Outbreak, Surveillance, Investigation & Response (OSIR) Journal
Field Epidemiology Training Program, Division of Epidemiology
Department of Disease Control, Ministry of Public Health, Thailand
Tel: +6625903894, Fax: +6625903845, Email: osireditor@osirjournal.net, http://www.osirjournal.net

An Outbreak of Guillain-Barre Syndrome with Respiratory Failure in Joypurhat, Bangladesh, 2018

Sohel Raman[1]*, Mallick Masum Billah[2], Monalisa[1], Manjur Hossain Khan Jony[1], Tahmina Shirin[1], Meerjady Sabrina Flora[3]

1 Institute of Epidemiology Disease Control and Research, Bangladesh

2 A program of The Task Force for Global Health, Training Programs in Epidemiology and Public Health Interventions Network Secretariat, USA

3 Directorate General Health Services, Bangladesh

*Corresponding author email: drsohel33@gmail.com

Abstract

We describe an investigation to identify the causative agent and risk factors for a cluster of Guillain-Barre Syndrome (GBS) reported in northern Bangladesh, November 2018. Medical record review and verbal autopsies were conducted. We actively searched for and interviewed other GBS cases in the hospital to gather demographic and clinical information. Blood samples were collected for serological testing for campylobacter and molecular testing for dengue, Zika, and Chikungunya and stool samples for poliovirus. We identified 13 GBS patients of which eight were males. The case fatality rate was 23%. We found development of respiratory muscle paralysis in 10 patients; three had rapid involvement within 48 hours and eventually died in the acute progressive phase without mechanical ventilation support. Serological tests confirmed the presence of antibodies against *Campylobacter jejuni* in three of seven patients. All other tests were negative. The high case fatality rate was due to rapid onset of respiratory muscle paralysis. We recommend establishing a surveillance system to timely capture and report GBS patients and to enhance investigation capacity. We also recommend that sufficient quantity of mechanical ventilators be present in peripheral tertiary hospitals.

Keywords: Guillain-Barre Syndrome, GBS, respiratory muscle paralysis, mechanical ventilation, Bangladesh, fatality

Introduction

Guillain-Barre Syndrome (GBS) is an autoimmune disease of the peripheral nerves that typically presents as acute, relatively symmetric, flaccid limb weakness.[1,2] The global incidence is estimated at 1–2 cases/100,000 population per year.[3] The rate in Bangladesh is less than 5/100,000 population per year.[4–6]

GBS has three phases: a progressive phase lasting from days to 4 weeks and peaks at 7–14 days, a plateau phase with little clinical change lasting from days to months, and a recovery phase lasting months to years.[7] Patients may develop autonomic instability, cranial nerve dysfunction and neuromuscular respiratory failure, which are the most common causes of death in GBS.[8-10] Deaths associated with GBS predominantly occur during the recovery phase.[11] Mortality from GBS is also associated with the need for mechanical ventilation resulting from respiratory failure in 14% of cases. It usually takes 10–14 days from development of first symptoms to peak weakness.[12] The median duration of mechanical ventilation is 28 days, interquartile range (IQR) 12–60 days. Tetraparesis or tetraplegia can develop within 24 hours. The reported mortality rates range from 3–7% in North America and Europe to 13% in Asia.[3,13]

In Guillain-Barre Syndrome, the immune system mistakenly attacks healthy nerves, the exact cause of this being unknown. Therefore, there is no known prevention. However, the disease's occurrence can be decreased by combating common triggering infected agents, such as *Campylobacter jejuni*, certain arboviruses (e.g., dengue, Chikungunya, and Zika viruses), *Mycoplasma pneumoniae*, cytomegalovirus, Epstein-Barr virus, *Haemophilus influenzae*, and *Leptospira*.[14,15]

On 8 Nov 2018, the Civil Surgeon of Joypurhat District, in northern Bangladesh, notified the Institute of Epidemiology, Disease Control and Research (IEDCR) about the deaths of three hospitalized patients with GBS in several hospitals. The IEDCR immediately deployed an outbreak investigation team, including three medical doctors, two medical technologists, one logistician, and one driver. The objectives of the investigation were to verify the event, identify the etiologic agent, determine associated factors of death due to GBS, and to contain the outbreak.

Methods

We investigated the outbreak from 8 to 17 Nov 2018 in Joypurhat District Hospital where GBS cases-patients were reported and in the communities of the case-patients. We conducted a descriptive study using mixed methods and field investigations. We also searched hospital records in the Joypurhat District Hospital for case-patients diagnosed with GBS and for previous records of GBS outbreaks at the local, regional, and national levels.

A suspected case was a resident of Joypurhat District with clinically diagnosed GBS from 1 Sep to 15 Nov 2018. A probable case was a suspected case with albuminocytologic dissociation in cerebrospinal fluid with or without electrophysiologic findings. The clinical diagnosis of GBS consisted of symmetrical ascending paralysis or weakness, reduction or loss of deep tendon reflex, autonomic neuropathy, and cranial nerve palsy. In this investigation, there were only suspected and probable cases because laboratory testing for GBS was not available.

We reviewed the medical records of all inpatients in the medicine, pediatric, and neurology departments of Sadar Hospital and all sub-district hospitals, Rajshashi Medical College and Shohid Ziaur Rahman Medical College to identify suspected and probable GBS cases. We abstracted the patient's clinical information and traveled to the patient's home to interview the case-patients and relatives of dead case-patients. We modified questionnaire, developed by the World Health Organization for verbal autopsies.[16] We collected cerebrospinal fluid (CSF) from the case-patients and performed nerve conduction studies.

Blood, urine and nasal swab samples were collected from the patients and tested for *Campylobacter jejuni (C. jejuni)*, Zika, dengue, and Chikungunya. The *C. jejuni* test determines the presence of lipo-oligosaccharides by ELISA and was done at the International Center for Diarrheal Disease Research, Bangladesh. Zika, dengue, and Chikungunya were tested by RT-PCR and ELISA for IgG and IgM and influenza by RT-PCR. A serological test was used to identify cytomegalovirus. Urine samples were tested at IEDCR lab for *Leptospira*. We also collected stool samples from children aged less than 18 years to test for poliovirus at the National Polio and Measles Laboratory in the Institute of Public Health.

Descriptive statistics, such as frequency, percentage, mean and standard deviation were used to summarize and describe the data. Analyzed data were presented in the form of tables and charts, including an epidemic curve and spot map.

Ethical Consideration

This investigation was exempt from Human Subjects Review Board because it was a response to an acute health event. Verbal consent was obtained from all case-patients and their relatives before they were interviewed.

Results

There were eight probable and five suspected GBS cases. The first case occurred on 28 Sep 2018. Cases increased gradually from September to mid-November 2018 with the highest number of cases reported during the first week of November. The last case was reported on 15 Nov 2018 (Figure 1). We continued surveillance until 13 Dec 2018 with no further GBS cases identified.

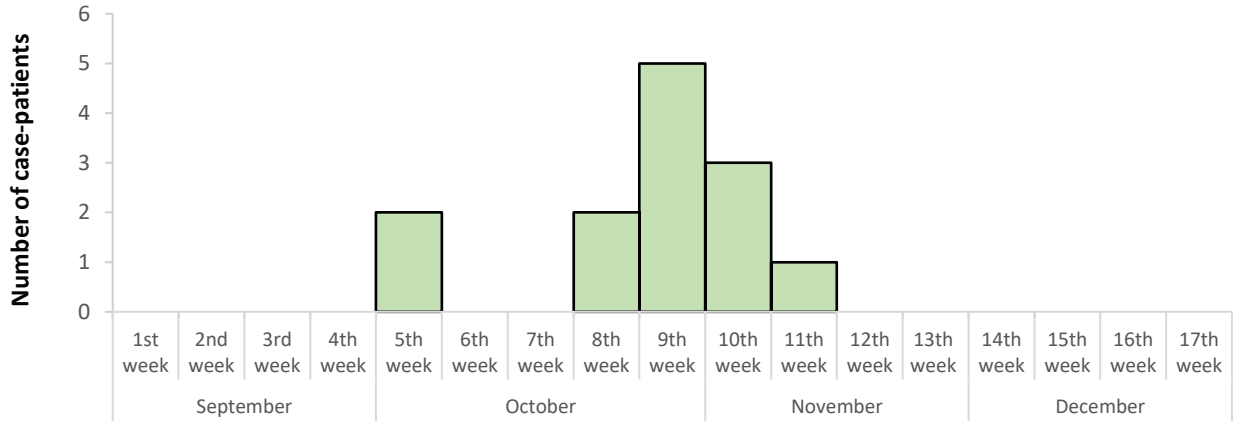

Figure 1: Distribution of GBS case-patients by week of illness onset, Joypurhat District, Bangladesh, 2018

We reviewed the medical records from January to September 2018, prior to the outbreak, at the district hospitals and found no more GBS cases.

The median age of the 13 GBS patients was 30 years (IQR: 18–51 years); eight were males; seven had attended higher than secondary school; 10 were from an urban area. The cases had a mixture of occupations. Five cases had a history of gastroenteritis or fever before onset of GBS (Table 1). Four cases resided within a half-kilometer radius and formed a time-place cluster (Figure 2).

Table 1. Socio-demographic status and epidemiological findings among GBS case-patients in Joypurhat District outbreak, Bangladesh, 2018 (n=13)

Characteristics of case-patients	n (%)
Age group	
<20 years	3 (23.1)
20 to <40 years	3 (23.1)
≥40 years	7 (53.8)
Gender	
Male	8 (61.5)
Female	5 (38.5)
Education	
Primary	2 (15.4)
Secondary	3 (23.1)
Higher than secondary	7 (53.8)
Occupation	
Student	3 (23.1)
Housewife	3 (23.1)
Farmer	2 (15.4)
Small business	2 (15.4)
Service	3 (23.1)
Location	
Within municipality (urban)	10 (76.9)
Outside municipality (rural)	3 (23.1)
Epidemiological findings	
History of gastroenteritis within 4-6 weeks	5 (38.5)
History of fever within 2-5 days	3 (23.1)
History of travel within 6 weeks	3 (23.1)
Relevant food history within 2-5 days	3 (23.1)

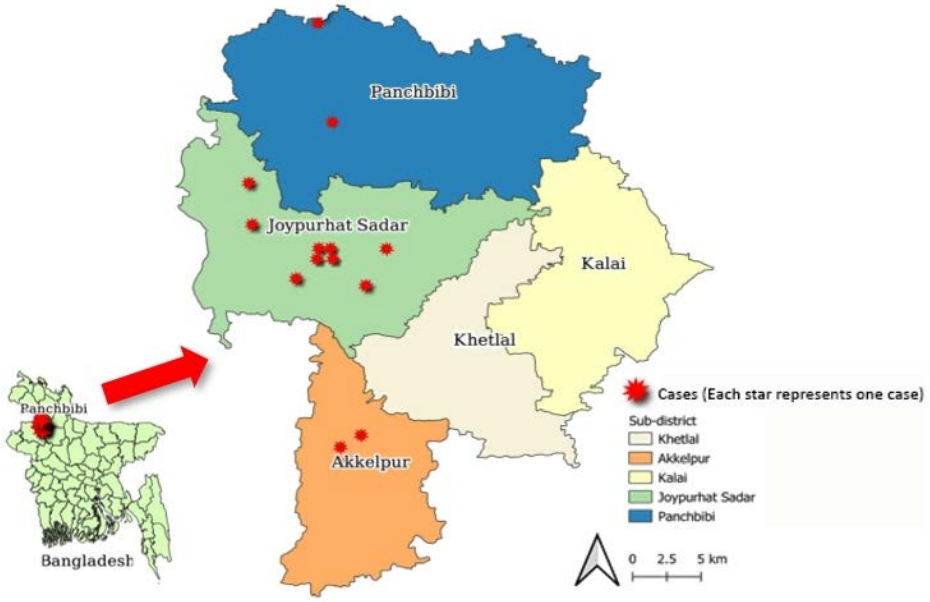

Figure 2. Map of Joypurhat District with residence of GBS cases and time space cluster of GBS cases in Joypurhat Sadar, November 2018

Clinical Profile and Laboratory Findings

Most of the cases had clinical signs and symptoms typical of GBS: symmetrical ascending paralysis (7/13), bulbar palsy (10/13), acute motor axonal neuropathy (4/13), autonomic neuropathy (5/13) and albuminocytologic dissociation in cerebrospinal fluid (8/13).

In this GBS cluster, tetraparesis occurred within 53.7 hours on average. Respiratory muscle involvement that resulted in paralysis was present among 10 case-patients and paralysis occurred within 48 hours (mean of 37.3 hours) in three cases. Five cases died in the acute progressive phase for a case fatality rate of 38.5% (Table 2 and Table 3). *C. jejuni* was isolated in three of seven blood samples. All other tests were negative.

Table 2. Clinical findings among Guillain Barre Syndrome case-patients in Joypurhat District, Bangladesh, 2018 (n=13)

Characteristics of case-patients	n (%)
Limb muscle involvement	
Areflexia (absent all deep tendon reflex)	13 (100.0)
Typical symmetrical ascending paralysis	7 (53.8)
Tetraparesis affecting upper limb first	6 (46.2)
Respiratory muscle involvement	
Respiratory muscle weakness	10 (76.9)
Mechanical ventilation needed	6 (46.2)
Rapid involvement of respiratory muscles (within 48 hours)	3 (23.1)
Cranial nerve involvement	
Bulbar palsy	10 (76.9)
Facial nerve palsy	0 (0.0)
Autonomic neuropathy	5 (38.5)
Time from onset of 1st symptoms to tetraparesis	
<24 hours	3 (23.1)
24 to <48 hours	4 (30.8)
48 to <72 hours	2 (15.4)
≥72 hours	4 (30.8)
Time from onset of tetraparesis to respiratory muscle paralysis (n=10)	
<12 hours	1 (7.7)
12 to <24 hours	5 (38.5)
≥24 hours	4 (30.8)
Clinical course (n=10)	
Use of mechanical ventilation	6 (46.2)
No use of mechanical ventilation	4 (30.8)
Duration between tetraparesis to ventilator dependency (n=5)	
<12 hours	2 (15.4)
12 to <24 hours	2 (15.4)
≥24 hours	1 (7.7)

Table 3. Laboratory findings among Guillain Barre Syndrome case-patients in Joypurhat District, Bangladesh, 2018

Laboratory findings	n (%)
Cerebrospinal fluid (CSF) profile (n=8)	
CSF protein (15-45 mg/dl)	
46-100 mg/dl	1 (12.5)
101-150 mg/dl	2 (25.0)
151-200 mg/dl	3 (37.5)
>200 mg/dl	2 (25.0)
CSF cell count ≤20 mm^3	
0-10 mm^3	6 (75.0)
11-20 mm^3	2 (25.0)
Lymphocytes (%)	
90-100 (%)	8 (100.0)
Nerve conduction studies (NCS) profile (n=5)	
Acute Motor Axonal Neuropathy (AMAN)	4 (80.0)
Mixed variety, both axonal and demyelinating	1 (20.0)
Serology (n=7)	
Campylobacter LOS (Lipo-oligosaccharide) ELISA	3 (23.1)
RT-PCR & Antibody IgG, IgM for dengue	0 (0.0)
RT-PCR & Antibody IgG, IgM for Zika	0 (0.0)
RT-PCR & Antibody IgG, IgM for Chikungunya	0 (0.0)
Stool sample (n=3)	
Test for poliovirus	0 (0.0)
Urine samples (n=7)	
Test for *Leptospira*	0 (0.0)

Clinical Description of Three Deaths that Occurred in the Early Progressive Phase

On 31 Oct 2018, an 18-year-old male presented with gradual development of weakness of fingers for two days (Table 4). On 1 Nov, he developed sudden paralysis of the upper limbs and then lower limbs within eight hours. From 2 to 3 Nov, he developed respiratory difficulty with respiratory failure within a few hours. He was transferred immediately to the intensive care unit and intubated. All deep tendon reflexes were absent and autonomic dysfunction and bulbar palsy developed. Cerebrospinal fluid and nerve conduction study results in implicated GBS with axonal and demyelinating neuropathy. He developed severe respiratory failure on 3 Nov and died. He had a history of gastroenteritis one month before onset of GBS.

On 1 Nov 2018, a 15-year-old male presented with weakness of both lower limbs. Rapid progression of weakness and muscle paralysis developed within 8-9 hours. Respiratory distress started rapidly and within 48 hours respiratory paralysis occurred. He was diagnosed clinically as GBS by a neurologist. He did not receive medical treatment and was referred to the National Institute of Neuroscience in Dhaka. He died from respiratory failure on route to Dhaka. He had a history of loose stool in the previous few months.

On 3 Nov 2018, a 55-year-old male presented with sudden development of weakness of both lower limbs. On 4 Nov, he developed tetraparesis followed by quadriplegia within 24–30 hours. On 5 Nov, he developed respiratory distress and was given oxygen and referred to a hospital with a higher level of treatment. On 5 Nov 2018, he was diagnosed with GBS based on results from cerebrospinal fluid. His oxygen saturation gradually decreased but he was not intubated. No bed in the intensive care unit was available at that time and he was referred to the National Institute of Neuroscience in Dhaka. He died on route.

Table 4. History of Guillain Barre Syndrome (GBS) case-patients in Joypurhat Outbreak, Bangladesh, 2018 (n=13)

Case Id	JH001	JH002	JH003
Gender	F	M	M
Symptoms	Weakness starts from finger to upper limbs, involves lower limbs within few hours; rapid progression of paralysis; respiratory involvement within 48 hours; history of fever 2 weeks back	Weakness starts from finger to upper limbs, involves lower limbs; rapid progression; no respiratory involvement	Weakness starts from finger to upper limbs, involves lower limbs within 72 hours; difficulty in deglutition; rapid progression of respiratory distress by day 4; tracheostomy in situ
Date of first symptom	27 Oct	31 Oct	30 Sep
Time of first symptom	6:00 PM	11:00 AM	5:30 AM
Date of first limb involvement	Upper limb, 27 Oct	Upper limb, October	Upper limb, 30 Sep
Onset of tetraparesis	28 Oct	4 Nov	3 Nov
Time from onset of 1st symptoms to tetraparesis (hours)	21	96	70
Time from tetraparesis to respiratory muscle paralysis (hours)	21	-	96
Time from onset to respiratory failure (hours)	46	-	166
Bulbar palsy	Yes	Yes	Yes
Autonomic neuropathy	Yes	No	Yes
Outcome	ICU	Under treatment	Under treatment

Case Id	JH004	JH005	JH006
Gender	F	F	M
Symptoms	Weakness starts from lower limbs, involves upper limbs; rapid progression of paralysis; respiratory distress	Weakness starts from lower limbs; rapid progression of ascending paralysis within 72 hours; no respiratory involvement	Problem in standing from knee bending position; weakness of both lower limbs; rapid progression of weakness; paralysis affects all limbs within 8-9 hours; respiratory involvement within 48 hours; history of loose motion 3 days back
Date of first symptom	6 Nov	25 Oct	1 Nov
Time of first symptom	7:00 AM	4:30 PM	4:00 PM
Date of first limb involvement	Lower limb, 6 Nov	Lower limb, 27 Oct	Standing from knee bending with weakness of both lower limbs
Onset of tetraparesis	7 Nov	28 Oct	22 Nov
Time from onset of 1st symptoms to Tetraparesis (hours)	35	72	9
Time from Tetraparesis to respiratory muscle paralysis (hours)	17	-	11
Time from onset to respiratory failure (hours)	72	-	20
Bulbar palsy	Yes	No	No
Autonomic neuropathy	Yes	No	No
Outcome	ICU	Under treatment	Death

Table 4. History of Guillain Barre Syndrome (GBS) case-patients in Joypurhat Outbreak, Bangladesh, 2018 (n=13) (cont.)

Case Id	JH007	JH008	JH009
Gender	M	F	M
Symptoms	Problem in swallowing solid food; rapid progression of ascending type of paralysis; all limbs affected by 24 hours; respiratory involvement within 48 hours; history of chronic loose motion	Difficulty in swallowing food; Problem in standing from knee bending position; rapid progression of ascending type of paralysis; all limbs affected by 72 hours; respiratory involvement after 5 days	Weakness of the finger first, followed by whole upper limb; rapid progression of paralysis within 8-10 hours; urinary retention; respiratory involvement after 2 days
Date of first symptom	20 Oct	4 Oct	31 Oct
Time of first symptom	7:00 AM	12:30 PM	3:00 PM
Date of first limb involvement	Lower limb, 21 Oct	Lower limb, 7 Oct	Upper limb, 1 Nov
Onset of tetraparesis	22 Oct	7 Oct	3 Nov
Time from onset of 1st symptoms to tetraparesis (hours)	39	54	10
Time from tetraparesis to respiratory muscle paralysis (hours)	72	66	22
Time from onset to respiratory failure (hours)	111	120	42
Bulbar palsy	Yes	Yes	Yes
Autonomic neuropathy	Yes	No	Yes
Outcome	Death	Death	Death

Case Id	JH010	JH011	JH012	JH013
Gender	M	M	M	M
Symptoms	Weakness of lower limb; rapid progression of paralysis within 6-8 hours; abdominal distention; vomiting; respiratory involvement after 12 hours	Difficulty in swallowing; ascending type of paralysis, both limbs affected after 4 days; respiratory involvement after 6 days	Problem in swallowing food; progression of lower limb paralysis within 24 hours, not affect all limbs; respiratory involvement within 72 hours; history of gastroenteritis 2 weeks back	Problem in swallowing food; both upper and lower limb weakness
Date of first symptom	3 Nov	29 Oct	9 Nov	3 Nov
Time of first symptom	7:30 PM	11:30 PM	8:45 AM	5:40 PM
Date of first limb involvement	Both lower limb, 3 Nov	Lower limb, 30 Nov	Lower limb, 10 Nov	Both lower limbs
Onset of tetraparesis	4 Nov	2 Nov	10 Nov	8 Nov
Time from onset of 1st symptoms to tetraparesis (hours)	24	82	39	144
Time from tetraparesis to respiratory muscle paralysis (hours)	23	43	33	-
Time from onset to respiratory failure (hours)	47	125	72	-
Bulbar palsy	Yes	Yes	Yes	No
Autonomic neuropathy	No	No	No	No
Outcome	Death	ICU	Under treatment	Under treatment

Discussion

In this outbreak, most of the suspected and probable cases had typical signs and symptoms of Guillain-Barre Syndrome. However, in many cases, weaknesses started from the arms and typical symmetrical ascending paralysis was not evident. Several studies found that in 10–15% of cases, symmetrical ascending paralysis was not present, rather the weakness started from the arms, and was not symmetrical.[17] Moreover, common facial palsy in case of cranial nerve involvement was not present, rather bulbar palsy was evident among most cases. Autonomic disturbance with typical sinus tachycardia, orthostatic hypotension, and changes in sweat affected five case-patients. Most of these case-patients developed limb muscle weakness and respiratory paralysis within three days and needed mechanical ventilation. This was unusual because, in most cases of GBS, respiratory failure occurs within 10–12 days.[12,18] Limb muscle weakness and respiratory failure reach a nadir at 2 to 4 weeks after symptoms onset.[19–22] Typically, mechanical ventilation resulting from respiratory failure occurs in about 14–30% of case-patients.[12]

Mechanical ventilation for GBS case-patients with acute respiratory failure is the most common risk factor for death.[9,12,23] In our investigation, six (46.2%) case-patients required mechanical ventilation and five died. The rapid progression of respiratory muscle paralysis required mechanical ventilation support with an increased risk for mortality. Moreover, three case-patients died due to the unavailability of mechanical ventilation.

Outbreaks of GBS have occurred after epidemics of dengue or Zika viral infections.[24–27] During this GBS outbreak, there was an unusual increase in dengue cases in Dhaka. Some of the cases traveled to Dhaka during the dengue outbreak. While no cases reported having dengue, asymptomatic dengue infections can occur in 20–30% of the cases.[28] A search of medical records in Joypurhat Sadar Hospital from July to October 2018 showed no evidence of the increased frequency of dengue cases or microsomia cases.

In this GBS outbreak, five cases had a history of gastroenteritis and three had blood cultures that isolated *C. jejuni*. In Bangladesh, many patients diagnosed with GBS have been reported after campylobacter infection following gastroenteritis.[1,29,30] Campylobacteriosis is the most commonly identified antecedent infection for GBS (20%–50%) cases.[6,30–32] In addition, annual rates of hospitalization for GBS were significantly correlated with campylobacteriosis.[33] Several studies have also suggested that campylobacter is associated with the acute motor axonal neuropathy subtype.[5,30,32,34,35] However, neurologic symptoms are more severe and more likely to be irreversible when GBS is preceded by *C. jejuni* infection.[36]

Other risk factors for death included bulbar nerve involvement, longer progressive phase, autonomic dysfunction, and older age.[23] In this study, most of the cases had bulbar palsy rather than facial palsy, autonomic dysfunction, and age more than or equal 40 years which is similar to the findings of other studies. A study in Bangladesh reported higher mortality when the progressive phase lasted more than eight days.[23]

In our study, most of the GBS deaths occurred in the acute progressive phase, while case-patients in high-income countries more frequently die in the recovery phase due to pulmonary infection and cardiovascular complications.[11,23] In one study in Bangladesh, 12% of GBS case-patients died within 6 months of disease onset.[6,13,15,26] The interval between the onset of weakness and death varied, but most of the deaths occurred within a month.

Most countries do not have a surveillance system for GBS or other neurological disorders. Physicians can notify health authorities when a cluster of unusual cases occurs. GBS may be reported as part of the acute flaccid paralysis surveillance system that is used by countries to identify polio. In addition, the United States and New Zealand, in their influenza vaccination programs, include the occurrence of GBS in their "Adverse Event Following Immunization" report.[33,37]

This investigation had several limitations. We could not use the Medical Research Council Score for measuring muscle strength among cases, because this indicator, which can help diagnose GBS, was not included in the patient's medical records. There was limited data on the cases that died, thus we were unable to compare those cases with cases that survived to determine risk factors. There was limited laboratory testing capacity for microbial agents associated with GBS and no samples were available from the decedents.

Conclusion and Recommendations

We confirmed an outbreak of GBS in Joypurhat District. The mortality rate was unexpectedly high due to rapid involvement of respiratory muscle paralysis and unavailability of mechanical ventilation in the hospitals. We suspect a *Campylobacter jejuni* infection may have been a contributing factor because five cases had a history of gastroenteritis one month before their onset of GBS.

Despite not having a surveillance system for GBS and other neurological diseases, this incident was reported to the District Civil Surgeon. However, the reporting was late, and these conditions are probably under-reported. Consequently, the burden of GBS and other neurological diseases is unknown.

We recommend increasing support for mechanical ventilation in intensive care units in tertiary hospitals, so people diagnosed with GBS can receive appropriate and timely care, which can reduce morbidity and mortality.

We also recommend establishing a surveillance system for neurological diseases that will describe the burden of these diseases and encourage timely diagnosis and reporting of neurological diseases. To increase awareness, we recommend educating people at risk for developing GBS and physicians about symptoms and risk factors of GBS.

Suggested Citation

Raman S, Billah MM, Monalisa, Jony MHK, Shirin T, Flora MS. An outbreak of Guillain–barre syndrome with respiratory failure in Joypurhat, Bangladesh, 2018. OSIR. 2021 Sep;14(3):104-14.

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