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Assessment of Therapeutic Outcomes of IVIG Versus Plasma Exchange in Severe Neuromuscular Disorders

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Abstract

Background: Severe neuromuscular disorders such as Guillain-Barré Syndrome and Myasthenia Gravis frequently require intensive neurological care because of rapidly progressive weakness, respiratory compromise, and autonomic dysfunction. Intravenous immunoglobulin (IVIG) and plasma exchange (PLEX) are widely accepted immunomodulatory therapies for these disorders. However, differences in therapeutic efficacy, duration of hospital stay, complication profile, and functional recovery remain clinically relevant, particularly in resource-limited tertiary care settings. ***Aim:*** To assess and compare the therapeutic outcomes of IVIG and plasma exchange in patients with severe neuromuscular disorders admitted to the Department of Neurology, Super Speciality Hospital, Government Medical College Jammu. ***Methods:*** This retrospective observational study included 100 patients diagnosed with severe neuromuscular disorders who received either IVIG or plasma exchange between 1 April 2024 and 31 March 2026. Demographic characteristics, diagnosis, duration of illness, treatment modality, ventilatory support, hospital stay, complications, and neurological outcomes were analyzed. Functional improvement was assessed using disease-specific neurological grading scales and discharge status. Statistical analysis was performed using chi-square test and independent t-test, with $p < 0.05$ considered statistically significant. ***Results:*** Among 100 patients, 52 received IVIG and 48 underwent plasma exchange. Guillain-Barré syndrome constituted the majority of cases followed by myasthenic crisis and chronic inflammatory demyelinating polyneuropathy. Improvement in neurological status was observed in 82.7% of the IVIG group and 79.2% of the plasma exchange group. Mean duration of hospital stay was significantly lower in the IVIG group (11.8 ± 3.6 days) compared with the plasma exchange group (15.4 ± 4.2 days) ($p=0.003$). Mechanical ventilation requirement was observed in 28.8% of IVIG-treated patients and 35.4% of plasma exchange patients. Adverse events such as hypotension, catheter-related infection, and electrolyte imbalance were more frequent in the plasma exchange group. Mortality was low and comparable between groups. ***Conclusion:*** Both IVIG and plasma exchange were effective therapeutic modalities for severe neuromuscular disorders. IVIG demonstrated shorter hospitalization and fewer treatment-related complications, whereas plasma exchange showed comparable neurological recovery. Early initiation of immunomodulatory therapy remains critical for favorable outcomes.

Keywords: neuromuscular disorders, Guillain-Barré Syndrome, Myasthenia Gravis, intensive neurological care.

INTRODUCTION

Severe neuromuscular disorders represent an important category of neurological illnesses characterized by acute or subacute weakness involving peripheral nerves, neuromuscular junctions, or muscles. These disorders frequently require emergency hospitalization because of rapidly progressive motor deficits, respiratory failure, bulbar dysfunction, and autonomic instability. Among these conditions, Guillain-Barré syndrome (GBS), myasthenic crisis associated with myasthenia gravis, and chronic inflammatory demyelinating polyneuropathy (CIDP) are commonly encountered immune-mediated neurological disorders requiring immunomodulatory therapy. Early diagnosis and prompt initiation of treatment are essential to reduce morbidity, mortality, and long-term disability. (1,2)

Guillain-Barré syndrome is an acute inflammatory demyelinating polyradiculoneuropathy characterized by ascending paralysis, areflexia, sensory disturbances, and autonomic dysfunction. It often follows antecedent infections and may progress rapidly to respiratory paralysis necessitating ventilatory support. Myasthenia

gravis, on the other hand, is an autoimmune disorder involving antibodies against acetylcholine receptors or associated proteins at the neuromuscular junction, resulting in fluctuating skeletal muscle weakness. Severe exacerbations may lead to myasthenic crisis requiring intensive care management. CIDP is a chronic immune-mediated neuropathy presenting with progressive or relapsing motor weakness and sensory dysfunction. (3,4)

Immunotherapy forms the cornerstone of management in these disorders. Intravenous immunoglobulin and plasma exchange are considered first-line therapies in severe cases. IVIG acts through multiple immunomodulatory mechanisms including neutralization of pathogenic antibodies, inhibition of complement activation, suppression of inflammatory cytokines, and modulation of Fc receptor activity. Plasma exchange removes circulating autoantibodies, immune complexes, and inflammatory mediators from the plasma, thereby reducing immune-mediated nerve injury. Both therapies have demonstrated efficacy in improving neurological recovery and reducing disease progression. (5,6)

Several randomized clinical trials and meta-analyses have shown comparable efficacy between IVIG and plasma exchange in GBS and myasthenic crisis. However, differences exist regarding accessibility, cost, adverse effect profile, duration of treatment, and requirement for specialized infrastructure. Plasma exchange is often associated with catheter-related complications, hemodynamic instability, electrolyte imbalance, and increased procedural requirements. IVIG is comparatively easier to administer but may be associated with infusion reactions, renal dysfunction, and thromboembolic complications. The choice of therapy frequently depends on disease severity, patient comorbidities, institutional resources, and clinician preference. (7,8)

In developing countries, especially in government tertiary care centers, resource allocation and treatment affordability significantly influence therapeutic decisions. Comparative real-world data from Indian healthcare settings remain limited, particularly from North Indian neurological centers. Evaluation of clinical outcomes in such settings may help optimize treatment protocols and improve patient care strategies. (9)

The present retrospective study was therefore undertaken to assess and compare therapeutic outcomes of IVIG and plasma exchange among patients with severe neuromuscular disorders admitted to the Department of Neurology, Super Speciality Hospital, Government Medical College Jammu over a two-year period. The study aimed to evaluate neurological improvement, duration of hospitalization, ventilatory requirement, treatment-related complications, and mortality associated with these two therapeutic modalities. (10)

MATERIALS AND METHODS

Study Design

This was a retrospective observational comparative study conducted in the Department of Neurology, Super Speciality Hospital, Government Medical College Jammu.

Study Duration

The study was conducted over a period of two years from 1 April 2024 to 31 March 2026.

Study Population

A total of 100 patients diagnosed with severe neuromuscular disorders and treated with either intravenous immunoglobulin or plasma exchange were included in the study.

Inclusion Criteria

Patients fulfilling the following criteria were included:

- Age above 18 years
- Confirmed diagnosis of severe Guillain-Barré syndrome, myasthenic crisis, or CIDP
- Patients receiving either IVIG or plasma exchange as definitive immunomodulatory therapy
- Availability of complete medical records

Exclusion Criteria

The following patients were excluded:

- Patients with incomplete treatment records
- Patients receiving both IVIG and plasma exchange sequentially
- Patients with severe systemic illness affecting neurological outcome
- Pediatric patients below 18 years

Data Collection

Patient records were retrieved from hospital medical archives and neurology department databases. Data collected included:

- Demographic details
- Clinical presentation
- Neurological diagnosis
- Duration of illness before admission
- Requirement of intensive care
- Need for mechanical ventilation
- Treatment modality administered
- Duration of hospitalization
- Treatment-related adverse effects
- Functional neurological outcome at discharge

Therapeutic Protocol

IVIG Group

Patients received IVIG at a standard dose of 0.4 g/kg/day for 5 consecutive days according to institutional protocol.

Plasma Exchange Group

Patients underwent 4–6 sessions of plasma exchange on alternate days using standard apheresis techniques under neurological and critical care supervision.

Outcome Measures

Primary outcomes assessed included:

- Neurological improvement at discharge
- Duration of hospital stay
- Requirement for mechanical ventilation
- Mortality

Secondary outcomes included:

- Treatment-related complications
- ICU admission duration
- Functional recovery status

Statistical Analysis

Data were entered into Microsoft Excel and analyzed using SPSS software version 25. Quantitative variables were expressed as mean ± standard deviation, whereas categorical variables were represented as frequencies and percentages. Independent t-test and chi-square test were applied for comparison between groups. A p-value less than 0.05 was considered statistically significant.

RESULTS

A total of 100 patients with severe neuromuscular disorders were evaluated during the study period. Among them, 52 patients received intravenous immunoglobulin therapy while 48 underwent plasma exchange. The mean age of the study population was 46.8 ± 15.2 years. Male patients constituted the majority of cases.

Table 1. Demographic and Clinical Characteristics of Study Population

Parameter	IVIG Group (n=52)	Plasma Exchange Group (n=48)	p-value
Mean age (years)	45.9 ± 14.7	47.8 ± 15.9	0.524
Male gender	34 (65.4%)	31 (64.6%)	0.931
Guillain-Barré syndrome	31 (59.6%)	29 (60.4%)	0.884
Myasthenic crisis	15 (28.8%)	13 (27.1%)	0.841
CIDP	6 (11.5%)	6 (12.5%)	0.873
ICU admission	20 (38.5%)	24 (50.0%)	0.241
Mechanical ventilation	15 (28.8%)	17 (35.4%)	0.471

Interpretation of Table 1

The demographic and baseline clinical characteristics were comparable between the two treatment groups. Guillain-Barré syndrome was the most common diagnosis, accounting for approximately 60% of cases in both groups. Mechanical ventilation requirement was slightly higher in the plasma exchange group (35.4%) compared with the IVIG group (28.8%), although the difference was statistically insignificant (p=0.471).

Table 2. Comparison of Therapeutic Outcomes

Outcome Parameter	IVIG Group (n=52)	Plasma Exchange Group (n=48)	p-value
Neurological improvement	43 (82.7%)	38 (79.2%)	0.652
Mean hospital stay (days)	11.8 ± 3.6	15.4 ± 4.2	0.003*
ICU stay >5 days	11 (21.2%)	18 (37.5%)	0.048*
Successful ventilator weaning	13 (86.7%)	14 (82.4%)	0.721
Mortality	2 (3.8%)	3 (6.3%)	0.564

Neurological improvement at discharge was observed in more than three-fourths of patients in both treatment groups, with no statistically significant difference. However, mean duration of hospital stay was significantly shorter in patients receiving IVIG compared with plasma exchange (11.8 vs 15.4 days, p=0.003). Prolonged ICU stay was more frequent among plasma exchange patients and reached statistical significance.

The mortality rate remained low in both groups, indicating effectiveness of both therapeutic modalities when administered early and appropriately.

Plasma exchange was associated with significantly higher rates of hypotension, catheter-related infections, and electrolyte imbalance compared with IVIG. Mild infusion reactions were more common in the IVIG group but were generally self-limiting. Renal dysfunction was infrequent and comparable between groups.

Table 3. Treatment-Related Complications

Complication	IVIG Group (n=52)	Plasma Exchange Group (n=48)	p-value
Hypotension	2 (3.8%)	11 (22.9%)	0.006*
Catheter-related infection	0 (0%)	7 (14.6%)	0.003*
Electrolyte imbalance	3 (5.8%)	10 (20.8%)	0.024*
Infusion reaction	6 (11.5%)	2 (4.2%)	0.184
Renal dysfunction	2 (3.8%)	1 (2.1%)	0.612

Overall, IVIG demonstrated a comparatively favorable safety profile with fewer severe procedural complications.

DISCUSSION

Severe neuromuscular disorders represent acute neurological emergencies because rapidly progressive weakness may lead to respiratory failure, autonomic instability, prolonged hospitalization, and functional disability. In the present retrospective study, therapeutic outcomes of intravenous immunoglobulin (IVIG) and plasma exchange were compared among 100 patients admitted with severe neuromuscular disorders. Both modalities produced clinically meaningful improvement, indicating that early immunomodulatory intervention remains central to the management of immune-mediated neuromuscular diseases.

Guillain-Barré syndrome constituted the major diagnostic category in the present study. This finding is consistent with the review by Lawn et al., who emphasized that GBS remains one of the most important causes of acute flaccid paralysis requiring intensive neurological monitoring, particularly when bulbar weakness, autonomic dysfunction, and rapid progression predict mechanical ventilation requirement. (5) In the present study, mechanical ventilation was required in nearly one-third of patients, reflecting the severe nature of illness at admission. Similar observations have been reported in GBS literature, where respiratory muscle weakness is considered a major determinant of morbidity and duration of hospital stay.

The present study observed comparable neurological improvement in both IVIG and plasma exchange groups. This finding supports earlier evidence summarized by Hughes et al., who reported that both IVIG and plasma exchange are effective immunotherapeutic options in Guillain-Barré syndrome, with no major difference in functional recovery when administered appropriately. (2) Plasma exchange acts by removing circulating pathogenic antibodies, complement components, and inflammatory mediators, whereas IVIG exerts immunomodulatory effects by neutralizing autoantibodies, inhibiting complement activation, and regulating Fc receptor-mediated immune responses. Therefore, although their mechanisms differ, both therapies target immune-mediated neuromuscular injury.

The duration of hospital stay was significantly shorter in the IVIG group compared with the plasma exchange group. This may be attributed to easier administration, avoidance of central venous catheterization, reduced procedural burden, and fewer hemodynamic complications. Kuwabara et al. identified early clinical improvement as an important predictor of faster recovery in GBS, supporting the importance of prompt and logistically feasible therapy. (11) In practical hospital settings, IVIG may allow earlier treatment initiation because it does not require apheresis equipment or specialized vascular access, which may translate into shorter hospitalization.

Plasma exchange, while effective, was associated with a higher frequency of treatment-related complications in the present study, particularly hypotension, catheter-related infection, and electrolyte imbalance. These findings are consistent with the American Academy of Neurology guideline update by Cortese et al., which recognized plasmapheresis as an evidence-based therapy in selected neurological disorders but also highlighted procedural risks related to vascular access and hemodynamic instability. (6) Chevret et al. also supported the efficacy of plasma exchange in GBS, but its use requires careful monitoring and adequate institutional infrastructure. (10)

Infusion reactions were more commonly observed in the IVIG group, although most were mild and self-limiting. Satya-Murti et al. discussed IVIG use in neurological disorders and noted that although IVIG is generally well tolerated, adverse effects such as headache, fever, chills, renal dysfunction, and thrombotic events may occur, especially in elderly patients or those with comorbidities. (7) In the present study, serious IVIG-related complications were infrequent, suggesting a favorable safety profile when patients are appropriately selected and monitored.

The comparable mortality observed between the two groups indicates that both therapies can be effective when integrated with good neurological and critical care support. van den Berg et al. emphasized that prognosis in GBS depends not only on immunotherapy but also on early diagnosis, respiratory monitoring, prevention of complications, rehabilitation, and multidisciplinary care. (8) This is particularly relevant in severe neuromuscular disorders, where supportive care may strongly influence final outcome.

Evidence from myasthenia gravis also supports the use of both immunomodulatory modalities. Heatwole et al. compared plasma exchange and IVIG in myasthenic crisis from an acute hospital cost perspective and highlighted that both treatments are used in severe exacerbations, with differences in resource utilization. (9) More recently, Manolopoulos et al. reviewed immunoglobulin therapy for myasthenia gravis and reinforced its role in acute worsening and crisis settings, although patient selection and clinical context remain important. (3)

The present findings are also supported by recent systematic reviews. Bellanti and Rinaldi provided an updated comprehensive review of Guillain-Barré syndrome, emphasizing early immunotherapy and supportive care as key determinants of outcome. (1) Kimber et al. reported that both therapeutic plasma exchange and IVIG have important clinical and economic implications in autoimmune neurological disorders, with treatment selection often influenced by cost, availability, safety profile, and institutional expertise. (4,12) Justiz-Vaillant et al. further described the broader immunological mechanisms of IVIG and other immunotherapies, supporting their biological plausibility in immune-mediated neurological diseases. (13)

The retrospective design of the present study remains an important limitation. Selection bias, incomplete documentation, variation in disease severity, and lack of long-term follow-up may influence interpretation. Nevertheless, the study provides useful real-world evidence from a tertiary government hospital setting. Overall, both IVIG and plasma exchange were effective in severe neuromuscular disorders, but IVIG showed advantages in terms of shorter hospital stay and fewer procedural complications. Treatment choice should therefore be individualized according to disease severity, contraindications, availability, cost, and patient-specific risk factors.

CONCLUSION

Both intravenous immunoglobulin and plasma exchange were effective in improving neurological outcomes among patients with severe neuromuscular disorders. Although neurological recovery and mortality rates were comparable, IVIG demonstrated shorter hospital stay and fewer severe complications. Plasma exchange remained an effective alternative but was associated with increased procedural adverse events. Early recognition, intensive neurological monitoring, and prompt immunomodulatory therapy are essential for optimizing patient outcomes in severe neuromuscular disorders.

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