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Preoperative Cognitive Assessment of the Elderly Surgical Patient: A Call For Action

Gregory Crosby, M.D.^{*}, Deborah J. Culley, M.D.[#], and Bradley T. Hyman, M.D., Ph.D.[^]

^{*}Harvard Medical School, Department of Anesthesiology, Perioperative, and Pain Medicine, Brigham and Women's Hospital, Boston, Massachusetts

[#]Harvard Medical School, Department of Anesthesiology, Perioperative, and Pain Medicine, Brigham and Women's Hospital, Massachusetts

[^]Harvard Medical School, Department of Neurology, Massachusetts General Hospital, and Director, Alzheimer Disease Research Center, Charlestown, Massachusetts

Being sick is not good for the brain. Surgery and all that goes with it (*e.g.*, stress, inflammation, pain, medications, anesthesia) makes people sick transiently. It should come as no surprise then that brain dysfunction is common perioperatively. This is a particular problem in elders, with 30–80% becoming delirious after major surgery and 30–40% and 10–15% developing, respectively, early and late postoperative cognitive dysfunction (POCD).^{1,2} This cognitive morbidity is also important; delirium and POCD are associated with longer hospital stay and cost, premature withdrawal from the workforce, and greater 1-yr mortality.^{1,3} Therefore, both in terms of incidence and associated adverse outcomes, perioperative brain dysfunction is every bit as serious as the other varieties of organ system dysfunction for which we routinely screen and evaluate surgical patients preoperatively. Why then don't we routinely and formally assess cognition preoperatively?

The article by Evered *et al.*⁴ in this issue of the Journal sheds light both on the complexity of doing so and what we might find if we looked. Evered *et al.*⁴ prospectively assessed cognition in 152 patients over the age of 60 yr who were scheduled for elective total hip replacement. They used two different constructs to identify impairment. One, called PreCI (preexisting cognitive impairment), is defined entirely by performance on neuropsychological tests. In this case, it was defined by poor performance on ≥ 2 of 7 cognitive tests, where impairment was defined as performance ≥ 2 standard deviations (SD) below norms for a given test. This construct has been used previously in the context of cognitive decline associated with cardiac surgery.⁵ The second construct was a subtype of mild cognitive impairment (MCI) called amnesic MCI (aMCI). MCI is a formal, widely accepted neurologic syndrome characterized by subjective and objective evidence of impairments, including decreased performance on formal cognitive testing, but symptoms are mild enough that they do not interfere with activities of daily life.^{6,7} aMCI is a subtype of MCI characterized by 1. memory complaints or decline as reported by the patient and ideally confirmed by an informant or nurse or physician; 2. objective evidence of memory impairment on memory related – but not other – neuropsychometric measures; 3. essentially normal activities of daily living; and 4. absence of dementia.^{6,7} Evered *et al.*⁴ asked

Corresponding Author: Gregory Crosby, M.D., Department of Anesthesiology, Harvard Medical School, Brigham & Women's Hospital, 75 Francis St., Boston, MA 02115. Phone: 617-732-7330; Fax: 617-730-2813; gcrosby@zeus.bwh.harvard.edu.

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subjects and informants structured questions about memory and tested immediate and delayed recall on a widely accepted test of auditory verbal memory; aMCI was diagnosed when a subject had subjective memory complaints and performed ≥ 1.5 SD below norms on ≥ 2 of 3 trials of the Auditory Verbal Learning Test. Their results are striking. About one in five patients scheduled for elective total hip replacement surgery had either PreCI or aMCI and prevalence increased with age, with PreCI identified in 55% of those in their 80s.⁴ Based on objective criteria alone (*i.e.*, performance on neuropsychological tests), 70% of patients with PreCI also satisfied criteria for aMCI but, when the subjective component of aMCI was included, only 33% of subjects classified as PreCI also met criteria for aMCI—so what one finds depends upon how one searches. As far as we know, this is the first study to compare a construct of cognitive impairment adopted by anesthesiologists with one utilized by neurologists and it has a number of important clinical implications.

First, Evered *et. al.*⁴ show that mild cognitive deficits are a common affliction of elders having major orthopedic surgery, even when they have normal activities of daily living. Not previously well documented in noncardiac surgical patients, this is perhaps no surprise because about 10–40% of community dwelling elders have MCI.^{6,7} Accordingly, it is reasonable to assume that Evered *et. al.*'s⁴ data apply to elders having most types of major elective noncardiac surgery. The implication is clear: we are routinely anesthetizing and operating on a large percentage of elderly patients whose brain is compromised preoperatively. The problem is that the deficits are often subtle enough that they would be missed by casual observation in the preoperative testing center, and patients are often reticent to admit to memory or cognitive problems. This emphasizes that we should be formally testing for cognitive impairment preoperatively, just as we test for occult anemia, pulmonary dysfunction, or cardiac disease in certain age groups.

Second, the study of Evered *et. al.*⁴ highlights the importance of coming to consensus about what and how to test. This is where the situation gets tricky. Because age-related cognitive decline affects specific cognitive domains, not global brain function, results obtained from a preoperative cognitive evaluation will vary with the tool used to perform the assessment. Evered *et. al.*⁴ show, for example, that simply adding subjective report of cognitive complaints—one of the diagnostic criteria for aMCI—to the objective neuropsychological testing results reduces the percentage of subjects defined as being impaired from 50% to 22%. With this in mind, Evered *et. al.*⁴ argue that rather than creating new criteria and definitions of preoperative cognitive impairment we should use criteria established for MCI. We strongly agree with this approach, at least conceptually. As Evered *et. al.*⁴ point out, adopting this convention would allow perioperative physicians to speak the same language as neurologists and psychogeriatricians. In addition, big dividends would accrue if cognitive risk and outcomes of surgical patients could be evaluated against the large database of the broader population, where the cognitive trajectory of MCI is well established, biomarkers are actively being sought, and interventions to prevent or slow decline are being developed.

Why might thinking in terms of MCI be helpful? The reason is that a diagnosis of MCI has diagnostic utility, which derives mainly from two features. The first is the growing recognition that for treatments of dementing illnesses such as Alzheimer's disease to be successful, it might be that they must be started before the brain is severely damaged, in the pre-dementia phase. MCI presumably identifies such people. The second is that MCI identifies patients with a high risk of progressing to dementia; patients with aMCI convert to dementia at a rate of 6–15% per year, with the higher rate applying to people referred to a memory disorders clinic and the lower to the elderly population at large.^{6,7} It is essential to remember, however, that MCI is not equal to a diagnosis of Alzheimer's disease; up to 40% of MCI patients do not progress to Alzheimer's related dementia.^{6,7} Nonetheless, identifying individuals with MCI (or even mild but previously undiagnosed dementia) prior to surgery

might help us anticipate perioperative cognitive problems better than we do now, predict long-term cognitive outcome, and impact plans for perioperative care, postoperative management, and recovery since these patients are probably at higher risk for confusion or delirium and more likely than unimpaired persons to have difficulty following through on postsurgical instructions. But adopting an MCI construct is easier said than done. Much like POCD,⁸ the diagnosis of MCI is not iron clad due in part to controversy about implementation (*e.g.*, population heterogeneity, variability in outcomes, use of normative data) and relevance (is it a clinical or pathological entity, or both?).⁷ However, an updated consensus on diagnostic criteria for MCI (or its equivalent) is currently being formulated by a National Institute on Aging-Alzheimer Association consensus conference, and a parallel process is revising criteria to be published in Diagnostic and Statistical Manual of Mental Disorders-V. This suggests that firmer clinical criteria for MCI are soon to be at hand, which will make using the construct preoperatively even more attractive.

In a broader context, knowing something about preoperative cognitive function would allow us to consider two bigger questions. One is whether preexisting cognitive impairment is a risk factor for POCD. Data on the subject are equivocal⁹ and the work of Evered *et. al.*⁴ does not speak to it directly but some causal relationship between preexisting cognitive disability and postoperative cognitive morbidity makes sense and the crude numbers fit the narrative (*i.e.*, the prevalence of PreCI or aMCI is about 20% and the incidence of POCD is 10–15%).^{2,4} Recent data also suggest that a large percentage of apparently clinically normal individuals above age 70 have a positive positron emission tomography scan for amyloid and, as assessed by a sensitive functional magnetic resonance imaging protocol, impaired function of neural networks, likely indicating they are in a preclinical phase of Alzheimer disease.¹⁰ As such, they may be a set up for worsening of cognitive function postoperatively.

The second question is more provocative: might most, if not all, of the cognitive decline that occurs postoperatively be progression of unrecognized MCI, independently of any dementia-inducing effect of anesthesia or surgery? Some data support this idea^{11,12} but it is unlikely that a clinical diagnosis of MCI will prove the theory. First, as already mentioned, defining preoperative cognitive status by clinical and neuropsychological criteria for MCI is not a panacea. MCI is typically diagnosed with a structured interview instrument called the Clinical Dementia Rating (CDR) Scale. This tool utilizes an interview and completion of a few questionnaires, a neurologic examination, and multiple neuropsychological tests for memory, executive function, language, and visuospatial skills. In contrast, MCI was diagnosed by Evered *et. al.*⁴ based on a structured questionnaire to probe for memory difficulties and performance on one test of the CERAD (Consortium to Establish a Registry for Alzheimer's Disease) battery, the Auditory Verbal Learning Test. While not as extensive a battery as used in many Alzheimer disease research settings, this approach likely identifies the majority of individuals who are impaired. Yet, it is a still time consuming solution for the preoperative setting and has not been validated by long-term follow up. Second, many people newly diagnosed with MCI remain cognitively stable for years. Over 40% diagnosed at an initial visit, as was the case in Evered *et. al.*'s study⁴ and would also be true for testing performed initially in a preoperative clinic, will actually improve and be back to normal 1 yr later.^{6,7} This test-retest variability is an inherent limitation of the Clinical Dementia Rating Scale. Consequently, although a diagnosis of MCI, and especially aMCI, identifies a group at high risk for progression to dementia, it is by no means a definitive measure of a predementia state, particularly if it is based on testing at a single visit, because many factors (*e.g.*, mood, medications) besides neurodegeneration affect cognitive performance on a given day.

Indeed, there is no easy solution to screening for dementia, let alone MCI, which is why current emphasis is on finding biomarkers in cerebrospinal fluid or blood.^{13,14} Already cerebrospinal fluid measures appear to be fairly reliable indices of Alzheimer-type pathology in the brain, even presymptomatically.¹⁵ While a preoperative lumbar puncture may not prove practical, optimism about the ultimate development of Alzheimer-related plasma based screening tools is high. Moreover, talking about MCI rather than PreCI or POCD gets us no closer to understanding the neurobiology of perioperative cognitive morbidity because MCI is itself a constellation of symptoms rather than a defined clinical-pathological entity. Nonetheless, an effort to clinically identify patients with MCI preoperatively would be a good, if imperfect, first step, as it could serve as a warning sign that may impact clinical care decisions and expectations and position us to capitalize on suitable biomarkers as they become available.

This leaves us with two major challenges. The first is to identify cognitive impairment in patients before they come to the operating room. This requires that we look for it. A paradigm shift is therefore necessary such that cognitive assessment becomes a routine part of the preoperative screening of elders, not just a research tool. Developing and validating a cognitive evaluation tool that is practical, reproducible, and robust will not be easy, as the brain is a complex organ and cognitive assessment is a complicated business under any circumstances let alone under the production pressure of the preoperative clinic or operating room. But the task is an important and necessary one and framing the approach toward identifying MCI (and even mild dementia, which is frequently not detected clinically) has tangible and theoretical benefits. An abbreviated and validated assessment tool for MCI, much like the Confusion Assessment Method (CAM) is a surrogate for the longer and more complicated Diagnostic and Statistical Manual of Mental Disorders IV criteria for bedside assessment of delirium,¹⁶ would be a valuable addition in this respect. Admittedly, routine preoperative assessment of cognition will consume already constrained time and resources. However, time and resources are currently expended obtaining electrocardiograms, chest radiographs, and the like preoperatively to guide decision making and head off potential problems that are less common and less morbid in the perioperative period than cognitive dysfunction. Although cognitive assessment alone may not be as definitive as we would like for identifying the patient with a compromised brain preoperatively, it is undoubtedly better than current practice, which is no cognitive assessment at all.

The second challenge is to begin to use knowledge such as provided by Evered *et. al.*⁴ about preoperative cognition to better understand perioperative cognitive morbidity. Are PreCI and POCD new animals or just MCI by other names? It would not be surprising if MCI were present in patients who develop POCD. Are delirium and POCD the expression of new brain injury or dysfunction that occurs during or after surgery and anesthesia or, as some recent studies suggest,¹¹ the natural trajectory of a preexisting condition? Perhaps both occur, but it seems self-evident that knowledge of the preexisting condition is important clinically. These are critical questions because if it turns out that POCD and MCI are similar entities, POCD would move from being a new syndrome somehow created *de novo* by anesthesia and surgery to a preexisting condition of reduced cognitive reserve that is unmasked by anesthesia and surgery.¹⁷ Such knowledge would affect profoundly how we think about the problem of perioperative cognitive morbidity, measure and research it, and intervene to mitigate it.

The work of Evered *et. al.*⁴ is the best documentation to date that many elderly patients presenting for major orthopedic, and presumably most elective noncardiac surgery procedures, are cognitively compromised at baseline. The fact that we currently make no effort to identify such patients preoperatively is an embarrassing state of affairs considering that anesthesiology champions thorough preoperative evaluation and that perioperative

cognitive morbidity in the elderly is so common and costly. It is time to be as concerned about the preoperative functioning of the brain in vulnerable patients as we are about preoperative functioning of other vital organ systems. As such, it is time to routinely screen elderly surgical patients preoperatively for the presence of cognitive impairment. Long neglected, the brain deserves the attention and what we learn will help improve cognitive outcomes in the older surgical patient.

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