Respiratory failure in tetanic patient: maintenance of airway problem in intensive care unit setting

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Abstract. Tetanus is a toxin-mediated disease caused by \textit{Clostridium tetani}, resulting in muscular stiffness and painful spasm. The case fatality rates are high (10-80%), and the most frequent cause of mortality is airway problem that results in respiratory failure. A 52-year-old male came to the hospital with lockjaw, rhesus sardonicus, opisthotonus, and seizure for the last 12 hours, diagnosed with tetanus grade II. We placed the patient in an isolation room, gave 3000U tetanus immunoglobulin, 20mg diazepam in 500ml dextrose 5%/8 hours, and 500mg/6hrs metronidazole. On the seventh day, seizure became frequent, respiratory rate increased with crackles found on the auscultation, and the blood gas analysis showed respiratory failure type II (PCO\(_2\) 53mmHg). The patient was immediately sent to the ICU, intubated and given ventilator support. The patient was sedated with continuous injection of midazolam 3 mg/h, morphine 10mcg/kgBW/h and also levofloxacin 750mg/24hours. Broncho-alveolar lavage culture was positive for \textit{Acinetobacter baumanii}, so we changed the antibiotic to amikacin injection 500 mg/8hrs. After four days, we extubated the ventilator and transferred from HCU three days later. The patient was fully recovered and discharged after eighteen days of hospitalization.

1. Introduction
Tetanus is an often fatal, disease caused by an exotoxin. It produced by the bacterium named \textit{Clostridium tetani}. The characteristics of tetanus known by generalized rigidity and spasms of skeletal muscles. The muscle stiffness usually involves the jaw (lockjaw) and neck and then becomes generalized.[1] As the disease progresses, muscle groups throughout the body are affected, and spontaneous generalized seizure-like tetanospasmin develop. In the absence of the ability to provide ventilator support, death is usually due to respiratory failure. Autonomic dysfunction, including hypertension and tachycardia alternating with bradycardia and hypotension, can be present in more severe tetanus cases and is associated with a poorer prognosis.[2] The disease can affect any age group, and case-fatality rates are high (10-80%) even where modern intensive care is available. There is no natural immunity against tetanus; protection can be provided by active immunization with tetanus toxoid-containing vaccine or administration of an anti-tetanus antibody (tetanus-specific immunoglobulin, TIG).[1]
2. Findings
Male patient 52 years old, came to the hospital with lockjaw, rhesus sardonicus, spasm of the neck, shoulder, abdominal, and back muscles (opisthotonus), which followed by generalized conscious seizure every time patient heard the sound or being touched. All of these symptoms fulfill the diagnosis of Tetanus grade II.

Seven days before admission to the hospital, the patient was having contaminated wound on his right foot while working in the rice-field. The patient had no history of tetanus immunization before and did not get anti-tetanus injection during wound care. This wound strongly suggests as the infection site of the *Clostridium tetani* which causes the disease.

The laboratory result shows normal finding, only slight elevation of ALT (95 U/L) and a slight decrease of sodium (135 mmol/L). ECG is in sinus rhythm with heart rate 65 times per minute and normoxic 50%. Chest x-ray showed no abnormality of the cor and chest.

We placed the patient in tetanus isolation room; we gave tetanus immunoglobulin 3000U, diazepam 20mg in dextrose 5% 500ml every 8hours, and metronidazole 500mg/6hours.

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The result of the blood gas analysis showed the improvement of the respiratory failure condition (Table 1) during the maintenance in the intensive care unit setting. After five days in the ICU, we did the extubation from the ventilator and patient able to do spontaneous breathing with normal respiratory rate and normal oxygen saturation.
Table 1. Blood gas analysis resultin hospitalization.

|                        | Normal Reference | Day 6th | Day 7th | Day 10th | Day 12th |
|------------------------|------------------|---------|---------|----------|----------|
| pH                     | 7.350-7.450      | 7.450   | 7.430   | 7.430    | 7.512    |
| BE                     | (-2) – (+3)      | 9.8     | 11.1    | 15.9     | 15.7     |
| PCO²                   | 27.0-41.0        | 49.0    | 53.0    | 59.0     | 48.1     |
| pO²                    | 83.0 – 108.0     | 104.0   | 106.0   | 93       | 122.1    |
| Hematocryt             | 37-50            | 36      | 38      | 20       | 39       |
| HCO₃                   | 21-28            | 31.7    | 32.4    | 40.1     | 38.9     |
| CO₂Total               | 19-24            | 35.5    | 36.9    | 60.0     | 40.4     |
| O₂Saturation           | 94-98            | 98.0    | 98.0    | 98.0     | 99.3     |
| Artery Lactate         | 0.36 – 0.75      | 1.10    | 0.70    | 0.70     | 0.70     |

Broncho-alveolar lavage culture was positive for *Acinetobacter baumannii* then we changed antibiotic to amikacin injection 500mg/8hours based on culture. Afterfour days, we extubated the patient from the ventilator and transferred from HCU three days later. The patient was fully recovered and discharged after eighteen days of hospitalization.

3. Discussion

Respiratory failure condition in this patient happened due to multifactorial; we suggest this is because of the worsening effect of the tetanospasmin and the risk of nosocomial infection during hospitalization. The seizure of the patient was getting worse during the time after the proper dose of diazepam. Tetanospasmin primarily affects inhibitory neurons, prevents the release of the neurotransmitters glycine and gamma-aminobutyric acid, and leads to failure of inhibition of motor reflex responses to sensory stimulation.[3] These are the causes for the muscle rigidity of a tetanic spasm of the patient. The worst complication of tetanus is spasm especially the uncontrolled one. Spasms may cause laryngeal obstruction, a reduction in chest wall compliance, and respiratory failure tetanus.[4] Nosocomial infections are common because of longer duration of hospitalization. Concomitant infections include sepsis from indwelling catheters, hospital-acquired pneumonia, and decubitus ulcers.[1] In this patient, we found pneumonia, which is proven by the culture result of the broncho-alveolar lavage *Acinetobacter baumannii*.

The keypoint maintenance of airway problem in tetanus patient is the closed monitoring and the ventilatory support. Therefore we transferred the patient to the intensive care unit. The ability to perform a tracheostomy and mechanically ventilate patients has contributed to a significant reduction in mortality due to respiratory failure.[5] The Guidelines for the management of accidental tetanus in adult patients by Associação de Medicina Intensiva Brasileira (AMIB) recommend management in the intensive care unit (ICU) for patients with moderate and severe accidental tetanus for better monitoring, rapid detection of complications and intensive care by a trained team.[6]

The choice of sedative drugs also plays an important role in controlling the seizure and spasm. In this case report, we sedated the continuous patient injection of midazolam 3mg/h and morphine 10mcg/kgBW/h. The most commonly used sedative agents are benzodiazepines and morphine. Benzodiazepines increase the affinity and efficacy of GABA, and morphine may act by replacing deficient endogenous opioids.[7] The patient fully recovered and discharged after eighteen days of hospitalization.
4. Conclusion
This case illustrated the successful maintenance of airway problem by giving ventilator support. We recommend management in the intensive care unit immediately to decrease the mortality rate of tetanus patient.

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