

## Original Research

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**Odontogenic Infection as a Hidden Route of Generalized Tetanus in Intensive Care Unit:  
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**ABSTRACT**

Tetanus, an infection caused by *Clostridium tetani*, remains a global health concern due to its high fatality, morbidity, and mortality rates. Although the spores of this bacterium are commonly found in soil and animal waste, contamination of the oral cavity due to poor oral hygiene and inadequate dental care also presents a significant risk. This study aimed to describe the role of dental infection in the incidence of tetanus in the intensive care unit. This study used descriptive study design with case report method. A 67-year-old male patient was admitted for 38 days to the intensive care unit of a government hospital in Bandung due to grade III generalized tetanus, with Ablett grade IV classification and Tetanus Severity Score (TSS) of 7. The patient had a history of stab wounds from wood and multiple plaque (+) in the oral cavity due to poor oral hygiene and had a habit of cleaning teeth using sticks that were not clean and not in accordance with recommended dental care tools. History of tetanus vaccine with incomplete dose. During treatment, the patient required mechanical ventilator assistance with CPAP-PS mode. Conclusion of this research that the route of entry for tetanus-causing bacteria can be through wounds, including wounds in the oral cavity that often go unnoticed. Therefore, it is very important to maintain oral hygiene through the application of proper oral hygiene and eliminate the habit of cleaning teeth with dirty tools.

## Introduction

Tetanus disease, caused by infection with *Clostridium tetani* bacterial spores, remains a global health threat with an estimated 50,000 fatal cases each years (Behrens, Ochmann, Dadonaite, & Roser, 2024). Data from WHO/UNICEF shows there were approximately 13,500 reported cases of tetanus worldwide in 2016, with the majority of these cases (85%) occurring in individuals beyond the newborn period (more than 28 days) or categorized as non-neonatal tetanus (WHO, 2018). According to the latest WHO data published in 2020, Tetanus deaths in Indonesia reached 2,742 or 0.16% of total deaths. The age-adjusted mortality rate was 1.13 per 100,000 population. Indonesia is ranked 22nd in the world (WHO, 2020).

The high prevalence of tetanus is not due to human transmission, but instead occurs due to environmental exposure. Tetanus is often associated with hygiene practices and low vaccination rates in an area (Centers for Disease Control and Prevention (CDC), 2025; Putri, 2020). This infection occurs when spores of the *Clostridium Tetani* bacteria enter the body through a wound or damaged tissue. These wounds are usually caused by deep penetrating wounds, open fractures, gunshot wounds, surgical procedures, or through superficial skin injuries, snake bites, and scorpion stings.

Tetanus caused by odontogenic infection or infection of the teeth is very rare (Meregildo-Rodriguez et al., 2023). In the last decade only six cases of tetanus due to odontogenic infection have been reported (Akbar et al., 2022). Case reports suggesting an association between tetanus and dental infections are related to dental procedures or conditions, including tooth extraction, root canal treatment, tooth decay, periodontal abscess, and trauma to the oral soft tissues (Amaliah & Wardhany, 2024; Aprilia, Prasanty, Santoso, & Choiriyah, 2024; Bassey, Anyanechi, & Osunde, 2018). In some cases, the entry point of the bacteria may not be identified or is no longer visible when symptoms begin (Tejpratap, Tiwari, Moro, & Acosta, 2021). The occurrence of tetanus caused by dental infection is identified when there is no entry point for the bacteria or the wound is resolved.

Tetanus infection often leads to the death of the patient in the hospital, mainly due to autonomic nervous system failure, cardiac disorders, and other complications affecting the central nervous system, including the peripheral motor endings, spinal cord, and brain, as well as in the sympathetic nervous system. Tetanus toxin works by interfering with the release of neurotransmitters, which block inhibitory impulses. This leads to continuous muscle contraction without relaxation (tonic spasm), seizures and can cause autonomic dysfunction (Tejpratap et al., 2021).

Due to the high fatality rate of tetanus and the high mortality rate, it is important to pay increased attention to this infection. Moreover, several studies have indicated that the source of infection is not only limited to common open wounds, but can also originate from various factors. In this case, odontogenic infection was only identified as the cause after the wound on the sole of the foot had healed. This case emphasizes that tetanus should be considered even without typical exposure to wounds, especially in areas with low vaccination coverage. Therefore, this case report aims to describe the role of dental infection in the incidence of tetanus in the intensive care unit.

## Method

This descriptive study using the case report method reports the case of a patient who developed generalized tetanus due to dental infection in Intensive Care Unit of a Bandung Government Hospital. for 4 days from march 2 to 5, 2025. Data collection included observation, interviews with the patient and family, physical examination and supporting examination. The data obtained were described and discussed based on theory. The legal aspects of ethics applied in this study are autonomy, non-maleficence, and confidentiality. The author obtained informed consent from the participant for publication of this case report, in compliance with ethical guidelines and protection of the patient's rights.

## Case

A 67-year-old man in Intensive Care Unit of Bandung Government Hospital with a medical diagnosis of Grade III general tetanus, patel joag grade IV ablet score with signs of dysautonomia and respiratory failure, Vulnus scissum regio plantar pedis sinistra post incision cross, apical periodontitis, gangrene radices 31,36, 41,42. The patient had poor personal hygiene habits, especially in oral hygiene. Before the illness, the patient admitted that he did not brush his teeth or perform other oral hygiene, the patient also had a habit of cleaning his teeth using tools such as toothpicks (including sticks) or other tools that were not clean.

On physical examination, a Glasgow Coma Scale (GCS) score of E4M6Vtc was found, indicating a somnolent state and unstable vital signs. Blood pressure fluctuated between 120/40 to 165/105, respiratory rate varied

between 19-25x/min, while heart rate was still in the normal range between 68-98x/min, normal temperature 36.5 degrees Celsius, oxygen saturation 100% with the help of mechanical ventilation CPAP-PS mode, pressure support 5, peep 5, FiO2 50%, PEAK 10, tidal volume 321 ml, installed tracheostomy with a depth of 7.5cm. Signs and symptoms of tetanus were still found, namely board-like abdominal rigidity (+). There are no other signs such as trimus (-) the patient can open the mouth 2 fingers wide, risus sardonicus (-), opisthotonus (-), spontaneous spasm (-), excitatory spasm (-). While the signs of dysautonomia that are still found, namely tachypnea (+), unstable blood pressure (+), and hyperhidrosis (+): there is excessive sweat output on the neck and forehead. There are no other signs such as tachycardi, hypersaliva, or hyperthermia.

**Figure 1.** Oral cavity findings in a tetanus patient with odontogenic infection



Source: Original photo by the author

The patient was diagnosed as grade III generalized tetanus with Ablett grade IV classification based on ablet score classification, as well as signs and symptoms of tetanus. Based on the prognosis assessment using the Tetanus Severitu Score (TSS), the patient has a total score of 7 which indicates a poor prognosis and has a high risk of complications. Laboratory examination showed that the patient had mild anemia and compensated respiratory acidosis while other electrolytes showed normal values. Thorax photograph showed bilateral bronchopneumonia (improvement) and no cardiomegaly. After intensive care, the patient showed improvement and was transferred to the regular ward.

## Discussion

Tetanus is an acute infectious condition caused by a toxigenic strain of *Clostridium Tetani* (C. Tetani) bacteria. C. Tetani is a slender rod-shaped, gram-positive bacterium that is anaerobic and capable of forming spores. The spores are resistant to heat, which in the sterilization process using an autoclave, C. Tetani can survive at 121°C for 10 to 15 minutes and is resistant to common antiseptics. Spores are often widespread on the soil surface and in animal feces. Thus, soil that has been mixed with manure will have a high potential for the presence of C.Tetani spores (Tejpratap et al., 2021). C.Tetani bacteria, including its spores,

can also be found as contaminants in the oral cavity. Teeth that are damaged by caries or wounds after tooth extraction are at risk of becoming the starting point for the entry of tetanus-causing bacteria into the body (Aprilia et al., 2024; Robinson & Laskin, 1957). Dipalma et al., (2024) explained that dental caries or cavities are the main source of odontogenic infection. Dental caries can cause enamel damage which allows bacteria to multiply and spread to the surrounding bone and soft tissue after reaching the dental pulp. Through this possibility, bacteria can also enter the bloodstream which has the potential to cause wider infection throughout the body.

Tetanus caused by secondary complications due to dental problems is rarely reported in the medical literature. The first published case report of odontogenic (tooth-derived) tetanus was in 1949 with the possibility of it occurring due to the use of contaminated instruments during tooth extraction (Darraj, Stone, Keynan, Thompson, & Snider, 2017). A similar incident occurred at MGM Dental College and Hospital, Navi Mumbai. After undergoing treatment of a carious tooth on the maxillary second premolar, the patient complained of signs and symptoms of tetanus such as trismus, dysphagia, and neck stiffness. The case report by Baviskar et al., (2021) explains that trauma due to rusty metal during dental treatment can occur, in addition to less than optimal cleaning of contaminated instruments, reuse of disposable anesthesia syringes can be a potential breeding ground for bacteria and a means of spreading infection.

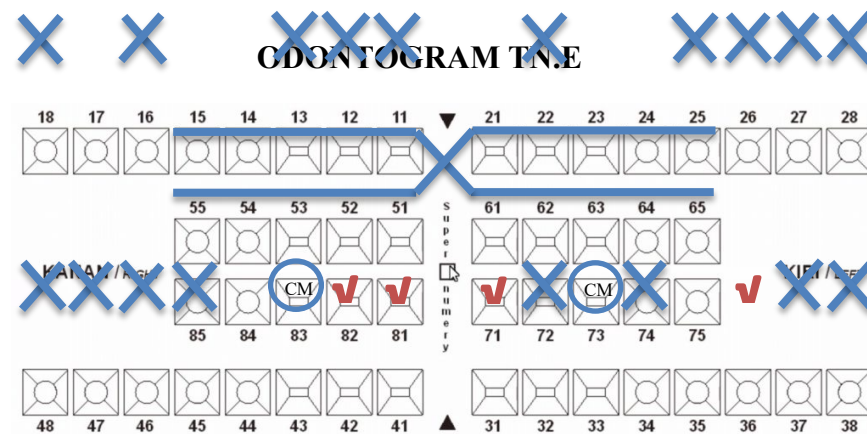
Other reports have also supported the association of tetanus cases with oral problems such as caries and molar fractures (Darraj et al., 2017; Ulfa & Husna, 2020) tooth extraction (Meregildo-Rodriguez, Asmat-Rubio, & Vásquez-Tirado, 2023), poor oral hygiene and cleaning teeth with tools not intended for teeth (Mubaraq, Saputra, & Prihatiyanto, 2024; Wati & Syahrul, 2018). However, the source of infection is often not identified. Darraj et al.

(2017) revealed that in a large proportion (up to 40% of all tetanus cases), doctors or other health workers could not identify the exact source of *Clostridium tetani* entry because there was no clear wound or injury history that could be a portal of entry for the bacteria and the possibility of infection from hidden infection source locations such as in the oral cavity so that the source of infection was often (Aprilia et al., 2024; Thwaites & Loan, 2015).

In this case, the patient was diagnosed with generalized Tetanus Grade III patel joag grade IV ablet score with signs of dysautonomia and respiratory failure, vulnus scissum regio plantar pedis sinistra post incision cross, apical periodontitis, radical gangrene 31,36,41,42. The patient had an initial history of wood stab wounds while working in the fields. The incubation period is usually about 8 days, with a general range of 1 to 21 days. In general, the incubation period is longer if the injury site is far from the central nervous system (Baviskar, Ahuja, Natarajan, & Bagchi, 2021). A shorter incubation period is also associated with severe illness and a higher risk of death (Surya, 2016). The incubation period experienced by the patient is still in the general range of 9 days.

In this particular case, a cross incision was performed from the beginning. However, despite a 19-day stay in the ICU, the patient still had persistent spasm which prompted the need for evaluation. Finally, further search for the source of infection was carried out through ear and intraoral infection examination. Ear examination revealed no ear source of infection while intraoral examination revealed apical periodontitis and radial gangrene in several teeth (31, 36, 41, 42). This indicated a chronic odontogenic infection exacerbated by the patient's poor oral hygiene habits. So it is highly suspected that it contributed to or aggravated his tetanus condition apart from the leg wound. The following is a picture of the patient's dental condition on the Odontogram:





The patient's odontogram showed apical periodontitis and radical gangrene on several teeth (31, 36, 41, 42) with calculus (+) or hardened dental plaque, while the mouth opening was difficult to assess. According to Setiawati et al. (2022) that the main cause of periodontal tissue damage is dental plaque. Periodontal tissue damage will increase in line with increasing age. This is because the accumulation of plaque formation in the elderly is faster than at a young age due to physiological changes in saliva or the opening of cementum tissue whose surface is rough, making it easier for dental plaque formation. In addition, the accumulation of plaque and dental calculus can also be caused by irregularity and improper brushing techniques, as well as reluctance to seek dental care from health professionals. This accumulation allows gingival inflammation to occur. Persistent gingivitis is a major risk predictor for periodontal attachment breakdown (Lertpimonchai, Rattanasiri, Arj-Ong Vallibhakara, Attia, & Thakkestian, 2017). These factors found in patients are major contributors to the cause of periodontitis.

Apical periodontitis and radical gangrene suffered by patients can potentially become secondary focal infections if *C. Tetani* contamination occurs. *C. Tetani* contamination in the oral cavity can be caused by invasive actions that are not in accordance with dental standards or through the habit of cleaning teeth using tools that should not be used on teeth (such as sticks) as a habit that the patient had before entering the hospital, which creates a portal of entry for

bacteria. Furthermore, Dipalma et al., (2024) revealed that periodontal infections can encourage the growth of harmful bacteria, because in periodontal infections there is damage to the gums, periodontal ligaments, and alveolar bone which is the tissue supporting the teeth. This damage can create inflammatory and necrotic conditions in the apical periodontium and dental radices that can facilitate colonization and proliferation of *C. tetani* due to supportive local anaerobic conditions.

Through these possible ports of entry, *C. Tetani* causes clinical manifestations of tetanus by producing two toxins, tetanolysin and tetanospasmin. Tetanospasmin, works to invade the central nervous system by inhibiting the release of neurotransmitters through retrograde axonal transport (the mechanism of transportation of molecules and organelles within the axon moving from the tip of the axon towards the nerve cell body). Neurotransmitters are chemicals that play a role in the transmission of nerve signals. GABA (Gamma Aminobutyric Acid) and Glycine are neurotransmitter inhibitors. When tetanospasmin enters the cell, the cell fails to inhibit the motor reflex response to sensory stimulation, resulting in continuous muscle contraction (spasm and muscle rigidity). The stiffness that occurs can start from the site of bacterial entry or in the masseter muscle (trimus) then becomes neck muscle stiffness accompanied by difficulty swallowing (McElaney, Iyanaga, Monks, & Michelson, 2019). When there is severe stiffness such as in

the extremities, chest muscles, abdominal muscles, and seizures have begun, it means that the toxin has entered the spinal cord. Then when spontaneous seizures occur, it indicates that the toxin has entered the cerebral cortex (Harum, 2014). Seizures cause arm flexion and adduction as well as strong clenched hands and legs in extension position.

In this case, rigidity has occurred throughout the body and seizures have occurred either triggered by stimulation or spontaneously. This indicates that the toxin may have spread to the entire central nervous system, including the spinal cord and cerebral cortex. However, after the source of infection was resolved (tooth extraction) and the patient was intensively treated in the ICU room, there was an improvement in the condition. The stiffness in the muscles of the body decreased and seizures no longer occurred. The patient's posture also began to improve, with the arms no longer in a flexion and adduction position. However, the patient's hands were still often in a clenched position, the legs were still often bent, and body movements were still limited.

Based on pathophysiological mechanisms, tetanus patients generally remain conscious despite experiencing severe pain and seizures, due to inhibition of GABA neurotransmitters that trigger increased activity of acetylcholine, dopamine, serotonin and norepinephrine (Harum, 2014; Wati & Syahrul, 2018). However, in our case, the patient received midazolam sedation which works to amplify the effects of GABA, resulting in decreased consciousness and reduced response to stimuli as part of the therapy to control spasm and prevent seizures.

Tetanus can increase morbidity and mortality due to complications such as laryngospasm, fractures, hypertension, nosocomial infections, pulmonary embolism and pneumonia. Laryngospasm or respiratory muscle spasm causes respiratory distress. Fractures of the spine or long bones may occur due to sustained contractions and spasms. Hyperactivity of the autonomic nervous system may cause hypertension or abnormal heart rhythms. Nosocomial infections are common due to prolonged hospitalization. Secondary infections

may include sepsis due to catheter insertion, hospital-acquired pneumonia and decubitus ulcers (Tejpratap et al., 2021). Often airway obstruction can be the primary cause of death from tetanus. However, the direct cause of death cannot be determined with certainty and can only be considered as a result of extreme fatigue. This case, the patient developed complications in the form of contraction of the respiratory muscles causing respiratory distress requiring mechanical ventilation support. The patient had sepsis shock due to Hospital-Acquired Pneumonia which was diagnosed on the 4th day of hospitalization. The complication worsened the patient's clinical condition and increased the length of hospitalization. The complexity of symptoms and the potential for vital organ failure make tetanus a disease that requires intensive and multidisciplinary treatment (Nakajima, Aso, Matsui, Fushimi, & Yasunaga, 2018).

## Conclusions

The patient had severe generalized tetanus complicated by autonomic dysfunction and respiratory failure that was likely triggered by two sources of infection, a wound on the leg and a chronic dental infection. A history of poor oral hygiene habits, no dental care, and cleaning teeth using dirty tools were strongly suspected to be contributing factors to the occurrence of tetanus in a patient with inflammatory and necrotic conditions in the apical periodontium and dental radices. Factors that aggravate the condition of tetanus in patients such as late and inappropriate wound management, advanced age, and incomplete immunization history encountered in patients. In addition to the direct complications of tetanus, the patient also had nosocomial infections such as pneumonia due to immobilization and ventilator use, which can increase morbidity and mortality. Thus this case report shows that untreated dental infections can be an entry point for C.Tetani and then develop into serious and potentially life-threatening complications. Therefore, prevention efforts through the application of proper oral hygiene and eliminating the habit of cleaning teeth with dirty tools are important steps in reducing the risk of odontogenic infections.

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## Author Contributions

Felantina Restyar Nintyas: Writing – Original Draft, Data Collection, and Data Analysis.

Anastasia anna: Supervision, Validation, Review and Editing.

Cecep Eli Kosasih: Critical Review and Evaluation

## Conflict of Interests

The authors declare that there is no conflict of interest regarding the publication of this article.

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