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From Critical Care to Community: A Case Report on Guillain-Barré Syndrome Rehabilitation.

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ABSTRACT

Background: Guillain–Barré Syndrome (GBS) is an acute immune-mediated polyradiculoneuropathy characterized by progressive symmetrical limb weakness and areflexia. This case study documents the comprehensive rehabilitation of a 30-year-old male with severe GBS, detailing the transition from the intensive care unit to community reintegration over 10 months. The patient initially presented with quadriparesis and required prolonged ventilatory support due to respiratory complications. A structured neurophysiotherapy protocol was implemented across different phases of recovery. Key strategies encompassed pulmonary rehabilitation techniques, including chest Proprioceptive Neuromuscular Facilitation (PNF), breathing exercises, functional strengthening, and robotic-assisted therapy. Notable outcomes included enhanced muscle strength, respiratory function, and independence in daily activities. This case highlights the critical role of structured, individualized rehabilitation protocols in optimizing recovery for severe GBS patients, particularly those with prolonged ICU stays.

KEYWORDS- Guillain–Barré Syndrom, Critical care, Rehabilitation, Functional training, Community reintegration.

INTRODUCTION

. Guillain-Barré Syndrome (GBS), an acute inflammatory condition, which involves demyelination of peripheral and autonomic nerves, leading to acute sensory, motor, and autonomic dysfunctions (figure 1).1-2 A global epidemiological systematic review reports that the overall incidence of Guillain-Barré Syndrome (GBS) ranges from 1.1 to 1.8 per 100,000 individuals annually among adults. Furthermore, the incidence increases with age, rising from 1.7 per 100,000 per year in individuals aged 50 years and above to 3.3 per 100,000 per year.3 Thirty percent of patients with GBS develop respiratory failure and need ventilator support during hospitalization.4

Approximately 20% of patients categorized as "severely affected" are unable to walk unaided even six months post-onset.4 Additionally, many individuals continue to experience varying degrees of remains a significant challenge.1-2 Peripheral fatigue is primarily observed in GBS due to nerve damage, resulting in muscle weakness and rapid exhaustion due to dysfunction of the lower motor units leading to muscular fatigue and cardiovascular fatigue.5 GBS substantially impacts social life and the ability to carry out daily activities even years after the initial onset.6-7 Given these challenges, long-term rehabilitation is crucial in mitigating complications, enhancing recovery, and improving quality of life.[8] While various rehabilitation protocols have been

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explored, there remains a lack of well-defined guidelines for comprehensive GBS management.[8–10] This case report addresses this gap by presenting a structured rehabilitation protocol tailored for GBS patients across the acute, subacute, and chronic phases.

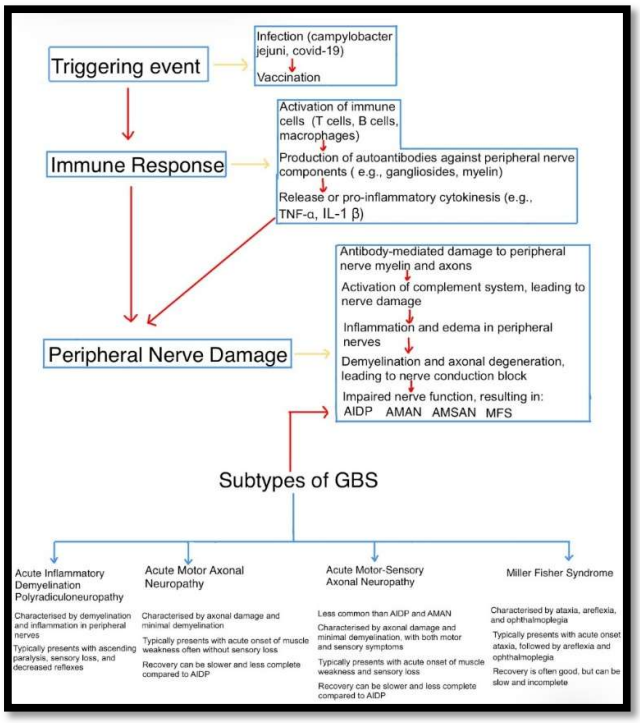

Figure 1: GBS cascade

CASE REPORT

History: A 30-year-old male, a chef by profession was referred to the Neuro-physiotherapy unit of Christian Medical College Ludhiana on March 2024, with complaints of progressive, symmetrical weakness predominantly affecting proximal muscles more than distal ones. He reported no sensory loss, breathlessness, facial deviation, loss of consciousness, recent fever, loose stools or any other signs of infections.

Investigations: A nerve conduction study revealed preserved sensory nerve conduction, absent F-wave, and absent H-reflex, suggesting a proximal conduction block or demyelination. These findings, along with motor nerve conduction abnormalities, supported a diagnosis of acute inflammatory demyelinating polyneuropathy (AIDP).

Medical Management: The patient received a 5-day intravenous immunoglobulin (IVIG) cycle. However, on the third day, his condition deteriorated, experiencing loss of consciousness and oxygen desaturation, necessitating oral intubation for two days. Despite initial stabilization, increasing respiratory distress required a tracheostomy on the fifth day. He was placed on volume control ventilation with FiO_2 set at 35% and PEEP at 5 cm H_2O. Autonomic dysfunction signs emerged, warranting a second IVIG cycle. Gradual respiratory improvement allowed ventilatory weaning, (table 1) but motor function remained unchanged. He was discharged from the ICU and later transitioned to outpatient physiotherapy.

5th day-20th days	21st day-36th day	37th day-50th day	51st day-64th day	65th day-79th day	80th day - 94th day	95th day onwards
Volume control mode FiO2 - 35%, PEEP - 5	CPAP	CPAP and BiPAP alternatively,	BiPAP	BiPAP to oxygen (12-6L)	Gradual weaning of oxygen support	Room air

PEEP- Positive end-expiratory pressure; CPAP-Continuous positive airway pressure; BiPAP-Bilevel Positive Airway Pressure; L-Liters

Table 1: Timeline of the patient's weaning from ventilator to room air.

Individual manual muscle test (MMT) was done by the physiotherapist to assess and note the progression of muscle strength.

Physiotherapy intervention:

ICU phase (0-3 months): The inpatient rehabilitation program included individualized, functional goal-oriented treatment, with approximately 5 hours of intervention a day, 7 days/week for a total of 12 weeks.11-12 The goals were decided based on the discussion with the physiotherapist, neurologists, and interventions:

- Weaning of ventilator
- Prevent secondary complications - muscle wasting, tightness, pneumonia, bedsore
- Improve vertical orientation

Each session was planned in a manner that allowed the patient to receive adequate rest before the next. Table 2 describes the protocol and the rational.

Other Further mobilization also contributed to in the removal of secretions.

The goals for the Out Patient Department (OPD) sessions were discussed with the caregivers to understand their expectations, which were as follows:

- Enhancing bed mobility
- Improving strength
- Improving functional status
- Maintaining bronchial hygiene and chest expansion
- Preventing secondary complications

Goals	Protocol	Rational
Weaning of ventilator	• Chest Proprioceptive Neuromuscular Facilitation (PNF) All techniques (15 reps x 2 sets), • Chest expansion exercises with towel (15 reps x 2 sets), • Sniff technique (15 reps x 2 sets), • Paper blowing of different thickness (15 reps x 2 sets) .	Chest PNF is based on Sherrington's Law of Successive Induction-involves the targeted stimulation of intrinsic respiratory muscles to enhance chest and diaphragmatic range of motion. The application of these techniques utilizes pressure and stretch to elicit a stretch reflex, thereby activating the respiratory muscles and facilitating improved respiratory movement and function. [13-14] breathing exercises mentioned above were given with an aim to improve chest expansion and strengthen respiratory muscles.[14-15]
Prevent secondary complications	• Electrical stimulation- surged faradic stimulation (30 contractions x 2 sets), • PNF for upper limb and lower limb (15 contractions x 2 sets), • Log rolling (15 reps x 2 sets), positioning.	PNF incorporates temporal summation, and spatial summation, where successive weak stimuli within a short period combine to trigger excitation applied simultaneously to different areas of the body collectively evoke a response.[16-17] Stimulation has been shown to preserve or restore muscle mass and epidermal thickness in lower motor neuro inflicted muscles. Findings from the RISE project reported a significant 75% increase in the

PNF-Proprioceptive neuromuscular facilitation; reps-repetitions.

Table 2: *Protocol and rational for the ICU sessions*

At 3 months gross motor movements of trunk and scapula initiation were noted during attempts to transition from side-lying to a supine position. Despite this progress, individual muscle strength assessments remained largely unchanged, except for the quadratus lumborum, which exhibited a strength of 2. The patient was on tracheostomy and required frequent suctioning with positional change but no drop in saturation was observed. A cautious approach was initially adopted, carefully considering the principle of overuse. This involved implementing fewer repetitions across multiple sets, with adequate rest periods, to build intensity while minimizing the risk of excessive strain progressively. However, during the chronic phase, repetitions were increased based on the findings of Khan F et al., which demonstrated that higher-intensity interventions yield promising outcomes[15,17-18]

The use of a tilt table provides several advantages, including improving chest expansion , improving weight-bearing in the lower limbs and muscle atrophy, and the facilitation of antigravity limb exercises to muscle activation.[19] Neuromuscular Electrical Stimulation (NMES) was employed to prevent muscle atrophy in patients with limited voluntary control, facilitating targeted muscle activation and neuromuscular re-education.[15] Robotic therapy was employed to enhance the number of repetitions for the forearm and hand, initially with mild assistance, progressing to independent movements.[19] As muscle endurance increased exercises were prescribed in fundamental positions, with a gradual progression to derived positions, to promote co-contraction of muscles and improve stability and control.[20]

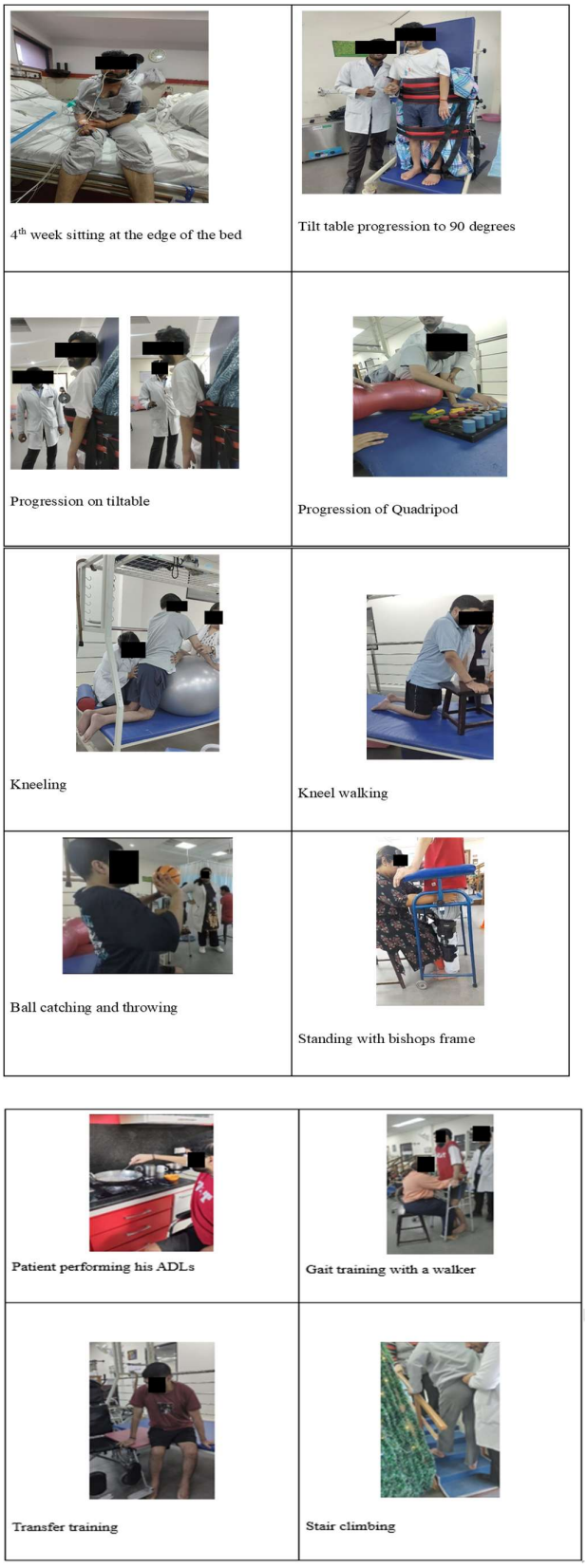

Figure 2: Patients journey from critical care to community.

RESULTS

1. Respiratory System: The comprehensive rehabilitation program helped prevent pneumonia and other ventilator-associated complications. The patient demonstrated improved secretion clearance and chest expansion, particularly with upright sitting. Fatigue management was achieved through frequent rest periods during activities. Over time, therapy focused on increasing activity tolerance and reducing perceived exertion levels.

2. Manual Muscle Testing (MMT): In the initial stages, lower extremity muscle strength was minimal, with grades of 0 or 1, indicating trace movement. By the 10th month, major muscle groups, particularly the quadriceps and gluteals, reached grade 2+. Similarly, the upper extremity initially exhibited significant weakness, with most muscles rated at grade 0 or 1. As recovery progressed, strength gradually improved to grades 2 or 2+ in key muscles such as the biceps, deltoids, and trapezius. By the 10th month, several muscle groups, including the biceps and triceps, achieved grades of 3 or higher.

3. Functional Activities: Initially, the patient required partial or full assistance with daily activities such as dressing, grooming, and toileting. Rehabilitation led to increasing independence, with key milestones including the ability to sit independently after 3 months and performing self-care tasks with minimal assistance by the 7th month. Transfer training emphasized safe movement between surfaces, initially requiring assistance and later progressing toward independence. Early interventions included the use of a tilt table, suspension therapy, and transfer boards to facilitate mobility. As strength improved, reliance on assistive devices decreased, and by the 7th month, the patient was able to use a walker with reduced support. Independent activities of daily living (IADLs), such as cooking and using a mobile phone, were gradually introduced. Figure 2 illustrates the patient's transition from critical care to an outpatient basis.

4. Walking: Gait training began in the 7th month with a walking frame, progressing to a walker by the 10th month. During this phase, the patient exhibited hip hiking as a compensatory strategy due to hip flexor weakness, assisting in limb

advancement during the swing phase. Additionally, dorsiflexor weakness necessitated greater effort from the hip flexors, further contributing to hip hiking as an adaptation to limited hip flexor strength.

DISCUSSION

To the author's knowledge, this is the first case study to detail the rehabilitation protocol for a patient with severe GBS, encompassing the journey of 10 months from intensive care unit to reintegration into the community. Improvements were observed on muscle strength (i.e. respiratory and peripheral) and functional independence.

During critical care, the focus was on weaning from ventilation and preventing complications using pulmonary rehabilitation techniques such as chest PNF, breathing exercises, spirometry, sniff techniques, and chest expansion exercises. Previous studies on GBS have reported that pulmonary rehabilitation, especially chest PNF has contributed to improving diaphragm strength and pulmonary function,[12-15] while we were unable to objectively measure the contribution of these interventions to the successful weaning process, the patient notably did not develop pneumonia despite the heightened risk associated with prolonged ventilatory support. Additionally, this favorable outcome could be attributed to implementation of comprehensive pulmonary rehabilitation, frequent positioning, and oral hygiene. Although mobilization efforts were delayed until the resolution of autonomic involvement permitted upright sitting and tilt table after the first month, included frequent variations in head-end elevation that were monitored and positional changes. These measures may have further mitigated the risks associated with immobility and ventilator-associated pneumonia.

Further the OPD basis focused on gradually increasing in the intensity as it was reported that higher intensity of training improves functional outcomes in GBS.[22] Literature focuses on the progressive strengthening of individual muscles among GBS patients, which at the acute phase in this case considering the muscle strength was less than 2 in the OPD phases.[21,25-27] However we did not adhere solely to passive movements, our protocol focused on challenging the patient through fundamental positions, on the tilt table or mat, with gradual progression to derived positions.[15, 21] This approach aimed to facilitate the co-contraction of multiple muscle groups and stimulating antigravity muscles simultaneously.

Challenges & Future Considerations

One of the key limitations of this case study was the lack of comprehensive quantitative assessments, which restricted the ability to refine and enhance the rehabilitation protocol further. However, the study provides a structured rehabilitation framework, detailing the dosage and progression of interventions from the acute to chronic phases. This contributed significantly to the patient's clinical improvements (Figure 2).

Future studies should incorporate objective outcome measures to better assess the effectiveness of rehabilitation strategies for severe GBS. Additionally, exploring the impact of early mobilization and high-intensity training on long-term functional recovery could provide valuable insights for optimizing rehabilitation protocols.

CONCLUSION

This case study highlights the essential role of neuro-physiotherapy in the management of GBS, particularly for patients requiring prolonged ventilatory support. A structured rehabilitation program, incorporating pulmonary rehabilitation, and functional exercises, led to notable improvements in the patient's strength, mobility, and quality of life. The absence of pneumonia, and other secondary complications underscores the effectiveness of targeted interventions based on carefully dosed rehabilitation strategies. These findings emphasize the need for early, intensive, and progressive rehabilitation to optimize recovery in severe GBS. This case offers insights for clinicians in designing individualized protocols that integrate pulmonary care, strengthening, and functional training. Future research should focus on standardizing rehabilitation frameworks to improve long-term outcomes.

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