

Micro-laparoscopic Cholecystectomy: An Alternative to Single-Port Surgery

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Abstract

Introduction Recent advances in minimally invasive surgery aimed at diminishing incision size have led to the development of single-port surgery (SPS). SPS has an increased level of complexity and requires a higher level of surgical skill compared to traditional laparoscopy. We explored micro-laparoscopy as an alternative to routine laparoscopic cholecystectomy.

Methods The study is a retrospective review of consecutive elective laparoscopic cholecystectomies performed by a single surgeon at a community teaching hospital over 24 months. All surgeries were performed using a 5-mm trocar for the umbilical port and 3-mm trocars for other ports in standard configuration.

Results Seventy-nine cholecystectomies were performed by micro-laparoscopy during the 24-month period. Three cases required upgrade in trocar size for technical reasons, resulting in a completion rate of 96%. Intraoperative cholangiography was performed in 70 cases (89%). There were no conversions to open surgery. There were no intra- or postoperative complications, and all patients were discharged on the day of surgery.

Conclusion Micro-laparoscopic cholecystectomy is safe, feasible, and represents an alternative to other minimally invasive techniques. Future developments in surgical technology will allow the use of even smaller instruments, diminishing the surgical “footprint” even further and contributing to better cosmesis and decreased postoperative pain in cholecystectomy patients.

Keywords Micro-laparoscopic · Cholecystectomy · Single port

Introduction

Conventional four-port laparoscopic cholecystectomy (LC) utilizing one 10-mm umbilical port and three 5-mm ports is currently the gold standard for the treatment of symptomatic gallstone disease. However, micro-laparoscopic cholecystectomy (MC) and single-port surgery (SPS) were

developed in an attempt to further decrease postoperative pain and improve cosmesis. MC employs smaller instruments in contrast to LC and has been associated with potentially decreased postoperative pain and improved cosmetic outcome, pulmonary function, and overall patient satisfaction in elective cases of cholecystectomy.^{1–5} SPS confers the same cosmetic advantage as MC, but is associated with the need to learn a new surgical technique and use of modified instruments.⁶ We therefore conducted a retrospective study to examine the feasibility and safety of MC in our hospital.

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Materials and Methods

A retrospective chart review was conducted of consecutive elective cases of micro-laparoscopic cholecystectomies performed by a single surgeon (KAZ) over a 24-month period. Variables included patient age, gender, body mass

index, indication for surgery, upgrade requirement, and complications.

Surgical Technique

One 5-mm port was inserted above the umbilicus, and three 3-mm ports (Ethicon Endosurgery, Cincinnati, OH) were inserted in the subxiphoid, right anterior and midclavicular axillary lines subcostally, according to standard configuration (Fig. 1). A 5-mm, 30° laparoscope (Karl Storz Endoscopy City) was then introduced into the umbilical port for adequate visualization of the gallbladder. Sufficient retraction and dissection of the cystic duct and artery were performed using 3-mm graspers and dissectors (Karl Storz Endoscopy City), creating a critical view of safety (Fig. 2). Intraoperative cholangiography (IOC) was performed when technically feasible. A negative IOC was defined as fluoroscopic imaging of the common bile duct, cystic duct, common, right and left hepatic ducts without filling defect. Upon completion of cholangiography, surgical clips were placed with an ethicon endosurgery ligamax (Ethicon Endosurgery, Cincinnati, OH) introduced through the 5-mm umbilical port while placing a 3-mm camera into the subxiphoid port. Monopolar electrocautery (Megadyne, Draper, UT, USA) was then used to remove the gallbladder from the liver bed and obtain adequate hemostasis. After removal from the liver bed, the gallbladder was placed in an Endocatch bag (Ethicon Endosurgery, Cincinnati, OH) and retrieved through the 5-mm incision under direct visualization of the 3-mm laparoscope (Karl Storz Endoscopy City). Gallbladder retrieval in many cases was facilitated by crushing and suctioning stone fragments within the specimen while extracting the Endocatch bag (Ethicon Endosurgery, Cincinnati, OH) through the 5-mm incision. In three (4%) cases of upgrade, the umbilical incision and fascial plane were minimally extended to facilitate removal of the gallbladder.

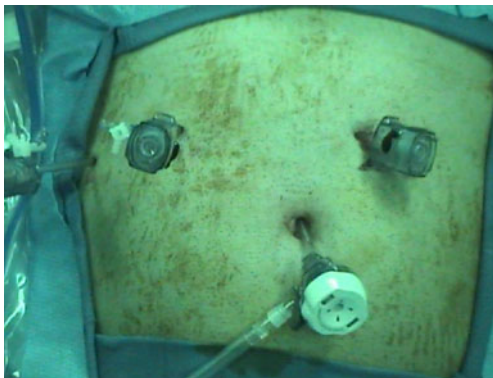


Fig. 1 The surgical technique involves insertion of one 5-mm port above the umbilicus and insertion of 3-mm ports in the subxiphoid, right anterior axillary and midclavicular line subcostally

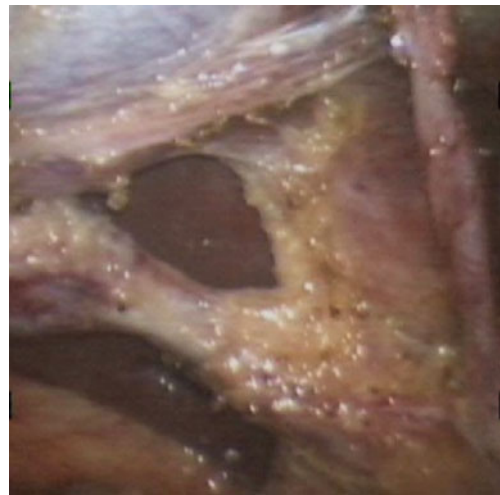


Fig. 2 Sufficient retraction and dissection of the cystic duct and artery were performed using 3-mm graspers and dissectors, creating a critical view of safety

Results

Elective micro-laparoscopic cholecystectomy was performed in 79 patients between October 2007 and November 2009. Demographics and indication for surgery are outlined in Tables 1 and 2, respectively. Fifty-four (68%) were female and 25 (32%) were male. The average age was 48 years old (range, 20–84). Average BMI was 29.7 (range, 19.2–46.4). Indications for cholecystectomy included biliary colic (89%), biliary dyskinesia (9%), and gallstone pancreatitis (3%). Seventy (89%) patients had routine IOC performed, which were all negative for choledocholithiasis. Three patients required upgrade to traditional 5-mm ports as a result of chronic gallbladder inflammation and wall thickening after repeated attempts to successfully grasp and retract the gallbladder using 3-mm instruments. In all three cases of upgrade, the indication for surgery was symptomatic cholelithiasis. Body mass indices for cases of upgrade were 28.1, 29.1, and 34.6, respectively. Upsizing the trocars was dictated by unanticipated pathology, including hydrops requiring decompression, an impacted stone in the infundibulum, and dense omental adhesions requiring extensive laparoscopic lysis. No patient required

Table 1 Patient demographics

Variable	(n=79)
Male	25 (32%)
Female	54 (68%)
Age	
Average (range)	48 (20–84)
Body mass index	
Average (range)	29.7 (19.2–46.4)

Table 2 Indications for surgery

Indication	(n=79)	%
Biliary colic	70	89
Biliary dyskinesia	7	9
Gallstone pancreatitis	2	3

conversion to an open procedure, and there were no intraoperative complications. In all cases of MC, patients were discharged the same operative day, and there were no cases of postoperative complication due to surgical technique within the established 2-week follow-up interval.

Discussion

Micro-laparoscopic cholecystectomy (MC) is a safe and technically feasible procedure for the treatment of gallstone disease and an alternative to single-port surgery (SPS). The procedure uses smaller adept instrumentation and represents a technological advancement of laparoscopic surgery and an improvement on the traditional laparoscopic method. Leggett and colleagues⁷ successfully performed MC with only three laparoscopic ports and Unger et al⁸ reported success of MC with port sizes as small as 2-mm. In a meta-analysis of MC versus LC, micro-laparoscopic cholecystectomy without IOC was successfully performed in a number of studies using a combination of three 3-mm ports with either 10-mm or 12-mm ports in study populations with variable exclusion criteria.³ We successfully performed MC with routine IOC using one 5-mm and three 3-mm ports in 89% of consecutive elective cases of cholecystectomy, eliminating the likelihood of selection bias and demonstrating that IOC can be sufficiently performed as an adjuvant to the MC technique when deemed appropriate based on surgeon judgment or preference.

Furthermore, today's technology allows us to perform MC with unparalleled feasibility due to the advent of high-definition imaging, which permits the use of 3-mm laparoscopes and better 3-mm instrumentation in the majority of surgical candidates. In our study, a critical view of safety was achieved and maintained in 100% of cases, demonstrating that MC affords the surgeon the same superior quality of visualization as LC without compromising patient safety. MC in this form rivals SPS and must be considered as a simpler if not safer alternative.

Three cases in our study required upgrade to 5-mm port size for improved gallbladder retraction due to advanced gallbladder pathology, creating an upsizing rate of 4%. The complication rate in our study was negligible and comparable to other low rates reported in the literature.^{1, 3–5, 7,}

⁸ Body mass indices in our study ranged from 19.2 to 46.4

and was not a determinant factor in the feasibility of MC completion; however, other studies have found that MC operative times are progressively longer in patients with higher body weights.⁸ Additionally, peritoneal adhesions, chronic inflammation, and gallbladder wall thickening have all been cited as obstacles to MC completion in various studies.³ Despite these challenges, the results of our present study show that MC can be routinely performed in an elective setting with a low rate of upgrade to conventional laparoscopic port size.

In this study, subjective outcomes of postoperative pain and cosmesis regarding 5-mm versus 3-mm incision sites were not assessed. From a financial perspective, there was no cost difference associated with the use of 3-mm ports and other MC instruments compared to conventional instrumentation based on our accounting and cost allocation records. The MC technique in this study and the search for adequate instrumentation were developed and conducted over the course of several months. A learning curve was not conducted as a part of this case series. However, the MC technique follows the same principles as a LC, allowing the surgeon to gradually perform the same operative technique as a traditional laparoscopic cholecystectomy with the possibility of upsizing or adding additional trocars in technically difficult cases, where the continuation of MC would have a deleterious impact on the patient. The SPS technique, in contrary, is associated with loss of triangulation and decreased maneuverability, making the procedure technically demanding.⁹ And while some may argue that SPS is a sensationally innovative procedure, it does not necessarily offer surgeons or patients a distinctive advantage over the gold standard in regard to cost, optimal pain control, and surgical feasibility.⁹ Ultimately, MC remains a low-risk procedure with a negligible complication rate. The technique is feasible, efficacious, and associated with improved cosmesis and decreased postoperative pain, therefore making it advantageous to both surgeons and patients alike and a practicable alternative to SPS.

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