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CASE REPORT

Intravenous Magnesium Sulphate Infusion in Treatment of Adult Tetanus: A Case Report

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ABSTRACT

Tetanus remains a significant public health concern in low- and middle-income countries (LMICs), particularly among adults with incomplete immunization. This case report describes a 40-year-old male farmer from rural India who developed generalized tetanus following a puncture wound to the foot. Classical clinical features including trismus, generalized muscle spasms, and signs of autonomic dysfunction were present. The patient was managed in the intensive care unit with continuous intravenous magnesium sulphate ($MgSO_4$) infusion at 1g/hour, alongside supportive care and antibiotics. Notably, mechanical ventilation and sedative agents were not required throughout the hospital stay. Progressive improvement in muscle rigidity and spasms was observed by day two of treatment, and the patient was discharged after three weeks without complications. This case highlights the efficacy of magnesium sulphate as a neuromuscular depressant and autonomic stabilizer in moderate to severe tetanus. It underscores its potential to reduce the need for invasive ventilation, especially in resource-limited settings, and supports its use as a safe and cost-effective adjunct in tetanus management.

KEYWORDS

• Tetanus • Cost-Effective • Magnesium Sulphate

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INTRODUCTION

Tetanus continues to pose a significant health challenge in many low-and middle-income countries (LMICs), particularly among adults who lack complete vaccination coverage. Caused by the potent neurotoxin produced by *Clostridium tetani,* the disease leads to the inhibition of inhibitory neurotransmitters such as gamma-aminobutyric acid (GABA) and glycine, resulting in sustained muscle rigidity, painful spasms, and autonomic dysfunction (Larrubia *et al.*). Effective clinical management often requires sedation, intensive monitoring, and mechanical ventilation resources that may be scarce in LMIC settings.

Magnesium sulphate ($MgSO_4$) has emerged as a valuable pharmacological agent in such contexts, due to its dual role as a neuromuscular depressant and autonomic stabilizer. Its low cost, wide availability and favourable safety profile make it a practical adjunct to standard care. Clinical evidence suggests that $MgSO_4$, especially when used in conjunction with benzodiazepines, can significantly reduce the severity and frequency of spasms, delay or decrease the need for mechanical ventilation, and shorten hospital stays by 3 to 7 days (Nepal). In some cases, $MgSO_4$ has been employed as a standalone therapy for spasm control, providing a cost-effective alternative to more expensive sedatives (Susanto).

Despite its advantages in symptom management, magnesium sulphate has not been shown to reduce mortality rates in tetanus (Nepal *et al.*). Nonetheless, its minimal toxicity and symptom-modulating capabilities make it an important tool in managing adult tetanus, particularly in under-resourced healthcare environments (Boer *et al.*). This case report underscores the clinical utility of magnesium sulphate in the management of adult tetanus and highlights its potential to improve outcomes in settings where advanced intensive care interventions are limited.

CASE REPORT

A 40-year-old male farmer, presented to the emergency department of ERAS Lucknow Medical College and Hospital with a chief complaint of reduced mouth opening for the past two days and generalized painful muscle spasms that had progressively worsened. His symptoms began approximately four days after he sustained an injury to the sole of his right foot by accidentally stepping on a rusted iron nail while walking barefoot on his farmland. At the time of injury, there was mild bleeding. The patient washed the wound with soap and water at home and did not seek immediate medical attention.

Figure 1: Clinical presentation of a 40-year-old male with generalized tetanus showing sustained muscle rigidity and painful spasms, particularly evident in the plantar flexion and inward curling of the toes (right foot), suggestive of spastic posturing. The patient is monitored in the Intensive Care Unit (ICU) with ongoing intravenous therapy and cardiorespiratory monitoring

Subsequently, he consulted a local practitioner who applied a topical ointment and administered a single dose of tetanus toxoid (TT) vaccine. However, there was no documentation of prior immunization status or follow-up vaccination. Three days later, the patient began experiencing difficulty in opening his mouth and described a sensation of tightening in his jaw and neck. The mouth opening, which he demonstrated previously allowed insertion of four vertically aligned fingers, was now reduced to a single finger width. He also reported muscle stiffness and cramping in both lower and upper limbs, which gradually intensified.

On admission, the patient was afebrile and fully conscious (Glasgow Coma Scale score of 15/15), oriented to time, place, and person. General physical examination revealed no pallor, icterus, cyanosis, clubbing,

lymphadenopathy, or pedal edema. Local examination of the right foot showed a healed circular scar approximately 1 cm × 0.5 cm in size, with ill-defined margins, mild tenderness, and no active discharge. Local temperature was not raised, and there was no pain on active movement of the foot.

Neurological examination revealed increased muscle tone in all four limbs, with sustained rigidity and visible spasms. Deep tendon reflexes (DTRs) were brisk. Classical signs of tetanus, including *trismus* and *risus sardonicus,* were present. By the second day of hospitalization, the patient developed board-like rigidity of the abdomen. On day four, signs of autonomic dysfunction appeared, including intermittent tachycardia, hypotension, and profuse sweating. Although opisthotonus was not fully developed, the patient exhibited early signs of arching and axial stiffness. Importantly, there were no signs of seizure activity, fever, photophobia, loss of consciousness, or bowel/bladder incontinence throughout the hospital stay.

Given the clinical diagnosis of generalized tetanus, the patient was immediately shifted to the Intensive Care Unit (ICU) for close monitoring and management. He was placed under minimal sensory stimulation and was initially started on **intravenous magnesium sulphate** infusion at a rate of 1 gram per hour. The therapeutic goal was to alleviate muscle spasms and delay the potential need for mechanical ventilation.

The use of magnesium sulphate was guided by its known role as a neuromuscular depressant, which helps in reducing muscle rigidity and autonomic hyperactivity. The patient also received metronidazole and other supportive treatment. Local wound care with antiseptic dressing was continued throughout the stay. Oral feeding was initially withheld; the patient was maintained on Ryle's tube feeds and intravenous fluids. By day two of ICU admission, improvement in mouth opening was observed, allowing oral liquid intake.

Over the following days, the severity of spasms gradually decreased, and there was partial resolution of stiffness. However, generalized body rigidity and some degree of trismus persisted. The patient remained hemodynamically stable with no requirement for mechanical ventilation throughout the hospital stay. After three weeks of treatment the patient was discharged.

This case demonstrates the utility of magnesium sulphate infusion in controlling the characteristic spasms of tetanus and delaying or possibly avoiding the need for invasive ventilatory support. While the patient's symptoms persisted to some degree, early clinical suspicion, prompt initiation of therapy, and vigilant supportive care contributed to stabilization and symptom improvement.

Figure 2: Plantar view of the right foot showing a healed puncture wound near the midsole, the site of entry of a rusted nail, which served as the portal for Clostridium tetani infection. The photograph illustrates environmental exposure, consistent with barefoot fieldwork in a rural setting—a common risk factor for tetanus in agricultural populations

Figure 3: Clinical photograph showing classical features of generalized tetanus in the patient, including trismus (lockjaw) and risus sardonicus (characteristic grimacing facial expression). A nasogastric tube is seen in situ for enteral feeding. These hallmark signs reflect the neurotoxic effects of tetanospasmin on cranial nerve motor function and facial

Figure 4: Facial appearance of the patient during a tetanic spasm episode, demonstrating pronounced trismus, risus sardonicus, and partial opisthotonus involving neck and facial musculature. A nasogastric tube and central venous access are in place as part of intensive supportive care. These features reflect ongoing neurotoxin-mediated muscle hyperactivity characteristic of generalized tetanus

DISCUSSION

The management of tetanus, especially in adults with limited immunization coverage, remains a complex clinical challenge in many low- and middle-income countries (LMICs). In our case, a 40-year-old male farmer developed generalized tetanus following a foot injury and presented with classical features such as trismus, limb spasms, and autonomic instability. Notably, the patient was successfully managed with intravenous magnesium sulphate ($MgSO_4$) infusion without requiring mechanical ventilation a promising outcome consistent with findings from several observational and interventional studies.

Magnesium sulphate has been explored in recent years for its role as an adjunct or even standalone therapy in tetanus. It acts as a neuromuscular depressant and calcium antagonist, helping to control muscle rigidity and sympathetic overactivity. In our case, the administration of $MgSO_4$ at a constant infusion rate of 1 g/hour led to noticeable improvement in symptoms by the second day, particularly in mouth opening and reduced severity of spasms, without sedation or respiratory compromise. This aligns with results reported by Mathew *et al.* (2010), where $MgSO_4$ alone controlled spasms in 6 of 33 patients (18.2%) all with mild disease (Ablett Grades I–II). However, they noted that 81.8% of patients still required mechanical ventilation, underscoring the difficulty in using $MgSO_4$ as monotherapy for severe tetanus.

In contrast, our patient, despite showing signs of Grade III tetanus (generalized rigidity with autonomic dysfunction), did not require ventilatory support. This favourable outcome mirrors findings from Attygalle *et al.* (2002), who reported that $MgSO_4$ effectively controlled spasms in 95% of patients (38 of 40), with only 17.5% requiring mechanical ventilation, primarily among elderly individuals. Similarly, Sikendar *et al.* (2009) observed that 72.7% of severe tetanus patients managed with $MgSO_4$ avoided mechanical ventilation. Our patient's relatively young age and early presentation might have contributed to the reduced severity and avoidance of airway intervention.

In terms of quantitative comparison, our single-patient outcome of zero need for mechanical ventilation, successful spasm control with $MgSO_4$, and minimal need for adjunctive sedation compares favourably with the following:

In the systematic review by Nepal *et al.* (2021), which synthesized data from 13 studies, it was found that $MgSO_4$ reduced the need for mechanical ventilation and shortened hospital stay by 3–7 days, although no mortality benefit was observed. They noted that the incidence of toxicity was low, consistent with our experience no adverse effects or ECG abnormalities were reported during continuous monitoring.

Interestingly, Osalusi *et al.* (2008) compared $MgSO_4$ with diazepam and found that while both were effective in controlling spasms, the mean time to cessation of spasms was significantly shorter in the magnesium group (17.3 ± 4.1 days vs. 20.4 ± 3.1 days). Although we did not observe complete symptom resolution in under two weeks, significant improvement in trismus and limb spasms by day 4 suggests early therapeutic benefit.

The absence of any need for diazepam or neuromuscular blockade in our patient contrasts with Ali *et al.* (2011), where only 22% of magnesium-treated patients avoided artificial

ventilation. Our strict protocol, consistent monitoring, and early ICU admission likely contributed to this favourable course.

Moreover, the patient did not exhibit magnesium toxicity (e.g., loss of reflexes, hypotension, ECG abnormalities), and serum monitoring was not needed due to the low-dose continuous infusion strategy. This supports recommendations by Attygalle *et al.* and Thwaites *et al.* for titrating $MgSO_4$ based on clinical signs like the patellar reflex.

Our case supports growing evidence that magnesium sulphate is an effective and safe adjunct in the management of moderate to severe tetanus. The case demonstrates its utility not only in symptom control but also in reducing the likelihood of mechanical ventilation a significant advantage in resource-limited settings. Though broader data is needed through randomized controlled trials, this case reinforces the role of $MgSO_4$ as a promising frontline therapy in tetanus, especially when applied early and under vigilant clinical supervision.

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