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Predictors of Tracheostomy in Mechanically Ventilated Guillain-Barré Syndrome (GBS) Patients in a Tertiary care Hospital in Bangladesh

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Abstract

Background: Patients suffering from Guillain-Barré syndrome (GBS) may frequently develop an acute respiratory failure and need ventilatory support with prolonged mechanical ventilation (MV) and tracheotomy. **Objective:** The present study was designed to search for factors that could predict the need for prolonged MV and ultimately need of tracheostomy after completion of immune therapy. **Methodology:** This retrospective study was performed in patients with GBS admitted to the intensive care unit (ICU) of National Institute of Neurosciences and Hospital, Dhaka, Bangladesh from January 2017 to December 2018. The patients were initiated mechanical ventilation within the first week of admission and were received mechanical ventilation for more than 2 weeks. Demographic, clinical, biological and electrophysiological data and times of endotracheal intubation, tracheotomy, and mechanical ventilation weaning were prospectively collected for all patients. Sequential daily neurological testing used standardized data collection by the same investigators all along the study period. **Results:** A total number of 74 patients were recruited for this study of which 50% cases required tracheostomy; 34(45.9%) patients needed prolonged mechanical ventilation more than 14 days. The mean duration of mechanical ventilation was 20 days. The strongest observed predictors of tracheostomy were muscle weakness, high CSF protein and Plasma exchange and prolonged mechanical ventilation (P value <0.05). These patients are more likely to need of tracheostomy. **Conclusion:** In conclusion ventilated GBS patients who have more muscle weakness at presentation, high CSF protein and prolonged mechanical ventilation are high risk of tracheostomy. *[Journal of National Institute of Neurosciences Bangladesh, January 2022;8(1): 23-27]*

Keywords: Guillain–Barré syndrome; mechanical ventilation; tracheostomy

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Introduction

Respiratory failure is a life-threatening manifestation of the Guillain–Barré syndrome (GBS) that occurs in 20.0% to 30.0% of patients with GBS[1-4]. The duration of the required MV varies widely in GBS, ranging from a few days to several months and even longer than 1 year. Immunomodulatory treatment reduces the proportion of patients who require mechanical ventilation (MV) as well as the duration of mechanical ventilation[5-6]. The patients may need duration of mechanical ventilation for variable days may complicate this decision in tracheostomy in clinical practice. In general, tracheostomy should be considered when the expected ventilation duration is more than 14 days[7-8].

Delayed tracheostomy in ventilated patients may result in avoidable damage of the vocal cords, laryngeal mucosa, and recurrent laryngeal nerves due to decubitus or local pressure from the endotracheal tube[7]. On the other hand, early tracheostomy may be unnecessary because of clinical improvement and exposes patients to the risk of perioperative bleeding, infection, esophageal perforation, pneumothorax, and tracheal stenosis and, in all cases, leaves a permanent scar[9]. Previous studies showed that the clinical course of GBS in individual patients can be predicted with reasonable accuracy[10-14]. In the current study, it had been described the need of tracheostomy on the basis of duration of mechanical ventilation and characteristics of GBS patients and aimed to identify predictors of tracheostomy. These predictors may support individual clinical decision-making about indication and timing of tracheostomy in patients with GBS patients in the course of their disease.

Methodology

Study Setting and Population: This retrospective study data were collected from patients with GBS in National Institute of Neurosciences and Hospital, Dhaka, Bangladesh from January 2017 to December 2018, who initiated mechanical ventilation within the first week of admission and who received mechanical ventilation for more than 2 weeks. Early tracheostomy was defined as tracheostomy performed within 14 days of mechanical ventilation. Potential predictors for prolonged mechanical ventilation, defined as duration of ≥14 days, were considered using crosstabs. Consecutive patients with GBS having respiratory involvement were prospectively evaluated. The study has been approved by Institute Ethics Committee. Prospectively collected data were used from GBS patients requiring mechanical ventilation who fulfilled the diagnostic criteria for GBS, were treated with either plasma exchange or intravenous immunoglobulin.

Evaluation: Evaluation of detailed medical history including preceding events such as flue like illness, rash, diarrhea, vaccination, trauma, pregnancy, childbirth and surgery were noted. Baseline characteristics were noted. Presence of cranial nerve palsy was recorded. Muscle weakness was graded on a 0 to 5 MRC (Medical Research Council) scale. The patients were closely followed up in ICU. Pulse, blood pressure, respiration and pulse oxymetry were continuously monitored in all. The ABG analysis was done daily or more frequently if needed. Blood counts, hemoglobin and serum electrolytes were done twice weekly and X-ray chest weekly or earlier if indicated. Blood culture, endotracheal or tracheostomy tube aspirate culture and urine culture were carried out as indicated. Pneumonia, pneumothorax, urinary infection, pressure sore, sepsis, deep vein thrombosis and pulmonary thromboembolism were closely monitored. Tracheostomy was done usually after 2 weeks of intubation based on the clinical condition. The patients admitted within 14 days of illness were prescribed IVIg 400 mg/kg/day for 5 days or plasma exchange every alternative day for consecutive 5 cycles which one they could afford. Enoxaparin prophylaxis was given to the patients who had severe weakness (MRC grade).

Study Procedure and Data Collection: Data collected prospectively for all patients were age, gender, preceding infections, number of days from onset of weakness to hospital admission, date of intubation and extubation, and neurological examination (cranial nerve testing, sensory and motor testing; using the Medical Research Council [MRC] grade during admission, the muscle scale grades muscle power on a scale of 0 to 5 in relation to the maximum expected for that muscle. For this study, we recorded neurological examination after admission in ICU requiring MV. Nerve conduction studies were performed in the first 2 weeks after inclusion, and the data were used to classify GBS as acute inflammatory demyelinating polyradiculoneuropathy (AIDP), acute motor axonal neuropathy (AMAN) and AMSAN

Endpoints: The primary endpoint in this study was the occurrence of prolonged mechanical ventilation which was defined as mechanical ventilation of more than 14 days, as an established criterion to consider tracheostomy[7-8]. Predictors of tracheostomy were sought at day 14 after start of ventilation, as a clinical decision point for considering tracheostomy.

Statistical Analysis: The patients with respiratory impairment requiring mechanical ventilation were compared for demographic details, age, sex, comorbidity, antecedent events, pattern of weakness, MRC grade, type of NCS, mode of treatment, need of tracheostomy, using X2 for categorical and independent ‘t’ test or Mann–Whitney U-test for continuous variables. The predictors of tracheostomy were evaluated by Chi-square test. The P-values of <0.05 were considered as significant. The statistical analysis was done by SPSS version 16 software.

Results

A total number of 74 patients were recruited for this study. The median age was 27 (range 3 to 65) years and 51 were male and 23 were females. The triggering events were patients diarrheal illness 53 (71.8%), RTI illness in 18(24.3%), others in 3 (4.1%) patients. The median peak disability was MRC grade -1 (56.8%). Facial weakness was present in 28(37.8%), bulbar weakness in 36(48.6%). After nerve conduction studies, the patients were categorized into AIDP in 19 (25.7%), AMAN in 46(62.2%), AMSAN in 3(4.1%). Intravenous immunoglobulin was given to 58 (78.4%) patients and plasma exchange in 16 (21.6%) patients (Table 1).

Table 1: Base line characteristics of BGS patients

Variables	Frequency	Percent
Age Group		
Less Than 20 Years	20	27.0
21 to 40 Years	36	48.6
More than 40 Years	18	24.3
Gender		
Male	51	68.9
Female	23	31.1
Comorbidity		
Diabetes	36	48.6
Brochial Asthma	10	13.5
Ischemic heart disease	18	24.3
Hypertension	10	13.5
Antecedent events		
Respiratory tract infection	18	24.3
Gastrointestinal tract infection	53	71.6
Others	3	4.1
Pattern of weakness		
Ascending	37	50.0
Descending	37	50.0
Cranial nerve involvement		
Facial nerve	28	37.8
Bulbar	36	48.6
No	10	13.5
MRC score on admission		
Grade-0 (Complete paralysis)	8	10.8
Grade-1 (minimal contraction)	42	56.8
Grade-2 (active movement with gravity eliminated)	17	23.0
Grade-3 (muscle movement is possible against gravity)	7	9.5
Grade-4 (weak contraction against gravity)	0	
Grade-5 (normal strength)	0	
Types of Nerve conduction study		
AIDP	19	25.7
AMAN	46	62.2
AMSAN	3	4.1
NCS not done	6	8.1
Immunomodulatory treatment		
Plasma exchange	16	21.6
IV Immunoglobulin	58	78.4
Duration of Mechanical ventilation		
Less Than 14 days	27	36.48
More Than 14 days	47	63.7

Out of 74 GBS patients with respiratory compromise, all needed mechanical ventilation based on ABG criteria after a median duration of 20 days of hospitalization. 63.71% patients were prolonged mechanical ventilation (> 14 days). Comparing the clinical data between the tracheostomized and

Table 2: Predictors of Tracheostomy

Variables	Tracheostomy		P value
	Yes	No	
Age Group			0.292
3 to 20 Years	14	22	
21 to 40 Years	16	34	
More than 41 Years	7	11	
Gender			
Male	29	22	0.079
Female	8	15	
Co-morbidity			
Yes	6	30	0.384
No	9	27	
Pattern of weakness			
Ascending	20	17	0.642
Descending	17	20	
Antecedent events			
RTI	12	6	0.324
GI Infection	24	29	
Chicken pox	1	2	
Cranial nerve involvement			
Facial nerve	20	12	0.131
Bulbar palsy	17	25	
MRC Grade			
Grade: 0-3	36	1	0.035
Grade : >3	1	36	
NCS			
AIDP	8	11	0.213
AMAN	25	25	
AMSAN	4	2	
CSF Protein			
Less Than 100 mg/dl	26	6	0.032
More Than 100 mg/dl	11	28	
CSF Lymphocyte			
0 to 3 per ml	30	7	0.409
4 to 6 per ml	29	8	
Mechanical Ventilation			
Less Than 14 Days	7	30	0.017
More Than 14 Days	34	3	
Immunomodulatory Treatment			
IV Immunoglobulin	23	35	0.001
Plasma exchange	14	2	

non-tracheostomized patients, there was no significant difference in the age (p=0.29), sex (p=0.07), co-morbidity (p=0.38), pattern of weakness (p=0.64) NCS variety (p=0.21), CSF cell count (p=0.40) and antecedent events (p=0.32). The tracheostomized patients had significantly more disability (p=0.03), high CSF protein (p=0.032) and prolong duration of mechanical ventilation (p=0.017). The patients who were treated with intravenous immunoglobulin were significantly less need of tracheostomy in comparison to who were treated with plasma exchange (p=0.001) (Table 2).

Discussion

In this study, all patients with GBS had respiratory compromise and all needed mechanical ventilation on the basis of clinical and ABG criteria. Severity of weakness (MRC grade) was an independent predictor of mechanical ventilation. In our study, we have not intubated the patients with bulbar weakness unless they had hypoxia or ABG abnormality. In this study, AIDP constituted 25.7% and AMAN in 62.2% patients. Higher frequency of AMAN although have been reported in the developing countries of Asia and America but on detailed nerve conduction studies, we have also found AMAN as a predominant subtype of GBS[15-20].

In the current study, ventilated and tracheostomized patients were not significant difference on variety of GBS requiring prolonged mechanical ventilation. One study revealed AMAN variety were associated more need of tracheostomy and ultimately prolonged ventilation[21]. One study indicated that the presence of AIDP was associated with a higher chance of respiratory failure[22] but we were unable to confirm that finding. The electrophysiology results are influenced by the applied classification criteria and the timing of the NCS. In Western countries, the axonal forms of GBS are relatively rare compared to AIDP and are found in 5.0% to 10.0% of GBS patients. In addition, NCS performed at 1 week is less accurate for identifying axonal GBS, as the axonal pattern may appear only after 2 to 4 weeks. At 1 week of admission, patients more frequently show unexcitable nerves in NCS. These patients may have either AIDP or axonal forms, but in all cases this is a sign of severe diffuse neuropathy. As such, unexcitable nerves may be a more frequent indication than AMAN for early tracheostomy. In most studies, older age is a predominant prognostic factor for poor outcome in GBS, including those of our own group.

In the current study, we found no association between age and prolonged MV neither did other previous studies. Also the presence of a preceding Campylobacter jejuni infection, which is a general poor prognostic factor in GBS, was not predictive for prolonged mechanical ventilation.

The decision for tracheostomy in patients with GBS depends on the expected duration of respiratory failure, which may range from a few days to more than 6 months. In the current study, 63.71% patients were prolonged mechanical ventilation (more than 14 days). The chance of prolonged MV were MRC grade 0 or 1 bilaterally, high protein in CSF and plasma exchange instead of IVIG. In these patients, it may be considered to perform an early tracheostomy. Several opinions still ongoing about the optimal timing of tracheostomy. A consensus report on MV indicated that the translaryngeal route is preferred when the expected duration is not exceeding 10 days, while tracheostomy is preferred for expected durations longer than 21 days[23]. Prolonged MV via the translaryngeal route carries significant risks, while tracheostomy has its own complications and leaves permanent disfigurement. Nowadays prospective trials show that early tracheostomy was associated with less sedative and analgesic administration, less frequent prescriptions of haloperidol to treat agitation or delirium, earlier oral nutrition, and out-of-bed mobilization. Early tracheostomy does not seem to shorten the duration of MV, length of hospital stay, mortality, or frequency of infectious complications[8, 24-27].

The current study has several limitations that need to be addressed. First, the group of ventilated patients was too small to be able to develop and validate a prognostic model, as was done previously for predicting respiratory failure in the first week in GBS[11]. Second, the patient population investigated was biased toward adult patients and patients with AMAN, which is the predominant GBS subtype in our study. The observed finding at present cannot be extrapolated to pediatric GBS or countries where AIDP forms predominate. Third, in this multicenter study, differences in the duration of MV may reflect variation in local clinical management; intubation or extubation criteria were not used in our patient group. Also, usage and timing of tracheostomy was not recorded in our cohort, and this probably influenced the duration of MV. Fourth, we cannot exclude that the criteria for extubation and supportive care have changed over time. In the future, larger cohorts of GBS patients, with clear

definitions regarding extubation criteria, will be needed to substantiate our findings.

Conclusion

Ventilated GBS patients who have more muscle weakness at presentation, high CSF protein, prolonged MV are high risk of tracheostomy. Whereas the patients who were treated with intravenous immunoglobulin were significantly less need of tracheostomy in comparison to who were treated with plasma exchange.

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