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Management of Cerebellar Ataxia-Physiotherapy Point of View New Insights

Dr. Dipti Shinde[1], Dr. Shrikant Sant[2], Akanksha Jadhav[3], Radhika Waghmare[4], Sejal Adhikari[5], Sakshi Rade[6], Neha Malekar[7].

[1]MPT Student, Community Department, MGM School of Physiotherapy, MGMIHS, Chh. Sambhajinagar.
[2]Professor HOD Community Department, MGM School of Physiotherapy, MGMIHS, Chh. Sambhajinagar.
[3]Intern, MGM School of Physiotherapy, MGMIHS, Chh. Sambhajinagar.
[4]Intern, MGM School of Physiotherapy, MGMIHS, Chh. Sambhajinagar.
[5]Intern, MGM School of Physiotherapy, MGMIHS, Chh. Sambhajinagar.
[6]Intern, MGM School of Physiotherapy, MGMIHS, Chh. Sambhajinagar.
[7]Intern, MGM School of Physiotherapy, MGMIHS, Chh. Sambhajinagar.

***Corresponding Author: -** Dr. Shrikant Sant.*
Professor HOD Community Department, MGM School of Physiotherapy, MGMIHS, Chh. Sambhajinagar, Maharashtra, India.
Orchid Id – https://orcid.org/0000-0002-4566-2919

Abstract

Background: Cerebellar Ataxia is caused due to damage to the cerebellum or the pathways connecting to it. Degenerative diseases, hereditary diseases also autosomal dominant diseases are leading causes of cerebellar ataxia. Balance and gait are most severely affected along with other clinical features named Dysmetria, Tremors, Dysdiadochokinesia, hypotonia, and ocular involvement. Outcome tools for assessing the diagnosis and severity of ataxia are the scale for the assessment and rating of ataxia (SARA), and International cooperative ataxia (ICARS). MRI can be used for accuracy to locate the area of incoordination by cerebellar atrophy in the intermediate and lateral lobule.

Method: We have extensively searched PubMed, Scopus, Cochrane Databases in which we included publications from the last 5 years.

Result: We found out that there is a positive impact in balance and gait in assistance with body weight support (BWS) along with the management of fatigue for patients with cerebellar ataxia.

Conclusion: Hence this communication reveals the combined management for ataxic patients focusing on areas of coordination like balance and gait by evaluating the areas of motor dysfunction.

Keywords: Ataxia, balance, gait, treadmill training, short communication, physical therapy.

1. INTRODUCTION

The cerebellum is the most unique brain structure which is easily noticeable on the dorsal surface of the brain stem. Motor coordination of movement and sensory feedback is the function that is regulated by the cerebellum. The main cause for cerebellar Ataxia is due to damage to the cerebellum or the pathways connecting to it [1]. The word 'Ataxia' means an abnormal wide base of support result in motor imbalance while walking or standing [2]. At times there is a delayed inactivation of muscle concerning time and duration or decreased magnitude with voluntary movement due to the acquired ataxic pattern of the person with cerebellar ataxia [3]. Cerebellar Strokes are not uncommon but in comparison with Cerebral Stroke, they are rare resulting in an incidence of less than 5 percent [2]. Degenerative diseases are also a contributing factor for the cause of cerebellar ataxia such as hereditary diseases and spinocerebellar ataxia (SCA) referred to as autosomal dominant disorders [1]. The clinical signs of a person with cerebellar dysfunction include limb involvement such as Dyssynergia, dysmetria, tremors, dysdiadochokinesia, asthenia, and hypotonia. Balance and gait dysfunction

are also leading features for patients with ataxia. Nystagmus, saccadic smooth pursuit, abnormal vestibular-ocular reflex, the reduced velocity of divergent eye movement, and dysarthria subsidize as ocular involvement resulting in the clinical manifestation for the same [4].

2. OUTCOME MEASURE FOR ASSESSMENT OF CEREBELLAR ATAXIA.

Activities of daily living (ADL) and the functions of the patients should be evaluated to ensure that patients and therapists understand the difference between the effectiveness of the pre and post-intervention [5,6]. The common scales used to recognize the severity of cerebellar ataxia are the Scale for assessment and rating of ataxia (SARA) [7,8,9,10,11] and also International cooperative ataxia rating scale (ICARS) [11] are the specialized measures that are widely used. These scales not only account for incoordination for the upper and lower limb but also a perception of stability while walking, standing, and sitting [5,11,12]. In Ataxic patients, postural disorder scales were used with an isometric testing mode along with a Biodex dynamometer (Medical Inc., Shirley, NY) which is used for force control. This was an important course that helped to estimate the contraction ability of the muscle to manage force in the lower limb. A change in the Posture and gait can be characterized by disruption in muscle contraction with reduced force control [13]. Walking and pedaling, movement is accomplished with both legs while patients with cerebellar ataxia possess difficulty with repetitive motion, amplitude, and pace [14]. Magnetic resonance imaging (MRI) can be used to pinpoint the exact location of incoordination. According to the study based on functional magnetic resonance imaging (fMRI), any interference with the rostral cortex lobules and caudal spinocerebellar sub-lobules comprises somatotopic maps of the cerebellum which are associated with voluntary limb movement are easily noticed [15]. People with cerebellar atrophy in the intermediate and lateral lobule have difficulty in voluntarily moving their limbs are detected using MRI [16,17,18].

3. PHYSIOTHERAPY AND REHABILITATION FRAMEWORK IN PATIENTS WITH CEREBELLAR ATAXIA:

Treatment approach targeting Balance Impairment -

The exercise program designed by Jl Kellar et al included the exercises which were to be performed at home after the session which was carried out at the hospital. The instruments were modified based on the severity of the disease which was a part of the program included a chair, an exercise ball, as well as a balance disc. At the end of four weeks of the treatment protocol, it was observed that gait functions were improved. After a hospital stay, this postural training was advised to be practiced at home based on the patient's comfort [19]. In the patient with cerebellar ataxia, an upper-extremity function was improved through core stability exercises. Improved trunk stability is thought to improve distal stability and controlled upper-extremity movement. The movement of the shoulders was ensured by trunk stability, the elbow, wrist, and fingers which resulted in gradual stability for the glenohumeral joint. Abdominal exercises help to benefit with upper limb component by enhancing trunk stabilization [20]. The further study revealed that the patients with ataxic neuropathy were given foot sensory stimulation along with balance and gait training as a part of the training program. These findings revealed that the intervention could help patients to enhance their motor function in association with coordination and gait[21]. Based on the previous study, the standardized physiotherapy activities for training static and dynamic standing balance were started with a single leg followed by sitting movement along with reach out and walking with assistance for 21 hrs. The intervention was practiced as a 3-month weekly protocol. Rhythmic PNS, activities for stabilization, and Frenkel drills were a training protocol including 4 weeks for thrice a week to develop balance in static and dynamic motion [3]

Correction of the gait pattern -

Cernak et al emphasized the Bodyweight support training (BWST) as a 4 weeks protocol for 5 times per week, using the system with overground walking practice. Following, four months of home training with BWST were accomplished. The amount of body weight support was changed to maximize upright posture across session posters and self-contained stepping. Firstly, around 30% of the body's weight was facilitated by the strap. Assistance with treadmill walking as well as while walking above ground was practiced by the second month, this leads to a reduction of body weight support by 10 percent. With the assistance of the therapist in lowering the leg to facilitate the leg, place one hand on top of each foot. Heel strike and toe clearance mostly during swing phase in the first stance and to prevent knee hyperextension; place the other hand behind the knees. Through the training session, the amount of type of

assistance from a manual was reduced. Training speed was gradually increased tailored to each individual's needs and ability to maintain adequate motor control of the legs. Progression of this training on a treadmill, the patient spent an hour and a half 15 minutes is a good starting point however the amount of time spent walking above ground as patients stepping ability and tolerance improved the dose was increased for physical activity[22]. An intervention included ten people with cerebellar ataxia and eight healthy people of the same age who participated in this study. Only once the perturbation was given to the people. The individual walked on a treadmill when doing so, Spontaneous waist-pull perturbation was applied either by an active tethered pelvic support device. During steady motion and preventive responses, spatiotemporal variables and dynamic stability were analyzed, both before and after training. Individuals with cerebellar ataxia showed a significant change than healthy individuals in the aspects related to maintaining a before and after the treatment, a larger base of support for restorative responses, and a consistent gait secondly through this training also does patients anterior and posterior margins of stability were shown to be effective during steady walking[23].

Assistive devices which facilitate gait training -

A recent study has shown to be effective in improving the mobility for the patient with spinocerebellar ataxia using an exoskeletal gait training device. The program was practiced for 8 weeks as three-session was held for 30 min. The program was practiced in three categories such as static standing balance for 5 min followed by weight-bearing and weight transfer exercises for 5 min overground walking with the support of the exoskeleton device. The speed and cadence for the patient are set based on the patients walking ability. The immobility of the patient was achieved through stimulation to the nervous or musculoskeletal system. Along with the muscular and nervous system, the cardiovascular endurance peak for the patient was been improving [24].

Fatigue -

Fatigue has been linked to many neurodegenerative disorders, and it has been shown to reduce the quality of life. In spinocerebellar ataxia, there is a lack of a systemic evaluation of this clinical feature. The study's primary purpose was to measure out how often people are getting tired and the factors that contribute to it in people with spinocerebellar ataxia. The Modified Fatigue Impact Scale (MFIS), the Beck Inventory Depression (BDI), and the Epworth Sleepiness Scale are all used to assess fatigue (ESS). The incidence of ataxia was determined using the Scale for the Assessment and Rating of Ataxia (SARA). To analyze the group's average score and proportion, we utilized Mann-Whitney and Fisher exact tests. To study parameters linked to fatigue in SCA3/MJD, linear regression analyses were used [25].

Role of the treadmill in cerebellar ataxia management -

Treadmill training improved SCA1 mice's cerebellum by motor coordination and neuronal ability to survive. They were encouraged at 12 m/min for 50 minutes each day for four weeks. In Purkinje cells, the mechanism is linked to the induction of rpS6 phosphorylation but not autophagy. The session positively impacted the cerebellum's NPAS4, a neural plasticity protein, and rise cell activity. This research helped to educate that treadmill training has a very powerful impact on the activation of the mTOR signaling mechanism[26].

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