

Supplementary Table 1 Univariate and multivariate Cox regression analyses of risk factors associated with recurrence-free survival

Variable	Univariate Analysis		Multivariate Analysis	
	HR (95%CI)	<i>P</i>	HR (95%CI)	<i>P</i>
Group				
non-PCT	reference		reference	
PCT	0.889 (0.474, 1.666)	0.712	0.545 (0.271, 1.096)	0.089
Sex				
Female	reference			
Male	0.921 (0.501, 1.696)	0.793		
Age, years				
≤57	reference			
>57	1.084 (0.665, 1.769)	0.746		
BMI, kg/m²				
≤23.9	reference			
>23.9	1.318 (0.806, 2.154)	0.271		
TACE				
No	reference			
Yes	1.316 (0.807, 2.145)	0.271		
Extent of resection				
Minor	reference			
Major	1.267 (0.701, 2.290)	0.433		
Cirrhosis				
No	reference			
Yes	0.709 (0.392, 1.281)	0.255		
Number				
Solitary	reference			
Multiple	0.715 (0.223, 2.287)	0.571		
Max diameter, cm				
≤5	reference		reference	
>5	2.870 (1.705, 4.831)	<0.001	2.546 (1.464, 4.428)	0.001
Vascular invasion				
No	reference		reference	
Yes	2.104 (1.164, 3.804)	0.014	2.510 (1.327, 4.750)	0.005
Edmondson–Steiner grade				
I–II	reference			
III–IV	0.925 (0.568, 1.506)	0.753		
Satellite nodule				
No	reference		reference	
Yes	1.800 (1.043, 3.107)	0.035	2.147 (1.189, 3.879)	0.011
Margin				
Narrow	reference		reference	
Wide	0.587 (0.345, 0.999)	0.049	0.740 (0.424, 1.293)	0.290
Necrosis				

	No	reference		reference	
	Yes	1.867 (1.138, 3.063)	0.013	1.603 (0.941, 2.731)	0.082
BCLC stage					
	0	reference			
	A	2.725 (0.853, 8.704)	0.091		
	B	2.788 (0.562, 13.838)	0.210		
Child–Pugh					
	A	reference			
	B	0.000 (0.000, Inf)	0.995		
Antiviral treatment					
	No	reference		reference	
	Yes	0.575 (0.339, 0.975)	0.040	0.692 (0.398, 1.202)	0.191
HBV DNA, IU/mL					
	<2000	reference			
	≥2000	1.590 (0.967, 2.614)	0.067		
HBsAg, ≥ IU/mL					
	<250	reference			
	≥250	0.983 (0.595, 1.621)	0.945		
HBeAg					
	Negative	reference			
	Positive	1.070 (0.510, 2.247)	0.858		
AFP, ng/mL					
	<400	reference		reference	
	≥400	1.690 (1.031, 2.770)	0.037	1.640 (0.983, 2.735)	0.058
ALT		1.000 (0.996, 1.004)	0.949		
AST		1.002 (0.997, 1.007)	0.475		
GGT		1.003 (1.002, 1.005)	<0.001	1.003 (1.000, 1.006)	0.019
ALP		1.006 (1.001, 1.011)	0.026	1.000 (0.993, 1.007)	0.935
ALB		0.964 (0.912, 1.019)	0.194		
TBIL		0.996 (0.961, 1.032)	0.812		

Data are presented as hazard ratios (95% confidence intervals). **Abbreviations:** PCT, postoperative combined therapy; PSM, propensity score matching; IPTW, inverse probability of treatment weighting; BMI, body mass index; TACE, transcatheter arterial chemoembolization; BCLC, Barcelona Clinical Liver Cancer; HBeAg, hepatitis B e antigen; HBV-DNA, hepatitis B virus-deoxyribonucleic acid; HBsAg, hepatitis B surface antigen; AFP, alpha-fetoprotein; ALT, alanine aminotransferase; AST, aspartate aminotransaminase; GGT, gamma glutamyl transferase; ALP, alkaline phosphatase.

Supplementary Table 2 Univariate and multivariate Cox regression analyses of risk factors associated with overall survival

Variable	Univariate Analysis		Multivariate Analysis	
	HR (95%CI)	P	HR(95%CI)	P
Group				
non-PCT	reference		reference	
PCT	0.658 (0.195, 2.224)	0.500	0.626 (0.176, 2.222)	0.469
Sex				
Female	reference			
Male	1.518 (0.450, 5.118)	0.501		
Age, years				
≤57	reference			
>57	0.777 (0.335, 1.801)	0.556		
BMI, kg/m²				
≤23.9	reference			
>23.9	1.415 (0.622, 3.218)	0.408		
TACE				
No	reference			
Yes	0.483 (0.189, 1.234)	0.128		
Extent of resection				
Minor	reference			
Major	1.499 (0.589, 3.812)	0.396		
Cirrhosis				
No	reference			
Yes	1.325 (0.392, 4.477)	0.651		
Number				
Solitary	reference			
Multiple	0.768 (0.103, 5.707)	0.797		
Max diameter, cm				
≤5	reference		reference	
>5	3.087 (1.216, 7.842)	0.018	1.886 (0.702, 5.065)	0.208
Vascular invasion				
No	reference			
Yes	1.376 (0.542, 3.493)	0.502		
Edmondson Steiner grade				
I–II	reference			
III–IV	0.749 (0.327, 1.715)	0.494		
Satellite nodule				
No	reference			
Yes	1.680 (0.690, 4.090)	0.253		
Margin				
Narrow	reference			
Wide	0.637 (0.260, 1.557)	0.322		
Necrosis				

No	reference		reference	
Yes	2.569 (1.132, 5.830)	0.024	2.323 (0.981, 5.503)	0.055
BCLC stage				
0	reference			
A	78324867.917 (0.000, Inf)	0.997		
B	79144799.033 (0.000, Inf)	0.997		
Child–Pugh				
A	reference			
B	0.000 (0.000, Inf)	0.998		
Antiviral treatment				
No	reference		reference	
Yes	0.302 (0.133, 0.685)	0.004	0.286 (0.122, 0.671)	0.004
HBV DNA, IU/mL				
<2000	reference			
≥2000	1.355 (0.587, 3.132)	0.477		
HBsAg, IU/mL				
<250	reference			
≥250	1.102 (0.467, 2.602)	0.824		
HBeAg				
Negative	reference			
Positive	1.610 (0.547, 4.740)	0.387		
AFP, ng/mL				
<400	reference			
≥400	2.161 (0.953, 4.899)	0.065		
ALT	1.002 (0.997, 1.007)	0.385		
AST	1.005 (0.998, 1.011)	0.146		
GGT	1.003 (1.002, 1.005)	<0.001	1.002 (1.000, 1.005)	0.085
ALP	1.009 (1.001, 1.016)	0.022	1.002 (0.992, 1.012)	0.682
ALB	0.933 (0.848, 1.026)	0.151		
TBIL	1.022 (0.971, 1.075)	0.410		

Data are presented as hazard ratios (95% confidence intervals). **Abbreviations:** PCT, postoperative combined therapy; PSM, propensity score matching; IPTW, inverse probability of treatment weighting; BMI, body mass index; TACE, transcatheter arterial chemoembolization; BCLC, Barcelona Clinical Liver Cancer; HBeAg, hepatitis B e antigen; HBV-DNA, hepatitis B virus-deoxyribonucleic acid; HBsAg, hepatitis B surface antigen; AFP, alpha-fetoprotein; ALT, alanine aminotransferase; AST, aspartate aminotransaminase; GGT, gamma glutamyl transferase; ALP, alkaline phosphatase.

Supplementary Table 3 Anti-PD-1/PD-L1 and anti-VEGFR utilization statistics

	anti-PD-1/PD-L1	anti-VEGFR
Median medication duration, months	7.8 (4.5–10.6)	6.8 (4.4–10.4).
Medication interruption	17 (56.7)	22 (73.3)
Due to adverse events	14 (46.7)	19 (63.3)
Other reasons	3 (10.0)	3 (10.0)
Medication modification	0	11 (36.7)
Withdrawal	10 (33.3)	12 (40.0)
Recurrence	4 (13.3)	4 (13.3)
Due to adverse events	2 (6.7)	4 (13.3)
Other reasons	4 (13.3)	4 (13.3)

Data are presented as n (%) or median (interquartile range). **Abbreviations:** PD-1, programmed death 1; PD-L1, programmed death ligand 1; VEGFR, vascular endothelial growth factor receptor;

Supplementary Table 4 Major liver function indices at different time points

Time (months)	non-PCT (n = 116)	PCT (n = 30)	P
ALT			
1	26.00 (20.00, 36.00)	34.00 (23.50, 43.62)	0.031
3	25.50 (19.15, 34.00)	43.00 (33.00, 66.00)	<0.001
6	22.00 (19.00, 35.00)	38.60 (30.00, 73.00)	<0.001
9	23.00 (17.30, 29.40)	38.50 (27.25, 47.08)	<0.001
12	21.00 (18.00, 26.00)	36.00 (28.50, 42.30)	<0.001
AST			
1	28.00 (23.00, 35.00)	31.00 (26.25, 40.50)	0.085
3	29.00 (22.75, 34.00)	43.00 (31.00, 63.00)	<0.001
6	26.00 (23.00, 34.00)	38.50 (32.50, 59.50)	<0.001
9	26.00 (22.25, 33.00)	35.00 (29.75, 47.40)	<0.001
12	27.00 (23.50, 30.20)	37.50 (31.00, 60.40)	<0.001
GGT			
1	42.00 (28.00, 73.00)	57.35 (32.75, 75.92)	0.237
3	42.00 (23.00, 71.25)	58.00 (33.00, 79.30)	0.070
6	27.00 (20.00, 49.00)	72.00 (26.55, 137.40)	<0.001
9	26.00 (18.00, 40.00)	51.50 (34.50, 99.75)	<0.001
12	21.20 (17.00, 34.50)	59.60 (43.50, 140.00)	<0.001
ALP			
1	97.00 (74.00, 119.00)	101.00 (87.75, 123.50)	0.371
3	89.50 (72.75, 112.00)	116.00 (97.00, 144.00)	<0.001
6	86.00 (70.00, 102.00)	110.00 (82.00, 160.00)	0.002
9	85.50 (68.00, 101.00)	103.00 (81.50, 134.75)	0.015
12	83.90 (69.00, 100.50)	115.00 (87.50, 172.00)	0.001
ALB			
1	41.96 ± 4.56	40.78 ± 4.55	0.214
3	44.05 (40.88, 46.60)	38.50 (34.70, 43.20)	<0.001
6	44.90 (42.30, 47.30)	39.10 (37.25, 42.45)	<0.001
9	45.45 (43.02, 46.70)	40.30 (39.72, 43.15)	<0.001
12	45.40 (44.10, 46.75)	40.80 (38.05, 43.45)	<0.001
TBIL			
1	14.30 (12.00, 18.30)	15.45 (13.03, 19.48)	0.330
3	13.80 (11.10, 16.42)	16.60 (13.80, 21.20)	0.022
6	15.20 (12.60, 18.10)	17.00 (11.75, 22.40)	0.400
9	15.30 (12.30, 22.00)	16.10 (10.10, 21.08)	0.538
12	16.30 (11.70, 19.55)	13.90 (11.10, 18.90)	0.576

The data of four patients with no measurements are excluded, and three patients with missing baseline data are filled in using the median.

Data are presented as median (interquartile range) or mean ± standard deviation. **Abbreviations:** PCT, postoperative combined therapy; ALB, Albumin; ALP, alkaline phosphatase; ALT, alanine aminotransferase; AST, aspartate aminotransaminase; GGT, gamma glutamyl transferase; TBIL, total bilirubin.

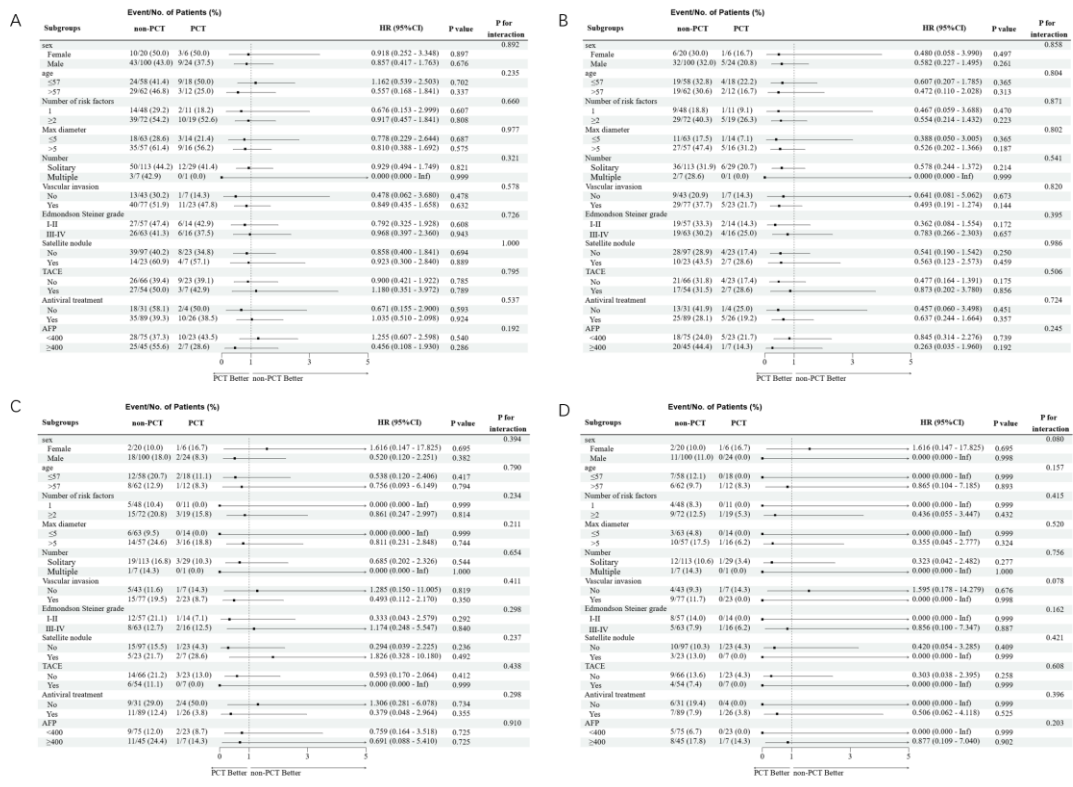
Supplementary Table 5 Generalized estimating equation model results for repeated measures of liver function indices

Time (months)	non-PCT	PCT	Difference within non-PCT group	Difference within PCT group	Difference between groups	P	P of group	P of time	P of group*time
ALT							0.001	0.322	0.017
1	31.50 (0.58)	33.22 (1.14)	-	-	1.73 (-0.97, 4.43)	0.210			
3	30.84 (2.47)	56.97 (8.46)	-0.65 (-5.38, 4.07); p=0.787	23.75 (7.40, 40.10); p=0.004	24.40 (7.38, 41.42)	0.005			
6	31.13 (2.46)	48.04 (5.78)	-0.37 (-5.57, 4.83); p=0.890	14.81 (2.61, 27.02); p=0.017	15.18 (1.91, 28.45)	0.025			
9	32.18 (3.44)	38.76 (4.63)	0.68 (-6.14, 7.50); p=0.845	5.54 (-3.98, 15.06); p=0.254	4.86 (-6.84, 16.55)	0.416			
12	28.01 (3.16)	35.34 (6.55)	-3.49 (-9.53, 2.56); p=0.258	2.12 (-11.68, 15.91); p=0.763	5.61 (-9.58, 20.80)	0.469			
AST							<0.001	0.339	0.012
1	31.16 (0.26)	31.23 (0.34)	-	-	0.07 (-0.80, 0.95)	0.872			
3	32.72 (1.92)	57.34 (8.65)	1.57 (-2.29, 5.42); p=0.425	26.11 (9.19, 43.03); p=0.002	24.54 (7.20, 41.88)	0.006			
6	32.69 (1.93)	49.98 (6.66)	1.53 (-2.37, 5.44); p=0.441	18.75 (5.54, 31.96); p=0.005	17.21 (3.43, 31.00)	0.014			
9	38.63 (6.95)	47.27 (7.60)	7.47 (-6.13, 21.07); p=0.282	16.04 (1.06, 31.03); p=0.036	8.57 (-11.61, 28.74)	0.405			
12	32.76 (2.74)	41.01 (4.45)	1.60 (-3.85, 7.05); p=0.564	9.78 (0.82, 18.74); p=0.032	8.18 (-2.35, 18.71)	0.128			
ln (GGT)							0.017	0.005	0.001
1	3.83 (0.01)	3.84 (0.02)	-	-	0.02 (-0.02, 0.05)	0.390			
3	3.83 (0.06)	3.92 (0.11)	-0.00 (-0.12, 0.12); p=0.997	0.08 (-0.14, 0.29); p=0.473	0.08 (-0.17, 0.32)	0.531			
6	3.61 (0.07)	4.12 (0.16)	-0.22 (-0.35, -0.08); p=0.002	0.28 (-0.03, 0.59); p=0.077	0.50 (0.16, 0.83)	0.004			
9	3.54 (0.09)	4.04 (0.18)	-0.28 (-0.46, -0.11); p=0.001	0.20 (-0.15, 0.54); p=0.267	0.48 (0.09, 0.86)	0.015			
12	3.40 (0.08)	4.13 (0.18)	-0.43 (-0.59, -0.26); p<0.001	0.28 (-0.07, 0.64); p=0.120	0.71 (0.32, 1.10)	1			
ALP							0.074	0.424	0.032
1	103.69 (0.71)	103.76 (0.38)	-	-	0.06 (-0.67, 0.80)	0.864			

	110.17								
3	(6.46)	121.96 (7.64)	6.47 (-7.25, 20.20); p=0.355	18.20 (3.31, 33.09); p=0.017	11.73 (-8.59, 32.05)	0.258			
	102.37	143.42							
6	(5.97)	(21.06)	-1.33 (-14.12, 11.47); p=0.839	39.66 (-1.86, 81.18); p=0.061	40.98 (-2.18, 84.14)	0.063			
		128.94							
9	99.78 (4.89)	(13.77)	-3.92 (-14.44, 6.61); p=0.466	25.19 (-1.99, 52.37); p=0.069	29.10 (0.21, 57.99)	0.048			
		134.51							
12	89.22 (4.28)	(13.66)	-14.47 (-22.86, -6.09); p=0.001	30.75 (3.89, 57.62); p=0.025	45.23 (17.18, 73.27)	0.002			
ALB							<0.001	<0.001	0.004
1	41.99 (0.14)	41.58 (0.29)	-	-	-0.41 (-1.04, 0.22)	0.202			
3	43.03 (0.40)	39.93 (0.75)	1.04 (0.17, 1.90); p=0.019	-1.65 (-3.07, -0.23); p=0.023	-2.69 (-4.35, -1.02)	0.002			
						<0.00			
6	44.08 (0.34)	40.65 (0.62)	2.09 (1.33, 2.84); p<0.001	-0.93 (-2.38, 0.53); p=0.212	-3.01 (-4.65, -1.37)	1			
9	44.42 (0.38)	41.58 (0.62)	2.43 (1.56, 3.30); p<0.001	-0.00 (-1.50, 1.50); p=0.998	-2.43 (-4.16, -0.69)	0.006			
12	44.39 (0.40)	41.93 (0.90)	2.40 (1.51, 3.29); p<0.001	0.34 (-1.68, 2.37); p=0.738	-2.05 (-4.26, 0.16)	0.068			
TBIL							0.808	0.314	0.540
1	16.57 (0.23)	16.76 (0.33)	-	-	0.19 (-0.61, 0.98)	0.645			
3	17.05 (1.85)	18.53 (1.46)	0.48 (-3.15, 4.10); p=0.797	1.77 (-1.06, 4.59); p=0.220	1.29 (-3.31, 5.89)	0.582			
6	17.70 (0.82)	17.40 (1.58)	1.12 (-0.53, 2.78); p=0.183	0.63 (-2.70, 3.97); p=0.709	-0.49 (-4.22, 3.24)	0.797			
9	19.79 (1.87)	17.54 (2.08)	3.21 (-0.54, 6.96); p=0.093	0.78 (-3.37, 4.93); p=0.713	-2.43 (-8.02, 3.16)	0.393			
12	17.90 (0.84)	15.83 (1.49)	1.33 (-0.46, 3.12); p=0.146	-0.94 (-4.07, 2.20); p=0.559	-2.26 (-5.90, 1.37)	0.221			

The data of four patients with no measurements are excluded, and three patients with missing baseline data are filled in using the median. Data are presented as mean (standard error) or difference (95% confidence interval). **Abbreviations:** PCT, postoperative combined therapy; ALB, Albumin; ALP, alkaline phosphatase; ALT, alanine aminotransferase; AST, aspartate aminotransaminase; GGT, gamma glutamyl transferase; TBIL, total bilirubin.

Supplementary Figure 1 Subgroup analysis of RFS and OS



RFS (A) and OS (C) subgroup analyses for the entire period. RFS (B) and OS (D) subgroup analyses performed at 12 months.

Abbreviations: PCT, postoperative combined therapy; TACE, transcatheter arterial chemoembolization; AFP, alpha-fetoprotein.