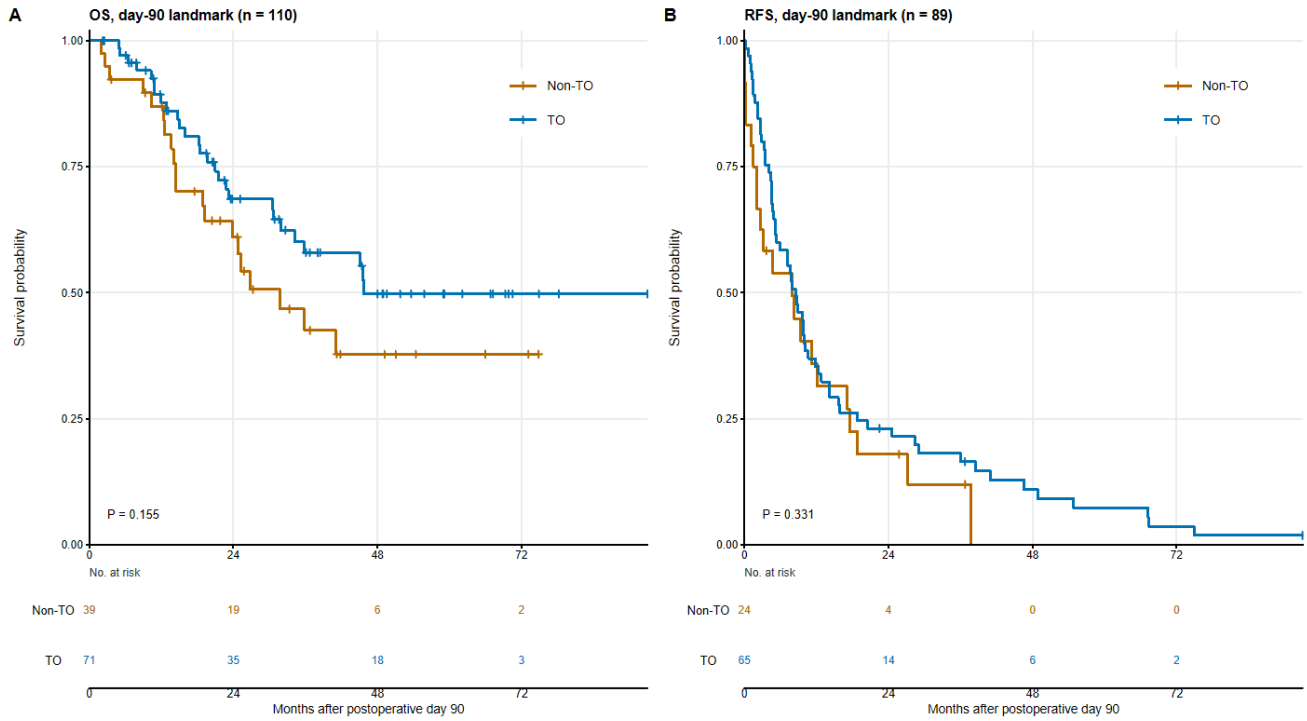

Supplementary Figure 1 Kaplan-Meier survival estimates using the postoperative day-90 landmark. A: Kaplan-Meier estimates of overall survival (OS); B: Kaplan-Meier estimates of recurrence-free survival (RFS). Kaplan-Meier estimates of OS (n = 110, 47 deaths; log-rank P = 0.155) and RFS (n = 89, 83 events; log-rank P = 0.331) using postoperative day 90 as the landmark. OS is time from surgery to all-cause death; RFS is time from surgery to first recurrence or all-cause death, whichever occurs first. Patients enter the relevant landmark cohort when the recorded endpoint interval exceeds 90 days. Time zero represents postoperative day 90, and the horizontal axis shows months thereafter. Initial risk sets are 39 non-textbook outcome (TO) and 71 TO patients for OS, and 24 non-TO and 65 TO patients for RFS. Blue curves indicate TO, orange curves indicate non-TO, and marks indicate censoring. Numbers at risk are shown at 0, 24, 48, and 72 months. Cohort derivation is reported in Supplementary Table 2; Cox estimates and Wald tests are reported in Supplementary Table 11. HR: Hazard ratio; OR: Odds ratio; OS: Overall survival; RFS: Recurrence-free survival; TO: Textbook outcome.

Supplementary Table 1 Variable dictionary, timing, coding, and missingness in the analytic dataset (n = 112)

Variable	Coding/definition	Role	Source	Missing, *n*
Overall survival	Time from surgery to death or last contact, months; event = all-cause death.	Continuous	Follow-up records	0
Recurrence-free survival	Time from surgery to first recurrence or all-cause death, whichever occurs first; event-free survivors censored at last contact. Months.	Continuous	Follow-up records	0
Treatment center	USTC (reference) / CancerHospital	Sensitivity covariate	Patient-level center records	0
Sarcopenia	0 = no; 1 = yes	Primary exposure	CT-based body composition	0
Sex	0 = female; 1 = male	Covariate	Electronic records	0
Age	Years; age ≥ 65 years derived	Covariate	Electronic records	0
BMI	kg/m²	Descriptive characteristic	Electronic records	0
Hypertension	0 = no; 1 = yes	Comorbidity	Electronic records	0
Diabetes	0 = no; 1 = yes	Comorbidity	Electronic records	0
CEA	ng/mL	Tumor marker	Laboratory records	3

CA19-9	U/mL	Tumor marker	Laboratory records	7
Primary tumor location	0 = rectum; 1 = colon	Tumor variable	Pathology/operative records	0
Number of liver metastases	Count; multiplicity derived	Tumor burden	Imaging records	0
Bilobar disease	0 = unilobar; 1 = bilobar	Tumor burden	Imaging records	0
Maximum hepatic tumor diameter	cm; maximum hepatic tumor diameter ≥ 5 cm derived	Tumor burden	Preoperative assessment records	0
Lymph node metastasis	0 = negative; 1 = positive	Tumor biology	Pathology records	0
Synchronous metastasis	0 = no; 1 = yes	Tumor variable	Electronic records	0
Tumor differentiation	0 = poor; 1 = moderate/high	Pathology variable	Pathology records	1
Vascular invasion	0 = absent; 1 = present	Pathology variable	Pathology records	5
Perineural invasion	0 = absent; 1 = present	Pathology variable	Pathology records	5
ASA score	0 = ASA I/II; 1 = ASA score	Physiologic	Anesthesia	0

III	III	variable	records	
Surgical approach	0 = open; 1 = laparoscopic	Operative variable	Operative records	0
Concomitant ablation	0 = no; 1 = yes	Operative variable	Operative records	0
Operative time	Minutes	Operative variable	Operative records	1
Blood loss	mL; blood loss ≥ 250 mL derived	Operative variable	Operative records	2
Intraoperative transfusion	0 = no; 1 = yes	Operative variable	Operative records	0
Postoperative hospital stay	Days; prolonged stay >15 d	TO component	Hospital records	0
Postoperative chemotherapy	0 = no; 1 = yes	Treatment proxy	Electronic records	2
Neoadjuvant therapy	0 = no; 1 = yes	Treatment variable	Electronic records	0
Textbook Outcome	0 = non-TO; 1 = TO	Composite outcome	Derived	0
Major complication	0 = no; 1 = Clavien-Dindo grade ≥ III	TO component	Clinical records	0
90-day	0 = no; 1 = yes	TO	Clinical records	0

readmission		component		
90-day mortality	0 = no; 1 = yes	TO component	Clinical records	0
Prolonged hospital stay	0 = no; 1 = >15 d	TO component	Hospital records	0
R1/R2 resection	0 = no; 1 = yes	TO component	Final pathology reports	0
Major hepatectomy	0 = no; 1 = resection of ≥ 3 Couinaud segments	Exploratory text-derived variable	Operative report text	0
Stoma creation	0 = no; 1 = ileostomy/colostomy/Hartmann	Exploratory text-derived variable	Operative report text	0
CT-to-surgery interval	Days from preoperative CT to surgery; median 7 (IQR 5-11), range 1-38	Measurement-timing variable	CT and operative dates	0
Skeletal muscle index	L3 skeletal muscle area/height², cm²/m²	Continuous source measure	CT-based body composition	0

The source cohort comprised 112 patients. Preoperative variables, postoperative pathological descriptors, operative measurements, and follow-up outcomes are distinguished below. Available denominators equal 112 minus the reported missing count. The primary model had complete data. Blood loss was unavailable for two patients, who were excluded from the perioperative sensitivity analysis. Center information was complete (USTC, *n* = 83; CancerHospital, n = 29) and was used in the center-adjusted sensitivity model. CT-to-surgery timing and continuous skeletal muscle index were available for all 112 patients. Major hepatectomy and stoma

creation were exploratory variables derived from operative reports. Surgeon identifiers, standardized colorectal-procedure and anastomotic variables, and site-specific margin fields were not available for model adjustment. Maximum hepatic tumor diameter refers to the preoperative measurement. For logistic regression, non-TO was coded as the event (1).

Supplementary Table 2 Construction of the postoperative day-90 landmark cohorts

Endpoint	Initial cohort	Endpoint offset ≤ 90 days: Excluded records	Landmark cohort	Subsequent events	TO/non-TO at landmark
OS	112	2 deaths	110	47 deaths	71 / 39
RFS	112	23 RFS events	89	83 RFS events	65 / 24

OS was defined as time from surgery to death from any cause, with survivors censored at last contact. RFS was defined as time from surgery to first recurrence or death from any cause, whichever occurred first, with event-free survivors censored at last contact. The endpoint day offset is the elapsed time from the surgery date to the applicable event or censoring date. The landmark date is the surgery date plus 90 days. Eligibility required an endpoint-specific offset >90 days; events and censoring on or before day 90 were excluded. Follow-up after the landmark is the interval from the landmark date to the applicable endpoint date, expressed in months. There were two early OS deaths and 23 early RFS events, with no early censored records. The cohort derivation is implemented in 01 Fit Models. R; aggregate cohort counts and risk sets are provided in results/02 landmark cohort summary.csv and results/04 landmark risk sets.csv, respectively.

Supplementary Table 3 Standardized differences in patient and tumor characteristics by sarcopenia group

Patient/tumor characteristic	Type	Non-sarcopenic n	Sarcopenic n	Absolute standardized

				difference
Age, years	continuous	57	55	0.462
Male sex	binary	57	55	0.604
BMI, kg/m²	continuous	57	55	0.694
Hypertension	binary	57	55	0.069
Diabetes	binary	57	55	0.012
CEA, ng/mL	continuous	56	53	0.339
CA19-9, U/mL	continuous	54	51	0.103
Colon primary	binary	57	55	0.139
Liver metastasis count	continuous	57	55	0.010
Multiple liver metastases	binary	57	55	0.106
Bilobar disease	binary	57	55	0.101
Maximum tumor diameter, cm	continuous	57	55	0.399
Lymph-node positive	binary	57	55	0.138
Synchronous metastasis	binary	57	55	0.272
Moderate/high differentiation	binary	56	55	0.014
Vascular invasion	binary	54	53	0.323
Perineural invasion	binary	54	53	0.055
ASA III	binary	57	55	0.385
Neoadjuvant therapy	binary	57	55	0.089

Absolute standardized differences are descriptive, not significance tests. Variable-specific nonmissing denominators are shown. Continuous-variable differences use

the square root of the mean of the two group variances; binary-variable differences use the square root of p-bar multiplied by one minus p-bar, where p-bar is the mean of the group proportions. Lymph-node status, differentiation, vascular invasion, and perineural invasion are postoperative pathological descriptors. Other listed characteristics were assessed before surgery; this table does not imply that all descriptors were used for preoperative adjustment.

Supplementary Table 4 Distribution of the number of failed Textbook Outcome components by sarcopenia group

Number of failed TO components	Non-sarcopenic (*n* = 57)	Sarcopenic (*n* = 55)
0	44/57 (77.2%)	27/55 (49.1%)
1	6/57 (10.5%)	11/55 (20.0%)
2	4/57 (7.0%)	14/55 (25.5%)
3 or more	3/57 (5.3%)	3/55 (5.5%)

The five components were major complications, 90-day readmission, 90-day mortality, prolonged hospital stay, and R1/R2 resection. A count of 0 failed components corresponds to TO achieved; the category counts sum to $n = 57$ and $n = 55$ in the non-sarcopenic and sarcopenic groups, respectively.

Supplementary Table 5 Observed combinations of failed Textbook Outcome components by sarcopenia group, *n* (%)

Observed failed-component pattern	Non-sarcopenic (*n* = 57)	Sarcopenic (*n* = 55)
Major complication	3/57 (5.3)	2/55 (3.6)
Major complication + 90-day mortality + R1/R2 resection	0/57 (0.0)	1/55 (1.8)
Major complication + 90-day readmission	1/57 (1.8)	5/55 (9.1)
Major complication + 90-day readmission + 90-	1/57 (1.8)	0/55 (0.0)

day mortality + Prolonged hospital stay + R1/R2 resection		
Major complication + 90-day readmission + Prolonged hospital stay	1/57 (1.8)	0/55 (0.0)
Major complication + 90-day readmission + Prolonged hospital stay + R1/R2 resection	0/57 (0.0)	1/55 (1.8)
Major complication + 90-day readmission + R1/R2 resection	0/57 (0.0)	1/55 (1.8)
Major complication + Prolonged hospital stay	3/57 (5.3)	8/55 (14.5)
Major complication + Prolonged hospital stay + R1/R2 resection	1/57 (1.8)	0/55 (0.0)
Prolonged hospital stay	3/57 (5.3)	7/55 (12.7)
Prolonged hospital stay + R1/R2 resection	0/57 (0.0)	1/55 (1.8)
R1/R2 resection	0/57 (0.0)	2/55 (3.6)

Only patterns observed among patients with at least one failed TO component are displayed. Percentages use the full sarcopenia-group denominators (non-sarcopenic, n = 57; sarcopenic, n = 55), rather than the non-TO subgroup denominators (n = 13 and n = 28). The displayed pattern counts sum to 13 and 28 patients, respectively. Patterns not observed in either group are not shown.

Supplementary Table 6 Additional pathological characteristics by sarcopenia status, *n* (%)

Variable	**Total (n = 112)**	**Non-sarcopenia (n = 57)**	**Sarcopenia (n = 55)**	***P* value**
Tumor differentiation (missing n = 1)				0.943

Poor	40 (36.0)	20 (35.7)	20 (36.4)	
Moderate/high	71 (64.0)	36 (64.3)	35 (63.6)	
Vascular invasion (missing *n* = 5)				0.094
Absent	40 (37.4)	16 (29.6)	24 (45.3)	
Present	67 (62.6)	38 (70.4)	29 (54.7)	
Perineural invasion (missing *n* = 5)				0.777
Absent	49 (45.8)	24 (44.4)	25 (47.2)	
Present	58 (54.2)	30 (55.6)	28 (52.8)	

P values were calculated using chi-square or Fisher exact tests, as appropriate. Missing n indicates unavailable pathological data. Percentages use the variable-specific nonmissing denominator within each group.

Supplementary Table 7 Center-adjusted sensitivity model

Variable	**Standard exp(coef) (95%CI)**	***P* value**	**Firth exp(coef) (95%CI)**	***P* value**
Intercept	0.18 (0.07-0.47)	< 0.001	0.20 (0.07-0.47)	< 0.001
Sarcopenia	3.90 (1.46-10.44)	0.007	3.57 (1.41-9.53)	0.007
Male sex	1.59 (0.58-4.34)	0.367	1.52 (0.59-4.13)	0.389
Age ≥ 65 years	0.40 (0.15-1.08)	0.071	0.43 (0.16-1.09)	0.076
Maximum diameter ≥ 5 cm	10.44 (2.49-43.71)	0.001	8.42 (2.45-37.44)	< 0.001
CancerHospital *vs* USTC	1.62 (0.60-4.37)	0.345	1.59 (0.60-4.17)	0.348

Center-adjusted sensitivity model: *n* = 112; 41 non-TO events; five slope parameters

(events per parameter = 8.20). The model included sarcopenia, sex, age ≥ 65 years, maximum hepatic tumor diameter ≥ 5 cm, and treatment center. USTC denotes the First Affiliated Hospital of University of Science and Technology of China (reference; *n* = 83); CancerHospital denotes Anhui Provincial Cancer Hospital (*n* = 29). Non-TO was coded as the event (1). Standard estimates use maximum likelihood with Wald 95% confidence intervals and tests. Firth estimates use profile penalized-likelihood confidence intervals and tests. The maximum-likelihood model converged with a full-rank design matrix and finite coefficients. Complete coefficients, standard errors, diagnostics, and reproducible code are provided in the accompanying statistical files. The exponentiated intercept represents baseline odds.

Supplementary Table 8 Primary preoperative model: all coefficient estimates

Variable	**Standard exp(coef) (95%CI)**	***P* value**	**Firth exp(coef) (95%CI)**	***P* value**
Intercept (baseline odds)	0.20 (0.08-0.50)	< 0.001	0.22 (0.09-0.50)	< 0.001
Sarcopenia	3.74 (1.41-9.97)	0.008	3.49 (1.38-9.31)	0.008
Maximum diameter ≥ 5 cm	9.96 (2.41-41.08)	0.001	8.19 (2.40-35.93)	< 0.001
Male sex	1.68 (0.62-4.56)	0.309	1.61 (0.62-4.36)	0.327
Age ≥ 65 years	0.39 (0.14-1.07)	0.068	0.42 (0.15-1.07)	0.070

Primary model: *n* = 112; 41 non-TO events; events-per-variable = 10.25. Covariates were specified on clinical grounds and were available before surgery. Standard estimates use Wald intervals and tests; Firth estimates use profile penalized-likelihood intervals and tests. The exponentiated intercept represents baseline odds, not an exposure odds ratio. Unexponentiated coefficients and standard errors are included in the statistical output.

Supplementary Table 9 Complete-case perioperative sensitivity model: all

coefficient estimates

Variable	Standard exp(coef) (95%CI)	*P* value	Firth exp(coef) (95%CI)	*P* value
Intercept (baseline odds)	0.34 (0.09-1.29)	0.111	0.36 (0.09-1.25)	0.109
Sarcopenia	2.88 (1.08-7.66)	0.034	2.68 (1.06-7.06)	0.037
Maximum diameter ≥ 5 cm	9.31 (1.76-49.10)	0.009	7.13 (1.78-40.30)	0.005
Laparoscopic approach	0.40 (0.13-1.21)	0.106	0.42 (0.15-1.23)	0.113
Blood loss ≥ 250 mL	2.59 (0.87-7.70)	0.087	2.46 (0.86-7.06)	0.093
Male sex	1.21 (0.43-3.45)	0.719	1.19 (0.44-3.32)	0.731

Perioperative sensitivity model: n = 110; 40 non-TO events. Two patients with unavailable blood-loss data were excluded. This model was used to assess robustness, not as the primary preoperative estimand. Covariates were sarcopenia, sex, maximum hepatic tumor diameter ≥ 5 cm, surgical approach, and blood loss ≥ 250 mL; age was not included in this separate specification. Interval and test methods, and the interpretation of the exponentiated intercept, are as in Supplementary Table 8.

Supplementary Table 10 Absolute achievement-rate differences

Outcome/component	Non-sarcopenic	Sarcopenic	Absolute difference, percentage points (95%CI)	Group-comparison *P* value
Textbook Outcome	44/57 (77.2%)	27/55 (49.1%)	28.10 (10.98 to 45.23)	0.003
No 90-day mortality	56/57 (98.2%)	54/55 (98.2%)	0.06 (-4.84 to 4.97)	1.000
No R1/R2 resection	55/57 (96.5%)	49/55 (89.1%)	7.40 (-2.12 to 16.92)	0.158
No 90-day readmission	54/57 (94.7%)	48/55 (87.3%)	7.46 (-3.08 to 18.01)	0.199

No prolonged hospital stay	48/57 (84.2%)	38/55 (69.1%)	15.12 (-0.33 to 30.57)	0.074
No major complications	47/57 (82.5%)	37/55 (67.3%)	15.18 (-0.67 to 31.03)	0.082

Absolute differences are non-sarcopenic minus sarcopenic achievement rates. Confidence intervals are unadjusted Wald intervals and are presented descriptively. *P* values are the two-sided Fisher exact comparisons reported for the component analysis.

Supplementary Table 11 Cox models using the postoperative day-90 landmark

Endpoint	Term/contrast	*n*	Events	HR (95%CI)	*P* value
OS	TO, total cohort (unadjusted)	110	47	0.66 (0.37-1.18)	0.158
OS	Sarcopenia, interaction model	110	47	2.82 (0.93-8.56)	0.067
OS	TO × sarcopenia	110	47	0.35 (0.09-1.32)	0.120
OS	TO in non-sarcopenic patients	56	23	0.91 (0.33-2.50)	0.857
OS	TO in sarcopenic patients	54	24	0.32 (0.13-0.79)	0.013
RFS	TO, total cohort (unadjusted)	89	83	0.78 (0.47-1.29)	0.332
RFS	Sarcopenia, interaction model	89	83	1.82 (0.72-4.57)	0.205
RFS	TO × sarcopenia	89	83	0.71 (0.25-2.01)	0.522
RFS	TO in non-sarcopenic patients	50	46	1.01 (0.46-2.21)	0.979
RFS	TO in sarcopenic patients	39	37	0.72 (0.34-1.50)	0.381

Overall TO rows are separate unadjusted models. Interaction models include TO, sarcopenia, TO × sarcopenia, sex, age ≥ 65 years, and maximum diameter ≥ 5 cm. Within-group TO estimates are contrasts from the same interaction model; their n and event counts describe the relevant subgroup, while model fitting uses the full endpoint-specific cohort. The sarcopenia coefficient describes its association among non-TO patients, the reference TO category. All Cox models use Efron ties and Wald confidence intervals and tests. Formal interaction tests, rather than within-group significance alone, inform the assessment of effect modification.

Supplementary Table 12 Landmark sensitivity analyses and proportional-hazards checks

Endpoint	Analysis	Estimate or test	*P* value
OS	Log-rank comparison by TO	$\chi^2 = 2.02$	0.155
RFS	Log-rank comparison by TO	$\chi^2 = 0.94$	0.331
OS	Primary TO × sarcopenia interaction	HR 0.35 (0.09-1.32)	0.120
OS	Interaction plus surgical approach	HR 0.29 (0.07-1.14)	0.077
RFS	Primary TO × sarcopenia interaction	HR 0.71 (0.25-2.01)	0.522
RFS	Interaction plus surgical approach	HR 0.71 (0.25-2.01)	0.520
OS	Global proportional-hazards test	$\chi^2 = 11.08$	0.086
RFS	Global proportional-hazards test	$\chi^2 = 4.53$	0.606

Survival analyses were exploratory without multiplicity adjustment. The surgical-approach sensitivity model adds laparoscopic approach to the primary interaction specification. OS models include 110 patients with 47 deaths, and RFS models include 89 patients with 83 events. The global proportional-hazards tests shown here refer to the primary interaction models. The statistical files additionally provide coefficient-specific tests and Schoenfeld-residual plots for the overall, interaction, and approach-sensitivity Cox models.