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Case report

Decision for early tracheostomy in respiratory failure of a paralyzed myasthenia gravis patient with sepsis-induced pneumonia: A case report

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ABSTRACT

Introduction: The neuromuscular condition myasthenia gravis (MG) can make treating sepsis-induced pneumonia more challenging. Since these patients risk respiratory failure, decisions about airway treatment, including tracheostomy, can be difficult. We report a case of a patient with sepsis and concurrent MG who underwent an early tracheostomy due to acute respiratory failure.

Presentation of case: A 44-year-old woman with a history of MG presented to the emergency department with a stiff tongue, hypersalivation, limb paralysis and a phlegmy cough causing severe respiratory distress, aggravated by community-acquired pneumonia. A chest X-ray showed extensive infiltration and consolidation in the lower lobes. The patient was transferred immediately to the intensive care unit on mechanical ventilation. Despite initial treatment with antibiotics and respiratory support, her mental and respiratory status deteriorated rapidly. Given the risk of myasthenic crisis, sepsis and impending respiratory failure, with anticipated lengthy ventilator utilization and hospitalization, a multidisciplinary team decided to perform an early tracheostomy.

Discussion: The early tracheostomy procedure was carried out securely on the third day of hospitalization. This allowed for better pulmonary hygiene, adequate ventilation, airway clearance and rehabilitation therapy. The family contributed to stoma care and breathing exercises. The patient's respiratory condition steadily improved over the following weeks. The cough reflex remained well, and mechanical ventilation was gradually weaned off.

Conclusion: Early tracheostomy in a paralyzed MG patient with sepsis-induced pneumonia can improve clinical outcomes and optimize airway management.

1. Introduction

Myasthenia gravis (MG) is a chronic autoimmune neuromuscular condition marked by muscle weakness and fatigability, caused by autoantibodies that attack the acetylcholine receptor at the neuromuscular junction [1]. MG is a condition with a wide range of clinical manifestations. Severe muscular weakness may impact the respiratory muscles in rare circumstances, resulting in sudden respiratory failure [2,3]. In MG, 15 to 20 % of patients develop a potentially life-threatening myasthenic crisis (MC), defined as respiratory failure requiring mechanical ventilation due to respiratory muscle weakness or bulbar dysfunction. The most common preceding factor is respiratory infection leading to sepsis [4].

Extubation or failure and reintubation occur frequently in patients with neuromuscular disorders and have been linked to increased mechanical ventilation duration, shortened weaning and intensive care unit (ICU) length of stay, and a greater incidence of ventilator-associated pneumonia [1]. We present a case of a patient with paralyzed MG who required an early tracheostomy due to acute respiratory failure. This case has been reported in line with the SCARE 2023 guidelines [5,6].

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2. Presentation of case

A 44-year-old woman with a history of MG presented to the emergency department with a stiff tongue, hypersalivation, weakness throughout her body, particularly her legs; a phlegmy cough; shortness of breath and fever over the previous four days. The patient could fall asleep promptly and felt heavy on opening her eyes; she had periodic nausea and vomiting, and her weight was decreasing. A month ago, a persistent abdominal ache was treated for *Helicobacter pylori* gastritis. A meatball-sized lump in the right breast had felt intermittent and unpleasant since a year ago.

At the initial assessment, the patient was vigilantly conscious, with a Glasgow Coma Scale score of E4V5M6, blood pressure of 195/115 mmHg, heart rate of 106 beats/min, respiration rate of 22 breaths/min, temperature of 39.3 °C and oxygen saturation of 96 % on room air. Her body weight was 60 kg. A physical examination revealed left eye ptosis and generalized muscle weakness, indicative of respiratory muscle fatigue. Bronchial breath sounds with bilateral coarse crackles were found, and wheezing was not found. The bowel sounds were good, and epigastric tenderness was found. The lower extremity motor strength was 2222/2222, with upper extremities 3333/3333. The extremities were palpably warm without leg edema.

Blood tests revealed leukocytosis and consistent acute respiratory acidosis (Table 1). An ECG showed sinus tachycardia. The chest X-ray examination indicated consolidation and infiltrate in the right lung's lower field.

Despite initial treatment with broad-spectrum antibiotics, the patient's mental and respiratory status deteriorated rapidly 3 h after she reported significant shortness of breath at the emergency department, and she described feeling progressively weak. She had a one-time tonic–clonic seizure. The re-examination revealed signs of acute respiratory distress and sepsis (blood pressure of 177/104 mmHg, pulse of 120 beats/min, temperature of 39.8 degrees Celsius, respiratory rate of 38 breaths/min). Intubation was performed using an ETT number 7.0 (depth 21 cm) and ventilation-mode volume-control SIMV. The VTE was 300–360, respiratory rate was 12, positive end-expiratory pressure was 5, FiO2 was 80 % and PS was 8. A urinary catheter, nasogastric tube and central venous catheter were applied. The patient was admitted to the ICU with a temporary diagnosis of diminished consciousness, acute respiratory distress syndrome, pneumonia, sepsis, MG and suspected cancer. She was consulted using a multidisciplinary approach.

Further testing was performed to evaluate the patient's respiratory function. A thoracic CT scan revealed bilateral pneumonia, long-active right pulmonary tuberculosis, bilateral bronchiectasis, bilateral lung nodules suggestive of metastasis, mild left pleural effusion and right pleural thickening. The blood culture investigation revealed *Staphylococcus warneri*, and the bronchial lavage sputum culture revealed Klebsiella pneumonia ssp. pneumoniae. The GeneXpert PCR-TB findings were negative, and the BTA was negative.

Electromyography with 3-Hz repetitive nerve stimulation was used for further exploration for two days in the ICU. The findings indicated post-synaptic neuromuscular junction abnormalities, giving the appearance of generalized MG. The ELISA serology approach increased the anti-acetylcholine receptor (binding) to 0.46 nmol/L (borderline stated). Histopathological examination of the proper breast tissue revealed a malignant tumour mass of invasive epithelial carcinoma NST, graded 3, with invasion reaching the lymph vasculature, involving tumour markers CEA 14.2 ng/mL and CA-125 26.34 U/mL.

A comprehensive examination revealed respiratory failure caused by pneumonia, exacerbated by MG and metastatic breast tumour progression. Due to the progressive and refractory nature of her symptoms, a decision was made to perform an early tracheostomy to facilitate long-term airway management. It also reduced the risks of prolonged endotracheal intubation, such as ventilator-associated pneumonia and airway injury.

After obtaining consent from the patient's family guardian, a percutaneous dilatational tracheostomy was performed on the third day of therapy. It used a fenestrated soft-seal cuff tracheostomy tube from Portex ®Blue Line Ultra with an inner diameter of 8.0 mm, an outer diameter of 11.9 mm and a length of 75.5 mm. The tracheostomy was uneventful, and the patient's respiratory status significantly improved. Alongside medical treatment, including corticosteroids and immunosuppressants, rehabilitation is essential in successful chest and coughing physiotherapy. The patient was gradually weaned from the ventilator on day 10. Over the subsequent weeks, her muscle strength gradually improved. She was discharged on the 15th day with a tracheostomy to preserve her airway since her swallowing function was inadequate, and she still had a nasogastric tube placed. The timeline of the airway evaluation is presented in Fig. 1.

Table 1
Laboratory test results.

Variables	Results	Normal value
Hemoglobin (g/dL)	14.2	13.2–17.3
Leukocytes ($\times 10^3/\mu$L)	17,210	3800–10,600
Platelets ($\times 10^3/\mu$L)	389,000	150,000–440,000
AST (mg/dL)	86	5–40
ALT (mg/dL)	98	7–56
Albumin (g/dL)	3.9	3.8–5.1
Urea (mg/dL)	34	6–21
Creatinine (mg/dL)	0.83	0.5–1.1
CRP (mg/dL)	6.10	<0.3
Procalcitonin (μg/dL)	0.10	<0.05
Arterial blood gas analysis		
pH	7.29	7.35–7.45
PaCO2 (mmHg)	64.5	35–45
PaO2 (mmHg)	186.8	75–100
HCO3 (mEq/L)	31.8	22–26
Base excess (mmol/L)	4.1	−4 to +2
SaO2 (%)	98.9	95–100

Note: AST, Aspartate aminotransferases; ALT, Alanine aminotransferases; CRP, C-reactive protein; pH, acid-base balance of the blood; PaCO2, partial pressure of carbon dioxide; PaO2, Partial pressure of oxygen; HCO3, Bicarbonate; SaO2, arterial oxygen saturation.

3. Discussion

Our patient had previously reported weakness without further evaluation. This was especially severe during a respiratory infection and the consequences of respiratory failure with sepsis. MG is more frequent in women under the age of 40 years and in men over the age of 60 years [7]. However, no correlation exists between age and indication for early tracheostomy placement [2–4,8].

The most frequent tracheostomy indications are (1) the requirement for protracted mechanical ventilation and acute respiratory failure (two thirds of instances involve either) and (2) severe or catastrophic neurologic insult requiring airway clearance, mechanical ventilation, or both. Conditions that do not justify early tracheotomy are medical or surgical patients on a ventilator without lung infections (assessed by a Clinical Pulmonary Infection Score of <6) and without serious systemic problems (assessed by a Sequential Organ Failure Assessment score of ≥5) [9]. The clinician in charge subjectively judged which patients to tracheostomize earlier [1,2,4]. If the prediction of prolonged ventilation is inaccurate, an early tracheostomy strategy may result in some patients undergoing tracheostomy unnecessarily. On the other hand, a late tracheostomy strategy may cause patients to undergo unnecessarily prolonged exposure to the need for a translaryngeal endotracheal tube and possibly prolonged weaning from mechanical ventilation. In patients with neuromuscular diseases, reintubation and extubation failure are common events that have been linked to increased rates of ventilator-associated pneumonia and a longer ICU stay. Because tracheostomy reduces anatomical dead space and enhances respiratory toilet effectiveness, it is believed to be more comfortable for the patient. This is particularly beneficial for individuals experiencing MC. Patient

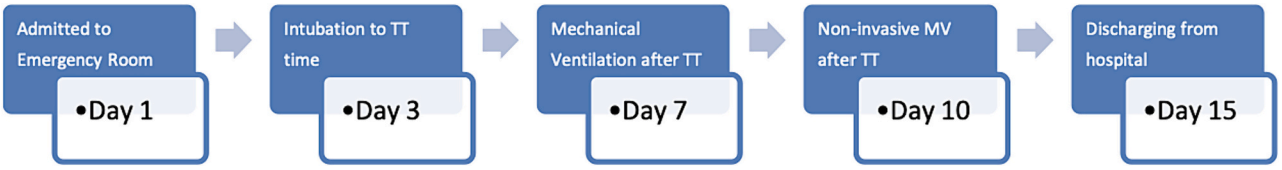

Fig. 1. Airway control timeline (TT, tracheostomy; MV, mechanical ventilation).

demographics and baseline characteristics [2,4], comorbidities (such as diabetes mellitus, previous stroke, hypertension, chronic obstructive pulmonary disease, poor cardiac function, renal impairment, and ischemic heart disease [10–12]), time since MG onset, and complications such as pneumonia and cardiopulmonary resuscitation have been linked to a longer duration of mechanical ventilation [2,4]. An early tracheostomy may be required when medical therapy fails and patients continue to worsen despite intubation. Given the combination of neuromuscular illness, respiratory insufficiency, dysphagia, and the significant likelihood of extubation failure, this might be explained by tracheostomy reducing anatomical dead space volume and improving breathing [1,4].

In this case, an early tracheotomy was provided for more stable and long-term airway control because the multidisciplinary team doctor had predicted that the patient would be on the ventilator for a long period due to respiratory muscle weakness (paralysis). Other patients, such as sepsis patients, do not have a tracheostomy because if the sepsis resolves, the ventilator can be weaned. A tracheostomy was determined after three days of mechanical ventilation. The patient spent her first seven days in the hospital on a ventilator connected to her tracheostomy. On her tenth day, she was successfully weaned from the ventilator and treated in a regular room for the next five days, making her total hospital stay 15 days. Weaning patients with MG tends to be complicated. Extubation failures frequently occur in MC (27–44 %) and have been linked to extended ICU and hospital lengths of stay [1].

Early tracheostomy seems to lower the incidence of ventilator reliance when assigned to a weaning facility [2,4,8]. Another study showed that early tracheostomy (<10 days) was related to a substantial reduction in the length of mechanical ventilation in the ICU (mean 26.2 days). It reduced ICU length of stay (mean 26.2 days), hospital length of stay, and ventilator dependence at discharge [1]. It also reduced the hazards of extended endotracheal intubation, such as ventilator-associated pneumonia and airway damage [2,4].

The ability to keep the airway open is not the only aspect that matters in this situation. A substantial part of the treatment involved multidisciplinary management. Patients are significantly helped by post-tracheostomy care and rehabilitation to respond to the advised therapy. Patients with tracheostomies can mobilize more easily, undergo chest rehabilitation and bronchial toilet procedures more efficiently, and have fewer airway injuries. Considering that this patient had a malignant illness in addition to MG, pain, stress and psychological therapy must also be addressed.

4. Conclusion

Tracheostomy decreases anatomical dead space volume and improves breathing, which may benefit individuals with neuromuscular disorders. Minimizing extubation failure allows for more effortless mobility during physiotherapy. Weaning might explain the early tracheostomy decision to optimize the airway management of neuromuscular illness and respiratory insufficiency related to lengthy hospitalization.

Consent

Written informed consent was obtained from the patient for publication of this case report and accompanying images. A copy of the written consent is available for review by the Editor-in-Chief of this journal on request.

Ethical approval

The case report is exempt from ethnical approval in our institution. It is only necessary to obtain the patient's consent.

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Author contribution

RK, AS, RS, DA, SKM, and DBP: study concept and surgical therapy for this patient. RK and AS: Data collection and Writing-Original draft preparation. DBP: senior author and the manuscript reviewer. RK: Editing and Writing. All authors read and approved the final manuscript.

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