



Case study

Tetanus – A Rare But Real Threat

David Moynan*, Ruth O’Riordan, Roisin O’Connor, Concepta Merry

St James’s Hospital, James’s Street, Dublin 8, Ireland

ARTICLE INFO

Keywords:

Tetanus
Neurophysiology
Vaccines
EMG
Dog bite

ABSTRACT

Tetanus is a potentially fatal disease of the nervous system arising from toxins produced by *Clostridium tetani*, an anaerobic bacterium found in soil [1]. Characterized by muscular rigidity, spasms and autonomic dysregulation its identification and, importantly, its prevention remain critical to the welfare of at risk patients. We present the case of a twenty two year old woman who presented to hospital with trismus and generalized muscle spasms three days following a dog bite to the right hand. Here, we discuss the presentation of generalized tetanus and the use of neurophysiology to facilitate its diagnosis.

Introduction

Tetanus is a potentially fatal disease of the nervous system arising from toxins produced by *Clostridium tetani*, an anaerobic bacterium found in soil [1]. Once this toxin is taken up by the nervous system, inhibitory synapses are blocked resulting in characteristic muscular rigidity, spasms and autonomic instability, with painful spasms of the masseter muscles; ‘lock-jaw’, well recognized as a cardinal feature of the disease [1]. Fortunately, its inclusion in routine childhood vaccination programs across developed countries has rendered this a rare disease. However, 12 cases of tetanus – including two deaths – were reported in Ireland between the years 2000 and 2015 [2]. With an estimated 50% of 20 year olds and 70% of 70 year olds in Ireland without a 10 year booster vaccination, knowledge and vigilance regarding the disease and its correct management remains crucial for clinicians [2].

Case presentation

We present the case of a 22 year old woman who presented to hospital with trismus, generalized muscle spasms and difficulty walking, three days following a dog bite to the right hand. The hand was not immediately washed and the patient did not initially seek medical attention. The patient’s background was notable only for irritable bowel syndrome and anxiety with a non-contributory family history. As a child, the patient reports receiving all scheduled vaccinations and possibly one tetanus booster, but was not certain of this.

In the three days following the bite, the patient reported feeling intermittently hot and cold with worsening headaches and palpitations. The patient visited her general practitioner, who administered tetanus toxoid IM following review of the wound. Despite this, the patient

noted progressive difficulty opening her mouth and walking. Substance misuse was denied, intravenous or otherwise, and no new medications had been commenced in the preceding days. As a result, the patient was referred to the local emergency department (ED).

On admission the patient’s vital signs included a heart rate of 95 beats per minute, respiratory rate of 14 breaths per minute, temperature of 37 °C and a blood pressure of 108/74 mmHg. Examination was notable for trismus (maximum one finger mouth opening) and hypertonicity in all four limbs, most marked in the lower extremities. Power was 4/5 in all areas and there were brisk reflexes and clonus bilaterally. Coordination and sensation were intact with no swallowing or breathing difficulties. Assessment of the hand demonstrated healing puncture wounds on the ventral aspect of the fifth digit with erythema, but no significant cellulitis. Cardio-respiratory examination was normal and the abdomen was mildly tense but non-tender. The patient remained alert and orientated.

Initial investigations demonstrated a c-reactive protein (CRP) of 1.5 mg/L, white cell count $7.8 \times 10^9/L$ and normal renal, liver and bone profiles. Blood cultures yielded no growth after five days. Given the clinical presentation, a diagnosis of generalized tetanus was made, differential including strychnine poisoning, although unlikely. As the patient remained clinically stable from a cardio-respiratory and neurological perspective, there was no immediate role for transfer to the intensive care unit. She was treated initially with 500 units of Tetanus Immunoglobulin (TIG) IM, the only dose available at the time in the ED, and benzodiazepines (diazepam) for her muscle spasms. The 2500 additional units of TIG were administered later that evening once available. Antimicrobial cover for the wound was commenced with high dose metronidazole intravenously for a total duration of ten days.

The wound was reviewed by the plastic surgeons, concluding that

* Corresponding author.

E-mail address: dmoynan@stjames.ie (D. Moynan).

there was no vascular or neural compromise resulting from the bite. A washout and debridement was performed the day after admission. There was no pus in the wound but swabs were sent yielding culture growth of *Staphylococcus epidermidis*. Interestingly, to further clarify our presumptive diagnosis, consultation was sought from our colleagues in neurophysiology who performed an electromyogram (EMG) of the masseter muscles, a useful and reliable tool in disease confirmation [3]. This identified a '*sustained motor unit activity in the masseter muscle and, while there was voluntary control noted, a silent period was absent which can be seen in patients with tetanus*'.

The patient's condition improved in the days following admission and subsequent treatment of mild, generalized tetanus. The patient was discharged well following a ten day inpatient stay.

Discussion

This case is remarkable for a presentation of what is now considered a rare infectious disease and the employment of neurophysiological studies to aid in its diagnosis, however it raises hugely important clinical questions. Given the rarity of the disease; familiarity with its presentation, establishing appropriate guidelines and the availability of appropriate therapy need to be addressed. In this instance, only 500 units of the Tlg were initially available on presentation, with the remaining 2500 units being administered a number of hours afterwards following its retrieval from an off-site facility, thereby prolonging time to treatment. However, it is worth noting that the Centre for Disease Control and Prevention (CDC) reports that 500 units is as effective as 3000 units in the treatment of tetanus and its use can cause less patient discomfort [4].

In this case, our patient reports a possible tetanus booster a number of years prior to presentation, suggesting either poor anti-tetanus toxin IgG titers (levels > 0.01 IU/mL conferring immunity, although these were not measured) or indeed having not completed the five tetanus vaccinations required to acquire 'lifelong immunity' [2]. However, it is important to note that cases of tetanus are documented in patients who report prior vaccination and in whom a protective level of anti-toxin has been measured [5]. While post vaccination serological testing is recommended by the National Immunisation Advisory Committee following hepatitis B vaccination in individuals at continuing risk [6], this does not appear to be the case regarding the tetanus vaccine. A series of five vaccinations (two months, four months and six months with a booster aged five and ten) is reported to give you lifelong immunity, with 10 yearly boosters recommended by many. However, recently the need for regular tetanus booster vaccinations has been questioned. A study published in *Epidemiology & Infection* measured anti-tetanus toxin IgG levels in a university cohort and showed that protective levels

persisted for much longer than the current thinking of 10 years, suggesting a revision of practice to a more conservative booster interval of 15 years or longer and the measurement of anti-tetanus toxin IgG levels prior to vaccination when feasible [7].

Interestingly, while the clinical presentation of tetanus is diagnostic in itself, it may sometimes be confused with a different process such as a drug induced dystonia, malignant neuroleptic syndrome or strychnine poisoning. While laboratory tests are now available to facilitate diagnosis including serum tetanus toxin or the detection of *Clostridium tetani* through PCR of a wound swab, this case is one of a few documented that employed the use of EMG of the masseter muscles to facilitate a diagnosis. While literature on EMG in tetanus is limited, a Swiss study analyzed its use in patients posing a diagnostic dilemma and concluded that EMG is a reliable and useful tool to support the diagnosis of tetanus [3]. While the trace itself can be normal, typical changes include the inability to suppress spontaneous activity of motor units and the absence of a silent period after stimulation of the nerve, which was demonstrated in this case.

Conclusion

While this case study does not bring to the fore a new disease or treatment, it serves as a reminder that even the rare infectious diseases for which we have effective vaccinations remain an issue and knowledge of their presentation and treatment is crucial. Fortunately, our patient had a favourable outcome despite an initial reluctance to present to medical services. The disease process was abated through timely diagnosis in the community and the delivery of treatment; Tlg, antimicrobials, appropriate surgical washout and symptomatic antispasmodics.

References

- [1] Sexton DJ. UpToDate. 2018 [Online] Available: https://www.uptodate.com/contents/tetanus?source=search_result&search=tetanus&selectedTitle=1~150 [Accessed Saturday July 2017].
- [2] Health Service Executive. Tetanus; Immunisation Guidelines. HSE; 2016.
- [3] Steinegger T, Wiederkehr M, Ludin H, Roth F. Electromyography as a diagnostic aid in tetanus. *Schweiz Med Wochenschr; Swiss Medical Weekly* 1996;10(126):379–85.
- [4] .Centre for Disease Control and Prevention. Epidemiology and Prevention of Vaccine-Preventable Diseases. Hamborsky J, Kroger A, Wolfe S, eds 13th ed. Washington D.C. Public Health Foundation, 2015.
- [5] Liyorsi D, Eaton M, Glass J. Generalized tetanus despite prior vaccination and a protective level of anti-tetanus antibodies 339. 2018. p. 200–1. February 2010.
- [6] H.S. Executive. www.hse.ie. 2018 [Online] Available: <https://www.hse.ie/eng/health/immunisation/hcpinfo/guidelines/chapter9.pdf> [Accessed 2017].
- [7] Borella-Venturini M, Frasson C, Paluan F, De Nuzzo D, Di Masi G, Giraldo M, et al. Tetanus vaccination, antibody persistence and decennial booster: a serosurvey of university students and at-risk workers. *Epidemiol Infect* 2017;9(145).