Current Problems in Surgery 56 (2019) 253–257

Contents lists available at ScienceDirect

Current Problems in Surgery

journal homepage: www.elsevier.com/locate/cpsurg

In brief

Marilyn Katz, MD[a], Nicole Silverstein, MD[a], Patrick Coll, MD[a], Gail Sullivan, MD, MPH[a], Eric M. Mortensen, MD, MSc[a], Adam Sachs, MD[b], Jeffery B. Gross, MD[b], Eric Girard, MD[c], Joy Liang, MD[c], Benjamin T. Ristau, MD, MHA[c], Christina Stevenson, MD[a], Phillip P. Smith, MD[c], Brian D. Shames, MD[c], Ryan Millea, MD[c], Irfan Ali, MD[a], Constantine M. Poulos, MD[a], Akila B. Ramaraj, MD[b], Azuka Onye Otukoya, DO[b], James Nolan, BS[a], Zulara Wahla, MBBS[a], Cara Hardy[d], Iman Al-Naggar, PhD[a], Lindsay A. Bliss, MD[e], David W. McFadden, MD[c,*]

In this monograph, a multidisciplinary group of faculty at the University of Connecticut discusses perioperative, anesthetic, and operative management in geriatric patients. As of 2016, there were 37 million people in the United States aged 65 years or older. The elderly population comprises a disproportionately large percentage of surgical patients. Even the healthiest elderly individual having surgery is at an increased risk of serious complications, including myocardial infarction and stroke, when compared to the younger cohort. These patients are also more likely to require an intensive care unit (ICU) level of care, longer hospital stay, and additional hospital readmissions. In this population, functional status and comorbid illnesses are of paramount importance. Older patients are more likely to have significant medical comorbidities, cognitive impairment, and frailty, all of which contribute to increased risk of perioperative and postoperative complications. Understanding that the risk of postoperative delirium, falls, and pressure ulcers increases dramatically in this population, the preoperative evaluation process for older patients includes assessment of these risks and an opportunity to introduce interventions for

From the [a]Department of Medicine, University of Connecticut School of Medicine, Farmington, CT; [b]Department of Anesthesiology, University of Connecticut School of Medicine, Farmington, CT; [c]Department of Surgery, University of Connecticut School of Medicine, Farmington, CT; [d]Department of Neuroscience, University of Connecticut School of Medicine, Farmington, CT; and [e]Department of Surgery, Medical College of Wisconsin, Milwaukee, WI

* Address reprint requests to David W. McFadden, MD, Department of Surgery, University of Connecticut School of Medicine, 200 Academic Way, Farmington, CT 06032.

E-mail address: dmcfadden@uchc.edu (D.W. McFadden).

https://doi.org/10.1067/j.cpsurg.2019.03.004

mitigation. In addition, the decision to choose surgical treatment rather than other options must consider the likelihood of lost function and quality of life.

Preoperative testing is widely over-utilized. Numerous studies have underlined the futility of many tests, even if abnormal, in predicting surgical outcomes. In a 2012 study of 73,596 patients undergoing hernia surgery, there was no difference in major complications or wound-related complications when comparing testing (hematology, chemistry, coagulation, or liver function) to no testing. Cardiac risk assessment depends on surgical timing: (1) emergency (2-4 hours), (2) urgent (6-24 hours), (3) time sensitive (1-6 weeks), and (4) elective. Pulmonary complications contribute equally to poor outcomes, as compared to cardiac events. Pulmonary complications occur more commonly than cardiac complications and are associated with increased morbidity, hospital length of stay, and higher costs. An issue with pulmonary risk assessment is that there is little evidence that interventions can decrease a patient's risk. Recent studies recommend baseline cognitive evaluation. Dementia increases with age and is the strongest independent risk factor for developing delirium postoperatively. The Mini-cog assessment tool has validity for this purpose, setting, and population.

All elderly patients who are scheduled for surgery should have functional assessment because impaired function predicts poor outcomes and may be a stronger predictor of morbidity and mortality than cardiac metabolic equivalents. All preoperative patients 75 years of age or older should be assessed for the presence of frailty with a standard frailty assessment. Frailty places older patients at high risk for poor outcomes and functional decline. Where possible, medications that have been demonstrated to put an older patient at risk for postoperative complications should be reduced or discontinued prior to surgery, and should not be used during or after surgery. Benzodiazepines, anticholinergics, antihistamines, and prescription sleep aids are the classes most commonly associated with adverse outcomes. Other medications, such as anti-Parkinson's or antipsychotic medications are also high risk but may be essential. "Prehabilitation" can be accomplished by referral to outpatient rehabilitation services and/or instructing the patient in exercises and activities which they can perform at home prior to the scheduled procedure. From the anesthesiologist's perspective, the preoperative evaluation focuses on the history of the present illness, comorbidities, current medications, and the functional reserve of vital organs, and most importantly, the cardiovascular and pulmonary reserves. The American Society of Anesthesiologists Physical Status Classification System (ASA score) is a well-known predictor of adverse postoperative outcomes but does not include age. Postoperative pain is a huge source of perioperative morbidity. Thoracic epidurals, transverse abdominis plane blocks, and intravenous lidocaine are all useful adjuncts.

More than one half of colorectal cancer (CRC) cases are in the geriatric population; however, this group accounts for 68.6% of deaths. The need for appropriate care of this specific population of patients is necessary, as geriatric patients are often excluded from clinical trials. The geriatric population has shown significant benefits of screening for CRC with a reduction in the incidence and risk of death. There are multiple benefits of colonoscopy over other screening modalities. The framework to consider screening relies on knowing the following 3 factors for the patient: life-expectancy, risk of death from cancer, and outcomes of screening. The 3 tenets of screening are altered in the extreme elderly: there is a decrease in life expectancy, decrease in the risk of death from colon cancer, and an increase in adverse outcomes from screening. There is a bias that elderly patients are less likely to be offered a standard treatment for rectal cancer, which stems from outdated reports demonstrating a higher perioperative mortality. Recent data suggest that elective colorectal surgery is safe for the elderly (with mortality rate as low as 4.7%). It should be noted that although operative mortality does not differ significantly between old and young populations, overall survival for the elderly with rectal cancer is worse. This is probably due to added complexity with increasing comorbidities.

Each year approximately 1.5 million Americans over the age of 60 years are admitted with emergency general surgery (EGS) diagnoses. Of these, more than 25% require emergency surgery with an estimated cost of $28.37 billion in 2010, more than the cost of many common medical admissions: acute MI ($11B), pneumonia ($10.6B), chronic obstructive pulmonary disease ($5.2B), and diabetes ($4.9B). EGS procedures in the geriatric patient population are associated

with higher mortality, more ICU admissions, multiple organ failure, longer hospital stays, and higher rate of transfer to rehabilitative facility after discharge. Emergency laparotomy carries a 15%-20% mortality. For patients more than 80 years old, the mortality rate increases to 20%-40%, with the most common cause being postoperative sepsis. Almost 50% of nonagenarians are dead within a year after an EGS procedure. Frailty is a better predictor of adverse outcome than age. However, none of the frailty screens accounts for how the acute surgical disease affects the patient's condition. All preoperative evaluations of geriatric patients should include a detailed medical/surgical history, goals of care, mental capacity, depression, delirium risk, substance abuse, and nutritional status.

Intraoperative considerations include proper positioning and padding to prevent pressure ulcers and nerve injury. Hypothermia is associated with increased risk of cardiac events, infection, and coagulopathy. Geriatric patients are especially prone to hypothermia due to the loss of thermoregulation, decreased muscle mass, and decreased metabolism. Any surgical procedure lasting longer than 30 minutes should include core temperature monitoring. Patients should be kept normothermic using warm saline for irrigation and infusion, heating blankets, and a warm operating environment. A multidisciplinary team approach (geriatrician, cardiologist, physical therapy, and nutritionist) in the postoperative management of delirium, pain control, polypharmacy, and early mobilization improves outcomes.

Bladder cancer, the fourth most common malignancy in men and ninth most common in women, has an average age at diagnosis of 73 years. Nearly 25% of patients with bladder cancer have muscle invasive disease for which current guidelines recommend cisplatin-based neoadjuvant chemotherapy followed by radical cystectomy and urinary diversion. This is a complex operation with a high risk of perioperative morbidity (60%, with 40% 90-day readmission rates). Ninety-day mortality is higher in octogenarians (9.2%) and septuagenarians (5.4%) as compared to patients younger than 70 years of age (2%). Geriatric assessment with a focus on modifiable preoperative risk factors may reduce the risk of morbidity following radical cystectomy and urinary diversion. Moreover, it holds the promise of improved stratification for patients who may benefit from more aggressive intervention.

There has been significant research done on the risk factors for breast cancer. Most of these are linked to hormonal influences. With increased age, it is presumed that elderly women would have increased hormonal exposure. Increased body mass index was shown to have an increased risk at age 75 or more years. Additionally, family history of breast cancer, an older age at menopause, and obesity conferred an increased risk, whereas a high number of live births were protective. This study was specific in terms of incidence of breast cancer in the elderly. An important issue is surveillance. The recommendations for elderly women are different than those for younger women. The benefits of mammograms are maximized in those who have a longer life expectancy and improved quality of life. The elderly breast cancer population is different in this regard because they may have an altered quality of life that is affected by increased age and adverse health. Additionally, older women may defer screening mammography as they may refuse intervention if malignancy is found due to concerns regarding their quality of life and/or life expectancy. Recommendations from the National Comprehensive Cancer Network (NCCN) of surgical options for geriatric breast cancer patients are nearly the same as for younger patients. One important difference is the role of the sentinel lymph node (SLN) biopsy. The NCCN notes that there is no definitive evidence for the role of SLN biopsy in certain select groups. Their recommendation is that for patients who are 65 years or older with no palpable axillary lymph nodes, SLN biopsy may be considered optional in terms of patients with favorable tumors, patients for whom the choice of adjuvant systemic therapy is unaffected, and patients with serious comorbidities. The NCCN extends this to axillary lymph node dissection and states that even these dissections may not be beneficial in this select group of geriatric breast cancer patients.

For most of adult life, urinary control is taken for granted. However, unlike homeostatic failures in other systems (eg, appendicitis, cancer, hypertension, and pneumonia), loss of normal urinary control carries significant social stigmata, significantly degrades quality of life, and may be evidence of deeper and more significant pathophysiologies (eg, multiple sclerosis or cognitive declines). Personal embarrassment and rationalization ("don't all women leak a

little?") frequently delay attention-seeking for urinary control disorders, often complicating evaluation and management of these common and distressing problems. With advancing age comes an increasing prevalence of urinary control problems. Urinary control disorders in the geriatric patient are associated with morbidities such as falls and fractures, immobilization, and institutionalization. Although death may not be strongly linked with urinary symptoms, urinary incontinence is feared more than death by hospitalized patients. Especially for the surgeon, seeming iatrogenic failure of urinary control following surgery is a risk that must be considered when contemplating procedural interventions.

Data suggest that the morbidity, mortality, and costs associated with pancreatectomy increase with increasing age. Data also suggest that patients aged 66 years or greater are not undergoing surgical resection of early-stage pancreatic malignancies even when eligible. Of those not undergoing operative intervention, 50% received no cancer treatment. With multivariate analysis, age was the only factor that was not a tumor characteristic that remained a statistically significant predictor of resection. Those patients who underwent resection enjoyed significantly longer survival, with median survival time of 24.3 months compared to 5.8 months without resection. Elderly patients also represent a relatively small percentage of liver resections, with only 11.7% of procedures performed in the elderly. However, they were more likely to undergo partial hepatectomies rather than anatomic resections. These resections were more likely to be performed for malignant disease compared to younger patients. Long-term outcomes were slightly worse among elderly patients with resected hepatocellular carcinomas. The evidence regarding resection of metastatic hepatic lesions is largely dominated by colorectal metastectomies. Acceptable rates of postoperative morbidity and mortality have been achieved for both initial and repeat hepatic resection for metastatic disease in patients older than 70 years. Reported mortality rates are 0% and 7% and morbidity rates of 41% and 38% for first and subsequent resections, respectively. Overall survival was 28 months among all patients following the first resection, which rose to 33 months when analyzing patients with R0 resections.

The average age at diagnosis of gastric adenocarcinoma in the United States is 69 years. Specific features of gastric cancer in elderly patients include increased CA 19-9, advanced disease, and node metastasis, with no significant differences in *Helicobacter pylori* status. The elderly had more synchronous tumors (17.2%). Access to care was recently reviewed from the Surveillance, Epidemiology, and End Results (SEER) database of nearly 6000 elderly patients with regional gastric adenocarcinoma. The review showed that 26.5% received no treatment. The lack of treatment was associated with age more than 80 years, black race, lower education levels, and diagnosis before 2007. Adjuvant chemotherapy in the elderly was evaluated in the elderly vs younger cohort, with no significant difference detected in survival.

Surgeons and emergency physicians who treat injured patients are facing a new paradigm in trauma care. Over the next decade and beyond, the aging population will continue to increase, as will their need for emergency medical care, which has been colloquially termed the "silver tsunami." The 2016 National Trauma Data Bank reports that more than 30% of the recorded injuries occur in patients 65 years old or greater, with more than 20% of the total fatalities. Overall in 2015, unintentional injury was the third leading cause of death, and the seventh leading cause of death in patients older than 65 years with more than 51,000 deaths reported. Patients older than 65 years currently use more than 30% of all health care dollars allocated for trauma care and expenditures will continue to rise.

Falls are the most common mechanism of both fatal and nonfatal injuries in older adults. More than half of all unintentional injury deaths were due to falls. Approximately 30% of older adults reported falling at least once in the preceding 12 months, or an estimated 29.0 million falls. Of these individuals, 37.5% reported at least 1 fall that required medical treatment or restricted activity for at least 1 day, resulting in more than 7.0 million fall injuries. In 2015, the medical costs associated with fatal and nonfatal falls were approximately $50 billion. In a review of 12 fall risk factor studies, it was determined that older age, history of previous falls, functional impairment, impaired mobility or use of walking assist devices, dementia, low activity level, and balance impairment carried the highest risk of fall events. Patients who require hospitalization following fall-related injury have poor outcomes. Within 1 year of the index injury, 44.6% of the

patients were readmitted, the 1-year mortality for this cohort was 33%, and for the patients who were discharged alive, the 1-year mortality rate was 24%.

Motor vehicle collisions (MVC) are the second most common mechanism of injury in the elderly population. MVCs have been attributed to visual disturbances, hearing impairments, physical disabilities, medications, or cognitive impairments including difficulties in managing sensory input and chronic diseases. It has been shown that age is a positive predictor of serious injury from motor vehicle trauma, the risk of which increases in nonlinear fashion as age increases. Several studies have shown that elderly drivers are less likely to be appropriately triaged to designated trauma centers. Geriatric patients involved in MVCs have been shown to fare better when assessed at a designated trauma center. Elderly drivers have more fatal crashes per mile driven than any other group except teenage males.

Pelvic and proximal femur fractures are common injuries in the geriatric trauma patient. Approximately 30% of fractures in men, 66% of fractures in women, and 70% of inpatient fractures are potentially osteoporotic. Each year more than 300,000 patients aged 65 years and older are hospitalized for hip fractures, mostly due to falls. Women account for three-quarters of all hip fractures, due to increased risk of osteoporosis. Delay in operative intervention for hip fracture is associated with a significant increase in mortality. Rib fractures are associated with significant mortality and morbidity, with mortality rates increasing linearly with increasing numbers of fractures. Rib fractures in the elderly carry twice the mortality and thoracic morbidity vs younger patients with similar injuries and that for each additional rib fracture, the mortality rate increases by 19% and the risk of pneumonia increases by 27%. Aggressive pain control strategies and chest physiotherapy are the mainstay interventions to decrease the risk of significant pulmonary complications. Treatment options such as narcotics, local rib blocks, paravertebral blocks or infusion pump systems, pleural infusion catheters, and epidural catheter directed analgesia are often employed. Each strategy has its own unique advantages and disadvantages. Intravenous opioid narcotics should be used with caution in elderly patients and administration should be closely monitored. The Eastern Association of the Surgery of Trauma recommends epidural analgesia as the preferred and optimal modality of pain relief for blunt thoracic trauma. Epidural catheter analgesia is associated with less respiratory depression, somnolence, and gastrointestinal symptoms when compared to narcotics.