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THE PATTERN OF ELECTROPHYSIOLOGICAL ABNORMALITIES IN A GROUP OF ROMANIAN PATIENTS

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ABSTRACT

Introduction: Electrodiagnostic studies measure muscle response or electrical activity in response to nerves stimulation of the muscle and consist in nerve conduction studies, needle electromyography, repetitive stimulation, late and blink reflexes. These methods provide data about primary motor neurons, nerve roots, brachial and lumbosacral plexuses, peripheral nerves, neuromuscular junctions and muscles disorders. **Methods:** We evaluated the frequency and type of nerve and muscle lesions on a group of 205 patients in Neurophysiology Laboratory from University of Medicine and Pharmacy of Craiova, Romania. Neuropack S1, EMG/EP Measuring System (Nihon Kohden) and surface electrodes were used for electroneurography and concentric EMG needle electrode for needle electromyography studies. We performed electroneurography for all patients and needle electromyography in 41 selected cases. Standard motor and sensitive nerves were evaluated, measuring latency, amplitude, duration of the response and conduction speed. **Results**: We found abnormal values in 87.32% of patients and normal results in 12.68%. Among abnormal cases, 173 (84.39%) had neuropathic pattern, 4 (1.95%) had myopathic pattern and in 2 (0.97%) cases neuromuscular junction lesions were recorded. Median neuropathy at the wrist (59 cases – 28.78%) was the most common neuropathic pattern, followed by different types of polyneuropathy (46 cases - 22.43%) and lumbosacral radiculopathy (28 cases – 10.65%). The motor neuron disease was found in only 2 cases (0.97%). **Conclusion:** The electrodiagnostic study is an important tool to evaluate the lesion site (muscle or nerve), pathophysiology (e.g. axonal or demyelinating) and severity of neuromuscular disorders.

KEYWORDS: electrodiagnostic study, neuromuscular disorders, nerve conduction, electroneurography, needle electromyography.

INTRODUCTION

Neuromuscular disorders include a group of diseases that affect motor nerves, muscles or neuromuscular junctions.[1,2] Both electrodiagnostic study and neurologic examination are very important tools for diagnosis of neuromuscular disorders.[1,3] Electrodiagnostic studies measure muscle response or electrical activity in response to nerves stimulation of the muscle and consist in nerve conduction studies, needle electromyography, repetitive stimulation, late and blink reflexes.[2,3] These methods provide data about primary motor neurons, nerve roots, brachial and lumbosacral plexuses, peripheral nerves, neuromuscular junctions and muscles disorders.[1,4]

The electrophysiological findings can be crucial in diagnosis of some diseases showing a neuropathic pattern in neuropathy or motor neuron disease, a myopathic pattern in myopathy or a characteristic pattern in neuromuscular junction disorders.[5] Also, analysis of combined pattern of abnormalities in nerve conduction study and needle electromyography make possible the assessment of the phase (hyperacute, acute or chronic) and sometimes the severity of the disease.[6]

The aim of our study was to evaluate the frequency and type of nerve and muscle lesions in a group of 205 Romanian patients.

METHODS

This retrospective study was carried out in in Neurophysiology Laboratory from University of Medicine and Pharmacy of Craiova, Romania. A total of 205 patients were included in this study, between 2015 and 2017 and informed consent was obtained from all to use data for research studies. Neuropack S1, EMG/EP Measuring System (Nihon Kohden) and surface electrodes were used for electroneurography and concentric EMG needle electrode for needle electromyography studies. We performed electroneurography for all patients and for selected cases, when needed, needle electromyography. Standard motor

and sensitive nerves were evaluated, measuring latency, amplitude, duration of the response and conduction velocity.

The study was approved by the Ethics Committee of University of Medicine and Pharmacy of Craiova, Romania.

RESULTS

A total of 205 patients were electrophysiologically investigated. The nerve conduction studies were provided to all participants and needle electromyography was done in 41 patients. We found abnormal values in 87.32% of patients and normal results in 12.68% (Table 1).

Among abnormal cases, 173 (84.39%) had neuropathic pattern, 4 (1.95%) had myopathic pattern (Fig. 1 and Table 2) and in 2 (0.97%) cases neuromuscular junction lesions were recorded. Median neuropathy at the wrist (59 cases – 28.78%) was the most common neuropathic pattern, followed by different types of polyneuropathy (46 cases - 22.43%) (Table 3) and lumbosacral radiculopathy (28 cases – 10.65%). The motor neuron disease was found in only 2 cases (0.97%).

Table 1: The frequency and type of electrophysiological findings.

Electrodiagnostic studies	Cases
Normal	**26 (12.68%)**
Neuropathic pattern	**173 (84.39%)**
- *median neuropathy at the wrist*	59 (28.78 %)
- *ulnar neuropathy at the elbow*	4 (1.95%)
- *peroneal neuropathy*	14 (6.82%)
- *motor and sensory axonal polyneuropathy*	14 (6.82%)
- *sensory axonal polyneuropathy*	6 (2.92)
- *motor and sensory hereditary polyneuropathy*	4 (1.95%)
- *chronic demyelinating polyneuropathy*	22 (10.73%)
- *L5 radiculopathy*	20 (9.75%)
- *S1 radiculopathy*	8 (3.90%)
- *cervical discopathy*	18 (8.78%)
- *brachial plexopathy*	2 (0.97%)
- *motor neuron disease*	2 (0.97%)
Myopathic pattern	**4 (1.95%)**
Neuromuscular junction lesions	**2 (0.97%)**

Table 2: Needle EMG findings in a case with myositis.

Muscle	Side	Insertional Activity	Fibs	Pos. wave	Fasc	Polyphasic	Normal MUP	Low Amp	High Amp	Durate	Recruitment
Biceps brachii	Left	Increased	+2	+2	0	N	+1	+3	0	Short	Full
Biceps brachii	Right	Increased	+3	+1	0	N	+2	+2	0	Short	Full
Deltoideus	Right	Normal	+2	+1	+1	N	+2	+2	0	Short	Full

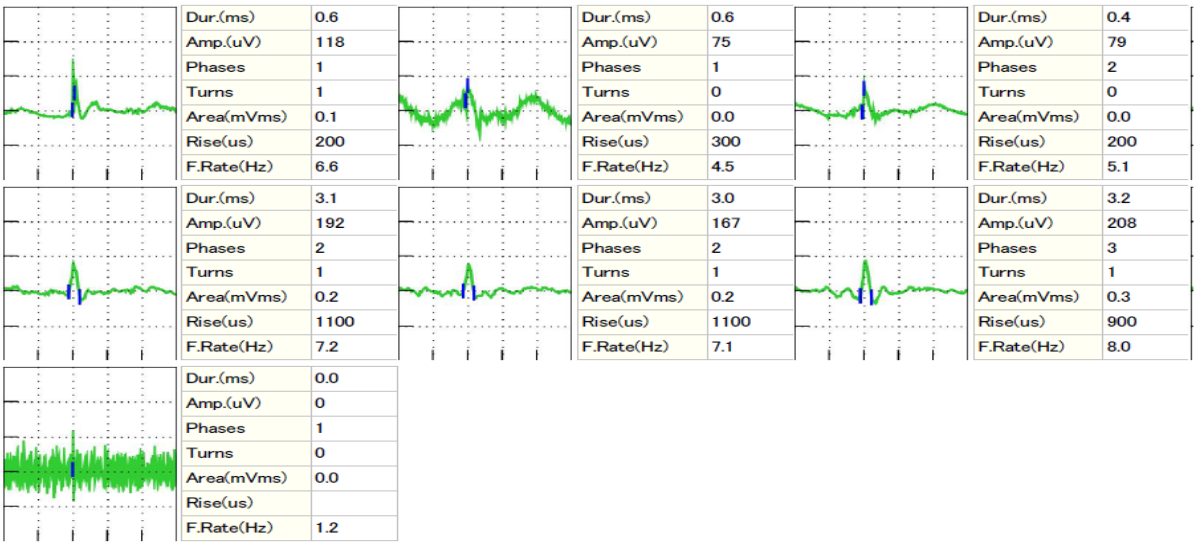

Figure 1: Motor unit action potentials analysis on right biceps brachii – a myositis case.

Table 3: Motor nerve conduction study in case with chronic demyelinating polyneuropathy.

Nerve/site	Latency (ms)	Amplitude (mv)	Nerve conduction speed (m/sec)
Nerve median right			
Wrist	4.9	9.0	39.1
Elbow	9.8	8.4	
Nerve peroneal left			
Ankle	6.0	3.9	34.5
Below fibula head	14.7	2.5	
Above fibula head	17.8	2.4	
Nerve peroneal right			
Ankle	6.4	4.6	34.2
Below fibula head	12.3	2.8	
Above fibula head	15.0	2,2	
Nerve tibial left			
Ankle	8.4	5.0	31.1
Popliteal	19.3	4.4	
Nerve tibial right			
Ankle	6.2	12.5	41.0
Popliteal	15.0	4.9	

DISCUSSIONS

The electrodiagnosis was achieved after electroneurography and electromyography in selected cases followed by analysis and interpretation of results, taking into consideration the clinical data.[1]

Nerve conduction studies assessed the sensitive and motor response and we evaluated the shape, amplitude, latency and conduction velocity of an electrical signal conducted over the tested nerve.[4,5] Two type of lesions can occur: axonal and demyelinating lesions, each being characterized by a distinctive pattern. Axonal loss leads to lower amplitudes, while demyelination lesions causes prolonged latency and slow conduction velocity.[6] Furthermore, a mild slowing of conduction velocity and prolongation of the distal latency may occur in axonal neuropathies if the fastest axons are lost.[6,7] Demyelinating lesions determine slowing of conduction velocity (slower than 75% of the lower limit) and prolongation of the distal latency (more than 130% of the upper limit).[7,8] Secondary axonal loss is found often in severe or chronic demyelinating lesions.

Needle electromyography can detect active axonal damage according to the presence of spontaneous muscle fiber activity (positive sharp waves and fibrillation potentials) at rest as result of denervation.[5] Analysis motor unit potentials (MUAPs) on needle EMG helps to determine the severity of nerve injury.[9] Long duration, large amplitude and polyphasic motor unit potentials are seen in chronic axonal neuropathies.[5] In demyelinating neuropathies, denervation and reinnervation do not occur, that is why no spontaneous activity is found and MUAP morphology is normal.[10]

In muscle disorders, electromyography show characteristic MUAPs with short duration, low amplitude and polyphasia with normal or early recruitment. Also, fibrillation potentials and positive sharp waves may appear.[7,10] Recruitment is early or full in myopathy, many MUAPs are recruited for maximal contraction because each small motor unit is able to generate only a reduced amount of force compared with normal.[10]

In conclusion, the electrodiagnostic study is an important tool to evaluate the lesion site (muscle or nerve), pathophysiology (e.g. axonal or demyelinating) and severity of neuromuscular disorders.

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