Section: General Medicine

Original Research Article

CLINICAL, LABORATORY AND ELECTROPHYSIOLOGICAL PREDICTORS OF RESPIRATORY FAILURE IN GUILLAIN–BARRÉ SYNDROME: A PROSPECTIVE OBSERVATIONAL STUDY

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Received *: 15/04/2026*
Received in revised form *: 21/05/2026*
Accepted *: 09/06/2026*

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DOI: 10.70034/ijmedph.2026.2.588

Source of Support: Nil,
Conflict of Interest: None declared

Int J Med Pub Health
2026; 16 (2); 3567-3571

ABSTRACT

Background: Guillain–Barré syndrome (GBS) is an acute immune-mediated polyradiculoneuropathy with variable clinical severity ranging from mild weakness to respiratory failure requiring mechanical ventilation. Early identification of predictors of respiratory compromise is important for timely intensive care management and prevention of complications. Aim: To identify clinical, laboratory, and electrophysiological predictors associated with respiratory failure in patients with Guillain–Barré syndrome.

Materials and Methods: This prospective observational study was conducted in the Department of General Medicine, Government General Hospital, Guntur, Andhra Pradesh, India, from June 2023 to May 2024. Fifty adult patients fulfilling standard diagnostic criteria for GBS were included in the study. Detailed clinical evaluation, serial bedside respiratory assessment including single breath count test (SBCT), cerebrospinal fluid (CSF) analysis, serum cortisol estimation, and nerve conduction studies were performed wherever feasible. Patients were prospectively monitored for development of respiratory failure and requirement of mechanical ventilation.

Results: Among the 50 patients included in the study, respiratory failure developed in 27 patients (54%). Bulbar palsy, facial weakness, autonomic dysfunction, neck muscle weakness, and rapid progression of weakness showed significant association with respiratory failure. Bulbar palsy was observed in 85% of patients who developed respiratory failure (p=0.0004). Elevated serum cortisol levels were significantly associated with respiratory compromise, with mean cortisol levels of 30.63 mcg/dL among patients with respiratory failure compared to 20.83 mcg/dL among those without respiratory failure (p=0.00015). CSF protein levels did not demonstrate statistically significant association with respiratory failure. Electrophysiological evaluation demonstrated both demyelinating and axonal variants of GBS. Patients who developed respiratory failure demonstrated lower SBCT values and rapid decline in serial respiratory assessments.

Conclusion: Bulbar palsy, facial weakness, autonomic dysfunction, neck muscle weakness, rapid progression of weakness, and elevated serum cortisol levels were important predictors of respiratory failure in patients with Guillain–Barré syndrome. Serial bedside respiratory monitoring using SBCT may aid in early identification of respiratory compromise and facilitate timely ventilatory support.

Keywords: Guillain–Barré syndrome; Respiratory failure; Mechanical ventilation; Serum cortisol; Single breath count test; Electrophysiology.

INTRODUCTION

Guillain–Barré syndrome (GBS) is an acute immune-mediated polyradiculoneuropathy characterized by rapidly progressive symmetrical weakness, areflexia, and varying degrees of sensory and autonomic dysfunction.[1,2] It is currently the most common cause of acute flaccid paralysis worldwide and demonstrates a broad spectrum of clinical severity ranging from mild limb weakness to complete paralysis with respiratory failure.[2,3]

Respiratory insufficiency remains one of the most serious complications of GBS and contributes significantly to morbidity, mortality, prolonged intensive care unit (ICU) stay, and ventilator-associated complications.[4,5] Approximately 20–30% of patients require mechanical ventilation during the course of illness.[5,6] Early prediction of respiratory compromise is therefore essential for appropriate ICU triage, timely elective intubation, and prevention of complications related to delayed ventilatory support.[6,7]

Several studies have identified clinical predictors associated with respiratory failure in GBS, including bulbar weakness, facial palsy, neck flexor weakness, autonomic dysfunction, rapid progression of weakness, and severe motor disability at presentation.[6,7,8] Electrophysiological abnormalities, particularly axonal variants such as acute motor axonal neuropathy (AMAN) and acute motor-sensory axonal neuropathy (AMSAN), have also been associated with severe disease and poor respiratory outcomes.[9,10]

The Erasmus Guillain–Barré Syndrome Respiratory Insufficiency Score (EGRIS) was developed as a clinical tool for predicting the risk of mechanical ventilation in the acute stages of the disease and has subsequently been validated in different populations.[5,11] However, data regarding early predictors of respiratory failure from Indian tertiary care settings remain limited.[12]

Antecedent respiratory and gastrointestinal infections have been frequently associated with the development of GBS.[13,14]

Bedside respiratory assessment tools such as single breath count test (SBCT) may provide a simple, rapid, and cost-effective method for monitoring respiratory reserve, particularly in resource-constrained settings.[15,16]

The present study was undertaken to evaluate clinical, laboratory, and electrophysiological predictors associated with respiratory failure in patients with Guillain–Barré syndrome admitted to a tertiary care teaching hospital.

Aim

To identify clinical, laboratory, and electrophysiological predictors associated with respiratory failure in Guillain–Barré syndrome.

Objectives

1. To evaluate the clinical predictors of respiratory failure in patients with Guillain–Barré syndrome.
2. To determine the association of serum cortisol levels and electrophysiological findings with respiratory failure.

MATERIALS AND METHODS

Study Design

This was a prospective observational study.

Study Period

The study was conducted over a period of one year from June 2023 to May 2024.

Study Setting

The study was conducted in the Department of General Medicine, Government General Hospital (GGH), Guntur, Andhra Pradesh, India.

Study Population

The study included adult patients diagnosed with Guillain–Barré syndrome presenting to the outpatient department and emergency department of Government General Hospital, Guntur.

Inclusion Criteria

Adult patients fulfilling standard diagnostic criteria for Guillain–Barré syndrome according to Brighton criteria were included in the study.

Exclusion Criteria

Patients with the following conditions were excluded:

1. Asymmetrical weakness with preserved reflexes
2. Fever at onset of neurological symptoms
3. Clinical or laboratory evidence suggestive of hypokalemic periodic paralysis
4. Progression of weakness beyond four weeks
5. Predominant or persistent bladder and bowel involvement

Study Procedure

Eligible patients were enrolled after obtaining informed consent. Detailed clinical history and neurological examination findings were recorded using a structured proforma. Serial bedside respiratory assessment was performed throughout hospitalization at least three times daily and included single breath count test (SBCT), breath-holding time, and chest expansion assessment.

The SBCT was performed by asking the patient to count aloud in a normal voice after taking a maximal deep inspiration. A single breath count of less than 16 was considered suggestive of significant respiratory compromise and reduced vital capacity.

Routine laboratory investigations including complete blood count, blood glucose, renal function tests, serum electrolytes, erythrocyte sedimentation rate, liver function tests, electrocardiography, and chest radiography were performed in all patients. Cerebrospinal fluid (CSF) analysis, including biochemical, microbiological, and cytological examination, was performed wherever feasible. Serum cortisol levels were estimated within 24 hours of admission.

Nerve conduction studies (NCS) were performed wherever feasible to classify electrophysiological subtypes and assess their association with respiratory failure.

Patients were prospectively monitored during hospitalization for the development of respiratory insufficiency and requirement of mechanical ventilation.

Statistical Analysis

Data were entered into Microsoft Excel and analyzed using SPSS software version 28. Continuous variables were expressed as mean ± standard deviation, while categorical variables were expressed as frequencies and percentages. Categorical variables were analyzed using the Chi-square test or Fisher's exact test, and continuous variables were analyzed using the independent Student's t-test. A p-value <0.05 was considered statistically significant.

RESULTS

A total of 50 patients with Guillain–Barré syndrome were included in the study. Respiratory failure requiring mechanical ventilation developed in 27 patients (54%).

Table 1: Baseline characteristics of the Patients

Variable	Finding
Total patients	50
Male	31 (62%)
Female	19 (38%)
Most Common Age-group	31-40 Years
Patients with Respiratory Failure	27 (54%)

Male predominance was observed in the study population. The majority of patients belonged to the 31–40 year age group.

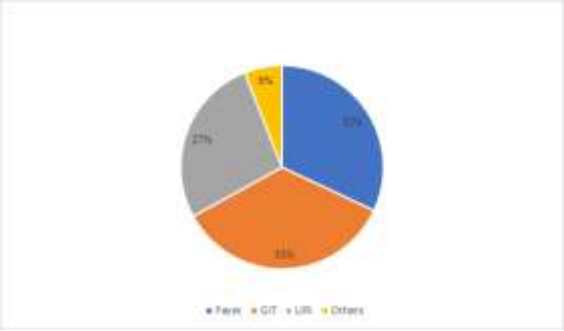

Figure 1: Distribution of Prior Illness among the Patients

Antecedent illnesses were observed in a significant proportion of patients, with fever, gastrointestinal infection, and upper respiratory tract infection being the commonest preceding events.

Table 2: Clinical Predictors of Respiratory Failure

Clinical Feature	With Respiratory Failure	Without Respiratory Failure	p-Value
Bulbar palsy (n=20)	17 (85%)	3 (15%)	0.0004
Facial palsy (n=24)	17 (71%)	7 (29%)	0.026
Autonomic dysfunction (n=12)	12 (100%)	0	0.0002
Neck muscle weakness (n=30)	20 (67%)	10 (33%)	0.043
Rapid progression (<7 days) (n=26)	19 (73%)	7 (27%)	0.0099

Bulbar palsy, facial weakness, autonomic dysfunction, neck muscle weakness, and rapid progression of weakness showed significant association with respiratory failure.

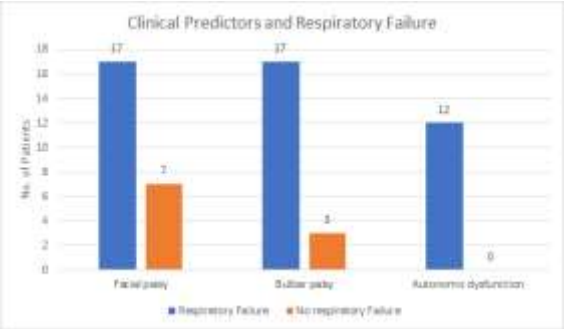

Figure 2: Association of Facial palsy, Bulbar Palsy and Autonomic Dysfunction with respiratory failure

Table 3: Laboratory Parameters Associated with Respiratory Failure

Parameter	Respiratory Failure	No Respiratory Failure	p-Value
Serum cortisol (mcg/dL)	30.63	20.83	0.00015
CSF protein (mg/dL)	117.39	111.73	0.11

Mean serum cortisol levels were significantly higher among patients who developed respiratory failure, whereas CSF protein levels did not demonstrate statistically significant association.

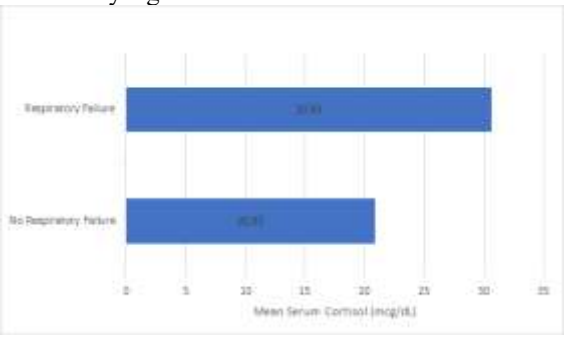

Figure 3: Comparison of mean serum cortisol levels between patients with and without respiratory failure

Patients who developed respiratory failure demonstrated markedly elevated mean serum cortisol levels compared to those without respiratory compromise.

Table 4: Electrophysiological Variants among patients

Electrophysiological Variant	Number of Patients
AIDP	21
AMAN	12
AMSAN	2
Normal NCS	4
Unexcitable/ Equivocal	2
Total	41

Acute inflammatory demyelinating polyneuropathy (AIDP) was the most common electrophysiological subtype observed. Both demyelinating and axonal variants were identified on nerve conduction studies.

DISCUSSION

Respiratory failure is one of the most serious complications of Guillain–Barré syndrome (GBS) and remains an important cause of morbidity and prolonged intensive care stay.[4,5] Early identification of patients at risk for respiratory compromise is therefore essential for timely ventilatory support.[6,7]

In the present study, respiratory failure developed in 54% of patients, which was higher than the incidence reported in most hospital-based studies.[5,6] This may be attributed to the fact that our institution functions as a tertiary care referral center receiving more severe cases.

Male predominance was observed in our study, with the majority of patients belonging to the 31–40 year age group. However, neither age nor gender showed statistically significant association with respiratory failure. Similar findings were reported by Lawn et al. and Sundar et al.[6,12]

Bulbar palsy, facial weakness, autonomic dysfunction, neck muscle weakness, and rapid progression of weakness showed significant association with respiratory failure in the present study. Similar observations were reported by Lawn et al., Sharshar et al., Durand et al., Green et al., and Galassi et al., who identified bulbar dysfunction, bifacial weakness, autonomic instability, and rapidly progressive disease as important predictors of mechanical ventilation in GBS.[6,7,8,17,18]

Mean CSF protein levels did not demonstrate statistically significant association with respiratory failure in our study. Similar findings were reported by Durand et al.[8]

Electrophysiological evaluation demonstrated both demyelinating and axonal variants of GBS, with acute inflammatory demyelinating polyneuropathy (AIDP) being the predominant subtype. Durand et al. and Cros et al. similarly emphasized the usefulness of electrophysiological evaluation in predicting respiratory compromise in GBS.[8,10]

Patients who subsequently developed respiratory failure demonstrated lower single breath count test (SBCT) values and rapid decline in serial measurements during hospitalization. SBCT served as a simple and useful bedside tool for respiratory monitoring in patients with neuromuscular weakness.[15,16]

Overall, the findings of the present study suggest that bulbar palsy, facial weakness, autonomic dysfunction, rapid progression of weakness, and elevated serum cortisol levels are important predictors of respiratory failure in Guillain–Barré syndrome. Early recognition of these predictors may facilitate timely ICU admission and ventilatory support, thereby improving patient outcomes.

CONCLUSION

Bulbar palsy, facial weakness, autonomic dysfunction, neck muscle weakness, rapid progression of weakness, and elevated serum cortisol levels were significantly associated with respiratory failure in patients with Guillain–Barré syndrome. Bedside respiratory monitoring using single breath count test (SBCT) proved useful for early identification of respiratory compromise. Early recognition of these predictors may facilitate timely intensive care admission and ventilatory support, thereby reducing morbidity and improving patient outcomes.

Limitations

1. The present study was conducted at a single tertiary care center with a relatively small sample size, which may limit the generalizability of the findings.
2. Complete electrophysiological evaluation could not be performed in all patients, limiting detailed statistical analysis of electrophysiological predictors of respiratory failure.

Ethical Approval: The study was conducted after obtaining approval from the Institutional Ethics Committee of Guntur Medical College and General Hospital, Guntur. Written informed consent was obtained from all participants included in the study.

Informed Consent: Written informed consent was obtained from all study participants prior to enrolment.

Conflict of Interest: The authors declare no conflict of interest.

Funding: No external funding was received for this study.

Authors' Contribution: All authors contributed to the conception and design of the study, data collection, analysis and interpretation of data, drafting of the manuscript, and approved the final version for publication.

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