

Surgical and Oncological Long term outcome of Laparoscopic liver resection for HCC(≤ 7 cm) compared to open liver resection.



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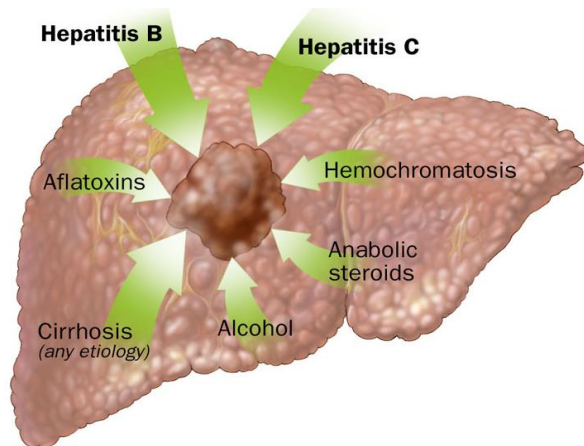
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Laparoscopic liver resection for Patients with Hepatocellular Carcinoma



Hepatocellular carcinoma

the leading cause of cancer-related death worldwide
develops with a background of cirrhosis

Potentially curative therapy for HCC

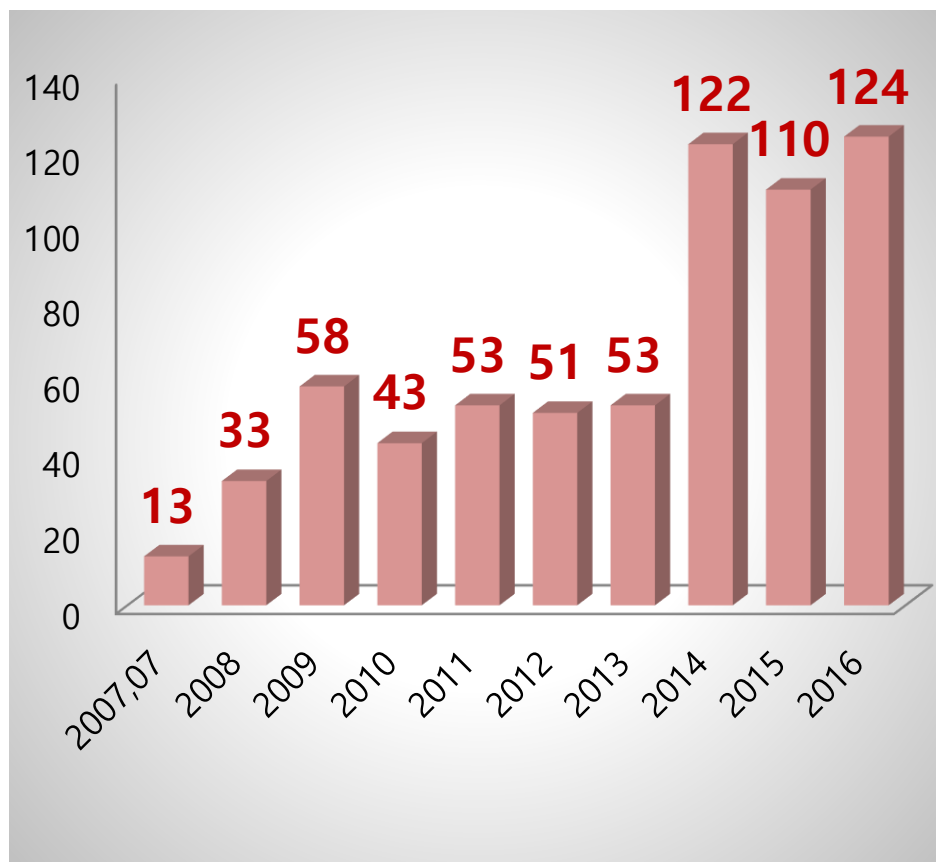
Liver resection, liver transplantation, and local ablation.
the standard treatment for resectable HCC.

The use of Laparoscopic techniques in the treatment of cancer

First Laparoscopic liver resection for HCC by Hashizume at 1995

Laparoscopic liver resection at AMC

658 Cases from Jul 4, 2007 to Dec 31, 2016



Types of liver resection	Number	658
Minor Hepatectomy	315	(47.9 %)
Left lateral sectionectomy	172	
Left medial sectionectomy	10	
Partial hepatectomy	107	
Caudate lobectomy	6	
Mono segmentectomy (III/V/VI)	1/9/10	
Major Hepatectomy	343	(52.1 %)
Left hepatectomy/Extended LH	162/4	
Left hepatectomy+S1	1	
Right hepatectomy/Extended RH	120/2	
Right anterior sectionectomy	11	
Right posterior sectionectomy	31	
Central bisectionectomy	11	

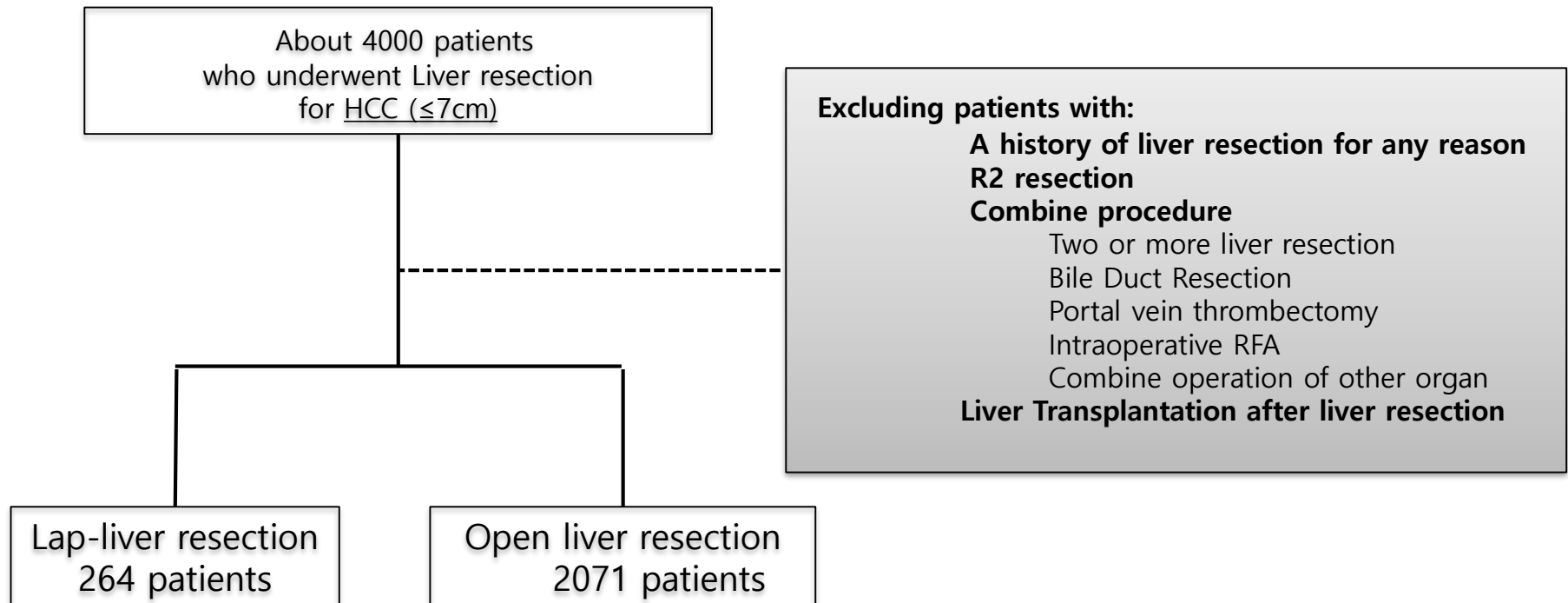
An increasing portion of pure Laparoscopic liver resection and anatomical sectionectomy

A single center retrospective study

- In patients with liver resection for HCC ($\leq 7\text{cm}$)
- ▶ To evaluate **the short -and long term outcomes** of laparoscopic hepatectomy versus open hepatectomy for HCC
- ▶ To investigate **clinical outcomes, oncological safety,** and any **potential advantages** of laparoscopic hepatectomy for HCC

Study design & Patients

- **Design:** A retrospective study
- **Period:** Between July 2007 and April 2016
- **Objec**



Study design & Patients

- **Design:** A retrospective study
- **Period:** Between July 2007 and April 2016
- **Objects**
 - ▶ 2335 patients who underwent Liver resection for HCC(≤ 7 cm) at AMC

Lap-liver resection 264 recipients	Open liver resection 2071 recipients
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- **Main outcome:** Operation details & Surgical outcomes
 - Recurrence-Free Survival rate
 - Overall Survival rate

Baseline characteristics

	Open group (n=2071)	Laparoscopic group (n=264)	p-value	
Age, year	58.73±9.52	55.95±9.71	<.0001	
Sex(M:F)	1672 : 399 (19.3%)	188 : 77 (29.2%)	0.000	
Liver disease			0.298	
HBsAg-positive	1686 (81.4%)	228 (86.4%)		
HCV-positive	94 (4.5%)	9 (3.4%)		
HBsAg/HCV-positive	5 (0.2%)	0 (0.0%)		
Hx of upper abdomen surgery	117 (5.7%)	9 (3.4%)	0.129	
Comorbid disease				
Cardiac disease	676 (32.6%)	82 (31.1%)	0.605	
Pulmonary disease	94 (4.5%)	9 (3.4%)	0.259	
Renal disease	2 (0.1%)	2 (0.8%)	0.065	
Diabetes mellitus	391 (18.9%)	38 (14.4%)	0.076	
Others	25(1.2%)	0(0)	0.104	
ASA score	I / II/ III	48/1961/61	3/253/8	0.464
Preoperative lab.				
Hemoglobin, g/Dl	13.89±1.51	13.9±1.53	0.851	
Total bilirubin, µmol/L	0.76±0.36	0.75±0.39	0.221	
Albumin, g/L	3.81±0.38	3.82±0.4	0.768	
Aspartate transaminase, IU/L	34.73±20.56	33.96±21.86	0.115	
Alanine transaminase, IU/L	35.26±28.2	34.23±30.51	0.080	
International normalized ratio	1.05±0.07	1.04±0.07	0.116	
Platelet count, x 10 ⁹ /L	156.3±57.63	153.85±55.54	0.357	
Creatine, µmol/L	0.86±0.5	0.83±0.21	0.440	
IGC retention rate at 15 min	14.01±7.88	13.34±6.56	0.117	

Baseline characteristics

		Open group (n=2071)	Laparoscopic group (n=264)	p-value
Hx of HCC treatment		410 (19.8%)	39 (14.8%)	0.051
Preop. PV embolization		106 (5.1%)	2 (0.76%)	0.001
Tumor marker	AFP level, ng/ml	485±2722.09	333±1061.45	0.042
	PIVKA	584.66±2722.09	255.91±1087.97	0.048
Tumor Location				<.0001
	Segment II	111 (5.4%)	62 (23.5%)	
	Segment III	106 (5.1%)	48 (18.2%)	
	Segment IV	235 (11.4%)	27 (10.2%)	
	Segment V	301 (14.5%)	36 (13.6%)	
	Segment VI	453 (21.8%)	53 (20.1%)	
	Segment VII	319 (15.4%)	16 (6.1%)	
	Segment VIII	547 (26.4%)	22 (8.3%)	

Surgical Characteristics & Surgical Outcomes

	Open group (n=2071)	Laparoscopic group (n=264)	p-value
Anatomical resection	1713 (82.7%)	198 (75.0%)	0.002
Type of resection			<.0001
Right hepatectomy	353 (17.0%)	44 (16.7%)	
Right anterior sectionectomy	381 (18.4%)	8 (3.0%)	
Right posterior sectionectomy	422 (20.4%)	17(6.4%)	
Central bisectionectomy	77 (3.7%)	6 (2.3%)	
Left medial sectionectomy	52 (2.5%)	2 (0.8%)	
Left hepatectomy	184 (8.9%)	40 (15.2%)	
Left lateral sectionectomy	125 (6.0%)	71 (26.9%)	
Anatomical mono segmentectomy	173 (8.4%)	10 (3.8%)	
Partial hepatectomy	358 (17.2%)	66 (25.0%)	

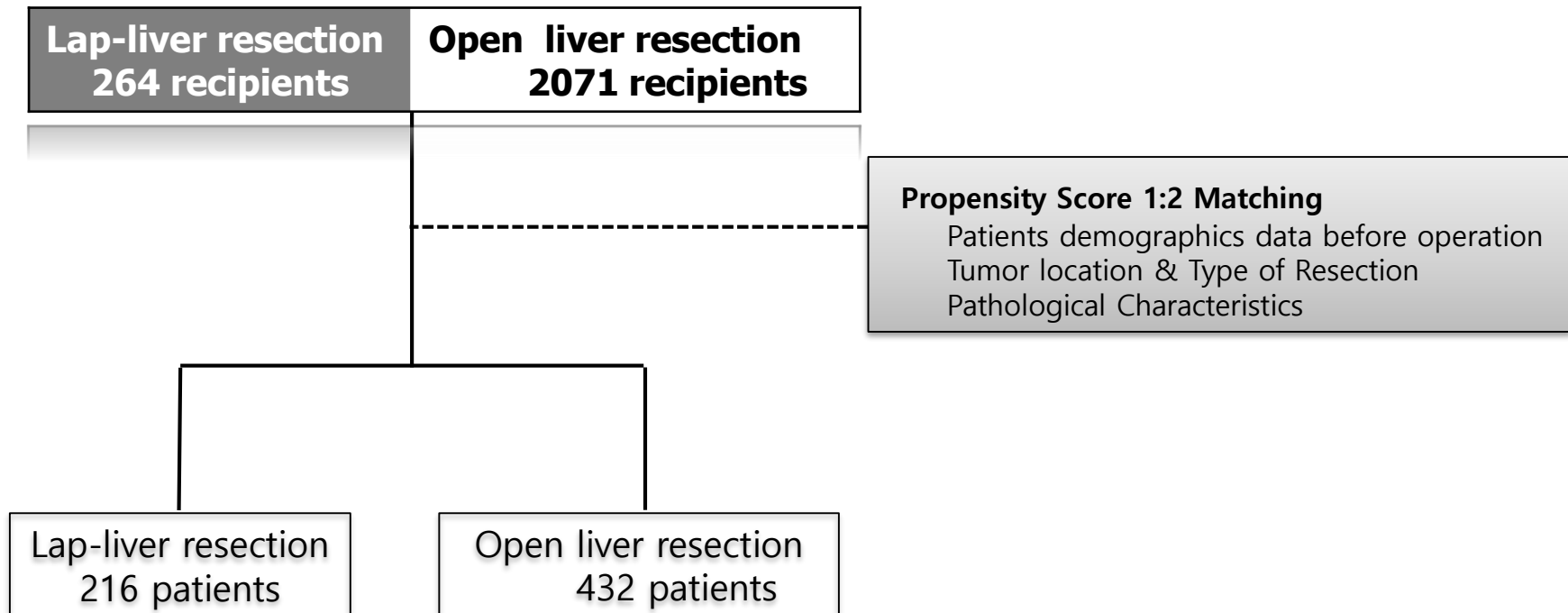
Pathological Characteristics

	Open group (n=2071)	Laparoscopic group (n=264)	p-value
Liver cirrhosis	1116 (53.9%)	180 (68.2%)	<.0001
Tumor size, cm	3.26 (0.2-7.0)	2.78 (0.5-7.0)	<.0001
Number of tumors, n	1.17±0.20	1.06±0.24	0.934
Lymphovascular invasion	208 (10.0%)	38 (14.4%)	0.030
Resection Margin status			0.807
	Not involved	2034 (98.2%)	259 (98.1%)
	Involved	37 (1.8%)	5 (1.9%)
Tumor-free margin(mm)	1.32±1.43	1.89±1.67	<.0001
Satellite nodule	114 (5.7%)	11 (4.2%)	0.085
Bile Duct invasion	13	2 (0.8%)	0.684
Portal vein invasion	43 (2.1%)	5 (1.9%)	0.843
Glisson capsule invasion	122 (5.9%)	23 (8.7%)	0.074
Edmonson-Steiner grade, n			0.030
	I	37 (1.8%)	0 (0%)
	II	536 (25.9%)	82 (31.1%)
	III	1001 (48.3%)	133 (50.4%)
	IV	372 (18.0%)	39 (14.8%)

Study design & Patients

- **Design:** A retrospective study
- **Period:** Between July 2007 and April 2016
- **Objects**

To reduce the impact of treatment- selection bias



Surgical Characteristics & Surgical Outcomes of PS matched patients

	Open group (n=432)	Laparoscopic group (n=216)	standardized diff.
Anatomical resection	315 (72.9%)	158 (73.2%)	0.005
Type of resection			0.140
Right hepatectomy	95 (22.0%)	41(19.0%)	
Right anterior sectionectomy	11 (2.6%)	8(3.7%)	
Right posterior sectionectomy	33 (7.6%)	17 (7.9%)	
Left hepatectomy	61 (14.1%)	35 (16.2%)	
Left medial sectionectomy	2 (0.5%)	2 (0.9%)	
Central bisectionectomy	16 (3.7%)	6 (2.8%)	
Left lateral sectionectomy	72 (16.7%)	39 (18.1%)	
Anatomical mono segmentectomy	25 (2.8%)	10 (4.6%)	
Wedge resection	117 (27.1%)	58 (26.9%)	

Surgical Characteristics & Surgical Outcomes of PS matched patients

		Open group (n=432)	Laparoscopic group (n=216)	p-value
Postoperative lab. (peak)	Aspartate transaminase, IU/L	202.1±175.86	226.04±233.98	0.697
	Alanine transaminase, IU/L	194.64±185.87	242.71±299.3	0.045
	Total bilirubin, µmol/L	1.82±1.73	1.66±0.89	0.212
Blood loss, mL		150.53±780.49	125.66±362.15	0.034
With blood transfusion		15 (3.5%)	4 (1.9%)	0.178
Total operation time, min		213.75±76.8	234.8±100.95	0.019
Pedicle clamping, n		283 (67.1%)	109 (50.4%)	<.0001
Maximum pain score		6.1±4.21	3.9±3.72	0.043
Hospital stay, day		15.1±25.57	8.79±2.52	<.0001

Surgical Characteristics & Surgical Outcomes of PS matched patients

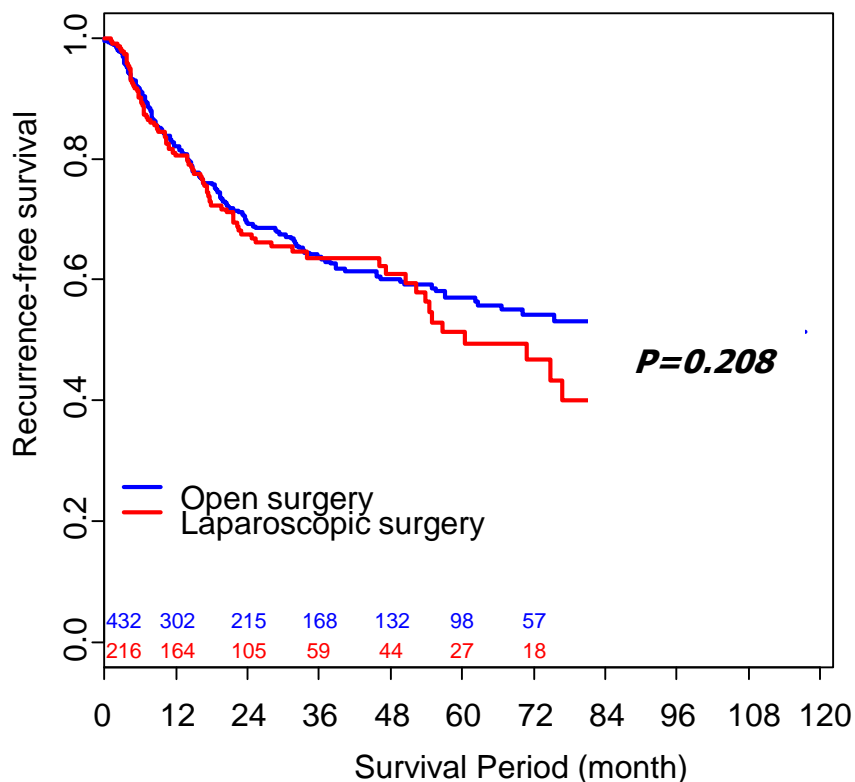
	Open group (n=432)	Laparoscopic group (n=216)	p-value
Complication	51 (11.8%)	12 (5.6%)	0.025
Ascites	10 (2.3%)	3 (1.4%)	
Pleural effusion	2 (0.5%)	1 (0.5%)	
Postoperative bleeding	1 (0.2%)	1 (0.5%)	
Bile leakage	4 (1.0%)		
Fluid collection	1 (0.2%)	1 (0.5%)	
Ileus	1 (0.2%)		
Wound seroma or infection	22 (5.1%)	5 (2.3%)	
Wound dehiscence	4 (0.9%)		
Incisional Hernia	2 (0.5%)	1 (0.5%)	
Portal Vein Thrombus	2 (0.5%)	1 (0.5%)	
Cholangitis	1 (0.2%)		
Derilium	2 (0.5%)		
Aspiration pneumonia	1 (0.2%)		
Hepatic Failure	1 (0.2%)		
Clavien-Dindo grade			0.027
III A	9	5	
III B	5	1	
IV A	1	0	
IV B	0	0	
V	1	0	
Comprehensive Complication Index	2.11±7.79	1.14±4.94	0.030

Kaplan-Meier Survival Curve

Disease-free survival rates

The 1-, 3-, and 5-year

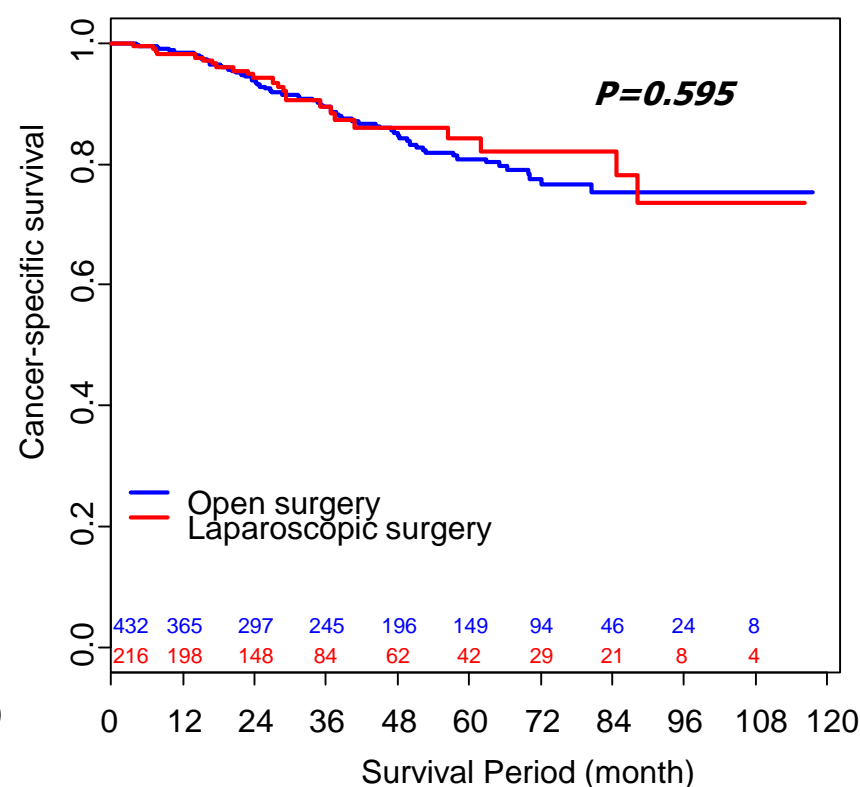
82.1%, 63.8%, and 57.0% for Open LR
vs. 80.6%, 63.6%, and 51.3% for Lap-LR



Cancer-specific survival rates

The 1-, 3-, and 5-year

98.5%, 89.4%, and 80.8% for Open LR
vs. 98.1%, 89.5%, and 84.2% for Lap-LR



with propensity score matching

Study limitation

Study limitation

- ✓ The patients were not assigned randomly.
 - > used the **PSM method** which was designed to balance the baseline covariates between groups.

Summary

- Although, Lap-liver resection needs longer operation time...
- Lap-liver resection was found to be significantly associated with lower blood loss, less pain, shorter hospital stay, and lower complication rates.
- No difference was found between the two groups regarding survival outcomes or tumor recurrence.

Conclusions

- Although the high vascularity of the liver parenchyma makes the operation technically very challenging..
- ▶ **This study provides:**
 - Lap-liver resection can be a feasible alternative to Open-liver resection for patients with HCC when performed by a surgeon experienced with the relevant surgical techniques.

Thank you

A decorative graphic consisting of two horizontal bars. The top bar is red and the bottom bar is gray. Both bars are slightly offset to the right, creating a layered effect.

Surgical Characteristics & Surgical Outcomes

	Open group (n=2071)	Laparoscopic group (n=264)	p-value
Complication	277 (13.4%)	13 (4.9%)	0.000
Clavien-Dindo grade			0.012
I	148 (7.2%)	5 (1.9%)	
II	18 (0.9%)	2 (0.8%)	
III A	85 (4.1%)	5 (1.9%)	
III B	18 (0.8%)	1 (0.4%)	
IV A	2 (0.1%)	0 (0.0%)	
IV B	0 (0.0%)	0 (0.0%)	
V	6 (0.3%)	0 (0.0%)	
Comprehensive Complication Index	2.5±8.47	0.98±4.66	<.0001

Selection Criteria for HCC patient

Selection criteria

: Size of lesions ≤ 5 cm $\rightarrow \leq 7$ cm

Contraindicaion

: close to the portal pedicle or hepatic veins

: ASA grade > 3

: decompensated cirrhosis (Child B or C)

: esophageal varices grade > 1

: platelet count $< 80,000$ /ml

Baseline characteristics of PS matched patients

	Open group (n=432)	Laparoscopic group (n=216)	standardized diff.	
Age, year	54.47±9.53	56.63±9.69	0.087	
Sex(M:F)	317 : 115	164 : 52	0.056	
Liver disease			0.068	
HBsAg-positive	360 (83.3%)	183 (84.7%)		
HCV-positive	22 (5.1%)	8 (3.7%)		
Hx of upper abdomen op	14 (3.2%)	8 (3.7%)	0.026	
Comorbid disease				
Cardiac disease	144 (33.3%)	70 (32.4%)	0.020	
Pulmonary disease	14 (3.2%)	8 (3.7%)	0.027	
Renal disease	0 (0.0%)	0 (0.0%)	0.000	
Diabetes mellitus	76 (17.6%)	34 (15.7%)	0.053	
Others	0 (0.0%)	0 (0.0%)	0.000	
ASA score	I / II/ III	6/416/10	3/206/7	0.056
Preoperative lab.				
Hemoglobin, g/Dl	13.84±1.54	13.97±1.41	0.084	
Total bilirubin, µmol/L	0.79±0.37	0.74±0.39	0.173	
Albumin, g/L	3.82±0.39	3.81±0.39	0.015	
Aspartate transaminase, IU/L	34.50±17.37	33.74±23.12	0.035	
Alanine transaminase, IU/L	33.81±20.61	34.22±31.24	0.013	
International normalized ratio	1.05±0.07	1.04±0.07	0.173	
Platelet count, x 10 ⁹ /L	154.78±70.47	151.29±51.51	0.063	
Creatine, µmol/L	0.84±0.26	0.84±0.17	0.010	
IGC retention rate at 15 min	13.75±7.01	13.76±6.64	0.003	

Baseline characteristics of PS matched patients

		Open group (n=432)	Laparoscopic group (n=216)	standardized diff.
Hx of HCC treatment		71 (16.4%)	36 (16.7%)	0.007
Preop. PV embolization		6 (1.4%)	2 (0.9%)	0.053
Tumor marker	AFP level, ng/ml	328.64±722.09	303.01±1011.45	0.034
	PIVKA	284.14±832.61	294.88±1201.51	0.010
Tumor Location				0.085
	Segment II	67 (15.5%)	35 (16.2%)	
	Segment III	57 (13.2%)	32 (14.8%)	
	Segment IV	48 (11.1%)	26 (12.0%)	
	Segment V	67 (15.5%)	35 (16.2%)	
	Segment VI	107 (24.8%)	50 (23.2%)	
	Segment VII	37 (8.6%)	16 (7.4%)	
	Segment VIII	49 (11.3%)	22 (10.2%)	

Pathological Characteristics of PS matched patients

		Open group (n=432)	Laparoscopic group (n=216)	standardized diff.
Liver cirrhosis		289 (66.9%)	143 (66.2%)	0.015
Tumor size, cm		2.93±1.38	2.85±1.29	0.057
Number of tumors, n		1.07±0.24	1.09±0.26	0.033
Lymphovascular invasion		56 (13.0%)	33(15.3%)	0.066
Resection Margin status				0.051
	Not involved	429 (99.3%)	213 (98.6%)	
	Involved	3 (1.0%)	3 (1.4%)	
Tumor-free margin(mm)		1.71±1.74	1.71±1.48	0.002
Satellite nodule		20 (4.6%)	11 (4.6%)	0.057
Bile Duct invasion		4 (0.9%)	2 (0.9%)	0.000
Portal vein invasion		13 (3.0%)	5 (2.3%)	0.051
Glisson capsule invasion		34 (7.9%)	18 (8.3%)	0.016
Edmonson-Steiner grade, n				0.069
	I	0 (0.0%)	0 (0.0%)	
	II	115 (26.6%)	58 (26.9%)	
	III	215 (49.8%)	113 (52.3%)	
	IV	79 (18.3%)	35 (16.2%)	