

Case Study

Tetanus and its Rehabilitation: A Case Study

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ABSTRACT

Tetanus is a global infectious disease that occurs due to the tetano-spasmin neurotoxin secreted by “anaerobic clostridium tetani”. Brain stem and spinal cord are affected by this tetano-spasmin neurotoxin, and if patient does not gets proper treatment in time then morbidity and mortality is very high. High risk population for tetanus in the US includes the elderly, diabetics, injection drug users and “unvaccinated” individuals.¹

KEYWORDS: Immunization, Trismus, Autonomic dysfunction, Opisthotonus position, Risus sardonicus.

INTRODUCTION

In 2017, globally 38,000 deaths were caused by tetanus in children especially aged under 5 years. It is a rare disease in the developed countries although worldwide mortality is very high due to incomplete vaccination in particular regions.¹

Mortality due to tetanus is variable in different regions of the world, Africa and South East Asia are having maximum death percentage, approximately 80%. Management of tetanus is a burden on medical fraternity. According to data, in the year 2018 lifesaving vaccines such as measles, diphtheria and tetanus were missed by 20 million children worldwide.²

Tetanus is a non-communicable disease. Wounds contaminated with soil, feces, saliva, puncher wound including unsterile injection sites, devitalized tissue including burn, avulsion & de-gloving injuries permitting to infection are the most common way the bacteria enters the body.³

Incubation period of tetanus is 3 - 21 days, most commonly 10 days.

Pierre Descombey developed immunization to protect people against tetanus in the year 1924 and it's become a routine practice in children's vaccination since the year 1940.⁴

Pathophysiology

It is a deadly, avoidable disease that occurs due to neurotoxin protein secreted by Clostridium tetani. Its spores contaminate necrotic wound and develop the fruitful bacterium that releases tetanus neurotoxin (TeNT). Once TeNT enter in blood circulation, it attaches itself to peripheral sensory-motor neurons; travel upwards to the spinal cord to the inhibitory inter-neuron, which block glycine or GABA release, resulting in spastic paralysis.⁵ (Fig 2 & 3)

Cases of tetanus in India according to WHO (2015-2019)

2015 - 2268
2016 - 3781
2017 - 7946
2018 - 7000
2019 - 7071

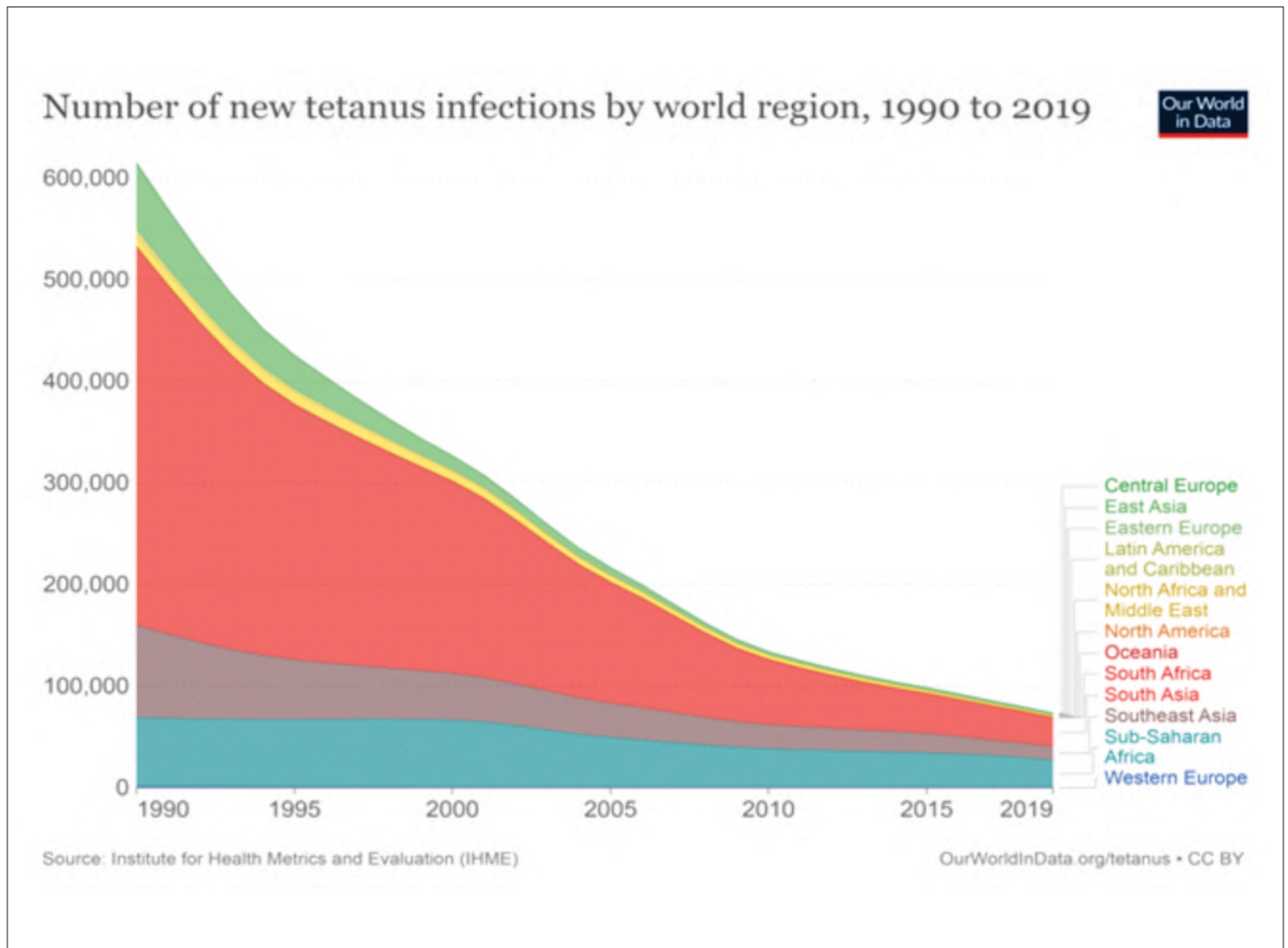


Fig. 1

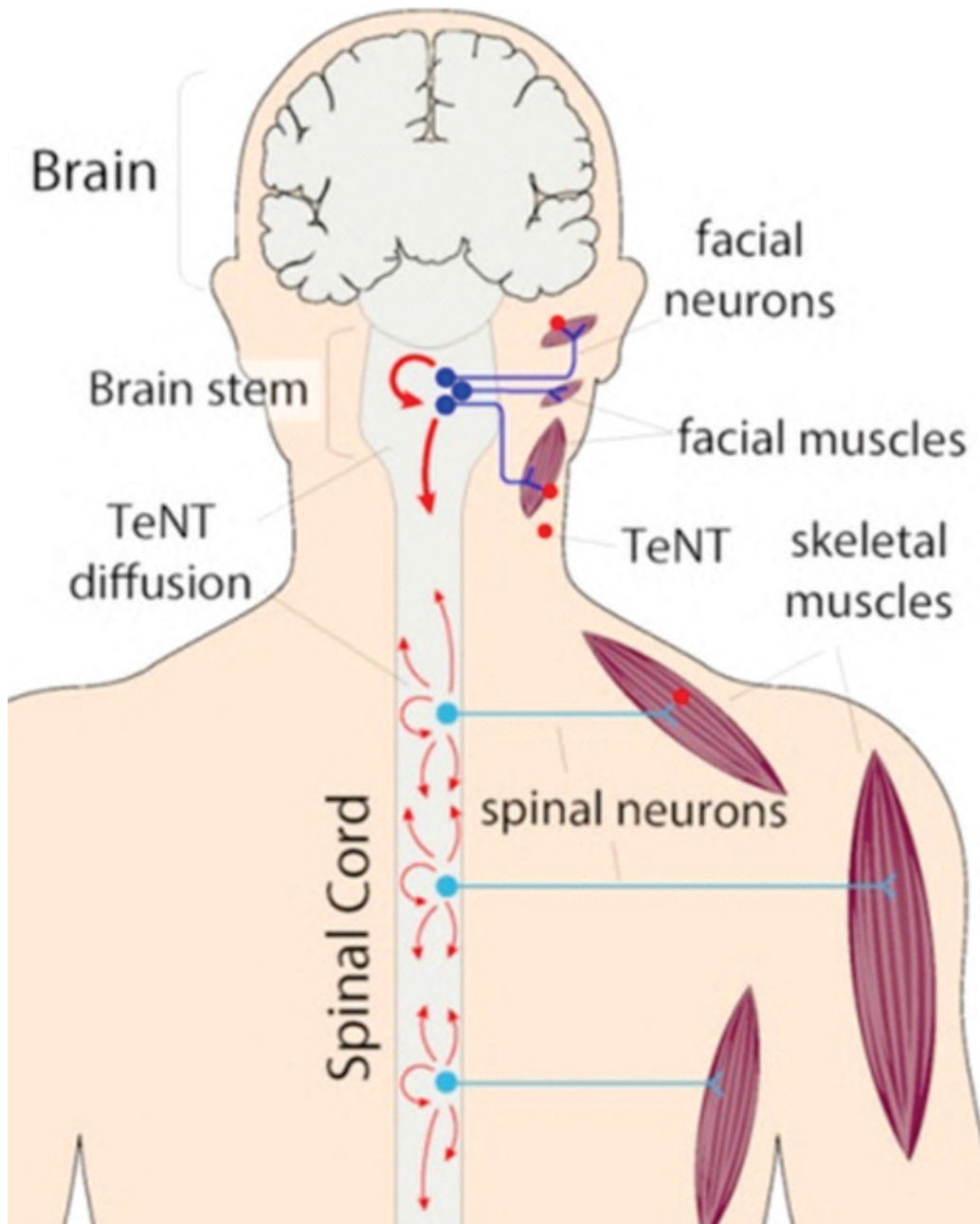


Fig. 2 Source: Wiley Online Library

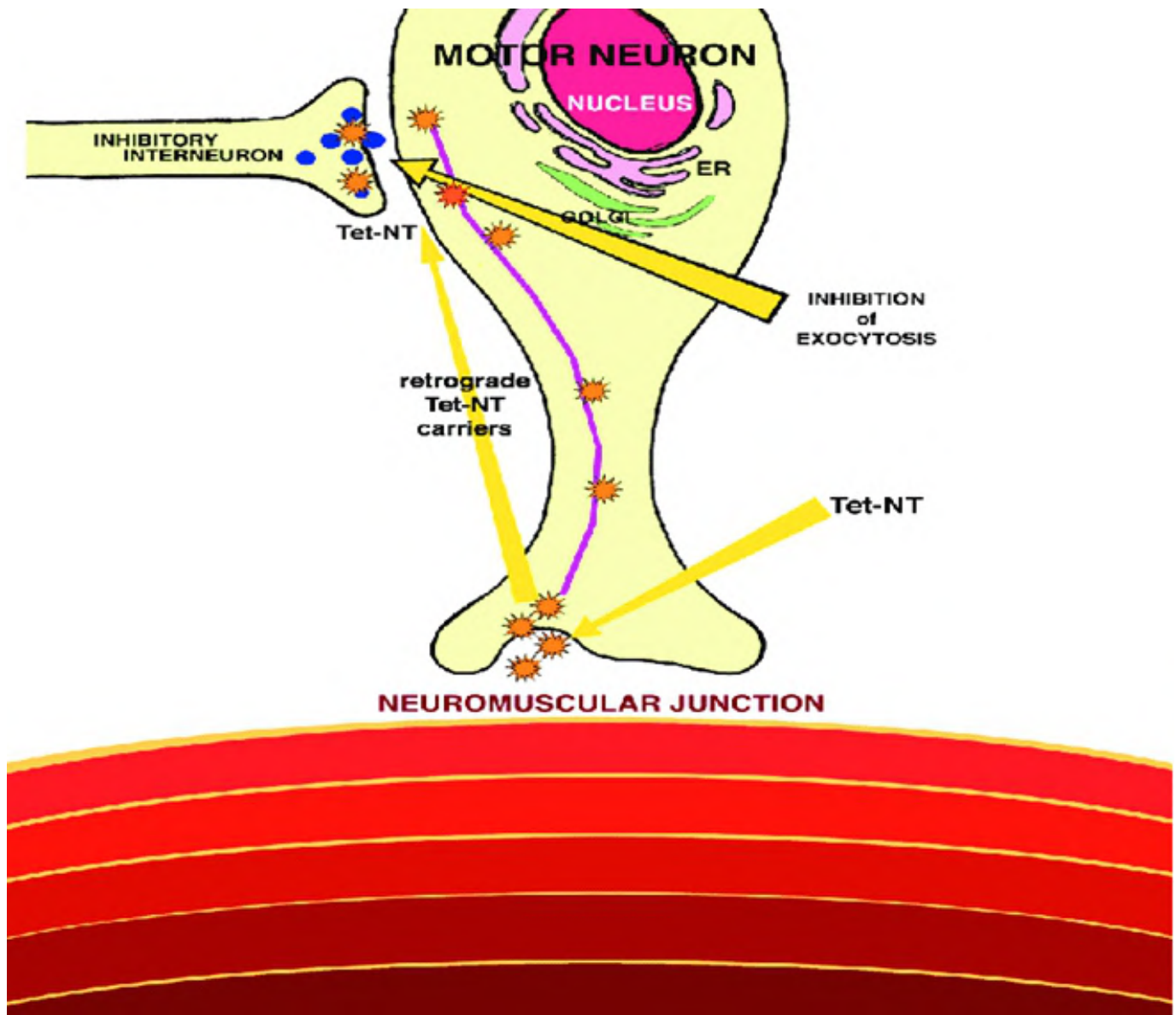


Fig. 3 : Tetanus neurotoxin {(TetNT), shown as yellow asterisks} travel retroaxonally (in purple line) by microtubules and actin microfilaments inside the motor neurons. Exocytosis of specific synaptic vesicles is inhibited by TetNT at inhibitory axonal terminals. Due to uninhibited action of excitatory axon terminals, results in spasticity. (Modified from Mayhew 2009).

Source: researchgate.net

Clinical Manifestation of Tetanus:

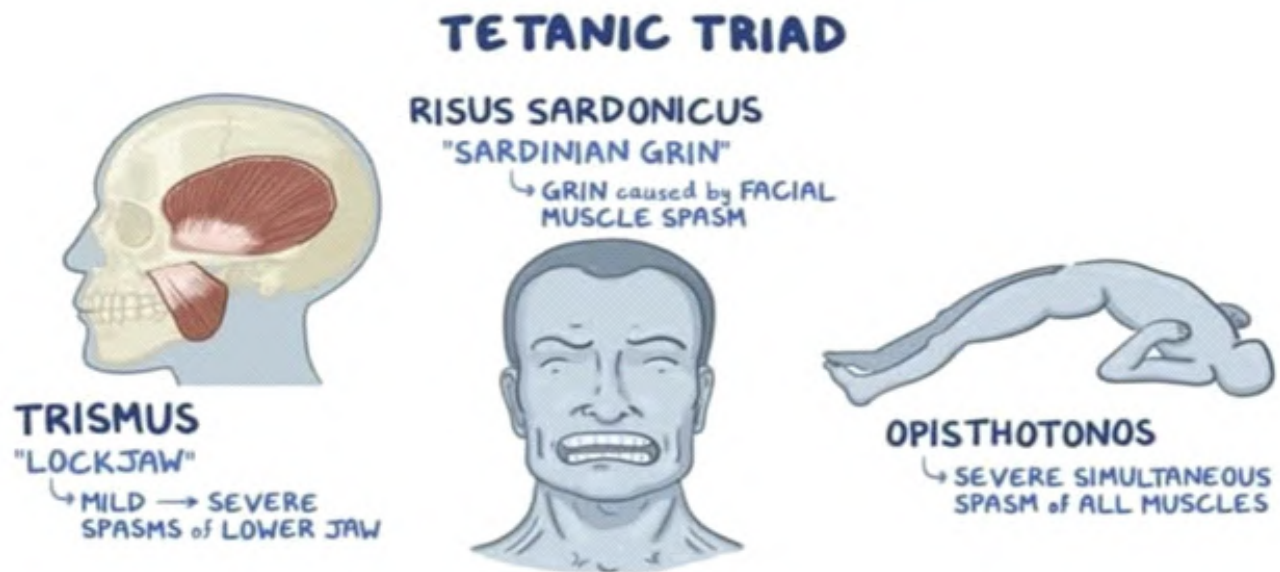


Fig. 2: Images showing Tetanus Triad of Trismus, Risus Sardonius, Opisthotonus Position
(Source : Kawir Medical Centre)

Trismus: Spasm of Masseter Muscles, also known as “Lock Jaw”. (Fig 4)

Risus Sardonius: Sustained contraction of facial musculature produces a sneering grin expression. Contraction of frontalis and muscles at the angle of mouth. (Fig 4)

Opisthotonus Position: Neck, back and legs extensors muscles spasm results in backward curvature. (Fig 4)

Autonomic Dysfunction: Hyperpyrexia, sweating, peripheral vasoconstriction, sustained hypertension, episodic tachycardia, dysrhythmia and cardiac arrest.

Muscle Spasticity

Dysphagia

Reflex Spasms

Laryngeal Spasms

Uncontrolled Urination and Defecation

Duration of illness: As recovery from tetanus requires formation of new axonal nerve terminals, its effects remain for longer period. Usual duration of tetanus is 4-6 weeks.⁶

Table 1 : Types of Tetanus:

Classification	Description
Generalized	Begins with trismus and risus sardonicus (spasm of the facial muscles), then proceeds to generalized spasms and opisthotonos
Localized	Muscle rigidity limited to the site of spore inoculation
Cephalic	Form of localized tetanus affecting cranial nerves, often following a head injury
Neonatal	Generalized tetanus in newborns resulting from infection of the umbilical stump

Table 2 : Ablett Classification of Tetanus Severity

Grade	Severity	Symptoms
1	Mild	Mild trismus, general spasticity, no respiratory compromise, no spasms, no dysphagia
2	Moderate	Moderate trismus, rigidity, short spasms, mild dysphagia, moderate respiratory involvement, respiratory rate >30 breaths/min
3	Severe	Severe trismus, generalized rigidity, prolonged spasms, severe dysphagia, apneic spells, pulse >120 beats/min, respiratory rate >40 breaths/min
4	Very severe	Grade 3 with autonomic dysfunction

CASE PRESENTATION

A 19 year old “unvaccinated” girl was admitted to Neuro ICU PMCH Udaipur, with complaint of difficulty in swallowing (dysphagia) and difficulty in opening the mouth (lock jaw), followed by neck pain and stiffness since 3 days associated with severe neck and stomach spasm. There was a history of right side wisdom tooth capping 10 days back and history of fever two day before admission. There was no history of any significant medical disease. At the time of admission patient vitals were: Pulse – 62/min regular, Blood Pressure – 106/60 mm Hg, Temp. – afebrile, Respiratory Rate – 21/min, SPO₂ – 96% on room air, GCS – E4 V4 M6, Pupil – B/L NSNR.

INVESTIGATIONS

MRI Brain (epilepsy protocol), 2D Echo– LVEF 65%, Blood test, Urine R/M, Urine culture, automated blood culture, TT culture, CVP tip culture, CSF culture

CSF examination: Total cell count – 5 cells/cu mm, 100% lymphocytes, 0% Neutrophils, RBCS – 110 cells/cumm, India ink – No capsulated yeast seen, KOH – No fungal element seen.

DIAGNOSIS

Patient's clinical presentation, recent history and unimmunized status indicated her diagnosis as “Generalized Tetanus”.

TREATMENT PLAN

1. Medical Management
2. Supportive Care
3. Physiotherapy Management

HOSPITAL COURSE

Patient gets vaccinated by Tetanus Vaccine and Tetanus Immunoglobulin (TIG) on 3rd day from admission.

During I Week:

Patient was tracheostomized on 2nd day of admission. She kept on invasive ventilation with SIMV (volume control) mode with FiO₂ – 50%, TV – 500, RR – 18b/m and PEEP – 5 with GCS E1VtM4. Patient attempted Opisthotonus position with minimal stimulation of “touch, sound and light”. Patient had single episode of frothing from mouth. Symptomatic medicines given to patient include antibacterial, muscle

relaxant, sedatives etc. and she was catheterized in 1st week only. As patient was hemodynamically unstable so we cannot start with her rehabilitation.

During II Week:

Patient was kept on ventilator support with CPAP (pressure support) mode FiO₂ – 40%, PEEP – 14, RR – 14 b/m. GCS – E3VtM6 with intermittent Opisthotonus position. After 3rd day of this week, patient put on T-Piece trial with 5 liter O₂ support and maintaining SpO₂ between 95-98%. At the end of this week O₂ support reduced to 3 liter. From Neuro ICU, patient was shifted to ward in a dark sound proof room with symptomatic medicines.



Fig. 5 : Patient was supported while sitting on bed

During III Week:

Patient with GCS –E4VtM6, had intermittent spasm in both upper limbs and neck. As patient was bed ridden from last 2 weeks, Chest x-ray showed haziness in both lower zones and abnormal breathe sound was present on auscultation. Patient was hemodynamically stable and vitals were within normal limits, so it's time to start her rehabilitation. We took meticulous therapeutic assessment and planned our management.

THERAPEUTIC ASSESSMENT**·Subjective Assessment**

Aggravating Factors: Light exposure, sudden touches and even light sound

Relieving Factor: Sound proof dark room

·Objective Assessment**On Observation:**

Position: Patient in supine position and attempted Opisthotonus position with light, touch and sound

Attitude of Limb: Bilateral elbow flexion with mid prone position and both hip adduction and ankle planter flexion.

On Examination:

Spasticity: B/L neck muscles (Trapezius, Sterno-Cleidomastoid), Upper limb muscles (Biceps, Triceps, Pronators), Lower limb muscles (Calf, Hamstring, Hip Adductors)

Pattern of movement: Uncoordinated movements with rigidity.

Reflex: Bilateral plantar flexor, rest no reflex asymmetry seen

Sensory: Not tested

On Auscultation: Crackles sound present in bilateral lower lobe

Day First of Therapeutic Intervention: GCSE4M6VT, On T-piece with 3 liter of O2 support, SPO2:95%

Temperature: Afebrile

PHYSIOTHERAPY MANAGEMENT**Treatment Goals**

1. To prevent respiratory complications
2. To reduce rigidity
3. To reduce muscle spasm
4. To mobilize the patient as early as possible

Physiotherapy Session was taken twice a day for 30-45 minutes.**Day 1-3** Exercises for first 3 days included:

- Stretching –Biceps
 - >Triceps
 - >Pronators
 - >Hip Adductors
 - >Sterno-cleidomastoid
 - >Trapezius
- Active-assisted movement
 - >Bilateral Upper Limb and Lower Limb
 - >Neck
 - >Trunk Rotation
- PNF of Upper Limb
- Mouth opening exercises
- Knee to chest (Single and Double)
- Chest Physiotherapy
 - > Manual Percussion and Vibration (Postural Drainage)
 - > PNF Respiration
 - > Segmental breathing exercises
- On Day first - Bed sitting at 45-90 degree
- Coordination exercises

Day 4-6:

Patient muscle power and chest condition improved, so we continued with same protocol

This exercises added in the regimen were:

- Active Range of Motion
 - > Bilateral Upper Limb and Lower Limb
 - > Neck
 - > Trunk Rotation
- Gripping Exercises
- Catch and throw activity
- Bridging
- Log Rolling
- Bedside sitting
- Gait training
- Wheel chair mobilization

Day 7-8:

With all the above mentioned protocol, the patient session was completed and then shifted to Neuro- ICU for Decannulization.

After Decannulization, Physiotherapy session included:

- Spirometry
- Deep Breathing Exercises
- Chest Expansion Exercises

Day of Discharge

The patient was discharged with GCS – E4V5M6 and hemodynamically stable.

Physiotherapy Protocol was taught to the patient and her guardian for home program i.e.

- Self-Stretching
 - >Sterno-Cleidomastoid
 - >Trapezius
 - >Biceps and Wrist Flexors
 - >Pectoralis Major
 - >Hamstring
 - >Calf
 - >Hip Adductors
- Active Range of motion exercises
- Sit to stand
- Single leg stance with support
- Mini squats with support
- Coordination exercises - Frankel's Exercises



Fig. 6 : Patient in Neuro ICU after Decannulization

- > Tandem walking
- > Side walking

- **Gait Training**
- **Chest Physiotherapy**
 - > Spirometry
 - > Breathing Exercises
 - > Chest Expansion Exercises
- Meditation with music
- Relaxation techniques for helping to cop up with normal lifestyle
- Psychological counseling for motivation

Discharge Treatment

Patient was discharged after 23 days with RT feed and catheter in-situ and appropriate medications.

FOLLOW UP AND OUTCOME

Patient came for follow-up after ten days.

First Follow Up: Patient complained of pain in back (mid back), difficulty in neck rotation, so symptomatic physiotherapy protocols were taught to the patient and her guardian. Catheter was removed 7 days after hospital discharge and was on RT feeding.

Second Follow Up: (Tele Consultation) Patient complained of intermittent back pain and difficulty in cooking (hand activities), so symptomatic physiotherapy protocols were taught to the patient and her guardian. RT removed after 15 days of hospital discharge.

Table 3 : Complications of Tetanus

Body System	Complication
Airway	Aspiration, Laryngospasm/Obstruction, Sedative Associated Obstruction
Respiratory	Apnea, Hypoxia Type I Respiratory Failure (Atelectasis, Aspiration, Pneumonia) Type II Respiratory Failure (Laryngeal Spasm, Prolonged Truncal Spasm, Excessive Sedation) ARDS, Complication of Prolonged Assisted Ventilation (E.G. Pneumonia), Tracheotomy Complication (E.G. Tracheal Stenosis)
Cardiovascular	Tachycardia, Hypertension, Ischaemia, Hypotension, Bradycardia, Tachyarrhythmias, Bradyarrhythmias, Asystole, Cardiac Failure
Renal	High Output Renal Failure, Oliguric Renal Failure, Urinary Stasis, Infection
Gastrointestinal	Gastric Stasis, Illus Diarrhea, Hemorrhage
Miscellaneous	Weight Loss, Thromboembolus, Sepsis and Multiple Organ Failures, Fracture of Vertebrae during Spasms, Tendon Avulsion during Spasms

DISCUSSION

The world came to know about Tetanus almost three thousand years ago in Egypt and was endemic all over the ancient world. It is global infectious disease occurs due to the tetano-spasmin neurotoxin secreted by “anaerobic clostridium tetani”.⁷ This disease most commonly occurs in those who are not vaccinated or in elderly with waning immunity. In 2017,

globally 38,000 deaths were caused by tetanus in children especially aged under 5 years. In year 2018, twenty three tetanus cases were reported to the National Notifiable Diseases Surveillance System (NNDSS), maintained by the Center for Disease Control (CDC).^{8, 9} In the year 2016, vaccination programme reviewed among adults, showed that only 62.2% of adults aged above 19 years took vaccination containing tetanus toxoid in last 10 years. Management of tetanus is burden on

medical fraternity. Pierre Descombey developed immunization to protect people against tetanus in year 1924 and it's become a routine practice in children's vaccination since the year 1940. Incubation period of tetanus is 3 - 21 days, most commonly 10 days.^{10,11}

Wounds contaminated with soil, feces, saliva, puncher wound including unsterile injection sites, devitalized tissue including burn, avulsion & de-gloving injuries permitting to infection are the most common ways the bacteria enter the body.^{12,13} The clinical presentation of tetanus is "Trismus, Risus Sardonius and Opisthotonus position"^{14,15} (Fig. 4)

A 19 year old "unvaccinated" girl presented with complains of lock jaw, dysphagia followed by neck spasm, stiffness and stomach spasm since 3 days. During Hospital course patient treatment started with Tetanus Vaccine and Immunoglobulin. To investigate all laboratory tests, MRI, CSF examination done and with the help of clinical manifestation and CSF finding, the diagnosis of "Generalized Tetanus" was made. Tracheotomy done on 2nd day of admission and patient was put on ventilator support SIMV (volume control) mode with GCS E1M4VT. Patient was moving all four limbs with rigidity and with minimal stimulus of light, sound and touch patient was getting in "Opisthotonus position". Patient was shifted to the ward at the end of 2nd week, with 3 liter of O₂ support in dark sound proof room. Decannulization was done at Neuro-ICU in 3rd week and the patient was discharged after 23 days from hospital. Symptomatic medicines were given and physiotherapy management included Stretching, Range of Motion, PNF Upper Limb, Chest Physiotherapy, Coordination Exercises, Core Strengthening, Gripping Exercises, TMJ Movement and Gait Training.^{16,17}

Prevention

The standard recommendation to prevent tetanus by vaccination with tetanus toxoid. A booster dose is needed every 10 years after primary immunization.¹⁸

CONCLUSION

Tetanus is a rare disease and very difficult to treat if a child is "unvaccinated" or the vaccine is delayed. In our case study, we explained about pathophysiology and clinical manifestations of tetanus, case presentation, hospital course, investigation, therapeutic assessment, symptomatic medicines along with physiotherapy management. Neuro-Rehabilitation regimen includes limb physiotherapy, chest clearance techniques, early mobilization, stretching, PNF technique and functional relearning activities that help the patient for getting back to ADL.^{19, 20} Functional recovery helps in reducing long term impairment and improving in quality of life (QOL). Physiotherapy effectiveness depends on tetanus severity.

In past years, no such study was done on specific physiotherapy management of tetanus, so we rehabilitated on basis of symptoms and our experience. We concluded that if managed properly, physiotherapy plays a very important role in a patient recovering from tetanus.

SOURCE OF FUNDING: None

CONFLICTS OF INTEREST: None

ACKNOWLEDGEMENT

The authors acknowledge the Pacific Medical College and Hospital (PMCH), Udaipur for providing facilities and support during the study. The authors also acknowledge the subject for her participation and cooperation in this study.

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