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Acute Motor Axonal Neuropathy: A Rare Variant of Guillain-Barré Syndrome - A Case Report

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ABSTRACT: This case study documents a description of a patient presenting with acute motor axonal neuropathy (AMAN), which is a subtype of Guillain-Barre Syndrome. The patient's experience in acute care is discussed briefly, while the patients' sub-acute and long-term rehabilitation is covered in more detail. The purpose of this case study is to highlight approaches to assessment, outcome planning, and treatment interventions in the context of a community-based rehabilitation setting during the sub-acute phase of the disease. The case study is unique as it employs an interdisciplinary approach and international classification of function, disability, and health (ICF) framework to address the pathology of the disease in a patient-specific manner.

I. INTRODUCTION

Acute motor axonal neuropathy (AMAN) is a variant type of Guillain-Barre Syndrome (GBS). AMAN is a non-inflammatory disease whereby axons of motor nerve cells are selectively targeted and destroyed by the body's own immune system. The myelin sheath surrounding the axon is unaffected. Studies suggest that the body's immune system specifically attacks the membrane surrounding the axon called the axolemma. AMAN is characterized by acute progressive motor weakness, areflexia, ataxia, oculomotor dysfunction and absence of sensory symptoms^[1]. AMAN is typically preceded by an infection from bacteria called *Campylobacter jejuni*^[2] or *Haemophilus influenzae*^[3]. Prevalence of AMAN is estimated at 5% of cases in North America and Europe^[1], while 30-65% of cases are located in Asia, Central and South America^[4].

The prognosis involves two categories of patients undergoing rapid recovery or slower recovery after reaching the highest levels of unchanging symptoms and dysfunction, or plateau phase^[5]. It is proposed that recovery is achieved through mechanisms such as terminal motor nerve axonal regeneration and collateral reinnervation processes^[6]. Documented cases in literature that are relevant find absent or minor sensory deficits are present among patients with AMAN, and majority of patients have complete symptom resolution with 5-day intravenous immunoglobulin (IV Ig) treatment^[7]. Patients with AMAN continue to see improvements in ambulation and functional ability up to four years post-diagnosis^[3]. This brings us to the purpose of the following case study of a patient with AMAN.

Physiotherapy assessment and treatment can help prevent the decline of functional status and maintain functional independence, muscle strength, posture, balance, and cardio-respiratory fitness. Moreover, it enables an individual to continue performing self-care routines and activities of daily living (ADLs). In accordance to the International Classification of Functioning, Disability and Health (ICF) framework^[8], the primary objective of this case study is to elaborate on how physical therapy rehabilitation assessment and treatment interventions can aim to address body structure and function impairments, activity limitations, and participation restrictions in patients with AMAN. The case study further aims to focus on patient-centred care and an interdisciplinary approach to assessment and management of AMAN in a community-based rehabilitation setting.^[9]

II. CASE BACKGROUND

Savitri Mule, a 62 year old female, initially presented with nausea and diarrhea one week after returning home from vacation in Vapi. Due to COVID-19 travel restrictions, Savitri refrained from visiting the hospital's emergency department. Instead, Savitri booked an appointment with her family doctor in two weeks' time after her quarantine was finished. Over the next week, Savitri complained of progressive muscle weakness in her hands and feet. She had difficulty grasping items with her hands and reported difficulty climbing stairs. During the subsequent week, Savitri reported decreased coordination while ambulating and unusual shortness of breath



and fatigue. Prior to the visit with her family doctor, Savitri lost her balance and fell while walking upstairs, which led to admission to the hospital's emergency department.

Although no injuries were sustained by the fall, diagnostic investigation continued and Savitri was diagnosed with acute motor axon neuropathy caused by *Campylobacter jejuni*, and was treated immediately with a high dose of intravenous immunoglobulin (IVIg) therapy^[10]. Savitri spent the next two weeks in the intensive care unit (ICU), where she required mechanical ventilation due to respiratory muscle weakness. The acute health care team performed passive range of motion, splinting, airway clearance techniques, and frequent repositioning to prevent the development of contractures, deep vein thrombosis, pressure ulcers, and other complications. Prior to discharge, Savitri was educated by an interdisciplinary team (including a physiotherapist, occupational therapist) about the rehabilitation plan, safety considerations, and was also fitted for a 4-wheel rollator to assist in her recovery. It has been 12 weeks since her discharge from the hospital. No other medical conditions or comorbidities have developed, and her medical status has remained stable.

The sub-acute phase of rehabilitation will be patient-specific, utilizing an ICF framework to address body function and structural impairments, activity limitations, and participation restrictions. In addition, health care providers will employ a safety-based approach to prevent patient exhaustion, and promote patient confidence in performing functional activities or tasks.

III. CLIENT CHARACTERISTICS

Patient Profile (PP): Savitri Mule, 62 year old female

Medical Diagnosis: Acute motor axonal neuropathy

Nature of the Condition: Sub-acute phase of the disease, in recovery

Primary Complaint:

- Weakness in muscles of hands, wrist, ankle, and feet,
- Fear of falling
- Decreased mobility and coordination
- Self-reported fatigue

Past Medical History (PMHx)

- Rotator Cuff Surgery 10 years ago (fully healed and no associated functional impairments)
- *Campylobacter jejuni* infection 12 weeks ago

Medications (Meds): High dose of intravenous immunoglobulin (IVIg) therapy as needed

Primary Reason For Referral: Recovery from AMAN

- Inability to perform certain ADLs without assistance
- Mobility levels, balance, coordination, joint range of motion, muscle strength/endurance have not returned to pre-AMAN levels
- Decreased aerobic capacity contributing to feelings of fatigue
- Decreased participation in previously enjoyed leisure activities/hobbies and physical activities

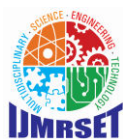
IV. EXAMINATION FINDINGS

Subjective

Presenting Condition:

Savitri reported that she was feeling unstable and did not have confidence when walking around. She stated that both her distal upper (hands, wrist) and lower extremities (ankle, feet) were weak, and that she was having difficulties performing basic activities such as opening a can, climbing stairs, or walking around her home. She has reported a loss of mobility due to muscle weakness in her ankles, which she further contributes to her instability when performing everyday tasks. Savitri notes that she has enough hand and wrist strength to carry light objects but fatigues quickly.

Savitri is able to ambulate 15 minutes with assistance from a rollator walker and AFO (ankle foot orthotic), however she proceeds with a slow gait speed and wide base of support. She does not report any pain while walking, but mentions that she is quite fatigued after walking and needs around 2 hours of rest before being able



to walk again. Savitri notes that fatigue is worse in her lower extremities as opposed to her upper extremities, and predominantly affects her ankle and feet. Also, Savitri reports extreme difficulty when ascending and descending stairs, needing assistance from her husband due to fear of falling, lack of balance, and motor weakness.

- In the assessment, Savitri states she has been feeling anxious and sad since her diagnosis, and she is concerned that it may impact the quality of her relationship with her husband and daughter as she relies on their assistance. With help from an occupational therapist, her home is being prepared for modifications to better meet her current needs and presentation. Furthermore, Savitri also sees a neurologist once a month to monitor the progress of her condition and medication.
- She lives in a 2 story home in the heart of the city. She has been having major difficulties navigating the stairs, and as a result her family helped her move her bedroom down to the first floor, instead of the second. She hopes to be able to climb 15 steps required to go to the second floor of her house.

Social History

- Savitri lives with her husband Suresh, while her daughter Mansi lives two blocks away from her. Suresh and Mansi have been supporting Savitri since her diagnosis.
- Prior to her retirement, Savitri worked as a Pilates instructor at the local YMCA, and had normally maintained high levels of physical activity before her diagnosis. Her husband is a retired Kinesiologist, who has been running weekly group circuit training sessions at the YMCA, in which Savitri participated faithfully.
- While Savitri is progressing slowly, she is concerned that she may never be able to participate in her previous enjoyable physical activity/exercise classes.
- Prior to her diagnosis, Savitri enjoyed going on hikes with her family and friends, and participated in an adult bowling league which took place once per week. Since her diagnosis, Savitri has not been able to hike or bowl with her friends, and reports feelings of isolation without them.

Yellow flags:

- Score of 9 on the General Anxiety Disorder-7 (GAD-7) scale
- Reports feeling sad and anxious since her diagnosis
- Concerned that she may be placing increased strain on her family due to her increased reliance
- Does not believe that physiotherapy will help recover her ability to navigate stairs
- Reports feelings of isolation due to reduced participation in activities with friends and family

Primary Goals:

- Savitri's main goal is to be able to ambulate independently or with assistance from a single point cane for at least one hour, so she can go back to exploring her community neighbourhood without the use of a rollator.
- She would also like to return to participating in her husband's weekly group circuit training sessions, as she felt that it was a great form of physical activity and a great opportunity to bond with him.
- Finally, she would like to get back to bowling with friends in their adult community bowling league, as it is a huge source of social support for her.
- Utilizing physiotherapy, Savitri is hoping to gain more confidence and balance when walking, be able to carry heavier objects such as grocery bags into her home, and open cans without assistance from her husband. Also, she would like to be able to navigate stairs with minimal assistance, however she is unsure if that is a realistic goal for her given her current condition.

Objective

Observation

- Client has bilateral motor weakness in her distal lower limbs (ankle, feet, toes) and bilateral motor weakness in her distal upper limbs (hands, fingers, wrist)
- Patient enters clinic using a rollator walker, patient has wide base of support when using rollator
- Bilateral foot drop

Skin Inspection

- No signs of deep vein thrombosis such as swelling or calf pain.
- No pressure ulcers, cuts or bruises.



Sensory Testing

Normal sensation was reported with the following tests

- Tactile localization
- Light touch
- Proprioception and kinesthetic sense
- Stereognosis
- Visual field test

Neurological Scan for Upper and Lower Body

Dermatomes: normal sensation bilaterally in C1 to T1 dermatomes and L1 to S2 dermatomes.

Myotomes: weakness in the following myotome groups:

- C6 wrist extension
- C7 wrist flexion
- C8 finger flexion
- T1 finger abduction
- L4 ankle dorsiflexion
- L5 big toe extension
- S1 ankle plantarflexion

Reflexes

- Achilles reflex → no response (0), bilaterally
- Quadriceps tendon → weak (1+), bilaterally
- Biceps and triceps tendon reflexes → normal (2+), bilaterally
- Upper motor neuron reflexes (Babinski and Clonus) → normal, bilaterally

Cardiorespiratory Assessment

Table 1: Vital Signs and Ventilatory Muscle Strength measured at the time of initial assessment.

Vital Sign	Measure	Interpretation
Heart Rate (HR)	78 bpm	WNL
Blood Pressure	128/82 mmHg	WNL
Respiratory Rate	18 bpm	WNL
Ventilatory Muscle Testing	Measure	Interpretation
Maximum expiratory pressure (MEP)	100 mmH2O	WNL
Minimum inspiratory pressure (MIP)	65 mmH2O	WNL

Function and Mobility Testing

- Grip strength: left hand 10 Kg, Right hand 11 Kg.
- Bed mobility: Savitri is able to independently roll and sit up in bed without assistance.
- Transfers: Savitri is able to transfer without assistance from chair to standing and walk short distances using a rollator and ankle foot orthotic
- Savitri is unable to maintain balance in response to small perturbations so she is at risk of falls.



Outcome Measures

Table 2: Outcome measure scores at the time of initial assessment.

Note: GBS= Guillain-Barre Syndrome; TUG= Timed Up And Go; BBS= Berg Balance Scale; 6-MWT= 6-Minute Walk Test.

Outcome Measure	Score	Interpretation
GBS disability score	3/6	Able to walk 5 meters with an aid
TUG	40 seconds	High risk of falls
BBS	31/56	High risk of falls
6-MWT	237 meters	Low function and mobility

Range of Motion and Manual Muscle Testing (MMT)

Table 3: Active range of motion (AROM), passive range of motion (PROM), and manual muscle testing (MMT) scores per joint at time of initial assessment.

Joint	AROM (degrees) L/R	PROM (degrees) L/R	Bilateral MMT score (out of 5)
Metatarsophalangeal joint	Unable to move (bilat)	Flexion 30/30 Extension 80/80	1 flexion, 1 extension
Subtalar	Unable to move (bilat)	Inversion 30/30 Eversion 10/10	1 inversion, 1 eversion
Ankle	Unable to move (bilat)	Plantarflexion 45/49 Dorsiflexion 18/20	2- plantarflexion, 2- dorsiflexion
Knee	Flexion: 110/ 115 extension: 10/ 8	Within normal limits (WNL)	4- flexion, 4- extension
Hip	Flexion: 100/ 105 Extension: 10/ 10 External rotation: 25/ 40 Internal rotation: 20/ 38 Abduction: 35/ 38 Adduction: 20/ 20	WNL	4- flexion, 4- abduction
Shoulder	Flexion: 90/ 115 Abduction: 85/ 100 External rotation: 50/ 70 Internal rotation: 55/ 75	WNL	4+ flexion, 4 abduction



Elbow	Flexion: 145/ 147 Extension: 0/0	WNL	4+ flexion, 4+ extension
Wrist	Flexion: 60/ 62 Extension: 50/ 54	WNL	4- flexion, 4- extension
Metacarpophalangeal joint	Flexion: 60/ 62 Extension: 10/ 10	WNL	3+ flexion, 3+ extension

V. CLINICAL IMPRESSION

Physiotherapy Diagnosis

Savitri’s primary clinical presentation is bilateral peripheral motor weakness without sensory loss which was due to a medical diagnosis of Acute Motor Axonal Neuropathy (AMAN), a variant of Guillain-Barre Syndrome. Her symptoms are more severe in the lower extremities, where she presents with loss of ROM and weakness in the dorsiflexors and plantarflexors. Consequently, she exhibits decreased ability to maintain balance, an increased fear of falls, and is also unable to ambulate without a mobility aid (4-wheeled rollator). Savitri does not require any ventilatory support, however she experiences extreme fatigue after 15 minutes of ambulation that subsides with rest. Although retaining full ROM in the upper extremity, she has decreased grip strength which limits her ability to perform certain ADLs independently such as turning door knobs and opening cans. Currently, Savitri is unable to participate in activities she previously enjoyed including pilates, bowling nights with her friends, and attending her husband’s fitness classes.

Problem List (based on the ICF framework)

Body Function and Body Structure Impairments

- Inability to perform full AROM ankle dorsiflexion or plantarflexion bilaterally
- Motor weakness in peripheral joints (wrist, ankle, and interphalangeal joints)
- Fatigue after walking 15 minutes
- Poor balance and coordination during standing and gait

Activity Limitations

- Limited ability to perform grasping actions (open jars, turn doorknobs, carrying groceries)
- Inability to go up stairs without 2 railings due to fear of falls
- Requires rollator for ambulation

Participation Restrictions

- Unable to participate in husbands group circuit training classes
- Unable to participate in hikes with family and friends since her diagnosis
- Inability to participate in weekly adult league bowling nights
- Anxious to interact with friends as she is embarrassed about her compensated ambulation patterns

VI. INTERVENTION

The purpose of the listed interventions are to:

- Help patients to maintain and regain muscle strength, ROM, and function during the remyelination process. It is important to note that although therapy does not directly facilitate nerve tissue repair, it allows patients to optimally use the muscles during the healing process.
- Creating a patient-centered treatment plan following the ICF framework to address body function and structure impairments, activity limitations, and participation restriction
- Educate patients on the proper use of mobility aids and functional adaptations that allow patients to resume activities as close to their previous level of activity.
- Will use a safety-based approach to help patients recognize and perform activities in ways they feel safe to do so.



Patient-Specific Goals

- During the next 2 weeks, Savitri will perform daily active ankle range-of-motion exercises using visualization techniques and a belt to self-facilitate movement.
- By week 3, Savitri will be able to attend and participate in a seated, modified version of her husband's weekly group circuit training.
- Within 4 weeks, Savitri will be able to ambulate for 20 minutes with a rollator without experiencing fatigue that lasts more than 15 minutes (fatigue is defined in this context as lack of energy that prevents her from performing/return to daily activities).

Management Program during Recovery Phase

- General notes for exercises[11]:
- Exercises should be matched to patients activity, performed in short intervals and not overly fatiguing.
- Exercise progression should only occur when patient shows improvement in exercises for a week, without deterioration of status (ie. increased fatigue)

Table 4: Detailed Explanation of Physiotherapy Interventions

Intervention	Rationale	FITT (frequency, intensity, time, type) principles	Additional Notes
<p>Education:</p> <ul style="list-style-type: none"> • Proper postural education (neutral spine, sitting up tall, shoulders back) and management (recommend postural adjustments that will help her maintain proper posture - lumbar roll) • Safety consideration when using a gait aid • Understand disease progression, prognosis, patient-specific goals, and treatment plan • Role of caregiver (supportive and motivating but should encourage patient self-management) • Indicators to decrease or increase the level of intervention, and safety associated with each exercise 	<p>Having the patient understand the development and progress of their condition can increase patient buy-in, increases patient safety, and allows patients to take a larger role in their own rehabilitation.</p>	<p>Education should begin during the first session of therapy. Use of pamphlets or videos may be helpful too.</p>	<p>As therapists, it is important to encourage patients without making promises on patient's recovery time and degree of recovery^[12].</p>
<p>Range-of-motion:</p> <ul style="list-style-type: none"> • Neuro-proprioception techniques to facilitate ankle dorsiflexion and plantarflexion 	<p>AAROM and PROM techniques that facilitate ankle ROM, to keep existing neuro-muscular junctions active, to encourage motor control.</p>	<p>10 reps x 3 times/day, performed daily</p> <p>Even if muscles are weak and full ROM cannot be achieved independently, the patient is encouraged to visualize the action during the exercise</p>	<ul style="list-style-type: none"> • Since sensation is not lost in these patients, can use external cues on on leg to promote muscle contraction • PROM can be assisted by the therapist • AAROM can be done as part of the home intervention plan using a belt to assist with ankle dorsiflexion



			PROM technique can be done in rehabilitation or by a caregiver in a home setting.
<p>Muscle strengthening:</p> <p>Examples include:</p> <ul style="list-style-type: none"> • supine glute bridges • seated hip flexion • mini-squats with hands supported on counter/ stable surface • theraband-resisted shoulder flexion and abduction • bicep curls 	<p>Continue to strengthen and maintain larger lower (ie. quadriceps glutes, and hamstring) and upper extremities (ie. biceps and tricep) and trunk prime movers, as these are required to regain previous activity levels and function</p>	<p>8 reps x 3 sets with adequate rest in between (patient dependent) 3x/wk</p> <p>Intensity: low to moderate level of exertion</p> <p>Type: isometric and isotonic resistance training</p>	<p>Patient should be aware of fatigue levels using the Rate of Perceived Exertion on the Borg Scale (begin at low intensity and progress to moderate intensity)</p> <p>Multi-joint exercises can also be included as it encourages muscle synergies (coordinate prime mover and stabilizer action)^[13]</p> <p>Should be taught in rehabilitation and performed in home setting.</p>
<p>Grip Strengthening:</p> <p>Hand therapy:GRASP (graded repetitive arm supplementary program)^{[14][15]}</p>	<p>This program focuses on upper extremity strengthening, fine motor tasks and repetitive functional tasks.</p> <p>Although this program is only validated in the acute stroke population, this can be beneficial if adapted to patients ability to improve grip strength and general upper functional outcomes.</p>	<p>1 hour of exercises, daily 8 weeks</p> <p>Remember to modify and adapt exercise to patient-specific fatigue levels, allow for rest as necessary</p>	<p>GRASP is a “homework-based” program that can be performed at home.</p> <p>Should be done in home setting.</p>
<p>Cardiovascular aerobic training:</p> <p>Examples</p> <ul style="list-style-type: none"> • Walking using gait aid • Arm Cycle ergometer • Stationary bike 	<p>Safe, low-level, aerobic exercise that does not go past level of fatigue is indicated for positive clinical outcomes</p>	<p>30 min total (can be broken up into 5-10 minute bouts) 3x/week</p> <p>Recommended to do walking with 4-wheeled rollator as this is a most functional activity</p>	<p>Patient should be aware of fatigue levels using the Rate of Perceived Exertion on the Borg Scale (begin at low intensity and progress to moderate intensity)^[16]</p> <p>Can be done in rehabilitation or home setting.</p>
<p>Balance and Gait</p> <ul style="list-style-type: none"> • Parallel bar gait training (walking, weight shift, challenge balance) • Body-weight supported treadmill training^[17] • Educate proper and safe 	<p>Training balance can help improve patient’s confidence in functional activities that require balance and help patients improve motor control patterns</p>	<p>Always perform this in a safe setting and with a therapist spotting the patient. Can be performed in a home setting if caregiver is taught the proper way</p>	<p>By using a body weight treadmill, the patient may feel safer and more comfortable to ambulate without holding on to a support as they are supported by a harness.</p>



use of gait aid	to support patient. • Use of ankle-foot orthosis as indicated • Use gait belt for safety as indicated	External facilitation to encourage ankle dorsiflexion and plantarflexion as indicated. Parallel bar and body-weight treadmill can be done in rehabilitation setting.
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Functional Training • Step up • Sit to stand • Reaching for objects while standing • Adapted pilates (e.g seated pilates)	Putting it all together: Functional training takes a multifaceted approach to help patients strengthen, improve ROM, coordination and balance in a patient relevant	10 reps (or as many as tolerated), 2x/day preformed daily For pilates perform 1-2x/wk When these exercises are performed at home, make sure that they are performed safely and within the patient’s limit to prevent excessive fatigue	Patient should be aware of fatigue levels using the Rate of Perceived Exertion on the Borg Scale (begin at low intensity and progress to moderate intensity) ^[16] Can be done in rehabilitation or home setting.
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Outcome

After 12 weeks of physiotherapy sessions, Savitri has improved significantly on multiple components of her diagnosis that have impacted her independence the most, such as her strength, range of motion, balance, and gait. She is also experiencing less fatigue in comparison to her initial assessment and can successfully ambulate over 25 minutes before feeling mild fatigue. Savitri was assessed at various intervals throughout her treatment to ensure the interventions matched and challenged her function and activity levels. Savitri’s progression at the 6-week interval is as follows:

Re-assessment 6-Weeks after Initial Assessment

Table 5: Outcome Measures at 6-Weeks Re-assessment

Outcome Measure	Score	Interpretation
GBS disability score	2/6	Able to walk for 5m or more without an aid
TUG	33 seconds	High risk of falls; requires gait aid
BBS	40/56	Increased functional balance
6-MWT	307 meters	Increased distance; improvement in patient’s mobility



Table 6. Range of motion (ROM) and Manual Muscle Testing (MMT) at 6-Weeks

Joint	End of Week 6 Update		
	AROM (degrees) L/R	PROM (degrees) L/R	Bilateral MMT score (out of 5)
Metatarsophalangeal joint	Flexion: 10/8 Extension: 15/12	Flexion: 33/32 Extension:84/84	2+ flexion, 2+ extension
Subtalar	Inversion: 7/10 Eversion: 4/4	Inversion: 34/34 Eversion: 14/16	3 inversion, 3 eversion
Ankle	Plantarflexion: 13/ 15 Dorsiflexion: 8/7	Plantarflexion: 47/51 Dorsiflexion: 22/24	3+ plantarflexion, 3+ dorsiflexion
Knee	Flexion: 117/ 120 Extension: 6/6	WNL	4 flexion, 4 extension
Hip	Flexion: 110/113 Extension: 13/14 External rotation: 30/42 Internal rotation: 25/42 Abduction: 39/41 Adduction: 25/25	WNL	4 flexion, 4 abduction
Shoulder	Flexion: 110/ 123 Abduction: 100/ 104 External rotation: 57/74 Internal Rotation: 64/79	WNL	4+ flexion, 4+ abduction
Elbow	Flexion: 153/153 Extension: 0/0	WNL	4+ flexion, 4+ extension
Wrist	Flexion: 66/69 Extension: 57/62	WNL	4 flexion, 4 extension
Metacarpophalangeal joint	Flexion: 65/68 Extension: 15/16	WNL	4 flexion, 4 extension

Progression of her scores can be attributed to intervention education provided to Savitri. She is eager to participate in her rehabilitation (strength, range of motion, and balance interventions) as she believes it will help her return to previous levels of independence and participate in her weekly hobbies. As Table 5. illustrates, Savitri’s TUG score has improved significantly (from 40 seconds to 33 seconds, MCID is 3.4 seconds^[18]). She also improved in her BBS score and has significantly increased in her 6-MWT (MCID estimated at 54-80 meters^[19]). These improvements can be attributed to the parallel bar and body-weight treadmill gait training that was implemented. Savitri reports that she sees increases in proficiency as she performs the prescribed muscle strengthening and functional exercises and believes she can return to her previous lifestyle. Savitri also reported feeling decreased fatigue after physiotherapy each session. Savitri is still advised to continue practicing neuro-proprioception techniques along with imagery to facilitate more ankle dorsiflexion and plantar flexion as part of the home intervention plan. Lastly, Savitri reported feeling depressed at the very beginning of her treatment plan. We referred her to a psychologist at this stage to provide psychological support for her and her family and gain motivation to participate in her plan of care^[20]. Since then, she reports improvement and is looking forward to advancing to the next stages of her treatment plan.



Re-assessment 12-Weeks after Initial Assessment

At the end of week 12, a final assessment was taken again. Her results are as follows:

Table 7: Outcome Measures at 12-weeks Re-Assessment

Outcome Measure	Score	Interpretation
GBS disability score	2/6	Able to walk for 5m or more without an aid
TUG	27 seconds	Patient still requires gait aid
BBS	46/56	Decreased risk of falling; functional balance improved
6-MWT	382 meters	Progression in distance; increase in patient’s mobility

Table 8. Range of motion (ROM) and Manual Muscle Testing (MMT) at 12-Weeks

Joint	End of Week 12		
	AROM (degrees) L/R	PROM (degrees) L/R	Bilateral MMT score (out of 5)
Metatarsophalangeal joint	Flexion: 13 /12 Extension: 20/19	Flexion: 35/35 Extension: 86/88	3 flexion, 3 extension
Subtalar	Inversion: 14 /14 Eversion: 8/9	Inversion: 35/35 Eversion: 16/17	4 inversion, 4 eversion
Ankle	Plantarflexion: 21/ 25 Dorsiflexion: 11/14	Plantarflexion: 49/52 Dorsiflexion: 24/25	4- plantarflexion, 4- dorsiflexion
Knee	Flexion: 126/132 Extension: 3/3	WNL	4+ flexion, 4+ extension
Hip	Flexion: 117/120 Extension: 16/18 External rotation: 35/45 Internal rotation: 32/45 Abduction: 44/46 Adduction: 30/31	WNL	4+ flexion, 4+ abduction
Shoulder	Flexion: 105/122 Abduction 120/122 External rotation: 65/80 Internal Rotation: 70/82	WNL	4+ flexion, 4+ abduction
Elbow	Flexion: 157/158 Extension: 0/0	WNL	4+ flexion, 4+ extension
Wrist	Flexion: 70/70 Extension: 64/65	WNL	4+ flexion, 4+ extension



Metacarpophalangeal joint	Flexion: 72/73 Extension: 20/22	WNL	4+ flexion, 4 extension
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With the help of the body-weight treadmill, Savitri is able to practice ambulation and train proper gait motor control in a supported environment. Along with this intervention, she reports increased ankle strength which has allowed her to ambulate more confidently. Savitri also has a significantly higher TUG score (from 33 seconds to 27 seconds, MCID is 3.4 seconds^[18]). She also gained significant improvements in her BBS overall and significantly improved her walking endurance as shown in the 6-MWT score (MCID 54-80 meters^[19]). As illustrated above in Table 8, Savitri has overall increased strength and has almost achieved full ROM in her ankle joint. She reports feeling reduced fatigue after physiotherapy sessions in her daily walks and can walk for up to 30 minutes before experiencing fatigue. Her grip strength also increased, which is reflected in her ability to perform ADLs independently. Lastly, Savitri reported feeling positive about her progression in therapy and mentioned feeling more independent when participating in her individual and social activities.

Discharge

Based on the current status of Savitri's progress, we recommend that Savitri decrease the frequency of her appointments from weekly sessions to monthly check-ups. In these sessions we will reassess her progress and help her work towards her goal to progress from a 4-wheeled rollator to a quad-cane, if indicated. Together with an occupational therapist, Savitri will find ways to modify her home environment based on her needs^[21]. We also recommended that Savitri take part in aquatic therapy programs, as it is beneficial for patients with neurological conditions, such as AMAN^[22]. Aquatic physical therapy can result in reduced pain, further reduce joint stiffness, promote greater physical function, and increase the quality of life for our patient^[23]. We will have ongoing discussions with Savitri as well as the interprofessional health team involved in her health.^[24]

Interdisciplinary Team

Patients with a diagnosis of Acute Motor Axonal Neuropathy (AMAN) require holistic care from a variety of healthcare professionals in order to help optimize patient outcomes. Patients with AMAN can experience lasting motor weakness deficits, which require interdisciplinary rehabilitation approaches to support and facilitate patients in regaining their previous level of functioning and independence. It is important to involve patients and/or family caregivers in their unique care, the decision-making process, as it promotes autonomy and facilitates self-efficacy.

A multidisciplinary healthcare team is needed to effectively manage and treat patients with a diagnosis of AMAN. We have listed different healthcare professionals involved in the treatment and management of patients with AMAN along with their roles. Note, this list is not exhaustive.

Physiotherapist:

- Assess, monitor, and prescribe interventions to improve patients respiratory muscle strength/functioning, airway clearance techniques
- Assess, monitor, and prescribe interventions to improve patients posture, range of motion, strength, endurance, balance, functional independence in performing ADLs
- Facilitate bed mobility and frequent re-positioning in the acute stages of the disease to prevent the development of pressure ulcers and deep vein thrombosis
- Utilizing pain management strategies and incorporating the biopsychosocial model
- Educating, fitting, prescribing patients with mobility aids to facilitate functional independence and reduce the risk of falls^[25]

Occupational Therapists

- Focus on muscle strengthening and help patients relearn movement strategies to improve performance of ADLs with minimal assistance
- Teach patients new techniques or modified techniques to facilitate functional independence
- Find ways to modify the patient's home environment based on patient limitations or patient-specific needs (ie. moving her bed to a first floor room before she is able to walk up stairs)^[21]



Psychologists

- Provide psychological support for patients and their families
- Upon diagnosis of AMAN, patients can experience anxiety, depression, or reduced motivation. Therefore, regular psychological counselling is important to help patients assess, monitor, and manage their newly-experience emotions associated with their diagnosis
- In addition, there are support groups for patients with AMAN, which provides an outlet for patients to recognize they are not alone and that there is a group for them to talk to which can help minimize social isolation^[20]

Neurologist

- Role in diagnosis and treatment of AMAN
- Neurologists can perform diagnostic procedures to aid in the diagnosis of AMAN
- In addition, neurologists can prescribe medications in the treatment of AMAN, and play an important role in monitoring patient progress^[26]

VII. DISCUSSION

Acute Motor Axonal Neuropathy (AMAN) is a variant type of Guillain-Barre syndrome, characterized by acute progressive motor weakness, areflexia, ataxia, oculomotor dysfunction and absence of sensory symptoms^[1]. Prognosis for this condition is typically positive, with severe cases continuing to recover movement and function up to four years after their initial diagnosis^[3]. Deficits observed in motor function, range of motion, aerobic and muscular endurance, and muscle strength are key factors that continue to limit the quality of life of individuals suffering from AMAN^[26].

In her assessment, Savitri presented with many of the listed signs and symptoms, which we measured via outcome measures in accordance with the ICF (such as the GBS disability score and TUG). The outcome measures were used to quantify her initial level of functioning, and as comparable signs to monitor her physiotherapy progress (at 6- and 12- weeks). Initially, Savitri's signs and symptoms led to a decrease in her level of independence and her ability to participate in enjoyable recreational activities such as pilates or bowling, leading in a reduction in her overall quality of life and mental health. Emphasis should be placed on the favourable prognosis of this condition when educating patients, along with highlighting the importance of physical therapy and a treatment approach revolving around functional activity.

Along with patient-stated goals, Savitri's 12-week treatment plan was structured with the ICF framework in mind. Her treatment focused on ROM, muscle strengthening, meaningful functional activities, aerobic exercise, and balance training to reduce her risk of falls. Throughout her engagement with the intervention program Savitri demonstrated excellent progress and has become more functionally independent. An increase in her ankle strength (MMT testing) has allowed her to ambulate more confidently, and her ability to effectively counter light external perturbations has reduced her fear of falls. Savitri still ambulates around her home and community with a rollator walker, although with notably improved endurance, and has not yet been able to get back to bowling with her friends. Her desire to progress to a cane and return to her husband's workout classes make her an excellent candidate to continue with rehabilitation. Physiotherapy continues to be beneficial as it can provide Savitri with more education and functional-focused intervention that can help her achieve her goals. Savitri's previously high levels of physical activity, motivation to return to activity, and continued support from her family are strong indicators that she will continue progressing, ideally to a level where she does not feel limited by her AMAN diagnosis. AMAN patients and those with similar conditions continue to benefit from the expertise of a multidisciplinary team well beyond their diagnosis, to ensure a maximization of their quality of life.

Self Study Questions

1. Which of the following symptoms is NOT typical of patients with AMAN
 - A) Bilateral motor weakness
 - B) Graphesthesia
 - C) Loss of balance
 - D) Increased fatigue



2. The main characteristic differentiating acute motor axonal neuropathy (AMAN) from Guillain-Barre Syndrome (GBS) is
 - A) GBS patients may experience a decrease in respiratory function while AMAN patients do not
 - B) AMAN patients may experience sensory deficits while GBS patients do not
 - C) AMAN involves purely motor deficits
 - D) Prognosis for AMAN is poor while GBS prognosis is typically positive
3. The most effective treatment approach for AMAN focuses on (choose the best answer)
 - A) Focus on functional activity
 - B) Sensory training
 - C) Muscle and endurance training
 - D) Aerobic exercise
 - E) A,C, and D only
4. Which of the following is NOT a proposed mechanism of recovery in AMAN?
 - A) Terminal motor nerve axonal regeneration
 - B) Collateral reinnervation
 - C) Agglutination

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