

# Optimal Perioperative Management of the Geriatric Patient: A Best Practices Guideline from the American College of Surgeons NSQIP and the American Geriatrics Society

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Adults age 65 and older (“older adults”) are the fastest growing segment of the United States population, and their number is expected to double to 89 million between 2010 and 2050.<sup>1</sup> Based on these evolving demographics, it is expected that there will be a concurrent rise in the demand for a variety of surgical services, including vascular surgery (with a projected growth of 31%) and general surgery (with a projected growth of 18%).<sup>2</sup>

Older adult surgical patients often require a different level of care than younger patients during the perioperative period. Many have multiple chronic illnesses other than the one for which surgery is required, and therefore are prone to developing postoperative complications, functional decline, loss of independence, and other untoward outcomes. In order to provide optimal care for the older surgical patient, a thorough assessment of the individual’s health status and a plan of care during the perioperative period designed to look for and address any identified deficits is essential. To assist clinicians with this assessment and subsequent care, in 2010, the American College of Surgeons (ACS) partnered with the American Geriatrics Society (AGS) and the John A Hartford Foundation to develop guidelines for the optimal surgical care of older adults. The first part of these guidelines, the *American College of Surgeons National Surgical Quality Improvement Program (NSQIP)/American Geriatrics Society (AGS) Best Practices Guidelines: Optimal Preoperative Assessment of the Geriatric Surgical Patient*<sup>3</sup> was published in 2012. This resource defined 9 assessment categories:

cognitive/behavioral disorders, cardiac evaluation, pulmonary evaluation, functional/performance status, frailty, nutritional status, medication management, patient counseling, and preoperative testing.

The second part of these guidelines, presented here, targets the rest of the perioperative period, beginning in the immediate preoperative period and extending through the postoperative period and discharge transition. These guidelines build on the domains of geriatric care and proposed geriatric competencies established by previous work and are designed to provide a framework for thinking about the complex issues around perioperative care in this patient population.<sup>4,5</sup>

## GERIATRIC SURGERY EXPERT PANEL, LITERATURE REVIEW, AND GUIDELINES DEVELOPMENT

Similar to the preoperative assessment guidelines, the optimal perioperative management guidelines leveraged the expertise of a 28-member, multidisciplinary panel representing the American College of Surgeons (ACS), American Society of Anesthesiologists, American Geriatrics Society (AGS), the ACS Geriatric Surgery Task Force, and the AGS Geriatrics for Specialists Initiative. This document is divided conceptually into 3 domains: the immediate preoperative, intraoperative, and postoperative periods. A literature review of MEDLINE was performed for each domain in order to identify systematic reviews, meta-analyses, practice guidelines, and clinical trials between January 1, 1995 and December 31, 2014, limited to English and human studies. Search terms included combinations of: *geriatrics, aged, elderly, decision-making, goals, preferences, advanced directive, perioperative care/period, preoperative care/period, postoperative care/period, evaluation, fasting, intraoperative, monitoring, nausea, vomiting, pressure, ulcers, injury, hypothermia, anesthesia, analgesia, regional, spinal, epidural, fluid management, goal directed therapy, physiologic parameters, functional status, functional decline, fall prevention, cognition disorders, dementia, cognitive impairment,*

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*delirium, nutrition, care transitions, urinary tract infection, risk, assessment, and stratification.* Additional articles were identified from manual searches of initial search results. The final document included 144 citations.

Given the scope of these guidelines and their intended purpose, to provide consensus recommendations given the best possible evidence, the expert panel further culled this list based on the study quality, relevance, and the time of their publication. In addition, several professional society position statements were sought in situations for which evidence does not exist (eg, the suspension of perioperative do-not-resuscitate orders).

Using the structure developed from a needs assessment and established work in geriatric quality indicators, the authors drafted a set of recommendations that were refined in an iterative process before evaluation by the expert panel. In addition, the AGS Executive Committee and Clinical Practice and Models of Care Committee and the American Society of Anesthesiologists (ASA) provided additional input. The final guidelines referenced 143 articles. The immediate preoperative, intraoperative, and postoperative management recommendations statements are summarized in [Tables 1](#) and [2](#).

## EXPERT PANEL CONSENSUS STATEMENTS

### Immediate preoperative management

#### **Patient goals, preferences, and advance directives**

##### Recommendations

1. The health care team (including the surgeon and anesthesiologist) should ensure that they discuss personal

goals and treatment preferences before surgery, including specific outcomes that may be important to older adults, such as postoperative functional decline, loss of independence, and skilled care burden.

2. The health care team should ensure that older adult patients undergoing surgery have an advance directive and a designated health care proxy (or surrogate decision-maker). This information should be documented in the patient's medical record.
3. Whenever possible, the health care team should consider early palliative care consultation in older adult patients with poor prognoses undergoing surgery, especially those not expected to survive more than 6 months postoperatively.
4. The health care team should use a structured approach that is consistent with established best practices (for example, as defined by relevant professional societies) and local norms when planning surgery for patients with existing advance directives that may limit resuscitative procedures during and after surgery. Any clarifications and modifications made to the advance directive should take into account exceptions to the order and include a plan for reinstating the order when the patient has recovered from anesthesia.

A 2010 study showed that nearly half of patients over age 60 required decisions about treatment in the final days of life, and that more than two-thirds of these patients lacked the capacity to make these decisions.<sup>6</sup>

**Table 1.** Immediate Preoperative and Intraoperative Management Consensus Recommendations

Immediate preoperative management
Confirm and document patient goals and treatment preferences, including advance directives.
Confirm and document patient's health care proxy or surrogate decision-maker.
In patients with existing advance directives, discuss new risks associated with the surgical procedure and an approach for potentially life-threatening problems consistent with the patient's values and preferences ("required reconsideration").
Consider shortened fluid fast (clear liquids up to 2 hours before anesthesia).
Adhere to existing best practices regarding antibiotic and venous thromboembolism prophylaxis.
Ensure nonessential medications have been stopped and essential medications have been taken.
Intraoperative management
Consideration of regional techniques to avoid postoperative complications and improve pain control.
Directed pain history.
Multi-modal or opioid-sparing techniques.
Postoperative nausea risk stratification and prevention strategies.
Strategies to avoid pressure ulcers and nerve damage.
Prevention of postoperative pulmonary complications and hypothermia.
Judicious use of intravenous fluids.
Appropriate hemodynamic management.
Continuation of indicated cardiac medications.

**Table 2.** Postoperative Rounding Checklist

Daily evaluation	Prevention/management strategies
Delirium/cognitive impairment	Pain control. Optimize physical environment (eg, sleep hygiene, sleep protocol, minimize tethers, encourage family at bedside). Vision and hearing aids accessible. Remove catheters. Monitor for substance withdrawal syndromes. Minimize psychoactive medications. Avoid potentially inappropriate medications (eg, Beers' criteria medications).
Perioperative acute pain	Ongoing education regarding safe and effective use of institutional treatment options. Directed pain history. Multimodal, individualized pain control. Vigilant dose titration.
Pulmonary complications	Chest physiotherapy and incentive spirometry. Early mobilization/ambulation. Aspiration precautions.
Fall risk	Universal fall precautions. Vision and hearing aids accessible. Scheduled toileting. Appropriate treatment of delirium. Early mobilization/ambulation. Early physical/occupational therapy if indicated. Assistive walking devices.
Ability to maintain adequate nutrition	Resume diet as early as feasible. Dentures made available. Supplementation if indicated.
Urinary tract infection prevention	Daily documentation of Foley catheter indication. Catheter care bundles, hand hygiene, barrier precautions.
Functional decline	Care models and pathways. Structural: uncluttered hallways, large clocks, and calendars. Multidisciplinary rounds. Early mobilization and/or physical therapy/occupational therapy. Family participation. Nutritional support. Minimize patient tethers.
Pressure ulcers	Reduce/minimize pressure, friction, humidity, shear force. Maintain adequate nutrition. Wound care.

Furthermore, the literature reports that surgeons do not routinely discuss these issues preoperatively.<sup>7,8</sup>

Ideally, personal goals and treatment preferences should be addressed in the outpatient setting before surgery. In the immediate preoperative period, however, it is important that the health care team confirms that this has taken place, and this should be documented.

When it comes to patients for whom surgery may be indicated, who have an existing advance directive, the position statements of several professional societies, including the ACS, suggest that the best policy is that of "required reconsideration."<sup>9-11</sup> This means that the new risks, benefits, and alternatives of the surgical procedure should be considered and discussed with the patient, and an approach to life-threatening problems that may

arise that is consistent with patient values and preferences be clarified. It is inappropriate to routinely set aside patient preferences, and the health care team should use a structured approach when caring for patients with advance directives that may limit resuscitative procedures.

### **Preoperative fasting Recommendations**

1. In adults undergoing nonemergent surgical procedures, fasting from the intake of clear liquids at least 2 hours before elective procedures requiring general anesthesia, regional anesthesia, or sedation/analgesia is recommended. Examples of clear liquids include

water, fruit juices without pulp, carbonated beverages, clear tea, and black coffee.

- In adults undergoing nonemergent surgical procedures, fasting from the intake of a light meal and/or nonhuman milk 6 hours or more before elective procedures requiring general anesthesia, regional anesthesia, or sedation/analgesia is recommended. Examples of a light meal include toast, cereal, soup, or applesauce.
- Additional fasting (8 hours or more) may be required depending on the amount and type of food ingested. Fried, fatty foods, or meat may prolong gastric emptying. Finally, these guidelines may not apply to patients with comorbidities or diseases (for example, diabetes, hiatal hernia) that affect gastric emptying or fluid volumes.

There is increasing agreement on the benefit of limiting extended periods (greater than 4 to 6 hours) of preoperative fasting. A recent review of the topic demonstrated no significant association between a shortened (2 to 3 hours), clear fluid fast (vs milk or juice with pulp), and subsequent risk of postoperative complications.<sup>12,13</sup> The American Society of Anesthesiologists also provides comprehensive guidelines on this topic.<sup>14</sup>

### **Medication management**

#### **Recommendations**

- In the immediate preoperative period, providers should repeat their review of the patient's medications and confirm that recommendations regarding management have been implemented, including:
  - Discontinuation of nonessential medications. General considerations may include the potential for withdrawal; progression of disease with interruption of drug therapy; and interactions with anesthetic agents.
  - Continuation of essential medications.
  - Planning for the resumption of all other baseline outpatient medications in the postoperative period with consideration for minimizing polypharmacy risk.

The ACS/AGS Best Practices Guidelines for the Optimal Preoperative Assessment of the Geriatric Surgical Patient discuss the management of essential and nonessential medications before surgery.<sup>3</sup> The immediate preoperative period is an ideal time to confirm and clarify that a plan regarding the discontinuation of nonessential chronic medications has occurred in accordance with

the preoperative plan, and that a plan for their continuation postoperatively is in place.

### **Intraoperative management**

#### **Anesthesia in the older adult**

##### **Recommendations**

- There is insufficient evidence to recommend a single "best" anesthetic plan for all older adults. The physiologic changes associated with normal aging should be considered when deciding on an anesthetic plan that is appropriate for each individual patient.
- Definitive evidence does not exist establishing the superiority of regional anesthesia compared with general anesthesia when used as a primary modality for surgical anesthesia in older adults.

Anesthetic medications have broad physiologic effects, ranging from changes in systemic vascular resistance to lung mechanics and oxygen diffusion. It is essential to address the complex interactions between these drugs and with the physiologic changes of the individual patient (Table 3) because many of the effects of anesthetic agents may be exaggerated and require dosage adjustments.<sup>15-18</sup>

Regional anesthesia refers to the blockade of nerves within the central nervous system ("neuraxial" blocks, encompassing both epidural injections and subarachnoid injections, or "spinal anesthesia"). Regional techniques may also block individual nerves or groups of nerves within the peripheral nervous system. These techniques may be used as the primary anesthetic modality, in combination with intravenous sedation, or may be combined with general anesthesia as an adjunctive modality for perioperative pain relieve (see corresponding section).

A recent Cochrane review<sup>19</sup> suggests there may be select patient populations and procedures in which regional anesthesia as the primary modality may offer benefit (Table 4). But this remains controversial due to study heterogeneity and the lack of consideration of regional technique risks.<sup>20-35</sup> The decision to offer regional anesthesia should occur in a multidisciplinary fashion, involving the surgeon, anesthesiologist, and, whenever possible, the geriatrician.<sup>36</sup>

#### **Perioperative analgesia in the older adult**

##### **Recommendations**

- Anesthesiologists offering perioperative analgesia services should provide, in collaboration with other health care professionals as appropriate, ongoing education and training to ensure that hospital personnel are knowledgeable and skilled with regard to the

**Table 3.** Alterations to Physiology and Clinical Implications for Anesthesia

System	Physiologic alterations	Clinical implications
Cardiovascular	Decreased sympathetic response. Decreased venous compliance; decrease in preload. Baroreceptor response impaired. Cardiac diastolic dysfunction.	Labile blood pressure. Susceptibility to hypotension. Susceptibility to volume overload. Exaggerated decline in cardiac function with inadequate cardiac filling.
Pulmonary	Increased pulmonary arterial pressures. Decreased response to hypoxia and hypercarbia. Decreased muscle mass and lung elasticity. Decreased cough reflex and esophageal motility.	Increased A-a gradient. Susceptibility to hypercarbia and hypoxemia. Susceptibility to residual anesthetic effects. Increased work of breathing. Increased dead space ventilation. Aspiration risk.
Nervous system	Decreased neurotransmitters.	Increased risk of postoperative delirium and cognitive dysfunction.
Endocrine system	Impaired glucose tolerance.	Increased intraoperative hyperglycemia.
Hepatic/renal system	Altered drug metabolism. Decreased renal mass.	Decreased drug clearance. Susceptible to acute kidney injury.
Thermoregulation	Decreased muscle mass. Decreased vascular reactivity.	Increased risk of hypothermia.

effective and safe use of available treatment options within the institution.

- Every older adult patient should receive a directed pain history and physical examination.
- An appropriate analgesic plan should be developed in every older adult patient before an operation. This plan should be multimodal in nature and accomplish the following:
  - Be appropriately titrated for the increased sensitivity and altered physiology of the older adult.
  - Include a prophylactic pharmacologic bowel regimen such as a stool softener (eg, docusate) and stimulant laxative (eg, bisacodyl) when appropriate.

Avoid potentially inappropriate medications as defined by the American Geriatrics Society Beers criteria, which include barbiturates, benzodiazepines, nonbenzodiazepine hypnotics (eszopiclone, zolpidem, zaleplon), pentazocine, meperidine, skeletal muscle relaxants (carisoprodol, chlorzoxazone, metaxalone, methocarbamol, orphenadrine), and non-Cox NSAIDs.

Use opioid-sparing techniques, which may include preoperative, intraoperative, and/or scheduled postoperative acetaminophen or the addition of regional techniques such as neuraxial blockade or peripheral nerve blocks.

- When added to general anesthesia and compared with systemic opioid-based pain relief, regional techniques in select patients can reduce pain, sedation frequency,

**Table 4.** Role of Regional Anesthetic Techniques for Anesthesia in Older Adults: Selected Examples

Scenario	Recommendation	Potential benefits of regional anesthesia
Repair of hip fracture	In appropriate patients undergoing surgery for hip fractures, patients should be offered regional anesthesia or general anesthesia after discussing the risks and benefits.	Reduced 30-day mortality. Reduced requirement of sedatives. Absence of airway instrumentation. Decreased risk of thrombosis and blood loss. Reduced postoperative confusion.
Elective hip and knee arthroplasty	In appropriate patients undergoing elective joint replacements, regional anesthesia should be considered after discussing the risks and benefits.	Reduced mortality. Better pain scores. Reduced sedation frequency. Reduced use of critical care. Reduced systemic infection. Increased urinary retention. Increased pruritus. Increased frequency of low blood pressure.
Lower limb revascularization	In appropriate patients undergoing lower limb revascularization, regional anesthesia should be considered after discussing the risks and benefits.	Reduced risk of pneumonia.



duration of tracheal intubation and mechanical ventilation, time to return of gastrointestinal function, risk of perioperative myocardial infarction, and overall risk of perioperative cardiovascular complications.

After a directed pain history and physical examination, all analgesic plans for older adults should be multimodal in order to avoid the untoward effects of opioid analgesics and anxiolytics, which include cognitive dysfunction, and hemodynamic and respiratory impairments.<sup>37-39</sup> Both the AGS Beers criteria and the ASA practice guidelines on acute pain management in the perioperative period inform these recommendations.<sup>40</sup>

In addition to intravenous opioids, oral opioids, non-opioid analgesics, and alternative methods (eg, acupuncture, music therapy, massage, cryotherapy), regional techniques are an important adjunctive analgesic modality in older adults. Their benefits include better pain scores, reduced sedation frequency, and reduced usage of opioid medications when compared with systemic opioids alone.<sup>23,27-30,41-43</sup> There are several selected examples (Table 5) in which multimodal analgesia, encompassing regional techniques, is particularly well studied.

### Perioperative nausea and vomiting

#### Recommendations

1. The risk factors for postoperative nausea and vomiting should be assessed in all older adult patients undergoing a surgical procedure.

2. Older adults at moderate or high risk for postoperative nausea and vomiting should receive prophylactic interventions and risk mitigation strategies based on their baseline risk factors per guidelines and local norms.
3. The health care team should be aware of medications used for postoperative nausea and vomiting prophylaxis and treatment that are on the American Geriatrics Society updated Beers criteria for potentially inappropriate medication use in older adults, and carefully weigh their potential benefits and risks.

Nausea and vomiting are among the most common complications of general anesthesia. They can be the source of a significant amount of patient fear and anxiety before surgery and can result in poor patient satisfaction, prolonged time in the postanesthesia care unit, and unplanned hospital admission in surgical outpatients.<sup>44,45</sup> Appropriate risk stratification is important in preventing and managing nausea and vomiting in older adults (Table 6). This may involve the use of an objective risk assessment tool, implementation of prevention strategies, and avoidance of medications typically used in this setting (eg, scopolamine) that may precipitate confusion and postoperative delirium.<sup>39,46-51</sup>

### Patient safety and intraoperative strategies to prevent postoperative complications and hypothermia

#### Recommendations

1. Measures should be taken to ensure proper positioning and padding of bony prominences of elderly patients

**Table 5.** Role of Regional Anesthetic Techniques in Multimodal Postoperative Analgesia in Older Adult Patient Groups: Selected Examples

Scenario	Recommendation	Potential benefits of regional anesthesia
Abdominal surgery, including open abdominal aortic aneurysm repair	In appropriate patients undergoing major abdominal surgery, addition of an epidural with local anesthetic may be considered.	When compared with systemic opioid therapy: Quicker return of bowel function. Reduced duration of tracheal intubation/mechanical ventilation. Reduced cardiac complications, respiratory failure, gastrointestinal complications, and renal failure. Improved pain scores.
Repair of hip fracture	Preoperative or postoperative nerve blocks (via femoral nerve or iliac blockade) should be considered for all patients undergoing hip fracture surgery.	Decreased hospital length of stay. Improved pain scores. Reduced sedation frequency.
Thoracotomy	In appropriate patients undergoing thoracotomy, the addition of thoracic epidural anesthesia should be considered. The role of paravertebral blocks in this patient group is not clear.	When compared to systemic opioid therapy: Better pain scores. Increased incidence of hypotension.
Elective hip and knee arthroplasty	Regional analgesic techniques should be considered in all older adult patients undergoing joint arthroplasty procedures without contraindications.	Reduced opioid usage. Improved pain scores.

**Table 6.** Risk Factors for Postoperative Nausea and Vomiting

Patient-specific
Female sex
Nonsmoking status
History of perioperative nausea and vomiting or motion sickness
Younger age (age <50 y)
Anesthetic- and surgery-related
Use of volatile anesthetics and nitrous oxide
General vs regional anesthesia
Use of intraoperative and postoperative opioids
Longer duration of surgery

undergoing elective or nonelective surgery to maintain skin integrity and limit pressure on peripheral nerves.<sup>52-54</sup>

2. In order to minimize the risk of pulmonary complications postoperatively, the health care team should, where possible, use epidurals, avoid intermediate- and long-acting neuromuscular blocking agents, ensure adequate recovery of neuromuscular function before extubation, and use laparoscopic approaches whenever possible, especially during bariatric surgery.
3. Core temperature should be monitored in operations lasting more than 30 minutes.
4. Patient warming with forced air warmers and/or warmed IV fluids should be used in older patients who are undergoing procedures longer than 30 minutes to avoid hypothermia.

Patient safety is an important consideration in the operating room. In older adults, the risk of peripheral nerve damage and pressure injuries from malpositioning is increased by skin atrophy and decreased skin integrity.<sup>55</sup> A national study found the prevalence of intraoperative ulceration to be 8.5%.<sup>56,57</sup>

Retrospective work has suggested that although this is a rare event, intraoperative pulmonary aspiration can potentially lead to significant morbidity.<sup>58,59</sup> In addition to following fasting recommendations, several intraoperative strategies should also be considered, such as the use of intermediate-acting neuromuscular blockers.<sup>60-62</sup>

Perioperative hypothermia is defined as a temperature of less than 36.0° C; almost all anesthetics can inhibit thermoregulatory function. The elderly, in particular, are predisposed to hypothermia due to altered thermoregulation from decreased muscle mass, metabolic rate, and vascular reactivity. Hypothermia is associated with adverse events in surgical patients, including infection, cardiac events, coagulopathy, and increased oxygen consumption.<sup>15,63-67</sup>

## **Fluid management and targeting physiologic parameters**

### **Recommendations**

1. In general, the administration of intravenous fluids should take into account the combined effects of aging, anesthetics, analgesics, and anxiolytics on physiology.
2. There is insufficient evidence to support a best practices statement for or against specific fluid management strategies or interventions designed to optimize physiologic parameters (“goal-directed therapy”) in the older adult.

Appropriate use of intravenous fluids to prevent effects associated with decreased physiologic reserve is important when caring for the geriatric surgical patient. Generally speaking, more restrictive or goal-directed strategies should be preferred over fixed-volume strategies, which can cause fluid overload.<sup>68-70</sup> Importantly, there is no consensus on definition of a restrictive strategy or the optimal monitoring method when using a goal-directed strategy.

A 2012 Cochrane review included 31 studies and more than 5,000 participants found that the use of fluids and/or vasoactive medications to achieve defined targets significantly increased global blood flow, but did not improve mortality.<sup>71</sup> A 2014 trial suggested that cardiac output-guided hemodynamic therapy did not have an effect on postoperative outcomes.<sup>72</sup> This literature does not allow for broad best practices statement regarding intraoperative fluid management, beyond the avoidance of fixed-volume strategies, in the older adult.

## **Postoperative management**

### **Postoperative delirium**

#### **Recommendations**

1. Health care professionals caring for surgical patients should perform an assessment of delirium risk factors, including age greater than 65 years, chronic cognitive decline or dementia, poor vision or hearing, severe illness (for example, ICU admission), and presence of infection.<sup>73</sup>
2. The health care team may consider instituting daily postoperative delirium screening of all older adult patients using a validated screening instrument (for example, Confusion Assessment Method [CAM]-short form) in order to initiate optimal delirium treatment as early as possible (Table 7).
3. All adults identified as high risk (eg, ICU patients) should be regularly assessed for delirium by an

**Table 7.** Confusion Assessment Method: Short Form

Feature	Question	Answer required
1. Acute onset and fluctuating course	Is there evidence of an acute change in mental status from baseline? Did the (abnormal behavior) fluctuate during the day, that is, tend to come and go or increase and decrease in severity?	At least 1 “Yes” answer
2. Inattention	Did the patient have difficulty focusing attention?	“Yes” answer
3. Disorganized thinking	Was the patient’s thinking disorganized or incoherent?	“Yes” answer
4. Altered level of consciousness	What is the patient’s level of consciousness? Alert – normal Vigilant – hyperalert Lethargic – drowsy, easily aroused Stupor – difficult to arouse Coma – unarousable	Any answer other than alert

Scoring: Suggestion of diagnosis requires the presence of 1 and 2 and either 3 or 4.

(Confusion Assessment Method. © 1988, 2003, Hospital Elder Life Program. All rights reserved. Adapted from: Inouye SK et al. *Ann Intern Med* 1990; 113:941–948,<sup>77</sup> with permission.)

- appropriate health care team member using a validated instrument.<sup>73-79</sup>
- The health care team should perform a physical examination and manage postoperative delirium based on positive screening and/or findings.
  - The health care team should evaluate all postoperative patients who develop delirium for possible precipitating conditions. These include uncontrolled pain, hypoxia, pneumonia, infection, electrolyte abnormalities, urinary retention, fecal impaction, medications, and hypoglycemia.
  - Health care professionals should implement strategies for the prevention of postoperative delirium in older adults (Table 8).
  - After addressing underlying causes, health care professionals should treat older adults with postoperative

delirium with multicomponent nonpharmacologic interventions and reserve pharmacologic interventions only for patients who pose substantial harm to themselves or others with agitated, hyperactive delirium behaviors.

Delirium is among the most significant age-related postoperative complications. It is characterized by an acute decline in cognitive function and attention, with evidence from the history that this is due to physiologic derangement, a medication, or multifactorial.<sup>80</sup> There are 3 distinct motor subtypes of delirium: hypoactive delirium, which presents with lack of awareness and decreased motor activity; hyperactive delirium, which occurs when a patient is combative or agitated; and a mixed subtype.<sup>81-83</sup>

Depending on the patient population, delirium prevalence ranges from 9% to 44% and is associated with worse surgical outcomes, longer hospital length of stay,

**Table 8.** Delirium Prevention Strategies

Education targeted to health care professionals about delirium
Multicomponent, multidisciplinary nonpharmacologic interventions that may include:
Daily physical activity
Cognitive reorientation
Bedside presence of a family member whenever possible
Sleep enhancement (eg, nonpharmacologic sleep protocol and sleep hygiene)
Early mobility and/or physical rehabilitation
Adaptations for visual and hearing impairment
Nutrition and fluid repletion
Pain management
Appropriate medication usage
Adequate oxygenation
Prevention of constipation
Minimization of patient tethers whenever possible (eg, Foley catheters, periodic removal of sequential compression devices, electrocardiogram cords)



**Table 9.** Treating Postoperative Delirium

Patient	Therapy	Details
All delirious elderly patients, first-line therapy	Multicomponent non-pharmacologic interventions	<ol style="list-style-type: none"> <li>1. Frequent reorientation with voice, calendars and clocks</li> <li>2. Calm environment</li> <li>3. Eliminating restraint use</li> <li>4. Familiar objects in the room</li> <li>5. Ensuring use of assistive devices (glasses, hearing aids)</li> </ol>
Agitated, delirious elderly patients threatening substantial harm to self and/or others, if behavioral measures have failed or are not feasible, second-line therapy	Antipsychotic medications at lowest effective dose	<ol style="list-style-type: none"> <li>1. Haloperidol starting at 0.5 to 1.0 mg po/intramuscular/intravenous (intravenous route not recommended due to increased risk of prolonged QT interval) Re-evaluate in 15 min to 1 h and double dose if ineffective Increased risk of prolonged QT interval when dose exceeds 35 mg/d</li> <li>2. The following can also be used: Risperidone Olanzapine Quetiapine Ziprasidone</li> </ol>

functional decline, higher rates of institutionalization, higher mortality, and higher costs and resource use.<sup>73,75,76,78,79,84-89</sup>

Current evidence regarding routine delirium screening in all patients suggests that though there are benefits in terms of earlier detection and treatment, routine screening could also result in misdiagnosis, inappropriate treatment, and increased costs. In appropriate settings, such as in high risk populations, the ICU, or a specialized unit, the health care team may choose to institute screening with a validated instrument.<sup>80</sup>

Up to 30% to 40% of cases of delirium are preventable.<sup>90</sup> The best treatment for delirium is prevention. Should delirium develop, the first step in management is to investigate possible causes. A recent comprehensive review of the literature on the evaluation and treatment of postoperative delirium was conducted by a multidisciplinary panel.<sup>80</sup> Their recommendations are summarized in [Table 9](#).

### **Pulmonary complication prevention**

#### **Recommendations**

1. The health care team should implement postoperative strategies for the prevention of pulmonary complications in the older adult ([Table 10](#)).

Pulmonary complications increase the risk of mortality after surgery.<sup>91,92</sup> Older age may be an independent predictor of postoperative pneumonia, after adjustment for comorbidity burden.<sup>93</sup> In addition to interventions designed to optimize pulmonary status during the preoperative and intraoperative periods, there are several postoperative strategies that can be used to prevent pulmonary complications in the older patient, including screening for signs and symptoms of dysphagia.<sup>93</sup>

### **Fall risk assessment and prevention**

#### **Recommendations**

1. All postoperative older adult patients should undergo an evaluation of their fall risk either through identification of risk factors (altered mental status, dehydration, frequent toileting, history of falls, impaired gait/mobility, medications, and visual impairment) or through the use of a risk scale.
2. Universal fall precautions ([Table 11](#)) are indicated in all older adult patients. Fall risk precautions should not interfere with early mobilization and ambulation in the postoperative setting.
3. Older adult patients with specific risk factors for falls in the postoperative period should receive targeted care planning for fall prevention ([Table 12](#)).

It is estimated that approximately 30% of older adults in the community fall every year.<sup>94</sup> Estimates of falls in hospitalized patients are between 700,000 and 1,000,000 events every year; one retrospective study demonstrated that 1.5% of surgical inpatients experience a postoperative fall.<sup>95,96</sup> Multifactorial interventions that address the myriad risk factors for falls in the hospitalized patient have proven most effective.<sup>96-98</sup>

### **Nutrition in the postoperative period**

#### **Recommendations**

1. Older adult patients should undergo daily evaluation of their ability to take in adequate nutrition, and this includes risk of aspiration ([Table 13](#)).<sup>99</sup> There should be an initiation of dietary consultation and/or formal swallowing assessment if indicated.

**Table 10.** Postoperative Strategies to Prevent Pulmonary Complications

Aspiration precautions:
Bedside evaluation of any patient with symptoms, signs or history of dysphagia
Instrumental swallow evaluation in select patients
Potential indications: signs/symptoms inconsistent with examination, nutritional or pulmonary compromise with possible dysphagic-related etiology, concern for safety and efficiency of swallowing, high risk diagnosis (eg, neurologic or gastrointestinal pathology), change in swallow function suspected
Head of bed elevation at all times with repositioning
Getting out of bed for all meals when possible
Sitting upright while eating and for 1 h after completing
Use of incentive spirometer and chest physical therapy
Use of deep breathing exercises
Epidural analgesia

Partially adapted from ACS NSQIP Best Practices Guidelines: Prevention of Postoperative Pulmonary Complications.

- Older adult patients who use dentures should have them easily available and accessible.
- All older adult patients who undergo inpatient surgery should have an elevated head of bed with repositioning and should be sitting upright while eating and for 1 hour after completion of eating.
- Older adult patients should undergo daily evaluation of fluid status for at least the first 5 postoperative days, such as daily recording of input/output or daily weights.

Older adult inpatients have high rates of malnutrition (up to 38%); several studies highlight the association of postoperative malnutrition markers with adverse outcomes.<sup>100-103</sup> The health care team should make every effort to initiate normal food intake or enteral feeding as early as possible (Table 14).<sup>104</sup> Patients with signs and symptoms of dysphagia, which include coughing or choking with swallowing, difficulty initiating swallow,

drooling, change in dietary habits, voice, or speech, nasal regurgitation, and history of aspiration pneumonia should undergo formal swallowing assessment.<sup>99</sup>

### Urinary tract infection prevention Recommendations

- Health care professionals should implement strategies before, during, and after the insertion of urinary catheters to prevent urinary tract infection.

**Table 12.** Targeted Falls Prevention

Risk factor	Assessment/intervention
Altered mental status	Assess for delirium. Frequent checks. Review medications.
Dehydration	Adequate hydration. Monitor for orthostatic hypotension.
Frequent toileting	Scheduled toileting.
History of falls	Assess injury risk (history of osteoporosis or low-trauma fractures). Identify patients on anticoagulant medications. Review physical environment to reduce injury risk. Assistive walking devices (eg, walkers) at bedside if used as outpatient.
Impaired gait or mobility	Participation in mobility program focused on positioning assistance and balance and gait training. Early physical and/or occupational therapy.
Medications	Daily medication review. Check for orthostatic hypotension.
Visual impairment	Corrective lens within reach.

**Table 11.** Universal Falls Precautions

Familiarize patient with environment.
Demonstrate call light use.
Maintain call light within reach.
Keep personal possessions within reach.
Sturdy handrails in bathrooms, room, and hallway.
Hospital bed in low position when patient resting; raised to comfortable height when patient transferring.
Hospital bed brakes locked.
Wheelchair wheels locked when stationary.
Nonslip, comfortable, well-fitting footwear.
Night light or supplemental lighting use.
Keep floor surfaces clean and dry; clean spills promptly.
Keep patient care areas uncluttered.
Follow safe patient handling practices.

**Table 13.** Signs of Symptoms of Dysphagia

Coughing or choking with swallowing
Difficulty initiating swallowing
Sensation of food sticking in throat
Drooling
Change in dietary habits
Change in voice or speech
Nasal regurgitation
Oral or pharyngeal regurgitation
History of aspiration pneumonia

- If an older adult patient has an indwelling catheter, daily review and documentation of its indication should be completed and attempts be made to remove the catheter as soon as possible (Table 15).

Urinary tract infections are among the most common postoperative complications, representing 32% to 40% of all nosocomial infections, and they are associated with significant health care costs.<sup>105-109</sup> Older adults are at particular risk for urinary tract infection, especially if they are immobilized. Importantly, indwelling catheters should not be used as a substitute for nursing care of the older adult patient who is incontinent. Additionally, they are not indicated as a means of obtaining urine culture when a patient can void, nor should they routine be used for patients receiving thoracic epidural anesthesia/analgesia.<sup>106,109</sup>

### Functional decline

#### Recommendations

- Health care professionals should implement interventions for the prevention of functional decline in the postoperative older adult, including early mobilization and referral to physical therapy.

Elderly patients are at a high risk for functional decline during and after hospitalization. More than 30% of older persons develop a new disability pertaining to activities of

daily living during hospitalization. Risk factors for functional decline are shown in Table 16. By 1 year, less than half of these patients have recovered to previous levels of functioning.<sup>110-112</sup> Though much of the literature on functional decline has focused on patients hospitalized with medical illness, the stress of surgery further increases the risk of functional decline. Risk factors and prevention strategies are summarized in Tables 16 and 17.<sup>113-116</sup>

The concept of a geriatric model of care deserves special mention. A model of care is a concept that broadly defines the way health services are delivered. In the context of older adult patients, several models of care are designed to address their unique needs. The goals of these models of care include prevention of age-related complications—the so-called “geriatric syndromes”—and addressing hospital characteristics that contribute to increased risk.<sup>117</sup>

In addition to preventing some of the age-related complications discussed earlier, geriatric models of care are also designed to reduce cost and length of hospital stay, reduce risk of mortality, increase likelihood of discharge to home, improve care transitions, and improve patient satisfaction and functional status at discharge.<sup>118,119</sup> Table 18 shows common components of several geriatric care models.

### Pressure ulcer prevention and treatment

#### Recommendations

- Health care teams should assess pressure ulcer risk in all older adult postoperative patients.
- Health care teams should implement multicomponent interventions to prevent and treat pressure ulcers in the postoperative patient at risk for developing pressure ulcers.

The hospitalized elderly are at high risk for developing pressure ulcers, largely due to their comorbidity burden. Up to two-thirds of pressure sores develop in patients over the age of 70. The majority of these occur in the acute hospital setting, usually during the first 2 weeks of

**Table 14.** Summary of European Society for Parenteral and Enteral Nutrition Guidelines on Enteral Nutrition: Geriatrics

- Normal food intake or enteral feeding should start as early as possible after gastrointestinal surgery (Grade A).
- Apply tube feeding in patients in whom early oral nutrition cannot be initiated, with special regard to those
  - undergoing major head/neck or gastrointestinal surgery for cancer (Grade A).
  - with severe trauma (Grade A).
  - with obvious undernutrition at the time of surgery (Grade A).
  - in whom oral intake will be inadequate (<60%) for more than 10 d (Grade C).
  - Initiate tube feeding for patients in need within 24 h after surgery (Grade A).
  - Start tube feeding at low flow rate due to limited intestinal tolerance (eg, 10 to 20 mL/hr) (Grade C).
  - It may take 5 to 7 days to reach target intake and this is not considered harmful (Grade C).
  - Reassess nutritional status regularly during the hospital stay and, if necessary, continue nutritional support after discharge in patients who have received nutritional support perioperatively (Grade C).

**Table 15.** Indications for Indwelling Bladder Catheterization

Patients undergoing genitourologic surgery, colorectal surgery, or surgery with extensive pelvic dissection.
Anticipated prolonged duration of surgery (these catheters should be removed in the postanesthesia care unit).
Patients anticipated to receive large-volume infusions or diuretics during surgery.
Need for intraoperative monitoring of urinary output.
Need for short-term frequent monitoring of urine output in critically ill patients.
Management of acute urinary retention or obstruction.
Need to facilitate healing of advanced pressure ulcers in incontinent patients.
Patient preference to improve comfort.

hospitalization. There are several validated scales, including the Braden scale, Waterlow score, or Norton risk-assessment scale; their use may be more accurate than clinical judgment.<sup>53,120-129</sup>

### Care transitions

#### Recommendations

- The health care team should assess the patient's social support and need for home health before discharge. Where appropriate, the family and caregivers should be involved with discharge planning.
  - Patient or patient caregiver should receive a complete list of all medications and dosages to continue on discharge from the hospital. Medication changes made during the hospital stay should be emphasized.
- A discussion with the patient or patient caregiver should be held and documented with a health care professional regarding the purpose of each drug, how it is to be taken, and the expected side effects and adverse reactions of new medications.
- Patients should undergo assessments of the following before discharge, and an appropriate follow-up plan should be initiated:

**Table 16.** Risk Factors for Functional Decline

Advanced age
Frailty
Cognitive impairment
Poor mobility or functional impairment
Depression
Low social functioning
Presence of other geriatric syndromes (falls, incontinence, pressure ulcers)

**Table 17.** Interventions for Preventing Functional Decline

Care models
Hospital Elderly Life Program <sup>78,87</sup>
Acute Care for Elderly units <sup>114,140-142</sup>
Nurses Improving Care of Health System Elders (NICHE) <sup>143</sup>
Structural characteristics
Handrails
Uncluttered hallways
Large clocks
Large calendars
Staffing
Nursing staff education
Daily multidisciplinary rounds
Patient-based
Promotion of family participation in care
Early mobilization
Early physical/occupational therapy referral
Geriatric consultation
Comprehensive discharge planning
Nutritional support

Nutrition (Mini Nutritional Assessment)

Cognition (3-Item Recall or Mini Mental State Exam)

Ambulation ability (Timed Up and Go Test)

Functional status

Presence of delirium

- If an elderly patient undergoes elective or nonelective inpatient surgery and is being discharged from a hospital to home or to a nursing home, then written discharge instructions should be given and the following should be performed:
  - Comprehension of verbal discharge instructions should be assessed by checking ability of patient or caretaker to repeat back to the health care provider the discharge instructions.
  - Documentation of pending laboratory tests or diagnostic studies, if applicable.
  - Documentation of follow-up appointment for nonsurgeon physician visits or medical treatments, if applicable.

**Table 18.** Components of Geriatric Care Models

Educate health-care providers in core geriatric principles.
Target risk factors for age-related complications.
Incorporate patient and family preferences and treatment goals.
Employ evidence-based interventions.
Multi- and interdisciplinary communication.
Emphasize care transitions.

**Table 19.** Common Components of Models of Transitional Care

Coordinated care, particularly with primary care physician
Engagement of patient, family, and/or caregiver
Patient-centered medical record (eg, a medical record that the patient understands)
Post-discharge follow-up plan
Medication management
Knowledge of important signs and symptoms

Documentation of follow-up appointment with the surgeon or telephone contact with the surgeon within 2 to 4 weeks of discharge.

- The health care team should document and communicate the clinical history of the patient's operation, its results, and any postoperative events or concerns with the patient's primary care doctor.

Transitional care refers to interventions that intend to ensure continuity and coordination of care as patients move between health care settings. The transfer of patient care from the hospital to community settings can often be an unsystematic, unstandardized, fragmented process. The process is frequently fraught with poor understanding of post-hospitalization recovery on the part of patients, due to both low health literacy and poor communication on the part of providers. These and other factors can lead to increased rates of adverse events and subsequent rehospitalization.<sup>130</sup> Up to 1 of 5 Medicare beneficiaries experience readmission within 30 days, and optimal care transitions from the hospital to home or post-acute care settings can help reduce hospital lengths of stay, emergency department use, and rates of rehospitalization.<sup>131,132</sup>

Finally, there are several models of transitional care, beyond the scope of this document, which are designed to address the pitfalls of care transitions.<sup>131,133-139</sup> Components of these models are shown in [Table 19](#).

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