

Original article

# Robotic single-site cholecystectomy in the obese: outcomes from a single institution

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## Abstract

**Background:** Robotic single-site cholecystectomy (RSSC) has been shown to be a safe alternative to the laparoscopic approach in selected patients. Patient exclusion criteria have prevented RSSC as a surgical option in many obese patients. This study reports the feasibility of performing RSSC in obese patients (body mass index [BMI]  $\geq 30$ ).

**Methods:** Between November 2012 and February 2014, a total of 200 patients underwent RSSC at our institution. All patients were offered the robotic procedure regardless of their BMI, age, previous surgery, and acuity of their disease with no exclusion criteria. All patients with BMI  $\geq 30$  were included in the study and were compared to nonobese patients for demographic characteristics, comorbidities, and postoperative outcomes. Data were compared to RSSC performed in nonobese patients by the same surgeon, as well to published data for standard laparoscopic cholecystectomy (LC).

**Results:** A total of 112 cholecystectomies were successfully performed with the robotic approach in patients with BMI  $\geq 30$  without conversion to open, laparoscopic, or multiport procedures. The mean BMI was 39.5 (range 30.1–62.3). Twenty-eight patients had a BMI  $\geq 40$  (25%), and 13 patients had a BMI  $\geq 50$  (11.6%). Fifty-two patients (46.4%) had a history of prior abdominal surgery. Most procedures were nonelective (78.6%) with patients presenting with acute symptoms. Pathology showed chronic cholecystitis and cholelithiasis in 79 patients (70.5%), acute cholecystitis in 26 patients (23.3%), cholelithiasis in 4 patients (3.5%), and gangrenous cholecystitis in 3 patients (2.7%). Total mean operative time was 69.8 (26) minutes for obese patients compared to 59.2 (19.7) minutes in the nonobese, which was statistically significant ( $P = .0012$ ). After a mean follow-up of 6 months, there were no major complications recorded including bile leak, hematoma, or ductal injury. There was 1 umbilical (incisional) hernia (0.9%) reported, and zero wound infections. When comparing RSSC performed in obese patients, RSSC in nonobese patients, and published data for standard LC, we found no difference in operative time, with less conversion to open.

**Conclusions:** Robotic single-site cholecystectomy is a feasible option in the obese patient population with excellent short-term outcomes. Patients should not be excluded based on their high BMI although further study is needed to determine long-term outcomes. (Surg Obes Relat Dis 2015;11:882–887.) © 2015 American Society for Metabolic and Bariatric Surgery. All rights reserved.

## Keywords:

Robotic surgery; Cholecystectomy; Gallbladder; Obesity laparoscopic; Minimally invasive; Robotic single-site cholecystectomy; Overweight; Acute cholecystitis; Biliary colic; Gallstone pancreatitis

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Multiport laparoscopic cholecystectomy (LC) is the current gold standard for the treatment of gallbladder disease. It has been shown to offer shorter recovery, faster return to work, and decreased postoperative pain compared

with open cholecystectomy [1]. Robotic single-site cholecystectomy (RSSC) is a relatively novel approach to gallbladder removal that is gaining popularity among surgeons [2]. The benefits of robotic surgery include unsurpassed 3-D visualization and stability, restored triangulation, surgeon control of working instruments including the camera, and better ergonomics at the console [3]. Despite its growing popularity, questions regarding its feasibility and safety in obese patients have yet to be answered. The aim of our study is to assess the feasibility of using the robot in performing single-site cholecystectomy in obese patients with no exclusion criteria.

## Methods

RSSC was performed on 200 consecutive patients between November 2012 and February 2014, of which 112 patients were obese as defined by a body mass index (BMI  $\geq 30$ ). After obtaining Institutional review board approval, perioperative data on patients were collected and maintained in a secure database. All patients with a diagnosis of gallbladder pathology requiring cholecystectomy were candidates for this approach. Nonobese patients who underwent RSSC were used as a comparison group for total operative time evaluated with student *t* test. Co-morbidities were compared using  $\chi^2$  test. These diagnoses included acute cholecystitis, symptomatic cholelithiasis, gallbladder polyps and gallstone pancreatitis. No exclusion criteria were applied for patient selection.

We compared the outcomes of RSSC in obese patients to the RSSC performed in nonobese patients. These included total operative time and conversion rate.

## Results

A total of 200 patients underwent RSSC during the study period, of which 112 patients (56%) were obese. The study group included 91 women and 21 men, with a mean age of 46.1(18.5) years (Table 1). The mean BMI was 39.5 (SD: 7.5, range: 30.1–62.3). Twenty-eight patients (25%) were morbidly obese (BMI  $> 40$ –50) and 13 patients (11.6%) were super-obese (BMI  $\geq 50$ ). Co-morbidities were common and included 52 (59%) patients with hypertension in the nonobese and 60 (53.6%) patients with hypertension in

the obese ( $P = .435$ ), 27 (30.7%) with diabetes mellitus in the nonobese and 25 (22.3%) with diabetes in the obese ( $P = .181$ ). Fifty-two patients had a prior history of abdominal surgery (46.4%) in the BMI  $> 30$  group. Of the 112 consecutive patients studied, 24 (21.4%) were elective procedures and 88 patients (78.6%) were acute cases.

Total operative time was 70 minutes (SD: 26) for RSSC in the obese patients compared to 60 minutes (SD: 20) in the nonobese. This was statistically significant with a *P* value of .0012. Compared with the published data for standard LC from a meta-analysis study the average total operative time was found to be 61.6 (22.2) for LC, conversion rate of .9% in LC, and overall complication rate of 2.9% in LC (Table 2) [4].

Pathology reports demonstrated findings of chronic cholecystitis with cholelithiasis in 79 patients (70.5%), acute cholecystitis in 26 patients (23.3%), cholelithiasis in 4 patients (3.5%), and gangrenous cholecystitis in 3 patients (2.7%). There were no conversions (0%) from RSSC to open, laparoscopic, or robotic multiport techniques. There were no major complications in our series, including common bile duct injury or bile leak. There were no reported wound infections. One patient developed an umbilical (incisional) hernia (0.9%)

## Discussion

This is the largest case series of robotic single-site cholecystectomies performed in the obese patient population. To our knowledge, this is also the first study without exclusion criteria for performing RSSC based on patient's BMI. We present the results of our first 112 cases performed with this technique on obese patients at a teaching institution by a single surgeon with active surgical resident involvement.

The prevalence of obesity is increasing globally. According to a study from the Center for Disease Control and Prevention, 35.9% of Americans are considered obese with a BMI  $> 30$  kg/m<sup>2</sup> with 17.4% of those having BMI  $> 35$  [5]. A BMI  $> 30$  is associated with a 3-fold increase in the incidence of cholelithiasis and biliary disease and diabetes carries a 1.9-fold increased risk [6–8]. Surgeons are continually challenged with the task of operating on an increasing number of high-risk patients. Using the safest optimal operative approach is especially important in the obese patient population.

In previous studies, obesity has been identified as an independent risk factor contributing to a higher rate of conversion from laparoscopic to open surgery [6–8]. Farkas et al. found that increased BMI was not associated with worse outcomes after LC with any increased risk of conversion to open surgery nor increased risk of perioperative complications. Other studies have shown that male sex, obesity, age  $> 65$ , and diabetes are all independent risk factors for complications including surgical site infection

Table 1  
Patient characteristics

No. of subjects	n = 112
Gender	Male 21 Female 91 Ratio 4.3:1
Age (yr)	46.1 (18.5)
BMI (kg/m <sup>2</sup> )	39.5 (7.5)
BMI 35–50	63 (56.3%)
BMI $> 50$	13 (11.6%)

BMI = body mass index

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