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GERIATRIC ORTHOPEDICS (C QUATMAN AND C QUATMAN-YATES, SECTION EDITORS)

Geriatric Orthopedics and Challenges with Mild Cognitive Impairment

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Abstract

Purpose of Review To examine the literature to identify the optimal methods to manage patients with mild cognitive impairment (MCI) in the perioperative period.

Recent Findings Several studies have identified the risk of delirium and other postoperative complications in patients with dementia and other cognitive disorders. Recent studies have shown a significant impact in performance on measures assessing processing speed and inhibitory function which can continue to have their effect after several years of surgery. Little research has been published that specifically focuses on elderly patients with mild cognitive impairment.

Summary An optimal treatment plan cannot be formed based on the available literature. Since the elderly with cognitive disorders such as MCI and dementia typically are accompanied by multiple comorbidities as well as impaired mobility, the physician should focus not only on treating the orthopedic problem but also on the patient. Further research on this specific topic is needed.

Keywords Mild cognitive impairment · Perioperative geriatrics · Orthopedic surgery · Early dementia · Surgical outcomes · Postsurgical recovery

Introduction

Mild cognitive impairment is prevalent in older adults. MCI represents an intermediate stage between normal aging and the development of pathologic aging and dementia [1]. Patients with MCI suffer from moderate memory impairment due to deficits in attention and cognitive flexibility but do not fulfill the diagnostic criteria of dementia [2]. The diagnosis of MCI was based on (1) impairment in one of the four cognitive domains; (2) cognitive concerns by the subject, informant, examining nurse, or physician; (3) essentially normal functional activities; and (4) absence of dementia (based on published criteria). MCI has two main types—amnestic and non-amnestic [3]. Amnestic MCI (MCI-A), in which memory impairment predominates, is a precursor of clinical Alzheimer's disease (AD) [3, 4]. Non-amnestic forms of MCI most commonly affects executive function and are not well studied but are associated with fewer negative outcomes compared to MCI-A. Due to its fluctuating course, many people with MCI are overlooked as having normal cognition; however, they remain at risk of developing dementia. Annual prevalence estimates for MCI range from 10 to 20% in persons older than 60 years, with the incidence increasing proportionally with age [5]. Although there are studies that examine the risk in patients with dementia undergoing cardiac procedures, there are no studies that directly assess the risk of perioperative complications in patients with mild cognitive impairment.

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Literature Review

Current Content databases in PubMed were searched using the following key terms: cognitive impairment, rehabilitation, orthopaedic procedures, surgical procedures, and mild

cognitive impairment. Our literature review revealed that there are no prospective studies that examine MCI and its impact on the patients undergoing orthopedic surgeries. Our understanding of the risks and complications is extrapolated from the several retrospective studies done on patients with dementia during their perioperative period [6]. Approximately 1 in 5 seniors, without dementia, who are scheduled for elective surgical procedures likely have underlying MCI [2, 7, 8]. The biggest perioperative factor in negative outcomes is postoperative delirium (POD) [9•, 10•, 11•, 12]. Patients who experienced POD were also more likely to be diagnosed with MCI at the first subsequent follow-up (23% vs. 7%) [6]. The cognitive decline was not limited to only MCI and up to 60% of geriatric patients who had delirium during their hospitalization were found to have dementia over the next 3 years following surgery [13]. This finding has led to various epidemiological, clinicopathological, neuroimaging, biomarker, and experimental studies suggesting that delirium and mild cognitive impairment share common pathological mechanisms [14–18].

Among surgeries, cardiac surgeries carry a higher risk of developing POD, but POD risk is increased in all surgeries, including orthopedic procedures [12, 19, 20]. POD increased the risk of postoperative pulmonary and cardiovascular complications, increased intensive care unit (ICU) stay, and hospital length of stay (LOS) [21]. Previous studies have identified a prevalence of MCI, specifically, MCI-A subtype was 45% among patients undergoing elective coronary artery bypass grafting (CABG) surgery. The prevalence of MCI-A in patients undergoing total hip joint replacement (THR) was about 20% which is significantly less than the reported prevalence before CABG surgery [22]. This may be attributed to the higher presence of cardiovascular risk factors present in subjects presenting for CABG surgery, as cardiovascular disease and risk factors for it are well known to be associated with cognitive impairment. Exposure of the elderly to anesthesia and surgery can also transiently affect postoperative cognitive function in some patients, a phenomenon referred to as postoperative cognitive dysfunction (POCD) [23–26]. POCD should be distinguished from MCI as the former is more transient [27–29]. Based on the duration, POCD can be classified into two types: short-term and long-term. The former is usually a transitory cognitive decline lasting up to 6 weeks after a cardiac operation with an incidence of 20–50%, whereas the latter can be a subtle deterioration of cognitive function occurring six months after an operation with an incidence of 10–30% [30]. General anesthesia alters activation and blood flow to the brain which could partly explain postoperative cognitive decline (POCD). Patients under propofol sedation or anesthesia have shown greater reductions in global cerebral blood flow, with a greater reduction in the inferior prefrontal region, relative to studies of healthy adults [31]. POD and POCD can occur concurrently and noted in 77% of surgical patients at discharge, which suggests that both conditions could share a common mechanism which in recent studies was associated with the increased concentration of peripheral inflammatory markers such as c-reactive protein (CRP) and interlukin-6 (IL-6) [18, 32, 33]. The timing of the surgery also plays a role as any delay in hip replacement independently increases the risk of perioperative delirium [34]. Postoperatively, MCI, especially when associated with POD, increased the LOS in the hospital and at rehabilitation, progress of functional improvement during rehabilitation, and the discharge destination [35].

Testing

Due to the paucity of guidelines, patients are not routinely screened for MCI before any orthopedic surgeries. Using MiniCog (a brief, validated, structured cognitive screening tool with high inter-rater reliability and patient acceptance) before surgery can diagnose 25–33% of elective surgical patients ≥ 65 years of age with probable cognitive impairment [36]. MiniCog evaluation was found to be performing better than mini-mental state examination (MMSE) for screening patients with MCI [37]. It could identify at-risk patients before the onset of POD and POCD.

Prevention

Once a patient is identified to be at risk for delirium in the perioperative setting, a comprehensive risk reduction strategy should be implemented. Initial assessment includes a complete history and physical, baseline cognitive testing, and medication reconciliation for deliriogenic medications. Family and caregivers should also be educated about delirium and ways they can help reduce the risk. Geriatric consultation is desirable where available.

Postoperatively, an interdisciplinary approach should include expert pain management, adequate hydration, early mobilization, sensory enhancement (glasses, hearing aids, and dentures), attempt to normalize sleep-wake cycles, placing clocks and calendars to encourage redirection, to name a few interventions.

Additionally, the Hospital Elder Life Program (HELP; now known as AGS CoCare: HELP) assesses and targets six risk factors for delirium and reduces the incidence by approximately 40%. Interventions are non-pharmacologic, low tech, and performed by trained volunteers.

The American Geriatrics Society CoCare has both Orthopedics curriculum as well has HELP curriculum to aid in delirium identification and prevention.

Conclusion

The measurement of baseline cognition in older adults undergoing orthopedic surgeries is important given the impact of underlying MCI on postsurgical outcomes. The patients are at increased risk of POD, POCD, increased risk of pulmonary and cardiovascular complications, increased intensive care unit (ICU) requirement, hospital length of stay (LOS), and impact on postoperative rehabilitation.

Compliance with Ethical Standards

Conflict of Interest The authors whose names are listed immediately below certify that they have NO affiliations with or involvement in any organization or entity with any financial interest (such as honoraria; educational grants; participation in speakers' bureaus; membership, employment, consultancies, stock ownership, or other equity interest; and expert testimony or patent-licensing arrangements), or non-financial interest (such as personal or professional relationships, affiliations, knowledge, or beliefs) in the subject matter or materials discussed in this manuscript.

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Human and Animal Rights and Informed Consent This article does not contain any studies with human or animal subjects performed by any of the authors.

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