JOURNAL OF SURGICAL RESEARCH XXX (2014) 1–7

Available online at www.sciencedirect.com

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journal homepage: www.JournalofSurgicalResearch.com

Obesity does not increase morbidity of laparoscopic cholecystectomy

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ARTICLE INFO

Article history:
Received 4 December 2013
Received in revised form
10 February 2014
Accepted 11 February 2014
Available online xxx

Keywords:
Complication
Conversion
Laparoscopic cholecystectomy
Morbid obesity
Morbidity
Obesity
Outcomes

ABSTRACT

Background: Obesity has historically been a positive predictor of surgical morbidity, especially in the morbidly obese. The purpose of our study was to compare outcomes of obese patients undergoing laparoscopic cholecystectomy (LC).

Methods: We reviewed 1382 consecutive patients retrospectively who underwent LC for various pathologies from January 2008 to August 2011. Patients were stratified based on the World Health Organization definitions of obesity: nonobese (body mass index [BMI] < 30 kg/m^2), obesity class I (BMI 30–34.9 kg/m^2), obesity class II (BMI 35–39.9 kg/m^2), and obesity class III (BMI $\geq$ 40 kg/m^2). The primary end points were conversion rates and surgical morbidity. The secondary end point was length of stay.

Results: There were significantly more females in the obesity II and III groups ($P = 0.0002$). American Society of Anesthesiologists scores were significantly higher in the obesity I, II, and III groups compared with the nonobese ($P < 0.05$; $P < 0.01$; and $P < 0.0001$, respectively). Independent predictors of conversion on multivariate analysis (MVA) included age ($P = 0.01$), acute cholecystitis ($P = 0.03$), operative time ($P < 0.0001$), blood loss ($P < 0.0001$), and fellowship-trained surgeons ($P < 0.0001$). Independent predictors of intraoperative complications on MVA included age ($P = 0.009$), white patients ($P = 0.009$), previous surgery ($P = 0.001$), operative time ($P < 0.0001$), and blood loss ($P = 0.01$). Independent predictors of postoperative complications on MVA included American Society of Anesthesiologists score ($P < 0.0001$), acute cholecystitis ($P < 0.0001$), and a postoperative complication ($P < 0.0001$). BMI was not a predictor of conversions or surgical morbidity. Length of stay was not significantly different between the four groups.

Conclusions: This study demonstrates that overall conversion rates and surgical morbidity are relatively low following LC, even in obese and morbidly obese patients.

1. Introduction

Since the early 1990s, the laparoscopic approach to gallbladder pathology has been the procedure of choice. As with any novel procedure at its introduction, laparoscopic cholecystectomy (LC) was limited to a subset of patients based on various contraindications to maintain patient safety. Obesity was considered a contraindication to LC initially [1,2]. With increased surgical experience and technological advancements, LC became permissible even in this patient

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http://dx.doi.org/10.1016/j.jss.2014.02.014

population. Moreover, the safety and feasibility of LC in the morbidly obese patient population has been established [3,4].

Various reports have deemed obesity to be a risk factor for an increased risk for conversion to open surgery, as well as increased surgical morbidity in both laparoscopic and open surgery [3,5–9]. Conversion to open surgery leads to longer hospitalizations and delays in patient convalescence [3]. Moreover, factors associated with increased technical difficulty with laparoscopy, such as obesity, may lend toward increased postoperative complications [8]. Thus, identifying patients at risk for conversion and postoperative complications is an important part of surgical planning and patient counseling.

Increased body mass index (BMI) is a recognized risk factor for cardiovascular disease and mortality in the general population and contributes to postoperative morbidity [5,10]. The purpose of our study was to examine the impact of increased BMI on risks of adverse surgical outcomes following LC. We hypothesized that obesity, including morbid obesity, may no longer be a risk factor for increased rates of conversion and surgical morbidity, as surgical techniques and surgeon expertise have matured over the last 2 decades.

2. Methods

2.1. Patient records

The records of all patients undergoing LC were reviewed in our institutional review board–approved database. We reviewed 1382 consecutive patients retrospectively who underwent an LC for acute cholecystitis, gallstone pancreatitis, choledocholithiasis, cholangitis, biliary colic/symptomatic cholelithiasis, biliary dyskinesia, gallbladder polyp, chronic cholecystitis, or adenomyosis of the gallbladder from January 2008 to August 2011. Patients were stratified based on the World Health Organization definitions of obesity [11]: Nonobese (BMI < 30 kg/m^2; $n = 903$), obesity class I (BMI 30–34.9 kg/m^2; $n = 268$), obesity class II (BMI 35–39.9 kg/m^2; $n = 133$), and obesity class III (BMI ≥ 40 kg/m^2; $n = 78$).

2.2. Patient and perioperative parameters

Preoperative parameters included age, gender, BMI, American Society of Anesthesiologists (ASA) score, and previous upper abdominal surgery. Previous upper abdominal surgery included any previous abdominal surgical procedure cephalad to the umbilicus. Surgical parameters included preoperative diagnosis, surgical technique (conventional *versus* single-incision laparoscopic surgery), surgeon with advanced laparoscopic fellowship training, total operative time, estimated blood loss, and use of intraoperative cholangiogram (IOC). Perioperative variables included conversion rate, intraoperative and postoperative morbidity at 30 d, and as postoperative hospital length of stay (LOS).

2.3. Complications

All complications were graded using the modified Clavien system [12] and were classified further by organ system. Grades 1 and 2 complications were classified as minor, and grades 3–5 were classified as major. Postoperative complications were classified into different categories. Genitourinary and electrolyte complications included acute kidney injury, urinary retention, and severe electrolyte abnormalities. Hematologic complications included postoperative bleeding treated with transfusion. Cardiac complications included arrhythmia and acute myocardial infarction. Respiratory complications included acute respiratory distress. Neurologic complications included altered mental status and syncope. Ophthalmic complications included corneal abrasion. Gastrointestinal complications included ileus and small bowel obstruction treated nonoperatively. Infectious complications were subdivided based on organ system.

2.4. Surgical technique

All LC were performed using a conventional 4-port technique unless specified otherwise. Multiple surgeons performed the procedures (G.D., R.Z., P.S.B., T.J.F., and A.P.) including others not listed. 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 an intraoperative cholangiography (IOC) was at the discretion of the attending surgeon.

2.5. 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 Kruskal-Wallis test or Mann-Whitney *U*-test (two-tailed). Univariate binary logistic regression analysis was used to generate variable predictors of conversion, intraoperative complications, and postoperative complications. Those variable with a $P < 0.05$ and BMI were included in the multivariate analysis. Multivariate logistic regression analysis was used to generate independent predictors of conversion, intraoperative complications, and postoperative complications. Both forward and backward stepwise regression analysis were used for removing variables with a $P > 0.15$. All results are expressed as mean $\pm$ standard deviation, unless specified otherwise. The null hypothesis was rejected when $\alpha < 0.05$.

3. Results

3.1. Preoperative patient characteristics

All preoperative parameters are listed in Table 1. There was no significant difference in age or previous upper surgical history among the four groups. The proportion of males was significantly different among the four groups ($P < 0.0001$); it was highest in the obesity I group (36%) and lowest in the obesity II and III groups (18% and 18%, respectively). The racial