Supplementary Figure 1 Kaplan-Meier curves of recurrence-free survival. A: Stratified by low/high levels of NLR in GIST patients before PSM; B: Stratified by low/high levels of PLR in GIST patients before PSM; C: Stratified by low/high levels of LMR in GIST patients before PSM; D: Stratified by low/high levels of PNI in GIST patients before PSM; E: Stratified by low/high levels of NLR in GIST patients after PSM; F: Stratified by low/high levels of PLR in GIST patients after PSM; G: Stratified by low/high levels of LMR in GIST patients after PSM; H: Stratified by low/high levels of PNI in GIST patients after PSM.
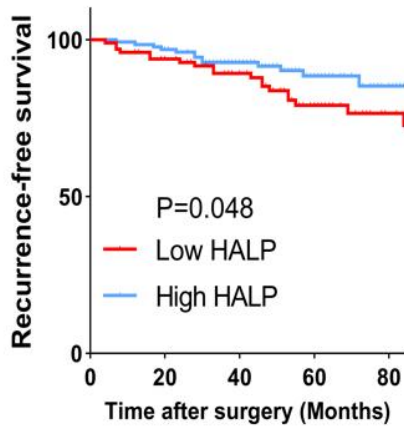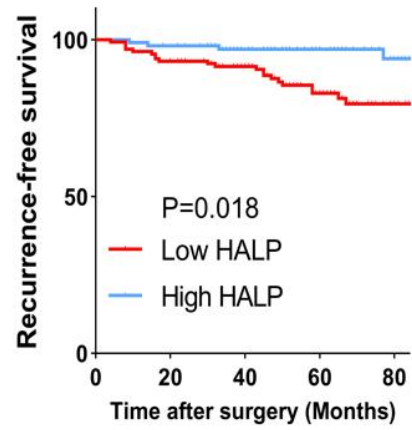
Supplementary Figure 2 Kaplan-Meier curves of recurrence-free survival. A: Stratified by low/high levels of HALP in male GIST patients after PSM; B: Stratified by low/high levels of HALP in female GIST patients after PSM.
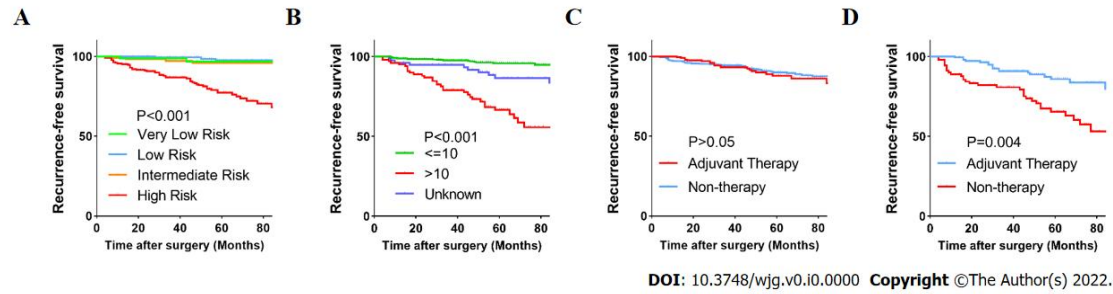
Supplementary Figure 3 Kaplan-Meier curves of recurrence-free survival. A: Stratified by NIH risk classification in all GIST patients; B: Stratified by Ki67 category in all GIST patients; C: Stratified by adjuvant therapy in all GIST patients; D: Stratified by adjuvant therapy in high-risk patients.

Supplementary Table 1 Baseline characteristics in patients with high or low hemoglobin, albumin, lymphocyte, and platelet before and after propensity scores matching

Characteristics	Before PSM[1]				After PSM			
	All	Low HALP, < 31.5	High HALP, ≥ 31.5	*P* value	All	Low HALP, < 31.5	High HALP ≥ 31.5	*P* value
n (%)	591	229 (38.7)	362 (61.3)	-	458	229 (50)	229 (50)	-
Age in yr, mean ± SD	56.3 ± 12.0	56.7 ± 12.2	56.1 ± 11.8		56.8 ± 12.1	56.7 ± 12.2	57.0 ± 12.1	
< 60	337 (57.0)	129	208		256 (55.9)	129	127	
≥ 60	254 (43.0)	100	154	0.788	202 (44.1)	100	102	0.851
Sex								
Male	280 (47.4)	98	182		233 (50.9)	131	102	
Female	311 (52.6)	131	180	0.076	225 (49.1)	98	127	0.007[a]
Tumor site								
Stomach	424 (71.7)	143	281		299 (65.3)	143	156	
Non-stomach	167 (28.3)	86	81	< 0.001[a]	159 (34.7)	86	73	0.202
Tumor size in cm, mean ± SD	6.16 ± 4.87	7.69 ± 5.65	5.18 ± 4.02		7.13 ± 5.08	7.69 ± 5.65	6.57 ± 4.38	
≤ 2	86 (14.6)	10	76		27 (5.9)	10	17	

2.1-5.0	251 (42.5)	87	164		177 (38.6)	87	90	
5.1-10.0	184 (31.1)	95	89		184 (40.2)	95	89	
> 10.0	70 (11.8)	37	33	< 0.001[a]	70 (15.3)	37	33	0.514
Mitotic index as /50HPF								
≤ 5	332 (56.2)	107	225		220 (48.0)	107	113	
6-10	100 (16.9)	45	55		91 (19.9)	45	46	
>10	91 (15.4)	49	42		89 (19.4)	49	40	
unknown	68 (11.5)	28	40	0.001[a]	58 (12.7)	28	30	0.764
CD117								
(+)	573 (97.0)	225	348		443 (96.7)	225	218	
(-)	18 (3.0)	4	14	0.218	15 (3.3)	4	11	0.066
CD34								
(+)	527 (89.2)	201	326		397 (86.7)	201	196	
(-)	64 (10.8)	28	36	0.416	61 (13.3)	28	33	0.583
DOG1								
(+)	529 (89.5)	211	318		412 (90.0)	211	201	
(-)	10 (1.7)	3	7		38 (8.3)	15	23	

Unknown	52 (8.8)	15	37	0.254	8 (1.7)	3	5	0.297
SMA								
(+)	44 (7.4)	22	22		34 (7.4)	22	12	
(+, partial)	85 (14.4)	37	48		66 (14.4)	37	29	
(-)	462 (78.2)	170	292	0.147	358 (78.2)	170	188	0.090
Desmin								
(+)	5 (0.8)	0	5		1 (0.2)	0	1	
(+, partial)	16 (2.8)	5	11		10 (2.2)	5	5	
(-)	570 (96.4)	224	346	0.164	447 (97.6)	224	223	0.409
Ki67								
≤ 10	417 (70.6)	140	277		308 (67.3)	140	168	
> 10	98 (16.6)	61	37		94 (20.5)	61	33	
Unknown	76 (12.9)	28	48	< 0.001[a]	26 (12.2)	28	28	0.004[a]
Histologic subtypes								
Spindle	518 (87.6)	197	321		393 (85.8)	197	196	
Epithelioid	13 (2.2)	3	10		10 (2.2)	3	7	
Mixed	60 (10.2)	29	31	0.146	55 (12.0)	29	26	0.414

NIH risk category								
Very low risk	72 (12.2)	9	63		21 (4.6)	9	12	
Low risk	178 (30.1)	52	126		113 (24.7)	52	61	
Intermediate risk	114 (19.3)	43	71		100 (21.8)	43	57	
High risk	227 (38.4)	125	102	< 0.001[a]	224 (48.9)	125	99	0.106
Adjuvant therapy								
Yes	201 (34.0)	99	102		193 (42.1)	99	94	
No	390 (66.0)	130	260	< 0.001[a]	265 (57.9)	130	135	0.636
Hemoglobin	118.30 ± 26.80	94.60 ± 22.81	133.30 ± 16.23	< 0.001[a]	113.8 ± 27.7	94.5 ± 22.8	133.1 ± 16.6	< 0.001[a]
Albumin	41.68 ± 4.38	39.52 ± 4.40	43.04 ± 3.78	< 0.001[a]	41.02 ± 4.45	39.52 ± 4.40	42.5 ± 3.97	< 0.001[a]
White blood cell	5.38 ± 1.47	5.32 ± 1.55	5.42 ± 1.42	0.187	5.45 ± 1.53	5.32 ± 1.55	5.57 ± 1.49	0.068
Neutrophil	3.40 ± 1.24	3.60 ± 1.40	3.27 ± 1.11	0.011	3.49 ± 1.29	3.60 ± 1.40	3.38 ± 1.16	0.071
Lymphocyte	1.47 ± 0.53	1.21 ± 0.42	1.64 ± 0.53	< 0.001[a]	1.43 ± 0.53	1.21 ± 0.42	1.65 ± 0.54	< 0.001[a]
Mononuclear cell	0.33 ± 0.15	0.33 ± 0.17	0.34 ± 0.14	0.396	0.34 ± 0.16	0.33 ± 0.17	0.35 ± 0.15	0.228
Platelet	201.6 ± 88.2	261.6 ± 95.7	163.7 ± 56.6	< 0.001[a]	211.9 ± 93.1	261.6 ± 95.7	162.1 ± 56.8	< 0.001[a]
NLR, mean ± SD	2.63 ± 1.74	3.41 ± 2.36	2.15 ± 0.92		2.81 ± 1.90	3.40 ± 2.36	2.21 ± 0.97	

< 2.60	369 (62.4)	99	270		266 (58.1)	99	167	
≥ 2.60	222 (37.6)	130	92	< 0.001[a]	192 (41.9)	130	62	< 0.001[a]
PLR, mean ± SD	152.8 ± 84.6	228.7 ± 84.1	104.7 ± 35.4		165.8 ± 89.9	228.7 ± 84.1	102.9 ± 34.5	
< 134.8	304 (51.4)	12	292		257 (56.1)	12	189	
≥ 134.8	287 (48.6)	217	70	< 0.001[a]	201 (43.9)	217	40	< 0.001[a]
LMR, mean ± SD	5.13 ± 3.00	4.45 ± 3.05	5.56 ± 2.90		4.92 ± 3.12	4.45 ± 3.04	5.40 ± 3.14	
< 4.0	381 (64.4)	110	271		273 (59.6)	110	163	
≥ 4.0	210 (35.6)	119	91	< 0.001[a]	185 (40.4)	119	66	< 0.001[a]
PNI, mean ± SD	49.04 ± 5.43	45.6 ± 5.03	51.25 ± 4.43		48.16 ± 5.46	45.56 ± 5.04	50.77 ± 4.56	
< 48.6	270 (45.7)	171	99		243 (53.1)	171	72	
≥ 48.6	321 (54.3)	58	263	< 0.001[a]	215 (46.9)	58	157	< 0.001[a]
Recurrence								
Yes	62 (10.5)	42	20		61 (13.3)	42	19	
No	529 (89.5)	187	342	< 0.001[a]	397 (86.7)	187	210	0.002[a]

[1]Method = nearest; Cliper value = 0.02.

[a]*P* < 0.05 was considered statistically significant.

HALP: Combination index of hemoglobin, albumin, lymphocyte, and platelet; HPF: High-power field; LMR: Lymphocyte-to-monocyte ratio; NIH: National Institutes of Health; NLR: Neutrophil-to-lymphocyte ratio; PLR: Platelet-to-lymphocyte ratio; PNI: Prognostic nutritional index; PSM: Propensity scores matching; SD: Standard deviation; SMA: Smooth muscle actin.

Supplementary Table 2 Demographic and clinicopathologic features of 227 resected high-risk gastrointestinal stromal tumor patients with high or low hemoglobin, albumin, lymphocyte, and platelet

Characteristics	n = 227	Low HALP, < 31.5	High HALP, ≥ 31.5	P value
Age in yr, mean ± SD	56.1 ± 12.5			
< 60	130 (57.3)	70	60	
≥ 60	97 (42.7)	55	42	0.688
Sex				
Male	134 (59.0)	63	71	
Female	93 (41.0)	62	31	0.003[a]
Tumor site: stomach *vs* non-stomach				
Stomach	129 (56.8)	69	60	
Non-stomach	98 (43.2)	56	42	0.584
Tumor size in cm, mean ± SD	9.68 ± 5.86			
≤ 2	1 (0.4)	0	1	
2.1-5.0	41 (18.1)	20	21	
5.1-10.0	116 (51.1)	68	48	
> 10.0	69 (30.4)	37	32	0.455

Mitotic index as /50HPF				
≤ 5	45 (19.8)	28	17	
6-10	61 (26.9)	28	33	
> 10	89 (39.2)	48	41	
Unknown	32 (14.1)	21	11	0.213
CD117 (+)				
(+)	223 (98.2)	124	99	
(-)	4(1.8)	1	3	0.329
CD34 (+)				
(+)	198 (87.2)	110	88	
(-)	29 (12.8)	15	14	0.696
DOG1 (+/-/unknown)				
(+)	204 (89.9)	113	91	
(-)	5 (2.2)	2	3	
Unknown	18 (7.9)	10	8	0.816
SMA				
(+)	18 (7.9)	15	3	

(+, partial)	35 (15.4)	23	12	
(-)	174 (76.7)	87	87	0.01[a]
Desmin				
(+)	0	0	0	
(+, partial)	5 (2.2)	2	3	
(-)	222 (97.8)	123	99	0.659
Ki67 (≤ 10/> 10/unknown)				
≤ 10	111 (48.9)	52	59	
> 10	89 (39.2)	59	30	
Unknown	27 (11.9)	14	13	0.022[a]
Histologic subtypes				
Spindle	183 (80.6)	104	79	
Epithelioid	6 (2.6)	2	4	
Mixed	38 (16.7)	19	19	0.436
Adjuvant therapy (yes/no)				
Yes	89 (39.2)	51	38	
No	138 (60.8)	74	64	0.586

Recurrence (yes/no)				
Yes	51 (22.5)	38	13	
No	176 (77.5)	87	89	0.002[a]
Hemoglobin, mean ± SD	112.97 ± 28.82	94.57 ± 23.14	135.51 ± 16.39	< 0.001[a]
Albumin, mean ± SD	40.11 ± 4.49	38.63 ± 4.28	41.92 ± 4.08	0.110
White blood cell, mean ± SD	5.63 ± 1.46	5.50 ± 1.47	5.78 ± 1.43	0.210
Neutrophil, mean ± SD	3.65 ± 1.21	3.77 ± 1.28	3.51 ± 1.10	0.184
Lymphocyte, mean ± SD	1.44 ± 0.55	1.24 ± 0.42	1.69 ± 0.58	0.024[a]
Mononuclear cell, mean ± SD	0.35 ± 0.15	0.33 ± 0.15	0.37 ± 0.16	0.155
Platelet, mean ± SD	222.8 ± 96.3	268.5 ± 100.57	166.8 ± 50.7	< 0.001[a]
NLR, mean ± SD	2.96 ± 2.09			
< 2.60	123 (54.2)	52	71	
≥ 2.60	104 (45.8)	73	31	< 0.001[a]
PLR, mean ± SD	172.04 ± 87.54			
< 134.8	88 (38.8)	6	82	
≥ 134.8	139 (61.2)	119	20	< 0.001[a]
LMR, mean ± SD	4.88 ± 3.69			

< 4.0	128 (56.4)	61	67	
≥ 4.0	99 (43.6)	64	35	0.015[a]
PNI, mean ± SD	47.31 ± 5.50			
< 48.6	131 (57.7)	96	35	
≥ 48.6	96 (42.3)	29	67	< 0.001[a]

[a]$P < 0.05$ was considered statistically significant.

HALP: Combination index of hemoglobin, albumin, lymphocyte, and platelet; HPF: High-power field; LMR: Lymphocyte-to-monocyte ratio; NLR: Neutrophil-to-lymphocyte ratio; PLR: Platelet-to-lymphocyte ratio; PNI: Prognostic nutritional index; SD: Standard deviation; SMA: Smooth muscle actin.

Supplementary Table 3 Univariate and multivariate regression analysis of prognostic factors in high-risk patients

Characteristics	Univariate analysis		Multivariate analysis	
	HR (95%CI)	*P* value	HR (95%CI)	*P* value
Age	1.011 (0.988-1.034)	0.351		NS
Sex	0.954 (0.546-1.668)	0.87		NS
Tumor site, stomach *vs* non-stomach	1.035 (0.594-1.805)	0.902	1.889 (1.043-3.423)	0.036[a]
Tumor size in cm: ≤ 2/2.1-5.0/5.1-10.0/> 10.0	1.353 (0.902-2.029)	0.144		NS
Mitotic index as /50HPF: ≤ 5/6-10/> 10/unknown	1.968 (1.451-2.671)	< 0.001[a]		0.001[a]
6-10 *vs* ≤ 5			8.719 (1.000-66.919)	0.05[a]
> 10 *vs* ≤ 5			12.879 (1.620-102.417)	0.016[a]
Unknown *vs* ≤ 5			16.936 (2.164-132.525)	0.007[a]
CD117: (+/-)	1.099 (0.152-7.979)	0.925		NA
DOG1: (+/-/unknown)	1.976 (0.979-3.992)	0.057		NA
Ki67: ≤ 10/> 10/unknown	1.959 (1.370-2.801)	< 0.001[a]		0.002[a]
≤ 10 *vs* > 10			3.818 (1.697-8.589)	0.001[a]
≤ 10 *vs* unknown			2.883 (1.061-7.839)	0.038[a]

Histologic subtypes: spindle/epithelioid/mixed	1.024 (0.710-1.478)	0.898		NA
Adjuvant therapy: yes/no	0.379 (0.216-0.665)	0.001[a]	0.384 (0.216-0.682)	0.001[a]
NLR: < 2.60/≥ 2.60	1.784 (1.021-3.117)	0.042[a]		NS
PLR: < 134.8/≥ 134.8	2.251 (1.154-4.389)	0.017[a]		NS
LMR: < 4.0/≥ 4.0	0.925 (0.529-1.618)	0.786		NA
PNI: < 48.6/≥ 48.6	0.430 (0.229-0.808)	0.009[a]		NS
HALP: < 31.5/≥ 31.5	0.504 (0.268-.947)	0.033[a]	0.469 (0.245-0.896)	0.022[a]

[a]$P < 0.05$ was considered statistically significant.

CI: Confidence interval; HALP: Combination index of hemoglobin, albumin, lymphocyte, and platelet; HR: Hazard ratio; LMR: Lymphocyte-to-monocyte ratio; NA: Not applicable; NLR: Neutrophil-to-lymphocyte ratio; NS: Not significant; PLR: Platelet-to-lymphocyte ratio; PNI: Prognostic nutritional index.