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## Robotic single-site combined cholecystectomy and hysterectomy: Advantages and limits



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## ABSTRACT

**INTRODUCTION:** Robotic single-site surgery (RSS) represents the latest innovation for clinical use of single incision surgery. Several applications have been reported in urology, general surgery and gynecology with potential application in benign cases as well as in oncology.

**PRESENTATION OF CASE:** To further explore potential applications of RSS, we present the first case reported in the literature of combined cholecystectomy and total hysterectomy using the da Vinci Si single-port platform (Intuitive Surgical Inc., Sunnyvale, CA).

**DISCUSSION:** A critical description of the procedure with potential advantages and limitations of the current platform for combined surgical procedure is provided.

**CONCLUSION:** Robotics may facilitate the widespread diffusion of single incision surgery, overcoming current laparoscopic and LESS limitations. However, the available robotic platform still has technical features that will limit its uptake amongst surgeons and further technological development is needed for a wider diffusion of single incision surgery.

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### 1. Introduction

During the past years, the field of endoscopic surgery has undergone several changes. With the evolution of robotic surgical units, continuous efforts have been made to reduce morbidity and improve cosmetics with a special focus on miniaturization of equipment, reduction of port size and number.

The widespread adoption of robotics for gynecological surgery has led to the inevitable hybridization of robotic technology with laparoendoscopic single-site surgery (LESS).<sup>1</sup> As a result, employment of the da Vinci surgical system (Intuitive Surgical Inc., Sunnyvale, CA) may allow greater surgical maneuverability, improving ergonomics.<sup>1</sup> Clinical application of robotic single-site surgery (RSS) has already been documented in general surgery, gynecology and urology. In particular, robotic single-site cholecystectomy (RSSC) can be performed safely and effectively with low rates of complications and conversions, as demonstrated in different studies.<sup>2–4</sup> Similarly, evidence supports the implementation of RSS for hysterectomy, especially after the introduction of robotic bipolar technology for single-site platform. Robotic single-site

hysterectomy (RSSH) has been proved to be feasible and reproducible in benign cases as well as in gynecological oncology.<sup>5–7</sup>

With the aim of exploring additional applications of RSS, we present a case of combined cholecystectomy and hysterectomy using the da Vinci surgical system with the single site platform. A critical analysis of the technique, including limitations of current single-site technology is also provided.

### 2. Case report

A 43-year-old Caucasian woman (body mass index 29.2 kg/m<sup>2</sup>), gravida 2, para 2, had a 1-year history of chronic pelvic pain, pelvic pressure, and deep dyspareunia. At pelvic ultrasound, the uterus measured 53 mm × 42 mm × 49 mm, with a cervical length of 25 mm and normal appearing adnexa bilaterally. The uterus was noted to have a fundic myoma measuring 18 mm × 18 mm, with a globular appearance consistent with adenomyosis. The patient reported a history of 2 normal vaginal deliveries without complications, but she denied any other important past medical or surgical history. She also complained of right upper quadrant abdominal pain and nausea, worsened by fatty food intake, suggestive of cholelithiasis. Right upper quadrant ultrasound confirmed the diagnosis and removal of gallbladder was indicated. After extensive counseling of the patient about the various laparoscopic techniques available to perform a combined surgical procedure, the patient

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opted for concomitant RSS cholecystectomy and total hysterectomy without oophorectomy.

The combined surgical procedure was successfully performed in approximately 4 h (skin-to skin time) via a single 25 mm intra-umbilical omega-shape incision. Once 12 mmHg pneumoperitoneum was established and the specific single-site trocar inserted, a right robot side-docking was realized. RSSC was performed first, in the usual manner, as previously extensively described.<sup>2,8</sup> The gallbladder was put in an Endobag and placed in the right upper quadrant of the abdomen. To perform RSSH, the da Vinci cart was undocked and moved in a 180 degree anti-clock rotation around the patient. The multichannel single port trocar with the camera cannula was left on the patient. A left robotic side-docking was performed. To improve vaginal access, side-docking was preferred over a medial docking between patient legs. Hysterectomy was performed using robotic bipolar forceps for sealing all vascular pedicles, monopolar hook and scissors for cutting tissues and a uterine manipulator (Hohl Uterine Manipulator, Storz, Germany) to expose the uterus. The overall procedure was similar to that of multiport robotically assisted surgery. Bilateral round ligaments were transected and bladder flap was developed with monopolar hook. Tubes and utero-ovarian ligament were coagulated and cut in the same way. After bilateral visualization of the uterine vessels, they were sealed and transected using robotic curved scissor. Circumferential colpotomy was then performed using the monopolar hook. At the end of the procedure, the endobag containing the gallbladder was extracted vaginally and the vaginal vault was then closed.<sup>2,9</sup>

The postoperative course was unremarkable. The patient reported minimal postoperative pain and was discharged from the hospital 36 h after the surgical procedure was completed. Pathologic analysis demonstrated a 142-g uterus with multiple leiomyomas, and a gallbladder with chronic cholecystitis and cholesterosis.

### 3. Discussion

LESS surgery has gradually gained acceptance in the field of general surgery, but adoption was slower by gynecologic surgeons. LESS surgery still presents obstacles that limit its widespread acceptance, such as reduced triangulation and internal/external clashing of instruments, all of which increase the level of difficulty of the operation. Development of single-site port robotic devices represents a substantial evolution. Compared to the standard LESS procedure, RSS may present several advantages, including increased dexterity, range of motion, instrument and scope stability, ergonomics, and decreased instrument clashing. All these technical improvements have shortened the learning curve for single-site procedures<sup>5,10</sup> and might represent the basis for wider utilization of single-site procedures.

In this regard, our case demonstrates the feasibility of performing general surgery and gynecologic procedures concomitantly using a RSS surgical approach. Cholecystectomy and total hysterectomy were conducted uneventfully and they were performed in a relatively short time by surgeons with previous experience of RSS, working in a multidisciplinary robotic center. However, even if RSS represents a significant improvement of LESS, it still has some technical limitations, especially for combined surgeries. In contrast with conventional single port laparoscopy, the current RSS platform implies a double docking for combining upper abdomen with lower abdomen procedures.<sup>11</sup> This may be time-consuming due to the longer docking procedure in comparison to the multiport platform.<sup>5</sup>

In our case, we completed a 180 degree rotation around the patient to perform left side-docking, improving vaginal access

and uterine mobilization by the assistant positioned between the patient legs. Multiple docking has been described in some gynecologic oncologic pelvic procedures to improve access both of the pelvis and higher abdomen and our case shows that it is also feasible with the RSS platform. However, rotation of the robot around the patient (or the patient around the robot) represents an additional limitation for combining surgical procedures in different abdominal sites, even with the current da Vinci Si multiport platform. This entails trained surgeons, anesthesiologists and assistants, in addition to a dedicated operation room, in order to optimize the process.

The postulated advantages of LESS over conventional laparoscopy include reduction of postoperative pain, faster recovery, less impact on quality of life and improved cosmetic results.<sup>12</sup> Recently it has been evidenced that patients have a favorable perception of single-port surgery. The positive impact of public opinion and patient perception toward this technique appears to be undeniable, especially among female patients.<sup>13</sup> In the US, approximately 700,000 cholecystectomies are performed each year to treat symptomatic gallstones and hysterectomy is the second most frequently performed major surgical procedure after cesarean delivery among women of reproductive-age, with approximately 600,000 procedures/year.<sup>14,15</sup> Elevated number of surgeries along with the increase demand of cosmetics and faster recovery will increase the attractiveness of single site surgery. Cholecystectomy, hysterectomy and appendectomy represent potential feasible RSS combined procedures.

### 4. Conclusion

Robotics may facilitate the widespread diffusion of single incision surgery, overcoming current laparoscopic and LESS limitations. However, the available robotic platform still has technical features that will limit its uptake amongst surgeons and further technological development is needed for a wider diffusion of single incision surgery. The recently FDA approved da Vinci Xi platform will avoid the need for multiple docking and potentially boost the development of combined single-site procedures.

### Conflict of interest

The authors report no conflict of interest.

### Funding

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### Ethical approval

Written informed consent was obtained from the patient for publication of this case report and accompanying images. A copy of the written consent is available for review by the Editor-in-Chief of this journal on request.

### Author contributions

Towards the organization of this work, Nicola Pluchino and Patrick Dällenbach contributed original conception of the study. Nicola Pluchino drafted the manuscript. Nicolas Buchs made data acquisition. Panagiotis Drakopoulos provided literature research about da Vinci single-site surgery. Patrick Dällenbach, Philippe Morel, Nicolas Buchs, Jean Marie Wenger performed data analysis, interpretation and manuscript revision. Finally, Nicola Pluchino approved of the final version of the manuscript for publication.

**Key learning points**

- Combined operations using the da Vinci surgical system with the single site platform is achievable
- Available robotic platform still has technical features that will limit its uptake amongst surgeons and further technological development is needed for a wider diffusion of single incision surgery

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