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Review

Prediction of surgical complications in the elderly: Can we improve outcomes?

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Abstract As the number of Americans aged 65 years and older continues to rise, there is projected to be a corresponding increase in demand for major surgeries within this population. Consequently, it is important to utilize accurate preoperative risk stratification techniques that are applicable to elderly individuals. Currently, commonly used preoperative risk assessments are subjective and often do not account for elderly-specific syndromes that may pose a hazard for geriatric patients if not addressed. Failure to accurately risk-stratify these patients may increase the risk of postoperative complications, morbidity, and mortality. Therefore, we aimed to identify and discuss the more objective and better-validated measurements indicative of poor surgical outcomes in the elderly with special focus on frailty, patient optimization, functional status, and cognitive ability.

1. Introduction

Over the last decade, the number of elderly individuals in the United States has dramatically risen. Nearly 13% of the United States population is aged 65 years or older, and this group is expected to comprise over 20% of Americans by 2030 [1]. In 2007, over one-third of all inpatient surgical procedures were performed on this population, a number which is projected to double by 2020 [2,3]. This rising demand for surgical interventions necessitates accurate preoperative risk stratification techniques that are applicable to elderly individuals. While commonly used preoperative risk assessments incorporate patient laboratory values, presence of comorbidities, and functional status to predict postoperative outcomes, most of these measures often do not account for elderly-specific syndromes that may pose a hazard for geriatric patients if not addressed. Prediction of surgical complications and postoperative morbidity and mortality is vital to the informed consent process and can help the surgeon guide patient expectations after surgery,

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particularly with regards to quality of life and ability to convalesce to their preoperative baseline level of functioning.

The most widely used scale has been the American Society of Anesthesiology (ASA) score, initially developed to classify a patient's physical status based on subjective degree of systemic disease prior to surgery rather than "operative risk" [4,5]. ASA score is used most commonly to give surgeons and anesthesiologists an estimate of risk of postoperative complications. However, it has been criticized for its lack of accuracy and its inconsistencies between evaluators [6]. Scoring systems such as the Preoperative Score to Predict Postoperative Mortality (POSPOM) incorporate objective markers such as dementia, diabetes, dialysis dependence, and heart failure to determine perioperative and postoperative risk of mortality, but do not include the individual's postoperative quality of life and morbidity [6]. Additionally, the Charlson Comorbidity Index is another commonly used scale that uses pre-existing chronic disease to determine a patient's 1-year mortality risk, and can help providers in deciding how aggressively to treat a condition in the preoperative period [7].

Overall, these assessments, among several others, shed insight on determining and improving upon physical, functional, and social issues in patients with the goal of optimizing outcomes. Unfortunately, preoperative assessments have not been adapted to identify geriatric-specific conditions and provide an opportunity for intervention in order to reduce risk. Comprehensive preoperative evaluation with execution of patient-focused treatment strategies is thought to reduce morbidity and mortality in otherwise potentially risky patients [8]. However, these assessment modalities can be particularly subjective and may demonstrate poor reliability between evaluators, ultimately resulting in variability of results [9].

Currently, there is no uniformly accepted method for preoperative prediction of surgical complications and few studies have highlighted specific recommendations for their use in elderly patients. Therefore, our purpose was to discuss the more objective and better-validated measurements indicative of poor surgical outcomes in the elderly. Specifically, we discuss considerations for frailty, patient optimization, functional status, and cognitive ability.

2. Frailty

Frailty can be defined as an increased susceptibility to stressors as a result of age- and disease-related declines in function across multiple domains [10,11]. This vulnerability results in decreased physiologic reserves, which compromises the ability to cope with stressors and potentially increases the risk of mortality and poor postoperative outcomes [11,12]. The prevalence of frailty is high among the elderly and increases with age, as it is seen in 40% of patients aged 80 years or older compared with 10% of patients aged between 65 and 75 years [13]. As compared to more fit patients, frail patients who undergo surgery have a greater likelihood of developing postoperative complications, being discharged to care facilities, and having longer hospital stays [14]. Postoperative complications can result in a series of events leading to loss of independence, disability, decline in quality of life, increased healthcare costs, and even death [15]. Therefore, adequate assessment of frailty as a domain of preoperative health status has been proposed so as to ascertain vulnerability in older adult patients.

The American College of Surgeons has recommended two modalities for evaluating frailty. One strategy is the multidimensional frailty assessment, which has shown to be a useful tool in identifying high-risk older patients in the preoperative setting [16–18]. This method assigns point values to each of the following seven assessments: functional dependence, nutritional status, mobility (timed up-and-go test [19]), presence of comorbidity (Charlson index [20]), age, cognitive ability, and presence of a geriatric syndrome (having one or more falls within 6 months of assessment) [21]. Robinson et al. [22] used this strategy to determine that geriatric patients with four or more of these markers have a greater 6-month postoperative mortality rate compared to those with fewer than four markers, with a sensitivity of 81% and specificity of 86%, independent of the procedural intervention. Specifically, they noted that impaired cognition, anemia, low albumin levels, lack of functional independence, and increased number of comorbidities were strong predictors of 6-month mortality ($p < 0.01$ for all).

Another way to evaluate frailty utilizes its phenotypic definition, which includes the following five features, each worth one point: shrinking (unintentional weight loss of 4.5 or more kilograms in the last year), weakness (decreased grip strength as measured by a handheld dynamometer), self-reported exhaustion (low effort and motivation), low physical activity (Minnesota Leisure Time Activities Questionnaire) and slow walking speed (several ways to assess) [23]. Patients with higher scores are categorized as more frail. Makary et al. [24] prospectively evaluated preoperative frailty in 594 patients aged 65 years or older using this scale. Patients scoring 0 to 1 were categorized as non-frail, 2 to 3 were intermediately frail, and 4 to 5 were frail. The authors determined that patients classified as frail had an increased risk for postoperative complications (odds ratio (OR) 2.54; 95% confidence interval (CI) 1.12–5.77), greater length of hospital stay (incidence rate ratio (IRR) 1.69; 95%CI 1.28–2.23), and greater likelihood of being discharged to a skilled or assisted-living facility after previously living at home (OR 20.48; 95%CI 5.54–75.68). Additionally, intermediately frail patients were associated with an increased risk for postoperative complications (OR 2.06; 95%CI 1.18–3.60), greater length of hospital stay (IRR 1.49; 95%CI 1.24–1.80), and discharge to a skilled or assisted-living facility after previously living at home (OR 3.16; 95%CI 1.0–9.99). This assessment helped predict complications after minor procedures, with an incidence of 3.9% in non-frail, 7.3% in intermediately frail, and 11.4% in frail patients. Furthermore, after major procedures, the incidence of complications was 19.5% in non-frail patients, 33.7% in intermediately frail, and 43.5% in frail patients.

Given the projected annual increase in operations performed on the elderly, it is important to be aware of factors that may influence surgical outcomes. Utilizing an appropriate frailty assessment index may provide additional insight to help surgeons make better predictions for the best interests of the patient.