

# Single-port access total laparoscopic hysterectomy for stage IA1 cancer of the cervix

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## ABSTRACT

**We describe the first case of single-port access total laparoscopic hysterectomy with intracorporeal suturing of the vault performed in Singapore. A 40-year-old woman with microinvasive squamous cell carcinoma of the cervix successfully underwent single-port access total laparoscopic hysterectomy. Unique articulated and multifunction laparoscopic instruments were used to complete the surgery in 118 minutes, with no complications. The patient had minimal pain postoperatively and recovered uneventfully within two weeks. This case illustrates the benefits of single-port access laparoscopic surgery in well-selected cases.**

**Keywords: intracorporeal suturing, laparoscopic single site surgery, single incision laparoscopic surgery, single-port access, total laparoscopic hysterectomy**

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## INTRODUCTION

Surgery by the minimally invasive approach has increasingly assumed a central role in the management of benign and malignant conditions in gynaecology. Although laparoscopy is associated with less pain and faster recovery as compared to laparotomy, it still requires up to four small separate incisions. With each incision lie the inherent risks of bleeding, infection, hernia development and internal organ damage, and with more incisions, a poorer cosmetic outcome. An alternative to conventional laparoscopy is single-port access laparoscopy,<sup>(1)</sup> where only one umbilical incision is made and surgery is performed through one specialised multilumen port. Single-port access laparoscopy thus reduces the morbidity of additional incisions and improves the final cosmetic outcome.<sup>(2)</sup> Laboratory and early clinical series have shown the feasibility and safety of single-port access surgery in general abdominal surgery,<sup>(3)</sup> urology<sup>(4)</sup> and increasingly, in gynaecology.<sup>(5)</sup> We describe the first case of single-port access total laparoscopic hysterectomy with intracorporeal suturing of the vault in Singapore.

## CASE REPORT

A 40-year-old woman with two previous term vaginal births was diagnosed with cervical intraepithelial neoplasia (CIN) after an abnormal PAP smear. A therapeutic laser cone biopsy revealed CIN 3 with a focus of microinvasive squamous cell carcinoma. Pelvic ultrasonography revealed no further pathology, and as the patient had completed her family, she was keen for hysterectomy with ovarian conservation through the minimally invasive approach. Under general anaesthesia, the patient was placed in the dorsal lithotomy position, and an indwelling urinary catheter was inserted. Using two tenaculums to hold the cervix at 6 o'clock and 12 o'clock positions, the cervical os was dilated and a KOH Colpotomizer™ System (CooperSurgical Inc, Trumbull, CT, USA) was inserted through the endocervical canal for uterine manipulation. A 5-mm abdominal incision was made along the upper perimeter of the umbilicus margin, and open entry into the peritoneal cavity was made. An initial diagnostic laparoscopy with a 5-mm laparoscope confirmed normal pelvic anatomy with no pelvic adhesions. The vaginal cup of the KOH Colpotomizer™ system was distinctly seen around the cervicovaginal junction, providing a clear demarcation of the vaginal vault.

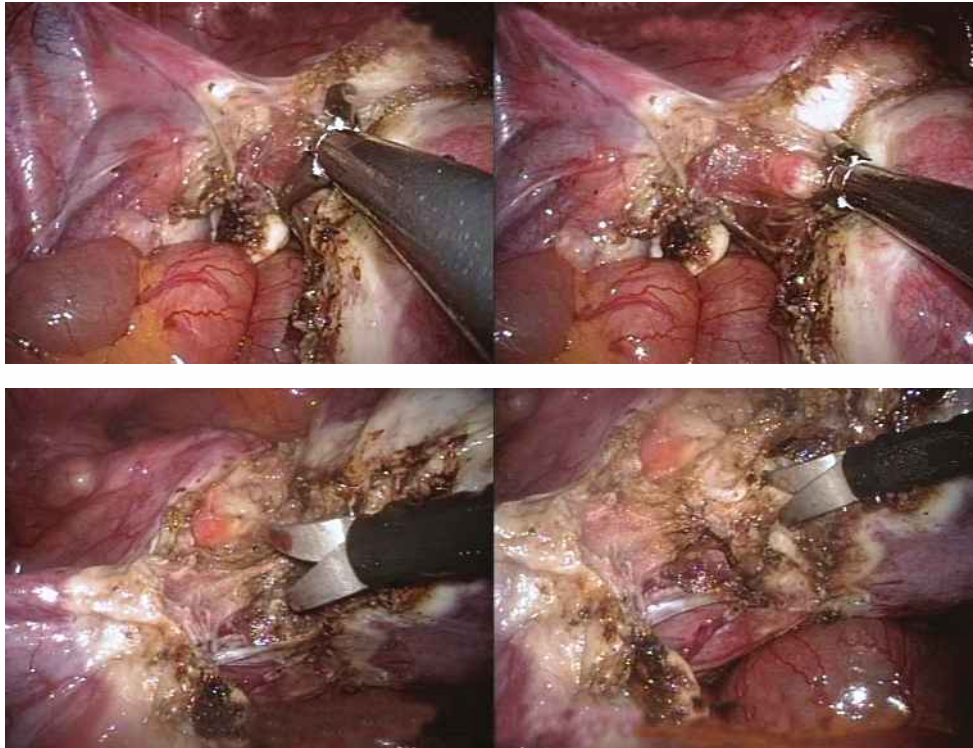
With these findings, a decision was made to proceed with single-port access total laparoscopic hysterectomy. The initial 5-mm incision was extended to 20 mm by cutting around the cephalad margin of the umbilicus from 3 o'clock to 9 o'clock. The underlying rectus fascia was further incised transversely to accommodate the single-access laparoscopic port. A four-channel flexible SILS™ port (Covidien, Dublin, Ireland) was inserted as recommended by the manufacturer. The port comprised one channel for peritoneal insufflation, one 12-mm operative channel and two 5-mm operative channels. Pneumoperitoneum was created to 14 mmHg, and intraperitoneal visualisation was obtained with the 5-mm flexible laparoscope (EndoEye LTF-VP, Olympus Medical Systems, Tokyo, Japan). A 5-mm grasper (Roticulator Endograsp, Covidien, Dublin, Ireland), 5-mm bipolar grasper (Olympus Medical Systems, Tokyo, Japan) and

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**Fig. 1** Photographs show the curved-tip instruments coagulating the pedicles transversely.

10-mm Ligasure Atlas vessel-sealing device (Covidien, Mansfield, MA, USA) were used to perform the total laparoscopic hysterectomy.

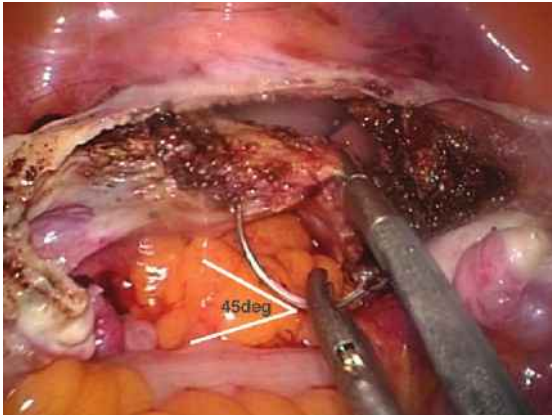
The round ligaments and ovarian ligaments were divided using the Ligasure vessel-sealing device. Subsequently, the ascending uterine vessels at the uterine isthmus were sealed with Ligasure but not divided. The uterovesical peritoneal fold was opened using monopolar cutting current (30 watts), and the bladder deflected downward. With the bladder and ureter dissected away from the vaginal vault, the uterine vessels and uterosacral ligaments were coagulated with the bipolar grasper (30 watts) and then divided. Entry into the vaginal vault was guided by cutting along the bevelled edge of the KOH cup using a monopolar cutting current. Following removal of the uterus through the vagina, the vaginal vault was closed with laparoscopic suturing using monofilament poliglecaprone sutures. The angles of the vault were caught and secured with extracorporeal knot tying, while the centre of the vault was closed with a “figure of 8” intracorporeal knot. The SILS™ port was removed, and the rectus fascia and skin closed in layers with braided polyglactin suture. The entire surgery (including diagnostic laparoscopy) took 118 minutes and the estimated blood loss was 10 ml.

The patient had a pain score (visual analogue score)

of 1/10 on postoperative Day 1 and did not require any analgesics. She was well and discharged on the evening of postoperative Day 1 after normal bowel and bladder functions were established. The final histology of the uterus and cervix revealed no residual dysplasia or malignancy. At the two-week follow-up, the patient reported no further pain or vaginal bleeding, and had resumed daily activities. At two months post surgery, the umbilical incision was barely visible, and the vaginal vault was completely re-epithelialised.

## DISCUSSION

Single-port access laparoscopy has been made possible with new technological innovations of articulated instruments. With articulated instruments allowing up to 80° bending and 360° rotation, triangulation of these instruments within the peritoneal cavity can be achieved. This enables effective traction and counter traction movements to perform surgery, even when instruments are introduced parallel through the single umbilical port. This key technological innovation negates the need to site additional laparoscopic ports on the abdomen to achieve instrument triangulation within the peritoneal cavity. Another key technological innovation for successful single port access laparoscopy is the use of the flexible-tip endoscope. If conventional rigid endoscope is used



**Fig. 2** Photograph shows a needle held obliquely to simulate a corkscrew manoeuvre for single-port suturing.

instead, there is a tendency for all operating instruments to crowd at the umbilicus, colliding with each other and with the endoscope, resulting in a shaky vision. As the flexible-tip endoscope is able to bend up to  $60^\circ$  in the vertical and horizontal planes as well as rotate  $360^\circ$  around, it becomes possible for the endoscope to be held laterally away from the umbilicus while still maintaining a good end-on vision of the entire pelvis. The flexible tip can be further manoeuvred to provide a side-on view for better depth perception to instruments coming in from the umbilical port, where necessary. The flexible endoscope provides a clear vision of the entire pelvis without having the need to jostle for space at the umbilical port, thus providing the surgeon more uninhibited room to perform surgery at the umbilical port.

As there are only two operative instruments at any one time at single-port access laparoscopy, it makes sense to employ instruments with integrated functions of tissue dissection, vessel sealing and tissue cutting. These integrated instruments improve surgical efficiency and reduce the need for frequent instrument change, thus improving surgical time. In this respect, we used the vessel-sealing device Ligasure Atlas in order to divide the pedicles of the uterus (round ligaments, tubes and ovarian ligaments) in a matter of minutes, with minimal need for additional instruments for tissue handling.

A final point with regard to instrument choice for single-port access laparoscopy is the advantage that curved-tip instruments have over straight-tip instruments. Curved-tip instruments entering the peritoneal cavity through the umbilicus provide a slight lateral angle of tissue contact as compared to straight-tip instruments. This slight lateral angle of tissue contact is helpful when attempting to coagulate and cut, in a transverse manner, the pedicles (uterine vessels, uterosacral ligaments, vaginal vault vessels) that run parallel to the instruments

from the umbilical port. To this effect, we used the curved-tip bipolar grasper and curved-tip scissors to coagulate and cut the uterine vessels and uterosacral ligaments transversely and cleanly, as opposed to coagulating and slicing them axially with straight-tip instruments (Fig 1).

Apart from the innovations of instrumentation for single-port access laparoscopy, two surgical aspects also differ from conventional laparoscopy. They are the concept of 'bringing the tissue to the instrument' and the concept of 'zero tolerance to bleeding'. The concept of 'bringing the tissue to the instrument' at single port access laparoscopy is in contrast to the traditional laparoscopy where at most times, the surgeon 'brings the instrument to the tissue'. Despite the use of a flexible endoscope to free up space at the umbilicus, crowding of two operative instruments can still happen, especially when a 10-mm instrument is used. In such an instance, it may be more efficient for the surgeon to operate with one hand at the umbilical port while manipulating the uterus with the other hand. The surgeon can then bring the tissue to the instrument and present the exact site for surgical action with more control with such two-handed single-access port laparoscopy. We employed this technique at the stage of dividing the uterine vessels, cardinal-uterosacral complex and incision of the vaginal vault. We found the KOH Colpotomizer<sup>TM</sup> System expedient in manipulating the uterus through all directions and the instrument compact in size for such two-handed surgery with no ergonomic strain.

Despite all the instrumental innovations and surgical techniques employed in single-port access laparoscopy, when bleeding occurs, a lag time ensues for instruments to isolate, irrigate, visualise and stem the bleeding point. For minor bleeds, haemostasis is often achievable, despite this lag time. However, for more active arterial bleeds, haemostasis may only be achieved after insertion of additional laparoscopic ports. Hence, for successful single-port access laparoscopy, 'zero tolerance to bleeding' is crucial. Additional and sometimes obsessive measures are taken to ensure that pedicles are totally desiccated before they are transected. These include coagulating large vascular pedicles with bipolar electrosurgery till they appear desiccated, cooling them with irrigation fluid and then coagulating the pedicles again before transection. At times, large vascular pedicles are transected partially and coagulated a second time before total division. Meticulous preemptive coagulation of small vessels with bipolar electrosurgery is performed before tissue cutting where possible, so as to minimise the need to 'chase the bleeding points'. We find this technique especially helpful while incising the vaginal vault, with no need for subsequent

haemostasis. It is likely that these obsessive steps at haemostasis contributed to the marked reduced blood loss (10 ml) and the slightly prolonged surgical time.

Finally, laparoscopic closure of the vaginal vault brings its own set of challenges to single-port access laparoscopy. Although the use of auto-suturing devices like the Endostitch (Covidien Autosuture, Dublin, Ireland) has been described to expedite suturing,<sup>(6)</sup> we believe that this challenge can be overcome with a slight modification of traditional laparoscopic suturing steps. In conventional laparoscopic suturing, the needle is held at 90° to the needle holder. This is an ineffective suturing angle when the needle holder is introduced through the umbilical port to stitch the vaginal vault. Instead, we loaded our needle at an oblique angle approximating 30°–45° forward (Fig. 2), thus enabling the needle to drive through the tissue in a corkscrew manner. Intracorporeal knot tying is then effected with the use of one angulated grasper bent to 90°, looping around the suture held in a vertical position by the needle holder.

An easier alternative to intracorporeal knot tying is the use of a sliding extracorporeal knot (e.g. modified Western knot or sliding variant of the reef knot) where the knot is slid down to the suture point when the free end is pulled. A sliding extracorporeal knot also has the advantage of not requiring a knot pusher. We managed to achieve complete closure of the vaginal vault laparoscopically through a single umbilical port using these technical modifications. Greenberg and Einarsson<sup>(7)</sup> described the newly launched barbed sutures (Quill Self Retaining Sutures SRS, Angiotech Pharmaceuticals Inc, Vancouver, Canada) as an alternative method to close the vault with ease. These new sutures have tiny barbs on its surface running in one direction, allowing the suture to lock on the tissue after it has been pulled through. This eliminates the need for laparoscopic knot tying and

makes vault closure at single-port access laparoscopy relatively easy.

This case describes the first single-port access total laparoscopic hysterectomy in Singapore, with a favourable outcome. Apart from the technological advancement and modification of surgical technique, the success of this case is also contributed by the fact that the pelvis was anatomically normal with no adhesions and the uterus size was not overtly large. As single-port access surgery is still in its infancy, it would be prudent to attempt complicated cases with caution. Cases involving moderate-to-severe degree of endometriosis and/or pelvic adhesions as well as enlarged uterus (larger than 16 weeks gestation) should ideally be attempted after surpassing the learning curve of single-port access surgery. Cases with malignancy exceeding stage II cervical or endometrial cancers should be contraindicated at present. Single-port access gynaecological laparoscopy is technically feasible in a well-selected case and is associated with reduced postoperative pain and a quick recovery.

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