ORIGINAL RESEARCH

Three-year follow-up outcomes of adult patients with Guillain-Barré Syndrome after rehabilitation

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Abstract

Background

Guillain-Barré syndrome (GBS), the most common cause of acute paralytic neuropathy, covers a number of recognizably different variants. We aimed to evaluate the clinical characteristics of the patients with GBS and the outcome results of the patients after rehabilitation.

Methods

We enrolled 24 adult patients with GBS and evaluated their demographic characteristics, signs, complications, functional levels, and residual symptoms at admission, discharge, and during the 1st and 3rd-year follow-up visits. Functional Independence Scale (FIM), Functional Ambulation Scale (FAS), Hughes functional grading scale, Six-Minute Walking Test (6MWT), and Fatigue Severity Scale (FSS) were used for patient evaluation.

Results

In this study, patients with a mean age of 47.29 ± 16.2 years (40% female) were hospitalized for an average of 28.91 ± 25.6 days. The predominant symptoms experienced by these patients were fatigue (100%), neuropathic pain (70.8%), joint pain (54.2%), and autonomic dysfunction (50%). Significant changes were observed in FIM, Hughes functional grading scale, FAS, 6MWT, and MRC score at admission, discharge, and 1st/3rd-year follow-ups ($p=0.000$, $p=0.000$, $p=0.000$, $p=0.001$, $p=0.000$, respectively). Fatigue and Hughes score increased significantly with age ($p=0.019$, $r=0.475$; $p=0.041$, $r=0.419$, respectively). Negative correlations were found between age and FAS, 6MWT, and MRC score at 1st-year follow-up ($p=0.025$, $r=-0.456$; $p=0.027$, $r=-0.450$; $p=0.008$, $r=-0.528$). FSS was above 4 before admission and in 53.1% at 3rd-year follow-up, correlating negatively with 6MWT and MRC sum score. GBS clinical types showed no significant differences.

Conclusion

Rehabilitation improves functional improvement in GBS patients, with long-term benefits observed. However, residual symptoms such as fatigue and neuropathic pain may persist despite functional improvement. These findings highlight the importance of incorporating rehabilitation into the management of GBS and addressing residual symptoms to improve patient outcomes.

Key words: Acute inflammatory demyelinating polyneuropathy; Guillain-Barré; Acute neuromuscular failure; Peripheral neuropathy, Rehabilitation.

Introduction

Guillain-Barré syndrome (GBS) is a potentially life-threatening postinfectious disease characterized by rapidly progressive, symmetrical weakness of the extremities[1]. It has an incidence of 0.6-4/100,000 in different geographies and can occur in all ages and races[2]. The incidence increases with increasing age[3]. Symptoms may occur after viral or bacterial infection, vaccination, trauma, surgery or systemic disease[4]. A major part of the treatment is supportive therapy and rehabilitation[5]. Most patients with GBS recover within 2 to 4 weeks; 40% need rehabilitation in the chronic period; 20% continue to need rehabilitation and assistive devices[6]. Rehabilitation aims to increase functional levels and ambulation, protect patients from sequelae, and give them independence.

Although there are many studies in the literature on patients' functional status, autonomic dysfunction, fatigue, neuropathic pain and return to activities of daily living after medical treatment, few studies evaluate residual symptoms after rehabilitation and in the long term[7]. Therefore, our study analyzed demographic and clinical characteristics, symptoms and complications, factors affecting rehabilitation outcomes, and functional status and residual symptoms of GBS patients three years after the disease.

Methods

The study included patients with GBS who were admitted to the Department of Physical Medicine and Rehabilitation between January 2015 and January 2019 and received inpatient physical therapy. After discharge, the patients were called for 1st year, 2nd year, and 3rd-year follow-ups and control evaluations were followed up prospectively. The patients included in the study were given an information text about the purpose and duration of the study, and a consent form was obtained from the patients. The study was approved before patients were enrolled in the study by the local Ethics Committee of the Health Sciences University Dıskapı Yıldırım Beyazıt Health Practice and Research Center.

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Table 1. Demographic and clinical characteristics of the patients

Variables	n (%) / ort ± SD/ med (min-max)
Age (years) mean ± SD	47.29 ± 16.2
BMI ort ± SD	26.5 ± 5.0
Gender Female Male	 9 (37.5) 15 (62.5)
Duration of education (years) mean ± SD	8.75 ± 5.24
Smoking n (%) still drinking never drank left	 4 (13.3) 17 (56.7) 9 (30)
Dominant hand n (%) Right Left	 22 (91.7) 2 (8.3)
Length of stay in rehabilitation clinic (days) mean ± SD	28.91 ± 25.6
Time to arrival at the rehabilitation clinic (days) mean ± SD	21.29 ± 12.3
Number of hospitalizations for rehabilitation med (min-max)	1 (1 – 3)
GBS clinical type AIDP OH AMSAN	 12 (50) 6 (25) 6 (25)
Pre-infection + URTI AGE	 12 (50) 5 (20.8)
Seasonal distribution Spring Summer Autumn Winter	 4 (16.7) 5 (20.8) 7 (29.2) 8 (33.3)
Initial symptom weakness in the legs weakness in arms and legs	 10 (41.7) 14 (58.3)
Treatment IVIG IVIG+ plasmapheresis	 21 (87.5) 3 (12.5)

n: number of patients, mean ± SD: mean ± standard deviation, med: median value, min: minimum value, max: maximum value, URTI: upper respiratory tract infection, AGE: acute gastroenteritis, AIDP: acute inflammatory demyelinating polyneuropathy, AMAN: acute motor axonal neuropathy, AMSAN: Acute Motor Sensorial Axonal Neuropathy, IVIG: intravenous immunoglobulin

Table 2. Findings and complications in patients

Findings and complications	Number of adult patients (n:24) (%)
Joint pain	13 (54.2)
neuropathic pain	17 (70.8)
pressure sore	4 (16.7)
Cramp	14 (58.3)
Autonomic dysfunction	12 (50)
dysphagia	4 (16.7)
dysarthria	4 (16.7)
facial nerve involvement	10 (41.7)
Depression	6 (25)
Sleeping disorder	14 (58.3)
malnutrition	3 (12.5)
contracture	2 (8.3)

Tablo 3. Correlations of the FSS, Hughes functional grading scale score, FAS, 6MWT, FIM motor score in patients by age

Evaluation scale	P value	R value
FSS Admission Discharge 1st year control	 0.094 0.074 0.019*	 0.358 0.371 0.475
Hughes score Admission Discharge	 0.070 0.041*	 0.376 0.419
FAS Admission Discharge 1st year control	 0.094 0.167 0.025*	 - 0.350 - 0.292 - 0.456
6MWT Admission Discharge 1st year control	 0.136 0.053 0.027*	 - 0.345 - 0.399 - 0.450
MRC sum score Admission Discharge 1st year control	 0.099 0.158 0.008*	 -0.344 -0.297 -0.528
FIM motor Admission Discharge 1st year control	 0.107 0.110 0.358	 - 0.337 - 0.335 - 0.196

FSS: fatigue severity scale, MRC: Medical Research Council sum score, 6MWT: 6-minute walk test, FAS: Functional Ambulation Scale, FIM: Functional Independence Scale

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Table 4. Comparison of functional assessment results of patients at rehabilitation admission and discharge

Evaluation scale	Admission (n) ort ±SD/med(min-max)	Discharge (n) ort ±SD/med(min-max)	P değeri (r değeri)
FIM motor	(24) 64.2 ± 21.71	(24) 77.0 ± 14.44	0.000* (0.908)
Hughes functional grading scale score	3(1 – 5)	2(0 – 4)	0.000* (0.882)
FAS	1(0 – 4)	4(0 – 5)	0.000* (0.854)
6MWT (m)	(24) 113.95±113.83	(24) 210.6 ± 142.2	0.001* (0.688)
MRC sum score	(24) 42.5 ± 12.3	(24) 48.91 ± 9.30	0.000* (0.956)

n: number of patients, mean ± SD: mean ± standard deviation, med: median değer, min: minimum, max: maximum, FSS: fatigue severity scale, MRC: Medical Research Council sum score, 6MWT: 6-minute walk test, FAS: Functional Ambulation Scale, FIM: Functional Independence Scale

smoking status, length of stay in the rehabilitation clinic, etiology of the disease, clinical type of the disease, time from the onset of the disease to hospitalization were examined. Educational status; is specified by the number of years of education. The detailed neurological and musculoskeletal examinations performed on the first day of admission to the rehabilitation clinic of the patients were recorded. BMI was calculated by looking at height and weight measurements.

In the physical examinations, deep tendon reflexes (DTR) loss, presence of sensory loss, facial nerve involvement, dysphagia, and speech disorder were examined. Pain, cramps, previous deep venous thrombosis (DVT), pressure sores, contractures, malnutrition, autonomic dysfunction (unstable blood pressure, arrhythmia, bladder and bowel dysfunction, etc.), depression, sleep disorder, pulmonary thromboembolism, which are the signs and complications of GBS that occur during the rehabilitation process. Fatigue and the presence of contracture were recorded. All patients were previously classified clinically and electrophysiologically by the neurology department as acute inflammatory demyelinating polyneuropathy (AIDP), acute motor axonal neuropathy (AMAN), acute motor-sensory axonal neuropathy (AMSAN).

Functional Disability Assessment

Muscle strength was assessed upon hospitalization, at discharge, and during the 1st, 2nd, and 3rd-year follow-ups. Various evaluation tools were employed to comprehensively understand patients' conditions. The 6-Minute Walk Test (6MWT) was utilized to assess endurance and cardiovascular fitness, shedding light on patients' overall physical capabilities. The Hughes Functional Grading Scale offered a general assessment of functional status, providing insight into the broader scope of patients' functional limitations and improvements.

Table 5. Correlation of the Patients' FSS and MRC muscle strength assessment results and 6MWT results

Evaluation time	FSS (n) ort ± SD	variables (n)ort ± SD	P value (r value)
Admission MRC	(24) 5.86 ± 0.94	(24) 42.5 ± 12.3	0.007* (-0.547)
Discharge MRC	(24) 5.36 ± 1.38	(24)48.91 ± 9.30	0.009* (-0.523)
1st year control MRC	(24) 4.63 ± 1.35	(24) 57.5 ± 5.84	0.025* (-0.456)
3rd year control MRC	(17) 4.42 ± 1.43	(17) 58.5 ± 4.34	0.280 (-0.278)
Admission (24) 6MWT	(24) 5.86 ± 0.94	(24) 113.95±113.83	0.001* (-0.719)
Discharge (24) 6MWT	(24) 5.36 ± 1.38	(24) 210.6 ± 142.2	0.038* (-0.426)
1st year control (24) 6MWT	(24) 4.63 ± 1.35	(24) 356.6 ± 134.9	0.004* (-0.566)
3rd year control (17) 6MWT	(17) 4.42 ± 1.43	(17) 413.52 ± 133.4	0.035* (-0.514)

n: number of patients, mean ± SD: mean ± standard deviation, FSS: fatigue severity scale, MRC: Medical Research Council sum score, 6MWT: 6-minute walk test.

Evaluation

Demographic-Disease Characteristics

Patients' age, gender, education level, comorbidities, body mass index (BMI), dominant hand, application season,

Additionally, the LANSS Pain Scale was applied to evaluate and differentiate neuropathic pain symptoms, while the Fatigue Severity Scale (FSS) was employed to assess the severity of fatigue experienced by patients.

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Table 6. Results of Functional Evaluation Scales According to GBS Clinical Types of The Patients

Evaluation test	AIDP n (%) ort±SD/ med (min– max)	AMAN n (%) ort ± SD/ med (min – max)	AMSAN n (%) ort ±SD/ med (min–max)	P value
FSS n (%) mean ± SD	12 (50)	6 (25)	6 (25)	
Admission	5.79 ± 0.80	5.8 ± 1.16	6.12 ± 1.13	0.447
Discharge	5.17 ± 1.46	5.31 ± 1.36	5.78 ± 1.37	0.358
1st year control	4.43 ± 1.35	4.26 ± 1.51	5.38 ± 1.10	0.355
Hughes score n (%)med (min-max)				
Admission	12 (50)	6 (25)	6 (25)	0.214
Discharge	2 (1 – 3)	3 (1 – 5)	4 (1 – 5)	0.214
1st year control	1 (0 – 4)	2 (0 – 2)	2 (1 – 4)	
FAS n (%) med (min–max)	12 (50)	6 (25)	6 (25)	
Admission	3.5 (0 – 4)	1 (0 – 4)	0 (0 – 4)	0.215
Discharge	4 (1 – 5)	3.5 (2 – 5)	3 (0 – 4)	0.239
1st year control	5 (4 – 5)	5 (4 – 5)	4.5 (1 – 5)	0.234
MRC sum score n (%) mean ± SD	12 (50)	6 (25)	6 (25)	
Admission	43.33 ± 10.35	43 ± 16.2	40.33 ± 13.8	0.714
Discharge	50.25 ± 6.41	50.16 ± 9.04	45.0 ± 14.1	0.811
1st year control	58.33 ± 2.05	59.6 ± 0.81	53.6 ± 11.05	0.288
FIM n (%)med (min–max)	12 (50)	6 (25)	6 (25)	
Admission	70.9 ± 9..5	63 ± 25.75	52.3 ± 19.54	0.252
Discharge	80.25 ± 12.1	79 ± 12.39	68.83 ± 19.2	0.318
1st year control	88.5 ± 4.10	90 ± 1.67	82 ± 15.31	0.591

n: number of patients, mean ± SD: mean ± standard deviation, med: median value, min: minimum value, max: maximum value, AIDP: acute inflammatory demyelinating polyneuropathy, AMAN: acute motor axonal neuropathy, AMSAN: Acute Motor Sensory Axonal Neuropathy, YSS: fatigue severity scale, FAS: functional ambulation scale, MRC: Medical Research Council, FIM: functional independence scale

Moreover, the Functional Ambulation Scale (FAS) specifically focused on evaluating patients' ambulation ability. By utilizing this array of diverse scales, we aimed to capture a more nuanced understanding of patients' functional progress over time. The combination of these scales allowed us to gather detailed information about muscle strength, endurance, cardiovascular fitness, functional independence, ambulation ability, presence of neuropathic pain, and the level of fatigue. This holistic approach ensured that various facets of patients' conditions were thoroughly evaluated, contributing to a comprehensive assessment of their recovery journey from Guillain-Barré Syndrome (GBS).These scales have been used in various studies on GBS[8,9,10].

Muscle strength was evaluated according to the Medical Research Council (MRC) sum score. Bilateral shoulder abduction, elbow flexion, and wrist extension for upper extremity in MRC scoring; For the lower extremities, hip flexion, knee extension, and ankle dorsiflexion muscle strength were evaluated between 0 and 5. The total score was recorded as 60 (normal) and 0 (tetraplegic) .

6-Minute Walking Test: In this test, participants walk for 6 minutes at the maximum possible walking speed without running a distance of 30 meters. Participants must be rested before the test. Before and after the test, heart rate and blood pressure are measured. This test is an evaluation method close to the submaximal exercise test.

Fatigue Severity Scale (FSS): It is a self-report scale consisting of 9 items that evaluate the degree of fatigue severity in the last 1 week. According to the 7-point Likert scale for each item, the most appropriate one of the statements ranging from 7 strongly agree to 1=strongly disagree is marked by the patient. The scores obtained from each item are added together and the total value is divided by 9. A high score indicates increased fatigue severity. An FSS score of 4 or above is considered severe fatigue[7].

LANSS: The LANSS is a test used to assess neuropathic pain. It consists of 7 questions and each question is rated on a 5-point scale. The total score is 24 and those with a score higher than 12 are considered likely to have neuropathic pain[11,12]. The goal of the test was to assess the severity and type of patients' neuropathic pain and to determine appropriate treatment .

Functional Independence Scale: FIM analyzes two different aspects of disability, namely motor and cognitive functions. It indicates the patient's level of independence in daily basic physical and cognitive activities[13].

FIM motor assessment; focuses on three functional areas such as self-care, sphincter control, and mobilization. In the motor assessment of FIM, a total of 13 activities are evaluated for functional independence using a 7-point scale for each[14]. Hughes functional grading scale score: The GBS disability score proposed by Hughes et al. (10) is stage 0; healthy, stage 1; mild symptoms and can run, stage 2; can walk 10 meters (m) without support but cannot run, stage 3; can walk 10 m with the support of a person

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or with equipment such as a walker, stage 4; wheelchair or bedridden, stage 5; needs mechanical ventilation, stage 6;death[15].

Functional Ambulation Scale (FAS): Although this scale was first developed to classify ambulation levels in post-stroke cases; In general, it is also used in neurological rehabilitation cases. Cases are classified between 0 and 5, and higher scores indicate a better level of functional ambulation[16].

Statistical analysis

The data were entered into the SPSS 20 statistical package program. Whether the continuous and discrete variables were distributed close to the normal distribution was investigated using the Shapiro-Wilk test. Whether there was a difference between the groups in terms of qualitative variables was examined with Yates corrected Chi-Square and Fisher's exact tests, and whether there was a difference in terms of numerical variables was examined with the Mann-Whitney U Test. Descriptive statistics were presented as mean ± standard deviation or median (minimum-maximum) for continuous and discrete numerical variables. Categorical variables were expressed as the number of cases and percentage. Whether there was a statistically significant change in numerical variables within the group was investigated with the Wilcoxon test, and the results were considered statistically significant for $p<0.05$. Spearman ro correlation analysis was used for correlation analysis of categorical variables.

Results

Twenty-four adult patients who received inpatient physical therapy at the Physical Medicine and Rehabilitation Clinic between January 2015 and January 2019 were included in the study. The mean age of the patients was 47.29 ± 16.2 years. In gender evaluation, 9 (37.5%) of all patients were female and 15 (62.5 %) were male. The duration of hospitalization in the rehabilitation clinic was 28.91 ± 25.6 days. When the patients were analyzed in terms of GBS clinical types, AIDP was seen in 12 (50%) adult patients, AMAN in 6 (25%) patients and AMSAN in 6 (25%) patients. In our study, 21 patients (87.5%) had received intravenous immunoglobulin (IVIG) and 3 patients (12.5%) had received IVIG+plasmapheresis treatment (Table 1).

While fatigue was seen in all patients, neuropathic pain was seen in 17 (70.8%) patients, joint pain in 13 (54.2%) patients, and autonomic dysfunction in 12 (50%) patients (Table 2).

In the follow-up of these patients, neuropathic pain continued in 15 (62.5%) before discharge, pregabalin treatment was started and their follow-up continued. Neuropathic pain complaints and pregabalin treatment continued in 12 (50%) patients in the 1st-year control, in 11 (50%) patients in the 2nd-year control, and 10 (58.8%) patients in the 3rd-year control.

Results showed that in the first-year follow-up, fatigue scores increased significantly with older age ($p=0.019$, $r=0.475$), and the Hughes functional grading scale score also increased significantly with older age at discharge ($p=0.041$, $r=0.419$). Additionally, there was a negative correlation between age and functional ambulation, walking endurance, and muscle strength in the first-year control ($p=0.025$, $r=-0.456$; $p=0.027$, $r=-0.450$; $p=0.008$, $r=-0.528$, respectively) (Table 3).

When the admission and discharge evaluations were examined, significant changes were observed in the FIM motor score, Hughes functional grading scale score, FAS, 6MWT, and MRC sum score ($p=0.000$, $p=0.000$, $p=0.000$, $p=0.001$, $p=0.000$, respectively) (Tablo 4).

All patients had fatigue. FSS was 5.85 ± 0.94 (4.2- 7) at admission and 5.36 ± 1.38 (2.3- 6.9) at discharge. The FSS score was found to be above 4 in all patients before admission to rehabilitation.

During the discharge, 19 (79%) of the patients, at the 1st year follow-up 18 (74.8%) of the patients, and at the 3rd year follow-up, 9 (53.1%) of the patients had an FSS score above 4.

There was a significant negative correlation in the FSS and 6MWT evaluations of the patients at admission, discharge, 1st year and 3rd year post-discharge visits. When the FSS and MRC sum score results of adult patients were evaluated at admission, discharge, 1st year control and 3rd year control, a significant negative correlation was observed between them at admission, discharge, and 1st year control evaluations. [$p=0.007$ ($r=-0.547$), $p=0.009$ ($r=-0.523$), $p=0.025$ ($r=-0.456$)] (table 5).

When the GBS clinical types of the patients included in our study were analyzed, 12 (50%) were AIDP, 6 (50%) were AMAN and 6 (50%) were AMSAN. In these patients, no significant difference was observed between GBS clinical types in the evaluations of FSS, Hughes functional grading scale score, FAS, MRC sum score, and FIM applied at the time of admission to rehabilitation and discharge ($p>0.05$) (Table 6).

Discussion

In this study, long-term results were evaluated in terms of clinical features, complications, ambulation level, and functional status. The study showed that significant functional improvements were achieved after neurological rehabilitation; however, residual symptoms such as fatigue and neuropathic pain continued in the patients at the 3rd-year follow-up.

The hospitalization period for adult patients in our study was 28.91 ± 25.6 days (range: 8-138 days). Comparing our findings with other studies conducted in Turkey, one study[17] reported an average length of stay in the rehabilitation clinic as 33.5 ± 4.9 days (range: 4-77 days), while another study[18] reported a longer duration of 86.4 ± 13.2 days. The time from disease onset to admission to the rehabilitation clinic for adult patients in our study was 21.29 ± 12 days, which aligns with the existing literature[17-19].

Regarding the clinical manifestations, literature reports indicate that weakness in the legs is present in 95% of cases, weakness in the arms in 90%, and loss of reflexes in 90%.[20]. In our study, we observed lower extremity weakness in all patients, while 50% of patients also had accompanying upper extremity weakness. Similarly, a Danish study[18] found that 35% of their GBS patients could walk independently upon hospital admission (Hughes functional grading scale score 0-2), which is consistent with our finding of 41.7%. Additionally, the Danish study[21] reported a sensory loss in 62% of their patients, whereas in our study, 87.5% of the patients had sensory loss.

GBS usually results in complete functional recovery, but around 40% of patients experience residual symptoms. Patients who require intensive care support in the acute period are more likely to experience psychosocial issues, while mild to moderate depression can be observed even in

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patients who have fully recovered . These residual symptoms can lead to workforce loss, job changes, and difficulties in daily life activities. In a study involving 122 GBS patients, it was found that 63% of patients experienced changes in their psychosocial status 3 to 6 years after GBS, particularly those with motor and sensory residual deficits[23]. In our study, 6 (25%) patients were diagnosed with depression by a psychiatrist and received antidepressant treatment.

In our study, over half of the patients (54.2%) reported joint pain, while 38.5% experienced low back pain, 23.1% had bilateral leg pain, and 7.7% had bilateral shoulder pain. The average VAS score was 59.23±13.2, consistent with previous research from Turkey[18,19]. Pain is a common symptom among GBS patients, with up to 89% reporting it in the literature[24]. To manage pain, physical therapy modalities such as hot packs, transcutaneous electrical nerve stimulation, ultrasound, and short-wave diathermy were utilized.Pressure sores, DVT, and pulmonary embolism have been reported among the complications associated with immobilization[25]. DVT and pulmonary embolism were not observed in our patients, but pressure ulcers occurred in 4 (16.7%) patients during the period until rehabilitation, and the pressure sores regressed with appropriate positioning and topical drug treatments.

In this study, 16.7% of patients had dysphagia and 41.7% of them had facial nerve involvement. In a study, dysphagia was observed in 25% and facial nerve involvement was in 5% of the patients[26]. In our study, all patients with facial involvement were given an exercise program with electrical stimulation. The facial asymmetry of all patients regressed within 1 year of follow-up.

The incidence of pain in GBS patients varies in the literature. Our study found that 70.8% of patients experienced neuropathic pain, which is higher than the reported rates of 50% and 31% in the studies by Sivrioğlu et al.[17] and Gonzalez et al.[27], respectively. Follow-up examinations in our study revealed that neuropathic pain persisted in 50% of patients after one year, 50% after two years, and 58.8% after three years. The prevalence of neuropathic pain remains high in both the acute and chronic phases of the disease in all studies.

Many studies have shown that fatigue is one of the most disabling symptoms in GBS patients and can seriously affect their functionality and quality of life[28]. In our study, in all of the patients (100%), the pre-rehabilitation VAS score was above 4 (severe fatigue). In the discharge evaluation, 19 (79%) of the patients, 18 (74.8%) at the 1st year follow-up, and 9 (53.1%) at the 3rd year follow-up had an FSS score above 4.

Merkies et al.[29] found that fatigue was present in 80% of GBS patients, regardless of functional recovery or minor symptoms. The relationship between muscle weakness, sensory impairment, and fatigue was also examined in the same study, and it was observed that even patients with normal muscle strength and sensation experienced fatigue. However, no significant correlation was found between them. In our study, a negative and significant correlation was found between FSS and MRC sum score, as well as the 6MWT, in the admission, discharge, and 1st-year control evaluations. This negative correlation is thought to be due to muscle dysfunction caused by GBS and is consistent with previous findings.

In our study, we examined the relationship between age and various outcome measures including FSS, Hughes functional grading scale score, FAS, 6MWT, MRC sum score, and FIM motor score. We observed significant associations between age and these measures upon analyzing the data at admission, discharge, and during the first-year follow-up. In the first-year follow-up, we found a significant increase in fatigue scores (FSS) with increasing age. Similarly, at discharge, the Hughes functional grading scale score showed a significantly increased with older age. Furthermore, there was a significant decrease in functional ambulation (FAS) and walking distance (6MWT) as age increased during the first-year control. Additionally, the first-year control showed a significant decrease in muscle strength (MRC sum score) as age increased. Comparing our findings with other studies, Zhang et al.[30] did not find a significant difference in the MRC sum score and Hughes functional grading scale score between age groups in 535 GBS patients. On the other hand, Chio et al.[31] reported a significant increase in Hughes functional grading scale score admission and 2nd-year scores with advancing age in 120 GBS patients over a 2-year follow-up.Our study supports the notion that older age is associated with slower and poorer recovery outcomes in GBS patients. However, it is important to note that larger study groups are needed to further emphasize the prognostic significance of age.Overall, our findings contribute to understanding the impact of age on the functional outcomes of GBS patients, highlighting the need for personalized management strategies considering age as a relevant factor.

In the literature, axonal degeneration is often considered an indicator of poor prognosis in GBS. It is known that the disease progresses faster in AMAN, reaching a functionally worse state more rapidly. However, patients with AMAN often demonstrate rapid recovery[32,33]. In a study by Chio et al.[31], a significant difference was observed between the admission Hughes functional grading scale score and the group with axonal damage. In line with the literature, our study also investigated the clinical types of GBS and found no significant differences in the evaluations of FSS, Hughes functional grading scale score, FAS, MRC sum score, FIM, and the first-year follow-up using FSS, FAS, and MRC sum score. Furthermore, consistent with previous research, our study found a significant improvement in functional evaluations following rehabilitation. Sivrioğlu et al.[17] also reported significant improvements in FIM, Hughes functional grading scale score, and FAS evaluations after rehabilitation. Additionally, similar to our findings, a study by Hiraga et al.[34] identified that 45% of GBS patients had AMAN and 34% had acute AIDP, and there was no significant difference in the Hughes functional grading scale score between these two patient groups when assessed before hospitalization and at the 6th-month follow-up. In summary, our findings align with existing literature regarding axonal degeneration's prognostic importance in GBS and rehabilitation's positive impact on functional outcomes.The absence of significant differences among clinical types in our study further emphasizes the complexity of GBS and the need for individualized management approaches.

Our study acknowledges several limitations that should be taken into account when interpreting the findings. Firstly, the sample size was small, which may limit the generalizability of the results. Additionally, the study participants had dissimilar premorbid characteristics, which could introduce confounding factors and affect the comparability of the

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data. Furthermore, there was an unequal distribution of GBS clinical types among the patients, which may impact the overall outcomes.Nevertheless, our study is valuable as it is one of the few to investigate the functional status and residual symptoms of patients over a 3-year follow-up period. In conclusion, early initiation of a rehabilitation program can prevent and treat complications in GBS patients, leading to functional improvement in the long term. However, residual symptoms such as fatigue and neuropathic pain may persist.

Conflict of interest

The authors declare that there are no conflicts of interest

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