Tetanus Overlooked Due to Involvement of Multiple Departments: A Case Report

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Abstract

Tetanus is a fatal disease caused by a neurotoxin produced by the biotrophic anaerobic bacterium Clostridium tetani, which causes muscle hypertonia and autonomic neuropathy. The diagnosis is based on clinical findings and not on specific tests, which makes the disease very difficult to diagnose at first sight, despite typical initial findings such as lockjaw, muscle spasms, and neck pain and stiffness.

This article discusses a 79-year-old woman who first consulted her local doctor because of the appearance of an opening disturbance. Seeing no improvement, she visited our hospital and was suspected of having tetanus after consulting with nine different departments over seven days from the initial visit. In developed countries, tetanus prevalence has declined due to immunization, leading to clinicians’s lack of experience in diagnosing it. Furthermore, the increasing specialization in general hospitals poses a risk of missing a tetanus diagnosis when a patient consults multiple departments.

Categories: Internal Medicine, Emergency Medicine, Infectious Disease

Keywords: multiple departments, delayed diagnosis, developed countries, vaccination, tetanus

Introduction

Tetanus is a fatal disease in which neurotoxins, produced by tetanus bacteria that invade the wound after trauma, spread haematogenously or lymphatically and derepress peripheral motor, cranial, and sympathetic nerves, causing muscle hypertonia and autonomic nervous disorders.

The incubation period between tetanus invasion and symptom onset can range from 24 hours to several months. The length of the incubation period is reflected in the distance the toxin travels from the wound site to the central nervous system and is thought to relate to the amount of toxin [1]. The period between initial symptom onset and the onset of convulsions is called the ‘onset time,’ and the shorter both the incubation period and the onset time, the poorer the prognosis [1,2].

Therefore, it is advisable to start treatment for tetanus as early as possible, but it is often difficult to make a definitive diagnosis at the initial visit, as previous literature reports a time from onset to diagnosis of 7.6 days [3]. The reasons for the difficulty in diagnosing tetanus include low awareness of useful diagnostic tests, such as the spatula test, which has a sensitivity of 94% and specificity of 100% [4], and the lack of blood tests and imaging tests that can serve as the first diagnostic criteria for doctors in general outpatient care. Notably, although this has been pointed out in previous reports, few patients have been reported, and doctors generally have limited experience with tetanus diagnosis [5].

Case Presentation

A 79-year-old woman had been seen by her primary care physician for symptoms that had appeared about two weeks prior to her visit, such as loss of voice and swallowing difficulty due to a lack of jaw opening, which meant that she could only consume soft foods. As there was no improvement after visiting the family doctor, the patient was referred to the department of otorhinolaryngology of our hospital (day -6), but was assessed as having a malfunction of the mouth and referred to the department of dentistry and oral surgery the following day. On the same day, she was also seen by the department of spinal cord surgery due to neck discomfort, and a magnetic resonance imaging (MRI) scan of her neck revealed that there were no problems associated with her spine. The next day (day -5), the patient was referred by the otorhinolaryngologist to an oral surgeon and was assessed as having no problems with the temporomandibular joint, with an opening of 1.5 lateral fingers and a forced opening of 30 mm. Upon the same-day request for an internal medicine examination, it was revealed that weight had dropped from 48 kg to 43 kg over the previous two months. Additionally, fatigue was reported, and imaging indicated a hypoabsorption zone in the left lobe of the thyroid gland. Subsequently, discharge was authorized. We decided to perform a close examination of thyroid hormones at a later date. During the visit, dysarthria was suspected, and a computed tomography and MRI scan of her head was performed. The only finding was a suspicion of right mastoiditis (Figure 1), so the patient was sent home that day.
On the evening of the following day (day -2), the patient developed a sense of dyspnoea and was taken to the emergency department; however, since airway obstruction was not observed, she was sent home with an assessment of hyperventilation. Finally, at the time of the otolaryngologist’s return visit (day 0), the possibility of tetanus was considered, and the patient again consulted with the internal medicine department (Figure 2).

FIGURE 2: History of outpatient visits.

The first outpatient visit was six days before admission to the hospital.

The red arrows indicate where one department had been consulted by another.

A total of nine visits were made to five departments: otolaryngology, spinal cord surgery, internal medicine, dentistry and oral surgery, and emergency medicine.
The consulting internist suspected tetanus, although there was no trauma on physical examination, and the patient was referred back to the emergency department. Based on the clinical findings, tetanus was considered undeniable, and the patient was admitted for observation.

After admission, the patient was started on metronidazole (500 mg, every 6 hours for 14 days) to treat tetanus. On the second day of admission, a single convulsive seizure appeared in the middle of the night, and intensive care management was started with intubation and ventilation. The seizure was judged to be tetanus, and 45000 units of human tetanus immunoglobulin were administered. Tetanus toxoid was administered on the third day of admission, and in consideration of the possibility of long-term ventilation, a tracheostomy was performed the day after the ventilator was started (day 5 of admission). Midazolam and then dexmedetomidine hydrochloride were used as sedative medication during ventilation. Ventilation continued until day 15 of hospitalization, and although her circulation was stable on admission, by day 14, the increase in blood pressure due to stimulation was poorly controlled. This occurred despite treatment with sedative medication, and she was started on labetalol hydrochloride (150 mg/day), which she continued to take until day 36. The complications that occurred during hospitalization included pneumonia due to the use of a respirator, as well as heart failure and pulmonary embolism, none of which were disabling after discharge. The tracheostomy was closed on day 38 of admission when the patient’s general condition had stabilized, and the patient was discharged after 56 days, following the completion of the rehabilitation treatment (Figure 3).

**FIGURE 3: Timeline of tetanus treatment.**

The date of admission is set as day 0, the medications used for treatment are listed in the top row, and the procedures performed are listed in the bottom row.

- HTIG: Human tetanus immunoglobulin was administered in 4500 units.
- Td: Tetanus toxoid was administered as a 0.5mL intramuscular injection.
- Metronidazole was administered at 500 mg every 6 hours for 14 days.
- Labetalol 50 mg was taken internally 3 times a day from day 14 to day 35.
- 50mg midazolam in 40mL of saline was controlled 2mL/H to 6mL/H from day 2 to day 13, then switched to Precedex on weaning from the ventilator and used until day 17.

**Discussion**

The isolation rate of tetanus is said to be about 30% because its causative agent, Clostridium tetani, is a biased anaerobe and cannot grow in the presence of oxygen [6]. According to the National Institute of Infectious Diseases in Japan, only one of 157 cases of tetanus reported in 1999-2000 could be isolated [7]. This means that the final diagnosis has to be based on clinical symptoms and the presence or absence of a trauma history, although in about 30% of patients, there is no clear history of trauma [1], which makes it difficult to definitively diagnose tetanus on the first visit. The Tokyo Metropolitan Centre for Health and Safety Research reported that the circumstances at the time of infection could be estimated in 34 patients, with the most common being gardening (including those described as gardening or fieldwork) in 12 (14.5%) and falls and bruises in nine (10.8%), while the remaining 49 patients had unknown sources of infection [8]. In the present patient, the infection was also thought to have been triggered by gardening, but the long incubation period meant that no obvious trauma could be identified at the time of examination, which delayed the diagnosis.

In developed countries, vaccination has been progressing, with the tetanus toxoid vaccine introduced in Japan in 1952 and the routine diphtheria-pertussis-tetanus combined vaccine in 1968. Although the number of patients has declined, and tetanus has become a disease of the past, around 100 incidences are reported each year in Japan. Notably, of the 499 reported patients in 2018, 80% were aged 60 years or older [9]. In a 2013 survey, only 5% of people >60 years of age had the seroprevalence of tetanus toxoid antibody (N0.1 IU/mL) [10], and this age group also represents the unvaccinated tetanus vaccine population.
The Tokyo Metropolitan Government, near our hospital, reported 83 patients with tetanus (5.9 cases per year) over a 14-year period from 2006 to 2019, which is about 5% of the total number of patients in Japan. In that study, only 17 patients (1.2 per year) were confirmed or estimated to have resided in a district that appeared to be close to our hospital environment over a 14-year period [8]. Therefore, the fact that most of our doctors, who practice in urban areas, had no experience in treating patients with tetanus may have been a reason for the delayed diagnosis.

In a study conducted in South Korea, a diagnosis of tetanus could only be made in emergency care in nine out of 17 patients (53%). The diseases that came up in the diagnosis were temporomandibular joint disorder, temporomandibular joint and cervical dystonia, meningitis, cerebral infarction, spinal cord injury, and hypertensive encephalopathy [11]. Clinical symptoms range from head and neck symptoms, such as dysphagia, to spinal symptoms, such as gait disturbance and urinary and defecation disorders, and prior case reports have revealed that this is not a disease that is treated by only one specific department. In 2012, a summary of the past 90 reported patients in Japan showed that 22% of the patients were treated by internal medicine, 19% by emergency medicine, 18% by otorhinolaryngology, 9% by surgery, and 7% by dental surgery, which did not necessarily mean that only a specific department was involved in the treatment of the patient at the time of the initial visit [12]. Although the patient had a characteristic clinical condition at the time of presentation, a total of nine departments were involved over a period of seven days, before the suspicion of tetanus was raised. The first otolaryngologist suspected mastoiditis, which was seen in the findings at the time of the MRI scan. The spinal surgeries were concerned about spinal disease because of cervical discomfort, and the oral surgeries, which saw the patient the next day, underestimated the patient’s oral dysphasia because he could open his mouth 30 mm by forced opening, and the policy was to refer him to a medical doctor. The internal medicine department also included thyroid disease due to anorexia, weight loss, and psychiatric disorders, as there were also complaints of hyperventilation-like respiratory distress symptoms. The involvement of multiple departments in the treatment of tetanus seemed to have led to a tendency to focus only on diseases in which each department had a specialization and to overlook tetanus that crossed multiple departments.

If the patient presents with typical symptoms without trauma that provides the basis for the diagnosis, the likelihood of suspecting tetanus is reduced. Conversely, the number of doctors experienced in the treatment of tetanus is also low in developed countries due to the progress made in vaccination. Patients typically visit several relevant departments because their tests are normal, but their symptoms do not improve. The combination of these factors is likely to be the cause of a vicious circle that delays the diagnosis of tetanus. To prevent missed tetanus diagnoses in developed countries, clinicians should receive regular tetanus education. Additionally, integrated healthcare teams involving multiple departments should collaborate to assess symptoms and make diagnoses, not just for tetanus but for various conditions.

Conclusions
One of the problems with tetanus diagnosis in developed countries is the lack of clinical experience in tetanus among doctors and the fragmentation of specialized diagnostic areas in acute general hospitals. These factors can lead to a risk of missing a tetanus diagnosis, even in patients with typical symptoms, due to the involvement of multiple departments. However, as tetanus remains present and patients may present to more than one department, collaboration between departments is essential for proper diagnosis.

Additional Information
Author Contributions
All authors have reviewed the final version to be published and agreed to be accountable for all aspects of the work.

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**References**