DOI: 10.7860/JCDR/2026/82891.24466

Case Report

Physiotherapy Section

From Paralysis to Play: A Case Report on Neurorehabilitation and Robotic Assisted Training in Paediatric Guillain-Barré Syndrome

RIYA DILIP BHATT[1], PRITI NISHEET AGNI[2]

ABSTRACT

Guillain-Barré Syndrome (GBS) is a post-infectious, immune-mediated polyneuropathy affecting motor, sensory, and occasionally autonomic nerves. Paediatric GBS is rare, with limited literature on advanced rehabilitation strategies. The present case highlights the role of hybrid rehabilitation, including robotic-assisted therapy, in a four-year-old female child with GBS. The rehabilitation timeline, referenced from symptom onset, included early hospital presentation, initiation of inpatient physiotherapy, emergence of motor recovery and transition to outpatient rehabilitation services from Day 25 onwards where the child presented with generalised hypotonia, muscle wasting (notably in the thenar, hypothenar, and quadriceps), and diminished deep tendon reflexes. Breathing was thoracic with pectus carinatum and reduced bilateral air entry. No sensory deficits or cranial nerve involvement were observed on the 25th day of assessment. Nerve conduction studies revealed absent F-waves in the right median, ulnar, and bilateral peroneal and tibial nerves, indicating a generalised non length-dependent pure motor axonal polyradiculopathy, consistent with the Acute Motor Axonal Neuropathy (AMAN) variant of GBS. Differential diagnoses such as transverse myelitis and poliomyelitis were ruled out. A 20-week phased rehabilitation protocol was implemented, consisting of conventional physiotherapy, task-specific strength training, and robotic-assisted therapy using the Rymo mobi-L device. The program included five stages: initial strengthening and advanced Neurodevelopmental Treatment (NDT), gait training, robotic-assisted training, dynamic balance, and endurance training. Progressive improvements were seen in tone (normalised by week 9), reflexes, and muscle strength. Functional mobility improved significantly, with the child returning to school by week 20. The present case demonstrates that early, structured, and technologically supported rehabilitation can significantly enhance recovery in paediatric GBS, especially in severe motor variants like AMAN.

Keywords: Acute motor axonal neuropathy, Muscle weakness, Paediatrics

CASE REPORT

A four-year-old female presented to the Inpatient Department (IPD) with rapidly progressive difficulty in sitting, standing, walking, and performing fine motor tasks, which began as bilateral lower limb weakness and progressed within 48 hours to poor neck holding and dysphagia. Examination revealed generalised hypotonia, quadriparesis (0/5 power), diminished reflexes, and sensation.

One month earlier, she had acute gastroenteritis, suggesting a post-infectious trigger with no other medical history reported by the informants.

Nerve conduction studies: This confirmed AMAN [Table/Fig-1-3] variant of GBS.

Sensory conduction study [Table/Fig-1]: Right median, ulnar sensory Nerve Conduction Study (NCS) showed Sensory Nerve Action Potential (SNAP) with normal latency, normal amplitude, and normal conduction velocity. Bilateral Sural, superficial NCS showed SNAPs with normal latency, normal amplitude, and normal conduction velocity.

Motor conduction Study [Table/Fig-2]: Motor nerve conduction studies revealed reduced Compound Muscle Action Potential (CMAP) amplitudes in the right median, bilateral peroneal, and bilateral tibial nerves, with preserved conduction velocities. The right median nerve additionally showed prolonged distal latency. The right ulnar nerve motor response was absent.

F-Wave and H Reflex Study [Table/Fig-3]: F-wave responses were absent in the right median, right ulnar, and bilateral peroneal and tibial nerves. These findings, in conjunction with motor NCS results, are consistent with a generalised non length-dependent pure motor axonal polyradiculopathy.

Child was treated with Intravenous Immunoglobulin (IVIG) at a standard dose of 2 g/kg over three days. The child subsequently showed improvement in upper limb power 3/5, lower limb power 2/5, with resolution of dysphagia.

At discharge, she was stable, feeding orally, continent, and referred for physiotherapy and occupational therapy. Preceding gastrointestinal infection, along with nerve conduction velocity findings of isolated compound muscle action potential involvement with preserved sensory nerve action potentials, supported a post-infectious aetiology of the AMAN variant of GBS [Table/Fig-1-3].

Following discharge, the patient presented to the Outpatient Department (OPD) on the 25th day after symptom onset, at which time the following clinical findings were recorded in the supine position. The clinical findings recorded showed muscle wasting at the thenar and hypothenar eminences and bilaterally at the quadriceps muscles. Vitals were stable; the child was alert with no speech, hearing, or visual deficits. Examination revealed pectus carinatum with thoracic breathing. Initial chest expansion was 0.5 inches at all levels, improving to one inch by week 3. Air entry reduced in middle and lower zones, became equal bilaterally by week 3. Sensations were intact. Deep tendon reflexes were diminished (C5-C6, C7-C8, L2-L4) indicating generalised hyporeflexia [Table/Fig-4]. Tone was initially flaccid/floppy [Table/Fig-5]. The overall timeline is explained in [Table/Fig-6].

Therapeutic Intervention

Phase 1: (Week 1-2): Rehabilitation focused on bed mobility training (supine-side-lying-sitting, prone on elbows/hands), progressing to kneel sitting and kneel standing for postural control. Respiratory

Sensory nerve conduction study									
Site	Lat.1 (ms)	Lat.2 (ms)	Amp	Area	Stimulation (mA)	Segment	Dist. (mm)	Interval (ms)	NCV (m/s)
Median-right									
Wrist	1.9	2.9	88.1 uV	4.8 uVms	16.0	Wrist	70	1.9	37.6
Ulnar-right									
Wrist	1.4	1.8	35.9 uV	0.4 uVms	22.0	Wrist	60	1.4	43.5
Sural-left									
Sural	2.2	1.7	51.3 uV	2.3 uVms	8.0	Sural	80	2.2	36.0
Sural-right									
Sural	1.7	2.2	49.6 uV	2.0 uVms	8.0	Sural	80	2.2	46.5
Superficial peroneal left									
Superficial peroneal	1.7	2.3	204 uV	0.8 uVms	16.0	Superficial Peroneal	90	1.7	52.3
Superficial peroneal right									
Superficial peroneal	1.8	2.3	28.9 uV	1.4 uVms	15.0	Superficial Peroneal	90	1.6	50.9

[Table/Fig-1]: Summary of sensory nerve conduction study parameters interpreted using age-appropriate reference values for children aged 3-5 years: Nerve Conduction Velocity (NCV) ≥40-50 m/s (median, ulnar, superficial peroneal) and ≥35-45 m/s (sural) (Preston DC, Shapiro BE. Electromyography and Neuromuscular Disorders: Clinical-Electrophysiologic Correlations. 3rd edition. Elsevier; 2013).

Motor Nerve Conduction Study									
Site	Latency	Duration	Amplitude	Area	Stimulation (mA)	Segment	Distance (mm)	Interval (ms)	NCV (m/s)
Median-right									
Wrist	4.6	8.1	2.4 mV	7.1 mVms	27.0	Wrist		4.6	
Elbow	8.2	8.6	1.5 mV	5.0 mVms	35.0	Wrist-elbow	130	3.6	36.1
Ulnar-right									
Wrist					41.0	Wrist			
B.Elbow					41.0	Wrist-b.elbow			
A.Elbow					41.0	Wrist-a.elbow			
Mid Arm					41.0	A.elbow- Mid Arm			
						Mid arm			
Peroneal-left									
Ankle	3.9	10.5	0.4 mV	1.9 mVms	52.0	Ankle		3.9	
Head of fibula	8.7	10.8	0.4 mV	2.3 mVms	71.0	Ankle head of fibula	200	4.9	41.2
Peroneal-right									
Ankle	5.8	10.6	0.6 mV	2.6 mVms	57.0	Ankle		5.8	
Head of fibula	9.3	10.3	0.6 mV	2.6 mVms	57.0	Ankle-head of fibula	200	3.5	57.1
Tibial-left									
Ankle	4.0	12.0	0.3 mV	1.1 mVms	44.0	Ankle		4.0	
Popliteal	9.2	10.2	0.2 mV	1.3 mVms	78.0	Ankle-popliteal	220	5.2	42.7
Tibial-right									
Ankle	4.7	9.0	0.7 mV	2.8 mVms	79.0	Ankle		4.7	
Popliteal	9.5	10.3	0.6 mV	2.3 mVms	100.0	Ankle-popliteal	220	4.8	45.8

[Table/Fig-2]: Summary of motor nerve conduction study findings for the right median, right ulnar, bilateral peroneal, and left tibial nerves.

training included thoracic expansion, diaphragmatic facilitation, and incentive spirometry (200 mL target).

Strengthening involved gravity-assisted core activation (transverse abdominis, obliques) and closed-chain bridging. ROM exercises were given to prevent contractures in hands, feet, and digits.

Interrupted Galvanic stimulation was applied to key upper and lower limb muscles (hand/forearm flexors-extensors, tibialis anterior, Extensor hallucis longus, Extensor Digitorum longus).

Phase 2: Week 3-5 advance neurodevelopment technique and gait training: Rehabilitation progressed to advanced NDT-half kneeling to standing, sit-to-stand, standing balance and gait training with pelvis as key point of control. Walking began with a posterior walker, later advancing to treadmill walking with pelvic facilitation. Stair climbing with NDT was introduced with therapist support for alignment and coordination. Respiratory training with incentive spirometry (350 mL) was continued. Strengthening included shoulder pushes on bolster, multiple angle isometrics for upper/lower limbs and IG stimulation with shorter pulse duration.

Phase 3: Weeks 6-9 robotic assisted training and core strengthening: Robotic-assisted training with the Rymo Mobi-L system [Table/Fig-7-9] (30 min, 3 days/week) targeting upper limb [Table/Fig-10] and lower limb [Table/Fig-11] movements in a gamified format as shown in IG stimulation (short pulse) continued, with surge faradic stimulation for bilateral dorsiflexors. Core strengthening progressed to gravity-resisted training, along with PNF D1-D2 patterns for upper and lower limbs. Lower limb strengthening included wall squats and partial lunges (5-10 sec hold). Respiratory training advanced with spirometry, reaching a 650 mL target volume.

Balance training progressed from stable surface standing (eyes open/closed, feet apart and together and tandem) to dynamic tasks. Hand strength and coordination were improved through sponge water transfer and playdough/therapy putty exercise with graded resistance to strengthen intrinsics muscles for pencil grip and control.

F-Wave			
Nerve	**Median**	**Side**	**Right**
Stim Site	Wrist	Recording Site	Abductor Pollicis Brevis
M-Latency		F-Occurrence	0/7,0%
	Min	Max	Mean
F-Latency	-	-	-
Nerve	**Ulnar**	**Side**	**Right**
Stimulation Site	Wrist	Recording Site	Abductor Digiti Minimi
M-Latency		F-Occurrence	0/7,0%
	Min	Max	Mean
F-Latency	-	-	-
Nerve	**Peroneal**	**Side**	**Left**
Stimulation Site	Ankle	Recording Site	Abductor hallucis
M-Latency		F-Occurrence	0/7,0%
	Min	Max	Mean
F-Latency	-	-	-
Nerve	**Peroneal**	**Side**	**Right**
Stimulation site	Ankle	Recording site	Abductor hallucis
M-Latency		F-Occurrence	0/7,0%
	Min	Max	Mean
F-Latency	-	-	-
Nerve	**Tibial**	**Side**	**Left**
Stimulation site	Ankle	Recording site	Abductor hallucis
M-Latency		F-Occurrence	0/6,0%
	Min	Max	Mean
F-Latency	-	-	-
Nerve	**Tibial**	**Side**	**Right**
Stimulation site	Ankle	Recording site	Abductor hallucis
M-Latency		F-Occurrence	0/6,0%
	Min	Max	Mean
F-Latency	-	-	-

[Table/Fig-3]: F-wave study of the median, ulnar, peroneal, and tibial nerves recorded from standard muscles following routine stimulation at the wrist and ankle. No reproducible F-wave responses were obtained bilaterally.

Phase 4: Weeks 10-15 increased resistance and dynamic balance: Robotic training progressed to resistive mode [Table/Fig-7,8] (Upper and Lower limbs 30 mins, 3 day/week, gamified format). Strengthening included inclined wall push-ups (upper limbs), weight-cuff exercises for lower limbs, full squats/lunges, and step-ups on a Bosu Ball. Balance training advanced to unstable surfaces (tilt board, Bosu Ball) with eyes open/closed, feet apart and together, incorporating strategy training.

Phase 5 Week 16-20 endurance training and retraining for school: Endurance and school-readiness training included treadmill walking with incline/speed, wall ladder climbing (upper body/grip), and frog jumps for lower limb power. Functional tasks involved obstacle courses on varied terrain for coordination and balance. Fine motor skills were targeted with tweezer transfers, sticker peeling/ placement, lacing cards, bead stringing, and tracing/ pre-writing shapes to improve pincer grasp, dexterity, and pencil control.

Follow-up and Outcome Measures

To assess the intervention adherence and tolerance every session pre post vitals were assessed for the child. Deep tendon reflex as mentioned in [Table/Fig-4], muscle tone using Modified Ashworth Scale as mentioned in [Table/Fig-5] were measured at 3rd 6th 9th 12th and 15thweek [1].

Functional Disability using GBS Disability Index (also referred as Hughes Scale) as mentioned in [Table/Fig-12] [2] and muscle strength were assessed from 3rd to 15th week, respectively [Table/Fig-13].

Muscle strength was assessed using Manual Muscle Testing (MMT) [Table/Fig-13]. The grading system described by Hislop, Avers, and Brown in Daniels and Worthingham's Muscle Testing was used for muscles where resistance testing was difficult, employing the qualitative grades trace, poor, fair, good, and normal [Table/Fig-14]. For detailed strength evaluation with numerical grading and intermediate levels (±), the criteria described by Magee in Orthopaedic Physical Assessment were followed [Table/Fig-15] [3,4].

DISCUSSION

The present case report describes a structured, multimodal rehabilitation protocol for a 4-year-old with AMAN-variant GBS. Over 15 weeks, intervention was progressively adapted according to the child's

	Right					Left				
Deep tendon reflex	**3rd week**	**6th week**	**9th week**	**12th week**	**15th Week**	**3rd week**	**6th week**	**9th week**	**12th week**	**15th week**
Biceps	1+	1+	2+	2+	2+	1+	1+	2+	2+	2+
Triceps	1+	2+	2+	2+	2+	1+	2+	2+	2+	2+
Supinator	2+	2+	2+	2+	2+	2+	2+	2+	2+	2+
Knee	1+	1+	2+	2+	2+	1+	1+	2+	2+	2+
Ankle	2+	2+	2+	2+	2+	2+	2+	2+	2+	2+

[Table/Fig-4]: Deep tendon reflex assessed from 3rd to 15th week.

	Right-side					Left-side				
Muscle group	**3rd week**	**6th week**	**9th week**	**12th Week**	**15th Week**	**3rd week**	**6th week**	**9th week**	**12th week**	**15th week**
Shoulder flexor	Normotonic	Normotonic	Normotonic	Normotonic	Normotonic	Normotonic	Normotonic	Normotonic	Normotonic	Normotonic
Shoulder extensor	Normotonic	Normotonic	Normotonic	Normotonic	Normotonic	Normotonic	Normotonic	Normotonic	Normotonic	Normotonic
Shoulder abductor	Normotonic	Normotonic	Normotonic	Normotonic	Normotonic	Normotonic	Normotonic	Normotonic	Normotonic	Normotonic
Shoulder adductor	Hypotonic	Normotonic	Normotonic	Normotonic	Normotonic	Hypotonic	Normotonic	Normotonic	Normotonic	Normotonic
Shoulder lateral rotator	Normotonic	Normotonic	Normotonic	Normotonic	Normotonic	Normotonic	Normotonic	Normotonic	Normotonic	Normotonic
Shoulder medial rotator	Hypotonic	Normotonic	Normotonic	Normotonic	Normotonic	Hypotonic	Normotonic	Normotonic	Normotonic	Normotonic
Elbow flexor	Hypotonic	Normotonic	Normotonic	Normotonic	Normotonic	Hypotonic	Normotonic	Normotonic	Normotonic	Normotonic
Elbow extensor	Normotonic	Normotonic	Normotonic	Normotonic	Normotonic	Normotonic	Normotonic	Normotonic	Normotonic	Normotonic
Forearm pronator	Hypotonic	Normotonic	Normotonic	Normotonic	Normotonic	Hypotonic	Normotonic	Normotonic	Normotonic	Normotonic
Forearm supinator	Normotonic	Normotonic	Normotonic	Normotonic	Normotonic	Normotonic	Normotonic	Normotonic	Normotonic	Normotonic

Wrist flexor	Normotonic	Normotonic	Normotonic	Normotonic	Normotonic	Normotonic	Normotonic	Normotonic	Normotonic	Normotonic
Wrist extensor	Normotonic	Normotonic	Normotonic	Normotonic	Normotonic	Normotonic	Normotonic	Normotonic	Normotonic	Normotonic
Hip flexor	Hypotonic	Normotonic	Normotonic	Normotonic	Normotonic	Hypotonic	Normotonic	Normotonic	Normotonic	Normotonic
Hip extensor	Hypotonic	Hypotonic	Normotonic	Normotonic	Normotonic	Normotonic	Hypotonic	Normotonic	Normotonic	Normotonic
Hip abductor	Normotonic	Normotonic	Normotonic	Normotonic	Normotonic	Hypotonic	Normotonic	Normotonic	Normotonic	Normotonic
Hip adductor	Hypotonic	Hypotonic	Normotonic	Normotonic	Normotonic	Hypotonic	Hypotonic	Normotonic	Normotonic	Normotonic
Hip lateral rotator	Hypotonic	Normotonic	Normotonic	Normotonic	Normotonic	Hypotonic	Normotonic	Normotonic	Normotonic	Normotonic
Hip medial rotator	Hypotonic	Hypotonic	Normotonic	Normotonic	Normotonic	Hypotonic	Hypotonic	Normotonic	Normotonic	Normotonic
Knee flexor	Hypotonic	Normotonic	Normotonic	Normotonic	Normotonic	Hypotonic	Normotonic	Normotonic	Normotonic	Normotonic
Knee extensor	Hypotonic	Normotonic	Normotonic	Normotonic	Normotonic	Hypotonic	Normotonic	Normotonic	Normotonic	Normotonic
Ankle Plantar flexor	Normotonic	Normotonic	Normotonic	Normotonic	Normotonic	Normotonic	Normotonic	Normotonic	Normotonic	Normotonic
Ankle dorsiflexor	Normotonic	Normotonic	Normotonic	Normotonic	Normotonic	Normotonic	Normotonic	Normotonic	Normotonic	Normotonic

[Table/Fig-5]: Muscle Tone - Modified Ashworth Scale. (MAS) assessed from 3rd to 15th week

Date	Event
Day 0	Onset of motor weakness
Day 3	Presented to paediatric neurology unit
Day 4	Nerve conduction studies performed
Day 5	Diagnosed with AMAN variant of GBS
Day 6	Initiated IVIG therapy
Day 7-21	Supportive care and physiotherapy started
Day 21 onwards	Gradual motor recovery observed
Day 25 onwards	Physiotherapy treatment at the outpatient department was started.
Day 40 onwards	The child was able to walk 10 m with walking aid (posterior walker)
Day 63 onwards	Able to walk 10 meters or more without assistance, but unable to run.
Day 84 onwards	Minimal signs and symptoms, able to run

[Table/Fig-6]: Time line of events and recovery.

[Table/Fig-7]: Upper limb pronation supination component of Rymo-Mobi-L machine.

[Table/Fig-8]: Rymo-Mobi-L machine

[Table/Fig-9]: Lower limb ankle dorsiflexion-plantarflexion component.

[Table/Fig-10]: Showing foot rehabilitation using Rymo Mobi-L device.
[Table/Fig-11]: Showing hand rehabilitation using Rymo Mobi-L device.

GBS Disability Index/Hughes scale	3rd weeks	6th weeks	9th weeks	12th weeks	15th weeks
	4 (Bed bound)	3 (Able to walk 5 m with walking aid or support)	2 (Ambulates independently (at least 5 m across an open space but incapable of manual work/ running)	1 (Minimal signs and symptoms, able to run)	1 (Minimal Signs and symptoms, able to run

[Table/Fig-12]: Functional mobility of the child at 3, 6, 9, 12, 15 weeks using GBS Disability Index (also referred as Hughes Scale) [2].

strength, tone, and functional recovery. The program integrated IVIG therapy, NDT-based rehabilitation, strengthening electrical stimulation, respiratory training, and robotic-assisted therapy.

Early IVIG treatment (2 g/kg over 3 days) is consistent with paediatric GBS guidelines and is well documented to reduce immune-mediated nerve injury and accelerate recovery [5]. Most children achieve near-complete recovery within a year, though outcomes depend on disease severity, timing of treatment, and complications [5].

Muscle	Right					Left				
	3rd week	6th week	9th week	12th week	15th week	3rd week	6th week	9th week	12th week	15th week
Shoulder flexor	2+	3	3	3+	4	2+	3	3	3+	4
Shoulder extensor	2+	3	3	3+	3+	2+	3	3	3+	3+
Shoulder abductor	2+	3	3	3+	4	2+	3	3	3+	4
Shoulder adductor	2+	3	3	3+	4	2+	3	3	3+	4
Elbow flexor	2+	3+	3+	4	4	2+	3+	3+	4	4
Elbow extensor	2-	3	3+	4	4	2-	3	3+	4	4
Wrist flexor	2+	3	3	4	4	2+	3	3	4	4
Wrist extensor	2-	3	3	4	4	2-	3	3	4	4
Extensor indices	0	Trace	Trace	Poor	Fair	0	Trace	Poor	Good	Good
Dorsal interossei	0	0	Trace	Poor	Fair	0	Trace	Trace	Poor	Fair
Palmar interossei	0	0	Trace	Poor	Fair	0	Trace	Trace	Poor	Fair
Flexor digitorum Profundus	Trace	Poor	Poor	Fair	Good	Trace	Poor	Poor	Fair	Good
Flexor digitorum superficialis	Trace	Poor	Poor	Fair	Good	Trace	Poor	Poor	Fair	Good
Flexor pollicis longus and brevis	0	Trace	Trace	Poor	Fair	0	Trace	Trace	Poor	Fair
Abductor pollicis	0	0	Trace	Poor	Fair	0	0	Trace	Poor	Fair
Opponens pollicis	0	0	Trace	Poor	Fair	0	0	Trace	Poor	Fair
Hip flexor	2	2+	3-	3	3+	2	2+	3-	3+	4
Hip extensor	2-	2+	2+	3	3+	2-	2+	3-	3	3+
Hip abductor	2	2+	2+	3	3+	2	2+	2+	3	3+
Knee flexor	0	2-	2+	3	3	0	2-	2+	3	3
Knee extensor	2+	3+	4	4	4	2+	3+	4	4	4
Gastro-soleus	2+	3+	3+	4	4	2+	3+	3+	4	4
Tibialis anterior	0	Trace	Trace	Poor	Fair	0	Trace	Trace	Poor	Fair
Peroneus tertius	0	0	Trace	Poor	Fair	0	0	Trace	Poor	Fair
Tibialis posterior	0	0	Trace	Poor	Poor	0	0	Trace	Poor	Poor
Peroneus longus	0	0	Trace	Poor	Poor	0	0	Trace	Poor	Poor
Extensor hallucis longus	0	Trace	Trace	Poor	Poor	0	Trace	Trace	Poor	Poor
Flexor hallucis longus and brevis	0	Poor	Poor	Fair	Poor	0	Poor	Poor	Fair	Fair
Trunk flexor	0		2		3	3	4			
Trunk extensor	0		2		3	3	4			

[Table/Fig-13]: Strength assessment using Manual Muscle Testing (MMT) for upper limb and lower limb muscles, trunk flexor, and extensor [3].
Trunk flexor and extensor muscle strength is assessed as a single midline measurement, right/left laterality is not applicable

Grade	Description
Normal (N)	Completes full ROM against gravity and maximal resistance
Good (G)	Completes full ROM against gravity and moderate resistance
Fair (F)	Completes full ROM against gravity only, no resistance
Poor (P)	Completes full ROM in gravity-eliminated position
Trace (T)	Palpable or visible muscle contraction, no joint movement
Zero	No muscle contraction detected

[Table/Fig-14]: Manual Muscle Testing (MMT) grading adapted from Daniels and Worthingham's Muscle Testing [2].

Grade	Description
0	No muscle contraction detected
1	Palpable or visible muscle contraction, no joint movement
2-	Less than half ROM in gravity-eliminated position
2	Partial ROM in gravity-eliminated position
2+	Full ROM in gravity-eliminated position
3-	More than half ROM against gravity
3	Full ROM against gravity without resistance
3+	Full ROM against gravity and holds against minimal resistance
4	Full ROM against gravity with moderate resistance
5	Full ROM against gravity with maximum resistance

[Table/Fig-15]: Manual Muscle Testing (MMT) adapted from Magee's Orthopaedic Physical Assessment [3].

Rehabilitation began with bed mobility, NDT postural transitions, and respiratory training targeting secondary prevention and early activation [6]. As recovery progressed, sit-to-stand, gait training, stair climbing and treadmill walking were introduced, emphasising pelvic control for alignment and efficient movement [7]. Treadmill practice also stimulated central pattern generators, reinforcing rhythmic stepping patterns and motor relearning [8].

Electrical stimulation (IG and surge faradic) was employed to maintain excitability in denervated muscles, prevent atrophy and facilitate reinnervation, particularly of dorsiflexors to counter foot drop [9].

Strengthening advanced from gravity-assisted to PNF patterns, resisted squats, lunges, wall push-ups, and weight-cuff exercises [10,11].

A key highlight of this case was the use of robotic assisted rehabilitation (Rymo Mobi-L system) from week 6 [Table/Fig-7-11]. Robotic devices provide intensive, repetitive, task specific training in a safe and controlled manner, which is crucial in paediatric neurorehabilitation [12-14].

Initially, the system was used in assistive mode, guiding the child's shoulder and hip movements (flexion-extension, abduction-adduction) [14]. This early phase reduced physical effort while allowing high-repetition practice, stimulating neuroplasticity. The gamified interface (Traffic Race, Jumping Doodle, Spider Infiltration) enhanced motivation, engagement, and adherence critical for young children with limited attention spans [14].

From week 10, robotic therapy advanced to resistive mode, where resistance was progressively increased according to performance [Table/Fig-10,11]. This allowed application of the progressive overload principle, fundamental to muscle hypertrophy and functional strength gains. Combining robotic assisted therapy thus provided a unique balance of precision, intensity, safety and motivation, complementing conventional physiotherapy and accelerating recovery [Table/Fig-7-11] [14].

Balance training progressed from stable stance to unstable platforms (tilt board, Bosu Ball), integrating strategy training for postural control and dynamic stability [15].

Functional retraining for school-readiness (fine motor activities such as tweezer transfer, sticker placement, tracing, and bead stringing) helped restore dexterity, handwriting control, and endurance for classroom activities [16].

The present case underscores the importance of an early, intensive, and multidisciplinary rehabilitation approach in paediatric AMAN-variant GBS. The integration of conventional physiotherapy with electrical stimulation and robotic-assisted therapy demonstrates that technology-augmented rehabilitation can safely enhance intensity, engagement, and functional outcomes in young children. Early initiation of rehabilitation alongside immunotherapy may shorten recovery time and reduce long-term disability.

While the present case demonstrates promising outcomes, larger controlled studies are needed to establish standardised rehabilitation protocols for paediatric GBS, particularly regarding the optimal timing, dosage, and cost-effectiveness of robotic-assisted therapy.

REFERENCES

[1] Harb A, Margetis K, Kishner S. Modified Ashworth Scale. [Updated 2025 Apr 4]. In: StatPearls [Internet]. Treasure Island (FL): StatPearls Publishing; 2026 Jan-. Available from: https://www.ncbi.nlm.nih.gov/books/NBK554572/.

[2] Hughes RAC, Cornblath DR, Jacobs BC, van Doorn PA. Guillain-Barré Syndrome disability scale. Journal of the Peripheral Nervous System. 2025;30(4):e70064.

[3] Hislop HJ, Avers D, Brown M. Daniels, and Worthingham's Muscle Testing: Techniques of Manual Examination and Performance Testing. 9th ed. St. Louis: Elsevier; 2014.

[4] Magee DJ. Orthopedic Physical Assessment. 5th ed. St. Louis: Saunders Elsevier; 2007.

[5] Savithri Nandeesha S, Kasagga A, Hawrami C, Ricci E, Hailu KT, Salib K, et al. Treatment efficacy of plasmapheresis versus intravenous immunoglobulin in Guillain-Barré syndrome management: A systematic review. Cureus. 2024;16(3):e57066.

[6] Sulli S, Scala L, Berardi A, Conte A, Baione V, Belvisi D, et al. The efficacy of rehabilitation in people with Guillain-Barrè syndrome: A systematic review of randomized controlled trials. Expert Review of Neurotherapeutics. 2021;21(4):455-61.

[7] Yousef NM, Adejumo DK, Hazari A, Kandakurti PK. A structured rehabilitation program for functional recovery in Guillain–Barré syndrome: A case report. Journal of Medical Case Reports. 2025;19(1):450.

[8] Su H, Jing L, Lv D, Huan Z, Xu W. Central pattern generators in spinal cord injury: Mechanisms, modulation, and therapeutic strategies for motor recovery. JOR spine. 2025;8(3):e70100.

[9] Harbo T, Markvardsen LK, Hellfritzsch MB, Severinsen K, Nielsen JF, Andersen H. Neuromuscular electrical stimulation in early rehabilitation of Guillain-Barré syndrome: A pilot study. Muscle Nerve. 2019;59(4):481-84.

[10] Nguyen PT, Chou LW, Hsieh YL. Proprioceptive neuromuscular facilitation-based physical therapy on the improvement of balance and gait in patients with chronic stroke: A systematic review and meta-analysis. Life (Basel). 2022;12(6):882.

[11] Kiper P, Chevrot M, Godart J, Cieélik B, Kiper A, Regazzetti M, et al. Physical exercise in Guillain-Barré Syndrome: A scoping review. Journal of Clinical Medicine. 2025;14(8):2655.

[12] Martino Cinnera A, D'Arienzo M, Piatti D, Casagrande Conti L, Deledda P, Tenore A, et al. Robot-assisted therapy in Guillain-Barrè Syndrome: Systematic review of primary evidence and study protocol for a randomized clinical trial. Journal of Clinical Medicine. 2024;13(23):7153.

[13] Yabuki J, Yoshikawa K, Koseki K, Ishibashi K, Matsushita A, Kohno Y. Improvement of functional mobility using a hip-wearable exoskeleton robot in Guillain-Barré syndrome with residual gait disturbance: A case report. Cureus. 2024;16(7):e63882.

[14] Rymo Technologies. Mobi-L: Robotic and VR-based rehabilitation system. Navi Mumbai (IN): Rymo. Available from: https://www.rymo.in/product/mobi-l.

[15] Chandra BM, Reddy NK, Balne NK, Gadde LP. Role of balance training in bilateral foot drop following guillain-barre syndrome: Indian J Physiother Occup Ther. 2024;18(3):23-29.

[16] Kaplan Kılıç B, Bumin G, Öğütlü H. Effect of telerehabilitation on handwriting performance in children with attention deficit hyperactivity disorder: Randomized controlled trial. Child: Care, Health and Development. 2025;51(2):e70055.

PARTICULARS OF CONTRIBUTORS:
1. Postgraduate Student, Department of Neurophysiotherapy, K J Somaiya College of Physiotherapy, Mumbai, Maharashtra, India.
2. Associate Professor, Department of Neurophysiotherapy, K J Somaiya College of Physiotherapy, Mumbai, Maharashtra, India.

NAME, ADDRESS, E-MAIL ID OF THE CORRESPONDING AUTHOR:
Riya Dilip Bhatt,
704, B/95, Taragagan C.H.S., Tilak Nagar, Chembur, Mumbai-400089,
Maharashtra, India.
E-mail: riya.db@somaiya.edu

PLAGIARISM CHECKING METHODS: [Jain H et al.]
- Plagiarism X-checker: Sep 09, 2025
- Manual Googling: Jun 06, 2026
- iThenticate Software: Jun 08, 2026 (1%)

ETYMOLOGY: Author Origin

EMENDATIONS: 9

AUTHOR DECLARATION:
- Financial or Other Competing Interests: None
- Was informed consent obtained from the subjects involved in the study? Yes
- For any images presented appropriate consent has been obtained from the subjects. Yes

Date of Submission: **Aug 31, 2025**
Date of Peer Review: **Dec 20, 2025**
Date of Acceptance: **Jun 10, 2026**
Date of Publishing: **Oct 01, 2026**