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Emergency department utilization and predictors of mortality for inpatient inguinal hernia repairs

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ARTICLE INFO

Article history:

Received 12 September 2016

Received in revised form

31 October 2016

Accepted 9 December 2016

Available online xxx

Keywords:

Inguinal hernia

Nationwide inpatient sample

Emergency department

Mortality

Inpatient

ABSTRACT

Background: Although inguinal hernias are common surgical diagnoses, minimally symptomatic patients are often not scheduled for repairs and are asked to seek medical attention if they develop symptoms. We investigated factors associated with emergency department (ED) utilization for inguinal hernia repairs and determined whether ED utilization affected mortality for this otherwise electively treated condition.

Methods: We performed a retrospective analysis of the 2009-2013 Nationwide Inpatient Sample to identify patients who presented through the ED and were then admitted for unilateral inguinal hernia repairs. Multivariable logistic regressions that adjusted for several patient and hospital characteristics determined predictors of both ED admission and postoperative mortality.

Results: There were 116,357 inpatient hospitalizations. The majority (57%) resulted from ED admissions, of which most (85%) had a diagnosis of obstruction or gangrene. Notable predictors of ED admission from the multivariable analysis included obstruction (odds ratio, 9.77 [95% confidence interval: 9.05-10.55]), gangrene (18.24 [13.00-25.59]), Black race (1.47 [1.29-1.69]), Hispanic ethnicity (1.35 [1.18-1.54]), self-pay (2.29 [1.97-2.66]) and Medicaid insurance (1.76 [1.50-2.06]). While overall mortality decreased from 2.03% in 2009 to 1.36% in 2013, admission through the ED was independently associated with higher mortality compared with elective repair (1.67 [1.21-2.29]), even after adjusting for the diagnosis of obstruction and gangrene. Other predictors of mortality included patient age and comorbidities.

Conclusions: In our study, Black, Hispanic, and self-pay patients were more likely to present through the ED. After adjusting for obstruction or gangrene, simply presenting through the ED was independently associated with a 67% higher postoperative mortality rate compared with that of an elective operation. Our findings suggest both a difference in ED utilization and subsequent difference in mortality by patient race and ethnicity and insurance for this common surgical condition.

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0022-4804/\$ – see front matter © 2016 Published by Elsevier Inc.
<http://dx.doi.org/10.1016/j.jss.2016.12.012>

Introduction

Inguinal hernia repairs are one of the most common surgical procedures in the United States. More than 750,000 are performed annually, with the lifetime risk of an inguinal hernia being 27% for men and 3% for women.^{1,2} Even though surgery is the only successful treatment of an inguinal hernia, the decision to operate is determined mostly by the patient's clinical history and examination. Asymptomatic and minimally symptomatic patients are often delegated to a "watchful waiting" treatment plan and are instructed to seek medical attention if they develop worsening symptoms, especially those associated with obstruction or gangrene.³⁻⁵ If this happens, patients commonly undergo a scheduled operation or alternatively receive surgery after being admitted through an emergency department (ED). Previous studies have suggested that up to one-quarter of patients who follow the "watchful waiting" paradigm end up getting surgical repair within 2 y.^{6,7}

While most inguinal hernia repairs are elective outpatient procedures and carry a postoperative mortality rate of <0.5%,^{1,8-10} many patients require emergent repairs because of exacerbating symptoms or strangulated tissue. Emergent repairs are associated with increased postoperative length of stay, greater medical costs, significant morbidity, and a 7-fold increase in mortality.^{10,11} However, while patients who undergo emergent hernia repairs often present through the ED, not every patient who presents to the ED with a symptomatic inguinal hernia will require an emergent surgical repair. Little is known about the current composition of patients using the ED for their inguinal hernia repair. Patients may be presenting because of worsening hernia symptomatology or due to a growing trend of increased ED utilization for nonurgent care.¹²⁻¹⁴ Also, little is known regarding differences in outcomes between patients with similar clinical presentations and comorbidities who are admitted through the ED for their hernia repair compared with those who undergo elective surgery.

This study had two aims in evaluating patients who require ED admission for their inguinal hernia repair. The first sought to better characterize the patient population that used the ED by identifying patient and hospital characteristics associated with ED admission. The second determined whether simply presenting through the ED, irrespective of obstruction or gangrene, for an inguinal hernia repair affected a patient's postoperative mortality rate for what should be an otherwise elective procedure. To assess the uncommon outcome of mortality from inguinal hernia repairs, we examined repairs that required postoperative inpatient care using the Nationwide Inpatient Sample (NIS) data from 2009 to 2013.

Methods

Study population

To understand the significance of outcomes in patients requiring ED admissions, we needed to compare this patient population with a similar group which may have comparable

clinical histories. We therefore chose to compare ED patients with those who undergo elective repair but require inpatient hospitalization afterward. We performed a retrospective analysis using the US NIS database, which is created and maintained by the Agency for Healthcare and Research Quality and is the largest all-payer inpatient healthcare database in the United States. We included all hospitalizations for unilateral inguinal hernia repairs from January 1, 2009 to December 31, 2013, the 5-y period before full implementation of the Affordable Care Act (ACA).¹⁵

We identified inpatient hospitalizations for unilateral inguinal hernia repairs using the International Classification of Diseases-9-Schedule Modification (ICD-9-CM). Inclusion criteria included ICD-9-CM codes 17.1 and 53.0 for unilateral repair of an inguinal hernia. Exclusion criteria included age <18 y, codes for bilateral repairs of inguinal hernias (53.1), unilateral repair of femoral hernias (53.2), bilateral repair of femoral hernias (53.3), a negative procedure day (i.e., due to readmission), and patients with cancer (140-239). We excluded hospitalizations with concurrent operations such as cholecystectomies (51.2) and appendectomies (47) to remove unilateral inguinal hernia repairs performed secondarily with procedures for other diagnoses. We also excluded hospitalizations indicating that patients had previously received the hernia repair at a separate facility, including transfers and readmissions.

Variable definitions

To determine whether an inpatient stay originated from an admission through the ED, we used the HCUP_ED variable in NIS. Hereafter, we label all sources of admission not through the ED as scheduled admissions. Mortality was based on the disposition at discharge indicating expired. Factors that may affect the relationship between admission source and mortality were determined *a priori*. These included patient age at admission, sex (male and female), race (White, Black, Hispanic ethnicity, Asian, Native American, and other), payer (Medicare, Medicaid, private, self-pay/no charge/other), preoperative obstruction (ICD-9-CM codes 550.10 and 550.11), preoperative gangrene (550.00 and 550.01), indicator that the patient had a history of hernia (550.01 and 550.11), and quarter and calendar year of the hernia repair. We also used the Elixhauser score, a method for measuring patient comorbidity from ICD-9-CM diagnosis codes.^{16,17} The list of 30 comorbidities that make up the Elixhauser score captures acute and chronic conditions and has been shown to be significantly associated with in-hospital mortality.^{16,17} Hospital characteristics included region, hospital type, bed size, and teaching institution.

Analysis

In all analyses, we used the recommended sampling weights accounting for the NIS stratum and clustering at the level of the hospital, including the Agency for Healthcare and Research Quality—provided trend weights that account for the redesign of the dataset in 2012.¹⁸ We first calculated the yearly number of patients who presented through the ED for their

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