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Predictive Factors of Respiratory Failure in Children with Guillain-Barre Syndrome

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Abstract

Introduction

Guillain-Barre Syndrome (GBS) is the most common cause of acute flaccid paralysis. Respiratory failure is the most serious short-term complication of GBS and invasive mechanical ventilation is required in 30% of patients. Moreover, 60% of those who are intubated develop major complications including pnemonia, sepsis,GI bleeding and pulmonary embolism. Thus respiratory failure prediction is crucial. The aim of this study was to determine clinical predictors of respiratory failure to avoid respiratory distress and aspiration.

Materials and Methods

In a cross sectional and analytical study 140 patients with clinically diagnosis of Guillain-Barre syndrome were enrolled in study, of October 2008 to October 2014. Demographic data, nerologic examination, cranial nerve and autonomic nervous system involvement, and respiratory failure were recorded prospectively.

Results

15 out of 140 patients (10.7%) developed respiratory failure and underwent mechanical ventilation. The male/female ratio in patients with respiratory failure and patients without respiratory involvement were $\frac{53\%}{47\%}$ and $\frac{54\%}{46\%}$ respectively (p-value=0.4). The mean age in these two groups were 2.7±1.9 and 5.5±3.2(P= 0.003). Cranial nerve involvement (7, 9, 10) was recorded in patients with respiratory failure and without respiratory failure 54% and 25% respectively (P =0.03). Absent upper limb deep tendon reflexes in these two groups were 70% and 44% respectively (P =0.03) and autonomic nervous system involvement 24% vs. 14% (P=0.3).

Conclusion

This study suggests that younger age, cranial nerve involvement and absent upper limb deep tendon reflexes are predictive factors of respiratory failure in patients with Guillain-Barre Syndrome (GBS).

***Key words*:** Guillain-Barre syndrome, Mechanical ventilation, Respiratory failure.

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Introduction

Guillain-Barre Syndrome (GBS) is an immune-mediated polyneuropathy, generally presenting with motor, sensory and autonomic symptoms (1). GBS is the most common cause of acute neuromuscular paralysis with an incidence 0.6 cases per 100, 000, per year throughout the world(2), but the most recent and careful population-based studies in Europe consistently report an incidence of 1.2–1.9 per 100, 000 (3-8). Recent studies have found that the incidence increases linearly with age and men are about 1.5 times more likely to be affected than women(9). Diagnosis is based on a set of defiened clinical and laboratory criteria (10). Combinition of rapidly progressive symmetrical weakness in the arms and legs with or without sensory disturbances, hyporeflexia or areflexia in the absence of Cerebrospinal Fluid (CSF) cellular reaction, remains the hallmark of clinical diagnosis of GBS (10). Respiratory failure requiring Endotracheal Mechanical Ventilation (ETMV) remains one of its most serious complications and occurs in approximately 30% of cases. Frequently insidious onset of respiratory failure increases the risk of life-threatening complications such as respiratory arrest or aspiration pneumonia. Therefore, early identification of patients at risk for respiratory failure is crucial. Respiratory failure in GBS is primarily due to inspiratory and expiratory muscle weakness leading to hypoventilation, impaired coughing, airway secretion retention and atelectasis (11-14). Moreover, 60% of those who are intubated develop major complications including pnemonia, sepsis, Gastrointestinal (GI) bleeding and pulmonary embolism (15).

The aim of this study was to determine clinical predictors of respiratory failure to avoid respiratory distress and aspiration.

Materials and Methods

A cross-sectional study was conducted in the department of pediatrics of referral hospital in Tabriz, South west of Iran, of October 2008 to October 2014, after seeking for institute's ethical committee approval. 140 Guillain-Barre Syndrome (GBS) patients were enrolled in this study according to clinically defined criteria for GBS (10). The diagnosis was always confirmed by Electromyography (EMG), which was symmetrically performed during the first week after hospital admission. The following characteristics were prospectively collected for all patients: age, sex, duration between Guillain-Barre syndrome onsets to hospital admission. Neurologic exams were performed according to standard clinical criteria. The following data were noted: (a)weakness of limbs, (b)deep tendon reflex, (c)cranial nerve impairment (7,9,10), (d)cardiovascular autonomic dysfunction defined as an increase or decrease (40mm Hg) in systolic blood pressure, spontaneous or induced bradycardia(heart rate decrease of greater than 20 beats per minute) or spontaneous tachycardia(matched for age).

Based on aim of our study, we compared the patients according to the need for Mechanical Ventilation (MV+) with patients without respiratory failure (MV-).

Descriptive analysis (Frequencies for categorical data, Mean±SD) was performed in two groups and were compared by chi-square test or fisher test when appropriate. P-value less than 0.05 considered significant.

Results

140 patients with Guillain-Barre syndrome (GBS) were enrolled in study. Baseline characteristics of patients have shown in (Table.1).

Table 1: Baseline characteristics of patients

Characteristic	MV+	MV-	P-value
Number	15	125	
M/F	8/7	68/57	0.4
Age(yr)	2.7±1.9	5.5±3,2	0.003
Cranial nerve involvement	8(54%)	31(25%)	0.03
Absent upper limb DTR	10(70%)	55(44%)	0.03
Autonomic dysfunction	4(26%)	18(14%)	0.3
Time from onset to admission	3(day)	5.5(day)	0.06

M/F: Male/female ratio
DTR: Deep tandon reflex
MV+: Patients underwent mechanical ventilation.
MV-: Patients without mechanical ventilation.

Of the 140 patients, 15 (10.7%) developed respiratory failure and undervent mechanical ventilation (MV+). According to our study gender did not influence development of respiratory failure (P>0.05). The current study suggests the following as clinal predictors of respiratory failure: younger age, cranial nerve involvement and absent upper limb DTR (P<0.05).

Discussion

Neuromuscular respiratory failure is one of the major factors influencing morbidity and mortality in Guillain-Barre syndrome (GBS). Respiratory failure in GBS results from a combinition of factors. Tongue, pharyngeal and laryngeal weakness causing poor secretion clearance and diaphragmatic-intercostal weakness causing progressive respiratory failure leading to atelectasis and progressive hypoxia (17). Successful management of Guillain-Barre syndrome mandates anticipation of respiratory failure.

Several studies have been done for identification of respiratory failure predictors in GBS in adult group but less in pediatrics.clinical and eletrophysiological variables have been studied mostly in adults.

In one study conducted in Raymond Poincare teaching Hospital by Marie-Christine Durand ,154 patients with GBS were included and 34(22%) were subsequently ventilated(15). Clinical characterstics predicting respiratory failure reported were :disability grade >3arm grade >2, bulbar dysfunction, inability to lift head and pure motor involvement. Demyelinating GBS was more common in ventilated patients (85% vs. 51%, P=0.0003) (9).
In a cohort study conducted in French intensive care and neurologic units, demographic, neurologic, and biologic data; vital capacity; and time of onset, admission, and endotracheal mechanical ventilation
were collected in 722 consecutive adults not ventilated at admission, endotracheal mechanical ventilation was required in 313(43%) patients. Multivariate analyses identified six predictors of endotracheal mechanical ventilation: time from onset to admission of <7 days (odds ratio, 2.51), inability to cough (odds ratio, 9.09), inability to stand (odds ratio, 2.53), inability to lift the elbows (odds ratio, 2.99) or head (odds ratio, 4.34), and liver enzyme increases (odds ratio, 2.09). In the 196 (27%) patients whose vital capacity was measured, time from onset to admission of <7 days (odds ratio, 5.00), inability to lift the head (odds ratio, 5.00), and vital capacity <60% (odds ratio, 2.86) predicted endotracheal mechanical ventilation (11). In our study, time from onset to admission for patients underwent mechanical ventilation and patients without

respiratory failure were 3 days and 5.5 days respectively (P=0.06).

In another study conducted by Francois Fourrier in adult group sixty-one patients with severe Guillain-Barre syndrome were studied. Sixty-six percent required mechanical ventilation (median length: 24 days). The lack of foot flexion ability at Intensive Care Unit (ICU) admission and at the end of immunotherapy was significantly associated with mechanical ventilation length > 15 days [positive predictive value: 82%; odds ratio: 5.4 (1.2 - 23.8) and 82%; 6.4 (1.4 - 28.8), respectively]. The association of a sciatic nerve motor conduction block with the lack of foot flexion at the end of immunotherapy was associated with prolonged MV with a 100% positive predictive value. The study suggested that in patients admitted to ICU with Guillain-Barré syndrome and acute respiratory failure, the lack of foot flexion ability at the end of immune therapy predicts a prolonged duration of mechanical ventilation . Combined with a sciatic motor conduction block, it may be a strong argument to perform an early tracheotomy (16).

Our study that is conducted in pediatrics suggests that younger age, cranial nerve involvement and absent upper limb DTR may be predictors of respiratory failure clinically.

Conclusion

Respiratory failure requiring Endotracheal Mechanical Ventilation (ETMV) remains one of its most serious complications and occurs in approximately 10.7% of cases. Therefore, early identification of patients at risk for respiratory failure is crucial.

Conflict of interests: None.

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