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EDITORIAL

Single incision laparoscopic surgery for hepatocellular carcinoma

Ilhan Karabicak, Kadir Yildirim, Mahmut Fikret Gursel, Zafer Malazgirt

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Abstract

Single incision laparoscopic liver resection (SILLR) is the most recent development in the laparoscopic approach to the liver. SILLR for hepatocellular carcinoma (HCC) has developed much more slowly than multiport LLR. So far, 195 patients completed SILLR for HCC. In this paper, we reviewed all published papers about SILLR for HCC and discussed the feasibility of the SILLR, peri and postoperative findings, tricks of patient selection and whether SILLR compromise the oncological principles.

Key Words: Single incision; Laparoscopic liver surgery; Liver resection; Hepatocellular carcinoma; Multiport laparoscopic liver resection

Core Tip: Single incision laparoscopic liver resection (SILLR) is the most recent development in the laparoscopic approach to the liver. SILLR is accepted less invasive than multiport LLR (MPLLR). SILLR became favorable among surgeons and patients with reduced pain and superior cosmetic appearance for benign liver tumors and in metastatic liver tumors while not compromising patient safety and oncologic principles. SILLR did not become as popular as MPLLR since most of hepatocellular carcinoma patients have an underlying chronic liver disease. One of the concerns is if SILLR would reduce the surgical margin because of the limited exposure and difficulty of procedure itself. However, large case series showed that all the patients had R0 resection even wider surgical margin.

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INTRODUCTION

Laparoscopic liver resection (LLR) for the surgical treatment of hepatocellular carcinoma (HCC) became standard surgery with similar or better oncological outcome in experienced centers. Most patients with HCC have underlying chronic liver disease. Deterioration of the cirrhosis is a cause of morbidity and mortality after surgery[1-3]. In cirrhotic patients, a limited surgical trauma at the abdominal wall caused by LLR preserves the collateral circulation in the abdominal wall, reduces significant blood loss and development of intractable postoperative ascites[1,4-6].

Single incision LLR (SILLR) is the most recent development in the laparoscopic approach to the liver and feasible modality like any other single incision laparoscopic surgery (SILS)[7-9]. Although SILLR is more challenging than multiport LLR (MPLLR), it is accepted less invasive than MPLLR[10-14]. SILLR became favorable among surgeons and patients with reduced pain and superior cosmetic appearance for benign liver tumors and in metastatic liver tumors while not compromising patient safety and oncologic principles[14-19]. SILLR for HCC has developed much more slowly than MPLLR for HCC and benign liver tumors. High risk of hemorrhage is the main reason why SILLR did not become as popular as MPLLR since most of HCC patients have an underlying chronic liver disease[20-24]. In this paper, we reviewed all published papers about SILLR for HCC and discussed the feasibility of the SILLR, peri and postoperative findings, tricks of patient selection and whether SILLR compromise the oncological principles. Technical description is beyond the remit of this paper and already discussed in many previous papers[12,17-26].

HOW MANY PATIENTS WITH HCC UNDERWENT SILLR?

A total of 27 papers have been published which includes SILLR for HCC[16-41]. First case of SILLR for HCC is reported by Kobayashi *et al*[25] in 2010. Until 2017, 57 patients with HCC underwent SILLR but 6 converted to laparoscopic or open surgery[16-18,25-36,42]. After 2017, 144 patients with HCC underwent SILLR[19-24,37-41]. Saad *et al*[24] have already published their 21 cases before in a study published by Hyun *et al*[21]. I did not included the studies of Han *et al* [20] and Inoue *et al*[39] in this paper. Han *et al*[20] mentioned 116 patients out of 155 SPLLR had malignant disease but the number of HCC is not reported in the study. Inoue *et al*[39] reported 6 patients with either HCC or intrahepatic cholangiocellular carcinoma underwent SPLLR but the number of patients with HCC is not clear in the paper. As of March 2024, after eliminating the repeat cases, converted cases and unclear number of HCC patients in the studies of Han *et al*[20] and Inoue *et al*[39], 195 patients with HCC underwent and completed SILLR. The number of patients and type of the surgical procedures are shown in Table 1. Before 2017, almost of the studies are case reports or small sized retrospective studies else Shetty *et al*[18]. Shetty *et al*[18] reported the largest series of 23 patients with HCC underwent SILLR in 2012. After 2017, the number of the patients increased steadily and oncological comparement of SILLR and MPLLR have been published[22,23].

WHO IS CANDIDATE FOR SILLR?

The most important step of the success of this procedure is the patient selection. Patient selection effects the peri and postoperative results as well as short and long term oncological outcome[18,22,23]. Liver function, tumor size and location are the most important parameters to decide whether the patient can undergo SILLS. Patients with HCC usually have underlying liver disease such as cirrhosis[20,22,23,38]. Most of the patient underwent SILLR for HCC have Child score A but patients with Child score B[17,19,32] and C[17] is also reported by experienced surgeons. Patients with Child score B or C cirrhosis or deeply located lesions close to major vessels in a cirrhotic liver are prone to bleed more which is the most common cause of conversion and should not be preferred as initial cases[12,18,19,42].

Left lateral liver or anterior and inferior liver segments are ideal tumor location for SILLR[12,18,20,23,24,38]. Tumors in segments 1, 7 or 8 are close to major blood vessels and far to reach. These increasing the risk of bleeding and convertion rate[16,18,21]. I recommend peripherally located and solitary, subcapsular small tumors in segments II-VI to perform SILLS as initial cases especially in the cirrhotic liver. SILLR is recommended for solitary HCC < 5 cm for not to extent the incision while extracting the tumor which defeats the purpose of the SILS[16,27,32,38]. Multiple HCC is not a contraindication for SILLS for experienced surgeons[18,20,24]. A history of upper abdominal surgery makes the SILS procedure difficult especially in a cirrhotic liver but SILLR for HCC is reported in patients with previous upper abdominal surgery [21,23].

WHAT IS THE MOST COMMON REASON FOR CONVERTION?

Patients with cirrhosis may have umbilical varices and upper quadrant incision may become useful to prevent bleeding before starting resection[13]. Conversion to either MPLLR or open liver resection can be necessary during SILLR. Bleeding, poor tumor location, severity of the underlying liver disease, experience of the surgeon and technical problems are the main reasons for convertion. Techniques in details have been described and different energy devices have been used to reduce the bleeding during parenchymal transection[18,19,21,24]. I prefer to use two energy devices at the same time during parenchymal transection which reduces bleeding and shortens the operation time. Although the aim is 'scarless' surgery, scar is less important in this patient group[13]. Cosmetic results should not be the aim in cirrhotic

Table 1 The number of patients and type of resection for hepatocellular carcinoma are shown

Ref.	*n*	Procedure				
		NAR	SR	LLS	LH	RH
Wu *et al*[16], 2014	2	2	-	-	-	-
Aikawa *et al*[17], 2012	5	5	-	-	-	-
Shetty *et al*[18], 2012[1]	17 (23)	3	9	4	1	1
Karabicak *et al*[19], 2017	2	2	-	-	-	-
Hyun *et al*[21], 2021	21	21	-	-	-	-
Tsai *et al*[22], 2020	27	ND	8	14	ND	ND
Wang *et al*[23], 2020	33	-	-	33	-	-
Saad *et al*[24], 2020[2]	12 (33)	ND	ND	ND	ND	ND
Kobayashi *et al*[25], 2010	1	1	-	-	-	-
Gaujoux *et al*[26], 2011	1	1	-	-	-	-
Pan *et al*[27], 2012	4	2	-	2	-	-
Chang *et al*[29], 2011	3	-	1	2	-	-
Toyama *et al*[30], 2013	1	1	-	-	-	-
Kim *et al*[31], 2014	3	-	2	1	-	-
Tayar *et al*[32], 2014	2	2	-	-	-	-
Tzanis *et al*[33], 2014	1	1	-	-	-	-
Zhao *et al*[34], 2011	2	2	-	-	-	-
Tan *et al*[35], 2012	3	-	1	2	-	-
Aldrighetti *et al*[36], 2012	6	-	-	6	-	-
Struecker *et al*[37], 2018	4	-	-	4	-	-
Pan *et al*[38], 2019	36	31	2		3	-
Mittermair *et al*[40], 2021	8	ND	ND	ND	ND	ND
Dai *et al*[41], 2023	1	-	-	-	1	-

[1]Shetty converted 6 out of 23 patients to either laparoscopic or open surgery.
[2]Although Saad *et al*[24] reported 33 hepatocellular carcinoma patients, they reported their first 21 cases in the paper of Hyun *et al*[21].
NAR: Nonanatomic resection; SR: Segment resection; LLR: Left lateral sectionectomy; LH: Left hepatectomy; RH: Right hepatectomy; ND: No data available.

patients who are facing hepatectomy. Surgeons should not be reluctant to add an additional port or converting to conventional laparoscopic surgery and even open surgery for not to jeopardise patient safety or oncological principles[18,36].

WHAT SHOULD BE THE EXTENT OF RESETION DURING SILLS FOR HCC?

Up until 2016, the vast majority of the patients underwent single incision laparoscopic wedge resection and segmentectomies and a few left lateral sectionectomy (LLS) for HCC[3,13,14,29,42]. Shetty *et al*[18] reported the largest series of 23 patients (6 converted to either laparoscopic or open surgery) with HCC underwent SILLR in 2012. Two patient underwent major surgeries (one right hepatectomy and one left hepatectomy) among 17 completed SILLR. With the gained experience LLS became the ideal procedure for SILLR especially for benign tumors. After 2017, more patients underwent single incision laparoscopic LLS have been reported[20,22,23,38].

Wang *et al*[23] has one of the largest series of single incision laparoscopic LLS for HCC. They have compared 33 SPL LLS with 39 MPL LLS. 24 patients in the SPL study had cirrhosis. They showed that no significant difference between SPLLR and MPLLR was found in the operation time, blood loss or complication. All patients were discharged without any complications. Tsai *et al*[22] performed 27 SILLR in patients with HCC and compared their outcome with 110 patients underwent MPLLR. 14 out of 27 patients in the single incision group underwent LLS and 8 patients underwent segment 5-6 resection. The patients in SILLR group exhibited significantly shorter operative time, less blood loss and wider surgical margin and shorter postoperative length of stay. I recommend to new beginners to choose initial HCC patients

without cirrhosis and solitary, superficial tumors located at the anterolateral segments which is not adjacent to major vessels. Wedge resection or segmentectomy should be the initial type of surgery in the cirrhotic liver. After gaining enough experience LLS can be the next step but do not recommend major SILLR in cirrhotic patients.

PERIOEPERATIVE FINDINGS IN LARGE SERIES

Wang *et al*[23] showed that SILLR provided similar operation time and blood loss but a significantly shorter length of stay compared with MPLLR, especially for patients without cirrhosis. In cirrhotic patients, the operation time was longer and the amount of blood loss was more than those without cirrhosis. They demonstrate excellent outcome by discharging all patients without complications. Tsai *et al*[22] showed patients underwent SIL LLS group had shorter surgical time, postoperative hospital stays compared with MPLLR group. No significant differences were observed in surgical time, blood loss, complications and mortality in the segment 5-6 group.

IS SILLR FOR HCC ONCOLOGICALLY SAFE?

One of the concern is if SILLR would reduce the surgical margin because of the limited exposure and difficulty of procedure itself. However, large case series showed that all the patients had R0 resection and Tsai *et al*[22] showed SIL segment 5-6 resection group had even wider surgical margin[21-23]. SILLR does not compromise oncological principles in patients with HCC. It has similar oncological outcomes to MPLLR or open resections in strictly selected patients when performed by experienced laparoscopic liver surgeons[22,23]. Dai *et al*[41] reported the fluorescence navigation in combination with SILLR to well identify the liver tumour borders to aid surgery.

Two studies compared the oncologic outcome of SILLR with those of MILLR in patients with HCC. Tsai *et al*[22] published the first study to compare long-term oncological outcomes of SILLR and MPLLR. The study included 27 patients with HCC who had undergone SILLR and 110 patients with HCC who had undergone MPLLR between 2010 and 2017. Patients with HCC who received SILLR had similar 1-, 2-, and 5-year overall survival and 1-, 3-, and 5-year recurrence free survival rates compared with patients who had undergone MILLR.

Wang *et al*[23] reported short-term oncological outcome of patients with HCC who had undergone SILLR or MILLR between January 2016 and August 2018. One year recurrence free survival rate for SILLR and MPLLR was similar. Recurrence free survival without cirrhosis was 100% in the SILLR group and 92.3% in the MPLLR group (P = 0.54). For those with cirrhosis, the corresponding 1-year recurrence free survival was 72.1% and 57.7% (P = 0.85).

CONCLUSION

SILLR for HCC has to be performed after gaining enough experience in LLR and SILS for other organs. Although limited number of patients underwent SILLR, and minor resections were performed, it has similar peri and post operative outcomes as MPLLS. Only one study has been published regarding the long term oncological outcome of SILLR. More papers demonstrating the long term oncological outcome are needed.

FOOTNOTES

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