Rehabilitation of Guillain-Barré Syndrome: A Case Report

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Background and Purpose: Guillain-Barré Syndrome (GBS) can be defined as an acute inflammatory demyelinating immune-mediated polyneuropathy that targets peripheral nerves and nerve roots. The effects of this autoimmune condition on nervous tissue result in motor neuropathy and flaccid paralysis. This case study discusses the examination, evaluation, interventions and results of physical therapy treatment for a young, active, female.

Case Description: The patient is a 28 year-old female accountant and recreational soccer coach who presented with acute sensory and motor deficits consistent with symptoms of GBS. The patient previously received 2 weeks of ICU physical therapy followed by 4 weeks of inpatient rehabilitation. Previous treatment was completed four weeks prior to beginning outpatient skilled physical therapy.

Outcomes: After 6 weeks of outpatient physical therapy, the patient improved in both dynamic balance and performance of activities of daily living (ADL), demonstrated by The BERG Balance Scale and Barthel Index scores, respectively. Patient also exhibited marked increased range of motion and muscle strength tests.

Discussion: Previous research supports increases in strength, however, other data indicates variations regarding a decrease in fatigue and increase in functional gains; therefore it is difficult to determine if the patient’s improvements can be attributed directly to the physical therapy treatment. GBS treatment protocols could benefit from research emphasizing rehabilitation of functional activities of the distal lower extremities as well as the efficacy of aquatic therapy for this patient population.

Introduction/Literature Review

Guillain-Barré Syndrome (GBS) is a common form of neuromuscular paralysis that affects the PNS. The etiology of GBS is still being understood, however, there is research to support that an infection triggers a cascade of events that lead to peripheral neuropathy and weakness. Some clinicians observed that GBS may have an immunologic etiology which involves immunoglobulin deposits left on myelin sheaths, antibodies that damage peripheral tissues, and leads to the destruction of Schwann cells. About 1 to 2 out of 100,000 people are affected by GBS with incidence rates increasing in developing countries. GBS affects both males and females, particularly young individuals and is a cause of long term disability. Prevalence, in conjunction with the increasing rate of incidence, makes GBS an important area to study for rehabilitation therapists.

Diagnosis is crucial for patients with GBS and is determined by an increased number of proteins within the cerebral spinal fluid (CSF). Patients with GBS will complain of flu like symptoms followed by muscle pain and symmetrical ascending weakness. Nerves quickly lose function and individuals typically hit nadir about 2 weeks from their initial symptoms. Nadir is defined as the point of greatest severity. For this reason, early diagnosis is crucial so the person may receive respiratory support. In addition, the patient will need to have their vital signs closely monitored as GBS may affect the respiratory and circulatory systems. This can lead to cardiac arrhythmias, uncontrollable changes in heart rate, and/or hyper/hypotension.
Throughout the progression of GBS, cognition and sensation remain intact. Recovery typically begins 2-4 weeks post onset and lasts for about 12 weeks. Approximately 80% of patients are ambulatory within 6 months of onset, 50% have minimal residual neurological deficits, and 15% have residual losses of function. Patients regain function in a descending fashion gaining core strength with progression distally.

In an acute setting the patient will receive treatment that will stabilize their vital signs first to prevent secondary complications. Treatments include plasma exchange, immunoglobulin infusions, and steroids. Past research has shown a variable change in fatigue. One study consisting of 90 patients concluded that fatigue decreased by 38.9% when compared to another study in which severe fatigue was still prevalent 1 year post onset. Rehabilitation in this setting will focus on optimal patient positioning and maintaining range of motion (ROM). Once the patient’s vital signs are stable, rehabilitation will focus on limiting disability and optimizing function.

**Purpose**

The purpose of this case study is to determine the efficacy of a multi-therapeutic treatment approach for a patient with Guillain-Barré Syndrome. The efficacy will be determined by comparing baseline measures and prior level of function to current levels of function after physical therapy.

**Subject Description/Prior Level of Function**

Jane Doe (J.D.) is a 28 year old Italian American female who works as an accountant and coaches soccer on the weekends. She is 5'6”, weighs 140 pounds, is right handed, and currently lives with her boyfriend in her second floor apartment in an urban setting. Her building has 10 steps and railings on both sides to front door. She commutes primarily by bus.

**Chief Complaint/Medical History**

Jane Doe is experiencing pain, weakness, fatigue, numbness/tingling, loss of sensation, and lower extremity spasticity. J.D. is seeking outpatient skilled physical therapy for progression to previous ADL level of function and has a goal of regaining previous level of ambulation. J.D. has been diagnosed with Guillain-Barré Syndrome 10 weeks prior to outpatient physical therapy. She previously received 2 weeks of ICU physical therapy and inpatient rehabilitation for 4 weeks.

Past medical history includes a left clavicle fracture in 2005, prescription birth control since 1997, and has had no previous surgeries.

**Physical Examination**

<table>
<thead>
<tr>
<th></th>
<th>AROM</th>
<th>PROM</th>
<th>MMT</th>
<th>MLT</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Shoulder</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Flexion</td>
<td>0-165°</td>
<td>0-164°</td>
<td>0-175°</td>
<td>0-173°</td>
</tr>
<tr>
<td>Extension</td>
<td>0-39°</td>
<td>0-40°</td>
<td>0-45°</td>
<td>0-44°</td>
</tr>
<tr>
<td>Internal Rot</td>
<td>0-63°</td>
<td>0-65°</td>
<td>0-69°</td>
<td>0-70°</td>
</tr>
<tr>
<td>External Rot</td>
<td>0-68°</td>
<td>0-70°</td>
<td>0-70°</td>
<td>0-73°</td>
</tr>
</tbody>
</table>
Table 1.0 Initial Physical Examination Results  Active range of motion (AROM), passive range of motion (PROM), manual muscle test (MMT), and muscle length test (MLT) were assessed based on results of gross ROM which determined limitations in the left (L) and right (R) shoulder, hip, knee and ankle joints. Bilateral shoulder ROM and MMT were within normal limits, bilateral measurements of the acromion to the table surface indicated tight pectoralis major/minor. Grossly, bilateral lower extremities were weak. Specific measurements of ROM and MMT indicated significant limitations in hip flexion and extension, knee extension, and ankle dorsiflexion.

Objectives/Physical Examination
The patient in this study was treated with goals of returning to previous level of function, soccer, and recreational activities. Following onset of GBS patient exhibits lower extremity muscle weakness, decreased lower and upper extremity ROM, decreased endurance, and increased pain. As a result of her signs and symptoms, the patient is unable to return to work and soccer. Changes in her signs and symptoms were accessed with the Berg Balance Scale, Goniometry, MMT, Barthel Index, Modified Ashworth Scale, and Visual Analog Scale (VAS).

The Berg Balance Scale: The Berg Balance Scale was used to determine her balance and quantify the results for comparison to later values. According to a study done by La Porta et al., the reliability of the test without static sitting and static standing is 95% and the internal validity is rated adequate.⁶
Goniometry: AROM and PROM were measured at the shoulder, hip, knee, and ankle to assess joint and muscle mobility. Elbow and wrist were not measured due to lack of impairment. The joints were measured with a standard goniometer with the placements as described by Reese and Bandy.  

Manual Muscle Test: MMT was used to measure hip extension. It was measured with the patient in supine with the hip and knee flexed at 90 degrees. The patient was instructed to resist upward force placed by the physical therapist on the posterior knee. The reliability for this test is 82% (p<0.01), indicating that the test is statistically significant. Overall MMT has been determined to have good reliability and validity in a review of more than 100 studies with patients who have neuromusculoskeletal dysfunction.  

VAS: Visual Analog Scale was utilized to measure pain on a scale from 0-10 (0 being pain-free, 10 being maximum pain). It was taken to quantify the patient’s pain. Reliability of the test is 90%.  

Barthel Index: Barthel Index was utilized to determine strength, pain, and level of disability. It was performed with the 10 scale to ensure a complete view of the patient. The reliability was 88% (ICC=.90). This indicates that it can produce consistent results and the test can be reproduced.  

Table 2.0 Outcome Measurements  

<table>
<thead>
<tr>
<th>Outcome Measure</th>
<th>Initial Evaluation</th>
<th>3 Weeks</th>
<th>Re-Evaluation (6 Weeks)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Berg Balance Scale</td>
<td>20-high fall risk</td>
<td>30-medium fall risk</td>
<td>45-low fall risk</td>
</tr>
<tr>
<td>VAS</td>
<td>6/10</td>
<td>4/10</td>
<td>3/10</td>
</tr>
<tr>
<td>The Barthel Index</td>
<td>75</td>
<td>80 (improve bathing)</td>
<td>85 (improve stairs)</td>
</tr>
<tr>
<td>MMT for Gluteus Maximus &amp; Quadriceps</td>
<td>GM: 3/5; Q: 3/5</td>
<td>GM: 3+/5; Q:3+/5</td>
<td>GM: 4/5; Q:4/5</td>
</tr>
</tbody>
</table>
Evaluation and PT Diagnosis:
J.D. presents with decreased ability to participate at work and recreational activities. She has decreased endurance and strength of both lower and upper extremities. J.D.’s signs and symptoms are consistent with Physical Therapy Practice Pattern: 5G: Impaired Motor Function and Sensory Integrity Associated with Acute or Chronic Polyneuropathies.

Prognosis
J.D. has excellent prognosis for regaining original level of function. This is demonstrated in a variety of ways including her complete independence prior to onset, active lifestyle, high motivation to return to work and coaching, and progress seen prior to beginning her outpatient therapy. J.D. has a strong support system and high expectations of being able to return to prior level of function, further motivating her to return to work. In addition, a study has shown that 80% of GBS patients are walking within 6 months post diagnosis, 50% having minor residual neurological deficits, and 15% having long term distal limb deficits. 2,3

Clinical Impression
The patient presents to outpatient physical therapy with impairments due to the onset of Guillain-Barré Syndrome 10 weeks ago. Symptoms included bilateral lower extremity (LE) weakness with spasticity, decreased lower and upper extremity ROM, decreased endurance, and generalized pain throughout her body (Table 2.0). Upon finding impairments, the physical therapist took measurements to establish a baseline for comparison and appropriate goals for the patient. The patient is applicable for this case study because her symptoms are characteristic of Guillain-Barré Syndrome, has agreed to full participation to completion, and displays impairments that are consistent for a multidisciplinary treatment approach.

Patient Rehab Goals:
STG:
1. Patient will increase hip extension strength from 3/5 to 4/5 in 3 weeks to improve sit to stand transfers in order to complete ADLs at home and participate in her community.
2. Patient will increase score from 20 to 40 on the Berg Balance Scale in 3 weeks to decrease her risk of falls at home and in her community.
3. Patient will adhere 80% to home exercise program in the first 3 weeks of the rehabilitation in order to maintain improvements in skilled physical therapy.

LTG:
1. Patient will increase hip extension strength from 4/5 to 5/5 in 6 weeks to improve sit to stand transfers in order to complete ADLs at home and participate in her community.
2. Patient will increase score from 40 to 53 on the Berg Balance Scale in 6 weeks to decrease her risk of falls at home and in her community.
3. Patient will adhere 100% to home exercise program in 6 weeks of rehabilitation in order to maintain improvements in skilled physical therapy.

Plan of Care
Patient attended physical therapy 3 times a week for the first 2 weeks with 45 minutes sessions. Of 3 sessions, 2 sessions were traditional land based and 1 was completed in an aquatic setting. Patient then proceeded to attend traditional land based physical therapy for an hour twice a week for 6 weeks. The intervention plan was focused
on increasing the patient’s independence by improving her ambulation, balance, range of motion, and strength. In addition to the therapeutic exercises, patient education was provided to maintain functional gains.

The first 2 weeks of physical therapy were committed to treadmill training, strengthening, and aquatic therapy. Treadmill training was completed with a body weight support system. Intermittent breaks were taken to prevent fatigue. Research has shown that fatigue may influence motor recovery. To optimize the time spent while on the treadmill, the physical therapist (PT) and physical therapist assistant (PTA) facilitated the patient in gait training. The PT and PTA actively assisted (75-15%) the patient in plantar flexion and dorsiflexion. Active assist is shown to increase neural input to the distal lower extremity in order to increase motor unit innervation. As the patient progressed, less aid was provided (60-15%). Strengthening of the gluteus maximus was performed using prone hip extension, progressing with ankle weights, and finally in quadruped position. Aquatic therapy focused on coordination of lower extremity, trunk, and upper extremity movements. Walking, strengthening, and functional activities such as climbing stairs or side walking were incorporated.

The next 4 weeks consisted of treadmill training, strengthening, and balance. Treadmill progression was facilitated by increasing treadmill speed. Strengthening of the gluteus maximus was progressed by using sit to stand exercises. Throughout the course of treatment, functional activity was incorporated into the therapeutic exercises.

**Functional Outcomes**

With 3 weeks of physical therapy, the patient’s active and passive range of motion (AROM/PROM) for hip extension and flexion improved, assisting in gait and transfers. After 6 weeks, there were further improvements that correlate with improvements in functional outcomes measures that were taken at 3 and 6 weeks.

Using the BERG balance scale to assess fall risk, the patient went from a high fall risk to a medium risk at 3 weeks, and progressed to a low fall risk after 6 weeks of treatment.

The Barthel Index scores improved in bathing areas after 3 weeks, and stair climbing improved by week 6, and is reflected in the improving scores on the measure.

Manual muscle testing was performed on lower extremity muscles gluteus maximus and quadriceps femoris every 3 and 6 weeks that showed an increased strength that contributed to better sit to stand transfers and improved gait.

**Discussion**

The purpose of this case study is to determine the efficiency of a multi-therapeutic approach to the rehabilitation of a person with GBS. The therapeutic approach consisted of aquatic therapy, treadmill gait training, strength training, and functional training. The patient had no comorbidities or secondary complications.

J.D. was able to gain functional range of motion within 3 weeks of physical therapy. She maintained this functional range of motion throughout the course of physical therapy. Initially J.D.’s risk of falling was high. Over the course of physical therapy, she increased her functional reach test from 5 inches to 10 inches outside of her base of support. This decreased her risk of falling from 4 times greater risk to no risk of falling. The patient’s functional strength, duration, and weight bearing ability increased while walking on a treadmill. Additionally, the amount the PT/PTA aided the patient in heel strike and toe off during gait decreased by 60%.

J.D. experienced functional gains during her rehabilitation course. Previous studies have determined strength increased
during rehabilitation of patients with GBS. An increase in strength improved J.D.’s ability to get in and out of a car and the bath tub. An increase in walking duration time indicated an increase in aerobic capacity and a decrease in fatigue. Past research has shown a variable change in fatigue. Considering past research has shown variability in functional gains during the progression of GBS, it is difficult to determine that the functional gains experienced by J.D. were directly influenced by the multi-therapeutic PT rehabilitation program.

Further studies should be conducted to determine more critically appraised functional outcomes and to determine the effect of aquatic therapy. There is a lack of research in the rehabilitation of motor control of the ankle during gait. Considering the pathology of patients with GBS, distal lower extremity assisted motion during treadmill training should be further investigated.
### Appendix 1. Detailed Description of 6 Weeks of Interventions

<table>
<thead>
<tr>
<th>Week</th>
<th>ROM</th>
<th>Balance</th>
<th>Strength</th>
<th>Treadmill</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>● Contract relax, 3X 20s. holds, Hip, all ranges o Knee, all ranges o Ankle, all ranges</td>
<td>● Weight shifting in pool o Single leg stance in pool o Static stance with turbulence o Walking</td>
<td>● Prone hip extensions with knee extended, bilaterally: 3 x 15 o Seated knee extensions, no weight, bilaterally: 3 X15 o Ankle DF/FP with yellow band in seated position, bilaterally: 2 X 15</td>
<td>● 1 minute walking intervals with 3 minute rest time o 65% body weight bearing o 75% AAROM of ankle by PTA/PT o Speed 3.3</td>
</tr>
<tr>
<td>2</td>
<td>● Contract relax, 3X 20s. holds, 5 second contractions o Hip, all ranges o Knee, all ranges o Ankle, all ranges</td>
<td>● Weight shifting in pool o Single leg stance in pool with turbulence o Walking against turbulence</td>
<td>● Prone hip extensions with knee extended: 3 x 15 o Seated knee extensions, no weight, bilaterally: 3 X15 o Ankle DF/FP with yellow band in seated position, bilaterally: 2 X 15</td>
<td>● 2 minute walking intervals with 3 minute rest time o 50% body weight bearing o 50% AAROM of ankle by PTA/PT o Speed 3.3</td>
</tr>
<tr>
<td>3</td>
<td>● Contract relax, 3X 20s. holds, 5 second contractions o Hip, all ranges o Knee, all ranges o Ankle, all ranges</td>
<td>● Weight shift on land in parallel bars o Chop/reverse chop PNF sitting on plinth</td>
<td>● Prone hip extensions with knee extended, 5 lbs ankle weights, bilaterally: 3 x 20 o Seated knee extensions, 3lbs ankle weights, bilaterally: 3 X20 o Ankle DF/FP with green band in seated position, bilaterally: 2 X 20</td>
<td>● 3 minute walking intervals with 2 minute rest time o 35% body weight bearing o 50% AAROM of ankle by PTA/PT o Speed 4.2</td>
</tr>
<tr>
<td>4</td>
<td>● Maintenance of functional ROM with passive stretching 30 seconds x 3 sets o All ranges for hip, knee, ankle</td>
<td>● Weight shift on land in parallel bars or walker if able o Reach 5 inches outside of base of support while sitting (various activities) o Chop/reverse chop PNF sitting on exercise ball</td>
<td>● Prone hip extensions with knee extended, 5 lbs ankle weights bilaterally: 3 x 20 o Seated knee extensions, 5lbs ankle weights, bilaterally: 3 X20 o Ankle DF/FP with green band in seated position, bilaterally: 2 X 20</td>
<td>● 4 minute walking intervals with 1 minute rest time o 25% body weight bearing o 50% AAROM of ankle by PTA/PT o Speed 4.5</td>
</tr>
<tr>
<td>5</td>
<td>● Maintenance of functional ROM with passive stretching 30 seconds x 3 sets o All ranges for hip, knee, ankle</td>
<td>● Step forward and to the side in parallel bars o Reach 10 inches outside base of support (various activities) o Chop/reverse chop PNF sitting on exercise ball</td>
<td>● Quadraped hip extensions, 2 X 10 bilaterally o Seated knee extensions, 7lbs ankle weights, bilaterally: 3 X20 o Ankle DF/FP with green band in seated position, bilaterally: 2 X 20</td>
<td>● 5 minute walking intervals with 2 minute rest time o 25% body weight bearing o 25% AAROM of ankle by PTA/PT o Speed 4.5</td>
</tr>
<tr>
<td>6</td>
<td>● Maintenance of functional ROM with passive stretching 30 seconds x 3 sets o All ranges for hip, knee, ankle</td>
<td>● Step forward and to the side in standard walker o Maintain reach of at least 10 inches outside base of support (various activities) o Chop/reverse chop PNF sitting on exercise ball</td>
<td>● Sit to Stand with slow 3 count ascending, and 3 count descending 2 X 10 o Half lunges, bilaterally 2 X 10 o Ankle DF/FP with green band in seated position, bilaterally: 2 X 20</td>
<td>● 5 minute walking intervals with 2 minute rest time o 15% body weight bearing o 15% AAROM of ankle by PTA/PT o Speed 4.5</td>
</tr>
</tbody>
</table>
References


7 Reese NB, Bandy WD. *Joint Range of Motion and Muscle Length Testing*. 2nd ed. St. Louis, MO: Elsevier Health Sciences; 2009.


