Supplementary Table 1. Patients' response and outcome assessment for immune therapy between the two genotypes.

	***BMP7*-rs6025211**			***WWOX*- rs13338697**			***WWOX*- rs13333314**		
Review according to mRECIST	**Non-TT (n = 82)**	**TT (n = 14)**	**p-value**	**Non-GG (n = 87)**	**GG (n = 9)**	**p-value**	**Non-AA (n = 87)**	**AA (n = 9)**	**p-value**
AFP decrease 20% from baseline[a], n (%)	23 (28.0)	4 (28.6)	1.000	24 (27.6)	3 (33.3)	1.000	24 (27.6)	3 (33.3)	1.000
Treatment response, n (%)			0.132			1.000			1.000
Complete response	0 (0)	(0)		0 (0)	(0)		0 (0)	(0)	
Partial response	18 (22.0)	2 (14.3)		18 (20.7)	2 (22.2)		18 (20.7)	2 (22.2)	
Stable disease	26 (31.7)	7 (50.0)		30 (34.5)	3 (33.3)		30 (34.5)	3 (33.3)	
Progressive disease	31 (37.8)	2 (14.3)		30 (34.5)	3 (33.3)		30 (34.5)	3 (33.3)	
Not evaluable	7 (8.5)	3 (21.4)		9 (10.3)	1 (11.1)		9 (10.3)	1 (11.1)	
Objective response rate, n (%)	18 (22.0)	2 (14.3)	1.000	18 (20.7)	2 (22.2)		18 (20.7)	2 (22.2)	
Disease control rate, n (%)	44 (53.7)	9 (64.3)	0.567	48 (55.2)	5 (55.6)	1.000	48 (55.2)	5 (55.6)	1.000
Follow up duration (months), median (range)	8.8 (0.3, 34.8)	8.1 (0.2, 33.7)	0.934	8.0 (0.1, 34.8)	12.0 (1.1, 27.1)	0.447	8.0 (0.1, 34.8)	12.0 (1.1, 27.1)	0.447
Overall survival (months), mean (95% CI)	17.2 (14.0, 20.4)	21.5 (13.3, 29.7)	0.381	18.5 (15.2-21.8)	12.7 (7.7-17.7)	0.408	18.5 (15.2-21.8)	12.7 (7.7-17.7)	0.408
Progression-free survival (months), mean (95% CI)	13.0 (9.9, 16.0)	19.6 (11.4, 27.9)	0.159	14.3 (11.2, 17.4)	10.4 (4.4, 16.4)	0.571	14.3 (11.2, 17.4)	10.4 (4.4, 16.4)	0.571

Abbreviations: mRECIST, modified Response Evaluation Criteria in Solid Tumors; AFP, alpha fetoprotein. [a]Patients with a baseline AFP level < 10 were excluded from AFP decrease by 20% analysis.

Supplementary Table 2. Side effects in patients with the two *GALNT14* genotypes.

	rs6752303		p-value	rs9679162		p-value
	Non-TT (n = 73)	TT (n = 23)		Non-GG (n = 75)	GG (n = 21)	
AST (grade), n (%)			0.010*			0.034*
0	29 (40.8)	15 (75.0)		31 (42.5)	13 (72.2)	
≥ 1	42 (59.2)	5 (25.0)		42 (57.5)	5 (27.8)	
ALT (grade), n (%)			0.135			0.301
0	36 (51.4)	15 (71.4)		38 (52.8)	13 (68.4)	
≥ 1	34 (48.6)	6 (28.6)		34 (47.2)	6 (31.6)	
Hypertension (grade), n (%)			0.228			0.193
0	62 (84.9)	17 (73.9)		64 (85.3)	15 (71.4)	
≥ 1	11 (15.1)	6 (26.1)		11 (14.7)	6 (28.6)	
Proteinuria (grade), n (%)			1.000			0.776
0	55 (75.3)	17 (73.9)		57 (76.0)	15 (71.4)	
≥ 1	18 (24.7)	6 (26.1)		18 (24.0)	6 (28.6)	
Hyperthyroidism (grade), n (%)			1.000			1.000
0	72 (98.6)	23 (100.0)		74 (98.7)	21 (100.0)	
≥ 1	1 (1.4)	0 (0)		1 (1.3)	0 (0)	
Hypothyroidism (grade), n (%)			0.672			0.645
0	68 (93.2)	21 (91.3)		70 (93.3)	19 (90.5)	
≥ 1	5 (6.8)	2 (8.7)		5 (6.7)	2 (9.5)	
Rash (grade), n (%)			1.000			1.000
0	66 (90.4)	21 (91.3)		68 (90.7)	19 (90.5)	
≥ 1	7 (9.6)	2 (8.7)		7 (9.3)	2 (9.5)	
Fatigue (grade), n (%)			1.000			0.757
0	60 (82.2)	19 (82.6)		61 (81.3)	18 (85.7)	
≥ 1	13 (17.8)	4 (17.4)		14 (18.7)	3 (14.3)	
Dizziness (grade), n (%)			0.590			0.300
0	70 (95.9)	21 (91.3)		72 (96.0)	19 (90.5)	
≥ 1	3 (4.1)	2 (8.7)		3 (4.0)	2 (9.5)	
Myalgia (grade), n (%)			0.672			1.000
0	68 (93.2)	21 (91.3)		69 (92.0)	20 (95.2)	
≥ 1	5 (6.8)	2 (8.7)		6 (8.0)	1 (4.8)	
Pruritus (grade), n (%)			1.000			1.000
0	66 (90.4)	21 (91.3)		68 (90.7)	19 (90.5)	
≥ 1	7 (9.6)	2 (8.7)		7 (9.3)	2 (9.5)	
Diarrhea (grade), n (%)			1.000			1.000
0	64 (87.7)	21 (91.4)		66 (88.0)	19 (90.5)	
≥ 1	9 (12.3)	2 (8.7)		9 (12.0)	2 (9.5)	
HFSR (grade), n (%)			1.000			1.000
0	70 (95.9)	22 (95.7)		72 (96.0)	20 (95.2)	
≥ 1	3 (4.1)	1 (4.3)		3 (4.0)	1 (4.8)	
Edema (grade), n (%)			0.627			0.609
0	69 (94.5)	21 (91.3)		71 (94.7)	19 (90.5)	
≥ 1	4 (5.5)	2 (8.7)		4 (5.3)	2 (9.5)	
Fever (grade), n (%)			0.147			0.229

0	56 (76.7)	21 (91.3)		58 (77.3)	19 (90.5)	
≥ 1	17 (23.3)	2 (8.7)		17 (22.7)	2 (9.5)	
Pneumonitis (grade), n (%)			1.000			1.000
0	72 (98.6)	23 (100.0)		74 (98.7)	21 (100.0)	
≥ 1	1 (1.4)	0 (0)		1 (1.3)	0 (0)	
Colitis (grade), n (%)			1.000			1.000
0	71 (97.3)	23 (100.0)		73 (97.3)	21 (100.0)	
≥ 1	2 (2.7)	0 (0)		2 (2.7)	0 (0)	
Abdominal pain (grade), n (%)			0.145			0.070
0	60 (82.2)	15 (65.2)		62 (82.7)	13 (61.9)	
≥ 1	13 (17.8)	8 (34.8)		13 (17.3)	8 (38.1)	
Vomiting + nausea (grade), n (%)			1.000			1.000
0	67 (91.8)	22 (95.7)		69 (92.0)	20 (95.2)	
≥ 1	6 (8.2)	1 (4.3)		6 (8.0)	1 (4.8)	
GI bleeding (grade), n (%)			0.721			0.701
0	65 (89.0)	20 (87.0)		67 (89.3)	18 (85.7)	
≥ 1	8 (11.0)	3 (13.0)		8 (10.7)	3 (14.3)	
GI bleeding prevention (grade), n (%)			0.672			0.645
0	68 (93.2)	21 (91.3)		70 (93.3)	19 (90.5)	
≥ 1	5 (6.8)	2 (8.7)		5 (6.7)	2 (9.5)	

AST, aspartate amino transferase; ALT, alanine amino transferase; HFSR, hand-foot skin reaction; GI, gastrointestinal.

Supplementary Table 3. Univariate and multivariate logistic regression analyses of post-treatment AST grade

Variables		Number	Univariate		Multivariate	
			OR (95% CI)	p-value	OR (95% CI)	p-value
Sex	Female	15	Ref.		Ref.	
	Male	81	0.788 (0.260, 2.389)	0.673	0.741 (0.233, 2.359)	0.612
Age		96	0.985 (0.949, 1.023)	0.436	0.989 (0.952, 1.028)	0.585
***GALNT14*-rs6752303**	Non-TT	73	Ref.		Ref.	
	TT	23	0.230 (0.075, 0.703)	0.010*	0.236 (0.077, 0.721)	0.011*
BCLC stage	A	6	Ref.			
	B	19	7.857 (0.352, 82.128)	0.185		
	C	71	5.469 (0.606, 49.351)	0.130		
MVI	No	49	Ref.			
	Yes	47	0.737 (0.323, 1.683)	0.467		
Out of up-to-7 criteria	No	21	Ref.			
	Yes	75	1.583 (0.592, 4.235)	0.360		
EHM	No	51	Ref.			
	Yes	45	1.495 (0.654, 3.419)	0.340		
Prior LRT	No	40	Ref.			
	Yes	56	0.530 (0.226, 1.247)	0.146		
Prior TKI	No	55	Ref.			
	Yes	40	0.691 (0.367, 1.946)	0.691		
ALBI	I	35	Ref.			
	II+III	61	0.545 (0.228, 1.303)	0.172		

AST, aspartate amino transferase; BCLC; Barcelona Clinic Liver Cancer classification; MVI, microvascular invasion; EHM, extra-hepatic metastasis; ALBI grade, albumin-bilirubin grade; AFP, alpha fetoprotein; OR, odds ratio; CI, confidence interval. *$p < 0.05$.

Supplementary Figure 1 Flowchart of patient inclusion. Abbreviations: HCC, hepatocellular carcinoma; ICI, immune checkpoint inhibitor.