Case Report

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# How is Guillain-Barre syndrome associated with COVID-19 infection differentiated from hypokalemic periodic paralysis? a case report

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**Background and importance:** Patients with coronavirus disease 2019 (COVID-19)-associated Guillain-Barre syndrome (GBS) exhibit a range of clinical symptoms, such as cranial nerve paralysis and axonal or motor-sensory electrophysiological signals.
**Case presentation** A 61-year-old retired black African female was brought into the emergency room on 13 May 2022, with a 4-day history of shortness of breath and high-grade fever and a 1-day history of global body weakness (bilateral paralysis of the upper and lower extremities). Motor examination indicated reduced muscular strength in all limbs, with a Medical Research Council score of 2/5 in the right arm of the upper extremities, 1/5 in the right leg of the lower extremities, 1/5 in the left leg of the lower extremities, and 2/5 in the left arm of the upper extremities. Her electrocardiogram revealed ST depression in the anterior-lateral leads and sinus tachycardia. For the COVID-related infection, azithromycin 500 mg per day for 5 days was begun. After cerebrospinal fluid findings supported the diagnosis of GBS, she underwent intravenous immunoglobulin 400 mg/kg every day for 5 days.
**Clinical discussion:** In the majority of COVID-19-related GBS cases, areflexic quadriparesis developed suddenly. A COVID-19 infection related to a GBS case was the only one that had preceding signs, including ageusia and hyposmia. By testing serum potassium levels, this study determined that there is no connection between GBS and hypokalemia, which can lead to diagnostic and therapeutic conundrums by evaluating serum potassium levels, which showed a normal value.
**Conclusion:** One of the neurological symptoms of the COVID-19 infection is GBS. Several weeks after a COVID-19 acute infection, GBS is frequently observed.

**Keywords:** case report, COVID-19 infection, dilemma, Guillain-Barre syndrome, hypokalemic periodic paralysis

## Introduction

An autoimmune neurological condition called Guillain-Barré syndrome (GBS) can cause respiratory failure and death[1,2]. In people infected with coronavirus disease-19 (COVID-19), ischemic stroke, GBS, encephalopathy from ICU syndrome, cytokine storm with high fevers, and ventilator usage are the most common neurological signs[3]. Several microbes, viruses, bacteria, and mycoplasma, such as influenza, the HIV, the Zika virus, and severe acute respiratory syndrome (SARS-CoV-2), have been identified as causes of GBS[4]. The three stages of GBS are: the progressive phase, which can last anywhere from a few days to 4 weeks; the plateau phase, which can last anywhere from a few days to several months; and the recovery phase, which can last anywhere from a few weeks up to a few years[5]. GBS is one of the neurological manifestations of COVID-19. The symptoms can vary from being mild to very severe, including needing mechanical ventilation and death[3]. The first symptoms of GBS include weakness or tingling sensations. They usually start in the legs, and can spread to the arms and face. For some people, these symptoms can lead to paralysis of the legs, arms, or muscles in the face[1]. Hypokalemic periodic paralysis secondary to renal tubular acidosis presents like GBS[5]. Currently, reverse transcription polymerase chain reaction nasopharyngeal swabs and serological antibody testing are the accepted and recommended methods for determining SARS-CoV-2 virus[3]. According to this case study, the retired woman had recently been diagnosed with GBS along with a confirmed COVID-19 infection. It also discusses how COVID-19-related GBS is different from other GBS risk factors

### HIGHLIGHTS

- One of the neurological symptoms of the coronavirus disease 2019 infection is Guillain-Barre syndrome.
- Guillain-Barre syndrome associated with severe acute respiratory syndrome coronavirus type 2 typically affects older people.
- Coronavirus disease 2019 causes a progressive weakening of the ascending limbs.

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and the relationship between hypokalemic periodic paralysis and COVID-19-related GBS. This case report was submitted in accordance with the surgical case report (SCARE) criteria[6].

## Case presentation

### *Chief complaints*

A 61-year-old retired black African female was brought into the emergency room on 13 May 2022, with a 4-day history of shortness of breath and high-grade fever and a 1-day history of global body weakness (bilateral paralysis of the upper and lower extremities).

### *History of the present illness*

She had had a fever, sore throat, unproductive cough, and increasing weakness during the previous 3 days. She frequently traveled outside of the city to visit her boys who were in the hospital. Her admitted son's test at the hospital was confirmed as COVID-19 positive. Three days before her admission, she had a possible history of COVID-19 exposure. The patient was admitted to the emergency room with hyperglycemia, generalized body weakness that included both the lower and upper extremities (they were unable to move their legs or their hands as they normally would), tingling in the feet and hands, an inability to walk without help, a loss of taste and smell, difficulty swallowing, a fever, a headache, and shortness of breath that lasted for 2 days. Before being admitted, the patient had quadriparesis, or muscular paralysis, in all four limbs (both legs and arms). Three days before being admitted, she was in good health.

### *History of past illnesses*

She had no past history of trauma, falls, bowel or urine incontinence, or infections of the upper respiratory tract. She had been told she had type 2 diabetes seven years earlier. She was taking 10 mg of glibenclamide twice a day, along with 1 g of metformin twice daily.

### *Family history*

She lacked any knowledge of her family's medical or medication history. She was unaware that her grandparents had a history of chronic conditions like high blood pressure, diabetes, chronic renal disease, etc. Four years before, her husband was killed in a vehicle accident.

**Table 1**

**Vital signs of the patient every three days from admission to discharge (during hospitalizations)**

| | Typical vital signs | | | | |
|---|---|---|---|---|---|
| Days | Blood pressure (mmHg) | Heart rate (bpm) | Respiratory rate (bpm) | Temperature (°C) | Saturated oxygen (%) |
| Day 1 | 127/78 | 110 | 18 | 37.3 | 87 |
| Day 4 | 121/86 | 98 | 21 | 37.5 | 89 |
| Day 7 | 121/81 | 91 | 17 | 36.9 | 90 |
| Day 10 | 119/79 | 83 | 18 | 37.1 | 94 |
| Day 13 | 126/78 | 76 | 16 | 37.0 | 98 |
| Day 16 | 123/85 | 73 | 14 | 37.1 | 97 |

### *Personal and social history*

She has a master's degree in business administration, spent 30 years working for government organizations, and is now retired. She was currently residing in an urban area. Her neighbors practiced the same customs. She had four children, all of whom had completed their schooling and were working in government institutions. She ate fruits and vegetables more frequently than other items like meat or packaged foods.

### *Physical examination*

Her vital signs upon entering the emergency room were as follows: axillary temperature: 37.3°C, body weight: 78.7 kg, height: 1.64 m, BMI: 29.5 kg/m$^2$, blood pressure: 127/78 mmHg, cycles per minute respiratory rate: 18, peripheral pulse rate: 110 beats per min, and saturated oxygen on room air: 87% (Table 1).

Her physical examination revealed that all of the following tests—skin, ear, and abdominal—were stable or normal. Motor examination indicated reduced muscular strength in all limbs, with a Medical Research Council (MRC) score of 2/5 in the right arm of the upper extremities and 1/5 in the right leg of the lower extremities, and 1/5 in the left leg of the lower extremities and 2/5 in the left arm of the upper extremities. The assessment of the Erasmus Guillain-Barré syndrome Respiratory Insufficiency Score (EGRIS) revealed that the time lapse between the patient's onset of weakness and hospital admission was three days and scored as 1, that facial and/or bulbar weakness at admission was absent and scored as 0, and that the MRC sum score at admission was 39 out of 60 and scored as 2. The patient's EGRIS totaled 3 (1 + 0 + 2). With a respiratory insufficiency score of 3–4 for GBS, this patient requires mechanical ventilation. Routine reverse transcription polymerase chain reaction testing at the emergency room found her to have a COVID-19 infection. Babinski sings, and other pathological reflexes are not present. Significant weakness can be seen alongside hypotonia.

### *Laboratory examinations*

Her blood investigations done upon her admission to the emergency room showed a white blood cell count of 11 200 cells/mm3, neutrophils of 64%, a fasting blood glucose of 192 mg/dl, a random blood glucose of 215 mg/dl, a 2 h postprandial blood glucose of 235 mg/dl, blood urea nitrogen of 46 mg/dl, serum creatinine of 2.3 mg/dl, hemoglobin of 14.8 g/dl, no abnormalities in any serum electrolytes, a hematocrit of 43%, and a positive urine analysis for urine ketones of $3^+$ (Table 2). The examination of cerebrospinal fluid revealed yellow fluid and albuminocytological dissociation with 1.39 g/l proteins. The

**Table 2**

**Blood chemistry upon her admission**

| Blood chemistry | Laboratory value | Normal range |
|---|---|---|
| White blood cell count (cells/mm3) | 11 200 | 4500–11 000 |
| Fasting blood glucose (mg/dl) | 192 | 100–125 |
| Hemoglobin (mg/dl) | 14.8 | 13.8–17.2 mg/dl |
| Hematocrit (%) | 43 | 41–50% |
| Serum creatinine (mg/dl) | 2.3 | 0.7–1.3 mg/dl |
| Neutrophils (%) | 61 | 40–60 |
| Random blood glucose (mg/dl) | 215 | < 140 |
| 2 h postprandial blood glucose (mg/dl) | 235 | < 180 |

presence of albumin-cytological separation supports the diagnosis of GBS.

### Imaging examinations

Her electrocardiogram revealed ST depression in the anterior-lateral leads and sinus tachycardia. The MRI of the brain, the brain computed tomography (CT) scan, the chest radiography, and the abdominal CT scan were normal.

### Final diagnosis

She was diagnosed with an acute motor axonal neuropathy subtype of GBS and a COVID-19 infection.

### Treatment

She started receiving fluid resuscitation (0.9% normal saline) and insulin delivery by drip as soon as she was admitted to an ICU. After 7 days, syringe pump delivery of insulin was stopped, and she started Neutral Protamine Hagedorn insulin 56/22 after 2 days of insulin drip in order to improve her poor metabolic control. She started oxygen inhalation with five liters of oxygen as soon as she arrived at the intensive care unit. For the COVID-19-related infection, azithromycin 500 mg per day for 5 days was begun. She started receiving 400 mg/kg per day of intravenous immunoglobulin for 5 days. To treat her confirmed COVID-19, she was given subcutaneous enoxaparin 80 mg 12 h a day. She received 500 mg of acetaminophen as needed to reduce her temperature. While giving instructions to the caregiver, the physician frequently adjusted the patient's posture and moved both the upper and lower extremities. After 15 days, Neutral Protamine Hagedorn was stopped, metformin 1.5 mg was reintroduced twice daily, and glibenclamide 10 mg was reintroduced twice daily.

### Outcome and follow-up

Following two consecutively negative throat swab tests for COVID-19, the patient was then discharged from the hospital on 30 May 2022. She was discharged with her previous oral antidiabetic drugs. Her functional motor impairments upon discharge could be measured using the GBS disability scale, and her Hughes disability score revealed that she had a grade 3 Hughes functional grading scale (able to walk 10 m across an open space with help). Her monthly follow-up at the ambulatory clinic was advised to continue.

## Discussion

Due to its high risk of spreading, the COVID-19 infection is regarded as a global pandemic[6]. The family Coronaviridae includes enclosed, nonsegmented, positive-stranded RNA viruses called coronaviruses. These viruses mostly bind to angiotensin-converting enzyme 2 receptors on cells. The nasal epithelium and lower respiratory airways contain these receptors, which cause respiratory symptoms[7,8].

Patients with COVID-19 who have GBS exhibit several clinical manifestations, such as ascending or cranial nerve paralysis, and electrophysiological (such as axonal or motor-sensory) manifestations[9]. GBS is distinguished by areflexia or hyporeflexia, progressive, ascending, symmetrical flaccid limb paralysis, and involvement of one or more cranial nerves. These symptoms can develop over a period of days to several weeks[10]. When compared to the aforementioned clinical manifestations, the patient in this study had clinical manifestations like generalized body weakness that affected both the lower and upper extremities (they were unable to move their legs or their hands as they normally would), tingling in the hands and feet, the inability to walk if unassisted, and difficulty swallowing. Because neurological involvement in patients with COVID is becoming more apparent[9], GBS is a possibility as a neurological complication of severe acute respiratory illness caused by coronavirus 2; Campylobacter jejuni, cytomegalovirus, Zika virus, infection with COVID-19, and Epstein-Barr virus infections are the most common causes of GBS[11]. The patient in this study had a confirmed COVID-19 infection, which is linked to a number of neurological complications, including movement difficulties, motor and sensory impairments, and ataxia.

A COVID-19 infection-related GBS was the only one that had preceding signs, including ageusia and hyposmia[12,13]. The majority of COVID-19-infected patients had axonal motor and axonal motor-sensory polyneuropathy, as opposed to conventional GBS and GBS associated with dengue and Zika viruses, which are more likely to cause demyelinating neuropathy[14]. Conventional GBS and dengue-related GBS affect people of all ages, whereas GBS caused by the Zika virus affects people in their middle to late years[15]. GBS associated with SARS-CoV-2 typically affects older people[11]. Certain findings in this study show how GBS complicated by COVID-19 infection differs from other GBS risk factors: the absence of deep tendon reflexes in all four limbs (both legs and both arms); specific symptoms of COVID-19-related GBS such as loss of taste and loss of smell; the acute motor axonal neuropathy subtype of GBS; and the patient in this study is elderly.

SARS-CoV-2 is a novel neuropathogenic virus that may be used to explain COVID-19 patient symptoms such as headaches, weakness, neuropathies, altered sensorium, and stroke due to the nervous system's expression of SARS-CoV-2 receptors[16]. Because respiratory compromise caused by GBS may be rapidly progressive but treatable with a high success rate in COVID-19 patients, physicians must identify and treat GBS early in all patients with COVID-19 infection due to the overlap of respiratory paralysis in GBS and COVID-19 infection[17]. According to this study, COVID-19 causes a progressive weakening of the ascending limbs, diminished or nonexistent reflexes, and a GBS-like appearance.

A rare muscular condition called hypokalemic periodic paralysis (which has symptoms that mimic GBS) is characterized by hypokalemic-related episodic weakness[18]. This study determined that there is no correlation between GBS and hypokalemia, which can lead to diagnostic and therapeutic conundrums, by evaluating serum potassium levels. In the presence of GBS, hyponatremia can arise, generally in a severe clinical scenario. One common and significant electrolyte issue that affects GBS patients is the syndrome of inappropriate antidiuretic hormone secretion[19]. This study also found no link between hyponatremia and the clinical circumstances surrounding GBS from the time of admission to discharge, nor did it find any syndrome of inappropriate antidiuretic hormone secretion linked to GBS. In this study, imaging examinations like an MRI, brain CT scan, and chest radiography are used to distinguish GBS from stroke. A brain CT scan does not reveal any bleeding or injury, and an MRI does not show any signs of damaged brain tissue. Based on this

patient's entire imaging evaluation, no signs of a stroke (ischemic, transitory, or hemorrhagic) were seen.

In individuals with GBS, dysautonomia is linked to a higher disability score and a noticeably increased risk of mortality. Due to the potential emergence of restrictive pulmonary dysfunction attributable to diaphragmatic denervation in GBS patients, spirometric parameters like the vital capacity must be regularly examined[20]. The diagnosis of GBS in SARS-CoV-2 patients is particularly difficult since symptoms like weariness and shortness of breath could be mistaken for secondary effects of SARS-CoV-2, which delays the examination for GBS. Therefore, it is strongly advised that physicians consider a neuromuscular etiology, such as GBS, right away when they encounter SARS-CoV-2 patients, even if the initial clinical symptoms are mild, including paresthesia, facial numbness, diplopia, or ptosis[21].

Mechanical ventilation in GBS was evaluated by the EGRIS. A score of 0–2 for Erasmus GBS respiratory insufficiency implies low risk, 3–4 for moderate risk, and greater than or equal to 5 for severe risk for mechanical ventilation[22]. The patient in this study has a Respiratory Insufficiency Score of 3 from Erasmus GBS, as discussed under the case presentation section, and requires mechanical ventilation. She then began inhaling 5 l of oxygen. The disability score for GBS (Hughes disability score) was graded as 0 in a healthy state, one in a minor symptom state and capable of running, two in those able to walk ten meters or more without assistance but unable to run, three in those able to walk ten meters across an open space with help, four in those bedridden or chairbound, five in those requiring assisted ventilation for at least part of the day, and six in patients who died[23]. In this study, the patient's GBS disability score was 3, indicating that the patient could walk 10 m across an open space with assistance.

Some claim that the quickly growing neuritis was brought on by COVID-19 because SARS-CoV-2 patients needed more mechanical ventilation. Whether GBS patients have slightly acute, severely acute, or chronic involvement will determine their course of treatment[4]. Dexamethasone is not recommended for GBS because it slows the recruitment of scavengers, which aid in nerve degradation, causing clinical recovery in GBS to be delayed[24]. In this study, she started receiving drip-delivered insulin as soon as she was hospitalized, along with 1000 ml of fluid resuscitation (0.9% normal saline) and 5 l of intranasal oxygen per minute. To treat her confirmed COVID-19, she was given subcutaneous enoxaparin 80 mg 12 h a day. She received intravenous immunoglobulin (400 mg/kg per day for 5 days) to treat her GBS, which is caused by antibodies that cause nerve damage in the body.

### *Some terminology definitions*

The MRC Scale for Muscle Strength, which ranges from Grade 5 (normal) to Grade 0 (no visible contraction), is a popular tool for measuring muscle strength.

The EGRIS is a prediction model that determines the likelihood that a specific GBS patient will experience respiratory failure.

The Hughes functional disability scale, which ranges from 0 (healthy) to 6 (death), is a widely used measure for evaluating the functional state of patients with GBS.

## Conclusion

The peripheral nervous system is involved in the immune-mediated condition known as GBS. Progressive ascending limb weakness and reduced or nonexistent reflexes are common in GBS presentations. The acute motor axonal neuropathy subtype of GBS, which affects individuals with COVID-19 infection more frequently, is present in this study. This study determined that there is no correlation between GBS and hypokalemia, which can lead to diagnostic and therapeutic conundrums, by evaluating serum potassium levels, which showed a normal value. As soon as she arrived at the intensive care unit, she began oxygen inhalation with five liters of oxygen. According to the clinical signs of GBS, the patient in this study received 400 mg/kg per day of intravenous immunoglobulin for 5 days.

## Ethical approval

This case report did not require review by ethics committee.

## Consent

Written informed consent was obtained from the patient for publication of this case report and accompanying images. A Copy of the written informed consent is available for review by the editor-in-chief of this journal on request.

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## Author contribution

G.B. contributes to the preparation of the proposal, participated in preparing the first draft of the manuscript and edits of the manuscript. The author checked and confirmed the final version of the manuscript.

## Conflicts of interest disclosure

The authors declared that they have no competing interest.

## Research registration unique identifying number (UIN)

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## Guarantor

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