

# Targeted Exercises in Phenytoin Toxicity Induced Cerebellar Motor Dysfunction: A Case Report

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**Abstract:** Purpose: To evaluate the effect of targeted exercises in phenytoin toxicity induced cerebellar motor dysfunction. Method: A 45 years old female with simple partial epilepsy under medication phenytoin sodium 200mg/day since seven years. Subject presented with the increased serum phenytoin level around 40.00 more than the normal range 10.00-20.00 all cerebellar test were positive including balance and coordination test. Four weeks physiotherapy management was conducted using coordination exercises, PNF and balance exercises. Result: Four weeks of physiotherapy management along with medical management patients improved balance, coordination and ADL function. Conclusion: Acute reversible Phenytoin toxicity induced cerebellar dysfunction can be managed by providing specific balance, coordination and PNF for upper limb and lower limb.

**Keywords:** Phenytoin Toxicity, Cerebellar Dysfunction, Epilepsy

## 1. Introduction

Phenytoin sodium is still one of the most effective and commonly used antiepileptic drugs. In Asia it's the most easily available and commonly used. Wide variability and narrow therapeutic range often leads to toxicity. [8] The normal serum level of phenytoin ranges 10.00-20.00µm/ml. There are several mechanisms of phenytoin toxicity including hypoxia due to frequent seizures of toxic effects on cerebellar Purkinje cells. The common side effect is neurological, haematological, metabolic and endocrinal effect.

Persistent cerebellar motor and sensory dysfunction with cerebellar atrophy is frequent complication of long term phenytoin use. Common reversible neurological signs are prominent on cerebellar ataxia, nystagmus, diplopia, in coordination, truncal ataxia, dysmetria, and impaired balance. [1-3]

In chronic and high dose induced are irreversible ophthalmoplegia, ecephalopathy. [4-7] Phenytoin induced toxicity are mostly dose-dependent as reversal of the clinical symptoms and signs after reduction and discontinuation. [6] There are many literatures available about the toxicity and

cerebellar atrophy.

But there is paucity of literatures about targeted exercises on various cerebellar motor controls. Though exercise induced neural plasticity is more effective [15] than any kinds of neurological approaches. This case study intended to find the effect of various targeted exercise in reversible phenytoin toxicity induced cerebellar motor dysfunction.

## 2. Case Description

A 45 year old female was admitted in hospital with the history of gradual loss of balance, dizziness, truncal ataxia, nystagmus with multiple episodes of fall, weakness of upper and lower limb, diplopia, since 6 month. Similarly patient gave a history of 3 episodes of fall within one month. The symptoms were gradually worsening and one week back she was not able to stand and walk followed by some episodes of fall with loss of consciousness. Patient had history of multiple episodes of seizure, 7 years back and was diagnosed as epilepsy for same Phenytoin sodium 100mg / twice a day (BD) started. During admission vitals sings was; Pulse Rate-78/min Blood Pressure 120/80mmHg, Temperature- A febrile, Respiratory Rate-25 /min After four weeks of admission: PR-76, BP-120/80mm Hg, Tem- A febrile, RR-

20/min. Patients was medically managed by Tab Rantac 150mg /BD, tab sturgeon 25mg/TD, tab. phenytoin, multivitamin cap/da, tab. folvite/BD.

On examination subject revealed no symptoms of higher mental function but following cerebellar signs were present - Dysmetria, adidokokinesia on left upper extremity, Truncal and gait ataxia Lt>Rt, Nystagmus- Gr II - Horizontal Nystagmus, Romberg test- +ve increased postural sway ant-post, med lat, Rebound Phenomena- +ve Lt, Intentional Tremor Lt <Rt. On cranial nerve examination optic nerve diplopia Horizontal +ve, optic atrophy as per ophthalmologist examination report. Motor examination Manual Muscle Testing- Upper Extremity Rt/4+/5, Lt 4/5, Lower Extremity bilateral 4/5, Deep- Kinaesthetic Sensation - partial affected, Proprioceptive - lower limb partial affected, Vibration sensation on Rt. Affected no abnormal on superficial and deep reflexes. Balance - Berg balance score 40/56.

Coordination Test Norn equilibrium test- Finger to nose - under shooting and over shooting, therapist finger to nose - similar, Pointing - intentional tremor bilateral Adidokokinesia - Lt +ve, Tapping - normal Rebound phenomena=+ve b/l.

Equilibrium Test - Heel to shin test- affected, Tandem standing- affected, Straight line walking- affected, Zig zag walking- affected, Turning 360 degree - affected, Tandem walking sharpen Romberg test - difficult to walk, Single limb standing - affected FIMS- 90/126 partially dependent.

Investigations - MRI - B/T2 and FLAIR Hyper intensities in deep white matter and fronto-parietal sub cortical white matter on both sides, bilateral cerebellum atrophy.

Electrophysiological Studies- Nerve Conduction Velocity - Motor NCV- Motor nerve conduction parameters are within normal limits in the nerves sampled except for mild reduction of motor nerve conduction velocity in right common peroneal across fibula. NCV- Sensory nerve parameters are within normal limits in the nerve sampled. Interpretation - Mild abnormal motor conduction velocity across the right fibula in personal nerve. Electro Encephalography (EEG) - Symmetrical background of alpha 9-10Hz posterior reacting to eye opening. Anteriorly Beta activity 16- 18herz is seen. Stimulation: Photoc and hyperventilation Interpretation-abnormal and low voltagee generalized sharp transients suggestive of epileptiform activity.

Lab Investigations- Serum Phenytoin sodium- 40miu/normal 10.00-20.00miu/ml, Hb-12gm/Dl. Based on the clinical and investigation patients was diagnosed as Phenytoin sodium induced cerebellar ataxia with cerebellar and optic atrophy.

*Physiotherapy Intervention* - Physiotherapy intervention was started from next day of admission as per the neurologist reference for physiotherapy. Equilibrium and non equilibrium coordination exercises, balance exercises both static and dynamic on stable surface and for strengthening upper limb and lower limb Propiceptive Neuromuscular Facilitation was given two times in day for four weeks. In

equilibrium mainly straight line walking Zig- Zag walking, tandem standing, tandem walking, and heel to shin were focused similarly non equilibrium rapid alternating movement, finger to nose and multidirectional pointing activity. Balance exercises were in both narrow and wide base of support condition. In both condition multidirectional activities were emphasised repetitively, standing with eye close and open eye, single limb standing. For strengthening of upper and lower limb D1 and D2 PNF pattern with slow reversal. Subject revealed gradual improvement on balance, coordination and functional abilities. After four weeks of intervention subjects was reevaluated and achieved almost normal balance, coordination and functional abilities. The berg balance score was 50/56 compared to baseline 35/56, Muscle strength was 5/5 in upper limb and lower limb compared to 4/5 on both limb and Functional Independence Measurement Scale 126/126 compared to baseline 90/126.

### 3. Discussion

Phenytoin intoxication is reversible the relationship between the therapeutic doses and exercises were very closely correlated. There are several reports on the long term effect of phenytoin toxicity. Some of the reports suggest that adverse effects are usually reported if the serum level is above the therapeutic range. "[7], [8], [9]" In this case there was gradual reduction of cerebellar motor dysfunction and increased balance, coordination and physical function. After four weeks of intervention patient did not have any cerebellar motor dysfunction signs on balance and in coordination. The berg balance score showed increased balance near to normal. Independency on Activity of Daily Living was another achievement which is proximally associated with improves balance, coordination and strength. Improvement in the locomotion, intentional tremor and head and truncal ataxia were the significant motor relearning following the intensive rehabilitation. "[12], [13], [17], [18]" These suggest that regular monitoring of plasma concentration for long term use. Nitin Kumar [8] et. al 2013 suggests that as most of the effects are reversible so, it is important to find out the clinical manifestations related to the drug toxicity. However in order to fined the motor control targeted exercise for specific motor deficit most be well functional adherent in daily life.

Proprioceptive Neuromuscular Facilitation technique such as rhythmic stabilization of trunk, scapula and pelvis enhanced static balance of the patient. Similarly hold relax and contract relax could facilitate coordinated motor control of upper and lower limb. Kadriye Armutlu 2001 [12] found that these PNF techniques were effective in postural stability and balance reaction. Rapid alternating motor control was the result of cerebellar functional reverse from the atrophy. However, this would be different compared to degenerative ataxia as it would be slow and minimal motor reversal. [14] Controlled movement of eye is fundamental to optimize the motor performance and binocular vision. [17] Basically three main control mechanisms for maintaining steady gaze-fixation, vestibule-ocular reflex and gaze-holding system,

these creates eccentric gaze position [18]. In present study the nystagmus was prominent during clinical examination with complain of diplopia. Stabilization of the eye ball exercises were suggested in front of the mirror. According to Byung In Han et. al 2011 by substitution vision, somatosensory cues and other postural strategies enhances reduction of nystagmus. [19]

The effect on the coordination and balance is due to activity induced reorganization of the cerebellum functional areas. As dysmetria could lead patient to misjudgement in the movement of limbs and coordination of various dynamic motor functions. According to DP Holschneider 2007, exercise training causes functional and morphological changes in normal and injured brain. [10] Exercises were for about four weeks which is sufficient for adaptive changes on balance and coordination because training induces for improvement of postural control which correlated with alteration of white matter in cerebellum. [11] Cerebellum executes movement planning, shaping and fine tuning movements Vaclav Marcian [13] et. al 2016. Basically global functional status of the patient was well improved. Hence, the gradual reduction of the phenytoin toxicity in the serum level is directly correlated with the balance and coordination training in cerebellar ataxia. Gait function was well improved as the ataxia of head, trunk, legs and impaired predictive postural adjustment. Because increased step width, variable foot placement, irregular foot trajectories and unstable stumbling walking path with very high movement is high risk of falling. [14], [16]

## 4. Conclusion

Acute reversible Phenytoin toxicity induced cerebellar motor dysfunction can be treated by various targeted motor control exercises such as specific balance, coordination and PNF for upper limb and lower limb. Specific motor learning exercises are key rehabilitation process. It's essential to understand at motor ataxia needs intensive motor training in order to prevent persistent functional ability.

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