



Review article

The utility of electrodiagnostic tests for the assessment of medically unexplained weakness and sensory deficit



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ABSTRACT

Patients with suspected medically unexplained symptoms or psychogenic disorders are frequently requested to undergo an EMG exam. However, the suspected diagnosis is not always told to the electromyography practitioner, who must be able to recognize such a condition to avoid false positive diagnosis without dismissing the possibility to uncover any true dysfunction. There are many clinical manoeuvres to assess the consistency of the patients' reported weakness or sensory deficit. The electrodiagnostic practitioner should be aware of those clinical tricks and interpret the electrodiagnostic findings in the clinical context. There are many electrodiagnostic tests that the practitioner can use for the assessment of motor and sensory functions but these tests have also important drawbacks and limitations. Only after a good clinical evaluation would the practitioner be able to give his/her opinion on the clinical relevance of the electrodiagnostic findings. Here we review some of the tests that can help the practitioner to define the electrophysiological characteristics of a suspected functional disorder presenting with weakness or sensory deficit.

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1. Introduction

Loss of strength or sensation are two of the most common symptoms for referral of patients to electrodiagnostic testing. The

examiner can use a variety of techniques in search of a pathophysiological explanation for those symptoms compatible with the clinical context. In theory, the examiner carrying out electrodiagnostic tests should report on objective parametric data, with as much quantitation as possible, for clinicians to figure out the whole spectrum of paraclinical tests in light of the clinical evaluation. Today's electrodiagnostic tools allow for assessment of many sensory and motor segments, including central tracts and peripheral nerves and, therefore, there are many possibilities for

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a dedicated electrodiagnostic expert to find the clinical-neurophysiological correlate of the disorder in question.

Unfortunately, though, time constraints in busy clinics and patient compliance generally limits the number of electrodiagnostic tests that can be performed. Furthermore, the expert in electrodiagnostic medicine knows that the results obtained make sense only if the tests performed were based on a clinical logic. To do that, the electrodiagnostic practitioner has to use data from patient's history and physical examination to decide on the steps of further testing and finally issue a clinically relevant report. Often, the referral note is not sufficient. The examiner should be aware of the possibility that some relevant symptoms and signs, not necessarily stated in the referral, are very relevant for the outcome of the study. Indeed, the electrodiagnostic examiner is the one ultimately responsible for the report, whatever be the syndrome that led to the patient's presentation for the examination. In fact, a good electrodiagnostic practitioner should have a thorough technical and clinical expertise, together with the necessary writing skills to be able to transmit to the referring physician his/her opinion beyond just cold data. Good practice in electrodiagnostic medicine contemplates as much refraining from raising clinically unfounded suspicions as not letting pass by clinically undiagnosed syndromes in which the electrodiagnostic tests play a relevant role.

Among the syndromes challenging the capacity of the electrodiagnostic practitioner are the medically unexplainable symptoms that affect the nervous system (Carson et al., 2000). The term psychogenic has been used for many years to describe this type of disorder but the more convenient term 'functional disorders' is now recommended (Stone and Carson, 2011). That a given disorder is functional and not derived from a recognizable neurological disorder is not a straightforward diagnosis. The clinical expression of some neurological disorders may be modified by will or adaptation, either amplifying or reducing the symptoms known to characterize the disorder. Compensatory mechanisms may be at play, which may modify the clinical expression in a way unknown to the patient, and sometimes also to the physician. On some occasions, the presence of a psychogenic disorder masks the diagnosis of a neurological disease with similar symptoms, as has been the case in a percentage of patients in many series of patients with functional neurological disorders reported so far. Finally, symptoms may derive from true psychiatric dysfunctions such as conversion disorder or hypochondria, or from disease-unrelated conditions, such as factitious disorders or malingering (Hallett, 2006, 2010). Table 1 summarizes the classification of the medically unexplained syndromes, according to the certainty of the diagnosis.

Most reports on medically unexplainable symptoms in neurology have dealt with functional movement disorders, which have

attracted the attention of researchers for a long time (Fahn and Williams, 1988; Koller et al., 1989; Lang et al., 1995; Stone et al., 2002, 2005; Hallett, 2006, 2010; Edwards and Bhatia, 2012; Ricciardi et al., 2015a). Research in this area has led to the development of interesting electrodiagnostic tests to uncover the voluntary nature of some apparently involuntary movements (Hallett, 2010). This is the case for myoclonus (Thompson et al., 1992; Brown and Thompson, 2001), tremor (O'Suilleabhain and Matsumoto, 1998; Kumru et al., 2004) and in some forms of dystonia (Schwingenschuh et al., 2011; Macerollo et al., 2015a). These patients are commonly referred for specific electrodiagnostic studies, in search of laboratory support for a clinically-based diagnostic suspicion of functional disorder. This is indeed an attractive challenge for researchers in the various neurophysiological techniques that characterize voluntary and involuntary movements. However, the electrodiagnostic examiner often faces situations in which patients complain of weakness or sensory deficit with uncertain diagnosis. In many countries, the physician referring the patient for an electrodiagnostic study may not be a neurologist, and he/she may hope that the electrodiagnostic examination shows clearly if the motor or sensory deficit described by the patient is related or not to a known neurological disorder, to decide on the next step. It is therefore the responsibility of the electrodiagnostic examiner to use all clues available to build up his/her opinion on the case, including history and physical examination data (Hallett, 2016) to finally write a sensible report on the patient's case. What follows is a review of the clinical and electrodiagnostic clues that the electrodiagnostic expert may use to determine whether or not the patient's symptoms of weakness and sensory deficit are related to a neurological disorder or are non-neurological in nature.

2. Functional weakness

According to Stone et al. (2010), functional weakness is defined as weakness that is both internally inconsistent and incongruent with any recognizable neurological disease. They described the incidence, demographic and clinical characteristics of 107 cases. They found that patients with functional weakness were as disabled as patients with weakness due to neurological disease. The most common manifestation of functional weakness is hemiparesis (79% of the 107 cases studied by Stone et al. (2010)). However, there may be many other forms of presentation, including weakness of distal or proximal limb segments. There are many exploratory tricks to uncover functional weakness (Stone et al., 2012; Tremolizzo et al., 2014). Close observation of how the patient activates the supposedly paretic limb during postural tasks may already be very informative. When the suspected psychogenic weakness affects one leg only, the Hoover's maneuver and the abductor's sign (Sonoo, 2004) may be very helpful. In Hoover's maneuver, the subject fails to press against the bed with the healthy leg when requested to raise the weak one. In the abductor's sign, the subject fails to fix the non paretic leg in a neutral position when requested to abduct the weak leg, while he/she is holding the paretic leg in a fixed straight position when requested to abduct the non-paretic one (see Sonoo (2004 for a graphical explanation of the maneuver). When supposedly psychogenic weakness affects both feet, some useful clinical information can be obtained by observing whether or not synkinetic movements occur in the upper limbs in the attempts to dorsiflex the toes. This is indeed the case shown in Fig. 1, where the patient with true weakness of dorsiflexion of the feet showed an involuntary extension of the hand and fingers accompanying his unsuccessful efforts to counteract the resistance offered by the examiner's hands opposing feet dorsiflexion. This indicates that the patient was indeed trying hard to perform the requested task. Such synkinesis is

Table 1
Classification of the medically unexplained syndromes.

Category	Definition
Possible	Symptoms consistent and congruous with a known disease but signs of obvious emotional disturbance or secondary gain
Probable	Symptoms consistent and congruous with a known disease but the patient has traits of psychogenicity or a psychiatric disorder
Clinically established	Symptoms are inconsistent and incongruent and the patient shows psychogenic signs, somatizations or psychiatric condition
Documented	Symptoms are completely relieved by placebo or the patient is witnessed to be free of symptoms when feeling unobserved

Adapted from Williams et al. (1995).

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