Needlescopic Cholecystectomy: Lessons Learned in 10 Years of Experience
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ABSTRACT

Objectives: Needlescopic cholecystectomy (NC) is a refinement of laparoscopic cholecystectomy (LC) using 2-mm instruments compared with the standard 5-mm and 10-mm ports. We review our experience with needlescopic cholecystectomy.

Methods: From 1994 to 2004, 303 patients underwent NC. All patients were operated on using 2-mm instruments and one 10-mm trocar for the laparoscope. The characteristics of patients, total operation time, complications, postoperative pain, and hospital course were documented.

Results: Patients' average age was 41.86 years; 262 were female and 41 were male. Mean BMI was 25.7. Mean length of surgery was 59.33 minutes. Intraoperative cholangiography was performed in all cases. Mean blood loss was 14.88 mL. One intraoperative complication occurred. Mean hospital stay was 22.68 hours. Postoperative pain was measured on a 0–10 pain scale; on day 0 it was 4.4 and on the first day it was 1.7. Analgesic doses required were 0 doses in 6.89%, 1 in 20.68%, 2 in 24.13%, 3 in 34.48%, 4 in 13.79%, and >4 doses was not required. No postoperative complications occurred. At 3-month follow-up, patient satisfaction was 100%, and in 99% of patients scars were imperceptible.

Conclusions: NC is safe and feasible without increased operative risk, with better cosmetic results, less pain, and good acceptance among patients.

Key Words: Needlescopic, Cholecystectomy, Microlaparoscopy, Miniaturized instruments, Fine-caliber instruments, Gallbladder, Pain.

INTRODUCTION

Laparoscopic cholecystectomy (LC) has become the gold standard operation for patients with gallbladder disease since the first hepatic case performed successfully by Mouret in 1987. Needlescopic cholecystectomy (NC) is a refinement of LC in which instruments and ports smaller than 3mm in diameter are used compared with the standard 5-mm and 10-mm sizes used in conventional laparoscopic cholecystectomy.

The perceived advantages of the needlescopic technique are wounds that heal leaving imperceptible scars,1,2 reduced postoperative analgesic use, potential reduced risk of trocar hernias, lower incidence of wound complications, a smaller sheath that makes the introduction smooth and effortless decreasing the risk of intraabdominal lesions, with a high satisfaction rate and possibly a faster recovery.2–4

The purpose of this retrospective study is to present an analysis of our experience performing a laparoscopic cholecystectomy using 2-mm instruments.

METHODS

All patients had a preoperative ultrasound examination of the gallbladder and biliary system. Blood was sampled for complete blood cell count, coagulation, liver function tests, and amylase.

All operations were performed with the patient under general anesthesia in the supine position, and a standard 4-port technique was used: three 2-mm MiniPort trocars (USSC, Norwalk, Connecticut, US) and a 10-mm laparoscope through the umbilicus. The wounds were infiltrated with 0.25% bupivacaine before incision of the skin. A 13-mm Hg pneumoperitoneum was established with CO₂ through a Veress needle (Surgineedle, USSC, Norwalk, Connecticut, USA) placed below the right costal margin in the anterior axillary line. Then a 2-mm trocar was fitted over the Veress needle and introduced into the abdomen. A 2-mm laparoscope was subsequently placed. A laparoscopic overview of the cavity was done and under direct vision, a 10-mm trocar was placed in the umbilicus. If adverad adhesions were present in the periumbilical region,
they were removed, using 2-mm scissors through a port in the right lower quadrant. The laparoscope was changed to a 0-degree, 10-mm instrument and introduced through the umbilical port. A 2-mm subxiphoid trocar and a 2-mm right lateral abdomen trocar were placed (in patients in whom this was not previously done). As we show in Figure 1, 2-mm graspers were used to manipulate the Hartman’s pouch and for the dissection around Calot’s triangle to expose both the cystic duct and cystic artery. Then, a Franklin endoscopic cholangiography catheter (Cook Surgical; Bloomington, IN, USA) was introduced through the cystic duct to perform a cholangiogram. Once the presence of common bile duct stones was excluded and anomalies of the biliary tree were evaluated, the laparoscope was changed to a 2-mm scope and placed through the right lateral trocar. A 10-mm clip applier (USSC, Norwalk, Connecticut, USA) was introduced through the umbilical port, and 2 clips in the proximal segment and one in the distal segment of the cystic duct were applied. The same maneuver was performed with the cystic artery. Then, both structures were divided with the 2-mm scissors (2-mm MiniSite MiniShears, USSC, Norwalk, Connecticut, USA) and a vaginal ultrasound probe cover, also known as a medical condom, was introduced through the umbilical port as an extraction bag.

The laparoscope was changed again to the 10-mm size through the umbilical port, and the gallbladder was detached from the gallbladder fossa with diathermy, using the 2-mm scissors, placed in the bag and removed through the umbilical incision in the typical fashion. The subhepatic space was irrigated and dried and clips were visualized and noted to be intact. The fascia of the umbilical incision was closed with a Carter-Thomason needle point suture passer (Inlet Medical Inc. Eden Prairie, MN, USA) using a 0-vicryl suture. The abdomen was deflated and the skin of the umbilical wound was closed with interrupted subcuticular suture of absorbable material. The rest of the 2-mm incisions were approximated with sterile tapes.

Patient characteristics, total operation time, complications, postoperative pain, number of analgesic doses used, hospital course, and patient satisfaction were documented.

Needlescopic cholecystectomy was considered successful if the procedure was done with instruments 2 mm in diameter. If any of these ports was changed to 5 mm or beyond during the course of the procedure, the case was counted as a conversion to a conventional laparoscopic procedure. If a laparotomy was necessary to complete the cholecystectomy, the case was considered a conversion to an open procedure. The surgery was considered an emergency if the procedure performed for acute cholecystitis was within the first 24 hours. The total operation time was taken as the time when the right upper quadrant incision was made to the time when all wounds were completely closed. Pain assessment scores were obtained by directly asking the patient to score the pain from 1 to 10, with 10 being the worst.

The total satisfaction was obtained by asking the patient directly at the follow-up appointment.

RESULTS

From September 1994 to September 2004, 303 patients with gallbladder disease underwent needlescopic cholecystectomy. The average patient age was 41.86 years (range, 14 to 82). Patients comprised 262 females (86.46%) and 41 males (13.53%). Mean body mass index was 25.7 (range, 16.3 to 39.2). Three cases were emergent (0.99%).

Intraoperative cholangiography was performed in all cases. One patient had an intraoperative complication (0.33%): a partial inadvertent laceration of the right hepatic duct because of an anomaly in the anatomy, which was repaired with a simple 5–0 resorbable braided suture and an endobiliary stent placement. This case was the only one that was converted to conventional LC (conversion rate to LC 0.33%). No conversions to open cholecystectomy were necessary.

The mean length of surgery was 59.33 minutes (range, 30
to 200). Concurrent procedures were done in 12 patients: 6 adhesiolysis, 1 common bile duct exploration, 5 appendectomies, and 1 ventral hernioplasty. The mean blood loss was 14.88 mL (range, 0 to 50).

Postoperative pain was measured according to a pain scale of 0 to 10. On the day of the operation, the mean score was 4.4, and for the first postoperative day it was 1.7. The number of analgesic doses required during hospitalization was 0 doses in 6.89% of patients, 1 in 20.68%, 2 in 24.13%, 3 in 34.48%, 4 in 13.79%, and 5 or more were not required. No in-hospital complications occurred. The mean hospital stay was 22.68 hours (range, 8 to 27). The mortality rate was 0%. We followed up all our patients at 2 weeks and 3 months.

**DISCUSSION**

The development of 2-mm laparoscopes, graspers, and scissors has made possible the use of miniaturized instrumentation for therapeutic purposes. These small-diameter instruments are less invasive than conventional laparoscopic instruments are, allowing for a reduction in the size of the abdominal incisions (cumulative port size 16 mm), with a resultant reduction in local tissue damage.5

The smaller wounds do not need to be sutured and the improvement in cosmetic results is evident compared with that of conventional laparoscopic cholecystectomy.2 Kimura et al6 found that the scars left by the trocars become significantly smaller as the size of the trocar decreases, not only immediately after the operation but also at 6-month follow-up. In addition, pigmentation decreases as the size of the scar becomes smaller. Bisgaard et al7 showed that cosmetic results were significantly better in the 3.5-mm group than in the LC group, and Cheah et al8 found that the scars after NC were 32% smaller than those after LC (median 17 vs 25 mm; P<0.001).

The issue of postoperative pain is controversial. Gagner et al2 reported a reduced need for postoperative analgesia in terms of narcotic doses in the needlescopic patients compared with that in the laparoscopic patients. Bisgaard et al7 found that in the 3.5-mm group, incisional pain was significantly decreased in the first postoperative week as compared with pain in the LC group; and in both groups, pain scores at the supraumbilical 10-mm port were significantly higher compared with pain at other port sites. In a randomized clinical trial, Cheah et al8 found that patients who had NC had significantly less postoperative pain according to mean visual analogue scores (2.2 vs 3.6), and this group tended to require fewer analgesic injections than did the LC group (7 vs 12 injections). In another study,9 NC in combination with a prophylactic multimodal analgesic regimen reduced postoperative pain for the first 3 postoperative hours. However, Look,4 in a prospective randomized trial, found no advantage for needlescopic patients compared with laparoscopic patients in terms of postoperative pain (mean pain scores and mean number for intramuscular analgesic injections required) and recovery. Kimura et al6 found no significant difference between the LC group and fine-caliber instrument (3-mm) group in the number of doses of intramuscular pentazocine required.

In our study, the mean pain score on operation day was 4.4 (range, 0–10) and 1.7 on the first postoperative day.

Concerning operative time, Gagner et al2 reported a statistically significant longer time for the needlescopic group compared with the conventional laparoscopic group (98 vs 81 min), whereas Lai3 reported a duration for needlescopic patients comparable to that for standard laparoscopy. Reardon et al5 reported an average operative time of 88.7 ± 5.9 minutes (mean ± SD) for the miniaturized instrumentation procedures versus 78 ± 5.5 minutes for the conventional LC (P=NS). Cheah et al8 found no significant difference in the median duration of surgery between the 2 groups (50 vs 45 min). We report a mean length of surgery of 59.33 minutes (range, 30 to 200).

Length of hospital stay has not been shown to be different between patients of NC and LC. Cheah et al1 reported 1.2 days for the NC group vs 1.3 days for the LC group. Reardon et al5 found 1.5 ± 0.2 days (mean ± SD) for the miniaturized instrumentation procedures versus 1.8 ± 0.4 days for the conventional LC (P=NS). The mean hospital stay for the patients in this study was 22.68 hours (range, 18 to 27).

Conversion of NC to conventional LC is a matter of surgeon experience and skill and the characteristics of patients. It has been reported to be 5%, 10%, 11%, and even 38%.2,5,8,9 The conversion rate in our study was 0.35%. We have to mention that the majority of our patients were nonobese or slightly overweight with a mean BMI of 25.7 (range, 16.3 to 39.2), and in only 3 cases was the operation secondary to acute cholecystitis.

The needlescopic technique has some disadvantages that have to be mentioned. Instruments smaller than 2 mm are delicate and if mishandled, can break easily. Also smaller graspers make sufficient manipulation of the gallbladder harder, particularly in obese patients or those with inflamed gallbladders. Also, the inferior optical resolution
and color reproduction of the 2-mm scope can be a problem, mainly because it is used during the placement of clips and division of the cystic artery and duct, a crucial part of the operation.1

We report 1 intraoperative complication (0.33%), an inadvertent partial right hepatic duct laceration, repaired with primary closure and placement of an endobiliary stent. This lesion we believe was secondary to an anomaly in the anatomy of the biliary tree that was recognized intraoperatively and repaired.

This complication rate did not differ from those previously reported in the literature.10

An unsuspected advantage to surgeons occurs as a result of their familiarizing themselves with 2-mm instruments and microlaparoscopic technique; we believe that needlescopic cholecystectomy is a stepping stone to learning skills necessary to safely perform advanced laparoscopic procedures such as intraluminal surgery.

CONCLUSION

Needlescopic cholecystectomy can be performed safely and expeditiously by experienced laparoscopic surgeons without increased risk in the majority of patients and probably with less pain, better cosmesis, shorter convalescence, and a high rate of patient acceptance.

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