

Comparison of Outcomes After Single-Port Laparoscopic Cholecystectomy in Relation to Patient Body Mass Index

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ABSTRACT

Background and Objectives: Single-port laparoscopic cholecystectomy may contribute to a paradigm shift in the field of laparoscopic cholecystectomy surgery by providing patients with benefits beyond those observed after other surgical procedures. This study was designed to evaluate clinically meaningful differences in operative outcomes between obese and nonobese patients after single-port laparoscopic cholecystectomy.

Methods: Data were collected retrospectively from 172 patients who had undergone single-port laparoscopic cholecystectomy performed by the same surgeon at a single medical center between January and December 2011. For the outcome analysis, patients were divided into nonobese and obese patient groups according to their body mass index ($<25 \text{ kg/m}^2$ vs $\geq 25 \text{ kg/m}^2$).

Results: Demographic and clinical data did not differ significantly between obese patients ($n = 65$) and nonobese patients ($n = 107$). In addition, statistically significant differences pertaining to most measured surgical outcomes including postoperative hospital stay, bile spillage, additional port use, and open conversion were not detected between the groups. However, the two groups differed significantly regarding operative time such that nonobese patients had shorter operative times than obese patients ($P < .05$).

Conclusion: The results of this study showed that operative time for single-port laparoscopic cholecystectomy was the only difference between obese and nonobese patients. Given this result, body mass index may not be as

relevant a factor in patient selection for single-port laparoscopic cholecystectomy as previously thought.

Key Words: Laparoscopic cholecystectomy, Single port, Body mass index (BMI).

INTRODUCTION

Laparoscopic cholecystectomy has been regarded as a first-choice treatment option for benign gallbladder (GB) disease.¹ This technique gained enormous popularity because of the significant advantages of reduced postoperative pain, shortened hospital stay, faster recuperation, and earlier return to normal function. Reduced postoperative pain in particular has been considered the most significant advantage associated with this procedure. Thus laparoscopic cholecystectomy has become one of the most frequently performed procedures in visceral surgery.² Furthermore, surgical procedures in general are becoming less invasive because of both patient and surgeon preferences for reduced trauma and improved cosmetic outcomes attributable to minimized incisions. The advent of single-port technology in recent years has furthered this trend.² Accordingly, the results of several studies have shown that single-port laparoscopic cholecystectomy (SPLC) differs significantly from conventional laparoscopic cholecystectomy. Although SPLC has limitations attributable to the highly sophisticated nature of the technique and associated high costs, it also has several advantages over conventional laparoscopic cholecystectomy, such as better cosmetic results, less pain, and faster recovery.^{3,4} It has also been speculated that SPLC may become the new gold standard for treating benign GB disease because of its advantages over more traditional procedures.^{5,6} However, increasing hernia formation is still a limitation.⁷

The full range of benefits and limitations of SPLC need to be determined more accurately, as do the medical indications and patient characteristics that may be best suited for this technique. Regarding the latter, patients with a higher body mass index (BMI) are sometimes considered “unsuitable” candidates for SPLC because of the need for a longer operation or an increased conversion rate to stan-

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dard multiport cholecystectomy.⁸ In support of this assertion, the results from one study indicated that contraindications to SPLC included obesity, a history of abdominal surgery, and acute cholecystitis.⁹

Considering the aforementioned changes in surgical trends and the studies regarding benefits and limitations of SPLC, this surgical technique will likely be used for a broad spectrum of surgical interventions, involving GB diseases, specifically in patients with obesity. To examine the relationship between SPLC and obesity from a clinical standpoint, differences in perioperative and postoperative outcomes between obese and nonobese patients were evaluated in a retrospective study. We expect this study to contribute to wider performance of SPLC to benefit more patients by giving clinical evidence of the merits of SPLC for obese patients.

PATIENTS AND METHODS

Data derived from 172 patients who underwent SPLC performed by the same surgeon at a single medical center between January and December 2011 were evaluated retrospectively. Demographic and clinical information included patient sex, age, BMI, and operative history. Operative information consisted of the following: preoperative diagnosis, final pathologic diagnosis, American Society of Anesthesiologists score, postoperative hospital stay, operative time, bile spillage, additional port use, and open conversion.

Patients were divided into obese and nonobese groups according to their BMI. For the outcome analyses, BMI criteria were defined using the World Health Organization (WHO) classification cutoff value for Asian populations of 25 kg/m² (<25 kg/m² vs ≥25 kg/m²).¹⁰

Surgical Procedure

All patients underwent SPLC in the supine position while under general anesthesia. The surgeon and the first assistant stood on the left side of the patient. A 2.5-cm transumbilical vertical incision was made, and a multichannel port (Octo Port; Dalim, Seoul, South Korea) was used to make the channel. The laparoscopic camera was then inserted through the 5-/10-mm port. The surgeon who performed all procedures was more accustomed to single-port surgery using straight instruments as opposed to dedicated single-port laparoscopic instruments. Therefore a Bovie flexible hook (Cambridge Endoscope Devices, Inc., Framingham, MA, USA) was the only additionally required instrument. All instruments were the same as those used for conventional laparoscopic cholecystec-

tomy, including a 30° angled rigid laparoscope of 5 mm in diameter. The cystic duct and artery were dissected with a laparoscopic rigid dissector, and a 10-mm Hem-O-Lok clip (Weck Closure Systems, Research Triangle Park, North Carolina) made with Prolene material was used to ligate the cystic duct. The proximal and distal ends of the cystic duct were clipped, and the cystic artery was ligated with a 5-mm Hem-O-Lok clip and sheared with laparoscopic scissors. The GB was retracted in the cephalic direction, separated from the liver bed, and removed directly through the port site. A drain was not inserted after the operation. The peritoneum, fascia, and subcutaneous tissue were sutured; however, skin sutures were not required after the skin edge was approximated because only a 5-mm vertical incision was visible.¹¹

Statistical Analysis

The SPSS program (version 20; SPSS, Chicago, Illinois) was used for statistical analysis, which consisted of χ^2 tests and independent *t* tests. *P* < .05 was considered to represent a statistically significant difference.

RESULTS

Of the 172 patients, 107 were categorized as nonobese and 65 as obese based on the WHO classification cutoff values for Asian populations.¹⁰ The mean BMI was 22.41 ± 1.75 kg/m² (range, 17.48–24.97 kg/m²) for the nonobese patients and 27.45 ± 2.40 kg/m² (range, 25.04–41.56 kg/m²) for the obese patients. The median follow-up period was 27.5 months (range, 22–33 months).

There were no statistically significant differences in age, American Society of Anesthesiologists score, preoperative diagnosis, or final pathologic diagnosis between the groups. A GB stone was the most common preoperative diagnosis for SPLC, followed by a GB polyp, acalculous cholecystitis, and GB adenoma. One patient in the nonobese group had bile leakage as a postoperative complication (Clavien classification grade IIIb) (**Table 1**). The only statistically significant difference between obese and nonobese patients was operative time: 63.85 ± 19.14 minutes in the obese group versus 56.38 ± 19.39 minutes in the nonobese group (*P* < .05).

Postoperative hospital stay, additional port use, open conversion ratio, and bile spillage did not differ significantly between the groups. During the SPLC operations, 15 patients in the nonobese group required an additional port and 2 patients required open conversion. Similarly, 19

Table 1.
Patient Characteristics

Variable	n (%)	Mean ± SD
All patients	172 (100.0)	
Sex		
Male	68 (39.5)	
Female	104 (60.5)	
Age (y)		48.03 ± 13.23
Preoperative diagnosis		
GB stone	126 (73.3)	
GB polyp	29 (16.9)	
Acalculous cholecystitis	11 (6.4)	
GB adenoma	6 (3.4)	
ASA ^a score		
1	54 (31.4)	
2	85 (49.4)	
3	31 (18.0)	
Unchecked	2 (1.2)	
Operative history		
Yes	25 (14.5)	
No	147 (85.5)	
BMI		24.35 ± 3.17 kg/m ²
<25 kg/m ²	107 (62.2)	22.41 ± 1.75 kg/m ²
≥25 kg/m ²	65 (37.8)	27.45 ± 2.40 kg/m ²
Final pathologic diagnosis		
Chronic cholecystitis	119 (69.2)	
Cholesterol polyp	28 (16.3)	
Adenomyomatosis	18 (10.4)	
Acute cholecystitis	5 (2.9)	
Adenocarcinoma	2 (1.2)	

^aASA = American Society of Anesthesiologists.

patients in the obese group required an additional port and 1 patient required open conversion (**Table 2**).

DISCUSSION

As obesity increases worldwide, especially in developed countries, so does related symptomatic GB disease and the subsequent requirement for laparoscopic cholecystectomy.^{12–14} Hence the outcome of laparoscopic cholecystectomy in obese patients is quickly becoming an important health issue.¹⁵ Moreover, the surgeon- and patient-driven desire for more minimally invasive surgery to improve

Table 2.
Comparisons Between Obese and Nonobese Groups

Variable	BMI <25 kg/m ² (n = 107)	BMI ≥25 kg/m ² (n = 65)	P Value
Sex [n (%)]			.003
Male	33 (30.8)	35 (53.8)	
Female	74 (69.2)	30 (46.2)	
Age (mean ± SD) (y)	46.80 ± 13.17	50.06 ± 13.18	.118
BMI (mean ± SD) (kg/m ²)	22.41 ± 1.75	27.45 ± 2.40	<.001
ASA ^a score [n (%)]			.083
1	40 (37.7)	14 (21.9)	
2	47 (44.3)	38 (59.4)	
3	19 (17.9)	12 (18.8)	
Unknown	1	1	
Operative history [n (%)]			.013
Yes	10 (9.3)	15 (23.1)	
No	97 (90.7)	50 (76.9)	
Postoperative hospital stay (mean ± SD) (d)	2.86 ± 2.73	2.54 ± 2.16	.421
Operative time (mean ± SD) (min)	56.38 ± 19.39	63.85 ± 19.14	.015
Bile spillage during operation [n (%)]			.975
Yes	13 (12.1)	8 (12.3)	
No	94 (87.9)	57 (87.7)	
Additional ports used [n (%)]			.055
Yes	15 (14.0)	19 (29.2)	
No	92 (86.0)	46 (70.8)	
Open conversion [n (%)]			.872
Yes	2 (1.9)	1 (1.5)	
No	105 (98.1)	64 (98.5)	

Independent *t* tests and χ^2 tests were used to compare groups.

^aASA = American Society of Anesthesiologists.

quality of life and medical safety may propel SPLC to become the new standard operative method. Several recent studies have examined the outcomes, benefits, and drawbacks of SPLC. One such study showed that SPLC produced better cosmetic results, less pain, and a faster recovery in selected patients.^{3,4} In addition, Chrestiana and Sucandy¹⁶ described SPLC as a safer and more feasi-

ble alternative for cholecystectomy, even in children. However, Geng et al¹⁷ showed that SPLC was associated with a longer operative time and required additional instruments.

Few of the aforementioned studies have assessed obesity-related outcomes associated with SPLC. Reibetanz et al¹⁸ and Yilmaz et al¹⁹ showed differences in both perioperative and postoperative outcomes between obese (BMI ≥ 30 kg/m²) and nonobese (BMI < 30 kg/m²) patients. According to Reibetanz et al, postoperative outcomes of obese patients after SPLC were not inferior to those of nonobese patients. However, Yilmaz et al showed that SPLC was associated with a prolonged operative time, a high level of additional port requirements, and increased wound complication rates. Additional studies have also shown that a high BMI is directly correlated with a longer operative time.^{20–22}

Our study explored factors such as postoperative hospital stay, bile spillage during the operation, additional port use, and open conversion in obese versus nonobese patients. Only operative time showed a statistically significant difference, although the prolongation of the operative time was only about 7 minutes and did not actually prove to be clinically significant. The results of this study, therefore, indicate that mean BMI should not be considered a key criterion in patient selection for SPLC.

This study deals with the data of only 1 surgeon who has performed SPLC in 400 cases up to now. In the early cases of SPLC—the data of which were not collected for this study—this surgeon did not perform SPLC in obese patients (BMI ≥ 25 kg/m²). Later, however, he began performing SPLC in obese patients because a clear view through 4 channels had been secured (with the Dalim device) and his surgical skill had improved. A clear view is the most important factor for performing SPLC in obese patients. To achieve this, the surgeon pressed the omentum using a laparoscopic fan retractor so that the Calot triangle was completely disclosed (**Figure 1A + B**).

The most unique aspect of this study was the BMI criteria used to classify and compare nonobese and obese patients (< 25 kg/m² vs ≥ 25 kg/m²). Previous studies have used a cutoff value of 30 kg/m² (< 30 kg/m² vs ≥ 30 kg/m²). In Asia the mean BMI ranges from 23 to 25 kg/m². The mean BMI in Korea is 25.2 kg/m² overall, 25.3 kg/m² for men, and 25.2 kg/m² for women. The mean BMI in China is 24.6 kg/m² overall, 24 kg/m² for men, and 24.3 kg/m² for women. In addition, use of the WHO classification of obesity as BMI of 30 kg/m² or greater would have resulted in only 4 of 172 patients being categorized

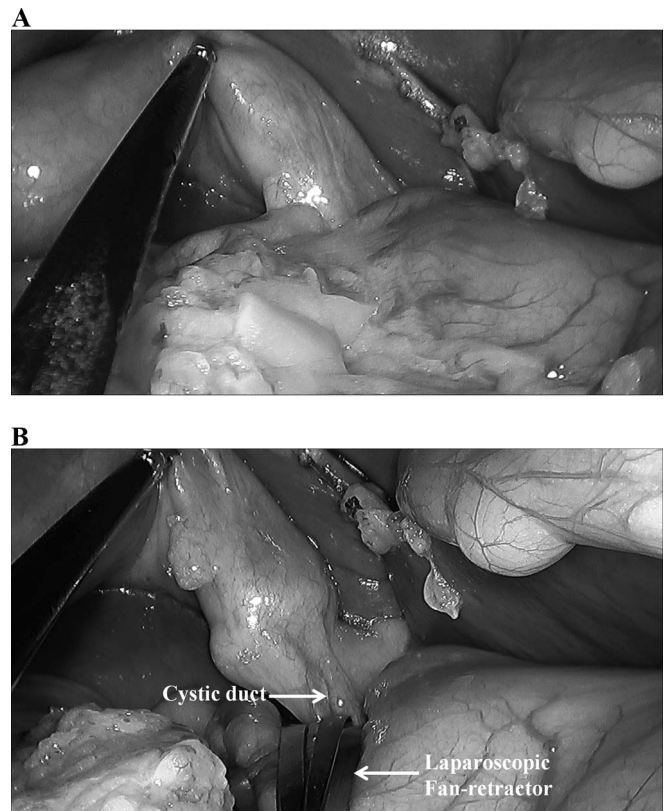


Figure 1. A + B. Using a laparoscopic fan retractor to press the omentum and duodenum allows a clearer view of the Calot triangle and cystic duct (B) than when not using the device (A).

as obese. Therefore a BMI of 25 kg/m² was deemed more suitable for this study, and our study results may only be applicable to Asian populations.

The primary limitations of this study were its retrospective design and its examination of patients operated on by a single surgeon. Furthermore, BMI is a simple index and therefore may not be an accurate estimate of visceral fat. In fact, results from several studies have suggested that computed tomography scan assessments of visceral fat would be a more optimal approach.²³ Concerning the postoperative complications found in this study, most were wound infections, although they were not severe and were able to be controlled by wound dressing in the outpatient department. Hernia did not develop in any case in our study. One case from the nonobese group had postoperative bile leakage due to common bile duct injury, which was controlled by reoperation.

CONCLUSION

The results of this study show that differences in operative outcomes between obese and nonobese patients were not

statistically significant, with the exception of operative time. Therefore BMI may not be a key criterion in patient selection for SPLC. Removal of BMI as a patient selection criterion should lead to more widespread performance of SPLC.

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