

Acta Med. Okayama, 2011
Vol. 65, No. 5, pp. 325-328

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Acta Medica
Okayama

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Original Article

Covert Laparoscopic Cholecystectomy: A New Minimally Invasive Technique

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To further improve our developed transumbilical endoscopic surgery (TUES), we developed a completely covert laparoscopic cholecystectomy (LC). Twelve cases of LC were recruited for this new approach. First, a 10-mm trocar was placed above the umbilicus for inserting the laparoscope. Two 5-mm trocars were then placed near the right and left ends of the superior margin of the suprapubic hair. After the 5-mm 30° laparoscope was shifted to the left suprapubic trocar, the harmonic scalper, electric hook, and grasper were inserted either through the 10-mm umbilical trocar or through the right suprapubic trocar. All gallbladders were successfully removed without intraoperative complications. The mean operating time was 28.5 ± 5.7 min (range 20–45 min). All patients felt well after surgery and did not need postoperative analgesia. They resumed free oral intake 6 h after the procedure. All patients were satisfied with the appearance of the incisions, which were completely hidden in the umbilicus and suprapubic hair. The approach we developed has overcome both external instrument interference around the umbilicus and the loss of triangulation in the operative field. It is relatively simpler than a typical TUES and offers better cosmetic results.

Key words: laparoscopy, cholecystectomy, scarless surgery

The world's first laparoscopic cholecystectomy was performed more than 20 years ago in 1987. This procedure has become the gold standard for the treatment of symptomatic gallbladder diseases. A procedure known as natural orifice transluminal endoscopic surgery (NOTES) was recently introduced to further reduce the scar resulting from laparoscopic cholecystectomy. Compared to the traditional laparoscopic cholecystectomy, NOTES has the advantage of faster patient recovery, reduced need for anesthesia, and better cosmetic results [1]. However, because of

its technical difficulty and risk of organ perforation and abdominal infection, this procedure may not be a truly minimally invasive surgery. Thus, the advantages and disadvantages are being scrutinized in worldwide clinical trials. Recently, a procedure known as transumbilical endoscopic surgery (TUES) was introduced to reduce abdominal scarring. This procedure appears to leave no visible abdominal surgical scar [2]. However, the original TUES procedure for cholecystectomies is technically difficult and takes a long time to complete. By optimizing the procedure, we were able to significantly shorten the time of operation with similar cosmetic results. Successful minimally invasive surgery is defined by the most effective surgery with the least pain, trauma, scar-

Received December 15, 2010; accepted April 7, 2011.

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ring, and recovery time. Based on our TUES experiences, we propose this alternative, easier technique for laparoscopic cholecystectomy, a covert laparoscopic cholecystectomy that leaves no visible scars on the abdomen.

Patients and Methods

Clinical data. Twelve patients (4 males and 8 females) with gallbladder diseases were selected for this procedure from January 2008 to March 2009. Two patients had gallbladder polyps and 10 had gallstones. All patients presented with upper abdominal discomfort. They were informed about the interventional technique and provided written informed consent to receive the procedure. All surgical interventions were performed by the same operative team at Shanghai East Hospital.

Surgical technique. The patients were placed in the lithotomy position. The surgeon stood on the patient's left side, and the scrub nurse stood on the right side. The camera holder stood between the patient's legs. A 10-mm trocar was placed through an umbilical incision. After establishment of a pneumoperitoneum, a 5-mm 30° laparoscope was introduced through the trocar. Two 5-mm suprapubic trocars were placed near the right and left ends of the superior margin of the suprapubic hair under the guidance of the laparoscope. The laparoscope was then moved to the left side trocar. The instruments were introduced through the umbilical and right side ports. A grasper, 10cm longer than the one commonly used (Kang-Ji Medical Device, Hangzhou City, Zhejiang Province, China), was used to pull the gallbladder (Fig. 1). Calot's triangle was dissected using a harmonic shear (Ethico Endo Surgery, Inc., Cincinnati, Ohio, USA). Subsequently, the gallbladder was dissected free of the liver bed using an electric hook. The cystic duct was then ligated by an absorbable endoloop (Ethicon, Endo-Surgery, Inc.) and cut with the harmonic shear. The gallbladder was put into a specimen bag and removed via the umbilical incision. The 3 ports were closed with subcutaneous stitches.

Results

The mean age of the patients was 39.6 years (range 24–55 years), and the mean body mass index



Fig. 1 Port position: A 10-mm trocar with converter was introduced through an umbilical incision. Two 5-mm suprapubic trocars were placed near the right and left ends of the superior margin of the suprapubic hair.

was 27.75 kg/m² (range 22–36 kg/m²). All gallbladders were removed successfully without severe bleeding; the average blood loss was 13.9 ml (range 10–25 ml; Table 1). This approach obtained an excellent exposure of the Calot's triangle (Fig. 2). The mean operating time was 28.8 ± 5.7 min (range 20–45 min). All patients felt well after the operation, did not need postoperative analgesia, and resumed free oral intake 6 h after the procedure. The suprapubic scars were covered by the hairline, and the patients were satisfied with the cosmetic results (Fig. 3). All the patients were discharged 48 h after the operation and returned to work within 7 postoperative days, except 1 patient who stayed in the hospital for 4 days because of previous surgical history and the placement of a drainage tube. All patients reported excellent clinical recovery without any complications at the one-month follow-up evaluation in the outpatient clinic. There were no visible scars on the abdomen (Fig. 3).

Discussion

With the improvement of minimally invasive techniques, NOTES has become an attractive trend in

Table 1 Patient and procedural characteristics

Case	Sex	Age, y	Diagnosis	Prior surgery	BMI	Operation time, min	Blood loss, ml	Length of hospital stay, d	Analgesics	Complications
1	F	24	Symptomatic gallstone	no	22	20	17	2	no	no
2	M	37	Symptomatic gallstone	no	25	29	12	3	no	no
3	F	47	Symptomatic gallstone	Yes	31	24	10	2	no	no
4	M	51	Gallbladder polyp	no	37	34	15	2	no	no
5	F	44	Symptomatic gallstone	no	26	29	10	2	no	no
6	F	32	Symptomatic gallstone	no	24	30	18	2	no	no
7	F	29	Gallbladder polyp	no	25	27	10	1	no	no
8	M	48	Symptomatic gallstone	no	33	31	15	2	no	no
9	F	55	Symptomatic gallstone	Yes	36	45	25	4	no	no
10	F	29	Symptomatic gallstone	no	27	27	15	2	no	no
11	F	38	Symptomatic gallstone	no	23	21	10	2	no	no
12	M	41	Symptomatic gallstone	no	24	29	10	2	no	no

BMI, body mass index

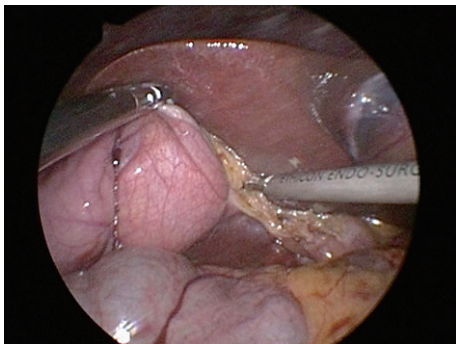


Fig. 2 The exposure of Calot's triangle during the operation. The harmonic shear was introduced in the umbilical trocar, and the grasper was introduced in the right suprapubic trocar, while the laparoscope was introduced in the left suprapubic trocar.

surgery because it produces no abdominal scars. Many reports on NOTES have been published since the initial description by Kalloos *et al.* [3]. To date, NOTES has been applied to many interventions, such as tubal ligation, splenectomy, cholecystectomy, abdominal exploration, and appendectomy, in both animal and clinical studies [1]. Although NOTES is technically feasible, it may be hampered by difficulty in accessing anatomical sites, lack of appropriate instruments, and concerns over sterility. These limitations have led to an interest in TUES or single-access endoscopic surgery. These procedures offer the potential for a technically easier operation with fewer complications but with the same outcome, as shown by the use of TUES in cholecystectomy, appendectomy, sleeve gastrectomy, and hemicolectomy [4-7].



Fig. 3 The lower abdominal scars are hidden below the supra-pubic hairline.

However, TUES is also more technically difficult than traditional laparoscopic surgery, because of the associated challenges of manipulating the laparoscope and other instruments, crowding in the umbilicus, and loss of triangulation between the 2 instruments in the operative field. TUES also requires greater manual dexterity and ambidexterity to perform the relatively intricate maneuvers.

Several solutions have been proposed to the problem of restricted movement of the instruments. Palenevula *et al.* [9] presented a variant of TUES in 10 patients with gallbladder stones. A flexible double

channel endoscope was introduced subumbilically into the abdominal cavity, and a rigid 3-mm transcutaneous trocar was placed in the left hypochondrium for lever retraction. Some cases in which this procedure was attempted had to be converted to conventional laparoscopic cholecystectomy, because of the difficulty in dissection or uncontrollable hemorrhaging. Therefore, the approach was unsatisfactory and further improvements in instruments and access are needed to increase the success rate and patient acceptance and satisfaction. Zornig *et al.* [10] described a hybrid technique that combined transvaginal and transumbilical cholecystectomy for the treatment of gallstones. Conventional instruments and techniques were used in this procedure. This technique offers the potential to optimize cholecystectomies in selected cases without the help of laparoscopic specialists. Gerdes *et al.* [11] introduced the technique of laparoscopic cholecystectomy (LC) without epigastric scars. Two trocars were introduced through the umbilical and suprapubic incisions, respectively. The gallbladder was fixed to the abdominal wall with a suture. The 5-mm intraumbilical incision was hidden in the umbilicus and the 10-mm suprapubic incision was hidden in the pubic hair. Only a minimal learning curve is needed when trained laparoscopic surgeons switch to this procedure, in contrast to learning other operative procedures.

The approach we introduced is only slightly different from conventional LC but produces better cosmetic results, and the operation time is almost equal to that of traditional LCs, according to our data. In a comparison with single-port laparoscopic cholecystectomy, we found the main advantage of our covert LC is the significantly short operation time. A comparative study with a large sample is underway and will be reported separately. Based on our experience performing TUES, we realized that the issues of losing triangulation between the instruments in the operative field and crowding needed to be improved to shorten the operation time and minimize complications [12]. After analyzing the advantages and disadvantages of several LC approaches, we proposed combining the TUES approach with 2 additional suprapubic ports. This technique was designed to address both the technical difficulties of the procedures and reduce visible scarring. We found that this approach was truly minimally invasive, because it was characterized

by no visible scar, a short operating time, minimal bleeding, a short in-patient stay, and no need of postoperative analgesia. We have applied this new approach to laparoscopic appendectomies and obtained excellent clinical results (data not shown). Because of the attractiveness of no visible scar, we often received positive feedback from the patients during follow-up. However, it may be necessary to use longer instruments because of the distance from the suprapubic region to the gallbladder. Further randomized clinical trials are warranted to verify the advantages of this technique and to make necessary improvements.

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