

A case series of liver resection using Senhance digital laparoscopy system

Saitama Medical University International Medical Center, Gastrointestinal Center

Masayasu Aikawa, Kenichiro Takase, Katsuya Okada, Yukihiro Watanabe, Kojun Okamoto, Yashumitsu Hirano, Hiroshi Sato, Shinichi Sakuramoto, Isamu Koyama

*I have no financial disclosure.

Senhance Digital Laparoscopy System ; SDLS

May 2019 : Approved for use by the Japanese Ministry of Health, Labor, and Welfare
July 2019 : **Japan Insurance coverage for 98 types of laparoscopic surgery**

- SDLS consists of the following three devices
  - Independent manipulator arm
  - Cock pit
  - Node



✓ Node Computer that controls digital signals from the manipulator arm and cockpit and video signals from the endoscopic camera system.

Senhance Digital Laparoscopy System ; SDLS

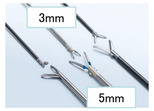
- The arms are independent and the endoscope and instrument can be attached to any arm.
- The cockpit is an open platform, not a peeping type.
- The surgeon can communicate in the same way as conventional laparoscopic surgery while directly looking at the assistant doctor, nurse and medical engineer around the bed.





Senhance Digital Laparoscopy System ; SDLS

- Devices and Equipment attached to the manipulator arm
  - Endoscope
  - Forceps
  - Clip applier
  - Ultrasonic scalpels





- Forceps:
  - Shaft diameter :3mm、5mm、10mm
  - Bipolar forceps :3mm、5mm
  - Monopolar forceps :3mm、5mm
  - Articulation forceps :10㎜

Aim

Senhance Digital Laparoscopy System(SDLS) has several novel characteristics, such as an eye-tracking camera control system and haptic feedback. Surgeons can perform in comfortable seated position without neck strain. These characteristics are different from the da Vinci® surgical system.

The purpose of this study is to compare the safety and efficacy between SDLS and conventional LLR .

Introduction of SDLS for liver surgery

Early introduction

Partial hepatectomy
Child Pugh A
Liver damage A
Visible tumor <3cm
except for S1 or S7

Expanded indications

Late introduction

Partial or lateral
Child Pugh A or B
Liver damage A or B
Surface Located <6cm
except for S1 or S7

Methods

Candidates

2020.12 ～2022. 8
SDLS 22

Partial resection 18 Lateral sectionectomy 4

Solitary

SDLS group 13
Partial resection(Solitary)

2020.1 ～ 2020.12
LLR 83

LLR group 28
Partial resection(Solitary)
Surface Located <6cm
except for S1 or S7

Perioperative outcome
Blood loss・OP duration
Complication・Hospital stay

Case Series of SDLS

Early phase

	Age	Sex	Diagnosis	BMI	Seg	size	Base	C-P	LD	Comorbidities	Preop Treatments	Surgical History	Procedure	OP Duration	Blood Loss	Hospital Stay
1	75	M	HCC	25.7	2	3.4	NASH+C	A	A	DM.MG	IFN	appe	Hr0	137	30	5
2	62	M	HCC	30.7	5	2.1	PostC	A	B	PBC psycho	IFN	(-)	Hr0	135	0	5
3	64	M	HCC	28.4	3	3.0	NASH	A	A	HT.DM	(-)	(-)	Hr0	203	0	6
4	78	M	HCC	22.5	6	1.4	NASH	A	A	HT	(-)	Lap ICR	Hr0	137	50	5
5	65	M	HCC	28.4	6	1.4	Alc	A	B	DM HT	Varix	(-)	Hr0	119	40	5
6	74	F	Hemangi	27.5	2	1.2	normal	A	A	DM DVT	(-)	Lap RHC	Hr0	114	0	4
7	74	M	HCC	22.4	6	2.0	Alc	A	B	HT. DM	TACE	LLR	Hr0	121	150	4
	74					2								135	30	5

CP: Child Pugh grade LD: Liver damage
ASA: American Society of Anesthesiologists Physical Status Classification
DM: Diabetes Mellitus HT: Hypertension MG: Myasthenia Gravis
LLR: Laparoscopic liver resection RHC: Right hemicolectomy ICR: Ileocecal resection

Case Series of SDLS

Late phase

	Age	Sex	Diagnosis	BMI	Seg	size	Base	C-P	LD	Comorbidities	Preop Treatments	Surgical History	Procedure	OP Duration	Blood Loss	Hospital Stay
8	58	M	HCC	20.4	3	1.5	Alc	A	B	(-)	TACE X2	(-)	Hr0	166	103	5
9	87	M	HCC	25.7	2	2.9	NASH	A	A	DM	TACEX6	(-)	Hr0	221	160	6
10	73	M	HCC	27.2	3	4.0	Alc	A	B	DM	Rupture TAE	(-)	Lat	211	150	6
11	46	F	Mets	21.1	3	5.0	D colon	A	A	(-)	CAOOX	Lap LHC	Lat	156	20	6
12	73	M	HCC	29.8	3	1.3	Alc C	B	B	(-)	(-)	LLR(Hr0 S8)	Hr0	116	50	5
13	80	F	HCC	30.6	8+6	2.2	PostC	A	A	HT	DAA	(-)	Hr0x2	274	100	8
14	72	M	HCC	25.4	5	3.5	NASH	B	B	HT	(-)	(-)	Hr0	133	0	5
15	76	M	HCC	29.8	3	1.8	NASH	A	B	(-)	RFA	LADG / LapC	Lat	167	0	4
16	64	M	HCC	22.4	3	2.0	Alc	B	B	DM	(-)	Appe	Lat	167	30	8
17	76	M	HCC	22.3	3	2.0	Alc	B	B	DM	(-)	(-)	Hr0	112	30	5
18	77	F	HCC	30.4	4	2.2	HCV	A	A	DM	TACE DAA	(-)	Hr0	110	0	5
19	75	M	HCC	22.4	3	2.2	Alc	B	B	HT	(-)	(-)	Hr0	97	0	5
20	44	F	Mets	18.2	5	1.0	Rectum	A	A	(-)	(-)	cesarean	Hr0+LAR	96	0	7
21	86	F	HCC	25.6	3	3.0	NASH	A	A	CKD(HD)	(-)	(-)	Hr1(3)	199	0	8
22	68	M	Mets	25.9	5	2.5	Rectum	A	A	(-)	(-)	Open LAR Stoma	Hr0	178	17	4
	75.5					2.2								155.5	8.5	5

Patient's characteristics

	SDLS n=18	LLR n=28	*P value*
Age	73.5 (58-78)	73.0 (51-87)	*0.7482*
Gender(M/F)	10 / 3	20 / 8	*n.s.*
BMI	26.6 (20.4-30.7)	24.6(19.8-33.5)	*0.1948*
Disease			*n.s.*
HCC	11	21	
Mets	1	5	
Miscellaneous	1	2	
Child Pugh	6 (5-8)	5 (5-8)	*0.1298*
Surgical History*	3	8	*n.s.*

* Upper abdominal surgery

Results

	SDLS n=18	LLR n=28	*P value*
OP Duration(min)	139(114-203)	106.5(68-242)	*0.0282*
Blood loss (ml)	35(0-160)	50(0-300)	*0.4746*
Complications*	0	2	*n.s.*
Respiratory	0	2	
SSI	0	1	
Hospital stay(days)	5(4-8)	6(3-18)	*0.0746*
Surgical margin	0	4	*n.s.*

*Clavien Dindo classification ＞G Ⅲ

Discussion

Hepatectomy with SDLS

Advantages

- A magnifying effect and a 3D view is very useful for surgery such as hepatectomy in which dissection is performed while grasping the depth in a narrow space.
- The forceps with haptic feedback can prevent excessive liver damage.
- Two surgeons can perform the laparoscopic liver surgery without stress
- The monitor is open and there is little fatigue even for a long time, so it seems to be suitable for long-term hepatectomy

Disadvantages

- Set up time
- More expensive than ordinary laparoscopic surgery

Conclusion

The 3D magnifying view and the haptic feedback system in SDLS make useful and safe for liver transection, which requires high visibility of tumor depth and confirmation of small vessels.

The presenter have no financial conflicts of interest to disclose concerning the presentation