Neurology Asia 2024; 29(4) : 1167 – 1170

Cephalic tetanus presenting as facial palsy, ptosis, trismus, and orthopnea following a fall

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Abstract

Tetanus is a bacterial infection of the nervous system caused by neurotoxins produced by *Clostridium tetani*. Cephalic tetanus is a rare, localized form of the disease that is often under-recognized and misdiagnosed. Patients typically present with cranial neuropathies, trismus, and stiffness localized to the head and neck. Early recognition of the disease is crucial, as it is easily treatable and can prevent progression to the more severe generalized form. In this report, we describe a patient who developed progressive neurological symptoms after sustaining a forehead laceration from a fall. Over the course of three weeks, he developed facial (VII) nerve palsy, ptosis, followed by trismus, and later orthopnea, which are uncommon manifestations of the disease. This case underscores the importance of early recognition, treatment, and prevention of this neglected condition, which is not commonly observed in well-developed healthcare systems where immunization is universally available.

Keywords: Tetanus, clostridium tetani, ptosis, neurotoxin, infectious diseases

INTRODUCTION

Tetanus is a disorder of the nervous system caused by the bacterium *Clostridium tetani*. The bacteria produce tetanus neurotoxin (TeNT), which can travel retrogradely from an affected wound to the neuromuscular junction (NMJ) and up the nerve axon to the spinal cord and brain, causing pathology anywhere along the neuroaxis.[1] The neurotoxin blocks pre-synaptic acetylcholine release at the NMJ and inhibits inhibitory neurotransmitters in the spinal and brainstem interneurons, causing neuronal over-excitation. Its clinical manifestations include muscle spasms, trismus (spasms and tightness of the temporomandibular joint), spastic paralysis, hyperthermia, and autonomic dysfunction.

Tetanus can present as one of 4 forms – generalized, localized, cephalic, and neonatal; of which the cephalic form is the least common, accounting for 1-3% of all cases.[2] Cephalic tetanus usually occurs when craniofacial injuries, ear or dental infections provide a portal of entry for bacteria.[3] It tends to be milder, and patients may develop cranial neuropathies, with the facial (VII) nerve being the most commonly affected cranial nerve.[4] Around two-thirds of cephalic tetanus can progress to generalized tetanus, which can be fatal in up to 15-30% of cases.[2] As it is a rare disease, it is under-recognized and often misdiagnosed as stroke or Bell's palsy.

CASE REPORT

A Chinese man in his 80s with a medical history notable for hypertension and type 2 diabetes mellitus presented to our hospital with a 3-week history of progressive neurological symptoms. Approximately four weeks preceding his presentation, he was ill with COVID-19-associated respiratory infection. During this period, he suffered a fall outside his residence where he hit his head against the pavement and sustained a forehead laceration. He sought care at an Emergency Department where his wound was irrigated and sutured. Four days post-fall, he developed a left ptosis and facial droop, leading to a diagnosis of left Bell's palsy.

Two weeks subsequent to the left ptosis and facial droop, he developed jaw tightness and

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Date of Submission: 17 November 2023; Date of Acceptance: 7 August 2024

https://doi.org/10.54029/2024vrj

progressive difficulty in mouth opening, which culminated in dysphagia and orthopnea. This progression prompted his hospital admission. Notably, he had no fevers, headaches, visual loss, diplopia, speech impairment, limb paresthesiae or weakness throughout this clinical course.

On examination, there was left facial asymmetry, characterized by diminished activation of the left frontalis, while lower facial movements were normal (Figure 1). There was a non-fatigable left eye ptosis and mild blepharospasm. Extra-ocular movements were intact and pupils were symmetrical and reactive to light. He reported jaw pain, accompanied by a reduction in jaw opening to one-finger's breadth, along with mild neck rigidity. A clean, 5 cm wound was identified over his left forehead. Tone was normal, limb reflexes were preserved, and power was full throughout. Sensation was normal and there were no cerebellar signs or parkinsonism. Additionally, a thorough examination revealed healthy dentition, and otoscopy findings were normal.

Basic serum investigations including blood counts and assessments of renal and liver function were normal. Serum creatine kinase was mildly elevated at 254 U/L (normal range: 40-200 U/L). Contrasted brain MRI and angiography showed no acute infarction or abnormal enhancement. A cervical spine MRI demonstrated severe C5-6 spondylosis which would not account for his symptoms. Repetitive nerve stimulation (RNS) and nerve conduction studies (NCS) which included blink reflexes and phrenic nerve studies, were normal. Needle electromyography was not performed on his face or neck muscles. Cerebrospinal fluid (CSF) analysis indicated a protein level of 0.33 g/L (normal range: 0.15-0.40 g/L) and a glucose level of 3.7 mmol/L (normal range: 2.2-3.9 mmol/L), both within normal limits. The CSF white blood cell count was normal at 3 (normal range: 0-5 /μL). CSF microbiological studies and cytology eturned negative. Wound cultures from his forehead laceration had no bacterial growth. Serum acetylcholine receptor antibodies were negative, and serum tetanus toxoid IgG levels were low at 0.03 IU/ml (Mayo Clinic, USA). Further evaluation for his orthopnea, including serial electrocardiograms and a trans-thoracic echocardiogram were unremarkable. Laryngoscopy showed no evidence of vocal cord palsy or oedema. Contrasted CT thorax revealed no signs of pulmonary embolism or lung parenchymal abnormalities. Although eventration of the right hemi-diaphragm was noted, diaphragmatic movements were equal and symmetrical on ultrasonography.

The stepwise gradual development of cranial neuropathies, trismus, and axial stiffness in temporal relation to an infected forehead wound

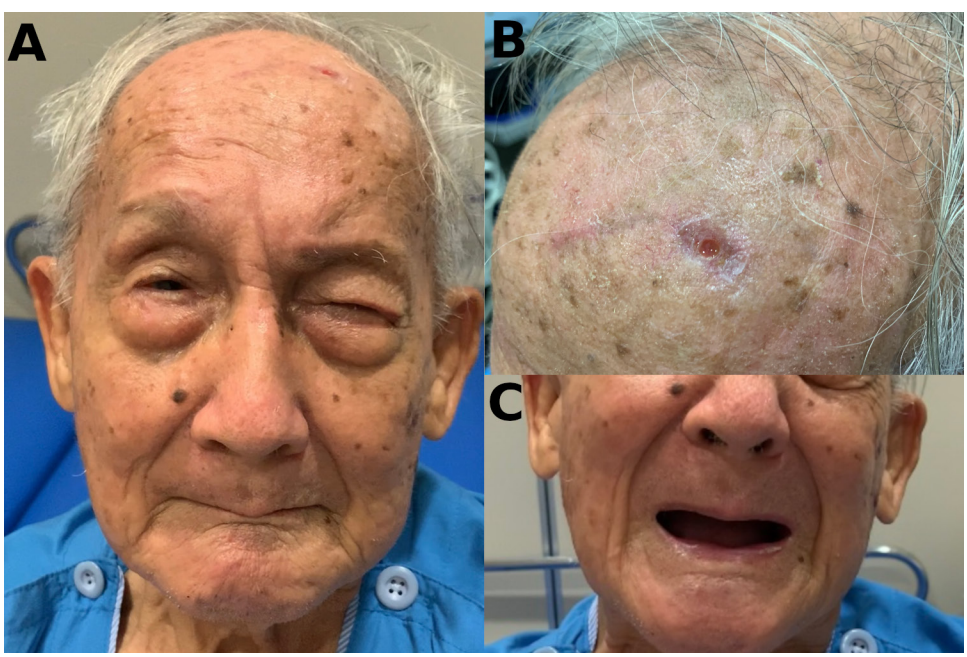

Figure 1. Clinical examination revealed left eye ptosis with left facial asymmetry affecting the left frontalis muscle at rest (A). There was a 5cm wound over the left forehead (B). Compared to mouth closed (A), mouth opening was painful and reduced at 1 finger-breadth (C).

was consistent with a diagnosis of cephalic tetanus. This was supported by low serum tetanus toxoid IgG levels. Our patient's last tetanus vaccination was more than a decade ago and he did not receive tetanus vaccination after sustaining his forehead laceration.

Additional differential diagnoses for his presentation include myasthenia gravis (MG) and Guillain-Barre Syndrome (GBS). MG was deemed unlikely given the absence of fluctuating or fatigable symptoms, the absence of acetylcholine receptor antibodies, and normal RNS results. GBS was considered a differential due to preceding COVID infection and the rapid progression of symptoms. However, the presence of preserved reflexes, normal NCS four weeks from symptom onset, and the lack of CSF cyto-albuminogic dissociation made this an improbable diagnosis.

Our patient was treated with 500 units of tetanus immunoglobulin and tetanus vaccination intramuscularly. He was given a 7-day course of intravenous metronidazole. Oral clonazepam was prescribed for symptomatic relief of trismus and a nasogastric tube was inserted for nutritional support. His symptoms improved over the course of three weeks and he was subsequently discharged from hospital.

DISCUSSION

In Singapore, tetanus is exceedingly rare, with only three previously documented cases of generalized tetanus in adults.[5] This rarity can be attributed to the comprehensive Singapore National Vaccination Program, a government-endorsed initiative that mandates regular tetanus vaccinations from childhood to adulthood.[6,7] Vaccinations are readily available and healthcare services are easily accessible to the entire population. Due to the low incidence and limited disease recognition, our patient was initially misdiagnosed and treated for Bell's palsy, and subsequently, when he developed new neurological symptoms, he was thought to have an acute ischaemic stroke. Trismus, a key symptom, was also overlooked by many healthcare professionals, contributing to a diagnostic delay, with cephalic tetanus only being identified four weeks after the onset of his initial symptoms.

The most probable portal of entry for our patient's tetanus infection was his forehead laceration. Although the wound received thorough irrigation, tetanus vaccination and prophylaxis were not administered, as it was considered a minor and clean wound. The absence of cultured bacteria did not rule out a diagnosis of tetanus, as studies have indicated that *C. tetani* can be present in unaffected individuals and may not always be isolated in affected wounds.[2] The incubation period of tetanus, ranging from 3 to 21 days, align with our patient's symptom onset four days after the injury. In a departure from the typical presentation where trismus precedes or accompanies cranial neuropathies, our patient developed trismus two weeks after the onset of facial (VIII) nerve palsy. While this temporal sequence is uncommon, similar presentations have been previously reported.[8,9]

Ptosis is a common symptom in cephalic tetanus, and its aetiology depends on the specific part of the neuroaxis affected by TeNT. Direct muscle or NMJ dysfunction can result in weakness of the levator palpebrae superioris. At the peripheral nerve level, neurotoxin-induced overexcitation of facial motor neurons can lead to blepharospasm and eyelid opening apraxia, a condition termed 'blepharoptosis'.[10] Frontalis weakness resulting from facial nerve palsy unmasking pre-existing congenital ptosis has also been described before.[9] If TeNT ascends to the brainstem, oculomotor nucleus or fascicular involvement may cause ptosis accompanied by pupillary and eye movement abnormalities. In our patient, we believe a combination of blepharospasm and unmasking of senile ptosis from frontalis weakness occurred, with no clinical evidence of oculomotor (III) nerve dysfunction.

Notably, orthopnea in our patient was an unusual finding, and this symptom has not been reported before in cephalic tetanus. We postulate that TeNT progressively affected his phrenic nerve, leading to diaphragm weakness and the onset of orthopnea approximately three weeks after the onset of facial (VII) nerve palsy. The diagnosis of phrenic nerve palsy can be difficult to demonstrate as NCS and ultrasonography can be normal.

While the diagnosis of cephalic tetanus is primarily clinical, serological testing can provide supportive evidence if antibody levels are low at the onset of symptoms. In this case, the antibody titre was low at 0.03 IU/ml, which corroborated the clinical diagnosis. Prompt recognition and treatment initiation is paramount to prevent the progression to generalized disease. Symptom management primarily involves supportive measures, and relief of muscle symptoms with benzodiazepines, baclofen, or, in severe cases, general anaesthetic agents. Tetanus immunoglobulin should be administered to neutralize circulating free toxins, particularly in

patients with low antibody titres. Antimicrobial therapy with metronidazole or penicillin is generally recommended, and in some cases, additional wound debridement may be necessary to completely eradicate remaining bacteria. Tetanus immunisation should be administered to all patients with open wounds, especially if their vaccination status is suboptimal or unknown. For more severe or contaminated wounds, prophylactic administration of tetanus immunoglobulin is also recommended.

In summary, we report a case of cephalic tetanus characterized by uncommon manifestations, including marked orthopnea and cranial neuropathies that preceded trismus. It should be included in the differential diagnosis for any patient presenting with trismus and cranial neuropathies, particularly in the context of a recent open wound. Additionally, tetanus prophylaxis must be considered in individuals with any open wound, especially in the elderly or those with an unclear immunization status. Early recognition and appropriate management are crucial to prevent the potentially fatal consequences of this uncommon but serious condition.

DISCLOSURE

Financial support: None

Conflict of Interest: None

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