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Case Report

Eradicated? Neonatal tetanus in Western Uganda; a case report of successful management

Nicole B. Kennard[1], Gyan Moorthy[2], Elizabeth Najjingo[3], Sadhana Chheda[4]*

[1]Texas Tech University Health Sciences Center, Foster School of Medicine, El Paso, Texas, USA
[2]University of Pennsylvania Perelman School of Medicine, Philadelphia, Pennsylvania, USA
[3]Department of Paediatrics and Child Health, Mbarara University of Science and Technology, Mbarara, Uganda
[4]Department of Pediatrics, Division of Neonatology, Texas Tech University Health Sciences Center, El Paso, Texas, USA

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***Correspondence:**
Dr. Sadhana Chheda,
E-mail: Sadhana.Chheda@ttuhsc.edu

ABSTRACT

Neonatal tetanus is a life-threatening condition with an almost 100% mortality in resource-limited settings. The standard of care ventilator support, parenteral nutrition and neuromuscular blockade is often inaccessible. Here, we present the successful workup and management of neonatal tetanus at a regional hospital in Western Uganda. Particular attention is paid to social and cost barriers to history-gathering and treatment and cross-institutional collaboration to improvise care based on pathophysiology. We reviewed records of a neonate treated for neonatal tetanus at Mbarara Regional Referral Hospital, in collaboration with physicians from TTUHSC El Paso, Texas. A term neonate was delivered at home in Western Uganda. She presented with intermittent fevers, refusal to feed and dystonia, which progressed to generalized stiffness and led to presumptive treatment for meningitis at an outside hospital. After referral with worsening symptoms, a sepsis workup was performed and she was started on intravenous antibiotics and phenobarbital. Further maternal history revealed lack of tetanus immunization and unsterile birthing practices. As symptoms progressed to trismus, opisthotonos, risus sardonicus and clinical suspicion for tetanus rose. She received tetanus immunoglobulin, diazepam, magnesium sulfate and supportive care. She was discharged after 19 days and had normal development at 19 months. This case highlights that successful management and survival from neonatal tetanus is possible without access to advanced NICU care. Mutually respectful collaboration enabled diagnosis and care improvisation using local resources to craft a protocol that can be formally evaluated for efficacy. Ongoing communication is key to making such adaptation ethical in global partnerships where resources differ.

Keywords: Cross-cultural collaboration, Global pediatrics, Magnesium sulfate, Neonatal tetanus, Resource-limited care

INTRODUCTION

Tetanus is caused by the toxin produced by the Gram-positive bacillus *Clostridium tetani*, which is an obligate anaerobe. The bacteria do not multiply in healthy tissue with normal oxygen tensions, but are able to grow and multiply in the low-oxygen-tension environment in devitalized or necrotic tissue. The toxin is released during the stationary phase of bacterial growth or after cell lysis and is one of the most potent toxins identified.

It enters the nervous system at the neuromuscular junction and is transported to the central nervous system where it inhibits presynaptic inhibitory interneurons, resulting in disinhibition of motor neuron discharge.[1,2] Tetanus spores are ubiquitous, so tetanus cannot be

eradicated, but the initiatives aimed to reduce transmission rates by immunizing children, expectant mothers and other women of reproductive age (WRA), as well as by promoting more hygienic deliveries and cord care practices in culturally sensitive ways help.

Treatment of neonatal tetanus is costly and, in some circumstances, requires medication and equipment in short supply in the developing world, including total parenteral nutrition (TPN) and mechanical ventilation. Additional costs to families in the form of time away from subsistence or other work are difficult to quantify.

In 1988, tetanus claimed the lives of nearly 800,000 neonates each year, at a rate of 6 to 7 deaths per 1000 live births per year, disproportionately in the developing world.[3-5] International health authorities at the World Health Organization (WHO) have attempted to combat neonatal tetanus through the Maternal and Neonatal Tetanus Elimination (MNTE) initiative.[3]

The MNTE initiative was implemented in Uganda in 2002. All women between the ages of 15 and 49 were offered a schedule of five separate tetanus vaccine doses and during their pregnancy (two per pregnancy). By 2011, after targeting 25 particularly high-risk districts, Uganda achieved MNTE elimination status, defined as incidence below one case per 1000 live births per year in every district.[6]

However, studies examining the perspectives of Ugandan healthcare workers and community leaders reveal that barriers to maternal tetanus vaccination persist, underscoring the need for culturally tailored interventions to improve uptake.[7] Case counts and reporting have fluctuated in recent years and without continued commitment, maintenance of this status is not guaranteed. This reinforces the need for ongoing surveillance and the potential for cases to arise even in low-incidence areas.[8,9]

The 2016 Uganda Demographic and Health Survey demonstrated that births protected against neonatal tetanus decreased to 81% from 84% in 2011.[6] Additionally, the standardization of protocols and intensive care management of neonates with tetanus have drastically reduced case fatality rates in resource-equipped settings, underscoring the importance of implementing these protocols.[10]

This article presents the case of a neonate born to parents in rural Western Uganda who presented to Mbarara Regional Referral Hospital with several days' intermittent fevers, refusal to feed and dystonia. It discusses principles of approach to diagnosis and treatment of neonates in resource-limited settings, including the importance of humility in cross-cultural and interdisciplinary work, diagnostic uncertainty, mutual trust to build physician-family partnerships and resource conscientiousness.

CASE REPORT

A term female neonate with unknown birthweight was delivered at home in Isingiro district in Nyakitunda and immediately cried robustly. Routine perinatal prophylactic measures were not performed. The umbilicus was cut with a new razor blade and then coated with Vaseline. Her mother attended three prenatal care visits and reported no medical conditions affecting pregnancy. However, she had not been immunized against tetanus. Home environment included a cow dung floor that was changed every six months.

On day-of-life (DOL) five, the neonate reportedly had subjective fever that was intermittent but overall worsening. She began to refuse to breastfeed and became unable to cry and medical attention was sought at a local clinic. Unknown traditional herbs were applied directly to the cord and given orally. An unknown prescription was written.

With lack of improvement by DOL, the neonate was brought to a private hospital in Mbarara, where she was found to have generalized stiffness and was diagnosed provisionally with neonatal sepsis versus neonatal meningitis.[11] She was given 50 mg/kg intravenous ampicillin, 5.4 mg/kg intravenous gentamicin and a 14-milliliter bolus of 10 percent intravenous dextrose pending transfer to our facility.

Upon arrival at Mbarara Regional Referral Hospital (MRRH), the neonate weighed 2630 g and was febrile to 38 °C and tachypneic with severe retractions. Shortly after intake, she had a generalized tonic-clonic seizure of approximately three minutes' duration. She was observed to be hypertonic, with a stiff neck, fisting and scissoring. She was started on a planned fourteen-day course of 100 mg/kg daily intravenous ceftriaxone and 7.5 mg/kg intravenous metronidazole thrice daily, as well as a loading dose of 20 mg/kg intravenous phenobarbital. She was additionally given vitamin K and started on maintenance dextrose intravenous fluids and 1 liter/ minute oxygen by nasal cannula.

A nasogastric tube was placed for the delivery of expressed breast milk at a rate of 10 milliliters every three hours. Because no refrigeration was available, the mother was requested to stay at bedside. Routine laboratory studies, to include a complete blood count and basic electrolytes, were ordered.

On DOL 12, a visiting neonatologist was invited to round on the infant ward with the primary treatment team. In collaboration with consulting pediatricians who observed the infant's modest weight gain to 2720 g but persistent tachycardia and dehydration and progression of hypertonia to include trismus, opisthotonos and risus sardonicus, she raised suspicion for neonatal tetanus. The neonate was further observed to be jaundiced, anemic and cyanotic, with clubbing of her digits. Her clothes were

wet and soiled and her cord was discolored with thick discharge. Laboratory results were notable for a lymphocytic-predominant leukocytosis to 13.6 K, platelet count elevated to 601 K and mild hypernatremia. Tetanus immunoglobulin (TIG) was administered. Immunization for tetanus for both the patient and the mother followed.

The cord was cleaned. Supportive measures and antibiotics were continued and tetanus-specific management was initiated. This consisted of a loading dose of 52.6 mg IV phenobarbital followed by 0.5 mg intravenous diazepam four times daily and intravenous magnesium sulfate, 100 mg/kg loaded over 30 minutes, followed by 50 mg/kg given over thirty minutes four times daily (Table 1).

By DOL 13, with improved appearance of the umbilical stump, fever had mostly revolved. Tone in the masseters and temporalis was reduced to near normal, with normal salivation and the neonate attempted to suckle. There was mild periorbital swelling, thought to be an adverse effect of the tetanus vaccine. Kidney function was normal.

This treatment regimen continued mostly unchanged through DOL 24, with continuous improvement. By DOL 29, she was afebrile, active in a flexed position and feeding. By DOL 32, her volume status was corrected, but her temperature was observed to be 35.6°C and she was observed to be mildly spastic, to have flexion contractures and to cry with passive limb extension. Diazepam was restarted and baclofen and in-ward physiotherapy were begun with speedy recovery. Health education and teaching for in-home physiotherapy exercises were performed before discharge on DOL 30.

At follow-up one week later, the infant weighed 3000 g and was feeding well but had excessive flexion at both her left knee and hip. Routine anticipatory guidance for childhood immunizations and developmental milestones were given to the parents by the local team in addition to catch-up immunizations that were administered and continuation of in-home physiotherapy advised.

At subsequent follow-up at age five months, 20 days, length was at the 1.2 percentile and weight at the 19.2 percentile, with adjusted length-for-weight at the 83.4 percentile and she was caught up on immunizations. She was referred for early childhood intervention. Final follow-up at 19 months revealed Bayley assessment motor score at the 79th percentile and language scores at the 27th percentile. Throughout the hospitalization, effective communication played a critical role in the neonate's diagnosis, treatment and recovery. The team's approach was rooted in humility and respect, acknowledging the family's lived experience and concerns while building confidence in the medical team's expertise. This collaborative communication style was essential in ensuring the mother's continued engagement with the care plan.

Upon admission, the patient's mother was encouraged to provide as much detail as possible about her history, as well as the birthing environment and perinatal care practices. Her active participation in the care of her newborn facilitated an open, culturally-informed dialogue, enabling the team to establish a thorough history and build mutual trust. Establishing the expectation of ongoing communication early was a priority to address any diagnostic uncertainty and treatment recommendations.

Given the lack of refrigeration, the patient's mother was at the bedside regularly to provide expressed breastmilk at preset intervals, further promoting real-time counseling and encouragement to empower the mother in her caregiving role. Additionally, the team was able to provide additional vaccination education as necessary and emphasize the importance of maternal and neonatal vaccination to minimize future risks. The team took care to explain the potential side effects of immunizations and treatments in accessible terms, ensuring the mother felt informed and reassured throughout.

During the rehabilitation process, the team worked to bridge literacy barriers by using visual aids and demonstrations and efforts were made to adapt instructions to align with the mother's home environment.

Regular communication with the team ensured ongoing support and reassessment, further strengthening the partnership between the family and medical providers. The mutual trust established throughout the hospitalization facilitated these continued interactions and adherence to recommendations, ultimately contributing to the neonate's successful recovery.

Table 1: Summary of the neonate's treatment regimen for neonatal tetanus at MRRH.

	Initial	Maintenance
Respiratory support	1 L/min oxygen by nasal cannula PRN	
Nutrition	EBM 10 ml q3hr	
Muscle relaxants	IV $MgSO_4$, 100 mg/kg over 30 mins	IV $MgSO_4$, 50 mg/kg mg over 30 mins QID
Sedative	52.6 mg IV phenobarbitone	0.5 mg IV diazepam QID
Antibiotics	100 mg/kg IV ceftriaxone qD 7.5 mg/kg IV metronidazole TID	

Table 2: Comparison of standard neonatal tetanus treatment protocols and adaptations for resource-limited settings in Uganda.

Treatment aspect	Standard treatment	Lower-resource setting in Uganda
Respiratory support	Intubation+ Mechanical ventilator	Oxygenation via Nasal Cannula
Nutrition	Total Parenteral Nutrition +Nasogastric Feeding (+/- fortification)	Dextrose IVF +Mother's Expressed Milk via NG Feeding, No available refrigeration
Neuromuscular treatment	Decrease/prevent muscle spasms + sedation (anticonvulsants e.g. barbiturates, benzodiazepines)	
	Midazolam	Diazepam
	Muscle relaxants	
	Baclofen	Magnesium Sulfate (Not available in NICU)
	Neuromuscular blocking agents	
	Vecuronium	Not used, no ventilator available
Antibiotics	Broad-spectrum antibiotics (e.g., Penicillin, Cephalosporin, Metronidazole) +Wound care	
		Dependent on availability and severity
Toxin neutralization and immunization	Tetanus Immunoglobulin +full vaccination series + maternal vaccination	
Environment	Incubator (low stimulation)	
		Limited availability
Pain and sedation	N-PASS scores Also used to titrate medication	

DISCUSSION

Neonatal tetanus results primarily through contamination of the umbilical stump by tetanus spores. C. tetani produces a potent neurotoxin, causing a bacterial infection with a high risk of mortality. Neonates exposed to tetanus may exhibit a range of clinical signs and symptoms in the early days to weeks following birth. Initially, neonates may present with poor feeding with difficulty opening the mouth due to trismus. Neonates may exhibit fisting and scissoring due to muscle stiffness and spasm and more advanced disease may manifest as trismus, risus sardonicus and opisthotonus. Additional nonspecific findings of neonatal tetanus include irritability, respiratory impairment, temperature instability and autonomic dysfunction.[4]

Challenges encountered in the course of diagnosis and treatment of the neonate patient in this article were many. Diagnostic uncertainty in this case was in part attributable to the near-eradication of neonatal tetanus in Uganda several years prior. The neonate was initially diagnosed with neonatal meningitis. Neither the local clinic or the private hospital considered neonatal tetanus amongst their differentials. Both neonatal tetanus and meningitis present with nonspecific findings of irritability, high fever, hypertonicity, poor feeding and respiratory distress.[11,12]

Key differences between these two neonatal diagnoses include generalized muscle rigidity, which can be accompanied by opisthotonos in neonatal tetanus versus localized nuchal rigidity in neonatal meningitis. The muscle spasms, stiffness and convulsions may also be misinterpreted as seizure activity. Furthermore, contamination of the umbilical stump is seen in the majority of neonatal tetanus cases, whereas neonatal meningitis would involve infection of the bloodstream or central nervous system. Diagnostic tools including blood tests and cerebrospinal fluid analysis by lumbar puncture are generally used to differentiate between the two conditions, however, they are not always available or in a timely fashion.

Outside of these resource constraints, neonatal tetanus is often linked to incomplete prenatal care, unhygienic birthing conditions and care of the umbilical cord.[13-15] Identifying and addressing these risk factors given language, cultural and literacy barriers can be extremely challenging. Many doctors in Uganda come from other areas of Africa and even those from Uganda may not speak the one of 70 generally spoken languages in the country and interpretation services may not be readily available. Recognition of the classic presentation of neonatal tetanus requires patience and given the aforementioned barriers, previous provider experience with the disease may be particularly helpful.

Resource constraints can arise in the actual treatment of neonatal tetanus in low-resource settings. The standard treatment for neonatal tetanus in well-resourced settings involves a complex and multidisciplinary approach in a neonatal intensive care unit (NICU) with access to advanced monitoring equipment. The goals of management include controlling hypertonicity and muscle spasms, administering antibiotics, managing respiratory distress, providing supportive measures including adequate wound care and preventing

complications such as pneumonia, sepsis or cardiac arrhythmias (Table 2). Additionally, even with effective treatment, patients may not fully recover and can still develop long-term complications, such as neurological or muscular damage and cognitive delays.[16] In the course of treating this patient, for example, in addition to the application of deep knowledge of physiology to arrive at the described regimen, using alternative drugs or equipment, quick thinking, creativity and teamwork was required to secure essential elements of the treatment regimen. Magnesium sulfate, used to control muscle spasms, was not readily available in the neonatal ward. Fortunately, given that MRRH has a large delivery service and magnesium sulfate on hand to treat mothers with preeclampsia, clear communication with leaders in that department allowed for borrowing of quantities of that drug sufficient to treat the neonatal tetanus patient.

Similar protocols for managing neonatal tetanus have shown promising outcomes at other regional hospitals in Uganda, demonstrating the importance of resource-sensitive adaptations.[17] In 2022, pediatricians at the Soroti Regional Referral Hospital in Eastern Uganda published a treatment regimen for neonatal tetanus similar to that outlined in this article.[18] Notable differences include a lower dose of intravenous magnesium in that protocol, loading at 50 mg/kg and maintenance of 30 mg/kg/hour. This case, with longer documented follow up, provides further evidence for the suitability of this regimen in resource-limited settings and further highlights the need to remain vigilant for neonatal tetanus and in all parts of the country, in spite of largely successful eradication efforts. It is unknown exactly how many cases of neonatal tetanus were treated in all of Western Uganda since this patient, but approximately 1-2 have been treated each year at MRRH.

Neonatal tetanus can result in death or myriad detrimental long-term outcomes if not treated promptly. These include neurological damage and corresponding developmental delay, muscle weakness or stiffness, respiratory compromise, nutritional challenges and emotional or psychological consequences. The absence of ventilators or other advanced airway support meant oxygenation could occur only by nasal cannula. The absence of TPN and expense of formula required use of maternal expressed breastmilk. Compounding the deviation from western standard of care and required sacrifice on the part of the mother, the absence of refrigeration necessitated her near-constant presence at bedside.

Extensive, culturally sensitive collaboration was required for the successful diagnosis and treatment of this neonate. In the absence of local neonatologists, a visiting neonatologist provided guidance, empowering local physicians and nurses with deep knowledge of resource constraints and insight into the values of the family to deliver high quality care. At the time, there was no strongly evidence-based protocol for treatment of neonatal tetanus in resource-limited settings. When pivoting from western standard of care, patient safety and autonomy are the primary considerations. In this case, none of the medications or techniques used were experimental and all were known to be safe for use in neonates at the doses prescribed. Secondary considerations include capacity building; in general, deferring to local physicians to direct the care of their patients, working to outline shared goals, paves the way for future productive collaboration.

CONCLUSION

This case report highlights the significant challenges in diagnosing and managing neonatal tetanus in a resource-limited setting and underscores the critical role of collaboration among healthcare providers, local stakeholders and the patient's family. Effective communication and flexibility were essential in overcoming resource constraints and addressing the diagnostic uncertainty initially faced. In this case, careful physical examination and continuous reassessment were instrumental in arriving at the correct diagnosis, while recognizing and adapting to the patient's social circumstances was equally important in shaping an appropriate treatment plan. Ethical considerations, particularly around modifying standard protocols due to limited resources, required sensitivity, a thorough understanding of disease physiology and clear communication with the family and local providers to set realistic goals of care.

Long-term follow-up revealed that early interventions, including regular physiotherapy, significantly supported the patient's motor development and prevented functional impairments. By 19 months, the patient displayed normal cognitive development with a Bayley motor score in the 79th percentile, indicating positive outcomes despite the limitations encountered during initial treatment. This success illustrates the potential for favorable prognoses through early rehabilitation and sustained support. While this case had a successful outcome, patients with more severe presentations may face poorer outcomes without access to critical resources such as mechanical ventilation and TPN. Continued investment in healthcare infrastructure and support from international health authorities remain crucial to sustaining these outcomes and ensuring that similar cases can be managed effectively in the future.

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