

Do TIAs instigate Cerebellar Ataxia? A single subject Case Report

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Abstract

Purpose: In cases with inherited ataxias an attack of stroke could prove to be instigating factor for worsening symptoms of primary disease. A graded exercise intervention approach would create significant improvement. The purpose of this study was to assess the applicability of an exercise protocol to improve balance and gait abnormalities in the patient.

Materials and Methods: A 63 year old male with history of inherited cerebellar ataxia, had an attack of stroke, after which his symptoms of cerebellar ataxia worsened. He had difficulty in standing, walking and writing. Level of ataxia and stroke severity was calculated by Scale for Assessment and Rating of Ataxia (SARA) and National Institutes of Health Stroke Scale. The physiotherapy protocol was of 6 weeks duration and modified every 2nd week depending upon the patient's progress. The protocol aimed at improving the balance and gait abnormalities along with cognition. Tinetti's Performance Oriented Mobility Scale and Timed Up and Go Test were assessed as outcomes at the baseline, and after every two weeks of intervention till 6 weeks.

Results: Post readings demonstrated significant changes in balance and gait of patient but the improvement showed to be neutral after follow up assessment. Pertaining to the fact that institution based or clinical based rehabilitation was much effective when compared to follow ups.

Conclusion: The protocol effectively reduced patient's symptoms and enhanced balance and stability which propels that it could be used effectively in future for such cases.

Keywords: Ataxia, Gait, Physical Therapy Modalities, Postural balance, Spinocerebellar Degenerations, Stroke, Walking.

Introduction:

Spinocerebellar ataxia is the most common autosomal dominant hereditary anomaly found in Indian population.¹ Type 2 of SCA prevails to be the most common among various alleles of SCA. Depending upon its occurrence ataxia can be genetic or developed (acquired)². Neurological findings adhering to SCAs are more or less involved with cerebellum impairments³. It is a broader term used to define the general characteristics of gait disturbances, in-coordination of functions of the extremities and balance abnormalities.². These symptoms are can be further deteriorated by any trauma or disturbance created in the vascular supply of the cerebellum leading to worsening of symptoms.⁴ One of these is the occurrence of Transient Ischemic Attack (TIA) or stroke which is most prevalent cause of disability in Indian population, with an incidence rate of 119-145/100,000.⁵ Thus, symptoms like dysmetria, tremors which may be intentional or resting, dysdiadochokinesia, hypotonia and unsteadiness of walking patterns along with other classical features of ataxia can be deteriorated.^{6,7,8} But a recent study suggests that there is a high chance of prevalence of cognitive deficit along with motor deficits in patients with SCAs.⁹

Physiotherapy can play a mainstay role in limiting effects of stroke as well as in facilitating improvement in symptoms of ataxia. Rehabilitation and exercise therapeutics are key domains of treatment for the disease^{10, 11} Exercise protocols defined for the treatment of balance abnormality and

ataxic gait such as Bobath approach, dynamic balance trainings, task oriented interventions and interventions for improving balance are practised regularly¹⁰. For the purpose of balance training, locomotor treadmill training equipped with or without weights was proved to be efficient¹². Body weight supported treadmill training has proven to be effective and used worldwide. Researchers have also utilized dance like movement patterns for the same purpose¹². Interventions rendered to ataxic patients mostly revolve around static and dynamic balance regimes. But when these symptoms get worsened by stroke, it needs a more detailed and accurate approach which can suggest improvising cognition along with motor deficits.⁹ For improving cognition in these patients Cranial Electrical Stimulations (CES) can be implied effectively.¹³

The basic aim of this report was to discuss about a case of inherited cerebellar ataxia which get worsened by stroke and the physiotherapeutic intervention designed for him which would be beneficial to overcome his super headed disabilities. So it becomes a challenge to treat such a patient and rehabilitate him through this intervention. It becomes important to evaluate the appropriate exercise regime and it may prove to be helpful for such type of patients in future researches.

Material and Method:

Patient background and examination:

A 63 year old male businessman presented with chief complaints of weakness in the left side of body with difficulty in writing, difficulty in standing for prolonged duration and fear of walking since 1 month. He lived with his spouse and lead an independent working life. He had right side dominant with body built mesomorphic. The patient had a history of inherited spinocerebellar ataxia, the symptoms of which got worsened following the episode of stroke on 20th July 2019, resulting into an additional left side hemiparesis. He was facing mild balance impairments for last 3 years but stroke exaggerated the symptoms of balance and gait abnormalities. Medical and personnel history of the patient revealed high blood pressure and irregular sleep patterns respectively. Diagnosis of spinocerebellar ataxia was made on the basis of a T2 Flair MRI scan which depicted reduction of grey matter volume in the cerebellar hemispheres.

On observation, patient demonstrated an ataxic gait pattern with reduced cadence and increased step length. Analysis of posture in sagittal plane substantiated the presence of rounded shoulders with forward head. On assessing the higher mental functions of patient through Mini-Mental State Examination (MMSE), attention was slightly distractible, judgement was slightly impaired, speech was slurry and repetitions were irregular with total score of 18/30 depicting moderate cognitive impairment. Sensory functions were intact. Comparison of muscle strength of both sides of patient's extremities were done and there was peculiar weakness in left sided lower limb flexors and dorsi-flexors (Grade 3+ out of 5 according to Medical Research Council scale) along with slight weakness in the left arm too which can be accounted for age factor. Prominent dysmetria with presence of intentional tremors, especially on the right side while writing or concentrating to write, was also seen. Diagnosis of the patient for ataxia was done on the basis of Scale for Assessment and Rating of Ataxia (SARA) whose score came to be 22/40.¹⁴ The score of patient depicted his lineage towards maximal dependency. The stroke severity of the patient was measured by the National Institutes of Health Stroke Scale (NIHSS)¹⁵ scoring 10/42, depicting moderate stroke severity.

Design and Outcome:

The study design of this research is single subject A-B-A design case study. Balance and Gait were taken as dependent variables as these were the major challenges for the patient to lead an independent life. The tests which are used as primary outcome measures are Tinetti's POMA scale and Timed Up and Go test (TUG). National Institutes of Health Stroke Scale (NIHSS) and Scale for Assessment and Rating of Ataxia (SARA) were considered as secondary outcomes. POMA has domains of both balance and gait. Balance domain of scale includes markings for sitting balance, sit-to stand balance, standing balance, turning around and again stand-to-sit balance.¹⁶ The highest marking for balance domain is 16. Markings of gait domains were done on the basis of activities such as initiation of gait, step length and height, step symmetry, step continuity, estimation of path, trunk stability and walking stance. The maximum scoring for gait domain is 12. The total score for the whole scale equals to be 28.¹⁷ For the TUG test, the patient was asked to sit in a chair with back and elbow support in front of a passage of 15 feet. He was then asked to stand, walk normally, return back to the chair and sit. The total time taken by him to complete whole ambulation was recorded.¹⁸

Intervention:

Informed consent was obtained from the patient prior to the treatment as well as for presentation of his case. The whole intervention was given in 3 sessions of 60 minutes each for 6 weeks. Each intervention was continued for 2 weeks and assessment was taken after each intervention. Follow up assessment was also taken after 6 weeks of intervention following home exercises. Refer to table 1 for detailed physiotherapeutic interventions performed for all the T1, T2, T3 and home exercise programme. The treatment session started from 5th August 2019.

(Place figure 1 almost here)

(Place table 1 almost here)

Outcomes:

The outcome measures were assessed at the baseline, after first session, after second session, post third session and at follow up. Pre assessment (A0) was performed at the beginning of treatment i.e. prior to first day of intervention which was considered as a baseline parameter. Post assessments were taken after every two weeks of intervention upto six weeks which were coined as A1, A2 and A3. A follow up assessment (A4) was also taken after 2 weeks of home exercises program following interventions. POMA assessments scores for whole interventions were A0score 10/28 constituting 35.71%, A1 scores found to be 13/28, i.e., 46.43%, A2 scores were 18/28 or 64.29%, A3 score was found to be 22/28 or 78.57%. Post these sessions the patient was taught home exercises and (A4) was taken post 2 weeks which was 16/28, i.e., 57.14%. Results depicting separate values for balance and gait domains are listed in figure 2. Another outcome measure was Timed Up and Go Test. The assessment scores were initially (A0) patient took 3 minutes 25 seconds, post 2 weeks of intervention (A1) the patient took 3 minutes 10 minutes, after another two weeks of intervention (A2) the patient took approximately 3 minutes. After the completion of third session (A3) patient took an approx. 2 minutes and 44 seconds time duration. At the follow up session (A4) the patient took 3 minutes approximately to complete the test. The graph depicting patient's overall result as recorded by TUG test are depicted in figure 3. On completion of 6 weeks of treatment protocol, the Scale for Assessment and Rating of Ataxia (SARA) score reached 14/40 from 22/40, changing from

maximal dependent to moderate dependent category and the National Institutes of Health Stroke Scales (NIHSS) score reached 4/42 from 10/42, promoting the patient from moderate stroke severity to minor stroke severity.

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Discussion:

The present study was aimed to evaluate the effects of a definite rehabilitation based protocol for patients with inherited cerebellar ataxia which may benefit the patient with the utmost care. A thorough rehabilitation protocol for this patient including the physiotherapeutic exercises and simple task related exercises could create a vast difference in improvements over pre-set time duration.¹⁹ After 6-week's protocol, patient showed improvements in his walking pattern, his balance anomalies, and his distance judgement capabilities after the rehabilitation which was rendered to the patient. He also reported that his quality of life was improved and he was able to accomplish his daily activities with more precision.

Post 6 weeks intervention programme, the scoring of NIHSS score made the patient fall in minor stroke severity category and scoring of SARA depicted moderate dependency from maximal dependency. However intentional tremor didn't show any significant improvement but there was comparatively less occurrence of tremors while performing the activities of his daily living. The effect of task oriented exercises which were actively performed by the patient was beneficial in making his concentration and coordination.²⁰ Balance and gait abnormalities were the main difficulties faced by the patient which were benefitted from the hurdle gait training and static balance exercises. Mostly patients with cerebellar ataxia have symptoms like balance and postural instabilities.¹² This was the main stay of the rehabilitation protocol to be laid emphasis on.

Frenkel's exercises along with the hurdle training and 8 pattern walking training exercises have been proven to beneficial for abnormalities of gait and redeem normal gait walking pattern with improvements in decision making while walking or stopping. Findings of the therapy showed that while the patient received physiotherapy treatment in supervision of therapists the scores of patient's progress continually increased every 2 weeks. But it also concludes that however home treatment procedures were not capable of pertaining the progress of the patient's health. However he also had problems with his tremors and his strength which were significantly enhanced. Patients with stroke are often treated according to their presenting symptoms. This study helps to identify that not only patients present condition but their past diagnosis could cause a great impact over the type of treatment chosen for the patient. Cranial Electrotherapy stimulation is proved to affect the cognition in patients with mild to moderate cognitive deficits and thus results of this case study is in line with previous literature.¹³

If proper diagnosis is not made it could lead to revolving around a protocol which won't be benefiting the patient's condition. The strengths of this case study is that the intervention rendered to patient involves not only his presenting symptoms but interventions which would treat the cause of such symptoms, feasibility of protocol devised and a combined protocol including conventional and recent evidence based treatment methods. Although this case study has a limitation which includes that protocol applied for this patient cannot be generalized as it is a single case study.

Conclusion:

The study concludes that the protocol applied for this patient may benefit other patients too which are suffering from stroke and having symptoms or genetic history of ataxia. A specific treatment regime of physiotherapy in accordance with the symptoms presented by patient makes treatment more concentrated and helpful.

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TABLE

Table 1: Shows detailed physiotherapy interventions.

Intervention	Type of Exercise	Description of Exercise	Intensity
T1 (for 1 st and 2 nd week)	Pelvic bridging exercises	The patient is asked to lie down supine with knees flexed and foot resting on the plinth. Then he is asked to raise his pelvis upwards.	10 reps
	Single leg bridging	Patient in spine position with one knee flexed and other extremity extended and is asked to raise the pelvis in the same position bilaterally.	10 reps
	Frenkel’s exercise in sitting	Patient is in high sitting position and is asked to step on a semi-circular arch at equidistance.	5 reps
	Figure of 8 walking	With a chalk a figure 8 is marked on floor and the patient is asked to walk over it.	5 reps
	Straight walking training	Patient is asked to walk over a straight line.	5 reps
	Resisted exercises for upper limb and lower limb	On every movement pattern a slight resistance was applied at the distal end of the extremity being moved.	10 reps

	Hurdle training	4 hurdles were placed on floor and patient was asked to move keeping distance from them.	5 reps
	Discrimination exercises	In this the patient was asked to keep his eyes closed and asked to identify different objects handed to him and practised with eyes open.	10 reps
T2 (for 3 rd and 4 th week)	Frenkel's exercise in standing	Patients were standing upright and were asked to step in a semi-circular arch having foot prints on it. Since patients were in high fall risk category, constant support was provided by 2 physiotherapists on side by the patient.	1. 2 sets, 5 reps
	Single leg bridging	Patient in spine position with one knee flexed and other extremity extended and is asked to raise the pelvis in the same position bilaterally.	2. 2 sets, 5 reps
	Pelvic bridging	The patient is asked to lie down supine with knees flexed and foot resting on the plinth. Then he is asked to raise his pelvis upwards.	3. 2 sets, 5 reps
	Pelvic rotation	The patient was asked to lie down in supine position and manually therapist performed pelvic rotations on both sides one by one.	4. 5 reps
	Single leg standing	Patient was asked to stand on his one leg for 30 seconds bilaterally supported by physiotherapists on both sides	5. 5 reps
	Proprioceptive exercises	Patient was told that different colours were assigned to his upper and lower extremities. Patient was asked to sit in high sitting position. Therapist when pronounced the assigned colour patient had to flex the extremity assigned that colour.	6. 2 sets, 5 reps
	Figure of 8 training	With a chalk a figure 8 is marked on floor and the patient is asked to walk over it.	7. 2 sets, 5 reps
	Hurdle training	5 hurdles were placed on floor and patient was asked to move keeping distance from them.	8. 2 sets, 5 reps
	Hand Gripping exercises	Patient was asked to practise on hand exercises for gripping activity	9. 5 reps
		Resisted exercise for left upper limb and lower limb	On every movement pattern a slight resistance was applied at the distal end of the extremity being moved.
T3 (for 5 th and 6 th week)	1. Frenkel's exercise in standing	1. Patients were standing upright and were asked to step in a semi-circular arch having foot prints on it. Since patients were in high fall risk category, constant support was provided by 2 physiotherapists on side by the patient.	1. 2 sets, 5 reps
	2. Single leg bridging	2. Patient in spine position with one knee flexed and other extremity extended and is asked to raise the pelvis in the same position bilaterally.	2. 2 sets, 5 reps
	3. Pelvic bridging	3. The patient is asked to lie down supine with knees flexed and foot resting on the plinth. Then he is asked to raise his pelvis upwards.	3. 5 reps

	<ol style="list-style-type: none"> 4. Single leg standing 5. Gait training combined 6. Proprioceptive exercises 7. Hurdle training 8. Resisted training of left upper limb and lower limb 9. Figure of 8 training 10. Gripping exercises 	<ol style="list-style-type: none"> 4. Patient was asked to stand on his one leg for 30 seconds bilaterally supported by physiotherapists on both sides. 5. During this training patient is asked to walk according to the instructions by the therapist i.e., when asked to walk straight walk straight, when asked to walk in sideways walking in sideways. 6. Patient was told that different colours were assigned to his upper and lower extremities. Patient was asked to sit in high sitting position. Therapist when pronounced the assigned colour patient had to flex the extremity assigned that colour. 7. 6 hurdles were placed on floor and patient was asked to move keeping distance from them. 8. On every movement pattern a slight resistance was applied at the distal end of the extremity being moved. 9. With a chalk a figure 8 is marked on floor and the patient is asked to walk over it. 10. Patient was asked to practise on hand exercises for gripping activity. 	<ol style="list-style-type: none"> 4. 2 sets, 5 reps 5. 3 sets, 5 reps 6. 3 sets, 5 reps 7. 3 sets 5 reps 8. 3 sets, 5 reps 9. 2 sets, 5 reps 10. 5 reps
<p>Home exercises programme</p>	<ol style="list-style-type: none"> 1. Gripping exercises with utensils easily available at home like ball, pen, pencil, etc. 2. Figure of 8 walking pattern 3. Single leg bridging 4. Pelvic bridging exercise 5. Single leg standing for 3 minutes each 	<ol style="list-style-type: none"> 1. Patient was asked to practise his hand gripping exercises by holding of different utensils at home. 2. With a chalk a figure 8 is marked on floor and the patient is asked to walk over it. 3. Patient in spine position with one knee flexed and other extremity extended and is asked to raise the pelvis in the same position bilaterally. 4. The patient is asked to lie down supine with knees flexed and foot resting on the plinth. Then he is asked to raise his pelvis upwards. 5. Patient was asked to stand on his one leg for 30 seconds bilaterally supported by walls or any support on both sides. 	<ol style="list-style-type: none"> 1. Atleast thrice a day. 2. Twice or thrice a day. 3. 3 sets, 10 reps. 4. 2 sets, 10 reps. 5. 1 minutes each leg

	leg thrice a day.		thrice a day
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Figure 1: Treatment Flowchart

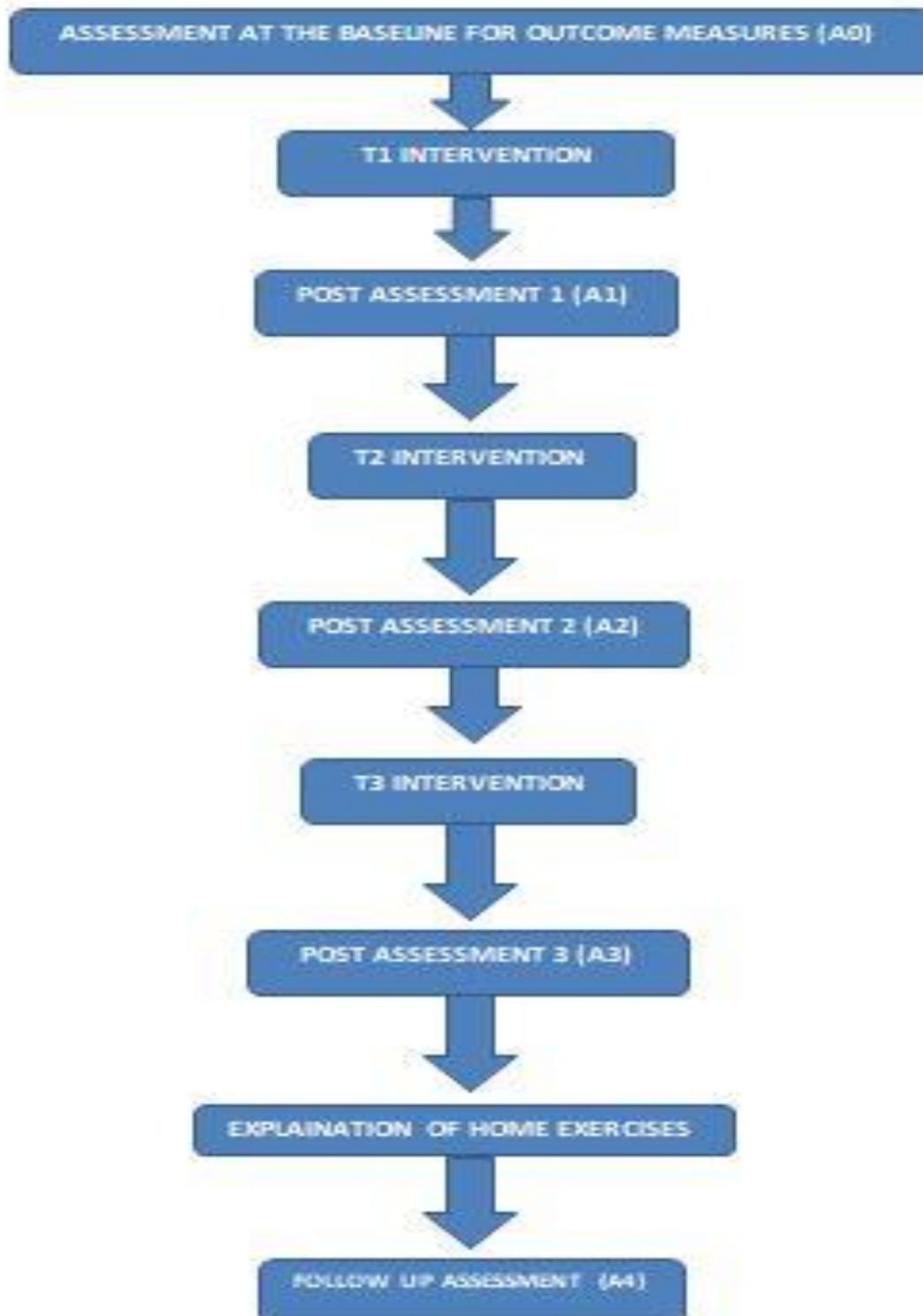


Figure 2: Showing improvements in POMA scale domains

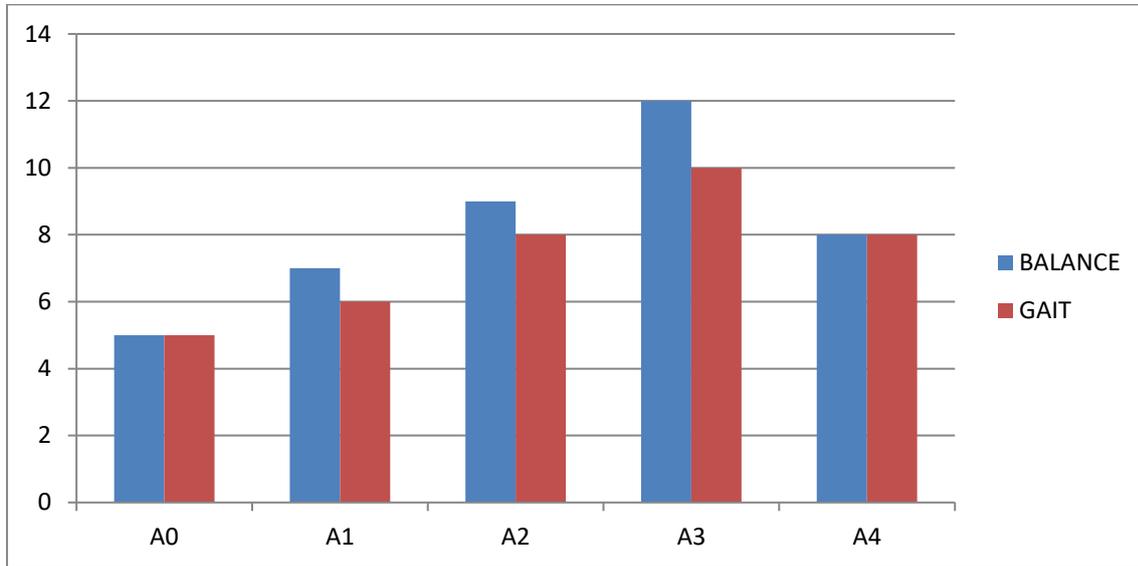


Figure 3: Showing results of Timed Up and Go Test

