Chapter 3
Managing Multiple Medical Comorbidities

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Pre-operative Risk Stratification and Communication of Risk

Pre-operative risk stratification in older adults helps to quantify the patient's risk of perioperative complications. There are a variety of risk stratification tools that are used to quantify perioperative risk, but none are geriatric-specific. The American College of Surgeons National Quality Improvement Program (ACP-NSQIP) has created and validated a risk assessment tool that takes into consideration the surgery-specific risk of the procedure, and incorporates a number of patient-specific variables, including geriatric variables such as age, functional status, and nutritional status. The other variables also include risk factors that are more common in older adults, such as respiratory disease, heart failure, and disseminated cancer. The ACS NSQIP tool quantifies risk of any complication, serious complication, post-op infections, thromboembolism, return to OR, readmission, and overall mortality. Other risk stratification tools, such as the Revised Cardiac Risk Index (RCRI) and the Gupta risk assessment, focus more on risk of major perioperative cardiovascular adverse events such as myocardial infarction.

After risk is assessed, surgical teams should assess whether the patient has capacity to make medical decisions about his or her care. Subsequently, surgical teams should discuss with patients and families their overall goals for treatment in the context of the patient's life expectancy. Many spine procedures are performed to reduce pain, and a realistic discussion of the recovery trajectory is important to elucidate the rate at which pain control can be achieved and whether this is consistent with the patient's overall goals of care. Open communication and shared decision-making are essential components of this process.

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Geriatric-Specific Risk Factors

There are a number of medical conditions that older adults are predisposed to and that increase risk of complications perioperatively. Older adults are more likely to have renal, cardiac, and pulmonary disease than their younger counterparts. There are four specific areas that should be assessed in older adults before spine surgery—cognitive status, functional status, nutrition, and overall frailty.

Patients with cognitive deficits are more likely to experience delirium in the hospital, which can in turn increase length of stay and lead to other post-operative complications. Cognitive function should be assessed prior to surgery, and patients with cognitive deficits should be referred to a geriatrician. Patients should be assessed for other conditions that predispose to cognitive deficits, such as hearing and vision loss, alcohol and other substance use, and side effects from medications.

Functional status is another important predictor of post-operative complications. Patients should be assessed for their ability to perform activities of daily living (ADLs), and a timed "up and go" test can be administered. This test measures the patient's ability to get up from a seated position, walk 10 ft, turn around, and sit back in the chair. An up and go test that takes longer than 15 s is associated with increased risk of post-op complications, and these patients should receive pre-operative physical and occupational therapy, and early PT should be initiated post-operatively.

Nutrition is another important predictor of post-operative complications. Malnutrition risk increases as people age, and poor nutrition is associated with increased risk of post-operative complications. Nutritional status can be assessed by checking pre-albumin and albumin levels, taking a history on unintentional weight loss from patients, and measuring body mass indices. In some cases, pre-operative nutritional support can improve post-operative outcomes.

These individual predictors can be combined to estimate overall frailty. Studies have shown that four of the following risk factors increase 6-month mortality: cognitive score of less than 3, albumin less than or equal to 3.3 g/dL, more than one fall in the last 6 months, hematocrit less than 35%, dependence with at least one ADL, and presence of at least three comorbidities.

Age as a Risk Factor

Mortality risk increases linearly with increasing age, but the risk of a major adverse cardiovascular event only increases slightly with increasing age, and age is not a predictor of cardiac complications in patients receiving spine surgery. There is, however, a significant risk of increased pulmonary complications as patients age.

Though age does increase risk of some post-operative complications, there is no evidence that increased age correlates with increases in mortality. When there is an increased mortality risk with increased age, this correlates with increasing numbers of comorbidities, such as cognitive and functional decline, malnutrition, and frailty.

Obesity

Obesity in itself does not increase risk of post-operative mortality and most post-operative complications. Obesity does increase risk of perioperative deep venous thrombosis, pulmonary embolism, wound infections, mechanical ventilation, and overall hospital length of stay.

Management of Diabetes

Release of neuroendocrine hormones perioperatively can cause hyperglycemia in patients with diabetes mellitus, and blood glucose levels should be monitored closely during the perioperative period in elderly patients receiving spine surgery. In addition, patients with diabetes have higher rates of coronary artery disease when compared to those without diabetes, so detailed cardiovascular pre-operative examination is important. The American Diabetes Association recommends post-operative blood glucose goals ranging from 80 to 180 mg/dL, though the data varies as to what an optimal target is for the perioperative period. Hypoglycemia below 70 mg/dL should be avoided. For patients already on oral diabetes medication, SGLT inhibitors should be held 3–4 days prior to surgery, as these medications can increase risk of UTI, volume depletion, acute kidney injury, and diabetic ketoacidosis in the post-op setting. Other oral medications can be taken until surgery but should be held on the morning of surgery. For patients on insulin, daily or twice daily basal insulin should generally be given at normal doses, but prandial insulin should be held. For premixed fixed-ratio insulin, approximately 20% of the normal insulin dose should be given the night before surgery, and 50% of the normal insulin dose should be given on the day of surgery. For complicated regimens, pre-operative evaluation with the patient's endocrinologist may be warranted. Post-operatively, most oral hypoglycemic and insulin regimens can be resumed once the patient is eating normally again. Metformin should be held if the patient has acute kidney injury or congestive heart failure, and SGLT-2 inhibitors should not be restarted in the hospital due to the risks of volume depletion and urinary tract infections. Patients who are receiving steroids are prone to hyperglycemia and may require higher doses of insulin.

Cardiac and Pulmonary Disease

Patients with advanced age who are receiving spine surgery have an increased chance of cardiac and pulmonary comorbidities, and should be evaluated thoroughly prior to surgery and risk stratified according to scoring systems such as the RCRI. Once risk stratification has taken place, discussions should take place with the patient and family members to discuss the relative risks and benefits of surgery. If the decision is made to proceed with surgery, on the day of surgery, ACE inhibitors, angiotensin receptor blockers, mineralocorticoid antagonists, and digoxin can generally be held, while beta-blockers are generally continued pre-operatively and in the post-op period.

Studies have consistently shown that age increases risk of pulmonary complications from spine surgery, including post-op atelectasis, pulmonary infection, COPD exacerbations, and respiratory failure. Obstructive sleep apnea (OSA) increases risk of post-operative complications including hypoxemia, respiratory failure, need for mechanical ventilation, and transfer to the ICU, and all patients should be screened pre-operatively for OSA. COPD and pulmonary hypertension also increase risk for pulmonary complications from spine surgery, but there is no clear established increase in risk for pulmonary complications in patients with asthma.

Venous Thromboembolism

Risk of post-operative deep venous thrombosis or pulmonary embolism is between 0% and 15% in spine surgeries. Patients with coexisting malignancies have increased risk of perioperative thromboembolism. All patients over the age of 75 are considered at moderate or high risk for post-operative venous thromboembolism. All of these patients with low bleeding risk should receive pharmacological prophylaxis. Studies have shown superiority of low molecular weight heparin or unfractionated heparin for the prevention of venous thromboembolism, so unfractionated heparin should only be used for prophylaxis in patients who have a contraindication to low molecular weight heparin such as renal insufficiency. In patients who are at high risk for a bleeding complication for whom anticoagulant prophylaxis may be contraindicated, mechanical prophylaxis using intermittent pneumatic compression is a reasonable approach.

Anemia

Older patients receiving major spinal surgery are prone to large amounts of blood loss. Patients should be transfused in the perioperative setting for hemoglobin levels greater than 7 or 8 g/dL.

Delirium

Post-operative delirium is an acute intermittent confusional state that is characterized by fluctuations in attention with or without cognitive changes that did not exist prior to surgery. Advanced age increases susceptibility to delirium, and in some studies, up to 62% of older patients receiving major surgery experienced delirium. Reversible causes of delirium include infection, electrolyte disturbances, uncontrolled pain, pre-existing dementia, medication side effects, and withdrawal from substances such as alcohol. Strategies to prevent post-operative delirium include non-pharmacological measures such as supplying aids to maintain sensory input such as glasses and hearing aids, reorientation and cognitive stimulation, and early mobilization. Medications that increase risk of delirium and should be avoided include benzodiazepines, anticholinergics, and opioids, though uncontrolled pain can also cause delirium, so opioid treatment may be necessary. If a patient is severely agitated due to delirium, reversible causes have been addressed, and non-pharmacological interventions such as redirection have failed, it is appropriate to treat with small doses of antipsychotic medications such as haloperidol. Benzodiazepines are not recommended in the setting for elderly patients, as they can worsen confusion and are sedating.

Pain Management Before and After Surgery

Pain management for patients receiving spine surgery may be challenging, as many of these patients are opioid-tolerant and have chronic pain. In addition, opioids have the potential to incite delirium and confusion in elderly patients, but poor pain control can also cause delirium, so thorough patient evaluation is essential. Multimodal analgesia, combining non-opioid medications with opioid medications for pain control, is an integrated approach that can improve overall pain management. Ketamine can be an effective adjuvant pain medication in patients who are opioid-tolerant. Gabapentinoids such as gabapentin and pregabalin are also an appropriate medication class that can decrease opioid requirements for post-op spine patients, but can also cause sedation and respiratory depression, so caution should be exercised when using these agents in elderly patients. Acetaminophen has a small but statistically significant benefit in pain control for patients who have undergone spine surgery, and has a favorable side effect profile. Nonsteroidal anti-inflammatory drugs (NSAIDs) are relatively contraindicated in many spinal procedures due to risk of nonunion, so discussion between anesthesiologist, internal medicine consultant, and spine surgeon in the pre-operative setting is important to establish whether these agents can be safely used for individual patients. In the post-operative setting, it is important to taper down opioid pain medications and to provide patients with a continuing tapering schedule on discharge from the hospital. Patients should be advised about the risk of opioid overdose and side effects, and if a patient is

discharged on greater than 90 oral morphine equivalents, he or she should receive intranasal naloxone and teaching of patient and family members on how to administer it in the case of opioid overdose.

Smoking, Alcohol, and Substance Use

Smoking increases risk of post-operative complications, including overall morbidity, wound infections, general complications, and pulmonary complications. Tobacco cessation interventions should be offered to all smokers, and there is evidence that the longer an individual is not smoking for, the greater the benefit. Alcohol misuse also is associated with increased risk of post-operative complications, including surgical site and general infections, cardiopulmonary complications, prolonged length of stay, increased ICU days, and higher rates of unexpected returns to OR. While there is little evidence that alcohol cessation pre-operatively decreases risk, there is little harm, so is a reasonable approach. It is also important to obtain a thorough substance use history, as this may reveal opioid use disorder, stimulant use disorder, or other substance use disorders that could affect the post-op course in areas such as pain management and risk of withdrawal from substance use.

Post-operative Disposition

Older patients who receive spine surgery often require prolonged inpatient stays and, in some cases, ICU-level care. Up to 10% of patients who have received lumbar spinal fusion have been shown to require care in an ICU, and patients who are older, are male, and have other comorbidities and more prone to post-operative complications require hospitalization. Procedures that take longer than 5 h and that require an anterior thoracic approach are associated with higher lengths of stay in the hospital. In addition, older patients who receive spine surgery have an increased risk of discharge to a healthcare facility other than home for recovery. This recovery period at a facility helps to provide consistent physical therapy, mobilization, and fall prevention to facilitate eventual discharge home.

Conclusions

Older adults undergoing spinal procedures often have multiple comorbidities that predispose them to longer hospital lengths of stay and post-operative complications. The effects of many of these complications can be mitigated by thorough pre-operative evaluation and communication between primary care physicians, the surgeon, and other consultants. It is paramount that the risks and benefits of surgery are

explained in a thorough manner with patients and families to ensure that they are making informed decisions about pursuing surgery and have a realistic sense of what the surgical and post-operative course will entail. Understanding patient priorities, providing comprehensive information with all options presented in a clear fashion, and consistent communication are essential to ensuring that older patients achieve success when receiving spine surgery.

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