency was observed, foreign bodies in the trachea were checked for, and respiratory and oral-nasal secretions were thoroughly cleared. The color, nature, and amount of vomitus and sputum were observed and accurately recorded. Third, ventilation parameters were closely monitored. When ventilator alarms occurred, causes were identified and parameters adjusted to achieve coordination and avoid patient-ventilator asynchrony. Fourth, blood gas analysis was performed as ordered to prevent respiratory acidosis or alkalosis from inadequate or excessive ventilation and to avoid excessive airway pressure. In this case, reasonable adjustment of ventilator parameters based on blood gas analysis results facilitated early weaning.

3.3.2 Artificial Airway Nursing [?]

Airway humidification can reduce sputum viscosity and decrease sputum crust formation [**?**]. Sputum plugs easily form in the airway, and strengthening airway humidification with appropriate ventilator humidification temperature settings can reduce their occurrence. Nebulization can effectively dilute sputum, relieve bronchospasm, reduce laryngeal edema, promote sputum expectoration, and significantly reduce respiratory complications [**?**]. The patient received nebulization and suctioning as needed, with sputum color, nature, amount, odor, and viscosity observed and recorded to evaluate the adequacy of humidification. Effective and timely suctioning was performed to prevent airway obstruction from thick secretions, with regular turning, back percussion, chest physiotherapy, and prompt suctioning. Vital signs, particularly oxygen saturation, were closely monitored, along with relief of dyspnea symptoms and changes in ventilator parameters, with immediate physician notification for any abnormalities.

3.3.3 Nursing Measures to Reduce Laryngeal Edema

Reduced cuff leakage that delays extubation increases the risk of laryngeal edema (such as prolonged intubation) [**?**]. First, a comfortable position was maintained (head of bed elevated 15-30°) to ensure airway patency without obstruction, with proper endotracheal tube depth and normal cuff pressure (normal value 25-30 cmH_2O), and position changes every 2 hours. Second, cuff pressure was monitored daily to maintain it within the reasonable range (20-30 cmH_2O) and prevent accidental extubation due to patient agitation. Third, the endotracheal tube was secured with a fixation device with one-finger tightness and internal padding to avoid skin damage. During daily oral care, the insertion depth of the tube was observed, and when changing gauze, the tube' s central position was checked with protection of the lip area. Fourth, nurses enhanced rounds and regularly observed the position of all tubes, promptly securing them

when twisting, displacement, blockage, folding, or compression was discovered. During patient turning, back percussion, and transport, tubes were properly secured to prevent traction.

3.4 Nursing Care to Prevent Acute Laryngeal Edema During Weaning

Not all mechanically ventilated patients can be successfully weaned, especially obese patients, those with cardiac insufficiency, or underlying lung disease who may face extubation failure. Weaning failure increases mechanical ventilation duration and hospital stay [**?**]. First, the patient underwent weaning training with tracheal oxygen at 2 L/min, maintaining oxygen saturation at 90-92%, with timely clearance of airway and oral-nasal secretions. Second, on the day of extubation, budesonide nebulization was administered, followed by complete cuff deflation and tracheal oxygen at 2 L/min for 2 hours, then changed to nasal cannula oxygen at 2 L/min. Third, blood oxygen and blood gas changes were closely monitored, with this patient's oxygen saturation maintained around 95%. Fourth, gradual tube occlusion was performed, with oxygen saturation maintained at 90-94% under nasal cannula oxygen. The head of bed was elevated to 45° to facilitate diaphragmatic descent, reduce intrathoracic pressure, and aid breathing and secretion clearance. Fifth, hormonal medication was started one week before extubation. Methylprednisolone and other corticosteroids were administered intravenously as ordered, with budesonide nebulization to reduce laryngeal edema. Sixth, during gradual weaning training, endotracheal tube fixation and cuff monitoring were performed to avoid weaning failure due to tube malposition [**?**]. Seventh, gentle manipulation was performed during procedures, following the natural curvature of the catheter and airway anatomy for smooth extubation. A suction catheter was placed in the endotracheal tube with appropriate pressure, and while suctioning, the catheter was withdrawn along with the endotracheal tube. Vital signs and all parameters were closely monitored and documented, with enhanced nursing care and monitoring to prevent complications.

3.5 Basic Nursing

First, before establishing an artificial airway, respiratory and oral-nasal secretions were thoroughly cleared. Second, during each turning, gentle movements were used while observing vital signs and dyspnea after position changes. Third, oral care was provided twice daily (morning and evening) with observation of oral mucosa. Fourth, an air mattress and soft pillows were used for pressure relief, with bilateral bed rails for protection to prevent pressure injuries. After bowel movements, timely cleaning was performed to avoid skin maceration and pressure injuries. Fifth, bed baths and weekly hair washing and nail trimming were provided. Sixth, an indwelling urinary catheter was placed with daily 0.9% saline bladder irrigation. The catheter was kept patent, avoiding compression, twisting, or blockage to prevent retrograde infection. Seventh, protective re-

straints were applied to both upper extremities with one-finger tightness, with daily awakening protocols. Eighth, lower extremities were elevated (20-30 cm above heart level) with daily bottom-up massage 3-4 times. Ninth, leg circumference was measured regularly to detect redness, swelling, increased skin temperature, or increased circumference, with immediate physician notification for abnormalities.

3.6.1 Dietary Nursing

Nutritional support is an essential component of comprehensive treatment for critically ill patients. For patients at high risk of aspiration or with feeding intolerance, guidelines recommend post-pyloric feeding via nasojejunal tube [**?**]. The patient was kept NPO (nothing by mouth) with albumin at 26.4 g/L (normal 40-55 g/L), and parenteral nutrition was provided.

3.6.2 Parenteral Nutrition Nursing

A peripherally inserted central catheter (PICC) was established. PICC catheter maintenance was standardized, with 10 ml normal saline pulsatile flushing after transfusing blood products or high-concentration nutritional solutions. If infusion rate was slow or duration was long, additional pulsatile flushing with normal saline was performed during infusion to prevent catheter blockage [**?**].

3.7 Health Education

First, since the patient was comatose before intubation, family members were educated about the importance of endotracheal intubation and related care to obtain their cooperation. Second, after intubation, as the patient's consciousness gradually cleared, non-verbal communication channels were actively established using paper, pen, gestures, picture cards, blinking, and nodding to understand the patient' s physiological needs and meet reasonable demands [**?**], thereby increasing confidence in overcoming the disease and compliance with treatment and nursing care. Effective breathing and coughing were encouraged. The etiology and clinical manifestations of refractory laryngeal edema were explained to the patient and family, along with recommendations for appropriate intake of high-quality protein and vitamin-rich foods. The patient and family were comforted to relieve anxiety and fear and obtain cooperation.

Laryngeal edema has an insidious onset with limited time for effective resuscitation and can be life-threatening. Endotracheal intubation and invasive mechanical ventilation are common life-saving measures in intensive care units. Laryngeal edema is a common complication after extubation. Studies both domestically and internationally have shown that 10.5% to 34% of patients develop laryngeal edema after extubation, with 18% to 60% requiring reintubation due to extubation failure. Extubation failure can increase mechanical ventilation duration, ICU length of stay, and mortality [**?**]. This case of acute pancreatitis complicated by refractory laryngeal edema achieved significant symptom

relief, improved quality of life, and eventual discharge through effective nursing planning and meticulous care. Inadequate early nursing management could easily lead to re-aspiration, respiratory failure, and disease progression, directly threatening life. Appropriate and timely nursing care reduced complications while initiating the emergency protocol for weaning and extubation in refractory laryngeal edema, with immediate resuscitation available if weaning failed.

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Note: Figure translations are in progress. See original paper for figures.