


CASE REPORT

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The role of physiotherapy in recovery from generalized tetanus: two case reports

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Abstract

Background A toxin produced by *Clostridium tetani* causes an acute illness called tetanus. Although there are still isolated incidences of the disease in emerging nations with social and economic squalor, the number of cases has dropped as a result of vaccination. This case report intends to describe the physical therapy treatments given to two patients at the Federal Medical Center in Abeokuta who were diagnosed with generalized tetanus.

Case presentations A 14-year-old girl and a 7-year-old boy were admitted to the Federal Medical Centre Abeokuta (FMCA) with symptoms of tetanus including an inability to open their mouths and muscle stiffness, and they were treated by pediatric physiotherapists with a combination of soft tissue massage, passive stretching, and passive movements to improve their muscle function. The patient in case 1 showed improvement in all clinical outcomes, such as muscle spasm, hypertonicity, muscle strength in the upper and lower limbs, and overall functional status, after undergoing therapy for 14 days. Similarly, the patient in case 2 also showed improvement in the same clinical outcomes after undergoing therapy for 8 days. Specifically, both patients showed Oxford muscle grading of 4/5 on both left and right limbs, and case 1 showed a functional independence measure score of 66/126 while case 2 showed a score of 56/126.

Conclusions These case reports provide evidence that physical therapy interventions are effective in improving clinical outcomes and functional status in patients with generalized tetanus, and highlight the importance of incorporating physiotherapy in the management of this condition.

Keywords Tetanus, Recovery, Physical therapy, Intervention

Background

The bacterium, *Clostridium tetani*, which poisons the nervous system, is primarily responsible for the ancient disease known as tetanus. Muscle spasms are a defining feature of this potentially catastrophic nerve system illness. Everywhere in the globe, *Clostridium tetani* is a gram-positive, non-encapsulated bacillus that naturally exists in the soil and surrounding environment. It can

enter the human body through a wound or bite contaminated by dirt. The spores can germinate and the bacteria can proliferate at the site of the lesion, generating tetanus toxin that spreads throughout the body once they are in an appropriate anaerobic environment, such as a contaminated wound. Four symptomatic subtypes of tetanus are recognized: neonatal, widespread (more than 80% of the time), local, and cephalic [1]. The diagnosis is mostly clinical; however, the course of treatment must be considered urgent and life-saving. Despite the organism's widespread distribution, poor nations [2] are significantly affected by this illness because to low vaccination rates.

Tetanolysin and tetanospasmin are types of the exotoxins that *Clostridium tetani* generates. Tetanolyisin's impact on human tetanus is unclear; however, it

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is thought to harm nearby healthy tissues and lower oxidation–reduction potential, which encourages the development of anaerobic organisms [3]. Tetanospasmin, another name for tetanus toxin, is neurotoxic. Tetanospasmin's capacity to block neurotransmitter release from the presynaptic membrane for several weeks causes all recognized tetanus manifestations; symptoms are caused by the involvement of central motor control, autonomic function, and the neuromuscular junction [3]. Tetanospasmin prevents inhibitory neurotransmitters like GABA and glycine from releasing, which results in painful and uncontrolled muscular contractions [4].

The illness remains perilous in many developing nations despite a global decline in its frequency [5–8]. Despite being uncommon, it is nonetheless occasionally recorded in developed countries, particularly in the farming community [9]. Tetanus cases were recorded globally in 2010 in about 9600 instances, according to data from the World Health Organization (WHO) [10]. Compared to the yearly incidence data from 1980, which topped 110,000, this is a significant decrease. A few decades ago, tetanus was a leading cause of neonatal and pediatric death, but thanks to successful immunization campaigns in many nations, the incidence has significantly decreased [11]. According to estimates from the World Health Organization, tetanus-related new-born deaths worldwide have decreased by 93% since the late 1980s [10].

Over 90% of babies are currently protected by vaccination programs in the majority of nations [10]. The prevalence of tetanus bacterial spores in the environment makes it difficult to completely eliminate the illness. Although several entry points have been identified, the source of infection may be unclear in 20% of instances [12]. Some of the portals that have been described include puncture wounds, circumcision, infected burns, post-abortal sepsis, injection sites, Guinea worm sores, road traffic accident wounds, otitis media, and surgical procedures performed with contaminated gloves or improperly sterilized catgut sutures [12]. The majority of tetanus cases that were documented in Nigeria happened after an acute injury, mostly to the feet or legs, and the injuries were commonly caused by treading on wood or cuts from a cutlass [12]. Tetanus is uncommon and unheard rarely seen by physiotherapists in Nigeria and throughout the world. This study highlights the physiotherapy interventions used in the management of generalized tetanus in a Nigerian hospital and also to contribute to the body of knowledge on the management of generalized tetanus in pediatric patients.

Case presentation

Case 1

The patient was a 14-year-old girl who was admitted to the children's emergency ward of our health care facility following complaints of inability to open her mouth and abnormal body movement 3 days prior to presentation. She was taken to two State-owned Hospitals before admission to this facility. She was in her usual state of health until 3 days prior to the presentation when she was unable to open her mouth. This was associated with mouth pain and difficulty in taking solid food. Abnormal body movement was noticed 1 day after and was characterized by abnormal stiffening of the body. The frequency of episodes was said to be increasing and occurred with or without touching the patient. There was no preceding history of ear discharge, and no history of the punctured wound prior to the onset of symptoms. The patient's immunization history could not be ascertained. Her developmental milestones were appropriately attained at when due. The patient is the third child in a monogamous family setting of 6 children comprising of 3 boys and 3 girls. Her parents are low-income earners. The father is a farmer and has SSCE as the highest level of education (his age could not be ascertained). The mother is a farmer with the First Leaving School Certificate (FSLC) as the highest level of education (her age could not be ascertained) and they live in a 4-bedroom apartment.

On presentation in this facility, she was conscious, oriented in time, place, and person, having a spontaneous spasm, locked jaw, and abdominal rigidity. The vital signs at the first visit were as follows; temperature = 36.5°C, pulse rate = 120 beats per minute, respiratory rate = 40 counts per minutes, and $SPO_2 = 98\%$. An assessment of generalized tetanus was made with an unknown portal of entry. The full blood count (FBC) results were; PCV-38%, WBC- $9.4 \times 10^9/l$ poly-68%, lymphocytes-68%, monocytes-05%, eosinophils-03%, basophils-00%, platelets- $213 \times 10^9/l$, MCH-25 pg, MCV-77 fl, and MCHC-32 g/dl. The results of the electrolyte, urea, and creatinine (E/U/CR) tests were done: Na-139 mmol/l K-2.8 mg/l Cl-102 mmol/l HCO₃-22 mmol/l urea-26 mg/dl Cr-0.52 mg/dl. She was referred for physiotherapy a month after being admitted to this facility. She had 14 sessions of physiotherapy while on admission to the ward and was discharged after she had gained independent function.

Physiotherapy assessment for case 1

On observation, the patient had a locked jaw and generalized rigidity, and she appeared dehydrated and malnourished. In the assessment of the neck, there was severe hypertonicity of all muscle groups. The active range of

motion (AROM) at the neck region was limited and pain-free. The passive range of motion (PROM) at the neck region was limited and painful. There was abdominal and trunk muscle stiffness, and hyperextension of the spine, and she complained of chest pain. In the upper limb (UL) assessment, there was reduced muscle bulk and increased tone bilaterally. The sensation was intact for both limbs. The patient had a gross motor power (GMP) of 3/5- bilaterally. On AROM, there was a limitation but no pain in all joints of both upper limbs (ULs). The PROM was full and pain-free at the elbow and wrist joints bilaterally, but painful at both shoulder joints.

Concerning the assessment of the lower limbs (LLs), there was normal muscle bulk and increased muscle tone bilaterally. AROM and PROM were limited and painful at the left knee and hip joints. There was obvious swelling at the right knee joint. There was tendon Achilles (TA) tightness bilaterally. The GMP for the lower limbs was 2/5 on the right and 3/5 on the left. On functional assessment, the patient was dependent on all activities of daily living (ADL). The patient can only move the neck from side to side minimally. She cannot roll from side to side independently and cannot sit up from a supine position. The patient was dependent on her mother for activities of daily living (ADL). The self-care, transfer, and locomotion portion of the functional independence measure (FIM) was completed, and the patient scored 1 in all tested areas (Table 1). The FIM is a standard instrument that is used to objectively evaluate a patient's level of disability and treatment response.

Case 2

A 7-year-old boy was brought in by his father on account of his inability to open his mouth and stiffness of muscles 4 days prior to presentation to this facility. He was apparently healthy before the onset of the presenting symptoms. About a day after the onset of symptoms, stiffness of the body was noticed and his parents resorted to giving him home-made herbal mixtures and he was consequently taken to a traditional doctor where he received a spiritual bath. The patient was brought to this facility when there was no improvement in the symptoms. He had a complete immunization based on the National Program on Immunization Schedule and had no history of delayed developmental milestones according to his grandmother. The patient lives with his paternal grandmother after being abandoned by his mother since he was 9 months of age. His parents got divorced, and he has lived with his paternal grandmother who is a trader since then.

On observation by the medical team, he was not pale, anicteric, not cyanosed, and febrile (37.8 °C). Vitals at the first visit were as follows: pulse rate of 80 beats per minute, respiratory rate of 34 counts per minute, and SPO₂ of 98% at room air. He had periodic spasms, board-like rigidity of the abdomen, and Risus Sardonius. The patient was admitted into the isolation unit of the children's emergency room and managed as a case of generalized tetanus, and the portal of entry could not be ascertained. The patient was placed on antispasmodics and sedatives. The patient was referred for physiotherapy

Table 1 Functional independence scores throughout treatment

	Case one				Case two		
	Initial	Week 4	Week 8	Week 14	Initial	Week 6	Week 8
Self-care							
Eating	1	2	5	6	1	2	5
Grooming	1	2	4	7	1	2	6
Bathing	1	2	3	6	1	2	5
Dressing-upper	1	1	4	5	1	1	4
Dressing-lower	1	1	4	5	1	1	4
Toileting	1	1	3	6	1	2	4
Transfers							
Bed, chair, wheelchair	1	2	4	6	1	2	7
Toilet	1	2	4	6	1	2	6
Tub, shower	1	2	3	6	1	2	4
Locomotion							
Walk/wheelchair	1	1	4	7	1	1	6
Stairs	1	1	1	6	1	1	5
Motor subtotal score	11	17	39	66	11	18	56

2 weeks after being admitted to this facility and had 8 sessions of physiotherapy when he gained independence.

Physiotherapy assessment for case 2

On examination, the patient was conscious and oriented in time, place, and person. There was severe and generalized hypertonicity. The AROM at the neck region was limited and pain-free while PROM was limited and painful. On the assessment of the trunk and abdomen, he had pain on the right lower quadrant of the stomach which was tender to touch. There was an increased tone of the core abdominal muscles. For the ULs, AROM was limited and without pain in all joints while PROM was limited and painful at the shoulder. The muscle bulk was preserved, the sensation was intact, and the GMP was 3/5 in both limbs. Concerning the lower limbs, the muscle bulk was preserved in both limbs. The AROM was limited and pain-free while PROM was also limited and painful bilaterally. The sensation was intact, there was the tightness of tendon Achilles bilaterally, and GMP was 3/5. The patient was dependent in all activities of daily living. He communicates and can move the neck from side to side minimally. He could not roll from side to side independently and could not sit up from supine position. The patient scored 1 in all tested areas of the FIM (Table 1).

Treatment plan and therapeutic intervention both case studies

The short-term goals of the physiotherapy management were to relieve pain, stretch tight structures, increase range of motion, reduce swelling, and prevent further physical deterioration while the long-term goals were to

rehabilitate the patient for independent walking and gait retraining. The patients (cases 1 and 2) were seen twice daily by the pediatric physiotherapists. Table 2 shows the flowchart of the rehabilitation process for both case reports.

Case one

To achieve the short-term goals for both patients, we carried out soft tissue massage using stroking and frictional techniques with topical analgesics, passive stretching to all muscle groups of both upper limbs and lower limbs, also passive movements to all joints of both upper limbs and lower limbs. These interventions were done in the first to fourth sessions. The treatment regimen from the fifth to eighth sessions included assisted active exercises to all muscle groups of both upper limbs and lower limbs in gravity-free plane, trunk rolling exercises, back extension exercises, assisted curl up exercises, bridging exercises, and rhythmic stabilization. The patient's GMP for the upper limbs was still 3/5 at the 8th session of therapy while that of lower limbs had increased from 2/5 to 3/5 for the right and still 3/5 for the left. The FIM scores were reassessed in the fourth and eighth weeks (Table 2). The patient was able to sit on the chair at beginning of the eight sessions. In the last four sessions, one-leg stance, and squatting exercises were prescribed. We also introduced tandem walking when the patient was noticed to be walking with a wide-based gait pattern. The patient was re-assessed at the fourteenth session, and the GMP had increased to 4/5 for both limbs. She had a FIM score of 66 (Table 1) and was found fit for discharge from physiotherapy.

Table 2 A flow chart of the rehabilitation process for both case studies (rehabilitation approach)

Goals	Treatment administered
<ul style="list-style-type: none"> • Relieve pain • Increase range of motion • Stretch tight structures of ULs, LLs, and trunk 	<ul style="list-style-type: none"> • Passive movement to all joints of bilateral ULs and lower limbs (25 reps) • Soft tissue massage using stroking and frictional technique with topical analgesic, passive stretching to all joints of the ULs and LLs • STM to the facial muscles • Gentle neck mobilization • Home exercise programs
<ul style="list-style-type: none"> • Strengthen weak muscles of ULs and LLs • Stretch tight structures • Trunk control retraining • Sitting education • Transfer training 	<ul style="list-style-type: none"> • Free active exercises (gravity-free plane) to bilateral hamstrings (x 10 reps x 2 sets) • Bridging exercises (x 10 secs x 10reps x 2 sets) • Rhythmic stabilization in high sitting • Assisted active exercises to all muscle groups of bilateral ULs and LLs in gravity free plane • Trunk rolling exercises, • Assisted curl-up exercises, 10 reps, 2 sets • Bridging exercise • Walking re-education using Zimmer's frame • Ward exercise programs
<ul style="list-style-type: none"> • Retrain balance and walking • Community reintegration 	<ul style="list-style-type: none"> • Walking reeducation • Squatting exercises • One leg stance exercise • Tandem walking

Abbreviations: ULs Upper limbs, LLs Lower limbs, STM Soft tissue massage, secs Seconds

Case two

The patient had twelve sessions of physiotherapy where he was seen for about 15 to 25 min. To achieve the immediate goals, we started with passive movements to all joints of the upper limbs and lower limbs to help increase ROM. A soft tissue massage was done for the shoulder and knee joints. We also incorporated gentle neck mobilization to the neck. Passive stretching exercises started in the third week, together with free active exercises to both the upper limbs and lower limbs. The trunk was trained in the fourth week with the use of bridging exercises and rhythmic stabilization in a high sitting. The patient was already sitting independently in bed at the end of the sixth week. The patient was reassessed in the sixth week, and the GMP was still 3/5 for both upper limbs and lower limbs while the FIM was 18. To further strengthen the trunk, rolling and curl-up exercises were added to the treatment regimen. In the seventh week, the patient began standing and walking re-education using Zimmer's frame. He progressed to walking without an aid at the end of the eighth week. The GMP had increased to 4/5 for both limbs. The patient also had an FIM score of 56 (Table 2) in the last week of treatment before discharge.

Discussion

Two case studies, a 14-year-old girl with generalized tetanus and a 7-year-old child, are included in this case report. Similar presentation and recovery patterns were seen in both patients. For case reports one and two, the spasms had ceased after 2 weeks and 4 weeks, respectively, when both patients were referred for physiotherapy care. This was also in accordance with Bleck and Brauner's 1997 global tetanus care guideline, which recommended starting physical therapy during the convalescent period [13]. There are limited clinical studies on the role of physiotherapy in the management of children with generalized tetanus; however, available evidence suggests that the treatment plan needs to be based on symptoms. It was observed in both studies that certain symptoms needed to improve first to allow other symptoms to be worked on. An example of this is stretching of the tight muscles to increase the range of motion needed for standing and walking re-education. The generalized rigidity was noticed to resolve significantly after about 4–5 physiotherapy sessions in both cases. It was observed that they both had wide-based gait patterns of walking, this was addressed by tandem walking, and their abnormal gait was corrected. Tetanus is a serious bacterial infection that affects the nervous system, leading to muscle stiffness and spasms. The muscle stiffness and spasms in tetanus can cause significant complications that can impact the patient's ability to function and can

even be life-threatening if left untreated. One of the main risks of tetanus is the development of joint stiffness. The prolonged muscle spasms can cause the joints to become stiff and immobile, making it difficult for the patient to move and perform daily activities. This joint stiffness can also be irreversible and can have long-lasting effects even after the infection has been treated. It is important to note that physiotherapy can play a crucial role in managing and preventing these complications in patients with tetanus. Physiotherapy can help to reduce muscle stiffness and spasms, promote the range of motion, and prevent muscle atrophy and joint stiffness. Techniques such as stretching, massage, and passive mobilization can help relieve muscle tension and prevent contractures.

The role of physiotherapy in the management of children with tetanus is yet to be studied using high-evidence research methods, such as randomized controlled trials and longitudinal studies. Regardless of this, our physiotherapy interventions proved beneficial to both patients. In addition to restoring the nervous and muscular systems, physiotherapy serves the important function of preventing other complications such as pneumonia, atelectasis, and thrombosis [14]. Prolonged immobility in an untreated tetanus and difficulty breathing due to muscle spasms can increase the risk of developing pneumonia and atelectasis. Physiotherapy techniques such as deep breathing exercises, chest physiotherapy, and postural drainage can help prevent and treat these complications by promoting lung expansion, clearing secretions, and improving ventilation. Thrombosis is another potential complication in patients with generalized tetanus, as immobility and dehydration can increase the risk of blood clot formation. Physiotherapy techniques such as early mobilization, compression therapy, and exercise can help prevent and treat thrombosis by improving blood circulation, reducing blood stasis, and preventing the formation of blood clots.

The combination of drug therapy and physiotherapy can have a synergistic effect in improving patient outcomes. For example, Diazepam, Chlorpromazine, and Phenobarbital were administered to both patients to reduce muscle tone and improve relaxation, allowing for easier movement during physiotherapy sessions. Diazepam is a benzodiazepine that acts as a muscle relaxant and anxiolytic, while Chlorpromazine is an antipsychotic medication that has sedative and antiemetic properties. Phenobarbital is a barbiturate that can be used to treat seizures and muscle spasms. The use of these medications can complement the physiotherapy management, allowing for improved participation in exercises, stretches, and other therapeutic interventions. This can ultimately lead to faster recovery times and improved patient outcomes. However, it is important to note that

the use of medications in conjunction with physiotherapy should be carefully monitored by a healthcare professional to ensure the safety and effectiveness of treatment. Any potential side effects or interactions between medications and physiotherapy techniques should be closely monitored and addressed as necessary to ensure the best possible outcomes for the patient.

We incorporated functional tasks such as sitting, then progressed to standing, then walking, as the hypertonicity resolved. Passive movement, stretching of tight structures, and pain relief should be the first line of physiotherapy management of children with tetanus as these ultimately influence the progression of rehabilitation. Functional tasks should be progressively incorporated once a significant range of motion is attained. Interventions must be evaluated daily due to the frequently changing symptoms and conditions of the patient. Although quality research on this topic is limited, this case study demonstrates that physical therapy interventions have a positive impact on regaining function and decreasing disability in patients with generalized tetanus.

Conclusion

Tetanus is a very rare condition seen in children, and in rarer cases results in death. It remains a clinical diagnosis because confirmatory laboratory tests are not available for routine use. It is essential to educate the public on the need to protect themselves against wounds and prompt treatment of every wound. Physiotherapy was indeed helpful in our case study for the recovery of generalized tetanus. Early referral for physical therapy at the convalescent stage, patient's clinical compliance, adherence to ward programs, and family support were seen to greatly influence the speed of recovery positively.

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Authors' contributions

AF, OS, and KA contributed to the conceptualization and designed of the study and drafted the initial manuscript. BM proofread the manuscript while EJ, TM, and BA collated the patients' histories. The authors read and approved the final manuscript.

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Declarations

Ethics approval and consent to participate

Ethical approval was not required for this study in accordance with national guidelines. Written informed consent was obtained from the parent/guardian of these participants. All the information gathered from the patients was handled confidentially, and it was used only for research purposes.

Consent for publication

Written informed consent was obtained from the parent/guardian for the publication of this case report and any accompanying images.

Competing interests

The authors declare that they have no competing interests.

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