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RESEARCH

Preoperative CT-derived sarcopenia as a predictor of postoperative complications in patients undergoing laparoscopic radical resection for non-metastatic colorectal cancer: a retrospective study

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Abstract

Purpose Sarcopenia is increasingly recognized as a risk factor for postoperative complications in gastrointestinal cancer surgery. This study aimed to assess the association between sarcopenia and postoperative complications following laparoscopic radical resection of non-metastatic colorectal cancer (CRC).

Methods In this retrospective study, 387 non-metastatic CRC patients undergoing laparoscopic radical resection were categorized into a sarcopenic group and a non-sarcopenic group based on preoperative skeletal muscle index (SMI, cm^2/m^2). Logistic regression analysis was performed to identify independent predictors for postoperative complications.

Results Sarcopenia was present in 156 (40.31%) patients. The incidence of postoperative complications was 32.3%, with a serious complication (Clavien-Dindo III–V) rate of 12.1%. Compared with non-sarcopenic patients, sarcopenic patients had significantly higher incidences of total complications ($P < 0.001$) and severe complications ($P = 0.026$). Multivariable analysis identified sarcopenia as an independent risk factor for total postoperative complications (OR = 3.42, 95%CI 1.85–6.31). Further analysis of specific types of postoperative complications revealed that anastomotic leakage ($P = 0.001$), surgical site infection ($P = 0.002$), and surgical site adverse events ($P = 0.001$) rates were higher in sarcopenic patients. In multivariable analysis, sarcopenia was independently associated with anastomotic leakage (OR = 3.36, 95%CI = 1.12–10.12) and surgical site adverse events (OR = 3.02, 95%CI = 1.55–5.90).

Conclusions Preoperative CT-derived sarcopenia can predict postoperative complications in patients with non-metastatic CRC undergoing laparoscopic radical resection, particularly anastomotic leakage and surgical site adverse events.

Keywords Colorectal cancer · Sarcopenia · Postoperative complications · Computed tomography

Introduction

Colorectal cancer (CRC) is the third leading cause of cancer death worldwide and the second leading cause of cancer-related mortality [1]. Radical resection is regarded as the primary treatment modality for non-metastatic CRC [2]. With the advancement of laparoscopic and robotic techniques, the effectiveness and safety of CRC surgery continue to improve progressively, yet the risk of postoperative complications remains [3, 4]. Postoperative complications may hinder patient recovery, prolong hospitalization, and increase mortality [5]. Therefore, it is important to investigate risk factors predicting postoperative complications to identify patients that may benefit more from radical resection of CRC.

At present, most studies on the postoperative complications of CRC focus on the tumor itself [6, 7]. However,

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tumor characteristics are not the only factors influencing postoperative complications. Host-related factors also play an important role in the postoperative complications of CRC patients. In recent years, an increasing number of studies have reported that sarcopenia is a risk factor for postoperative complications in patients with many malignant tumors [8–10]. Sarcopenia is an age-related syndrome characterized by progressive generalized loss of muscle mass [11]. Patients with gastrointestinal tumors are most likely to have sarcopenia due to impaired digestion and absorption [12]. A meta-analysis revealed that sarcopenia was associated with an increased risk of total postoperative complications after tumor resection across a wide range of gastrointestinal cancers [13]. However, previous studies have mainly included patients undergoing open resection and those with metastatic tumors, with limited research focusing on patients with non-metastatic CRC after laparoscopic colorectal surgery [14–16]. Moreover, the effect of sarcopenia on postoperative complications in patients with non-metastatic CRC undergoing laparoscopic radical resection remains controversial. Some studies have suggested that sarcopenia was not associated with postoperative complications in CRC patients [17, 18].

The identification of sarcopenia involves three key elements: low muscle strength, low muscle mass, and low physical performance. Muscle quantity or muscle mass can be determined by several techniques, with computed tomography (CT) being recognized as the gold standard for non-invasive muscle mass assessment [19]. The most commonly used approach involves calculating the total skeletal muscle area at the level of the third lumbar vertebra. Since CT is a routinely used for the clinical staging of cancer patients, CT-derived sarcopenia is expected to be an economical and convenient method for predicting postoperative complications of CRC.

In this study, we aimed to determine whether CT-derived sarcopenia serves as a negative prognostic predictor for postoperative outcomes in patients with non-metastatic CRC undergoing laparoscopic surgery.

Materials and methods

Patient selection

We retrospectively investigated 387 patients with histologically confirmed CRC who underwent laparoscopic radical resection at our institution from January 2016 to December 2020. The exclusion criteria comprised (1) patients younger than 18 or older than 80 years; (2) patients with distant metastases; (3) patients undergoing non-laparoscopic surgery; (4) patients receiving neoadjuvant chemoradiotherapy; (5) patients with coexisting other malignant tumors; (6) patients with inadequate clinical or imaging data; and (7) patients with severe pre-existing health conditions. After applying the exclusion criteria, the final sample size was obtained (Fig. 1).

This study was conducted in accordance with the principles of the Declaration of Helsinki and was approved by the Ethics Committee of Shantou University Medical College (No. B-2022–234) [20]. Given the retrospective nature of this study, the requirement for informed consent was waived.

Data collection

For each patient, the following parameters were collected: (1) patient characteristics, including age, gender, and body mass index (BMI). (2) Nutritional Risk Score (NRS) 2002 score and preoperative laboratory markers, including serum albumin, neutrophil, hemoglobin, platelet, lymphocyte, and carcinoma embryonic antigen (CEA) concentration, along with the calculated neutrophil-to-lymphocyte ratio (NLR), lymphocyte-to-monocyte ratio (LMR), and platelet-to-lymphocyte ratio (PLR) which served as indicators of inflammation [21]. (3) Surgery details, including American Society of Anesthesiologists (ASA) grade, tumor location, and surgical duration. Tumors in the cecum, right-sided, and transverse colon were classified as right-sided; those in the left colon and rectum were classified as left-sided. (4) Postoperative outcome assessment, including length of hospital stay, hospitalization costs, and postoperative complications. Postoperative complications were defined as symptoms meeting the Clavien-Dindo (CD) classification criteria between the date of operation and the date of hospital discharge, with serious complications defined as a score of ≥ 3 [22]. This study specifically investigated six key postoperative complications: incisional hernia, surgical site infection, anastomotic leakage, anastomotic bleeding, abdominal infection, and intestinal obstruction. For analytical purposes, incisional hernia and surgical site infection were categorized as surgical site adverse events. (5) Postoperative pathological tumor node metastasis (TNM) stage (8th edition of American Joint Committee on Cancer Staging Manual) [23].

Assessment of skeletal muscle mass and definition of sarcopenia

Abdominal CT examination was performed 2 weeks before surgery to assess preoperative cancer staging. As the gold standard for body composition assessment, CT enables muscle mass quantification using third lumbar vertebra cross-sectional images with visible transverse processes [19]. Skeletal musculature at this level consists of the psoas muscle, quadratus lumborum, erector spinae, transversus abdominis muscle, internal and external oblique muscles, and rectus abdominis. Skeletal muscle area was measured

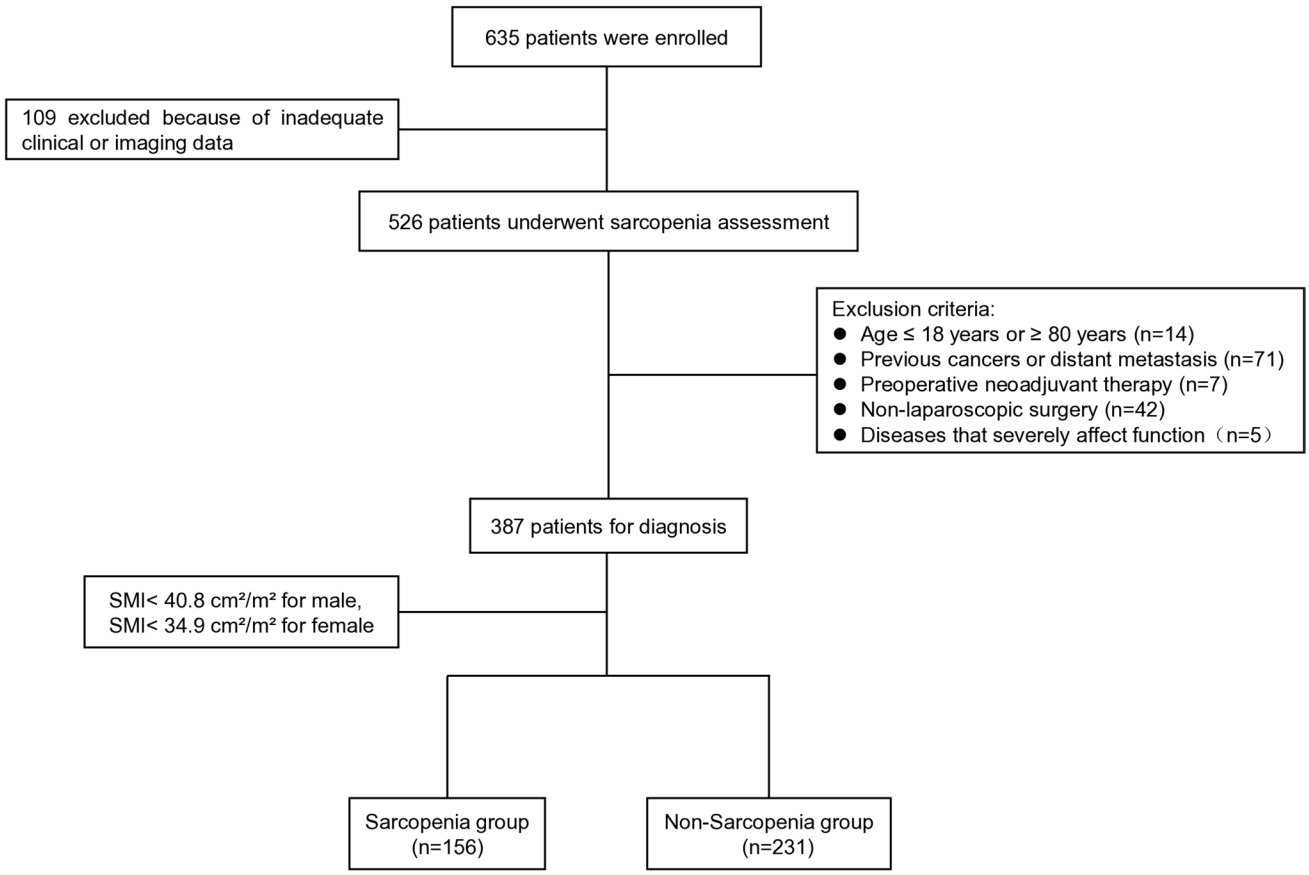

Fig. 1 Flowchart depicting the patient selection process

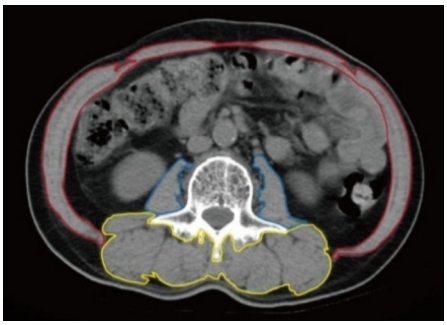

Fig. 2 CT scan image analysis method of skeletal muscle at the third lumbar spine vertebra level

by manually outlining the CT images using the commercially available system (Advantage Windows Workstation 4.4, GE Healthcare, Milwaukee, Wisconsin, USA), as shown in Fig. 2. Skeletal muscle was identified based on Hounsfield Unit thresholds ranging from −29 to +150, as previously described. The skeletal muscle area was normalized by square height (m^2) to derive the lumbar skeletal muscle index (SMI, cm^2/m^2). Sarcopenia was defined in this study using sex-specific SMI cutoff values of less than 40.8 cm^2/m^2 for males and less than 34.9 cm^2/m^2 for females, based on the study of Zhuang et al., which was reported to be optimal SMI cutoff values for sarcopenia of Chinese [24].

Statistical analysis

Continuous variables were presented as means ± standard deviations (SD), while categorical variables were presented as numbers and percentages. The Student *t*-test was used for continuous parameters, and Chi-square tests and/or Fisher precision tests were used for categorical parameters to compare baseline characteristics between sarcopenic and non-sarcopenic groups. Logistic regression analyses, both univariate and multivariate, were conducted to identify factors associated with an increased risk of postoperative complications. The degree of association was estimated using corresponding odds ratios (OR) and their 95% confidence intervals (CI). All tests conducted in this study were two-sided, with a *P*-value of less than 0.05 deemed statistically significant. Variables with $P < 0.1$ in the univariate analysis were entered in a multivariate logistic regression analysis. The statistical analyses were carried out using the

commercial statistics software SPSS (version 26.0, IBM, Armonk, NY, USA).

Results

Baseline demographic and clinicopathological characteristics

A total of 387 patients were enrolled in this study and 156 (40.31%) patients had preoperative sarcopenia. Patients with sarcopenia were older than those with non-sarcopenia (median age ± SD: 62.9 ± 10.0 vs 60.6 ± 9.9, $P = 0.024$). Sarcopenic patients were more likely to have a lower BMI and an NRS 2002 score ≥ 3 than non-sarcopenic patients ($P < 0.001$). Regarding preoperative blood parameters, patients with sarcopenia had lower serum albumin ($P < 0.001$), hemoglobin ($P = 0.001$) levels, and higher NLR ($P = 0.002$), PLR ($P = 0.038$) levels than those with non-sarcopenia. There was no difference in LMR ($P = 0.250$) and CEA level ($P = 0.863$) between the two groups. The tumor locations in patients with sarcopenia were more common in right-sided ($P < 0.001$). There was no significant difference in pTNM stage ($P = 0.447$) between the two groups. All descriptive data are summarized in Table 1.

Postoperative outcome

According to the CD system classification, postoperative complications were observed in 125 patients (32.3%), of which 47 patients (12.1%) were classified as severe (CD III–V). Among the six specific types of postoperative complications in this study, surgical site infection emerged as the most prevalent complication, affecting 32 patients (8.3%), followed by anastomotic leak (7.5%), abdominal infection (6.2%), incisional hernia (3.1%), anastomotic bleeding

Table 1 Comparison of basic characteristics between the sarcopenic group and the non-sarcopenic group

Characteristic	Overall ($n = 387$)	Sarcopenia ($n = 156$)	Non-sarcopenia($n = 231$)	P-value
Age (years)	61.5 ± 10.0	62.9 ± 10.0	60.6 ± 9.9	0.024*
Sex, *n* (%)				0.548
Male	218 (56.3)	85 (54.5)	133 (57.6)	
Female	169 (43.7)	71 (45.5)	98 (42.4)	
BMI (kg/m^2)	22.2 ± 3.4	20.6 ± 2.8	23.3 ± 3.3	< 0.001*
NRS 2002 score, *n* (%)				< 0.001*
≥ 3 score	178 (46.0)	135 (86.5)	43 (18.6)	
< 3 score	209 (54.0)	21 (13.5)	188 (81.4)	
ASA grade, *n* (%)				0.211
1	23 (5.9)	8 (5.1)	15 (6.5)	
2	320 (82.7)	125 (80.1)	195 (84.4)	
3	44 (11.4)	23 (14.7)	21 (9.1)	
Preoperative blood results				
Serum albumin (g/L)	36.4 ± 4.6	35.2 ± 4.7	37.1 ± 4.3	< 0.001*
Hemoglobin (g/L)	120.3 ± 22.6	115.8 ± 22.7	123.3 ± 22.1	0.001*
NLR	2.7 ± 2.0	3.0 ± 2.1	2.5 ± 1.9	0.002*
LMR	4.0 ± 1.9	3.9 ± 1.7	4.2 ± 2.0	0.250
PLR	160.9 ± 86.9	175.3 ± 100.8	151.1 ± 74.8	0.038*
CEA (μg/L)	12.9 ± 29.7	13.3 ± 34.8	12.6 ± 25.8	0.863
Tumor location, *n* (%)				< 0.001*
Left-sided	315 (81.4)	113 (72.4)	202 (87.4)	
Right-sided	72 (18.6)	43 (27.6)	29 (12.6)	
pTNM stage, *n* (%)				0.477
I	58 (15.0)	19 (12.2)	39 (16.9)	
II	178 (46.0)	72 (46.2)	106 (45.9)	
III	151 (39.0)	65 (41.7)	86 (37.2)	

BMI, body mass index; *NRS 2002*, Nutritional Risk Screening 2002; *ASA*, American Society of Anesthesiology; *NLR*, neutrophil-to-lymphocyte ratio; *LMR*, lymphocyte-to-monocyte ratio; *PLR*, platelet-to-lymphocyte ratio; *CEA*, carcinoembryonic antigen; *TNM*, tumor node metastasis

*P-value of < 0.05 was considered to indicate statistical significance

(2.1%), and intestinal obstruction (1.6%). Table 2 summarized postoperative outcomes and complications. Patients with sarcopenia were significantly more likely to experience any complication (73/156, 46.8%). Additionally, these patients demonstrated a significantly higher incidence of severe postoperative complications (33/156, 21.2%). Anastomotic leakage occurred in 20 (12.8%) patients with sarcopenia and 9 (3.9%) patients with non-sarcopenia, and the difference was significant ($P = 0.001$). Surgical site infection occurred in 21 (13.5%) patients with sarcopenia and 11 (4.8%) patients with non-sarcopenia, with a significant difference ($P = 0.002$). Surgical site adverse events occurred in 28 (17.9%) patients with sarcopenia and 15 (6.5%) patients with non-sarcopenia, and the difference was significant ($P = 0.001$). There was no difference in incisional hernia ($P = 0.111$), anastomotic bleeding ($P = 0.841$), abdominal infection ($P = 0.889$), and intestinal obstruction ($P = 0.946$) between the two groups. Patients with sarcopenia had a significantly longer length of hospital stay and higher hospitalization costs compared to those with non-sarcopenia ($P < 0.001$). There was no significant difference in surgical duration ($P = 0.801$) between the two groups.

Risk factors for postoperative complications after CRC resection

The univariate analysis revealed that sarcopenia (OR = 3.03, 95%CI = 1.95–4.07) and NRS 2002 score ≥ 3 (OR = 1.91, 95%CI = 1.24–2.93) were significant risk factors for total postoperative complications. Multivariate analysis identified sarcopenia as an independent significant predictor for total postoperative complications (OR = 3.42, 95%CI = 1.85–6.31), detailed in Table 3. When specific types of postoperative complications were assessed, sarcopenia alone remained a significant independent predictor of postoperative anastomotic leakage (OR = 3.36, 95%CI = 1.12–10.12) and surgical site adverse events (OR = 3.02, 95%CI = 1.55–5.90), detailed in Table 4.

Discussion

This study confirmed that sarcopenia was significantly associated with an increased incidence of postoperative complications following laparoscopic radical resection for non-metastatic CRC. Furthermore, we demonstrated that sarcopenia served as an independent predictor of anastomotic leakage and surgical site adverse events in patients undergoing CRC surgery.

Sarcopenia is a progressive and generalized skeletal muscle disorder characterized by a pathological decline in muscle strength, quantity, and quality [11]. Some organizations worldwide, including those in Europe and Asia, have established their own diagnostic guidelines for sarcopenia [25, 26]. Although the definition of sarcopenia should include muscle strength and function as well as muscle mass, cancer-associated sarcopenia research has predominantly relied on CT-determined muscle mass as a diagnostic criterion, given its widespread use in cancer staging and surveillance [27–29]. For CRC patients, abdominal CT scan is routinely performed as part of the preoperative examination. CT-based assessment offers higher accuracy in measuring skeletal muscle mass, making it an economical, convenient, and reliable method for diagnosing sarcopenia in this population. Nevertheless, existing studies have primarily established cutoff values for the SMI based on Western populations,

Table 2 Comparison of clinical outcomes between the sarcopenia group and non-sarcopenia group

	Total ($n = 387$)	Sarcopenia ($n = 156$)	Non-sarcopenia ($n = 231$)	*P*-value
Overall complications, *n* (%)	125 (32.3)	73 (46.8)	52 (22.5)	< 0.001*
Serious complication, *n* (%) (CDC ≥ III grade)	47 (12.1)	33 (21.2)	14 (6.1)	0.026*
Incisional hernia, *n* (%)	12 (3.1)	8 (5.1)	4 (1.7)	0.111
Anastomotic leakage, *n* (%)	29 (7.5)	20 (12.8)	9 (3.9)	0.001*
Anastomotic bleeding, *n* (%)	8 (2.1)	4 (2.6)	4 (1.7)	0.841
Surgical site infection, *n* (%)	32 (8.3)	21 (13.5)	11 (4.8)	0.002*
Abdominal infection, *n* (%)	24 (6.2)	10 (6.4)	14 (6.1)	0.889
Intestinal obstruction, *n* (%)	6 (1.6)	3 (1.9)	3 (1.9)	0.946
Surgical site adverse events, *n* (%)	43 (11.1)	28 (17.9)	15 (6.5)	0.001*
Surgical duration (min)	199.7 ± 61.5	197.4 ± 53.2	201.3 ± 66.6	0.801
Length of hospital stay (days)	20.5 ± 8.6	23.0 ± 8.9	18.9 ± 8.0	< 0.001*
Hospitalization costs (yuan)	49,397.1 ± 13,274.0	52,226.7 ± 14,312.7	47,486.2 ± 12,188.5	< 0.001*

*P-value of < 0.05 was considered to indicate statistical significance

Table 3 Uni- and multivariate analyses of predictive factors for postoperative complications

Factors	Univariate analysis		Multivariate analysis	
	OR (95% CI)	*P*-value	OR (95% CI)	*P*-value
Age (years)	1.01 (0.99–1.03)	0.515		
Sex (male/female)	0.73 (0.47–1.12)	0.149		
Charlson Comorbidity Index	1.06 (0.91–1.23)	0.477		
Sarcopenia, yes	3.03 (1.95–4.07)	< 0.001#	3.42 (1.85–6.31)	< 0.001*
BMI (kg/m^2)	0.99 (0.93–1.06)	0.750		
NRS 2002 score, ≥ 3	1.91 (1.24–2.93)	0.003#	0.84 (0.45–1.54)	0.570
Serum albumin (g/L)	1.00 (0.99–1.01)	0.850		
Hemoglobin (g/L)	0.96 (0.92–1.01)	0.102		
ASA grade, < 3	0.59 (0.31–1.12)	0.104		
Tumor location, right	1.06 (0.62–1.83)	0.835		
Surgical duration (min)	1.00 (1.00–1.01)	0.222		
TNM stage, < 3 grade	1.34 (0.87–2.06)	0.188		
NLR	1.00 (0.90–1.11)	0.997		
LMR	0.97 (0.86–1.08)	0.546		
PLR	1.00 (1.00–1.00)	0.372		

OR, odds ratios; *CI*, confidence intervals; *BMI*, body mass index; *NRS 2002*, Nutritional Risk Screening 2002; *ASA*, American Society of Anesthesiology; *TNM*, tumor node metastasis; *NLR*, neutrophil-to-lymphocyte ratio; *LMR*, lymphocyte-to-monocyte ratio; *PLR*, platelet-to-lymphocyte ratio

#*P*-value of < 0.1 was considered to indicate statistical significance

**P*-value of < 0.05 was considered to indicate statistical significance

Table 4 Uni- and multivariate analyses of predictive factors for anastomotic leakage and surgical site adverse events

Factors	Anastomotic Leakage			Surgical site adverse events		
	Univariate analysis	Multivariable analysis		Univariate analysis	Multivariable analysis	
	P-value	OR (95%CI)	*P*-value	*P*-value	OR (95%CI)	*P*-value
Age (years)	0.487			0.285		
Sex (male/female)	0.796			0.800		
Charlson Comorbidity Index	0.260			0.386		
Sarcopenia, yes	0.002#	3.36 (1.12–10.12)	0.031*	0.001#	3.02 (1.55–5.90)	0.001*
BMI (kg/m^2)	0.765			0.795		
NRS 2002 score, ≥ 3	0.032#	0.97 (0.33–2.86)	0.962	0.173		
Serum albumin (g/L)	0.731			0.507		
Hemoglobin (g/L)	0.070#	0.95 (0.88–1.04)	0.247	0.849		
ASA grade, < 3	0.305			0.041#	0.48 (0.21–1.11)	0.086
Tumor location, right	0.111			0.408		
Surgical duration (min)	0.790			0.118		
TNM stage, < 3 grade	0.950			0.635		
NLR	0.956			0.581		
LMR	0.583			0.699		
PLR	0.836			0.588		

OR, odds ratios; *CI*, confidence intervals; *BMI*, body mass index; *NRS 2002*, nutritional risk screening 2002; *ASA*, American Society of Anesthesiology; *TNM*, tumor node metastasis; *NLR*, neutrophil-to-lymphocyte ratio; *LMR*, lymphocyte-to-monocyte ratio; *PLR*, platelet-to-lymphocyte ratio

#*P*-value of < 0.1 was considered to indicate statistical significance

**P*-value of < 0.05 was considered to indicate statistical significance

with limited data available for Asian cohorts [30–32]. Since all the patients in our study were Chinese, we adopted the sex-specific SMI cutoff values derived from Zhuang et al.'s study, which were reported to be optimal SMI cutoff values for Chinese [24]. Based on these SMI cutoff values, the morbidity of sarcopenia in our cohort was 40.31%, which was similar to that reported in a recent meta-analysis [33, 34].

In recent years, sarcopenia has been found to have a negative impact on the outcomes in CRC patients. Our findings align with previous studies, confirming that sarcopenic CRC patients exhibit higher rates of total and serious postoperative complications, prolonged hospitalization, and increased healthcare costs[14, 15]. However, most prior studies have predominantly focused on open resection or included patients with metastasis, rarely exploring the association between sarcopenia and postoperative complications following laparoscopic non-metastatic CRC resection [14–16]. Laparoscopic technology has become an important approach for the radical resection of non-metastatic CRC, offering advantages such as shortening hospital stay and promoting rapid recovery [35, 36]. However, this technique presents inherent challenges, especially in mid-low rectal surgeries, where the narrow pelvic space and restricted operating angles increase surgical difficulty and risk [37, 38]. Consequently, postoperative complications remain a critical concern in laparoscopic radical resection of CRC. Our findings indicated that sarcopenia was associated with an increased risk of postoperative complications in patients undergoing laparoscopic radical resection for non-metastatic CRC. Importantly, multivariable analysis identified sarcopenia as an independent risk factor for postoperative complications.

Furthermore, we conducted a detailed analysis of the association between sarcopenia and specific types of postoperative complications. While a previous study evaluating the clinical impact of sarcopenia in colon cancer patients undergoing laparoscopic surgery found it associated with overall postoperative complications but not specific types [39], our findings demonstrated that anastomotic fistula, surgical site infection, and surgical site adverse events were more frequently observed in sarcopenic CRC patients. Multivariable regression analysis showed that sarcopenia independently predicted both anastomotic fistula and surgical site adverse events undergoing laparoscopic radical resection for non-metastatic CRC.

The mechanism of sarcopenia is multifactorial, and it can alter systemic inflammatory response, endocrine function, nutritional status, and insulin resistance [40]. These mechanisms may contribute to increased incidence of postoperative complications. Systemic inflammatory response is recognized as a key factor in the occurrence and development of sarcopenia [41]. High inflammatory response is often observed in patients with sarcopenia. In our research, it can also be seen that the inflammation indicators such as NLR and PLR were higher in the sarcopenic group. Moreover, Zhou et al.'s research demonstrated that postoperative inflammatory indicator levels in sarcopenic patients were significantly elevated compared to preoperative baseline values [42]. Additionally, previous studies, including our present study, found sarcopenia was associated with malnutrition such as lower BMI, decreased hemoglobin levels, serum albumin, and lower NRS 2002 scores. Malnutrition may also lead to a pro-inflammatory state [43, 44]. Hyperinflammatory state resulting from these factors can hamper the healing capacity of intestinal tissues and wounds. This can explain why sarcopenia is associated with anastomotic leakage and surgical site adverse events after CRC surgery.

By analyzing the odds ratio (OR = 3.42), this study indicated that a threefold increased risk of postoperative complications for CRC patients undergoing laparoscopic radical resection once sarcopenia occurred. These findings suggested that sarcopenia might be a potential therapeutic point for surgeons during the perioperative period in the future. Several current studies have demonstrated that resistance training and supplementation of supportive proteins can increase or prevent further loss of muscle mass of patients with CRC [45]. However, as a retrospective study, our research could not evaluate whether such physical and nutritional interventions might reduce the incidence of postoperative complications in patients with CRC. This requires further verification through future clinical trials. Additionally, emerging surgical techniques may offer additional benefits for sarcopenic patients. Previous studies have demonstrated that natural orifice specimen extraction surgery (NOSES) for CRC, which was less invasive than laparoscopic surgery with auxiliary incisions, can avoid auxiliary incisions in the abdomen and reduce the incidence of postoperative incisional hernia and incisional infection [46, 47]. Therefore, NOSES could represent a preferable surgical approach for CRC patients with sarcopenia, provided that radical surgical specimens are suitable for natural orifice extraction. This requires further investigation in future studies.

While this study provides valuable insights, it is essential to acknowledge its limitations. Firstly, as a single-center study, the bias on the different population may be inevitable. Large-scale and multi-center studies are warranted to verify our conclusion. Secondly, the further long-term outcome regarding the prognosis of sarcopenic patients with CRC was not present in this study, and it remains to be investigated through further long-term follow-up.

Conclusion

In conclusion, our study demonstrated that in patients with laparoscopic radical resection of non-metastatic CRC, preoperative CT-derived sarcopenia was an independent

predictor for postoperative complications, particularly anastomotic leakage and surgical site adverse events.

Supplementary Information The online version contains supplementary material available at https://doi.org/10.1007/s00384-025-04932-8.

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Author contribution SSY, LXX and HRB were involved in study concepts and design. CZL, HLP and XYB were responsible for imaging data measurement. YFJ and HXJ contributed to clinical data collection. LZJ, CYK and ZZQ focused on data analysis and interpretation. SSY, LZJ and CZL wrote the manuscript. HRB and LXX served as the corresponding author, overseeing the review of the article and providing guidance. All authors have approved the final manuscript.

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Data availability No datasets were generated or analysed during the current study.

Declarations

Ethical approval This study was approved by the Ethics Committee of Shantou University Medical College (No. B-2022–234) and performed in accordance with the Declaration of Helsinki.

Competing interests The authors declare no competing interests.

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