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#### CASE REPORT / OLGU SUNUMU

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#### Generalized Tetanus in an Unvaccinated Adult Following Foot Injury: A Case Report

##### Salduz et al. Tetanus After Foot Injury

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#### Abstract

Tetanus is an acute and potentially fatal infection caused by *Clostridium tetani*, characterized by profound neuromuscular involvement. Although effective treatment options remain limited, tetanus remains a significant public health concern because it is entirely preventable through vaccination. Here, we describe a case of generalized tetanus in a 21-year-old unvaccinated man who developed the disease after a nail puncture wound sustained at a construction site. The patient presented with classic manifestations, including trismus, risus sardonicus, generalized muscle rigidity, and autonomic instability. Despite prompt administration of tetanus vaccine, human tetanus immunoglobulin, and metronidazole, he experienced worsening muscle spasms and respiratory compromise that necessitated mechanical ventilation and deep sedation in the intensive care unit. His clinical course was further complicated by ventilator-associated pneumonia and subglottic stenosis related to prolonged intubation, the latter of which was successfully treated with bronchoscopic dilation. Following 70 days of intensive care and inpatient management, the patient recovered and was discharged. This case underscores the essential role of vaccination in preventing tetanus and highlights the complexities involved in the multidisciplinary management of severe tetanus.

**Keywords:** *Clostridium tetani*, tetanus, tetanus prophylaxis

#### Öz

Tetanoz, *Clostridium tetani* adlı anaerobik bakterinin ürettiği nörotoksin tetanospazminin etkisiyle nöromusküler sistemi tutan, tonik kas spazmları ile karakterize ve mortalitesi yüksek potansiyel olarak ölümcül bir enfeksiyon hastalığıdır. Bu çalışmada, inşaat alanında ayağına çivi batması sonrası tetanoz aşısı olmayan 21 yaşındaki erkek hastada gelişen genelleşmiş tetanoz olgusu sunulmaktadır. Hastada trismus, risus sardonicus, yaygın kas rijiditesi ve otonomik disfonksiyon gibi tipik klinik bulgular gözlenmiştir. Erken dönemde tetanoz aşısı, insan tetanoz immünoglobulini ve metronidazol tedavisi başlanmasına rağmen hastada ilerleyici kas spazmları ve solunum yetmezliği gelişmiş, yoğun bakım koşullarında mekanik ventilasyon ve sedasyon uygulanmıştır. Klinik seyrir sırasında ventilatör ilişkili pnömoni ve uzun süreli entübasyona bağlı subglottik stenoz gibi komplikasyonlar ortaya çıkmış, bronkoskopik dilatasyon ile başarılı şekilde tedavi edilmiştir. Hasta 70 günlük yoğun bakım ve servis takibi sonrasında klinik iyileşme göstererek taburcu edilmiştir. Bu olgu, tetanozun önlenmesinde aşılanmanın kritik önemini ve ağır tetanoz vakalarının multidisipliner yönetimindeki zorlukları vurgulamaktadır.

**Anahtar Kelimeler:** *Clostridium tetani*, tetanoz, tetanus profilaksisi

#### Introduction

Tetanus is an acute, potentially fatal infectious disease caused by the anaerobic bacterium *Clostridium tetani*, which affects the neuromuscular system through a potent neurotoxin and is characterized by tonic muscle contractions<sup>[1]</sup>. *Clostridium tetani* exists in soil and the gastrointestinal tract of mammals in the form of resilient spores. These spores can enter the body through skin injuries, where they transform into a vegetative form and produce the neurotoxin tetanospasmin<sup>[2]</sup>. Tetanospasmin induces widespread, simultaneous contraction of agonist and antagonist muscle groups, a phenomenon known as tetanic spasm. The toxin primarily targets motor endplates at the neuromuscular junction, resulting in rigidity, muscle spasms, and autonomic dysfunction<sup>[3]</sup>.

Tetanus manifests in several clinical forms, including generalized, localized, cephalic, and neonatal tetanus, with generalized tetanus being the most common and severe<sup>[4]</sup>. Diagnosis is primarily clinical, based on characteristic muscle rigidity and spasms, combined with a history of insufficient immunization and recent trauma<sup>[5]</sup>. Although vaccination programs have largely reduced its incidence, tetanus remains a public health concern in developing countries due to incomplete immunization coverage<sup>[6]</sup>. This case report aims to contribute to the literature by presenting a patient who developed generalized tetanus following a nail puncture injury in the absence of prior vaccination.

#### Case Report

A 21-year-old man with no known chronic illnesses presented to an external healthcare center with difficulty swallowing, sore throat, and abdominal and back pain. He was subsequently referred to our hospital's emergency department with a preliminary diagnosis of tetanus. Detailed history revealed that approximately five days earlier, he had stepped on a nail at a construction site and had not sought medical care for wound management or tetanus vaccination.

Five days after the injury, he developed pain in the nape, back, and abdomen, accompanied by muscle spasms and dysphagia. On admission, his vital signs, including temperature, were within normal limits. Physical examination revealed a conscious, oriented, and cooperative patient with the characteristic “risus sardonius” (sardonic smile) (Figure 1). Additional findings included neck stiffness, trismus, and generalized hypertonia. Abdominal palpation demonstrated a “board-like” rigidity. Examination of the right foot revealed a 0.5 × 1 cm non-necrotic puncture wound. No surrounding lesions required debridement, so the wound was left intact.

Laboratory investigations showed leukocytosis (14,000/mm<sup>3</sup>), markedly elevated creatine kinase (CK, 2,522 U/L; reference range 30–200 U/L), normal C-reactive protein (0.41 mg/dL), and creatinine (1 mg/dL). Given the patient’s unknown immunization status, history of nail puncture, and classic clinical features, a preliminary diagnosis of tetanus was made. Treatment was initiated with intravenous (IV) metronidazole 500 mg four times daily.

The patient was admitted to the intensive care unit for close monitoring in a quiet, dark environment to minimize muscle spasms. Oral baclofen (20 mg twice daily) was initiated to control spasms, and tramadol (50 mg three times daily) was administered for severe muscle pain. On the second day of hospitalization, worsening muscle spasms and increased respiratory difficulty necessitated elective intubation, and sedation was initiated with IV midazolam (5 mL/hour) and fentanyl (1 mL/hour).

As spasms persisted, baclofen was increased to 20 mg three times daily, and continuous rocuronium infusion (2 mL/hour) was added to achieve neuromuscular blockade. On the fifth day, the patient developed fever and elevated acute-phase reactants; thoracic computed tomography revealed pneumonic infiltration, raising suspicion for ventilator-associated pneumonia. Empirical antimicrobial therapy was initiated with meropenem (1 g three times daily) and tigecycline (100 mg loading dose followed by 50 mg twice daily intravenously). Upon detection of *Acinetobacter baumannii* in aspirate culture, meropenem was discontinued, and colistin (300 mg loading dose followed by 150 mg twice daily IV) was administered. Antibacterial therapy was completed over a total of 14 days.

On the eighth day, persistent muscle spasms despite baclofen and rocuronium prompted initiation of dexmedetomidine infusion (5 mL/hour) for additional analgesic and anxiolytic support. By the 25<sup>th</sup> day, clinical stabilization allowed sequential discontinuation of rocuronium, dexmedetomidine, and midazolam. During follow-up, the patient experienced prolonged fever and tachycardia; with no other infection focus identified, these findings were attributed to autonomic dysfunction.

Following clinical stabilization, the tracheostomy was closed on day 40, and the patient was transferred to the Infectious Diseases Service. On day 60, he developed acute stridor and dyspnea, raising suspicion of tracheostomy-related complications. Thoracic surgery consultation and bronchoscopic evaluation revealed subglottic stenosis secondary to prolonged intubation, which was successfully treated with rigid bronchoscopy and dilation. The patient’s condition gradually improved, and he was discharged fully recovered on day 70 of hospitalization.

## Discussion

In resource-rich countries, the incidence of tetanus has declined dramatically since the 1940s due to universal tetanus toxoid vaccination programs<sup>[5]</sup>. In contrast, tetanus remains endemic in resource-limited settings<sup>[7]</sup>. Between 2013 and 2022, a total of 267 tetanus cases and 13 deaths were reported in the United States<sup>[8]</sup>. According to World Health Organization (WHO)/United Nations Children’s Fund Estimates of National Immunization Coverage, DTP1 (the first dose of the diphtheria, tetanus, and pertussis vaccine) coverage in Türkiye has remained consistently high, ranging from 94% to 98% between 2020 and 2024, indicating that childhood tetanus immunization is well maintained nationally<sup>[9]</sup>.

However, surveillance data from the WHO indicate that tetanus has not been completely eliminated in Türkiye. Reported cases numbered 9 in 2020, none in 2021, 10 in 2022, 12 in 2023, and increased markedly to 34 in 2024. These data suggest that tetanus remains a rare but persistent public health concern with fluctuations in incidence over time<sup>[9]</sup>. Vaccination significantly reduces the risk of tetanus, as demonstrated in a study of 53 cases by Saltoglu et al.<sup>[10]</sup>, in which only 28.3% of patients had received a single tetanus vaccine dose prior to hospital admission, while 71.7% had not received primary immunization.

The incubation period of tetanus averages 8 days, typically ranging from 3 to 21 days<sup>[8]</sup>. In a Turkish study by Saltoglu et al.<sup>[10]</sup>, the mean incubation period was 11.5 days (range: 2–40 days), with 22.6% of patients presenting within 7 days and 77.3% after 7 days<sup>[10]</sup>. Case reports demonstrate considerable variability: Kaya et al.<sup>[11]</sup> reported an incubation period of 2 days, Kuzucuoğlu et al.<sup>[12]</sup> observed symptom onset at 15 days post-exposure, and Sah et al.<sup>[5]</sup> reported onset at 7 days. In the present case, symptoms appeared on day 5 post-exposure, consistent with the reported range.

Tetanus is primarily a clinical diagnosis, based on characteristic findings in the absence of alternative explanations, as no laboratory test can definitively confirm or exclude the disease<sup>[8]</sup>. Generalized tetanus, observed in approximately 80% of cases, is the most common form<sup>[3]</sup>. Patients typically present with tonic contractions and intermittent severe spasms of skeletal muscles. Trismus is the most frequent early sign, followed by dysphagia and neck stiffness<sup>[3]</sup>. As the disease progresses, continuous and widespread muscle spasms may occur, leading to rigidity of the back muscles. Spasms can be severe enough to cause opisthotonus or fractures of long bones and vertebrae<sup>[14]</sup>.

In tetanus, consciousness and awareness are typically preserved, so muscle spasms are associated with severe pain. Involvement of the facial muscles may produce the characteristic sardonic smile, or *risus sardonius*. When autonomic dysfunction occurs, patients may exhibit blood pressure fluctuations, tachycardia, and fever<sup>[5]</sup>. In a retrospective analysis of 29 tetanus cases, Pérez-González et al.<sup>[16]</sup> reported trismus, or “lockjaw,” as the most common clinical finding.

Our patient presented to the emergency department approximately five days after stepping on a nail, with complaints of dysphagia, headache, and pain in the back, neck, and abdomen. During hospitalization, signs of autonomic dysfunction—including fever, tachycardia, and hypertension—were noted in addition to generalized muscle spasms. Given the history of nail puncture and widespread hypertonia, tetanus was strongly suspected.

Comprehensive, universally accepted clinical guidelines for tetanus management remain limited, largely because tetanus predominantly occurs in resource-limited settings, which hinders the conduct of randomized controlled trials<sup>[17]</sup>. Evidence supporting the effectiveness of tetanus treatments is scarce, with only six randomized controlled trials published over the past 20 years<sup>[18]</sup>.

The primary principles of tetanus management include neutralization of tetanus toxin, antibiotic therapy, wound debridement to prevent further toxin production, and mitigation of toxin effects on the central nervous system<sup>[19]</sup>. Early removal of infected tissue and foreign bodies is critical to preventing toxin production<sup>[20]</sup>. However, inadequate wound debridement can reduce the efficacy of antimicrobial therapy against *Clostridium tetani*, as demonstrated in a study of 84 Vietnamese patients with severe tetanus, in which 45 *Clostridium tetani* isolates were recovered from wound samples<sup>[21]</sup>. Preferred antibiotics include metronidazole and penicillin, typically administered for 7–10 days<sup>[20]</sup>.

In our patient, a 0.5 × 1 cm non-necrotic puncture wound was present on the right foot. As no surrounding tissue required debridement, the wound was left intact. Given the high clinical suspicion for tetanus, IV metronidazole 500 mg four times daily was initiated.

Tetanus toxin binds irreversibly to neural tissues, so only circulating free toxin can be neutralized. Consequently, passive immunization through administration of tetanus antitoxin is associated with reduced mortality<sup>[22]</sup>. Tetanus immunoglobulin (TIG) should be administered intramuscularly as soon as possible after diagnosis. Because TIG neutralizes only free toxin, early administration can prevent progression by blocking toxin entry into the nervous system. Previously, doses of 3,000–6,000 units were suggested; however, current Centers for Disease Control and Prevention guidelines recommend a single intramuscular dose of 500 units<sup>[8]</sup>.

As natural immunity is not conferred following tetanus infection, all patients require a full active immunization series. Vaccination should be initiated at the time of diagnosis<sup>[23]</sup>. Accordingly, in our patient, who presented with a provisional diagnosis of tetanus and unknown vaccination status, a single

intramuscular dose of 500 units TIG was administered at multiple anatomical sites, along with one dose of tetanus vaccine. A schedule for primary immunization was planned, with two additional tetanus vaccine doses at 1 and 6 months.

The principal determinant of tetanus-related mortality is generalized muscle spasms, which may lead to life-threatening complications, including respiratory failure, aspiration, and multisystem dysfunction. Although high-quality evidence is limited, sedation and muscle relaxants, combined with mechanical ventilation when indicated, have been shown to improve survival. Benzodiazepines, such as diazepam and midazolam, act by enhancing gamma-aminobutyric acid receptor activity and are commonly used for muscle relaxation<sup>[24]</sup>. Neuromuscular blocking agents are indicated in severe cases when sedation alone is insufficient.

In the present case, oral baclofen (20 mg twice daily) was initially administered for pre-intubation muscle spasms, along with tramadol (50 mg three times daily) for severe pain. On the second day of hospitalization, worsening spasms prompted elective intubation and transition to IV midazolam and fentanyl for sedation. Persistent spasms necessitated escalation of baclofen and initiation of continuous rocuronium (esmeron) infusion for neuromuscular blockade. With the onset of autonomic dysfunction, including fever and tachycardia, dexmedetomidine—an alpha-2 adrenergic agonist with sedative, analgesic, and sympatholytic properties—was added. Following clinical stabilization, doses of sedatives and spasmolytics were gradually reduced, and by day 25 all such therapies were discontinued. The patient's condition stabilized, and he was transferred to the Infectious Diseases Service on day 40 of hospitalization.

Although tetanus is rare in the modern era, case reports continue, particularly among unvaccinated individuals in developing countries. In cases of penetrating trauma, absent or incomplete vaccination, or the presence of suspicious clinical signs, tetanus should always be considered. For patients with uncertain immunization status, the need for both tetanus vaccine and TIG should be evaluated regardless of wound characteristics. Early recognition, prompt administration of TIG and antibiotics, and appropriate supportive care remain crucial in reducing morbidity and mortality associated with tetanus.

## Ethics

### Informed Consent:

## Footnotes

### Authorship Contributions

Surgical and Medical Practices: E.S., F.M., F.Ö., Concept: E.S., F.M., F.Ö., Design: E.S., F.M., F.Ö., Data Collection or Processing: E.S., F.M., F.Ö., Analysis or Interpretation: E.S., F.M., F.Ö., Literature Search: E.S., F.M., Writing: E.S.

**Conflict of Interest:** The author declare no conflict of interest.

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Figure 1. xxxxxxxxxx

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