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Comparison of Open versus Laparoscopic Approaches in Salvage Hepatectomy for Recurrent Hepatocellular Carcinoma after Radiofrequency Ablation

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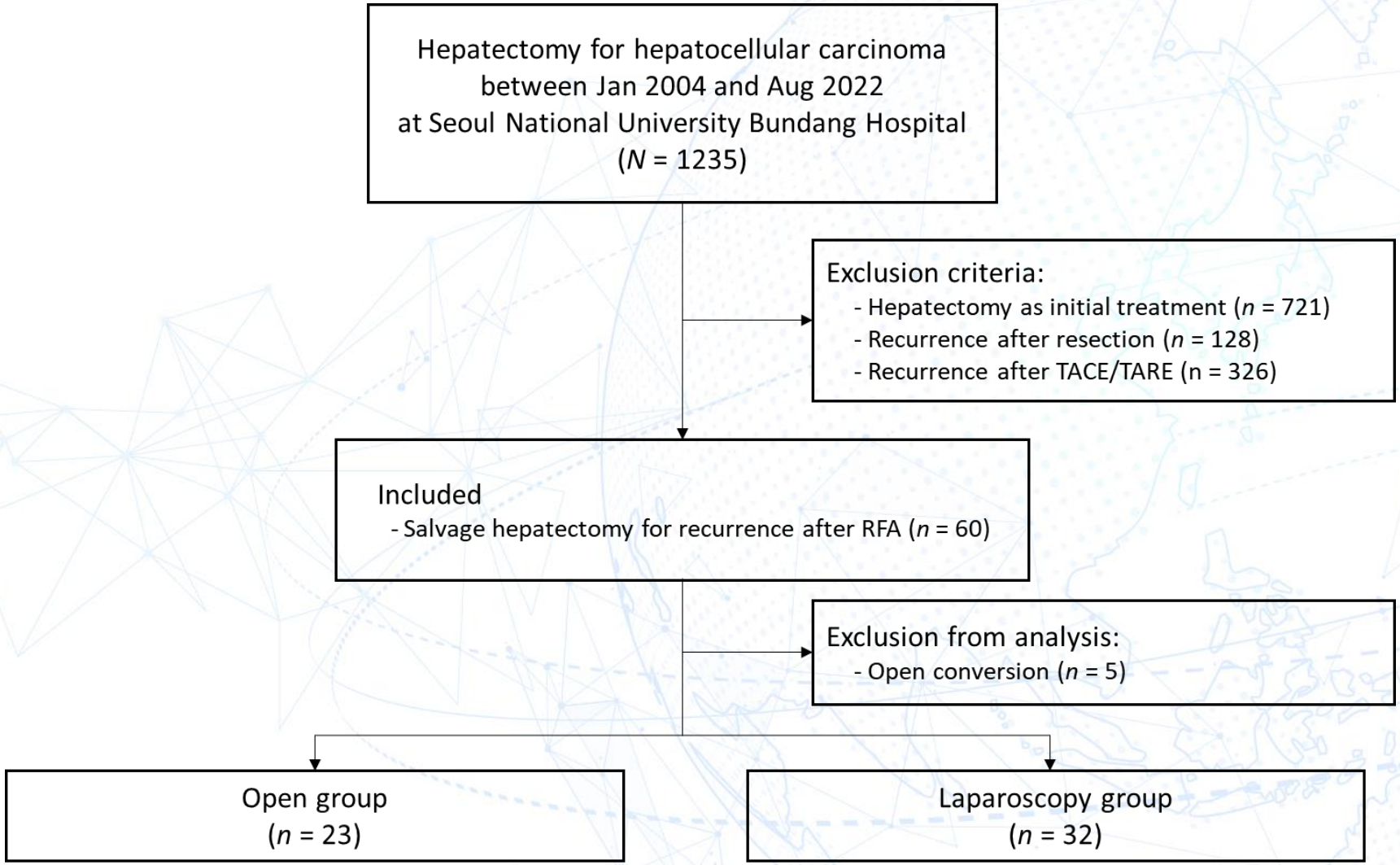
Background

- **Local recurrence after radiofrequency ablation (RFA) for hepatocellular carcinomas (HCC) is relatively common and recurrent tumors exhibit more aggressive behavior.**
  - When complete ablation of the tumor is not achieved, patients have an almost threefold higher risk of tumor progression.
  - This is possibly due to higher vascular invasion rates and dedifferentiation of the tumor by heat shock effect.
- **Treatment modalities for locally recurrent tumors significantly influence the overall survival rate.**
  - Most patients experiencing local recurrence are referred for repeated local ablation or transcatheter arterial chemoembolization.
  - The value of surgical resection is still unclear.
- **Previous studies have questioned the technical feasibility of salvage hepatectomy.**
  - In certain cases, RFA procedures might cause dense adhesions that render the approach for liver mobilization extremely difficult.
  - More extensive resections might be necessary due to advanced tumors.
- **The aim of this study was to compare open and laparoscopic approaches in salvage hepatectomy for recurrent HCC after RFA.**
  - Short-term postoperative outcomes and long-term survival outcomes were compared between the two groups.
  - Risk factors for disease-free and overall survival were evaluated.

Method


Hepatectomy for hepatocellular carcinoma
between Jan 2004 and Aug 2022
at Seoul National University Bundang Hospital
(N = 1235)
Exclusion criteria:
- Hepatectomy as initial treatment (n = 721)
- Recurrence after resection (n = 128)
- Recurrence after TACE/TARE (n = 326)
Included
- Salvage hepatectomy for recurrence after RFA (n = 60)
Exclusion from analysis:
- Open conversion (n = 5)
Open group
(n = 23)
Laparoscopy group
(n = 32)

Results

Baseline Clinicopathological Characteristics

	Open (n = 23)	Laparoscopy (n = 32)	Total (n = 55)	P-value
Age (years)	61 (53 - 69)	63 (54 - 68)	62 (54 - 68)	0.755
Sex (male:female)	21:2	28:4	49:6	0.999
BMI	24.0 ± 3.6	24.9 ± 2.6	24.6 ± 3.1	0.276
Hepatitis B	18 (78.3)	27 (84.4)	45 (81.8)	0.726
Hepatitis C	4 (17.4)	2 (6.3)	6 (10.9)	0.223
Alcoholic	3 (13.0)	5 (15.6)	8 (14.5)	> 0.999
Operation history	8 (34.8)	12 (37.5)	20 (36.4)	> 0.999
Child Pugh class				0.418
A	22 (95.7)	32 (100)	54 (98.2)	
B	1 (4.3)	0	1 (1.8)	
MELD score	7.2 (6.8 - 8.4)	7.2 (6.8 - 8.2)	7.2 (6.8 - 8.4)	0.746
Platelet count (10^4/ul)	180 (100 - 242)	158 (117 - 194)	161 (113 - 226)	0.379
Prothrombin time (INR)	1.03 (1.01 - 1.11)	1.05 (1.00 - 1.10)	1.04 (1.01 - 1.10)	0.850
Total bilirubin (mg/dl)	0.76 (0.50 - 1.11)	0.71 (0.62 - 1.10)	0.71 (0.60 - 1.10)	0.374
Serum albumin (g/dl)	4.3 (4.1 - 4.7)	4.3 (3.9 - 4.5)	4.3 (4.0 - 4.6)	0.276
AFP (ng/ml)	18.5 (2.8 - 137.5)	4.5 (3.2 - 51.0)	7.1 (3.0 - 59.3)	0.256
DCP (AU/ml)	27 (19 - 65)	24 (16 - 77)	25 (17 - 69)	0.836

Results

Operative Parameters

	Open (n = 23)	Laparoscopy (n = 32)	Total (n = 55)	P-value
Operative extent				***0.049***
Major resection	9 (39.1)	4 (12.5)	13 (23.6)	
Minor resection	14 (60.9)	28 (87.5)	42 (76.4)	
Anatomical resection	12 (52.2)	11 (34.4)	23 (41.8)	0.297
Deviation from initial plan				0.604
More extensive resection	10 (43.5)	10 (31.3)	20 (36.4)	
Less extensive resection	1 (4.3)	1 (3.1)	2 (3.6)	
Operation time (min)	230 (163 - 308)	153 (108 - 293)	220 (125 - 305)	0.144
Pringle time (min)	20 (15 - 30)	40 (23 - 60)	30 (15 - 45)	0.111
Estimated blood loss (cc)	450 (325 - 750)	300 (200 - 600)	350 (300 - 700)	***0.034***
RBC transfusion	3 (13.0)	3 (9.4)	6 (10.9)	> 0.999

Results

Pathological Features

	Open (n = 23)	Laparoscopy (n = 32)	Total (n = 55)	P-value
Tumor location				0.655
Anterolateral	16 (69.6)	24 (75.0)	40 (72.7)	
Posterosuperior	7 (30.4)	8 (25.0)	15 (27.3)	
Tumor number	1 (1 - 1)	1 (1 - 1)	1 (1 - 1)	0.592
Tumor size (cm)	3.0 (1.9 - 3.5)	2.0 (1.2 - 3.0)	2.6 (1.5 - 3.2)	***0.049***
Edmonson grade				0.555
1	0	1 (3.4)	1 (1.8)	
2	8 (40.0)	8 (27.6)	16 (29.1)	
3	8 (40.0)	16 (55.2)	24 (43.6)	
4	4 (20.0)	4 (13.8)	8 (14.5)	
Vascular invasion				
Macrovascular	5 (21.7)	2 (6.9)	7 (12.7)	0.251
Microvascular	11 (47.8)	10 (34.5)	21 (38.2)	0.491
Margin status				> 0.999
R0	20 (87.0)	26 (89.7)	46 (88.5)	
R1	3 (13.0)	3 (10.3)	6 (11.5)	
Liver cirrhosis	10 (43.5)	17 (53.1)	27 (49.1)	0.480

Results

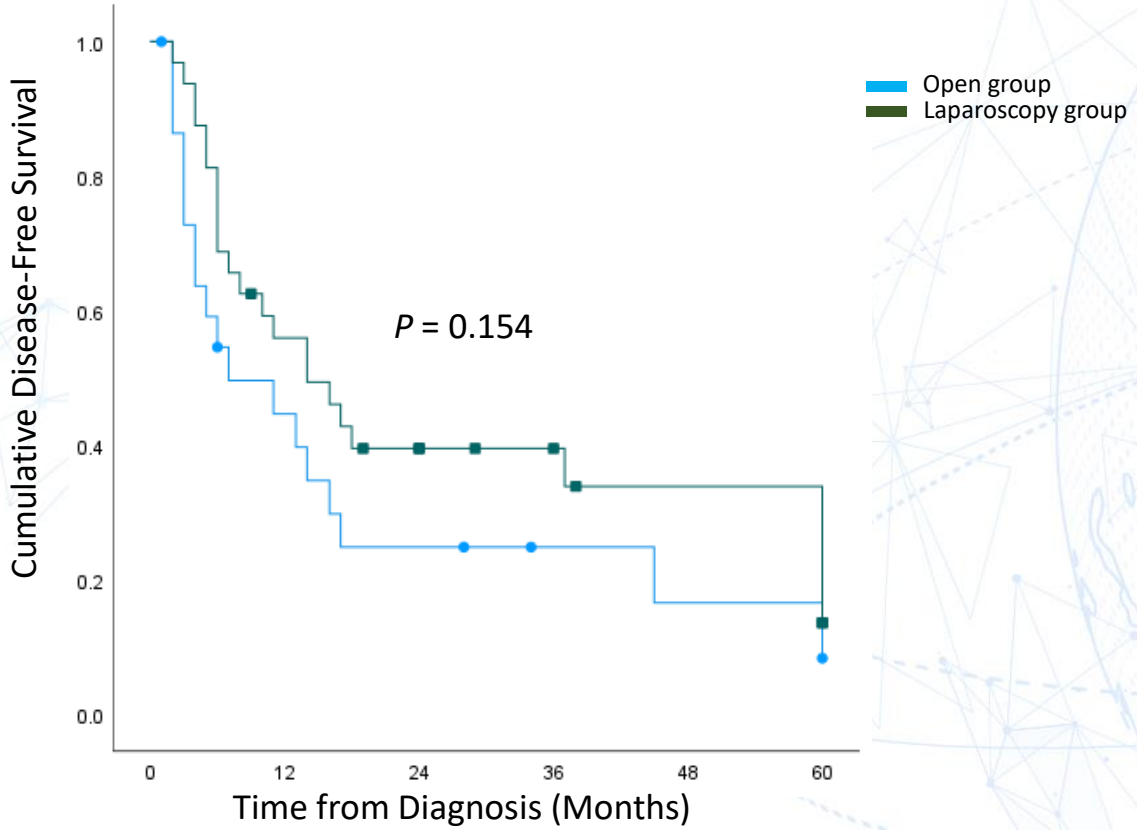
Postoperative Outcomes

	Open (n = 23)	Laparoscopy (n = 32)	Total (n = 55)	P-value
Complication	4 (17.4)	3 (9.4)	7 (13.2)	0.639
Angina	0	1 (3.1)	1 (1.7)	
Pleural effusion	2 (8.7)	0	3 (5.0)	
Pulmonary thromboembolism	1 (4.3)	0	1 (1.7)	
Bile leakage	2 (8.7)	2 (6.2)	5 (8.3)	
Post-hepatectomy liver failure	1 (4.3)	0	1 (1.7)	
Ileus	0	1 (3.1)	1 (1.7)	
Clavien-Dindo grade ≥ IIIa complication	3 (14.3)	1 (3.1)	4 (7.5)	0.289
Intensive care unit stay	1 (4.8)	3 (9.4)	4 (7.5)	0.999
In-hospital death	0	0	0	-
Postoperative hospital stay (day)	8 (6 - 11)	5 (4 - 7)	6 (5 - 9)	***0.028***
Follow-up (months)	28 (16 - 95)	36 (19 - 74)	33 (18 - 74)	0.999
Recurrence				
Local recurrence	11 (47.8)	21 (65.6)	32 (58.2)	0.187
Systemic recurrence	11 (47.8)	9 (28.1)	20 (36.4)	0.134
Cancer-related death	5 (21.7)	8 (25.0)	13 (23.6)	0.779
Complication	4 (17.4)	3 (9.4)	7 (13.2)	0.639

Results

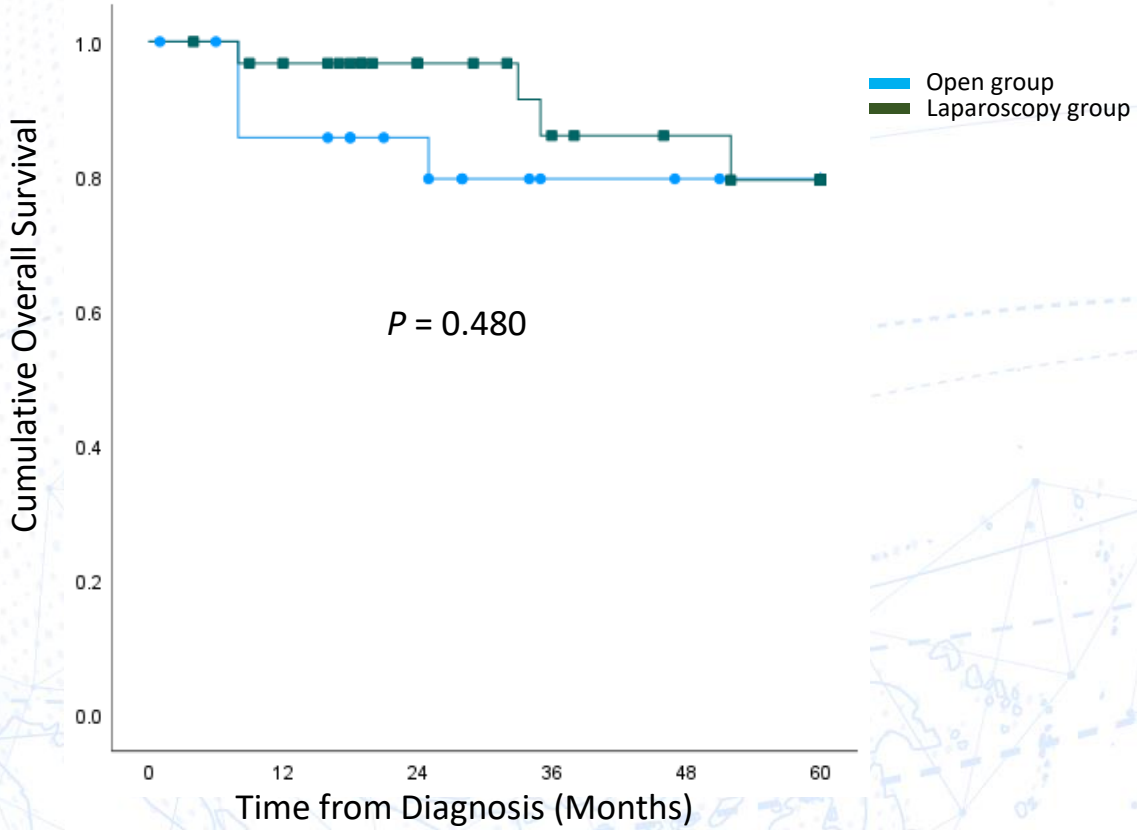
5-Year Disease-Free and Overall Survival Rates

(a) 5-Year Disease-Free Survival (DFS)



1YR DFS: 44.6% vs. 62.5%
3YR DFS: 16.5% vs. 13.5%
5YR DFS: 8.3% vs. 13.5%

(b) 5-Year Overall Survival (OS)



1YR OS: 85.7% vs. 96.8%
3YR OS: 79.6% vs. 86.0%
5YR OS: 79.6% vs. 79.4%

Results

Cox Regression Analysis for Risk Factors of Recurrence

Recurrence								
	Univariable		*Multivariable*			*Univariable*		*Multivariable*	
	HR (95% CI)	P-value	HR (95% CI)	P-value		HR (95% CI)	P-value	HR (95% CI)	P-value
Sex					**Tumor location**				
Male	Ref.				Anterolateral	Ref.			
Female	0.86 (0.30 - 2.42)	0.768			Posterosuperior	1.06 (0.53 - 2.16)	0.864		
Age (years)					**Tumor number**				
<60	Ref.				<3	Ref.		Ref.	
≥60	1.41 (0.71 - 2.80)	0.332			≥3	3.05 (1.31 - 7.08)	***0.009***	3.05 (1.31 - 7.08)	***0.009***
Child Pugh class					**Tumor size (cm)**				
A	Ref.				<3.0	Ref.			
B	4.44 (0.57 - 34.37)	0.154			≥3.0	0.85 (0.44 - 1.64)	0.620		
AFP (ng/ml)					**Tumor grade**				
<200	Ref.				Well/moderate	Ref.			
≥200	0.94 (0.33 - 2.67)	0.912			Poor	2.00 (0.92 - 4.34)	0.079		
Operative method					**Vascular invasion**				
Open	Ref.				No	Ref.			
Laparoscopic	0.62 (0.32 - 1.18)	0.145			Yes	1.38 (0.53 - 3.60)	0.508		
Operative extent					**Resection status**				
Minor resection	Ref.				R0	Ref.			
Major resection	0.84 (0.38 - 1.84)	0.660			R1	2.80 (0.84 - 9.36)	0.095		

Conclusions

- Laparoscopic salvage hepatectomy shows oncologic outcomes comparable to the open approach with less intraoperative blood loss and faster postoperative recovery rates.
- For large tumors requiring major hepatectomy, open surgery should be considered.
- In other cases, the laparoscopic approach could be used as a first-line option, especially in regards of the high local recurrence rates after surgery.