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The minimally conscious state : Definition and diagnostic criteria

J.T. Giacino, S. Ashwal, N. Childs, et al.

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Table Comparison of clinical features associated with coma, vegetative state, minimally conscious state, and locked-in syndrome

Condition	Consciousness	Sleep/wake	Motor function	Auditory function	Visual function	Communication	Emotion
Coma	None	Absent	Reflex and postural responses only	None	None	None	None
Vegetative state	None	Present	Postures or withdraws to noxious stimuli	Startle	Startle	None	None
			Occasional nonpurposeful movement	Brief orienting to sound	Brief visual fixation		Reflexive crying or smiling
Minimally conscious state	Partial	Present	Localizes noxious stimuli	Localizes sound location	Sustained visual fixation	Contingent vocalization	Contingent smiling or crying
			Reaches for objects	Inconsistent command following	Sustained visual pursuit	Inconsistent but intelligible verbalization or gesture	
			Holds or touches objects in a manner that accommodates size and shape				
Locked-in syndrome	Full	Present	Automatic movements (e.g., scratching)				
			Quadriplegic	Preserved	Preserved	Aphonic/Anarthric	Preserved
						Vertical eye movement and blinking usually intact	

behavioral evidence of consciousness but remain unable to reproduce this behavior consistently. This condition is referred to here as the minimally conscious state (MCS). MCS is distinguished from VS by the partial preservation of conscious awareness.¹³ This distinction is important for prognosis, treatment decisions, resource allocation, and medicolegal judgements. Some studies suggest a high rate of misdiagnosis (false positives and false negatives) among disorders of consciousness.^{14,15} The prevalence of adult and pediatric cases of MCS is estimated to be between 112,000 to 280,000, based on operationally defined diagnostic criteria extracted from a large state registry.¹⁶

This article, prepared by the Aspen Neurobehavioral Conference Workgroup, proposes diagnostic criteria for MCS.

Methods. Evidence review process. Nine formal meetings of the Aspen Workgroup were held between March 1995 and October 2000. National and international delegates represented the fields of bioethics, neurology, neuropsychology, neurosurgery, psychiatry, nursing, and allied health. Although it was not possible for each participant to attend all nine meetings, the current document was approved by all members of the workgroup. All delegates previously participated in the development of discipline-

specific position statements on disorders of consciousness or made substantial contributions to the peer-reviewed literature. A list of the organizations represented by each author appears in the appendix, which also includes the names of all conference participants.

Selected members of the workgroup completed independent MEDLINE searches of published articles using the key words coma, vegetative state, minimally responsive state, stupor, slow-to-recover, severe disability, and Glasgow Coma Scale. These terms were then cross-indexed with brain injury, diagnosis, and outcome in eight different permutations to retrieve articles that included patients who did not meet diagnostic criteria for VS, but at the same time, were not considered fully conscious. A total of 260 abstracts containing one or more of the terms were retrieved. Only five reports^{8,17-20} differentiated patients in VS from those with inconsistent signs of consciousness, defined here as MCS. The workgroup concluded that there were insufficient data to establish evidence-based guidelines for diagnosis, prognosis, and management of MCS. Consequently, consensus-based recommendations were developed for the definition of MCS as well as criteria for entry into and emergence from this condition.

Results. Definition of the minimally conscious state. The minimally conscious state is a condition of severely altered consciousness in which minimal but definite behav-

1. Adequate stimulation should be administered to ensure that arousal level is maximized.
2. Factors adversely affecting arousal should be addressed (e.g., sedating medications and occurrence of seizures).
3. Attempts to elicit behavioral responses through verbal instruction should not involve behaviors that frequently occur on a reflexive basis.
4. Command-following trials should incorporate motor behaviors that are within the patient's capability.
5. A variety of different behavioral responses should be investigated using a broad range of eliciting stimuli.
6. Examination procedures should be conducted in a distraction-free environment.
7. Serial reassessment incorporating systematic observation and reliable measurement strategies should be used to confirm the validity of the initial assessment. Specialized tools and procedures designed for quantitative assessment may be useful.^{17,19,21,25}
8. Observations of family members, caregivers, and professional staff participating in daily care should be considered in designing assessment procedures.

Special care must be taken when evaluating infants and children younger than 3 years of age who have sustained severe brain injury. In this age group, assessment of cognitive function is constrained by immature language and motor development. This limits the degree to which command following, verbal expression, and purposeful movement can be relied on to determine whether the diagnostic criteria for MCS have been met;

Prognosis. The natural history and long-term outcome of MCS have not yet been adequately investigated. It is essential to recognize that MCS may occur in a variety of neurologic conditions, such as traumatic brain injury, stroke, progressive degenerative disorders, tumors, neuro-metabolic diseases, and congenital or developmental disorders. Clinical experience indicates that MCS after an acute injury can exist as a transitional or permanent state. Few studies of the natural history of MCS have been reported.^{22,26,27} Giacino and Kalmar²² followed 104 patients diagnosed with VS (n = 55) or MCS (n = 49) on admission to rehabilitation during the first 12 months after injury. The diagnosis of MCS was made retrospectively using clinical criteria that approximate the current definition. The MCS group showed more continuous improvement and attained significantly more favorable outcomes on the Disability Rating Scale²⁸ by 1 year than did the VS group. These differences were more pronounced in patients diagnosed with MCS after traumatic brain injury. Fifty percent of patients in the MCS group with traumatic brain injury were found to have none to moderate disability at 12 months, whereas none of the patients in the MCS group without traumatic brain injury were classified in these outcome categories. Although it is not known how many patients will emerge from MCS after 12 months after injury, most patients in MCS for this length of time remain severely disabled according to the Glasgow Outcome Scale.²⁹ As with VS, the likelihood of significant functional improvement diminishes over time.

Consensus-based general approaches to care. There are no existing guidelines regarding the care of patients in MCS. Until sufficient empirical data become available, the following general consensus-based approaches to care are recommended. Evaluation and management decisions will

differ depending on the prognosis and the needs of the patient. In all circumstances, the patient should be treated with dignity, and caregivers should be cognizant of the patient's potential for understanding and perception of pain. In early MCS, prevention of complications and maintenance of bodily integrity should be emphasized because of the likelihood of further improvement. Efforts should be made to establish functional communication and environmental interaction when possible. A person with experience in neurologic assessment of patients with impaired consciousness should be primarily responsible for establishing the diagnosis and prognosis and for coordinating clinical management. An additional opinion of a physician or other professional with particular expertise in the evaluation, diagnosis, and prognosis of patients in VS and MCS is recommended when the assessment will impact critical management decisions. Such decisions include, but are not limited to, those regarding changes in level of care, disputed treatment decisions, and withdrawal of life-sustaining treatment.

Future directions for research. The care of patients with severe disturbances of consciousness remains a complex challenge partly because of an inadequate foundation of scientific evidence. There are a number of critical areas in which scientific evidence is lacking and additional research is indicated. These areas include:

1. Incidence and prevalence of MCS.
2. Natural history, recovery course, and outcome.
3. Interrater and test-retest reliability of the diagnostic criteria for MCS.
4. Validation of diagnostic criteria for MCS with respect to pathophysiologic mechanisms and outcome.
5. Differences in rate of recovery and outcome between adults and children.
6. Interactions among cause of the injury (e.g., trauma vs anoxia vs dementia), length of time after onset, and recovery of consciousness.
7. Predictors and patterns of emergence from VS and MCS.
8. Utility of existing assessment methods and scales for monitoring recovery and predicting outcome.
9. Treatment efficacy.
10. Efficacy and cost analysis of different care settings.
11. Issues related to family beliefs and their relation to functional outcome, service use, and evaluative decisions regarding quality of life.
12. Cross-cultural differences in evaluation and management practices.

These recommendations are intended to serve as a reference for clinicians involved in the examination and treatment of patients with severe alterations in consciousness. They are based on the current state of knowledge and are expected to be revised and refined as additional empirical data become available. The primary purpose of these recommendations is to facilitate future scientific investigation and multidisciplinary discussion by providing a common frame of reference for the examination and treatment of patients in MCS.

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