Port-Site Incisional Hernias in Laparoscopic Cholecystectomy: Should the 10/12mm Site be Closed at the Fascia?

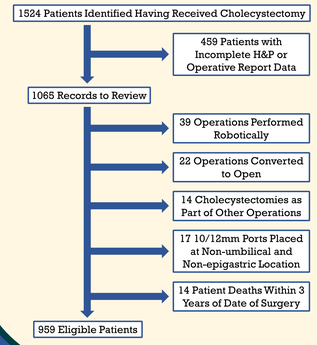
Navtej Singh Grewal M.D., Kelly Tang D.O., James Fraley M.D., Samuel Grasso D.O.

William Beaumont Army Medical Center, 18511 Highlander Medics St. Ft Bliss, TX 79918 *navtej.s.grewal.mil@health.mil*

Introduction

In the United States approximately 140,000 surgeries are performed annually to address incisional hernias with an estimated cost of $3.2 billion per year. A vast majority of these are secondary to laparotomies with 10-20% of patients developing an incisional hernia following open abdominal surgery. While approximately 60% are asymptomatic and 30% go undiagnosed, for many there exists the impact of cosmesis and quality of life as well as the risk of obstruction, incarceration, and strangulation which can lead to emergent reoperation and subsequent morbidity and mortality.

The benefits of laparoscopic surgery are widespread and include, but are not limited to, reduced postoperative pain, shorter hospital length of stay, and equivalent long-term outcomes. In particular, reported rates of incisional hernia following laparoscopic surgery range from only 1-6%. This analysis was designed to investigate which patient, perioperative, and intraoperative characteristics contribute to the development of incisional hernia in laparoscopic cholecystectomy.



Methods

Retrospective review was performed using surgical records at William Beaumont Army Medical Center (WBAMC) to identify all patients who underwent cholecystectomy from January 1st, 2015 to December 31st, 2020. This range was selected to allow evaluation within 3 years from date of surgery which was demonstrated in literature review to account for 90% of incisional hernia development in laparoscopic surgery. In total, 1524 patients were initially identified having received a cholecystectomy. This was reduced to a total of 959 patients after excluding those who underwent robot-assisted cholecystectomy, were converted to an open cholecystectomy, had cholecystectomy as part of another operation, had died within 3 years of their date of surgery, or due to incomplete record of preoperative history and physical or operative report.

Determination of development of incisional hernia was made by review of the patients' medical record for corresponding ICD-10 code, subsequent evaluation by the WBAMC General Surgery Clinic for incisional hernia, and review of all abdominal imaging including superficial ultrasound, CT, and MRI within 3 years of date of surgery. Beyond development of incisional hernia, the following perioperative and intraoperative variables were selected for analysis to determine their correlation to hernia development: umbilical vs epigastric location of the 10/12mm port, if fascial closure was performed at the site of the 10/12mm port and with what type of suture, operative length, urgent vs elective cholecystectomy, and need for port site dilation for gallbladder removal. Additionally, the following patient characteristics were also analyzed: COPD status, diabetes status, history of abdominal surgery, active tobacco use, BMI, age, and sex.

Operative Characteristics and Rate of Hernia Development Unpaired T-Test

Operative Factor	Number of Patients (%)	Hernia Development (%)	p
10/12mm Port Placement[a]			
Umbilical	338 (35.2)	22 (6.5)	
Epigastric	627 (65.3)	7 (1.1)	
		44[b]	
Epigastric Fascial Closure			
Yes	491 (78.3)	6 (1.2)	0.633
No	136 (21.7)	1 (0.7)	
Epigastric Fascial Suture			
Polyglactin	266 (54.2)	5 (1.9)	0.150
Polydioxanone	225 (45.8)	1 (0.4)	
Umbilical Fascial Suture[c]			
Polyglactin	294 (86.9)	21 (7.1)	0.223
Polydioxanone	44 (13.1)	1 (2.3)	
Port-Site Enlargement			
Yes	128 (13.3)	8 (6.3)	0.533
No	831 (86.7)	65 (7.8)	
Timing of Cholecystectomy			
Urgent	342 (35.7)	27 (7.9)	0.806
Elective	617 (64.3)	46 (7.5)	
Operative Length (min)[d]			
<77	467 (48.7)	36 (7.7)	0.913
77+	492 (51.3)	37 (7.5)	

a: 6 patients received a 10/12mm port at both the umbilicus and epigastrium
b: Of the 73 hernias identified, only 29 correlated to patients who had a large port at that site
c: All 10/12mm umbilical ports were closed
d: Median operative length, 77 minutes

Preoperative Patient Characteristics and Rate of Hernia Development Unpaired T-Test

Patient Factor	Number of Patients (%)	Hernia Development (%)	p
COPD Status			
Yes	21 (2.2)	7 (33.3)	0.0001
No	938 (97.8)	66 (7.0)	
Age			
<45	577 (60.1)	32 (5.5)	0.003
45+	382 (39.9)	41 (10.7)	
Sex			
Male	342 (35.7)	32 (9.4)	0.130
Female	617 (64.3)	41 (6.6)	
Diabetes			
Yes	164 (17.1)	17 (10.4)	0.144
No	795 (82.9)	56 (7.0)	
Previous Abdominal Surgery			
Yes	447 (46.6)	40 (9.0)	0.145
No	512 (53.4)	33 (6.4)	
Active Tobacco Use			
Yes	134 (14.0)	10 (7.5)	0.926
No	825 (86.0)	63 (7.6)	
BMI			
<30	472 (49.2)	36 (7.6)	0.986
30+	487 (50.8)	37 (7.6)	

Results and Discussion

Among the 959 patients included in this review 73 developed hernia representing 7.6% of patients within 3 years of their date of surgery. Of these patients, 45.2% developed a hernia at 1 year from their date of surgery and 79.5% by 2 years, with a median of 410 days from date of surgery. Comparable long-term reviews focused on time to hernia development in laparoscopic surgery were not found, with most prospective studies following patients to only 1 year from date of surgery and reporting rates of hernia development of 1-4.5% which our data is consistent with demonstrating a rate of hernia development of 3.4% at 1 year. With respect to distribution of hernia location and contents, 8 were identified at the epigastrium and 65 at the umbilicus. Of these, all were fat-containing hernias except one small bowel containing hernia at the umbilicus. Interestingly, among epigastric hernias, 87.5% occurred in the setting of that being the site of the 10/12mm port; however, this correlation was poor among umbilical hernias with only 33.8% occurring in the setting of that being the 10/12mm port site. Despite this weak correlation, considering 65.4% of patients had a large epigastric port compared to 35.2% having a large umbilical port, this suggests an increased risk of hernia development with placement of the 10/12mm port at the umbilicus. Of note, 6 patients had a 10/12mm port placed at both the umbilicus and in the epigastrium.

With respect to fascial closure of the 10/12mm port-site, 21.7% of epigastric port-sites were not closed at the time of surgery whereas all umbilical port-sites were closed. Among the patients with a 10/12mm epigastric port-site, there was no significant difference in hernia development among those who had this site closed, 1.2% compared to those that did not 0.7% (p=0.633). Furthermore, there was no significant difference seen when stratified by use of polyglactin (Vicryl ® Ethicon) suture vs. polydioxanone (PDS ® Ethicon) suture with 1.9% and 0.4% hernia development, respectively (p=0.150). This was also demonstrated among patients with a 10/12mm umbilical port-site, with 7.1% and 2.3% developing a port-site hernia after closure with polyglactin and polydioxanone, respectively (p=0.223).

Other perioperative and intraoperative factors included urgent vs elective surgery, length of time, and port-site enlargement for specimen retrieval. There was no significant difference in hernia development seen in patients who had urgent cholecystectomy (acute cholecystitis, gallstone pancreatitis, or cholangitis), with 7.9% developing hernias compared to 7.5% of patients receiving elective cholecystectomy (symptomatic cholelithiasis, biliary dyskinesia, or gallbladder polyps) (p=0.806). Operative length has been implicated in risk of hernia development; however, no significant difference was seen in operative length. In this series, median operative length was 77 minutes, with no significant difference seen in hernia development between those with operative time <77 minutes compared to ≥77 minutes (p=0.913). Similarly, no significant difference was seen in hernia development amongst those who had port-site enlargement, 6.3%, compared to those who did not, 7.8% (p=0.533).

When analyzing patient characteristics, COPD status and age demonstrated significantly increased risk of hernia development. With respect to COPD status, 33.3% of patients with COPD developed hernias compared to 7.04% without (p<0.001); however, the overall number of patients with COPD was markedly lower. Older age also demonstrated an increased rate of hernia development, with patients <45 having a hernia rate of 5.5% compared to those ≥45 demonstrating a hernia rate of 10.7% (p=0.003). This is hypothesized to be secondary to increased intra-abdominal pressure in COPD patients and relatively weaker abdominal musculature and connective tissue strength in older patients, respectively.

Other patient characteristics which demonstrated a statistically insignificant difference in hernia development included diabetes status, history of abdominal surgery, and sex. While diabetic patients did demonstrate an elevated rate of hernia development 10.4% compared to 7.0% in nondiabetics, this difference was not significant (p=0.144). Similarly, patients with a history of abdominal surgery had an insignificantly increased rate of hernia development with 9.0% of patients with previous abdominal surgery developing hernias compared to 6.4% of those without history of abdominal surgery (p=0.145). With respect to sex, male patients demonstrated an increased rate of hernia development of 9.4% compared to 6.6% of female patients; however, this was not significant (p=0.130). Smoking status had no significant association with hernia development, with 7.5% of active smokers developing hernias compared to 7.6% of nonsmokers (p=0.926). Lastly, there was no significant difference in hernia rate comparing obese to non-obese patients with them both demonstrating a hernia occurrence rate of 7.6% (p=0.986).

Conclusions

This retrospective review of 959 patients who underwent laparoscopic cholecystectomy demonstrated an overall hernia development rate of 7.6% with median time to diagnosis of 410 days from day of surgery. Significant risk factors to hernia development included COPD status and age ≥45. No significant difference was seen in the rates of hernia development with suture type used for fascial closure, operative length, port-site enlargement for specimen retrieval, or operation being performed in the urgent versus elective setting. Additionally, no significant difference in hernia development was demonstrated when analyzing diabetes status, history of previous abdominal surgery, sex, tobacco use, and patient BMI.

Limitations of this study include timeframe of postoperative investigation with some reports demonstrating hernia development 5-10 years after the date of surgery. Additionally, due to the smaller size of port-site hernias and often their only contents being pre-peritoneal fat, most are asymptomatic which likely results in underdiagnosis of their true incidence. Furthermore, there exists the possibility that patients with symptomatic hernias sought repair through other hospital organizations causing their incidence to be unrepresented in this dataset.

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