

Rethinking unresponsiveness: Cognitive motor dissociation in disorders of consciousness

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Dear Editor,

Disorders of consciousness encompass a range of clinical states, including unresponsive wakefulness syndrome (UWS), minimally conscious states minus and plus (MCS-, MCS+), emergence from MCS (MCS E), and cognitive motor dissociation (CMD) [1,2]. Table 1 summarizes the behavioral, motor, and neurophysiological features of each category. Accurate assessment of consciousness remains one of the most challenging aspects of neurocritical care.

Recent advances in the field of disorders of consciousness have shown that behavior-based clinical assessments may not always accurately reflect a patient's level of consciousness. CMD, also referred to as covert consciousness, is a recently defined concept describing a dissociation between cognitive processes and motor output [3]. This concept challenges established assumptions about consciousness evaluation in patients who appear clinically unresponsive [1,2,4].

Current evidence suggests that patients identified as having CMD differ from other subgroups of disorders of consciousness in terms of brain network organization and clinical characteristics. This indicates that CMD has been described as a potentially distinct subgroup with unique brain network characteristics, although its classification remains to be fully established. In some patients who are clinically diagnosed at the bedside as having UWS or MCS-, the evidence of willful brain activity using advanced neurophysiological methods

has led to the recognition of this new entity [2,4]. From a diagnostic perspective, CMD is defined by the detection of voluntary brain responses using task-based functional magnetic resonance imaging (fMRI) or electroencephalography (EEG) in patients who show no behavioral signs of consciousness during bedside examination [2,5,6].

Recent studies have also explored alternative techniques for detecting CMD. For example, a 2025 study using functional near-infrared spectroscopy (fNIRS) combined with a motor imagery paradigm detected covert command-following in a subset of patients who were behaviorally diagnosed as UWS or MCS- [7]. Because fNIRS is portable and can be applied at the bedside, it may represent a more accessible tool for identifying covert consciousness in clinical practice [7,8]. However, its clinical applicability and diagnostic accuracy require further validation. Despite these advances, the routine clinical implementation of these techniques remains limited because of technical complexity, cost, and the need for specialized expertise [8].

It is unclear whether CMD is a stage between MCS- and MCS+, or a separate condition [1,4]. This makes its exact classification within current clinical systems uncertain. Nevertheless, since 2017, studies employing task-based fMRI and EEG paradigms have demonstrated the presence of CMD in a subset of behaviorally unresponsive patients in intensive care units [2,4,5]. The true prevalence of CMD in patients with acute and subacute-chronic disorders of consciousness is not yet

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Table 1. Clinical comparison of cognitive motor dissociation and other disorders of consciousness [1-6]

Feature	UWS	MCS-	MCS+	MCS-E	CMD
Behavioral response	No observable response	Very limited, inconsistent	Consistent but limited	Functional, reliable	No observable response
Evidence of consciousness	No behavioral evidence	Inconsistent, low-level signs	Clear but limited	Clear	Brain-based evidence only
Brain response to commands	Not detected	Inconsistent	Present	Consistent	Detected (EEG/fMRI)
Diagnostic method	Bedside examination	Bedside examination	Bedside examination	Bedside examination	Advanced methods (EEG/fMRI)
Motor output	None	Very limited	Limited but intentional	Functional, intentional	None
Clinical significance/prognosis	Poor	Variable	More Favorable	Favorable	Uncertain

Note: Clinical and neurophysiological findings should be interpreted with caution, as responses may vary and false-negative results may occur depending on patient condition and methodology.

Abbreviations: UWS = Unresponsive Wakefulness Syndrome; MCS- = Minimally Conscious State minus; MCS+ = Minimally Conscious State plus; MCS-E = Emergence from MCS; CMD = Cognitive Motor Dissociation.; EEG: Electroencephalography; fMRI: functional magnetic resonance imaging

known with certainty [1,2]. Reported prevalence rates vary across studies, with some suggesting that CMD may be present in a subset of patients with disorders of consciousness. In addition, CMD detection in the ICU has been associated with functional recovery in some cohorts, although findings remain heterogeneous [1,2]. Recent evidence from a large multicenter prospective cohort study further supports the clinical relevance of cognitive-motor dissociation. In this study, task-based fMRI or EEG detected command-following brain activity in approximately 25% of patients who showed no behavioral response to commands at bedside. These findings highlight that a notable proportion of patients who appear clinically unresponsive may retain covert cognitive processing that is not detectable through behavioral examination [2]. Considering that hundreds of thousands of individuals worldwide live with chronic disorders of consciousness, and that access to advanced diagnostic tools remains limited, the number of unrecognized CMD cases may be higher than currently estimated [2].

At present, meaningful communication with patients diagnosed with CMD is not possible. However, advances in EEG-based brain-computer interface systems raise

the possibility that communication with patients in the acute stage of CMD may become feasible in the future [6]. It is still unknown whether a diagnosis of CMD leads to directly actionable treatments, and its prognostic value has not yet been fully clarified. Furthermore, whether and how such findings should be communicated to patients' families raises important ethical concerns [9].

In conclusion, CMD is an important concept that calls for a reconsideration of how disorders of consciousness are evaluated. The integration of advanced neuroimaging and neurophysiological methods into clinical assessment in appropriately selected patients may improve diagnostic accuracy and contribute to more informed prognostic assessment. Importantly, the absence of detectable task-related responses does not exclude preserved consciousness, as false-negative results may occur due to fluctuations in arousal, impaired comprehension, sensory deficits, or methodological limitations. Therefore, negative findings should be interpreted with caution and integrated with clinical and longitudinal assessments. Further studies are needed to clarify the diagnostic, prognostic, and clinical implications of CMD.

Author contribution

Conception and design: O.S.; Data acquisition: O.S.; Data analysis: O.S.; Data interpretation: O.S.; Drafting of the manuscript: O.S.; Critical revision of the manuscript: O.S.; All authors reviewed the results, approved the final version of the manuscript, and agreed to be accountable for all aspects of this study.

Data availability statement

Data sharing is not applicable to this article as no new datasets were generated or analyzed during this study.

Conflict of interest

The authors declares that this study was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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