



Featured Article

Clinical outcomes in older surgical patients with mild cognitive impairment

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Abstract

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23 **Introduction:** Older adults, including those with mild cognitive impairment (MCI), are increasingly
24 undergoing surgery.

25 **Methods:** Relative risks (RRs) of MCI alone or with delirium on adverse outcomes were estimated in
26 an ongoing prospective, observational cohort study of 560 nondemented adults aged ≥ 70 years.

27 **Results:** MCI ($n = 61$, 11%) was associated with increased RR of delirium ($RR = 1.9$, $P < .001$) and
28 delirium severity ($RR = 4.6$, $P < .001$). Delirium alone ($n = 107$), but not MCI alone ($n = 34$), was
29 associated with multiple adverse outcomes including more major postoperative complication(s)
30 ($RR = 2.5$, $P = .002$) and longer length of stay ($RR = 2.2$, $P < .001$). Patients with concurrent
31 MCI and delirium ($n = 27$) were more often discharged to a postacute facility ($RR = 1.4$,
32 $P < .001$) and had synergistically increased risk for new impairments in cognitive functioning
33 ($RR = 3.6$, $P < .001$).

34 **Discussion:** MCI is associated with increased risk of delirium incidence and severity. Patients with
35 delirium and MCI have synergistically elevated risk of developing new difficulties in cognitively
36 demanding tasks.

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Keywords:

38 Mild cognitive impairment; Prodromal Alzheimer's disease; Surgery; delirium; Postoperative

1. Introduction

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Adults aged ≥ 65 years undergo over 19 million surgeries each year in the United States [1] and represent over 50% of all surgical admissions [2] despite comprising only 15% of the population. The number of surgical procedures in this

age group increased by 30% between 2000 and 2010 [1]; total knee replacement increased by 100%, from 31 to 62 per 10,000 patients from 1991 to 2010 [3]. Current projections indicate that surgeries in seniors will increase by 50–600% by 2030, with the variation depending on surgical type [4].

Accompanying the growing rates of surgery in older adults is a rise in persons with mild cognitive impairment (MCI) undergoing surgery. MCI has been proposed as a transitional stage between the cognitive changes of normal aging and dementia, in which individuals have impairments in one or more cognitive domains but not severe enough to interfere

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with normal day to day activities [5]. While 10–15% of individuals with MCI with memory impairment progress to dementia due to Alzheimer's disease (AD) each year compared to 1–2% of the general elderly population [6,7], MCI can also lead to non-AD dementia, revert to normal cognition or remains stable. Previous studies have found that MCI is often present but undiagnosed at time of surgery [8,9] and is associated with increased rates of various postoperative complications [8,10–14] including delirium [9,12,15–20]. Postoperative delirium is the most common surgical complication in older adults generally, occurring in 5%–50% of this population [21]. Little is known about whether MCI and delirium exert disparate or synergistic effects on adverse postoperative outcomes during hospitalization and follow-up. A better understanding of both the distinct and combined risks of MCI and delirium holds important clinical implications, with the potential to strongly influence surgical management of this vulnerable and growing segment of the older population.

The objectives of the present study were as follows: (1) to examine the rates of MCI at baseline in a large prospective cohort of older adults without dementia before undergoing major scheduled surgery; (2) to determine whether MCI was associated with increased risk for incidence or higher severity of postoperative delirium; (3) to evaluate the association between MCI and other adverse clinical outcomes during hospitalization and at 1-month follow-up; and (4) to evaluate potential interactions between delirium and MCI on risk of clinical outcomes. We hypothesized that baseline MCI would be associated with increased risk and severity of postoperative delirium and worse clinical outcomes during hospitalization and at 1-month follow-up. We further hypothesized based on prior work demonstrating that delirium can accelerate cognitive decline in patients with AD [22,23] that delirium and MCI would have synergistic deleterious effects on clinical outcomes, particularly for new functional impairments related to cognition.

2. Methods

2.1. Study population

The Successful Aging after Elective Surgery study is an ongoing prospective, observational cohort study of older adults without dementia undergoing major elective surgery. The study design and methods have been described in detail previously [24,25]. In brief, eligible participants were aged ≥ 70 years, speaking English, scheduled to undergo elective surgery at one of two Harvard-affiliated academic medical centers, and with an anticipated length of stay of at least 3 days. Eligible surgical procedures included the following: total hip or knee replacement; lumbar, cervical, or sacral laminectomy; lower extremity arterial bypass surgery; open abdominal aortic aneurysm repair; and open or laparoscopic colectomy. Exclusion criteria were evidence of dementia, delirium, or hospitalization within 3 months;

terminal condition; legal blindness; severe deafness; history of schizophrenia or psychosis; and history of alcohol abuse or withdrawal. A total of 566 patients met all eligibility criteria and were enrolled between June 18, 2010 and August 8, 2013; thus, recruitment is complete but longitudinal follow-up is ongoing. Six subjects were excluded after enrollment due to suspected dementia, determined by neuropsychological testing and clinical review by an expert multidisciplinary panel, leaving a final sample of 560 participants. Written informed consent for study participation was obtained from all participants according to procedures approved by the institutional review boards of Beth Israel Deaconess Medical Center and Brigham and Women's Hospital, the two study hospitals, and Hebrew SeniorLife, the coordinating center for the study.

2.2. Data collection

Participants underwent baseline assessment in their homes. From the first postoperative day through discharge, participants underwent a daily delirium assessment (detailed below). Participants were interviewed 1 month later, and medical record review was completed. All study interviews were conducted by experienced interviewers, who underwent 2–4 weeks of intensive training and standardization [24]. Inter-rater reliability assessment and standardization on all key study variables, including delirium assessment, was conducted every 6 months continually throughout the study, and coding questions were addressed in weekly meetings of all study staff.

2.3. Assessment of cognitive function and MCI

Before surgery and after 1 month, patients were tested with a standardized neuropsychological battery consisting of the Hopkins Verbal Learning Test-Revised, Visual Search and Attention Test, Trail Making Test Parts A and B, Digit Symbol Substitution Test, Digit Span Test Forward and Backward, Verbal Fluency, Category Fluency, Boston Naming Test, and copying pentagons, to assess attention, memory, language, visuospatial, and executive functioning.

MCI was defined according to clinical consensus or psychometric criteria. For consensus-MCI, cases were first identified by a decline in cognitive performance greater than 1.5 standard deviations (SD) from the age-adjusted mean on any memory test or greater than one SD on two or more neuropsychological tests, one of which was a memory test [26]. Cases were subjected to rigorous review by a multidisciplinary expert panel (one neurologist, two neuropsychologists, two geriatricians, and two geriatric psychiatrists). The participant's medical history, demographics, neuropsychological testing results, proxy report of cognitive function (Informant Questionnaire on Cognitive Decline in the Elderly), and basic (activities of daily living) and instrumental activities of daily living (ADLs and IADLs, respectively) were provided to the clinical consensus panel [24].

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