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Preoperative Assessment and Optimization of Cognitive Dysfunction and Frailty in the Ambulatory Surgical Patient

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Abstract

Purpose of Review: The number and the complexity of procedures taking place at ambulatory surgery centers is steadily increasing; the rate at which medically complex patients, including those with baseline neurocognitive disorders, are undergoing ambulatory procedures is seeing a concurrent rise. Given the significant physical and psychological stress associated with surgery even in the ambulatory setting, it is essential to evaluate the ability of a patient to acclimate to stressful triggers in order to assess risk of subpar medical outcomes and increased morality. In this review, we discuss recent advances in the assessment of both cognition and frailty and describe the implementation of these tools in the ambulatory surgery setting.

Recent Findings: The Society for Perioperative Assessment and Quality Improvement (SPAQI) recommendations for evaluating at-risk patients focus on a two-pronged approach that encompasses screening for both impaired cognition and frailty. Screening should take place as early as possible but protocols for day-of-surgery assessments such as the Mini-Cog and the FRAIL Questionnaire are efficient and effective, especially for higher-risk patients.

Summary: The recognition of at-risk patients using standardized screening and the use of this assessment to guide perioperative treatment is essential for optimizing outcomes for the complex ambulatory surgery patient.

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Introduction

As the number and the complexity of ambulatory procedures rises, the number of medically complex patients undergoing outpatient treatments will continue to increase. Outpatient populations at risk for perioperative complications must be identified to decrease readmission rates and to improve overall patient outcomes. Even patients undergoing low-risk ambulatory procedures and those who are relatively healthy at baseline may be susceptible to complications secondary to preexisting cognitive decline and/or frailty. There is no consensus regarding the best way to assess a patient's readiness and predict responses to surgical interventions, even when using existing risk calculators. Below we discuss both assessments of both cognition and frailty and describe implications for patient outcomes with an emphasis on the ambulatory setting.

Cognitive Impairment

Scope of the Problem

Each year in the United States the number of surgical procedures requiring hospitalization of elderly (>65 years old) patients is approximately 19 million; this number is augmented by the already-high yet constantly increasing number of outpatient procedures (1). Preoperative NCD prevalence is much higher in these elderly populations, with cognitive impairment being present in approximately 1 of every 6 patients (1,2). These millions of patients are at risk of worse outcomes if their impaired functional status is not recognized preoperatively and if this information is not used to make perioperative management decisions. An individualized approach is important: one study showed that if an elderly patient develops postoperative delirium, he or she has a 40% chance to never return to their preoperative cognitive baseline (3,4). In a recent survey of 211 elderly (>65-year-old) patients, cognitive screening showed that impaired patients (24%) were significantly more likely to develop postoperative delirium, have a longer length of stay in the hospital, and to be discharged to a place that is not home (5). From these outcomes, it is evident that compared to healthy controls, cognitively impaired patients who are the same age undergoing similar surgeries have more complicated postoperative courses. These results also highlight that multidisciplinary recognition of the magnitude of this problem is required: operating room and post-anesthesia care unit staff, as well as family members, must be educated about the red flags of delirium and taught to intervene appropriately (6-9).

Screening Tools

The American College of Surgeons (ACS) and the American Geriatric Society (AGS) agree that the early identification and recognition of neurocognitive disorders in patients undergoing surgery is paramount to improving outcomes in both the inpatient and ambulatory settings (10). The Diagnostic and Statistical Manual of Mental Disorders, 5th Edition (DSM-5) deliberately combined the individual neurologic and cognitive

classifications from previous iterations under the single “neurocognitive” umbrella to encompass the entire scope of the various included pathologies (11). The ACS and AGS agreed on this inclusive approach and recommend the establishment of baseline cognition preoperatively in all elderly patients, defined as over 65 years old, or any patient with preexisting neurocognitive risks (10). In this most recent version of the DSM, perioperative terminology was added as a way to refer to any known preoperative disorder or postoperative decline occurring within 12 months of surgery (12). This terminology encompasses either an acute event such as delirium or longer-term processes such as cognitive decline (12). The DSM-5 diagnosis “neurocognitive disorders (NCD)” includes all diseases that link brain regions, neural pathways, and subcortical networks with physiologic, psychologic, and behavioral processes that make up an individual’s cognitive function (11,12). Taking into consideration a preoperative baseline, any patient diagnosed with a perioperative neurocognitive function that deviates from baseline should be referred for further testing.

NCD can be further broken down into mild NCD and major NCD. Mild NCD can then be classified as that which includes or excludes memory loss (amnestic vs. non-amnestic) (1). Patients with mild NCD have cognitive decline without impairment of daily function. On the other hand, patients with major NCD experience disruption of their activities of daily living (ADLs) and have significant cognitive impairment in at least one of the following domains: learning and memory, language, executive function, perceptual-motor function, social cognition (1). This delineation roughly agrees with the more common National Institute on Aging classifications of mild cognitive impairment (MCI) and dementia (13,14).

Due to the connection between preoperative NCD and the development of perioperative NCD, effective, time-sensitive screening mechanisms are required to evaluate patients. Unfortunately, evidence from clinical studies suggesting that routine screening for preoperative NCD improves patient outcomes is lacking (1). Recently, the Society for Perioperative Assessment and Quality Improvement (SPAQI) released recommendations to help guide the preoperative management of patients at risk for pre- or perioperative cognitive impairment (15). Their recommendations include the use of a multimodal approach of cognitive screening in coordination with frailty screening (15,16).

Recent clinical guidance from SPAQI also addresses the evaluation of a patient in the preoperative setting who has not yet had any relevant cognitive baselines performed prior to surgery (16). This guidance includes recommendations for performing cognitive assessments and reviews the different screening tools available to clinicians (16). These screening tools can be completed, according to multiple studies, in between 1 and 10 minutes (16). While it is more beneficial to identify at-risk patients at an earlier date, same-day recognition allows for stabilization techniques and last-minute planning such as reducing polypharmacy, decreasing of psychological distress, and obtaining additional information that will be available to the perioperative team including anesthesiologists, surgeons, and nurses (16).

In terms of cognitive screening, the Montreal Cognitive Assessment (MoCA), Mini-Mental State Examination (MMSE), and Mini-Cog have all been independently validated, to varying degrees, to serve as cognitive assessments to help define cognitive impairment

(17-19). It should be noted that these tests can be confounded by anxiety, depression, pain, and medication side effects (17). The MoCA and MMSE are both scored out of 30 points and are much more involved than tests like the aptly named Mini-Cog; a score of <26 on the MoCA is indicative of likely cognitive impairment while a score of <24 on the MMSE suggests the patient is at an increased risk for dementia (18,19). Both of these tests involve dozens of commands and a standardized testing form, decreasing their utility in the busy preoperative setting, even in the outpatient environment (18,19). These observations are especially relevant since many ambulatory patients are not seen in person for preoperative assessment and are instead evaluated on the day of surgery. The Mini-Cog consists of only three questions and requires no preprinted testing sheets (17). The Mini-Cog involves three tasks: three-word registration and immediate recall, followed by drawing an analog clock on any blank sheet of paper, and delayed recall of the initially registered words (17). The test is then initially scored from 0 to 3 based solely on the last step, the three-word recall; a score a 3 indicates no suspected dementia (negative Mini-Cog) and a score of 0 suggests suspected dementia (positive Mini-Cog) (17). The scores of 1 and 2 are not sensitive or specific on their own, so in these cases, the clock drawing is used as a tiebreaker with a normal clock drawing indicating a negative test and an abnormal drawing indicating a positive test and suspected cognitive impairment (17). Obviously, this leads to subjectivity and bias associated with the meaning of “normal” as the examiner looks at the clock drawing, which partially explains the potential testing inaccuracy that has been reported (17). The Mini-Cog has been accepted as a quick, albeit imperfect, method to screen patients in a preoperative setting and can is appropriate for ambulatory settings.

Risk Factors

Given the prevalence of preoperative NCD in patients older than age 65, approximated to be between 16% to 24%, and the reality of an aging American population, widespread recognition of risk factors can help define treatment strategies to improve outcomes (2,5). Unfortunately, since most estimates of the prevalence of NCD have stemmed from inpatient cohorts, including orthopedic, cardiac, and vascular surgery cases, the prevalence of NCD in the ambulatory population is difficult to ascertain (2). Gaulton et al. were the first to estimate the prevalence of NCD in the ambulatory surgery population from a US-based sample (2). By using data from the Health and Retirement Survey, a biennial nationwide assessment of health and functioning in adults 65 and older, the study estimated that approximately 1 in 6 patients undergoing outpatient surgery had preexisting cognitive impairment (2). Patients over the age of 85 were found to have even higher rates of possible cognitive impairment and notably, over half of all patients who had endorsed ambulatory surgery had experienced a decrease in cognition in the four years preceding their operation (2). Assessment of risk factors identified male gender, non-Hispanic African American race, lower socioeconomic status, lower education level, history of stroke, and baseline functional dependence as significantly associated with preoperative NCD (2). This study, despite providing an estimate of the burden of cognitive impairment in the ambulatory surgery population, was limited in the fact that it lacked data regarding the type of outpatient surgery and the specific outcomes (2,20). Furthermore, the study faced limitations secondary to use of the Health and Retirement Study data, which may have potentiated recall bias due to reliance on patient-self reporting and resulted in the creation of a nonrepresentative (2,20).

Also, the overall lower rates of cognitive impairment in the older ambulatory population may be due to selection bias as fewer patients in this group may be offered elective outpatient surgery.

Medical conditions such as coronary artery disease, history of visual or hearing impairment, and diabetes mellitus that have been linked to dementia in the general population have also been suggested to be associated with the development of preoperative NCD (1). Genetic factors such as the presence of the APOE4 genotype have been also studied as a potential risk factors with a recent study determining that the presence of the APOE4 genotype statistically increases the probability of developing preoperative NCD (21). While data are limited, it is important to be mindful of these findings, and specific comorbidities as more older adults undergo surgical procedures in the ambulatory setting.

Certain modifiable risk factors for NCD can be managed the day of and immediately following surgery. The presence of respiratory complications, hypoxia, and dysglycemia during surgery has been shown to be a reliable predictor of worse postoperative cognitive function (22). Length of surgery and presence of intraoperative hypothermia are both weakly correlated with increased development of NCD, and some authors have proposed that heightened inflammatory states as indicated by increased C-reative protein (CRP) (21,22). On the other hand, the use of propofol-based total intravenous anesthesia (TIVA) is associated with increased rates of delirium and worse outcomes such as increased mortality and prolonged length of hospital stay; however, the evidence supporting these claims is of low quality (23). As the patient begins to wake up and recover from surgery, the use of morphine and sedative-hypnotic drugs for postoperative relief also increases the risk of postoperative NCD, with the use of these medications following discharge shown to be significantly more deleterious than their use in the PACU (21). Postoperative infection and uncontrolled generalized pain have been shown to be strongly associated with worse overall cognitive and functional outcomes (22). Of note, a recent study showed that preoperative cognitive impairment and chronic risk factors are more predictive of postoperative cognitive status than the type of surgery and anesthesia (24). After the development of an NCD, regardless of timing, multiple blood markers such as neurofilament light and tau protein have been hypothesized to correlate with neuronal injury (25). If more research corroborates these initial findings and associated costs are low, these markers can be used to objectively confirm the presence of damage (25).

Management Recommendations

The only thing more important than identifying patients who are more likely to develop perioperative NCD is determining the best path forward for each patient. Planning must be performed using shared decision-making practices. If both the cognitive screening and frailty screening shows negative/low risk, treatment-as-usual should be continued (15). If the patient’s screening results are cognitive impairment positive or pre-frail/frail, the patient is deemed high risk and the following are recommended: informing all members of the surgical team; if a geriatrician is available, involving their expertise and tailoring an interventional plan; if a geriatrician is not available involving the primary care provider to make an informed shared-decision; and prehabilitation on physical, nutritional, and psychological

fronts (15). These conversations should ideally be occurring days to weeks prior to a procedure (15). In some cases, the risk analysis of a high-risk patient may sway them against undergoing surgery, which may as well be the safest and best option. Often these patients will still require surgery and protective, risk-reducing mechanisms should be employed (20).

Once a patient decides to move forward with surgery, the plan for ambulatory surgery versus an inpatient stay will vary depending on the individual patient. A combination of factors such as surgical complexity, type of facility, and the individual's comorbidities, social situation, and ability to comply with post-discharge instructions may aid in weighing the benefits of outpatient surgery versus the risks of inpatient admission (Table 1) (20). It is important to note that discharging the patient "home" as soon as possible has its benefits for cognitive recovery, as the home setting allows for recovery in a familiar environment with minimal disruption to daily routine and sleep (6-8).

Avoiding the above modifiable risk factors includes optimizing medication management through adequate pain control with minimal opioids, avoiding homeostatic deviations during surgery, minimizing overall anesthesia burden by using EEG-based anesthetic techniques (as there is some evidence to support its use), and avoiding benzodiazepines (7,22). Further indications include educating the patient's family on the Family Confusion Assessment Method (FAM-CAM) to accurately make early diagnoses of home delirium, regardless of the at-risk patient's length of stay in the hospital (8). Depending on the social situation and familial support at hand, additional assistance and home health services might be indicated to improve outcomes.

Frailty

Scope of the Problem

Frailty is different from neurocognitive disability and is considered a pre-disabled state that describes an individual's decreased ability to respond to physiologic stressors (26). An increasing volume of evidence shows that frailty is associated with a higher risk of negative outcomes in patients' daily lives and especially in interventions that require surgical treatment (27). Frailty describes a state in which patients are at increased susceptibility to poor outcomes secondary to both age and disease burden, which in combination, further increase risk (28). The degree of frailty can be defined as the overall reduced ability of a patient to be able to respond to stressors and is associated with worse medical outcomes and increased mortality (29). Given the large stress burden introduced to a patient during surgery and the potential effects on outcomes, there is a need to consider the degree of frailty in elderly patients undergoing surgery (28).

Screening Tools

There has been a push toward an examination of simple questions that can even be answered over the phone to facilitate the identification of frailty in larger populations without an inpatient visit or in the setting of preoperative time restrictions (Table 2) (27,30,31). This is especially important in the outpatient setting. One screening tool is the FRAIL Questionnaire, which combines four parts of the Health Study Frailty Index and one part of

the Rockwood Scale to assess fatigue, resistance, ambulation, illnesses, and loss of weight and to report an individual's potential frailty as a score from 0 to 5 (32,33). Scores from 3 to 5 indicate frailty, 1 to 2 indicate that the patient is pre-frail or at risk for becoming frail, and an ideal score of 0 indicates that the patient does not currently show signs of frailty (27).

It should be noted that because the questions combine subjective and objective wording, the FRAIL Questionnaire is subject to recall bias (27). All 6 questions are scored either 0 or 1 depending on the response. The Questionnaire begins inquiring about the patient's fatigue over the past 5 weeks, on a five-part scale from "None of the time" to "All of the time". A positive response is counted if the patient endorses that they feel fatigued either "Most of the time" or "All of the time". Then, resistance is assessed: the patient responds "Yes" or "No" to the question, "Do you have difficulty walking up ten steps without resting and without aids?" with "Yes" earning the patient another point (27). Ambulation is assessed in a yes or no fashion based on whether the patient has difficulty walking several hundred yards alone without walking aids. Eleven separate illnesses (i.e., hypertension, diabetes, cancer, chronic lung disease, heart attack, congestive heart failure, angina, asthma, arthritis, stroke, and kidney disease) are inquired about, and any patient with a history of at least 5 comorbidities earns another point. A self-reported loss of weight greater than 5% within the last 12 months accounts for the last point. When sampling data from the African American Health Project, a study of over 1,500 individuals with a mean age of mid-fifties, the individual questions had varied responses. Most likely to be positive was difficulty with ambulation (27.7%) followed closely by resistance (25.5%). Loss of weight (21.0%) and fatigue (20.1%) were in third and fourth place. Least likely to be positive was the illnesses question (2.1%) with a very small number of people endorsing at least 5 comorbidities (27).

Despite widespread recognition of the importance of frailty in dictating patient outcomes and the need for screening, few studies have compared the accuracy and ease of use of existing screening instruments. A recent systematic review and meta-analysis assessed the ability of popular frailty instruments to predict post-operative outcomes in conjunction with their feasibility (34). All 70 included studies prospectively applied a frailty screning tool prior to surgery and described postoperative outcomes. The included screening instruments were the Clinical Frailty Scale, Edmonton Frail Scale, Frailty Index, Frailty Phenotype, Gronigen Frailty Indicator, Risk Analysis Index-Clinical, Gait Speed, and the Short Physical Performance Battery. Of these eight frailty instruments, it was determined that frailty measured using the Clinical Fraiity Scale was most strongly associated with both mortality and discharge to a place other than home. The Clinical Frailty Scale also had the highest reported measures of feasibility. The Edmonton Frail Scale was found to be the strongest predictor of complications while the Frailty Phenotype was most highly associated with the development of postoperative delirium (34). While these results suggest that the Clinical Frailty Scale may be both the most accurate and most practical screening instrument currently available, future research should aim to evaluate these tools and outcomes from a more patient-centered approach.

Management Recommendations

Once a diagnosis of frailty has been made, the focus shifts to improving prognosis and outcomes for the frail patient. Three domains have been defined as important to optimizing the postsurgical course of a frail patient: shared decision making, prehabilation, and multidisciplinary care that involves management by geriatricians (15). In this context, shared decision making involves implementing assessments such as the FRAIL Questionnaire or the comprehensive geriatric assessment and using the results to carry out a careful discussion with the patient, his or her caregivers, and other providers in order to set appropriate expectations regarding the outcomes of surgery (15). While it is generally agreed that prehabilitation for the elderly patient should include nutrition, exercise, and psychological care, evidence-based recommendations have not yet been developed. At present, it is believed that while prehabilitation should span at least four weeks prior to survey or ideally 6-8 weeks, specific interventions should be individualized to the patient and take into account factors such as baseline functional and cognitive status as well as medical and psychological comorbidities (15). Geriatric co-management of older patients has been demonstrated to improve outcomes through cooperation between geriatricians, anesthesiologists, and surgical specialists (15). Current co-management models emphasize factors such as early evaluation of the patient, frequent communication among care teams to decrease rates of medical and functional complications, early mobilization, and advance discharge planning (15). However, similar to that regarding prehabilitation, specific recommendations for co-management are not yet available, and existing co-management models focus on patient age rather than frailty (15). It is evident that as more frail patients are encountered in the ambulatory setting, it will become imperative to develop innovative care models that will help to best identify and address their unique needs.

Conclusion

As numbers of ambulatory procedures continue to increase and involve more medically complex, older patients who undergo both simple and more complicated procedures, screening for cognitive impairment and frailty will become more important. The ACS and AGS are steadfast in their support of screening methods for preoperative frailty and cognitive impairment to help risk-stratify patients in their readiness for surgery and the level of required postoperative care. The SPAQI guidelines for screening patients include a two-pronged approach: a screen for both impairment cognition and frailty with a combined decision-making tree that is dependent on the patient’s scores. Any increased risk burden should include multidisciplinary discussions about the best way to prepare the patient and monitor him or her through their surgical experience. Ideally, this screening would be done days to weeks in advance. If that is not possible, which is often the case in the many outpatient settings, a combination of a Mini-Cog and FRAIL assessment can be performed in the preoperative area, especially in higher risk patients. Recognizing at-risk patients should guide treatment throughout the surgery, regardless of inpatient or ambulatory status. This includes evidence-based anesthetic management and postoperative care as well as the patient’s discharge and transition to home. Multimodal analgesia and family education to recognize the development of postoperative NCD early will improve overall outcomes. In summary, the older ambulatory surgical patient requires a multifaceted approach to care that

involves the attention and involvement of both healthcare professionals and the patient's caregivers.

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analysis, the authors evaluated patient outcomes at each frailty assessment instrument level. Both accuracy and feasibility were described for each frailty assessment tool used.

Key Points:

- The number and the complexity of procedures taking place at ambulatory surgery centers is steadily increasing; the rate at which elderly and medically complex patients are undergoing ambulatory procedures is seeing a concurrent rise.
- It is estimated that 1 in 6 patients undergoing outpatient surgery has preexisting cognitive impairment, placing him or her at increased risk of postoperative delirium, extended hospital stay, and an inabillity to be discharged home.
- Important risk factors for the development of perioperative neurocognitive decline include male gender, non-Hispanic African American race, low socioeconomic status and educational attainment, baseline functional impairment, and history of stroke.
- Early assessment of risk of neurocognitive decline is essential to deciding for or against surgery, guiding the perioperative treatment plan, and addressing modifiable risk factors.
- Frailty, the reduced ability of an individual to respond to physiological stressors, can be assessed using the FRAIL Questionnaire and managed through the combination of shared decision making, prehabilitation, and multidisciplinary care.

Table 1.

Main risk factors associated with the development of neurocognitive disorders during the perioperative period in the ambulatory surgery setting.

Risk factors associated with perioperative neurocognitive disorders
Patient-related risk factors
Older age (>60)
Reduced baseline cognitive function
Lower educational level
Lack of sleep
Alcohol or drug withdrawal
Frailty
Functional limitations
Major surgery
Visual or hearing impairment
Coronary artery disease
Diabetes mellitus
Neurodegenerative disease (i.e., Parkinson's disease)
Apoliprotein E4 (APOE4) geotype
Facility-related risk factors
Increasing duration of anesthesia (>90 minutes)
Depth of anesthesia
Type of surgery and reoperation
Postoperative infection
Respiratory complications
Hypoxia
Dysglycemia (high and low)
Pain
Use of vasoactive drugs
Use of benzodiazepines

Table 2.

Tools for the assessment of frailty in the ambulatory surgery setting based on Society for Perioperative Assessment and Quality Improvement (SPAQI) recommendations. (Adapted from Alvarez et al (17))

Assessment tool	Description
Fralty Index-Comprehensive Geriatric Assessment (GCA)	Assesss accumulated deficits across several domains including baseline cognitive function, strength, mobility, nutrition, and activities of daily living (ADLs). The index is derived as a ratio of th enumber of deficits divided by the total number of domains evaluated. Frailty index (FI) is classified as: Non-frail: FI ≤ 0.10 Vulnerable: 0.1 < FI ≤ 0.2 Frail: 0.21 < FI ≤ 0.45 Most frail: FI > 0.45
Cardiovascular Health Study-derived criteria (“Fried” criteria)	Evaluates frailty phenotype across 5 domains: 1. Unintentional weight loss (> 10 pound loss in past year) 2. Self-reported exhaustion 3. Weakness (grip strength within Jamar hand dynamometer) 4. Slow walking speed (seconds across 15 feet) 5. Low physical activity (Minnesota Leisure Time Activity Questionnaire) A patient with presence of ≥ 3 domains is “frail” while patient with ≥ 1 domain is “prefrail.”
FRAIL Questionnaire Screening Tool	Simple screening tool consisting of 5 self-reported questions assessing **f**atigue, activity against **r**esistance, **a**erobic activity, **i**llnesses, and **l**oss of weight. Measured on a five-point scale. Robust: 0 points Prefrail: 1-2 points Frail: ≥ 3 points
Endmonton Frail Scale	Assesses 9 domains including cognition, general health status, functional independence, and medication use. Each domain scored out of 2 possible points. Robust: 0 points Prefrail: 1-2 points Frail: ≥ 3 points
Modified Frailty Index	Calculated based on presence of 5 comorbidities (score 0 to 5): congestive heart failure within 30 days prior to surgery, diabetes mellitus, chronic obstructive pulmonary disease or pneumonia, partially dependent or totally dependent functional heatlh status, and hypertension requiring medication.