Tetanus Infection in a Deaf-Mute Patient Presenting with Lumbar and Knee Pain, Abdominal Distension, and Constipation: A Case Report and Literature Review (Post-Print)

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Abstract

Abstract: This paper reports a case of tetanus infection in a deaf-mute patient presenting with low back pain, bilateral knee pain, and abdominal distension with constipation as initial symptoms. The patient initially visited the Department of Orthopedics and Pain Management with these complaints. During treatment, a history of contaminated wound trauma was identified, and the patient gradually developed fatigue, yellow sputum production, neck stiffness and discomfort, bilateral temporomandibular joint pain, and trismus. Physical examination revealed thoracic muscle spasms, abdominal rigidity, and neck muscle spasms, leading to an immediate diagnosis of tetanus. The patient was transferred to the Department of Neurological Critical Care Medicine for tetanus antitoxin therapy and other symptomatic treatments. Under the general practice diagnosis and treatment system, the patient improved and was discharged after 22 days of timely diagnosis and treatment. This case highlights the need for clinicians to enhance their clinical differentiation and management capabilities for tetanus. Universal vaccination, early immunological intervention following contaminated wound trauma, timely diagnosis to prevent misdiagnosis, and effective treatment are essential for preventing and treating tetanus infection and reducing mortality.

Full Text

Tetanus Infection in a Deaf-Mute Patient with Low Back and Knee Pain, Abdominal Distension and Constipation as Initial Presentations: A Case Report and Literature Review

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Abstract

This article reports a case of tetanus infection in a deaf-mute patient who presented with low back pain, bilateral knee pain, and abdominal distension with constipation as initial symptoms. The patient sought treatment at the Orthopedics and Pain Department with complaints of low back pain, bilateral knee pain, and abdominal distension with constipation. During treatment, a history of contaminated wound trauma was identified, and the patient gradually developed symptoms including fatigue, yellow sputum, neck stiffness, bilateral temporomandibular joint pain, and difficulty opening the mouth. Physical examination revealed spasms of the thoracic muscles, abdominal muscle rigidity, and neck muscle spasms, leading to an immediate diagnosis of tetanus. The patient was transferred to the Neurocritical Care Department for tetanus antitoxin therapy and other symptomatic treatments. Under a comprehensive general medical management system, the patient improved after 22 days of timely diagnosis and treatment and was discharged. This case highlights the need for clinicians to improve their clinical differentiation and management capabilities for tetanus. Prevention through vaccination, early immunological intervention after contaminated wounds, timely diagnosis to avoid misdiagnosis, and effective treatment are essential for preventing tetanus infection and reducing mortality.

Keywords: tetanus; low back pain; knee pain; deaf-mutism

1. Case Report

Tetanus is a life-threatening and potentially fatal disease that is preventable through vaccination. With China' s healthcare development and increasing vaccine coverage, tetanus has become increasingly rare. Since the mid-20th century, the incidence of tetanus has declined dramatically worldwide, primarily due to

the development and administration of tetanus toxoid vaccines. Nevertheless, tetanus remains a significant cause of mortality in developing countries. The World Health Organization (Geneva, Switzerland) reported 13,532 tetanus cases globally in 2015, though the estimated annual incidence is as high as 1 million cases. Notably, in economically underdeveloped rural areas of China, particularly among middle-aged and elderly populations, there are individuals who have never received tetanus vaccination, and both the public and primary care physicians often lack adequate knowledge of the disease. Tetanus diagnosis relies entirely on history and clinical presentation. Therefore, for primary care clinicians who have never encountered a case in their careers, accurate recognition and timely management can be challenging, often leading to misdiagnosis and delayed treatment. Without prompt treatment, tetanus patients face a high risk of death.

This article reports a case of tetanus in a deaf-mute patient presenting with low back pain, bilateral knee pain, abdominal distension, and constipation as initial symptoms, accompanied by a literature review. We aim to raise awareness among physicians, particularly primary care clinicians, and improve clinical differentiation and management capabilities while emphasizing the necessity of promoting routine tetanus vaccination.

1.1 Patient Information A 49-year-old male with congenital deaf-mutism was admitted to the Orthopedics and Pain Department with a chief complaint (provided by family members) of "intermittent low back pain and bilateral knee pain for over six months, worsening with abdominal pain, distension, and constipation for five days." The family reported that the patient had developed intermittent lumbosacral and bilateral knee pain six months prior due to overexertion, which gradually progressed and worsened with activity. The pain intensified with cold exposure and improved with warmth, alleviating with rest. He self-administered analgesics during pain episodes. In the week before admission, his lumbosacral and knee pain worsened, prompting a visit to a local county hospital where he received acupuncture, massage, physiotherapy, and intravenous fluids (specific medications unknown) without significant relief. He subsequently developed shoulder and back pain, abdominal distension, and constipation, and was diagnosed with lumbar disc herniation, bilateral knee arthritis, and intestinal gas accumulation. He was then referred to our hospital' s department.

At admission, the patient presented with persistent lumbosacral pain radiating to the posterior thigh, lateral calf, and foot; bilateral knee pain; shoulder and back pain; worsening pain with increased abdominal pressure; occasional mild temporomandibular joint pain when opening his mouth; and abdominal distension and pain without gas passage or bowel movements. He denied fever, chills, night sweats, chest pain, cough, hemoptysis, chest tightness, palpitations, or shortness of breath. Recent weight change was not significant. Tongue coating was white and greasy, pulse was deep and slow. The patient had congenital

deaf-mutism, generally good constitution, no past medical history, no history of surgery or blood transfusion, and no known food or drug allergies. He led a regular lifestyle without alcohol, smoking, or special 不良嗜好, and had no family genetic history.

Admission physical examination: Temperature 36.8°C, pulse 85 beats/min, respiratory rate 19 breaths/min, blood pressure 120/80 mmHg (1 mmHg = 0.133 kPa). Heart and lungs were unremarkable. The lower abdomen was slightly distended with tense abdominal muscles, board-like rigidity, and significant tenderness. Bilateral knee joints showed marked peripatellar tenderness. The thoracolumbar spine exhibited tenderness on palpation and percussion beside the spinous processes and in the paravertebral regions, with limited lumbar mobility. Bilateral Huantiao acupoints were tender. Straight leg raise test was positive, bilateral femoral nerve stretch test was positive, and prone hip extension test was positive. Sensation was slightly decreased in the medial knee, anterolateral calf, bilateral ankles, and lateral feet. Muscle strength was grade 5 in all four limbs, with weakened toe flexion strength. Patellar and Achilles tendon reflexes were both (++). No lower limb edema was present.

1.2 Laboratory and Imaging Results Laboratory tests showed normal complete blood count, erythrocyte sedimentation rate, C-reactive protein, glucose (dry chemistry method), coagulation panel, liver function, urinalysis, stool routine, hepatitis B surface antigen, hepatitis C surface antigen, Treponema pallidum-specific antibody, and HIV antibody. Rheumatoid factor (RF) was 40.5 IU/mL (reference range 0-30 IU/mL), and anti-streptolysin O (ASO) was 220.6 IU/mL (reference range 0-200 IU/mL).

Imaging studies: Bilateral knee X-ray showed degenerative changes. Lumbar CT revealed: (1) L3/4 and L4/5 disc bulge, L5/S1 disc protrusion, and lumbar degenerative changes; (2) T12 wedge-shaped change; (3) Cervical CT showed no abnormal changes; (4) Pelvic CT showed partial intestinal gas accumulation and dilation; (5) Brain MRI showed bilateral maxillary sinusitis; (6) Abdominal ultrasound showed renal cysts, with no abnormalities in liver, gallbladder, pancreas, or spleen; (7) Chest X-ray showed no obvious abnormalities, and abdominal X-ray showed intestinal gas accumulation.

1.3 Treatment Course and Follow-up Based on the patient' s complaints and laboratory and imaging findings, the initial diagnosis was lumbar disc herniation, bilateral knee arthritis, rheumatoid disease, constipation, intestinal gas accumulation, and bilateral maxillary sinusitis. Treatment focused on symptomatic relief and rehabilitation using integrated traditional Chinese and Western medicine. The patient underwent local anesthesia for lumbar Shu needle minimally invasive therapy, lumbar acupoint block therapy, left knee Shu needle minimally invasive therapy, left knee acupoint block therapy, lumbar Shu needle stimulation, and massage therapy. Traditional Chinese medicine decoction (Zhishi 20g, Houpo 20g, Dahuang 30g, Ganjiang 20g, Rougui 20g, Jianghuang

12g, Baishao 15g, Danggui 40g, Gancao 20g, Taoren 15g, Mangxiao 20g) was administered orally to promote qi movement and relieve abdominal distension. After treatment, the patient' s lumbosacral pain significantly decreased, abdominal distension improved, gas passage and bowel movements resumed, and abdominal muscles became soft and flat.

During treatment, a wound was discovered on the patient' s right hand. Upon questioning the family, it was revealed that the patient had sustained a firecracker injury to his right hand half a month before admission. The wound was not treated promptly and was discovered by family members a week before admission, at which point he underwent surgical debridement and dressing at a local health clinic. On day 3 of admission, the patient developed cold symptoms with cough and yellow sputum. He was treated with intravenous cefazolin sodium 0.1g in 250ml 0.9% sodium chloride injection, and traditional Chinese medicine decoction (Jinyinhua 20g, Banlangen 20g, Baihuasheshecao 12g, Pugongying 15g, Shegan 10g, Zhizi 12g, Bohe 9g, Baijiezi 15g, Jiegeng 15g, Zhike 12g, Jiangbanxia 12g, Tiannanxing 12g, Zhebeimu 12g, Qianhu 12g, Lianqiao 20g, Leigongteng 20g, Qingfengteng 15g, Jixueteng 15g, Qianghuo 15g, Guizhi 30g, Fengfang 15g, Yanhusuo 20g, Xixin 12g, Chuanxiong 15g, Zhihuangqi 60g, Gancao 15g, Chenpi 20g, Dahuang 12g added later) orally. The patient' s upper respiratory symptoms essentially resolved.

On day 8 of admission, the patient (through gestures, with family interpretation) reported neck stiffness, bilateral temporomandibular joint pain, difficulty opening his mouth, and gradually developing generalized weakness. Immediate physical examination revealed thoracic muscle spasms, abdominal muscle rigidity (see [Figure 1: see original paper]), and neck muscle spasms (see [Figure 2: see original paper]). Considering the patient' s history of trauma half a month before admission (wound shown in [Figure 3: see original paper]), although the family claimed prompt treatment, there may have been inadequate wound cleaning and lack of tetanus antitoxin injection. We strongly suspected tetanus infection and immediately organized a multidisciplinary consultation with the Infectious Disease Department. The diagnosis of tetanus was confirmed, and the patient was transferred to the Neurocritical Care Department on the afternoon of day 8. Chest CT scan showed infection in the right lower lung. Treatment included tetanus antitoxin 75,000 IU intravenous drip, oxygen therapy, penicillin sodium 3.2 million U intravenous drip every 8 hours from day 8 to day 12, then changed to moxifloxacin hydrochloride and sodium chloride injection 0.4g once daily until discharge for anti-infection, combined with toxin neutralization, sedation, acetylcysteine solution 0.3g + levalbuterol hydrochloride inhalation solution 1.26mg nebulized inhalation every 8 hours, nutritional support, and other comprehensive treatments. After 22 days of hospitalization, the patient' s pulmonary symptoms improved, systemic pain and spasms disappeared, and blood counts recovered (see). He was discharged. Follow-up half a month later revealed no special discomfort, and the patient had returned to normal work. Repeat chest CT and blood tests at a local hospital showed no obvious abnormalities.

[Figure 1: see original paper] Thoracoabdominal muscle spasms
[Figure 2: see original paper] Neck and facial masticatory muscle spasms
[Figure 3: see original paper] Wound on the second metacarpophalangeal joint of the right hand

2. Discussion

2.1 Diagnosis and Differential Diagnosis *Clostridium tetani* is the causative agent of tetanus. The bacillus is slender, measuring (0.5-1.7) m × (2.1-18.1) m, Gram-positive, with peritrichous flagella and no capsule. *C. tetani* is strictly anaerobic, and its spores are commonly found in soil and feces, showing high resistance to high temperatures and common disinfectants. *C. tetani* produces two exotoxins: oxygen-sensitive tetanolysin and tetanospasmin, with the latter being the primary pathogenic substance causing tetanus. Tetanus typically results from skin breaches allowing *C. tetani* invasion, most commonly through contaminated wounds, particularly puncture wounds from nails or iron wires, followed by cuts from vegetation, bamboo, branches, glass, and injuries from falls, traffic accidents, or falling objects. Poor perinatal hygiene and improper neonatal umbilical cord care can also cause tetanus. Puncture wounds are most conducive to *C. tetani* spore germination due to the low-oxygen microenvironment that favors bacterial growth. Under anaerobic conditions, dormant *C. tetani* spores germinate into bacilli and produce the neurotoxin tetanospasmin, which inhibits the release of gamma-aminobutyric acid (GABA) and glycine in the central nervous system. Both glycine and GABA are skeletal muscle inhibitors; therefore, their blockade induces the characteristic muscle spasms seen in tetanus. Direct smear microscopy and bacterial isolation from wounds have low positive rates in tetanus patients and are generally not performed. Clinical diagnosis is primarily based on typical symptoms and history.

The incubation period for tetanus ranges from 2 to 36 days. The farther the initial wound is from the central nervous system, the longer the incubation period. Tetanus can be classified into four main forms: generalized, neonatal, localized, and cephalic. Generalized tetanus is the most common type (accounting for 80% of reported cases), with gradual onset approximately 3 to 21 days after infection. Symptoms typically worsen within one week, beginning with masseter muscle spasms causing trismus, followed by spread of spasms from head and neck to trunk, lasting for weeks. Classic manifestations include "risus sardonicus" from facial muscle contraction and "opisthotonus" from spasmodic arching of the head, neck, and spine. Laryngospasm or diaphragmatic spasm can rapidly lead to death. Additional autonomic disturbances may include fever, sweating, hypertension, and tachycardia, with complications such as rhabdomyolysis. Neonatal tetanus is generalized tetanus in children under one month, usually occurring 3-7 days after delivery, presenting with feeding difficulties, sucking/swallowing problems, excessive crying, and obvious spasms. Localized tetanus is rare, limited to muscle contractions in the injured area, with only 1%

mortality. Cephalic tetanus is very rare but may be associated with head lesions or chronic otitis media, typically presenting with cranial nerve palsies 1-2 days after infection. Both localized and cephalic tetanus can progress to generalized tetanus, which has a mortality rate of approximately 15%-30%.

Tetanus has a variable incubation period, and initial symptoms differ among patients, who often do not suspect tetanus and typically seek care at specialty departments based on their presenting symptoms. Previous clinical reports include tetanus cases presenting with vertigo at otolaryngology departments, difficulty opening the right eye with decreased forehead wrinkles at neurology departments, neck pain and discomfort at community hospitals, and cases misdiagnosed as temporomandibular arthritis. These patients were often unvaccinated and had histories of contaminated trauma. Only when they progressed to severe typical tetanus muscle spasms shortly after initial symptom onset did clinicians recognize the infection. However, many undiagnosed tetanus cases likely exist. Therefore, clinicians across different specialties should meticulously obtain histories, perform thorough physical examinations, and conduct proper differential diagnosis to reduce misdiagnosis and enable early diagnosis and treatment to save patients' lives.

2.2 Treatment Highlights To date, tetanus vaccination remains the primary prevention method. The clinical efficacy of tetanus toxoid-containing vaccines (TTCV) is nearly 100%, making vaccination essential for virtually everyone to obtain protection. Since 1978, China has implemented planned immunization for children, incorporating the diphtheria-pertussis-tetanus combined vaccine into routine childhood immunization programs. However, vaccination coverage in China remains concerning. An epidemiological investigation by the Guilin Municipal Center for Disease Control and Prevention on tetanus cases treated at secondary-level and above medical institutions in Guilin from 2015-2017 reported 69 tetanus cases, with an average annual incidence rate of 0.431/100,000. Except for one neonatal tetanus case, the median age of non-neonatal tetanus cases was 62 years (range 19-92), with 94.20% aged over 40. Only one case had completed 4 doses of TTCV, with a 16-year interval since the last dose; all other cases had no TTCV vaccination history.

The primary treatment goal is preventing further toxin release in the central nervous system through thorough surgical debridement and antibiotic therapy. Metronidazole is usually the first-line antibiotic, superior to penicillin, which has lower tissue penetration and GABA antagonistic activity that may enhance tetanospasmin effects. Other acceptable antibiotic options include erythromycin, tetracycline, chloramphenicol, and clindamycin. This case initially used cefazolin sodium, penicillin, and moxifloxacin, ultimately achieving good antibiotic efficacy.

The second treatment goal is neutralizing circulating toxin outside the central nervous system with human tetanus immune globulin (HTIG). Patients without complete tetanus vaccination (defined as at least 3 doses of TTCV) or with

unknown vaccination status who present with dirty or contaminated wounds should receive intramuscular HTIG for passive immunization within 24 hours of diagnosis. If HTIG is unavailable, equine anti-tetanus F(ab')$_2$ should be prioritized, followed by tetanus antitoxin (TAT). Our patient had never received tetanus vaccination, did not receive timely treatment after trauma, and the wound was discovered by family more than ten days later. He did not receive tetanus immunoprophylaxis during wound management at the health clinic, creating an extremely critical situation. After diagnosing tetanus, we urgently administered TAT.

The third treatment goal is minimizing toxin effects on the central nervous system through sedation, respiratory support, and autonomic control. High-dose benzodiazepines are commonly used to control muscle spasms. We implemented this treatment after transferring the patient to the Neurocritical Care Department.

Additionally, complications of tetanus must be treated. A retrospective study analyzing 25 tetanus patients reported complications including pneumonia (58%), conjunctivitis (41%), gastrointestinal bleeding (37.5%), urinary tract infection (33%), acute kidney injury (AKI) following rhabdomyolysis (33%), sepsis (29%), disseminated intravascular coagulation (DIC) (25%), pressure sores (25%), and acute respiratory distress syndrome (ARDS) (20%). Severe abdominal pain due to tetanus has also been reported. The pulmonary infection, fever, and abdominal distension with constipation in our case were also considered tetanus complications and were actively treated.

2.3 Insights and Limitations For this patient, the initial symptoms of low back pain, bilateral knee pain, and abdominal distension with constipation did not manifest as typical tetanus symptoms and were similar to his previous back and knee pain. Given that these symptoms were associated with orthopedic degenerative diseases such as lumbar disc herniation and bilateral knee arthritis, supported by imaging findings, both the patient and clinicians initially focused on musculoskeletal disorders. Additionally, the patient's congenital deaf-mutism hindered detailed history taking, preventing acquisition of critical information about delayed wound management and lack of tetanus immunoprophylaxis. This led to insufficient differentiation of other causes. Fortunately, when subsequent symptoms of back pain, thoracoabdominal muscle spasms, and neck and facial masticatory muscle spasms appeared, tetanus was immediately diagnosed and appropriately treated.

Since tetanus diagnosis relies primarily on clinical presentation and history, clinicians, especially primary care physicians, should enhance their knowledge and diagnostic skills for tetanus and obtain comprehensive histories. This patient was a congenitally deaf-mute individual, and doctor-patient communication could only occur through family members, which was the main reason for delayed communication and impacted timely and accurate clinical judgment. This warrants serious attention from clinicians. Furthermore, when clinicians identify

tetanus infection, prompt administration of tetanus immunoprophylaxis and anti-tetanus treatment is essential. Additionally, when trauma patients seek care from primary care physicians, clinicians should thoroughly irrigate, debride, and perform sterile management of wounds, and rationally use tetanus immunoprophylaxis to prevent tetanus infection.

In summary, prevention through vaccination, early immunological intervention after contaminated wounds, timely diagnosis to avoid misdiagnosis, and effective treatment are crucial for preventing tetanus infection and reducing patient mortality.

Author Contributions

BAO Yiru was responsible for conceptualization, literature search, and manuscript writing, with overall responsibility for the article; BAO Shouqian, ZHANG Zhaohui, and ZHANG Yinchuan were responsible for case data collection and organization.

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Note: Figure translations are in progress. See original paper for figures.