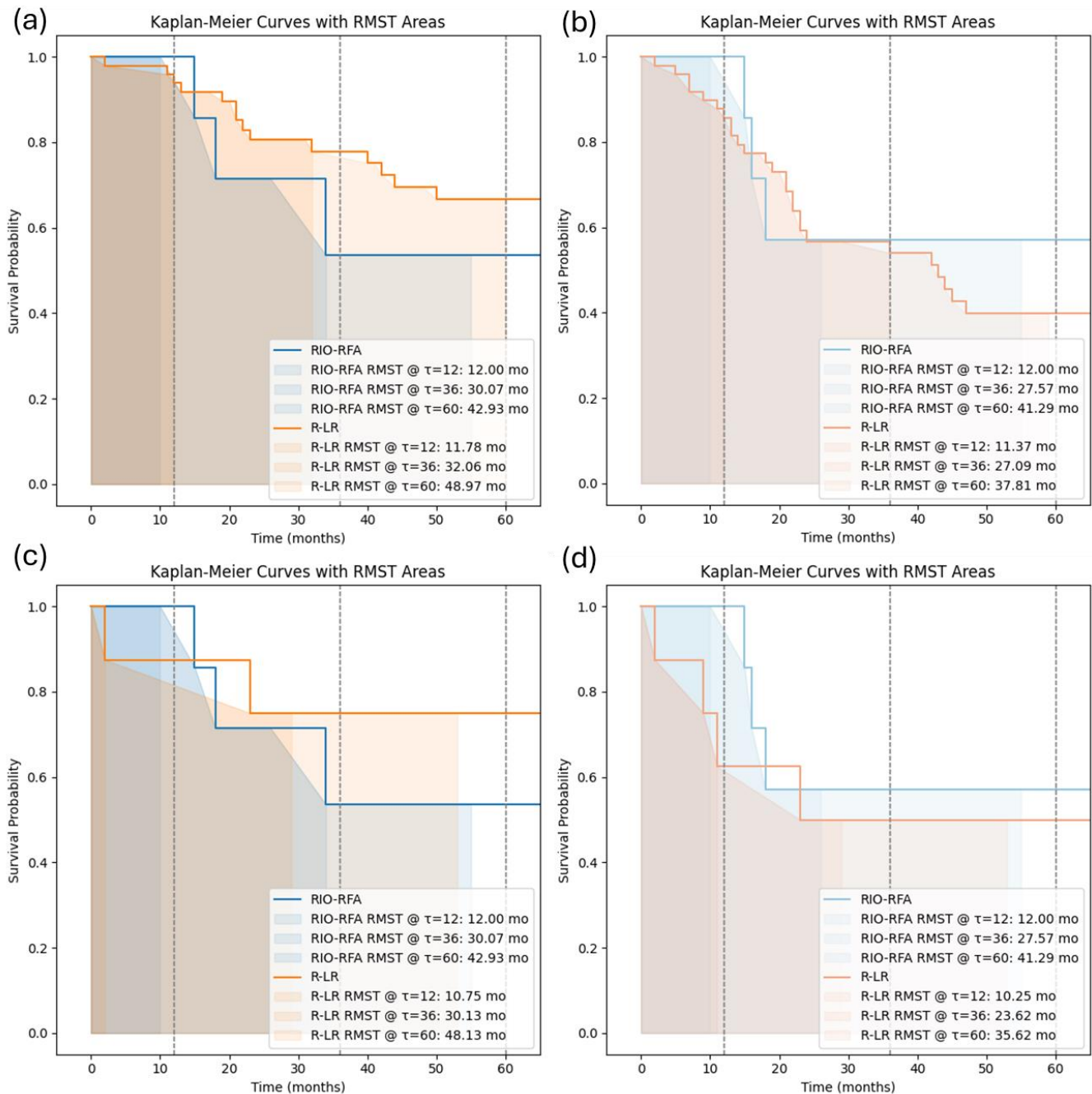




Supplementary Figure 1 Kaplan-Meier survival curves with restricted mean survival time at 1 year, 3 years, and 5 years for overall survival (blue and orange lines) and recurrence-free survival (light blue and light orange lines) in the *de novo* cohort, before and after propensity score matching. (A) Overall survival (OS) before Propensity score (PS) matching; (B) Recurrence-free survival before PS matching; (C) OS after PS matching; and (D) Recurrence-free survival after PS matching.

Supplementary Table S Overall survival, recurrence-free survival, restricted mean survival time, and survival/recurrence rates in the de novo hepatocellular carcinoma cohort treated with robotic liver resection versus robotic intraoperative radiofrequency ablation, before and after propensity score matching. Duration data were compared using the Mann–Whitney U test, time-to-event outcomes were analyzed with RMST at 1 year, 3 years, and 5 years, and survival/recurrence rates were compared using the χ^2 test

Variable		Before PS matching			<i>P</i> value	After PS matching			
		RIO-RFA (<i>n</i> = 8)	R-LR (<i>n</i> = 49)	Difference		RIO-RFA (<i>n</i> = 8)	R-LR (<i>n</i> = 8)	Difference	<i>P</i> value
OS	duration (months)	30.0 (17.2–46.8)	44.0 (22.0–69.0)	NA	0.1902	30.0 (17.2–46.8)	52.5 (27.5–78.0)	NA	0.2786
OS RMST (months)									
	1-year	12.0 (12.0–12.0)	11.8 (11.3–12.0)	-0.2 (-0.7–0.0)	0.2940	12.0 (12.0–12.0)	10.7 (7.7–12.0)	-1.3 (-4.3–0.0)	0.7000
	3-year	30.0 (22.4–36.0)	32.0 (29.4–34.3)	2.1 (-4.6–10.0)	0.6160	30.2 (23.2–36.0)	30.1 (20.0–36.0)	-0.1 (-11.0–10.2)	0.964
	5-year	42.9 (27.6–60.0)	48.9 (43.4–54.0)	6.0 (-10.8–21.7)	0.5060	42.9 (26.7–60.0)	48.1 (31.0–60.0)	5.2 (-17.4–26.7)	0.7260
Survival rate									
	1-year	8 (100.0%)	46 (93.9%)	NA	1	8 (100.0%)	7 (87.5%)	NA	1
	3-year	5 (62.5%)	39 (79.6%)	NA	0.5393	5 (62.5%)	6 (75.0%)	NA	1
	5-year	5 (62.5%)	35 (71.4%)	NA	0.9243	5 (62.5%)	6 (75.0%)	NA	1
RFS	duration (months)	22.0 (15.8–46.8)	23.0 (17.0–51.0)	NA	0.7303	22.0 (15.8–46.8)	26.0 (10.5–59.0)	NA	1
RFS	RMST (months)								
	1-year	12.0 (12.0–12.0)	11.4 (10.8–11.9)	-0.6 (-1.2--0.1)	0.0040	12.0 (12.0–12.0)	10.3 (7.2–12.0)	-1.7 (-4.8–0.0)	0.0700

3-year	27.6 (19.6–36.0)	27.1 (23.6–30.3)	-0.5 (-8.9–7.8)	0.8500	27.6 (20.0–36.0)	23.7 (14.0–32.9)	-3.9 (-16.5–8.6)	0.5080
5-year	41.3 (24.6–60.0)	37.8 (31.6–44.1)	-3.5 (-22.3–14.0)	0.6560	41.3 (23.1–60.0)	35.6 (17.9–53.0)	-5.7 (-30.0–19.9)	0.6400
Recurrence rate								
1-year	0 (0.0%)	7 (14.3%)	NA	0.5751	0 (0.0%)	3 (37.5%)	NA	0.2002
3-year	3 (37.5%)	21 (42.9%)	NA	1	3 (37.5%)	4 (50.0%)	NA	1
5-year	3 (37.5%)	26 (53.1%)	NA	0.6636	3 (37.5%)	4 (50.0%)	NA	1

OS: Overall survival; RFS: Recurrence-free survival; R-LR: Robotic liver resection; RIO- radiofrequency ablation: Robotic intraoperative RFA; PS: Propensity score; RMST: restricted mean survival time.

Supplementary Table 2 Cox regression analyses of prognostic factors associated with long-term OS within the resection R-LR group in the *de novo* cohort, before and after propensity score matching

Variable	Before PS matching		After PS matching	
	HR (95% CI)	P value	HR (95% CI)	P value
Age	1.04 (0.99-1.09)	0.168	10.16 (0.00-194224.28)	0.645
Male	3.98 (1.39-11.36)	0.01	2.04 (0.13-33.10)	0.616
Height	0.97 (0.91-1.04)	0.405	0.96 (0.80-1.14)	0.638
Weight	0.97 (0.93-1.01)	0.137	0.98 (0.87-1.10)	0.681
BMI	0.90 (0.78-1.04)	0.143	0.95 (0.64-1.41)	0.814
HBV	1.03 (0.35-3.02)	0.958	4879121.53 (0.00-inf)	0.995
HCV	0.72 (0.20-2.57)	0.616	0.00 (0.00-inf)	0.995
ICG-R15	0.73 (0.23-2.31)	0.596	0.00 (0.00-inf)	0.995
Platelet	1.00 (0.99-1.01)	0.501	1.00 (0.98-1.03)	0.937
Prothrombin time	1.04 (0.74-1.45)	0.842	2.02 (0.25-16.43)	0.512
AST	1.00 (1.00-1.00)	0.775	1.00 (1.00-1.00)	0.852
ALT	1.00 (1.00-1.00)	0.903	1.00 (1.00-1.00)	0.677
AFP ≥100 ng/ mL	1.73 (0.49-6.18)	0.396	0.00 (0.00-inf)	0.997
Bilirubine.T	0.42 (0.06-2.75)	0.364	0.37 (0.00-258.97)	0.767
Albumin	0.62 (0.21-1.86)	0.397	0.03 (0.00-8.15)	0.22
ALBI	1.38 (0.39-4.91)	0.616	42095974.60 (0.00-inf)	0.994
Child-Pugh	0.00 (0.00-inf)	0.996	-	-
T stage	2.24 (0.84-5.96)	0.106	1.49 (0.09-23.92)	0.778
Major tumor size	1.21 (0.98-1.50)	0.079	1.70 (0.31-9.47)	0.544
Aggregate tumor size	1.20 (0.97-1.48)	0.088	1.39 (0.23-8.33)	0.716
Tumor numbers	1.34 (0.43-4.22)	0.616	0.00 (0.00-inf)	0.997

Multi-tumors	0.75 (0.24-2.35)	0.616	3711624.65 (0.00-inf)	0.997
BCLC	2.35 (0.97-5.69)	0.058	4879121.53 (0.00-inf)	0.995
Op time	1.00 (0.99-1.01)	0.676	1.00 (0.98-1.02)	0.931
SAS	0.99 (0.36-2.74)	0.989	30384608.71 (0.00-inf)	0.996
blood loss	1.00 (1.00-1.00)	0.941	1.23 (0.01-117.08)	0.93
Blood transfusion	1.54 (0.55-4.37)	0.412	4.24 (0.25-70.72)	0.314
Complication	0.74 (0.17-3.30)	0.696	4.24 (0.25-70.72)	0.314
Hospital stay	0.96 (0.85-1.09)	0.544	1.02 (0.65-1.62)	0.917

OS: Overall survival; RFS: Recurrence-free survival; R-LR: Robotic liver resection; RIO-RFA: Robotic intraoperative RFA; HR: Hazard ratios; 95% CI: 95% confidence intervals; BMI: Body mass index; HBV: Hepatitis B virus; HCV: Hepatitis B virus; ICG-R15: Indocyanine green retention rate at 15 min; AST: Aspartate aminotransferase; ALT: Alanine aminotransferase; AFP: Alpha-fetoprotein; ALBI: Albumin-Bilirubin grade; BCLC: Barcelona Clinic Liver Cancer; SAS: Surgical Apgar Score.

Supplementary Table 3 Cox regression analyses of prognostic factors associated with long-term OS within the resection RIO-RFA group in the *de novo* cohort-before and after propensity score matching

Variable	Before PS matching		After PS matching	
	HR (95% CI)	P value	HR (95% CI)	P value
Age	0.98 (0.79-1.21)	0.83	0.98 (0.79-1.21)	0.83
Male	0.00 (0.00-inf)	0.996	0.00 (0.00-inf)	0.996
Height	1.40 (0.86-2.28)	0.173	1.40 (0.86-2.28)	0.173
Weight	1.01 (0.88-1.14)	0.939	1.01 (0.88-1.14)	0.939
BMI	0.89 (0.60-1.32)	0.552	0.89 (0.60-1.32)	0.552
HBV	0.36 (0.03-4.01)	0.403	0.36 (0.03-4.01)	0.403
HCV	0.36 (0.03-4.43)	0.426	0.36 (0.03-4.43)	0.426
ICG-R15	0.00 (0.00-inf)	0.995	0.00 (0.00-inf)	0.995
Platelet	1.00 (0.98-1.02)	0.934	1.00 (0.98-1.02)	0.934
Prothrombin	12.96 (0.40-421.59)	0.149	12.96 (0.40-421.59)	0.149
time				
AST	1.00 (1.00-1.00)	0.187	1.00 (1.00-1.00)	0.187
ALT	1.00 (1.00-1.00)	0.212	1.00 (1.00-1.00)	0.212
AFP ≥100 ng/ mL	0.00 (0.00-inf)	0.996	0.00 (0.00-inf)	0.996
Bilirubine.T	0.11 (0.00-139.29)	0.548	0.11 (0.00-139.29)	0.548
Albumin	0.20 (0.01-6.23)	0.362	0.20 (0.01-6.23)	0.362
ALBI	2.24 (0.14-35.90)	0.57	2.24 (0.14-35.90)	0.57
Child-Pugh	0.00 (0.00-inf)	0.995	0.00 (0.00-inf)	0.995
T stage	0.01 (0.00-inf)	0.995	0.01 (0.00-inf)	0.995
Major tumor size	1.81 (0.42-7.85)	0.428	1.81 (0.42-7.85)	0.428
Aggregate tumor	1.74 (0.34-8.87)	0.504	1.74 (0.34-8.87)	0.504
size				
Tumor numbers	0.00 (0.00-inf)	0.995	0.00 (0.00-inf)	0.995

Multi-tumors	14058195.54 (0.00-inf)	0.996	14058195.54 (0.00-inf)	0.996
BCLC	0.36 (0.04-3.23)	0.362	0.36 (0.04-3.23)	0.362
Op time	1.04 (0.98-1.10)	0.165	1.04 (0.98-1.10)	0.165
SAS	0.98 (0.09-11.15)	0.988	0.98 (0.09-11.15)	0.988
blood loss	0.83 (0.00-9.7E+25.00)	0.995	0.83 (0.00-9.7E+25.00)	0.995
Blood transfusion	90744557.53 (0.00-inf)	0.996	90744557.53 (0.00-inf)	0.996
Complication	5.48 (0.34-87.82)	0.23	5.48 (0.34-87.82)	0.23
Hospital stay	1.12 (0.94-1.34)	0.208	1.12 (0.94-1.34)	0.208

OS: Overall survival; RFS: Recurrence-free survival; R-LR: Robotic liver resection; RIO-RFA: Robotic intraoperative RFA; HR: Hazard ratios; 95% CI: 95% confidence intervals; BMI: Body mass index; HBV: Hepatitis B virus; HCV: Hepatitis B virus; ICG-R15: Indocyanine green retention rate at 15 min; AST: Aspartate aminotransferase; ALT: Alanine aminotransferase; AFP: Alpha-fetoprotein; ALBI: Albumin-Bilirubin grade; BCLC: Barcelona Clinic Liver Cancer; SAS: Surgical Apgar Score.

Table S4. Cox regression analyses of prognostic factors associated with long-term OS within the resection R-LR group in the first recurrence cohort-before and after propensity score matching

Variable	Before PS matching		After PS matching	
	HR (95% CI)	<i>P</i> value	HR (95% CI)	<i>P</i> value
Age	1.04 (0.99-1.09)	0.168	10.16 (0.00-194224.28)	0.645
Male	3.98 (1.39-11.36)	0.01	2.04 (0.13-33.10)	0.616
Height	0.97 (0.91-1.04)	0.405	0.96 (0.80-1.14)	0.638
Weight	0.97 (0.93-1.01)	0.137	0.98 (0.87-1.10)	0.681
BMI	0.90 (0.78-1.04)	0.143	0.95 (0.64-1.41)	0.814
HBV	1.03 (0.35-3.02)	0.958	4879121.53 (0.00-inf)	0.995
HCV	0.72 (0.20-2.57)	0.616	0.00 (0.00-inf)	0.995
ICG-R15	0.73 (0.23-2.31)	0.596	0.00 (0.00-inf)	0.995
Platelet	1.00 (0.99-1.01)	0.501	1.00 (0.98-1.03)	0.937
Prothrombin time	1.04 (0.74-1.45)	0.842	2.02 (0.25-16.43)	0.512
AST	1.00 (1.00-1.00)	0.775	1.00 (1.00-1.00)	0.852
ALT	1.00 (1.00-1.00)	0.903	1.00 (1.00-1.00)	0.677
AFP ≥100 ng/mL	1.73 (0.49-6.18)	0.396	0.00 (0.00-inf)	0.997
Bilirubine.T	0.42 (0.06-2.75)	0.364	0.37 (0.00-258.97)	0.767
Albumin	0.62 (0.21-1.86)	0.397	0.03 (0.00-8.15)	0.22
ALBI	1.38 (0.39-4.91)	0.616	42095974.60 (0.00-inf)	0.994
Child-Pugh	0.00 (0.00-inf)	0.996	-	-
T stage	2.24 (0.84-5.96)	0.106	1.49 (0.09-23.92)	0.778
Major tumor size	1.21 (0.98-1.50)	0.079	1.70 (0.31-9.47)	0.544
Aggregate tumor size	1.20 (0.97-1.48)	0.088	1.39 (0.23-8.33)	0.716
Tumor numbers	1.34 (0.43-4.22)	0.616	0.00 (0.00-inf)	0.997
Multi-tumors	0.75 (0.24-2.35)	0.616	3711624.65 (0.00-inf)	0.997

BCLC	2.35 (0.97-5.69)	0.058	4879121.53 (0.00-inf)	0.995
Op time	1.00 (0.99-1.01)	0.676	1.00 (0.98-1.02)	0.931
SAS	0.99 (0.36-2.74)	0.989	30384608.71 (0.00-inf)	0.996
blood loss	1.00 (1.00-1.00)	0.941	1.23 (0.01-117.08)	0.93
Blood transfusion	1.54 (0.55-4.37)	0.412	4.24 (0.25-70.72)	0.314
Complication	0.74 (0.17-3.30)	0.696	4.24 (0.25-70.72)	0.314
Hospital stay	0.96 (0.85-1.09)	0.544	1.02 (0.65-1.62)	0.917

OS: Overall survival; RFS: Recurrence-free survival; R-LR: Robotic liver resection; RIO-RFA: Robotic intraoperative RFA; HR: Hazard ratios; 95% CI: 95% confidence intervals; BMI: Body mass index; HBV: Hepatitis B virus; HCV: Hepatitis B virus; ICG-R15: Indocyanine green retention rate at 15 min; AST: Aspartate aminotransferase; ALT: Alanine aminotransferase; AFP: Alpha-fetoprotein; ALBI: Albumin-Bilirubin grade; BCLC: Barcelona Clinic Liver Cancer; SAS: Surgical Apgar Score.

Supplementary Table 5 Cox regression analyses of prognostic factors associated with long-term OS within the resection RIO-RFA group in the first recurrence cohort-before and after propensity score matching

Variable	Before PS matching		After PS matching	
	HR (95% CI)	<i>P</i> value	HR (95% CI)	<i>P</i> value
Age	0.98 (0.79-1.21)	0.83	0.98 (0.79-1.21)	0.83
Male	0.00 (0.00-inf)	0.996	0.00 (0.00-inf)	0.996
Height	1.40 (0.86-2.28)	0.173	1.40 (0.86-2.28)	0.173
Weight	1.01 (0.88-1.14)	0.939	1.01 (0.88-1.14)	0.939
BMI	0.89 (0.60-1.32)	0.552	0.89 (0.60-1.32)	0.552
HBV	0.36 (0.03-4.01)	0.403	0.36 (0.03-4.01)	0.403
HCV	0.36 (0.03-4.43)	0.426	0.36 (0.03-4.43)	0.426
ICG-R15	0.00 (0.00-inf)	0.995	0.00 (0.00-inf)	0.995
Platelet	1.00 (0.98-1.02)	0.934	1.00 (0.98-1.02)	0.934
Prothrombin	12.96 (0.40-421.59)	0.149	12.96 (0.40-421.59)	0.149
time				
AST	1.00 (1.00-1.00)	0.187	1.00 (1.00-1.00)	0.187
ALT	1.00 (1.00-1.00)	0.212	1.00 (1.00-1.00)	0.212
AFP ≥100 ng/ mL	0.00 (0.00-inf)	0.996	0.00 (0.00-inf)	0.996
Bilirubine.T	0.11 (0.00-139.29)	0.548	0.11 (0.00-139.29)	0.548
Albumin	0.20 (0.01-6.23)	0.362	0.20 (0.01-6.23)	0.362
ALBI	2.24 (0.14-35.90)	0.57	2.24 (0.14-35.90)	0.57
Child-Pugh	0.00 (0.00-inf)	0.995	0.00 (0.00-inf)	0.995
T stage	0.01 (0.00-inf)	0.995	0.01 (0.00-inf)	0.995
Major tumor size	1.81 (0.42-7.85)	0.428	1.81 (0.42-7.85)	0.428
Aggregate tumor	1.74 (0.34-8.87)	0.504	1.74 (0.34-8.87)	0.504
size				
Tumor numbers	0.00 (0.00-inf)	0.995	0.00 (0.00-inf)	0.995

Multi-tumors	14058195.54 (0.00-inf)	0.996	14058195.54 (0.00-inf)	0.996
BCLC	0.36 (0.04-3.23)	0.362	0.36 (0.04-3.23)	0.362
Op time	1.04 (0.98-1.10)	0.165	1.04 (0.98-1.10)	0.165
SAS	0.98 (0.09-11.15)	0.988	0.98 (0.09-11.15)	0.988
blood loss	0.83 (0.00-9.7E+25.00)	0.995	0.83 (0.00-9.7E+25.00)	0.995
Blood transfusion	90744557.53 (0.00-inf)	0.996	90744557.53 (0.00-inf)	0.996
Complication	5.48 (0.34-87.82)	0.23	5.48 (0.34-87.82)	0.23
Hospital stay	1.12 (0.94-1.34)	0.208	1.12 (0.94-1.34)	0.208

OS: Overall survival; RFS: Recurrence-free survival; R-LR: Robotic liver resection; RIO-RFA: Robotic intraoperative RFA; HR: Hazard ratios; 95% CI: 95% confidence intervals; BMI: Body mass index; HBV: Hepatitis B virus; HCV: Hepatitis B virus; ICG-R15: Indocyanine green retention rate at 15 min; AST: Aspartate aminotransferase; ALT: Alanine aminotransferase; AFP: Alpha-fetoprotein; ALBI: Albumin-Bilirubin grade; BCLC: Barcelona Clinic Liver Cancer; SAS: Surgical Apgar Score.

Supplementary Table 6 Cox regression analyses of prognostic factors associated with long-term RFS within the resection R-LR group in the *de novo* cohort-before and after propensity score matching

Variable	Before PS matching		After PS matching	
	HR (95% CI)	P value	HR (95% CI)	P value
Age	1.01 (0.98-1.05)	0.394	1.19 (1.00-1.41)	0.052
Male	1.48 (0.68-3.22)	0.323	0.62 (0.06-6.01)	0.681
Height	1.00 (0.96-1.05)	0.862	0.97 (0.86-1.08)	0.556
Weight	0.99 (0.96-1.02)	0.493	1.03 (0.96-1.11)	0.358
BMI	0.95 (0.86-1.04)	0.278	1.21 (0.96-1.52)	0.116
HBV	0.54 (0.25-1.16)	0.116	0.15 (0.01-1.66)	0.122
HCV	1.70 (0.74-3.92)	0.211	6.79 (0.60-76.65)	0.122
ICG-R15	0.50 (0.20-1.23)	0.131	0.00 (0.00-inf)	0.995
Platelet	0.99 (0.99-1.00)	0.015	1.00 (0.98-1.01)	0.581
Prothrombin time	1.74 (0.99-3.05)	0.055	2.81 (0.54-14.49)	0.218
AST	1.00 (1.00-1.00)	0.368	1.00 (1.00-1.00)	0.656
ALT	1.00 (1.00-1.00)	0.428	1.00 (1.00-1.00)	0.633
AFP ≥100 ng/ mL	0.95 (0.33-2.76)	0.924	0.00 (0.00-inf)	0.995
Bilirubine.T	4.05 (0.84-19.59)	0.082	13.77 (0.30-623.50)	0.178
Albumin	0.48 (0.20-1.14)	0.095	0.07 (0.00-4.03)	0.198
ALBI	1.71 (0.64-4.56)	0.281	42095974.61 (0.00-inf)	0.994
Child-Pugh	4.78 (0.60-37.71)	0.138		
T stage	1.32 (0.60-2.90)	0.495	1.61 (0.23-11.46)	0.637
Major tumor size	1.04 (0.87-1.23)	0.698	0.85 (0.30-2.45)	0.766
Aggregate tumor size	1.05 (0.89-1.24)	0.56	1.11 (0.36-3.40)	0.852
Tumor numbers	2.15 (0.93-4.92)	0.072	6.48 (0.40-103.82)	0.187

Multi-tumors	0.47 (0.20-1.07)	0.072	0.15 (0.01-2.47)	0.187
BCLC	1.27 (0.67-2.39)	0.469	1.10 (0.11-10.67)	0.938
Op time	1.00 (0.99-1.00)	0.29	0.99 (0.97-1.01)	0.452
SAS	1.93 (0.90-4.13)	0.093	61997109.80 (0.00-inf)	0.995
blood loss	1.00 (1.00-1.00)	0.546	1.01 (1.00-1.02)	0.159
Blood transfusion	1.02 (0.46-2.28)	0.961	1.43 (0.15-13.93)	0.759
Complication	0.49 (0.15-1.64)	0.248	1.43 (0.15-13.93)	0.759
Hospital stay	1.00 (0.91-1.09)	0.946	0.93 (0.65-1.35)	0.715

OS: Overall survival; RFS: Recurrence-free survival; R-LR: Robotic liver resection; RIO-RFA: Robotic intraoperative RFA; HR: Hazard ratios; 95% CI: 95% confidence intervals; BMI: Body mass index; HBV: Hepatitis B virus; HCV: Hepatitis B virus; ICG-R15: Indocyanine green retention rate at 15 min; AST: Aspartate aminotransferase; ALT: Alanine aminotransferase; AFP: Alpha-fetoprotein; ALBI: Albumin-Bilirubin grade; BCLC: Barcelona Clinic Liver Cancer; SAS: Surgical Apgar Score.

Supplementary Table 7 Cox regression analyses of prognostic factors associated with long-term RFS within the resection RIO-RFA group in the *de novo* cohort-before and after propensity score matching

Variable	Before PS matching		After PS matching	
	HR (95% CI)	P value	HR (95% CI)	P value
Age	1.00 (0.82-1.22)	0.966	1.00 (0.82-1.22)	0.966
Male	0.00 (0.00-inf)	0.996	0.00 (0.00-inf)	0.996
Height	1.30 (0.88-1.92)	0.192	1.30 (0.88-1.92)	0.192
Weight	1.01 (0.89-1.14)	0.881	1.01 (0.89-1.14)	0.881
BMI	0.90 (0.62-1.31)	0.596	0.90 (0.62-1.31)	0.596
HBV	0.22 (0.02-2.57)	0.227	0.22 (0.02-2.57)	0.227
HCV	0.63 (0.06-6.97)	0.704	0.63 (0.06-6.97)	0.704
ICG-R15	0.00 (0.00-inf)	0.995	0.00 (0.00-inf)	0.995
Platelet	1.00 (0.98-1.03)	0.875	1.00 (0.98-1.03)	0.875
Prothrombin time	11.85 (0.38-367.35)	0.158	11.85 (0.38-367.35)	0.158
AST	1.00 (1.00-1.00)	0.353	1.00 (1.00-1.00)	0.353
ALT	1.00 (1.00-1.00)	0.396	1.00 (1.00-1.00)	0.396
AFP ≥100 ng/ mL	0.00 (0.00-inf)	0.996	0.00 (0.00-inf)	0.996
Bilirubine.T	0.26 (0.00-177.47)	0.683	0.26 (0.00-177.47)	0.683
Albumin	0.55 (0.03-9.19)	0.676	0.55 (0.03-9.19)	0.676
ALBI	0.97 (0.09-10.84)	0.981	0.97 (0.09-10.84)	0.981
Child-Pugh	0.00 (0.00-inf)	0.995	0.00 (0.00-inf)	0.995
T stage	0.01 (0.00-inf)	0.995	0.01 (0.00-inf)	0.995
Major tumor size	1.48 (0.42-5.24)	0.542	1.48 (0.42-5.24)	0.542
Aggregate tumor size	1.32 (0.29-6.02)	0.724	1.32 (0.29-6.02)	0.724
Tumor numbers	0.00 (0.00-inf)	0.996	0.00 (0.00-inf)	0.996

Multi-tumors	16042823.63 (0.00-inf)	0.996	16042823.63 (0.00-inf)	0.996
BCLC	0.24 (0.03-2.25)	0.213	0.24 (0.03-2.25)	0.213
Op time	1.03 (0.98-1.08)	0.255	1.03 (0.98-1.08)	0.255
SAS	0.79 (0.07-8.78)	0.848	0.79 (0.07-8.78)	0.848
blood loss	0.83 (0.00-9.8E+26)	0.995	0.83 (0.00-9.8E+26)	0.995
Blood transfusion	7.47 (0.66-84.17)	0.104	7.47 (0.66-84.17)	0.104
Complication	2.46 (0.22-27.28)	0.465	2.46 (0.22-27.28)	0.465
Hospital stay	1.06 (0.91-1.24)	0.442	1.06 (0.91-1.24)	0.442

OS: Overall survival; RFS: Recurrence-free survival; R-LR: Robotic liver resection; RIO-RFA: Robotic intraoperative RFA; HR: Hazard ratios; 95% CI: 95% confidence intervals; BMI: Body mass index; HBV: Hepatitis B virus; HCV: Hepatitis B virus; ICG-R15: Indocyanine green retention rate at 15 min; AST: Aspartate aminotransferase; ALT: Alanine aminotransferase; AFP: Alpha-fetoprotein; ALBI: Albumin-Bilirubin grade; BCLC: Barcelona Clinic Liver Cancer; SAS: Surgical Apgar Score.

Supplementary Table 8 Cox regression analyses of prognostic factors associated with long-term RFS within the resection R-LR group in the first recurrence cohort-before and after propensity score matching

Variable	Before PS matching		After PS matching	
	HR (95% CI)	<i>P</i> value	HR (95% CI)	<i>P</i> value
Age	0.98 (0.93-1.03)	0.442	1.00 (0.94-1.07)	0.972
Male	7.56 (1.47-38.77)	0.015	8.47 (1.67-43.06)	0.01
Height	0.99 (0.87-1.12)	0.828	0.92 (0.81-1.05)	0.203
Weight	0.99 (0.93-1.06)	0.791	0.97 (0.91-1.04)	0.449
BMI	0.99 (0.79-1.23)	0.918	0.97 (0.78-1.21)	0.799
HBV	0.77 (0.19-3.08)	0.709	0.93 (0.22-3.92)	0.923
HCV	1.06 (0.26-4.33)	0.937	0.89 (0.21-3.89)	0.881
ICG-R15	0.99 (0.24-3.98)	0.986	2.51 (0.47-13.35)	0.282
Platelet	1.00 (0.99-1.01)	0.624	1.00 (0.99-1.01)	0.827
Prothrombin time	0.76 (0.57-1.01)	0.061	0.77 (0.58-1.03)	0.075
AST	1.00 (1.00-1.01)	0.465	1.00 (1.00-1.01)	0.841
ALT	1.00 (1.00-1.00)	0.999	1.00 (1.00-1.00)	0.827
AFP ≥100 ng/ mL	2.62 (0.68-10.10)	0.162	4.41 (1.06-18.26)	0.041
Bilirubine.T	0.59 (0.08-4.19)	0.595	0.08 (0.00-2.67)	0.157
Albumin	5.89 (1.03-33.71)	0.046	5.61 (0.90-34.77)	0.064
ALBI	0.42 (0.05-3.39)	0.417	0.00 (0.00-inf)	0.994
Child-Pugh	0.00 (0.00-inf)	0.995	0.00 (0.00-inf)	0.996
T stage	0.28 (0.06-1.41)	0.123	0.20 (0.02-1.69)	0.141
Major tumor size	0.94 (0.52-1.72)	0.852	0.93 (0.44-1.97)	0.855
Aggregate tumor size	0.73 (0.42-1.27)	0.265	0.75 (0.34-1.62)	0.463
Tumor numbers	0.48 (0.14-1.60)	0.232	0.67 (0.23-1.94)	0.455

Multi-tumors	3.55 (0.69-18.29)	0.13	2.01 (0.39-10.43)	0.404
BCLC	0.55 (0.19-1.54)	0.252	0.74 (0.24-2.25)	0.593
Op time	1.00 (0.99-1.01)	0.898	1.00 (0.98-1.02)	0.763
SAS	0.34 (0.07-1.65)	0.182	0.56 (0.11-2.81)	0.486
blood loss	1.00 (1.00-1.00)	0.836	1.00 (1.00-1.00)	0.924
Blood transfusion	1.14 (0.29-4.49)	0.852	1.26 (0.28-5.58)	0.764
Complication	2.53 (0.50-12.71)	0.26	2.33 (0.44-12.26)	0.317
Hospital stay	1.07 (0.90-1.28)	0.426	1.06 (0.88-1.27)	0.548

OS: Overall survival; RFS: Recurrence-free survival; R-LR: Robotic liver resection; RIO-RFA: Robotic intraoperative RFA; HR: Hazard ratios; 95% CI: 95% confidence intervals; BMI: Body mass index; HBV: Hepatitis B virus; HCV: Hepatitis B virus; ICG-R15: Indocyanine green retention rate at 15 min; AST: Aspartate aminotransferase; ALT: Alanine aminotransferase; AFP: Alpha-fetoprotein; ALBI: Albumin-Bilirubin grade; BCLC: Barcelona Clinic Liver Cancer; SAS: Surgical Apgar Score.

Table S9. Cox regression analyses of prognostic factors associated with long-term OS within the resection RIO-RFA group in the first recurrence cohort-before and after propensity score matching.

Variable	Before PS matching		After PS matching	
	HR (95% CI)	p-value	HR (95% CI)	p-value
Age	1.01 (0.94-1.08)	0.786	1.01 (0.94-1.08)	0.786
Male	1.48 (0.31-6.98)	0.622	1.48 (0.31-6.98)	0.622
Height	1.00 (0.92-1.10)	0.947	1.00 (0.92-1.10)	0.947
Weight	1.03 (0.97-1.08)	0.375	1.03 (0.97-1.08)	0.375
BMI	1.11 (0.90-1.38)	0.332	1.11 (0.90-1.38)	0.332
HBV	0.86 (0.26-2.81)	0.798	0.86 (0.26-2.81)	0.798
HCV	0.78 (0.20-3.02)	0.714	0.78 (0.20-3.02)	0.714
ICG-R15	1.61 (0.46-5.60)	0.451	1.61 (0.46-5.60)	0.451
Platelet	0.99 (0.97-1.00)	0.1	0.99 (0.97-1.00)	0.1
Prothrombin time	1.74 (1.07-2.85)	0.027	1.74 (1.07-2.85)	0.027
AST	1.00 (1.00-1.00)	0.612	1.00 (1.00-1.00)	0.612
ALT	1.00 (1.00-1.00)	0.323	1.00 (1.00-1.00)	0.323
AFP ≥100 ng/mL	2.14 (0.51-9.06)	0.301	2.14 (0.51-9.06)	0.301
Bilirubine.T	2.23 (0.60-8.26)	0.229	2.23 (0.60-8.26)	0.229
Albumin	0.28 (0.09-0.89)	0.032	0.28 (0.09-0.89)	0.032
ALBI	3.52 (0.97-12.79)	0.056	3.52 (0.97-12.79)	0.056
Child-Pugh	2.00 (0.52-7.69)	0.311	2.00 (0.52-7.69)	0.311
T stage	2.89 (0.63-13.32)	0.172	2.89 (0.63-13.32)	0.172
Major tumor size	1.11 (0.62-2.01)	0.717	1.11 (0.62-2.01)	0.717
Aggregate tumor size	1.06 (0.86-1.30)	0.584	1.06 (0.86-1.30)	0.584
Tumor numbers	1.24 (0.79-1.93)	0.349	1.24 (0.79-1.93)	0.349

Multi-tumors	0.42 (0.11-1.60)	0.207	0.42 (0.11-1.60)	0.207
BCLC	2.21 (0.51-9.60)	0.288	2.21 (0.51-9.60)	0.288
Op time	0.98 (0.97-1.00)	0.06	0.98 (0.97-1.00)	0.06
SAS	1.53 (0.46-5.10)	0.489	1.53 (0.46-5.10)	0.489
blood loss	1.00 (0.99-1.01)	0.585	1.00 (0.99-1.01)	0.585
Blood transfusion	2.75 (0.78-9.69)	0.115	2.75 (0.78-9.69)	0.115
Complication	3.18 (0.96-10.56)	0.059	3.18 (0.96-10.56)	0.059
Hospital stay	1.20 (0.96-1.51)	0.111	1.20 (0.96-1.51)	0.111

OS: overall survival; RFS: recurrence-free survival; R-LR: robotic liver resection; RIO-RFA: robotic intraoperative RFA; HR: Hazard ratios; 95% CI: 95% confidence intervals; BMI: body mass index; HBV: Hepatitis B virus; HCV: Hepatitis B virus; ICG-R15: indocyanine green retention rate at 15 min; AST: aspartate aminotransferase; ALT: alanine aminotransferase; AFP: alpha-fetoprotein; ALBI: Albumin-Bilirubin grade; BCLC: Barcelona Clinic Liver Cancer; SAS: Surgical Apgar Score.