

Single Incision Laparoscopic Surgery (SILS)

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Abstract

Single incision Laparoscopy (SILS) is a very exciting new modality in the field of minimal access surgery which works to further reduce the scars of standard laparoscopy and towards scar less surgery. It offers less postoperative pain, less invasiveness, shorter hospital stay and has best cosmetic results. Although the SILS takes longer time compared with standard laparoscopy, this can be significantly reduced by experience and more advances on the type of instruments used.

Introduction

For many years, large incisions were required to perform abdominal surgical procedures. Although effective, multiple morbidities were associated with this method, including postoperative pain, wound infection, incisional hernia, and prolonged hospitalization. Some surgeons' perceptions that complications and morbidities were associated with the size and extent of the incision led them to minimize their incision length. By making much smaller incisions that were protected by a port (laparoscopy), there was a great reduction in incision-related complications.¹ There was faster postoperative recovery, pain reduction, less need for narcotics, respiratory function improvement, decrease in infection and hernias, and better overall cosmesis.^{2,3} Currently about 65-70% of hysterectomies in the United States are performed using a large abdominal incision. Since late 1980's and early 1990's, surgeons have been exploring minimally invasive techniques to decrease the complication rate and shorten the recovery time of the traditional open hysterectomy.

Single incision laparoscopic surgery (SILS), also known as Single port laparoscopy (SPL), single port access surgery (SPA), single port incisionless conventional equipment-utilizing surgery (SPICES), Single access endoscopic surgery (SAES), laparo-endoscopic single-site surgery (LESS), natural orifice transumbilical surgery (NOTUS), and one port umbilical surgery (OPUS), is a recently developed technique in laparoscopic surgery.⁴ It is a minimally invasive surgical procedure in which the surgeon operates almost exclusively through a single entry point, typically the patient's navel. Unlike a traditional multi-port laparoscopic approach, SILS leaves only a single small scar.⁵ In gynaecologic practice, single incision laparoscopy has been used to perform a number of procedures including oophorectomy, salpingectomy, bilateral tubal ligation 1990s.⁶⁻⁸ This approach has recently seen more publicity and excitement as surgeons continue to develop techniques to evolve surgery to less invasive approaches. The first described SILS procedure was a gallbladder removal in 1997 by Navarra et al⁷ with two transumbilical trocars. Since that time, thousands of SILS procedures have been successfully performed in the United States, from general surgery to urologic, gynecologic and bariatric surgery applications. These advances in minimal access surgery offer benefits like less postoperative pain, less invasive and cosmetically the outcome is good and superior to other procedures.

Surgical technique and equipment

SETUP

The umbilicus is presently the most common site of access in single port incision laparoscopy. Therefore instruments must be held closer to the midline and more cephalad than during conventional multi-port laparoscopy to permit adequate visualisation of the abdominal organs and manipulation of the instruments. For these reasons the surgeon needs to assume a higher position over the thorax of the patient and both patients' arms must be tucked. Patient is placed in the dorsal lithotomy position with a uterine manipulator in place to facilitate surgery.

Irrespective of the procedures to be carried out, the basic principle is that multiple instruments or multiple trocars are placed in a single port of entry. SILS is accomplished

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through a single 20 mm incision in the umbilicus (trans/periumbilical) or in the pubic hair line medially the choice of which is influenced by the surgeon preference, type of surgery and age of the patient,⁵ minimizing the scarring and incisional pain associated with the multiple points of entry used during traditional laparoscopic surgery.⁵

Specialized equipment for SILS surgery falls into two broad categories; access ports and hand instruments. There are a number of different access ports including GelPOINT system from Applied Medical, the SILS device from Covidien, the TriPort+, TriPort15 and QuadPort+ from Advanced Surgical Concepts and the Uni-X from PnaveL.⁹ Hand instruments come in two configurations - standard or articulating. Standard hand instruments are rigid in design and were developed over the last 30 years for use in laparoscopy. Articulation is designed to overcome one of the challenges inherent in SILS, decreased triangulation of instrument. A number of factors influence a surgeon's decision to use standard or articulating hand instruments including which access port they use, their own surgical skills and cost as articulating instruments are significantly more expensive than standard instruments.⁹

ADDITIONAL INSTRUMENTS

There are variety of single port options available, each with unique design and method of insertion. In fact the development of port with multiple instrument channels has revolutionized Single Port Laparoscopic Surgery. They are placed using an open technique into a single skin incision. Trocars and instruments of varying size can be exchanged with ease without affecting the pneumoperitoneum already created.

The ability to visualise the operative field is vital to any procedure including SILS (Single Incision Laparoscopic Surgery). The use of the flexible laparoscope improves visualisation of the entire operative field. The flexible camera can be held laterally outside the abdomen and away from the midline to help reduce instrument overcrowding. If a flexible instrument is not available, a rigid 30° or 45° angled scope can be used, although with limited visualisation and adequate triangulation of instruments may be difficult to achieve.

SPECIAL DESIGN

The major disadvantage of SILS has been the limited movement from the close proximity of the instruments and instrument handles. The latest designs are specially made to make articulation possible for tissue graspers, vessel sealers, scissors and scopes. The value of articulation is apparent inside the abdomen where it allows perfect positioning of the area of the dissection. Outside the abdomen the handles may be arranged in an

angular fashion to allow for comfortability of the surgeon and the assistant. For example in a four handed procedure, one hand is on the camera, another hand on the uterine manipulator and the remaining two hands operate the grasper, sealer and other instruments. The latest instruments are designed to dissect, cauterize and cut so as to minimise the number of instrument exchanges.

SUTURING AID

Suturing during single port surgery can be very challenging. Closure of the vaginal cuff during laparoscopic or laparoscopic assisted vaginal hysterectomy is usually performed vaginally from below. Standard endoscopic suturing can be performed through either intracorporeal or extracorporeal methods during SILS. Suturing aids such as Endo stitch or Lapra-Ty are helpful.

SPECIMEN REMOVAL

There are various options of specimen removal during single port surgeries. Small specimens can be removed directly through a single port system that has been opened, or they can be extracted after the system is removed, with rapid desufflation. Compared with the conventional laparoscopy, the larger incision associated with the single port surgery facilitates the specimen removal. Larger and potentially malignant specimens can be placed into EndoCatch bag inserted through the single incision 10mm cannula. In total laparoscopic hysterectomy or laparoscopic assisted vaginal hysterectomy, the uterus is removed vaginally. In supracervical hysterectomy a small uterus can be removed through the cul-de-sac. Mocolation instrument can be inserted through the cul-de-sac, cervix or a single port.

SILS is enhanced by the use of specialized medical devices such as the SILS Multiple Instrument Access Port manufactured by Covidien and Laparo-Angle Articulating Instruments made by Cambridge Endoscopic Devices, Inc. The flexible port that can be fitted through a small incision in the navel to allow surgeons to use up to three laparoscopic devices simultaneously. Certain articulating instruments can be inserted through such specialized ports, providing surgeons with maneuverability and access to the target tissue from a single access point⁹.

Application

The SILS technique has been used to perform many types of surgery, including adjustable gastric banding, appendectomy, cholecystectomy,^{7, 8} colectomy, hernia repair hysterectomy, sleeve gastrectomy,¹⁰

nephrectomy,¹¹ and sacrocolpopexy. Others includes; adrenalectomy, splenectomy, omental resection, liver biopsy and procedures on small bowel.⁹ Although a number of single incision techniques use specialized instrumentation, most SILS operations in the United States and Europe have used standard instrumentation.

Risks and Benefits of SILS

When compared with traditional multi-port laparoscopic techniques, benefits of SILS techniques include less postoperative pain, less chance of infection, less chance of port site hernias, less blood loss, faster recovery time, and better cosmetic results.^{1-3,5,9} Studies have shown that smaller incisions, including smaller port size, decrease morbidity in both appendectomy and cholecystectomy patients. In comparing patients undergoing SILS versus conventional laparoscopic appendectomy, the SILS group had a shorter hospital stay (1.3 days vs. 3.2 days), reduced narcotic requirements, and faster return to work (8 days vs. 17 days) than controls.¹² In a similar study pertaining to cholecystectomy patients, the group with SILS reported less incisional pain in the first postoperative week.¹³ Based on the results of these studies it seems logical to conclude that eliminating multiple incision/ports will significantly reduce morbidity however, no prospective randomized study demonstrating superiority of SILS over conventional laparoscopy has been reported.

Despite the potential advantages of SILS techniques, there may also be complications. Potential complications include significant postoperative pain, injury to organs, bleeding, infection, incisional hernia, intestinal adhesions and scarring.⁹

The commonly encountered technical problems in SILS includes; clashing of instruments, lack of ideal operative ports, difficulty with retraction of organs or structures, interference and deflection of laparoscope's light source by operating instruments, interference of wires or tubing that connect perpendicularly to the instruments (i.e. cautery), change of surgeon's mindset, lack of time and patience to learn and loss of proprioception due to cross instrument.^{4,9,14} These are rarely encountered with traditional multi-port laparoscopic techniques.

However, the probable solutions to these problems include use of curved, reticulating, or flexible instruments, use of very low-profile trocars, staggering height and heads of trocars, use of noval multichannel ports, use of a laparoscope with a light source on the back of the camera, use of flexible-tip endoscope, maintenance of equivalent operative exposure, design of sigmoid-shaped instruments, implementation of magnetically anchored instruments deployed through a single incision, implementation of robotic platforms, sound surgical judgment, low threshold for the use of

additional ports at the initial incision site or prompt conversion to conventional or open surgery and above all continuous medical education.⁹

Conclusion

This review has demonstrated the theoretical benefit of SILS over traditional multiports approach. There is need for randomized prospective studies to compare SILS with standard laparoscopy. However despite its advantages the procedure has been found to be associated with complications and numerous technical problems. Therefore all measures at addressing these technical problems will enhance the safety of the procedure and make it more acceptable to the patients.

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