



ORIGINAL ARTICLE

Comparison study of clinical outcomes between single-site robotic cholecystectomy and single incision laparoscopic cholecystectomy



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Summary *Background:* Multiport laparoscopic cholecystectomy is the standard surgical procedure for symptomatic gallbladder diseases. The latest evolution is single incision laparoscopic cholecystectomy (SILC). Single-site robotic cholecystectomy (SSRC) overcomes several limitations of manual SILC. The aim of this study is to present our initial experiences in SSRC and to compare its clinical outcomes with those of SILC.

Methods: This study retrospectively reviewed data for patients who received SSRC or SILC from February 2014 to September 2015. The following variables were analyzed: age, sex, body mass index, indications, pain scale, length of stay, and complications. The data were analyzed with Student *t* test or by Fisher exact test.

Results: The analysis included 51 SSRC (33 women, 18 men) and 63 SILC patients (40 women, 23 men). Patients in both groups had similar demographic features and indications for surgery. The SSRC group required no conversions to conventional laparoscopy and no additional trocars, whereas the SILC group had two (3.17%) cases. Length of stay did not significantly differ between the SSRC and SILC groups (4.29 ± 0.72 vs. 4.13 ± 0.93 days, respectively; $p = 0.823$). However, the SSRC group had shorter operative time (71.30 ± 48.88 vs. 74.70 ± 30.16 minutes; $p = 0.772$), less perioperative bile spillage (9.81% vs. 19.05%; $p = 0.189$), and less postoperative bile leakage (0% vs. 3.17%; $p = 0.501$). However, the parameters mentioned above were not statistically significant, whereas pain scale scores were significantly lower in the SSRC group (2.11 ± 0.76 vs. 3.98 ± 0.84 ; $p < 0.01$).

Conflicts of interests: None.

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Conclusions: Both SSRC and SILC are safe and feasible procedures for performing single incision cholecystectomy. SSRC, however, has the advantage of significantly decreased postoperative pain.

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1. Introduction

Whereas laparoscopic cholecystectomy is considered the standard treatment for symptomatic gallstones, the latest evolution in cholecystectomy is single incision surgery. Single incision laparoscopic cholecystectomy (SILC), which was first introduced in 1995,¹ is considered an effective minimally invasive method of managing benign gallbladder diseases. It avoids scarring because the entry point is hidden in the umbilicus, and it does not cause substantial postoperative pain or reduction in postoperative quality of life.^{2,3} However, SILC is not widely used by laparoscopic surgeons because the narrow working space markedly limits the movement of instruments and the number of instruments that can be used at one time.⁴ Retraction or other assistance is often required.⁵ Additional technical difficulties of SILC include loss of triangulation, poor ergonomic conditions, an unstable platform, a high learning curve, and counterintuitive instruments.

In 2011, the da Vinci Single-Site Instrumentation and Accessories (Intuitive Surgical, Inc., Sunnyvale, CA, USA) system was developed to overcome these limitations.^{6–8} This novel computer-based platform incorporates a multi-channel single port that accommodates two curved, robotic cannulae. These interchangeable semirigid instruments cross each other within the trocar such that the cannula entering from the left becomes the right-side operative instrument and *vice versa*.⁹ The da Vinci platform triangulation problems occur when conventional laparoscopic instruments are used.¹⁰

This three-dimensional endoscope provides extremely fine visualization and avoids the problem of collisions between bedside surgeons or between intra-abdominal instruments. The da Vinci single-site platform performed equivalently to traditional multiport cholecystectomy.⁷ Finally, the platform improves ergonomic comfort by enabling the surgeon to operate the endoscope while seated at the console.

To the best of our knowledge, the only reported use of the da Vinci platform for single-site robotic cholecystectomy (SSRC) in an Asian population is a 2015 study performed in a Korean population.¹¹ After our center implemented the da Vinci platform in February 2014, our surgical team was the first to use it.

The aim of this study was to evaluate the feasibility and efficacy of SSRC in 51 consecutive cases and to compare clinical outcomes between SSRC and SILC.

2. Methods and materials

Data were collected for all SSRC procedures performed at our institution from February 2014 to September 2015,

which included 51 cases. The indications for cholecystectomy were symptomatic gallbladder stone (with or without acute cholecystitis) and gallbladder polyps. For comparison, the analysis included an additional 63 patients who had received SILC with the same surgical indications. Because of the high cost of instruments for both procedures, the inclusion criteria call for those who are willing to pay for the additional expense. The exclusion criteria include patients who cannot tolerate the laparoscopic surgery and those with previous major abdominal surgery.

The data analysis in this study included demographic data, comorbidities, and indications for surgery, complications, rate of conversion, average length of hospital stay (LOS), pain scale score, and total operative time. Data collected for both SSRC and SILC patients included age, sex, body mass index (BMI), diagnosis, operative outcome (operative time, conversion rate, and intraoperative complications), postoperative outcome (LOS, pain scale score, and postoperative complications), and total operative time (time from skin incision to skin closure). The pain scale score was measured at 8 hours after the surgery using the visual analog scale (VAS) method.

In the SSRC group, the da Vinci Single-Site surgical system (Intuitive Surgical, Inc, Sunnyvale, CA, USA) was used to perform cholecystectomy. The patients were placed in a supine position, and a vertical 2.5-cm incision was made through the umbilicus. The da Vinci Single-Site multi-channel Port was introduced into the peritoneal cavity, and pneumoperitoneum was created by an injection of carbon dioxide gas under 15 mmHg intra-abdominal pressure. The patient was placed in a reverse Trendelenburg position with a 15° inclination and tilted to the left side. Curved cannulae and accessory trocars were inserted into the port under direct endoscopic visualization, and the docking procedure was performed. After the flexible da Vinci instruments were inserted through the curved cannulae, the robotic surgical system automatically established an association between the hands of the surgeon and the ipsilateral tip of the surgical instrument to enable intuitive control. The assistant then grasped and lifted the fundus of the gallbladder in a lateral upward direction to expose the subhepatic space. After safe retraction and visualization of the Calot's triangle, the surgeon could begin using the console for surgery. The cystic duct and cystic artery were skeletonized and dissected, and then clipped with Hemo-o-lok clips. Cholecystectomy was performed in a retrograde fashion. The excised gallbladder was extracted through the umbilicus with the port. The fascial defect and the skin incision were closed with absorbable sutures.

The SILC group received cholecystectomy with the assistance of Lagiport, a commercial kit made in Taiwan. The port had three attachments: wound retractor,

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