



The supporting (sometimes decisive!) role of transcranial magnetic stimulation in forensic medicine



Dear Editor,

Most neurologists are aware that approximately one-third of outpatients have symptoms that cannot be explained by a clearly recognized “organic” disease. In such cases, the Diagnostic and Statistical Manual of Mental Disorders-Fifth Edition usually assigns them the diagnostic label of “functional neurological symptom disorder” (FNSD).

In forensic medicine, however, there are two further terms that need to be considered: factitious disorder and malingering. The former refers to those situations where the motivation (gain) is considered “internal” to the patient, e.g., in response to a psychological drive, such as the need for attention or to reduce loneliness. Conversely, in malingering, the motivation is “external” to the patient, typically the possibility to receive money or other forms of compensation.

The prevalence of malingering in patient’s referrals from civil (e.g., personal injuries) and criminal legal settings is estimated to be from 10% to 50% [1] in those seeking compensation who report a wide range of clinical disorders, such as mild traumatic brain injury, whiplash neck injury, and psychogenic non-epileptic seizures, with an estimated cost of 20 billion USD for adult mental disorder claimants [1]. In this scenario, clinical assessment is a multifaceted process that requires an accurate collection of information from several and possibly independent sources, including: review of medical records; history from detailed interviews; observation of patient’s behavior, especially when the subject does not know of being watched; consideration of information from collateral sources; formal psychological and neuropsychological testing; surveillance video.

We report a 26-years old male who came to the Forensic Medicine service of the Azienda Ospedaliero-Universitaria Policlinico “G. Rodolico-San Marco” of Catania (Italy) for a revision of his physical disability certificate. Informed consent was collected, as for routine clinical practice. Three years before, he had a motorcycle incident. At that time, he was admitted to the Emergency Department for clinical observation and discharged after two days without any clinical or radiological evidence of traumatic injury, except for a subjective report of headache and neck pain. A month after the incident, the patient came back to the Emergency Department complaining the persistence of headache and neck pain, as well as the occurrence of paresthesia at the four limbs.

A cervical spine magnetic resonance imaging (MRI) showed a C4–C5 disk protrusion, along with an unclear signal hyperintensity within the spinal cord suggestive of compressive myelopathy, which was treated conservatively. Five months after the incident,

he started to complain motor weakness at the four limbs, along with some gait difficulties. For this reason, he underwent surgical laminectomy from C3 to C7, which, however, did not relieve his symptoms. Then, the patients started a legal dispute against the insurance company for compensation claims.

Over the following years, he underwent several medical examinations for a broad range of both neurological and non-neurological symptoms (i.e., respiratory difficulties, bladder incontinence, sensory deficits, worsening of diffuse motor deficit, etc.). However, these examinations produced conflicting findings, including different degrees of sensory and motor impairment, the latter ranging from hemiparesis to paraparesis or tetraparesis. Nonetheless, he was able to receive compensation for sustained injuries and declaration of work inability.

During the visit, he stated to be unable to move if unassisted, except for the head movements; he also complained complete anesthesia below the chin. Deep tendon reflexes were brisk, with flexor plantar responses (negative Babinski sign), while both muscle tone and trophism were preserved. No clear neurological abnormal signs were present. Somatosensory evoked potentials (SSEPs), previously performed, showed normal results. To objectively assess central motor function, motor evoked potentials (MEPs) to transcranial magnetic stimulation (TMS) were recorded at the four limbs, disclosing normal values (Fig. 1). Based on these results, the patient’s profile was considered as malingering, as subsequently confirmed by a psychiatric evaluation, and the financial benefit was then revoked.

As both clinicians and forensic physicians know, limb weakness is a frequent claim in insurance and work-related compensation requests; at the same time, this is probably one of the most readily manipulated features of malingering behavior. Many tests attempting to detect non-organic causes of paralysis, such as the Hoover’s sign, have been proposed for both upper and lower limbs. However, most of these signs have been investigated on small and low quality case-control studies only [2]. Therefore, the diagnosis of functional weakness is often challenging in routine clinical practice, particularly when the examination is not performed by an experienced neurologist. In this context, neurophysiological measures, such as MEPs and SSEPs, have shown a good correlation with neuroimaging findings, allowing to establish a link between structural and functional involvement and to reliably predict functional outcomes.

TMS was originally introduced as a non-invasive and painless neurophysiological tool able to evaluate the excitability of the primary motor cortex and the conductivity along the cortical-spinal tract, thus being applied in many cerebral and/or spinal disorders affecting the motor system, both clinically and subclinically. Normal

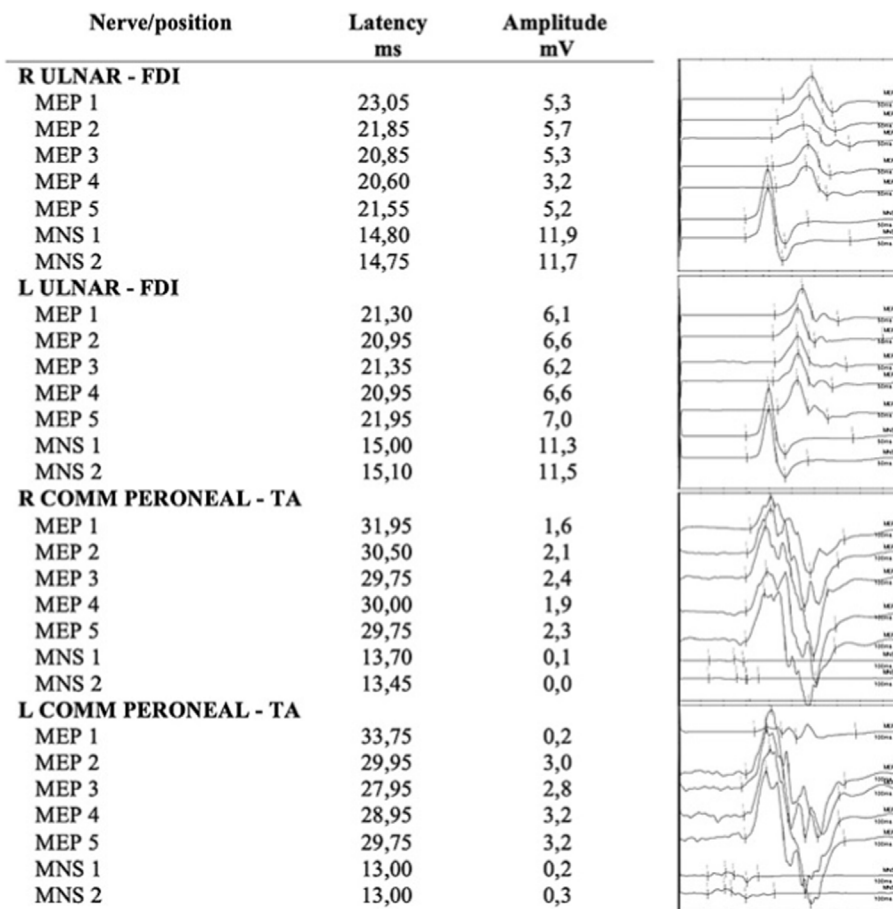


Fig. 1. Motor evoked potentials obtained from the subject. COMM: common; FDI: first dorsal interosseous muscle; L: left; MEP: motor evoked potential; MNS: magnetic nerve stimulation; R: right; TA: tibialis anterior muscle.

reference values sampled on large populations are also available and a good correlation between MEP responses and severity of motor deficit was demonstrated; as such, MEPs represent a highly accurate diagnostic test, particularly for spinal cord diseases [3].

Previous reports confirmed the clinical usefulness of TMS in discriminating between organic motor deficit and functional/non-organic paralysis [4–9], thus speeding up the correct diagnosis (e.g., factitious disorder, FSND, etc.) and guiding a proper management [10]. Surprisingly, however, TMS in forensic medicine is not routinely performed, probably due, at least in part, to a lack of knowledge of the technique and its applications by most of forensic physicians and related operators.

The main limitation of the present paper is the case report-based design. Also, given that no previous spinal MRI was available, it is unclear whether the described injury occurred after the traumatic incident or if it was already present; however, the computed tomography, performed immediately after the incident, showed no abnormality. Finally, MEPs were not recorded before surgery.

Concluding, we encourage for a more widespread use of TMS to support neurological examination, thus providing an objective evaluation in medical-legal disputes or insurance claims and reducing time and costs of diagnostic exams and forensic procedures.

Declaration of competing interest

None.

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