

# An interesting presentation of pediatric tetanus

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## ABSTRACT

Despite successful large-scale immunization programs in North America, there remains a significant population without active immunity to tetanus toxins because immunizations have been refused or delayed, and because of waning immunity. We report the case of a 7-year-old boy who presented to the emergency department with a chin laceration and a 7-day history of repeated falls of increasing frequency. We found this case to be associated with dysphagia and facial spasm, and we learned that the child had dropped a brick on his foot 2 weeks previously. The patient was subsequently diagnosed with tetanus and treated accordingly. Tetanus presentations to emergency departments may vary from mild muscular rigidity to advanced respiratory failure and thus clinicians should consider the diagnosis in various clinical presentations, especially in areas remote from advanced supportive care.

**Keywords:** tetanus, pediatric, immunization

## RÉSUMÉ

Malgré le succès qu'ont connu les programmes de vaccination à grande échelle en Amérique du Nord, il y a encore un important segment de la population sans immunité active contre la toxine du tétanos en raison d'un refus ou d'un report de la vaccination ou d'une baisse d'immunité. Nous présentons le cas d'un garçonnet de 7 ans qui s'est présenté à l'urgence avec une laceration au menton et des antécédents sur 7 jours de chutes répétées de fréquence croissante. Nous avons déterminé que ce cas était associé à une dysphagie et à des spasmes du visage et avons appris que l'enfant avait laissé échapper une brique sur son pied 2 semaines auparavant. Le patient a ensuite reçu un diagnostic de tétanos et a été traité en conséquence. Les présentations cliniques du tétanos à l'urgence peuvent varier de la rigidité musculaire bénigne à une insuffisance respiratoire aiguë. Les médecins devraient envisager le diagnostic d'après diverses présentations cliniques, tout particulièrement dans les régions éloignées des soins de soutien avancés.

## INTRODUCTION

Tetanus, a disorder of intensive muscular spasms caused by the toxins of *Clostridium tetani*, has been recognized since the ancient Egyptians and Greeks in terms of its association with traumatic injuries and potential for lethal complications. It has only been since the 1940s, with the development of the tetanus immunization and subsequent immunization campaigns, that there has been a dramatic decline in tetanus presentations. A significant population of susceptible people remains in the developed world, however, because of the refusal or delay of childhood or booster immunizations, and because of waning immunity. Immunization refusal may be a result of a number of factors, such as a fear of adverse reactions, or religious and other philosophical views.

## CASE REPORT

A 7-year-old previously healthy boy presented to the emergency department with the triage complaint identified as "laceration on his chin." The mother of the patient stated that the child had fallen and cut his chin, and remarked that he had been falling unexpectedly for the past week. During the first few days, the boy had fallen only about once per day, which was unwitnessed, although during the 2 days preceding the visit there were 2 to 3 witnessed falls per day. As the mother described, the boy would just fall without any apparent reason and that he would not reach out his hands to break his fall. He was described as "falling like a statue." On further questioning, the boy apparently had experienced mild difficulty eating ice cream 1 week previously,

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although this was not bothersome to the patient. It also appeared that the boy had been opening his mouth progressively less than usual when speaking and eating. The parents recalled that the patient had had slightly less energy than normal, although all other activities of the active boy were described as typical including walking, running and rough play with his siblings. A partially healed wound on the child's left big toe was described as having occurred about 2 weeks earlier when a brick was dropped on his foot.

Medical history was unremarkable except for a remote history of febrile seizures. He was an active child from a nurturing, well-functioning home with a normal birth history and developmental milestones. When the patient was an infant, immunizations had been declined because of fear of adverse effects.

On examination, the patient had a temperature of 36.3°C, a heart rate of 93 beats/min, a respiratory rate of 20 breaths/min and oxygen saturation of 99% on room air. He was alert, cooperative and responding appropriately, with a Glasgow Coma Scale score of 15/15, although he had difficulty opening his mouth to speak. A head and neck examination revealed nuchal rigidity, bilateral submandibular lymphadenopathy and a submental wound. The patient could open his mouth only 1 cm. He exhibited episodic facial contortions described as risus sardonicus. Abdominal examination revealed tight wall muscles with no guarding or focal abnormalities. Dermatological examination revealed several superficial bruises consistent with the history of repeated falls and a healing first toe with a partially detached nail. Neurologic examination showed global rigidity without clonus. Feet were maintained in a plantar flexed position. Coordination and gait were affected only as would be expected by rigidity. Chest and genitourinary examinations were unremarkable.

All laboratory investigations including complete blood count, electrolytes test, lumbar puncture and cervical spine radiography were normal. Intracranial imaging was not performed. Initial differential diagnoses such as meningitis, other central nervous system sources of infection, adverse drug reactions and electrolyte imbalances were ruled out with the history, physical examination and laboratory studies.

The patient was diagnosed with tetanus on clinical grounds and was treated with tetanus immunoglobulin and penicillin G. In preparation for possible impending respiratory failure, steps were then taken for transfer to a centre of higher acuity. The patient was admitted to a pediatric intensive care unit, although his stay was not

complicated by progression to full spastic tetany or need for ventilatory support. At discharge after 5 days in hospital, he was able to eat without difficulty, but did have persistent hypertonicity in his limbs. The child was immunized, as tetanus does not confer immunity following active disease. After discharge he made a full recovery in 2 to 3 weeks.

## **DISCUSSION**

Although a significant health problem in some parts of the world, the presentation of tetanus in Canadian emergency departments is now a rare occurrence because of the widespread success of immunization programs. In British Columbia in 2007, with a population of more than 4.6 million, 4 cases of tetanus were reported, including this patient and 3 adult patients all older than 50 years.<sup>1</sup> Before this, there had been no reported cases since 2001, and there were no reported cases in 2008. Between 1980 and 2004 there was an average of 4 cases reported in Canada per year with the last reported death from tetanus in 1997.<sup>2</sup> This is in comparison with an estimated 213 000 worldwide deaths secondary to tetanus in 2002, of which 180 000 represented neonatal deaths.<sup>3</sup> However, global tetanus immunizations have seen a dramatic rise since the 1980s with an estimated increase of 20% to 81% coverage in 2007 of children under 1 year of age.

Tetanus is a diagnosis that must still be considered in North America, as factors such as waning immunity, philosophical or religious objections to immunization, and missed or delayed childhood immunizations can result in people without adequate disease protection. Refusal of immunizations because of philosophical rationales is a significant public relations obstacle and perhaps is a factor in the decline of immunization rates of the last decade. The Canadian National Immunization Coverage Survey reported rates of 83% and 73% of tetanus immunization coverage for 2-year-olds in 1997 and 2004, respectively.<sup>4</sup> Strategies have been implemented including the National Immunization Strategy, which was implemented to improve vaccination rates and national homogeneity, and to monitor progress, although debate exists regarding its effectiveness.<sup>5</sup> The United States, a country with significant historical emphasis on individual freedoms, has used compulsory vaccine legislation since 1809. Since the early 1980s, all 50 states have had school immunization requirements, although differing tolerance for philosophical or religious exemptions exists. As this method

has been proven to be effective,<sup>6</sup> perhaps similar legislation should be considered in Canada.

A case-control study examining the reasons for philosophical childhood exemptions revealed that the most common reason (69%) for not vaccinating was the concern that the vaccine might cause harm.<sup>7</sup> Other common responses from parents included fear of “overloading” the immune system, or belief that their child was not at risk for the disease, that the disease was not dangerous or that the vaccine might not work. The parents who refused vaccination were more likely to have higher education, to report use of complementary and alternative medicine, to perceive the government or conventional medical professionals as suboptimal sources of information, to perceive less individual and community gain from vaccines, and to report their child’s primary health care provider to be a complementary and alternative medicine professional or nurse practitioner. Furthermore, children with exemptions have been shown to have significantly higher risks of contracting vaccine-preventable diseases.<sup>8</sup> The effects of delayed immunization schedules, another strategy used to avoid the perceived risks of immunizations, has not been studied in detail but may leave children vulnerable as the risk of contraction and sequelae of vaccine preventable diseases is not constant throughout childhood.<sup>8</sup>

Although childhood immunization schedules have seen great success in the past century, scheduled boosters for adults with predictable waning immunity have not had the same support.<sup>9</sup> Studies of serum antibody levels in the 1990s found that only 72.3% of Americans had protective quantities of tetanus antibodies.<sup>10</sup> The prevalence was 45% and 21% for men and women over 70 years old, respectively,<sup>10</sup> and 87.7% for children 6–11 years old.<sup>11</sup> Rates were found to be less than average for those with low education and socio-economic status. Further complicating factors include the imperfect efficacy of the vaccine (cases of tetanus have been described in immunized children)<sup>12</sup> and, unlike other infectious diseases, with tetanus there is no protection from herd immunity.

Tetanus is caused by the toxin of the gram-negative obligate anaerobe *Clostridium tetani*. The organism is found in soil and is also part of the normal intestinal flora of mammals and humans. The spores of *Clostridium tetani* can remain latent for several years and are resistant to disinfectants and boiling. Access to damaged human tissue is passively achieved by spores that subsequently produce the toxin tetanospasmin resulting in neurotransmitter blockade leading to muscular hypertonicity.

Although this is classically a postinjury state, in up to 30% of patients, no nidus of injury is determined.<sup>13</sup> Patterns of disease can be classified as localized tetanus, primarily affecting one area of the body; generalized, involving muscles throughout the body; or cephalic, affecting only the cranial nerve musculature. After an incubation period of 7–10 (range 1–60) days, patients experience symptoms of rigidity and muscle spasms.<sup>14</sup> This can present with the symptoms of lock-jaw or risus sardonicus as seen in this case. Other symptoms can include opisthotonos (retraction of the head), trunchal rigidity, dysphagia and involvement of other muscles of the body. Complications of autonomic instability, respiratory failure, laryngospasm, gastric and urinary stasis, rhabdomyolysis or vertebral compression fractures can arise.<sup>14</sup> Recovery is achieved through regrowth of the axon terminals and toxin destruction.

Differential diagnosis should include drug-induced dystonias, hypocalcemia, seizures, strychnine toxicity and infections of the head, neck and central nervous system. In certain circumstances, rigidity syndromes, such as neuroleptic malignant syndrome, serotonin syndrome or malignant hyperthermia should be considered. As there is no specific laboratory test immediately available, the diagnosis of tetanus must be made on a clinical basis.

Treatment consists of wound débridement when possible, antimicrobial therapy and the neutralization of unbound toxin by passive immunization with human tetanus immunoglobulin. The traditional antimicrobial therapy of penicillin was for a time considered inferior to metronidazole,<sup>15</sup> although subsequent evidence has shown similar rates of survival with both treatments.<sup>16</sup> Patients randomly assigned to receive penicillin did require higher doses of sedatives and muscle relaxants however, perhaps because of the gamma aminobutyric acid (GABA) antagonist effects of penicillin. For this reason, metronidazole is a reasonable first-line treatment.<sup>13</sup> Supportive care with sedation, nondepolarizing paralysis, respiratory support and the treatment of autonomic instability may also be required. Prognosis is dependent on availability of supportive care and access to ventilatory support.<sup>17</sup>

The patient in question was not immunized before the events described and lives on a dairy farm, both of which likely increased the risk of tetanus inoculation. This is not an uncommon scenario in British Columbia’s Fraser Valley, which is home to a relatively high proportion of nonimmunized people, many of whom work in the farming industry. This patient’s toe injury was undoubtedly

the nidus of tetanus infection. The patient and his siblings were all immunized after this presentation.

## CONCLUSION

Despite a successful immunization program in Canada and the majority of the developed world, there are still many people without active immunity to the disease caused by tetanus. As falling immunization rates will have direct implications for emergency departments, emergency physicians should be a strong voice of support for strategies to improve vaccination rates and public education. Tetanus presentations may vary from mild muscular rigidity to advanced respiratory failure necessitating clinicians to consider the diagnosis in various clinical presentations, especially in areas remote from advanced supportive care.

**Competing interests:** None declared.

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