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GUILLAIN–BARRÉ SYNDROME ASSOCIATED WITH SARS-COV-2 INFECTION: A SCOPING REVIEW

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ABSTRACT

Background: Severe acute respiratory syndrome coronavirus 2 (SARV-Cov-2) infections can affect the nervous system, triggering problems such as Guillain-Barre Syndrome (GBS) and this association can bring complications to the patient.

Objective: This scoping review aims to clarify the clinical features and analyze patients with GBS associated with SARV-Cov-2 infection, looking at morbidity, mortality and neurological outcomes.

Search Strategy: The search was conducted through Medline, Web of Science, Embase, CINAHAL, Latin-American and Caribbean Literature in Health Sciencies (LILACS), clinicaltrials.gov, SCOPUS and the Cochrane Central Register of Controlled Trials.

Selection Criteria: Observational studies, published after 2019, which describing patients with GBS associated with SARV-Cov-2 infection. There were no language restrictions while selecting the studies.

Data Collection and Analysis: Three authors, KSM, LTAM and WFS independently screened the search results using the titles and abstracts. Duplicate studies were excluded. The same authors then went through the full text to determine whether the studies meet the inclusion criteria. Discrepancies were resolved by others reviewers, APFC, ACAS and AKG. The selection of the studies was summarized in a PRISMA flow diagram.

Main Results: Principle manifestations were fever, coughing, dyspnea, sore throat, ageusia, anosmia, and respiratory failure, besides this, paresthesia of the upper and lower limbs, tetraparesis, facial diplegia, arreflexia, astenia, mastoid pain, sensitive ataxia, fatigue, numbness, swallowing disorder and moderate low back pain.

Conclusion: Coronavirus disease 2019 (COVID-19) can trigger GBS, despite the few studies on this topic. Because the patients had clinical manifestations of COVID-19 infection and neurological manifestations characterizing GBS.

Keywords: COVID-19; SARS-CoV-2; Guillain-Barre Syndrome.

INTRODUCTION

In December 2019, an outbreak of SARV-Cov-2, the virus that causes COVID-19 was detected in Wuhan City, Hubei Province of China. COVID-19 primarily affects the respiratory tract and the lungs and the appearance of symptoms depends on the age

and the patient's underlying medical illness and also the condition of the immune system [1, 2].

The infected individuals usually have simple respiratory symptoms, fever, dry cough, and tiredness, which can progress to pneumonia and dyspnea [3]. The reported neurological manifestations and complications of COVID-19 include anosmia, headaches, dizziness, delirium, stroke, epilepsy, encephalitis, encephalopathy, myalgias and Guillain-Barré syndrome (GBS) [1,2].

The GBS is an acute immune-mediated disease of the peripheral nerves and nerve roots (polyradiculoneuropathy) that is usually preceded by various infections [2]. The classical clinical manifestations include paresthesia, progressive, ascending, and symmetrical flaccid limbs paralysis, muscle weakness, and areflexia. It may also present an infection of the gastrointestinal or respiratory tract before neurological symptoms [1].

The aims of this scoping review is to clarify the clinical features of patients with Guillain-Barre syndrome associated with SARV-Cov-2 infection, their morbidity and mortality, as well as, about this important neurological manifestation caused by COVID-19.

METHODS

The Scoping Review has carried out following PRISMA-ScR (Preferred Reporting Items for Systematic reviews and Meta-Analyses extension for Scoping Reviews) checklist[5].

Protocol and registration

The review was not registered in PROSPERO, and corresponding authors were not contacted due to time constraints. Ethical approval was not required for this review.

Eligibility criteria

This scoping review included the following studies: observational studies (case report, case series, case-control, and cohort) describing patients with Guillain-Barre syndrome associated with SARV-Cov-2 infection; and studies published after 2019,

because the first case of COVID-19 was registered in Wuhan, China, in December 2019[6]. There were no language restrictions while selecting studies.

Information Sources

Medline, Web of Science, Embase, CINAHAL, Latin American and Caribbean Literature in Health Sciences (LILACS), clinicaltrials.gov, SCOPUS, and the Cochrane Central Register of Controlled Trials were used to search for articles published between December 2019 and April 2020. We selected the publications starting from December 2019 because the first case of COVID-19 was registered in Wuhan, China, in December 2019[6].

Search

The medical subject headings (MESH) terms were (COVID-19 OR severe acute respiratory syndrome coronavirus 2 OR SARS-CoV-2) AND (Guillain Barre Syndrome OR Guillain-Barré Syndrome OR Landry-Guillain-Barre Syndrome OR Acute Autoimmune Neuropathy) (table 1). Eligible studies were also selected from the reference lists of the retrieved articles. The research included articles published until June 26.

Selection of sources of evidence

Three authors, KSM, LTAM, and WFS, independently screened the search results using the titles and abstracts. Duplicate studies were excluded. The same authors then went through the full text to determine whether the studies meet the inclusion criteria. Discrepancies were resolved by others reviewers, APFC, ACAS and AKG. The selection of the studies was summarized in a PRISMA flow diagram (figure 1).

Data items and Synthesis of results

Various characteristics of the eligible studies were extracted, including the first authors last names, year of publication, location of the study (country), study design, primary objective, level of evidence, number of patients, gender, mean age of patients, comorbidities, clinical manifestations, muscle strength assessment, patient outcome,

chest imaging, laboratory tests, tests diagnosis and treatment. Standardized data extraction forms were specifically created in Excel for this review, and the results were entered into a database. All data entries were double-checked. Subsequently, qualitative Synthesis was summarized in one table.

Critical appraisal of individual sources of evidence

The quality of included studies was assessed using the New JBI Levels of Evidence developed by the Joanna Briggs Institute Levels of Evidence and Grades of Recommendation Working Party October 2013[7]. We then used a Checklist for Case Series[8] and Checklist for case reports[9].

RESULTS

Selection of sources of evidence

The database search identified 196 articles. Excluding duplicates, a total of thirty-eight articles; one hundred and fifty-eight were considered eligible. However, forty-seven were excluded because titles and abstracts were considered irrelevant to the topic or published before 2019. Subsequently, one hundred and eleven full-text articles were identified and assessed for eligibility. However, eighty-two publications were excluded because the data was insufficient to be extracted or calculated. Thus, twenty-nine articles were analyzed. The PRISMA-ScR flowchart for selecting the available studies is shown in Figure 1.

Characteristics of sources of evidence

The articles were carried out in different places, being Iran[1], Italy[10-15], China[16], United States[17-20], France[21-24], Spain[25-30], Canada[31], Switzerland[32,33], Austria[34], Holland[35], Turkey[36] and Germany[37]. Twenty-seven articles were in English and three in Spanish, published in 2020 and are presented in the data extraction Table 1.

Critical appraisal within sources of evidence

Twenty-six articles were case reports (level of evidence 4.d) and three case series (level of evidence 4.c). Therefore, we observed that the studies included in this review have low levels of evidence, according to the New Levels of Evidence from JBI[7]. This can be explained due to the recent appearance of the disease.

Despite this, all studies were well designed and well evaluated by the JBI Critical Appraisal Checklist for Case Series[8] and Case Reports[9], that is, they achieved a high score and, thusly, they were included in the review.

Synthesis of results

Clinical manifestations

Principle clinical manifestations were fever, coughing, dyspnea, sore throat, ageusia, anosmia, respiratory failure and diarrhea, as shown in the table 2.

Toscano et al. (2020) describing three patients [P1, P3 and P5] who received mechanical ventilation and two were admitted to the Intensive Care Unit (ICU) [P3 and P5]. The condition of P5 deteriorates during hospitalization, presentation of hypercapnia, paradoxical breathing and acidosis, leading to admission to the ICU, where mechanical ventilation by tracheostomy and pneumonia by acinetobacter is allowed.

Alberti et al. (2020) describing a patient who has hemodynamic disorders with severe hypertension resistant to drugs and arterial blood gases indicates severe hypoxia.

Assini et al. (2020) describes a patient who needs tracheostomy and assisted ventilation [P2].

Ottaviani et al. (2020) describes a patient who was treated for organ failure, in addition to deep venous thrombosis of the legs and overlapping bacterial infection (pneumonia ab ingestis).

Rana et al. (2020) describes a patient who developed persistent difficulty in urinating, or who ended up requiring a permanent catheter.

Su et al. (2020) describes a patient who had a sputum culture Stenotrophomonas maltophilia, an organism associated with pneumonia associated with mechanical ventilation.

However, Chan et al. (2020) describes an asymptomatic patient. In addition, other patients require ventilatory support[11-14,16,17,19,21,23,27,29,34], five need for intubation[11,14,18,19,34] and eight were admitted to the ICU[11,13,14,17,19,21,23,29]. However,

two[12,27] of the twenty-nine patients die during treatment from progressive respiratory failure.

Diagnosis

The main methods for diagnosing SARS-Cov-2 infection (COVID-19) were nasopharyngeal swabs for polymerase chain reaction with real-time reverse transcriptase (RT-PCR), ELISA technique, chest radiography, chest tomography (CT) and clinical[1, 10-37].

Sixteen studies used CT and RT-PCR in the chest[1,10-14,16,17,21-25,27,36,37]; six studies used chest radiography and RT-PCR[17-19,26,28,29] ; five studies used only RT-PCR[20,31-33,37]; two studies used the ELISA and CT technique[15,34] and two studies used only the ELISA technique[30,35].

For the diagnosis of GBS, electromyography and clinical methods were used[1,10-37], with strong muscle evaluation using the Medical Research Council (MRC)[1,10,12,14-16,18,19,21,23,26,29,34,36].

Treatment

The main treatment methods mentioned were empirical antibiotics[1,10,16-18,21,22,24,26-29,31,36]; Hydroxychloroquine[1,12-14,16,18,20,22-26,28,29,36]; antivirals (lopinavir and ritonavir)[1,10,12-14,21,25,26]; room isolation[10,16]; and plasma exchange[17,34,36]. Thirty-six patients were treated with intravenous immunoglobulin (IVIG)[1,10-24,26,28-35,37].

Neurological outcome

The main neurological manifestations were: weakness in the lower extremities[1,10,12,14-18,22-24,29,30,33,35]; paresthesia of the upper and lower limbs[11,12,15,17-19,21,23,24,28,29,31,33-35,37]; tetraparesis[1,12,17,21,23,27-29,33]; facial diplegia[1,14,17,23,25,26,28-31,33,35]; areflexia[10,17,18,22,24,27,30,31,33]; asthenia[11,17,23]; mastoid pain and sensitive ataxia[17]; fatigue[10,14,32,34]; numbness[16,18,36,37]; swallowing disorders[21,26-28,33]; low back pain[12,27-29]; difficulty or loss in walking[14,23,26,30,35]; myalgia[15,20,23,30,32-34]; odynophagia[18,30,33]; hypoesthesia[22,23,27]; paraparesis[22,30,32]; dysarthria[31,36]; hyporeflexia[13,20]; bilateral eyelid

ptosis[13]; progressive ophthalmoparesis[20]; desesthesia[14,34]; dysgeusia, cacosmia, disautonomy, arthralgia and tetraplegia[33].

Patient outcomes

Principle patient outcome were:

- Only nine studies revealed comorbidities, type 2 diabetes mellitus[1,22,33]; hypertension, abdominal aortic aneurysm and lung cancer[12]; obesity[23]; dyslipidemia and active smoking[28]; rheumatoid arthritis[24]; hypertension, hyperlipidemia, restless legs syndrome and back pain[18] and coronary artery disease, hypertension and alcohol[19];
- Patients with Sofriam lymphopenia[10,13,17,28,33,36];
-As the images show multiple opacities in the ground glass[1,10-12,14-17,19-24,26,28,29,31,34,36] or inflammation in the lungs and a small amount of pleural effusion[1,17];
- Muscle strength testing showed failure in four limbs using a Medical Research Council scale (MRC)[1,10,12,14-16,18,19,21,26,29,34,36];
- There were hospitalizations in intensive care units[11,13,14,17,19,21,29] and patients with advanced support for mechanical ventilation of the airways[11-14,16,19,21,23,27,29,34];
- Patients undergoing physical therapy for rehabilitation[16-18,23];
- Lung auscultation revealed diffuse rales[22];
- There were cases that present variant forms of GBS, such as acute sensory-motor neuropathy, acute axonal neuropathy and Miller-Fisher syndrome[1,13,25,30].

Discussion

Until now, little is known about the neurological manifestations from COVID-19 and its direct relationship with GBS. The first case was recently described where neurological characteristics were observed that stood out from the COVID-19 clinical symptoms; the main symptoms included acute weakness in the legs and severe fatigue, with rapid progression[10]. For this reason, there are concerns that this virus is a possible trigger for GBS.

Sedaghat & Karimi (2020), in one case report, describe GBS in one infected patient with COVID-19, for the first time. The patient reported acute progressive symmetric ascending quadriparesis. Two weeks before hospitalization, the patient suffered from cough, fever, and RT-PCR was reported positive for COVID-19 infection. The

electrodiagnostic test showed that the patient had an Acute Motor-Sensory Axonal Neuropathy (AMSAN) variant of GBS.

In the study realized by Toscano et al. (2020), five patients were examined who had GBS after the onset of Covid-19. The first symptoms were lower-limb weakness and paresthesia in four patients and facial diplegia, followed by ataxia and paresthesia in one patient. In summary, flaccid tetraparesis or tetraplegia evolved from 36 hours to 4 days in four patients; three received mechanical ventilation. The interval between the onset of symptoms of Covid-19 and the first symptoms of GBS ranged from 5 to 10 days. This interval is similar to the interval seen with GBS that occurs during or after other infections. As in previous studies, the authors point out that a possible relationship between these two diseases is the fact that COVID-19 through stimulation of inflammatory cells produces various inflammatory cytokines, and as a result, creates immune-mediated processes. As the GBS is an immune-mediated disorder, molecular mimicry as a mechanism of autoimmune disorder plays a vital role in its creation.

Zhao et al. (2020) reported a woman who presented with acute weakness in both legs and severe fatigue, progressing within one day. Neurological examination disclosed symmetric weakness and areflexia in both legs and feet. Three days after admission, her symptoms progressed. Oropharyngeal swabs were positive for SARS-CoV-2 with RT-PCR assay. Considering the temporal association, it was speculated that SARS-CoV-2 infection might have been responsible for the development of GBS.

Virani et al. (2020), in their study, describes a case where the patient with COVID-19 presented neurological symptoms, including numbness and weakness of the extremities, consequently, there was a decrease in reflexes of the tendons with rapid progression. The mechanism proposed for this association is an autoimmune reaction where antibodies to surface glycoproteins are developed in the offending pathogen that also corresponds to similar protein structures of peripheral nerve components (molecular mimicry), leading to neurologic involvement.

Camdessanche et al. (2020), in their study, also reported on one patient without medical history who was admitted after he fell and hurt the left shoulder leading to a tear of the rotator cuff. He had a fever and cough for two days. SARS-CoV-2 RT-PCR with nasopharyngeal swab was performed and proved to be positive. Eleven days after the symptom onset, the patient complained of paresthesia in feet and hands. In three days, he demonstrated severe flaccid tetraparesis. The patient complained of swallowing

disturbance with a risk of suffocation as liquids took the wrong path. The patient was admitted to ICU and mechanically ventilated because of respiratory insufficiency.

Padroni et al. (2020), describe a case of GBS following a clinically resolved paucisymptomatic COVID-19. The patient complained of asthenia, hands, and feet paresthesia and gait difficulties, progressing within one day. Symptoms of COVID-19 were resolved in a few days. The neurological examination disclosed moderate symmetric distal upper and lower limb weakness, loss of deep tendon reflexes, preserved light touch, and pinpricking sensation.

Assini et al. (2020), describes two cases of GBS and Covid-19. In one of them, the patient needed invasive ventilation in the ICU and 20 days after admission he had an acute onset of bilateral eyelid ptosis, dysphonia and dysphalgia. Furthermore, through neurological examination, he demonstrated a deficit in the protrusion of the tongue due to bilateral paralysis of the hypoglossal nerve and hyporeflexia of the upper and lower limbs, bilateral masseter weakness.

Putting together all of these findings, the causal association between GBS and COVID-19 remains speculative but very probable. Neurologists and other clinicians should be aware of the essential early recognition and treatment of the potential neuromuscular and autonomic worsening leading to cardio-respiratory failure in patients with GBS and mild or controlled pulmonary COVID-19. More in-depth research should be carried out about this association, so that there is an established protocol of suitable diagnosis and treatment, in order to avoid high degrees of debilitation caused by Guillan-Barré syndrome.

LIMITATIONS

The main limitation of this review is the lack of studies with the number largest of patients.

CONCLUSION

In conclusion, through well-designed primary studies, it is evident that COVID-19 can trigger GBS. Because the patients had clinical manifestations of COVID-19 infection and neurological manifestations characterizing GBS. Although the small number of patients limits our estimates, we believe that the results listed here are

important for a better diagnosis and treatment of patients with neurological symptoms concomitant with respiratory symptoms

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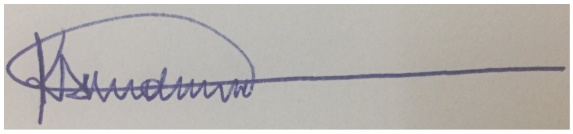
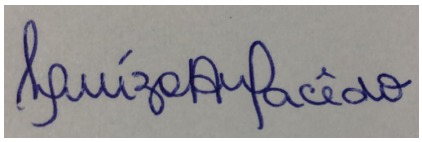


Kleyton Santos de Medeiros



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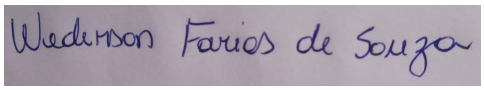

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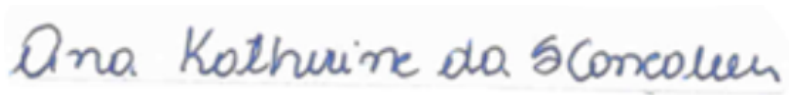

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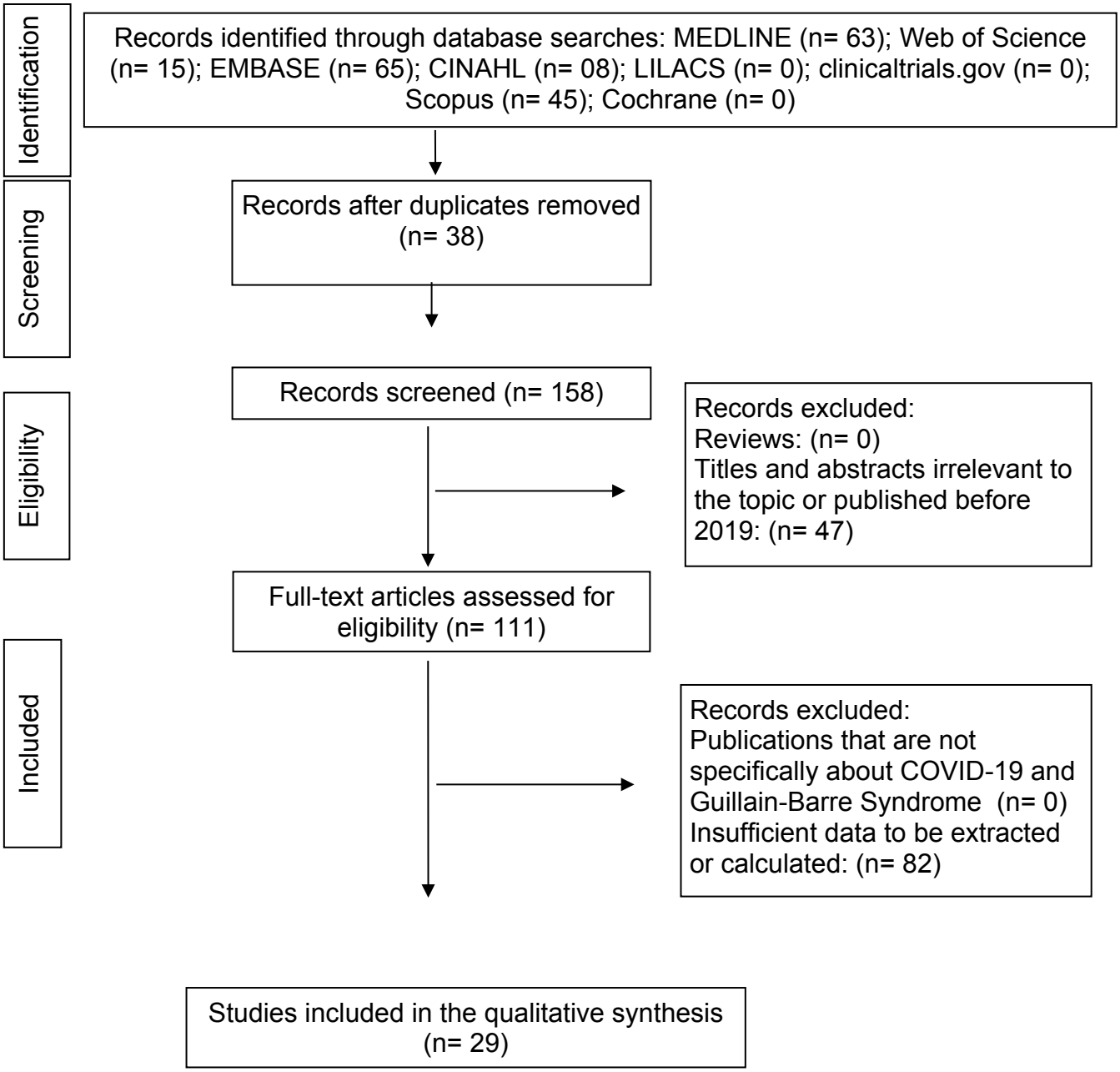

Figure 1 Flow diagram of the search for eligible studies COVID-19 and Guillain-Barre Syndrome: CENTRAL, Cochrane Central Register of Controlled Trials.

AUTHOR	GENDER	AGE	COMORBIDITIES	CLINICAL MANIFESTATIONS	PATIENT OUTCOME	CHEST IMAGING	TREATMENT	DIAGNOSIS
Sedaghat, et al. (1)	Man	65	Diabetes Mellitus 2	Presented neurological manifestations such as acute progressive weakness of the distal lower extremities, progressing from the distal limbs to the proximal limbs and, shortly afterwards, he presented quadriplegia and facial paresis bilaterally.)	On physical examination, the patient was normal vital sintmptms and was conscious.	CT showed diffused consolidations and ground-glass opacities in both lungs, and bilateral pleural effusion.	Hydroxychloroquine, Lopinavir/Ritonavir (LPV/RTV) and Azithro-mycin. And 0.40 g/kg/day intravenous Immunoglobulin; and metformin 2 diabetes mellitus.	RT- PCR; chest CT and EMG.
Toscano, et al. (10)	P1-Woman	77	NA	Paresthesia in the lower limbs and hands. Flaccid areflexic tetraplegia evolving to facial weakness, upper-limb paresthesia (36 hr), and respiratory failure (day 6)	Lymphocytopenia, Raised CRP, LDH and ketonuria.	CT scan of the thorax revealed interstitial bilateral pneumonia.	IVIg treatment.	RT-PCR and EMG.
	P2- Man	23	NA	Upper and lower facial weakness, which became bilateral and complete within 2 days, accompanied by mastoid pain, loss of taste, and lower limb paresthesia.	Lymphocytopenia, raised ferritine, CRP, LDH, and AST.	Normal thorax imaging.	Amoxicillin for five days and IVIG.	RT-PCR, EMG and brain MRI.
	P3- Man	55	NA	Flaccid tetraparesis and facial weakness evolving to areflexia (day 2) and respiratory failure (day 5).	Lymphocytopenia, raised CRP, LDH, AST, and GGT; and ketonuria.	A CT scan of the thorax revealed multiple bilateral, ground-glass opacities compatible with interstitial pneumonia.	Azithromycin and received 2 cycles of IVIG.	RT-PCR and EMG.
	P4 - Man	76	NA	Lumbar pain and lower limb weakness and on the 4th day after admission, muscle weakness rapidly evolved to a flaccid areflexic tetraparesis.	Lymphocytopenia, raised CRP, ketonuria. IVIg treatment resulted in motor improvement, more evident in upper limbs, but he was still unable to stand.	Normal thorax imaging.	IVIg treatment.	RT-PCR

	P5 - Man	61	NA	Complained of asthenia, loss of taste and smell, for one week.	Lymphocytopenia, raised CRP, LDH and AST. Developed respiratory failure with neuromuscular features (hypercapnia, paradox respiration, acidosis) and was referred to the ICU, were he received mechanical ventilation through tracheostomy. The patient developed acinetobacter pneumonia.	Thorax X-ray and CT showed interstitial pneumonia, without parenchymal opacities nor alveolar damage.	Received IVIG and plasma exchange; had bacterial pneumonia during IVIG treatment, which delayed plasma exchange.	RT-PCR and EMG.
Padroni, et al. (11)	Woman	70	NA	Complaining of asthenia, hands and feet paresthesia and gait difficulties progressing within 1 day. On Mar-4 she had developed fever (body temperature—BT = 38.5 °C) and dry cough.	Arterial blood gas analysis showed pO2=76 mmHg with normal p/f ratio (=363). The patient was intubated and mechanical ventilation was applied, because of respiratory failure due to the worsening of muscle weakness.	A chest high-resolution computed tomography revealed some small “ground glass” areas in both lungs.	Intravenous immunoglobulin (IVIg) 400mg/die for 5 days was started.	RT-PCR and the neurological examination disclosed moderate.
Alberti, et al. (12)	Man	71	Hypertension, abdominal aortic aneurysm and lung cancer treated with surgery only in 2017 with negative oncological follow-up; no previous neurologic history was reported.	Paresthesia at limb extremities, followed by distal weakness rapidly evolving to a severe, flaccid tetraparesis over the previous 3 days. Neurologic examination showed symmetric limb weakness, symmetric and extensive stocking-and-glove hypesthesia at the 4 limbs (more pronounced at lower limbs), absent deep tendon reflexes, and normal plantar response. Moderate low back pain were present.	He showed hemodynamic disturbances with severe drug-resistant hypertension. Arterial blood gases indicated severe hypoxia (paO2 65 mm Hg without supplemental oxygen). Unresponsive to continuous positive airway pressure ventilation and prone positioning. The patient died a few hours later because of progressive respiratory failure.	Brain CT scan was normal, whereas chest CT scan showed multiple bilateral ground glass opacities and consolidations, typical of COVID-19 pneumonia.	High-dose IV immunoglobulins (0.4 g/kg/d for 5 days) were started few hours after admission, together with high-flow 60%–80% oxygen via nonrebreather mask, antiviral therapy (lopinavir + ritonavir), and hydroxychloroquine	RT- PCR; chest CT and EMG.

Assini, et al. (13)	P1- Man	55	NA	Severe respiratory syndrome preceded by anosmia and ageusia, fever, and cough; acute onset of bilateral eyelid ptosis, dysphagia, and dysphonia.	Neurological examination showed bilateral masseter weakness, tongue protrusion deficit due to bilateral paralysis of the hypoglossal nerve, and hyporeflexia of upper and lower limbs, without muscle weakness. The patient was moved to intensive care unit for invasive ventilation. Lymphocytopenia.	NA	Hydroxychloroquine, Arbidol, ritonavir and lopinavir; intravenous immunoglobulins.	RT- PCR; EMG.
	P2 – Man	60	NA	Fever and cough; weakness in lower limbs with distal distribution and foot drop on the right side.	Simultaneously, massive disorders of the vegetative nervous system, consisting of gastroplegia, paralytic ileus, and loss of blood pressure control occurred. Neurological examination showed distal weakness at four limbs, with foot drop. Tracheostomy and assisted ventilation. Blood tests showed lymphocytopenia, increased LDH and GGT, and leukocytosis.	NA	Hydroxychloroquine, antiretroviral therapy, and tocilizumab. intravenous immunoglobulin therapy.	RT-PCR and thoracic CT scan.
Ottaviani, et al. (14)	Woman	66	NA	History of increasing difficulty walking and acute fatigue; she had mild fever and cough 10 days earlier. She also manifested a transient pruriginous dorsal rash, besides mild hypertension treated with beta-blockers . On evaluation, she was paraparetic with a rapidly progressive symmetric weakness in the lower limbs, leading to falls and paraplegia. Progressively developed proximal weakness in all limbs, dysesthesia, and unilateral facial palsy.	Maintaining reasonable respiratory function with supplemental oxygen. Moreover, gas exchanges worsened with a sudden desaturation, requiring intubation and intensive care unit admission, where she was treated for multi-organ failure along with a leg deep vein thrombosis and a superimposed bacterial infection (ab ingestis pneumonia).	Lung CT scan showed bilateral ground glass opacities.	IVIg; antiretroviral drugs (lopinavir and ritonavir) and hydroxychloroquine.	RT-PCR and the neurological examination disclosed moderate (Medical Research Council grade 4/5).

Riva, et al. (15)	Man	60	NA	Three-day history of progressive limb weakness and distal paresthesia at four-limbs. His past medical history was unremarkable. Twenty days before he had developed fever (37.7–38.5 °C), headache and myalgia followed by anosmia and ageusia.	Cell blood count, C-reactive protein, creatine phosphokinase, arterial blood gases, renal and hepatic function tests were normal. Anti-ganglioside antibodies tested negative.	Chest CT scan showed bilateral ground-glass opacities, consistent with COVID-19 pneumonia.	IVIg;	Antibodies for SARS-CoV-2 IgM/IgG and the neurological examination disclosed moderate.
Zhao, et al. (16)	Woman	61	NA	Presented with acute weakness in both legs and severe fatigue. Neurological examination disclosed symmetric weakness.	Her clinical condition improved gradually and her lymphocyte and thrombocyte counts normalised on day 20. At discharge on day 30, she had normal muscle strength in both arms and legs and return of tendon reflexes in both legs and feet.	Chest CT showed ground-glass opacities in both lungs.	Intravenous immunoglobulin; infection isolation room and received supportive care and antiviral drugs of arbidol, lopinavir, and ritonavir.	RT-PCR
Virani, et al. (17)	Man	54	NA	Complaints of numbness and weakness of his lower extremities of 2-day duration. The weakness progressed. The patient complained of difficulty breathing and weakness was noted to ascend up to his nipples.	He was electively placed on mechanical ventilator support for concerns of impending respiratory failure. His clinical course showed improvement in his respiratory status with liberation from mechanical ventilation on day 4 of IVIG therapy. Neurologically, his upper extremity weakness resolved after completion of the course of IVIG. Lower extremity weakness persisted.	Magnetic resonance imaging (MRI) of thoracic and lumbar spine that did not reveal any abnormal spinal pathology. This imaging, however, did reveal incidental findings of bilateral basilar opacities in the lungs.	Oral amoxicillin and steroids. 400mg/kg of intravenous immune globulin (IVIG) therapy for a planned 5-day course. Hydroxychloroquine 400 mg for the first two doses with subsequent 200 mg dose twice a day for an additional eight doses.	RT-PCR and MRI.

Rana, et al. (18)	Man	54	Hypertension, hyperlipidemia, restless leg syndrome, and chronic back pain.	Ascending limb weakness and numbness that followed symptoms of a respiratory infection. Two weeks before presentation, he initially developed rhinorrhea, odynophagia, fevers, chills, and night sweats; he developed watery diarrhea ; Over the next few days, he noted worsening paresthesias of his distal extremities bilaterally. His symptoms progressed to weakness of all limbs and difficulty voiding urine, developed progressive shortness of breath requiring intubation. quadriparesis and areflexia with mute plantar responses.	He was extubated on hospital day 4. On hospital day 7, he was discharged to an inpatient rehabilitation facility. While in the inpatient rehabilitation, he was noted to have resting tachycardia and persistent difficulty urinating, which eventually required an indwelling catheter. He reported burning dysesthesias in his distal extremities and trunk, and complained of diplopia, which was worse on rightward	Chest X-ray was negative other than an incidental finding of bibasilar lung infiltrates versus atelectasis. MRI of the thoracic and lumbar spine was reported to show no evidence of myelopathy or radiculopathy.	Amoxicillin; metronidazole. Hydroxychloroquine and azithromycin; IVIg.	RT-PCR; the neurological examination disclosed moderate (Medical Research Council grade 4/5) and EMG.
Su, et al. (19)	Man	72	Coronary artery disease, hypertension and alcohol abuse	Symmetric aresthesias and ascending appendicular weakness. Seven days earlier he had mild diarrhea, anorexia, and chills, without fever or respiratory symptoms. This condition resolved in 5 days. Weakness began 6 days after diarrhea, and the patient presented 1 day after neurological symptom onset. On admission, he was afebrile with normal vital signs. Mental status and cranial nerves were normal.	On day 3, the patient developed respiratory distress with a negative inspiratory force of −20 cmH2O and vital capacity of 1350 mL. He was transferred to the intensive care unit and intubated. He remained afebrile and followed commands. Oxygen saturation was normal on ventilator settings positive end-expiratory pressure 5 cm H2O and fraction of inspired oxygen 30%. Chest X-ray was stable. Sputum culture grew Stenotrophomonas maltophilia.	Chest X-ray showed mild bibasilar atelectasis vs patchy consolidations. Computed tomography of the head was normal. Incompatible implant precluded magnetic resonance imaging. On day 10, his oropharyngeal secretions increased, and chest X-ray showed new right lower lobe consolidation.	IVIg	RT-PCR and the neurological examination disclosed moderate (Medical Research Council grade 4/5).

Lantos, et al. (20)	Man	36	NA	Aresenting with left eye drooping, blurry vision, and reduced sensation and paresthesia in both legs for 2 days. He was in his usual state of health until 4 days before presentation, when he developed viral symptoms in a COVID-19-endemic region, reporting subjective fevers, chills, and myalgia.	Physical examination was notable for a partial left third nerve palsy and decreased sensation below the knees to all modalities. Nonetheless, the patient's hospital course was characterized by progressive ophthalmoparesis (including initial left CN III and eventual bilateral CN VI palsies), ataxia, and hyporeflexia, and the clinical picture was thought to be consistent with MFS from COVID-19 infection.	Brain MRI: prominent enhancement with gadolinium, and T2 hyperintense signal of the left cranial nerve (CN) III. No other cranial nerves demonstrated abnormal signal. No cerebellar lesions were seen to explain the patient's ataxia.	IVIg; hydroxychloroquine.	RT-PCR and RMI.
Camdessanche, et al. (21)	Man	64	NA	The patient fell and hurt his left shoulder leading to a tear of the rotator cuff. Eleven days after the symptom onset, the patient complained of paresthesia in feet and hands. In three days, he installed a flaccid severe tetraparesia. The patient complained swallowing disturbance with a risk of suffocation.	Clinical presentation was moderate with high grade fever for three days requiring oxygen 2-3 L/min through nasal cannula for five days. The patient was admitted in ICU and mechanically ventilated because of respiratory insufficiency.	Thoracic CT scan showed only 10-25% of ground glass opacities.	Paracetamol, preventing thromboembolism by low molecular weight heparin and lopinavir/ritonavir 400/100 mg twice a day for ten days. IVIg (0,4g/kg per day during 5 days).	EMG
Arnaud, et al. (22)	Man	64	Diabetes mellitus type 2	Cough, dyspnea, diarrhea and fever. fast progressive lower-limb weakness; The neurological examination showed generalized areflexia, severe flaccid paraparesis, mainly affecting proximal muscles, and a decreased proprioceptive length-dependent sensitivity involving the four limbs. We also found hypoesthesia to light touch and pinprick in lower extremities rather.	Respiratory rate was 30 breaths/min and the oxygen saturation was 93% on ambient air. Lung auscultation revealed diffuse crackles.	A chest computed tomography (CT) showed bilateral, diffuse and subpleural ground-glass opacities with a crazy-paving appearance, and a band of air space consolidation.	Cefotaxime, Azithromycin; IVIg and Hydroxychloroquine.	RT-PCR and EMG.

Bigaut, et al. (23)	P1- Man	43	NA	Presented with cough, asthenia, and myalgia in legs, followed by acute anosmia and ageusia with diarrhea the next day. Symptoms resolved spontaneously after 2 weeks. Twenty-one days after the beginning of respiratory symptoms, he presented with in a rapidly progressive manner paraesthesia, hypoesthesia, and distal weakness in the lower limbs. In the following 2 days, these symptoms extended to the midthigh and tip of the fingers associated with ataxia, and he was hospitalized at day 4 because a right peripheral facial palsy had occurred.	His body temperature was 36.9°C and oxygen saturation was 99%.	CT of the chest showed ground-glass opacities; MRI at day 7 showed multiple cranial neuritis (in nerves III, V, VI, VII, and VIII), radiculitis, and plexitis on both the brachial and lumbar plexus.	IVIg.	RT-PCR and the neurological examination disclosed moderate (Medical Research Council grade 4/5).
	P2- Woman	70	Obesity	Anosmia and ageusia, followed by diarrhea for 2 days. She complained of mild asthenia and myalgia without fever. Seven days later, she presented with acute proximal tetraparesis and distal forelimb and perioral. dyspnea and loss of ambulation.	Rapidly transferred to an intensive care unit for noninvasive ventilation for acute respiratory failure with hypercapnia. She was discharged from the intensive care unit 9 days later, without requiring invasive mechanical ventilation. Her clinical condition improved slowly with physiotherapy, needing a transfer in a rehabilitation center.	CT of the chest showed moderate ground-glass opacities in both lungs.	IVIg.	RT-PCR and the neurological examination disclosed moderate (Medical Research Council grade 4/5).

Otmani, et al. (24)	Woman	70	Rheumatoid arthritis	Presented with a rapidly, bilateral weakness and tingling sensation in all four extremities resulting in a total functional disability within 48 hours. The patient denied any sphincter disturbances, dyspnea or swallowing difficulties. neurological examination showed quadriplegia, hypotonia, areflexia and bilateral positive Lase`gue sign. Cranial nerves were intact. Three days prior to the ongoing symptom's onset, the patient presented an episode of dry cough without dyspnea or fever, spontaneously resolving within 48 hours.	Temperature, lung and cardiac auscultation were, also normal.	Chest CT (day 10) revealed ground-glass opacities in the left lung.	IVIg (2 g/kg for 5 days) and a combination of Hydroxychloroquine (600 mg per day) and Azithromycine.	RT-PCR
Juliao, et al. (25)	Man	61	NA	Fever and coughing without dyspnea on day 1 of the illness; right peripheral facial nerve palsy.	NA	Brain CT and MRI were performed without any acute pathological findings.	Hydroxychloroquine and lopinavir/Ritonavir; oral prednisone.	X-ray and RT-PCR.
Galán, et al. (26)	Man	43	NA	Consultation for symmetric and global weakness of the 4 extremities of progressive intensity with impossibility for walking, as well as alteration in the sensitivity of the 4 members at the distal level. Three days before, there was a self-limited diarrhea episode, followed by symptoms of infection of the upper respiratory tract. bilateral facial paresis and dysphagia.	NA	En la radiografía de tórax se objetivan alteraciones sugerentes de neumonía incipiente por COVID-19.	IVIg; sulfato de hidroxicloroquina, antirretrovirales (lopinavir y ritonavir), antibiótico (amoxicilina), corticoides y oxigenoterapia de bajo flujo.	RT-PCR; EMG and the neurological examination disclosed moderate (Medical Research Council grade 4/5).

Marta-Enguita, et al. (27)	Woman	76	NA	Evolution of low back pain radiating to the posterior aspect of both legs and progressive tetraparesis with paresthesias of distal onset. The pain was bilateral, with right predominance and greater night intensity. He associated progressive weakness predominantly proximal in the lower extremities, and 2 days before our evaluation, he presented weakness in the upper extremities, with functional limitation. Eight days before the onset of the symptoms, he had started with a cough and fever without dyspnea, with 72 hours of evolution; He associated global areflexia and hypoesthesia in both legs.	The patient was admitted and at 4 h presented dysphagia for liquids and progressively for solids, with a nasal voice and difficulty swallowing her own saliva, with progressive onset of a picture of ventilatory failure. It presents a progressive deterioration, requiring oxygen therapy (FiO2 60%), with maintained SatO2 levels of around 91%, which do not show a problem of alveolar capillary junction or gas exchange. Finally, he dies 12 h.	Normal cranial computed tomography (CT) and cervical spine were performed, showing degenerative signs at the level of the vertebral bodies, without invasion of the spinal canal. On chest CT, a pattern compatible with the level of pulmonary impairment due to SARS-CoV-2 infection was observed.	NSAIDs, pyrazolones and transdermal morphics. amoxicillin-clavulanic acid and azithromycin.	RT-PCR
Molina, et al. (28)	Woman	55	Dyslipemia and active smoking.	Fever, unproductive cough and dyspnea after 15 days of evolution. In the past 24 hours, he reported paresthesias in the hands and feet, as well as weakness in the lower extremities. severe low back pain radiating to both legs with progressive weakness in the 4 extremities associated with dysphagia. At 48 hours, the patient presented worsening of neurological symptoms, with areflexic tetraparesis. Along with this, liquid dysphagia, bilateral facial diplegia, weakness in closing the eyelids, lingual and perioral paresthesias. No meningeal signs.	At the initial examination, the patient is conscious and oriented. Blood pressure 155/102 mmHg, heart rate 103 beats per minute, temperature 36.6 ºC, oxygen saturation 93% basal (SatO2). Eupneic with 20 breaths per minute. Bibasal crackles on pulmonary auscultation. Strength and sensitivity preserved in the 4 limbs. Rest of physical examination without significant changes. Adequate ventilatory mechanics and SatO2 without the need for respiratory support. In this context, it was decided to transfer to the Intensive Care Unit.	Chest radiography revealed consolidation in the left lower lobe; Using magnetic resonance imaging, a slight leptomeningeal improvement is observed in the brain stem and cervical cord.	hydroxychloroquine, ceftriaxone and azithromycin; IVIg.	RT-PCR and the neurological examination disclosed moderate (Medical Research Council grade 4/5).

Sancho-Saldaña, et al. (29)	Woman	56	NA	Recent unsteadiness and paraesthesia in both hands. Fifteen days earlier, she had reported fever, dry cough and shortness of breath that was controlled with symptomatic treatment. she developed lumbar pain and progressive proximal lower limb weakness. bilateral facial nerve palsy, oropharyngeal weakness and severe proximal tetraparesis with cervical flexion.	She was transferred to the intensive care unit for 5 days due to the risk of respiratory insufficiency and began rehabilitation, not needing mechanical ventilation. She started recovering by day 7 after the onset of weakness.	Her chest X-ray showed a lobar consolidation.	hydroxychloroquine and azithromycin; IVIg.	RT-PCR and the neurological examination disclosed moderate (Medical Research Council grade 4/5).
Reyes-Bueno, et al. (30)	Woman	51	NA	Diarrhea, odinophagia and cough. The condition lasted approximately 10 days, after which she kept feeling discomfort in the throat. She did not refer ageusia or anosmia.	From March 30th, she started having intense root-type pain in all four limbs, especially in the legs as well as dorsal and lumbar back pain. On April 4th she started with weakness in his lower limbs which progressed to the point of preventing her from walking in a few days, associated with double binocular vision. The neurological exploration showed paresis of the left external rectus muscle with horizontal diplopia when looking to the left, discrete predominantly inferior bilateral facial paresis, symmetrical paraparesis with 3+/5 weakness in psoas, hamstrings, gluteus and quadriceps, 3/5 in gastrocnemius, 2/5 in posterior tibial and peroneal; and global areflexia. She also presented symptoms of autonomic dysfunction such as dry mouth, diarrhea and unstable blood pressure.	NA	IVIg.	RT-PCR and ELISA technique; the neurological examination disclosed moderate (Medical Research Council grade 4/5).

Chan, et al. (31)	Man	58	NA	Presented with acute-onset bilateral facial weakness, dysarthria, and paresthesia in his feet. He denied any other neurological symptoms, including anosmia and ageusia. He denied fever, fatigue, cough, shortness of breath, or any other symptoms on review of systems.Neurological examination demonstrated complete facial diplegia and areflexia in the lower extremities. he had slight movements of his facial muscles and the distal paresthesias of his lower extremities were unchanged.	Temperature of 36.6°C, maximum heart rate of 140 beats/minute, maximum blood pressure of 187/103 mmHg, maximum respiratory rate of 34 breaths/minute, and an oxygen saturation of 96% on room air, with resolution of tachycardia, hypertension, and tachypnea within 12 hours. Auscultation of the lungs revealed diffuse crackles bilaterally.	Chest x-ray demonstrated diffuse heterogeneous infiltration in both lungs. Computed tomography (CT) and CT angiography (CTA) of the head and neck did not demonstrate any intracranial or vascular abnormalities but demonstrated ground-glass opacities in both lung apices.	Empiric ceftriaxone and azithromycin; IVIg.	RT-PCR and EMG;
Coen, et al. (32)	Man	70	NA	Paraparesis, distal allodynia, difficulties in voiding and constipation. Ten days before he developed myalgia, fatigue, and a dry cough.	Physical examination revealed fine crackles in the left base, bilateral lower limb flaccid paresis, absent deep tendon reflexes of the upper and lower limb and idiomuscular response to percussion of the muscle tibialis anterior, indifferent plantar reflexes. There was no sensory deficit.FilmArray Meningitis/Encephalitis (ME) Panel testing (BioFire Diagnostics, Salt Lake City, UT) and SARS-CoV-2 RT-PCR were negative. showed decreased persistence or absent F-waves in tested nerves.	Chest X-ray was normal. Contrast-enhanced MRI excluded myelopathy. Nerve conduction study showed sensorimotor demyelinating polyneuropathy with “sural sparing pattern”; F wave study showed decreased persistence or absent F-waves in tested nerves.	IVIg.	RT-PCR and ELISA technique.
Lascano, et al. (33)	P1-Woman	52	NA	Dry cough, fever, odynophagia, arthralgia, diarrhoea. Back pain, limb weakness, ataxia, distal paresthesia, dysgeusia, cacosmia. Developed respiratory failure, dysautonomia and tetraplegia with areflexia.	Improvement of tetraparesis. Able to stand up with assistance. GBS disability clinical score 4/6. Spinal cord: no nerve root gadolinium enhancement.	NA	IVIg	RT-PCR and Antibodies for SARS-CoV-2 IgM/IgG.

	P2-Woman	63	Diabetes mellitus type 2	Dry cough, shivering, odynophagia, breathing difficulties, chest pain. Lower limb pain, mild weakness and normal deep tendon reflexes. Developed tetraparesis, distal paresthesia and areflexia.	Dismissal with full motor recovery. Persistence of lower limb areflexia and distal paresthesia. GBS disability clinical score 1/6.	NA	IVIg	RT-PCR
	P3-Woman	61	NA	Productive cough, fever, myalgia, vasovagal syncope, diarrhoea, nausea and vomiting. Lower limb weakness and distal paresthesia, dizziness, dysphagia, dysautonomia, areflexia. Presented worsening of bulbar symptoms and bilateral facial palsy.	Improvement of tetraparesis and ability to walk with assistance. Persistence of neuropathic pain and distal paresthesia. GBS disability clinical score 3/6. Spinal cord: lumbosacral nerve root enhancement. Normal brain imaging.	NA	IVIg	RT-PCR
Helbok, et al. (34)	Man	68	NA	Cough, headache, fatigue, myalgia and fever up to 39°C followed by anosmia and ageusia. but still complained of severe fatigue and developed symmetric distal tingling in both feet followed by ascending dysesthesias up to the knees and proximal weakness.	His respiratory condition worsened, and the patient required oxygen supplementation (3L/min) followed by pressure support non-invasive ventilation after 36 h. The next day he presented inability to walk. On examination, the patient was alert and fully oriented, afebrile with normal vital signs (oxygen saturation 98% on room air, blood pressure 143/90mmHg, heat rate 85 bpm). Due to muscle weakness accompanied by respiratory failure the patient underwent elective intubation in a fully conscious state.	Chest Computed tomography was performed and revealed residual ground-glass opacities in both lower lungs	IVIg and plasma exchange	RT-PCR and Antibodies for SARS-CoV-2 IgM/IgG; the neurological examination disclosed moderate (Medical Research Council grade 4/5).

Kilinc, et al. (35)	Man	50	NA	Four days of progressive bilateral facial weakness, paresthesia of distal extremities and an unsteady gait. Four weeks earlier he had experienced an episode of dry cough lasting several days without fever or other symptoms of infection. Neurologic examination showed facial diplegia, normal eye movements, mild symmetric proximal muscle weakness and impaired propriocepsis in the legs. Patient had an ataxic gait and tendon reflexes were absent.	Routine blood examination showed no abnormalities. Routine analysis of cerebrospinal fluid (CSF) showed a normal cell count and total protein level.			RT-PCR and Antibodies for SARS-CoV-2 IgM/IgG; EMG.
Oguz-Akarsu, et al. (36)	Woman	53	NA	History of dysarthria associated with progressive weakness and numbness of the lower extremities. She had a mild fever (37.5°C) but no cough, dyspnea, anosmia or ageusia.	NA	Focal intensities suspicious for COVID-19 pneumonia were incidentally identified in peripheral areas of lungs on STIR sequence of the brachial plexus MRI ; Chest computed tomography showed bilateral peripheral ground-glass opacities and consolidations on both lungs.	Plasma exchange; hydroxychloroquine and azithromycin.	RT-PCR
Scheidl, et al. (37)	Woman	54	NA	Areflexia, numbness, and tingling of all extremities were also found, with initial maintained gain ability. She did not experience fever, respiratory or gastrointestinal symptoms, but reported about a transient loss of smell and taste 2 weeks before the GBS symptoms occurred.	The first electrophysiological evaluation (at admission) showed significantly prolonged distal motor latencies and temporal dispersion of the CMAP of the common peroneal nerve bilaterally.	MRI of the cervical spine and the chest x-ray examination did not show pathological findings. Electrophysiological studies were performed using a Nicolet Viking EMG device.	IVIg	RT-PCR and EMG.

NA: Not Applicable; LDH: lactate dehydrogenase; AST: aspartate aminotransferase; CRP: C-reactive protein; GGT: gamaglutamiltranspeptidase; EMG: electromyography; MRI: Magnetic resonance imaging; IVIg: intravenous immune globulin.

Author	Fever	Coughing	Dyspnea	Sore thoat	Ageusia	Anosmia	Respiratory failure	Diarrhea
Sedaghat, et al. (1)	Yes	Yes	Sometimes	No	No	No	No	No
	Three yes; two no	Four Yes; one no	Five no	One Yes; Four no	Three yes; two no	Two yes; three no	Three yes; two no	No
Toscano, et al. (10)	Yes	Yes	No	No	Yes	No	Yes	No
	Yes	No	No	Yes	Yes	No	No	No
	Yes	Yes	No	No	No	No	Yes	No
	No	Yes	No	No	No	Yes	No	No
	No	Yes	No	No	Yes	Yes	Yes	No
Padroni, et al. (11)	Yes	Yes	No	No	No	No	Yes	No
Alberti, et al.(12)	Yes	No	Yes	No	No	No	Yes	No
Assini, et al. (13)	Yes	Yes	No	No	Yes	Yes	Yes	No
	Yes	Yes	No	No	No	No	No	No
Ottaviani, et al.(14)	Yes	Yes	No	No	No	No	Yes	No
Riva, et al. (15)	Yes	No	No	No	Yes	Yes	No	No
Zhao, et al. (16)	Yes	Yes	No	No	No	No	No	No

Virani, et al. (17)	Yes	Yes	Yes	No	No	No	No	Yes
Rana, et al. (18)	Yes	No	No	No	No	No	Yes	Yes
Su, et al. (19)	No	No	No	No	No	No	Yes	Yes
Lantos, et al. (20)	Yes	No	No	No	No	No	No	No
Camdessanche, et al. (21)	Yes	Yes	No	No	No	No	Yes	No
Arnaud, et al. (22)	Yes	Yes	Yes	No	No	No	No	Yes
Bigaut, et al. (23)	No	Yes	No	No	Yes	Yes	No	Yes
	No	No	Yes	No	Yes	Yes	Yes	Yes
Otmani, et al. (24)	No	Yes	No	No	No	No	No	No
Juliao, et al. (25)	Yes	Yes	No	No	No	No	No	No
Galán, et al. (26)	No	No	No	No	No	No	No	Yes
Marta-Enguita, et al. (27)	Yes	Yes	No	No	No	No	Yes	No
Molina, et al. (28)	Yes	Yes	Yes	No	No	No	No	No
Sancho-Saldaña, et al. (29)	Yes	Yes	Yes	No	No	No	No	No

Reyes-Bueno, et al. (30)	No	Yes	No	Yes	No	No	No	Yes
Chan, et al. (31)	No	No	No	No	No	No	No	No
Coen, et al. (32)	No	Yes	No	No	No	No	No	No
Lascano, et al. (33)	Yes	Yes	No	No	No	No	Yes	Yes
	No	Yes	Yes	No	No	No	No	No
	Yes	Yes	No	No	No	No	No	Yes
Helbok, et al. (34)	Yes	Yes	Yes	No	Yes	Yes	Yes	No
Kilinc, et al. (35)	No	Yes	No	No	No	No	No	No
Oguz-Akarsu, et al. (36)	Yes	No	No	No	No	No	No	No
Scheidl, et al. (37)	No	No	No	No	Yes	Yes	No	No

Preferred Reporting Items for Systematic reviews and Meta-Analyses extension for Scoping Reviews (PRISMA-ScR) Checklist

SECTION	ITEM	PRISMA-ScR CHECKLIST ITEM	REPORTED ON PAGE #
TITLE			
Title	1	Identify the report as a scoping review.	X
ABSTRACT			
Structured summary	2	Provide a structured summary that includes (as applicable): background, objectives, eligibility criteria, sources of evidence, charting methods, results, and conclusions that relate to the review questions and objectives.	X
INTRODUCTION			
Rationale	3	Describe the rationale for the review in the context of what is already known. Explain why the review questions/objectives lend themselves to a scoping review approach.	X
Objectives	4	Provide an explicit statement of the questions and objectives being addressed with reference to their key elements (e.g., population or participants, concepts, and context) or other relevant key elements used to conceptualize the review questions and/or objectives.	X
METHODS			
Protocol and registration	5	Indicate whether a review protocol exists; state if and where it can be accessed (e.g., a Web address); and if available, provide registration information, including the registration number.	X
Eligibility criteria	6	Specify characteristics of the sources of evidence used as eligibility criteria (e.g., years considered, language, and publication status), and provide a rationale.	X
Information sources*	7	Describe all information sources in the search (e.g., databases with dates of coverage and contact with authors to identify additional sources), as well as the date the most recent search was executed.	X
Search	8	Present the full electronic search strategy for at least 1 database, including any limits used, such that it could be repeated.	X
Selection of sources of evidence†	9	State the process for selecting sources of evidence (i.e., screening and eligibility) included in the scoping review.	X
Data charting process‡	10	Describe the methods of charting data from the included sources of evidence (e.g., calibrated forms or forms that have been tested by the team before their use, and whether data charting was done independently or in duplicate) and any processes for obtaining and confirming data from investigators.	X
Data items	11	List and define all variables for which data were sought and any assumptions and simplifications made.	X
Critical appraisal of individual sources of evidence§	12	If done, provide a rationale for conducting a critical appraisal of included sources of evidence; describe the methods used and how this information was used in any data synthesis (if appropriate).	X
Synthesis of results	13	Describe the methods of handling and summarizing the data that were charted.	X

SECTION	ITEM	PRISMA-ScR CHECKLIST ITEM	REPORTED ON PAGE #
RESULTS			
Selection of sources of evidence	14	Give numbers of sources of evidence screened, assessed for eligibility, and included in the review, with reasons for exclusions at each stage, ideally using a flow diagram.	X
Characteristics of sources of evidence	15	For each source of evidence, present characteristics for which data were charted and provide the citations.	X
Critical appraisal within sources of evidence	16	If done, present data on critical appraisal of included sources of evidence (see item 12).	X
Results of individual sources of evidence	17	For each included source of evidence, present the relevant data that were charted that relate to the review questions and objectives.	X
Synthesis of results	18	Summarize and/or present the charting results as they relate to the review questions and objectives.	X
DISCUSSION			
Summary of evidence	19	Summarize the main results (including an overview of concepts, themes, and types of evidence available), link to the review questions and objectives, and consider the relevance to key groups.	X
Limitations	20	Discuss the limitations of the scoping review process.	X
Conclusions	21	Provide a general interpretation of the results with respect to the review questions and objectives, as well as potential implications and/or next steps.	X
FUNDING			
Funding	22	Describe sources of funding for the included sources of evidence, as well as sources of funding for the scoping review. Describe the role of the funders of the scoping review.	X

JBI = Joanna Briggs Institute; PRISMA-ScR = Preferred Reporting Items for Systematic reviews and Meta-Analyses extension for Scoping Reviews.
* Where *sources of evidence* (see second footnote) are compiled from, such as bibliographic databases, social media platforms, and Web sites.
† A more inclusive/heterogeneous term used to account for the different types of evidence or data sources (e.g., quantitative and/or qualitative research, expert opinion, and policy documents) that may be eligible in a scoping review as opposed to only studies. This is not to be confused with *information sources* (see first footnote).
‡ The frameworks by Arksey and O'Malley (6) and Levac and colleagues (7) and the JBI guidance (4, 5) refer to the process of data extraction in a scoping review as data charting.
§ The process of systematically examining research evidence to assess its validity, results, and relevance before using it to inform a decision. This term is used for items 12 and 19 instead of "risk of bias" (which is more applicable to systematic reviews of interventions) to include and acknowledge the various sources of evidence that may be used in a scoping review (e.g., quantitative and/or qualitative research, expert opinion, and policy document).

From: Tricco AC, Lillie E, Zarin W, O'Brien KK, Colquhoun H, Levac D, et al. PRISMA Extension for Scoping Reviews (PRISMAScR): Checklist and Explanation. Ann Intern Med. 2018;169:467–473. doi: 10.7326/M18-0850.