

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 study described the physical therapy treatments given to two patients at the Federal Medical Centre in Abeokuta (FMCA) who were diagnosed with generalized tetanus.

Case presentation: The first case was a 14-year-old girl who was admitted after complaining of being unable to open her mouth and having abnormal bodily movements. The second patient was a 7 years old boy who also presented on account of an inability to open his mouth and stiffness of the muscles. Both patients were managed by pediatric physiotherapists at Federal Medical Centre Abeokuta (FMCA). Physical therapy interventions administered were soft tissue massage using stroking and frictional technique with topical analgesics, passive stretching to all muscle groups of both upper limbs and lower limbs, and passive movements to all joints of both upper limbs and lower limbs. In addition, bridging exercises, rhythmic stabilization in high sitting, trunk rolling, standing and walking re-education were also among the treatments administered. Following physical therapy rehabilitation, the patients demonstrated improvements in Range of Motion (ROM), strength, balance and ambulation.

Conclusion: Physical therapy was immensely helpful for the patients, who were then able to resume their usual activities of daily living.

Keywords: Tetanus, Recovery, Physical therapy, Intervention.

List of abbreviations: ROM: Range of Motion; GABA: Gama-Amino Butyric Acid; WHO: World Health Organization injury; PCV: Packed Cell Volume; WBC: White Blood Cells; MCH: Mean Corpuscular Haemoglobin; MCHC: Mean Corpuscular Haemoglobin Concentration; MCV: Mean Corpuscular Volume; AROM: Active Range of motion; PROM: Passive Range of Motion; UL: Upper Limbs; LL: Lower Limbs; GMP: Gross Motor Power; TA: Tendon Achilles; ADL: Activities of Daily Living; FIM: Functional Independence Measure

Introduction

The bacterium, *Clostridium tetani*, which poisons the nervous system, is primarily responsible for the disease known as tetanus. Muscle spasms are a defining feature of this potentially catastrophic nerve system illness. *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 [1]. 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. 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 are significantly affected by this illness because to low vaccination rates [2].

Tetanolysin and tetanospasmin are types of the exotoxins that *Clostridium tetani* generates. Tetanolysin's impact on human tetanus is unclear, however it is thought to harm nearby healthy tissues and lower oxidation-reduction potential, which encourages the development of anaerobic organisms. 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 involvement of central motor control, autonomic function, and the neuromuscular junction. Tetanospasmin prevents inhibitory neurotransmitters like GABA and glycine from releasing, which results in painful and uncontrolled muscular contractions [3].

The illness remains perilous in many developing nations despite a global decline in its frequency. Despite being uncommon, it is nonetheless occasionally recorded in developed countries, particularly in the farming community. Tetanus cases were recorded globally in 2010 in about 9,600

instances, according to data from the World Health Organization. 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. According to estimates from the world health organization, tetanus related new-born deaths worldwide have decreased by 93% since the late 1980's [4].

Over 90% of babies are currently protected by vaccination programs in the majority of nations. 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. Some of the portals that have been described include puncture wounds, circumcision, infected burns, post-abortals sepsis, injection sites, Guinea worm sores and road traffic accident wounds, otitis media, surgical procedures performed with contaminated gloves or improperly sterilized catgut sutures. 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. Tetanus is not commonly seen by physiotherapists in Nigeria or anywhere else in the world, thus it is crucial to highlight this case, its presentation and the role of physiotherapists in its recovery [5].

Case Presentation

Case one

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 three days prior to presentation. She was taken to two state owned hospitals before admission at this facility. She was in her usual state of health until 3 days prior to 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. Frequency of episodes was said to be increasing and occurred with or without touching the patient. There was no preceding history of ear discharge, no history of punctured wound prior to the onset of symptoms. Patient's immunization history could not be ascertained. Her developmental milestones were appropriately attained at when due. 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 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 [6].

On presentation in this facility, she was conscious, oriented in time, place and person, having spontaneous spasm, locked jaw and abdominal rigidity. Vital signs were as follows;

temperature=36.5°C, pulse rate=120 beats per minute, respiratory rate=40 counts per minutes, SPO₂=98%. An assessment of generalised tetanus was made with unknown portal of entry. The Full Blood Count (FBC) results were; PCV-38%, WBC-9.4 × 10⁹/l poly-68%, lymphocytes-68%, monocytes-5%, eosinophils-3%, basophils-0%, platelets-213 × 10⁹/l, MCH-25 pg, MCV-77 fl, 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 in this facility. She had 14 sessions of Physiotherapy while on admission in the ward, and was discharged after she had gained independent function [7].

Physiotherapy assessment for case one: On observation, patient had locked jaw, generalised rigidity, 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 neck region was limited and pain free. The Passive Range of Motion (PROM) at neck region was limited and painful. There were abdominal and trunk muscle stiffness, hyperextension of 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. Patient had a Gross Motor Power (GMP) of 3/5-bilaterally. On AROM, there was limitation but no pain in all joints of both Upper Limbs (ULs). The PROM was full and pain free at elbow and wrist joints bilaterally, but painful at both shoulder joints [8].

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 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 were 2/5-on the right, and 3/5-on the left. On functional assessment, patient was dependent in all Activities of Daily Living (ADL). Patient can only move the neck from side to side minimally. She can't roll from side to side independently and can't sit up from 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 patient scored 1 in all tested areas. The FIM is a standard instrument that is used to objectively evaluate a patient's level of disability and treatment response [9].

Case two

A 7 years old boy was brought in by his father on account of inability to open his mouth and stiffness of muscles four 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 symptom, 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. 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. 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 [10].

On observation by the medical team, he was not pale, anicteric, not cyanosed, febrile (37.8°C). Vitals were; Pulse rate of 80 beats per minute, Respiratory rate: 34 counts per minute, SPO₂: 98% on room air. He had periodic spasms, board like rigidity of the abdomen and risus sardonicus. Patient was admitted into the Isolation Unit of the Children Emergency Room and managed as a case of generalised tetanus, portal of entry could not be ascertained. Patient was placed on antispasmodics and sedatives. Patient was referred for physiotherapy two weeks after being admitted in this facility and had 8 sessions of Physiotherapy when he had gained independence.

Physiotherapy assessment for case two: On examination, patient was conscious and oriented in time, place and person.

There was severe and generalized hypertonicity. The AROM at neck region was limited and pain free while PROM was limited and painful. On assessment of the trunk and abdomen, he had pain on the right lower quadrant of the stomach which was tender to touch. There was 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, sensation was intact and the GMP was 3/5 in both limbs. Concerning the lower limbs, 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 tightness of tendon achilles bilaterally and GMP was 3/5. The patient was dependent in all activities of daily living. He communicates, 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).

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

Results and Discussion

Treatment plan and therapeutic intervention both case studies

The short-term goals of 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 patient for

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

To achieve the short-term goals for both patients, we carried out soft tissue massage using stroking and frictional technique 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 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 exercise, bridging exercise 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 at the fourth and eighth weeks (Table 2). Patient was able to sit on 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 patient was noticed to be walking with a wide based gait pattern. Patient was re-assessed at 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.

Patient had twelve sessions of physiotherapy where he was seen about 15 to 25 minutes. To achieve the immediate goals,

we started with passive movements to all joints of upper limbs and lower limbs to help increase ROM. Soft tissue massage was done for the shoulder and knee joints. We also incorporated gentle neck mobilization to the neck. Passive stretching exercises started at the third week, together with free active exercises to both upper limbs and lower limbs. The trunk was trained at the fourth week with the use of bridging exercises and rhythmic stabilization in high sitting. Patient was already sitting independently in bed at the end of the sixth week. Patient was reassessed at the sixth week; 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. At the seventh week, 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. Patient also had an FIM score of 56 at the last week of treatment before discharge (Table 2).

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

Goals	Treatment administered
Relieve pain	Passive movement to all joints of bilateral ULs and lower limbs (25 reps)
Increase range of motion	Soft tissue massage using stroking and frictional technique with topical analgesic, passive stretching to all joints of the ULs and LLs,
Stretch tight structures of ULs, LLs and trunk	STM to the facial muscles
-	Gentle neck mobilization
-	Home exercise programmes
Strengthen weak muscles of ULs and LLs	Free active exercises (gravity free plane) to bilateral hamstrings (x10 reps x2 sets)
Stretch tight structures	Bridging exercises (x10 secs, x 10 reps, x 2 sets)
Trunk control retraining	Rhythmic stabilization in high sitting
Sitting education	Assisted active exercises to all muscle groups of bilateral ULs and LLs in gravity free plane
Transfer training	Trunk rolling exercises,
-	Assisted curl up exercises, 10 reps, 2 sets
-	Bridging exercise
-	Walking re-education using Zimmer's frame
-	Ward exercise programmes
Retrain balance and walking	Walking re-education
Community reintegration	Squatting exercises
-	One leg stance exercise
-	Tandem walking

The prevalence of tetanus has significantly decreased since 1940 as a result of the widespread immunization with tetanus toxoid in resource-rich nations. There were 264 tetanus cases recorded in the United States between 2009 and 2017 according to the Centers for Disease Control and Prevention. Tetanus is still prevalent in nations with little resources, in contrast to those with abundant resources. Tetanus is thought to

have caused 40,000-80,000 fatalities worldwide in 2016. Since most sickness cases in many nations go unreported, the true disease incidence is unclear. Neonatal tetanus has been eradicated in 45 countries as a result of the world health organization's maternal and neonatal preventive effort. Additionally, even in impoverished nations, incidences of

generalized tetanus in adults are extremely uncommon and most likely rarely reported.

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 global tetanus care guideline, which recommended starting physical therapy during the convalescent period.

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 tight muscles to increase 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 pattern of walking, this was addressed by tandem walking, and their abnormal gait was corrected.

The role of physiotherapy in 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. We incorporated functional tasks such as sitting, then progressed to standing, then walking, as the hyper tonicity 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 condition 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. The mortality associated with the infection is very high, especially in our environment where the lack of adequate facilities hampers comprehensive and optimal hospital in-patient care. 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 programmes and family support were seen to greatly influence the speed of recovery positively.

Ethics Approval and Consent to Participate

Ethical approval is not applicable for the case report. All written informed consent for medical procedures and patient's medical information study was obtained from the patient to publish this case report. All ethical principles for medical research studies established by our hospital have been followed.

Consent for Publication

Written informed consent was obtained from the patient for publication of this case report and any accompanying images. A copy of the written consent is available for review by the Editor-in-Chief of this journal.

Availability of Data and Materials

Essential data supporting the findings of this study are available within the article. Further data are available on request from the corresponding author. The data are not publicly available due to privacy reasons.

Competing Interests

The authors declare that they have no competing interests.

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Authors' Contribution

AOF, WOA, KO, made substantial contributions to the conception and design of the study. HOI, SOO and KOA participated in the data collection on EMR. The manuscript submitted has been read and approved by all authors, the requirements for authorship have been met, and authors believe that the manuscript represents honest work. All authors read and approved the final manuscript.

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