The Importance of Age on Short-Term Outcomes Associated With Repair of Giant Paraesophageal Hernias

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Background. **Older patients have an increased incidence of paraesophageal hernia (PEH) and can be denied surgical assessment due to the perception of increased complications and mortality. This study examines the influence of age and comorbidities on early complications and other short-term outcomes of PEH repair.**

Methods. **From 2000 to 2016, data of surgically treated patients with PEH were prospectively recorded in an Institutional Review Board–approved database. Only patients whose hernia involved over 50% of the stomach were included. Patients were stratified by age (<70, 70 to 79, ≥80 years of age) and compared in univariate and multivariate analyses.**

Results. **Overall, 524 patients underwent surgical PEH repair (<70: 261 [50%]; 70 to 79: 163 [31%]; ≥80: 100 [19%]). Patients greater than or equal to 80 years of age had higher American Society of Anesthesiologists class, more comorbidities, larger hernias, and higher incidences of type IV PEH and acute presentation. Patients greater than or equal to 80 years of age had more postoperative complications, but not higher grade complications (Clavien-Dindo grade ≥IIIa). Median length of stay was 1 day longer for patients greater than or equal to 80 years of age (5 days versus 4 days for patients <70 and 70 to 79 years of age, respectively). Objective, radiologic hernia recurrence at 4.3 months postoperation was 17.3% and was not increased in the greater than or equal to 80 years of age group. After adjustment for comorbidities and other factors, age greater than or equal to 80 years was not a significant factor in predicting severe complications, readmission within 30 days, or early recurrence.**

Conclusions. **PEH repair is safe in physiologically stable patients, irrespective of age. Incidence of complications is higher in older patients, but complication severity and mortality are similar to those of younger patients. Patients with giant PEH should be given the opportunity to review treatments options with an experienced surgeon.**

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Giant (types II, III, and IV) paraesophageal hernias (PEHs) are relatively uncommon and account for up to 5% to 10% of all hiatal hernias [1, 2]. It has been historically perceived that a significant number of giant PEH patients are asymptomatic leading many practitioners to recommend conservative management, especially in the older population [3]. However, this concept has been questioned in recent case series suggesting that the majority of patients assessed by a surgeon will have symptoms affecting their daily quality of life [4, 5]. A recent study by Carrott and colleagues [6] demonstrated that 269 of 270 patients had a mean of 4 symptoms potentially related to their PEH. Presenting symptoms varied but included heartburn (59%), postprandial chest pain (40%), cough (16%), shortness of breath (53%), early satiety (54%), dysphagia (47%), and anemia (37%) [7–9]. In addition, a portion of patients with PEH will present acutely with incarceration or serious life-threatening complications such as strangulated gastric volvulus.

The U.S. population older than 65 years of age increased from 13% to 17% between 2000 and 2015 and is predicted to increase to 24% in 2060 [10]. As PEH tends

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to present in older patients, we can expect the incidence of these hernias to increase over time with the growing older adult population. Chronological age is felt by some to be a contraindication for elective surgical management of PEH, perhaps secondary to concerns such as increased complications and mortality and perceived lack of significant symptomatic benefit. Although current surgical guidelines suggest that age should not preclude repair in symptomatic patients [2], few studies have examined age and outcomes in detail, specifically comparing very old patients (eg, those 80 years of age and older) to other age groups.

Our hypothesis is that physiologically stable older patients with giant PEH can undergo elective PEH repair with similar expectations for success, as seen in younger patients. This study examines a large cohort of patients presenting with giant PEH over a period of 15 years at a high-volume surgical center. The aim of this study was to evaluate the demographics and outcomes in older as compared to younger patients.

Patients and Methods

All patients with giant PEH (type II, III, or IV) who underwent surgical repair at our institution between January 2000 and January 2016 were prospectively recorded in an Institutional Review Board–approved database. Patients with type I hiatal hernias, those who underwent other major procedures in addition to PEH repair, and those with incomplete preoperative data were excluded. Patients who had PEH involving over 50% of intrathoracic stomach on preoperative contrast studies were included.

Patient demographics, American Society of Anesthesiologists (ASA) class, Charlson comorbidity index (CCI), presenting symptoms, comorbidities, perioperative variables, and surgical details were collected. All patients underwent a preoperative barium swallow study, standard manometry, or high-resolution manometry (as of the year 2009), and upper gastrointestinal endoscopy. Other diagnostic modalities such as pulmonary function tests, computed tomography scan, and pH testing were selectively performed. Based on preoperative characteristics, including esophageal function, appearance on witnessed swallow study, and potential for shortened esophagus, a tailored approach to repair was pursued utilizing either the modified open Hill repair, or a fundoplication (Nissen, Dor, or Toupet). Intraabdominal esophagus of 3 to 4 cm was considered adequate for fundoplication. Collis gastroplasty or hiatal mesh reinforcement was not performed on any patients in this cohort. Gastropexy and gastrostomy were done selectively, taking into account concern for short esophagus and hernia size.

Patients were stratified into 3 groups by age: less than 70, 70 to 79, and 80 years of age or older. Surgical details and outcomes including hospital length of stay (LOS), complications with Clavien-Dindo (CD) grading, 30-day readmission, and 30-day mortality were recorded. Protocols included a scheduled follow-up barium swallow at 3 months following surgery.

Categorical data were presented as count (frequency) and analyzed with Pearson's chi-square test or Fisher's exact test, as appropriate, with correction for multiple comparisons. Continuous, normally distributed data were analyzed with the analysis of variance test and post hoc Šidák correction, and presented as mean ± SD. Non-normally distributed continuous variables and discrete variables were presented as median (interquartile range) and analyzed using the Kruskal-Wallis test with Dunn's post hoc test and Šidák correction. Log-binomial regression models were constructed to estimate adjusted relative risk (RR) of higher-grade complications (CD grade ≥IIIa), 30-day readmission, and recurrence. A generalized Poisson model was constructed to estimate incidence rate ratio (IRR) for LOS. Variables with known clinical relevance and those approaching significance on univariate testing ($p \leq 0.20$) were included in adjusted models. Interactions were tested based on bivariate correlations. Variate p values and model information criteria (Akaike and Bayesian) were used to direct model optimization of the complications model. Subsequent models used the same variables for comparison, adding upstream causal covariates as indicated. Sensitivity analysis was performed for each model to evaluate the associations of different age groupings with the outcomes of interest (Supplemental Table S1). All statistical analyses were conducted with Stata/SE 14.1 (StataCorp LP, College Station, TX) using an a priori 2-tailed significance level of 0.05. Forest plots were generated with Prism 6.01 (GraphPad Software Inc, La Jolla, CA).

Results

Between January 2000 and January 2016, 539 consecutive patients with PEH underwent surgical repair at our institution. Fifteen patients were excluded: there were 2 patients with incomplete preoperative data and 13 who underwent concomitant procedures (eg, cholecystectomy, ventral hernia repair). The remaining 524 comprised the study cohort, and were grouped by age: less than or equal to 70 (n = 261) had a mean age of 60.2 ± 7.7 years old, 70 to 79 (n = 163) had a mean age of 74.6 ± 3.0 years old, and greater than or equal to 80 (n = 100) had a mean age of 84.5 ± 4.0 years old. Baseline characteristics were compared and demonstrated variability among the studied groups. Mean body mass index was significantly higher in the less than 70 and 70 to 79 groups as compared to the greater than or equal to 80 group (30.6 versus 28.9 versus 26.7, respectively; $p < 0.001$). Older patients more frequently had higher ASA class (III or IV) and higher CCI (Table 1). Renal comorbidities, hypertension, and diabetes were more common in the 70 to 79 and greater than or equal to 80 groups.

The presenting symptoms such as cough, regurgitation, early satiety, hoarseness, and heartburn were similar among the groups (Table 2). The exception was chest pain, which was more common in the greater than or equal to 80 group (59% versus 41% versus 45% for the ≥80, <70, and 70 to 79 groups, respectively; $p = 0.012$). Dysphagia to solids was commonly present in all