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RESEARCH

Clinical characteristics and factors associated with functional outcome in patients with Guillain Barré syndrome

Guillain Barré sendromu olan hastaların klinik özellikleri ve fonksiyonel sonuçlarla ilişkili faktörler

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Abstract

Purpose: We aimed to evaluate the clinical characteristics of Guillain Barré syndrome (GBS) patients retrospectively and identify the prognostic factors associated with worse outcome at discharge and at the end of the first month in patients with GBS.

Materials and Methods: Patients who were followed up with the diagnosis of GBS were evaluated retrospectively. Demographic characteristics of the patients, cerebrospinal fluid examinations, treatment regimens, Medical Research Council (MRC) and Hughes Motor Scale (HMS) scores were recorded and HMS ≥3 was accepted as associated with poor prognosis in patients. SPSS version 25 program was used in the statistical analysis of the data. $p<0.05$ was found to be statistically significant.

Results: After the exclusion criteria 82 patients were evaluated in this study. The mean age of patients was 56.88±17.14 years and 57.3% (n=47) of the patients were male. The most common neurological finding was paresis in the lower extremities (n=67, 81.7%) followed by paresis in the upper extremities (n=48, 58.5%). Presence of paresis in lower extremities, the median of the duration of hospitalization and the mean of MRC scores at admission were statistically significantly different in patients with poor prognosis at discharge and at the end of the first month.

Conclusion: Since patients may have different clinical and electrophysiological characteristics between countries, we believe that there is a need for various publications from different countries to collect information related to the clinical features and prognosis of patients, and we think our study will contribute to these data.

Keywords: Guillain Barré syndrome, prognosis, Hughes motor scale

Öz

Amaç: Bu çalışmada Guillain Barré sendromu (GBS) olan hastaların klinik özelliklerini retrospektif olarak değerlendirmeyi ve taburculuk ile birinci ayın sonunda kötü prognozla ilişkili prognostik faktörleri belirlemeyi amaçladık.

Gereç ve Yöntem: GBS tanısıyla takip edilen hastalar geriye dönük olarak değerlendirildi. Hastaların demografik özellikleri, beyin omurilik sıvısı sonuçları, muayene bulguları, tedavi rejimleri, Medical Research Council (MRC) ve Hughes Motor Skalası (HMS) değerleri kaydedildi ve HMS ≥3 hastalar kötü prognoz ile ilişkili kabul edildi. Verilerin istatistiksel analizinde SPSS (versiyon 25) programı kullanıldı. $p<0.05$ istatistiksel olarak anlamlı bulundu.

Bulgular: Dışlama kriterleri sonrasında 82 hasta çalışmaya dahil edildi. Hastaların ortalama yaşı 56.88±17.14 yıl olup, hastaların %57.3'ü (n=47) erkekti. En sık görülen nörolojik bulgu alt ekstremitede parezi (n=67, %81.7) iken bunu üst ekstremitede parezi (n=48, %58.5) izlemekteydi. Alt ekstremitede parezi varlığı, yatış süresi ortancası ve başvuru anındaki MRC skorlarının ortalaması kötü ve iyi prognozlu hastalarda taburculukta ve birinci ay sonunda istatistiksel olarak anlamlı derecede farklıydı.

Sonuç: Hastalar ülkeler arasında farklı klinik ve elektrofizyolojik özelliklere sahip olabileceğinden hastaların klinik özellikleri ve prognozlarına ilişkin bilgi toplamak için farklı ülkelerden çeşitli yayınlara ihtiyaç duyulduğunu ve çalışmamızın bu verilere katkı sağlayacağını düşünüyoruz.

Anahtar kelimeler: Guillain Barré sendromu, prognoz, Hughes motor skalası

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INTRODUCTION

Guillain Barré syndrome (GBS) is the most common cause of acute flaccid paralysis worldwide. It is an acute inflammatory immune-mediated peripheral nerve disease that mostly presents with ascending paresthesia and progressive muscle weakness in patients[1,2]. The lifetime risk of developing GBS is 1/1000 for individuals and it is more frequently seen in men than women[2].

Symptoms and clinical signs usually begin following a primary upper respiratory or gastrointestinal infection in the majority of patients and can progress for up to 4 weeks[1-3]. The clinical signs of the disease are diverse, including progressive limb muscle weakness, respiratory muscle weakness, sensory symptoms, cranial nerve involvement and autonomic findings[2]. Different clinical subtypes such as acute inflammatory demyelinating polyneuropathy (AIDP), acute motor axonal neuropathy (AMAN), acute motor-sensory axonal neuropathy (AMSAN) and Miller Fisher syndrome (MFS), have been identified and their frequency varies according to geographical regions[4].

While most patients recover with treatment, mortality ranges from 3% to 13% in GBS and some patients recover with long term sequelae and increased morbidity[1,4,5]. Clinical features and prognosis vary widely among patients, and various factors have been suggested to predict prognosis[3,6].

The aim of the study was to retrospectively evaluate the clinical characteristics of GBS patients and identify prognostic factors associated with worse outcomes at discharge and at the end of the first month in patients with GBS. Since patients may have different clinical and electrophysiological characteristics between countries, we believe that there is a need for various publications from different countries to collect information related to the clinical features and prognosis of patients, and we think our study will contribute to these data.

MATERIALS AND METHODS

Sample

In this study, the data and files of totally 164 patients over the age of 18 who were followed up with the preliminary diagnosis of GBS in any of the Neurology outpatient clinics, neurology inpatient service / intensive care unit of Baskent University Hospital or were hospitalized in Baskent University Physical Therapy and Rehabilitation Center between 1996 and 2021 were evaluated retrospectively. In the study, patients were evaluated at Baskent University Hospital. The hospital is a university hospital and all neurological diseases could be evaluated and patients are followed up and treated. All files of the patients were reviewed by experienced neurologists and patients that were included from the rehabilitation center were consulted to our neurology department and evaluated by a qualified neurologist.

Attention was paid to file reliability, and patients whose file information and reliability were inadequate were excluded from the study. A detailed clinical evaluation and suitable tests were performed to exclude other conditions that can be misdiagnosed with GBS. Patients with muscle diseases that may cause acute progressive muscle weakness, neuromuscular junction diseases, anterior horn, spinal cord, brainstem diseases and acute neuropathy due to vasculitis, diabetes mellitus and toxin exposure were also excluded.

The study was approved by Baskent University Institutional Review Board (08/06/2021- Project No: KA21/291).

Assessment

Clinical and additional supporting data were used for the diagnosis of GBS of the patients, and the level of diagnostic precision was determined according to the Brighton criteria, accompanied by clinical, electrophysiological and cerebrospinal fluid (CSF) findings[7].

Demographic characteristics of the patients, prodromal history (such as infection, vaccination or other diseases), season of admission, complaints during admission, physical and neurological examination characteristics including detailed examination of motor/sensory deficits, deep tendon reflexes, cranial nerves and presence of autonomic dysfunction were evaluated. Treatment regimens, intensive care hospitalization, need for ventilation and complications that developed in the first month were recorded.

Medical Research Council (MRC) scores were used to evaluate the clinical findings of the patients at admission and during follow up. The MRC total score was calculated by adding up the MRC scores of 6

muscles on both sides (deltoid, biceps, wrist extensor, iliopsoas, quadriceps, and tibialis anterior) separately. The score ranges from 60 (normal) to 0 (tetraplegic)[8].

Patients with cardiac arrhythmia, changes in heart rate and blood pressure, gastrointestinal dysfunction, abnormality in sweating and urinary retention were identified as to having autonomic dysfunction.

Electrophysiological examinations

In routine electrodiagnostic examinations, median, ulnar, tibial and common peroneal motor nerve conductions; ulnar, median mixed, sural and superficial peroneal sensory nerve conductions and median, ulnar, tibial and common peroneal F latencies were investigated. Patients were divided into subgroups as AIDP, AMAN and AMSAN according to the criteria for the electrodiagnostic test variables[9]. Patients with areflexia, ataxia, ophthalmoplegia and electrophysiological findings were evaluated as MFS.

Cerebrospinal fluid and blood tests

Data about CSF protein, albumin values and pleocytosis after lumbar puncture (LP) were recorded. The normal range for CSF protein was 15-45 mg /dl and albumin was 10-30mg/dl in our laboratory. Albuminocytologic dissociation was defined as a combination of an increased albumin level and normal cell count in CSF. Routine blood tests were performed in all patients. Total blood count samples were collected in ethylene-diamine-tetra-acetic acid (EDTA) tubes and hemoglobin, leukocyte, neutrophil, lymphocyte and platelet values were listed. Neutrophil to lymphocyte ratio (NLR) was calculated by dividing the neutrophil count by the lymphocyte count. The presence of antibodies againt gangliosides was also recorded if they were tested in patients.

Functional status grading scale

The functional status and disability of patients were evaluated at admission, discharge and at the first month after discharge using the Hughes motor scale (HMS). The scale ranges from 0 to 6 (0-asymptomatic, 1-mild signs or symptoms but able to run, 2-able to walk unaided for 5 m, 3-able to walk 5 m with support, 4-bed-ridden or wheel-chair bound, 5-requiring ventilatory assistance, 6-death)10. A score of ≥3 was considered as associated with poor prognosis in patients.

Statistical analysis

Statistical analysis was conducted using SPSS version 25 program. The distribution of numerical data was assessed using the Kolmogorov-Smirnov test. Categorical variables were reported as frequencies and percentages, normally distributed numerical variables as mean ± standard deviation (SD), and non-normally distributed numerical variables as median (interquartile range (IQR)). The Independent-Samples T test was used for comparing numerical variables with normal distribution and the chi-squared test and Fisher exact test were used for categorical variables. Mann–Whitney U test was used for comparing continuous data with skewed distribution. A p-value of <0.05 was considered to be statistically significant.

RESULTS

After the exclusion criteria 82 patients were included in this study. The mean age of the patients was 56.88 ± 17.14 years (20-89 years) and 57.3% (n=47) of the patients were male. The number of patients increased with age peaking in the >60-year group. Antecedent events were recorded in 57 patients (69.5%) prior to the neurological complaints and the neurological complaints started to appear with a median duration of 10 days (IQR: 9) after the antecedent event. Most of the cases were preceded by upper respiratory tract infection (URTI). The majority of patients were admitted during the winter and spring seasons and were diagnosed after 2015. The demographic data of the patients were listed in Table 1.

Eleven patients (13.4%) were diagnosed in the severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) era. Four of them had URTI complaints before the diagnosis. One of those 11 patients was diagnosed with SARS-CoV-2 infection 3 days after the diagnosis of GBS.

At admission 22 patients (26.8%) had complaints of weakness in upper extremities, while 59 patients (72.0%) had complaint of weakness in lower extremities. Thirty-five patients (42.7%) and 30 patients (36.6%) had lower and upper extremity sensory complaints respectively. Ten patients (12.2%) were admitted with gait imbalance. Three patients (3.7%) had respiratory insufficiency, 9 patients (11%) had diplopia and 5 patients (6.1%) had complaints of difficulty in swallowing at admission.

The most common neurological finding was paresis in the lower extremities followed by paresis in the upper extremities (Table 2). Ataxia was present in 9.8% of patients. Twenty-six patients had cranial nerve involvement and facial weakness was the most commonly detected cranial nerve involvement. The detailed clinical profile of the patients was mentioned in Table 2.

Table 1. Demographic data of patients

Variable	n (%)
Gender	
Female	35 (42.7)
Male	47 (57.3)
Age distribution (years)	
<40	20 (24.4)
40-60	22 (26.8)
>60	40 (48.8)
Season	
Spring	25 (30.5)
Summer	14 (17.1)
Autumn	18 (22.0)
Winter	25 (30.5)
Year of diagnosis	
1996-2005	16 (19.5)
2005-2010	14 (17.1)
2010-2015	15 (18.3)
2015-2021	37 (45.1)
Antecedent events	
URTI	28 (34.1)
Gastroenteritis	17 (20.7)
Other infections	9 (11.0)
Vaccine	2 (2.4)
Surgery	1 (1.2)
No antecedent events	25 (30.5)

URTI: Upper respiratory tract infection

The mean of the MRC scores at admission was 44.55± 10.71. Most patients had MRC scores at admission ranging between 41-50 (40.2%). At admission 42 patients (51.2%) had HMS score ≥3. The distribution of the MRC and HMS scores of the patients at admission was listed in Table 2.

Lumbar puncture was performed in 90.2% (n=74) of the patients. The CSF protein level was high in 72.0% of all patients, with a median value of 74.25 mg/dl (IQR: 80.3). Albuminocytological dissociation was detected in 63.4% of the patients. The presence of antiganglioside antibodies in CSF was tested in 28.0% of the patients. Two patients had anti-GM1 antibodies while 2 other patients had anti-GQ1b antibodies. Anti-GM1 positive patients had generalized muscle weakness upon application. One patient had bulbar symptoms and ataxia additionally. Among the blood tests the median NLR was 3.13 (IQR: 3.21).

Table 2. Clinical profile of patients

Variable	n (% of total)
Motor deficit	
Upper	48 (58.5)
Lower	67 (81.7)
Sensory deficit	
Upper	14 (17.1)
Lower	24 (29.3)
Cranial nerve involvement	26 (31.7)
Facial palsy	18 (22.0)
Bulbar palsy	7 (8.5)
Opthalmoplegia	8 (9.8)
Ataxia	8 (9.8)
Deep tendon reflexes	
Normal	4 (4.9)
Diminished/absent	
Only in upper	2 (2.4)
Only in lower	29 (35.4)
Both in upper and lower	47 (57.3)
MRC score at admission	
51-60	22 (26.8)
41-50	33 (40.2)
31-40	18 (22.0)
<30	9 (11.0)
HMS score at admission	
0	9 (11.0)
1	17 (20.7)
2	14 (17.1)
3	22 (26.8)
4	20(24.4)
5	-
6	-

MRC: Medical Research Council, HMS: Hughes Motor Scale

Nerve conduction studies were evaluated in 89% (n=73) of the patients. F wave latency was normal in 7 patients, while it was either longer or absent in 58 patients (70.7%). Data about the results of the CSF and nerve conduction studies were shown in Table 3. Overall, AIDP was the most common subtype found in patients. Lumbar spinal magnetic resonance imaging (MRI) was conducted in 47.6% (n=39) of the patients and 3 patients had contrast enhancement on cauda equina (Table 3).

Forty patients (48.8%) were treated with intravenous immunoglobulin (IVIg), while 35 patients (42.7%) and 7 patients (8.5%) were treated with plasma exchange and both treatments consecutively, respectively. The median duration of hospitalization was 12 days (IQR: 11). 38 patients (46.3%) had no complication during the treatment and for one month. Urinary tract infections (UTI) were the most common complications in patients, affecting 18.3%. 39% of patients (n=32) were monitored in the

intensive care unit (ICU), with 13 of them (15.9%) experiencing respiratory insufficiency and 5 of them (6.1%) needing to be intubated during hospitalization.

Table 3. Laboratory and imaging findings of patients

Variable	
CSF evaluation	
CSF protein (mg/dl) , median (IQR)	71.8 (69)
CSF albumin (mg/dl), median (IQR)	47.3 (42)
Albuminocytological dissociation, n(%)	52 (63.4)
Ganglioside antibodies, n(%)	23 (28.0)
GM1	2 (2.4)
GQ1b	2 (2.4)
Nerve Conduction Studies, n(%)	
F wave latency	
Longer or absent in only upper extremities	5 (6.1)
Longer or absent in only lower extremities	7 (8.5)
Longer or absent in both upper and lower extremities	46 (56.1)
Normal	7 (8.5)
No information on F wave latency	8 (9.8)
Imaging, n(%)	
Lumbar spinal MRI	39 (47.6)
Contrast enhancement on cauda equina	3 (3.7)
Subtype/variant, n(%)	
AIDP	59 (72.0)
AMAN	6 (7.3)
AMSAN	5 (6.1)
MFS	6(7.3)
No information on subtype	6(7.3)

CSF: Cerebrospinal fluid, IQR: Interquartile range, MRI: Magnetic resonance imaging, AIDP: Acute inflammatory demyelinating polyneuropathy, AMAN: Acute motor axonal neuropathy, AMSAN: Acute motor-sensory axonal neuropathy, MFS: Miller Fisher syndrome

Table 4. Treatment regimens, clinical features and complications of the patients during follow up.

Variable	**n (% of total)**
Treatment	
IVIg	40 (48.8)
Plasma exchange	35 (42.7)
Both IVIg and plasma exchange	7 (8.5)
Complications	
UTI	15 (18.3)
Electrolyte imbalances	8 (9.8)
Sepsis	7 (8.5)
Pneumonia	5 (6.1)
Other infections	5 (6.1)
Thrombocytopenia	5 (6.1)
Deep vein thrombosis	3 (3.7)
No complication	38 (46.3)
Other	15 (18.3)
ICU	32 (39.0)
Respiratory insufficiency	13 (15.9)
Mechanical ventilation	5 (6.1)
Mortality	2 (2.4)

IVIg: Intravenous immunoglobulin, UTI: Urinary tract infections, ICU: Intensive care unit

The mortality rate was 2.4% (n=2). Both patients had multiple systemic comorbid diseases. One patient died as a result of sepsis, while the other had hypotension and vital instability. Treatment regimens and complications observed during the treatment and follow-up period were listed in Table 4. The median MRC score was 50 (IQR: 12) at discharge and 53.50 (IQR:14) at the end of the first month. The HMS was ≥3 in 32 patients (39.0%) at discharge and ≥3 in 22 patients (26.8%) at the end of the first month.

Table 5. The relationship between the factors for poor prognosis in GBS patients at discharge and at the end of the first month

	HMS <3 at discharge (n=48)	**HMS ≥3 at discharge (n=32)**	**p value**	**HMS <3 at the end of 1st month (n=52)**	**HMS ≥3 at the end of 1st month (n=22)**	**p value**
Age , years, (mean±SD)	55.73±17.57	59.72±16.19	0.308	55.77±17.25	60.45±16.19	0.281
Male, (n,%)	29(60.4%)	17(53.1%)	0.678	31(59.6%)	11(50.0%)	0.613
Presence of antecedent event, (n,%)	31(64.6%)	24(75%)	0.460	34(65.4%)	17(77.3%)	0.462
Paresis in lower extremities, (n,%)	35(72.9%)	30(93.8%)	**0.041**	38(73.1%)	21(95.5%)	**0.030**
Paresis in upper extremities, (n,%)	24(50.0%)	22(68.8%)	0.152	28(53.8%)	15(68.2%)	0.376
Cranial nerve involvement, (n,%)	17(35.4%)	7(21.9%)	0.296	18(34.6%)	4(18.2%)	0.256
MRC score at admission, (mean±SD)	49.29±8.13	37.31±10.51	**<0.001**	48.23±10.19	37.73±8.57	**<0.001**
Duration of hospital stay, median (IQR)	11.00 (7)	18.00 (16)	**<0.001**	11.00 (7)	21.00 (15)	**<0.001**
CSF protein, median (IQR)	67.60 (57.9)	78.40 (140.3)	0.228	70 (55.9)	73.60 (77.3)	0.770
Albumino-cytological dissociation, (n,%)	29(67.4%)	21(72.4%)	0.851	33(70.2%)	15(71.4%)	0.919
NLR, median (IQR)	2.91 (2.40)	4.00 (4.62)	**0.031**	3.07 (2.83)	3.11 (3.46)	0.119
ICU follow-up , (n,%)	17(35.4%)	15(46.9%)	0.428	18(34.6%)	11(50.0%)	0.328
Treatment, (n,%)			0.901			0.145
IVIg	25(52.1%)	15(46.9%)		29(55.8%)	8(36.4%)	
Plasma exchange	19(39.6%)	14(43.8%)		20(38.5%)	10(45.5%)	
IVIg+Plasma exchange	4(8.3%)	3(9.4%)		3(5.8%)	4(18.2%)	
Complication(n, %)	21(43.8%)	22(68.8%)	**0.049**	25(48.1%)	15(68.2%)	0.183

SD: Standard deviation, HMS: Hughes Motor Scale, MRC: Medical Research Council, CSF: Cerebrospinal fluid, IQR: Interquartile range, NLR: Neutrophil to lymphocyte ratio, AIDP: Acute inflammatory demyelinating polyneuropathy, AMAN: Acute motor axonal neuropathy, AMSAN: Acute motor-sensory axonal neuropathy, MFS: Miller Fisher syndrome, IVIg: Intravenous immunoglobulin, ICU: Intensive care unit

Age, gender and the presence of antecedent events showed no significant association with poor prognosis (HMS ≥3) at discharge or at the end of the first month (Table 5). The presence of paresis in the lower extremities was the only statistically significant associated factor with poor prognosis in patients among the clinical signs and symptoms ($p< 0.05$) (Table 5). No significant association was found between the subtype of GBS and poor prognosis in patients. The presence of complications was found to be associated with a poor prognosis at discharge ($p< 0.05$), but it had no effect on the poor prognosis at the end of the first month (Table 5).

DISCUSSION

GBS is an immune mediated polyradiculoneuropathy that is reported in many countries[1]. The clinical findings and outcomes vary among patients and different factors can affect the prognosis of the patients[2]. Estimating prognosis is important in patients with GBS, as early-stage appropriate medical and supportive treatment can be provided by predicting the prognosis. Therefore in this study we aimed to investigate the clinical characteristics of patients with GBS retrospectively and identify possible prognostic factors that can be associated with a worse short term prognosis.

The incidence of GBS tends to increase with age in both men and women[1, 11]. In our study, patiens with older age and male patients were found to be dominant in consistent with other studies[3,12,13]. Previous researches have shown that older age is associated with higher disability scores at discharge[11,14]. Although the age of the patients were higher in group with an unfavorable outcome at discharge and at the end of one month in our study, the difference was not statistically significant.

GBS can occur in any month of the year but there were regional differences in the season of diagnosis among patients[1,11]. Most patients in this study were diagnosed in winter and spring. However, other studies have shown an increased incidence in summer and autumn among patients with GBS[11,14]. The variability in the seasons are thought to be related to the climatic zone and antecedent infections that are seen in different regions[11,15]. Additionally, seasonal differences can be observed based on the subtype of GBS. Matsui et al. reported seasonal clustering in spring and summer among the AMAN and MFS groups, but no significant difference was found[12]. We did not found any seasonal difference between the subtypes of GBS in our study.

Antecedent events were recorded in 69.5% of the patients in this study. In a study by Alanzy et al. ¾ of the patients had an antecedent event[16]. Similar to previous studies the most common antecedent events were URTI and gastroenteritis in this study[11,14,16,17]. Findings regarding the prognosis in patients with GBS and antecedent events are controversial. We found no significant difference between the presence or type of antecedent event and the MRC and Hughes scores at discharge and at the end of the first month. Similar to our findings Tunc et al observed no statistical correlation between functional disability and antecendent events.[3] In contrast in another study, gastroenteritis as an antecedent event was found to be associated with a poor prognosis in GBS patients[14].

Eleven of the patients (13.4%) were diagnosed in the SARS-CoV-2 era. Four of them had URTI complaints before the diagnosis. One of those 11 patients was diagnosed with SARS-CoV-2 infection 3 days after the diagnosis of GBS. However, since commercial SARS-CoV-2 PCR testing was not available back then, it is unknown whether those other patients had an accompanying SARS-CoV-2 infection.

The most common variant of GBS in our patient group was observed as AIDP, followed by AMAN, MFS and AMSAN. We observed no association between GBS subtypes and poor prognosis at discharge or at the end of first month. A study from our country reported no association between the variants of GBS and poor prognosis[14]. Similarly, in a different study from Japan no significant difference was found between the GBS disability score and different subgroups of GBS[12].

CSF analysis could be performed in 74 patients due to admission time, vital unstability or patient consent for the procedure. CSF protein levels were found to be elevated in 72.0% of the patients. The prognostic usefullness of CSF protein in GBS is uncertain[18]. CSF protein levels are suggested to be associated with increased accumulation of myelin degradation products, antibodies and complements results from the inflammation of the nervous system and elevated CSF protein levels shows the destruction of the blood nerve barrier[3,19]. We observed that the median protein levels were high in patients with HMS ≥3 at discharge and at the end of the first month but the

association was not statistically significant. Moreover in a study by Saba et al. no significant correlation was found between MRC scores at discharge and CSF protein levels[18]. In contrast in different studies, CSF protein levels were found to be significantly correlated with poor prognosis at the beginning and end of the first or sixth month[3,19].

Previous studies have shown that low MRC scores (<40) before treatment are predictors of poor outcomes and low MRS score at admission is associated with the inability to walk at 4 weeks[20]. The mean MRC score at admission was lower in patients with HMS≥3 at discharge and at the end of the first month in our study and the difference was statistically significant.

Quadriparesis and alterations of deep tendon reflexes are common signs at admission in patients with GBS[15]. Weakness in lower extremities was the most common clinical finding in our patients and was significantly associated with a worse prognosis (HMS≥3) at discharge and at the end of the first month. Deep tendon reflexes were either absent or diminished in 95.1% of the patients but no association was observed between the deep tendon reflexes and HMS scores at discharge or at the first month.

Respiratory failure was previously reported to be observed in 25%-30% of the patients with GBS[2]. Mechanical ventilation (MV) was reported to be required by 13.3% of patients in studies conducted by Zhai et al. and 16.1% of patients by Bhagat et al[11, 21]. In different studies conducted in our country by Cetiner et al. and Akan et al. 17.6% and 26.7% of patients were found to require MV respectively[14,17]. In our study 6.1% of patients required MV which is lower than in previous studies. Also we observed a significant difference between the need for MV and poor prognosis (HMS≥3) at discharge and at the end of the first month. In accordance with a study by Shangab et al. the disability scores after a month were higher in patients who needed MV and Di et al. found a significant association between patients with HMS >3 at discharge and the need for MV during hospitalization[13,22].

In a study by Tunc et al. cranial nerve involvement was detected in 27% of patients and was found to be associated with a worse clinical outcome[3]. Cranial nerve involvement was observed in 22% of patients in our study. However no significant association was observed between cranial nerve involvement and poor prognosis at discharge and at the end of the first month.

In a study by Shangab et al. it was reported that the disability score was 4 (IQR:1) at presentation and 2 (IQR: 3) at the end of the one month[13]. We found that 39.0% of the patients had HMS ≥3 at discharge and 26.8% of the patients had HMS ≥3 at the end of the first month. Similarly in another study, it was shown that according to Hughes scoring 20 patients (39.2%) had a poor prognosis (Hughes score ≥3) on the 3rd month after discharge[14]. In contrast Bhagat et al. found that 92.8% of the patients with GBS had a good outcome at discharge[21].

The NLR and mean platelet volume to platelet count ratio (MPV/PR) have been proven to be useful for assessing prognosis in various neurological diseases including stroke, Alzheimer's disease, Parkinson's disease, and multiple sclerosis[23]. Leukocyte, neutrophil values and NLR were found to be significantly higher in patients with GBS than the control group previously[24]. Moreover in different studies NLR was found to be correlated with poor prognosis at discharge and at the end of the first month[3,22]. A recent study also reported that NLR can be an independent predictor of respiratory failure in GBS[23]. The median of NLR in patients with HMS ≥3 at discharge was found to be higher than in patients <3 and the difference was shown to be statistically significant. Although NLR values had a relationship with the early disability of the patients, we found no significant association between NLR and the patients with HMS ≥3 at the end of the first month.

For the treatment of GBS immunomodulatory therapies such as plasma exchange and administration of IVIg can be used in patients[2]. Both treatments can be recommended and no significant difference is observed in the effect of the combination therapy to IVIg alone[2]. In our study IVIg was found to be the most common therapy chosen for the treatment of patients similarly to other studies. Although it is suggested to be impractical to use plasma exchange after IVIg treatment, we preferred in a small group of patients who did not respond to IVIg alone. Five out of these 7 patients treated with the combined regime had an MRC score lower than 40 at admission.

The mortality of the patients during hospitalization was reported as 6.45% in a previous study in Nepal and 6.8% in a study from Turkey[17,21]. Our mortality rate (2.4%) was detected lower than in previous

studies. The difference in mortality rates may be due to the changes in comorbid diseases of patient groups, access to treatment or intensive care conditions between various studies conducted in different countries.

Anti-ganglioside antibodies were tested in patients applying with suspected symptoms. We observed that anti-ganglioside antibody tests were done in 23 patients and only four of them had positive results. Anti-ganglioside antibody tests have been available as a panel only after 2017 in our center and before that, only one suspected, clinically relevant antibody could be tested. We thought this could result in missing antibody data in patients.

In order to rule out any other pathologies, especially in patients applying with paraparesis lumbal MRI was performed. Contrast enhancement of thickened nerve roots of the conus medullaris and cauda equina is accepted as a sensitive supportive test for diagnosing GBS[25,26]. In a previous study nerve root enhancement was reported in 42.7% of the patients[16]. Although in our study among those patients with MRI data, only three showed contrast enhancement on the cauda equina suggesting that although sensitive, it is not found as a frequent finding.

There are some limitations of the study. Firstly the study was retrospective in design. Secondly it should be noted that anti-ganglioside antibody tests have been available as a panel only after 2017 in our center and before that, only one suspected, clinically relevant antibody could be tested. Also because of the cost of these tests patients can refuse the tests and there can be missing data. Thirdly, only short term clinical results of the patients were evaluated and long term prognosis and clinical outcomes could not be discussed.

This study evaluated the clinical characteristics of patients with GBS and we found that paresis in lower extremities, need for MV and MRC scores at admission can be the possible prognostic factors associated with worse prognosis in short term for patients with GBS. In conclusion, the epidemiological, clinical features, clinical disability outcomes and prognostic factors of GBS may vary in different regions. Despite current developments, GBS is still an important cause of mortality and morbidity and clinical, electrophysiological and biological factors for predicting the prognosis at early stages are still uncertain. Further larger studies from different regions are needed for establishing the clinical course and prognosis of patients with GBS.

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