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Severe Guillain-Barré syndrome with motor nerve inexcitability but a good outcome

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ABSTRACT

Background: Inexcitable motor nerves in the initial stages of Guillain-Barré syndrome (GBS) are thought as findings of axonal degeneration and suggest a poor outcome.

Objectives: To describe 2 severe GBS patients with motor nerves inexcitability but a good outcome.

Naoki Kasahata,
Severe Guillain-Barré syndrome with motor nerve inexcitability but a good outcome,
Medical Science, 2016, 20(81), 174-180,
www.discoveryjournals.com

Methods: We encountered 2 severe GBS patients with inexcitable motor nerves but a good outcome. They presented with quadriplegia, respiratory muscle paralysis, generalized areflexia, and mild sensory disturbance. We followed nerve conduction study and patients' courses.
Results: When compound muscle action potentials (CMAPs) obtained, they showed conduction slowing with the preserved shapes of CMAPs, and prolonged F wave latencies. These findings suggested acute inflammatory demyelinating polyneuropathy. Both 2 patients have recovered and have been able to walk independently.
Conclusions: We think some severe GBS patients with early inexcitable motor nerves show a good outcome. Inexcitable motor nerves in initial stages of GBS do not always suggest axonal degeneration. Proper treatment, respiratory management in intensive care unit, and sufficient rehabilitation improved prognosis.

Keywords: Guillain-Barré syndrome, motor nerve inexcitability, acute inflammatory demyelinating polyneuropathy

Abbreviations: GBS - Guillain-Barré syndrome

1. INTRODUCTION

Inexcitable motor nerves in the initial stage of Guillain-Barré syndrome (GBS) have been thought as findings of axonal degeneration and have suggested a poor outcome (Feasby et al., 1986; Reisin et al., 1993; Feasby et al, 1994; Griffin et al., 1995; Hadden et al., 1998). However, some patients with inexcitable motor nerves have been reported as a good outcome (Triggs et al., 1992; Cros et al., 1994; Cros et al., 1996; Kang et al., 2007). We encountered 2 severe GBS patients presented with early inexcitable motor nerves but a good outcome. Here we report the characteristics of these patients and discuss about inexcitable motor nerves and prognostic factors of severe GBS.

2. MATERIALS AND METHODS

Patient 1

A 29-years-old woman admitted to the hospital because of weakness and dyspnea. She was well until approximately 3 weeks before admission, when she developed acute gastroenteritis. Seven days before admission, she developed common cold. Five days before admission, she delivered full term baby. Three days before admission, she developed difficulty in walking, and she developed weakness and edema of both arms and she was unable to raise her arms. Two days before admission, she developed dyspnea and dysphagia. One day before admission, she developed weakness of neck. Past history and family history were unremarkable. She had no history of diabetes mellitus. She drunk a bottle of beer per week, and she did not smoke. She worked as a dental technician.
Neurological examination showed right facial palsy, proximal dominant upper extremities weakness: 2/5 strength, and generalized areflexia.

Laboratory examination showed WBC 19900/ l, Hb 11.2 g/dl total protein 5.3 g/dl, Na 126 mEq/l, Cl 93 mEq/l, Ca 7.5 mg/dl, AST 65 U/l, ALT 54 U/l, LDH 569 U/l, ALP 603 U/l, -GTP 83 U/l, CRP 9.94 mg/dl and otherwise normal. Blood glucose has been within normal range. Urinary screen for porphyrins were normal. Cerebrospinal fluid (CSF) examined on day 2 contained 4.3 white blood cells/mm^3 with glucose 47 mg/dl, protein 82 mg/dl, and IgG 10 mg/dl. Both antiGM1 and antiGQ1b antibodies were negative.

MOTOR NERVE INEXCITABILITY:

Motor nerve inexcitability is a phenomenon of difficult to obtain CMAPs using strong electrical stimulation of motor nerve. Since inexcitable motor nerves as findings of acute axonal form of GBS are reported, inexcitable motor nerves early in the course of GBS are considered as poor prognosis. However, some GBS patients with motor nerve inexcitablitiy had a good outcome. These patients have reported as AIDP. Why motor nerves of AIDP patients showed inexcitability? Possible mechanisms of inexcitable motor nerves include as follows: distal conduction block corresponding to denuded axon; very slow CMAPs that we were unable to identify; elevated threshold such as tissue edema of surrounding nerves; and axonal degeneration. Obtained CMAPs of present patients showed slow conduction velocity and the shape of CMAPs were preserved. These findings suggested that demyalination and remyelination processes were homogenous. Based on these findings, distal conduction block or very slow CMAPs were the considerable causes of inexcitability of present patients.

Naoki Kasahata,
Severe Guillain-Barré syndrome with motor nerve inexcitability but a good outcome,
Medical Science, 2016, 20(81), 174-180,
www.discoveryjournals.com

CSF examined on day 65 contained 22.3 white blood cells/mm^3 with glucose 77 mg/dl, protein 454 mg/dl, and IgG 78 mg/dl. Chest computed tomography revealed bilateral pneumonia.

5-day course human immunoglobulin (0.4 g/kg per day) therapy and SBT/ABPC 6 g/day was begun. Her upper extremities weakness improved. She complained abnormal sensation of her hands as her hands became edematous. On day 3, she complained dysarthria. On day 4, her respiratory state exacerbated. She was intubated and ventilator assisted in intensive care unit (ICU) (Grade 5). She underwent tracheostomy. Her weakness progressed, and she became quadriplegic with bilateral abducens palsy and facial palsy. No movement of muscle of extremities were observed (abductor pollicis brevis: APB 0/0 abductor digiti minimi: ADM 0/0 palmar interossei 0/0 flexor hallucis brevis: FHB 0/0 extensor digitorum brevis: EDB 0/0 flexor digitorum brevis: FDB 0/0). On day 19, another 5-day course human immunoglobulin (0.4 g/kg/per day) was added. On day 21, she developed abnormal sensation of bilateral thigh. Thereafter, her respiratory state, cranial nerves, upper extremities and lower extremities weakness improved sequentially. On day 77, she breathed without ventilator. After 10 months from onset she has shown full recovery and has walked independently but her extremities have appeared atrophic (Grade 1).

CMAP (Compound Muscle Action Potential):
The summation of nearly synchronous muscle fiber action potentials recorded from a muscle commonly produced by stimulation of the nerve supplying the muscle. (Kimura, 1989)

Patient 2

A 60-year-old man admitted to the hospital because of gait disturbance. He was well until approximately 1 week before admission when he had common cold. One day before admission, he developed difficulty in walking. He was unable to walk straight as he drunk. He developed weakness in his hands. On the morning of admission, he was unable to stand. He also developed dysarthria and tingling sensations of his hands. He had had sinusitis. His family history was unremarkable. He drank 700 ml beer per week.
Neurological examination showed ptosis, bulbar palsy, weakness of all extremities, generalized areflexia, mild disturbance of position sense, and subjective sensory disturbance: tingling sensation.

Laboratory examination showed protein 8.9 mg/dl, GTP 98 mg/dl, glucose 181 mg/dl, HbA1c 7.8% CRP 2.36 mg/dl. CSF contained 2.7 white blood cells/mm^3 with glucose 101 mg/dl, protein 36 mg/dl, and IgG 0 mg/dl. Urinary screen for porphyrins were normal. CSF examined on day 37 contained 2.7 white blood cells/mm^3 with glucose 133 mg/dl, protein 280 mg/dl, and IgG 41 mg/dl. Blood gas analysis on admission showed pH 7.263 pCO2 63.7 mmHg pO2 85.6 mmHg HCO3 28.1.

Since respiratory muscle paralysis was suspected, he was intubated and ventilator assisted in ICU. A 5-day course human immunoglobulin (0.4 g/kg per day) therapy was begun. He developed autonomic symptoms such as episodic hypertension with sweating and paralytic ileus. From day 14 to day 19, 4 times course plasmapheresis was added. On day 5, he was quadriplegic and showed no movement (APB 0/0 ADM 0/0 palmar interossei 0/0 FHB 0/0 EDB 0/0 FDB 0/0 neck extensor 0/0 sternocleidmastoideus 0/0). On day 9, he was only able to move his neck slightly. Thereafter, he was gradually improved.

After 3 years, he has shown recovery and has walked independently but he has remained weakness of his hands and difficulty in fine finger movement.

Methods

We followed nerve conduction study and clinical findings of these patients.

3. RESUTLS

Nerve conduction studies (NCS) of patient 1 performed on day 30 showed inexcitable motor nerves and sural nerve: median, ulnar, fibular, tibial compound muscle action potentials (CMAP) and sural sensory nerve action potential (SNAP) were absent. NCS on day 65 showed inexcitable motor nerves and sural nerve; median, fibular, tibial CMAPs and sural SNAP were absent. But only ulnar CMAP stimulated wrist was obtained: distal latency (DL) 19.4 ms, CMAP shape was preserved. On day 148, median and ulnar nerve showed conduction slowing with preserved CMAPs shapes, although fibular and tibial CMAPs remained absent. F wave latencies were prolonged. (Table 1)

Figure 1 showed right ulnar nerve motor conduction studies of patient 1 on day 176. The sites of stimulation include wrist (A1), below the elbow (B1), above the elbow (C1), axilla (D1), and Erb's point (E1). Distal latency was 9.3 milliseconds. The shapes of the CMAPs are relatively preserved while conduction slowing and prolonged latencies were observed: conduction velocity at forearm was 25.3 meter/second.

Naoki Kasahata,
Severe Guillain-Barré syndrome with motor nerve inexcitability but a good outcome,
Medical Science, 2016, 20(81), 174-180,
www.discoveryjournals.com

NCS of patient 2 on day 30 showed inexcitable ulnar CMAP and sural SNAP and conduction slowing with low amplitude: conduction slowing of median, fibular, and tibial nerves but shapes of CMAPs were preserved. Thereafter, F wave latencies were prolonged. (Table 1)

Table 1

Nerve	Conduction	Studies	results								
		Patient 1					Patient 2				
Day		30 (L)	65 (R)	120 (R)	148 (L)	176 (R)	30 (R)	44 (L)	125 (R)	132 (L)	153 (R)
Median	DL (ms)	NR	NR	11.7	13.0	12.5	6.0	NR	NR	NR	NR
MCS	CV (m/s)	NR	NR	18.6	21.4	30.0	28.0	NR	NR	NR	NR
	CMAP (mV)	NR	NR	2.7	3.0	1.6	0.22	NR	NR	NR	NR
	F (ms)				40.0	85.4	NR				
Ulnar	DL (ms)	NR	18.4	9.4	13.2	9.3	NR	4.9	NR	5.0	NR
MCS	CV (m/s)	NR	-	13.7	19.1	25.3	NR	44.0	NR	47.4	NR
	CMAP (mV)	NR	0.5	2.3	2.0	3.5	NR	0.044	NR	0.14	NR
	F (ms)				76.2	81.8		NR	NR	NR	NR
Fibular	DL (ms)	NR	NR	NR	NR	NR	6.1	NR	NR	NR	NR
MCS	CV (m/s)	NR	NR	NR	NR	NR	11.5	NR	NR	NR	NR
	CMAP	NR	NR	NR	NR	NR	0.27	NR	NR	NR	NR
	F (ms)						NR				
Tibial	DL (ms)	NR	NR	NR	NR	NR	5.9	5.1	5.8	5.6	5.0
MCS	CV (m/s)	NR	NR	NR	NR	NR	37.9	33.9	36.6	37.5	34.9
	CMAP (mV)	NR	NR	NR	NR	NR	1.7	0.22	1.3	1.0	0.9
	F (ms)						54.4	40.8	41.9	70.0	67.8
Median	CV (m/s)			NR	(35.2)	NR	56.0	(57.6)	NR	45.8	47.3
SCS	SNAP (V)			NR	(0.1)	NR	2.1	(0.3)	NR	1.2	1.0
Ulnar	CV (m/s)			NR	(14.0)	NR	43.5	(48.0)	NR	46.9	(48.2)
SCS	SNAP (V)			NR	(0.4)	NR	1.2	(0.8)	NR	1.6	(0.7)
Sural	CV (m/s)	NR	NR		NR	(45.0)	NR	NR	NR	NR	(49.0)
SCS	SNAP (V)	NR	NR		NR	(1.8)	NR	NR	NR	NR	(0.7)

CMAP: compound muscle action potential; CV: conduction velocity; DL: distal latency; F: F wave minimal latency; L: left; MCS: motor conduction studies; NR: no response; -: not available; R: right; SCS: sensory conduction studies; SNAP: sensory nerve action potential

Naoki Kasahata,
Severe Guillain-Barré syndrome with motor nerve inexcitability but a good outcome,
Medical Science, 2016, 20(81), 174-180,
www.discoveryjournals.com

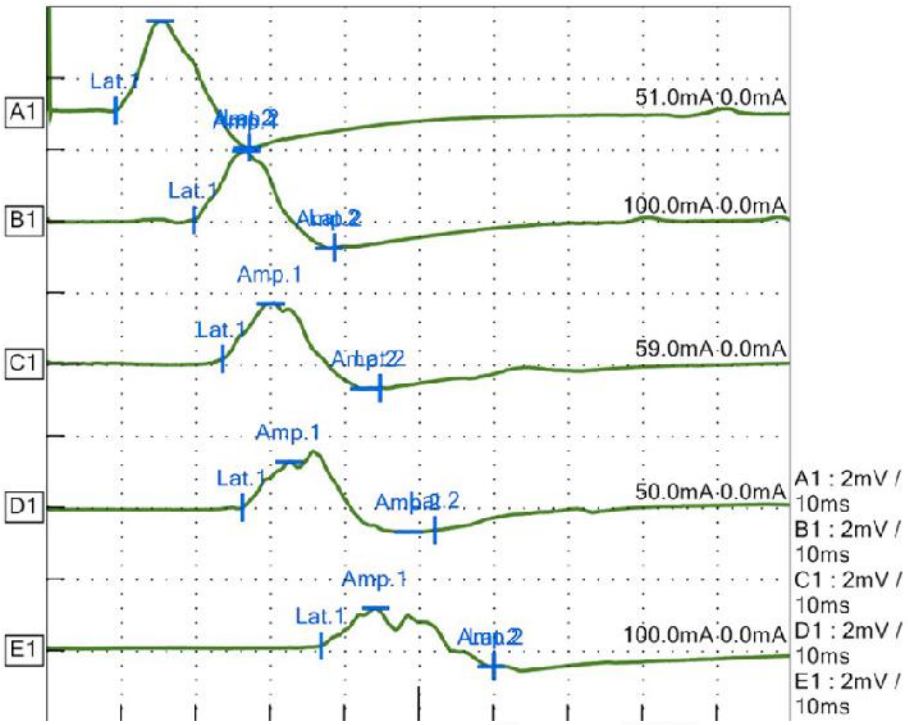

Figure 1 Right ulnar nerve motor conduction study of patient 1 on day 176.
The sites of stimulation include wrist (A1), below the elbow (B1), above the elbow (C1), axilla (D1), and Erb's point (E1).
Distal latency is 9.3 milliseconds. Conduction slowing and prolonged latencies are observed. However, shapes of the compound muscle action potentials are relatively preserved: conduction velocity at forearm is 25.3 meter/second.

4. DISCUSSION

These 2 patients were severe GBS with inexcitable motor nerves but showed a good outcome, especially patient 2 presented with a fulminant course. Both patients met the clinical criteria for GBS defined by Asbury and Cornblath (Asbury et al., 1990). Both patients presented with sensory disturbance and showed inexcitable motor nerves. However, when CMAPs were obtained, they showed conduction slowing and delayed F wave latencies. Therefore, these 2 patients seemed to be acute inflammatory demyelinating polyneuropathy (AIDP).

These 2 patients showed slow recovery (inability to walk independently at six months after onset). Previously, slow recovery AIDP patients are only 2 of 97 GBS patients (Hiraga et al., 2005). Therefore, these 2 patients were thought to be severe AIDP patients.

Since inexcitable motor nerves as findings of acute axonal form of GBS are reported, inexcitable motor nerves early in the course of GBS are considered as poor prognosis (Feasby et al., 1986; Reisin et al., 1993; Feasby et al, 1994; Griffin et al., 1995; Hadden et al., 1998). Only Triggs et al. reported that some patients with motor nerve inexcitablitiy had a good outcome (Triggs et al., 1992). Moreover, a fulminant GBS patient with inexcitability of most nerves but recovered completely is reported (Kang et al., 2007). These patients have reported as AIDP. Present patients shared common findings with these previously reported patients. Therefore, present patients presented with inexcitable motor nerves were associated with severe AIDP. However, Cross and Triggs argue against axonal GBS (Cros et al., 1994). After establishment of AMAN (acute motor axonal neuropathy) (Griffin et al., 1995), present patients seemed to be only cases report of severe GBS with inexcitable motor nerves but a good outcome because previous one is a case report.

AIDP (Acute Inflammatory Demyelinating Polyneuropathy): Demyelinating form of Gullain-Barré syndrome. AIDP is usually large fiber dominant and motor dominant acute sensori-motor neuropathy. Sometimes it present with autonomic nerve involvement. AIDP is a common form of GBS in Caucasians.

Naoki Kasahata,
Severe Guillain-Barré syndrome with motor nerve inexcitability but a good outcome,
Medical Science, 2016, 20(81), 174-180,
www.discoveryjournals.com

AMAN (Acute Motor Axonal Neuropathy):
AMAN is an axonal form of GBS. AMAN is usually pure motor neuropathy. AMAN is common in Chinese, frequent in Japanese, but rare in Caucasians.

Rehabilitation:
Sufficient rehabilitation may be difficult for severe Guillain-Barré syndrome patients. Ventilator dependent periods may be long in severe Guillain-Barré syndrome patients. It may be another reason for difficulty in sufficient rehabilitation for severe Guillain-Barré syndrome patients in Japan.

Why motor nerves showed inexcitability? Possible mechanisms include as follows: distal conduction block corresponding to denuded axon; very slow CMAPs that we were unable to identify; elevated threshold such as tissue edema of surrounding nerves; and axonal degeneration. Obtained CMAPs showed slow conduction velocity and the shape of CMAPs were preserved. These findings suggested that demyalination and remyelination processes were homogenous. Based on these findings, distal conduction block or very slow CMAPs were the considerable causes of inexcitability of present patients.

Prognoses of severe GBS patients are not so good and difficult to walk independently (Rees et al., 1998). These 2 patients, however, presented with severe GBS but showed a good outcome. The considerable reasons of the good outcome of present patients included as follows: underlying pathology seemed to be AIDP; proper treatment using -globulin or plasmapheresis; respiratory management in ICU; and sufficient rehabilitation.

5. CONCLUSION

We think some severe GBS patients with inexcitable motor nerves show a good outcome. Inexcitable motor nerves in the initial stage of GBS do not always suggest axonal degeneration. Therefore, if motor nerve inexcitability is observed, proper management and sufficient rehabilitation are required. Proper treatment, respiratory management in ICU, and sufficient rehabilitation improved prognosis.

SUMMARY OF RESEARCH

1.We think some severe GBS patients with inexcitable motor nerves show a good outcome.
2.Inexcitable motor nerves in the initial stage of GBS do not always suggest axonal degeneration. They may suggest demyelination: distal conduction block or very slow CMAPs.
3.Proper treatment using -globulin or plasmapheresis, respiratory management in ICU, and sufficient rehabilitation improved prognosis of severe AIDP.

FUTURE ISSUES

I believe that the mechanism of the inexcitable motor nerves in the initial stage of AIDP will be revealed. Detailed and frequent nerve conduction study of severe AIDP patients will reveal the mechanism. I also believe that the prognosis of severe AIDP will be more improved.

DISCLOSURE STATEMENT

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Naoki Kasahata,
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Naoki Kasahata,
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