



# Single-port laparoscopic surgery for colorectal cancer: how can we move forward?

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The successful introduction of laparoscopic colorectal surgery results in remarkable improvement of short-term outcomes, such as less postoperative pain, early return of gastrointestinal function, hence shorter length of hospital stay (LOS) and less estimated blood loss. In recent years, improvements in surgical instrumentation has dramatically impacted the surgical approach to gastrointestinal surgery and single-port laparoscopic surgery (SPLS) has been developed as a new alternative to conventional laparoscopy surgery (CLS). The potential benefits of SPLS are to help decrease morbidity, optimize the cosmetic outcomes of CLS and minimize the surgical trauma, when compared to CLS. Each incision in CLS carries potential morbidity risks of bleeding, visceral organ damage, pain and formation of incisional hernia. Moreover the small incisions performed for trocar placement may result in multiple scar formation and compromised cosmetic outcome. SPLS performed through a vertical trans-umbilical incision can have a wound hidden within the umbilicus or a patient with a rectal cancer can be virtually scarless without any incision after operation by operating through a planned stoma site. On the other hand, SPLS is more difficult and requires high surgical skills to overcome the problems. Technical difficulties of single-access as the lack of triangulation and exposure, the in-axis view and conflicts between instruments are the most important challenges. The handling of both a grasper and an energy-based device in parallel with the laparoscope through the single port decreases the possibility of the surgeons manoeuvre and result in inadequate exposure and difficult dissection in the surgical field

The feasibility and safety of SPLS for colorectal cancer is demonstrated by many case series, comparative studies, and some randomized trials. Two randomized controlled trials, one measured postoperative pain as primary outcome proved that SPLS is associated with less pain and earlier discharge after operation and the other study showed that SPLS for rectal cancer may reduce postoperative pain and it may have a similar trauma-induced inflammatory response compared to CLS (1,2). In contrary to the common belief, most reports showed that the procedure time of SPLS is not significantly longer than CLS. Other short term operative outcomes of the two procedures are also similar. However, a few drawbacks hamper still the further implementation of the SPLS approach in colorectal surgery. Procedure times are sometimes longer, patient applicability may be limited, the current technology remains inadequate and difficulties with training result in a significant learning curve (LC). The SPLS approach inevitably is a one-operating-surgeon technique, which may impose a negative impact on surgical education and training (3).

Many studies reported similar operating time between SPLC and CLS. These studies may reflect that the SPLS approach is not difficult in hands of experienced laparoscopic surgeons. However, there is also little is known about how many conventional laparoscopic colectomies one has to do before attempting SPLS. The steepness of the LC for SPLS is another big concern if this procedure will be practiced widely and subsequently by trainees. Kim *et al.* reported in his single surgeon series that the operating time for SPLS reduced significantly after 48 cases and became

comparable to that required for CLS (4).

Recently, Kim *et al.* published multicenter observational study using multidimensional statistical methods about LC of SPLS for colon cancer concluded that the LC of SPLS for anterior resection and right colectomy performed by more than 200 CLS-experienced surgeons were 13–36 and 6–15 cases, respectively. For surgeons experienced in conventional laparoscopic colorectal surgery, the LCs of SPLS for colon cancer ranged from 6 to 36 cases, which is shorter than the LCs reported for conventional laparoscopic surgery. Data were collected from two studies; one from a retrospective pooled analysis and the other one from a multicenter controlled trial. The achievements of each participating surgeon were analysed using multidimensional statistic methods. The main factors to overcome technical difficulties during the SPLS procedures were different baseline characteristics of Asian patients, such as lower BMI and shorter abdominal circumference, or particularly greater experienced surgeons in CLS. Despite these advantages the LC could be longer for new surgeons (5). It is obvious that SPLS requires substantial skills in two-handed laparoscopy. To optimize clinical outcome specialized training in advanced laparoscopy, e.g., computer-based and clinical training is recommended before this technically demanding procedure is introduced in a general clinical setting. Robotic technology may also contribute to overcome the restrictions of limited space and instrument collision inherent to SPLS. There are some similarities between SPLS and transanal endoscopic microsurgery (TEM). Experience from TEM training courses may be useful for educating future colorectal surgeons in SPLR.

At the present, there is still need some important information about SPLS. When introducing any new technology and surgical technique, associated costs need to be considered. SPLS requires purchase of proprietary access devices and maybe additional equipment in some cases and it can be difficult to demonstrate any economic benefit compared with CLS. Only a few conversions, a shorter LOS and less morbidity, will make SPLS more cost-efficient. The patient satisfaction related with body image perception after SPLS has also not been evaluated. If better cosmetic result in some patient groups remains to an important drive for performing SPLS, its impact to patient satisfaction should be studied. It is important to stress that most of published reports of SPLS for colorectal cancer were done in selected patients by highly experienced laparoscopic surgeon. Even when SPLS is performed safely in the competent hands, it seems that its benefits are likely

to be modest. Continued acceptance of SPLS for colorectal cancer depends on benefits, improved patient outcomes, surgeon efficiency, and maybe decreased healthcare costs without compromising patient safety. It will only be widely recognized in surgical community, if they can be reproduced by more large prospective randomized trials. Eventually, patient preferences are more likely than physiological benefits to decide whether CLS or SPLS will become the method of choice for the minimally invasive treatment of colorectal cancer.

SPLS is a major step after CLS and represents the crossing link between robotic surgery and natural orifice surgery (NOTES). The huge developments in the fields of imaging, data processing, simulation and virtual reality in the future have the potential to help SPLS mature as computer-assisted single-access surgery through a single transabdominal incision or a natural orifice. It is believed that the future of minimally invasive surgery will be a hybrid form of SPLS, NOTES and robotic surgery.

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