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The impact of frailty on outcomes of paraesophageal hernia repair

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ABSTRACT

Background: Frailty is a measure of physiological reserve that has been used to predict outcomes after surgical procedures in the elderly. We hypothesized that frailty would be associated with outcomes after paraesophageal hernia (PEH) repair.

Methods: The National Surgical Quality Improvement Program database (2011-2013) was queried for International Classification of Diseases, Version 9 and Current Procedural Terminology codes associated with PEH repair in patients aged ≥ 60 y. A previously described modified frailty index (mFI), based on 11 clinical variables in National Surgical Quality Improvement Program was used to quantify frailty. Multivariate logistic regression was used to determine the relationship between frailty, complications, and mortality.

Results: Of the 4434 PEH repairs that met inclusion criteria, 885 records were included in the final analysis (20%). Excluded patients were missing one or more variables in the mFI. The rate of complications that were Clavien–Dindo Grade ≥ 3 was 6.1%. Mortality was 0.9%. The readmission rate was 8.2%, and 10.9% of patients were discharged to a facility other than home. Relative to mFI scores of 0, 1, 2, and ≥3, the respective occurrence percentages were as follows; Grade ≥3 complication: 3.2%, 4.7%, 9.8%, and 23.3% ($P < 0.0001$; odds ratio [OR] 3.51; confidence interval [CI] 1.46-8.46); mortality: 0.0%, 0.9%, 1.8%, and 2.3% ($P = 0.0974$); discharge to facility other than home: 4.4%, 10.9%, 15.7%, and 31.7% ($P < 0.0001$; OR 4.07; CI 1.29-12.82); and readmission: 8.9%, 6.8%, 8.5%, and 16.3% ($P = 0.1703$; OR 1.01; CI 0.36-2.84). Complications and discharge destination were significantly correlated with the mFI.

Conclusions: Frailty, as assessed by the mFI, is correlated with postoperative complications and discharge to a facility other than home after PEH repair.

Introduction

Paraesophageal hernias (PEHs) are defined as having both the gastroesophageal junction and gastric fundus displaced above the diaphragm.[1] Over 90% of PEHs are type III hiatal hernias in which the stomach is herniated alongside the esophagus, and the gastroesophageal junction is displaced above the diaphragm.[2] PEHs account for 5%-10% of all hiatal hernias but are increasingly common with advancing age.[1-4] Generally, PEHs tend to enlarge with time, and the annual incidence of acute

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symptoms requiring emergency surgery is estimated to be 0.7%-7% per year.[4,5] Surgery is indicated for symptomatic PEHs.[4,6] Although the elderly are more likely to suffer from a symptomatic PEH and experience diminished quality of life, clinicians may be reluctant to seek surgical consultation or offer surgical intervention secondary to fear of increased morbidity and mortality and a perceived lack of symptomatic benefit.[7]

Frailty is increasingly recognized as an important predictor of health care outcomes, as it is thought to estimate physiological reserves primarily in older adults.[8,9] With an aging US population, the ability to identify frailty is becoming of paramount importance given the fact that over half of all operations in the United States are being performed on patients aged 60 y and older, and this is the fastest growing segment of the US population.[5,8] Frailty relates to an individual patient's physiological reserve and resistance to stressors.[8-10] Frailty is defined as a decrease in physiological reserves giving rise to vulnerability separate from the normal aging process.[8,11] Although there is a universal intuitive recognition of frailty by most physicians caring for older people, there is not a standardized assessment tool to quantify the phenomenon of frailty used frequently in clinical practice.[12] To quantify frailty, two models have been described. The first, a physical phenotype model described by Fried *et al.*, is based on the following characteristics: unintentional weight loss, exhaustion, weakened grip strength, slow walking, and low physical activity.[11,13,14] The second, a multiple domain aggregate model validated by a number of studies including a 70-item scale large population–based study, the Canadian Study of Health and Aging, is based on the concept of cumulative deficits integrating medical, psychological, and functional capabilities.[13,15] A simplified modified frailty index (mFI), based on 11 clinical variables has been derived from the latter model and validated in several surgical studies.[11,15,16]

To our knowledge, the mFI has not been considered for older adults undergoing PEH repair. We hypothesized that the use of the mFI would be a predictor of adverse occurrences and mortality in patients aged ≥60 y undergoing PEH repair.

Methods

We used the American College of Surgeons National Surgical Quality Improvement Program (NSQIP) participant user file (PUF), years 2011-2013 for this study. Patients were included if they underwent surgery based on Current Procedural Terminology (CPT) and International Classification of Diseases, Version 9 (ICD-9) codes (Table 1) and if they were ≥60 y. Exclusion criteria included patients with missing preoperative data in reference to any of the 11 modified frailty variables (Table 2). An mFI based on these 11 variables was calculated for each patient by adding the number of variables present for each patient. Patients with a score of 3 or greater were classified as a high-frailty cohort.

From the NSQIP database, we abstracted details of patient's age, gender, race, procedure timing (emergent *versus* nonemergent), functional status, American Society of Anesthesiologists (ASA) classification, wound classification, preoperative serum albumin, and procedure type (laparoscopic *versus* open). The occurrence of 30-d postoperative adverse outcomes and mortality were evaluated and analyzed relative to the mFI. The primary outcomes analyzed were 30-d occurrences of superficial surgical site infection (SSI), acute renal failure, peripheral nerve injury, deep incisional SSI, organ space SSI, wound disruption, deep venous thrombosis/thrombophlebitis, pulmonary embolism, pneumonia, urinary tract infection, bleeding requiring transfusion, sepsis, reoperation, need for ventilator >48 h, unplanned intubation, septic shock, myocardial infarction, cardiac arrest requiring cardiopulmonary resuscitation, coma, progressive renal insufficiency, and mortality. The secondary outcomes analyzed were discharge destination and readmission.

Table 1 – CPT procedure and ICD-9 diagnosis codes.

CPT procedure codes and description	
43,281	Laparoscopy, surgical, repair of paraesophageal hernia, without mesh
43,282	Laparoscopy, surgical, repair of paraesophageal hernia, with mesh
43,332	Open, repair of paraesophageal hiatal hernia, via laparotomy, without mesh
43,333	Open, repair of paraesophageal hiatal hernia, via laparotomy, with mesh
43,334	Thoracic repair, repair of paraesophageal hiatal hernia, via thoracotomy, without mesh
43,335	Thoracic repair, repair of paraesophageal hiatal hernia, via thoracotomy, with mesh
43,336	Repair of paraesophageal hiatal hernia, via thoracoabdominal incision, without mesh
43,337	Repair of paraesophageal hiatal hernia, via thoracoabdominal incision, with mesh
ICD-9 diagnosis codes and description	
551.3	Diaphragm hernia with gangrene
552.3	Diaphragm hernia with obstruction
553.3	Diaphragm hernia

CPT = Current Procedural Terminology; ICD-9 = International Classification of Diseases, Version 9.

The severity of the postoperative complications was evaluated using the Clavien–Dindo Classification system. The Clavien–Dindo surgical complication grading system ranks complications based on the magnitude of the interventions required to manage the complication and whether that complication causes permanent disability or death.[11,17,18] The aforementioned postoperative complications tracked through NSQIP were grouped based on how they are treated in routine clinical practice under Clavien–Dindo grading criteria (Table 3).[18]

For statistical analysis, univariate analysis of categorical data was performed using chi-square tests and Fischer exact tests. Multiple logistic regression analysis was presented as odds Ratio (OR; 95% confidence interval [CI]) and used to determine each outcome by mFI category after adjusting for the other variables in the model. Logistic regression analysis excluded unknown and expired patients. We chose to omit the records of patients missing one or more of the 11