



# Single-incision laparoscopic surgery (SILS) for colorectal cancer: a narrative review

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**Abstract:** Single-incision laparoscopic surgery (SILS) for colorectal cancer is a procedure that requires only a small incision in the umbilicus to complete, which has been performed worldwide since it was first reported in 2008. SILS is thought to have benefits with respect to cosmetics and pain, and has recently been reported to contribute to a lower risk of developing delirium. This technique has not spread sufficiently at present because of the complexity of the procedure and the lack of confirmation of oncological safety. However, the randomized controlled trials (RCTs) that have been conducted on SILS have concluded that SILS has no disadvantages over conventional laparoscopic surgery (CLS), and the other some retrospective studies revealed the long-term oncological safety of SILS in colorectal cancer patients. Surgeons' concerns about SILS will be alleviated if the procedure is further standardized to reduce the complexity of the surgery and if the long-term safety of SILS as a cancer surgery is confirmed by high-quality RCTs. In addition, the development of various surgical robots has been remarkable in recent years, and they continue to evolve day by day. SILS is likely to benefit from the evolution of surgical robotics, and with it, SILS is expected to gain renewed attention and become a more common surgical procedure.

**Keywords:** Single-incision laparoscopic surgery (SILS); colorectal cancer; SILS plus one

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## Introduction

Since laparoscopic colorectal resection was first reported in 1991, there have been many reports on its safety and oncological equivalence. The advantages of laparoscopic surgery over open surgery include reduced intraoperative blood loss, faster recovery of bowel motility, fewer wound-related complications, shorter postoperative hospital stay, reduced pain, and improved postoperative appearance. Single-incision laparoscopic surgery (SILS) may offer additional advantages with respect to postoperative appearance and reduction in postoperative pain and wound-related complications.

SILS for colorectal cancer was first proposed in 2008. SILS is completed through a single small incision in the umbilicus, approximately 3 cm, through which a multi-channel port is placed for passage of the laparoscope and surgical instruments. The umbilical incision can also be used for removal of the resected specimen. SILS is considered to have superior cosmetic outcomes compared to conventional techniques because it requires only the single incision at the umbilicus.

In 2008, Bucher *et al.* (1) and Remzi *et al.* (2) first reported colorectal SILS procedures at about the same time. Takemasa *et al.* (3) published the first report of SILS

in Japan in 2010. Afterward, the number of cases of SILS for colorectal cancer in Japan increased rapidly until 2011, but then increased slowly, and began a downward trend in 2015. At present, SILS is not widely accepted in Japan and its use is limited. The reasons for this are the complexity of the procedure and the lack of confirmation of oncological safety. It will be necessary to standardize the procedure and confirm its safety through randomized clinical trials in order to promote its use in the future.

We present the following article in accordance with the narrative review checklist (available at <http://dx.doi.org/10.21037/dmr-21-2>).

### **Current status of single incision laparoscopic surgery for colon cancer**

Previous studies comparing SILS and conventional methods are shown in *Table 1* (4-24). All papers in *Table 1* were published as original papers between 2011 and 2019. Although many of the studies are retrospective, none of the comparisons between the two groups show significant differences.

Four randomized controlled trials (RCTs) comparing SILS and conventional laparoscopic surgery (CLS) for colon cancer have been reported to date (10,12,19,23). The RCT by Watanabe *et al.* (19) includes 200 patients with colon cancer and is the largest of these studies so far. The others are smaller and include 32, 36, and 42 patients with colon cancer.

A number of variables were examined in each study, but in general, there were no differences in perioperative or short-term outcomes. There was no difference in the mean number of dissected lymph node between SILS and CLS, and there was no difference in operative mortality and complication rates. Also, the study by Maggiori *et al.* (23) showed an improvement in satisfaction with postoperative appearance in the SILS group in a questionnaire six months after surgery.

Regarding the long-term oncological outcomes of SILS, although retrospective, the study by Miyo *et al.* (21), which uses propensity score matching to compare the long-term prognostic value of SILS with that of the conventional method, showed not only the perioperative results of SILS, but also the non-inferiority of the long-term results. In order to promote this procedure as a safe oncological procedure in the future, we look forward to the long-term results of the aforementioned RCT by Watanabe *et al.* in 200 cases.

### **Current status of single incision laparoscopic surgery for rectal cancer**

Only one RCT comparing SILS and CLS for rectal cancer has been reported. This relatively small study by Bulut *et al.* (25) included 40 patients, 20 in the SILS group and 20 in the CLS group, and found that the patients in the SILS group had significantly shorter total incision length and significantly milder postoperative pain in the first four days after surgery. There were no other significant differences between SILS and CLS in terms of perioperative and short-term oncological outcomes, including operative time, blood loss, complications, and operative death. Several other comparative studies with retrospective data have been reported. Perioperative and short-term oncological outcomes in these studies were similar to those of the aforementioned RCTs.

There are very few reports of SILS for rectal cancer, except for recto-sigmoid cancer, because of the difficulty of separating the rectum vertically during rectal dissection using the umbilical approach. In Japan, there are many centers that implant surgical drains after radical surgery for rectal cancer. In our department, a drain is inserted during laparoscopic surgery for rectal cancer, and we perform rectal cancer surgery with SILS plus one port (SILS+1), which is SILS with an additional port placed from the start of surgery in the right lower abdomen, near the area where the drain is planned to be inserted. The extra port in SILS+1 also allows insertion of an automatic suture through the right lower abdominal port, and we believe it is a useful technique because it allows for easy dissection of the rectum in the same way as the conventional method. In about half of the comparative studies, SILS was performed with an additional port, SILS+1, as in our cases.

In the rectum, as the tumor site gets closer to the anus, the resection is more complicated and difficult to perform with SILS. Therefore, it seems reasonable to choose the SILS+1 technique, with the extra port at the planned site for a drain or a temporary ileostomy.

### **Advantages and disadvantages of single incision laparoscopic surgery in colorectal cancer**

An advantage of SILS is its superiority in terms of postoperative appearance. As noted, the RCT conducted by Maggiori *et al.* (23) showed that the satisfaction with wounds at six months postoperatively was significantly higher in the SILS group. In addition, because the port

**Table 1** Patient background and clinical outcomes

Year	First author	Number of patients		Age (y)		Mortality, n (%)		Morbidity, n (%)		Operative time (min)		Blood loss (mL)		Hospital stay (days)	
		SILC	CLC	SILC	CLC	SILC	CLC	SILC	CLC	SILC	CLC	SILC	CLC	SILC	CLC
2011	Kim SJ	73	106	65	63	0	1 (1.37)	23 (31.5)	39 (36.8)	274	254	282	418	9.6	15.5
2011	McNally ME	27	46	67	73	0	0	5 (18.5)	16 (34.8)	114	135	50	50	3	5
2011	Papaconstantinou HT	26	26	65	66	-	-	-	-	144	144	57	87	3.6	5
2012	Currò G	10	10	60	59	0	0	2 (20.0)	1 (10.0)	170	160	35	50	6	6
2012	Egi H	10	10	68.5	68	0	0	0	0	192	222	48	51.5	8	10.5
2012	Fujii S	23	23	63.9	65.2	0	0	3 (13.0)	5 (21.7)	174	179	9	109	8.2	12.7
2012	Huscher CG	16	16	70	70	0	0	3 (18.8)	5 (31.3)	147	129	200	-	6	7
2012	Lu CC	27	68	60.26	64.29	0	0	2 (7.4)	3 (4.4)	180	184	35	50	7	7
2012	Poon JT	25	25	67	67	0	0	4 (16.0)	3 (12.0)	155	124	50	80	4	5
2013	Kwag SJ	24	48	59.5	59	0	0	2 (8.3)	4 (8.3)	251	237	135	144	7.1	8.1
2013	Mynster T	18	36	70	73	0	0	3 (16.7)	6 (16.7)	167	189	0	38	3	3
2013	Pedraza R	50	50	64.6	66.3	-	-	7 (14.0)	4 (8.0)	127.9	126.7	64.4	87.2	4.5	4
2013	Yun JA	66	93	61	59	0	0	6 (9.1)	14 (15.1)	155	174	-	-	8	9
2014	Takemasa I	150	150	64.3	65.5	0	0	18 (12.0)	25 (16.7)	172	173	32	37	8.2	8.7
2014	Lim SW	44	263	63.9	63.8	0	1 (0.11)	7 (15.9)	46 (17.5)	185	139.2	82.3	70.1	8.2	8.8
2016	Watanabe J	100	100	66.7	66.6	0	0	12 (12.0)	15 (15.0)	156	162	21.4	8.8	6	6
2016	Suzuki O	35	35	68	69	0	0	4 (11.0)	5 (14.0)	167	162	26	23	7	9
2017	Miyo M	110	107	-	-	0	0	3 (1.5)	8 (4.0)	188	207	30	40	-	-
2017	Kim CW	40	80	66.4	65.8	0	0	2 (5.0)	0 (0)	195.9	218.3	75	50	6.1	8.5
2018	Maggioli L	62	63	48	51	0	0	6 (10.0)	2 (3.0)	132	138	29	45	6	6
2019	Song Z	32	32	59.5	60.5	0	0	2 (6.3)	5 (15.6)	175	145	65	100	10	10

SILS, single-incision laparoscopic colectomy; CLC, conventional laparoscopic colectomy.

is not inserted into anything other than a small incision at the umbilicus, SILS might reduce the risk of wound-related complications such as infection and incisional hernia. Furthermore, SILS has been reported to reduce postoperative delirium compared to conventional methods. Nishizawa *et al.* reported that the incidence of postoperative delirium was significantly lower in colon cancer surgery patients aged 75 years or older, at 13.8% in the SILS group compared with 30.0% in the conventional method. Although the reason for such a result is not clear, the report suggests that SILS may have reduced wound pain compared to the conventional method, thereby reducing postoperative delirium in elderly patients.

In addition, because of the nature of SILS, the operative field is maintained using only the forceps in the surgeon's left hand, and it is expected that familiarity with this technique will improve the movement of the surgeon's left hand. In trans-anal total mesorectal excision (TaTME), which is now rapidly gaining popularity, a SILS is performed with an additional multichannel device inserted into the anus. A scope and two forceps are inserted from the device for manipulation, and because the forceps manipulation is similar to SILS in many ways, we believe that SILS could also be a useful training for learning TaTME.

Disadvantages of SILS include the difficulty of assisting the assistant to the surgeon, the inability to use conventional techniques, such as maintaining a large visual field, and the need to learn dissection techniques specific to SILS. Another disadvantage is that it is difficult to insert additional ports when necessary to deal with bleeding, because the procedure is usually completed by two surgeons, the operating surgeon and the camera operator, which may make it difficult to insert additional ports in the event of bleeding.

### The future of single incision laparoscopic surgery in colorectal cancer

One of the factors hindering the widespread adoption of SILS is the complexity and difficulty of the procedure, and surgical robots could be a useful solution to this problem. In fact, Morelli *et al.* (26) reported the first single-incision robotic right colon resection in the world in 2013, and a small number of single-incision robotic surgeries have been reported since. However, as single-incision robotic colorectal resection has not been widely adopted, there may still be a high hurdle for performing SILS with current robotic systems.

Various surgical robots are currently being developed and commercialized in many countries, and it will not be long before a SILS assistant robot is developed that can maintain the field of view or operate the forceps. As robotic capabilities continue to improve in the future, many of the challenges of SILS may be resolved, and single-incision robotic colorectal resection could become a common procedure.

### Conclusions

Previous studies have shown that SILS is a safe technique for colorectal cancer in the short term and has a good postoperative appearance. In the future, it is likely to expand as difficulties are eliminated through further standardization of procedures and confirmation by high-quality RCTs of the long-term safety for colorectal cancers. In addition, the application of surgical robots to SILS is expected to bring about further breakthroughs by improving operability and surgical field deployment.

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### Footnote

*Reporting Checklist:* The authors have completed the narrative review checklist. Available at <http://dx.doi.org/10.21037/dmr-21-2>

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