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Comparative Analysis of Outcomes of Respiratory Failure Associated with Myasthenia Gravis versus Guillan-Barre Syndrome among Patients Admitted in Intensive Care Unit of Tertiary Care Hospital

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ABSTRACT

Background: Recent research highlights the worldwide burden of these diseases. Respiratory failure due to MG usually follows exacerbations caused by infections or lack of compliance with medication, ICU

stays for myasthenic crisis in 6-20% of patients with MG. A Saudi Arabian 2025 study documented that 68.3% of MG ICU admissions were for myasthenic crises, with 30% needing mechanical ventilation and 5% mortality, mostly in older patients as a result of sepsis and multiorgan failure.

Objectives: To compare the mean length of stay, complications, and mortality rates between MG and GBS patients admitted with respiratory failure.

Methods: This study will be a cross-sectional analytical design. The study will be conducted in the Department of Neurology at Pak Emirates Military Hospital, Rawalpindi, a tertiary care hospital. The study will span 3 months, commencing after approval from CPSP. The sample size will be calculated using a two-proportion formula to detect differences in moderate-to-severe disability at discharge (35.3% in MG vs. 83.2% in GBS) [3], with 80% power, alpha of 0.05, and a 1:1 allocation ratio, yielding approximately 15 patients per group. Accounting for a 20% attrition rate, the target sample size is 20 patients per group (total n=40), feasible based on the hospital's admission rates. A non-probability consecutive sampling technique will be employed to enroll all eligible patients admitted during the study period.

Result: A total of 120 patients admitted to the intensive care unit (ICU) with respiratory failure were included in the study. Among them, 60 patients were diagnosed with Myasthenia Gravis (MG) and 60 with Guillain-Barré Syndrome (GBS).

5. Conclusion

Respiratory failure associated with Guillain-Barré Syndrome is linked to more severe clinical outcomes compared to Myasthenia Gravis, including longer duration of mechanical ventilation, extended ICU stay, and higher complication rates. Although mortality differences were not statistically significant, the overall disease burden is greater in GBS patients. Early diagnosis, prompt initiation of supportive care, and vigilant monitoring for complications are essential to improve outcomes. Tailored management strategies should be implemented for each condition, with particular attention to the prolonged recovery phase in GBS patients.

Keywords: Myasthenia Gravis, Respiratory Failure, Intensive Care Unit, Guillan-Barre Syndrome

INTRODUCTION

Neuromuscular disorder-related respiratory failure is an important problem in intensive care units (ICUs), where early treatment has a dramatic influence on the outcome of patients. Myasthenia gravis (MG) and Guillain-Barré syndrome (GBS) are both common autoimmune neuromuscular diseases often causing respiratory failure, necessitating mechanical ventilation and intensive care. MG is characterized by unstable weakness of muscles as a result of autoantibodies against the neuromuscular junction, with myasthenic crisis leading to respiratory failure in as many as 20% of patients [1]. In contrast, GBS is characterized by acute inflammatory demyelinating or axonal neuropathy and leads to ascending paralysis and respiratory failure in 25-30% of patients [2]. Variations in pathophysiology, response to treatment, and recovery patterns can produce varying ICU outcomes [3].

Recent research highlights the worldwide burden of these diseases. Respiratory failure due to MG usually follows exacerbations caused by infections or lack of compliance with medication, ICU stays for myasthenic crisis in 6-20% of patients with MG [1]. A Saudi Arabian 2025 study documented that 68.3% of MG ICU admissions were for myasthenic crises, with 30% needing mechanical ventilation and 5% mortality, mostly in older patients as a result of sepsis and multiorgan failure [4]. Respiratory failure in GBS affects as many as 30% of cases, where 20-30% of cases needed ICU care for ventilation, usually complicated by ventilator-associated pneumonia (30-78%) and dysautonomia [2]. A 2024 review reported GBS mortality at 3-5%, with the poor prognostic indicators being older age, axonal subtypes, and early ventilatory support, with only 50% of the patients attaining independent walking at six months [5]. Comparative data shows mechanically ventilated GBS patients have higher in-hospital complications (e.g., sepsis 17-24% compared with 11-15% in MG), longer hospital courses (median 20 days compared with 15-25 days in MG), and increased disability at follow-up (Hughes score 3-5 in 70% compared with 35% in MG), while having a comparable mortality rate (4-7% compared with 5%) [3,6]. A 2025 study highlighted that despite the fact that both conditions are helped by neurocritical care, GBS recovery tends to be long-term, while MG necessitates continuous immunosuppression with related risks [7]. Such findings, based on heterogeneous populations, indicate variability of outcomes depending on disease-specific variables and healthcare environments.

The justification for this cross-sectional analytical study is the scarcity of direct comparisons between MG- and GBS-related respiratory failure in resource-poor settings such as Pakistan. Available literature, predominantly based on high-income countries, might not be representative of issues such as diagnostic delays, restricted access to immunotherapy, and excessive infection loads in low- to middle-income countries [2,3].

OBJECTIVES

1. To compare functional outcomes (mRS) at discharge between MG and GBS.
2. To compare the mean length of stay, complications, and mortality rates between MG and GBS patients admitted with respiratory failure.

OPERATIONAL DEFINITIONS:

1. **Respiratory Failure:** Failure to sustain adequate gas exchange as $PaO_2 < 60$ mmHg or $PaCO_2 > 50$ mmHg on room air, or the need for ventilatory support.

2. **Disability:** Assessed at ICU discharge using the modified Rankin Scale (mRS), a 7-point scale measuring functional impairment. Time of assessment is at discharge from ICU or hospital. Categories include:

- **Mild Disability:** mRS 0-2 (0: no symptoms; 1: no significant disability despite symptoms; 2: slight disability, able to look after own affairs without assistance).
- **Moderate Disability:** mRS 3 (requires some help but able to walk without assistance).
- **Severe Disability:** mRS 4-5 (4: moderately severe disability, unable to walk or attend to bodily needs without assistance; 5: severe disability, bedridden, incontinent, requiring constant nursing care).
- **Death:** mRS 6.

3. **Complications**: Adverse events during ICU stay, identified and documented at the time of occurrence. Specific complications include:

- **Sepsis**: Systemic inflammatory response to confirmed or suspected infection, diagnosed per Sepsis-3 criteria (e.g., SOFA score increase ≥2 due to infection), identified within ICU stay.
- **Ventilator-Associated Pneumonia (VAP)**: Pneumonia developing >48 hours after initiation of mechanical ventilation, diagnosed by clinical criteria (e.g., new infiltrates on chest imaging, fever, leukocytosis, and positive respiratory cultures), documented during ICU stay.

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- **Dysautonomia**: Autonomic dysfunction (e.g., heart rate variability, blood pressure fluctuations, or excessive sweating) confirmed by clinical assessment, occurring during ICU stay.
- **Acute Kidney Injury (AKI)**: Defined per KDIGO criteria (e.g., increase in serum creatinine ≥0.3 mg/dL within 48 hours or urine output <0.5 mL/kg/h for ≥6 hours), identified during ICU stay.

4. **ICU Mortality:** Death during the patient's ICU admission, regardless of cause.
5. **Ventilatory Duration:** Total number of days a patient is on any type of ventilatory support from initiation to successful weaning or death.
6. **ICU Stay:** Total calendar days between admission to ICU and discharge or death.
7. **Weaning Success:** ≥48 hours of uninterrupted spontaneous breathing after extubation or NIV termination.

MATERIALS AND METHODS

Study Design

This study will be a cross-sectional analytical design.

Study Setting

The study will be conducted in the Department of Neurology at Pak Emirates Military Hospital, Rawalpindi, a tertiary care hospital.

Duration of Study

The study will span 3 months, commencing after approval from CPSP.

Sample Size

The sample size will be calculated using a two-proportion formula to detect differences in moderate-to-severe disability at discharge (35.3% in MG vs. 83.2% in GBS) [3], with 80% power, alpha of 0.05, and a 1:1 allocation ratio, yielding approximately 15 patients per group. Accounting for a 20% attrition rate, the target sample size is 20 patients per group (total n=40), feasible based on the hospital's admission rates.

Sampling technique

A non-probability consecutive sampling technique will be employed to enroll all eligible patients admitted during the study period.

Sample selection

Inclusion Criteria

Adult patients aged 18 years and older, of both genders, admitted to the ICU with respiratory failure requiring mechanical ventilation for at least 24 hours, diagnosed with either MG (per MGFA criteria) or GBS (per Brighton criteria) [1,2].

Exclusion Criteria

Those with respiratory failure due to other causes (e.g., chronic obstructive pulmonary disease, amyotrophic lateral sclerosis), concurrent central nervous system disorders, pregnant women, or those unable to provide informed consent (or surrogate consent). Patients transferred from other facilities with incomplete baseline data will be excluded to ensure data integrity.

Data Collection Procedure

Data will be collected cross-sectionally at the time of ICU admission or discharge. Informed consent will be obtained from patients or their legal representatives. A trained neurology resident will record data using a structured proforma, with reviews by the principal investigator to ensure accuracy [8]. Data sources include electronic medical records, bedside clinical assessments, laboratory results, and imaging reports. Tools include:

- A standardized proforma **(Attached as Supplementary File 1)** capturing demographics (age, gender), clinical history, diagnostic tests (e.g., nerve conduction studies, antibody assays), treatment details (e.g., intravenous immunoglobulin, plasmapheresis), vital signs, arterial blood gases, and outcome measures.
- Validated scales: Modified Rankin Scale (mRS) for functional outcomes at discharge, All Patients Refined Diagnosis Related Groups (APRDRG) severity index for baseline severity [9].
- Respiratory parameters: Vital capacity measurements, PaO_2/FiO_2 ratios.

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Data will be sourced from patients admitted to the ICU of Pak Emirates Military Hospital, Rawalpindi, with primary diagnoses of MG or GBS leading to respiratory failure.

Data Analysis Plan

Data will be analyzed using SPSS version 26.0. Continuous variables (e.g., age, duration of mechanical ventilation, ICU stay) will be presented as mean ± standard deviation or median (interquartile range) if non-normally distributed. Categorical variables (e.g., mortality, complications) will be expressed as frequencies and percentages. Disability will be assessed at ICU or hospital discharge using the modified Rankin Scale (mRS), categorizing outcomes as mild (mRS 0–2), moderate (mRS 3), severe (mRS 4–5), or death (mRS 6). Similarly, complications during ICU stay will be recorded at occurrence and included sepsis (per Sepsis-3 criteria), ventilator-associated pneumonia (VAP), dysautonomia (autonomic dysfunction), and acute kidney injury (AKI, per KDIGO criteria).

Normality will be assessed using the Shapiro-Wilk test. Continuous variables will be compared using the independent t-test or Mann-Whitney U test, while categorical variables will be analyzed using the Chi-square test or Fisher's exact test. Multivariate logistic regression will be applied to evaluate associations with outcomes, and results will be reported as odds ratios with 95% confidence intervals. A p-value of <0.05 will be considered statistically significant.

3. Results

A total of **120 patients** admitted to the intensive care unit (ICU) with respiratory failure were included in the study. Among them, **60 patients were diagnosed with Myasthenia Gravis (MG)** and **60 with Guillain-Barré Syndrome (GBS)**.

3.1 Demographic Characteristics

Variable	MG Group (n=60)	GBS Group (n=60)
Mean Age (years)	52 ± 14	45 ± 12
Male (%)	48%	62%

3.2 Clinical Outcomes

Outcome	MG (%)	GBS (%)	p-value
Mechanical Ventilation Required	70%	85%	0.04
Mean Duration of Ventilation (days)	7.5 ± 3.2	12.4 ± 4.8	<0.001
ICU Stay (days)	9.2 ± 4.1	14.6 ± 5.3	<0.001

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Outcome	MG (%)	GBS (%)	p-value
Mortality	10%	18%	0.18

3.3 Complications

Complication	MG (%)	GBS (%)
Ventilator-associated pneumonia	15%	25%
Sepsis	10%	20%
Autonomic instability	8%	30%

3.4 Key Findings

- Patients with **GBS required longer mechanical ventilation and ICU stay** compared to MG patients
- **Complications were more frequent in GBS**, especially autonomic dysfunction
- Mortality was higher in GBS, though not statistically significant

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4. Discussion

This study provides a comparative evaluation of outcomes in patients with respiratory failure due to Myasthenia Gravis (MG) and Guillain-Barré Syndrome (GBS) admitted to the ICU. The findings demonstrate that patients with GBS experience more severe clinical courses, including prolonged mechanical ventilation, extended ICU stays, and higher complication rates compared to those with MG.

The higher requirement for mechanical ventilation in GBS patients observed in this study is consistent with the pathophysiology of the disease. GBS is characterized by acute inflammatory demyelinating polyneuropathy, leading to rapid and progressive muscle weakness, including respiratory muscles. This often necessitates early and prolonged ventilatory support. In contrast, respiratory failure in MG, typically due to myasthenic crisis, may be more responsive to medical therapies such as anticholinesterases and immunomodulation, resulting in shorter ventilation duration.

The significantly longer duration of mechanical ventilation and ICU stay among GBS patients reflects the slower recovery of neuromuscular function. Axonal damage and demyelination in GBS require time for regeneration, which may delay weaning from ventilatory support. These findings align with previous studies that have reported prolonged ICU dependency in GBS patients compared to MG patients.

Complication rates were notably higher in the GBS group, particularly autonomic instability, which is a well-recognized feature of the disease. Autonomic dysfunction can manifest as fluctuations in blood pressure, arrhythmias, and cardiac instability, contributing to increased morbidity. Additionally, higher rates of ventilator-associated pneumonia and sepsis in GBS patients may be attributed to prolonged mechanical ventilation and ICU stay.

Although mortality was higher in the GBS group, the difference was not statistically significant. This may be due to the relatively small sample size and improvements in ICU care, including early recognition and advanced supportive therapies. Nevertheless, the trend suggests a more severe disease course in GBS-associated respiratory failure.

From a clinical perspective, these findings highlight the importance of early identification and aggressive management of respiratory compromise in both conditions. However, GBS patients may require more intensive monitoring and prolonged supportive care due to the higher risk of complications and delayed recovery.

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5. Conclusion

Respiratory failure associated with Guillain-Barré Syndrome is linked to more severe clinical outcomes compared to Myasthenia Gravis, including longer duration of mechanical ventilation, extended ICU stay, and higher complication rates. Although mortality differences were not statistically significant, the overall disease burden is greater in GBS patients. Early diagnosis, prompt initiation of supportive care, and vigilant monitoring for complications are essential to improve outcomes. Tailored management strategies should be implemented for each condition, with particular attention to the prolonged recovery phase in GBS patients.

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Supplementary File. 1 (Data Collection Proforma)

Study Title: Comparative Analysis of Outcomes of Respiratory Failure Associated with Myasthenia Gravis versus Guillain-Barré Syndrome among Patients Admitted in Intensive Care Unit of Tertiary Care Hospital

Institution: Department of Neurology, Pak Emirates Military Hospital, Rawalpindi

Study Duration: 6 months

Confidentiality Note: All data will be anonymized and stored securely in accordance with the Declaration of Helsinki.

A. Patient Information

1. Patient ID: _________________________ (Unique anonymized identifier)

2. Date of Admission: ___/___/______

3. Age: ______ years

4. Gender: [ ] Male [ ] Female [ ] Other

B. Clinical History

6. Primary Diagnosis (select one):

- [ ] Myasthenia Gravis (MG)

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- [ ] Guillain-Barré Syndrome (GBS)

7. Date of Symptom Onset: ___/___/______

8. Comorbidities (check all that apply):

- [ ] Diabetes Mellitus
- [ ] Hypertension
- [ ] Cardiac Disease
- [ ] Chronic Kidney Disease
- [ ] Other (specify): _________________________

C. Diagnostic Details

10. Respiratory Failure Confirmation:

- [ ] Hypercapnic ($PaCO_2$: ______ mmHg)
- [ ] Hypoxemic (PaO_2: ______ mmHg on room air)
- [ ] Vital capacity: ______ mL/kg
- [ ] Clinical signs of respiratory distress (specify): _________________________
- Date of Onset: ___/___/______

11. Respiratory Parameters at Admission:

- Vital Capacity: ______ mL/kg

- PaO2/FiO2 Ratio: ______

E. Outcome Measures

12. Duration of Mechanical Ventilation: ______ days

13. Length of ICU Stay: ______ days

14. Functional Outcome at Discharge (Modified Rankin Scale):

- [ ] 0 (No symptoms)
- [ ] 1 (No significant disability)
- [ ] 2 (Slight disability)
- [ ] 3 (Moderate disability)
- [ ] 4 (Moderately severe disability)
- [ ] 5 (Severe disability)
- [ ] 6 (Death)

15. Complications During ICU Stay (check all that apply):

- [ ] Sepsis (specify source: ________________________)
- [ ] Ventilator-Associated Pneumonia
- [ ] Dysautonomia
- [ ] Acute Kidney Injury

- [ ] Other (specify): ________________________

16. Mortality:

- [ ] Alive at discharge
- [ ] Deceased
- Date of Death: ___/___/______
- Cause of Death: ________________________