

# Optimal Preoperative Assessment of the Geriatric Surgical Patient: A Best Practices Guideline from the American College of Surgeons National Surgical Quality Improvement Program and the American Geriatrics Society

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The population of the United States (US) is growing and aging. The US Census Bureau projects that the number of Americans age 65 years and older will more than double between 2010 and 2050. The percentage of Americans 65 and older will grow from 13% to more than 20% of the total population by 2030, and the fastest growing segment of this group (individuals 85 years and older) is expected to triple in number over the next 4 decades. These changes in the age demographics of the US population are largely due to people living longer and the “baby boomer” generation crossing into the 65 and older age bracket in 2011.<sup>1</sup> How will this demographic change affect the health care system?

The National Hospital Discharge Survey has demonstrated increasing hospital utilization by elderly persons. In 1970, individuals 65 and older represented 10% of the population,<sup>2</sup> and they accounted for 20% of hospital discharges and 33% of the days of care.<sup>3</sup> By 2007, the percentage of persons 65 and older grew modestly to 13%, yet their hospital use increased drastically to 37% of hospital discharges and 43% of the days of care.<sup>4</sup> The older individuals have significantly higher rates per population of both inpatient and outpatient surgical and nonsurgical procedures compared with other age groups.<sup>3-5</sup> In 2006, elderly patients underwent 35.3% of inpatient procedures and 32.1% of outpatient procedures.<sup>3,5</sup> As the population of the US continues to age, it will place greater demands on surgical services.<sup>6</sup> It is imperative that strategies are developed to meet these growing demands and to ensure higher quality care for geriatric surgical patients.

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## GERIATRIC SURGERY EXPERT PANEL

Recognizing the necessity for quality improvement in the geriatric surgical care, the American College of Surgeons National Surgical Quality Improvement Program (ACS NSQIP) and the American Geriatrics Society (AGS) collaborated to create best practices guidelines around optimal perioperative care of the geriatric surgical patient (the guidelines focusing on optimal preoperative assessment of these patients are presented here). A 21-member, multidisciplinary panel was assembled that represented 2 health care professional societies, the ACS Geriatric Surgery Task Force, 14 medical centers, and representatives from multiple specialties: surgical oncology, gastrointestinal surgery, colorectal surgery, cardiothoracic surgery, endocrine surgery, advanced laparoscopic surgery, urology, anesthesiology, and geriatric medicine.

## LITERATURE REVIEW

The authors performed a focused, structured literature review on PubMed to identify systematic reviews, meta-analyses, practice guidelines, and clinical trials published between January 1, 1990 and December 31, 2011. Search terms included combinations of *geriatric, elderly, surgery, preoperative, perioperative, evaluation, risk factors, cognitive impairment, dementia, decision-making capacity, depression, delirium, alcohol abuse, substance abuse, cardiac, pulmonary, functional status, frailty, nutrition, medications, polypharmacy, screening, and diagnostic tests*. Search limits included English language and human subjects. Additional articles were obtained from manual searches of materials referenced in the initial results, and from resources published by professional medical organizations.

The initial search identified 25,978 citations, of which 5,879 abstracts were screened. From these abstracts, the authors selected 309 publications as appropriate for the study purposes. The expert panel further narrowed the citations based on strength of evidence, recentness of publication, relevance to geriatric patients, and endorsement by

### Abbreviations and Acronyms

ACS	= American College of Surgeons
ADL	= activities of daily living
AGS	= American Geriatrics Society
MI	= myocardial infarction
NSQIP	= National Surgical Quality Improvement Program
PPC	= postoperative pulmonary complications
TUGT	= Timed Up and Go Test

professional associations (eg, American College of Cardiology, American Heart Association, American College of Physicians, etc). The sponsoring organizations recommended 2 more documents for inclusion: the 2012 updated Beers Criteria<sup>7</sup> from the AGS and the ACS NSQIP Best Practices Guidelines on Prevention of Postoperative Pulmonary Complications.<sup>8</sup> The final guidelines referenced 117 selected citations.

## GUIDELINES DEVELOPMENT

The expert panel initially performed a semistructured needs assessment to prioritize domains of perioperative care for geriatric patients. Because a large number of domains were identified, the expert panel decided to focus this first set of guidelines on the preoperative assessment. Preoperative domains included problems specific to elderly individuals (eg, cognitive impairment, frailty, polypharmacy, etc), and vulnerabilities more commonly encountered with this group (eg, risk of malnutrition, lack of family or social support, etc). The authors drafted a set of recommendations and statements, which was submitted to the expert panel for critical evaluation in 4 rounds. The AGS Executive Committee and the AGS Clinical Practice and Models of Care Committee made additional revisions.

## CONSENSUS STATEMENTS AND EVIDENCE-BASED RECOMMENDATIONS

Through consensus, the expert panel selected evidence-based recommendations for improving the preoperative assessment of geriatric patients, which are summarized in checklist form (Table 1).

Although this comprehensive evaluation may require more resources and time to complete compared with the conventional assessment, the authors and the expert panel strongly believe that additional steps are justified by the benefits from identifying high-risk patients, improving communication between the surgeon and patients, and potentially preventing perioperative adverse events. In addition, whether the surgeon completes the entire evaluation or delegates aspects to other physicians, the surgeon must understand the components of the geriatric preoperative

**Table 1.** Checklist for the Optimal Preoperative Assessment of the Geriatric Surgical Patient

In addition to conducting a complete history and physical examination of the patient, the following assessments are strongly recommended:

- ☐ Assess the patient's **cognitive ability** and **capacity** to understand the anticipated surgery.
- ☐ Screen the patient for **depression**.
- ☐ Identify the patient's risk factors for developing postoperative **delirium**.
- ☐ Screen for **alcohol** and other **substance abuse/dependence**.
- ☐ Perform a preoperative **cardiac** evaluation according to the American College of Cardiology/American Heart Association algorithm for patients undergoing noncardiac surgery.
- ☐ Identify the patient's risk factors for postoperative **pulmonary** complications and implement appropriate strategies for prevention.
- ☐ Document **functional status** and history of **falls**.
- ☐ Determine baseline **frailty** score.
- ☐ Assess patient's **nutritional status** and consider preoperative interventions if the patient is at severe nutritional risk.
- ☐ Take an accurate and detailed **medication history** and consider appropriate perioperative adjustments. Monitor for **polypharmacy**.
- ☐ Determine the patient's **treatment goals** and **expectations** in the context of the possible treatment outcomes.
- ☐ Determine patient's **family** and **social support system**.
- ☐ Order appropriate preoperative **diagnostic tests** focused on elderly patients.

assessment and be able to interpret the results. Finally, as the physician ultimately responsible for the surgical patient, the surgeon must advocate for the patient to receive all the appropriate preoperative evaluations and interventions to ensure that the patient can make informed decisions and receive the highest quality care.

## COGNITIVE IMPAIRMENT AND DEMENTIA

### Recommendations

- For any patient without a known history of cognitive impairment or dementia, obtaining a detailed history and performing a cognitive assessment, such as the Mini-Cog<sup>9</sup> (Tables 2, 3) is strongly recommended. If the patient has evidence of cognitive impairment based on the Mini-Cog, consider referring the patient to a primary care physician, geriatrician, or mental health specialist for further evaluation.<sup>10,11</sup>
- If knowledgeable informants (eg, spouse or family members) are available, interviewing them about the evolution of any cognitive or functional decline in the patient is recommended. If the patient has experienced a decline, consider referring the patient to a primary

**Table 2.** Cognitive Assessment with the Mini-Cog: 3 Item Recall and Clock Draw<sup>9</sup>

1. GET THE PATIENT’S ATTENTION, THEN SAY: “I am going to say three words that I want you to remember now and later. The words are: <i>banana, sunrise, chair</i> . Please say them for me now.” Give the patient 3 tries to repeat the words. If unable after 3 tries, go to next item.
2. SAY ALL THE FOLLOWING PHRASES IN THE ORDER INDICATED: “Please draw a clock in the space below. Start by drawing a large circle. Put all the numbers in the circle and set the hands to show 11:10 (10 past 11).” If subject has not finished clock drawing in 3 minutes, discontinue and ask for recall items.
3. SAY: “What were the three words I asked you to remember?”
(Mini-Cog™ copyright S Borson [soon@uw.edu]. From: S Borson, with permission).

- care physician, geriatrician, or mental health specialist for further evaluation.<sup>12</sup>
3. Careful documentation of the patient’s preoperative cognitive status is strongly recommended because postoperative cognitive dysfunction is common but difficult to quantify without record of the baseline cognitive status.<sup>13,14</sup>
4. *It is strongly recommended that the cognitive assessment be performed early in the patient evaluation because any evidence of cognitive impairment or dementia may indicate that subsequent assessment of functional status and/or medications use may be unreliable.*

In 2002, the incidences of cognitive impairment and dementia among individuals 71 years and older in the US were estimated at 22.2% and 13.9%, respectively.<sup>15,16</sup> The prevalence of dementia increases exponentially with increasing age over 65 years.<sup>17</sup> As the proportion of Americans 85 years and older grows, the number of people living with dementia is projected to rise dramatically.<sup>18</sup> Pre-existing cognitive impairment strongly predicts postoperative delirium,<sup>19–23</sup> which is associated with worse surgical outcomes, including longer hospital stays, increased risk of perioperative mortality,<sup>19,21</sup> and postoperative functional decline.<sup>22</sup>

**DECISION-MAKING CAPACITY**  
**Recommendations**

1. Before obtaining the surgical consent, the surgeon should determine whether or not the patient has decision-making capacity.
- Assessing the patient’s decision-making capacity is critical in determining his or her ability to provide informed sur-

**Table 3.** Interpretation of the Mini-Cog<sup>9</sup>

SCORING:	
3 item recall (0 to 3 points):	1 point for each correct word
Clock draw (0 or 2 points):	0 points for abnormal clock 2 points for normal clock
A NORMAL CLOCK HAS ALL OF THE FOLLOWING ELEMENTS:	
All numbers 1 to 12, each only once, are present in the correct order and direction (clockwise) inside the circle.	
Two hands are present, one pointing to 11 and one pointing to 2.	
ANY CLOCK MISSING ANY OF THESE ELEMENTS IS SCORED ABNORMAL. REFUSAL TO DRAW A CLOCK IS SCORED ABNORMAL.	
Total score of 0, 1, or 2 suggests possible impairment.	
Total score of 3, 4, or 5 suggests no impairment.	
(Mini-Cog™ copyright S Borson [soon@uw.edu]. From: S Borson, with permission).	

gical consent. The physician should confirm that the patient is able to describe, in his or her own words, the important features of the discussion, including his or her medical condition and the indications, benefits, risks, and alternatives to surgery. The 4 legally relevant criteria for decision-making capacity<sup>24</sup> are:

1. The patient can clearly indicate his or her treatment choice.
2. The patient understands the relevant information communicated by the physician.
3. The patient acknowledges his or her medical condition, treatment options, and the likely outcomes.
4. The patient can engage in a rational discussion about the treatment options.

**DEPRESSION**  
**Recommendations**

1. Screening patients for depression is strongly recommended. The physician may use simple tools, such as

**Table 4.** Screening for Depression with the Patient Health Questionnaire-2 (PHQ-2)<sup>25</sup>

ASK THE PATIENT THE FOLLOWING QUESTIONS:	
1. “In the past 12 months, have you ever had a time when you felt sad, blue, depressed, or down for most of the time for at least 2 weeks?”	
2. “In the past 12 months, have you ever had a time, lasting at least 2 weeks, when you didn’t care about the things that you usually cared about or when you didn’t enjoy the things that you usually enjoyed?”	
If the patient answers YES to either question, then further evaluation by a primary care physician, geriatrician, or mental health specialist is recommended.	

**Table 5.** Risk Factors for Postoperative Delirium<sup>10,11,20,21,33-40</sup>

Cognitive and behavioral disorders
Cognitive impairment and dementia
Untreated or inadequately controlled pain
Depression
Alcohol use
Sleep deprivation
Disease- or illness-related
Severe illness or comorbidities
Renal insufficiency
Anemia
Hypoxia
Metabolic
Poor nutrition
Dehydration
Electrolyte abnormalities
Functional impairments
Poor functional status
Immobilization
Hearing or vision impairment
Other
Older age $\geq 70$ y
Polypharmacy and use of psychotropic medications (benzodiazepines, anticholinergics, and antihistamines)
Risk of urinary retention or constipation, presence of urinary catheter

the Patient Health Questionnaire-2<sup>25</sup> (PHQ-2, Table 4). If the patient answers YES to either question, then further evaluation by a primary care physician, geriatrician, or mental health specialist is recommended.

Note: The PHQ-2 has not been validated in extremely frail elderly patients, those with severe concurrent medical illnesses, those suffering from medication side effects, or those with impaired communication skills.

A recent study estimates the prevalence of depression among the US population 71 years and older to be 11%.<sup>26</sup> In the general elderly population, major depression occurs in 1% to 3%, with an additional 8% to 16% exhibiting clinically significant depressive symptoms. Risk factors for depression among geriatric patients include female sex, disability, bereavement, sleep disturbance, and earlier depression. Possible risk factors include poor health status, cognitive impairment, living alone, and new medical illness.<sup>27</sup> Preoperative depression has been associated with increased mortality after coronary artery bypass graft (CABG)<sup>28,29</sup> and longer postoperative length of stay after coronary artery bypass graft and valve operations.<sup>30</sup> Depression has also been associated with higher pain perception and increased postoperative analgesic use.<sup>31,32</sup>

**Table 6.** Risk Factors for Postoperative Pulmonary Complications

Patient-related factors
Age $> 60$ y <sup>55-60</sup>
Chronic obstructive pulmonary disease (COPD) <sup>55,56,58-60</sup>
American Society of Anesthesiologists (ASA) class II or greater <sup>56,58,59</sup>
Functional dependence <sup>*55,58-60</sup>
Congestive heart failure <sup>56,58,59</sup>
Obstructive sleep apnea <sup>58,59,61</sup>
Pulmonary hypertension <sup>62-64</sup>
Current cigarette use <sup>58-60</sup>
Impaired sensorium <sup>†56,58-60</sup>
Preoperative sepsis <sup>56</sup>
Weight loss $> 10\%$ in 6 months <sup>58-60</sup>
Serum albumin $< 3.5$ mg/dL <sup>55,56,58,59</sup>
Blood urea nitrogen (BUN) $\geq 7.5$ mmol/L ( $\geq 21$ mg/dL) <sup>58-60</sup>
Serum creatinine $> 133$ $\mu$ mol/L ( $> 1.5$ mg/dL) <sup>59,66</sup>
Surgery-related factors
Prolonged operation $> 3$ h <sup>57-59</sup>
Surgical site <sup>‡55,56,58-60</sup>
Emergency operation <sup>55,56,58-60</sup>
General anesthesia <sup>58-60</sup>
Perioperative transfusion <sup>56,58-60</sup>
Residual neuromuscular blockade after an operation <sup>58,65</sup>
Not risk factors
Obesity <sup>58,59</sup>
Well-controlled asthma <sup>58,59</sup>
Diabetes <sup>58,59</sup>

\*Total dependence was the inability to perform any activities of daily living. Partial dependence was the need for equipment or devices and assistance from another person for some activities of daily living.

†Acutely confused or delirious patient who is able to respond to verbal or mild tactile stimulation, or mental status changes or delirium in the context of current illness.

‡Highest risk procedures: upper abdominal, thoracic, neurosurgical, head and neck, vascular (eg, aortic aneurysm repair).

## POSTOPERATIVE DELIRIUM

### Recommendations

1. The surgeon should identify the patient's risk factors for developing postoperative delirium (Table 5).<sup>10,11,20,21,33-40</sup> It is strongly recommended that the surgeon document these risk factors.
2. For patients at risk for postoperative delirium, administration of benzodiazepines and antihistamines (eg, diphenhydramine/Benadryl [McNeil]) should be avoided, except in certain circumstances (see Medication Management below).<sup>33,35</sup>

Postoperative delirium is a common complication in elderly patients. In one prospective study of patients undergoing major, elective, noncardiac operations, 9% of patients developed postoperative delirium.<sup>20</sup> In another study of patients undergoing surgery requiring postoperative ICU stay, 44% of the patients experienced postoperative delirium.<sup>21</sup> Other studies have described incidence of de-



**Table 7.** Preoperative Strategies for Preventing Postoperative Pulmonary Complications

1. Preoperative optimization of pulmonary function in patients with COPD and asthma that is not well controlled<sup>68,73</sup>
2. Smoking cessation<sup>\*64,67,70-72</sup>
3. Preoperative intensive inspiratory muscle training<sup>†64,69</sup>
4. Selective chest radiograph and pulmonary function tests<sup>‡58,73</sup>

\*Regarding the timing of smoking cessation, one study showed increased rates of postoperative pulmonary complications (PPCs) in patients who stop smoking within 8 weeks of surgery; another study found that smoking cessation was beneficial as late as 4 weeks before surgery; a meta-analysis found no increase risk in PPCs with cessation within 8 weeks of surgery.

†Based on one single-blinded randomized control trial of patients undergoing elective coronary artery bypass grafting (CABG).

‡Routine chest radiographs and pulmonary function tests are not recommended.

lirium ranging from 5.1% to 52.2%, with higher rates after hip fracture and aortic surgery.<sup>36</sup>

Risk factors for postoperative delirium are shown in Table 5, with the strongest predisposing factor being pre-existing cognitive impairment and dementia.<sup>21,34</sup> Postoperative delirium is associated with higher mortality and complications, rates of institutionalization, greater costs and use of hospital resources, longer lengths of stay, and compromised functional recovery.<sup>19-21,34,36</sup>

## ALCOHOL AND SUBSTANCE ABUSE

### Recommendations

1. Consider screening patients for alcohol and substance abuse and dependence using the modified CAGE (Cut down, Annoyed, Guilty, Eye-opener) questionnaire.<sup>41-44</sup>
  - a. For patients who answer YES to any of these questions, consider perioperative prophylaxis for withdrawal syndromes.
  - b. If the operation can be delayed, consider referring motivated patients to a substance abuse specialist for preoperative abstinence or medical detoxification.
2. It is recommended that patients with alcohol use disorder receive perioperative daily multivitamins (with folic acid) and high-dose oral or parental thiamine (100 mg).

A national survey estimated 60% of individuals 50 years and older used alcohol during the 2005 to 2006 period; many fewer people used drugs (2.6% marijuana, and 0.41% cocaine).<sup>45</sup> For elderly men ( $\geq 65$  years), the prevalence of at-risk (2+ drinks/day) and binge-drinking (5+ drinks/day) were 13% and 14.5%, respectively; for elderly women, the prevalence of at-risk and binge drinking were 8.1% and 3.3%.<sup>46</sup> Preoperative alcohol abuse and dependence are associated with increased rates of postoperative mortality and complications, including pneumonia, sepsis,

**Table 8.** Short Simple Screening Test for Functional Assessment<sup>11,78</sup>

ASK THE PATIENT THE FOLLOWING QUESTIONS:

1. "Can you get out of bed or chair yourself?"
2. "Can you dress and bathe yourself?"
3. "Can you make your own meals?"
4. "Can you do your own shopping?"

If NO to any of these questions, more in-depth evaluation should be performed, including full screening of activities of daily living and instrumental activities of daily living.

Deficits should be documented and may prompt perioperative interventions (ie, referral to occupational therapy and/or physical therapy) and proactive discharge planning.

wound infection and disruption, and prolonged length of hospital stay.<sup>47,48</sup>

## CARDIAC EVALUATION

### Recommendations

1. All patients should be evaluated for perioperative cardiac risk according to the American College of Cardiology and American Heart Association (ACC/AHA) algorithm for noncardiac surgery.<sup>49</sup>

For noncardiac surgery, studies describe major perioperative cardiac complications rates at 2% for unselected patients<sup>50</sup> and 3.9% for patients with or at risk of cardiac disease.<sup>51</sup> The rates exceed 5% for high-risk cardiac patients.<sup>50-53</sup> Postoperative myocardial infarction (MI) is associated with hospital mortality rates of 15% to 25%; and patients experiencing nonfatal perioperative MI are at greater risk for cardiovascular death and nonfatal MI during the 6 months after surgery.<sup>51</sup> Older patients are more vulnerable to perioperative cardiac adverse events.<sup>54</sup> Therefore, it is critical to identify elderly patients with higher risk of cardiac complications to determine appropriate perioperative management and to effectively communicate operative risk.

## PULMONARY EVALUATION

### Recommendations

1. Assessing patients for their risk of developing postoperative pulmonary complications, or PPCs<sup>55-66</sup> (Table 6), is strongly recommended.
2. The surgeon should consider implementing appropriate preoperative strategies<sup>58,64,67-73</sup> to reduce risk for PPCs (Table 7).

Postoperative pulmonary complications are common and contribute considerably to overall morbidity and mortality.<sup>56</sup> In a systematic review of PPCs in patients undergoing noncardiac surgery, the rate of PPCs across all the studies was 6.8%.<sup>59</sup> In the same review, study subsets

**Table 9.** Assessment of Gait and Mobility Limitations with the Timed Up and Go Test (TUGT)<sup>81-83</sup>

Patients should sit in a standard armchair with a line 10 feet in length in front of the chair. They should use standard footwear and walking aids and should not receive any assistance.
HAVE THE PATIENT PERFORM THE FOLLOWING COMMANDS:
1. Rise from the chair (if possible, without using the armrests)
2. Walk to the line on the floor (10 feet)
3. Turn
4. Return to the chair
5. Sit down again

showed median PPC rates of 14% and 15% in patients ≥65 years and ≥70 years, respectively. In a study of patients undergoing elective abdominal procedures, pulmonary complications occurred more often than cardiac adverse events and were associated with longer hospital stays.<sup>74,75</sup> For patients undergoing general and vascular operations at a single NSQIP hospital, PPCs incurred the highest total hospital cost compared with infectious, thromboembolic, and cardiac adverse events, and required the longest median length of stay.<sup>76</sup> Pulmonary complications also predicted long-term mortality in elderly patients (≥70 years) undergoing noncardiac surgery.<sup>77</sup>

The *ACS NSQIP Best Practices Guidelines: Prevention of Postoperative Pulmonary Complications* identifies perioperative risk factors for PPCs and prevention strategies.<sup>8</sup>

FUNCTIONAL STATUS, MOBILITY, AND FALL RISK

Recommendations

1. All patients should be assessed for their ability to perform daily activities (functional status). Table 8 shows a short, simple screening test<sup>11,78</sup> for assessing baseline and current functional status in ambulatory patients.
  - a. If the patient answers NO to any of these questions, consider a more in-depth evaluation, including full screening of activities of daily living (ADL) and instrumental ADL.<sup>79,80</sup>
  - b. Any functional limitations should be documented and may prompt perioperative interventions (ie, referral to occupational and/or physical therapy) and proactive discharge planning.
2. Any reported deficits in vision, hearing, or swallowing should be documented.
3. All patients should be asked about history of falls (“Have you fallen in the past year?”).
4. It is strongly recommended that the patient be eval-

**Table 10.** Frailty Score (Operational Definition)<sup>91</sup>

Criteria	Definition
Shrinkage	Unintentional weight loss ≥ 10 past year
Weakness	Decreased grip strength
Exhaustion	Self-reported poor energy and endurance
Low physical activity	Low weekly energy expenditure
Slowness	Slow walking

The patient receives 1 point for each criterion met: 0 to 1, not frail; 2 to 3, intermediate frail (pre-frail); 4 to 5, frail.  
(Adapted from Makary MA, Segev DL, Pronovost PJ, et al. Frailty as a predictor of surgical outcomes in older patients. J Am Coll Surg 2010;210:901–908, with permission).

- uated for limitations in gait and mobility using the Timed Up and Go Test, or TUGT<sup>81-83</sup> (Table 9).
- a. Any person demonstrating difficulty rising from the chair or requiring more than 15 seconds to complete the test is at high risk for falls.
  - b. For patients with gait or mobility deficits, consider preoperative referral to physical therapy for more detailed gait assessment.

In one prospective study of elderly patients undergoing major operations requiring ICU stay, functional dependence was the strongest predictor of postoperative 6-month mortality.<sup>84</sup> Another study of Veterans Administration (VA) patients >80 years old showed that 30-day mortality was more strongly predicted by functional status than age.<sup>85</sup> Impaired mobility in elderly patients has also been linked to increased risk of postoperative delirium<sup>36,86</sup> and surgical site infections with MRSA.<sup>87,88</sup> In a study of elderly surgical patients requiring ICU stay, prolonged TUGT (≥ 15 seconds) and any functional dependence were the strongest predictors for requiring postoperative discharge institutionalization.<sup>89</sup> In addition, more independent preoperative functional status strongly predicts both better postoperative function (in terms of ADLs and instrumental ADLs) and shorter recovery periods after major abdominal surgery.<sup>90</sup>

FRAILITY  
Recommendations

1. Evaluation of the patient for frailty syndrome and documentation of his or her frailty score<sup>91</sup> is recommended (Table 10).
- Frailty is a syndrome of decreased physiologic reserve and resistance to stressors, which leaves patients more vulnerable to poor health outcomes, including falls, worsening mobility and ADL disability, hospitalizations, and death. It is a clinically distinct entity from comorbidity and disability.<sup>91,92</sup> An operational definition for frailty by Fried and

**Table 11.** American College of Cardiology/American Heart Association Guidelines for Perioperative Beta Blockers<sup>11,49</sup>**Indications:**

The guidelines support administration of beta blockers to:

Patients who are already on beta blockers, particularly those with independent cardiac indications for these medications (such as arrhythmia or history of myocardial infarction).

Patients undergoing intermediate risk or vascular surgery with known coronary artery disease or with multiple clinical risk factors for ischemic heart disease.

**Initiation and titration:**

If beta blockers are indicated, when feasible, they should be started at least days to weeks before elective surgery, titrated to a heart rate of 60 to 80 beats/min in the absence of hypotension. Titrated rate control with beta blockers should continue during the intraoperative and postoperative periods.

**Discontinuation:**

Beta blockers should be tapered off slowly to minimize risk of withdrawal.

At the time of this writing, the current American College of Cardiology/American Heart Association guidelines state that routine administration of high-dose beta-blockers in the absence of dose titration is not useful and may be harmful to patients not currently taking beta-blockers who are undergoing noncardiac surgery.

colleagues<sup>91</sup> has been validated by Makary and associates<sup>93</sup> for elderly surgical patients. Frailty has been shown to independently predict higher rates of postoperative adverse events, increased length of stay, and higher likelihood of discharge to a skilled or assisted-living facility in elderly surgical patients.<sup>93</sup> In addition, intermediate frail patients have elevated risk for postoperative complications and more than a 2-fold increased risk of becoming frail over 3 years compared with nonfrail patients.<sup>91</sup>

Robinson and coworkers<sup>84</sup> proposed 2 other definitions of frailty for elderly surgical patients. The first definition measures cognitive impairment (Mini-Cog  $\leq 3$ ), poor nutrition (serum albumin  $\leq 3.3$  g/dL), history of falls ( $\geq 1$  fall in the previous 6 months), and low hematocrit ( $< 35\%$ ). The second definition includes the factors from the first definition, with the addition of functional impairment (TUGT  $\geq 15$  seconds, and dependence in any ADL), and comorbidity (Charlson index score  $\geq 3$ ).<sup>89</sup>

## NUTRITIONAL STATUS

### Recommendations

- All patients should be evaluated for their nutritional status:
  - Document height and weight and calculate body mass index (BMI).<sup>10,11</sup>
  - Measure baseline serum albumin and prealbumin levels.<sup>10,11</sup>
  - Inquire about unintentional weight loss in the last year.
- Document patients with severe nutritional risk<sup>94</sup> if they exhibit any of the following:
  - BMI  $< 18.5$  kg/m<sup>2</sup>
  - Serum albumin  $< 3.0$  g/dL (with no evidence of hepatic or renal dysfunction)

c. Unintentional weight loss  $> 10\%$  to  $15\%$  within 6 months.

- Patients at severe nutritional risk should, if feasible, undergo a full nutritional assessment by a dietician to design a perioperative nutritional plan to address deficits, and should be considered for preoperative nutritional support (see the recommendations by The European Society For Clinical Nutrition and Metabolism [ESPEN]<sup>94,95</sup>).

Rates of malnutrition were found to be 5.8% among elderly individuals in the community, 13.8% in nursing homes, 38.7% in hospitals, and 50.5% in rehabilitation.<sup>96</sup> Poor nutritional status is associated with increased risk of postoperative adverse events, mostly infectious complications (eg, surgical site infections, pneumonia, urinary tract infections, etc) and wound complications (eg, dehiscence and anastomotic leaks), and increased length of stay for patients undergoing elective gastrointestinal surgery.<sup>97</sup>

## MEDICATION MANAGEMENT

### Recommendations:

- Review and document the patient's complete medication lists, including use of nonprescription agents (over-

**Table 12.** ACC/AH American College of Cardiology/American Heart Association A Guidelines for Initiation of Statin Therapy<sup>11,49,100</sup>

- Preoperative statins should be started as soon as possible before surgery for patients who have known vascular disease, elevated low-density lipoprotein cholesterol, or ischemia on thallium testing.
- For patients undergoing noncardiac surgery, who are currently taking statins, statin therapy should be continued. Statin use may also be considered for patients undergoing vascular and intermediate risk surgery.

**Table 13.** Preoperative Tests Recommended for All Geriatric Surgical Patients<sup>10,11,109-111</sup>

Preoperative tests	Indications
Hemoglobin	Recommended for all geriatric surgical patients, especially those: Undergoing operations with anticipated clinically significant blood loss or transfusion requirement. With suspected or known severe anemia.
Renal function tests (blood urea nitrogen, creatinine)	Recommended for all geriatric surgical patients, especially those: Undergoing major surgery.* With diabetes, hypertension, cardiovascular disease, or who use medications that affect renal function (angiotensin-converting enzyme [ACE] inhibitors, NSAIDs).
Serum albumin	Recommended for all geriatric surgical patients, especially those: With known liver disease, multiple serious chronic illnesses, and recent major illness. Undergoing major surgery. Likely to have malnutrition.

\*Major surgery includes cardiac, vascular, thoracic, and abdominal operations.

the-counter, nonsteroidal anti-inflammatory drugs [NSAIDs], vitamins, eye drops, topical) and herbal products.<sup>98</sup>

2. Consider minimizing the patient's risk for adverse drug reactions by identify medications that should be discontinued before surgery or should be avoided, and by dose-reducing or substituting potentially inappropriate medications (see AGS Updated Beers Criteria for Potentially Inappropriate Medication Use in Older Adults<sup>7</sup>).

tinued before surgery or should be avoided, and by dose-reducing or substituting potentially inappropriate medications (see AGS Updated Beers Criteria for Potentially Inappropriate Medication Use in Older Adults<sup>7</sup>).

3. For patients at risk for developing postoperative delirium:
  - a. Avoid starting new prescriptions for benzodiazepines and consider reducing benzodiazepines when possible.<sup>33,35</sup>
  - b. Avoid using meperidine for treatment of pain.<sup>99</sup> Ensure that pain is adequately controlled to reduce risk for developing postoperative delirium.<sup>37-40</sup>
  - c. Use caution when prescribing antihistamine H<sub>1</sub> antagonists (especially diphenhydramine/Benadryl [McNeil]) and other medications with strong anticholinergic effects.<sup>33,35</sup>
4. Consider which medications should be started or continued preoperatively to reduce perioperative risks of adverse events (cardiac, stroke, etc). Follow the ACC/AHA guidelines for perioperative beta blockers<sup>11,49</sup> and statins<sup>11,49,100</sup> (Tables 11, 12).
5. Adjust doses of medications for renal function based on glomerular filtration rate, not on serum creatinine alone.
6. Monitor for polypharmacy and potential adverse interactions. When possible, nonessential medications should be discontinued perioperatively and the addition of new medications should be kept to a minimum.

**Table 14.** Preoperative Laboratory Tests Recommended for Selected Geriatric Surgical Patients

Preoperative tests	Indications*
White blood cell count (WBC)	Known or suspected infection or myeloproliferative disease, or at high risk for leukopenia from drugs or other known disease. <sup>11,111</sup> May be included as part of a complete blood count.
Platelet count	High likelihood of thrombocytopenia or thrombocytosis. May be included as part of a complete blood count.
Coagulation tests (PT/INR/PTT)	History of bleeding disorders, on medications affecting coagulation, on warfarin, or on hemodialysis. <sup>11,110,111,114</sup> Undergoing specific types of surgery, such as arterial reconstruction, cardiac surgery, cancer operations, and ones in which small amounts of bleeding can cause dramatic complications (neurosurgical or orthopaedic spine procedures). <sup>11,110</sup> Malnutrition, malabsorption, or liver disease. <sup>11,110,111,114</sup>
Electrolytes (Na, K, Cl, CO <sub>2</sub> )	Baseline renal insufficiency, congestive heart failure. Taking diuretics, digoxin, angiotensin-converting enzyme (ACE) inhibitors, or other medications that increase likelihood of abnormal results. <sup>11,111</sup>
Serum glucose	Known or suspected diabetes, or obesity. <sup>111</sup>
Urinalysis	Suspected urinary tract infection <sup>11,111</sup> , known diabetes <sup>111</sup> , or undergoing urogenital surgery. <sup>110</sup>

\*These test are NOT RECOMMENDED for routine preoperative screening.<sup>11,49,73,110,113,114,117</sup>

INR, international normalized ratio; PT, prothrombin time; PTT, partial thromboplastin time.



**Table 15.** Preoperative Imaging and Body Functional Tests Recommended for Selected Geriatric Surgical Patients

Preoperative tests	Indications*
Chest radiograph (CXR) <sup>110,113</sup>	Acute cardiopulmonary disease (including smoking, asthma, and COPD) >70 years old with history of stable chronic cardiopulmonary disease without recent CXR in past 6 months Possible ICU stay – obtain for baseline CXR Undergoing major surgery <sup>†</sup>
Electrocardiograms (ECG) <sup>11,49,110,111</sup>	Undergoing intermediate-risk or vascular surgery. Known ischemic heart disease, previous myocardial infarction, cardiac arrhythmias, peripheral vascular disease, cerebrovascular diseases, compensated or prior heart failure, diabetes, renal insufficiency, or respiratory disease.
Pulmonary function tests (PFT)	Undergoing lung resection. <sup>11,73,112</sup> Poorly characterized dyspnea or exercise intolerance with diagnostic uncertainty between cardiac or pulmonary limitation vs simple deconditioning. <sup>59,117</sup> Obstructive lung disease with questionable preoperative optimization. <sup>59,117</sup>
Noninvasive stress testing <sup>49</sup>	≥3 clinical risk factors and poor functional capacity (less than 4 METs) undergoing vascular surgery ≥1 clinical risk factor and poor functional capacity (less than 4 METs) undergoing intermediate risk or vascular surgery, if it will change management.

\*These test are NOT RECOMMENDED for routine preoperative screening.<sup>11,49,73,110,113,114,117</sup>

<sup>†</sup>Major surgery includes cardiac, thoracic, abdominal, and some esophageal, thyroidectomy, head and neck, neurosurgery, and lymph node operations.  
MET, metabolic equivalent.

Older patients are at greater risk for adverse drug reactions. Compared with younger adults, elderly individuals are more likely to have impaired renal function and chronic kidney disease. Because many medications are renally cleared, it is critical to adjust dosages to prevent adverse reactions. Geriatric patients are also more sensitive to the psychoactive effects of medications, including those commonly used in the perioperative period, such as narcotics, benzodiazepines, and antihistamines. Caution must be exercised to minimize the risk of postoperative delirium.

With a greater burden of illnesses and diseases, older patients are more likely to regularly take multiple medications. Polypharmacy has been associated with increased risk of cognitive impairment, morbidity, and mortality, as well as compromised medication compliance. The risk of adverse drug reactions also increases with greater numbers of medications, leading to more hospital admissions.<sup>101,102</sup>

## PATIENT COUNSELING

### Recommendations

1. It is strongly recommended that the surgeon ensure that the patient has an advance directive and a designated a health care proxy or surrogate decision makers. These documents should be placed in the medical chart.
2. The surgeon should discuss the treatment goals and plans with the patient and should *understand the pa-*

*tient's preferences and expectations.* Discussions of the patient's preferences and expectations and ensuing changes should be documented in the medical records.

3. Describe the expected postoperative course and possible complications with the patient. *If relevant, include discussion of possible functional decline and need for rehabilitation or nursing home care during the informed consent process.*
4. Determine the patient's family and social support systems, which are of significant importance for discharge disposition. If there is concern of an insufficient family or social support system, consider preoperative referral to a social worker.

A study of deceased elderly individuals found that nearly 30% required medical decision making near the end of life, but lacked decision-making capacity. Approximately two-thirds had advance directives, and these individuals received care strongly associated with their preferences.<sup>103</sup> Although the number of elderly individuals with advance directives has increased, one study of older patients undergoing major surgery observed that advance directives were rarely present in the medical chart during hospitalization.<sup>104</sup>

In the absence of documented preferences, physicians often rely on health care proxies to make end-of-life decisions for patients. Family members, surrogates, and physicians frequently failed to accurately predict patients' treatment preferences.<sup>105-107</sup> Few patients had ever discussed their preferences with their family members and their physicians.<sup>106</sup>

Patients' expectations influence their treatment preferences. In one study, nearly all of the surveyed elderly patients with limited life expectancy stated that they would undergo a low-burden treatment to restore current health; however, if the outcomes included survival with severe functional impairment or cognitive impairment, most patients (74.4% and 88.8%, respectively) would forgo treatment.<sup>108</sup>

## PREOPERATIVE TESTING

### Recommendations

1. Routine sets of preoperative *screening* tests are NOT recommended. Three exceptions are hemoglobin, renal function tests, and albumin, which are indicated for all geriatric surgical patients<sup>10,11,109-111</sup> (Table 13).
2. Preoperative *diagnostic* tests should be performed selectively,<sup>11,49,58,73,110-114</sup> and limited to higher risk patients who can be identified based on history and physical examination, known comorbidities, and the type of procedure to be performed. A guideline for recommended diagnostic tests is described in Table 14 and Table 15.
3. Normal laboratory values obtained up to 4 months before surgery can be used safely as preoperative tests as long as no substantial interval change in the patient's clinical status has occurred.<sup>111,115</sup>

Screening tests, which are used to detect or predict disease in apparently healthy individuals, can be distinguished from diagnostic tests, which are used to confirm the presence or absence of disease in persons with symptoms or with suspicion based on earlier tests. Over the past few decades, a number of studies have highlighted the relatively low yield of routine preoperative screening and the high aggregate cost from both the direct cost of tests and the subsequent studies for abnormal results. The reports have shown that many of the screening tests produce low rates of abnormal values in asymptomatic patients, are unlikely to change clinical management for the patient with abnormal values, do not strongly predict good or adverse outcomes, or are subject to a combination of these limitations.<sup>11,109-111,114,116</sup>

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