Original research

Advanced laparoscopic fellowship training decreases conversion rates during laparoscopic cholecystectomy for acute biliary diseases: A retrospective cohort study

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HIGHLIGHTS

- Acute biliary pathology may increase morbidity during laparoscopic cholecystectomy.
- We examine the impact of advanced laparoscopic fellowship-trained surgeons on surgical morbidity.
- The conversion rate for the fellowship-trained group was significantly lower than for the non-fellowship trained group.
- Laparoscopic fellowship training may shorten hospitalization among patients presenting with acute biliary pathology.

ARTICLE INFO

ABSTRACT

Introduction: Acute biliary pathology is a risk factor for conversion to open surgery and increased surgical morbidity during laparoscopic cholecystectomy (LC). The purpose of our study was to examine the impact of an advanced laparoscopic fellowship-trained surgeon on risks of conversion, surgical morbidity, and postoperative complications in this patient population. **Methods**: Of 1382 patients who underwent an LC from January 2008 to August 2011, 592 patients were diagnosed with an acute biliary process and were included in the study. Patients were divided into two groups; those operated on by an advanced laparoscopic fellowship-trained surgeon ($N = 237$), and those operated on by a non-laparoscopic fellowship-trained surgeon ($N = 355$). The primary end-points were conversion rates and surgical morbidity. The secondary end-point was operative time. **Results**: Fellowship-trained surgeons were more likely to perform IOC (57%) versus non-fellowship trained surgeons (20%) ($p < 0.0001$). The conversion rate for the fellowship-trained group was significantly lower than for the non-fellowship trained group (1.7% vs 8.5%, $p = 0.0004$). The intraoperative and postoperative complication rates for the fellowship-trained group were not significantly different. The operative time was slightly longer in the non-fellowship trained group compared to the fellowship-trained group (104 min vs 111 min, $p = 0.04$). **Discussion**: Our data demonstrate that advanced laparoscopic fellowship training decreases conversion rates of laparoscopic cholecystectomy for acute biliary pathology. Moreover, given the lower conversion rates, patients may have experienced shorter hospitalizations. **Conclusions**: Formal advanced laparoscopic fellowship training may decrease length of stay among patients presenting with acute biliary pathology who undergo laparoscopic cholecystectomy.

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1. Introduction

Since the early 1990s, the laparoscopic approach to symptomatic cholelithiasis has been the procedure of choice [1,2]. Initially, open cholecystectomy (OC) was still performed routinely, and considered the safe option, especially in patients with acute biliary pathology [1–3]. With increased surgical experience and technical

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advancements, laparoscopic cholecystectomy (LC) became increasingly common even in this patient population.

Multiple studies have deemed acute biliary pathology to be a risk factor for conversion to open surgery and for increased surgical morbidity [1,4–7]. Various studies investigated other factors that also may be linked to increased conversion rates and morbidity, including surgeon experience [3,8–11], timing of operation [12,13], age [5,11,14–16], gender [5,11,15,16], body mass index (BMI) [7,16,18], and previous abdominal surgery [6].

Minimally invasive surgery fellowships have become increasingly popular over the past decade as laparoscopy becomes the preferred approach for a multitude of procedures. The purpose of this study was to examine the impact of an advanced laparoscopic fellowship trained surgeon on risks of conversion, surgical morbidity and postoperative complications. We hypothesized that advanced laparoscopic fellowship training decreases the rate of conversion and surgical morbidity during laparoscopic cholecystectomy for acute biliary pathology.

2. Methods & methods

2.1. Study design

2.1.1. Patient records
The records of all patients undergoing LC were reviewed in our institutional review board-approved data base. We retrospectively reviewed 1382 consecutive patients who underwent only an LC for any pathology from January 2008 to August 2011. Of 1382 patients, 592 patients were diagnosed with an acute biliary process and were included in the study. We chose to include consecutive patients in the aforementioned time period with the intended diagnoses to avoid any potential patient selection bias. Inclusion diagnoses were: acute cholecystitis, choledocholithiasis, cholangitis, and gallstone pancreatitis. Patients were excluded if simultaneous procedures were being performed at the time of cholecystectomy (i.e. ventral hernia repair, liver biopsy) or if they had one or more of the following diagnoses: cholelithiasis, biliary dyskinesia, gallbladder polyp, chronic cholecystitis, and gallbladder adenomyosis. Patients were stratified into two groups based on whether the lead surgeon completed advanced laparoscopic fellowship training. Of the nine surgeons participating in the study, three completed advanced laparoscopic fellowship training. A total of 237 patients were included in the fellowship-trained group and 355 patients were included in the non-fellowship trained group.

2.1.2. Preoperative and surgical parameters
Preoperative parameters included age, gender, race, BMI, American Society of Anesthesiologists (ASA) score, previous upper abdominal surgery, and preoperative diagnosis. Previous upper abdominal surgery included any previous abdominal surgical procedure cephalad to the umbilicus. Surgical parameters included surgical technique (conventional versus single-incision laparoscopic surgery [SILS]), total operative time, estimated blood loss (EBL), use of intraoperative cholangiogram (IOC), conversion rate, intraoperative complications, postoperative complications, and length of stay (LOS). All postoperative complications were graded using the modified Clavien-Dindo system [19] and were classified further by organ system. Grade 1 and 2 complications were regarded as minor, and grades 3-5 were regarded as major. Length of stay was also compared between the two groups.

2.1.3. Surgical technique
All LC were performed using a conventional 4-port technique unless specified otherwise. Nine surgeons performed the procedures. Access to the abdomen was performed typically using the Hasson cut-down technique in the umbilicus to achieve carbon dioxide insufflation. For single-incision cholecystectomies, a 2 cm infraumbilical incision was made and the Gel Point™ system [Applied Medical, Rancho Santa Margarita, CA] was used in the majority of cases. Performance of IOC was at the discretion of the attending surgeon.

2.1.4. Statistical analysis
Statistical analyses were performed using Graphpad Prism software version 5.03 [GraphPad Software, Inc. La Jolla, CA] and MYSTAT version 12 [SYSTAT Software, Inc. Chicago, IL]. Categorical variables were compared using Fisher's exact test or chi-square test when appropriate, whereas continuous variables were compared using the Kruskall−Wallis test or Mann−Whitney U test (two-tailed). Univariate binary logistic regression analysis was utilized to identify predictors of conversion, intraoperative complications, and postoperative complications. Those parameters with a $P < 0.05$ as well as BMI were included in the multivariable analysis. Multivariate logistic regression analysis was used to identify independent predictors of conversion, intraoperative complications, and postoperative complications. Both forward and backwards stepwise regression analyses were utilized removing parameters with a $P > 0.15$. All results are expressed as mean ± SD, unless specified otherwise. The null hypothesis was rejected when $\alpha < 0.05$.

3. Results

We retrospectively reviewed 1382 consecutive patients who underwent only an LC for any pathology from January 2008 to August 2011. Of 1382 patients, 592 patients were diagnosed with an acute biliary process and were included in the study. A total of 237 patients were included in the fellowship-trained group and 355 patients were included in the non-fellowship trained group (Fig. 1).

3.1. Preoperative patient characteristics

All preoperative parameters are listed in Table 1. There was no significant difference in age, racial distribution, ASA Score, or previous upper abdominal surgical history between the groups. The BMI was significantly different between the two groups with an average BMI of 35.6 kg/m^2 in the fellowship-trained group compared to 33.3 kg/m^2 in the non-fellowship trained group ($p = 0.005$). The distribution of diagnoses was also significantly different ($p = 0.049$), as there was a higher percentage of patients with acute cholecystitis in the fellowship-trained group (70%)
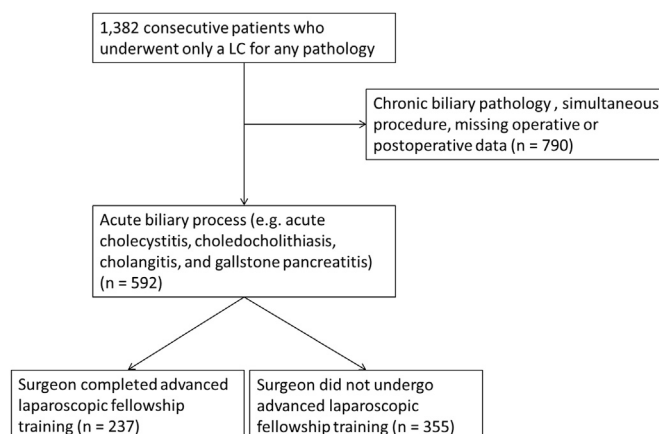

Fig. 1. Inclusion and exclusion criteria.