
Guillain-Barré syndrome. Experience with 91 Children at a Pediatric Hospital in Northwestern Mexico

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Síndrome de Guillain-Barré. Experiencia con 91 niños en el Hospital Pediátrico en el Noroeste de México

Resumen

Introducción: síndrome de Guillain-Barré (SGB), polirradiculoneuropatía inflamatoria aguda desmielinizante, se presenta después de infecciones.

Objetivos: describir comportamiento clínico, tratamiento y evolución en 91 niños.

Material y métodos: variables: edad, sexo, estación del año, vacunas, grados de discapacidad según escala de Hughes, variantes clínicas, laboratorio, gabinete, terapéutica, evolución. Estadísticas utilizando paquete JMP.SAS.

Resultados: masculinos, 55, (P=0.035). Predominaron, preescolares 42%. En primavera-verano, hubo 75%, P<0.0001; vacunación previa en 5.4%. Signos y síntomas, dolor 48%, debilidad muscular, 100%, hipertensión arterial 16%, fiebre 9.8%, Miller-Fisher 17%. Disociación albumino-citológica en 68%; a 6.5% se hizo electrodiagnóstico. Escala de Hughes, 49% con grado 4 de discapacidad a 48 horas de estancia, P< 0.0001. Tratamiento: 39.5% recibieron inmunoglobulina intravenosa (IGIV), la recuperación fue 15 días menor, P= 0.0478; la ventilación asistida prolongo estancia, P<0.0001, no hubo mortalidad.

Discusión: El comportamiento fue estacional primavera-verano; con el uso de IGIV hubo menor tiempo de hospitalización.

Palabras clave: síndrome de Guillain-Barré, síndrome Miller-Fisher, polirradiculoneuropatía aguda inflamatoria, anticuerpos antigangliosidos.

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Abstract

Introduction: Guillain-Barré syndrome (GBS) is an acute, inflammatory, demyelinating polyradiculoneuropathy .

Objective: To describe the clinical course, treatment, and evolution in 91 children.

Methods: The variables were: age, gender, season, vaccines, disability grade, clinical variants, laboratory test, treatment, and evolution. JMP,SAS, software package.

Results: Most were males ($p = 0.035$). Preschooler age (42%), Seventy five percent of cases ($p < 0.0001$) appeared during spring-summer; 5.4 %, received vaccines previously. Signs and symptoms: pain 48%, weakness 100%, high blood pressure 16%, Miller-Fisher variety 17%. By the Hughes scale at 48 h, 49% exhibited disability grade 4 ($p < 0.0001$). Albumin-cytological dissociation 68%. Treatment, 39.5% received Intravenous immunoglobulin (IVIG), and their recovery in less time than with other treatments ($p = 0.0478$); ventilator assistance led to longer hospital stay ($p < 0.0001$), and there was no mortality.

Discussion: GBS presentation was seasonal, and with the use of IVIG, the hospital stay was shorter.

Key words: Guillain-Barré syndrome, Miller-Fisher syndrome, acute inflammatory demyelinating polyradiculoneuropathy, anti-ganglyoside antibodies.

Introduction

Worldwide, it is estimated that each year, there are between 0.4 and 1.3 cases of Guillain-Barré syndrome (GBS) for every 100,000 inhabitants under 14 years age; this syndrome is described as an inflammatory polyneuropathy commonly characterized by marked debility and progressive, symmetric areflexia, which generally begins in the lower but can ascend to the upper limbs, thorax, face, and cranium with combined autonomic symptoms. To date, the precise cause of GBS remains unknown; it usually occurs after respiratory or digestive-tract infections; it is considered that the mechanism by which it affects the peripheral nervous system is of the autoimmune type¹⁻³.

Currently, GBS has been subclassified; thus, the following have been taken into account: clinical

findings; changes in the Cerebrospinal fluid (CSF); associated etiological factors such as anti-ganglyoside antibodies, with glycolipid variants (Anti-Gm1, GM1b, Ga1Nac-GD1a) that are frequently associated with patients with campilobacter jejuni-related infection. All of these taken together, in addition to the electrophysiological patterns, have given rise to consideration of the following clinical variants: Acute demyelinating inflammatory polyradiculoneuropathy (ADIP) and associated forms that include Acute motor-sensory axonal neuropathy (AMSAN) and Acute motor axonal neuropathy (AMAN); the following have also been considered: Bickerstaff's Brainstem encephalitis (BBE); Miller-Fisher syndrome (MFS); Facial diplegia (FD), and the Pharyngeal-cervical-braquial (PCB) variant^{1,2,4,5}. The following diverse treatments have been utilized: support measures; steroids; adrenocortico-

tropic hormone (ACTH); plasmapheresis; immunosuppressors of the azathioprin, 6-mercaptopurine, and cyclophosphamide types, and, more recently, Intravenous immunoglobulin (IVIG)⁶⁻⁸. Prognosis for the disease tends to be good in children as well as in adults but, depending on disease evolution time and clinical course, it can leave diverse-grade motor sequelae. Sometimes the severity of the patient's clinical chart can be fatal as a consequence of a respiratory failure and severe cardiac-rhythm disorders^{1-3,9}.

In this work, we describe the evolution of and treatment for GBS received by a group of patients cared for at a secondary healthcare-level hospital of the National Health System in Mexico during the 1997-2008 period.

Materials and Methods

We conducted a retrospective, observational, descriptive, and comparative study in 91 patients with GBS who were hospitalized during the years 1997-2008.

The variables studied were the following: age; gender; time of the year; antecedents of vaccination; application of vaccinations prior to initiation of the clinical picture; ingestion of *Karwinskia humboldtiana* ("tullidora", small Mexican coyote); data of botulism, myasthenia, myositis; contact with lead; clinical signs; grades of disability; established clinical variants; fever; pain; sensitivity disorders; neurological assessment; laboratory and office studies; therapeutic interventions; intravenous immunoglobulin (IVIG); care with symptomatic measures; corticoids; plasmapheresis; use of assisted breathing, and time of hospital-stay evolution. Statistical tests among the variables considered were processed with the JMP8.0 software package for descriptive statistical analysis (percentages, mean, Standard deviation [SD]); for bivariate analysis (one way fixed-effect model variance, the Fisher F-test for homogeneous variance; the Walsh F-test for non-homogeneous variance; the Bartlett, Levene, and Brown-Forsythe tests for homogeneity of variance; the Tukey-Kramer test for mean multiple comparison; the student t test; contingency tables

with Pearson's chi-squared test, and analysis by classification; for multivariate analysis, the multiple correlation matrix, and calculation of Spearman and Pearson correlation coefficient¹⁰.

The study protocol was approved by the Research and Ethics Committees of the Hospital Infantil del Estado de Sonora in Hermosillo, Mexico.

Results

All 91 patients resided in the state of Sonora; 55 were masculine gender (60.4%) and 36 (39.5%), feminine, with a predominance of males ($p = 0.035^*$). With respect to age groups, there were two patients (2.1%) aged 2-11 months, 16 (17%) between the ages of 1 and 2 years, 39 were between the ages of 3 and 6 years (42%), 20 were aged between 7 and 10 years (21.9%), and there were 14 patients (15%) aged 11-15 years.

During spring and summer seasons, there were 69 cases presented (76%), that which were more, significantly ($p < 0.0001^{**}$) than those (22 cases; 24%) observed in autumn and winter.

A total of 85 patients (93%) had received the complete immunization schedule; in six patients, vaccinations were incomplete; five patients (5.4%) had been administered vaccinations within a time lapse of <1 month prior to initiation of signs and symptoms; three preschoolers aged 2-3 years and one 4-year-old preschooler received the Sabin vaccination and two had had the Bacillus Calmette-Guérin (BCG) vaccination, with one of the latter children aged 4 months and the remaining child, 5 years.

We found no antecedents of patients ingesting *Karwinskia*, nor with contact with lead, nor botulism, nor signs of myasthenia or myositis; 37 children (40%) had a prior respiratory infection; in nine (9.8%) patients, there was the antecedent of diarrhea prior to manifestations of GBS.

Among disease signs and symptoms, 44 (48.3%) patients presented limb pain, nine (9.8%) had fever at symptoms initiation, 91 (100%) experienced progressive muscular weakness, and nine (9.8%) referred paresthesia and alteration in sensitivity associated with painful manifestations. Sixteen patients (17.5%) experienced manifestations such as

upper-limb weakness, ophthalmoplegia, and ataxia, which were considered as a Miller-Fisher syndrome variant, and high blood pressure presented in 15 patients (16%). Main antecedents and clinical findings are depicted in table 1.

All patients were submitted to complete blood biometry, with erythrocytation velocity rate, complete blood chemistry, electrolytes in serum, C-reactive protein, and four patients were tested for Creatinine phosphokinase (CPK); 37 patients (40%) were submitted to liver function tests, finding moderate alterations in two patients. A total of 26 patients had total protein measurements, with normal results; in nine patients, we requested antistreptolysine and pharyngoamygdalitis cultures; no detection was made of *Campylobacter-jejuni* antibodies in fecal culture, nor of cytomegalovirus. In 62 patients (68%), study of the Cerebrospinal fluid (CSF) showed at hospital admittance the characteristic elevation of proteins with scarce or null cellularity, and in 22 (24%) patients, changes were evident at week 2 of evolution; in seven children, this was normal, and in 65 (71%) children we performed CRL culture, which resulted negative. In six children (6.5%), we performed electrodiagnostic studies after week 3, which demonstrated Mo-

tor-nerve conduction-velocity (MNCD) reduction, prolonged latencies, and abnormal dispersion or temporary conduction block.

Thoracic x-ray was conducted in all cases, cranial tomography in 20 patients (21%), above all in those with initial diagnostic doubts, and especially in those manifesting Miller-Fisher variant signs.

Once laboratory studies were completed and the patient was catalogued as having GBS, in the course of day 1 a report was made to the Service of Epidemiology in compliance with that established by the Mexican Ministry of Health (SSA) Guidelines for care of flaccid paralyses¹¹.

To assess the grade of disability of patients, we utilized the Hughes disability grade scale¹², which considered the following degrees: **1.** signs and symptoms of slight neuropathy that allow for performing activities, walking, running with difficulty, dressing oneself, bathing oneself, and eating; **2.** walking >5 meters without help, no jumping, running, or performing personal care, incapable of manual work; **3.** capable of walking with the aid of a cane; **4.** use of a wheelchair; **5.** the need for assisted breathing, and **6.** death. We observed that at 48 h of hospitalization, 45 patients (49%) presented grade 4 disability, while in 12 (13%) grades 3-5 were registered, and there were 11 patients (11%) with grades 1-2, highlighting that the most commonly observed classification was grade 4 ($p < 0.0001^{**}$).

With regard to treatment, 45 patients (49%) received symptomatic treatment and support measures alone; in 36 patients (39.5%), we administered IVIG in 400-mg doses \times kg \times day during 5 days; nine patients (9.8%) received cortisone in different presentations, four patients were administered prednisone at 2 mg \times kg \times day for 2 or 3 weeks, and three patients received dexamethasone at 8-mg doses daily for 1 week; plasmapheresis was experienced by three patients (3.2%), with rechanges of 50 ml/kg in 2 and 4 different sessions administered in 1 or 2 weeks.

Twenty seven patients (29%) required tracheotomy due to disability that evolved from grade 4 to grade 5.

With respect to the treatment administered, 36 patients (39.5%) who received IGIV registered an

average recuperation time less than 23.1 days compared with 52 patients who received different treatment modalities, such as support treatment alone, steroids, and plasmapheresis, with an average recuperation time of 38.6 days, (Welch means-difference test with unequal variances, $p = 0.0478^*$), that is, average recuperation time was 15 days less than in those using IGIV with respect to the other treatments considered.

We found good correlation between hospitalization days and grade of disability assessment according to the Hughes scale. Correlation between hospitalized days and disability assessment is <48 h ($r = 0.398$); this improved substantially at 1 week of the hospital stay (0.679) and reached its maximum at 2 weeks of hospitalization ($r = 0.707$); average hospitalization times depended on the disability grade, and this is independent of evaluation of this grade (48 h, $p = 0.0046^{**}$; 1 week, $p < 0.0001^{**}$; 2 weeks, $p < 0.0001^{**}$). Hospitalization time was always significantly greater for grade 5 disability (Tukey-Kramer, $p = 0.05$) except for classification 1 in week 1. On the other hand, we carried out a test to verify whether the classification taking into account time of hospital stay at 48 h and at 1 week was similar to week 2, finding that these are different (Pearson chi-squared test, $p = 0.0046$). When recuperation times were compared with other variables (age, gender, time of hospital stay, disability grade, use of IVIG, steroids, and plasmapheresis) and use of assisted breathing, there was no difference for age ($p = 0.1498$) and gender ($p = 0.5968$).

On analyzing steroid use and recuperation time separately, the test did not show evidence that use of the former exerted an influence on recuperation time ($p = 0.5107$); likewise, there was no correlation between recuperation time and plasmapheresis administration on considering average hospital stay (38.67 vs. 32.04 days). In terms of ventilation use, we observed that this actually does influence an increase of average hospital-stay time (18.89 to 59.45 days) ($p < 0.0001^{**}$). Considering hospitalization time at 48 h, a scarce correlation is appreciated between ventilator use and disability grade ($R^2 = 0.038$); however, use of a ventilator is not the same for each disability grade (chi-squared

test, maximum likelihood, $p = 0.052$; Pearson ($p = 0.044^*$). Using correspondence analysis, we were able to appreciate a greater association of ventilator use and grade 5 disability.

Eighty seven children (45.6%) had rehabilitation therapy that began at the end of week 1, and nine patients were transferred to another institution on establishment of their diagnoses.

Two patients (2.1%) were re-hospitalized due to their having presented relapse after 3 years of the first study.

Average hospital-stay time was 34.6 days, and 57 patients (62%) were hospitalized for 21 days; they were discharged from the hospital due to good recuperation. Patients who needed respiratory assistance with the ventilator required between 8 and 18 months to begin to walk again without help and to carry out daily living activities.

Discussion

The description of acute demyelinating inflammatory postinfection polyradiculoneuropathy, known as Guillain-Barré syndrome (GBS), appeared for the first time in 1859 in the work of Landry de Theiler, with the name of ascending paralysis; from this time and up to 1916, Drs. Georges Guillian, Jean Alexander Barré, and André Strohl describe this in complete fashion with the results of chemical analyses of the cerebrospinal fluid that we know as GBS. From that time until the present, the etiology has not been well known; some infectious agents have been involved, such as *Campylobacter jejuni*, cytomegalovirus, Epstein-Barr virus, *Haemophilus influenzae*, varicela Zoster virus, *Mycoplasma pneumoniae*, and some viral-type vaccines; GBS has been found to be associated eventually with surgical events, pregnancy, oncological processes, autoimmune diseases, drug use, spinal anesthesia, transplants, and insect bites^{1, 4, 6, 13, 14}.

The classically described physiopathology for GBS comprises the presence of a rapidly progressive polyneuropathy that exhibits absence or delay in nerve-fiber conduction as the result of demyelination of the nerves' axonal cells, mainly affecting peripheral nerves and spinal roots, although cra-

nial nerves can also be involved; to date, it is sustained that the lesions are the result of an autoimmune response mediated by both humoral and cellular mechanisms following a recent infection or diverse preexisting medical pathology problems, with the participation of several factors ranging from Human leukocyte antigen (HLA) histocompatibility complexes of the patient, chemokines present in the axons, macrophages, and blood vessels, as well as the presence of bacterial strains or prevailing microorganisms in the environment that infect the patient, in addition to molecular mimicking between infecting agent and neuronal structures; in this regard, a relation has been found between anti-ganglioside antibodies (the glycosphingolipids GM1, asialoGM1, GM1b, Ga1Nac-GD1a, GD1b, 9-0-acetyl-GD1b, GD3, GT1a, GT1b, GQ1b, and LM1), as well as isotopes in the lipopolysaccharide layer of some infectious agents, with the existence of dual recognition in host and infecting agent by T-cell receptor or antibodies, leading to erroneous recognition of autoantigens, triggering the immune response against host tissues and, particularly in *Campylobacter jejuni*, cell-wall lipopolysaccharides, which possess a structural similarity with human gangliosides GM1 and GD1 of peripheral nerve axons^{15,16}. In the cases reported in this study, the study procedure did not include determination of antibodies that seek etiology, such as the following: anti-ganglioside and anti-*Campylobacter jejuni* antibodies IgA, IgG, and IgM; these studies, according to current evidence, are related with patients whose syndrome initiation was preceded by diarrheic disease. These cases are more frequent in the variant known as acute axonal motor neuropathy (AMAN) and tend to be found also associated with the Fisher and Miller-Fisher variants^{1-3, 15-17}; in this series, a sole patient catalogued with the MF variant had an antecedent of a diarrheic clinical picture.

Worldwide incidence of the disease is reported at between 0.6 and 4 cases per 100,000 inhabitants, observing an increase of 20% every 10 years^{18,19}; this amount is more notable during the adult life stage. For Latin America and the Caribbean, an incidence is reported of 0.82/100,000 in children aged 5 years²⁰. In Mexico, according to Nation-

al Center for Epidemiological Surveillance registries, in a lapse of 24 years there were between 400 and 600 cases annually, with an average incidence of 1.5/100,000 inhabitants, corresponding to the 5-14-years-of-age group (18.75%) of all cases¹¹; at the Hospital Infantil del Estado de Sonora in Hermosillo, according to data provided by the Department of Archives and Biostatistics in the 1997-2008 period, there were 62,894 patients discharged from the hospital; the percentage of GBS was 0.0014%, equivalent to one case per 692 hospital discharges^{1-3, 18, 19-22}. We observed a predominance of masculine gender; the number of cases in pediatric ages is sensitively less compared with adults, and it is rare to find GBS in infant patients aged <1 year^{1-5, 23, 24}; however, in this review we found two cases in infants <1 year of age: one aged 4 months, and another, 10 months of age. The groups in which the greatest number of patients was registered was between 3 and 6 (42%) and between 7 and 15 years of age (37%); the most frequent age peak found for GBS presentation during childhood has been reported at between 4 and 8 years of age. The time of year when the greatest number of cases was registered was spring and summer ($p < 0.0001$)(table 1).

There was no relation with the increase of diarrheic disease in the summer, because of the nine cases registered, two presented in the spring, two in the summer, and the remaining five in the winter^{1-5, 23, 24}. Of antecedents considered in the clinical history for differential diagnosis and etiological factors, it was only noteworthy that of five patients, three had received the Sabin vaccine as revaccination and in two, there was late application of the BCG vaccine. Reports of GBS associated with these two vaccines are isolated²⁵⁻²⁷; although insistence has been placed on the possibility that application of diverse vaccines has been related with GBS, in these patients that we registered, it is difficult to establish a cause-effect relationship precisely with the vaccines received^{26, 27}. On the other hand, the vaccine most persistently reported is that of the influenza virus^{15, 18, 19, 25}.

In no case among all those that we reviewed we did not find elements related with other causes of paralysis; the antecedent of respiratory infec-

tion was found in 40% of the children and 9.8% had manifested diarrheic disease at least 1 week prior to hospital admittance; unfortunately, these patients were not submitted to studies for *Campylobacter jejuni*, *Mycoplasma pneumoniae*, and Cytomegalovirus antibodies¹⁵⁻¹⁷; thus, we were unable to infer some relationship. In this regard, it has been published that in Mexico, the behavior of GBS can be related to a greater degree with acute diarrheic disease and with the subtype of Acute motor axonal neuropathy (AMAN), associated with *Campylobacter*-related digestive-tract infection, in addition to its having seasonal behavior, as occurs in reports on northern China^{20, 21}; however, it would be convenient to conduct a study of this nature in northern Mexico to demonstrate whether there are indeed differences.

Signs and symptoms in 48.3% of patients included limb pain and weakness was registered in all cases; no alterations in sensitivity were registered in 82 children; a smaller group of patients had parestheses and cramps, manifestations that were associated with pain. Nine patients presented moderate fever at the beginning of the symptoms (9.8%). Sixteen children (17.5%) exhibited the characteristic signs and symptoms of the Miller-Fisher variant; in these patients, we tended to find more frequently a greater association between the positivity of the anti-glycoprotein antibody, as well as also greater frequency of *Campylobacter jejuni*-related infection;²⁸ The incidence in general for the Miller-Fisher variant of GBS is estimated at 10%, although it has also been mentioned that in Asian countries, it appears to present geographic variability and incidence ranges from 20-25%. Patients in this series who manifested the Miller-Fisher variant comprised 17% of the whole and all experienced satisfactory evolution^{2, 4, 9, 17, 28}.

Of patients presenting other signs of dysautonomia, represented by high blood pressure corresponding to 16%, it has been referred that this is variable and that than it can occur in up to 25%, independently on the clinical variant^{1-5, 29}.

With regard to laboratory studies, it is currently recommended that, in each patient and to the extent possible, determinations should be made of anti-ganglioside antibodies, and also of *Cam-*

pylobacter jejuni, *Mycoplasma pneumoniae*, and Cytomegalovirus. Very recently, determination has been suggested of antiglycan antibodies²⁹; in our healthcare ambit, clinical guides for GBS care basically consider cytochemical analysis of the cerebrospinal fluid, seeking to document the characteristic albuminocytologic dissociation; in the report, we found that on hospital admittance, there were 62 patients (68%) with this dissociation; in the remaining 22 children, we were able to observe, in a second study conducted locally in week 2, that seven of these reported normal CSF. It is known that in patients arriving during the course of week 1, we are able to find the CSF with normal cytochemical characteristics, the latter even remaining without alterations in week 2; however, the clinical picture continues its evolution and it is until 21 days that it is possible to continue to find characteristic changes: some patients evolve rapidly to respiratory paralysis, having presented normal CSF on their admittance to the hospital^{1-5, 29, 30-32}.

Of the office studies, only six children received electrodiagnostic tests. The pattern of alterations in patients was commonly described for GBS; 57 patients did not require electrodiagnostic tests because they were admitted within the course of the first 21 days post-admittance and the guidelines specify at least 3 weeks for carrying out this diagnostic procedure^{11, 31}; but on the other hand, the institution does not possess electromyographic equipment; thus, the studies must be performed at private hospitals with a cost ranging between \$8,000 and \$12,000 Mexican pesos, this depending on whether it is a study of one or all four limbs and constituting a cost that the majority of our patients' families are unable to defray.

Twenty patients had Computed tomography (CT) of the cranium due to initial doubts concerning diagnosis; among these were included children with the Miller-Fisher disease variant.

The predominating disability grade at 48 h was Hughes scale grade 4 and this was also the grade most commonly observed ($p < 0.0001^{**}$), followed by grades 3 and 5 (11%); this can explain the number of patients requiring assisted ventilation.

The treatment employed was IMIG in 36 patients, and in the 52 remaining subjects three had plas-

mapheresis, nine received cortisone, and three were administered support measures when they were transferred to another institution; we are able to observe that hospitalization times were 15 days less in patients who received IGIV ($p = 0.0478$) with an average 23.1-day hospital stay against one of 38.6 days. To date, discussion continues concerning the cost-benefit of plasmapheresis use compared with that of IVIG; however, with the availability and easier use of IVIG in an ever greater number of patients treated with better evolution and less hospitalization time, the latter appears to possess advantages. In Mexico, IGIV has been included in the basic drug list and among other therapeutic materials in the health systems^{1-9, 28, 30-33}.

On comparing recuperation times with disability grades, we found that the former depend on the disability grade independently of which disease stage is evaluated with the Hughes scale, and this was logically higher for grade 5 disability.

Regarding the use of steroids and plasmapheresis, while there were 11 cases between both therapeutic modalities, no statistical evidence showed that these exerted an influence on shorter recuperation time ($p = 0.5107$). In a recently published study in which the cost-benefit of plasmapheresis and IVIG use were analyzed, the authors concluded that both were equally effective in GBS, but there is evidence that plasmapheresis is a less expensive therapeutic option, although it required more technical procedures³³.

In terms of ventilator use, we observed that this exerts an influence on prolongation of average hospitalization time from 18.89 to 59.45 days ($p < 0.0001^{**}$) with a notable association with grade 5 disability^{33, 34}.

Physical rehabilitation was administered to 87 children from the end of week 1; this is an important factor in recuperation and to aid in avoiding prostration-related complications, especially in pa-

tients with the highest grades of disability or who come to require assisted ventilation.

It has been estimated that the complication are more common in patients under 6 year age; on the other hand mortality in pediatric ages is up to 5%; in this series, notwithstanding the number of children with respiratory problems, no mortality was registered^{1-5, 28, 31, 33-36}.

Conclusions

GBS is the most frequent cause of paralysis in children in our healthcare ambit, this after the eradication of poliomyelitis. In the review of experiences obtained at a pediatric hospital in north-eastern Mexico, we are able to conclude that notwithstanding the Health Sector guidelines in Mexico for the study and follow-up of cases of flaccid paralyzes, there are deficiencies, such as the difficulty in classifying the disease variables when attempting to utilize diagnostic aids such as that of electrodiagnosis, this in view of the scarcity of trained professionals for performing the latter, because in the majority of secondary-level healthcare hospitals there persist notorious limitations in this sense even 20 years after establishment of the norms. This also applies to the serological and bacteriological laboratory studies that have been recommended as useful in the study and better knowledge of this disease

Currently the efforts to study and classify the different variants of GBS in Mexico appear to be restricted to the isolated efforts of researchers interested in this pathology²⁰⁻²².

In this series, we observed that the use of IVIG shortens hospital-stay time and improves recuperation. It can be concluded that this is a useful therapeutic procedure in the treatment of Guillain-Barré syndrome.

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**Artículo sin conflicto
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