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Original Article

Association of Admission Serum Albumin Level With 90-Day Functional Outcome in Patients with Guillain–Barré Syndrome: An Observational Study

Sara Tanzila[1*], Tuhfie Jannat[2], Kazi Giasuddin Ahmed[3]

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*Corresponding author

ABSTRACT

Introduction: Guillain–Barré syndrome (GBS) is an acute immune-mediated peripheral neuropathy that can result in substantial disability despite appropriate treatment. Serum albumin is a routinely available and inexpensive laboratory parameter that may reflect systemic inflammation and disease severity. The study aimed to assess the association between admission serum albumin level and 90-day functional outcome in patients with Guillain–Barré syndrome. **Methods & Materials:** This observational study was conducted in the Department of Neurology and Department of Medicine, Dhaka Medical College Hospital (DMCH), Dhaka, over a period of 24 months from July 2018 to June 2020. A total of 55 patients were recruited by purposive sampling. Data were analyzed using Statistical Package for the Social Sciences (SPSS) version 23.0. **Result:** At admission, GBS disability scores were comparable between hypoalbuminaemic and normoalbuminaemic groups; however, at the 90th day, disability was significantly greater in the hypoalbuminaemic group (3.0±1.76 vs. 1.86±0.46, p=0.001). Poor outcome occurred in 64% of hypoalbuminaemic patients compared with 5% of normoalbuminaemic patients (p=0.001). Serum albumin showed a significant inverse correlation with 90-day disability score (r=−0.424, p=0.001), and ROC analysis identified 3.30 g/dL as the optimal cut-off, with 96% sensitivity, 78% specificity, and AUC 0.952 (p=0.001) for predicting poor outcome. **Conclusion:** Lower admission serum albumin was significantly associated with poorer 90-day functional outcome in patients with Guillain–Barré syndrome. Although hypoalbuminemia was present in only 20% of patients, those with reduced albumin had significantly higher disability at the 90th day, with poor outcome occurring in 64% of the hypoalbuminaemic group compared with 5% of the normoalbuminaemic group (p=0.001). Moreover, serum albumin showed a significant inverse correlation with 90-day GBS disability score (r=−0.424, p=0.001), indicating greater disability with lower albumin levels. ROC analysis identified 3.30 g/dL as the optimal cut-off, providing 96.0% sensitivity and 78.0% specificity, with an AUC of 0.952 (95% CI: 0.883–1.000; p=0.001).

Keywords: *Serum Albumin, Functional Outcome, Guillain–Barré Syndrome.*

1. *Assistant Professor, Department of Neurology, Jashore Medical College Hospital, Jashore, Bangladesh (ORCID: 0009-0009-8694-4283)*
2. *Assistant Professor, Department of Neurology, National Institute of Neurosciences and Hospital, Dhaka, Bangladesh*
3. *Professor, Department of Neurology, Dhaka Medical College & Hospital, Dhaka, Bangladesh*

INTRODUCTION

Guillain–Barré syndrome (GBS) is an acute immune-mediated polyradiculoneuropathy and remains the most common cause of acute flaccid paralysis worldwide. It typically presents with rapidly progressive, relatively symmetric limb weakness accompanied by hyporeflexia or areflexia, while sensory symptoms, cranial neuropathy, autonomic dysfunction and respiratory failure may occur in varying combinations. The disease is frequently preceded by an infectious illness, particularly *Campylobacter jejuni*, and its clinical spectrum ranges from mild weakness to rapidly progressive paralysis requiring intensive care and mechanical ventilation. A systematic review of epidemiological studies reported GBS incidence ranging from 0.30 to 6.08 cases per 100,000 population across cohort studies, demonstrating substantial geographic variation in disease burden [1]. The pathobiology involves aberrant immune responses against peripheral nerve components, with complement activation, antiganglioside antibodies, and molecular mimicry contributing to nerve injury [2]. Despite effective disease-modifying treatment with intravenous immunoglobulin (IVIg) or plasma exchange, functional recovery remains highly heterogeneous. Approximately one-quarter of patients may develop respiratory insufficiency, and severe weakness, cranial nerve involvement, autonomic dysfunction, and rapid disease progression are associated with greater risk of intensive care requirements and poor outcome [2]. In a Chinese cohort of 541 patients, 80 (14.8%) required mechanical ventilation, while lower Medical Research Council (MRC) scores, cranial nerve involvement, and shorter intervals between disease onset and hospital admission were important predictors of ventilation [3]. In another Asian tertiary-care cohort of 216 patients, 24.5% required mechanical ventilation and overall mortality was 7.9%; among ventilated patients, increasing age, areflexia and longer hospital stay independently predicted poor outcome [4]. Functional outcome in GBS is commonly assessed using disability-based measures such as the Hughes GBS disability scale, with inability to walk independently representing a clinically meaningful marker of poor recovery. The modified Erasmus GBS Outcome Score (mEGOS) incorporates age, preceding diarrhea or respiratory infection and degree of muscle weakness to estimate the probability of inability to walk at 4 and 26 weeks. International validation demonstrated that mEGOS had an area under the receiver-operating characteristic curve above 0.70 across regional groups, although predictive performance varied geographically [5]. Importantly, a Bangladesh-based validation involving 506 patients found mEGOS AUC values of 0.69 at entry and 0.78 at week 1 for predicting poor 4-week outcome, and 0.67 and 0.70, respectively, for poor 26-week outcome, confirming the relevance of structured prognostication in the Bangladeshi population [6]. Serum albumin is an inexpensive, routinely available laboratory parameter and a negative acute-phase protein that decreases during systemic inflammation. Its prognostic significance in GBS has attracted increasing attention. In a multicenter study of 174 severely affected, IVIg-treated patients, median albumin decreased from 4.2 g/dL before treatment to 3.7 g/dL two weeks later; hypoalbuminemia was associated with respiratory failure, inability to walk unaided, and greater muscle weakness at both 4 weeks and 6 months [7]. Ethemoglu and Calik similarly found significantly lower albumin

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concentrations among adult GBS patients with Hughes disability scores ≥3, and albumin was an independent predictor of prognosis at discharge [8]. A retrospective study of 81 patients also reported that lower albumin was significantly associated with worse functional status and poor prognosis at one month [9]. More recently, a systematic review of prognostic factors identified hypoalbuminemia among laboratory abnormalities associated with adverse GBS outcomes, while newer biomarker studies have shown that lower admission albumin correlates with higher disability scores, intensive-care requirements and inability to walk independently at six months [10]. The study aimed to assess the association between admission serum albumin level and 90-day functional outcome in patients with Guillain–Barré syndrome.

METHODS & MATERIALS

This observational study was conducted in the Department of Neurology and Department of Medicine, Dhaka Medical College Hospital (DMCH), Dhaka, over a period of 24 months from July 2018 to June 2020. The study population comprised patients aged >18 years who were admitted to the Departments of Neurology and Medicine with Guillain–Barré syndrome (GBS). A total of 55 patients were recruited by purposive sampling. Patients were included if they were aged >18 years, fulfilled the diagnostic criteria for GBS suggested by Asbury and Cornblath, were admitted within two weeks of symptom onset, were experiencing their first attack of GBS, and were willing to participate and provided informed written consent. Patients aged <18 years and those with pregnancy, diabetes mellitus, severe malnutrition, associated infection, liver disease, renal disease, or recurrent GBS were excluded. Based on serum albumin concentration at admission, the patients were divided into two groups: hypoalbuminaemic patients (Group I) and normoalbuminaemic patients (Group II). The patients were assessed at admission and subsequently followed up until the 90th day of illness, and functional outcome was evaluated using the GBS disability score. Relevant demographic, clinical, laboratory and outcome-related information was collected using a structured data collection form containing a predesigned questionnaire. Ethical clearance was obtained from the Ethical Review Committee of Dhaka Medical College before commencement of the study. All collected data were coded, registered, documented and analyzed using Statistical Package for the Social Sciences (SPSS) version 23.0. Quantitative variables were expressed as mean ± standard deviation (SD), while categorical variables were presented as frequency and percentage. The unpaired Student's *t* test and one-way analysis of variance (ANOVA) followed by a Bonferroni post-hoc test were used for comparison of quantitative variables, whereas the Chi-square test was used to assess associations between categorical variables. Pearson's correlation coefficient was used to determine correlations between quantitative variables, while Spearman's rank correlation coefficient was applied for ordinal variables. Changes in variables over time were demonstrated using line charts. A receiver-operating characteristic (ROC) curve was constructed to evaluate the predictive performance of admission serum albumin level for poor functional outcome in patients with GBS. A *p*-value of <0.05 was considered statistically significant.

RESULTS

It was observed that more than one-fourth (27%) of patients belonged to the age group 21-30 years in group I and 12(27%) in group B. The mean±SD age was 36.3±14.7 years in group I and 32.1±16.2 years in group II. Almost two-thirds (64%) of patients were male in group I and 30(68%) in group II. The difference was not statistically significant (p>0.05) between the two groups (*Table I*).

Table I
Distribution of the study patients by demographic profile (*n*=55).

Demographic profile	Total population (N=55) n(%)	Group I (n=11) n(%)	Group II (n=44) n(%)	p value
Age in years				
≤ 20	18(33)	2(18)	16(36)	a0.791ns
21 – 30	14(26)	3(27)	12(27)	
31 – 40	11(20)	3(27)	7(16)	
41 – 50	4(7)	1(9)	3(7)	
>50	8(15)	2(18)	6(14)	
Mean±SD	32.9±15.9	36.3±14.7	32.1±16.2	b0.436ns
Range	18-75	19-65	18-75	-
Sex				
Male	37(67)	7(64)	30(68)	a0.778ns
Female	18(33)	4(36)	14(32)	

ns=not significant; ap value reached from the Chi-square test; bp value obtained from Unpaired t-test; Group I = Patients with low serum albumin level (<3.4 g/dl); Group II = Patients with normal serum albumin level (3.4-5.0 g/dl)

The mean±SD interval between onset of illness and hospital admission was 6.45±1.75 days in group I and 6.68±1.43 days in group II. The difference was not statistically significant (p>0.05) between the two groups (*Table II*).

Table II
Distribution of the study patients by interval between onset of illness and hospital admission (*n*=55).

Interval between onset of illness and hospital admission	Total population (N=55)	Group I (n=11)	Group II (n=44)	p value
Mean±SD	6.64±1.48	6.45±1.75	6.68±1.43	0.651ns
Range	4-10	4-10	5-9	

ns=not significant; p-value obtained from Unpaired t-test.

It was observed that almost half (46%) of patients had facial weakness in group I and 16(36%) in group II, followed by 4(36%) having bulbar weakness in group I and 5 (11%) in group II, 3(27%) had autonomic involvement in group I and 3(7%) in group II and 4(36%) had mechanical ventilation requirement in group I and 1(2%) in group II. The difference in bulbar weakness and mechanical ventilation requirement was statistically significant (p<0.05) between the two groups (*Table III*).

Table III
Distribution of the study patients by clinical parameter (*n*=55).

Clinical parameter	Total population (N=55) n (%)	Group I (n=11) n (%)	Group II (n=44) n (%)	p value
Facial weakness	21(38)	5(46)	16(36)	0.578ns
Bulbar weakness	9(16)	4(36)	5(11)	0.045s
Autonomic involvement	6(11)	3(27)	3(7)	0.051ns
Mechanical ventilation requirement	5(9)	4(36)	1(2)	0.001s

s=significant; ns=not significant; p-value obtained from the Chi-square test.

It was observed that almost half (46%) patients had diarrhea in group I and 17(39%) in group II. Almost half (45%) patients had RTI in group I and 13(29%) in group II. one (9%) patient had not any infection in group I and 14(32%) in group II. The difference was not statistically significant (p>0.05) between two groups (*Table IV*).

Table IV
Distribution of the study patients by preceding infection (*n*=55).

Preceding infection	Total population (N=55)	Group I (n=11)	Group II (n=44)	p value
	n(%)	n(%)	n(%)	
Diarrhea	22(40)	5(46)	17(39)	0.679ns
RTI	18(33)	5(45)	13(29)	0.314ns
None	15(27)	1(9)	14(32)	

ns=not significant; p-value obtained from Chi-square test.

It was observed that the majority (80%) of patients had normal serum albumin. In 11 (20%) patients, it was reduced (<3.4 g/dl). The mean±SD serum albumin level was 3.79±0.41 g/dl, ranging from 2.9 to 4.6 g/dl (*Table V*).

Table V
Distribution of the study patients by serum albumin level (*n*=55).

Serum albumin g/dl	Number of patients (n)	Percentage
Normal (3.4-5 g/dl)	44	80
Reduced (<3.4g/dl)	11	20
Mean±SD	3.79	±0.41
Range	2.9	-4.6

It was observed that almost three-fourths (73%) of patients had 4 GBS disability score in group I and 37(84%) in group II. The mean±SD GBS disability score at admission was 3.91±0.54 in group I and 3.82±0.45 in group II. The difference was not statistically significant (p>0.05) between the two groups (*Table VI*).

Table VI
Distribution of the study patients by GBS disability score at admission (*n*=55).

GBS disability score at admission	Total population (N=55) n (%)	Group I (n=11) n (%)	Group II (n=44) n (%)	p value
0	0(0)	0(0)	0(0)	a0.211ns
1	0(0)	0(0)	0(0)	
2	1(2)	0(0)	1(23)	
3	8(14)	2(18)	6(14)	
4	45(82)	8(73)	37(84)	
5	1(2)	1(9)	0(0)	
6	0(0)	0(0)	0(0)	
Mean±SD	3.84±0.46	3.91±0.54	3.82±0.45	b0.571ns
Range	2-5	3-5	2-4	-

ns=not significant; ap value reached from the Chi-square test; bp value reached from Unpaired t-test.

Regarding the GBS disability score at 14th day of illness, it was observed that majority (46%) of the patients had GBS disability score 4 in group I but most (55%) of the patients had score 3 i< group II. The mean±SD GBS disability score at admission was 4.18±1.08 in group I and 3.39±0.62 in group II. The difference was statistically significant (p<0.05) between two groups (*Table VII*).

Table VII
Distribution of the study patients by GBS disability score at 14th day of illness (*n*=55).

GBS disability score at 14th day of illness	Total population (N=55) n(%)	Group I (n=11) n(%)	Group II (n=44) n(%)	p value
0	0(0)	0(0)	0(0)	a0.001s
1	0(0)	0(0)	0(0)	
2	1(2)	1(9)	0(0)	
3	25(45)	1(9)	25(55)	
4	25(45)	5(46)	20(45)	
5	3(6)	3(27)	0(0)	
6	1(2)	1(9)	0(0)	
Mean±SD	3.55±0.79	4.18±1.08	3.39±0.62	b0.002s
Range	1-6	2-6	1-4	-

s= significant; [a]p value reached from Chi-square test; [b]p value reached from Unpaired t-test.

It was observed that half (50%) of the patients had a GBS disability score of 3 in group I, but more than two-thirds (75%) of the patients had a score of 2 in group II. The mean±SD GBS disability score at admission was 3.0±1.76 in group I and 1.86±0.46 in group II. The difference was statistically significant ($p<0.05$) between the two groups (*Table VIII*).

Table VIII
Distribution of the study patients by GBS disability score at the 90th day of illness (*n*=55).

GBS disability score at 90th day of illness	Total population (N=55) n (%)	Group I (n=11) n (%)	Group II (n=44) n (%)	p value
0	0(0)	0(0)	0(0)	a0.001s
1	12(22)	2(20)	10(23)	
2	34(63)	1(10)	33(75)	
3	6(11)	5(50)	1(2)	
4	0(0)	0(0)	0(0)	
5	0(0)	0(0)	0(0)	
6	2(4)	2(20)	0(0)	
Mean±SD	2.07±0.95	3.0±1.76	1.86±0.46	b0.001s
Range	1-6	1-6	1-3	-

s= significant; ap value reached from Chi-square test; p-value reached from Unpaired t-test.

It was observed that almost two-thirds (64%) of patients had a poor outcome (GBS Disability score > 2) in group I and 2(5%) in group II. The difference was statistically significant ($p<0.05$) between the two groups (*Table IX*).

Table IX
Distribution of the study patients by outcome (*n*=55).

Outcome	Total population (N=55) n (%)	Group I (n=11) n (%)	Group II (n=44) n (%)	p value
Good outcome (GBS Disability score ≤ 2)	46(84)	4(36)	42(95)	0.001s
Poor outcome (GBS Disability score > 2)	9(16)	7(64)	2(5)	

s=significant; p-value obtained from the Chi-square test.

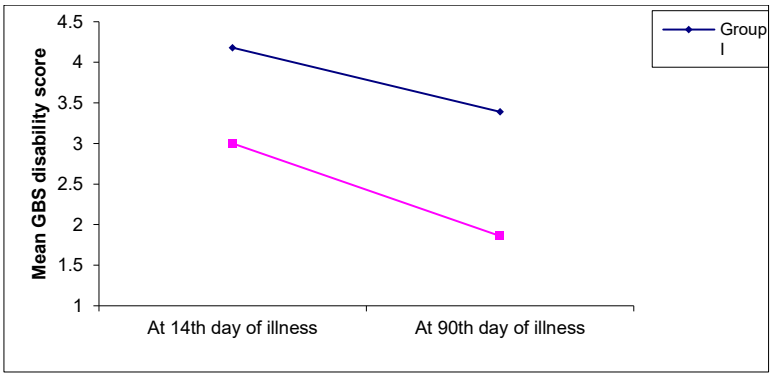


Figure 1 Line chart showing distribution of study patients by change of GBS disability score on 14th and 90th day of illness (*n*=55).

Figure 1 shows that distribution of study patients by change of GBS disability score on 14th and 90th day of illness. It was observed that GBS disability score was lower on 90th day of illness in comparison to that of on 14th day of illness in both groups. But the reduction of the score was less marked in group I than group II.

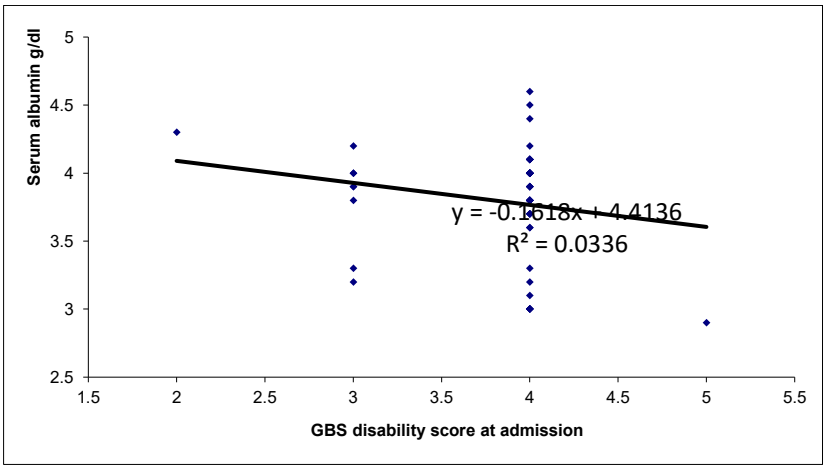


Figure 2 Scatter diagram showing correlation between serum albumin and GBS disability score at admission (*n*=55).

Figure 2 shows a scatter diagram showing a negative, not significant Spearman correlation (r=-0.145; *p*=0.290) between serum albumin and GBS disability score at 90th days of illness. A low GBS disability score was associated with a high serum albumin level and vice versa. But this was not statistically significant (*p*>0.05)

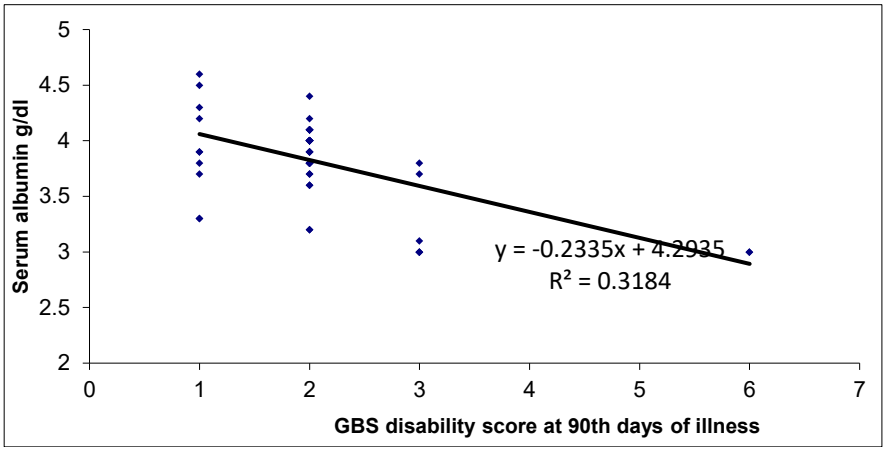


Figure 3 Scatter diagram showing correlation between serum albumin and GBS disability score at 90th days of illness (*n*=55).

Figure 3 shows a scatter diagram showing a significant Spearman correlation (r=-0.424; *p*=0.001) between serum albumin and GBS disability score at the 90th day of illness. A low GBS disability score was associated with a high serum albumin level and vice versa. This was statistically significant (*p*<0.05)

ROC curve analysis showed that a serum albumin cut-off value of 3.30 g/dL predicted poor outcome in GBS patients with 96.0% sensitivity and 78.0% specificity. The AUC was 0.952 (95% CI: 0.883–1.000), indicating excellent discriminatory ability of serum albumin for predicting poor outcome. The association was statistically significant (*p*=0.001) (*Table X*).

Table X Receiver operating characteristic (ROC) curve analysis of serum albumin level for prediction of poor outcome in GBS patients (*n*=55).

Serum albumin (g/dL)	Cut-off value (g/dL)	Sensitivity (%)	Specificity (%)	Area under ROC curve (AUC)	p value	95% CI Lower Bound	95% CI Upper Bound
Serum albumin	3.30	96.0	78.0	0.952	0.001	0.883	1.000

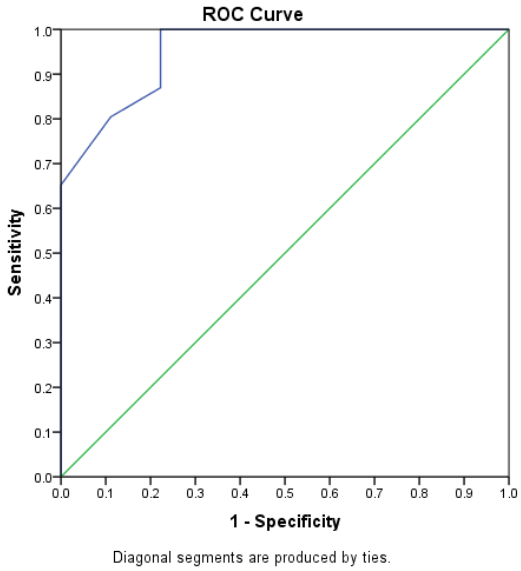


Figure 4 Receiver-operator characteristic (ROC) curve by serum albumin level for prediction of poor outcome in GBS patients (*n*=55).

DISCUSSION

In the present study, it was observed that 33% of patients belonged to the age group □20 years. The mean±SD age was 32.9±15.9 years, ranging from 18 to 75 years. In the Badshah et al. study, the mean age was 35.3 years, which is consistent with the current study [11]. The difference between the mean age and age range obtained by the above authors may be due to geographical and racial variations. In this study, it was also observed that GBS was predominant in male subjects, with 67% being male. The differences in age and gender distribution were not statistically significant (p>0.05) between group I (hypoalbuminaemic) and group II (normoalbuminaemic). Similar observations regarding male predominance were also found by Ceylan and Sonkaya and Badshah et al. [11, 12]. In the present study, it was observed that the mean±SD GBS disability score was 3.84±0.46 at admission ranging from 2 to 5, was 3.53±0.79 on the 14th day of illness, ranging from 1 to 6; and 2.04±0.98 on the 90th day of illness, ranging from 1 to 6. Thus, the GBS disability score declined after 14 days of illness and also declined after 90 days of illness, which is similar to the Fokkink et al. study [13]. At the 90th day of illness, half (50%) of the patients had a GBS disability score of 3 in group I, but more than two-thirds (75%) of the patients had a score of 2 in group II. The mean±SD GBS disability score at that period was 3.0±1.76 in group I and 1.86±0.46 in group II. The difference was statistically significant (p<0.05) between the two groups. According to this study, 84% of patients had a good outcome, and 16% had a poor outcome (GBS Disability score > 2). Almost two-thirds (64%) of patients had a poor outcome in group I and 2% (5%) in group II. The difference was statistically significant (p<0.05) between the two groups. The mean±SD serum albumin level was 3.91±0.29 g/dl in good outcome and 3.16±0.33 g/dl in poor outcome. The mean serum albumin was significantly (p<0.05) lower in poor outcome compared to good outcome patients. Hughes study stated that mortality in GBS was 3-10% and outcome was poor in 10-20%, which is consistent with the present study [14]. In this study, there was a negative not significant Spearman correlation (r=-0.145; p=0.290) between serum albumin and GBS disability score at admission (n=55), but a negative significant Spearman correlation (r=-0.424; p=0.001) between serum albumin and GBS disability score at 90th days of illness. Thus, a low serum albumin level is associated with a high GBS disability score and poor outcome. This is also comparable with some other international studies that also observed a similar type of correlation between serum albumin level and outcome of GBS patients [11,12]. In this study receiver-operator characteristic (ROC) curve was constructed using Serum albumin value of the poor outcome patients of GBS with a best combination of sensitivity and specificity for poor outcome of GBS which gave serum albumin cut off value of 3.30 and area under curve of 0.952 with 96% sensitivity and 78% specificity as the value and for identifying poor outcome of GBS, which was also significantly associated to identification of poor outcome of GBS. A similar finding was found in Su et al. study, showing a serum albumin cut-off value of 4.4 and an area under the curve of 0.944, with 93.0% sensitivity and 85.0% specificity as the value for identifying poor outcome of GBS [16].

LIMITATIONS

The study was conducted in a single hospital with a small sample size. So, the results may not represent the whole community.

CONCLUSION

This study concluded that lower admission serum albumin was significantly associated with poorer 90-day functional outcome in patients with Guillain–Barré syndrome. Although hypoalbuminemia was present in only 20% of patients, those with reduced albumin had significantly higher disability at the 90th day, with poor outcome occurring in 64% of the hypoalbuminaemic group compared with 5% of the normoalbuminaemic group (p=0.001). Moreover, serum albumin showed a significant inverse correlation with 90-day GBS disability score (r=−0.424, p=0.001), indicating greater disability with lower albumin levels. ROC analysis identified 3.30 g/dL as the optimal cut-off, providing 96.0% sensitivity and 78.0% specificity, with an AUC of 0.952 (95% CI: 0.883–1.000; p=0.001).

RECOMMENDATION

Routine assessment of serum albumin at admission may be considered as part of early prognostic evaluation in patients with GBS, particularly to identify those at higher risk of poor functional recovery. Patients with low albumin may benefit from closer monitoring, timely supportive management, and early rehabilitation. Further prospective multicenter studies with larger sample sizes are recommended to validate the prognostic cut-off and determine its clinical utility in routine GBS management.

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CONFLICT OF INTEREST

None declared

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