Original Research Article

Patterns of Clinical Presentation and In-Hospital Outcome of Adult Patient with Guillain-Barre Syndrome

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Abstract: **Background**: Guillain Barre Syndrome (GBS) is an acute, inflammatory, immune-mediated disorder of the peripheral nervous system triggered usually by a bacterial or viral infection or other antecedent events. GBS has become the leading cause of acute flaccid paralysis with a worldwide distribution. The incidence of GBS is variable across the world with overall incidence of 0.81-1.89/100000/year and incidence increases with age. **Aim of the Study**: This observational study was carried out to observe the pattern of clinical presentation, electrophysiological profile, and in-hospital outcome of Guillain-Barre Syndrome (GBS). **Methods**: A total number of 40 GBS patients at the department of Internal medicine, Neurology and Intensive care unit (ICU) of Sylhet M.A.G Osmani Medical College Hospital, Sylhet were enrolled during the period of February 2020 to March 2021. All patients were studied in detail including history, clinical examination and investigation. **Results**: The age of the patients ranged from 16 to 46 years with the mean age of 30.10 ± 13.44 years. Most of the cases occurred in autumn (60.0%) and antecedent event was present in 27.5% cases. In 40% patient's initial symptom was bipedal edema who eventually went on to develop limb weakness/paralysis after various interval. Limb weakness was initial symptoms in 50% patients where Ascending paralysis was noted in the most of the cases (90%) and rest all 4 limbs. About 30% of the cases had objective sensory disturbance in the form distortion of pain (12%) and light touch (20%). Out of 40 patients 3 were treated with IVIg and 4 patients were managed in ICU. At discharge good or favorable outcome (GBS score < 3) was in 72.5% of the study population and poor or unfavorable outcome (GBS score ≥ 3) was in 27.5%. In hospital mortality was 10% in our study. A high GBS disability score at admission, ICU admission and mechanical ventilation were the factors that significantly associated with poor in-hospital outcome in GBS (p value <0.001 and <0.004 respectively). **Conclusion**: A good number of patients had pedal edema as initial symptom and all in-hospital outcome was favorable.
Keywords: Guillain Barre Syndrome (GBS), Electrophysiological study (EPS), Cerebrospinal Fluid (CSF), Hospital Outcome.

INTRODUCTION

Guillain Barre Syndrome (GBS) is an acute, inflammatory, immune-mediated disorder of the peripheral nervous system triggered usually by a bacterial or viral infection or other antecedent events. GBS has become the leading cause of acute flaccid paralysis with a worldwide distribution. The incidence of GBS is variable across the world with overall incidence of 0.81-189/100000/year and increases with age [1]. The disease is typically triggered by a preceding infection in two thirds of cases [2]. This induces an autoimmune response targeting peripheral nerves and their spinal roots [3]. This ultimately results in nerve damage or functional blockade of nerve conduction. There is molecular mimicry between microbial and a nerve antigen which leads to the development of the disorder. The exact mechanism of interplay between microbes and host factors is still not well understood. The usual pattern of presentation is ascending flaccid paralysis. Weakness typically evolves over hours to few days and reaches in maximum severity in 4 weeks. GBS is frequently associated with tingling in extremities that typically start distally in symmetrical pattern. Autonomic involvement is common [4]. Patients may develop acute respiratory failure due to progressive weakness of respiratory muscles and of bulbar dysfunction. About 30% of GBS patients become ventilator dependent, with subsequent increase risk of death [5].

The mainstay of treatment is supportive care that includes multidisciplinary care to prevent and manage complications as well as rehabilitation programs [6]. Immunotherapy in the form of Intravenous immunoglobulin (IVIg) or plasma exchange is proven effective treatment in early stage of the disease that has been shown to be effective in early recovery [7]. Despite the availability of treatment, outcome in patients with GBS has not significantly changed in the last two decades. The outcome of GBS varies from spontaneous recovery to wheelchair dependency to death. Case fatality rate and poor outcome is lower in high-income countries in comparison to low-income country [8]. But there were few studies regarding in-hospital outcome and predictors of poor in-hospital outcome. To date there are few studies in Bangladesh regarding in hospital outcome of GBS. Specially in the northeastern region of the country the in-hospital outcome and whether clinical presentation, electrophysiological subtypes or given treatment have impact upon the outcome still unknown. The aim of the study was to assess clinical, electrophysiological profile, any peculiarities of presentation of GBS and in-hospital outcome of GBS and predictors of poor in-hospital outcome in that specific region.

Objectives General Objective
- To identify patterns of clinical presentation and in-hospital outcome of adult patient with GBS.

Specific Objective
- To record initial symptoms and pattern of limb weakness in patients with GBS.
- To record the clinical findings in neurological examination of GBS patients.
- To assess subtypes of GBS by electrophysiological study.
- To record demographic variables in patients with GBS.
- To record In-hospital outcome of GBS patients.

MATERIALS & METHODS
The study was an observational study. The patients were selected Sampling was done by purposive sampling method. A total of 40 patients were included in this study. Patients presenting with recently developed ascending paralysis admitted in the department of Medicine. All Patients fulfilling the diagnostic criteria of Guillain-Barre syndrome. The study was conducted in Medicine, Neurology and Intensive care unit of Sylhet MAG Osmani medical college hospital, Sylhet which is a tertiary care hospital the North-eastern region of Bangladesh. At January 2019 to December 2021.

Inclusion Criteria:
- Patients fulfilling the diagnostic criteria for GBS.

Exclusion Criteria:
- Early and prominent bladder and bowel dysfunction.
- Feature of disease like myasthenia gravis, botulism, porphyria and diphtheria.

Procedure of Data Collection:
After taking ethical clearance from the ethical review committee of Sylhet MAG Osmani Medical College all proceeding was started. A prior permission was taken from the department of Medicine, Neurology and ICU. Both the patients and caregiver were informed about the purpose of the study and ethical issue was informed to them. They were informed about the right to withdraw from the study at any stage without any consequence. Clinical diagnosis of GBS was done according to diagnostic criteria. After taking informed written consent data collection procedure was initiated through one-to-one interview.

Statistical Analysis

Data were processed and analyzed with the help of Microsoft Excel Spread Sheet 2010. Quantitative data were expressed as mean and standard deviation. Qualitative data were expressed as frequency and percentage. Patients were divided into two groups. GBS disability score of 0-2 was considered as good outcome and ≥3 was considered as poor outcome. Comparison between 2 groups was done by Chi-Square test or Fisher's Exact test. Frequency of various possible prognostic factor within the two groups was then determined and possible association were tested. All analyses were assessed with 5% level of significance. That means that an effect of a variable is significant if P value is <0.05 (5%).

Ethical Issues

Ethical clearance was taken from the ethical review committee of Sylhet MAG Osmani Medical College prior to commencement of the study. Informed written consent was taken from the patient and study related information was explained in local language to patient.
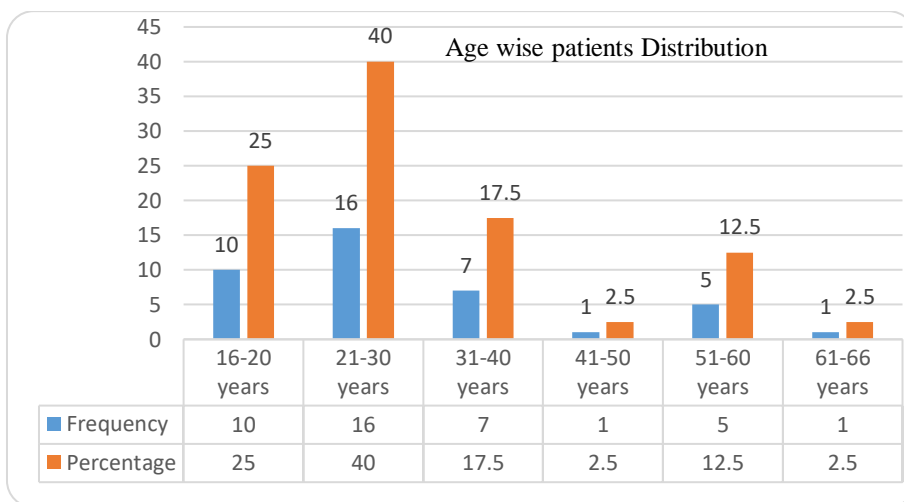
RESULTS

Figure I: Distribution of the patients on the basis of age (N=40)

Figure I showed the age of the patients ranged from 16 to 46 years with the mean age of 30.10 ± 13.44 years. Figure 4.1 showed the distribution of the patients on the basis of age group. There were 16 (40.0%) patients in the age group of 21- 30 years, 10 (25.0%) patients in the age group of 16-20 years, 7 (17.5%) patients in the age group of 31-40 years, 5 (12.5%) patients in the age group of 51-60 years, and 1 (2.5%) patient in the age group of 41-50 years and 61-66 years.
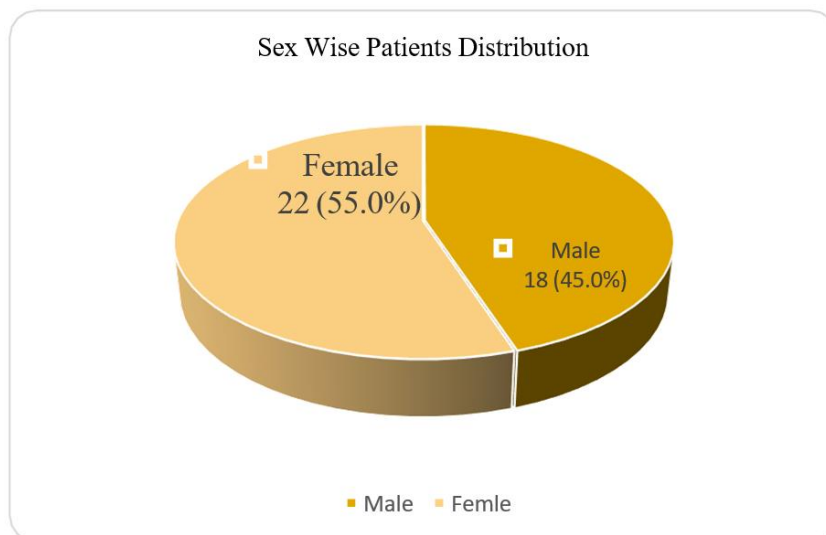

Figure II: Distribution of the patients according to sex (N=40)

Figure II showed the frequency distribution of patients according to sex. There were 18 (45.0%) male and 22 (55.0%) female with a ratio of male to female was 1:1.22.

Table 1: Distribution of the patients according to antecedent events (N=40)

Antecedent events	Frequency	Percentage
Absent	29	72.5
Gastroenteritis	8	20
RTI	3	7.5
Others	0	0
Total	**40**	**100.0**

Table 1 showed the frequency distribution of patients according to antecedent events. In this study 27.5% of the patients had antecedent events within 4 weeks (20%) had gastroenteritis and (7.5%) had RTI.

Table 2: Distribution of the patients according to initial symptom of the illness (N=40)

Initial symptoms	Frequency	Percentage
Limb weakness	20	50.0
Pedal oedema	16	40.0
Sensory symptoms	4	10.0

Table 2 showed the initial symptoms of the illness were in the form of limb weakness in 20 (50.0%) and pedal oedema in 16(40.0%) patients. There was no multiple response.

Table 3: Distribution of the patients according to pattern of limb weakness (N=40)

Pattern of limb weakness	Frequency	Percentage
Ascending paralysis	36	90.0
Descending paralysis	0	0.0
All four limb weakness	4	10.0

Table 3 showed the Pattern of limb weakness was ascending paralysis in 36 (90.0%) cases, all four limb weakness in 4 (10.0%) cases and none had descending paralysis.

Table 4: Distribution of the patients by clinical findings (N=40)

Clinical findings	Frequency	Percentage
Reflex (decreased/ absent)	40	100.0
Sensory dysfunction	13	32.5
Loss of pain sensation	5	12.5
Loss of light touch sensation	8	20.0
Autonomic dysfunction	2	5.0
Resting tachycardia	1	2.5
Postural hypotension	1	2.5
Cranial nerve involvement	0	0.0

Table 4 showed Reflexes were decreased/ absent in affected limb in all patients (100.0%) Thirteen (32.5%) patients had some sensory deficit in the form of loss of pain sensation in 8 (20.0%) patients and light touch in 5 (12.5%) patients. Two (5.0%) patients had some autonomic dysfunction. The autonomic dysfunction was resting tachycardia in 1 (2.5%) patients and postural hypotension in 1 (2.5%) patient.

Table 5: Distribution of the patients by modalities of treatment (N=40)

Modalities of treatment	Frequency	Percentage
Symptomatic	33	82.5
Intravenous immunoglobulins	3	7.5
ICU management	4	10.0
Total	**40**	**100.0**

Table 5 showed the details of mode of treatment. Most of the patients (82.5%) were treated symptomatically; whereas 3 (7.5%) patients were treated with intravenous immunoglobulins in addition to symptomatic therapy and 4 (10.0%) patients were treated in ICU.

Table 6: Distribution of the patients on the basis of length of hospital stay (N=40)

Length of hospital stay	Frequency	Percentage
<14 days	37	92.5
≥14 days	3	7.5
Total	**40**	**100.0**

Table 6 showed the length of hospital stay ranged from 1 to 28 days with the median of 5.5 (IQR, 5-7) days. In 37 (92.5%) patients the length of hospital stay was less than 14 days and in 3 (7.5%) patients the length of hospital stay was 14 days or above.
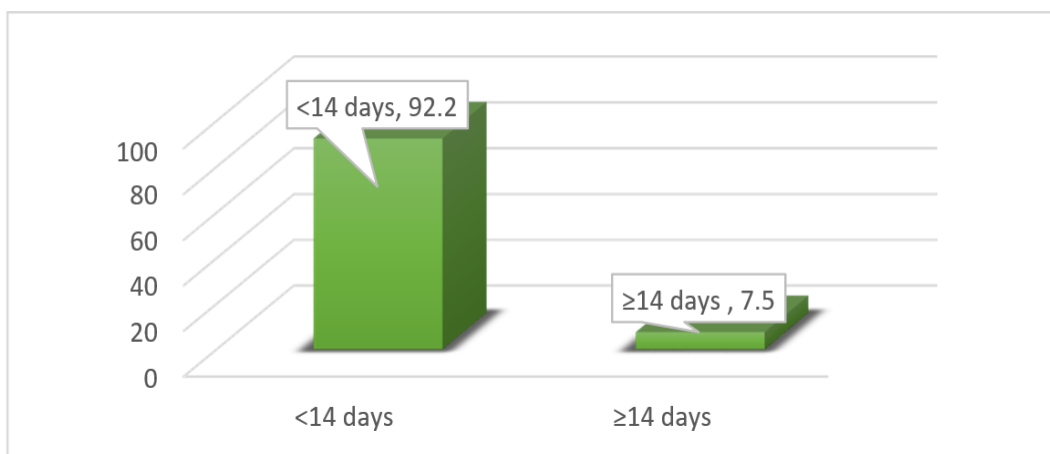

Figure III: Distribution of the patients length of hospital stay (N=40)

Table 7: Distribution of the patients according to clinical outcome (N=40)

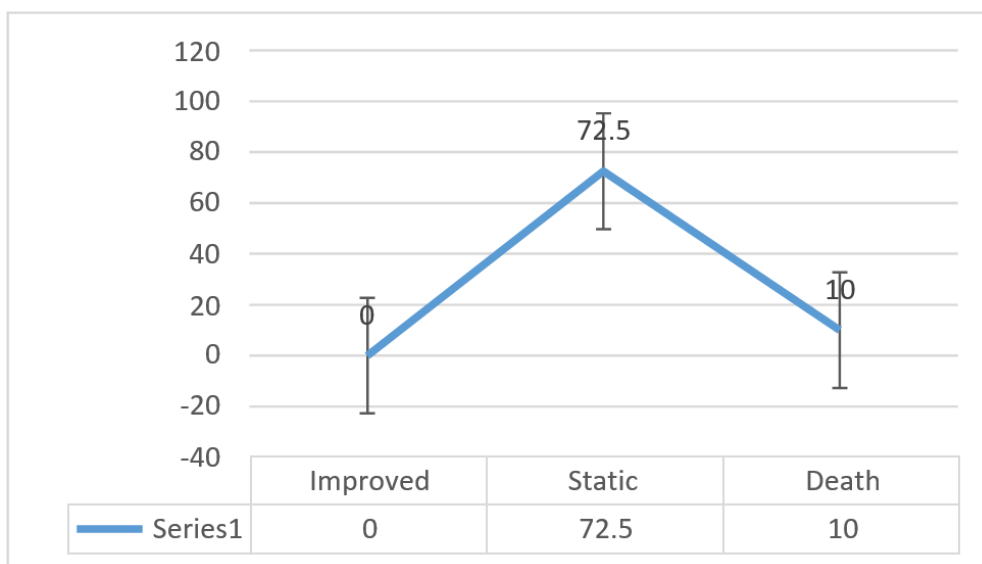| Clinical outcome	Frequency	Percentage
Improved	7	17.5
Static	29	72.5
Death	4	10.0
Total	**40**	**100.0**

Figure IV: Distribution of the patients according to clinical outcome (N=40)

Table-7 showed the details of clinical outcome. Clinical outcome (in term of GBS disability score) was improved in 7 (16.5%) patients, static 29 (72.5%) patients and death in 4 (10.0%) patients. In 4 patients died in ICU could not afford IVIG due to financial constraint.

Table 8: Comparison of patients requiring immunotherapy and clinical outcome (N=16)

Immunotherapy	Improved	Static
Given (n=3)	3 (100.0%)	0 (0.0)
Not given (n=37)	1 (2.7%)	36 (97.3%)
Total	**4**	**36**

Table-8 showed the 3 patients received intravenous immunoglobulin and all were improve; whereas 37% IVIG was not given. Of them 1 (2.7%) patient improved and 36 (97.3%) patients became static.

Table 9: Relationship between different parameters of the patients and outcome by GBS score at discharge N = 40)

Parameters	Good outcome (n=29)	Poor outcome (n=11)	p-value
Age			
≤40 years	23 (79.3%)	10 (90.9%)	p=0.650
>40 years	6 (20.7%)	1 (9.1%)	
Sex			
Male	14 (48.3%)	4 (36.4%)	p=0.723
Female	15 (51.7%)	7 (63.6%)	
Antecedent infection			
Present	6 (20.7%)	5 (45.5%)	p=0.137
Absent	23 (79.3%)	6 (54.5%)	
Initial symptoms			
Limb weakness	13 (44.8%)	7 (63.6%)	p=0.480
Pedal oedema	16 (55.2%)	4 (36.4%)	
Autonomic dysfunction			
Present	1 (3.4%)	1 (9.1%)	p=0.479
Absent	28 (96.6%)	10 (90.9%)	
Sensory dysfunction			
Present	12 (41.4%)	1 (9.1%)	p=0.068
Absent	17 (58.6%)	10 (90.9%)	
Intravenous Ig			
Given	3 (10.3%)	0 (0.0%)	p=0.548
Not given	26 (89.7%)	11 (100.0%)	
ICU management			
Given	0 (0.0%)	4 (36.4%)	p=0.004
Not given	29 (100.0%)	7 (63.6%)	

Table-9 showed the Among the good outcome at discharge 23 (79.3%) patients were up to 40 years of age and 6 (20.7%) patients were above 40 years of age; whereas among the poor outcome 10 (90.9%) patients were up to 40 years of age and 1 (9.1%) patients were above 40 years of age. Outcome at discharge did not affect in this age category (p=0.650).

Among the good outcome at discharge 14 (48.3%) patients were male and 15 (51.7%) patients were female; whereas in poor outcome at discharge 10 (90.9%) patient were male and 7 (63.6%) patients were female. Outcome at discharge did not differ significantly between male and female (p=0.723)

Antecedent infection was found in 6 (20.7%) patients in good outcome at discharge and 5 (45.5%) patients in poor outcome at discharge. Presence of antecedent infection did not affect the outcome at discharge (p=0.137) Initial symptoms were limb weakness in 13 (44.8%) patients and pedal oedema in 16 (55.2%) patients of good outcome group at discharge; whereas limb weakness in 7 (63.6%) patients and pedal oedema in 4 (36.4%) patients of poor outcome group at discharge; Initial symptoms did not affect the outcome at discharge (p=0.480).

Autonomic dysfunction was found in 1 (3.4%) patients in good outcome at discharge and 1 (9.1%) patients in poor outcome at discharge.

Presence of autonomic dysfunction did not affect the outcome at discharge (p=0.479`). Sensory dysfunction was found in 12 (41.4%) patients in good outcome at discharge and 1 (9.1%) patients in poor outcome at discharge. Presence of sensory dysfunction did not affect the outcome at discharge (p=0.068).

DISCUSSION

The age of the patients ranged from 16 to 46 with a mean age of 30 years. Maximum number of patients were in the age group of 21-30 years (40%). This clearly coincides with the result of previous studies done in Bangladesh. In our study, there was a slight female preponderance with a female: male ratio of 1.2:1. Diseases with an autoimmune etiology usually show a clear sex difference in prevalence, whereby females are more commonly affected. Contrary to this, GBS studies show a clear male preponderance. There is significant history of preceding illness. An observational study in several tertiary hospital in Bangladesh revealed a much higher incidence of antecedent events [9]. The incidence and pattern of antecedent infections were lower than those observed in previous studies. One patient (2.5%) had previous history of GBS. Diagnosis of recurrent GBS was made according to suggestion by Kuitwaard *et al.,* (2009) [10]. The onset of GBS was heralded by symptoms mainly in the form of paresthesia confined to toes in 10% of cases. In the rest of the patient's limb weakness was the initial symptoms of illness. Sensory symptoms were present in 5.6% cases during the course of their illness mainly in the form of paresthesia and numbness. This does not match with previous other studies which showed much higher incidence of sensory symptoms [11]. Ascending paralysis was noted in 90% of cases while rest showed simultaneous involvement of all 4 limbs. None showed descending paralysis. According to [12] number of patients with ascending paralysis is almost same as our study. About 30% of the cases had objective sensory disturbance in the form distortion of pain (12%) and light touch (20%). Observational study by Kabir *et al.,* (2015) [12] revealed showed maximum patients had no objective sensory loss and vibration and position sense was the most common sensory entity to be disturbed. Autonomic dysfunction was found in good number of patients in most of the of the previous studies [13, 14].

Multidisciplinary medical supportive care remains the cornerstone of therapy during the acute phase to prevent complications and facilitate recovery. Good nursing care with IVIg or plasmapheresis is considered as effective mode of treatment in many studies [15-17]. Our patients were admitted to Medicine and Neurology ward. Depending on progression and treatment offered, they were shifted from ward to the ICU. Most of the patients were managed in the ward with symptomatic treatment. 7.5% patients were treated with intravenous immunoglobulin in addition to symptomatic therapy and 10.0% patients were treated in ICU. Plasmapheresis was not available in the hospital setting. Four patients develop respiratory failure and mechanical ventilation was done. All 4 patients were presented <4 days of onset of weakness and rapidly developed respiratory failure, all of them were under gone mechanical ventilation <48 hrs. Early mechanical ventilation was significantly associated with poor in hospital outcome. Thirteen patients were advised treatment with IVIg. Out of these, 3 patients could afford. The remaining 13 patients could not afford IVIg, all of them due to financial constraint. Of these 13, 1 (7.7%) patient improved and 12 (92.3%) patients became static. Intravenous immunoglobulin administration does not significantly affect the clinical outcome at discharge. In our study the mean duration of hospital stay was 5.5 days, with 10% patients undergone ICU management. Outcome at discharge did not affect in this age category (p=0.650). In this study low GBS disability score was not an exclusion criteria. In addition to that our study had a low number of patients. In our study a higher proportion of males had a bad outcome than females Outcome at discharge did not differ significantly between male and female (p=0.723). In our study GBS score at presentation ≤3 was in 24 (82.8%) patients' good outcome at discharge and none of poor outcome at discharge; whereas GBS score >3 was in 5 (17.2%) patients of good outcome at discharge and 11 (100.0%) of poor outcome at discharge. Lower GBS score at presentation had significantly good outcome at discharge. Intravenous immunoglobulin (IVIg) received in 10.3% patients was in good outcome group at discharge. About 87% of those who did not get IVIg was in good outcome group. IVIg administration did not affect the outcome at discharge (p=0.548). This was consistent with previous studies [18]. Those received ICU management with assisted ventilation had significantly poor outcome at discharge. This is consistent with several prognostic studies [19,20, 21] found that those who needed mechanical ventilation, the short duration between first symptom and mechanical ventilation had significantly poor prognosis. This may be due to the short duration is an indicator of rapid worsening of GBS with compromised respiratory function.

Limitation of the Study

the Patients were only followed up at the time of discharge from the hospital but not thereafter. Most of the patients lacked certain parameter that was found to be significant in previous studies as

prognostic factors. Long time prognosis could not be assessed. Sample size in this study was too small to reliably perform multivariate analysis.

CONCLUSION

The results showed greater incidence in younger age group of 21-30 years, a slight female preponderance. Few peculiarities were found like, in a good number of patients pedal edema was the initial symptom. Most of the patients had a good outcome at discharge from hospital and in hospital mortality was 10%. High GBS disability score at admission, ICU admission and mechanical ventilation were the factors associated with poor outcome at discharge. Age, cranial nerve palsy, electrophysiological subtype and treatment administered were not associated with poor outcome.

RECOMMENDATIONS

This study showed a good number of patients with history of pedal edema before development of weakness/paralysis. Further study is recommended to determine the cause of such presentation. Antecedent illness was present only in few no. Patients. There was seasonal clustering with maximum patients presented during autumn. Whether these are coincidence or geographic variation is a factor, further study is recommended. All the patients showed Axonal variants on NCS. Further study is recommended to determine the factors responsible for such presentation. Further longitudinal study is recommended to observe long term outcome of GBS after discharge from hospital to determine prognostic factor affecting the short and long-term outcome. A multi-center study involving large sample should be conducted to reach a valid conclusion.

REFERENCES
1. Van den Berg, B., Walgaard, C., Drenthen, J., Fokke, C., Jacobs, B. C., & Van Doorn, P. A. (2014). Guillain–Barré syndrome: pathogenesis, diagnosis, treatment and prognosis. *Nature Reviews Neurology*, *10*(8), 469-482.
2. Walgaard, C., Lingsma, H. F., Ruts, L., Drenthen, J., van Koningsveld, R., Garssen, M. J., ... & Jacobs, B. C. (2010). Prediction of respiratory insufficiency in Guillain-Barré syndrome. *Annals of neurology*, *67*(6), 781-787.
3. Govoni, V., & Granieri, E. (2001). Epidemiology of the Guillain-Barre syndrome. *Current Opinion in Neurology, 14,* 605–613.
4. Kumar, M., Aroor, S., Mundkur, S., & Kumar, S. (2015). Guillain-Barré Syndrome: A Clinical Study of Twenty Children Paediatrics Section. *Journal of Clinical and Diagnostic Research, 9*, SC09-SC12.
5. Hughes, R. A. C., & Rees, J. H. (1997). Clinical and epidemiologic features of Guillain Barre syndrome. *The Journal of Infectious Diseases,176*, S92–S98.
6. Hughes, R. A., Swan, A. V., & van Doorn, P. A. (2014). Intravenous immunoglobulin for Guillain-Barré syndrome. *The Cochrane Database of Systematic Reviews, 9*, CD002063.
7. Alshekhlee, A., Hussain, Z., Sultan, B., & Katirji, B. (2008). Guillain–Barré syndrome: incidence and mortality rates in US hospitals. *Neurology*, *70*(18), 1608-1613.
8. Mallick, U. K., Chowdhury, M. S. J. H., Hussain, M. E., Asaduzzaman, M., Islam, M. S., Hoque, M. S., Azam, S., Islam, M. Z., Mamtaz, F., Kabir, M. M., Haque, K. I., Chowdhury, M. T., Hossain, M. A., Das, S. C., & Ara, F. (2019). Comparison of Intravenous Immunoglobulin and Plasma Exchange in Treatment of Mechanically Ventilated Patients with Guillain Barré Syndrome in a Neuro-Intensive Care Unit in a Govt. Hospital of Bangladesh: A Observational Cohort Study. *Journal of National Institute of Neurosciences Bangladesh, 5*, 118-122.
9. McGrogan, A., Madle, G. C., Seaman, H. E., & De Vries, C. S. (2009). The epidemiology of Guillain-Barré syndrome worldwide: a systematic literature review. *Neuroepidemiology*, *32*(2), 150-163.
10. Kuitwaard, K., van Koningsveld, R., Ruts, L., Jacobs, B. C., & van Doorn, P. A. (2009). Recurrent Guillain–Barré syndrome. *Journal of Neurology, Neurosurgery & Psychiatry*, *80*(1), 56-59.
11. Roberts, L. G. (1963). Machine perception of three-dimensional solids (Doctoral dissertation, Massachusetts Institute of Technology).
12. Kabir, A. T. M., Rahman, M., Ali, B., Kabiruzzaman, & Ahmad, M. (2015). Pattern of presentation of Guillain-Barre syndrome in three tertiary level Hospital in Bangladesh. *Journal of Armed Forces Medical College, Bangladesh, 10*, 50-52.
13. Alloush, T., Fahmy, N. A., Fouad, M. M., Albaroudy, H. O., Hamdy, M., & Salem, H. H. (2019). Prediction of outcome in patients with Guillain Barre syndrome—An Egyptian study. *Neuroscience and Medicine*, *10*(3), 232-246.
14. Flachenecker, P., Wermuth, P., Hartung, H. P., & Reiners, K. (1997). Quantitative assessment of cardiovascular autonomic function in Guillain-Barré syndrome. *Annals of Neurology: Official Journal of the American Neurological Association and the Child Neurology Society*, *42*(2), 171-179.
15. Hughes, R. A., Swan, A. V., Raphaël, J. C., Annane, D., van Koningsveld, R., & van Doorn, P. A. (2007). Immunotherapy for Guillain-Barré syndrome: a systematic review. *Brain*, *130*(9), 2245-2257.
16. Hughes, R. A., & van Doorn, P. A. (2012). Corticosteroids for Guillain-Barré syndrome. *The Cochrane Database of Systematic Reviews, 8*, CD001446.

17. Raphaël, J. C., Chevret, S., Hughes, R. A., & Annane, D. (2012). Plasma exchange for Guillain-Barré syndrome. *The Cochrane Database of Systematic Reviews, 7*, CD001798.
18. Latov, N., & Hughes, R. (2004). Practice parameter: Immunotherapy for Guillian-Barre syndrome: Report of the Quality Standards Subcomittee of the American Academy of Neurology. *Neurology, 62*, 1653-1654.
19. Wu, X., Li, C., Zhang, B., Shen, D., Li, T., Liu, K., & Zhang, H. L. (2015). Predictors for mechanical ventilation and short-term prognosis in patients with Guillain-Barré syndrome. *Critical care*, *19*, 1-9.
20. El Khayat, N. M., Nada, M. A., Afeefy, H. H. E. S., & Ashour, M. A. N. (2018). Factors associated with prognosis of Guillain-Barre syndrome. *The Egyptian Journal of Hospital Medicine (July 2018)*, *72*(11), 5552-5560.
21. Islam, Z., Papri, N., Ara, G., Ishaque, T., Alam, A. U., Jahan, I., ... & Mohammad, Q. D. (2019). Risk factors for respiratory failure in Guillain-Barré syndrome in Bangladesh: a prospective study. *Annals of clinical and translational neurology*, *6*(2), 324-332.