Emergency General Surgery in the Elderly: Too Old or Too Frail?

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BACKGROUND: Assessment of operative risk in geriatric patients undergoing emergency general surgery (EGS) is challenging. Frailty is an established measure for risk assessment in elective surgical cases. Emerging literature suggests the superiority of frailty measurements to chronological age in predicting outcomes. The aim of this study was to assess the outcomes in elderly patients undergoing EGS using an established Rockwood frailty index.

STUDY DESIGN: We prospectively measured preadmission frailty in all geriatric (aged 65 years and older) patients undergoing EGS at our institution during a 2-year period. Frailty index (FI) was calculated using the modified 50-variable Rockwood Preadmission FI. Frail patients were defined by FI $\geq$ 0.25. Outcomes measures were in-hospital complications, development of major complications, and mortality. Multivariate regression analysis was performed.

RESULTS: A total of 220 patients were enrolled, of which 82 (37%) were frail. Frailty index score did not correlate with age ($R = 0.64$; $R^2 = 0.53$; $p = 0.1$) and poorly correlated with American Society of Anesthesiologists score ($R = 0.51$; $R^2 = 0.44$; $p = 0.045$). Thirty-five percent (n = 77) of patients had postoperative complications and 19% (n = 42) had major complications. Frailty index was an independent predictor for development of in-hospital complications (odds ratio = 2.13; 95% CI, 1.09-4.16; $p = 0.02$) and major complications (odds ratio = 3.87; 95% CI, 1.69-8.84; $p = 0.001$). Age and American Society of Anesthesiologists score were not predictive of postoperative and major complications. Our FI model had 80% sensitivity, 72% specificity, and area under the curve of 0.75 in predicting complications in geriatric patients undergoing EGS. The overall mortality rate was 3.2% (n = 7) and all patients who died were frail.

CONCLUSIONS: Frailty index independently predicts postoperative complications, major complications, and hospital length of stay in elderly patients undergoing emergency general surgery. Use of FI will provide insight into the hospital course of elderly patients, allowing for identification of patients in need and more efficient allocation of hospital resources. (J Am Coll Surg 2016;222:805–813. © 2016 by the American College of Surgeons. Published by Elsevier Inc. All rights reserved.)

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The elderly population is rapidly increasing within the United States. In 2012, there were >43 million people aged 65 years or older, and population growth projections predict twice this number by 2060.[1,2] In the past 20 years, however, the number of patients requiring an operation has outpaced even this expansive growth in the aging population. Currently, more than half of the operations in the United States are performed on those 65 years and older.[3,4] This growth presents a new challenge for surgeons who face an increasing number of elderly patients requiring emergency procedures.

Many studies confirmed that the older patients undergoing surgery have a higher risk for both mortality and complications.[5,6] The term *old* does not reflect a clear

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Abbreviations and Acronyms
ASA = American Society of Anesthesiologists
EGS = emergency general surgery
FI = frailty index
OR = odds ratio

image of a patient's condition, as it only refers to the chronological age of the patient. In addition, commonly used tools for the prediction of complications and risk adjustment cannot measure the physiologic reserve of elderly patients, as they are mostly subjective and often limited to a single organ system.[7-10] These tools are further limited in emergency situations, requiring trained personnel and patient cooperation, which is rarely feasible.

Frailty syndrome is a clinically recognizable increased vulnerability resulting from the age-associated accumulation of deficits in multiple physiologic systems.[11,12] Emerging literature suggests the superiority of frailty measurements to chronological age in predicting outcomes.[13-19] Using frailty as an assessment tool is an evolving concept in the management of elderly surgical patients.[20-23] The advantage of using the frailty index (FI) is that it takes patient's physiologic, cognitive, social, and psychological deficits into account and translates them into a quantifiable variable known as "frailty index," while excluding the physical movement and gait speed that can be cumbersome for emergency surgical patients.

The aim of our study was to identify the impact of the established Rockwood frailty index on outcomes in elderly patients undergoing emergency general surgery (EGS). We hypothesized that FI $>$ 0.25 measured by an established Rockwood FI is associated with a higher rate of in-hospital complications, longer hospital length of stay, and a higher mortality rate in elderly EGS patients.

METHODS

Study settings and patients

After obtaining approval from IRB at the University of Arizona, College of Medicine, we performed an 18-month (October 2012 through March 2014) prospective observational study of consecutive EGS patients aged 65 years and older presenting to our acute care surgery-verified Level I trauma center. Only patients with in-hospital admission who underwent a procedure in the operating room were included. Patients who were transferred from other institutions, rehabilitation centers, or skilled nursing facilities, and those who refused to consent, were excluded.

A power analysis was performed. It has been reported in the literature that, in comparison with nonfrail patients, frail patients are 55% more likely to have in-hospital complications develop.[24] By using this 55% difference, effect size of 0.55, α error probability of 0.05, and power of 80%, the targeted study sample size was 239. We enrolled 242 patients and, after meeting the exclusion criteria, we included 220 elderly patients with EGS.

Data points and definitions

We recorded the following data points for each patient: patient demographic characteristics, including age, sex, vital parameters, initial diagnosis, type of procedure, American Society of Anesthesiologists (ASA) score, comorbidities, insurance status, and hospital and ICU length of stay, hospital and ICU-free days, ventilator days, ventilator-free days, discharge disposition, and in hospital mortality. Hospital-free days were defined as the number of the days between hospital discharge and day 28 after hospital admission. Ventilator-free days were defined as the number of days between successful weaning from mechanical ventilation and day 28 after hospital admission. Intensive care unit-free days were defined as the number of days between ICU discharge and day 28 after hospital admission.

Patients were approached by a single investigator within the first 24 hours of their hospital admission for enrollment in the study. After obtaining informed consent, frailty data were gathered using modified Rockwood frailty questionnaire (Appendix; available online) and FI was calculated for each patient by dividing the sum of all scores to 50.[25] The variables comprising the FI were explained to each patient, and it was clarified that the answers should state patient's preadmission health condition.

We categorized patients into 2 groups based on their FI: frail or nonfrail. Frail was defined as FI $\geq$ 0.25 and nonfrail was defined as FI $<$ 0.25. We chose an established cutoff point of 0.25 for dichotomizing, based on previously published studies.[13,15] Our primary outcomes measure was in-hospital complications. Our secondary outcomes measures were hospital length of stay and mortality.

Using American College of Surgeons NSQIP definitions, we categorized overall in-hospital complications into minor and major complications. Major complications were defined as sepsis, intra-abdominal abscess, enterocutaneous fistula, delirium or confusion, pneumonia, deep venous thrombosis, cholangitis, pulmonary emboli, hemorrhage/ischemia, ARDS, acute kidney injury, deep surgical site infection, and return to the operating room. Minor complications were defined as urinary tract infection, superficial surgical site infection, and gastroenteritis.[26]