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# Risk Factors and Outcomes of Acute Versus Elective Groin Hernia Surgery

Youmna Abi-Haidar, MD, Vivian Sanchez, MD, FACS, Kamal MF Itani, MD, FACS

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**BACKGROUND:** Hernia characteristics and patient factors associated with acute compared with elective groin hernia surgery are unknown.

**STUDY DESIGN:** A retrospective study of 1,034 consecutive groin hernia repair cases performed between 2001 and 2009 at a single Veterans Affairs Hospital was conducted. Patient variables, hernia characteristics, time to surgery, and morbidity and mortality outcomes were abstracted and compared between acute and elective hernia repairs. A Kaplan-Meier survival analysis for the two groups was also performed. Logistic regression analysis was conducted to identify associations between type of surgery, patient demographics, and hernia characteristics.

**RESULTS:** Compared with 971 elective repair patients, the 63 acute repair patients had a higher rate of femoral hernias (2.5% vs 7.4%,  $p = 0.03$ ), a higher rate of scrotal hernias (16.2% vs 32.4%,  $p = 0.0006$ ), and a higher rate of recurrent hernias (16.7% vs 30.9%,  $p = 0.0026$ ). Patient age, femoral, scrotal, and recurrent hernias were significantly associated with acute hernia presentation on univariate and multivariable analyses. Complications occurred in 27% and 15.1% of acute and elective repair patients, respectively ( $p = 0.01$ ). Intraoperative organ resection was required in 7 (11.1%) acute hernia repairs, and in 2 (0.2%) elective repairs ( $p < 0.0001$ ). Three acute repair patients (4.8%) underwent reoperation within 30 days after surgery, compared with 15 elective repair patients (1.5%),  $p = 0.05$ . Age-adjusted Kaplan-Meier survival analysis revealed a shorter time to death among acute repair patients compared with elective repair patients ( $p < 0.0001$ ).

**CONCLUSIONS:** Age, femoral, scrotal, and recurrent groin hernias are associated with increased risk for acute hernia surgery. Acute hernia repair carries a higher morbidity and lower survival. (*J Am Coll Surg* 2011;213:363–369. © 2011 by the American College of Surgeons)

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Inguinal hernia repair is the most frequently performed general surgery operation in the United States.<sup>1</sup> Data from the National Center for Health Statistics have indicated that 770,000 inguinal hernia repairs were performed in the United States in 2003, representing about 77% of the nearly 1 million abdominal wall hernia repairs completed annually in the country.<sup>2</sup> According to Primatesta and Goldacre,<sup>3</sup> the lifetime risk of undergoing groin hernia surgery amounts to 27.3% for males, and 2.6% for females.

Studies on the outcomes of acute groin hernia surgery have shown increased morbidity and mortality, and an increase in the length of hospital stay compared with elective groin hernia repair.<sup>4-6</sup> According to a Swedish registry

study of 107,838 groin hernias, the 30-day mortality after groin hernia surgery was 2.3 times higher than that of the background population, owing mostly to the higher mortality after acute groin hernia surgery.<sup>7</sup> To avoid the high risk of morbidity and mortality associated with acute groin hernia surgery, several opinion leaders have recommended that most groin hernias be treated surgically soon after diagnosis.<sup>3,4,8-13</sup>

However, in 2006, Fitzgibbons and colleagues<sup>14</sup> published a randomized controlled trial enrolling 720 men with minimally symptomatic inguinal hernias, assigned randomly to watchful waiting or open tension-free repair. It was concluded that watchful waiting is a safe and acceptable option for managing men with minimally symptomatic inguinal hernias. The patients were only followed for a mean of 3.2 years (range 2 to 4.2 years); of those patients who were in the watchful waiting group, only 1 patient developed an acute incarceration at 2 years, and 1 patient developed an acute incarceration and bowel obstruction at 4 years. These figures tend to underestimate the true occurrence of incarceration and

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Received January 11, 2011; Revised May 10, 2011; Accepted May 16, 2011. From the VA Boston Healthcare System and Boston University (Abi-Haidar, Sanchez, Itani), and Harvard Medical School (Itani), Boston, MA. Correspondence address: Kamal MF Itani, MD, FACS, VABHCS (112A), 1400 VFW Pkwy, West Roxbury, MA 02132. email: [kitani@va.gov](mailto:kitani@va.gov)

bowel obstruction because these events are more likely to occur with longer periods of observation.

In order to better understand the factors associated with acute groin hernia surgery, we reviewed our cohort of groin hernia surgery patients at the VA Boston Health Care System over the last 8 years.

## METHODS

After IRB approval, the VA Computerized Records System (CPRS) was used to review the records of all patients who underwent surgery for both elective and acute groin hernia repair at the Boston VA Healthcare System between fiscal years 2001 and 2009. We defined acute hernia repair as being either emergent or urgent. Emergent surgery was defined as a procedure resulting from a patient presentation to the emergency center or urgent care for acute hernia symptoms such as acute pain, incarceration, bowel obstruction, strangulation, or peritonitis, resulting in immediate surgical intervention. In the urgent group, the groin hernia was reduced, but patients were admitted to the hospital out of concern for the seriousness of the incarceration in the judgment of the admitting surgeon; they were not taken emergently to the operating room because of a severe medical condition and had their hernia repaired as soon as their medical condition was stabilized. Operative notes, general surgery consultation notes, primary care, urology, and all surgical progress notes were reviewed. Charts of elective repair patients were abstracted from time of the first general surgery consultation for the index hernia to the 30<sup>th</sup> postoperative day. Records of acute repair patients were reviewed in their entirety until the 30<sup>th</sup> postoperative day, for the purpose of abstraction of time from first hernia diagnosis to operation. The variables recorded were sex, age at time of surgical repair, priority (acute vs elective), hernia type and characteristics, primary or recurrent, incarceration or strangulation (for acute hernia repairs), symptomatic or asymptomatic, time from diagnosis to surgery (for acute hernia repairs), time from general surgery consultation to surgery (for elective repairs), intraoperative organ resection, reoperation, 30-day morbidity, 30-day mortality, and long-term mortality.

In the morbidity analyses, multiple complications experienced per patient were accounted for individually. Complications were classified into 3 groups: hernia-specific, major, and organ systems-based. Hernia-specific complications consisted of complications directly related to the hernia surgery, such as hematoma, surgical site infections, pain requiring more than one hospital visit, paresthesias, testicular infarction, orchitis, orchiectomy, and recurrence. Major complications consisted of sepsis, peritonitis, cardiac arrest, cerebral infarction, and pulmonary embolism. Or-

gan systems-based complications included cardiac (myocardial infarction, arrhythmia, EKG changes, hypotension, congestive heart failure exacerbation, and other cardiac complications), gastrointestinal (ileus, bleeding, bowel obstruction, diarrhea, and elevations in liver function tests), renal (renal insufficiency, acute renal failure, dehydration, and hyponatremia), neurologic (encephalopathy, delirium, syncope, failure to thrive, and falls), pulmonary (pneumonia, bronchitis, and pneumothorax), infectious (dialysis catheter infection, prosthetic urinary sphincter infection, parotitis, and phlebitis), hematologic (drop in hematocrit requiring transfusion), endocrine (hypoglycemia, gout, and hyperthyroidism), and urinary (urinary retention, urinary tract infection, false passage of Foley catheter and incontinence) complications.

The data were analyzed using SAS statistical analysis program, version 9.1. We calculated the frequencies of the discrete variables and the means of the continuous variables for each of the acute and elective surgery groups. We compared these numbers between the acute and elective groups using the chi-square test for the frequencies and the *t*-test for the means. Variables with a sample size of 5 entries or less were compared using a Fisher's exact test. A Cox proportional hazards model was used to compare survival rates over time between the acute and elective surgery groups; age as a continuous variable was adjusted for in the model using the PHREG procedure. Univariate and multivariable logistic regression analysis, with Wald confidence limits set at 95%, was used to examine the association of age and hernia type (femoral, scrotal, direct/indirect/pantaloon, bilateral, and recurrent) with acute hernia presentation. Age was analyzed as a continuous variable, and hernia types as categorical variables in all logistic models. A *p* value  $\leq 0.2$  on univariate analysis was required for inclusion of the variables in the multivariable analysis.

## RESULTS

### Baseline patient characteristics

There were 1,034 consecutive patients who underwent 1,196 groin hernia repairs at our institution between October 1, 2001 and September 30, 2009. Most patients were male (98.4% in the acute group, and 99.4% in the elective group). One female (1.6%) in the acute group and 6 females (0.6%) in the elective group underwent repair. Patients in the acute group were significantly older ( $p < 0.0001$ ), with a mean ( $\pm$ SD) age of 74 years ( $\pm 11.1$ ), compared with the elective group, where the mean ( $\pm$ SD) age was 64 years ( $\pm 13.0$ ) (Table 1).

There were 63 (6.1%) patients who underwent acute groin hernia surgery, and 971 (93.9%) patients who underwent elective groin hernia surgery. Of the 63 patients who

**Table 1.** Patient and Hernia Characteristics

Variable	Acute	Elective	p Value
Patient level			
n (%)	63 (6.1)	971 (93.9)	
Patients who underwent bilateral repair, n (%)	5 (7.9)	157 (16.2)	0.1100
Sex, n (%)			0.3600
Male	62 (98.4)	965 (99.4)	
Female	1 (1.6)	6 (0.6)	
Age, y, mean ( $\pm$ )	73.8 ( $\pm$ 11.1)	64.2 ( $\pm$ 13.0)	<0.0001
Hernia level, n (%)			
Direct	26 (38.2)	376 (33.2)	0.3900
Indirect	37 (54.4)	564 (49.8)	0.4600
Pantaloon	0 (0.0)	158 (14.0)	0.0001
Femoral	5 (7.4)	28 (2.5)	0.0300
Unknown	0 (0.0)	6 (0.5)	>0.9900
Scrotal	22 (32.4)	183 (16.2)	0.0006
Recurrent	21 (30.9)	188 (16.7)	0.0026
Symptomatic	64 (94.2)	872 (77.0)	0.0010

presented with an acute event, 28 (44.4%) were emergent, and 35 (55.6%) were urgent. Bilateral repairs were done in 5 patients (7.9%) presenting acutely, and in 157 patients (16.2%) in the elective group. Four of the 5 patients who underwent bilateral acute repairs had 1 symptomatic hernia side, and the fifth patient presented with both hernia sides acutely symptomatic (Table 1).

### Interval to treatment

A mean of 26.1 months (median 2.0, interquartile range [IQR] 1.0 to 3.0) had elapsed from the first diagnosis of a groin hernia to the time of acute repair. For the elective repair hernias, the mean time from the first general surgery consult to elective repair was 4.9 months (median 13.0 months, IQR 2.5 to 47.0 months). Thirty-three patients (53%) in the acute group were never diagnosed with a hernia before acute presentation, and the remaining 30 patients (47%) were diagnosed before presentation. Of the undiagnosed patients, 25 (75.8%) did not know they had a hernia, 5 (15.2%) knew they had a hernia but never sought medical attention, and 3 (9.0%) presented with symptoms to the clinic or emergency center, but the hernia was missed on physical examination. Among previously diagnosed patients, 14 (46.6%) did not undergo repair due to severe comorbidities, 9 (30%) refused surgery, 5 (16.7%) were asymptomatic and were watchfully observed, and 2 (6.7%) were not offered surgery for unknown reasons (Table 2).

### Hernia characteristics

In the acute group, 5 hernias (7.4%) were femoral, compared with 28 hernias (2.5%) in the elective repair group ( $p = 0.03$ ). In addition, 22 acutely repaired hernias were scrotal (32.4%), compared with 183 (16.2%) electively repaired hernias ( $p = 0.0006$ ). A higher percentage of recurrent hernias was observed in the acutely repaired group ( $n = 21$ , 30.9%) in comparison to the elective group ( $n = 188$ ; 16.7%),  $p = 0.0026$  (Table 1).

Results of the multivariable logistic regression analysis indicated a higher likelihood of acute compared with elective hernia repair with older age (odds ratio [OR] = 1.07 [95% CI 1.05 to 1.10],  $p < 0.0001$ ), femoral hernia (OR = 5.40 [95% CI 1.77 to 16.49],  $p = 0.0031$ ), scrotal hernia (OR = 2.25 [95% CI 1.27 to 4.01],  $p = 0.0057$ ), and recurrent hernia (OR = 2.75 [95% CI 1.48 to 5.11],  $p = 0.0013$ ). A higher likelihood of acute vs elective hernia repair was also observed with indirect hernias (OR = 2.21 [95% CI 1.23 to 3.98],  $p = 0.0078$ ). Direct hernia had a  $p$  value greater than 0.2 on univariate analysis ( $p = 0.89$ ), and pantaloon hernia was not fit for analysis due to questionable validity of the model fit, leading to exclusion of these 2 variables from the multivariable analysis. Conversely, a lower likelihood of acute compared with elective hernia repair was observed with bilateral hernia in the multivariable analysis (OR = 0.37, [95% CI 0.16 to 0.88],  $p = 0.0245$ ) (Table 3).

### Morbidity

Seventeen (27%) of the 63 acutely operated patients experienced at least 1 complication within 30 days, compared with 147 patients (15.1%) of 971 patients in the elective group ( $p = 0.01$ ). Acute repair patients also experienced a significantly higher rate of major complications ( $p = 0.004$ ) and organ systems-based complications ( $p = 0.008$ ) compared with elective repair patients. Intraoperatively, 7 (11.1%) acute hernia repairs involved organ resection (6 bowel resections, 1 orchiectomy), compared with 2 (0.2%) orchiectomies among elective repairs ( $p < 0.0001$ ) (Table 2).

Thirty-two complications in total were experienced by the acute repair patients, and 211 complications were experienced by the elective repair group. Among acute groin hernia repairs, 18.8% of the complications were hernia-specific, 12.5% were major, and 68.8% were organ systems-based. Among elective hernia repairs, 38.8% of the complications were hernia-specific, 3.8% were major, and 56.9% were organ systems-based (Table 4). Surgical site infection ( $n = 3$ , 9.4%) and pain requiring multiple emergency department visits ( $n = 2$ , 6.3%) were the most commonly encountered hernia-specific complications in the

**Table 2.** Time to Surgery and Outcomes

Variable	Acute	Elective	p Value
Patient level			
n (%)	63 (6.1)	971 (93.9)	
Consult to surgery time, mo, mean, (median, IQR)]	—	4.9 (13.0, 2.5 – 47.0)	
Diagnosis to presentation, mo, mean, (median, IQR)*	26.1 (2.0, 1.0 – 3.0)	—	
Morbidity (30-d)			
Total, n (%)	17 (27.0)	147 (15.1)	0.01
Hernia-specific, n (%)	3 (4.8)	68 (7.0)	0.80
Major, n (%)	3 (4.8)	3 (0.3)	0.004
Organ systems, n (%)	11 (17.5)	76 (7.8)	0.008
Intraoperative organ resection, n (%)	7 (11.1)	2 (0.2)	<0.0001
Reoperation, 30-d, n (%)	3 (4.8)	15 (1.5)	0.05
Mortality, 30-d, n (%)	1 (1.6)	1 (0.1)	0.12

\*Patients who were not diagnosed with their hernia before acute presentation (n = 33) are excluded. IQR, interquartile range.

acute repair group; hematoma (n = 38, 18.0%) and surgical site infection (n = 17, 8.1%) were the most common in the elective repair group. Among the major complications, those encountered in the acute repair group were peritonitis (n = 2, 6.3%), sepsis (n = 1, 3.1%), and cardiac arrest (n = 1, 3.1%); in the elective repair group, peritonitis (n = 3, 1.4%), cerebral infarction (n = 2, 0.9%), pulmonary embolism (n = 2, 0.9%), and sepsis (n = 1, 0.5%) were encountered. Gastrointestinal (n = 7, 21.9%) followed by cardiac (n = 4, 12.5%) complications were the most commonly seen organ systems-based complications in the acute group, and urinary (n = 46, 21.8%) followed by cardiac (n = 21, 10.0%) complications were the most common in the elective group.

Three patients (4.8%) underwent reoperations within 30 days in the acute repair group. In the elective group, 15 patients (1.5%) underwent 16 reoperations (p = 0.05). Reoperations in the acute group were the result of bowel leak in 2 patients and persistent bowel obstruction in 1

patient. However, in the elective group, the reoperations consisted mostly of hematoma evacuations (n = 5), removal of infected mesh (n = 2), and early recurrent hernia repairs (n = 2).

### Mortality

One acute repair patient (1.6%) died within 30 days of surgery, as compared with 1 elective repair patient (0.1%), p = 0.12.

### Survival

Age-adjusted survival analysis using a Cox proportional hazards model revealed a significant postoperative decrease in survival over time among acute repair patients as compared with elective repair patients, with a statistically significant p value of <0.0001 generated from the Cox model (Fig. 1).

**Table 3.** Logistic Regression Analysis of Significant Factors Associated with Acute Compared with Elective Groin Hernia Surgery

Factors	Univariate analysis for significant variables		Multivariable analysis for significant variables	
	Odds ratio (95% Wald confidence limits)	p Value	Odds ratio (95% Wald confidence limits)	p Value
Age, y	1.08 (1.05–1.10)	<0.0001	1.07 (1.05–1.10)	<0.0001
Femoral	3.34 (1.25–8.97)	0.0200	5.40 (1.77–16.49)	0.0031
Scrotal	2.72 (1.58–4.66)	0.0003	2.25 (1.27–4.01)	0.0057
Recurrent	1.97 (1.12–3.46)	0.0195	2.75 (1.48–5.11)	0.0013
Bilateral	0.26 (0.11–0.61)	0.0019	0.37 (0.16–0.88)	0.0245
Indirect	2.12 (1.24–3.65)	0.0064	2.21 (1.23–3.98)	0.0078
Direct	—	—	—	—
Pantaloon	*	—	—	—

\*Because of a quasi-complete separation of data points in the acute vs elective distributions, maximum likelihood estimator may not exist, and validity of the model fit is questionable.

**Table 4.** Percent Ratios of Each Type of Complication Relative to the Total Number of Complications Among Acute and Elective Repairs

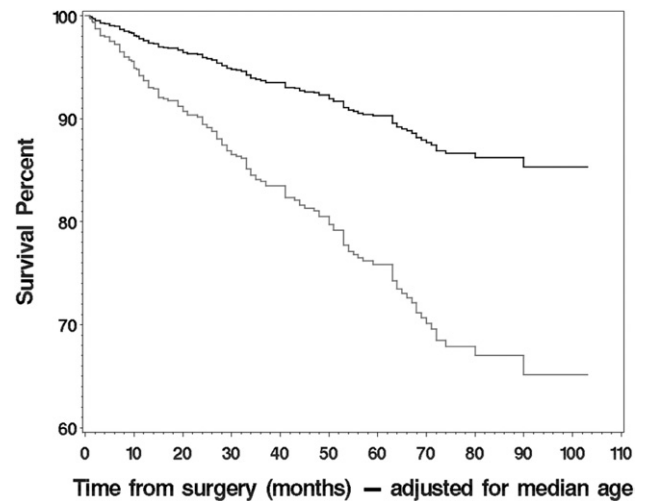
Complications	Acute group (n <sub>total</sub> = 32)		Elective group (n <sub>total</sub> = 211)	
	n	%	n	%
Hernia-specific complications	6	18.8	82	38.8
Surgical site infection	3	9.4	17	8.1
Pain requiring multiple ED visits	2	6.3	4	2
Hematoma	1	3.1	38	18
Recurrence	—		13	6
Bleeding from hematoma/surgical site	—		2	0.9
Retroperitoneal bleeding	—		2	0.9
Infected seroma	—		2	0.9
Testicular infarction	—		1	0.5
Orchiectomy	—		3	1.4
Major complications	4	12.5	8	3.8
Peritonitis	2	6.3	3	1.4
Sepsis	1	3.1	1	0.5
Cardiac arrest	1	3.1	—	
Cerebral infarction	—		2	0.9
Pulmonary embolism	—		2	0.9
Organ systems complications	22	68.8	120	56.9
Gastrointestinal	7	21.9	11	5.2
Cardiac	4	12.5	21	10.0
Neurologic	3	9.4	13	6.2
Urinary	3	9.4	46	21.8
Hematologic	2	6.3	4	1.9
Renal	1	3.1	8	3.8
Endocrine	1	3.1	2	0.9
Pulmonary	1	3.1	13	6.2
Infectious	—		2	0.9

Each patient may have experienced more than 1 complication. Percentages are calculated based on the total number of complications in each of the acute and elective groups.

ED, emergency department.

## DISCUSSION

In order to study the natural history of groin hernias, a large nontreated patient population needs to be followed over several years. With the prevalence of surgical treatment, no such study design can be achieved to date. The only available prospective recordings done on a population of patients with groin hernias date back to 1896, at a time when the Bassini repair method was in its infancy.<sup>15</sup> The observations were made on 8,633 patients enrolled in Paul Berger's truss clinic in Paris, and the calculated yearly risk of bowel obstruction or strangulation was 0.0037 per patient. A more recent initiative involved the prospective data collection from a random, stratified sample of civilians in Cali, Colombia, matched



**Figure 1.** Age-adjusted Cox model estimates for survival over time are demonstrated in this plot, which shows the percent survival of acute and elective hernia repair patients as a function of time elapsed after surgery. Black line, elective repair patients, grey line, acute repair patients. The Cox model yielded a  $p < 0.0001$ , indicating that the differences in survival over time between acute and elective repair patients are statistically significant.

with retrospective reviews of hospital records of acute hernia presentations; the study revealed a 0.0036 yearly risk of hernia incarceration or strangulation.<sup>16</sup> Both the French and Colombian studies resulted in a similar risk of incarceration or strangulation.

A recent prospective randomized controlled trial evaluated watchful waiting vs surgical repair of groin hernias.<sup>14</sup> At 2 years, the rate of crossover of watchfully observed patients to surgical repair was as high as 23%, with pain being the most common reason for crossover (86%) in that study. Another prospective trial of 160 men aged 55 years or older randomized to watchful waiting vs surgical repair similarly showed a crossover rate of 30.7% at 574 days.<sup>17</sup> Only 2 acute hernia incarcerations (over 4 years) in the first study, and 1 acute hernia event (over 1 year) in the second study were captured, and these occurred only in watchful waiting patients. The high rate of crossover in both studies is of concern because it may lead to an underestimation of the actual risk of acute hernia events.

Another weakness of prospective studies is the inability to account for patients with a groin hernia who are not diagnosed by the caring physician, or who are diagnosed but not referred to surgery. With undiagnosed patients constituting 47% of acutely presenting hernia patients in one study<sup>12</sup> and 33 of 63 (53%) in our study, we question the representativeness of prospectively enrolled hernia patients followed for acute hernia events. More specifically, our study results revealed that 25 of 63 (40%) acute repair patients did not know they had a hernia, and 5 of 63 (8%)



did not seek medical attention for their hernia. Another report found that 65% of patients with strangulated hernias who had previously presented to primary care were not referred to surgery.<sup>18</sup> In a study from Denmark, delays in the diagnosis of groin hernias were observed in 41% of patients who died within 30 days of emergency hernia repair.<sup>19</sup> The general surgical community should undertake education initiatives to increase awareness and screening for hernias by referring physicians. Particular attention should be paid to femoral hernias, which are at higher risk of acute presentation and may be missed by caregivers; all 5 of the acutely repaired femoral hernias we studied were undiagnosed before presentation.

One of the risks implicated in watchfully observing older patients is the increase in likelihood of an acute hernia event over time; this risk is amplified by a parallel increase in the number and severity of patient comorbidities at the time of surgery. In our study, acute groin surgery patients were an average of 10 years older than elective repair patients. The higher incidence of groin hernias in the elderly population has been established, with rates as high as 13:1,000 after 65 years of age.<sup>18</sup> In addition, the rates of emergency hernia repair increase exponentially with age in persons older than 50 years,<sup>3</sup> and incarcerated hernia repairs are one of the most commonly performed emergency procedures in the elderly.<sup>20</sup> Up to 67% of patients undergoing incarcerated groin hernia repairs are above 65 years of age.<sup>4</sup> In our multivariable analysis, acute hernia repairs were more likely to occur with older age (OR 1.07), femoral hernias (OR 5.40), scrotal hernias (OR 2.25), and recurrent hernias (OR 2.75), compared with elective repairs. Although watchful waiting for minimally symptomatic inguinal hernias has been proposed by Fitzgibbons and associates,<sup>14</sup> our study suggests that femoral, scrotal, and recurrent hernias, especially in older patients, should be repaired, even if minimally symptomatic or associated with severe comorbidities.

Evidence in support of early elective repair also comes from the higher morbidity and reoperation rates observed among acutely operated patients, and their resulting lower survival. Acute hernia repairs were associated with a 27.0% 30-day morbidity rate compared with a rate of 15.1% in the elective group. Acute repairs also resulted in a significantly higher rate of organ systems-based and major complications compared with elective repairs. Others have reported a morbidity rate varying between 25% and 41.5%.<sup>4,21</sup> Our results also showed a 4.8% rate of reoperations in the acute repair group, which was higher than the 1.5% reoperation rate in the elective group ( $p = 0.05$ ). A reoperation rate of 2.7% among emergency hernia repairs was reported in another study.<sup>4</sup> Bowel leak and persistent

bowel obstruction were the most common reasons for reoperation in the acute group, compared with hematoma evacuation, infected mesh removal, and early recurrent hernia repair in the elective group. Our age-adjusted survival analysis showed a significant and dramatic decrease in postoperative survival over time among acute repair patients. Due to the heterogeneity in the types and degrees of severity of encountered complications, the survival curves could not be adjusted for complications encountered within each group; more severe complications within the acute surgery group might have accounted for a decreased survival over time. These results argue for optimization of a patient's medical condition at the first diagnosis of a hernia to enable expedient elective repair, especially when the hernia is femoral, recurrent, or scrotal. The reported safety of elective hernia repair in elderly patients<sup>7,17,22</sup> and the improvement in the quality of life of those patients<sup>17</sup> warrant elective repair soon after diagnosis of a femoral, recurrent, or scrotal hernia.

In our study, bilateral hernias were associated with lower odds of acute repair. The fact that bilateral hernias are less likely to be of the indirect type might explain their decreased likelihood of incarcerating or strangulating, as suggested by our study and others.<sup>23,24</sup>

## CONCLUSIONS

In summary, older patients with femoral, scrotal, or recurrent hernias are at increased risk for acute hernia surgery. Efforts should be made to identify those patients and operate on them electively after addressing their comorbid conditions. The results of this study should be viewed as complementary to the rigorously conducted prospective randomized clinical trials<sup>14,17</sup> in the field of hernia management, and will allow for a more selective approach to patients assigned to watchful waiting.

## Author Contributions

Study conception and design: Abi-Haidar, Sanchez, Itani

Acquisition of data: Abi-Haidar, Sanchez, Itani

Analysis and interpretation of data: Abi-Haidar, Sanchez, Itani

Drafting of manuscript: Abi-Haidar, Sanchez, Itani

Critical revision: Abi-Haidar, Sanchez, Itani

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## REFERENCES

1. Matthews RD, Neumayer L. Inguinal hernia in the 21st century: an evidence-based review. *Curr Prob Surg* 2008;45:261–312.
2. Rutkow IM. Demographic and socioeconomic aspects of hernia repair in the United States in 2003. *Surg Clin North Am* 2003;83:1045–1051.
3. Primatesta P, Goldacre MJ. Inguinal hernia repair: incidence of elective and emergency surgery, readmission and mortality. *Int J Epidemiol* 1996;25:835–839.
4. Alvarez JA, Baldonado RF, Bear IG, et al. Incarcerated groin hernias in adults: presentation and outcome. *Hernia* 2003;8:121–126.
5. Gallegos NC, Dawson J, Jarvis M, Hobsley M. Risk of strangulation in groin hernias. *Br J Surg* 1991;78:1171–1173.
6. Davies M, Chris D, Davies C, et al. Emergency presentation of abdominal hernias: outcome and reasons for delay in treatment—a prospective study. *Ann R Coll Surg Engl* 2007;89:47–50.
7. Nillson H, Stylianidis G, Haapamaki M, et al. Mortality after groin hernia surgery. *Ann Surg* 2007;245:656–660.
8. Society for Surgery of the Alimentary Tract. Patient care guidelines. 2000. Available at: [www.ssat.com/cgi-bin/hernia6.cgi](http://www.ssat.com/cgi-bin/hernia6.cgi). Accessed May 28, 2010.
9. Andrews NJ. Presentation and outcome of strangulated external hernia in a district general hospital. *Br J Surg* 1981;68:329–332.
10. Haapaniemi S, Sandblom G, Nilsson E. Mortality after elective and emergency surgery for inguinal and femoral hernia. *Hernia* 1999;3:205–208.
11. Oishi SN, Page CP, Schwesinger WH. Complicated presentations of groin hernias. *Am J Surg* 1991;162:568–570.
12. McEntee GP, O'Carroll A, Mooney B, et al. Timing of strangulation in adult hernias. *Br J Surg* 1989;76:725–726.
13. Ohana G, Manevitch I, Weil R, et al. Inguinal hernia: challenging the traditional indication for surgery in asymptomatic patients. *Hernia* 2004;8:117–120.
14. Fitzgibbons RJ, Giobbie-Hurder A, Gibbs JO, et al. Watchful waiting vs repair of inguinal hernia in minimally symptomatic men: a randomized clinical trial. *JAMA* 2006;295:285–292.
15. Berger P. Résultats de L'examen de Dix Mille Observations de Hernies Recueillies à la Consultation des Bandages au Bureau Central, du 4 Février 1881 au 11 Août 1884. Procès-Verbaux, Mémoires, et Discussions (Congrès Français de Chirurgie) 1986;9:264–317.
16. Neutra R, Velez A, Ferrada R, Galan R. Risk of incarceration of inguinal hernia in Cali, Colombia. *J Chron Dis* 1981;34:561–564.
17. O'Dwyer PJ, Norrie J, Alani A, et al. Observation or operation for patients with an asymptomatic inguinal hernia: a randomized clinical trial. *Ann Surg* 2006;244:167–173.
18. Askew G, Williams GT, Brown SC. Delay in presentation and misdiagnosis of strangulated hernia: prospective study. *J R Coll Surg Edinb* 1992;37:37–38.
19. Kjaergaard J, Bay-Nielsen M, Kehlet H. Mortality following emergency groin hernia surgery in Denmark. *Hernia* 2010;14:351–355.
20. Rosenthal RA, Zenilman ME. Surgery in the elderly. In: Review of Townsend CM, Beauchamp DR, Evers BM, Mattox KL. *Sabiston Textbook of Surgery: The Biological Basis of Modern Surgical Practice*. 16th ed. Philadelphia: WB Saunders; 2001: 226–246.
21. Kulah B, Duzgun AP, Moran M, et al. Emergency hernia repairs in elderly patients. *Am J Surg* 2001;182:455–459.
22. Bay-Nielsen M, Kehlet H, Strand L, et al. Quality assessment of 26,304 herniorrhaphies in Denmark: a prospective nationwide study. *Lancet* 2001;358:1124–1128.
23. Serpell JW, Jarrett PEM, Johnson CD. A prospective study of bilateral inguinal hernia repair. *Ann R Coll Surg Engl* 1990;72:299–303.
24. Bouillot JL, Aouad K, Heudes D, et al. Bilateral inguinal hernias repair: analytic study of 71 patients. *Hernia* 1997;1:179–183.