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Maternal generalized tetanus following spontaneous abortion in a vaccinated woman: a rare but persistent threat

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Abstract

Tetanus is a life-threatening, preventable infection caused by the neurotoxin of *Clostridium tetani*. Despite global vaccination initiatives, cases of adult and maternal tetanus still occur even in individuals with prior immunization. A 21-year-old female presented 15 days after a spontaneous home abortion with fever, trismus, neck stiffness, generalized rigidity, and stimulus-induced spasms. She had received the complete tetanus vaccination. Examination revealed risus sardonicus, opisthotonus, and autonomic instability. Laboratory investigations revealed mild anemia and elevated liver enzymes, and protective anti-tetanus IgG levels, while neuroimaging, abdominal imaging, and cultures were unremarkable. She received human tetanus immunoglobulin, antibiotics, benzodiazepines, magnesium sulfate, baclofen, and intensive supportive care, including mechanical ventilation and vasopressors. Despite intensive care unit care, the patient's condition worsened, resulting in death on day 10. Tetanospasmin irreversibly blocks inhibitory neurons, causing uncontrolled muscle spasms and autonomic dysfunction. Diagnosis is clinical; laboratory tests are often non-contributory. Management focuses on neutralizing circulating toxin, preventing bacterial proliferation, controlling spasms, and providing intensive supportive care. Even with intensive management, mortality remains high, primarily due to respiratory failure and autonomic dysfunction. Maternal generalized tetanus may occur following spontaneous abortion outside a healthcare setting, even in previously vaccinated individuals with protective antibody levels, and carries a high risk of mortality.

Key words: post-abort tetanus, *Clostridium tetani*, trismus, human tetanus immunoglobulin.

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Highlights

- Maternal tetanus may follow spontaneous abortion occurring outside healthcare facilities.
- Tetanus can occur despite prior vaccination and protective antibody levels;
- Non-sterile conditions and retained devitalized tissue can create an anaerobic environment favorable for *Clostridium tetani* germination;
- Diagnosis is clinical; investigations are often non-diagnostic;
- Mortality remains high despite aggressive ICU management;
- Emphasizes the need for hygienic post-abort care and improved adult booster vaccination.

Introduction

Tetanus is a preventable but potentially fatal infection caused by a neurotoxin from *Clostridium tetani*, an anaerobic Gram-positive bacillus.¹ The toxin blocks inhibitory neurotransmitters, leading to uncontrolled muscle spasms, rigidity, lockjaw, risus sardonicus, painful muscle contractions, and sometimes involuntary urination or defecation.²

Maternal tetanus remains a global public health concern due to low tetanus toxoid immunization coverage.³ About 75 million

women and newborns are still unprotected, leaving them vulnerable to infection, death, or severe complications.⁴ Poor hygiene during delivery or postpartum can trigger infection, which may occur during pregnancy or within six weeks after birth. The disease highlights health inequities, as it disproportionately affects disadvantaged populations with limited access to quality healthcare.³ Although the World Health Organization (WHO) has made strong efforts to eliminate tetanus, the disease continues to be responsible for a significant cause of maternal deaths.

Most new cases occur in South Asia and Sub-Saharan Africa,

which together account for over 80% of the global burden. In 2019, India alone reported 7,071 cases, nearly half of all reported worldwide.⁵ According to the Global Burden of Disease study, 77% of the 38,000 tetanus-related deaths in 2017 were from these regions. Mortality in developing countries remains high, ranging between 10 to 50%, largely due to limited healthcare resources and shortages of trained staff.⁶ In Africa, the estimated death rate reaches nearly 49%.⁷

Tetanus is preventable through vaccination, proper wound care, timely antitoxin after injuries, vigilant neonatal tetanus surveillance, safe hygienic delivery and cord care, and immunization of pregnant women and women of reproductive age.⁸

Adult tetanus, a neurotoxin-mediated disease, persists despite the availability of an effective vaccine. Although India eliminated neonatal and maternal tetanus in 2015 through childhood DPT (diphtheria, pertussis, tetanus) vaccination and antenatal Tetanus Toxoid (TT) immunization, adult vaccine coverage remains uneven. Pregnant women are routinely vaccinated, but booster coverage among non-pregnant adults is low, and tetanus cases in pregnancy continue to be reported, particularly in low-resource settings where immunization coverage and safe obstetric practices are inadequate.

Case Report

A 21-year-old female with a history of prior tetanus vaccination presented with fever, painful spastic contractions, and neck stiffness for 4 days. She had undergone a spontaneous abortion at home 15 days earlier at 4 months of gestation. There was no history suggestive of induced or instrumental abortion, and no evidence of unsafe or illegal procedural intervention. Following the abortion, she remained well for 11 days before developing intermittent fever, later followed by progressive spastic contractions involving the face, neck, and limbs. Spasms were precipitated by trivial stimuli such as light, sound, or touch. She also complained of difficulty opening her mouth (trismus), neck stiffness, and dysphagia. There was no history of trauma, seizures, altered sensorium, cough, burning micturition, rash, ear discharge, or drug history. No past medical history of Diabetes mellitus, hypertension, hypothyroidism, or any chronic illness. Obstetric history was Gravida 0, Para 0, Abortion 1, Live 0 (G0P0A1L0). On examination, she was alert, febrile, tachycardic, and anxious, with risus sardonicus, generalized hypertonia, and opisthotonus. Painful spasms were observed, triggered by auditory and tactile stimuli. Autonomic instability in the form of fluctuating blood pressure and tachycardia was noted. The constellation of a recent abortion, incubation period of ~11 days, classical signs (trismus, risus sardonicus, opisthotonus, stimulus-induced spasms), and autonomic disturbances strongly pointed toward post-abortion tetanus.

On examination, the patient was anxious, alert, restless, and febrile with a temperature of 101°F (~38.3°C). Vital signs revealed a pulse rate (PR) of 103 beats per minute, blood pressure (BP) of 160/90 mmHg, respiratory rate (RR) of 18 per minute, and oxygen saturation (SpO₂) of 98% on room air. Pallor was present, while icterus, clubbing, cyanosis, edema, and lymphadenopathy were absent. Neurological examination showed a full Glasgow Coma Scale (GCS) score of 15/15, with increased tone in all four limbs, hyperreflexia, neck rigidity, trismus, and spasms precipitated by minimal stimuli. The respiratory system was clear with no added sounds, the cardiovascular system revealed normal first and second heart sounds without murmurs, and the abdomen was soft, nontender, with no organomegaly.

Her laboratory parameters are summarized in Table 1. Arterial

Blood Gas (ABG) analysis was within normal limits. Neuroimaging, including Magnetic Resonance Imaging (MRI) of the brain and spine, revealed no abnormalities. Cerebrospinal Fluid (CSF) analysis was normal, and CSF, blood, and urine cultures were sterile. Procalcitonin, serum vitamin B12, and folate levels were within the reference range. Viral markers for Human Immunodeficiency Virus (HIV), Hepatitis B Virus (HBV), and Hepatitis C Virus (HCV) were negative. Peripheral blood smear demonstrated normocytic normochromic anemia, while D-dimer levels were normal. Electroencephalography (EEG) findings were unremarkable. Cardiac evaluation with echocardiography was within normal limits, and abdominal ultrasonography revealed no abnormalities.

The patient was managed with injection metronidazole 500 mg Intravenous (IV) Three Times Daily (TDS), meropenem 1 g IV TDS, pantoprazole 40 mg IV Once Daily (OD), ondansetron 4 mg IV TDS, paracetamol 100 mL IV TDS, diazepam 10 mg IV TDS, magnesium sulfate 1 g IV TDS, tetanus toxoid immunoglobulin 6000 IU Intramuscular (IM), dextrose 25% IV TDS, tablet baclofen 30 mg TDS, and intravenous fluids. On the third day of

Table 1. Laboratory parameters at admission.

Analytes	Result	Normal range
Hb	6.8	12-16 g/dL (female)
TLC	19300	4,000-11,000 /μL
DLC	85/10	Neutrophils: 40-70%, Lymphocytes: 20-40%
Platelet	3.14	1.5-4.5 × 10 ⁵ /μL
MCV	90.2	80-100 fL
S. Creatinine	0.94	0.6-1.2 mg/dL
S. Urea	42	15-45 mg/dL
S. Uric acid	5.2	3.5-7.2 mg/dL
S. Na ⁺	138.6	135-145 mmol/L
S. K ⁺	4.30	3.5-5.0 mmol/L
S. Ca ²⁺ (T/I)	2.20/1.03	Total: 2.1-2.6, Ionized: 1.1-1.3
Bilirubin (Total)	0.42	0.3-1.2 mg/dL
S. Protein	6.1	6.0-8.0 g/dL
S. Albumin	3.6	3.5-5.0 g/dL
AST	111	5-40 U/L
ALT	37	5-40 U/L
ALP	180	40-130 U/L
ESR	41	0-20 mm/hr
CRP	53	<5 mg/L
HbA1C	4.1%	4-5.6 %
Ferritin	27.14	12-150 ng/mL
INR	1.58	0.8-1.2
S. Mg	1.88mg/dl	1.7-2.2 mg/dL
CPK	65	26-192 U/L
Procalcitonin	.04	<0.1 ng/mL
Anti-Tetanus IgG Level (IU/mL)	≥0.18	Protective immunity ≥0.1 IU/mL

Abbreviations: Hb, hemoglobin; TLC, total leukocyte count; DLC, differential leukocyte count; PLT, platelet count; MCV, mean corpuscular volume; S. Cr, serum creatinine; S. Urea, serum urea; S. UA, serum uric acid; Na⁺, sodium; K⁺, potassium; Ca²⁺, calcium (total and ionized); TB, total bilirubin; S. Protein, serum protein; S. Albumin, serum albumin; AST, aspartate aminotransferase; ALT, alanine aminotransferase; ALP, alkaline phosphatase; ESR, erythrocyte sedimentation rate; CRP, C-reactive protein; HbA1c, glycated hemoglobin; Ferritin, iron stores; INR, international normalized ratio; S. Mg²⁺, serum magnesium.

admission, she developed dyspnoea with desaturation, necessitating intubation and initiation of mechanical ventilation with Intermittent Positive Pressure Ventilation (IPPV). Subsequently, she developed hypotension, which was managed with a noradrenaline infusion at 0.2 µg/kg/min, along with transfusion of one unit of Packed Red Blood Cells (PRBC). In view of worsening shock, injection teicoplanin 400 mg IV every 12 hours for three doses as a loading dose, followed by 400 mg IV once daily, was added with the addition of vasopressors and steroids. Despite intensive management, her condition worsened, and she succumbed on day 10 of hospitalization.

Discussion

Maternal and Neonatal Tetanus (MNT) remains a preventable cause of mortality in low-income countries, particularly among undervaccinated mothers and neonates following unhygienic deliveries. The Maternal and Neonatal Tetanus Elimination (MNTE) initiative targets 59 priority countries. Between 2000 and 2022, 80% of these countries achieved validated elimination. Over this period, reported neonatal tetanus cases declined by 89%, and estimated neonatal tetanus deaths decreased by 84%, reducing tetanus-attributable neonatal mortality from 2% to 0.3%. Despite substantial progress, challenges persist.⁹

Maternal tetanus is defined as tetanus occurring during pregnancy or within six weeks after birth, miscarriage, or abortion. While post-abortion tetanus has been more commonly reported after unsafe induced abortions in low-resource settings, it may also occur following spontaneous abortion managed outside healthcare facilities. In such settings, heavy bleeding, retained products of conception, and contamination during perineal care may create an anaerobic environment favorable for *Clostridium tetani* spore germination. Although unsafe abortion practices remain an important contributor globally, maternal tetanus can develop even in the absence of instrumentation when hygienic conditions are suboptimal. Although no formal reporting system exists, its elimination is assumed once neonatal tetanus elimination is achieved. Case fatality approaches 100% without care and 10-20% with optimal treatment.¹⁰ Abortion-related tetanus is a distinct and severe form of maternal tetanus, associated with higher mortality than tetanus acquired through other routes. Reliable global incidence data are limited; however, studies from low-resource settings indicate a substantial burden. In Bangladesh during the late 1990s, post-abortion tetanus accounted for approximately 55% of tetanus-related deaths among women aged 10–50 years and 35% of pregnancy-related tetanus deaths. An analysis of 1,101 maternal tetanus cases from developing countries reported that 27% were secondary to abortion. Globally, an estimated 22 million unsafe abortions occurred in 2008.¹¹ Women undergoing unsafe abortions often avoid formal health-care services, resulting in missed opportunities for tetanus immunization. Studies have demonstrated inadequate protective antitetanus antibody levels in a significant proportion of adolescents with a history of abortion.¹² Despite this risk, current WHO abortion care guidelines do not specifically address concurrent tetanus immunization strategies.¹³

Tetanus results from the production of tetanospasmin by *Clostridium tetani* following spore inoculation into a wound. The toxin disseminates via blood and lymph to peripheral nerves, enters at the neuromuscular junction, and undergoes retrograde axonal transport to the central nervous system. There, it targets inhibitory interneurons, blocking the release of gamma-aminobu-

tyric acid before (GABA) and glycine. Loss of inhibitory control over anterior horn and autonomic neurons leads to unopposed excitatory activity, manifesting as muscle rigidity, painful spasms, and autonomic dysfunction.¹⁴

C. tetani spores are highly resistant to heat, antiseptics, and environmental conditions. While wound contamination is common, toxin production occurs only in low-oxygen environments like devitalized tissue or dirty wounds, often with other microbes. Toxin binding is irreversible; neural recovery relies on new nerve terminals and synapse formation.¹⁵ Tetanus usually follows contaminated wound infection, but sometimes arises without visible injury, linked to chronic skin lesions.

Tetanus presents in three clinical forms: generalized, localized, and cephalic. Generalized tetanus, the most common, begins with jaw muscle spasms and progresses to painful spasms in the neck, abdomen, or limbs, sometimes causing autonomic instability and cardiac arrest. Localized tetanus affects muscles near the wound, while cephalic tetanus, the rarest form, arises from head or facial injuries and causes cranial nerve palsies with flaccid paralysis. Both localized and cephalic forms can advance to generalized tetanus if untreated.

Tetanus is diagnosed clinically; lab tests and wound cultures are unreliable. Conditions like strychnine poisoning, drug-induced dystonia, and hypocalcemic tetany can mimic tetanus and must be ruled out. With advanced supportive care, tetanus patients generally achieve good recovery and low mortality.¹⁶ Death is often due to hospital-acquired infections or severe autonomic dysfunction. Circulatory disturbances from autonomic dysfunction remain a major treatment challenge, peaking in the second week.¹⁷ This unstable phase involves malignant hypertension, tachycardia, hypotension, or bradycardia and can be managed using sedatives, anesthetics, clonidine, dexmedetomidine, and beta-blockers.^{18,19} Despite aggressive Intensive care unit (ICU) care, including mechanical ventilation and vasopressor support, mortality remains high in severe post-abortion tetanus due to respiratory compromise and autonomic instability.

Tetanus has occurred even in individuals with protective antitoxin antibody levels.²⁰ Similarly, a systematic review by Hopkins et al. identified 359 cases in patients with prior vaccination or antibody titers above the protective threshold.²¹ The exact cause of tetanus in vaccinated individuals is unclear. Proposed explanations include the toxin overwhelming the immune system, differences in antigenicity between the toxin and toxoid, or a weakened immune response.²² It is also suggested that some people may not develop immunity from the tetanus vaccine or may lack protection specifically against the neurotoxin.²³

The WHO recommends a primary tetanus vaccination series of 3 doses from 6 weeks to 6 months of age, followed by 3 booster doses.²⁴ Levels of anti-tetanus toxoid IgG ≥ 0.15 IU/mL are considered sufficient for protective immunity.

Tetanus management focuses on neutralizing circulating toxins, preventing further toxin production with antibiotics and wound care, and reducing central nervous system (CNS) effects.²⁵ Human tetanus immunoglobulins are given to neutralize circulating tetanus toxin before it enters the central nervous system, as existing CNS-bound tetanospasmin cannot be reversed.³ Traditionally, 3,000 to 6,000 units of immunoglobulin are administered intramuscularly.

Antibiotics in tetanus are recommended despite limited evidence; metronidazole and penicillin G are preferred, with no proven superiority between agents.²⁶ Management focuses on symptom control with benzodiazepines for muscle spasms, magne-

sium sulphate for autonomic instability, and ventilatory support when needed.^{27,28} Severe spasms may require intrathecal baclofen.^{29,30} Autonomic dysfunction is treated with labetalol; clonidine, alone or with labetalol, helps control blood pressure fluctuations and may reduce mortality.³¹ Supportive care, including nutrition and fluids, is essential. Prevention relies on vaccination and meticulous wound care; early, thorough debridement may better prevent toxin formation than antibiotics alone, though standardized guidelines are lacking.^{7,32}

Emergency physicians should suspect tetanus in patients presenting with trismus, painful muscle stiffness or spasms, or unexplained generalized rigidity, even if previously vaccinated. These red flags are particularly important in individuals with recent wounds, surgery, abortion (spontaneous or induced), or delivery, even when injuries are minor or unapparent. Prior vaccination does not exclude tetanus, as immunity may be incomplete or wane over time, and cases can occur despite protective antitetanic antibody levels. Tetanus remains a clinical diagnosis, and laboratory tests or serology are often unhelpful. Early clinical recognition and a high index of suspicion are essential to initiate prompt empiric treatment without waiting for confirmation, thereby preventing disease progression and reducing morbidity and mortality.

Conclusions

Vaccination alone may not ensure complete protection against tetanus, as immunity can be incomplete or wane over time. Prevention depends on ensuring hygienic obstetric and post-abort care, even in spontaneous abortions occurring outside health-care facilities. Clinicians should recognize that maternal tetanus may develop despite prior vaccination and apparently protective antibody levels.

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