Definition of post-operative complications

The severity of complications was assessed according to the Clavien–Dindo classification (CDC). Overall complications were defined as grade ≥ II, and major complications were defined as grade ≥ III. Post-operative complications were categorized by organ system, including respiratory complications (pneumonia, pleural effusion, and respiratory failure), cardiovascular complications (arrhythmia, myocardial ischemia, and heart failure), digestive complications (anastomotic leakage, anastomotic bleeding, ileus or bowel obstruction, intra-abdominal infection, and lymphatic leakage), and nutritional and metabolic complications (electrolyte imbalance, hypoalbuminemia, and anemia).

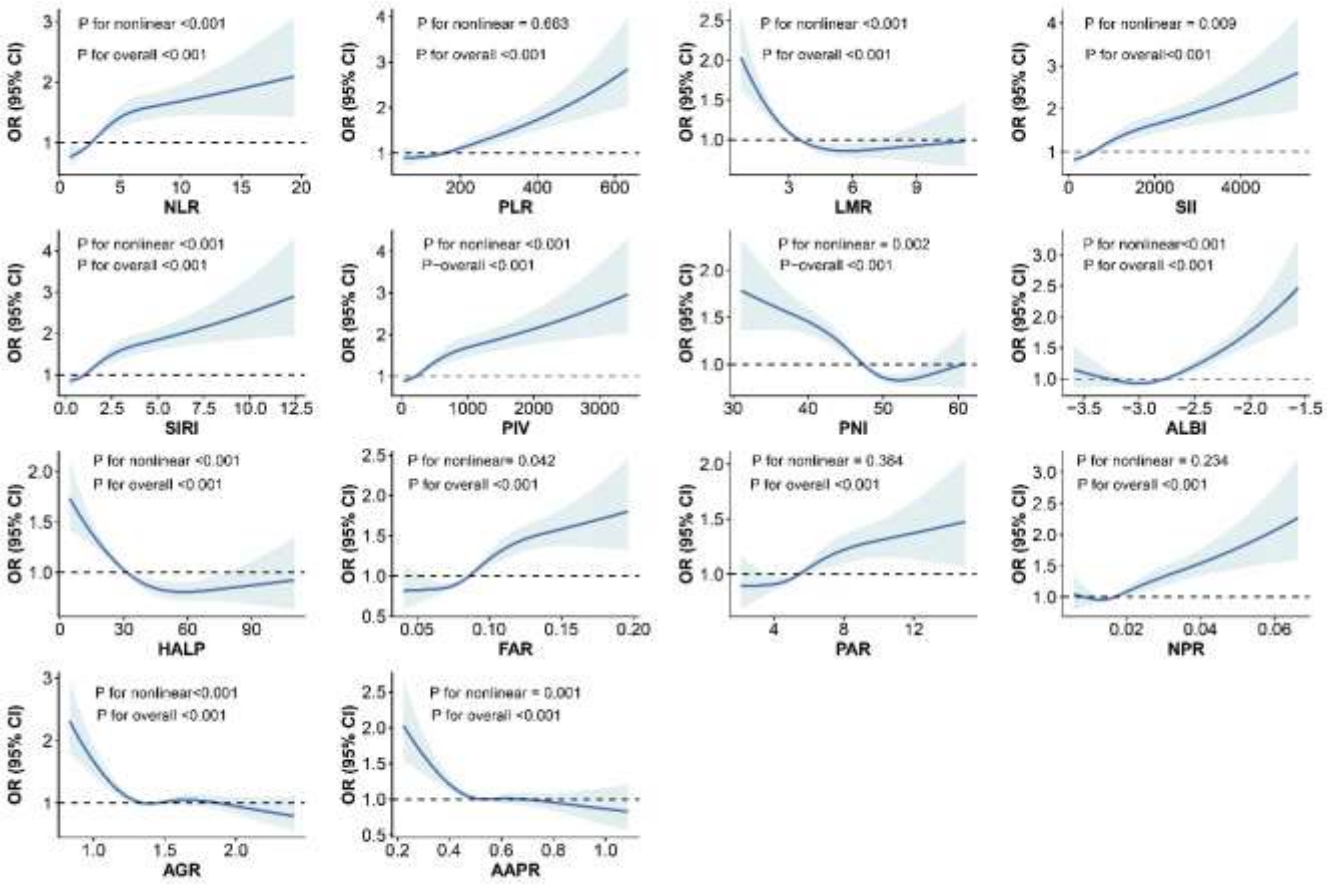
Definition and calculation of Systemic inflammation-, nutrition-, and metabolism-related indicators

Composite indicators were calculated using the following laboratory parameters: neutrophil count (NEU, $\times 10^9$/L), lymphocyte count (LYM, $\times 10^9$/L), monocyte count (MONO, $\times 10^9$/L), platelet count (PLT, $\times 10^9$/L), hemoglobin (Hb, g/L), albumin (Alb, g/L), globulin (Glb, g/L), fibrinogen (Fib, g/L), total bilirubin (TBil, μmol/L), alkaline phosphatase (ALP, U/L), fasting blood glucose (FBG, mg/dL), triglyceride (TG, mg/dL), and high-density lipoprotein cholesterol (HDL-C, mg/dL).

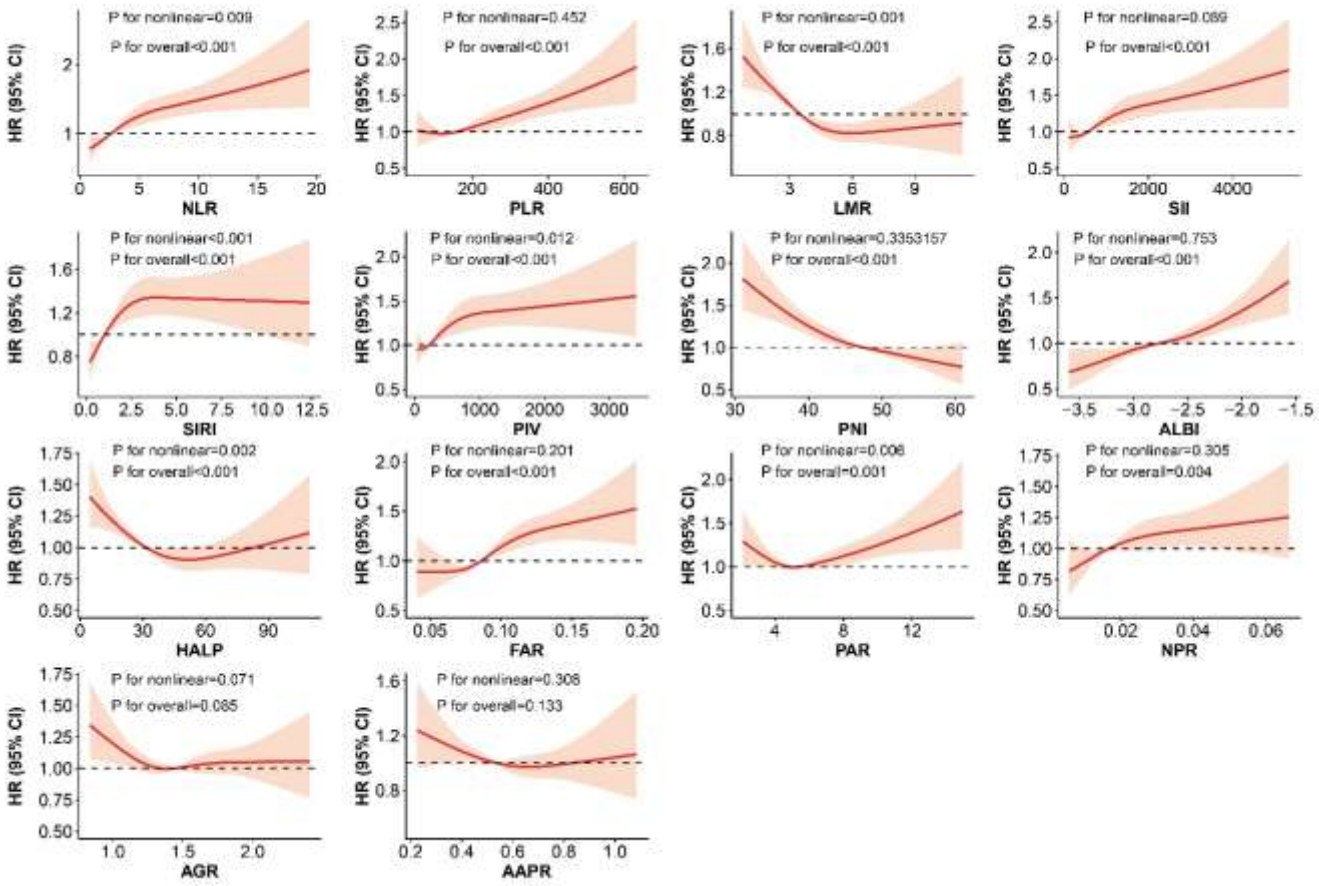
The inflammatory indicators were calculated as follows: neutrophil-to-lymphocyte ratio (NLR = NEU / LYM), platelet-to-lymphocyte ratio (PLR = PLT / LYM), lymphocyte-to-monocyte ratio (LMR = LYM / MONO), systemic immune-inflammation index (SII = PLT × NEU / LYM), systemic inflammation response index (SIRI = NEU × MONO / LYM), and pan-immune-inflammation value (PIV = NEU × MONO × PLT / LYM).

The nutrition-related indicators were calculated as follows: prognostic nutritional index (PNI = Alb + 5 × LYM), albumin–bilirubin index (ALBI = log10(TBil) × 0.66 −0.085 × Alb), hemoglobin–albumin–lymphocyte–platelet index (HALP = Hb × Alb × LYM / PLT), fibrinogen-to-albumin ratio (FAR = Fib / Alb), platelet-to-albumin ratio (PAR = PLT / Alb), neutrophil-to-platelet ratio (NPR = NEU / PLT), albumin-to-globulin ratio (AGR = Alb / Glb), and albumin-to-alkaline phosphatase ratio (AAPR = Alb / ALP).

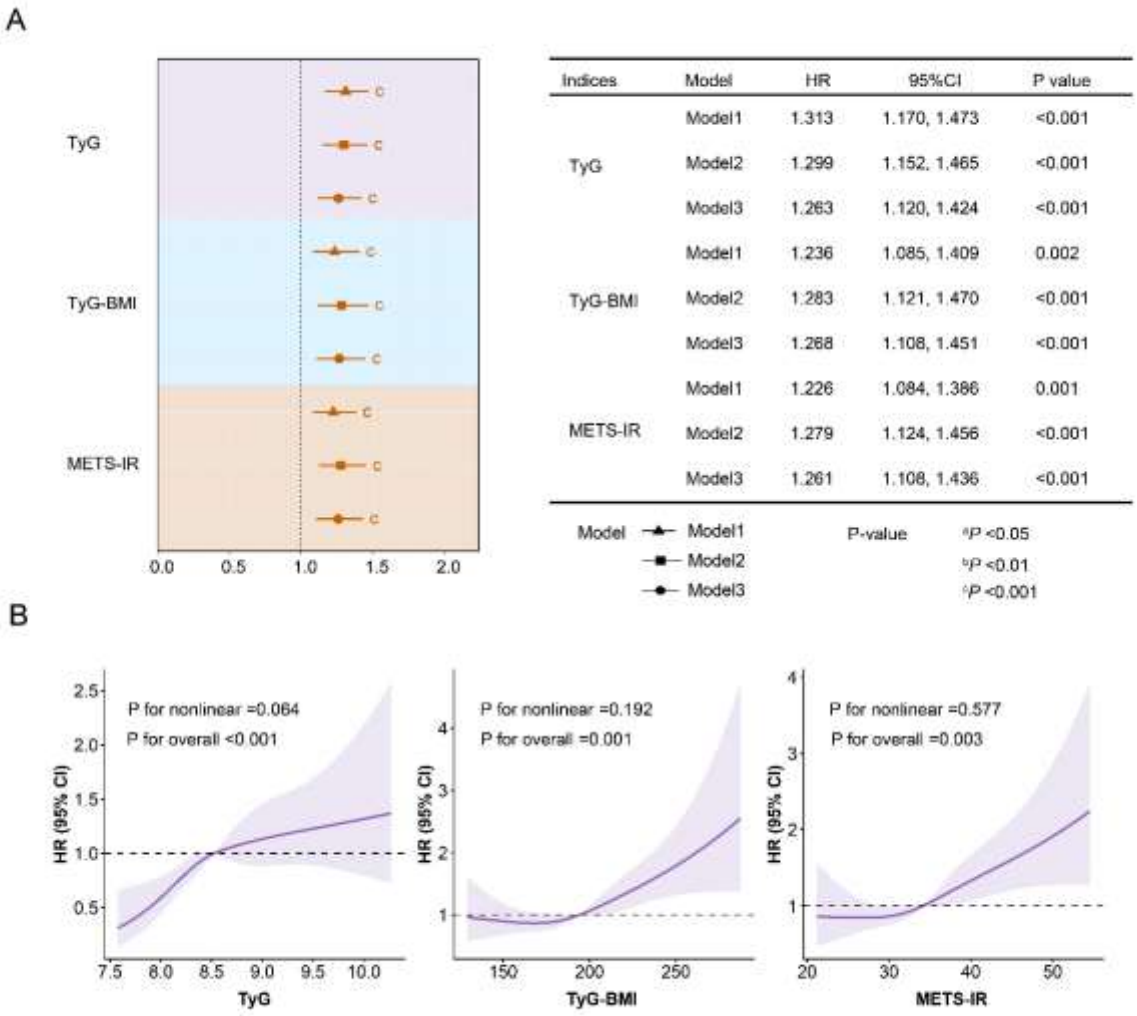
The metabolic-related indicators were calculated as follows: triglyceride-glucose index (TyG = ln(TG × FBG / 2)), TyG-BMI (TyG-BMI = TyG × BMI), and metabolic score for insulin resistance (METS-IR = ln(2 × FBG + TG) × BMI / ln(HDL-C)). These metabolic indices were evaluated in an exploratory analysis within the Center A subcohort.



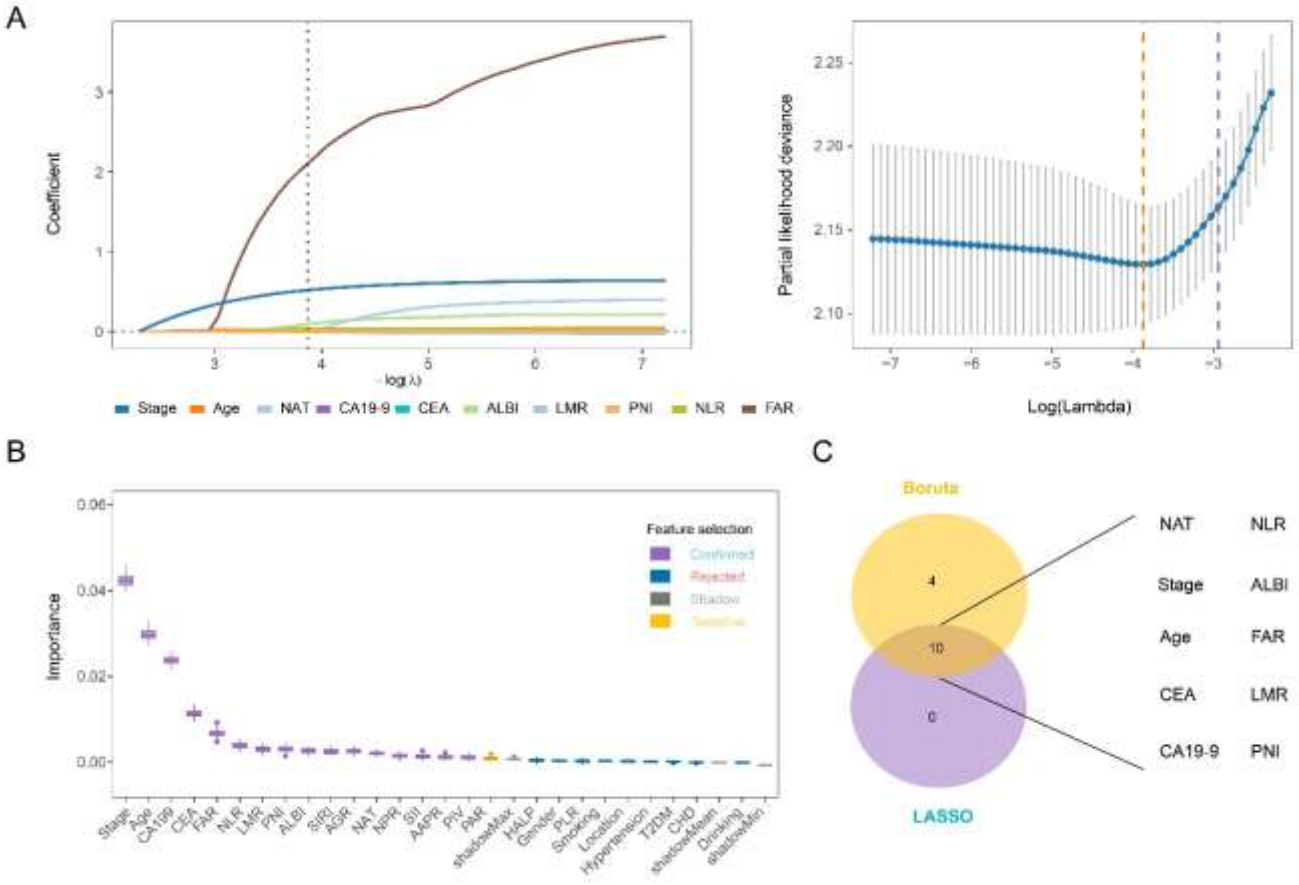
Supplementary Figure 1 Restricted cubic spline analyses showing dose-response associations between SINRIs and overall post-operative complications.



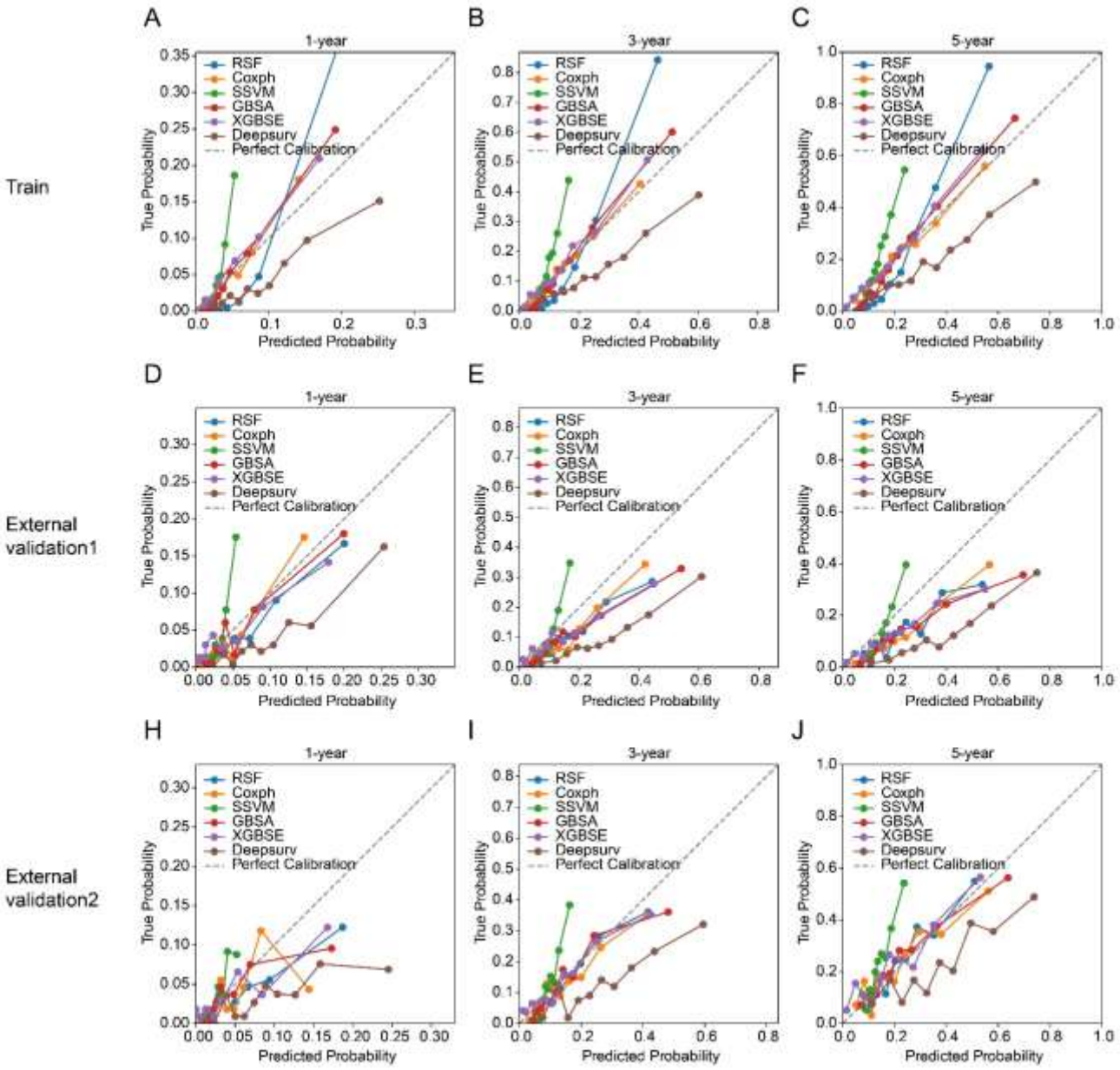
Supplementary Figure 2 Restricted cubic spline analyses showing dose-response associations between SINRIs and overall survival.



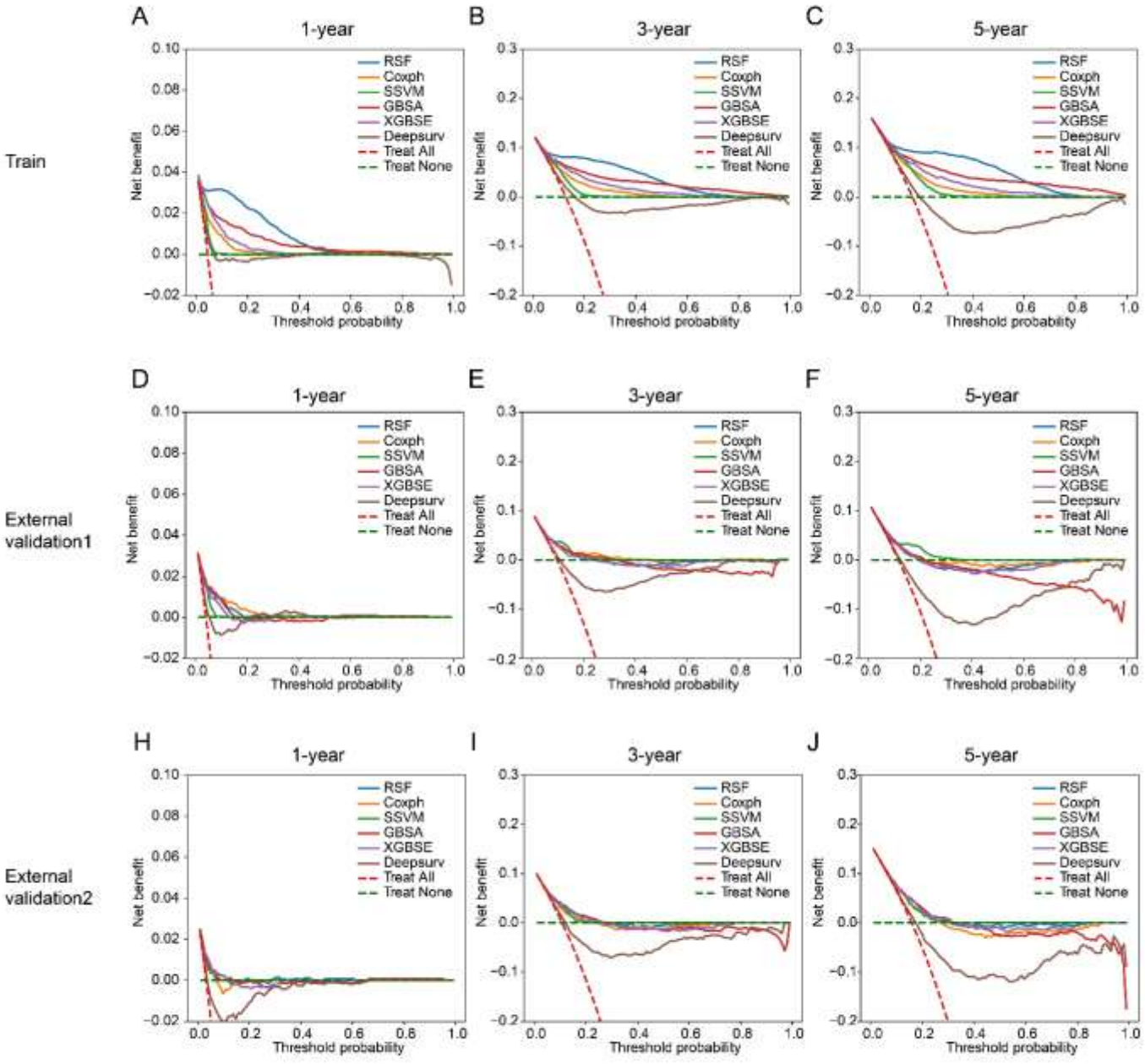
Supplementary Figure 3 Subcohort analysis of the associations between metabolic dysfunction indicators and CRC mortality risk. A: Multivariable Cox regression analyses of the associations of TyG, TyG-BMI, and METS-IR with CRC mortality risk; B: Restricted cubic spline analyses showing dose-response associations between metabolic dysfunction indicators and overall survival.



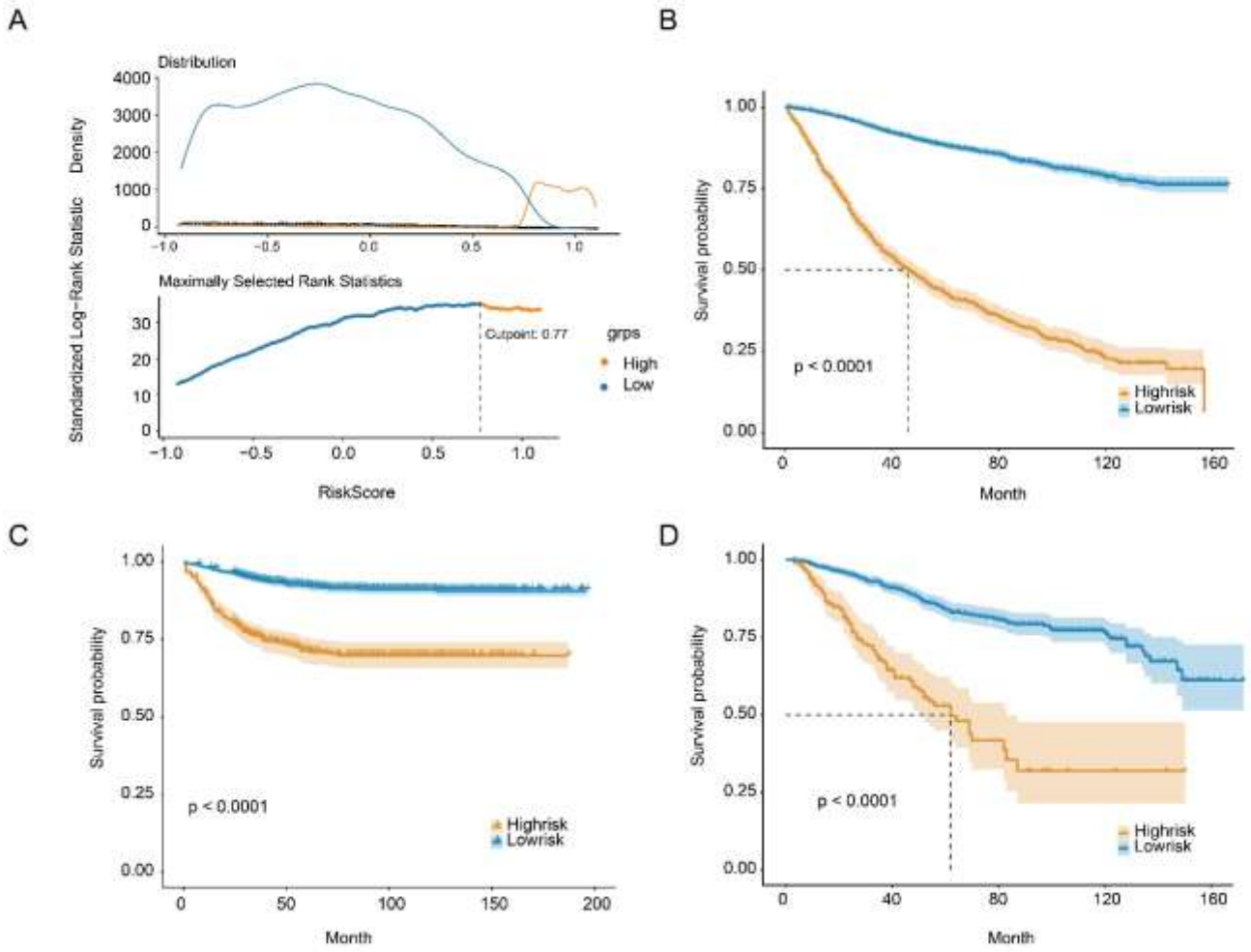
Supplementary Figure 4 Feature-selection workflow and results. (A) LASSO coefficient profiles of candidate variables. (B) Boxplot of feature-importance distribution by Boruta algorithm. (C) Venn diagram of the overlapping predictors retained by LASSO and Boru



Supplementary Figure 5 Bootstrap corrected calibration curves at 1-, 3-, and 5-year time points horizons across different models. (A-C) Training set. (D-F) External validation cohort 1. (G-I) External validation cohort 2.



Supplementary Figure 6 Bootstrap-corrected decision-curve analysis at 1-, 3-, and 5-year time points across different models. (A-C) Training set. (D-F) External validation cohort 1. (G-I) External validation cohort 2.



Supplementary Figure 7 Risk classification for CRC patient undergoing radical surgery. A: Optimal risk-score cutoff identified using maximally selected rank statistics. (B–D) Kaplan–Meier survival curves for low- and high-risk groups in the training set, external validation cohort 1, and external validation cohort 2.

Supplementary Table 1 Association between SINRIs and postoperative complications across quartiles

Ratio	Level	Model1		Model2		Model3	
		OR(95%CI)	P-value	OR(95%CI)	P-value	OR(95%CI)	P-value
NLR	Q1	ref		ref		ref	
	Q2	1.170 (1.016–1.349)	0.03	1.151 (0.998–1.328)	0.053	1.142 (0.990–1.318)	0.069
	Q3	1.298 (1.129–1.493)	<0.001	1.250 (1.086–1.440)	0.002	1.238 (1.075–1.426)	0.003
	Q4	1.880 (1.645–2.151)	<0.001	1.792 (1.565–2.053)	<0.001	1.772 (1.546–2.033)	<0.001
	Per SD	1.225 (1.174–1.278)	<0.001	1.206 (1.156–1.259)	<0.001	1.202 (1.151–1.255)	<0.001
PLR	Q1	ref		ref		ref	
	Q2	0.953 (0.829–1.096)	0.502	0.976 (0.848–1.123)	0.73	0.967 (0.840–1.113)	0.639
	Q3	1.163 (1.016–1.333)	0.029	1.180 (1.030–1.353)	0.017	1.168 (1.018–1.340)	0.027
	Q4	1.486 (1.303–1.696)	<0.001	1.513 (1.325–1.728)	<0.001	1.497 (1.308–1.715)	<0.001
	Per SD	1.222 (1.169–1.277)	<0.001	1.222 (1.169–1.277)	<0.001	1.222 (1.168–1.279)	<0.001
LMR	Q1	ref		ref		ref	
	Q2	0.732 (0.644–0.831)	<0.001	0.749 (0.658–0.852)	<0.001	0.741 (0.651–0.843)	<0.001
	Q3	0.643 (0.564–0.733)	<0.001	0.684 (0.599–0.780)	<0.001	0.671 (0.587–0.767)	<0.001
	Q4	0.546 (0.477–0.624)	<0.001	0.603 (0.525–0.692)	<0.001	0.593 (0.515–0.683)	<0.001
	Per SD	0.800 (0.760–0.842)	<0.001	0.833 (0.791–0.878)	<0.001	0.828 (0.785–0.873)	<0.001
SII	Q1	ref		ref		ref	
	Q2	1.156 (1.004–1.332)	0.044	1.171 (1.017–1.350)	0.029	1.163 (1.009–1.341)	0.037
	Q3	1.261 (1.097–1.450)	0.001	1.270 (1.104–1.461)	<0.001	1.260 (1.095–1.451)	0.001
	Q4	1.808 (1.582–2.067)	<0.001	1.817 (1.589–2.080)	<0.001	1.798 (1.566–2.064)	<0.001
	Per SD	1.237 (1.185–1.290)	<0.001	1.234 (1.182–1.287)	<0.001	1.230 (1.177–1.284)	<0.001

SIRI	Q1	ref		ref		ref	
	Q2	1.144 (0.991–1.320)	0.067	1.108 (0.959–1.281)	0.163	1.099 (0.950–1.270)	0.204
	Q3	1.362 (1.184–1.567)	<0.001	1.283 (1.114–1.480)	<0.001	1.276 (1.106–1.472)	<0.001
	Q4	1.996 (1.745–2.284)	<0.001	1.863 (1.625–2.138)	<0.001	1.843 (1.604–2.119)	<0.001
	Per SD	1.254 (1.202–1.307)	<0.001	1.233 (1.181–1.286)	<0.001	1.229 (1.177–1.282)	<0.001
PIV	Q1	ref		ref		ref	
	Q2	1.060 (0.920–1.223)	0.42	1.042 (0.903–1.203)	0.57	1.034 (0.896–1.194)	0.646
	Q3	1.286 (1.120–1.478)	<0.001	1.251 (1.088–1.439)	0.002	1.243 (1.080–1.431)	0.002
	Q4	1.850 (1.620–2.114)	<0.001	1.788 (1.564–2.047)	<0.001	1.769 (1.542–2.032)	<0.001
	Per SD	1.238 (1.188–1.291)	<0.001	1.230 (1.179–1.283)	<0.001	1.226 (1.174–1.280)	<0.001
PNI	Q1	ref		ref		ref	
	Q2	0.734 (0.646–0.833)	<0.001	0.776 (0.682–0.882)	<0.001	0.774 (0.680–0.880)	<0.001
	Q3	0.570 (0.499–0.650)	<0.001	0.617 (0.539–0.705)	<0.001	0.613 (0.535–0.702)	<0.001
	Q4	0.540 (0.472–0.617)	<0.001	0.615 (0.535–0.706)	<0.001	0.609 (0.528–0.701)	<0.001
	Per SD	0.783 (0.747–0.821)	<0.001	0.821 (0.782–0.863)	<0.001	0.818 (0.778–0.860)	<0.001
ALBI	Q1	ref		ref		ref	
	Q2	0.949 (0.823–1.094)	0.472	0.906 (0.785–1.045)	0.176	0.908 (0.787–1.049)	0.19
	Q3	1.250 (1.090–1.433)	0.001	1.146 (0.998–1.318)	0.054	1.144 (0.995–1.315)	0.058
	Q4	1.667 (1.461–1.903)	<0.001	1.453 (1.267–1.668)	<0.001	1.452 (1.264–1.668)	<0.001
	Per SD	1.262 (1.204–1.322)	<0.001	1.200 (1.143–1.260)	<0.001	1.200 (1.142–1.261)	<0.001
HALP	Q1	ref		ref		ref	
	Q2	0.702 (0.618–0.797)	<0.001	0.714 (0.627–0.811)	<0.001	0.706 (0.620–0.804)	<0.001
	Q3	0.585 (0.513–0.667)	<0.001	0.600 (0.525–0.684)	<0.001	0.590 (0.514–0.675)	<0.001

	Q4	0.535 (0.467–0.611)	<0.001	0.549 (0.479–0.629)	<0.001	0.544 (0.472–0.626)	<0.001
	Per SD	0.808 (0.768–0.850)	<0.001	0.816 (0.775–0.859)	<0.001	0.817 (0.774–0.861)	<0.001
FAR	Q1	ref		ref		ref	
	Q2	1.162 (1.005–1.343)	0.042	1.107 (0.957–1.281)	0.172	1.097 (0.948–1.270)	0.214
	Q3	1.542 (1.342–1.773)	<0.001	1.426 (1.239–1.642)	<0.001	1.409 (1.223–1.624)	<0.001
	Q4	1.982 (1.732–2.272)	<0.001	1.754 (1.527–2.016)	<0.001	1.729 (1.501–1.994)	<0.001
	Per SD	1.280 (1.223–1.338)	<0.001	1.230 (1.175–1.288)	<0.001	1.226 (1.169–1.285)	<0.001
PAR	Q1	ref		ref		ref	
	Q2	1.046 (0.911–1.201)	0.522	1.053 (0.917–1.210)	0.465	1.038 (0.903–1.194)	0.6
	Q3	1.202 (1.050–1.376)	0.008	1.225 (1.069–1.404)	0.004	1.199 (1.044–1.377)	0.01
	Q4	1.361 (1.191–1.556)	<0.001	1.396 (1.220–1.598)	<0.001	1.356 (1.180–1.560)	<0.001
	Per SD	1.132 (1.081–1.184)	<0.001	1.142 (1.090–1.196)	<0.001	1.133 (1.079–1.188)	<0.001
NPR	Q1	ref		ref		ref	
	Q2	1.081 (0.941–1.243)	0.269	1.045 (0.909–1.203)	0.535	1.048 (0.911–1.206)	0.513
	Q3	1.162 (1.013–1.334)	0.032	1.094 (0.952–1.258)	0.207	1.095 (0.952–1.259)	0.203
	Q4	1.548 (1.356–1.768)	<0.001	1.442 (1.259–1.651)	<0.001	1.443 (1.259–1.653)	<0.001
	Per SD	1.184 (1.133–1.237)	<0.001	1.160 (1.109–1.213)	<0.001	1.159 (1.107–1.212)	<0.001
AGR	Q1	ref		ref		ref	
	Q2	0.707 (0.620–0.805)	<0.001	0.741 (0.650–0.846)	<0.001	0.745 (0.652–0.850)	<0.001
	Q3	0.700 (0.614–0.798)	<0.001	0.756 (0.662–0.864)	<0.001	0.762 (0.666–0.872)	<0.001
	Q4	0.671 (0.588–0.765)	<0.001	0.729 (0.637–0.835)	<0.001	0.738 (0.643–0.846)	<0.001
	Per SD	0.850 (0.810–0.892)	<0.001	0.877 (0.835–0.922)	<0.001	0.881 (0.838–0.927)	<0.001
AAPR	Q1	ref		ref		ref	

	Q2	0.753 (0.660–0.857)	<0.001	0.762 (0.668–0.869)	<0.001	0.761 (0.667–0.868)	<0.001
	Q3	0.753 (0.660–0.857)	<0.001	0.777 (0.681–0.886)	<0.001	0.777 (0.681–0.887)	<0.001
	Q4	0.689 (0.603–0.786)	<0.001	0.732 (0.639–0.837)	<0.001	0.738 (0.644–0.845)	<0.001
	Per SD	0.865 (0.824–0.908)	<0.001	0.888 (0.845–0.932)	<0.001	0.891 (0.847–0.936)	<0.001

Model 1: unadjusted.

Model 2 adjusted for gender, age, smoking status, drinking status, hypertension, T2DM, CHD.

Model 3 adjusted for gender, age, smoking status, drinking status, hypertension, T2DM, CHD, NAT, tumor location, and tumor stage.

Abbreviations: SINRIs, systemic inflammation- and nutrition-related indices; NLR, neutrophil-to-lymphocyte ratio; PLR, platelet-to-lymphocyte ratio; LMR, lymphocyte-to-monocyte ratio; SII, systemic immune-inflammation index; SIRI, systemic immune-inflammation response index; PIV, pan-immune-inflammation value; PNI, prognostic nutritional index; ALBI, albumin-bilirubin score; HALP, hemoglobin, albumin, lymphocyte, and platelet score; FAR, fibrinogen-to-albumin ratio; PAR, platelet-to-albumin ratio; NPR, neutrophil-to-platelet ratio; AGR, albumin-to-globulin ratio; AAPR, albumin-to-alkaline phosphatase ratio; CI, confidence interval; OR, odds ratio; CRC, colorectal cancer.

Supplementary Table 2 The associations between SINRIs and postoperative complications in CRC patients

Indicator	Model 1				Model 2				Model 3				Complication
	OR	LB	UB	P value	OR	LB	UB	P value	OR	LB	UB	P value	
NLR	1.238	1.112	1.378	<0.001	1.203	1.077	1.345	0.001	1.234	1.104	1.379	<0.001	Major
PLR	1.137	0.995	1.299	0.059	1.131	0.991	1.291	0.068	1.182	1.033	1.352	0.015	Major
LMR	0.723	0.609	0.858	<0.001	0.8	0.672	0.953	0.012	0.771	0.644	0.924	0.005	Major
SII	1.172	1.042	1.318	0.008	1.157	1.028	1.302	0.015	1.209	1.074	1.361	0.002	Major
SIRI	1.242	1.121	1.376	<0.001	1.203	1.081	1.34	<0.001	1.236	1.111	1.376	<0.001	Major
PIV	1.158	1.033	1.299	0.012	1.135	1.009	1.277	0.034	1.183	1.051	1.332	0.005	Major
PNI	0.728	0.63	0.841	<0.001	0.783	0.673	0.911	0.002	0.751	0.643	0.877	<0.001	Major
ALBI	1.414	1.229	1.627	<0.001	1.315	1.135	1.524	<0.001	1.359	1.171	1.577	<0.001	Major
HALP	0.868	0.741	1.015	0.077	0.868	0.741	1.017	0.08	0.817	0.692	0.965	0.017	Major
FAR	1.233	1.079	1.408	0.002	1.152	1.00	1.324	0.046	1.208	1.048	1.392	0.009	Major

						3							
PAR	1.016	0.878	1.176	0.832	1.041	0.89	1.207	0.591	1.106	0.949	1.288	0.196	Major
						9							
NPR	1.241	1.1	1.401	<0.001	1.188	1.04	1.347	0.007	1.191	1.049	1.351	0.007	Major
						7							
AGR	0.892	0.767	1.039	0.141	0.917	0.78	1.071	0.273	0.889	0.759	1.041	0.143	Major
						6							
AAPR	0.9	0.773	1.048	0.176	0.923	0.79	1.079	0.315	0.907	0.775	1.061	0.221	Major
NLR	1.224	1.089	1.377	<0.001	1.184	1.04	1.339	0.007	1.16	1.023	1.315	0.021	Cardiovascular
						7							
PLR	1.183	1.03	1.36	0.018	1.141	0.99	1.313	0.066	1.108	0.958	1.281	0.167	Cardiovascular
						1							
LMR	0.876	0.739	1.038	0.127	0.965	0.81	1.147	0.688	1	0.839	1.192	0.998	Cardiovascular
						2							
SII	1.211	1.074	1.366	0.002	1.18	1.04	1.333	0.008	1.149	1.012	1.304	0.032	Cardiovascular
						4							
SIRI	1.256	1.127	1.4	<0.001	1.228	1.09	1.376	<0.001	1.204	1.071	1.353	0.002	Cardiovascular
						6							
PIV	1.171	1.037	1.322	0.011	1.154	1.01	1.309	0.025	1.123	0.985	1.279	0.083	Cardiovascular
						8							
PNI	0.64	0.548	0.748	<0.001	0.764	0.64	0.901	0.001	0.782	0.661	0.925	0.004	Cardiovascular
						8							
ALBI	1.599	1.377	1.857	<0.001	1.361	1.16	1.597	<0.001	1.338	1.138	1.575	<0.001	Cardiovascular

HALP	0.719	0.598	0.865	<0.001	0.818	0.679	0.985	0.034	0.856	0.708	1.036	0.11	Cardiovascular
FAR	1.214	1.05	1.402	0.009	1.063	0.909	1.244	0.442	1.024	0.872	1.203	0.77	Cardiovascular
PAR	1.257	1.093	1.446	0.001	1.224	1.059	1.413	0.006	1.188	1.022	1.381	0.025	Cardiovascular
NPR	1.092	0.943	1.265	0.241	1.066	0.916	1.24	0.41	1.062	0.914	1.234	0.434	Cardiovascular
AGR	0.665	0.557	0.793	<0.001	0.791	0.662	0.945	0.01	0.814	0.68	0.973	0.024	Cardiovascular
AAPR	0.722	0.605	0.86	<0.001	0.789	0.661	0.943	0.009	0.803	0.672	0.96	0.016	Cardiovascular
NLR	1.124	1.058	1.194	<0.001	1.106	1.04	1.176	0.001	1.12	1.053	1.191	<0.001	Digestive
PLR	1.059	0.991	1.132	0.09	1.065	0.996	1.138	0.064	1.087	1.016	1.163	0.016	Digestive
LMR	0.814	0.755	0.878	<0.001	0.856	0.792	0.925	<0.001	0.842	0.778	0.912	<0.001	Digestive
SII	1.118	1.052	1.188	<0.001	1.117	1.051	1.188	<0.001	1.144	1.075	1.217	<0.001	Digestive
SIRI	1.183	1.119	1.251	<0.001	1.157	1.093	1.225	<0.001	1.174	1.109	1.244	<0.001	Digestive
PIV	1.15	1.086	1.218	<0.001	1.136	1.072	1.204	<0.001	1.162	1.096	1.233	<0.001	Digestive

PNI	0.886	0.827	0.949	<0.001	0.906	0.843	0.973	0.007	0.891	0.828	0.958	0.002	Digestive
ALBI	1.129	1.055	1.208	<0.001	1.103	1.028	1.185	0.007	1.118	1.041	1.202	0.002	Digestive
HALP	0.968	0.903	1.038	0.361	0.953	0.888	1.023	0.184	0.93	0.864	1.001	0.054	Digestive
FAR	1.183	1.109	1.262	<0.001	1.152	1.078	1.231	<0.001	1.182	1.104	1.266	<0.001	Digestive
PAR	1.021	0.954	1.093	0.549	1.042	0.972	1.116	0.246	1.075	1.001	1.154	0.048	Digestive
NPR	1.178	1.108	1.253	<0.001	1.14	1.071	1.215	<0.001	1.141	1.071	1.215	<0.001	Digestive
AGR	0.901	0.84	0.967	0.004	0.9	0.837	0.968	0.004	0.886	0.823	0.954	0.001	Digestive
AAPR	0.939	0.875	1.007	0.078	0.941	0.876	1.011	0.096	0.934	0.869	1.004	0.064	Digestive
NLR	1.311	1.237	1.39	<0.001	1.281	1.206	1.36	<0.001	1.247	1.172	1.326	<0.001	Respiratory
PLR	1.407	1.319	1.501	<0.001	1.397	1.309	1.491	<0.001	1.35	1.262	1.445	<0.001	Respiratory
LMR	0.67	0.609	0.737	<0.001	0.729	0.661	0.804	<0.001	0.744	0.673	0.822	<0.001	Respiratory
SII	1.343	1.268	1.423	<0.001	1.332	1.25	1.412	<0.001	1.282	1.206	1.362	<0.001	Respiratory

						7								
SIRI	1.292	1.221	1.368	<0.001	1.262	1.19	1.339	<0.001	1.226	1.153	1.303	<0.001	Respiratory	
PIV	1.323	1.252	1.398	<0.001	1.314	1.24	1.39	<0.001	1.265	1.193	1.342	<0.001	Respiratory	
						1								
PNI	0.727	0.672	0.787	<0.001	0.806	0.74	0.876	<0.001	0.832	0.765	0.906	<0.001	Respiratory	
						2								
ALBI	1.24	1.147	1.341	<0.001	1.105	1.01	1.2	0.018	1.071	0.986	1.165	0.106	Respiratory	
						7								
HALP	0.656	0.596	0.722	<0.001	0.675	0.61	0.744	<0.001	0.717	0.649	0.792	<0.001	Respiratory	
						3								
FAR	1.347	1.255	1.447	<0.001	1.257	1.16	1.354	<0.001	1.196	1.108	1.291	<0.001	Respiratory	
						7								
PAR	1.253	1.166	1.346	<0.001	1.272	1.18	1.369	<0.001	1.194	1.106	1.289	<0.001	Respiratory	
						2								
NPR	1.151	1.072	1.237	<0.001	1.108	1.02	1.193	0.007	1.104	1.025	1.19	0.009	Respiratory	
						8								
AGR	0.84	0.773	0.913	<0.001	0.897	0.82	0.977	0.013	0.934	0.857	1.017	0.117	Respiratory	
						4								
AAPR	0.801	0.735	0.872	<0.001	0.833	0.76	0.909	<0.001	0.851	0.78	0.93	<0.001	Respiratory	
						3								
NLR	1.161	1.082	1.245	<0.001	1.157	1.07	1.241	<0.001	1.139	1.06	1.225	<0.001	Nutritional	and
						8							metabolic	
PLR	1.291	1.201	1.386	<0.001	1.285	1.19	1.38	<0.001	1.271	1.18	1.368	<0.001	Nutritional	and

						6							metabolic	
LMR	0.803	0.731	0.883	<0.001	0.798	0.72	0.878	<0.001	0.792	0.717	0.875	<0.001	Nutritional	and
						4							metabolic	
SII	1.213	1.135	1.297	<0.001	1.21	1.13	1.294	<0.001	1.183	1.104	1.268	<0.001	Nutritional	and
						2							metabolic	
SIRI	1.158	1.082	1.241	<0.001	1.159	1.08	1.241	<0.001	1.14	1.062	1.224	<0.001	Nutritional	and
						1							metabolic	
PIV	1.192	1.116	1.273	<0.001	1.193	1.11	1.274	<0.001	1.167	1.09	1.249	<0.001	Nutritional	and
						7							metabolic	
PNI	0.731	0.672	0.795	<0.001	0.743	0.68	0.811	<0.001	0.744	0.68	0.813	<0.001	Nutritional	and
						1							metabolic	
ALBI	1.353	1.247	1.469	<0.001	1.332	1.22	1.451	<0.001	1.325	1.215	1.445	<0.001	Nutritional	and
						3							metabolic	
HALP	0.682	0.617	0.754	<0.001	0.695	0.62	0.769	<0.001	0.704	0.634	0.782	<0.001	Nutritional	and
						8							metabolic	
FAR	1.236	1.144	1.336	<0.001	1.214	1.12	1.315	<0.001	1.185	1.091	1.286	<0.001	Nutritional	and
						1							metabolic	
PAR	1.263	1.17	1.363	<0.001	1.256	1.16	1.356	<0.001	1.217	1.123	1.319	<0.001	Nutritional	and
						3							metabolic	
NPR	1.043	0.961	1.133	0.311	1.046	0.96	1.137	0.286	1.043	0.959	1.133	0.326	Nutritional	and
						3							metabolic	
AGR	0.748	0.683	0.82	<0.001	0.77	0.70	0.845	<0.001	0.779	0.709	0.857	<0.001	Nutritional	and
						1							metabolic	

AAPR	0.796	0.726	0.871	<0.001	0.815	0.743	0.894	<0.001	0.821	0.748	0.901	<0.001	Nutritional and metabolic

Model 1: unadjusted.

Model 2 adjusted for gender, age, smoking status, drinking status, hypertension, T2DM, CHD.

Model 3 adjusted for gender, age, smoking status, drinking status, hypertension, T2DM, CHD, NAT, tumor location, and tumor stage.

Abbreviations: SINRIs, systemic inflammation- and nutrition-related indicators; NLR, neutrophil-to-lymphocyte ratio; PLR, platelet-to-lymphocyte ratio; LMR, lymphocyte-to-monocyte ratio; SII, systemic immune-inflammation index; SIRI, systemic immune-inflammation response index; PIV, pan-immune-inflammation value; PNI, prognostic nutritional index; ALBI, albumin-bilirubin score; HALP, hemoglobin, albumin, lymphocyte, and platelet score; FAR, fibrinogen-to-albumin ratio; PAR, platelet-to-albumin ratio; NPR, neutrophil-to-platelet ratio; AGR, albumin-to-globulin ratio; AAPR, albumin-to-alkaline phosphatase ratio; CI, confidence interval; OR, odds ratio; CRC, colorectal cancer.

Supplementary Table 3 Association between SINRIs and overall survival

Ratio	Level	Model1		Model2		Model3	
		HR(95%CI)	P-value	HR(95%CI)	P-value	HR(95%CI)	P-value
NLR	Q1	ref		ref		ref	
	Q2	1.222 (1.058–1.412)	0.006	1.198 (1.036–1.384)	0.014	1.187 (1.027–1.372)	0.02
	Q3	1.398 (1.215–1.608)	<0.001	1.321 (1.147–1.520)	<0.001	1.298 (1.128–1.495)	<0.001
	Q4	1.841 (1.611–2.104)	<0.001	1.688 (1.476–1.931)	<0.001	1.559 (1.361–1.785)	<0.001
	Per SD	1.199 (1.158, 1.241)	<0.001	1.172 (1.132, 1.215)	<0.001	1.147 (1.105, 1.189)	<0.001
PLR	Q1	ref		ref		ref	
	Q2	1.023 (0.895–1.169)	0.736	1.048 (0.917–1.197)	0.495	1.052 (0.920–1.203)	0.458
	Q3	1.025 (0.897–1.172)	0.713	1.022 (0.894–1.168)	0.755	0.972 (0.849–1.112)	0.676
	Q4	1.360 (1.200–1.542)	<0.001	1.363 (1.202–1.546)	<0.001	1.257 (1.106–1.430)	<0.001
	Per SD	1.154 (1.107, 1.202)	<0.001	1.145 (1.100, 1.193)	<0.001	1.119 (1.072, 1.167)	<0.001
LMR	Q1	ref		ref		ref	
	Q2	0.776 (0.688–0.874)	<0.001	0.819 (0.727–0.924)	0.001	0.858 (0.761–0.968)	0.013
	Q3	0.598 (0.527–0.678)	<0.001	0.673 (0.593–0.765)	<0.001	0.723 (0.635–0.822)	<0.001
	Q4	0.500 (0.439–0.570)	<0.001	0.598 (0.523–0.684)	<0.001	0.669 (0.584–0.766)	<0.001
	Per SD	0.753 (0.716, 0.792)	<0.001	0.810 (0.769, 0.852)	<0.001	0.849 (0.806, 0.894)	<0.001
SII	Q1	ref		ref		ref	
	Q2	0.983 (0.856–1.130)	0.815	1.001 (0.871–1.151)	0.989	1.010 (0.878–1.162)	0.889
	Q3	1.184 (1.036–1.353)	0.013	1.206 (1.055–1.378)	0.006	1.172 (1.025–1.340)	0.02
	Q4	1.464 (1.289–1.663)	<0.001	1.455 (1.281–1.653)	<0.001	1.362 (1.195–1.552)	<0.001
	Per SD	1.165 (1.124, 1.209)	<0.001	1.149 (1.108, 1.192)	<0.001	1.126 (1.084, 1.170)	<0.001

SIRI	Q1	ref		ref		ref	
	Q2	1.195 (1.037–1.377)	0.014	1.153 (1.000–1.329)	0.051	1.093 (0.948–1.261)	0.221
	Q3	1.398 (1.218–1.605)	<0.001	1.273 (1.107–1.464)	<0.001	1.219 (1.059–1.401)	0.006
	Q4	1.886 (1.655–2.148)	<0.001	1.671 (1.463–1.908)	<0.001	1.508 (1.319–1.725)	<0.001
	Per SD	1.167 (1.128, 1.208)	<0.001	1.135 (1.095, 1.176)	<0.001	1.103 (1.063, 1.145)	<0.001
PIV	Q1	ref		ref		ref	
	Q2	1.080 (0.941–1.239)	0.274	1.053 (0.918–1.209)	0.461	1.011 (0.881–1.161)	0.874
	Q3	1.248 (1.091–1.427)	0.001	1.196 (1.046–1.369)	0.009	1.156 (1.010–1.323)	0.036
	Q4	1.577 (1.388–1.791)	<0.001	1.470 (1.293–1.672)	<0.001	1.345 (1.179–1.533)	<0.001
	Per SD	1.142 (1.102, 1.184)	<0.001	1.127 (1.087, 1.169)	<0.001	1.102 (1.061, 1.145)	<0.001
PNI	Q1	ref		ref		ref	
	Q2	0.729 (0.647–0.821)	<0.001	0.825 (0.731–0.930)	0.002	0.853 (0.756–0.962)	0.01
	Q3	0.615 (0.543–0.696)	<0.001	0.736 (0.649–0.835)	<0.001	0.785 (0.691–0.892)	<0.001
	Q4	0.472 (0.413–0.539)	<0.001	0.632 (0.551–0.726)	<0.001	0.686 (0.597–0.789)	<0.001
	Per SD	0.742 (0.710, 0.776)	<0.001	0.828 (0.790, 0.867)	<0.001	0.853 (0.814, 0.894)	<0.001
ALBI	Q1	ref		ref		ref	
	Q2	1.300 (1.125–1.502)	<0.001	1.162 (1.005–1.343)	0.043	1.142 (0.988–1.320)	0.073
	Q3	1.613 (1.403–1.854)	<0.001	1.329 (1.154–1.531)	<0.001	1.276 (1.108–1.470)	<0.001
	Q4	2.027 (1.773–2.317)	<0.001	1.498 (1.304–1.720)	<0.001	1.433 (1.246–1.647)	<0.001
	Per SD	1.312 (1.257, 1.370)	<0.001	1.173 (1.121, 1.227)	<0.001	1.160 (1.107, 1.214)	<0.001
HALP	Q1	ref		ref		ref	
	Q2	0.817 (0.724–0.923)	0.001	0.838 (0.742–0.945)	0.004	0.879 (0.778–0.993)	0.038
	Q3	0.660 (0.582–0.750)	<0.001	0.703 (0.619–0.799)	<0.001	0.761 (0.668–0.867)	<0.001

	Q4	0.618 (0.544–0.703)	<0.001	0.688 (0.604–0.785)	<0.001	0.776 (0.678–0.888)	<0.001
	Per SD	0.828 (0.788, 0.869)	<0.001	0.861 (0.820, 0.905)	<0.001	0.903 (0.858, 0.950)	<0.001
FAR	Q1	ref		ref		ref	
	Q2	1.354 (1.168–1.570)	<0.001	1.227 (1.058–1.423)	0.007	1.131 (0.975–1.313)	0.104
	Q3	1.596 (1.383–1.842)	<0.001	1.361 (1.178–1.572)	<0.001	1.244 (1.075–1.438)	0.003
	Q4	2.211 (1.930–2.532)	<0.001	1.723 (1.499–1.980)	<0.001	1.527 (1.325–1.758)	<0.001
	Per SD	1.283 (1.232, 1.335)	<0.001	1.189 (1.140, 1.241)	<0.001	1.149 (1.100, 1.201)	<0.001
PAR	Q1	ref		ref		ref	
	Q2	0.919 (0.807–1.047)	0.206	0.905 (0.794–1.032)	0.136	0.877 (0.769–1.000)	0.05
	Q3	0.959 (0.843–1.092)	0.531	0.947 (0.831–1.078)	0.407	0.904 (0.792–1.031)	0.131
	Q4	1.115 (0.984–1.264)	0.089	1.106 (0.975–1.254)	0.119	1.024 (0.898–1.167)	0.721
	Per SD	1.071 (1.025, 1.120)	0.002	1.074 (1.027, 1.123)	0.002	1.055 (1.006, 1.105)	0.027
NPR	Q1	ref		ref		ref	
	Q2	1.207 (1.052–1.385)	0.007	1.151 (1.003–1.322)	0.045	1.154 (1.005–1.325)	0.042
	Q3	1.209 (1.054–1.386)	0.007	1.109 (0.966–1.273)	0.142	1.096 (0.954–1.259)	0.194
	Q4	1.414 (1.240–1.613)	<0.001	1.275 (1.116–1.457)	<0.001	1.295 (1.133–1.480)	<0.001
	Per SD	1.112 (1.068, 1.158)	<0.001	1.079 (1.036, 1.125)	<0.001	1.074 (1.031, 1.119)	<0.001
AGR	Q1	ref		ref		ref	
	Q2	0.843 (0.746–0.952)	0.006	0.935 (0.826–1.057)	0.28	0.989 (0.874–1.119)	0.861
	Q3	0.674 (0.593–0.766)	<0.001	0.797 (0.700–0.907)	<0.001	0.872 (0.765–0.994)	0.041
	Q4	0.699 (0.616–0.794)	<0.001	0.852 (0.748–0.970)	0.016	0.959 (0.841–1.094)	0.534
	Per SD	0.859 (0.820, 0.900)	<0.001	0.931 (0.888, 0.976)	0.003	0.974 (0.928, 1.022)	0.281
AAPR	Q1	ref		ref		ref	

Q2	0.869 (0.768–0.983)	0.025	0.905 (0.800–1.024)	0.114	0.914 (0.808–1.034)	0.153
Q3	0.840 (0.742–0.952)	0.006	0.904 (0.798–1.025)	0.115	0.932 (0.823–1.057)	0.273
Q4	0.708 (0.621–0.807)	<0.001	0.809 (0.709–0.923)	0.002	0.881 (0.772–1.006)	0.061
Per SD	0.872 (0.832, 0.914)	<0.001	0.922 (0.879, 0.968)	<0.001	0.957 (0.912, 1.005)	0.076

Model 1: unadjusted.

Model 2 adjusted for gender, age, smoking status, drinking status, hypertension, T2DM, CHD.

Model 3 adjusted for gender, age, smoking status, drinking status, hypertension, T2DM, CHD, NAT, tumor location, and tumor stage.

Abbreviations: SINRIs, systemic inflammation- and nutrition-related indicators; NLR, neutrophil-to-lymphocyte ratio; PLR, platelet-to-lymphocyte ratio; LMR, lymphocyte-to-monocyte ratio; SII, systemic immune-inflammation index; SIRI, systemic immune-inflammation response index; PIV, pan-immune-inflammation value; PNI, prognostic nutritional index; ALBI, albumin-bilirubin score; HALP, hemoglobin, albumin, lymphocyte, and platelet score; FAR, fibrinogen-to-albumin ratio; PAR, platelet-to-albumin ratio; NPR, neutrophil-to-platelet ratio; AGR, albumin-to-globulin ratio; AAPR, albumin-to-alkaline phosphatase ratio; CI, confidence interval; HR, Hazard ratio; CRC, colorectal cancer.

Supplementary Table 4 Baseline characteristics of the included information for subcohort analysis

Characteristic	N = 1,2471
Gender	
Male	727.0 (58.3%)
Female	520.0 (41.7%)
Age (year)	65.00 (56.00, 72.00)
Smoking	415.0 (33.3%)
Drinking	338.0 (27.1%)
Hypertension	347.0 (27.8%)
T2DM	182.0 (14.6%)
CHD	69.0 (5.5%)
NAT	112.0 (9.0%)
Location	
Rectal	639.0 (51.2%)
Colon	608.0 (48.8%)
Stage	
I	260.0 (20.9%)
II	497.0 (39.9%)
III	419.0 (33.6%)
IV	71.0 (5.7%)
Overall complications	205.0 (16.4%)
Major complications	24.0 (1.9%)
Cardiovascular complications	18.0 (1.4%)

Digestive complications	125.0 (10.0%)
Respiratory complications	30.0 (2.4%)
Nutritional and metabolic complications	47.0 (3.8%)
Status	247.0 (19.8%)
Follow-up (Month)	39.00 (24.00, 61.00)
TyG	8.55 (8.27, 8.85)
TyG-BMI	196.39 (174.20, 217.52)
METS-IR	34.50 (30.09, 39.06)

n (%); Median (Q1, Q3)

Abbreviations: T2DM, type 2 diabetes mellitus; CHD, coronary heart disease; NAT, neoadjuvant therapy; TyG, triglyceride-glucose index; TyG-BMI, triglyceride-glucose index adjusted by body mass index; METS-IR, metabolic score for insulin resistance

Supplementary Table 5 Subcohort analysis of the associations between metabolic dysfunction indices and overall survival

	Model1		Model2		Model3	
Ratio	**HR(95%CI)**	**P-value**	**HR(95%CI)**	**P-value**	**HR(95%CI)**	**P-value**
TyG (per SD)	1.313(1.170, 1.473)	<0.001	1.299 (1.152, 1.465)	<0.001	1.263 (1.120, 1.424)	<0.001
TyG-BMI (per SD)	1.236 (1.085, 1.409)	0.002	1.283 (1.121, 1.470)	<0.001	1.268 (1.108, 1.451)	<0.001
METS-IR (per SD)	1.226 (1.084, 1.386)	0.001	1.279 (1.124, 1.456)	<0.001	1.261 (1.108, 1.436)	<0.001

Model 1: unadjusted.

Model 2 adjusted for gender, age, smoking status, drinking status, hypertension, T2DM, CHD.

Model 3 adjusted for gender, age, smoking status, drinking status, hypertension, T2DM, CHD, NAT, tumor location, and tumor stage.

Abbreviations: TyG, Triglyceride–glucose index; TyG-BMI, Triglyceride–glucose body mass index; METS-IR, Metabolic score for insulin resistance; CI, confidence interval; HR, Hazard ratio; CRC, colorectal cancer.

Supplementary Table 6 Baseline characteristics of the included participants in training and external validation cohorts

Characteristic	Train	External validation 1	External validation 2	p-value
	N = 6737	N = 2331	N = 1137	
Gender				0.3
Male	3,983 (59%)	1,340 (57%)	655 (58%)	
Female	2,754 (41%)	991 (43%)	482 (42%)	
Age (year)	64 (55, 72)	65 (56, 73)	67 (57, 73)	<0.001
Smoking	2,420 (36%)	792 (34%)	418 (37%)	0.2
Drinking	1,967 (29%)	681 (29%)	415 (36%)	<0.001
Hypertension	1,775 (26%)	680 (29%)	296 (26%)	0.023
T2DM	866 (13%)	327 (14%)	112 (9.9%)	0.002
CHD	315 (4.7%)	193 (8.3%)	58 (5.1%)	<0.001
NAT	536 (8.0%)	103 (4.4%)	26 (2.3%)	<0.001
Tumor Location				0.022
Rectal	3,441 (51%)	1,201 (52%)	631 (55%)	
Colon	3,296 (49%)	1,130 (48%)	506 (45%)	
Stage				<0.001
I	1,341 (20%)	531 (23%)	220 (19%)	
II	2,777 (41%)	858 (37%)	454 (40%)	
III	2,266 (34%)	842 (36%)	396 (35%)	
IV	353 (5.2%)	100 (4.3%)	67 (5.9%)	
Overall complications	1,289 (19%)	534 (23%)	389 (34%)	<0.001
Major complications	151 (2.2%)	15 (0.6%)	13 (1.1%)	<0.001

Cardiovascular complications	107 (1.6%)	11 (0.5%)	61 (5.4%)	<0.001
Digestive complications	617 (9.2%)	201 (8.6%)	81 (7.1%)	0.076
Respiratory complications	202 (3.0%)	314 (13%)	127 (11%)	<0.001
Nutritional and metabolic complications	322 (4.8%)	57 (2.4%)	192 (17%)	<0.001
Status	1,355 (20%)	284 (12%)	211 (19%)	<0.001
Follow-up	45 (26, 79)	60 (35, 96)	49 (24, 83)	<0.001
NLR	2.50 (1.79, 3.55)	2.91 (2.13, 4.40)	2.76 (2.03, 4.18)	<0.001
PLR	153 (114, 208)	165 (125, 235)	166 (126, 237)	<0.001
LMR	3.48 (2.55, 4.70)	3.48 (2.51, 4.87)	3.38 (2.38, 4.45)	<0.001
SII	539 (352, 856)	632 (431, 1,082)	638 (428, 1,051)	<0.001
SIRI	1.01 (0.64, 1.63)	1.07 (0.69, 1.80)	1.11 (0.72, 1.88)	<0.001
PIV	215 (125, 387)	228 (136, 439)	248 (150, 472)	<0.001
PNI	47.4 (43.4, 51.0)	47.7 (44.3, 51.2)	46.9 (42.9, 50.6)	<0.001
ALBI	-2.75 (-2.98, -2.47)	-2.84 (-3.06, -2.60)	-2.76 (-2.99, -2.49)	<0.001
HALP	32 (20, 47)	31 (18, 44)	30 (18, 42)	<0.001
FAR	0.086 (0.072, 0.105)	0.086 (0.073, 0.105)	0.086 (0.069, 0.102)	0.005
PAR	5.44 (4.27, 6.93)	5.45 (4.32, 6.80)	5.67 (4.63, 7.15)	<0.001
NPR	0.017 (0.013, 0.022)	0.018 (0.013, 0.024)	0.017 (0.013, 0.023)	<0.001
AGR	1.44 (1.27, 1.66)	1.43 (1.24, 1.60)	1.48 (1.32, 1.70)	<0.001
AAPR	0.54 (0.45, 0.65)	0.54 (0.44, 0.64)	0.52 (0.43, 0.62)	<0.001
CA19-9	12 (7, 23)	9 (4, 23)	12 (6, 23)	<0.001
CEA	4 (2, 8)	3 (2, 8)	4 (2, 9)	<0.001

n (%); Median (Q1, Q3)

Pearson's Chi-squared test; Kruskal-Wallis rank sum test

Abbreviations: T2DM, type 2 diabetes mellitus; CHD, coronary heart disease; NAT, neoadjuvant therapy; CA19-9, carbohydrate antigen 19-9; CEA, carcinoembryonic antigen; NLR, neutrophil-to-lymphocyte ratio; PLR, platelet-to-lymphocyte ratio; LMR, lymphocyte-to-monocyte ratio; SII, systemic immune-inflammation index; SIRI, systemic immune-inflammation response index; PIV, pan-immune-inflammation value; PNI, prognostic nutritional index; ALBI, albumin-bilirubin score; HALP, hemoglobin, albumin, lymphocyte, and platelet score; FAR, fibrinogen-to-albumin ratio; PAR, platelet-to-albumin ratio; NPR, neutrophil-to-platelet ratio; AGR, albumin-to-globulin ratio; AAPR, albumin-to-alkaline phosphatase ratio;

Supplementary Table 7 Hyperparameter search spaces for the six survival prediction models.

Model	Hyperparameter
RSF	n_estimators': [50, 100, 200],
	'max_depth': [10, 20],
	'min_samples_split': [2, 5, 10],
	'max_features':['sqrt', 0.5, 1.0]
CoxPH	NA
SSVM	alpha': [0.01, 0.1, 1.0, 10.0],
	'max_iter': [100, 300],
	'rank_ratio': [0.0, 0.5, 1.0],
	'fit_intercept': [True, False]
GBSA	n_estimators': [100, 200],
	'learning_rate': [0.05, 0.1],'max_depth': [3, 4, 5],
	'subsample': [0.8],
	'min_samples_split': [10, 20],
	'min_samples_leaf': [3, 5, 10],
	'loss':['coxph']
XGBSE	"n_neighbors": [30, 50, 80],
	"max_depth": [2, 3, 4],
	"n_estimators": [300, 600],
	"learning_rate": [0.03, 0.05],
	"min_child_weight": [1, 10],
	"subsample": [0.8],

	"colsample_bytree": [0.8]
Deepsurv	"num_nodes": [[16, 16], [32, 32], [64, 32], [64, 64]],
	"dropout": [0.0, 0.1, 0.2, 0.3],
	"lr": [1e-4, 3e-4, 1e-3],
	"weight_decay": [0.0, 1e-5, 1e-4],
	"batch_size": [128, 256]

Abbreviations: RSF, random survival forest; CoxPH, Cox proportional hazards model; SSVM, survival support vector machine; GBSA, gradient boosting survival analysis; XGBSE, eXtreme gradient boosting for survival embeddings;

Supplementary Table 8 Predictive performance of six machine learning models for overall and year-specific survival

Model	Cohort	TimePoint	Mean C-index	95%CI-low	95%CI-high	p-value
RSF	Train	overall	0.882	0.874	0.89	<0.001
RSF	Train	1-year	0.912	0.899	0.923	<0.001
RSF	Train	3-year	0.892	0.883	0.901	<0.001
RSF	Train	5-year	0.886	0.878	0.894	<0.001
RSF	External validation 1	overall	0.736	0.707	0.76	0.172
RSF	External validation 1	1-year	0.782	0.737	0.823	0.876
RSF	External validation 1	3-year	0.748	0.718	0.776	0.342
RSF	External validation 1	5-year	0.74	0.711	0.766	0.162
RSF	External validation 2	overall	0.723	0.688	0.757	0.116
RSF	External validation 2	1-year	0.753	0.683	0.821	0.034
RSF	External validation 2	3-year	0.737	0.695	0.778	0.062
RSF	External validation 2	5-year	0.726	0.688	0.762	0.06
GBSA	Train	overall	0.808	0.796	0.819	<0.001
GBSA	Train	1-year	0.859	0.839	0.877	<0.001
GBSA	Train	3-year	0.824	0.811	0.837	<0.001
GBSA	Train	5-year	0.814	0.803	0.826	<0.001
GBSA	External validation 1	overall	0.739	0.712	0.763	0.368
GBSA	External validation 1	1-year	0.785	0.74	0.826	0.97
GBSA	External validation 1	3-year	0.752	0.721	0.779	0.524
GBSA	External validation 1	5-year	0.746	0.717	0.77	0.294
GBSA	External validation 2	overall	0.723	0.689	0.757	0.086

GBSA	External validation 2	1-year	0.748	0.681	0.813	0.034
GBSA	External validation 2	3-year	0.735	0.693	0.776	0.046
GBSA	External validation 2	5-year	0.721	0.683	0.757	0.064
SSVM	Train	overall	0.737	0.724	0.751	<0.001
SSVM	Train	1-year	0.789	0.765	0.813	<0.001
SSVM	Train	3-year	0.752	0.737	0.767	<0.001
SSVM	Train	5-year	0.741	0.727	0.755	<0.001
SSVM	External validation 1	overall	0.747	0.719	0.773	0.568
SSVM	External validation 1	1-year	0.781	0.733	0.825	0.658
SSVM	External validation 1	3-year	0.757	0.726	0.787	0.69
SSVM	External validation 1	5-year	0.752	0.724	0.779	0.584
SSVM	External validation 2	overall	0.708	0.669	0.743	0.264
SSVM	External validation 2	1-year	0.743	0.669	0.813	0.008
SSVM	External validation 2	3-year	0.718	0.674	0.763	0.134
SSVM	External validation 2	5-year	0.706	0.667	0.742	0.202
XGBSE	Train	overall	0.743	0.73	0.756	0.002
XGBSE	Train	1-year	0.838	0.821	0.856	<0.001
XGBSE	Train	3-year	0.789	0.775	0.802	<0.001
XGBSE	Train	5-year	0.771	0.757	0.783	<0.001
XGBSE	External validation 1	overall	0.705	0.674	0.733	<0.001
XGBSE	External validation 1	1-year	0.725	0.669	0.774	<0.001
XGBSE	External validation 1	3-year	0.708	0.674	0.74	<0.001
XGBSE	External validation 1	5-year	0.704	0.673	0.733	<0.001

XGBSE	External validation 2	overall	0.683	0.647	0.719	0.228
XGBSE	External validation 2	1-year	0.74	0.657	0.814	0.152
XGBSE	External validation 2	3-year	0.712	0.664	0.757	0.766
XGBSE	External validation 2	5-year	0.706	0.666	0.742	0.564
Deepsurv	Train	overall	0.731	0.718	0.745	0.016
Deepsurv	Train	1-year	0.775	0.749	0.802	0.76
Deepsurv	Train	3-year	0.741	0.725	0.757	0.292
Deepsurv	Train	5-year	0.733	0.718	0.747	0.074
Deepsurv	External validation 1	overall	0.741	0.713	0.768	0.136
Deepsurv	External validation 1	1-year	0.774	0.724	0.818	0.166
Deepsurv	External validation 1	3-year	0.748	0.718	0.777	0.068
Deepsurv	External validation 1	5-year	0.746	0.717	0.773	0.1
Deepsurv	External validation 2	overall	0.689	0.652	0.725	0.168
Deepsurv	External validation 2	1-year	0.706	0.627	0.776	0.476
Deepsurv	External validation 2	3-year	0.696	0.651	0.74	0.36
Deepsurv	External validation 2	5-year	0.687	0.651	0.726	0.264
Coxph	Train	overall	0.725	0.711	0.739	
Coxph	Train	1-year	0.774	0.748	0.799	
Coxph	Train	3-year	0.737	0.722	0.754	
Coxph	Train	5-year	0.728	0.714	0.743	
Coxph	External validation 1	overall	0.749	0.721	0.776	
Coxph	External validation 1	1-year	0.784	0.734	0.83	
Coxph	External validation 1	3-year	0.759	0.728	0.788	

Coxph	External validation 1	5-year	0.755	0.725	0.781
Coxph	External validation 2	overall	0.7	0.664	0.737
Coxph	External validation 2	1-year	0.694	0.617	0.771
Coxph	External validation 2	3-year	0.706	0.663	0.749
Coxph	External validation 2	5-year	0.697	0.659	0.735

Abbreviations: C-index, Harrell's concordance index; CIs, Confidence Intervals; RSF, random survival forest; CoxPH, Cox proportional hazards model; SSVM, survival support vector machine; GBSA, gradient boosting survival analysis; XGBSE, eXtreme gradient boosting for survival embeddings;