**Supplementary Table 1.** Part of significant-enriched pathways in Short-term through GSEA analysis

Enrichment pathways	Normalized Enrichment Score (NES)	NOM p-val	FDR q-val
Ribosome	-1.7009071	0	0.005358497
Proteasome	-1.6258279	0	0.017680043
ECM-receptor interaction	-1.5425298	0.001121076	0.1031432
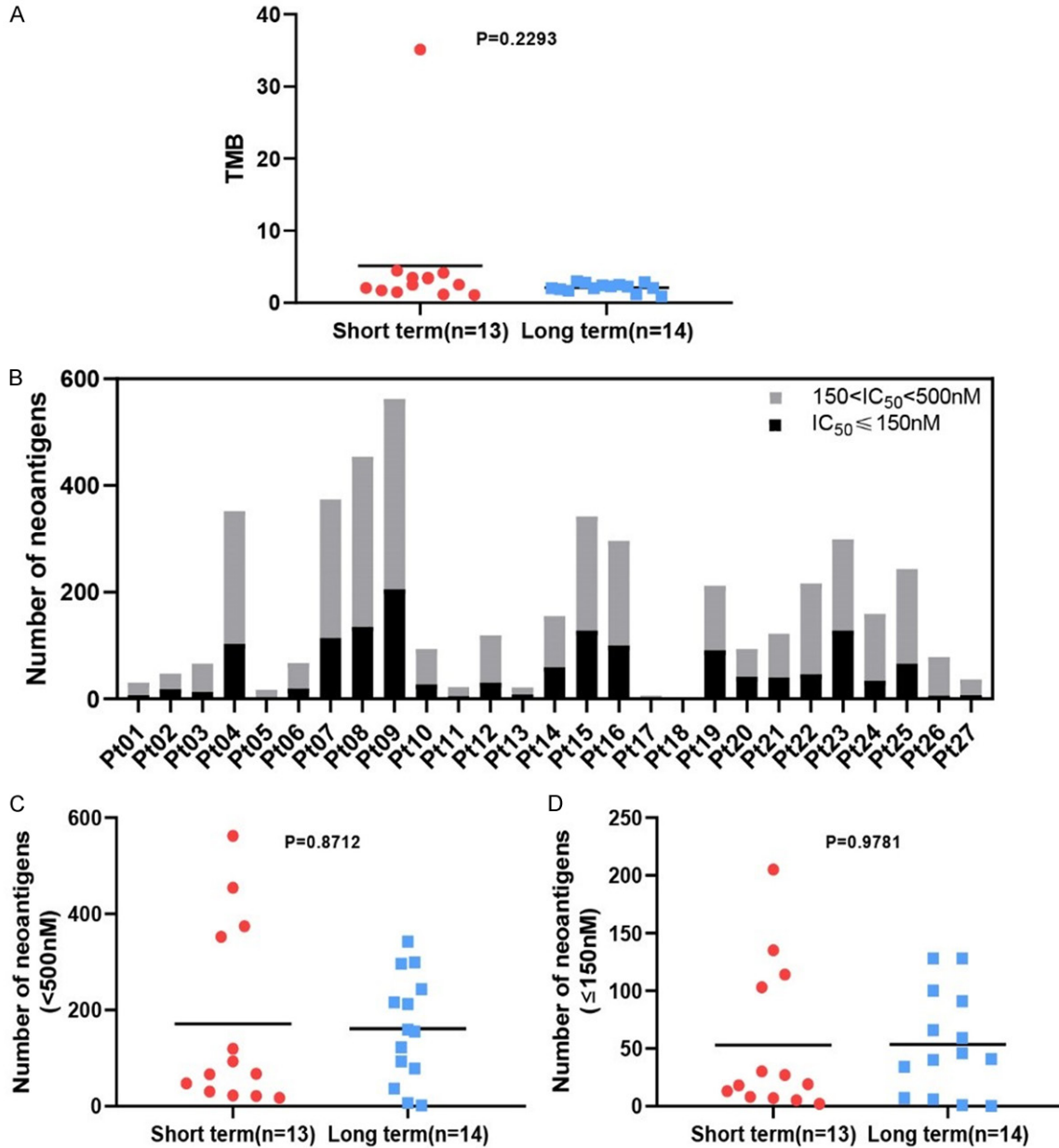
Supplementary Figure 1. TMB, neoantigen load comparison between Long-term and Short-term. A. TMB comparison between Long-term and Short-term, P = 0.2293. B. Neoantigen number per patient in Pt01~Pt27. C. Total neoantigen (IC_{50} < 500 nM) load comparison between Long-term and Short-term. D. High-quality neoantigen ($IC_{50} \leq$ 150 nM) load comparison between Long-term and Short-term.
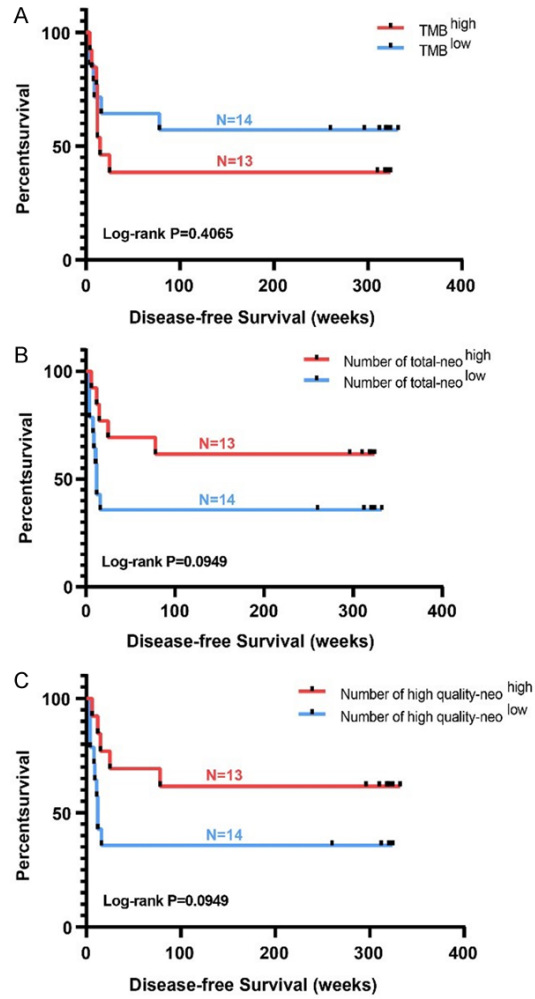
Supplementary Figure 2. Correlation between TMB, neoantigen load and prognosis. A. TMB and prognosis, P = 0.4065. B. Total neoantigen (IC_{50} < 500 nM) load and prognosis, P = 0.0949. C. High-quality neoantigen ($IC_{50} \leq 150$ nM) load and prognosis, P = 0.0949.

Supplementary Table 3. Clinical variables included in univariate-Cox proportional hazards model

Factor	HR	95% CI	*P* value
Neutrophil ratio	13.600	0.267-696.000	0.1930
Tumor thrombus	4.070	1.120-14.800	0.0329
Albumin/Globulin ratio	1.430	0.209-9.790	0.7150
Family history of liver cancer	1.350	0.467-3.890	0.5810
Diabete	0.000	0.000-Inf	0.9980
Thrombocytocrit (%)	1.210	0.083-17.500	0.8900
Alcohol	1.170	0.391-3.500	0.7790
Prothrombin time (s)	1.160	0.564-2.390	0.6850
Gender	1.120	0.313-4.050	0.8570
AST (U/L)	1.020	1.000-1.030	0.0188
Neutrophil number (/L)	1.020	0.784-1.320	0.8940
DBIL (umol/L)	1.010	1.000-1.020	0.0023
ALT (U/L)	1.010	1.000-1.020	0.0336
ALP (U/L)	1.010	1.000-1.020	0.0020
TBIL (umol/L)	1.010	1.000-1.010	0.0027
AFP (nk/mL)	1.000	1.000-1.000	0.0201
CHE (U/L)	1.000	0.999-1.000	0.0475
Platelet number (/L)	1.000	0.998-1.010	0.1580
Neutrophil/Lymphocyte Ratio	0.997	0.862-1.150	0.9700
Hemoglobin (g/L)	0.985	0.955-1.020	0.3470
CRE (umol/L)	0.981	0.948-1.020	0.2770
Age	0.980	0.922-1.040	0.4990
Leukocyte number (/L)	0.964	0.743-1.250	0.7840
Smoke	0.964	0.322-2.890	0.9480
Prothrombin activity	0.957	0.889-1.030	0.2340
Albumin (g/L)	0.938	0.798-1.100	0.4370
Globulin (g/L)	0.914	0.787-1.060	0.2370
TP (g/L)	0.913	0.813-1.030	0.1270
Erythrocyte number (/L)	0.887	0.285-2.770	0.8370
Lymphocyte number (/L)	0.784	0.369-1.670	0.5270
BUN (mmol/L)	0.765	0.465-1.260	0.2920
Antiviral therapy	0.679	0.227-2.030	0.4890
Monocyte number (/L)	0.176	0.006-5.350	0.3190
Virus	0.049	0.004-0.571	0.0160
Lymphocyte ratio	0.040	0.000-4.930	0.1900

Abbreviations: AST, Aspertate Aminotransferase; DBIL, Direct bilirubin; ALT, Alanine transaminase; ALP, Alkaline phosphatase; TBIL, Total bilirubin; AFP, Alpha fetoprotein; CHE, Cholinesterase; CRE, Creatinine; TP, Total protein; BUN, Blood urea nitrogen.