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Suspected tetanus in an unvaccinated pediatric patient

Kimberly Walter, BS[a], Renita Thomas, MD[b], Swasti Gyawali, DO[b], and Sowmya Kallur, MD[b]

[a]Texas A&M School of Medicine, Temple, Texas; [b]Department of Pediatrics Critical Care, Baylor Scott & White McLane Children's Medical Center, Temple, Texas

ABSTRACT

Tetanus is a vaccine-preventable neuromuscular disease with a high mortality rate. The incidence of tetanus in developed countries has significantly declined due to preventive vaccination measures, but the potential for long-term complications and mortality from this disease remains high in the unvaccinated population. There are only a few individual case reports of tetanus in the pediatric population in the United States. We present a case of suspected tetanus in a 10-year-old unvaccinated child in Central Texas who sustained multiple cardiovascular and pulmonary complications during a 1-month hospitalization course. This case highlights the importance of pediatric immunization for prevention of this potentially fatal disease process and its long-term complications. Physicians should maintain a high clinical suspicion for tetanus infection in unvaccinated children to prevent delay in necessary treatment.

KEYWORDS *Clostridium tetani*; pediatrics; spasms; tetanus; vaccination

Tetanus is a life-threatening vaccine-preventable illness. It is caused by tetanospasmin, a potent exotoxin of *Clostridium tetani*. Tetanospasmin causes neuromuscular dysfunction by inhibiting presynaptic GABA and glycine release. This leads to tonic spasms and paroxysmal contractions of skeletal muscles.[1] Spores of *Clostridium tetani* are present throughout the environment in soil, dust, and manure and are often transmitted to humans via contaminated wounds. Tetanus is extremely rare in the United States due to vaccination efforts, with only 20 cases reported in 2018 and 26 cases in 2019.[2,3] Here, we describe a suspected case of tetanus in a 10-year-old unvaccinated child in central Texas resulting in a 1-month stay in the pediatric intensive care unit and ultimately requiring a tracheostomy tube.

CASE DESCRIPTION

An unvaccinated 10-year-old boy presented to the emergency department with a 2-day history of respiratory distress, cough, congestion, fever, and abdominal pain. Respiratory viral panel was positive for adenovirus and rhinovirus. Chest x-ray showed evidence of left lower lobe opacity concerning for aspiration. The child was admitted to the pediatric intensive care unit for acute hypoxemic respiratory failure requiring bilevel positive airway pressure support. A few hours into admission, muscle spasms occurred, which increased in frequency and worsened in severity. The spasms originated at the abdomen and progressed into posturing with hyperextension of the head, neck, and spine, consistent with opisthotonos. He also had restricted jaw movements and muscle stiffness. His parents reported similar movements over the past few days, where he complained of abdominal pain and would subsequently arch his back. His family lives in a rural area of central Texas and is a part of a religious community that does not promote vaccinations. There was no history of a puncture wound or recent injury, but the child frequently walked barefoot outdoors and was exposed to farm animals. On hospital day 2, he was treated for presumed tetanus infection with 375 mg/kg of intravenous immune globulin, a 10-day course of metronidazole, and intravenous diazepam for muscle spasms. Tetanus-specific intravenous immune globulin treatment was not initially available in our area. Infectious disease was consulted and recommended extensive workup including blood and urine cultures, lumbar puncture, and imaging of the brain and spine. Results of these labs and imaging were unremarkable. *Tables 1–3* summarize pertinent laboratory and imaging results.

The patient had frequent apneic events with muscle spasms leading to emergent intubation on hospital day 2. He required vasoactive agents to maintain an adequate blood

Corresponding author: Kimberly Walter, BS, Department of Pediatrics, Baylor Scott & White McLane Children's Medical Center, 1901 SW HK Dodgen Loop, Temple, TX 76502 (e-mail: kwalter8@tamu.edu)
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Table 1. Laboratory values on presentation

Test	Value	Reference range
Glucose (mg/dL)	193	70–100
Blood urine nitrogen (mg/dL)	24	5–18
Creatinine (mg/dL)	0.77	0.30–1.00
Sodium (mEq/L)	150	136–145
Potassium (mEq/L)	4.5	3.5–5.3
Chloride (mEq/L)	119	97–111
Carbon dioxide (mEq/L)	19	18–27
Calcium (mg/dL)	9.5	8.6–10.1
Bilirubin, total (mg/dL)	<0.5	0.2–1.2
Alkaline phosphatase (IU/L)	196	135–520
Apartate aminotransferase (IU/L)	72	10–45
Aanine aminotransferase (IU/L)	31	0–68
Albumin (g/dL)	3.8	3.6–5.1
Phosphorus (mg/dL)	5.7	3.7–5.6
Magnesium (g/dL)	3.5	1.8–2.4
Creatine kinase (IU/L)	1301	0–225
Lactate dehydrogenase (IU/L)	297	100–300
Myoglobin (ng/mL)	189	28–72
C-reactive protein (g/dL)	19	0–3.2
Lactic acid (mmol/L)	0.9	0.5–2.0
pH venous	7.16	7.33–7.43
pCO_2–venous (mm Hg)	55	38–50
Bicarbonate–venous (mmol/L)	20	23–27
Base excess–venous (mmol/L)	−9.5	−2.0–2.0
White blood cells (/10^9/L)	16.1	4.8–10.8
Red blood cells (/10^{12}/L)	4.13	4.7–6.1
Hemoglobin (g/dL)	12.3	11.0–16.0
Platelet count (/10^9/L)	288	150–450

pCO_2 indicates partial pressure of carbon dioxide.

Table 2. Additional diagnostic laboratory workup

Lab	Result [reference]
Respiratory viral panel	Positive for rhinovirus/enterovirus and adenovirus
Tetanus IgG	Lab unable to be processed
Blood culture	Negative
Tracheal culture	Positive for *Streptococcus* pneumonia and methicillin-sensitive *Staphylococcus aureus*
Encephalopathy panel	No informative autoantibodies
Cerebrospinal fluid culture	Negative
Ferritin	118 ng/mL [26–388]
West Nile IgG	0.44 [<1.29 IV]
Myositis panel	Negative for targets
Arbovirus panel	Negative for dengue, chikungunya, and Zika virus by PCR
Meningitis/encephalitis panel by PCR	Negative for targets
SARS-Cov2 IgG	Positive
SARS-Cov2 IgM	Negative
Copper serum	74.9 μg/dL [75–153]

PCR indicates polymerase chain reaction.

pressure. On the third hospital day, 500 units of tetanus immune globulin and the Tdap (tetanus, diphtheria, acellular pertussis) vaccine were given at separate sites with separate syringes. Neurology was consulted to assess worsening muscle spasms, and baclofen and enteral diazepam were started.

Extubation was attempted on hospital day 9 with initial success. On day 11 of admission, respiratory failure worsened significantly, requiring emergent reintubation. Two hours after reintubation, the patient developed significant hypoxia and bradycardia after bag suctioning. He developed a left tension pneumothorax secondary to high peak inspiratory pressure and was treated with needle decompression and thoracentesis. After the chest tube was placed, the patient had a code event requiring one round of compressions. Two hours after this event, he had an additional code event requiring two rounds of compression and a dose of epinephrine before return of spontaneous circulation. His respiratory status began to stabilize, and sedation was gradually weaned. Tracheotomy was performed on hospital day 16 for airway management.

After tracheostomy placement, the patient began physical and occupational therapy. Once transitioned to the tracheal collar, he was able to tolerate oral feeds. With significant clinical improvement, no longer experiencing muscle spasms or respiratory distress, the patient was discharged home on baclofen and diazepam wean after a 32-day hospital course. The family was counseled about the importance of completing vaccinations.

DISCUSSION

Tetanus is extremely rare in developed countries (with only 26 cases reported in the US in 2019[3]) so many clinicians are not adept at recognizing its presenting features. Tetanus is a clinical diagnosis. Clinical history varies from preceding lacerations, puncture wounds, animal bites, or even otitis media.[4] There are four different clinical presentations of tetanus. Generalized tetanus, the most common, typically presents with abnormal sustained contraction of facial muscles, spastic backward arching of the head/spine, muscle rigidity, dysphagia, and autonomic disturbances. Neonatal

Table 3. Pertinent imaging results

Day of hospitalization	Image	Impression
1	Chest x-ray	Retrocardiac left lower lobe opacity may reflect volume loss or pneumonia. The lungs are otherwise free of focal consolidation. No pleural effusion. No evidence of pneumothorax. The heart size and vascularity are within normal limits. No acute osseous findings.
2	Chest and abdomen x-ray	Endotracheal tube and gastric catheter appropriately positioned. Pneumomediastinum and soft tissue gas over the neck and axillary regions. Increased right upper lobe atelectasis. Stable left lower atelectasis vs pneumonia. Question of organomegaly and possible calcification in the left upper quadrant of the abdomen
2	MRI	Unremarkable MRI of lumbar, thoracic, and cervical spine.
2	MRI	Normal appearing contrast-enhanced MRI of the brain.
3	Echocardiogram	Normal segmental anatomy and cardiac chamber size. Normal right ventricular systolic function. Mildly hyperdynamic left ventricular systolic function. No coarctation. No pericardial effusion.
4	Ultrasound abdomen	Mild hepatomegaly, bilateral echogenic kidneys associated with mild hydronephrosis, mild ascites.
11	Chest x-ray	New left thoracostomy catheter and associated soft tissue gas in the chest wall.
11	Echocardiogram	Mild to moderately depressed left ventricular ejection fraction of 40% to 50%.
12	Echocardiogram	Much improved systolic function with left ventricular ejection fraction of 70%.

MRI indicates magnetic resonance imaging.

tetanus is a form of generalized tetanus that occurs in newborns, usually due to an umbilical stump infection and lack of maternal passive immunity. Localized tetanus consists of persistent contraction of the muscles surrounding the area of injury. Cephalic tetanus involves the cranial nerves and can occur after otitis media or cranial injury.[5,6] In our case, the patient presented with a generalized form of tetanus *without* a known preceding injury. Symptoms that indicate a poor prognosis include short interval between exposure and symptoms, infection of internal structures, severe spasms, and unvaccinated status.[7] Despite the fact that our patient had several poor prognostic factors including rapid symptom progression to severe spasms and respiratory failure, he made a full recovery. Due to the severe symptomatology and potential complications, tetanus should be kept in the differential diagnosis for patients who present with abnormal muscle spasms even if they may not fit the typical clinical history.

There are a few recent case studies of pediatric tetanus in the United States, all involving unvaccinated or partially vaccinated children.[8–10] Our case, along with these others, highlights the importance for physicians and health organizations to promote vaccinations. Specifically, emphasis should be placed on the need for full tetanus vaccination during childhood and booster maintenance throughout adulthood. Our case demonstrates a suspected diagnosis of tetanus in an unvaccinated pediatric patient without the typical clinical history; the patient presented with nonspecific but consistent symptoms that escalated rapidly to respiratory failure. Maintaining a high clinical suspicion in similar clinical presentations is critical for timely intervention and to provide patients with the best treatment outcome.

ORCID

Kimberly Walter http://orcid.org/0000-0003-0532-6889
Renita Thomas http://orcid.org/0000-0001-7267-2138

1. Brook I. Current concepts in the management of *Clostridium tetani* infection. *Expert Rev Anti-Infect Ther*. 2008;6(3):327–336. doi:10.1586/14787210.6.3.327.
2. Centers for Disease Control and Prevention. *Tetanus Disease (Lockjaw)*. 2019. https://www.cdc.gov/tetanus/index.html. Accessed February 7, 2022.
3. Centers for Disease Control and Prevention. *National Notifiable Diseases Surveillance System, Weekly Tables of Infectious Disease Data*. CDC Division of Health Informatics and Surveillance. https://wonder.cdc.gov/nndss/static/2019/annual/2019-table2q.html. Accessed February 7, 2022.
4. Hsu SS, Groleau G. Tetanus in the emergency department: a current review. *J Emergency Med*. 2001;20(4):357–365. doi:10.1016/s0736-4679(01)00312-2.
5. Rhinesmith E, Fu L. Tetanus disease, treatment, management. *Pediatr Rev*. 2018;39(8):430–432. doi:10.1542/pir.2017-0238.
6. Baker CJ, ed. Tetanus (lockjaw). In: *Red Book Atlas of Pediatric Infectious Diseases*. 4th ed. Itasca, IL: American Academy of Pediatrics; 2020:700–704.
7. Bae C, Bourget D. Tetanus. In: *StatPearls*. Treasure Island, FL: StatPearls Publishing; 2022.
8. Ahmed BS, Beck MJ, Williamson G, Ericson JE, Kumar P. Pediatric tetanus in central Pennsylvania. *J Pediatric Infect Dis Soc*. 2019;8(4):358–360. doi:10.1093/jpids/piy086.
9. Akane Y, Tsugawa T, Hori T, et al. Tetanus in a partially immunized child. *J Infect Chemother*. 2018;24(12):980–982. doi:10.1016/j.jiac.2018.05.002.
10. Johnson MG, Bradley KK, Mendus S, Burnsed L, Clinton R, Tiwari T. Vaccine-preventable disease among homeschooled children: two cases of tetanus in Oklahoma. *Pediatrics*. 2013;132(6):e1686–e1689. doi:10.1542/peds.2013-1636.