AANEM Case Report # 30
Multifocal Motor Neuropathy

Gareth J.G. Parry, MB, ChB
AAEM CASE REPORT #30:
MULTIFOCAL MOTOR NEUROPATHY

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CME STUDY GUIDE

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CERTIFYING ORGANIZATION

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EDUCATIONAL OBJECTIVES

The primary purpose of this case report is to familiarize the electrodiagnostic medicine consultant with the clinical and electrodiagnostic features of multifocal motor neuropathy. The report shows the importance of careful motor nerve conduction studies in nerves which are clinically affected in establishing a correct diagnosis and distinguishing multifocal motor neuropathy from motor neuron diseases. In addition, the pathological features of the disorder and its treatment are described.

INSTRUCTIONS

1. The reader should carefully and thoroughly study this case report. If further clarification is needed, the references should be consulted. Do not neglect illustrative material.

2. Read the CME questions at the end of the case report. Choose the correct answer to each question and record it on the CME Registration form on the last page. Retain a copy of your answers for your records.

3. Complete the Evaluation form on the reverse side of the CME Registration form.

4. After completing the CME Registration and Evaluation forms, mail with a stamped, self-addressed envelope to the AAEM office as indicated.

5. Correct answers to the CME questions and a certificate of CME credit earned will be mailed to you.

6. Review those parts of the case report dealing with the question(s) you answered incorrectly, and read the supplemental materials on this aspect of the subject listed in the references.
Multifocal motor neuropathy (MMN) is a rare neuropathy with many unusual features. Much has been made of a resemblance to motor neuron disease, but the similarities are quite minimal. In fact, the manifestations of MMN are sufficiently characteristic to allow for accurate clinical diagnosis in the majority of cases. However, a completely confident diagnosis rests on the electrodiagnostic studies, which show severe conduction block which is confined to motor axons. Pathological studies show inflammatory demyelination and lend credence to the hypothesis that this is an immune-mediated disorder, perhaps akin to chronic inflammatory demyelinating polyneuropathy (CIDP). Further support for this notion comes from the association, in some cases, with high titers of antibodies to GM1 ganglioside and the sometimes gratifying response to immune manipulation.

CASE REPORT

History. A 57-year-old man noticed fasciculations, which developed in his right forearm in early 1978, following heavy lifting. Over the subsequent years, the fasciculations spread to the shoulder region and in late 1979, he developed mild weakness in the shoulder. The weakness progressed slowly until his first neurological evaluation in late 1981. At the time, the patient’s complaints of weakness were confined to the shoulder. There was no subjective weakness elsewhere, and he had no sensory complaints. Examination showed obvious fasciculations in the muscles around his right shoulder girdle and in the extensor muscles of the forearm. There was mild weakness of the spinati, deltoid, biceps, and the wrist and finger extensors. Sensation was normal. Biceps and brachioradialis reflexes were reduced on the right but
all other reflexes were normal, and the Babinski response was negative. Needle electromyography (EMG) showed “chronic neurogenic changes in C5-6 muscles.” Nerve conduction studies were not reported. The patient was diagnosed with “focal motor neuron disease” and was followed clinically. Weakness progressed very slowly over subsequent years. In between his 6 monthly evaluations, no obvious deterioration occurred; however, it ultimately became clear that the weakness was becoming worse. He developed atrophy, particularly of the spinati, deltoid, and biceps. In May of 1983, the patient transiently deteriorated more rapidly, with an associated attack of asthma, but spontaneously returned to baseline within a matter of weeks. At the time, he was also found to have an immunoglobulin G (IgG) lambda monoclonal gammopathy, which was of undetermined significance. The weakness and atrophy slowly continued to worsen and in 1988, 10 years after his initial motor symptoms, he developed his first sensory symptoms, consisting of intermittent paresthesias in the right thumb and index finger. There was no objective sensory loss. During 1992, the patient had several asthmatic attacks and noted that he became weaker during each and returned to baseline within a few weeks, in some cases during treatment for the asthma with corticosteroids. Because of these apparent relapses and remissions and the restriction of weakness to muscles innervated by individual peripheral nerves, his new neurologist considered that this might be a clue to an underlying immune-mediated neuropathy and ordered repeat electrodiagnostic studies.

Examination (November 1992). Neurological abnormalities were confined to the right arm. There was severe atrophy of biceps and less severe atrophy of the spinati, deltoid, brachioradialis, and the muscles of the posterior forearm. Occasional fasciculations were seen in these same muscles. He was unable to flex the elbow against gravity and could only minimally flex with gravity eliminated. The spinati and deltoid were rated at 3/5 on the Medical Research Council (MRC) scale. Wrist and finger extensors were 4/5. Strength and bulk were normal in triceps, wrist, and finger flexors, and median and ulnar innervated hand muscles. Despite complaints of intermittent paresthesias, the sensory examination was normal. The biceps reflex was absent, the brachioradialis reflex was barely elicitable, and the triceps reflex was reduced compared to the left. There was no palpable enlargement of nerves in the arm or in the supraclavicular fossa.

Laboratory Studies. Routine laboratory studies, which included complete blood count, liver function tests, thyroid function tests, crythrocyte sedimentation rate (ESR), and antinuclear antibodies, were all normal. Serum protein electrophoresis revealed a monoclonal spike in the gamma region. Immunofixation studies showed this to be an IgG lambda monoclonal protein. Skeletal roentgen-ray survey, bone scan, and bone marrow examination were normal. IgG and IgM antibodies to GM1 ganglioside were not elevated but there was a mild increase in IgM antibodies to asialo-GM1 (patient = 1240, control < 600). Magnetic resonance imaging (MRI) of the brachial plexus showed marked enlargement of the C6 nerve root and the upper trunk of the brachial plexus with high signal intensity on the T2-weighted images and gadolinium enhancement (Fig. 1).

ELECTRODIAGNOSTIC STUDIES

Methods. Motor nerve conduction studies were done with supramaximal percutaneous stimulation. To ensure that stimulation of proximal nerves in the brachial plexus was supramaximal, the current was slowly increased until no further increase in compound muscle action potential (CMAP) amplitude was detected. The current output of the stimulator was then doubled and a single stimulus was delivered to ensure that the amplitude did not increase further. The CMAP was recorded with surface electrodes; the active electrode was placed over the motor point of the muscle and the indifferent electrode over the muscle tendon. The musculocutaneous nerve was stimulated in anterior axillary fold and at the level of the lateral cord of the brachial plexus with recording made from the biceps. The radial nerve was stimulated at the elbow, in the radial groove, and at the level of the posterior cord of the brachial plexus with recording made from extensor indicis proprius.

FIGURE 1. Magnetic resonance imaging of the brachial plexus.

The increased signal from the greatly enlarged upper trunk of the brachial plexus on the right side is indicated by the arrowheads.
Sensory nerve conduction studies were done with surface stimulation but the sensory nerve action potentials (SNAPs) were recorded with near-nerve platinum needles. Needle EMG was done with disposable concentric needle electrodes.

**RESULTS**

**Nerve Conduction Studies.** Motor nerve conduction studies (Figs. 2 and 3, Table 1) showed signs of demyelination consisting of severe conduction block in the musculocutaneous and radial nerves on the right with marked conduction slowing in the radial nerve between the spiral groove and the supraclavicular fossa. Ulnar motor nerve conduction studies were normal. The median distal motor latency was prolonged and the median sensory conduction across the carpal tunnel was markedly slowed, indicating carpal tunnel syndrome. More proximal median conduction studies were normal. The lateral antebrachial cutaneous sensory amplitude was normal but the radial and ulnar sensory amplitudes were mildly reduced (Table 2).

**Needle EMG.** There was abundant fibrillation in the infraspinatus, supraspinatus, deltoid, and biceps but none in the triceps, extensor digitorum communis (EDC), abductor pollicis brevis (APB), or the first dorsal interosseous (FDI). No fasciculations or myokymia were seen. No motor units were recruited in the biceps. In the spinati and deltoid, there was severely reduced recruitment of large-amplitude, long-duration motor unit potentials, many of which were

**Table 1. Motor Nerve Conduction Studies.**

<table>
<thead>
<tr>
<th></th>
<th>Amplitude (mV)</th>
<th>Latency (ms)</th>
<th>MCV (m/s)</th>
<th>F wave (ms)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Median</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Wrist</td>
<td>6.1 (&gt; 5)</td>
<td>4.6 (&lt; 4.5)</td>
<td>47.0 (&gt; 48)</td>
<td>34.9 (&lt; 32)</td>
</tr>
<tr>
<td>Elbow</td>
<td>5.7</td>
<td>8.8</td>
<td>55.0</td>
<td></td>
</tr>
<tr>
<td>Axilla</td>
<td>5.7</td>
<td>11.5</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Ulnar</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Wrist</td>
<td>9.2 (&gt; 5)</td>
<td>3.1 (&lt; 3.5)</td>
<td>59.0 (&gt; 48)</td>
<td>34.9 (&lt; 32)</td>
</tr>
<tr>
<td>Elbow</td>
<td>9.0</td>
<td>7.8</td>
<td>65.0</td>
<td></td>
</tr>
<tr>
<td>Axilla</td>
<td>8.5</td>
<td>9.3</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Musculocutaneous</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Axilla</td>
<td>4.6 (&gt; 5)</td>
<td>3.6 (&lt; 3.5)</td>
<td>48.0 (&gt; 50)</td>
<td></td>
</tr>
<tr>
<td>Supraclavicular</td>
<td>0.5</td>
<td>7.8</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Radial</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Elbow</td>
<td>6.5 (&gt; 5)</td>
<td>3.5 (&lt; 3.5)</td>
<td>59.0 (&gt; 50)</td>
<td></td>
</tr>
<tr>
<td>Spiral groove</td>
<td>6.3</td>
<td>6.7</td>
<td>25.0</td>
<td></td>
</tr>
<tr>
<td>Supraclavicular</td>
<td>1.3</td>
<td>16.6</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*MCV* = motor conduction velocity.

*All nerves shown are from the right arm. Normal values in parentheses.*

AAEM Case Report #30: Multifocal Motor Neuropathy
Table 2. Sensory Nerve Conduction Studies.

<table>
<thead>
<tr>
<th>Stimulation</th>
<th>Record</th>
<th>Amplitude (µV)</th>
<th>SCV (m/s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Median</td>
<td>D2</td>
<td>Wrist</td>
<td>NR (&gt; 10)</td>
</tr>
<tr>
<td></td>
<td>Palm</td>
<td>Wrist</td>
<td>1.5</td>
</tr>
<tr>
<td>Ulnar</td>
<td>D5</td>
<td>Wrist</td>
<td>4.9 (&gt; 8)</td>
</tr>
<tr>
<td>Radial</td>
<td>Forearm</td>
<td>Wrist</td>
<td>3.3 (&gt; 15)</td>
</tr>
<tr>
<td>LAC</td>
<td>Forearm</td>
<td>Elbow</td>
<td>6.0 (&gt; 5)</td>
</tr>
</tbody>
</table>

SCV = sensory conduction velocity; D2 = 2nd index finger; D5 = 2nd little finger; LAC = lateral antebrachial cutaneous; NR = no response. All nerves shown are from the right arm. Normal values in parentheses. All conduction velocities should be greater than 50 m/s.

polyphasic. In the EDC, there were less severe abnormalities of motor unit configuration and recruitment. Voluntary activity was normal in the triceps, APB, and FDI.

CLINICAL COURSE

Based on the clinical picture and electrodiagnostic findings, a diagnosis of multifocal motor neuropathy was made and, in June 1993, treatment with high-dose intravenous immunoglobulin (IV Ig) was started. The patient received eight courses of IV Ig of 2 g/kg, each administered over 5 days, at approximately monthly intervals. During this time there was steady improvement in muscle strength, documented on quantitative muscle strength testing (Table 3), paralleled by partial resolution of conduction block (Figs. 2 and 3). The conduction velocity in the musculocutaneous nerve appeared to fall with treatment but this was probably an artifact; in the initial study the amplitude of the proximally elicited response was so low that it was difficult to accurately measure the latency, and the initial velocity was probably incorrect.

DISCUSSION

This case demonstrates the cardinal clinical and electrodiagnostic features of MMN. Clinically, the first indication of a neurological problem was the development of fasciculations in the right arm followed by the gradual onset and indolent progression of highly focal weakness, confined to specific muscles in that arm. The most parsimonious anatomic diagnosis would be a single lesion involving the upper trunk of the brachial plexus, although the weakness of finger extensors, innervated by nerves originating in the middle and lower trunks (C7-8), certainly suggested more extensive involvement. After several years of weakness, the patient also developed atrophy. Despite more than a decade of progressive disease, the weakness remained confined to the muscles initially involved; there was no subjective or objective evidence of spread to the forearm flexors, long finger flexors, or small hand muscles. Nor was there involvement of the left arm, of either leg, or of cranial-innervated or respiratory muscles. Furthermore, the patient never developed objective sensory loss and had only minor, intermittent sensory symptoms; however, there was reduction of reflexes in the right arm.

Table 3. Quantitative muscle strength testing.

<table>
<thead>
<tr>
<th>Date</th>
<th>Shoulder flexion</th>
<th>Shoulder extension</th>
<th>Elbow flexion</th>
<th>Wrist extension</th>
</tr>
</thead>
<tbody>
<tr>
<td>6/93</td>
<td>10.4</td>
<td>25.0</td>
<td>7.3</td>
<td>6.0</td>
</tr>
<tr>
<td>8/93</td>
<td>18.6</td>
<td>40.0</td>
<td>12.9</td>
<td>7.4</td>
</tr>
<tr>
<td>11/93</td>
<td>22.0</td>
<td>44.0</td>
<td>14.6</td>
<td>10.8</td>
</tr>
</tbody>
</table>

Numbers refer to the weight in kilograms that the patient could lift. All values shown are from the right arm.

FIGURE 3. The results of the motor nerve conduction studies performed in the right musculocutaneous nerve is shown. The upper pair of tracings show severe conduction block between the upper arm and the supraclavicular fossa. The lower pair of tracings show partial resolution of the conduction block and improvement in the conduction velocity following several courses of treatment with high-dose intravenous immunoglobulin. The details of the stimulation and recording methods are provided in the text.
Although there was marked nerve hypertrophy on the MRI scan, none was palpable. Clinical nerve hypertrophy does occur and may be profound. Laboratory studies did little to clarify the diagnosis; specifically antibodies to GMI, ganglioside were not elevated and those to asialo-GM1 were only mildly increased. The relationship of the neuropathy to the monoclonal protein is probably coincidental. The patient had symptoms for at least 5 years before the protein was detected, making a causal relationship unlikely. Furthermore, the protein was an IgG lambda spike, which is commonly found in the elderly with no associated disease. While paraproteinemimic neuropathies are usually found with IgM proteins.

The diagnosis of MMN was established by the electrodiagnostic studies, which also demonstrated the importance of examining motor conduction in nerves innervating weak muscles. Over the first 10 years of his illness, this patient had multiple electrodagnostic studies in which median and ulnar motor, but neither musculocutaneous nor radial motor nerve conduction were studied. When finally studied, these latter two nerves showed nearly 90% and nearly 80% conduction block, respectively. There was some temporal dispersion of the proximal response and conduction velocity was reduced. These are the features of a severe but highly restricted demyelinating neuropathy, with foci of demyelination apparently confined to the radial nerve at its origin from the posterior cord of the brachial plexus and to the musculocutaneous nerve at its origin from the lateral cord. EMG showed severe chronic and active denervation, indicating that these were not purely demyelinating lesions. This denervation was somewhat more widespread, involving the spinat and deltoid, indicating that involvement extended proximally into the upper trunk. In fact, MRI showed extension all the way to the C6 root (Fig. 1).

Despite severe axonal degeneration and a 15-year lapse between onset of symptoms and starting treatment, the patient responded well to treatment. Repeated courses of high-dose IVlg have resulted in partial reversal of conduction block accompanied by improvement in strength, as measured both by quantitative muscle strength testing and by his ability to carry out his activities of daily living.

The clinical features of MMN are well exemplified by this case. The essential clinical features are weakness and atrophy, which are often accompanied by fasciculations and cramps and occasionally by myokymia. Perhaps the most unusual clinical feature is the remarkable locality of the weakness and atrophy. Clinical deficits can usually be traced to individual peripheral nerves and often remain extremely restricted in their anatomical distribution for many years, as was the case in this patient. Spinal segmental distribution of findings is unusual and this is among the features that help to distinguish the disorder from motor neuron disease. Atrophy is usually severe but in some muscles there may be relative preservation of bulk in the face of severe weakness. For example, in the patient described here, although there was profound atrophy of the biceps, there was relative preservation of bulk in the spinat and the deltoid despite severe weakness. The lack of atrophy in severely weak muscles may also help to distinguish MMN from other lower motor neuron causes of weakness, such as motor neuron disease. Weakness is usually distally accentuated in MMN but, as this case demonstrates, may be proximal.

Involvement of cranial nerves has been described in only one case and respiratory involvement is equally rare. The disorder has a curious predilection for involvement of the arms, particularly median or ulnar nerves. Symptoms characteristically begin and progress indolently, over years or even decades; one of the author’s patients died, probably of unrelated causes, more than 20 years after the onset of weakness, and a similar duration of disease has been described by others.

Only one probable case has progressed rapidly; van den Bergh and colleagues described a young woman who progressed to quadriplegia within 12 months of onset. In most cases, the weakness remains strikingly restricted in its distribution for many years but spreading to other areas may occur, leading ultimately, in rare instances, to severe disability and even death from respiratory failure. MMN is a predominantly motor neuropathy; however, most cases described in the literature have some sensory signs or symptoms, as did the case described here. Evanescent sensory symptoms around the time of onset of weakness may occur or sensory abnormalities may develop after many years of purely motor disease.

Quantitative sensory testing is abnormal in most cases. Reflex loss is almost always seen in the weakest muscles but is also found in muscles which are strong, suggesting involvement of afferent fibers from muscle spindles. In some cases the reflexes are preserved, despite severe weakness, and this is a feature that has led to confusion with amyotrophic lateral sclerosis (ALS); however, reflexes are not usually increased and there is never overt spasticity or Babinski reflexes. Nor is there involvement of autonomic functions.

The electrophysiological sine qua non of MMN is motor conduction block. By the time a patient presents for electrodiagnostic studies the degree of
conduction block is invariably severe, at least in some nerves. There has been considerable controversy about the degree of segmental amplitude change that is needed to establish the presence of conduction block; however, in MMN there is seldom any doubt. In every case that the author has seen, there has been a fall in amplitude of more than 80% in at least some nerves and even complete conduction block has been described.\textsuperscript{12} It is certainly possible that lesser degrees of conduction block may be seen in mildly involved nerves, but the disease evolves very slowly and by the time the patient seeks medical attention, there is always severe weakness and atrophy and concomitant severe conduction block in the areas which are most symptomatic. The conduction block may be restricted to segments as short as 3 cm, but longer nerve segments may be involved. More than one site of block in a single nerve may occur. The most common site of block is in the distal forearm but any nerve segment, including nerve roots, may be involved.

Conduction velocity through segments of block is usually very slow. Over the nerve segments traditionally used for routine nerve conduction studies, velocity may be relatively preserved, probably reflecting the very short length of nerve involved. Although the very prominent changes in motor conduction are highly localized, there may be subtle abnormalities in a more widespread distribution. Thus, some patients have prolonged distal motor latencies and F-wave latencies, even in nerves not otherwise affected.\textsuperscript{9} The amplitudes of distal motor responses are usually reduced, reflecting the accompanying axonal degeneration. However, the relative preservation of distal amplitude may be an important clue to the underlying demyelinating pathology. For example, in the patient described in this case report, the amplitude of the motor response recorded from the biceps was close to normal despite almost complete muscular paralysis and severe atrophy.

Distal sensory conduction studies are characteristically normal in MMN, although low amplitude responses may be seen, as was the case in this patient. Furthermore, sensory conduction proceeds normally through segments of mixed nerves which show severe, or even complete, motor conduction block. Even when the distal sensory nerve action potential amplitude is reduced, there is no conduction block in sensory fibers.\textsuperscript{12} This suggests that sensory axons, rather than undergoing primary demyelination, may be injured in an "innocent bystander" reaction to closely adjacent motor axons undergoing immune-mediated demyelination. The frequent, albeit mild, sensory features make a mockery of any attempt to distinguish MMN from the multifocal neuropathy described by Lewis and colleagues,\textsuperscript{14} which was also predominantly motor in most patients and which differs from MMN only by virtue of the degree of sensory involvement.

Needle EMG is always abnormal in patients with MMN. In the most severely involved muscles, there is prominent fibrillation, but in less weak muscles there may be none. Fasciculations are also very common and grouped repetitive discharges (myokymia) may also be seen.\textsuperscript{15} The latter comprise an important EMG indication of a demyelinating disorder and are rarely seen in motor neuron diseases. An important, and often overlooked, point which usually enables MMN to be distinguished from ALS and other motor neuron diseases is that the signs of denervation are almost invariably confined to muscles that are clinically weak. In the motor neuron diseases, they are nearly always diffusely distributed and clinically normal muscles are often denervated. In addition, denervation in MMN can usually be traced back to individual peripheral nerve territories, while in motor neuron diseases it is in a spinal segmental pattern. Thus, there may be denervation in median, but not ulnar, innervated muscles, both innervated by the C8-T1 myotomes, a pattern which is not seen in motor neuron diseases. It is not always this straightforward, as this case demonstrates; clinically and by needle EMG, the denervation could have been attributed to a lesion involving the C5-C6 spinal segments and the correct diagnosis is dependent on performing motor nerve conduction studies in nerves innervating weak muscles.

Multifocal motor neuropathy is a disorder which is defined by multifocal motor conduction block. The only established pathological substrate of persistent conduction block is segmental demyelination and, in keeping with this, the primary pathology in MMN is chronic demyelination and remyelination. Although this neuropathy is predominantly motor, changes in pure sensory nerves are often seen but are mild. Most frequently there is mild loss of myelinated fibers with some increase in thinly myelinated fibers and rare, rudimentary onion bulbs.\textsuperscript{2,12,27} Occasionally there is sparse lymphocytic infiltration around epineurial blood vessels. Motor nerves show much more dramatic changes. Most biopsy specimens have been taken intentionally or inadvertently from the brachial plexus\textsuperscript{4,9,15} although identical pathological changes have been described in the proximal ulnar nerve.\textsuperscript{2} There is endoneurial edema, which may be marked and partly accounts for the clinically observed nerve hypertrophy.\textsuperscript{3,16} The edema is diffusely distributed throughout the fascicle. Lymphocytic inflammation has been found in some cases and may be severe. It
is most prominent in the endoneurial space and is concentrated around venules. Many macrophages are also seen. Myelinated fiber density is reduced to a variable degree and many of the remaining fibers are thinly myelinated. In some cases, these thinly myelinated fibers may be concentrated within restricted areas of the fascicle and it is tempting to suggest that these areas correspond to groups of motor axons. Onion bulb formation is a quintessential feature of MMN. Kaji and colleagues noted that they are not well developed and suggested that there may be a relationship between onion bulb formation and MMN, accounting for the persistence of conduction block at highly localized nerve segments. However, extremely exuberant onion bulb formation is also seen. These pathological changes are qualitatively identical to those seen in CIDP. The chief differences is the marked predominance in motor nerves in MMN. The nature of the pathology supports the notion that MMN results from immune-mediated demyelination, perhaps due to high levels of circulating antibodies to GM1 ganglioside or other glycolipids, but sheds little light on why demyelination is so predominant in motor axons.

The role of antibodies to GM1 ganglioside in the pathogenesis of MMN remains controversial. A relationship was suggested by Pestronk, first in 2 patients with well-defined MMN who had high titers and in whom improvement with treatment was paralleled by a fall in antibody titers and later in a larger, but less well-defined, group of 25 patients with distal weakness and proximal conduction block. A high proportion of these patients (84%) had elevated titers, some to a marked degree. However, subsequent studies of sera from patients with spinal muscular atrophy, ALS, CIDP, all disorders which share clinical and electrophysiological features with MMN, showed that they also have increased anti-GM1 antibody titers. Titers are generally higher in MMN than in these other conditions and the very highest titers are almost always from patients with MMN, but it is clear that elevated antibody titers cannot be used to reliably distinguish between MMN and clinically similar disorders. Furthermore, as more and more sera are tested, it has become apparent that high antibody titers are present in only about 50% of patients with MMN so the absence of GM1 antibodies certainly does not rule out MMN if the clinical and electrophysiological picture is characteristic.

A consensus seems to be developing concerning the treatment of MMN. Multiple courses of high dose IVlg probably should constitute the first line of treatment. This treatment was used in the patient outlined in this case study and has resulted in a steady improvement in strength and partial resolution of conduction block. The efficacy of this treatment was first suggested by Kaji and colleagues and since then has been confirmed in several small studies of patients. Early reports indicated that high-dose intravenous cyclophosphamide is also effective; however, the author’s experience has not been positive and the treatment obviously carries significant morbidity. Some patients respond to corticosteroids but the response is inconsistent and the complications frequent due to the need for high doses and long-term treatment. Anecdotally, the author has had some success in reducing the frequency of IVlg treatment by adding corticosteroids, alone or in combination with azathioprine. Plasmafiltration is not useful. Although antibody titers fall in response to treatment with high-dose intravenous cyclophosphamide, efficacy of treatment with IVlg has been shown to be independent of the pretreatment anti-GM1 antibody titer or the change in titer during treatment.

In summary, MMN is a demyelinating neuropathy which has a highly characteristic clinical picture but which can only be diagnosed with confidence with electrodiagnostic studies, concentrating on motor nerve conduction. Pathology is typical of immune-mediated demyelination, lending credence to the autoimmune hypothesis concerning its pathogenesis. Most patients respond to treatment by immune manipulation and high-dose IVlg is currently the treatment of choice.

REFERENCES


