Case Report

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Use of Weighted Exercise and Gait Training To Improve Function in the Ataxic Patient: A Case Study on a Patient with Acute Motor-Sensory Axonal Neuropathy

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ABSTRACT

Background: *Acute motor-sensory axonal neuropathy (AMSAN) is a rare subtype of Guillain Barre Syndrome (GBS) accounting for 3-5% of cases. Common symptoms include impaired joint proprioception, ataxia, and weakness. Treatment includes medication and physical therapy (PT). Research is limited on PT protocols for management of this condition, specifically for treatment of ataxia.*

Objective: *This case demonstrates the effectiveness of weighted exercise and gait training in an ataxic patient with AMSAN in an inpatient rehabilitation unit.*

Methods: *Patient participated in a typical acute inpatient rehabilitation program. In addition, treatment incorporated 2-3lb ankle weights for proprioceptive feedback during supine, sitting, standing, and gait tasks starting week two of rehab stay. At week six ankle weights were removed for all training. Progress was tracked weekly via joint proprioception assessment, FIM scores, and assistance required for functional mobility.*

Results and Discussion: *Patient completed eight weeks of intensive rehabilitation. Patient made significant improvements in proprioception of bilateral great toes, hips, ankles, and knees. Patient's FIM scores progressed from dependent (0/1) to supervision level (5). This case suggests use of weighted exercise can effectively improve ataxia and functional independence in a patient with AMSAN. Using weights to improve proprioception and ataxia in populations such as multiple sclerosis has been documented however further research is needed in the GBS/AMSAN population.*

Keywords

Acute motor-sensory axonal neuropathy, Weighted exercise, Ataxia, Rehabilitation.

Introduction

AMSAN is a rare subtype of Guillain Barre Syndrome (GBS) and accounts for 3-5% of cases [1]. Common symptoms include distal weakness, impaired joint proprioception and ataxia, with marked decreases in muscle action potentials and sensory nerve action potential amplitude [1]. Common treatments include: IVIG, high-dose methylprednisolone, plasmapheresis, and aggressive rehabilitation by physical therapy (PT) [2]. Recovery is often delayed and incomplete in this subtype [2]. Research is limited on PT protocols for management of this condition, specifically for the

treatment of ataxia. There is evidence on use of weighted exercise to improve ataxia in other neurological populations. Studies suggest weights provide joint compression, increase sensory feedback, and increase joint position awareness [3-5]. This theoretically improves muscles ability to contract at the correct time during movements, decreasing ataxia, and improving functional mobility [3-5]. Based on the above research, there is evidence that there is a positive correlation with use of weighted exercise and improving function and decreasing ataxia in people with ataxic movement. Therefore this study aims to describe the effectiveness of weighted exercise and gait training in an ataxic patient with AMSAN in an inpatient rehabilitation department.

Case Description/Methods

A 40 year old female with an eight day history of progressive weakness and numbness in bilateral upper and lower extremities was admitted to the emergency room and given the diagnosis of AMSAN. Patient received acute care management including bedside PT, plasmapheresis, and IVIG before being admitted to acute inpatient rehabilitation. Impairments included absent proprioception at the knees, ankles, and toes, and ataxia in bilateral upper and lower extremities. Patient also presented with bilateral extremity weakness in her arms and legs, most significantly in the hip adductors (2±5), and knee extensors (3±5), and diminished sensation in all extremities. Functionally, patient presented as a three person assist for bed mobility and transfers and was unable to ambulate or complete stairs.

Patient received standard inpatient rehabilitation treatments of 180 minutes a day, 5 days a week, for 8 weeks. Treatment included functional training, therex, endurance training, and pain management as well as the addition of a weighted exercise program during her scheduled therapy. Without weights, patient presented with increased ataxic movement and impaired foot placement during pre-gait activities. Patient was unable to complete a sit to stand or stand pivot transfer secondary to extreme ataxia in both lower extremities. Patient had decreased awareness of her lower extremity joint position in space, leading to knee hyperextension as well as sudden knee buckling, and also inability to place feet accurately to take a step. This lead to the use of a beasy-board for safe bed to chair transfers initially. During standing and stepping tasks, when asked to step forward patient's foot stepped backwards and patient frequently went into hip extension versus hip flexion requiring dependent placement of the foot by the therapist. Minimal improvement was seen with visual feedback of patient looking at her feet or at a mirror and patient had extreme difficulty when attempting to control any lower extremity movement. With the addition of weights, patient demonstrated immediate improvement in the control of her extremities. Patient was able to slow down her lower extremity movements with decreased ataxic motions and improved accuracy of foot placement. Week 1 focused on supine frenkel exercises and beasy-board transfers. Weighted exercise started on week two with 3lb ankle weights for proprioceptive feedback, starting with standing weight-shifting and seated multidirectional toe taps. Week two also focused on transfer training using a stand-pivot technique to promote weight-bearing through both lower extremities. This progressed to pre-gait exercises including standing marching, side stepping, and toe taps onto a step with body weight support. The patient was then advanced to gait training over-ground with body weight support and a walker and continued use of 3lb ankle weights. At week six ankle weights were removed for all training and gait training progressed to use of the walker and no body weight support. By week eight PT was focusing on advanced functional mobility training including gait with the walker on uneven surfaces and stair training with bilateral upper extremity support on one rail. By discharge patient was independent with bed mobility, supervision with the walker for transfers, and ambulating 160ft at supervision level (Table 1).

Week	Exercise Program
1	Supine frenkel Exercises were initiated with ankle weights, including heel slides and hip abduction/adduction.
2	Seated weighted exercises initiated with 3lb ankle weights on right and left foot. Treatments included blocked transfer training, standing weight-shifting/balance activities, and seated multidirectional toe taps.
3	Pre-gait training was initiated in the parallel bars with 3lb ankle weights and lite gait body weight support for safety. Treatments included standing marching, blocked forward step practice, and continuation of weight shift and standing balance activities.
4	Overground walking was initiated with 3lb ankle weights, body weight support harness and rolling walker. Treatment also included standing weighted toe taps onto a step, and seated toe taps with eyes closed to focus on improving proprioception.
5-6	Body weight support was removed and gait training continued with ankle weights and rolling walker. Weight was taken off by the beginning of week 6.
7-8	Advanced functional mobility training continued with gait training with the walker, step up and stair training, and more dynamic standing balance tasks.

Table 1: Exercise progression during rehabilitation stay.

Results

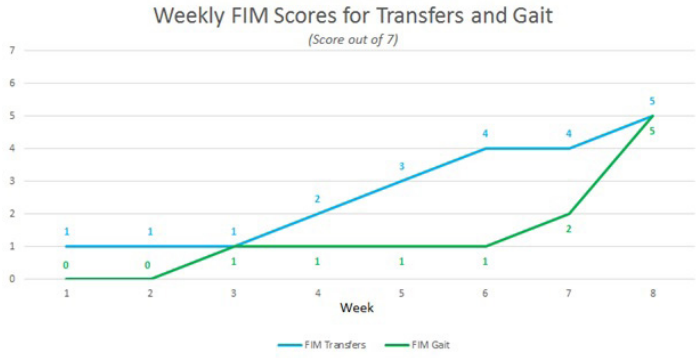
As demonstrated in the table 2 below, proprioception significantly improved at all joints. The right and left hip improved from 0/10 to 10/10 bilaterally. The remainder of the lower extremity joints all improved, with the right side showing greater improvement than the left. The right knee improved from 0/10 to 6/10 and the left knee from 0/10 to 3/10. Both ankles and great toes improved from 0/10 to 2/10 on the left side and to 5/10 and 4/10 on the right side (respectively).

Joint	Evaluation Proprioception		Discharge Proprioception	
	LEFT	RIGHT	LEFT	RIGHT
Hip	0/10	0/10	10/10	10/10
Knee	0/10	0/10	3/10	6/10
Ankle	0/10	0/10	2/10	5/10
Great Toe	0/10	0/10	2/10	4/10

Table 2: Proprioception at evaluation and discharge of the lower extremities.

These improvements in proprioception corresponded with the significant improvements noted in the FIM scores in graph 1.

Patient progressed from 3 people assistance for transfers and inability to ambulate to a supervision level. This correlated to FIM scores of a 1 for transfers and 0 for gait at evaluation to a 5 for both tasks at discharge. Burden of care decreased from three people for mobility to one person supervising her mobility. Qualitatively, patient had improved accuracy of foot placement with transfers and gait, decreased ataxic trunk and lower extremity movements, improved knee control, and decreased reliance on verbal and visual cues from the therapist.



Graph 1: Transfer and Gait FIM score through patient's rehabilitation stay.

Discussion

This is one of the first case studies demonstrating the potential positive impact weighted exercise and weighted walking has on ataxia with the diagnosis of AMSAN. As noted in the introduction to this case study, there is evidence that weighted exercise can improve ataxia in other populations, such as the elderly and multiple sclerosis [5,6]. Kim et al. demonstrated improved knee joint repositioning sense in the elderly population during a 1 day trial, showing an immediate positive effect of weighted exercise on proprioception [5]. Another case study looked at a 6 week weighted vest treatment protocol with a patient with MS and the carry over effect with and without the weighted vest [6]. The patient with multiple sclerosis demonstrated improvements in balance and function with and without the weights, correlating with the changes seen in the AMSAN population [6]. This present case study demonstrates that an intensive PT treatment plan focused on weighted exercise and gait training can be effective in improving functional outcomes in the ataxic patient with AMSAN. There is evidence on the use of weights to improve ataxia in multiple populations, but research remains limited in the AMSAN GBS population [5,6]. Further research is needed to demonstrate the benefits of weighted exercise in patients with GBS where ataxia is limiting functional independence.

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