

CASE REPORT

CAN NAIL DAMAGE BE FATAL? A CASE REPORT OF TETANUS IN A GERMAN BOXER

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Address: Zmaja od Bosne 90, 71000 Sarajevo, Bosnia and Herzegovina**Phone:** 0038763732458**ORCID:** 0009-0002-8385-7191**E-mail:** antealjubez@gmail.com**Original Submission:**

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How to cite this article: Ljubez A, Čamo D, Mutevelić T. 2024. Can nail damage be fatal? A case report of tetanus in a German boxer. *Veterinaria*, 73(3), 250-5.**ABSTRACT**

Tetanus is a neurologic disease caused by the action of tetanus toxin (TeNT) produced by the Gram-positive, ubiquitous, sporulating, anaerobic bacterium *Clostridium tetani*. It is a rare disease in dogs due to their resistance to the toxin. A 1-year-old, male German Boxer presented with a three-day history of lethargy, facial abnormalities, dyspnea, ptialism, dysuria and constipation. The owners also reported that the dog's nail had broken two weeks ago. Clinical examination revealed ptialism, hyperthermia, abnormal facial expressions (wrinkled forehead, *risus sardonius*) and eyes' position (ventrolateral strabismus), trismus, dysuria, and muscle rigidity, which progressed to seizures and generalized spastic tetraplegia. Complete blood count showed increased reticulocyte count, low reticulocyte hemoglobin content, and eosinopenia. The biochemistry profile revealed decreased amylase values, hypochloremia, and creatine kinase was significantly elevated. A presumptive diagnosis of generalized tetanus was based on the history, wound presence, and characteristic clinical signs. The initial treatment was based on previously published recommendations, and it included: IV fluids, sedation and muscle relaxation, antibiotic (metronidazole), tetanus antitoxin, and supportive care. Unfortunately, during an episode of spastic muscle rigidity, apnea occurred, leading to the dog's death.

Keywords: Dog, muscle spasm, nail, tetanus

INTRODUCTION

Tetanus is a neurologic, potentially life-threatening disease caused by tetanus toxin. It is a potent neurotoxin produced by the Gram-positive, ubiquitous, anaerobic, sporulating bacterium *Clostridium tetani* (Popoff, 2020). The most common source of infection is a penetrating wound, but it can also be a damaged or broken tooth, umbilical infection in newborns, or *C. tetani*-contaminated surgical wounds (Popoff, 2020; Fawcett and Irwin, 2014). In an anaerobic environment, the spores germinate and the toxins are released. Tetanus is a rare disease in carnivores due to their relative resistance to the TeNT, and it can appear in generalized or localized forms (Greene, 2012; Maksimović et al., 2016). TeNT inhibits the release of inhibitory neurotransmitters gamma-aminobutyric acid (GABA) and glycine, leading to muscle spasms and characteristic clinical manifestations such as trismus, *risus sardonicus*, muscle rigidity, hyperextension of the limbs, ocular and facial abnormalities, urethral and anal sphincter hypertonicity, hyperthermia in generalized tetanus (Popoff, 2020; Fawcett and Irwin, 2014; Rhee et al., 2005), and painful, spastic muscles in the infected region in localized tetanus (Popoff, 2020). There is no available diagnostic test for tetanus; diagnosis is typically based on the patient's history, the presence of a wound and characteristic clinical signs (Greene, 2012; Adamantos and Boag, 2007). Complete blood count and biochemistry typically reveal non-specific abnormalities, though the muscle enzyme creatine kinase may be significantly elevated. Treatment of tetanus consists of the wound management, tetanus antitoxin, sedation and muscle relaxation, antibiotics, and supportive care (Acke et al., 2004). Possible complications may include: aspiration pneumonia, hiatal hernia, laryngeal spasm, respiratory arrest, and urinary tract infections (Adamantos and Boag, 2007). Untreated and neglected cases are usually fatal (Acke et al., 2004).

This is a case report of the diagnosis, treatment and outcome of generalized tetanus in a one- year-old male dog.

Case description

A 1-year-old male German Boxer, weighing 24 kg, was presented with a three-day history of lethargy, difficulty in breathing and eating, facial abnormalities, ptialism, dysuria, and constipation. The first clinical sign that owners noticed was a change in facial expression. The local veterinarian suspected an allergic reaction and treated the dog with antihistamines. Due to the lack of visible improvement, the dog was referred to the Clinic for Internal Diseases, Oncology and Emergency Medicine of the University of Sarajevo - Veterinary Faculty for further investigation. The owners reported that the dog's nail had broken on the rails during a walk two weeks earlier. On the same day, the wound was treated with normal saline and chlorhexidene. According to the owners, the dog did not experience any head or spinal trauma. On admission, clinical examination revealed dyspnea, hyperthermia (39.9 °C), ptialism and dysphagia. Neurological examination revealed generalized stiffness, retracted facial muscles and lips (*risus sardonicus*), wrinkled forehead, ventrolateral strabismus (Figure 1), trismus, and rigidity of the limb and tail muscles. This condition rapidly progressed throughout the day, leading to seizures and generalized spastic tetraplegia (Figure 2). Based on characteristic clinical signs and the history of an old wound, generalized tetanus was suspected. Diazepam was used as a muscle relaxant (0.5 mg/kg rectally) to enable intravenous cannulation and blood sampling. In order to achieve sedation to relieve distress, intravenous propofol was administered at a dose of 2 mg/kg. Diazepam administration achieved only mild muscle relaxation. On the other hand, propofol successfully achieved adequate sedation level (Youngblood et al., 2018). During the sedation, basic vital parameters were monitored using an electronic sphygmomanometer and pulse oximeter (Contec Medical System, China). A cuff for non-invasive BP measurement was placed on the upper front limb of the laterally recumbent animal, and

the SpO₂ sensor was connected to the upper lip. SpO₂ revealed the heart rate of 95 beats per minute, and oxygen blood saturation was between 94-96% on spontaneous ventilation. Blood pressure was 170/70 mmHg with the mean arterial pressure of 110 mmHg, with the body temperature of 38.6 °C during sedation. The history, clinical examination, and sedation were followed by blood sampling from the cephalic vein into an IDEXX EDTA KE/1.3 microtube for hematology and an L-heparin LH/1.3 microtube for heparinised plasma biochemistry panel (Chem 17 CLIP), electrolytes (Lyte 4 CLIP), and creatine kinase blood tests. Complete blood count was performed using a ProCyte® Hematology Analyzer (Idexx Laboratories Inc.), and biochemistry panel, electrolyte and creatine kinase using a Catalyst One® Chemistry Analyzer (Idexx Laboratories Inc.). Complete blood count revealed increased reticulocyte count, low reticulocyte hemoglobin content, and eosinopenia. Biochemistry profile showed decreased amylase values, hypochloremia, and CK was significantly elevated (774 U/L (reference ranges: 10-200 U/L)). With the exception of creatine kinase, which was abnormal, no other laboratory parameters were clinically relevant.

Based on characteristic clinical signs and the history of the old wound, generalized tetanus was suspected. Differential diagnoses for the dog included immune-mediated polymyositis, strychnine toxicity, spinal trauma, hypocalcemia, and meningoencephalitis. Immune-mediated polymyositis and meningoencephalitis were ruled out due to the lack of specific symptoms. Spinal trauma and strychnine toxicity were ruled out based on the history, and hypocalcemia could be ruled out based on the normal calcium values on the biochemical panel.

Intravenous fluid therapy with balanced isotonic crystalloid solutions (3 mL/kg/h of 0.9% normal saline) was used to maintain adequate hydration. Metronidazole (Fresenius Kabi, Austria (15 mg/kg IV)) was the antibiotic of choice. Initially, the patient received 60 IU of anti-tetanus equine serum (Clotean, Bioveta, Czech Republic) subcutaneously. Thirty minutes later, after verifying the absence of

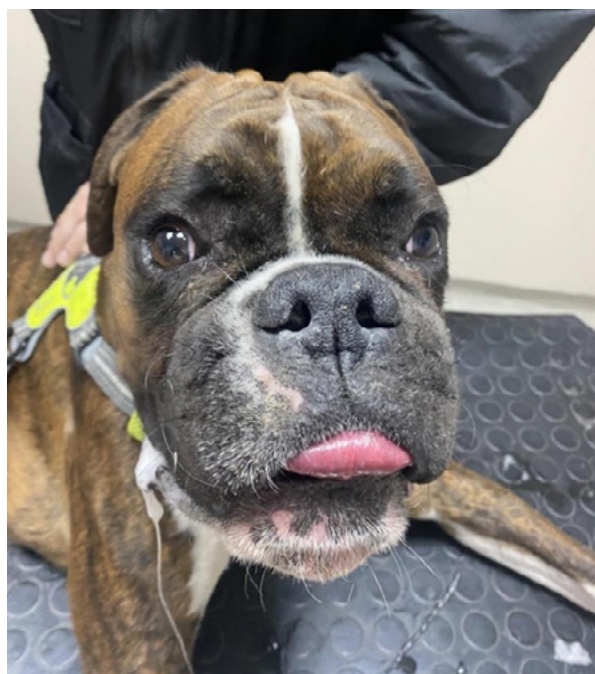


Figure 1

Abnormal facial expression and ptialism in the dog with tetanus

hypersensitivity to the serum, the full dose (12 000 IU) was given as a bolus intravenously over 30 minutes. Catheterization was performed due to the inability to urinate voluntarily.

On the same day, the dog was sent to the primary veterinary clinic for continued intensive care. Unfortunately, although the dog was stable during the day, its condition worsened in the evening. Due to a spastic muscle rigidity episode, apnea occurred, and it resulted in the dog's death.

DISCUSSION AND CONCLUSION

Tetanus is a rare neurological disease in dogs due to their species' inherent resistance to the TeNT. It is believed that their peripheral nervous tissue is insensitive to penetration by the toxin, anyhow, cases of tetanus have been reported in dogs (Adamantos and Boag, 2007; Acke et al., 2004; Matthews and Forbes, 1985; Bandt et al., 2007; Burkitt et al., 2007; Sprot, 2008). An anaerobic environment is necessary for bacteria to produce



Figure 2

Spastic tetraplegia
in the dog with
tetanus

the neurotoxin. Toxin enters the axons of the peripheral nerves and migrates to the neuronal cell body in the spinal cord and the brain. From that point, TeNT is transported to the interneurons with which they irreversibly bind and inhibit the release of GABA and glycine, leading to muscle spasm (Greene, 2012). The most common form of tetanus in dogs is the generalized form; the first noticed clinical signs before progression to the generalized form are usually ocular and facial abnormalities (Ives, 2014). The clinical signs of the dog in this case were in typical progression, as it was described by Ives (2014). Clinical signs may develop 3-18 days after wounding, as was found in this case. Due to the aforementioned toxin resistance of dogs, disease onset may occur even 3 weeks after an injury. Incubation time varies, and it is also dependent on the distance of the wound from the central nervous system. The incubation period is longer when the wound is farther from the head, but usually, it lasts between 5 and 10 days (Greene, 2012; Burkitt et al., 2007). It is also well known that younger animals may be more likely to develop more severe clinical signs due to their immature natural immunity (Greene, 2012). The head-wound distance and the dog's age significantly corroborate with our case report in which the nail of the one-year-old dog had been broken two weeks ago.

There are no available antemortem diagnostic tests for tetanus, and the diagnosis is usually based on the

history, the presence of a wound, and characteristic clinical signs (Greene, 2012; Adamantos and Boag, 2007). There are some potentially helpful parameters such as muscle enzymes creatine kinase and aspartate aminotransferase (AST) whose values are elevated due to continuous muscle contractions. Elevated creatine kinase further increased the suspicion of tetanus in this case. Even though thoracic radiography may be useful to rule out the presence of complications such as aspiration pneumonia or hiatal hernia (Ives, 2014), it was not taken in this case. Radiological examination was postponed to avoid increased muscle spasm due to manipulation, since it is known that it is usually triggered by stimulations such as touch, noise or light and that over-stimulation may just worsen the degree of spasm (Popoff, 2020; Ives, 2014). Anaerobic bacterial culture and serum antibody titers to tetanus toxin theoretically may be used. The reason why these tests are not widely used in practice is the small possibility of *C. tetani* culturing. Furthermore, serum antibody titers to tetanus toxin tests require comparing values to control animals (Ives, 2014). Both of these tests would be time-consuming, and the therapy in cases of tetanus needs to be started as soon as possible. For this reason, these tests were not performed in this case. Differential diagnoses for the dog included immune-mediated polymyositis, strychnine toxicity, spinal trauma, hypocalcemia, and meningoencephalitis (Spratt, 2008). Immune-mediated polymyositis and meningoencephalitis

were ruled out due to the lack of specific symptoms (Sprott, 2008; Morozumi et al., 1991). Spinal trauma and strychnine toxicity were ruled out based on the history, and hypocalcemia could be ruled out based on the normal calcium values on the biochemical panel. Tetanus treatment is not specific, but rather based on recommendations such as wound debridement, tetanus antitoxin, sedation and muscle relaxation, antibiotics, and supportive care (Popoff, 2020; Acke et al., 2004). In this case, the therapy was mainly based on previously published recommendations. Tetanus antitoxin usage in carnivores is controversial because the optimal dose and the efficacy of the antitoxin have not been clearly defined (Adamantos and Boag, 2007). Its role is to neutralize unbound toxins, and it is not effective in neutralizing already bound toxins. The dose ranges from 100 units/kg up to a maximum dose of 20.000 units (Sprott, 2008). Its half-life is approximately two weeks, so only one dose is needed (Adamantos and Boag, 2007). Although penicillin has been recommended for many years, metronidazole is the drug of choice for the treatment of dogs with tetanus recently. According to Ahmadsyah and Salim (1985), its use has been associated with a shorter recovery time and lower mortality rates. Besides that, dogs treated with metronidazole needed smaller doses of muscle relaxants and sedatives (Farrar et al., 2000). Penicillin is effective against anaerobic Gram-positive bacteria, but it is also a GABA antagonist so it may potentiate the effects of the TeNT (Adamantos and Boag, 2007). The addition

of magnesium seemed to be beneficial in the early and latter stages of tetanus. Magnesium was used to increase muscle relaxation and to increase the time interval between a sedative administration (Papageorgiou and Anagnostou, 2021). As stated by Sun et al. (2019), there is a possible negative impact of wound debridement in cases of moderate or severe tetanus where the wound have already healed. In that case, debridement should be done after stabilization.

As it was explained by Burkitt et al. (2007), a canine tetanus severity classification system is derived from the human classification system, and it included 4 classes. Class I included dogs with facial signs of tetanus; class II included dogs with dysphagia and generalized rigidity with or without facial signs; class III included dogs with signs described in class I and/or class II along with recumbency and seizures; and class IV included dogs with some of the previously mentioned signs along with abnormal heart and respiratory rate or abnormal blood pressure measurements. Most of the 38 dogs evaluated in the retrospective case series by Burkitt et al. developed more severe clinical signs after the first evaluation. In this case, the dog was initially graded as class II due to the presence of facial abnormalities along with generalized rigidity and dysphagia, and it progressed during the day to class III with recumbency and seizures. In such cases, the prognosis is poor with a survival rate of 58% (Burkitt et al., 2007).

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MOŽE LI OŠTEĆENJE NOKTA BITI KOBNO? PRIKAZ SLUČAJA TETANUSA KOD NJEMAČKOG BOKSERA

SAŽETAK

Tetanus je neurološko oboljenje nastalo djelovanjem tetanusnog toksina (TeNT) kojeg proizvodi gram-pozitivna, ubikvitarna, sporogena anaerobna bakterija *Clostridium tetani*. Tetanus je kod pasa rijetko oboljenje zahvaljujući njihovoj rezistenciji na toksin. Jednogodišnji mužjak njemačkog boksera primljen je sa slikom trodnevne letargije, facijalnih abnormalnosti, dispnejom, ptijalizmom, disurijom i konstipacijom. Prema riječima vlasnika, pas je prije dvije sedmice slomio nokat. Klinički pregled je pokazao ptijalizam, hipertermiju, patološke facijalne ekspresije (nabrano čelo, *risus sardonicus*) i položaj očiju (ventrolateralni strabizam), trizmus, disuriju i mišićnu rigidnost koji su uznapredovali do konvulzija i generalizirane spastične tetraplegije. Kompletna krvna slika je pokazala povećan broj retikulocita, nizak sadržaj hemoglobina u retikulocitima i eozinopeniju. Biohemijska analiza krvi pokazala je snižene vrijednosti amilaze i klora, dok je kreatin kinaza bila signifikantno povišena. Presumptivna dijagnoza generaliziranog tetanusa je postavljena na osnovu istorije bolesti, prisustva rane i karakterističnih kliničkih znakova. Terapija se zasnivala na prethodno objavljenim smjernicama i uključivala je infuziju, sedaciju i mišićnu relaksaciju, antibiotik (metronidazol), tetanusni antitoksin i potporu. Nažalost, za vrijeme epizode spastične mišićne rigidnosti, došlo je do apneje koja je dovela do uginuća psa.

Cljučne riječi: Mišićni spazam, nokat, pas, tetanus