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Single-incision laparoscopic cholecystectomy with needlescope via an another port

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Background: In single-incision laparoscopic cholecystectomy (SILC), the additional needlescopic instrument has often been inserted in the right subcostal region to improve the transumbilical manipulability between the laparoscope and surgical instruments. We applied a 3.3-mm needlescope with a zoom function via the additional port to obtain further improvement of SILC.

Patients and Methods: Between August 2009 and July 2012, 30 patients with gallbladder stones were performed SILC with a needlescope. There were 10 males and 20 females, with a mean age of 52 years. Under general anesthesia, a 2.5-cm transumbilical skin incision was made. A lap-protector was applied and covered with a glove. Two 5-mm ports and one 2-mm needlescopic instrument were inserted into the peritoneal cavity through the glove. A 3.3-mm needlescope was inserted through the right subcostal needle port. After obtaining the critical view, the cystic artery was divided using laparoscopic coagulating shears and the cystic duct was also divided after clipping. The gallbladder was freed from the liver bed and retrieved through the umbilicus.

Results: All procedures were performed without adding another ports or conversion to open approach. The mean operation time was 78 min. There were no major intra- or postoperative complications. The 3.3-mm needlescope yielded higher quality image than the one used previously, and its zoom function allowed accurate observation. Clashing between the laparoscope and the 5-mm instruments was reduced by changing the insertion site of needlescope.

Conclusion: Our procedure is feasible and safe for performing SILC, and the improved results are attributable to the introduction of a 3.3-mm needlescope through the right subcostal port.

Key words: single incision laparoscopic surgery, needlescopic surgery, needlescopic cholecystectomy, laparoscopic cholecystectomy

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Introduction

Over the last three years, single-incision laparoscopic cholecystectomy (SILC) has been adopted worldwide [1-3], because it allows reduction of postoperative pain and leaves an innocuous operative scar in comparison with

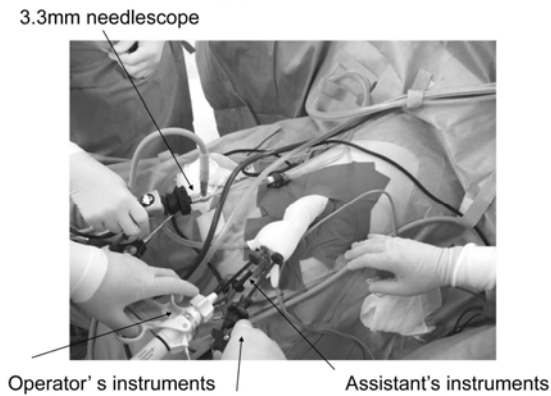


Figure 1: Outside operative view of single-incision needlescopic cholecystectomy.

conventional laparoscopic procedures. We have also performed gasless one port laparoscopic cholecystectomy between October 1997 and May 1998 [4] as a modification of the procedure reported by Navarra et al. in 1977 [5]. At that time, however, its manipulability was limited due to insufficient instruments and poor visualization. To compensate for those issues, the use of flexible endoscopy [6], extracorporeal stay suture and roticulating instruments [7, 8], multiport trocars and placement of an additional port site outside the umbilicus [9] were introduced. Here we report the technique of single-incision needlescopic cholecystectomy (SINC) using a needlescope with zoom function introduced via the additional port to avoid clashing between the endoscope and instruments via the umbilicus.

Patients and Methods

Between August 2009 and July 2012, 30 patients with gallbladder stones were performed SILC with a needlescope. There were 10 males and 20 females, with a mean age of 52 years (range: 34-77years). Their body mass index ranged from 21.8 to 31.5 kg/m² with a mean of 24.3 kg/m². The approval of ethical committee was obtained before this study, and informed consent was also obtained from all patients.

Under general anesthesia, the patient was placed in a supine position with insertion of a nasogastric tube and urinary catheter. The operator stood between the legs of the patient,

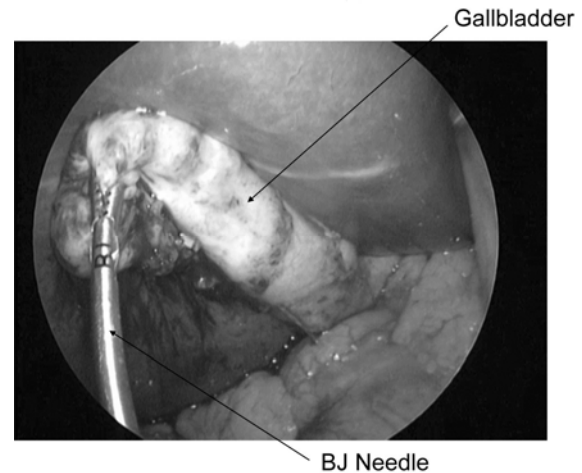


Figure 2: The infundibulum of the gallbladder was grasped with BJ needle.

with the assistants on the right and left sides. Initially, a single transumbilical 2.5-cm vertical incision was made to enter the peritoneal cavity. A lap protector (Mini-type, Hakko, Japan) was set up through the small umbilical incision, and EZ access or a surgical glove (5 and 1/2 size) attached with two 5-mm ports and one 2-mm port was then fixed to the outer ring of the lap protector. The patient was then placed in the reverse Trendelenburg position with the right side rotated up. After creating pneumoperitoneum using CO₂ gas with an intraperitoneal pressure of 10 mmHg, two standard rigid 5-mm laparoscopic instruments and one 2-mm needlescopic instrument (BJ needle: Nithion, Japan) were inserted through the umbilical port site. An additional port (Mini Step™ 2/3-mm Cannula and Dilator: Covidien) outside of the umbilicus was inserted in the right subcostal area for observation using a 3.3-mm needlescope (Karl-Storz). Intraperitoneal pressure was changed to 8 mmHg when the procedure was started (Fig.1). The operator manipulated two 5-mm instruments including dissecting forceps, scissors, electrocauterizer, laparoscopic coagulating shears (LCS) (SonoSurg: Olympus K.K. Tokyo, Japan) or clips using both hands. The assistant manipulated a 2-mm needlescopic instrument and the endoscopist manipulated a 3.3-mm needlescope. The infundibulum of the gallbladder was grasped with the BJ needle (Fig.

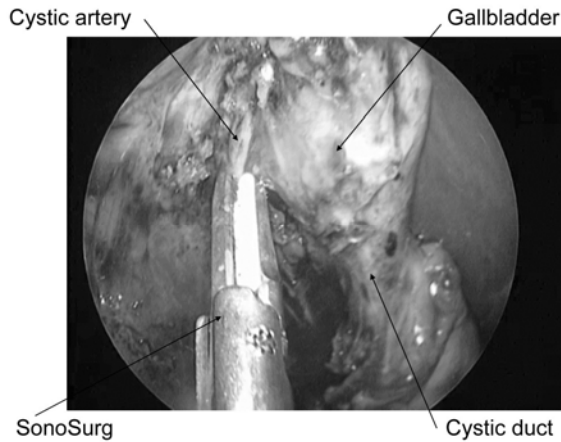


Figure 3: The cystic artery was divided and identified.

2) and retracted laterally and upward to expose Calot's triangle. First, the posterior portion of the gallbladder neck was dissected, and subsequently the dissection was carefully continued to the junction between the gallbladder and the cystic duct. The cystic duct was identified and cleared by sweeping back and forth with a right-angle forceps. The cystic artery was also identified within Calot' triangle (Fig. 3). After obtaining the critical view, the cystic artery was divided using a Sonosurg and the cystic duct was ligated with clips (Fig. 4) and divided with scissors. The gallbladder was freed from the liver bed during its retraction in various directions. The gallbladder was retrieved through the umbilical wound (Fig. 5). After removing the lap protector, the fascia and subcutaneous layer of the umbilical wound was only closed with 2-0 absorbable sutures (Fig. 6), and packed a small gauze ball beneath a dressing.

Result

All procedures were performed without adding another ports or conversion to open approach. The mean operation time and estimated blood loss were 78 min (range: 54-118 min) and minimal, respectively. There were no intra- or postoperative complications. The median postoperative hospital stay was 3 days (range: 2-4 days). The 3.3-mm needlescope yielded higher quality image than the one used

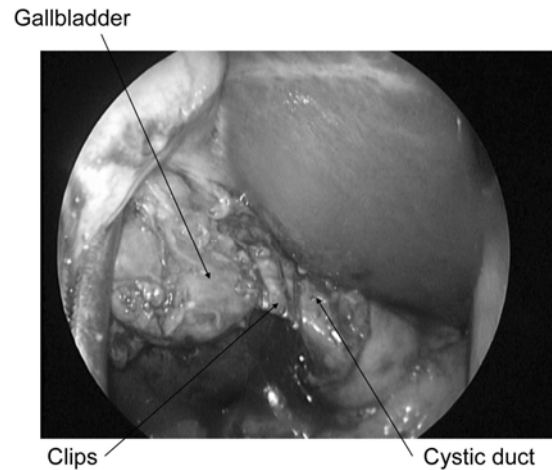


Figure 4: The cystic duct was ligated with clips.

previously, and its zoom function allowed accurate observation. Clashing between the laparoscope and the 5-mm instruments was reduced by changing the insertion site of needlescope.

Discussion

SILC is an attractive procedure for the patients offering better cosmesis, less postoperative pain and early recovery. However, it is stressful for the surgeons in view of its low manipulability and poor visualization. The problems of SILS include clashing of instruments, lack of ideal ports, interference and deflection of the laparoscope's light source by operating instruments, interference of wires and tubes that connect perpendicularly to the instruments, difficulty with retraction of organs and structures, changes in the surgeon's mindset, and so on [8]. To avoid clashing between the instruments and the laparoscope, and to minimize interference and deflection of the laparoscope's light source, wires and tubes connecting to the instruments, we applied a 3.3-mm needlescope via an additional port placed outside the umbilicus. In general, this additional port was used to grasp the infundibulum of the gallbladder by needlescopic instruments [9]. This distinctive feature allows separation of the endoscope and several laparoscopic instruments. Thus, clashing between the endoscope and several laparoscopic instruments

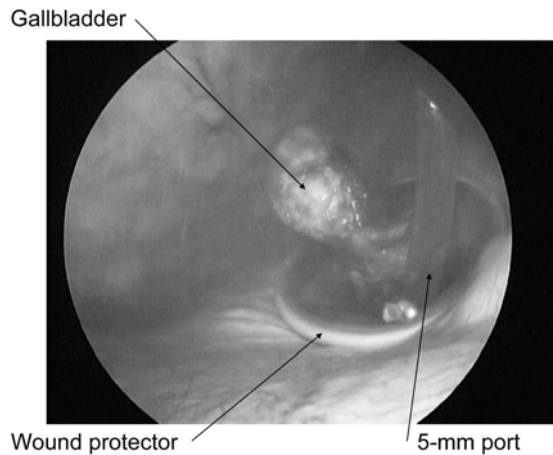


Figure 5: The needlescope visualize retrieval of the resected gallbladder through the umbilical wound.

is avoided, and high manipulability of at the umbilicus is obtained in comparison with SILC.

Regarding endoscopic visualization, we previously experienced the use of 2-mm and 3-mm endoscope. These yielded a low quality of visualization, including blurred vision, strong halation and easy crushing with other instruments. However, the 3.3-mm endoscope with zoom function provided visualization similar to that obtained with a 5-mm endoscope, because its zoom function yielded a magnifying effect without being too close to other instruments. This helped to reduce halation and crushing. Furthermore, this endoscope has a rigid 30-degree tip, providing better manipulation than that of previously employed 2-mm or 3-mm endoscope.

To create the operative field during SILC, several groups have adopted the use of an extracorporeal stay suture to manipulate the gallbladder [1, 4, 5, 7, 8] or have inserted an additional 2-mm or 3-mm port [9]. However, there is minor bile spillage resulting from placement of the stitch in the former. We think that this maneuver is not indicated for polypoid lesions with an unclear pathological diagnosis due to the possibility of tumor cells in the bile juice. We placed an additional 3-mm port to replace the stay suture, while manipulating the gallbladder. Furthermore, to achieve better manipulability, we inserted a 3.3-mm needlescope into the additional port to avoid

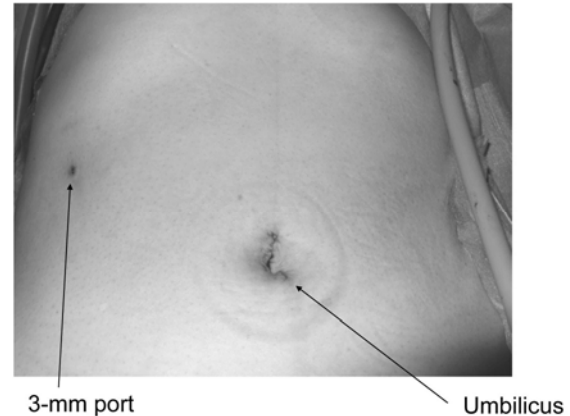


Figure 6: Outside view after the operation.

clashing between the needlescope and other instruments. Our operation time (78 min) is relatively long due to chronic cholecystitis after acute cholecystitis or adhesions after previous abdominal surgery. However, mean operation time except for SINC was 98 min (range: 34-185 min) in the same period. We think that the operation time is improved by the adoption of a 3.3-mm needlescope. Recently, Shussman et al. [10] reported an endo-retractor containing two grasping forceps. This is able to manipulate the gallbladder intraperitoneally without any skin incision or extracorporeal maneuver, and will be used more frequently even in SINC to improve operative outcome.

At present, although intraoperative cholangiography (IOC) is not commonly performed during SILC, IOC was performed routinely in our initial study. However, IOC requires cannulation into the cystic duct, arrangement of X-ray equipment, use of radioactivity and more operation time. Therefore, we introduced ICG cholangiography to evaluate the anatomy of the biliary tree during SILC [11]. ICG fluorescence imaging is safe and useful for navigation of the biliary anatomy during SILC without any special equipment. Recently, a few reports have demonstrated postoperative complications after SILC [12, 13], including transection of the bile ducts and the right hepatic artery, requiring open reconstruction of the biliary tract. It is necessary to avoid or minimize damage to the bile duct or blood vessels during SILC. ICG cholangiography provides a clear

cholangiogram and displays the flow of the cystic artery, being an important tool for reduction of intraoperative and postoperative complications.

Conclusion

Our procedure is feasible and safe for performing SILC, and the improved performance is attributable to introduction of a 3.3-mm needlescope through the right subcostal port.

Authors' Contribution

TN: Prepared literature search and the draft manuscript

SA: SY: Helped in designing the study

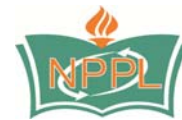
OM: Helped in writing manuscript

Conflict of Interests

The authors declare that they have no conflict of interest.

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