THE VALUE OF ELECTROMYOGRAPHY IN NEUROLOGY
AND NEUROSURGERY*

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It is the purpose of this paper to survey the increasing value of electromyography as an aid in the field of neurologic diagnosis. In 1943 Weddell, Feinstein and Pattle presented some of the clinical applications of electromyography. Since then much valuable investigative work has been done. It would seem timely, therefore, to present a systematic review of how the electromyograph can be of practical use to the clinical neurologist and the neurosurgeon. This practical value largely depends on detecting the presence or absence of lower motor neuron disease which evidences itself by denervation fibrillation potentials accurately recorded both visually and acoustically by the electromyograph. It should be emphasized, however, that electromyography, like any other laboratory procedure, is in no way a substitute for a careful anamnesis and meticulous neurologic examination.

It is now generally accepted that for accurate electromyography it is necessary to use a needle electrode placed directly into the muscle to be tested, rather than the older method using a percutaneous electrode. The authors prefer the Meditron Clinical Electromyograph, Model 201, which utilizes a monopolar needle electrode, a cathode ray oscilloscope, a sensitive sound amplifier and a myoscope.

We have used this instrument to examine patients with the usual wide variety of disorders seen in the practice of clinical neurology and neurosurgery. We have been surprised by the amount of useful diagnostic information obtained. Many puzzling problems that could not be accurately diagnosed by ordinary clinical means fell, logically, into their proper classification with the information given us by the electromyograph. We shall attempt to present the bioelectric findings in diseases of the nervous system, and to point out features that have proved useful in differential diagnosis.

A detailed description of the Meditron Clinical Electromyograph, and the methods used in its clinical application, have been recently published. In addition, a myoscope is now available which permanently records, by means of a magnetic tape, electromyographic patterns. This tape can be played back through the instrument and faithfully reproduces, visually and acoustically, the muscle action potentials as recorded at the time of the original examination.

Those diseases of the spinal cord that affect the anterior horn cells often are not only diagnostically confusing, but difficult to detect in their early stages. Since one of the causes of denervation fibrillation is anterior horn cell damage, it is often possible, with the electromyograph, to detect minimal or early involvement where the classical clinical signs are absent. We have found this of particular value in cases in which the patient has been diagnosed as having a “functional” rather than an organic disorder. In other words, no true objective neurological abnormalities could be found, yet the patient’s symptoms were corroborated as organic by the EMG findings of scattered lower motor neuron disease. Case 1 illustrates this point:

Case 1. Mrs. P., a 60-year-old white female, entered Mercy Hospital with the chief complaint of increasing weakness and numbness of both legs over a period of 6 months. She stated that these symptoms had come on gradually after the death of her husband, accompanied by nervousness and depression. The disability had progressed to the point where she could no longer climb stairs.

Neurological examination revealed only absent abdominal reflexes, diminished ankle jerks, and generalized weakness of the lower extremities without fasciculations or focal atrophies. The plantar responses were flexor. Vibratory and position sense were slightly diminished. No true loss of pain, touch or temperature sensation could be demonstrated. Ethyl iodophenylundecylate myelography was negative. A psychiatric diagnosis of psychoneurosis, conversion hysteria, was made.

The EMG, however, revealed evidence of diffuse lower motor neuron disease of all four extremities, more marked in the lower. A diagnosis of arteriosclerotic myopathy was suggested. Subsequently the disease progressed to almost complete spastic paraplegia with bilateral extensor plantar responses.

DEGENERATIVE DISEASES OF THE SPINAL CORD

The EMG achieves one of its most important functions in the diagnosis of degenerative diseases of the spinal cord. For example, in early amytrophic lateral sclerosis clinical examination may reveal evidences of anterior horn cell damage only in the intrinsic muscles of the hands, whereas electromyographic examination demonstrates denervation fibrillation and fasciculation voltages in the lower extremities as well. Later in the disease the EMG continues to reveal this widespread anterior horn cell damage, even though it is impossible clinically to demonstrate it in the lower extremities because of the marked pyramidal tract involvement producing a spastic paraplegia. It should be emphasized that careful multiple needle insertions must be made in the various muscles in all four extremities in order to demonstrate these abnormal electrical impulses. This is necessary because the frequency of the diagnostic wave forms varies from muscle to muscle. Thus, multiple sampling becomes an indispensable feature of accurate electromyography. We have all seen patients who are suspected of having either amyotrophic lateral sclerosis or a cervical cord tumor. If denervation fibrillation and fasciculation voltages in such a patient are found in the lower extremities, the possibility of a cervical cord tumor is automatically ruled out.